The Effect of *Microphallus* on *Orconectes rusticus* Behavior and Aggression

BIOS: 569: Practicum in Field Biology

Judith Lakomy

Advisor: Lindsey Sargent

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ABSTRACT:

The trematode parasite *Microphallus* sp. infects the rusty crayfish, *Orconectes rusticus*, which lives within certain lake regions of northern Michigan and Wisconsin. *Microphallus* first infects snails, and then infects the rusty crayfish, which is its intermediate host. The definitive host has not yet been discovered. The rusty crayfish is a non-native species which was introduced by anglers. Non-native crayfish can affect the entire food-web, from snails and mayflies to amphibians and fish. *Microphallus* may cause crayfish to be more aggressive than normal. This experiment involved collecting crayfish from Lake Ottawa, Star Lake and High Lake where we have an idea of infection levels based on past research. We then paired either two size and sex matched infected crayfish or two uninfected crayfish and observed their reactions toward each other. They were then assigned a scale of aggression. After each trail, the crayfish were place in a Whirl-bag containing 70% ethanol solution. They were later dissected and parasites were counted from the hepatopancreas. Based on past research, we thought that the infected crayfish would be more aggressive than the uninfected crayfish. However, statistical analysis showed them to have similar aggression levels. Therefore we do not think would affect aggression in natural populations.

INTRODUCTION:

The trematode parasite, *Microphallus* spp. first starts in a snail, then progresses to the crayfish which is the intermediate host. Its definitive host is yet unknown. In my opinion, it may be a raccoon, fish, bird or anything that eats crayfish.

The rusty crayfish *(O.rusticus)* was introduced to the lakes in the Great Lakes region in the 1960s by anglers using it as bait. (Olden et.al. 2006) Nonnative crayfish may affect freshwater food webs at all levels. Nonnative crayfish reduce basal resources like aquatic macrophytes, and prey on invertebrates like snails and mayflies, which may reduce abundances and growth of amphibians and fish. (Twardochleb, LA)

We hypothesize that the crayfish that are infected with the microphallus parasite will be more aggressive that those not infected with the parasite. For example, by pairing infected or uninfected crayfish together and then examining their behavior, we will see if there is any correlation.

METHODS:

Crayfish were collected by hand at three different lakes: Ottawa Waukesha County, Wisconsin) which has high infection levels in some places and low infection levels in other places. Star Lake (Plum Lake, WI) which has low infection levels, and High Lake (Boulder Junction, WI) which has high infection levels. Only males in non-breeding form were used for this experiment.

Crayfish were taken to a remote research station on Big Lake and kept overnight with PVC pipes providing shelter. Trials were performed within one or two days of collection. Infected crayfish were paired with infected crayfish and uninfected crayfish were paired with uninfected crayfish. Crayfish used were similar in size (within 1 mm in carapace length). Crayfish were first placed into a 3 gallon bucket with a clear plastic divider between them so they could acclimate. The divider had holes so they could both see and smell each other. After 15 minutes, the divider was removed and the crayfish were given 15 minutes to interact with each other. Aggression levels were based on a scale from 1 to 5 using an Ethogram scale from Bergman and Moore (2003). Scores were later added up and the aggression level for that trial was recorded. After each trail, the crayfish were place in a Whirl-bag containing 70% ethanol solution. They were later dissected and parasites were counted from the hepatopancreas. In order to see if there was a difference, we ran one anova on overall aggression, comparing infected and uninfected trials. The count and maximum aggression level were also calculated by compairing infected and uninfected trials.

An anova was performed with the following results with infection as an independent variable. The sum was the number of interactions combined with the intensity of their interactions. ($F_{1, 57} = 2.15$, $P = 0.1482$). The count was how many

interactions they had. (F1, 57 =1.26, P=0.2666). The max was the greatest intensity level in each interaction. (F1, 57 =2.18, P=0.1456).

Regression results, using only using infected crayfish and looking at the effect of infection level were the following. The sum was the number of interactions combined with the intensity of their interactions. (F1, 15 =2.28, P=0.1534). The count was how many interactions they had. (F1, 15 = 0.29, P=0.6005). The max was the greatest intensity level in each interaction. (F1, 15 =9.60, P=0.0079***)

RESULTS:

An anova was performed with the following results with infection as a category. The sum was the number of interactions combined with the intensity of their interactions. ($F_{1, 57}$ =2.15, P=0.1482). The count was how many interactions they had. (F1, 57 =1.26, P=0.2666). The max was the greatest intensity level in each interaction. (F1, 57 =2.18, P=0.1456).

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P=0.6005). The max was the greatest intensity level in each interaction. ($F_{1, 15}$ =9.60, P=0.0079)

DISCUSSION:

There were no significant results in the aggressive levels in the infected crayfish versus the non-infected. Some reasons for this are that we may not have collected as many infected crayfish as we thought. Because there were not many crayfish at an area normally known for infected crayfish, we collected all we could and many of these were small. Crayfish that were larger, and therefore older, were more likely to be infected with the parasite.

More trials with infected crayfish may be needed to help support the hypothesis. Crayfish that were infected with thousands of parasites seemed less aggressive then crayfish that were infected with a lesser number of parasites. Perhaps the parasites are wearing the crayfish's energy level and thus they crayfish does not have the energy to fight, no matter what its aggression level.

TABLES:

FIGURES:

ACKNOWLEDGEMENTS:

There are many people I would like to thank in their help with this project. I would first like to thank my mentor, Lindsey Sargent for her inspiration and dedication.

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REFERENCES CITED:

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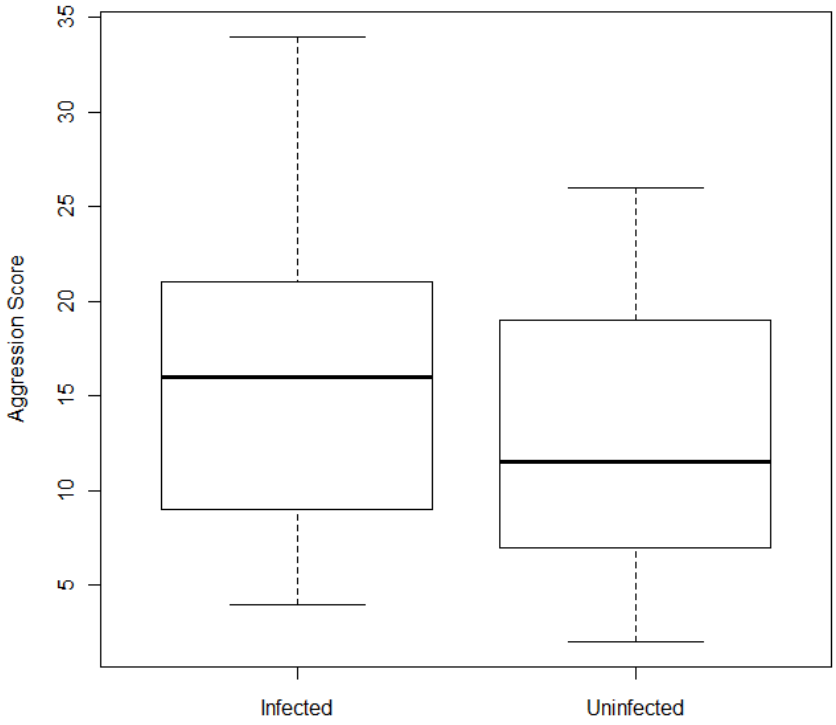
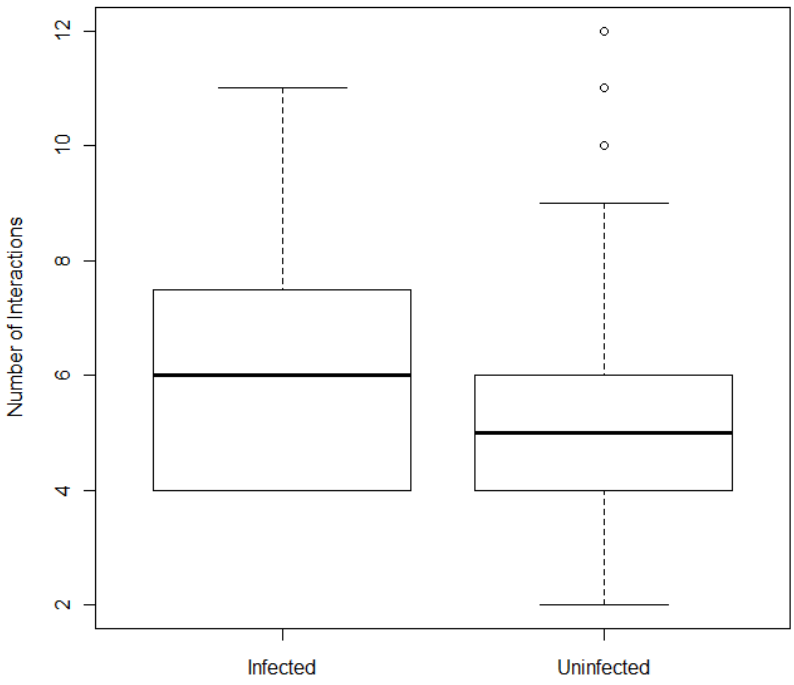
A global meta-analysis of the ecological impacts of nonnative crayfish, Twardochleb, LA (Twardochleb, Laura A.)[1] ; Olden, JD (Olden, Julian D.)[1] ; Larson, ER (Larson, Eric R.)[2] FRESHWATER SCIENCE Volume: 32 Issue: 4 Pages: 1367-1382

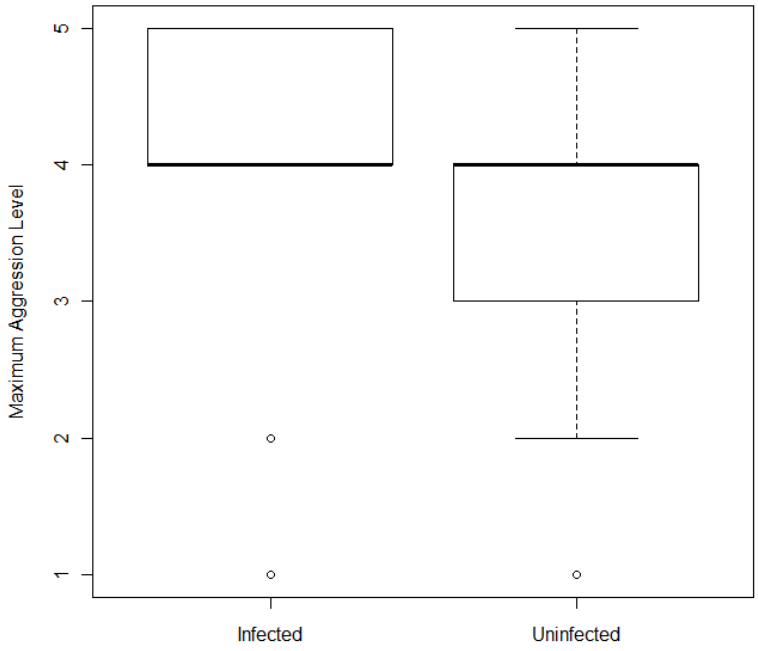
Comparing aggression scores between infected and uninfected crayfish



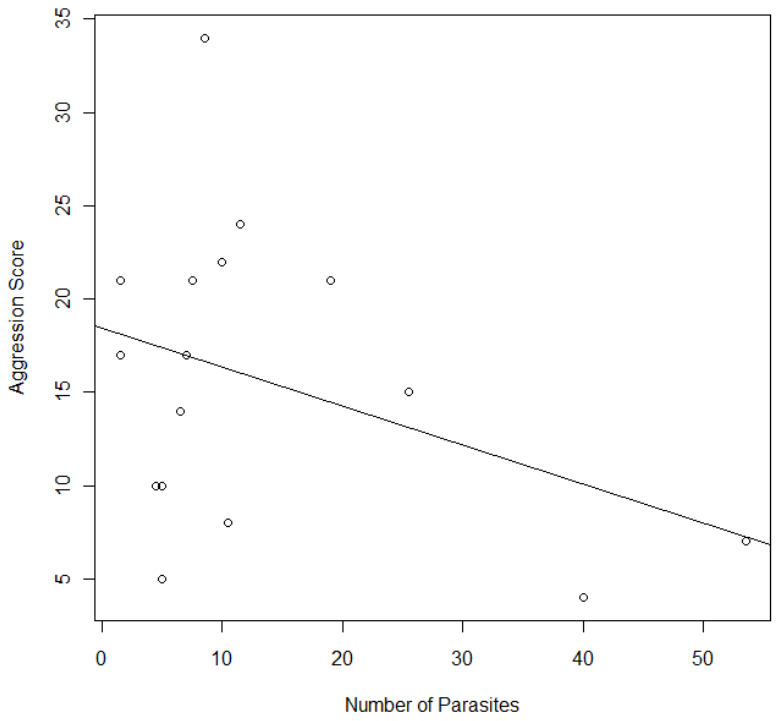
Comparing COUNT(number of interactions) between infected and uninfected



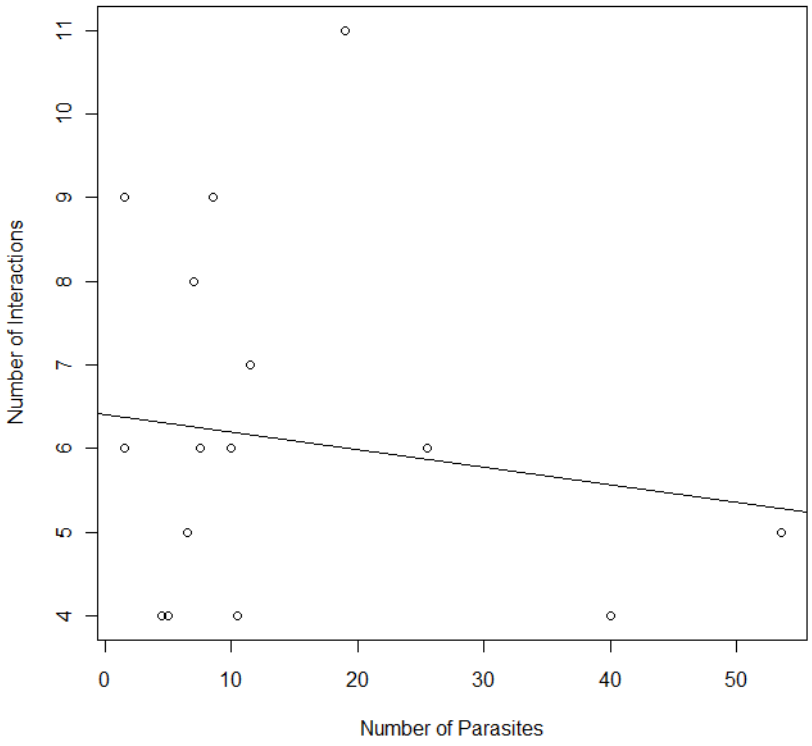
Comparing MAX(maximum aggression level) between infected and uninfected



Comparing aggression scores among infected crayfish



Comparing number of interactions among infected crayfish



Comparing maximum aggression level among infected crayfish