SNAILed it! Testing for a Correlation Between Water pH and Snail Populations

Adam Kamp[1], Sarah Weber[1], and Anne Kloimwieder[1]

[1]Ethical Culture Fieldston School

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Abstract

The parks in NYC use high amounts of fertilizer, which runs off into water, changing the acidity of the water, and ultimately influencing which species populate bodies of water. Snails are good indicators of the effect of pH on the species populating an area because snails have been shown to have a close relationship with the pH of their habitat. We tested the effect of the pH of the water on snail species. Snails were collected from different sites in NYC's Van Cortlandt Park and DNA sequencing was used to identify the species. The pH of these bodies of water was also tested. *Planorbella anceps* was found in slightly more basic water (pH > 6.8) than *Physella acuta*.

Introduction

One factor that can influence biological diversity in NYC is the acidity of various habitats, specifically aquatic bodies. Fertilizer runoff from NYC parks can change the acidity (pH) of bodies of water, which is harmful to the species populating that area.[1]

Snails are good indicators of the relationship between species populating an area and the acidity of the area because they have been shown to have a close relationship with the pH of their habitats. Snails prefer freshwater with a pH of 6 to 7.5.[2]

The purpose of this investigation was to use DNA sequencing to provide insight into the correlation between the species of snails populating a body of water and the pH of that body of water. Snails were collected from bodies of water and the pH of the water was recorded. The DNA of the snails was tested to identify their species. We hypothesized that there is a relationship between the pH of the water and the species of snails living in it.

Materials & Methods

1. 10 snails and water pH data were collected from three sites in Van Cortlandt Park.
2. The DNA of each sample was extracted and isolated.
3. PCR was used to amplify the DNA.
4. Gel electrophoresis was used to confirm that the PCR was successful and the correct length.
5. The amplified DNA from the PCRs was sequenced.
6. Each sequence was analyzed using the DNA subway program to find the species of each sample.

Results

Figure 1. Map of Van Cortlandt Park and Sample Collection Sites

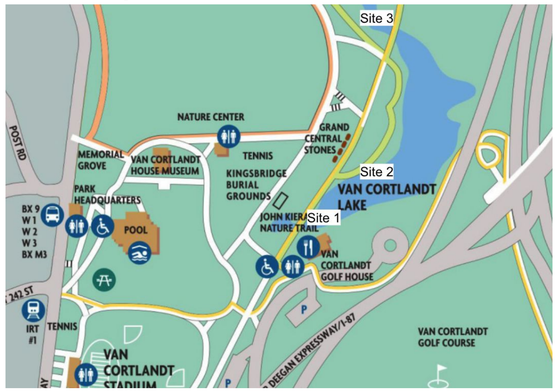


Figure 1. A map of Van Cortlandt Park in the Bronx. Sites 1, 2, and 3 are labeled. Sites 1 and 2 are located in Van Cortlandt Lake, while site 3 is located in Tibbett's Brook, a tributary of Van Cortlandt Lake.[3]

Figure 2. Maximum Likelihood Phylogenetic Tree of DNA Sequences

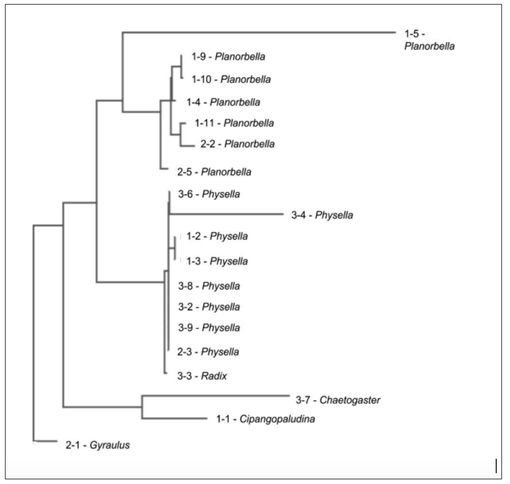
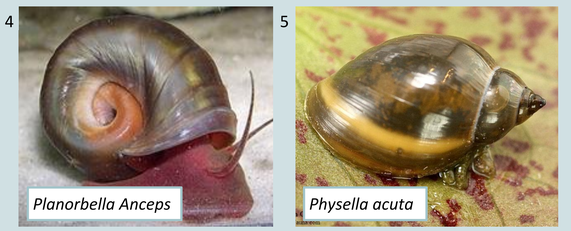


Figure 2. The maximum likelihood phylogenetic tree for the snail sample sequences. Labels on each branch indicate the sample number and the species.

Table 1. Most Common Snail Species and pH of Water at Three Sites in Van Cortlandt Park

Site	Most Common Species	pH
1	*Planorbella anceps*	6.83
2	*Planorbella anceps*	7
3	*Physella acuta*	6.75

Table 1. The most common snail species in Sites 1, 2, and 3. The pH (acidity) of the water at each site is also shown. pH values are the mean from three trials of water testing.



References

1. "Organic Fertilizers- Benefits & How to Apply?" *Organic Facts*, 23 Aug.2017,www.organicfacts.net/organic-products/organic-cultivation/benefits-of-organic-fertilizers.html.
2. "Snails (Mollusca: Gastropoda)." *Snails (Mollusca: Gastropoda) - NYS Dept. of Environmental Conservation*, www.dec.ny.gov/animals/92624.html.
3. "Van Cortlandt Park Map." *Friends of Van Cortlandt Park*, vancortlandt.org/wp-content/uploads/Imageviewer/Mappage.html.
4. Mifsud, Stephen. "Wild Plants of Malta and Gozo." Online Flora of Malta, www.maltawildplants.com/lfaunafungi/maltawildlife.php?species. a
5. Revolvy, LLC. "Planorbella" on Revolvy.com. www.revolvy.com/main/index.php?s=Planorbella.

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Discussion

Snail Species and pH

The results from this experiment support the hypothesis that there is a relationship between the pH of the water and the species of snail living in it. The most common snail species, *Planorbella anceps*, was the same at Sites 1 and 2, and the pH at both of these sites was above 6.8, which indicates that *Planorbella anceps* is more likely to be found in waters that are very close to neutral (Table 1). *Physella acuta* was more common at a site where the pH was below 6.8, which indicates that *Physella acuta* may be attracted to more acidic water than *Planorbella anceps*.

Given that the difference in the average pH between each site is extremely small (Table 1), the results are inconclusive. The more plausible reason for the discrepancies between the most common snail species was the location itself, and not the pH: Sites 1 and 2 were rather close together and the most common species at those sites was the same, while Site 3 was in a tributary rather than in still water. This pattern shows that the relative location may have a greater effect on snail species than the pH of the water.

Outliers of the Phylogenetic Tree

Sample 3-7 was identified as C*haetogaster limnaei,* which is a segmented worm that is a common parasite of snails. Sample 1-5, which was identified to be *Planorbella anceps,* is consistent with the species of the branch that it is part of. However, the species of this sample could not be reliably determined because the sequence was too short.

Future Experiments

In the future it would be interesting to test the identified species' shells in water of different pHs to see how the pH specifically affects the shells of the snails. Using the shells, one could also test the effect of different minerals in the water on shell rigidity or makeup, or compare the effect of different contaminants in water on snail shells. Another experiment could be to test snails' reactions to being removed from Van Cortlandt Park and being placed in pure water in a lab. We could also test the effect of water quality on the population size of snails in different locations, or test the snail species populating different NYC bodies of water, like the Central Park Reservoir.