

## Current Research Activities

### Monitoring & Detection

- **Improvement of optical techniques for the detection of larval mussels** – This project is intended to improve methods for detecting zebra and quagga mussels in water samples using microscopy. Researchers are evaluating scanning electron microscopy (SEM) to validate findings from cross polarization microscopy. The outcomes are expected to assist with the identification of suspect organisms and improve confidence for early detection. *Reclamation contact:* Denise Hosler ([dhosler@usbr.gov](mailto:dhosler@usbr.gov))
- **Enumeration method validation for larval mussels** – This project seeks to develop improved methods and protocols for quantifying the number of larval mussel veligers in water samples. Enumeration in the sample analysis process will assist response planning efforts by providing, in the early stages, further information on level of infestation for response planning. *Reclamation contact:* Denise Hosler ([dhosler@usbr.gov](mailto:dhosler@usbr.gov))
- **Early detection of zebra and quagga mussels using Polymerase Chain Reaction (PCR)** – PCR is a method being developed and applied for confirmation of the presence of zebra and quagga mussels in water samples. The advantage of PCR is that it potentially represents a highly sensitive method for confirming the presence of mussel DNA in samples where mussel larvae (veligers) have been detected using microscopy. *Reclamation contact:* Dr. Kevin Kelly ([kkelly@usbr.gov](mailto:kkelly@usbr.gov))

### Control

- **Antifouling and foul-release coatings evaluations** – In partnership with Reclamation's LC Dams Office various commercially available protective coatings are being evaluated at Reclamation's Parker Dam. While this study is expected to expand in scope and continue for several years, promising coatings solutions are being identified and our current understanding regarding the effectiveness of different coatings systems in the context of invasive mussel fouling has improved. *Reclamation contact:* Dr. Allen Skaja ([askaja@usbr.gov](mailto:askaja@usbr.gov))
- **Filtration evaluations at Parker and Hoover Dams** – Although filtration has limited application due to the relatively low capacity, there are many situations where filtration appears promising. Reclamation researchers, in partnership with Reclamation's LC Dams Office, are evaluating 40- and 80-micron self cleaning filtration systems developed for ballast water applications. The purpose is to demonstrate the practicality and effectiveness of filtration in either excluding or preventing settlement in water supply lines and cooling water systems. The added advantage of filtration is that it eliminates the need for conventional oxidizing chemicals. *Reclamation contacts:* Fred Nibling ([fnibling@usbr.gov](mailto:fnibling@usbr.gov)) & Leonard Willett ([lwillett@usbr.gov](mailto:lwillett@usbr.gov))
- **Ultraviolet (UV) treatment evaluations at Hoover Dam** – Reclamation researchers will be evaluating ultraviolet (UV) treatment as a means for impeding mussel settlement in water supply lines and potentially power plant cooling water systems. The primary advantage of this treatment method is that it would eliminate the need for conventional oxidizing chemicals and as such it represents an environmentally safe alternative to mussel control. An added advantage of UV is the known effective treatment for other waterborne organisms in drinking water systems. *Reclamation contacts:* Fred Nibling ([fnibling@usbr.gov](mailto:fnibling@usbr.gov)) & Leonard Willett ([lwillett@usbr.gov](mailto:lwillett@usbr.gov))

- **Field trials using *Pseudomonas fluorescens*** – In partnership with Marrone Bio Innovations (MBI), field demonstration of Zequanox™, a bacterial product made from dead *Pseudomonas fluorescens* in controlling adult quagga mussels is being pursued. This new product is lethal only to quagga and zebra mussels, it potentially offers an environmentally friendly alternative to many conventional molluscicides, and it is expected to have wide-ranging applications for treatment of systems exposed to mussels. Reclamation is developing a Cooperative Research and Development Agreement with MBI. *Reclamation contacts:* Fred Nibling ([fnibling@usbr.gov](mailto:fnibling@usbr.gov)) & Leonard Willett ([lwillett@usbr.gov](mailto:lwillett@usbr.gov))
- **Modifications to Davis Dam service water intake to enable field evaluations** – For field testing of Zequanox® and other promising treatment methods, it was necessary to modify the service water intake at Davis Dam to isolate service water system. Under this same project, Reclamation took the opportunity to demonstrate the effectiveness of high pressure water jetting for cleanout of a heavily infested service water line. This project was completed in December 2008. *Reclamation contacts:* Dr. Allen Skaja ([askaja@usbr.gov](mailto:askaja@usbr.gov)) & Aaron Muehlberg ([amuehlberg@usbr.gov](mailto:amuehlberg@usbr.gov))
- **Investigation of fish screening technologies to reduce mussel impacts** – Many Reclamation facilities throughout the Western United States have large investments in fish protection facilities. Recognizing the potential future impacts that invasive mussels pose to fish screen facilities, Reclamation is proactively studying promising screening technologies that can operate effectively and efficiently in the presence mussel infestations. To identify and develop solutions for fish screen facilities, Reclamation will be field-testing commercially available screen systems in mussel-infested water along the lower reaches of the Colorado River. *Reclamation contact:* Steve Hiebert ([shiebert@usbr.gov](mailto:shiebert@usbr.gov))
- **Controlling mussels with natural predators** – A variety of potential natural predators exist for control of invasive mussel populations. This project seeks, as an initial or scoping level effort, to identify those species that may have application to water delivery systems (e.g., canals) and provide recommendations for future research toward implementation. *Reclamation contact:* Cathy Karp ([ckarp@usbr.gov](mailto:ckarp@usbr.gov)) & Fred Nibling ([fnibling@usbr.gov](mailto:fnibling@usbr.gov))
- **Quagga mussel control using copper-ion generators** – The use of copper-ion generators for facilities protection from mussel settlement has been identified as having potential. Through this scoping-level effort, recommendations will be made regarding applicability and value of this technology for future field demonstration. *Reclamation contact:* Roger Turcotte ([rturcotte@usbr.gov](mailto:rturcotte@usbr.gov))

## Ecological impacts

- **Effects and spread of invasive mussels in lotic environments** – Recent infestations in the Western United States are expected to have significant ecological impacts similar to those experienced in the Great Lakes. However, an improved understanding of those impacts in the West is needed. The findings from this project are expected to highlight issues and assist in future prioritization of actions for mitigating invasive mussel impacts on natural resources. *Reclamation contact:* S. Mark Nelson ([snelson@usbr.gov](mailto:snelson@usbr.gov))

- **Impact of zebra mussels on the physical, chemical, and biological attributes of Lake Pueblo, Colorado** – In 2008, zebra mussels were detected in Lake Pueblo, Colorado. Having discovered these mussels in the very early stage of infestation affords the opportunity to track limnological changes in the water body as the infestation progresses. This is expected to provide further information regarding the manifestation and ecological impacts attributable to mussels. *Reclamation contacts:* Denise Hosler ([dhosler@usbr.gov](mailto:dhosler@usbr.gov)) & Davine Lieberman ([dlieberman@usbr.gov](mailto:dlieberman@usbr.gov)).