

## Work Task C30: Development and Evaluation of Measures to Reduce Transport of Quagga Mussel During Fish Transfer and Stocking Activities

FY11 Estimate	FY11 Actual Obligations	Cumulative Expenditures Through FY11	FY12 Approved Estimate	FY13 Proposed Estimate	FY14 Proposed Estimate	FY15 Proposed Estimate
\$150,000	\$91,603.18	\$237,588.46	\$150,000	\$160,000	\$0	\$0

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**Start Date:** FY09

**Expected Duration:** FY13

**Long-term Goal:** Maintain effectiveness of the fish augmentation program.

**Conservation Measures:** BONY2, BONY3, BONY4, BONY5, RASU2, RASU3, RASU4, RASU5, RASU6, and RASU8.

**Location:** Various state and federal hatcheries and laboratories in Boulder City, Nevada; Willow Beach, Arizona; Cornville, Arizona.

**Purpose:** To develop and test measures to assure non-transmittal of quagga mussel larvae and adult quagga mussels during the fish transport and stocking activities of the LCR MSCP Fish Augmentation Program.

**Connections with Other Work Tasks (past and future):** This work is related to all fish facilities in B2, B3, B4, B5, B6, B7, B10, and B11 as RASU and/or BONY are moved between these sites and the lower Colorado River. Work began as a literature investigation under G3.

**Project Description:** This study will develop and test means to assure that quagga mussel larvae and adult mussels are not being transported throughout the Colorado River system as a result of the Fish Augmentation Program. The original Fish Augmentation Plan called for capture of wild RASU larvae from Lake Mohave, which are provided to Willow Beach NFH (B2), Dexter NFH (B4), and Bubbling Ponds SFH (B5). In addition, RASU larvae and juveniles are transported from Willow Beach NFH to Lake Mead SFH (B6) and to lake-side rearing ponds (B7). BONY are transferred from Dexter NFH to Willow Beach NFH and to Achii Hanyo Rearing Station (B3), and directly to the river system. This is an acceptable pathway because quagga mussels are already present at the Willow Beach and Achii Hanyo facilities; therefore, no quagga-free facility is exposed to quagga infestation as the result of this strategy. Transfers of fish from quagga-infested facilities to non-infested facilities have been halted until such time that assurances can be made that quagga mussels are not being carried along with these fish. This study will attempt to develop measures to allow such certification.

**Previous Activities:** During January 2007, the exotic quagga mussel was discovered in Lake Mead, and subsequently found in both Lake Mead SFH (B6) and Willow Beach NFH (B2). Larval RASU that were to be transferred to Bubbling Ponds SFH (B5) were not collected (B1) and no RASU of any size or year class were delivered to waters outside the Lower Colorado River corridor. Quagga mussels have not severely impacted the maintenance or operations at Willow Beach NFH. However, quagga mussels continue to have an impact on delivery of fish. Preventing further movement or transfer of quagga mussels is a priority for state and federal agencies. Fish transport protocols for the lower Colorado River corridor have been developed and are under review by cooperating resource agencies. Studies conducted by the USFWS determined that concentrations of potassium chloride (KCl) and formalin, which had been recommended for killing quagga mussel larvae in transport water, were not effective in killing quagga larvae under the water conditions at Willow Beach NFH and the levels of KCl/formalin tested may be toxic to native fish species. In FY10 three chemicals were chosen for testing by USFWS at Willow Beach NFH to evaluate their effectiveness at killing quagga mussel life stages. Quagga mussel veligers exhibited resistance to most of the concentrations of all three chemicals tested in the 6-7 hour time frame allotted which simulates the average transportation time for stocking fish into the lower Colorado River. Mortality in 100% of veligers was observed only in the two highest concentrations of peracetic acid; however, BONY exposed to one half concentrations died in less than 30 minutes.

**FY11 Accomplishments:** A new two-year agreement was formed in FY11, as standard operating procedures with KCL/formalin were not found to be effective under water conditions present at Willow Beach NFH. Objectives of the new agreement are: 1) to perform a literature search on physiological stress responses of mussel species to chemical and environmental stressors, 2) to develop alternative treatment protocols, and conduct tests using those protocols in a laboratory setting on quagga mussel veligers at Willow Beach NFH to determine lethality, 3) to test protocols found to produce 100% mortality of veligers from objective 2 on endangered fish species to determine the effect of the treatment on fish, 4) based on the results from objective 3, conduct trials to evaluate lethality of treatment protocols under normal transport conditions with fish present, and 5) make management recommendations for hauling protocols to agencies transporting fish from quagga-positive waters. Objectives 1, 2, and part of 3 were accomplished in FY11. The literature search resulted in six chemicals being chosen for testing on quagga mussel veligers; benzocaine, clove oil, magnesium chloride ( $MgCl_2$ ), menthol, a clove oil/menthol mix, and propylene phenoxytol. Four of the six chemicals produced 100% mortality in quagga mussel veligers but only at relatively high concentrations within the specified time frames of each test. However, a high degree of physical deterioration was observed among the surviving veligers in the lower concentrations of  $MgCl_2$ . Preliminary acute toxicity tests with those four chemicals were then conducted on juvenile humpback chub at Dexter. Menthol, the clove oil/menthol mix, and propylene phenoxytol were found to be highly toxic, killing all the fish in less than 30 minutes in the concentrations needed to kill mussel veligers. Magnesium chloride has shown the most promise to date for a potential treatment to be used for quagga mussel veligers.

**FY12 Activities:** Research will be conducted to determine the lowest concentration of  $MgCl_2$  required to produce 100% veliger mortality. Research on the acute toxicity of  $MgCl_2$  to endangered larval fish species as well as the chronic effects on larval development will be conducted. Research on  $MgCl_2$  toxicity to mussel veligers may also be expanded to include

different water quality conditions such as temperature and hardness, and potential synergistic effects of chemical additives. Currently regulations on the use of  $MgCl_2$  to treat water containing fish intended for consumption are being investigated through cooperation with Colorado Division of Wildlife (CDOW). Investigations will continue in order to find alternative treatment methods and to establish a protocol that is effective at killing quagga mussel larvae without harming native fish.

Investigations into the efficacy of Zequanox, a trademarked bio-control agent, will also be undertaken in 2012. Zequanox has been shown to be effective in controlling the spread of quagga and zebra mussels in other parts of the country and work will be done to test its efficacy in the water quality parameters present in the Lower Colorado region.

**Proposed FY13 Activities:** Investigations will continue into alternative treatment regimes.

**Pertinent Reports:** The scope of work is available upon request. Annual reports from each year will be posted to the LCR MSCP website.