



Funded by the
Thompson Family
Foundation

Snail Diversity in Van Cortlandt Park



Garrett Friedman,¹ Spencer O'Flanagan,¹ Leo Satlof,¹ Anne Kloimwieder¹

¹Ethical Culture Fieldston School

Abstract

The purpose of this project was to examine if there is a correlation between the water quality in Van Cortlandt Park and the type of snail found in each body of water by studying the number of lunged vs gilled snails. High fertilizer runoff and pollution affects the species that reside in the water. Our goal was to discover if the number of lunged vs gilled snails at certain locations correlated with the water quality. Snails were collected from three separate locations within Van Cortlandt Park. At each collection site water quality tests were also taken. DNA was extracted from the snails and sent for sequencing. All of the snails tested were found to be lunged except one gilled snail.

Introduction

Snail is the common name for many species of gastropod molluscs. Lunged snails are a type of freshwater snail in the group *Pulmonata*.¹ Gilled snails are also a type of freshwater snail in the class *Prosobranchia*.

Low oxygen content is often linked to polluted water. The nitrogen used in fertilizer can flow into bodies of water and increase algae growth.² Algae cause lower oxygen levels in the water by increasing the activity of oxygen-depleting bacteria. Gilled snails can only breathe by using dissolved oxygen in the water.³ When oxygen levels are low in water it becomes difficult for gilled snails to survive.

For this experiment, snails were gathered from Van Cortlandt Park and their DNA was sequenced to determine their species. Water quality tests were also conducted. We hypothesized that there would be a correlation between the number of lunged snails and the water quality.

Materials and Methods

Snails were collected from three locations in Van Cortlandt Park. Each snail was placed in a test tube with ethanol. Dissolved oxygen and other measures of water quality were also tested at each location. Next, the DNA was isolated, amplified by PCR, and sent to be sequenced. BLAST was used to identify the species of snail.

Results

Sample	Species	Breathing Type
Site 1		
1-4-	<i>Planorbella anceps</i>	Lunged
1-1	<i>Cipangopaludina japonica</i>	Gilled
1-11	<i>Planorbella anceps</i>	Lunged
1-5-	N/A - sequence too short	*
1-3-	<i>Physella acuta</i>	Lunged
1-10	<i>Planorbella anceps</i>	Lunged
1-9	<i>Planorbella anceps</i>	Lunged
1-2-	<i>Physella acuta</i>	Lunged
1-5	N/A - missing sequence	**
Site 2		
2-1	<i>Gyraulus sp.</i>	Lunged
2-2	<i>Planorbella anceps</i>	Lunged
2-3	<i>Physella acuta</i>	Lunged
2-5	<i>Planorbella anceps</i>	Lunged
Site 3		
3-1	N/A - sequence too short	*
3-2	<i>Physella acuta</i>	Lunged
3-3	<i>Radix swinhoei</i>	Lunged
3-4	<i>Physella acuta</i>	Lunged
3-6	<i>Physella acuta</i>	Lunged
3-7	<i>Chaetogaster limnaei</i>	†□
3-8	<i>Physella acuta</i>	Lunged
3-9	<i>Physella acuta</i>	Lunged

Table 1. The Species of Snails Identified in Van Cortlandt Park. This table shows the sample number on the left and the most likely species in the middle. On the far right is the method of breathing that the species of snail uses. *The sequence of DNA that was readable was too short to make a conclusive result. **The DNA sequence was not in the reference database of known species. ††*Chaetogaster limnaei* is not a species of snail. It is a parasite commonly found in snails and due to the amplification process of the DNA we believe that the parasitic DNA was amplified instead of the snail DNA.

Location	pH	Temperature °C	Dissolved O ₂ Saturation
1	6.83 good/excellent	18	35%
2	7 excellent	18	35%
3	6.75 good/excellent	18	35%

	Nitrates (ppm)	Nitrates	Phosphate (ppm)	Phosphate	Coliform
1	5	fair	1.08	excellent	positive sewage
2	4.3	fair	0.5	excellent	positive sewage
3	n/a*	n/a	0.46	excellent	n/a*

Table 2. Water Quality Data. This data table shows the data collected on the quality of the water at each of three locations in Van Cortlandt Park. The table shows pH, temperature, dissolved O₂, nitrates, phosphate, and coliform. The location number corresponds to the first digit of the sample number. *No nitrate or coliform test was performed at these locations



Figure 1. Van Cortlandt Park Sample Location Map. This map shows where the samples were collected in Van Cortlandt Park. The first and second locations were in Van Cortlandt Lake. The last location was Tibbett's Brook, a tributary which flows into Van Cortlandt Lake.

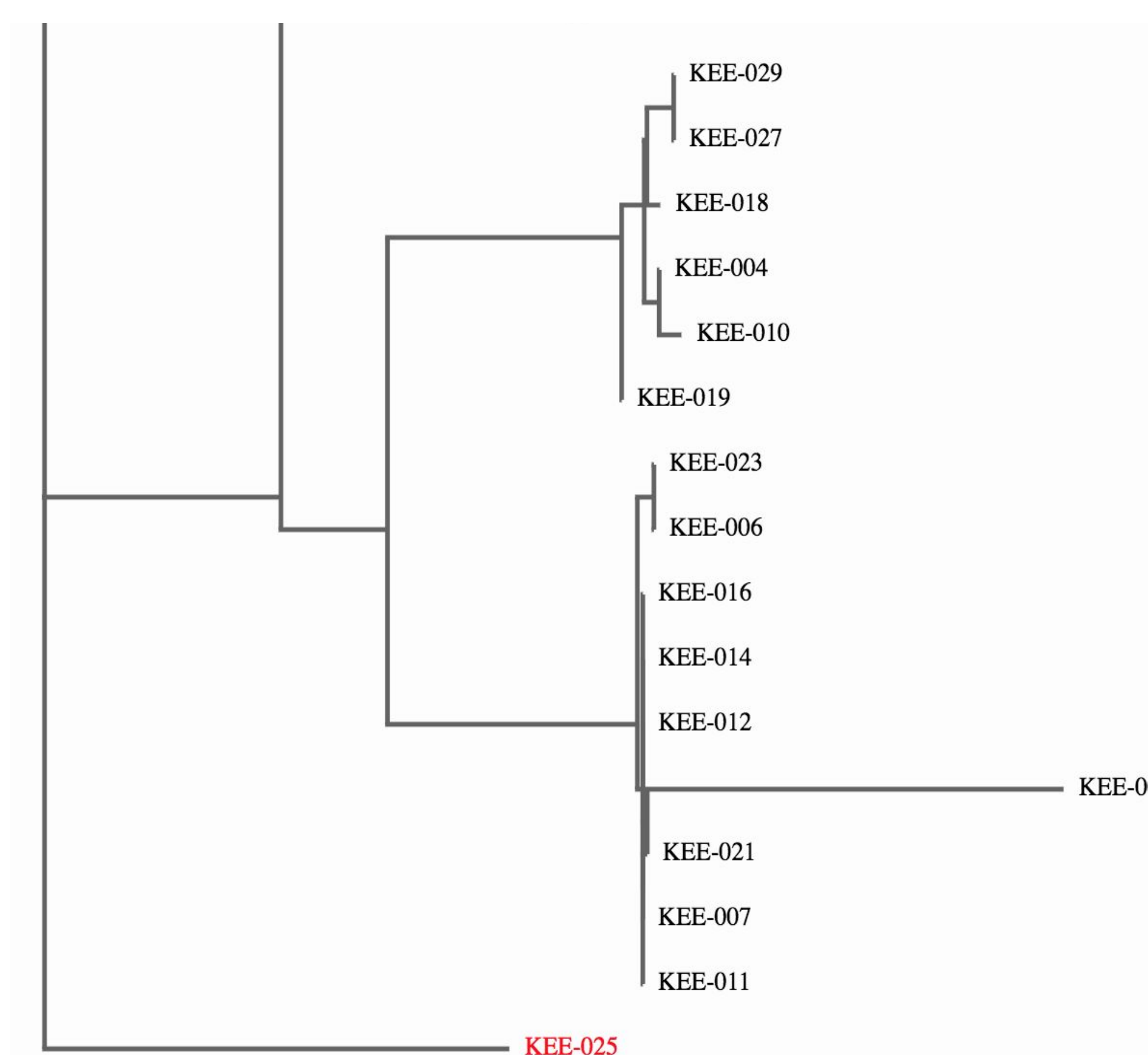


Figure 3. Maximum Likelihood Phylogenetic Tree of Sequencing Results. This is a maximum likelihood phylogenetic tree generated by PHYLIP of the sequences of the specimens. It shows how closely related the samples are to each other.

Discussion

The results of this lab show that there were many more lunged snails than gilled snails in all locations tested. Lunged snails are known to be pollution tolerant, which may mean that the bodies of water that they were collected from were polluted. The water from two locations had a slightly acidic pH, while the pH from one site was neutral. The dissolved oxygen content of the water was 35% which is poor. In water with low oxygen content, it is difficult for certain animal species to survive. This supports the idea that water quality is correlated to the species of snails found. However, it is difficult to draw a direct correlation between the snails and the water quality, as there were many other factors that may have affected which type of snail was collected.

There were a few notable issues with the experiment. Samples were only taken from three locations, which limited the results from accurately portraying the snail population in all of the bodies of water in Van Cortlandt Park. Snails were only able to be collected on the surface and on the rim of the lake, prohibiting the ability to accurately obtain samples from the whole lake. In the future it would be interesting to gather snails during different seasons, as well as to try and gather snails from all sections of the lake. This would enable a more accurate portrait of the makeup of all of the snails species in Van Cortlandt Park.

References

- "Gilled Aquatic Snails." Retrieved 10.21.17 from <https://nature.mdc.mo.gov/discover-nature/field-guide/gilled-aquatic-snails-prosobranch-pond-snails>
- "Golf Course Pesticides FAQs." Northern Ohio Golf Course Superintendents Assoc. Accessed October 13, 2017. <http://www.nogcsa.com/Golf-Course-Pesticides-FAQs-19C1.html?LayoutID=6>.
- Zinni, Yasmin. "What Do Snails Need to Live?" *Sciencing*, 24 Apr. 2017, [sciencing.com/do-snails-need-live-8717972.html](https://www.sciencing.com/do-snails-need-live-8717972.html).

Acknowledgements

We would like to acknowledge John Butler and Alex Bryne for helping us collect samples. We would like to acknowledge Sarah Weber and Adam Kamp for working with us on some aspects of the project.