

**COLORADO RIVER RECOVERY PROGRAM  
FY-2003–2004 PROPOSED SCOPE OF WORK for:  
(Centrarchid monitoring plan)**

Project No.: 137

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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:

**Development of a centrarchid monitoring plan for the Colorado River, Colorado.**

II. Relationship to RIPRAP:

COLORADO RIVER ACTION PLAN: MAINSTEM

III. Reduce negative interactions between non-native and endangered fishes.

III.A. Develop and implement control programs in reaches of the Colorado River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continued as needed.

III.A.3. Nonnative cyprinids and centrarchids in nursery habitats.

V. Monitor populations and habitat and conduct research to support recovery actions (Research, monitoring, and data management).

### III. Study Background/Rationale and Hypotheses:

*Background.*-Recovery Program acceptance of the stocking plan for non-native fishes in the Upper Colorado River Basin required monitoring of centrarchid populations in backwaters of the Colorado River in the Grand Valley, Colorado. The goal of such monitoring was to determine if stocking regulations were having an impact on reducing abundance of centrarchids in backwaters of the Colorado River, Colorado. Escapement of stocked predaceous non-native centrarchids, particularly largemouth bass *Micropterus salmoides*, from the flood plain and into backwaters may negate efforts to recover native endangered fishes such as Colorado pikeminnow *Ptychocheilus lucius*. Stocking regulations were implemented to reduce such escapement.

Efficacy of an existing program, the Interagency Standardized Monitoring Program (ISMP), to fulfill the need for monitoring was evaluated (Bundy and Bestgen 2001). The ISMP sampling approach underestimated the number of backwaters occupied by largemouth bass and green sunfish by about 50 % and underestimated abundance of those species by about 67% (Bundy and Bestgen 2001). This suggested that ISMP was inadequate for monitoring centrarchid abundance in backwaters of the Colorado River in the Grand Valley. This finding invoked another stipulation of Recovery Program acceptance of stocking regulations: if the ISMP technique was found wanting, a new monitoring protocol would be developed and implemented.

In light of the findings reported above, we began development of such a monitoring protocol in autumn 2002. The goal of the study was to develop a sampling methodology to more accurately detect the presence and estimate the abundance of centrarchid fishes in backwaters of the Colorado River, CO. Our approach had three main objectives.

1. Develop a sampling program and technique to determine the number of backwaters to be sampled in the reach. An optimal design will determine the minimum number of backwaters to be sampled in the reach to obtain unbiased and accurate estimates of presence and abundance of centrarchids in backwaters.
2. Develop comparisons of seining and electrofishing techniques to detect presence and abundance of centrarchids within backwaters. This can be accomplished only partially with existing data and will include a cost/effort component.
3. Given data gathered in objective 2, develop estimates of the level of sampling intensity needed to provide unbiased estimates of centrarchid presence and abundance in backwaters that are selected. This can be accomplished partially with existing data and partially with new data.

Because of ongoing discussions since early spring 2002 regarding the fate of CAP 18/19 activities, we decided to wait on implementing Task 1 and focused instead on Task 2 in autumn 2002.

Task 2 involved staged sampling with four sampling occasions (passes) and two levels of effort. The first pass used effort equivalent to  $\frac{1}{2}$  a sampling pass, which essentially covered about  $\frac{1}{2}$  the backwater area with sampling effort. This was followed by three more full pass efforts, each of which covered the entire surface of the backwater. This data will allow us to do two things. First, we will be able to accurately estimate abundance of centrarchids in backwaters. Data from Bundy and Bestgen (2001) and from autumn 2002 showed that intensive removal or capture-recapture sampling accurately and precisely estimated abundance of centrarchids in backwaters. The second thing we can do with these data is assess what level of sampling is appropriate for monitoring. Comparison of sequentially collected data will suggest

what level monitoring, whether it is ½ a pass, a full pass, or more needs to be conducted to provide density estimates that are comparable to the full 3-4 pass abundance estimation effort. Our intent was to do this staged effort sampling in backwaters of a variety of sizes and evaluate efficiency of both seining and electrofishing gears.

In autumn 2002, a total of seven backwaters were sampled in the Colorado River with various gear types so that we could begin to develop comparisons of sampling techniques to develop the monitoring program. Nearly all backwaters in the accessible reach were sampled and several were identified as hot spots of centrarchid abundance from earlier studies. Large backwater size demanded that capture-recapture sampling be used as the estimation technique in 6 of 7 backwaters. Large backwater size, presence of heavy cover, and deep mud necessitated use of electrofishing gear in those six backwaters. Removal sampling with seines was possible in only the one smaller backwater.

Centrarchids were present in 100% of backwaters and were abundant in most of those in 2002. Largemouth bass and green sunfish were present in 100 % (7 of 7) of backwaters sampled in 2002. In 1997 and 1998, largemouth bass were detected in 65% of backwaters (30 of 46) sampled and green sunfish were found in 87% of backwaters (40 of 46). The small sample size of backwaters in 2002 limits inferences that can be made from these data but suggested that bass and green sunfish remain in relatively large numbers in large backwaters of the Colorado River. Though sample size was small, we noted that bluegill were present in a larger number of backwaters (4 of 7, 57%) in 2002 than previously and were more abundant. Bluegill were a major population component in at least one backwater near Connected Lakes. In 1997 and 1998, bluegill were found in only 8 of 46 backwaters (17%) and were never abundant. The long-term consequences of more abundant bluegill population was unknown and inferences were limited by the small backwater sample size. However, 2002 data may indicate more escapement or in-river reproduction of lentic-adapted bluegill from flood plain sources.

Although abundance estimates are not yet available, we removed 1,493 centrarchids from the seven backwaters sampled in 2002. Green sunfish *Lepomis cyanellus* was the most abundant species, followed by largemouth bass *Micropterus salmoides*, bluegill *L. macrochirus*, and black crappie *Pomoxis nigromaculatus*. These fish represented only those captured on one of the marking passes that were too small to mark (< 55 mm total length) or fish captured on the last (4<sup>th</sup>) sampling pass when all centrarchids were removed. Because the fish that we removed represent a small percentage of the total handled, abundance estimates for some backwaters may be quite high. Recapture rates were estimated to be 15 to 30% so abundance estimates should be relatively precise.

In autumn 2002, the CAP 18/19 scope of work, the umbrella project under which this project was funded, was revised to include only stable isotope research. That scope of work was approved because it has a high likelihood of being able to pinpoint the source of centrarchids (floodplains vs river backwaters), which should guide further management actions. It was further recommended that the scope of work for this project be revised and re-submitted separately. Specifically, the Program Directors office encouraged that we resubmit a scope of work that worked only with existing data, and discouraged additional collection of field data. Part of this discussion, which included the State of Colorado, was a collective desire to maintain the principal investigators momentum and continuity afforded by the existing 97-98 and 2002 data sets. Another advantage of funding this work now would be that when isotope results are available, a preliminary monitoring plan, based on existing data would be ready to field test and implement. We anticipate that results of this work will be also useful to design studies to assess effects of non-native predator removal on response of native fishes in the Upper Colorado River Basin.

What we propose then is to work with existing data, including that collected in 1997 and 1998, as well as in autumn 2002, to develop our best approximation of a useful program to monitor centrarchid distribution and abundance in the Grand Valley of Colorado. This work will focus on efforts outlined in the tasks 1 and 3 of the previous proposal (above).

End Product. A sampling program to accurately detect the presence and estimate the abundance of centrarchids in backwaters. The sampling program developed would be conceptual and methodological, and require field testing prior to implementation.

## V. Study Area

Data used is that gathered from backwater fish communities in the Grand Valley reach of the Colorado River in Colorado.

## VI. Study Methods/Approach

Task 1. Develop a sampling program and technique to determine the number of backwaters to be sampled in the reach.

Sampling the entire population of backwaters within the study reach may not be feasible given time and monetary constraints and may not be necessary if sub-sampling provides robust estimates of the presence and abundance of centrarchids in backwaters. However, the optimal number of backwaters to sample to provide such estimates is unknown. The goal of this project element is to determine the optimal number of backwaters to be sampled in the study reach in any given year.

This will be accomplished by analysis of existing data and partially with new data. Computer simulations will be implemented with data gathered in 1997 and 1998 (Bundy and Bestgen 2001) and data collected in 2002. Simulations will be used to determine the level of bias and precision that can be obtained with a given level of sampling. For example, in 1997 and 1998, largemouth bass were determined to be present in 30 of 46, or 65% of backwaters in the Grand Valley. Simulation re-sampling of presence/absence data over a large number of trials should yield estimates of bias and precision of estimates of presence given that a particular number of backwaters are sampled. The same technique could be employed with abundance data. Because only a single sampling occasion is used during a given year, the number of backwaters chosen for sampling should be sufficient to yield a reasonably precise estimate (e.g., estimates within 10 to 20% of the true parameter in 80 to 90% of the years sampled) of bass

presence or abundance for the reach during that single pass. For example, a result may be that over an infinitely large number of sampling years, on average it takes only a sample of 25% of all backwaters to estimate the presence of largemouth bass within 10% of the true number. However, in order to be 90% certain in any given year that sampling will yield a result that is within 10% of the true parameter, a larger number will likely have to be sampled.

Understanding the tradeoffs between sampling intensity and parameter bias and precision is at the heart of this analysis. Once such tradeoffs are quantified, the Recovery Program can then decide what an acceptable level of sampling (and sampling error) is to adequately monitor centrarchid abundance in backwaters and at what cost. When precision of estimates is quantified, one could also then determine when a certain level of change in centrarchid abundance would be detectable (increase, decrease, no change) given a certain number of annual sampling events. This information would be useful to determine if different management actions are needed, or are ultimately effective, for centrarchid management in the Grand Valley.

Task 2. Using existing data, develop best estimates of the level of sampling intensity needed to provide unbiased estimates of centrarchid presence and abundance in backwaters selected for sampling.

Much of the data for this step was to be collected in the field because we felt that we lacked sufficient data at different levels of effort, particularly with electrofishing. That situation was partially ameliorated in autumn 2002. Comparison of sequentially collected data will suggest what level monitoring, whether it is ½ a pass, a full pass, or more needs to be conducted to provide density estimates that are comparable to those achieved with more accurate 3-4 pass abundance estimation effort.

This effort analysis would provide the data needed to understand tradeoffs between cost and efficiency of different levels of effort relative to the goal of gathering unbiased and precise estimates of presence, abundance, and size-structure of the centrarchid fish community. Such an approach would allow several comparisons to be made. First, presence and abundance estimates derived from different levels of seining or electrofishing effort (one or two passes) could be compared to the true estimate derived from both seining and electrofishing. Similarly, size-structure comparisons of centrarchids captured only with seining or electrofishing could be compared with size-structure data gathered from both sampling techniques. Presence, abundance, and size-structure data gathered for each technique compared with true estimates would allow analysis of bias and precision for each technique.

Expected results.--Data from all tasks will be critically analyzed to understand the number (or proportion) of backwaters to be sampled and the level of effort and gear type needed in each. We also expect this work will be useful to guide other efforts to monitor predator abundance and study effects of their removal on the response of native fishes.

## VII. Task Description and Schedule (FY-2003)

Task 1. Develop a sampling program and technique to determine the number of backwaters to be sampled in the reach.

Task 2. Develop estimates of the level of sampling intensity needed to provide unbiased estimates of centrarchid presence, abundance, and size-structure in backwaters that are selected.

Task 3. Data analysis and reporting.

Schedule of tasks, April 2003 to September 2003.

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

Task Description and Schedule (FY-2004)

Task 1. Develop a sampling program and technique to determine the number of backwaters to be sampled in the reach.

Task 2. Develop estimates of the level of sampling intensity needed to provide unbiased estimates of centrarchid presence, abundance, and size-structure in backwaters that are selected.

Task 3. Data analysis and reporting.

Schedule of tasks October 2003 to September 2004

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

VIII.FY-2003 budget

- Deliverables/Due Dates

- Budget by Task:

Task	Labor	Equipment	Travel	Supplies	other	Total
Task 1	9,000			400		9400
Task 2						0
Task 3	3,000		400	900		4300
						13700

FY 2003 budget total \$13,700

Task	Labor	Equipment	Travel	Supplies	other	Total
Task 1						0
Task 2	8,000			100		8100
Task 3	6,000		600	200		6800
						14900

FY 2004 budget total \$14,900

FY 2003-2004 budget total \$28,600

Labor based on a PI salary of \$6000/mo (75% of the total, 3.25 mos) and a technician salary of \$2,500/mo (25% of total, 2.6 mos), benefits and overhead also need to be taken out of that total.

#### IX. Budget Summary

FY-2003	\$13,700
FY-2004	<u>\$14,900</u>
Total:	\$28,600

#### X. Reviewers:

#### 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.