

Work Task C40: Genetic and Demographic Studies to Guide Conservation Management of Razorback Sucker and Bonytail in Off-Channel Habitats

| FY14 Estimate | FY14 Actual Obligations | Cumulative Expenditures Through FY14 | FY15 Approved Estimate | FY16 Proposed Estimate | FY17 Proposed Estimate | FY18 Proposed Estimate |
|---------------|-------------------------|--------------------------------------|------------------------|------------------------|------------------------|------------------------|
| \$180,000 | \$180,030.92 | \$509,383.69 | \$190,000 | \$275,000 | \$275,000 | \$275,000 |

Contact: Jeff Lantow (702) 293-8557, jlantow@usbr.gov

Start Date: FY10

Expected Duration: FY18

Long-Term Goal: Effective fishery management of backwater habitats developed under the LCR MSCP

Conservation Measures: RASU2, RASU6, BONY2, and BONY5

Location: Backwater habitats (Reach 2–5)

Purpose: To quantify genetic and demographic parameters that are necessary for informed, long-term management of razorback sucker and bonytail in off-channel habitats

Connections with Other Work Tasks (Past and Future): This work task is related to Work Tasks B7, C25, C31, C56, and G3.

Project Description: In Lake Mohave and elsewhere, razorback sucker and bonytail demonstrate a group spawning behavior whereby a female will spawn with multiple partners many times over a period of a few weeks. These observations led biologists to believe that all possible genetic crosses were being made during the spawn. However, analyses of adult razorback sucker placed into the Yuma Cove backwater in 1991 and 1992, along with analyses of the larval razorback sucker produced each year, showed that not all of the adults contributed genetic material to the next generation. It is possible that individual adults do not spawn every year, or that even if they do, they do not always contribute genetic material to the next generation. This information needs to be verified in order to model a population structure within these isolated habitats over subsequent generations and to predict at what frequency genetic material needs to be exchanged between habitats to maintain the robustness of the overall razorback sucker and bonytail populations within the LCR MSCP area.

Demographic and genetic information will be collected that will lead to recommendations to optimize long-term management of off-channel habitats for these two critically endangered fishes. Genetic data will be captured from larval, juvenile, and adult razorback sucker and bonytail from at least two replicate groups from off-channel habitats. Characterization of microsatellite and mitochondrial DNA variation will be used to assign the parentage of individual larvae to specific adults. These data can then be compared and contrasted to determine the actual number of individuals that participate in annual spawning activities, census the populations, and quantify patterns of survivorship.

There are three phases to the study: field observations, laboratory analyses of genetic materials, and modeling of population dynamics. The study will require multiple years of data collection and analyses; final recommendations are anticipated by 2018. Numbers of samples will be fewest during the first 2 years of the study, but estimated costs are initially high to cover the purchase of specialized, analytical equipment.

This project requires stable populations for both razorback sucker and bonytail to allow for multiple years of censusing. These stable populations are currently unavailable for razorback sucker, and bonytail will be incorporated into the study as habitats and populations of bonytail become available.

Previous Activities: Adults, larvae, and juveniles have been genotyped, and multiple iterations of in situ spawning have been completed in the AJ, Dandy, and Yuma Cove backwaters along Lake Mohave. Collections from FY10 to FY13 were analyzed, identifying considerable variability in individual reproductive success within and especially among different lake-side ponds.

FY14 Accomplishments: The AJ backwater has typically produced offspring that remained viable into the autumn, with little change in the proportion of individuals contributing to larval production across years. This year was similar to FY13, as the proportion of the original individuals contributing to larvae was reduced. There were also fewer juveniles captured this fall; however, a pond breach in the summer may explain this result. There were no larvae or juveniles obtained from the Dandy backwater. This was the second year of sampling from the Yuma Cove backwater; larvae were readily captured, with parental contributions to larvae reduced and similar to AJ for this year. Despite high survivorship of remaining resident adults, nearly 85% of individuals stocked into the Yuma Cove backwater died shortly after stocking. Furthermore, only two of the newly stocked males contributed to larval production. This pattern was unexpected, as individuals from the same lot stocked into the AJ and Dandy backwaters at the same time did not exhibit similar patterns of mortality.

Despite the high level of contribution of different stocked individuals to the larval pool, a small proportion of individuals seemed to be contributing a relatively large number of larvae in any given year. This variation needs to be quantified in order to effectively generate a management strategy for backwater ponds.

Three Lake Mohave backwater ponds were no longer being used for razorback sucker production, so they were dedicated to bonytail genetic experiments. The North Nine Mile, Nevada Egg, and Nevada Larvae backwaters were all stocked with equal numbers of male and female adult bonytail. Spawning was successful in the North Nine Mile and Nevada Egg backwaters. From these backwaters, 397 and 593 genetic samples of larvae and age-0 fish samples were collected from North Nine Mile and Nevada Egg, respectively. Parentage was determined for almost all larvae and age-0 fish samples produced within the North Nine Mile and Nevada Egg backwaters. Reproductive success was high for both sires (fathers of the progeny) and dams (mothers of the progeny) in both backwaters. Reproductive success differed dramatically between backwaters. Allelic diversity declined between the parental and progeny collections although this decline was not statistically significant.

FY15 Activities: The addition of the two bonytail backwaters has resulted in an increased effort for the backwater genetic work and is expected to impact budgets in subsequent years. Razorback sucker and bonytail spawn at different times of the year, and this limits the amount of cost sharing while collecting larvae. Sample collections and analyses similar to previous years will continue for both razorback sucker and bonytail dedicated backwaters.

In the Yuma Cove backwater, the relative survival of the newly stocked razorback sucker versus the surviving razorback sucker from previous years will be monitored. Additional augmentation to this population may be required to maintain an adult population in excess of 150 individuals. The AJ and Dandy backwaters will be used to provide replication that will allow the assessment of stability of life history parameters. Data suggest that these patterns are fluctuating regularly over time.

Proposed FY16 Activities: Efforts will be expanded in FY16 to evaluate additional research questions about razorback sucker and bonytail and to address challenges encountered in previous study years. Budget estimates in FY16–18 correspond to these changes and additional efforts. Stocking densities will be reduced in the AJ and Dandy backwaters (100 individuals per location) to assess the impact of reduced density on life history parameters. Additional genetic tools will be used to assess the differences in parental contributions among backwaters and attempt to identify the factors contributing to these differences. The adult razorback sucker population at the Yuma Cove backwater will also need to be augmented again to re-establish the population there; reproduction and survivorship will also continue to be monitored. Additional years of sampling

and analyses will be required to be able to draw inference regarding the long-term genetic management of these backwaters. Protocols for collections and analyses will continue, similar to previous years.

Pertinent Reports: Two interim reports (2011 and 2012) titled *Genetic and Demographic Studies to Guide Conservation Management of Bonytail Chub and Razorback Sucker in Off-Channel Habitats* are posted on the LCR MSCP Web site, and a final report is completed and will be posted on the Web site as well. An additional report titled *Development and Characterization of Microsatellite PCR Primers for Bonytail Chub for Use in Assessing Relatedness of Fishes Produced in Off-Channel Habitats* was completed under Work Task G3 and will also be posted on the Web site.