

## The Effects of Depth on the Biodiversity of Aquatic Macroinvertebrates in a Manmade Pond

#### Abstract

Aquatic macroinvertebrate biodiversity is impacted by depth in natural ponds. The goal for this project was to determine whether aquatic macroinvertebrate biodiversity is impacted by water depth in a man-made pond. We expected to find a difference in the manmade pond, since there has already been an observed difference in natural ponds. To collect samples we took from both sediments and the water column using various methods, including aquatic nets and leaf-pack traps. Using taxonomic identification aquatic macroinvertebrates were identified by physical characteristics. To check our taxonomic identification we used Barcode Long Island procedures and methods to extract DNA and amplify it by PCR. We then used gel electrophoresis to visualize our specimen's DNA. Finally we used DNA Subway to identify our species. Our result was that there was a higher biodiversity of aquatic macroinvertebrate in the shallower parts of the man-made pond.

### Introduction

- Aquatic macroinvertebrates are a group of organisms that do not have a backbone, and live in both freshwater and saltwater environments such as small ponds, rivers, lakes, seas, and oceans.
- These organisms are important to study because their biodiversity serves as an indicator of water quality and other factors that impact their habitats. For example, aquatic macroinvertebrates are negatively affected by low pH. One reason for this is because low pH can increase the bioaccumulation of metals and increase the toxicity of metals aquatic macroinvertebrates are exposed to (Muotka, 2017).
- Aquatic macroinvertebrates possess many of the important traits of good bioindicators, for example aquatic macroinvertebrates can be influenced by light, temperature, nutrients, and competition. (Holt, 2011). In addition to water quality, the presence or absence of aquatic macroinvertebrates can be impacted by other factors, such as vegetation cover, water depth and conductivity (Mereta, 2012).
- Also, they are significant parts of the food chain since many animals rely on them as a food source, as well as aquatic macroinvertebrates themselves feeding on plants and other organisms. They are eaten by fish, birds, and other animals.
- Aquatic macroinvertebrates are also important to study because they help clean up the water by scavenging dead animals and plants (School of Geosciences).



#### **Picture of Gel Electrophoresis**



Figure 1. Specimens 1-15.

Figure 2. Specimens 16-20.

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#### **Methods and Materials**

To collect specimens, sediments were dug up with a shovel and then searched through. Also samples were collected by sifting through the water to pick up the aquatic macroinvertebrates. Most importantly, leaf packs which are empty mesh bags filled with leaves were placed at certain depths. These traps made it possible to collect at various depths and over long periods of time. After samples were collected they were frozen and then put in ethanol until ready for DNA extraction. Before doing the barcoding process the samples were taxonomically identified. Then DNA was extracted from the samples and DNA barcoding was performed. This was done to confirm the identity of the species that have been identified.

#### Results

It was found that there is a higher biodiversity of aquatic macroinvertebrates in shallow parts of the pond than the deep parts of the pond.

#### Discussion

The data shows that there were more species and a higher biodiversity near the surface of the water then the deeper parts of the pond. This is most likely because the surface of the water has a more favorable environment. The surface of the water has less pressure, more vegetation cover, and more food. All of the species were identified taxonomically, and the process was really difficult. The reason was because many macroinvertebrates have similar features and there are many different species. It was really tough to choose from many species that look very similar. There were also many difficulties with sample collection because the traps rarely worked. Attempts were made for many different traps but most of them failed. The data shows that shallow water has a higher biodiversity of aquatic macroinvertebrates then in deeper water level in a man-made pond. Metadata was not useful in explaining the results because there was no difference in water quality between the deep and shallow water.

#### Future work/Next steps

While the project is almost complete, we are still awaiting the DNA sequences of our samples. After that we will need to determine the species of each sample using a barcoding database. This will allow us to confirm that we correctly taxonomically identified all of species.



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15 10

# 10 11 13 15 16 17 18 19

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#### References

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#### Our pond vs. Healthy Pond



Depth	Scientific Name	Genetically confirmed
shallow	Tubifex	
shallow	Boyeria	
shallow	Optioservus	
shallow	Gerris	
shallow	Gerris	X
shallow	Gammarus pseudolimnaeus	
shallow	Ameletus	X
shallow	Phidippus	×
shallow	Phidippus	X
shallow	Phidippus tyrrelli	X
deep	Chironomidae	X
deep	Tipulidae	×
deep	Chironomidae	X
deep	Chironomidae	×
deep	Tipulidae	×
deep	Chironomidae	X
deep	Chironomidae	X
deep	Chironomidae	×
deep	Tipulidae	X
deep	Chironomidae	×