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

FY12 Estimate	FY12 Actual Obligations	Cumulative Expenditures Through FY12	FY13 Approved Estimate	FY14 Proposed Estimate	FY15 Proposed Estimate	FY16 Proposed Estimate
$125,000	$115,711.54	$381,393.84	$115,000	$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 restoration sites.

Project Description: This study will determine through laboratory testing the upper and lower limits of water quality parameters needed to sustain various life stages of BONY and RASU in backwater habitats developed by the LCR MSCP.

Previous Activities: Salinity concentrations evaluated during FY07 and FY08 indicated that upper salinity tolerances ranged from 11,000 to 12,000 µS/cm for RASU eggs, and from 23,000 to 27,750 µS/cm for RASU larvae. Observations during larval trials also showed that long-term survival may be possible at salinities as high 23,000 µS/cm when larval RASU are properly acclimated.

During FY09, research focused on determining dissolved oxygen limits for early life stage RASU. Results from egg trials indicated 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 indicated 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.

Research during FY11 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. Results from BONY trials indicated that the upper lethal limit is near pH 10 at both 20°C and 30°C. Low levels of mortality were observed at both temperatures 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 increased in lower pH trials and it should be noted 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 indicated that the upper lethal limit is near pH 10 at both 20°C and 30°C. For the pH 10 trial run at 20°C, zero mortality was observed during the first 72 hours. However, mortality for this treatment 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, survival increased for RASU exposed to pH 9.5 and below.

FY12 Accomplishments: Research during this study year focused on determining the lower lethal dissolved oxygen limits for fingerling BONY. Trials were run at both 20°C and 30°C, and fish were exposed to dissolved oxygen concentrations of 2-6 mg/L in triplicate. Survival was evaluated at 72 hours (acute toxicity) and after 15 or 20 days of exposure (chronic toxicity).

Results from the 20°C trials indicated that the lower lethal dissolved oxygen limit is below 2 mg/L at this temperature. Only 17% mortality was recorded for BONY exposed to the 2 mg/L treatment for 15 days, and all mortality for this treatment occurred within the first 24 hours of exposure. Mortality for the remaining treatments was greatly reduced, with only 1% mortality for all fish exposed to oxygen concentrations of 3-6 mg/L.

Results from the 30°C trials indicated that the lower lethal limit is near 2 mg/L at this temperature. Sixty-seven percent mortality was observed for this treatment at 72 hours, and 100 percent mortality was observed at 18 days. Mortality decreased incrementally as dissolved oxygen concentrations increased for the remaining treatments at 30°C. Twenty-day mortality was observed at 57 percent, 37 percent, 5 percent, and 5 percent for 3, 4, 5, and 6 mg/L treatments, respectively.

FY13 Activities: Research during this study year will be focused on determining dissolved oxygen limits for BONY eggs and larvae. 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 from 2 mg/L to saturation (at 1 mg/L increments) with temperatures ranging from 20°C to 30°C.

Proposed FY14 Activities: Research actions will continue based on findings from previous study years, observations and measurements made during monitoring, and the review of available literature.

Pertinent Reports: The 2011 report, *Effects of Temperature and Elevated pH on Mortality of Juvenile Bonytail and Razorback Sucker,* and the 2012 report, *Dissolved Oxygen Tolerances of Juvenile Bonytail* will be posted to the website.