Work Task C32: Determination of Salinity, Temperature, and Oxygen Limits for Bonytail and Razorback Sucker

FY11 Estimate	FY11 Actual Obligations	Cumulative Expenditures Through FY11	FY12 Approved Estimate	FY13 Proposed Estimate	FY14 Proposed Estimate	FY15 Proposed Estimate
$100,000	$92,560.49	$265,682.30	$125,000	$115,000	$115,000	$115,000

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Start Date: FY09

Expected Duration: FY17

Long-term Goal: To develop and maintain high quality backwater habitats for native fishes.

Conservation Measures: RASU2, RASU3, RASU5, RASU6, BONY2, BONY3, BONY5.

Location: LCR MSCP Native Fish Laboratory, Boulder City, Nevada.

Purpose: To determine RASU and BONY early life stage thresholds of survival for salinity, dissolved oxygen, temperature, and pH.

Connections with Other Work Tasks (past and future): This work began under Adaptive Management Research Projects (G3). This work is related to management of fish habitat restorations sites (e.g., E14).

Project Description: This study will evaluate through laboratory testing the threshold levels needed to sustain various life stages of RASU and BONY in backwater habitats developed by the LCR MSCP. This study was originally planned to run through FY12 and look at single parameter thresholds (salinity, dissolved oxygen, and temperature). Reclamation has now extended the study for five years to allow for the inclusion of pH studies and the investigation of double parameter tests for eggs, larvae, and fingerlings.

Previous Activities: Laboratory research began in March of FY07 under work task G3. Salinity concentrations evaluated during the first two study years indicated that upper salinity tolerances ranged from 11,000 to 12,000 µS/cm and from 23,000 to 27,750 µS/cm for RASU eggs and larvae respectively. Observations during larval trials showed that long-term survival may be possible at salinities as high 23,000 µS/cm when larval RASU are properly acclimated. FY09 was the first year this continuing research was accomplished under work task C32. During this study year research to determine RASU early life stage dissolved oxygen limits was conducted. Results from egg trials indicate that the lower dissolved oxygen limit for this life stage is in the 2.5 to 3 mg/L range. The limit observed for RASU larvae was slightly lower, with increased mortality occurring at dissolved oxygen concentrations near 2 mg/L. Larvae exposed to concentrations of 3mg/L or greater showed low levels of mortality and displayed no behavioral

abnormalities. Research during the FY10 study year was focused on determining the threshold levels of pH for early life stage RASU. Results from egg trials indicate that the threshold levels for successful embryo development are between pH 9 and 10. The pH threshold observed for RASU larvae was slightly higher, with long-term exposure (20 days) to pH 10 resulting in 98% survival.

FY11 Accomplishments: Research during this study year focused on determining the threshold levels of pH for fingerling BONY and RASU survival. Trials for BONY and RASU were run separately, and both were exposed to pH ranging from 7 to 11 at 20°C and 30°C. Survival was evaluated at 72 hours (acute toxicity) and after 15-20 days of exposure (chronic toxicity). Each pH treatment was run as a static bath in triplicate and each tank contained 20 or 25 fish depending on availability. Water quality was recorded at least three times each day, and manual water exchanges were performed when un-ionized ammonia concentrations (measured as mg NH3-N/L) began to increase. Bio filters were also used to alleviate un-ionized ammonia buildup.

Results from BONY trials indicate that the threshold levels for survival are likely near pH 10 at both 20°C and 30°C. At both temperatures low levels of mortality were observed during the first 72 hours, but mortality increased to 93% after 20 days of exposure at 20°C and to 83% after 15 days of exposure at 30°C. Survival improved at pH 9.5 with only 22% mortality after 28 days at 20°C and approximately 40% mortality after 15 days at 30°C. It should be noted however that BONY exposed to pH 9 at 20°C displayed zero mortality over 20 days and only 8% mortality after a 15 day exposure at 30°C.

Results from RASU trials also indicate that the threshold levels for survival are likely near pH 10 at both 20°C and 30°C. For the 20° trials, zero mortality was observed during the first 72 hours, but mortality increased to 87% after 15 days of exposure. Survival at 30°C was lower, with 38% mortality observed in the first 72 hours and 97% mortality observed over 15 days. Similar to the results from the BONY trials, RASU survival increased significantly in pH 9.5 and below.

FY12 Activities: Research during this study year will be focused on determining dissolved oxygen limits for fingerling BONY. It is anticipated that multiple trials will be run to evaluate the combined effects of increased temperature and decreased dissolved oxygen on BONY survival. The current study design includes dissolved oxygen levels of 1 mg/L to saturation (at 1 mg/L increments) and temperatures of 20°C, 25°C, and 30°C. Additional trials may be conducted for fingerling RASU if they become available during the study year.

Proposed FY13 Activities: Research actions will continue to build based on findings from previous study years, observations and measurements made during monitoring, and the review of available literature.

Pertinent Reports: Study plans are available upon request. A draft report, *Effects of Elevated pH on Egg and Larval Stages of Razorback Sucker,* detailing the 2010 pH study is in review, and the 2011 annual report, *Effects of Temperature and Elevated pH on mortality of Juvenile Bonytail and Razorback Sucker,* is in development.