DOES DEPTH AFFECT ZEBRA MUSSEL LENGTH IN SCALP LAKE?

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***Abstract*—Since its first sighting in 1996, zebra mussels *Dreissena polymorpha* have been confirmed in hundreds of Minnesota lakes. Not only were they found in lakes, but they are also found in rivers too. With lack of effective treatments to impede their spread, zebra mussels continue to colonize new areas causing ecological as well as economic harm. The objective of this study was to see if there was a relationship between a zebra mussel length and the depth, they are found using shell length (mm) and depth (cm). The comparison of zebra mussel length and depth was done by performing a regression analysis. On 18 October 2024, 150 zebra mussels were sampled at 10 different depths from the north, east, south, and west parts of Scalp Lake. Scalp Lake was chosen for the lake to sample because of the high-water clarity and the high number of zebra mussels present. Average zebra mussel length was 12.00 mm (SD = 1.20) on the north shore; 12.64 mm (SD = 1.64) on the east shore; 16.58 mm (SD = 1.57) on the south shore; and 12.65 mm (SD = 1.06) on the west shore. There was no significant relationship between zebra mussel length and depth in any quadrant around the lake (north shore P = 0.85; east shore P = 0.42; south shore P = 0.35; west shore P = 0.29). The results show that zebra mussel size is more related to lake location and less depth. This could be due to the fact that vegetation densities are different around each quadrant of the lake.**

I. INTRODUCTION

Originally from Eastern Europe, the zebra mussel *Dreissena polymorpha* is one of the most alarming invasive species in North America. It has drastically changed in recent decades, altered natural processes and resulted in billions of damaged objects. Every time a boat or other aquatic vessel goes to a different body of lake or river, there is a chance that zebra mussels get introduced to that water system. Since its first appearance in 1986 in Lake St. Clair (Roberts 1990), zebra mussels have rapidly expanded throughout the United States.

Zebra mussels are extremely efficient suspension filter feeders that take nutrients from the water column's phytoplankton while interfering with the normal flow and circulation of organic material. They have a significant impact on the water clarity of lakes and rivers due to their feeding on phytoplankton, bacteria, and other organic compounds (Cohen and Weinstein 1998). The more they eat, the clearer the water becomes. The invasion of shallow lakes and ponds by zebra mussels can potentially lead to a redirection of production and biomass from pelagic to benthic food webs (MacIsaac 1996). This shift in ecosystems can result in the transition to an alternative state.

Determining the length of a zebra mussel under water, at a certain depth, is difficult without the physical collection of the specimen. The objective of this study is to see if there is a relationship between the length of zebra mussels and how deep they are when they are collected in the north, east, south, and west parts of Scalp Lake.

II. METHODS

Study Area

Scalp Lake is a 103-hectare lake in the city of Frazee, within Ottertail County. The lake has a maximum depth of 27 meters. The recent zebra mussel infestation and the paucity of information regarding the population's condition are the reasons Scalp Lake was selected for this investigation. Furthermore, it is crucial to comprehend the potential effects of this invasive species on Scalp Lake and the surrounding lakes, since it is a component of numerous other bodies of water.

Sample Collection

Sampling occurred on 18 October 2024. Ten to fifteen zebra mussels were taken from 10 different depths (10 – 100 cm) from the north, east, south, and west quadrants of Scalp Lake. Waders were used to walk in the water and to locate the zebra mussels at the appropriate depth. Once the zebra mussels were taken from the water ground, they were put in plastic bags which were labeled with the appropriate quadrant and depth that they were collected. The zebra mussels were put in a cooler and then transported to the lab for measurements.

Data Analysis

The zebra mussels were measured to a hundredth of a millimeter (mm) using a micrometer. The measurement was taken along the longest axis of each individual zebra mussel. To test for a relationship between the zebra mussel length and sample depth, regression analysis was used on each quadrant of the lake separately.

III. Results

A total of 600 zebra mussels were collected and measured. Average zebra mussel lengths were taken from the north, east, south, and west shores. North shore: average zebra mussel length 12 mm (SD = 1.20). East shore: average zebra mussel length 12.64 mm (SD = 1.64). South shore: average zebra mussel length 16.58 mm (SD = 1.57). West shore: average zebra mussel length 12.65 mm (SD = 1.06). Regression analysis was used for each quadrant, (north shore P = 0.85); (east shore P = 0.42); (south shore P = 0.35); and (west shore P = 0.29).

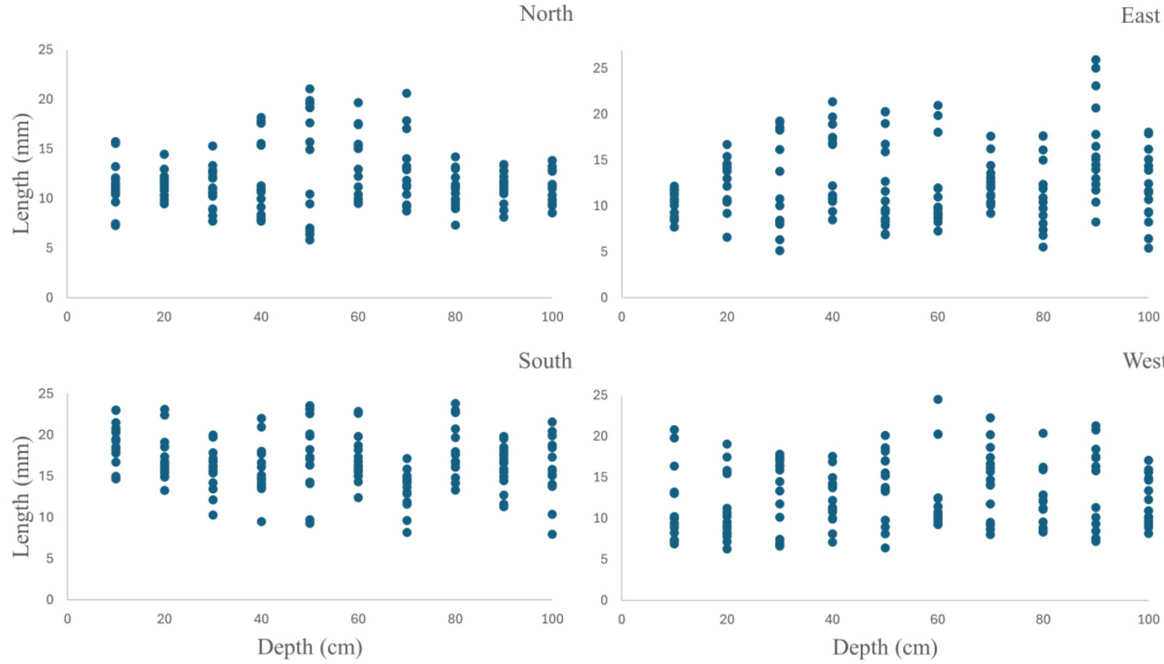

Fig. 5. The relationships between zebra mussel length (cm) and depth (cm) at the north, east, south, and west shore at Scalp Lake.

IV. Discussion

On the north, south, and west shores of Scalp Lake, there was not a significant relationship between zebra mussel length and depth. This result could be because of different limnological variables in Scalp Lake like Chlorophyll. Chlorophyll is important in determining zebra mussel growth because of the number of zooplankton and algae present at that location (Chakraborti et al. 2008). Zebra mussels thrive in nutrient rich environments which leads to rapid growth. The lack of zooplankton and other algae organisms is possibly why there is not a significant relationship with zebra mussel length and depth.

The growth rates of zebra mussels may have been influenced by many factors such as water temperature, food availability, and competition with other species (Garton and Johnson 2000). According to a study done in Lake Wawasee, scientists were doing a study on measuring the response of shell growth of zebra mussels in different environment gradients. Shell growth in mussels decreased with initial shell length and depth, with shallow water mussels having growth rates nearly twice that of deeper water mussels. In Lake Wawasee, growth took place early in the spring and differed greatly between locations. Additionally, the study discovered that mussel shell growth was not significantly impacted by the cage design or the spacing between growth cages.

By establishing a correlation between zebra mussel length, sample depth, and the areas of the lake from which they were gathered, this study developed a framework for comprehending Scalp Lakes zebra mussel populations. To support these conclusions, more research should be done on population patterns and the ensuing effects on the nearby water systems.

References

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