Bythotrephes longimanus presence causes density differences in *Bosmina spp.* and *Daphnia spp.* in three lakes in northern Minnesota

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INTRODUCTION

- Invasive species in novel locations can lead to rapid and irreversible changes in the ecosystem. *Bythotrephes longimanus* (spiny water flea) is an invasive species of zooplankton which feeds on *Daphnia spp.* and *Bosmina spp.* The presence of *B. longimanus* has negative impacts on the biomass and abundance of its prey, leading to increases in algae and higher rates of eutrophication in lakes[1,2]. They can also cause changes in predator and competitor populations[3].
- Hypothesis: The duration of post-invasion affects the density of *B. longimanus* and its prey. Burntside was declared infested in 2010, while the others were in 2014, so the *B. longimanus* will be greater and the prey populations will be smaller in Burntside.[4]

METHODS

- Samples were taken from three lakes, Burntside, Shagawa, and Fall, in northern Minnesota, near Ely, and just south of the Boundary Waters Canoe Area Wilderness during late June 2019
- Three vertical tows were taken with a zooplankton net at three locations in each sample lake
- Samples were preserved with ethanol and counted using subsamples
- The Kruskal-Wallis One-way Analysis of Variance and the Dwass-Steel-Chritchlow-Fligner Test for All Pairwise Comparisons were run on the data with a significance threshold of $p < 0.05$

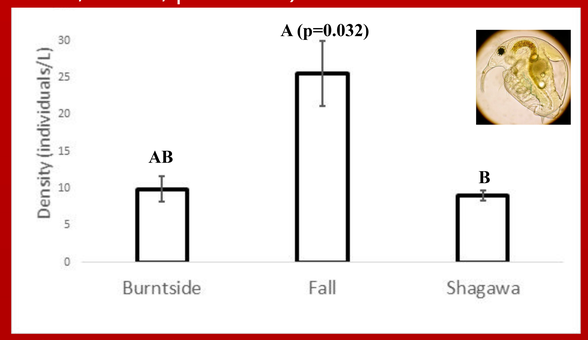
Satellite image of the sample lakes, Burntside, Fall, and Shagawa, with markers for each of the sample locations

Information about each sample lake

Variable	Burntside	Fall	Shagawa
Area (ha)	18072.6	5580.7	5793.3
Littoral Area (ha)	3652.1	2910.8	1756.9
Shore Length (km)	166.5	49.8	37.6
Max depth (m)	38.4	9.8	14.6
Trophic Status	Oligotrophic	Mesotrophic to slightly eutrophic	Mesotrophic

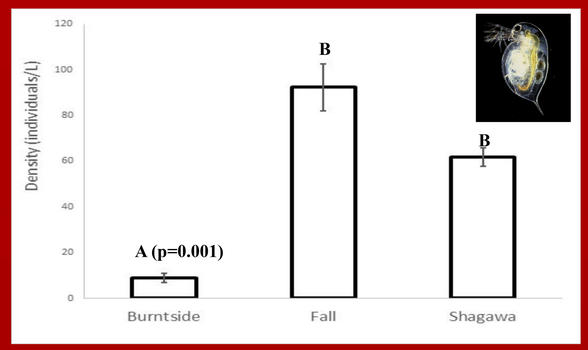
RESULTS

- *Bosmina spp.* densities differed between lakes (KW = 8.032, df = 2, p = 0.018)



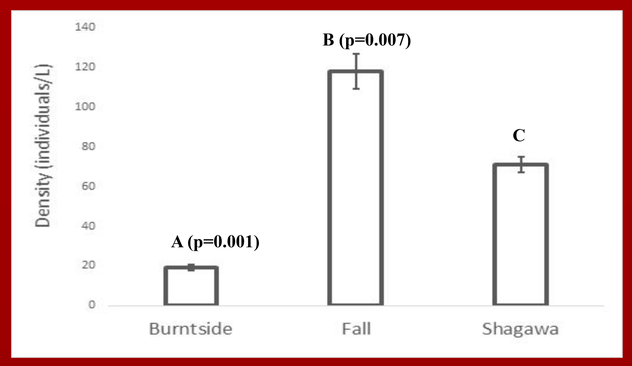
Fall had a significantly greater *Bosmina spp.* density than Shagawa

- *Daphnia spp.* densities differed between lakes (KW = 19.305, df = 2, p < 0.001)



Burntside has a significantly lower *Daphnia spp.* density

- The totals differed between lakes (KW = 21.562, df = 2, p < 0.001)
- The lakes did not have significantly different densities of *B. longimanus*



The sum of the densities of the three species, *B. longimanus, Bosmina spp.,* and *Daphnia spp.* was significantly higher in Fall and significantly lower in Burntside

CONCLUSIONS

- Densities of *B. longimanus* were not significant likely due to the lack of their presence in samples. In studies, they were not detected until after early to mid-July[2,5]
- Population densities of *Daphnia spp.* supported my hypothesis, with the density being the lowest in Burntside[6]
  - There was a large presence of *Polyphemus pediculus* in Burntside likely due to predation of *B. longimanus* on *Daphnia spp*
- The densities of *Bosmina spp.* partially supported my hypothesis, as Fall had a significantly greater density. Shagawa had a lower density and did not fit the hypothesis. However, Fall is mesotrophic to slightly eutrophic, which are environments where *Bosmina spp.* is more commonly found[7]
- The differences between the total species are driven by prey densities
- Limitations included the season that samples were taken, and only including three locations in each lake. Future work would include sampling multiple times throughout the summer months
- This study furthers knowledge on the effects of an invasive species on the prey species, and can guide conservation efforts

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