COLORADO RIVER RECOVERY PROGRAM
FY 99 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: CAP-6 SE-2

I. Project Title: Selenium effects on larval razorback sucker: field verification of laboratory results.

II. Principal Investigator(s): Daniel W. Beyers, Ph.D., Larval Fish Laboratory, Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins, CO 80523; T: 970-491-5475; F: 970-491-5091; E: danb@lamar.colostate.edu

III. Project Summary: Many potential nursery habitats have selenium in water and food organisms that may be toxic to fish. Concern exists about potential effects on larval razorback sucker that may reside in these habitats. In response to this concern, a study entitled "*Assessment and Prediction of Effects of Selenium Exposure to Larval Razorback Sucker*" (CAP-6 SE-1) was completed.

This study evaluates and extends predictions of the previous study, and will determine if co-contaminants in nursery habitats influence toxicity. Methods were similar to those in the companion project except exposure water was obtained from potential nursery habitats in the Colorado River. Growth and survival of larvae was monitored over a 28-day period. Analyses are being conducted to evaluate agreement between observed and predicted toxicity.

IV. Study Schedule: Initial year: FY99; final year: FY00. The project currently has "ongoing" status with investigations scheduled to be completed by the end of February 2000.

V. Relationship to RIPRAP:

General Recovery Program Action Plan
II. restore habitat
- II.A. restore flooded bottom land habitats
  - II.A.2. screen high-priority sites for restoration
- II.B. support actions to reduce contaminant impacts
  - II.B.1. evaluate effects of... ...agriculture, and municipal... ...sources of potential contaminants throughout the Upper Basin
  - II.C.1. identify what restoration and protection are needed

Green River Action Plan
II. restore habitat
- II.A. restore flooded bottom land habitats
  - II.A.2.a. identify and evaluate sites
- II.D. support actions to reduce contaminant impacts at Ashley Creek and Stewart Drain

Colorado River Action Plan-Mainstem
II. restore habitat

II.A. restore and manage flooded bottom land habitat
II.A.1. 29-1/2 Road gravel pit
II.A.1.e. monitor and evaluate success
II.A.2. Adobe Creek
II.A.2.e. monitor and evaluate success
II.A.3. Walter Walker
II.A.3.e. monitor and evaluate success
II.A.4. develop and implement levee removal
II.A.4.a. preconstruction contaminants screening
Colorado River Action Plan-Gunnison
II. restore habitat
II.A. restore flooded bottom land habitat
II.A.2.a. preconstruction contaminants screening
II.A.2.d. evaluation

VI. Accomplishment of FY 99 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Objective 1: Use 28-day early life-stage toxicity tests to expose larval razorback sucker to five test waters (four site waters and control water), and to food organisms that have been reared in test waters.

Status: This objective was accomplished. Site waters were obtained weekly from three localities on the Colorado River: backwater near Debeque; backwater at Griffith's Bottom near Grand Junction; and North Pond at Walter Walker State Wildlife Area near Grand Junction. An additional site-water treatment was made using water obtained from North Pond diluted 50:50 with laboratory water to evaluate effects of diluting selenium concentrations at field sites. Monocultures of the freshwater algae *Chlorella vulgaris* (Carolina Biological Supply Company, Burlington, North Carolina) and the rotifer *Brachionus calyciflorus* (Florida Aqua Farms, Dade City, Florida) were successfully cultured in control and site waters. Both organisms were maintained in batch cultures. Each batch of rotifers was fed algae from the corresponding site water two times daily. Abundance of rotifers in batch cultures was quantified daily by subsampling. Razorback sucker larvae were obtained from Dexter National Fish Hatchery and Technology Center (Dexter, NM). Experimental treatments were assigned to replicate aquaria (n=4) using a randomized, balanced 5×2 factorial design with five exposure waters, and control or site-water cultured rotifer diet. This experimental design was equivalent to conducting two toxicity tests simultaneously. In one test, razorback sucker were exposed to site water and rotifer diet cultured in site water. In the other, razorback sucker larvae were exposed to site water and control diet. Ten larvae were assigned to each exposure aquarium (experimental unit). Larvae were transferred from mass cultures to static exposure aquaria about 24 h before starting the exposure. Water in exposure aquaria was replaced every 24 hours. Aquaria were polyethylene vessels having a diameter of 12 cm and height of 15 cm. Depth of test solutions was 9.5 cm. Cool-white fluorescent lamps were the only source of illumination (530 lx), and a 12:12-h light:dark photoperiod was

maintained.

Larvae were fed a ration of 1000 rotifers per day. Survival of fish in each treatment was monitored daily. Growth was quantified at the end of the exposure period by determining the average blotted wet mass and average total length (TL) of fish that survived. Average mass was measured to 0.0001 g; TL to 0.1 mm.

Samples of algae, rotifer, and fish have been submitted for chemical analysis for determination of tissue selenium concentrations. Results of these analyses are anticipated to be available in late January. Tissue concentrations are critical for evaluating results of this research. Consequently, in-depth analyses of data have not been conducted.

Initial findings: The food chain exposures were conducted as planned. Survival of razorback sucker in the control was 97.5%. Preliminary analysis suggests that there was no obvious difference in survival in control or site waters. Analysis of growth data has not been completed. Water quality analyses have been completed, but have not been compiled and tabulated.

Shortcomings: None.

Objective 2: Use equations that predict razorback sucker survival and growth as functions of selenium concentration to estimate the response of study fish to site waters, and compare predicted and observed responses.

Status and initial findings: This statistical comparison has not been completed. However, the methodology is relatively straight forward and easily accomplished once all of the data have been received from analytical laboratories.

Shortcomings: None.

VII. Recommendations:

1. **Recommend that the program guidance be modified to include an investigation to describe the time course of selenium bioaccumulation in fish food organisms in backwaters.** Data that describe the time-dependent relationship between selenium concentrations in backwaters and tissue concentrations in food organisms are needed in order to estimate dietary exposure of fish (adults and larvae) in the field. Because backwaters may fill and drain annually, selenium concentrations in resident food organisms probably changes over time and this is a major source of uncertainty for evaluating the influence of dietary exposure on wild fish.

2. **Recommend that the program guidance be modified to include further evaluation of selenium effects on reproductively active razorback sucker.** Current research will thoroughly describe effects of selenium exposure on larval razorback sucker, but additional studies are needed to evaluate effects of selenium exposure on reproductively-active adults. Future investigations should emphasize bioaccumulation of

selenium in adult fish prior to spawning and monitor survival of resulting embryos and larvae. This research should be conducted under controlled conditions so that selenium exposure is well known and confounding influences are minimized.

3. **Recommend that the program guidance be modified to include evaluation of influence of fish movement on selenium bioaccumulation.** Existing or new radio telemetry investigations of movements of razorback sucker adults could be linked with selenium investigations. Adult fish may move in and out of selenium contaminated areas. Assessments that do not account for this behavior will over estimate effects of selenium on adult fish. Radio telemetry data can be linked to bioaccumulation results using a computer model. The model could simulate accumulation of selenium given fish movements in and out of contaminated areas and estimate reproductive effects.

VIII. Project Status: Project is considered "ongoing." A draft report is anticipated by the end of February 2000.

IX. FY 99 Budget Status

A. Funds Provided: $78,370
B. Funds Expended: $61,541
C. Difference: $16,829: $2,195 indirect cost; $13,282 to cover costs of selenium analyses that are currently underway; $1,352 to cover quality assurance and data entry when chemical analyses are complete.
D. Percent of the FY 99 work completed, and projected costs to complete: Proposed research is 95% complete; remaining budget is adequate to finish this component.
E. Recovery Program funds spent for publication charges: $0.00

X. Status of Data Submission (Where applicable): NA

XI. Signed: Daniel W. Beyers, Ph.D. 3 December 1999
Principal Investigator Date