

**COLORADO RIVER RECOVERY PROGRAM**  
**FY-2003-2006 PROPOSED SCOPE OF WORK for:**  
(Centrarchid isotope analyses)

**Project No.: C-18/19**

Lead Agency: Colorado Division of Wildlife

Submitted by:

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Date: April 30, 2002

Revised: December 11, 2002 per Biology Committee; 6/11/03 by Pat Nelson

Revised: February 10, 2004 per Biology Committee; 2/24/04 by Anita Martinez

Category:

Ongoing Project  
 Ongoing-revised project  
 Requested new project       Other (explain)  
 Unsolicited proposal

Expected Funding Source:

Annual funds  
 Capital funds

**I. Title of Proposal:** Stable Isotope Analysis of Centrarchid Concentration Areas

**II. Relationship to RIPRAP:**

This proposal addresses the movement of nonnative fish into river reaches of critical habitat from floodplain habitats known to support large numbers of Centrarchidae fish species. Nonnative fish including largemouth bass, green sunfish, bluegill, and black crappie are known to occur in floodplain ponds, backwaters, beaver ponds, washes and irrigation drainage ditches throughout the Grand Valley reach of the Colorado River. Upon escapement from pond habitats, these fish species typically seek backwater or slow moving side channel habitats upon entering the main stem river. It is in these riverine habitats that these Centrarchids are believed to pose a significant predatory threat to the young life stages of endangered and other native fishes (Tyus and Saunders 1996). However, it is uncertain to what extent the presence of centrarchid species in low-velocity riverine habitats is the result of escapement from off-channel ponds or resident “in-stream” reproduction. Overall, this study is intended to identify the source of nonnative fishes in the Colorado River through isotopic analysis.

General Recovery Program Support Action Plan:

III. Reduce negative impacts of nonnative fishes and sport fish management activities.

III.A.2. Identify and implement viable control measures.

Colorado River Action Plan: Main stem

III. Reduce negative impacts of nonnative fishes and sport fish management activities.

III.A.4.a. Evaluate sources of nonnative fishes and make recommendations.

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

**Background/Rationale:**

Floodplain corridors bordering the main stem rivers in the Upper Colorado River Basin are considered an integral and necessary element in the recovery of the four endangered big river fish species. Lentic habitats comprised of backwaters, embayments created by flooded terraces, and ponds created in depressions all have been identified as critical habitat components in the life histories of the listed species, and generally important to the native fish community and ecological functions supporting the endangered fishes (Irving and Burdick 1995). Nonnative fish species are present throughout the Upper Basin (Martinez 2002, Trammel et al. 2002), and can adversely impact the recovery progress for endangered fishes through predation or competition at critical life stages or in critical locales. The negative interactions between certain nonnative fish species and young life stages of the endangered fishes in floodplain nursery habitats are a concern that needs to be addressed through research and analysis. This Scope of Work addresses the source of nonnative fish to the Colorado River.

The provenance of nonnative fishes is the key to addressing concerns about centrarchids and their impacts in backwaters. The origin of the centrarchids present in backwaters is questionable. These fishes may originate from floodplain ponds and associated habitats where they are known to be self-sustaining or may be periodically stocked by humans, or they may be successfully breeding in the backwaters themselves. Further, a question exists as to whether or not known centrarchid numbers in the river are the result of continual addition from along the river's course through the Grand Valley (non-point scenario) or if certain sites in the river and its floodplain (point sources) are responsible for the bulk of the centrarchids in backwaters. The treatment approach to controlling centrarchids could become more fiscally and ecologically efficient if major "point" sources of these nonnative fishes could be identified and treated to control their abundance in and/or escapement into the river. Martinez et al. (2001) demonstrated that stable isotope analysis appears to have promise for studying trophic relationships and movement patterns of native and nonnative fishes in the Upper Colorado River Basin and this technique will be employed for this investigation.

**Hypotheses:**

Naturally occurring stable isotopes of carbon and nitrogen provide naturally occurring markers to track origins and movements of nonnative fishes in the upper Colorado River basin (Martinez et al.

2001). Ponds along the Colorado and Gunnison rivers represent potential chronic long-term sources of nonnative fish species having documented or presumed negative impacts on the early life stages of Colorado pikeminnow and razorback sucker. The predominant source of nonnative fish in the Colorado River is unknown. These nonnative fishes may originate from riverside ponds, backwaters, isolated ponds in side channels, and/or wetlands. Isotopic analysis of fish tissue, invertebrates and vegetation will be employed to identify the source of nonnative fish within riverine reaches of critical habitat in the Grand Valley.

#### **IV. Study Goals, Objectives, End Product:**

**Study Goal:** To identify sources of nonnative fish to riverine critical habitat.

##### **Study Objectives:**

1. To negotiate access to backwaters, irrigation drainage ditches, washes, and ponds with private/municipal landowners for collection of samples for isotopic analysis.
2. To determine whether the origins and movements (collectively termed provenance) of centrarchids in the study area can be identified using stable isotope and/or microchemical analyses.
3. To determine the proportion of centrarchids in backwaters within the study area that originated from out-of-channel ponds versus in-channel habitats. Currently, hydrogen appears to be most suitable for this purpose.
4. If feasible, to pinpoint “hotspots” where centrarchids present in connected backwaters have originated by narrowing the list of possible sources (e.g. from “off-channel ponds” to specific ponds or groups of ponds). Currently, we are examining selenium and nitrogen to address objective 4. Other markers may be added at a later date as new knowledge becomes available.

##### **End Products:**

1. Identification of the origin and contributing sources of target nonnative fishes to critical habitat, and an increased understanding of trophic relationships of native and nonnative fishes in floodplain and backwater habitats to facilitate the fiscal and ecological efficiency of nonnative fish control.
2. Recommendations regarding the effectiveness of control of centrarchid concentration sites in the Grand Valley reach of the Colorado River. Recommendations will be based on identification of pond or riverine habitats as primary production sources of centrarchids.

## V. Study Area:

The principal area of study for this SOW will be the Colorado River and adjacent floodplain from Rifle downstream to Horsethief Canyon.

## VI. Study Methods/Approach:

Naturally occurring stable isotopes provide markers to track origins and movements of nonnative fishes in the Upper Colorado River Basin (Martinez et al. 2001). Isotopic or microchemical analyses of hydrogen, nitrogen, and selenium will be incorporated into this investigation to facilitate identifying provenance of target nonnative fish species found in backwaters and to track specific sources of fish. Primary objectives of the isotope investigation will be to:

1. establish the framework and methodology for using stable hydrogen and nitrogen isotope analysis and selenium analysis of fish otoliths to determine non-native fish provenance,
2. determine the proportion of centrarchids in connected backwaters that originated from off-channel ponds versus in-channel habitats,
3. pinpoint “hotspots” where centrarchids present in connected backwaters have originated (narrow list of possible sources), and
4. improve our understanding of trophic relationships among native and nonnative fishes in these habitats.

Water, fish tissue (muscle, otolith), and *Corbicula* samples will be collected for isotopic analyses. Other basic data including size, diet, and growth data will be collected from fish to further examine ecological differences of floodplain habitats vs. backwaters and to corroborate distinctions in isotopic signatures.

Dr. Brett Johnson of the Department of Fishery and Wildlife Biology at CSU will hire and supervise a post-doctoral research associate to identify sampling intensity, oversee isotopic analyses, evaluate data and provide findings. CDOW will maintain oversight of this project and perform most of the field sample collection in cooperation with the post-doctoral research associate. This study will compliment the focus on “hot-spot” nonnative fish concentration sites and will also provide analyses in other segments within critical habitat of the Colorado River to follow-up on river reach and trophic trends in isotopic signatures identified in Martinez et al. (2001).

## **VII. Task Description and Schedule:**

### **FY 2003:**

- Task 1. Hire a post-doctoral research associate to identify sampling intensity, oversee isotopic analyses, evaluate data and provide findings.

An annual report will be submitted to Pat Nelson by December 15, 2003.

### **FY 2004:**

- Task 1. Anita Martinez, CDOW Nonnative Fish Control biologist, will lead field sampling access and collection efforts in cooperation with Pat Martinez, CDOW Aquatic Researcher and field technicians. Consultation with the CSU post-doc will guide all sampling efforts. Sampling site selection and intensity for the study will be based on several factors:

- 1) in part on findings of prior isotopic work by Martinez et al. (2001),
- 2) on preliminary floodplain pond/riverine biota isotopic data from 2001-2002 (P. Martinez, CDOW, and B. Johnson, CSU, in progress),
- 3) on results of A. Martinez's work on Centrarchid concentration areas (Hot Spots), and
- 4) on the GIS analysis of fish distributions resulting from the Nonnative Fish Regulation evaluation (P. Martinez and N. Nibbelink, UoWY, in progress).
- 5) on obtaining access from private/municipal landowners.

- Task 2. Sampling will be conducted approximately two weeks every month as needed.

- Task 3. Dr. Brett Johnson at CSU will select a post-doctoral research associate to perform analyses and interpretation of isotopic samples. Work will involve year round sample and data analysis, the post-doctoral research associate will advise CDOW on field sample collection and ongoing sample preparation for isotopic analyses. The post-doctoral research associate will submit quarterly reports to Pat Martinez, CDOW.

An annual report will be submitted to Pat Nelson by November 15, 2004.

### **FY 2005:**

- Task 1. Anita Martinez, CDOW Nonnative Fish Control biologist, will lead field sampling access and collection efforts in cooperation with Pat Martinez, CDOW Aquatic Researcher and field technicians. Consultation with the CSU post-doc will guide all sampling efforts. Sampling site selection and intensity for the study will be based on several factors:

- 1) in part on findings of prior isotopic work by Martinez et al. (2001),

- 2) on preliminary floodplain pond/riverine biota isotopic data from 2001-2002 (P. Martinez, CDOW, and B. Johnson, CSU, in progress),
- 3) on results of A. Martinez's work on Centrarchid concentration areas (Hot Spots), and
- 4) on the GIS analysis of fish distributions resulting from the Nonnative Fish Regulation evaluation (P. Martinez and N. Nibbelink, UoWY, in progress).
- 5) on obtaining access from private/municipal landowners.
- 6) results from 2004 will guide 2005 sampling efforts.

Task 2. Sampling will be conducted approximately two weeks every month when feasible.

Task 3. CSU post-doctoral research associate will perform analyses and interpretation of isotopic samples. Post-doctoral research associate will submit quarterly reports to Pat Martinez, CDOW. Post-doctoral research associate will also present preliminary findings at Upper Basin Researcher's Meeting and prepare Draft Final Report in RIP format in conjunction with Dr. Brett Johnson, CSU and A. Martinez and P. Martinez, CDOW.

Reporting: Draft final report to Pat Nelson – December 15, 2005  
 1<sup>st</sup> revised draft final report to peer review – January 15, 2006  
 (peer reviews due to author – February 15, 2006; BC comments due – March 3, 2006)  
 2<sup>nd</sup> revised draft final report to Biology Committee – April 3, 2006

### **VIII. FY- 2003 through 2005 Work:**

#### **FY 2003 Deliverables:**

Preliminary findings summarized in annual report to Program- December 2003.

#### **FY 2004 Deliverables:**

Presentation of preliminary findings at Upper Basin Researcher's Meeting (January 2004);  
 Preliminary findings summarized in annual report to Program- November 2004.

#### **FY 2005 Deliverables:**

Presentation of preliminary findings at Upper Basin Researcher's Meeting (January 2005); Draft final report in RIP format to coordinator by 15 December 2005.

## Budget

*NOTE: Due to a delay in hiring the post-doctoral research associate, funds received in FY2003 for field collection and isotopic analysis will roll-forward into FY2004. Similarly, funds received in FY2004 for field collection and isotopic analysis will roll-forward into FY2005.*

### FY 2003 Costs:

#### Task 1 and 2 - Field Collection

- Fishery Biologist (6 months) & fringe	26,800
- Seasonal Labor (6 months)	10,600
- Equipment	740
- Travel, vehicle	<u>4,430</u>
Total	\$42,570

#### Task 3 - Isotopic Analysis

- Post-doctoral scientist & fringe (12 months)	44,491
- CSU professor salary, fringe (1 month)	8,372
- Student hourly & fringe (720 hours)	7,272
- Mass spec. Use fees	5,250
- Travel	2,500
- Field and lab supplies	2,000
- University indirect cost @ 15% (funds passed through existing Larval Lab- or BMR-USBR agreement)	<u>10,483</u>
Total	\$80,368

**TOTAL (FY 2003) \$122,938**

### FY 2004 Costs:

#### Task 1 and 2 - Field Collection

- Fishery Biologist & fringe (6 months at \$4,467/month)	26,800
- Seasonal Labor (6 months at \$1,767/month)	10,600
- Equipment	740
- Travel, vehicle (6-month lease at \$738/month)	<u>4,430</u>
Total	\$42,570

#### Task 3 - Isotopic Analysis

- Post-doctoral scientist & fringe (12 months at \$3,708/month)	44,491
- CSU professor salary, fringe (1 month at \$8,372/month)	8,372
- Student hourly & fringe (720 hours at \$10.10/hour)	7,272
- Sample analysis ( $\delta^2\text{H}$ , $\delta^{15}\text{N}$ , Se)	25,000

- Mass spec. use fees (210 samples at \$25/sample)	5,250
- Travel (6 trips, one to two people, ~\$250/person-trip)	2,500
- Field and lab supplies (primarily containers)	2,000
- University indirect cost @ 15% (funds passed through existing Larval Lab or BMR-USBR agreement)	<u>10,483</u>
Total	\$105,368
<b>TOTAL (FY 2004)</b>	<b>\$147,938</b>

**IX. Budget Summary:**

**FY-2003**

Field Collection: \$ 42,570

Isotopic Analyses: \$ 80,368

**Total \$122,938**

**FY-2004**

Field Collection: \$ 42,570

Isotopic Analyses: \$105,368

**Total \$147,938**

**Amount Requested from Recovery Program (FY03 & FY04) \$270,876**

**X. Reviewers:** Tom Nesler, Robert Muth, Recovery Program Biology Committee

**XI. References:**

Irving, D. B., and B. D. Burdick. 1995. Reconnaissance inventory and prioritization of existing and potential bottomlands in the Upper Colorado River Basin: 1993-1994. Recovery Implementation Project for Endangered Fishes in the Upper Colorado River Basin Final Report. U.S. Fish and Wildlife Service, Denver, Colorado.

Martinez, A. M. 2002. Nonnative fish control in Colorado, 1997-2001. *in* R. Muth, moderator. Nonnative Fish Control Workshop. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Martinez, A. M., J. T. Romatzke, and D. R. Powell. 2002. Proposed redirection of the nonnative fish control program in Colorado from pond reclamation/isolation to intensive control of nonnative fish in one area of the Colorado River that is considered a "hot spot" for centrarchids. Report of Colorado Division of Wildlife to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

- Martinez, P. J., B. M. Johnson, and J. D. Hobgood. 2001. Stable isotope signatures of native and nonnative fishes in Upper Colorado River backwaters and ponds. *The Southwestern Naturalist* 46: 311-322.
- Trammell, M. A., R. A. Valdez, L. Jonas, and H. Johnstone, 2002. Non-native fish control in backwater habitats in the Colorado River. Final Report to Colorado Division of Wildlife Resources. SWCA, Inc., Environmental Consultants, Flagstaff, AZ.
- Tyus, H. M., and J. F. Saunders, III. 1996. Nonnative fishes in natural ecosystems and a strategic plan for control of nonnatives in the Upper Colorado River basin. Recovery Implementation Program DRAFT REPORT. Cooperative Agreement No. 14-48-006-95-923. U.S. Fish and Wildlife Service, Denver, Colorado.