Water Quality and its Effect on the Biodiversity of Inhabiting Mosses

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Abstract

The objective of this study is to determine the effect of pH levels on the species and diversity of mosses in our local area. We extracted multiple different samples of mosses and water samples from the bodies which we collected the moss from, ran extensive tests on both, and determined the pH and species of moss we had obtained. In total, we collected 7 samples and used them to present our project. After we gathered out data, we plotted the results into a histogram to see if there was a correlation between pH and moss prevalence. We found that within a certain range, 7.25-8.00 pH, the most moss species were found.

Introduction

pH is important in the freshwater ecosystem as it sets up the conditions for how easily nutrients are available and how easily things like heavy metals can dissolve in the water3. Different water bodies have different levels of pH, depending on location, temperature, and other factors. Moss is a bioindicator, meaning that it is a naturally occurring indicator of pollution, air quality, and water quality4.

We wanted to investigate if the difference in pH level would affect biodiversity of the inhabiting moss. We also wondered if there will be an ideal pH level that allows many different species of moss to inhabit. Our hypothesis was that biodiversity would peak as the pH level of surrounding water gets closer to 7.

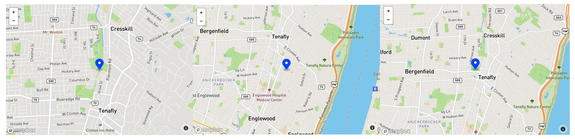
Methods

Collecting Moss

We first chose a specific week when the weather was humid, so that we could collect large amounts of moss. We aimed to collect all types of moss from different water bodies in order to test our hypothesis.

We collected moss using tongs, and we put the samples in plastic bags to avoid contamination.

Our moss samples are from various places near water streams in our town.



KWW-001 and KWW-002 | KWW-003, KWW-004, and KWW-005 | KWW-006 and KWW-007

We went to the Harlem DNA Learning Center with our samples to figure out their species using DNA barcoding.

Collecting Water

When we collected the moss, we also collected water simultaneously from the nearby water stream. We stored them in plastic bottles and closed the caps firmly to avoid contamination.

Data

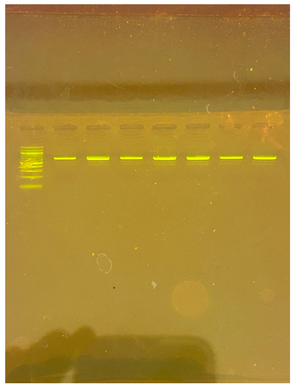
	A	B
	Sample	pH
	KWW-001	6.8
	KWW-002	7.3
	KWW-003	6.8
	KWW-004	7.8
	KWW-005	7.9
	KWW-006	7.9
	KWW-007	8.5
	Lyelia aspera Polytrichales	7.3
	Oedepium Griffthianum	7.3
	Andreaea Rothii	7.3
	Hypodontium Pottiales	8.4
	Mesotachete taxiforme Aulacomni	7.9
	Encalypta Rhaptocarpa	8
	Grimmia Orbicularis	7.7
	Schistotega Pennata	7.9
	Disphyscium Fulvifolium	8.2

This chart shows the number of species we found with each pH value. This includes both our samples and our estimated values for related species.

DNA Isolation and Barcoding

Through sequences of centrifuging, we separated DNA from other organic matter in our samples. We then sent the DNA to Cold Spring Harbor Laboratory to be barcoded.

To explain further, we first cut out a small section of our sample and placed it into a 1.5 mL test tube. We added 300 µL of lysis solution to it, and then ground up the sample to fully break down and dissolve the organic matter. After incubating at 65 °C for 10 minutes, we put it in a centrifuge for a minute to isolate the supernatant. Then, we transferred 150 µL of the supernatant to a clean 1.5 mL tube. Next, we added 3 µL of silica resin to the tube and incubated it for 5 minutes at 57 °C. After putting it in the centrifuge for 30 seconds, we added 500 µL of wash buffer and mixed it. Next, we put the test tube in the centrifuge for another 30 seconds and took out the supernatant. Later, we added 100 µL of distilled water, mixed, and incubated the mixture at 57° C for 5 minutes. After more centrifuging, we took the remaining 50 µL of supernatant to a clean test tube. We disposed the silica resin, and then continued with PCR. After PCR, we sent the remaining samples for barcoding at an external laboratory.

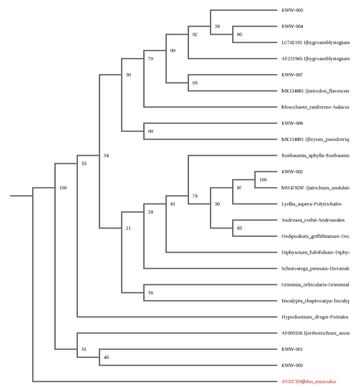


The is the PCR. We harvested viable DNA samples for barcoding. We used the other part of DNA to barcode it and figure out its species.

References

[1] Tenafly High School
[2] Cold Spring Harbor Laboratory
[3] Water Rangers. (2022, June 15). *Ph in freshwater*. pH in freshwater. Retrieved November 9, 2022, from https://waterrangers.ca/testkits/tests/ph-in-freshwater
[4] Fondriest Environmental. (2019, January 23). *Ph of water*. Environmental Measurement Systems. Retrieved November 9, 2022, from https://www.fondriest.com/environmental-measurements/parameters/water-quality/ph/
[5]DNA Barcoding 101. *Silica DNA Isolation*. Silica DNA Isolation. Retrieved May 22, 2023, from https://dnabarcoding101.org/lab/protocol-2.html#alternateb
[6]Rutgers New Jersey Agricultural Experiment Station.(2012, July 10) *Tenakill Brook Watershed Restoration & Protection Plan*. Tenakill Brook Watershed Restoration & Protection Plan. Retrieved May 22, 2023, from http://water.rutgers.edu/Projects/Tenakill/Tenakill_Restoration_Plan.pdf

Results



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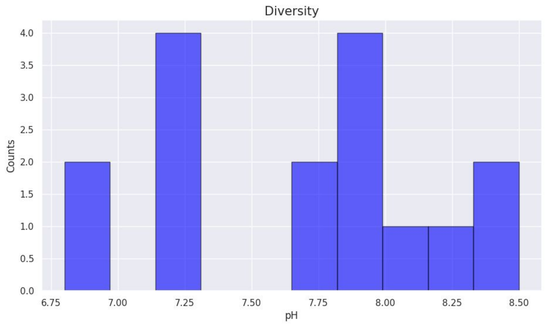

This graph shows how different numbers of species were found in water streams with different pH values.

Discussion

We observed that the biodiversity of moss peaks at around pH 7 and 8. This means that pH 7 to 8 is the ideal condition for diverse species of moss to thrive. This result is important because it shows how different species of moss are and aren't capable of living in certain environments, which influences the degree of biodiversity in different places.

We originally hypothesized that the biodiversity will peak at a certain value of pH. From the graph we can determine that the biodiversity peaks at two values – 7.3 and 7.9 – while the biodiversity for pH values in between 7.3 and 7.9 stays low. For future study, we would have to collect many more samples to see if the biodiversity generally peaks around pH 7.3 and 7.9, or if it was only for our samples.