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Natural Science Fellowship Summary

Freshwater ecosystems in the Northeast are adversely impacted by road salt usage during winter months. In the state of Maine, high usage of road salt has led to an increase in salinity in some bodies of water (Dugan et al. 2017). A compound as common and seemingly innocuous as sodium chloride has been shown to have detrimental effects on reproduction, development, and general survival of some freshwater organisms (Karraker et. al, 2008). *Daphnia ambigua* is a species of zooplankton that inhabits bodies of freshwater, including ponds and lakes of Maine. *Daphnia ambigua* are considered a model species due to their sensitivity to pollutants in their environment and their role as a keystone species in aquatic ecosystems. These tiny crustaceans are a food source for many invertebrates and small fish, causing them to play a critical role in controlling algal productivity in lakes (Miner 2012). Due to their sensitivity, they are used as indicators of environmental stressors, and their response can shed light on ecological changes and imbalances (Martins 2007). The water chemistry of these lakes plays an important role when beginning to analyze and discuss the importance of calcium as a buffer towards salt toxicity. The harmful effects of salt can be counterbalanced via the addition of calcium.

During the summer of 2020, the Rogalski lab conducted an experiment testing the effect of sodium chloride on the health and reproduction of *Daphnia ambigua* amongst 3 lakes. They found that Daphnia from higher calcium lakes were most tolerant towards salt. This summer we conducted a similar experiment in order to quantify and analyze the effect of calcium chloride on the reproductive ability and growth of *Daphnia ambigua*. *Daphnia* from Hall Pond were used in the 6 experimental groups in order to control for genetic diversity. Hall water, Egypt water, and Hall water with added Ca+ were the three control groups. Calcium was added to Hall water to match the natural calcium levels found in Egypt pond water. These 3 control groups possessed a treatment counterpart that was spiked with 500 mg/L Cl-, resulting in 6 total groups (20 replicates per group). At the end of the 14-day trial, CellSens was used to photograph the *Daphnia* while ImageJ was used to measure and record the length of their bodies.

Following the end of data collection, we used RStudio to assist in data analysis and graphing. Offspring were collected and accounted for daily, over the course of 14 days at the Rogalski Lab. The addition of salt resulted in significant decreases in progeny between treatment groups. The treatment groups exposed to salt were heavily affected. Despite this, Hall water with the calcium addition proved to withstand and buffer the salt toxicity. On the other hand, Hall water without calcium resulted in the lowest number of progeny. In the future, this experiment should be repeated with greater accuracy in order to avoid minor issues and determine if Egypt water results in greater differences.

Faculty Mentor: Mary Rogalski
Funded by the Kufe Family Research Fellowship

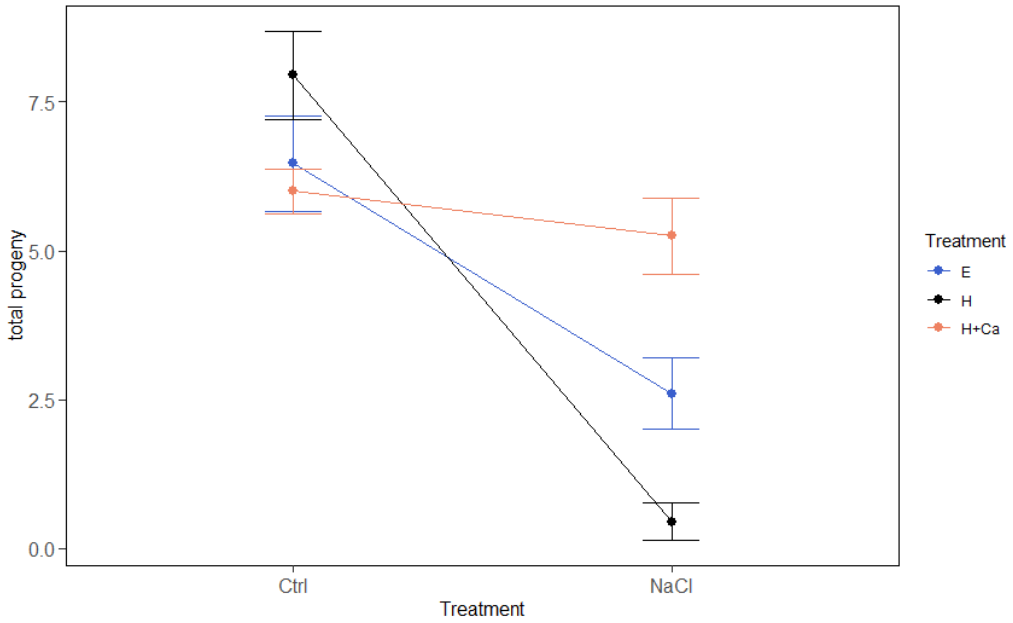

Fig 1. *Daphnia ambigua* that were exposed to the calcium treatment in Hall water produced a higher total progeny than both the untreated Egypt and Hall Pond water under the NaCl treatment. The x-axis depicts the treatment groups (control and NaCl addition), while the y-axis represents the total average progeny. Colors represent the water source used in the experiment. Blue represents untreated Egypt water, black represents untreated Hall water, and orange represents Hall water with calcium added (matching levels found in Egypt). Error bars denote 1 standard error of the mean (95% confidence).

References:

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