Factors Controlling Invasive Mussel Distribution in Arizona

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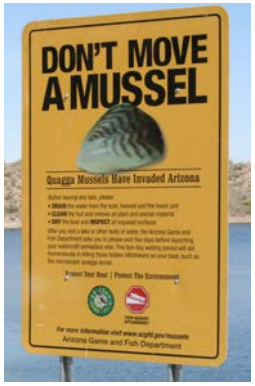
Background

Dreissena bugensis, known commonly as the Quagga mussel, is an invasive mollusk species that was introduced to North America from its native Ukraine in 1989 by way of Lake Erie. Since then, the species has spread throughout the great lakes and in 2007 was first found in Lake Mead. Quagga mussels continue to spread in the Colorado River basin and can now be found in Lake Havasu, Lake Pleasant, and the Central Arizona Project canal system. The mussels are extremely disruptive to the natural ecology of North American freshwater ecosystems. Although adults are only 20-25 millimeter in diameter, each individual mussel can filter up to a liter of water per day and remove essential phytoplankton, zooplankton, and algae that make up the base of the food chain in a freshwater ecosystem[9]. Additionally, the mussels also pose a threat to human water use by attaching to and damaging water intake valves at power and water treatment plants. They can also hurt the recreation industry by damaging boats, buoys, docks, and beaches. *D. bugensis* larvae, known as veligers, have been found in Salt River Project canals as well as the CAP canals, yet for a currently unknown reason have not been able to establish adult colonies in canals carrying SRP water. Presently the only known way to safely eliminate *D. bugensis* is through manual removal of adult mussels. Although edible to humans and many aquatic animals, the mussels accumulate toxins which are passed up the food chain to fish, birds, and potentially humans.



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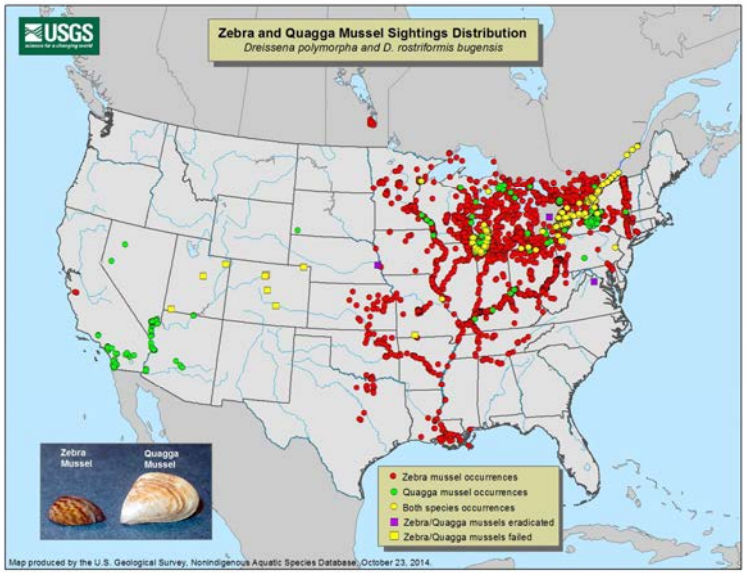

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Project Goals

- Identify factors that are preventing *D. bugensis* populations from establishing within SRP reservoir/ canal system
- Use knowledge gained to identify aquatic environments that are most sensitive or at risk to invasive mussel colonization so that they can be protected from future ecological and economic damage
- Use laboratory findings to develop new and improved methods of containment, prevention, and eradication if possible

Procedure

D. bugensis specimens are being collected from the Mark Wilmer Pumping Plant in Lake Havasu, Arizona by the Central Arizona Project. Plate traps have been laid out which the mussels will attach to and grow on. Once collected, the mussels will be transported to the lab and placed in a recirculating model canal that simulates flowrates and conditions of the CAP and SRP canal systems. A system with water acquired from the CAP canals will be set up as a control along with a system with water acquired from SRP canals. The survival of adult mussels will be observed. Further research will include observation of survival rates of adult mussels in CAP water with changing water quality parameters. Potential examples are:

Conductivity/Salinity – Average salinities in CAP water and SRP water are 650 mg/l and 480 mg/l respectively, well below the maximum survivable concentration of 60,000 mg/l demonstrated by Wright et al 1996 in brackish *Dreissena* populations. However, changes in the salinity can potentially affect microbial populations, including potential mussel pathogens[4,11].

Calcium – SRP water in Tempe averaged 47 mg/L while CAP water averaged 70 mg/L in 2011. According to Clark et al 2011, 25-125 mg/L concentrations show high colonization potential. Waters having higher calcium showing higher potential for mussel colonization[3,6].

Dissolved Oxygen – Dissolved oxygen concentrations less than 4 mg/l have shown to be inhibitory to veliger settlement. Regional water quality sampling has shown average D.O. concentrations to be higher in Lake Pleasant (CAP system) than Saguaro Lake (SRP System) with summer averages near/below the threshold respectively[5,7].

Microbial activity - Molloy et al 2013 demonstrated that a certain strain of *Pseudomonas fluorescens*, strain CL145A, was found to be highly pathogenic to *D. bugensis* in laboratory tests. While difficult, identification of microbial constituents in water samples can potentially identify other mussel pathogens that could be present in the Salt River reservoirs/ canals[10].

When testing the impact of chemical parameters on the mussels water in each canal will be subject to UV disinfection to kill any potential mussel pathogens. This ensures that any differences in survival are due to water chemistry and not microbial pathogens. Supplemental food sources will be provided for the mussels in the system. Other water quality parameters may also be tested with further research.

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