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Quantitative Survey of Zebra Mussels (*Dreissena polymorpha*) Within Wilson Lake and Kanopolis Lake

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ABSTRACT

Zebra mussels, *Dreissena polymorpha,* are a non-native invasive species that are capable of causing substantial ecological and economic damage. They have been spreading throughout the United States since 1986. Research was conducted at Wilson Lake and Kanopolis Lake in Kansas to develop a better understanding of the habitats that zebra mussels prefer to infest. A rocky, sandy, and Marina habitat, were chosen at both lakes. A total of six locations, three in each lake were studied in this report. Five samples were taken at each location on two different dates, the first being in September and the second in December. The samples were analyzed to determine a population difference in habitats for the zebra mussels. It was concluded that zebra mussels were present in Wilson Lake at the "rocky" habitat and the Marina. However, the "rocky" habitat had a more established population with a mean value of 242.00 ± 17.74 in comparison to the Marina with a value of 119.30 ± 8.38. However, the sandy habitat at Wilson Lake did not show any signs of zebra mussel inhabitation. No zebra mussels were found at any of the Kanopolis Lake sampling areas.

Keywords: *Zebra mussels (Dreissena polymorpha), Wilson Lake, Kanopolis Lake.*

INTRODUCTION

The zebra mussel (*Dreissena polymorpha*) is a small mollusk native to Europe and Asia. It was first introduced, most likely inadvertently, to the United States around 1985. They were first detected in the Great Lakes, but since then, the zebra mussels have been spreading to other parts of the country. Currently, they are present in all of the Great Lakes, many rivers, and 230 other lakes through the United States (Benson 2010). Since introduction of *Dreissena polymorpha* to Kansas in 2001, they have infested 18 different bodies of water including Marion Reservoir, Milford Lake, Cheney Reservoir, and the Missouri River. Any species introduced into a new environment can potentially cause problems within the ecosystem, but zebra mussels are capable of causing both ecologic and economic problems. *Dreissena polymorpha* reproduce at such a high rate that one mature female can produce up to one million eggs within a lifetime. They obstruct irrigation systems, boat motors, as well as disrupt the natural ecosystem (KDHE 2003). Several methods to rid the lakes of these invaders have been proposed, such as chemical treatments and introduction of a predator, but both could cause negative impacts on the lake. Chemical treatment can interfere with other species within the ecosystem along with humans that partake in the lake. The most effective method is prevention. Preventing the further spread of *Dreissena polymorpha* can be done by washing boats with warm water and soap immediately following removal from an inhabited lake. (Benson 2010) Also, by not transporting water from one infested body of water to another (Benson 2010).

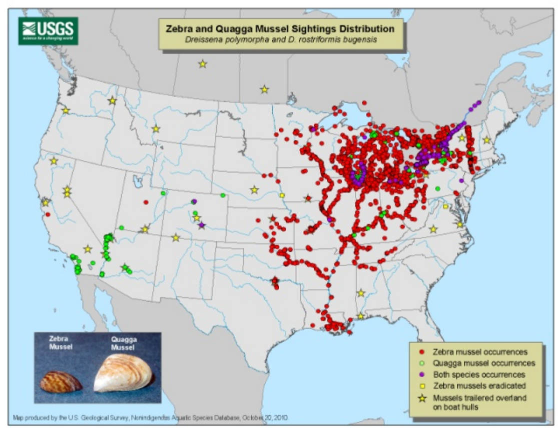

Figure 1. The outbreak of *Dreissena polymorpha* throughout the United States is shown on this map.

It is important to recognize the habits of this invasive species in order to understand the effects on the ecosystem of the lake. "Zebra mussels [*Dreissena polymorpha* (Pallas)] provide an example of an invasive species that influences community structure and ecosystem function of lakes due to rapid establishment and high filtering capacity" (Naddafi 2007).

Several different models of zebra mussel population dynamics have been proposed. One being that the invader will develop slowly, and then increase rapidly until some equilibrium is reached (Burlakova 2006). Another, known as "boom and bust," suggests a collapse following an extremely high density (Burlakova 2006). The first step in distinguishing these organisms is examining population dynamics. In this study, density measurements were taken from different locations on Wilson and Kanopolis Lakes. Using those measurements, an average population per environment was derived. The purpose of this experiment was to develop an understanding of what environments *Dreissena polymorpha* prefer to develop in, and use that information to slow, stop or even eliminate this non-native species from our lakes. Education regarding this invasive species is vital to controlling the outbreak in the United States. With the information gathered, I hope to educate the public on proper techniques to stop the spread of mussels, while also providing more data for development of a remedy to this growing problem.

MATERIALS AND METHODS

Permission was obtained from the US Army Corps of Engineers for completion of this experiment. My points of contact were Nolan Fisher park manager of Wilson Lake, Lester Tacha park manager of Kanopolis Lake, and Dan Hays operations manager of Wilson and Kanopolis Lake. Additionally, Lester Tacha was consulted for habitat suggestions. The experiment was conducted at Wilson Lake which is located in Russell County, Kansas and Kanopolis Lake in Ellsworth County. Wilson Lake has an average depth of 24 feet, surface area of 9,020 acres, and it is located on the Saline River, controlling a drainage area of 1,917 square miles. Kanopolis Lake, on the other hand, has an average depth of 19 feet, surface area of 3,406 acres, and is located on the Smoky Hill River and controls a drainage area of 7,860 square miles. A measurable population of *Dreissena polymorpha* was found in Wilson Lake in 2009. Due to the recent finding of these invaders, the population has not reached the equilibrium that is often times met after introduction to a new location. Kanopolis Lake is still uninhabited by *Dreissena polymorpha*.

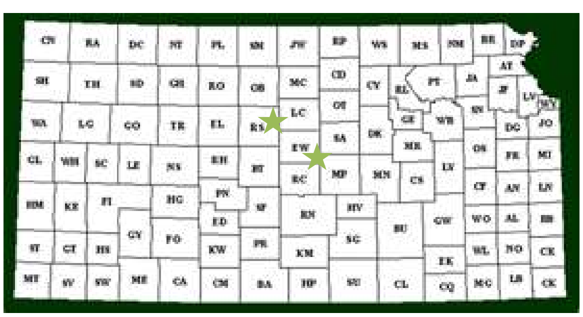

Figure 2. The two sampling locations, Wilson Lake and Kanopolis Lake, can be seen on this map of Kansas.

All samples were taken at three locations along the shoreline of each lake. The 3 locations were chosen in an attempt to resemble a location from the other lake. With the help of the park managers from Wilson and Kanopolis, I decided on a "sandy" area (Venango Beach and Tower Beach), a "rocky" area (Boldt Bluff Access and Hell Creek Bridge) and the marinas (Tower Harbor Marina and Lake Wilson Marina) from each lake.

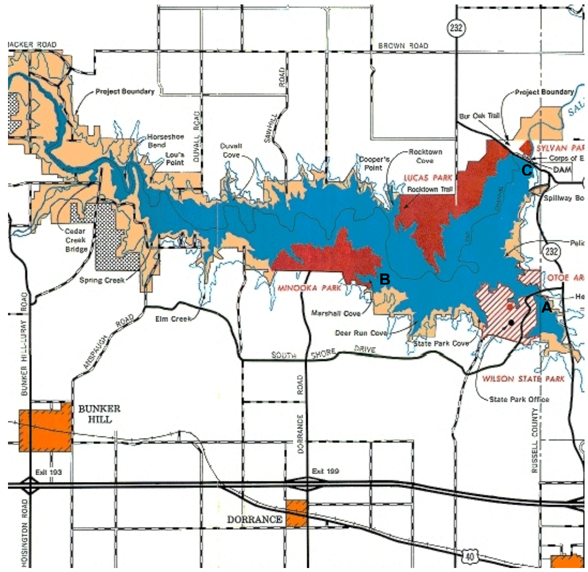

Figure 3. The sampling locations, Hell Creek Bridge (A), Wilson Lake Marina (B), and Wilson Lake Tower (C) can be found in this map of Wilson Lake.

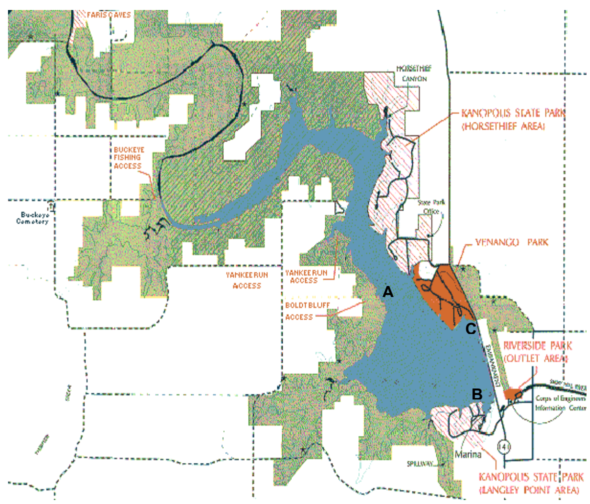

Figure 4. The sampling locations, Boldt Bluff Access (A), Tower Harbor Marina (B), and Venango Beach (C), can be found in this map of Kanopolis Lake.

The methods outlined in the USACE report for zebra mussel abundance prepared by the National Park Service were used to derive the methods for this study. From the three predetermined locations, five quadrants (1/8 m^2) were thrown randomly. All material within each quadrant to fingers depth was collected in a plastic pail with small holes approximately 3mm in diameter drilled in bottom to release water. The contents of the pail were then transferred to a plastic Ziploc bag labeled for each quadrant. Samples collected from each quadrant were labeled and stored in a cooler for later analysis. After going through the initial filtering process, each sample from each quadrant was examined separately to determine the exact number of zebra mussels in each sample. Photos and descriptions of *Driessena polymorpha* were used to determine the species present within the samples.

Several weeks after the secondary sampling, water was released from the Kanopolis Lake reservoir exposing much of the shoreline. A follow up observation was completed by walking the shorelines and examining for the presence of zebra mussels and none were found.

RESULTS

After each sample was collected and counted, the data was analyzed using SigmaStat. Each set of data was run through a descriptive statistics test. Because zebra mussels (Dreissena polymorpha) were not discovered at Kanopolis Lake during testing, Those samples were excluded from SigmaStat analysis.

The samples taken from Hell Creek Bridge at Wilson Lake on 9/22/10 had a mean value of 253.2 ± 43.57. While the samples taken on 12/11/10 had a mean value of 230.8 ± 69.77.

Wilson Lake Marina samples had a mean value of 120.6 ± 30.80 and 118 ± 25.03 respectively. The overall small size of the zebra mussel combined with relatively small amount of samples that were taken are the cause of the large standard deviations associated with the Wilson Lake Marina and Hell Creek Bridge values.

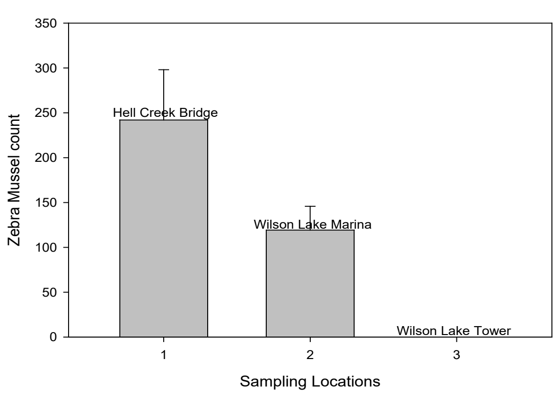

Figure 5. The values of *Dreissena polymorpha* found in the sampling locations at Wilson Lake also described in the text. The error bars show the standard deviation associated with each value.

Samples taken from the Wilson Lake Tower were also uninhabited by zebra mussels. This is most likely due to the terrain at this location. The Wilson Lake Tower provides a sandy environment that Dreissena polymorpha seem to have difficulty establishing in.

DISCUSSION

The Hell Creek Bridge location at Wilson Lake had a much larger overall mean value than the other locations. This large value is most likely due to the habitat that makes up that location. Hell Creek Bridge is an extremely rocky area with little sand. The zebra mussels at this location were stacked several layers high. This could be reflective upon the environment or the duration they have inhabited that particular location.

Samples taken at Wilson Lake Marina had a mean value much lower than the Hell Creek Bridge samples. Sampling at this location was slightly different from the others because the mussels were removed from the flotation supporting the docks. This means that the zebra mussels were under little water and their exposure was dependent on the lake elevation. I assumed the counts at the Marinas would be much lower than the other areas but sampled them due to the high boat traffic that enters and leaves the marinas. The zebra mussels here were only a couple layers thick leading me to believe that the population had not been there as long as the Hell Creek Bridge mussels or they did not prefer this area in comparison to the rocky area.

Wilson Lake Tower results were somewhat surprising. The values were anticipated to be much lower due to the environment, but were not expected to be nonexistent. This could be a result of the zebra mussels' habitat requirements or my sampling techniques. Some of the Dreissena polymorpha are so small that it would be difficult to detect them by sifting through wet sand.

After the analysis of all my samples of Kanopolis Lake, no *Dreissena polymorpha* were detected. This makes Kanopolis one of the last lakes in the area to still be uninhabited. With the surrounding lakes being infected and the high amount of visitation that occurs at Kanopolis Lake, the infestation of zebra mussels is probable.

For further research, I would suggest an increased amount of samples per location. This would allow for a more accurate mean value and standard deviation. The relative size of zebra mussels in comparison to the sampling location made it very difficult to get consistent values. I would also sample at completely random locations if possible. Meaning, I would not constrict the sampling locations to only on the shoreline. That would enable one to estimate a total population of Dreissena polymorpha for the entire lake. It would also be interesting to expand the environments that are sampled to include submerged objects such as trees. I believe these few changes would make a considerable difference in the outcome of the experiment.

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