Effect of Water Level and Nutrient Concentration on European Frog-Bit Turion Production

Spencer Dzyacky, Sam Schurkamp, Shane Lishawa
Loyola University Chicago – School of Environmental Sustainability

Introduction

Hydrocharis morsus-ranae (European frog-bit; EFB) is a free floating aquatic plant native to Europe and Asia (Zhu, 2018). EFB forms dense mats that reduce dissolved oxygen (during decomposition) concentration in aquatic systems, thus depleting native biodiversity and ecosystem productivity (Catling, 2003). To date, the variables that contribute to EFB's proliferation are understudied, so determining optimal growth conditions are key to preventing its spread.

In this study collected EFB from two Great Lakes Coastal Wetlands in Michigan coastal wetlands and assessed their survival in varying nutrient concentrations and water depths.

Research Question

Research Question: How is the growth of EFB affected by water depth and nutrient concentration?

Photo 1: Beautiful University of Michigan Biological Station

Photo 2: Not as beautiful view of EFB growing in high nutrient, high water level treatment

Methods

Experiment 1:

- Collected 40 individuals from Munuscong Marsh on July 19th 2022 and housed them in freshwater pools
- Placed EFB in four total treatments; 2 water levels (21 cm, 12 cm) and 2 nutrient concentrations (Eutrophic1400 ug/L, 700 ug/L) with ten (10) replications

Experiment 2:

- Collected an additional 40 individuals from Cheboygan marsh (Cheboygan, MI) on July 25th 2022 for environmental chamber analysis
- Compared nutrient concentration effects for 40 individuals in four total treatments (2100 ug/L, 1400 ug/L, 700 ug/L, 100ug/L.

Results

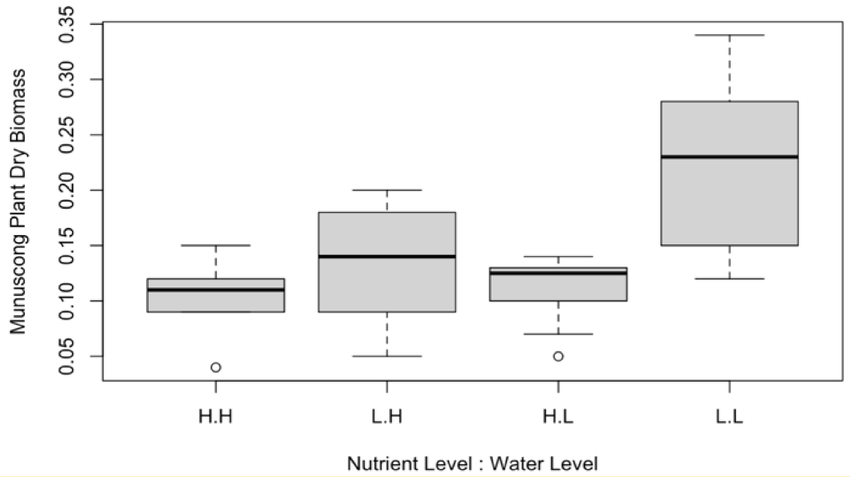

Figure 1: The interaction of nutrient concentration and water depth on Munuscong plant wet biomass, ANOVA p= 0.041. Significant interactions between low water depth, low nutrient concentration and high water depth and high nutrient concentration occurred (L:L-H:H; $p < 0.01$). H.H: High nutrient, high water; L.H: Low nutrient, high water; H.L: High Nutrient, low water; L.L: low nutrient, low water. **(Experiment 1)**

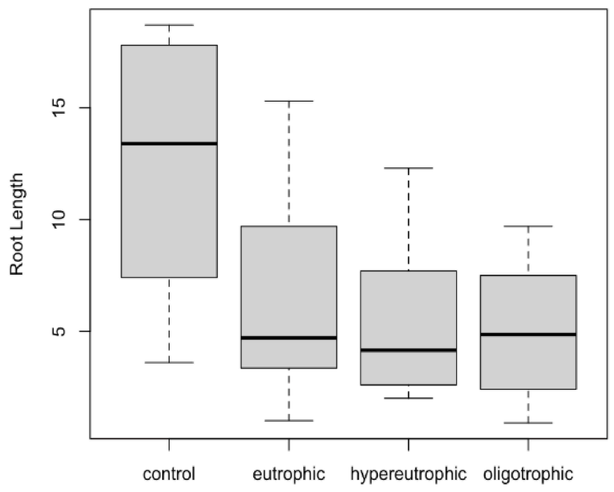

Figure 2: is the effect of nutrient concentration on the root length of environmental chamber plants' root length, ANOV A p= .037. (Experiment 2)

Photo 3: EFB flower!

Summary

Experiment 1: I found that low water depth and low nutrient concentration best supported EFB growth. Root length and biomass of Munuscong EFB were negatively correlated with nutrient concentration.

Experiment 2: Root length and biomass of Munuscong EFB chamber were negatively correlated with nutrient concentration.

I observed that most of the plants in the treatments with the highest nutrient concentration had fully dissolved and were undetectable. The plants kept in the waiting pool looked healthy and produced male and female inflorescences.

This preliminary data provides insight as to why EFB is seen in large numbers in stands of *Typha x. Glauca*, a plant known for its ability to reduce nutrient pollution in freshwater systems. The literature surrounding EFB is conflicting as some studies have found that EFB prefers high nutrient conditions.

Future Directions

My research group will be continuing our work on invaded wetland systems and to aid that I will be looking at the wave action tolerance of EFB in the St. Marys River, MI.

References

1. https://doi.org/10.1093/jpe/rtx031. Catling, P. M., et al. "The Biology of Canadian Weeds. 124. *Hydrocharis Morsus-Ranae* L." *Canadian Journal of Plant Science*, vol. 83, no. 4, 2003, pp. 1001–1016., https://doi.org/10.4141/p02-033.
2. Zhu, Bin, et al. "Invasive European Frogbit (Hydrocharis Morsus-Ranae L.) in North America: An Updated Review 2003–16." *Journal of Plant Ecology*, vol. 11, no. 1, 2018, pp. 17–25.,

Acknowledgements

I would like to thank all of my research team for motivating and supporting me through this study. I would like to thank Dr. Brian Ohsowski, Shane Lishawa, Sam Schurkamp, and Andrew Monks for their guidance and mentorship.