

- I. Project Title: Evaluation of interspecific sensitivity to dietary selenium exposure: razorback sucker versus flannelmouth sucker.
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- III. Project Summary: Recently, the impact of changing water quality on razorback sucker has been a concern, but questions remain about why co-occurring native fishes are relatively abundant in the Upper Colorado River Basin. This apparent paradox has led to the hypothesis that the razorback sucker may have different sensitivity to selenium exposure.
To quantify species sensitivity, early life-stage toxicity tests were conducted with razorback sucker and the flannelmouth sucker. Larval fish were exposed to gradients of selenium-contaminated water and food organisms. Growth and survival of larvae was monitored over a 28-day period.
A separate study was conducted to compare the sensitivity of razorback sucker and flannelmouth sucker to dissolved selenium. Both species were studied simultaneously using standard 96-hour acute toxicity tests.
- IV. Study Schedule: Initial year: FY99; final year: FY00. All activities scheduled to be completed by the end of February 2001.
- V. Relationship to RIPRAP:

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

Because selenium contamination is a concern throughout the Colorado River Basin, the proposed research is also relevant to the completed project entitled "*Assessment and Prediction of Effects of Selenium Exposure to Larval Razorback Sucker*" (CAP-6 SE-1), the ongoing project entitled "*Selenium Effects on Larval Razorback Suckers: Field Verification of Laboratory Results*" (CAP-6 SE-2) and the following components of the 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.4. develop and implement levee removal

II.A.4.a. preconstruction contaminants screening

VI. Accomplishment of FY 00 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

The objective of this investigation was to compare the relative sensitivity of razorback sucker (*Xyrauchen texanus*) and flannelmouth sucker (*Catostomus latipinnis*) to selenium exposure using early life-stage (ELS) toxicity tests. Species comparisons were made by exposing larval fish to gradients of selenate-contaminated water (<1, 25.4, 50.6, 98.9, and 190. µg/L) and food organisms (<0.702, 1.35, 2.02, 4.63, and 8.24 µg/g). Dietary exposure was accomplished by culturing food chains (algae, rotifer, and 41-d-old razorback or 11-d-old flannelmouth sucker) in the selenium gradient. Survival, growth, and whole-body selenium concentrations of larvae were measured at the end of a 28-d exposure period.

No negative effects on survival or growth were detected. Existing guidelines suggest that exposure to dietary selenium concentrations greater than 3 µg/g dry weight produce adverse effects in fish. In our study, the highest dietary exposure concentration in rotifer was 8.24 µg/g. Results are consistent with findings of other laboratory food-chain investigations with fathead minnow. Together, results of our food-chain investigations suggest that the threshold for adverse effects from dietary exposure is above 8.24 µg/g selenium for larval razorback and flannelmouth suckers.

A separate study was conducted to compare the relative sensitivity of razorback sucker, flannelmouth sucker, and fathead minnow to dissolved selenate using standard 96-hour acute toxicity tests. Median lethal concentrations and 95% confidence limits for

razorback sucker, flannelmouth sucker, and fathead minnow exposed to dissolved selenium were 35.5 (32.3, 38.8), 32.5 (28.9, 35.1), and 21.8 mg/L (18.6, 25.2), respectively.

Results of this investigation do not support the hypothesis that larval razorback sucker are more sensitive to selenium exposure than flannelmouth sucker. Both species had similar responses to dietary selenium concentrations up to 8.24 µg/g, and to acutely toxic dissolved selenium concentrations. It should be noted that larval razorback sucker were 30 and 5 days older than flannelmouth sucker in the ELS and acute tests, respectively. It is not certain how this age difference may have influenced relative sensitivity of the two species.

Lack of detection of adverse effects from exposure does not imply that razorback sucker populations are not affected by increased selenium concentrations. Other life stages may be affected by ambient selenium concentrations in some environments.

Shortcomings: None.

VII. Recommendations:

Conduct investigations to evaluate potential for reduced overwinter survival of young-of-year fish from selenium exposure.

Conduct investigations to predict selenium bioaccumulation in wild adult razorback sucker and link bioaccumulation to natural movements of fish using radio telemetry.

Conduct mesocosm-scale investigations with young-of-year fish to evaluate effects of exposure under environmentally realistic conditions of selenium cycling, physical habitat, and natural food organisms.

Consider additional investigations on effects of selenium on reproductive success depending on conclusions of previous investigations.

VIII. Project Status: Draft final report has been approved by the Biology Committee. Preparation of the final report is underway and should be available February 2001.

IX. FY 00 Budget Status

A. Funds Provided: \$16,300

B. Funds Expended: \$15,000

C. Difference: \$1,300 to cover indirect and direct costs of report printing and distribution.

A. Percent of the FY 00 work completed, and projected costs to complete: Proposed research is 99% complete; remaining budget is adequate to finish this component.

- B. Recovery Program funds spent for publication charges: \$0.00
- X. Status of Data Submission (Where applicable): NA
- XI. Signed: Daniel W. Beyers, Ph.D. 7 December 2000
Principal Investigator Date