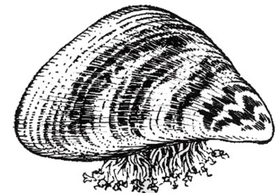
Effects of calcium on the survival of the invasive zebra mussel (Dreissena polymorpha).



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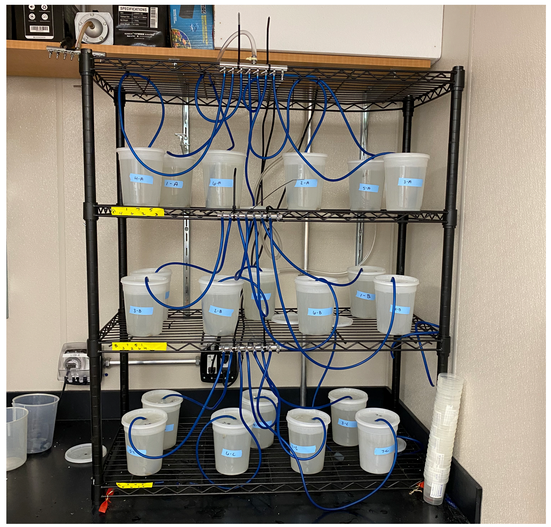
Abstract

Zebra mussels are an introduced species that has spread throughout much of the eastern United States and recently invaded Texas. These freshwater mussels cause ecological damage by reducing food available and outcompeting native clams. They cause significant economic damage by attaching to hard surfaces in the water such as pipes to factories and water treatment plants. Understanding where they might spread is an important step in controlling their invasion. Predicting their distribution can be challenging; however, several factors are indicative of where zebra mussels may spread (pH levels, temperature, calcium). Of these factors, calcium is currently viewed as the most significant. Zebra mussels needing calcium for general blood physiology, creating their calcium carbonate shells, and by developing larvae which have small shells. The working model is that zebra mussels will thrive in waters with calcium levels greater than 27mg/L, zebra mussel adults may survive but the larvae may not survive in calcium levels between 27-12 mg/L, and less than 12mg/L of calcium is too low for any stage of mussels to survive for an extended period. My projected look at survival of zebra mussels at varying concentrations of calcium in waters on zebra mussels. Differing calcium levels of 0, 5, 10, 20, and 30 mg/L in artificial pondwater were be used to determine at what levels of calcium zebra mussels are able to survive.

Introduction

Zebra mussels are an introduced species that has spread throughout much of the eastern United States and recently invaded Texas. These freshwater mussels cause ecological damage by reducing food available and outcompeting native clams. They cause significant economic damage by attaching to hard surfaces in the water such as pipes to factories and water treatment plants. Understanding where they might spread is an important step in controlling their invasion. Predicting their distribution can be challenging; however, several factors are indicative of where zebra mussels may spread (pH levels, temperature, calcium). Of these factors, calcium is currently viewed as the most significant. Zebra mussels needing calcium for general blood physiology, creating their calcium carbonate shells, and by developing larvae which have small shells. The working model is that zebra mussels will thrive in waters with calcium levels greater than 27mg/L, zebra mussel adults may survive but the larvae may not survive in calcium levels between 27-12 mg/L, and less than 12mg/L of calcium is too low for any stage of mussels to survive for an extended period. I will conduct research on the effects of varying concentrations of calcium in waters on zebra mussel adults or developmental stages. Differing calcium levels of 0, 5, 10, 20, and 30 mg/L in artificial water will be used to determine at what levels of calcium are gametes are viable, at what levels fertilization occur, at what levels larvae can survive and develop.



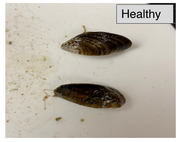
Methods

Zebra mussels were placed in plastic 1L cups on a shelved unit with 10 zebra mussels per container. There were three 1L cups per solution of concentration (0,5,10,15, 20, 30, and deionized water) for a total of 21 cups. Each shelf had one cup of each concentration placed at a randomized order. Zebra mussels were fed consistently three times a week and the water was changed once a week at which times the cups were inspected for dead specimens. Temperature and oxygen levels were also checked once a week.

Declined mussel health in low calcium waters

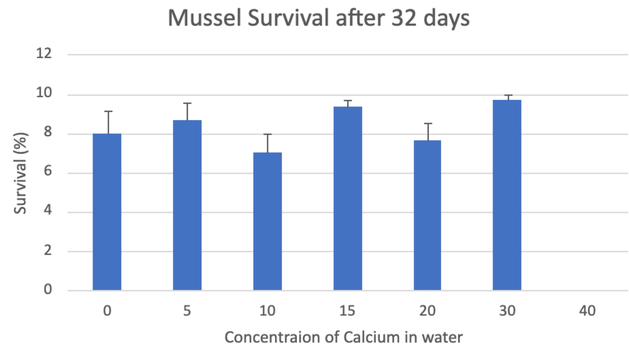
Mussels held in High Risk Waters

Mussels held in Low Risk Waters



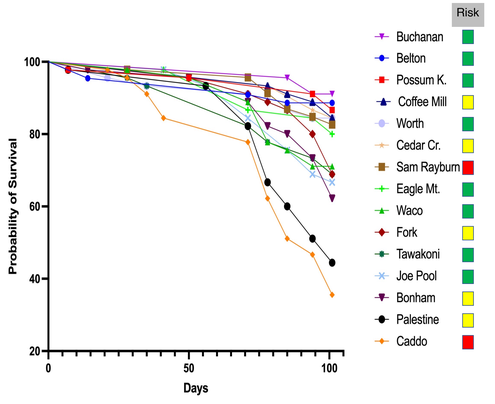
Mussels in low calcium waters (Low Risk – right) showed decreased health as indicated by decaying of the periostracum (the outer, organic layer of the shell) relative to mussel in high calcium (High Risk – left)

Survival of mussels in waters of varying calcium concentrations.



Mussels were housed in water containing various calcium concentrations for 32 days.

Survival Probability for mussels of varying calcium concentrations.



Probability of survival for zebra mussels after 32 days based on a Mantel-Cox test.

Conclusions

- Mussels in water with lower calcium levels showed reduced survival and declining health.
- Mussels in water with lower calcium levels showed reduced survival probability.

Acknowledgement

- TCU SERC funding
- Dr. Mike Misamore

Literature Cited

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