

ABSTRACT

It is universally agreed among pond owners that a pond aerator enhances water quality and provides various benefits to the pond’s ecosystem. With this in mind, our group employed DNA barcoding to investigate whether installing an aerator impacts a pond’s biodiversity. We hypothesized that ponds with aerators would have higher biodiversity than those without. We were able to collect 20 aquatic macroinvertebrate specimens from each pond. After extracting and amplifying their DNA, the DNA was sequenced, and DNA subway was used to determine the genus and species of each of our specimens. We did not find a significant difference in biodiversity between the ponds, suggesting that draining and installing an aerator does not affect the biodiversity of invertebrates in ponds. However, our sample size was too small to come to any definitive conclusions. Further research is needed to draw a conclusion on whether or not aerators affect the macroinvertebrate diversity of ponds.

INTRODUCTION

A common practice among pond owners to improve their pond’s aesthetics is to install aerators. Research shows that aerators added to small freshwater bodies can provide more oxygen for the species that live in the pond. Aeration can also help reduce the chances of algae blooms by promoting the growth of beneficial aerobic bacteria (West, 2023). An aerator can provide other valuable services, including lowering stratification, decomposing organic matter, and circulating water so that mosquitoes cannot breed (Swistock, 2019). Since an aerator provides benefits to the pond’s ecosystem, a hypothesis could be made that it allows animals, such as aquatic macroinvertebrates, to flourish. Aquatic macroinvertebrates are animals without backbones that live in water and are large enough to be seen with the naked eye. These little creatures play a key role in the nutrient cycling of aquatic ecosystems. They also serve as a vital food source for fish and other animals. Due to their sensitivity to environmental changes, these animals are valuable indicators of water quality and ecosystem health. With this knowledge in mind, our group decided to investigate whether installing an aerator in a freshwater pond would enhance the pond's biodiversity. Our data were collected from Shu Swamp, a permanent, undisturbed pond located in Mill Neck, New York, and Bailey’s Arboretum, a freshwater pond recently equipped with an aerator in Lattingtown, New York. We hypothesized that ponds equipped with aerators would exhibit greater biodiversity than those without aerators.

MATERIALS & METHODS

1. Specimen collection

Collect 20 samples from both collection sites using D-nets
2. Extraction

We extracted the DNA using the Chelex protocol
3. Amplification via PCR

Using COI primers the DNA was amplified
4. Gel electrophoresis:

Used to confirm the DNA was processed and amplified properly
5. DNA Subway

Upload data to the DNA Subway to confirm the identity of the species

Figure 1- *Caecidotea racovitzai*, also known as a sideswimmer.

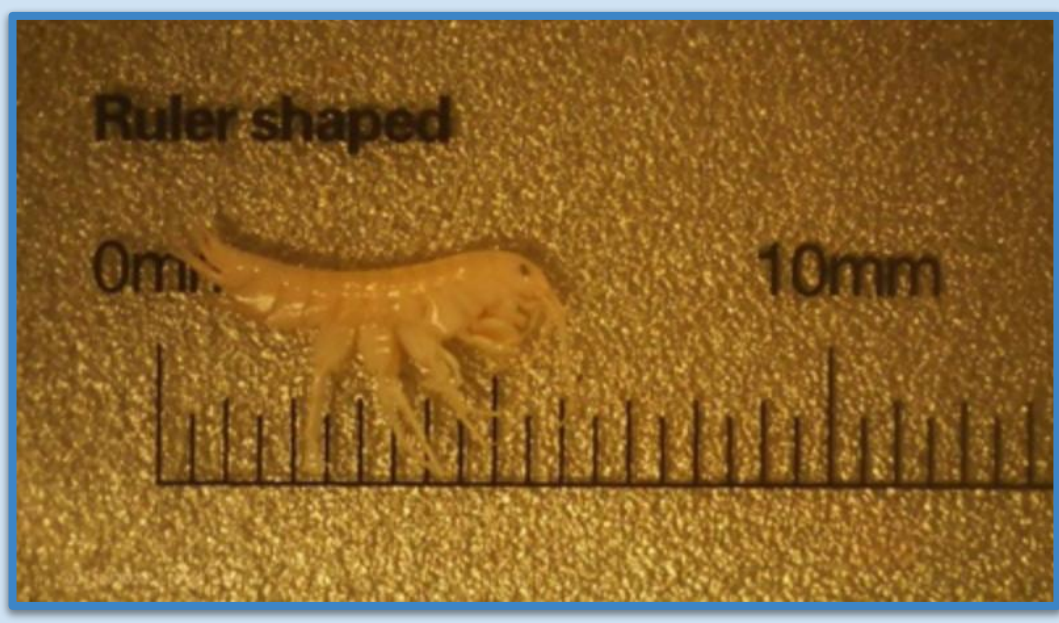
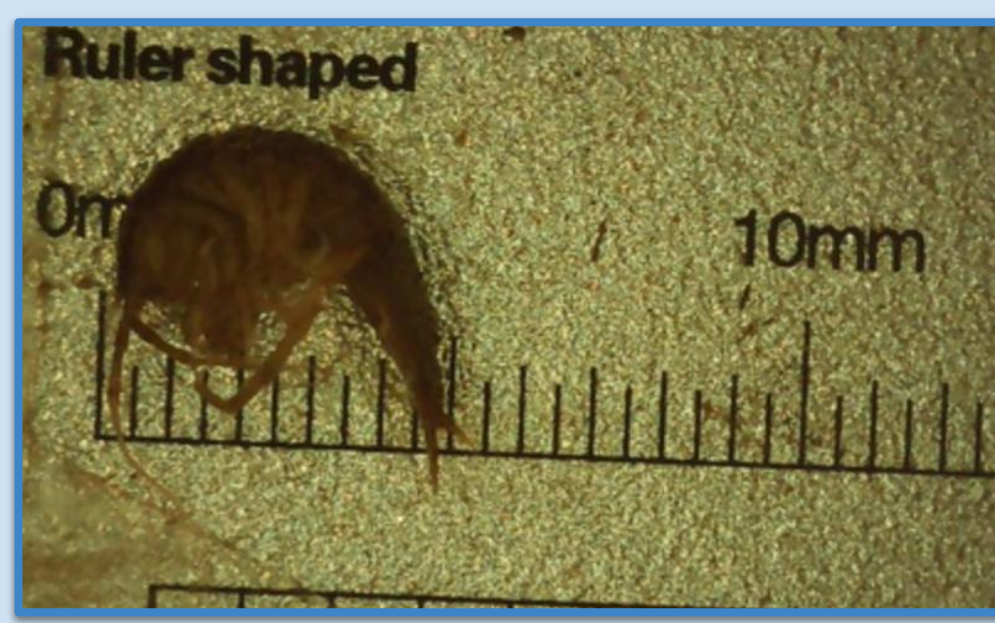


Figure 2- *Lumbriculus sp.*, also known as the bloodworm.



Figure 3- *Ischnura verticalis*, also known as the common stonefly.



RESULTS

Twenty samples were collected from aerated Bailey’s Arboretum, and twenty samples were collected from non-aerated Shu Swamp. Our initial identification was based on field guides, which identified three species in Shu Swamp and four species in Bailey's Arboretum. Our group sent thirteen samples to be sequenced, of which eight samples were sequenced successfully. We identified two species in each pond, and three species overall. *Caecidotea racovitzai* and *Ischnura verticalis* were found in the aerated pond. *Caecidotea racovitzai* and *Lumbriculus sp.* were found in the non-aerated pond.

ACKNOWLEDGEMENTS

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REFERENCES

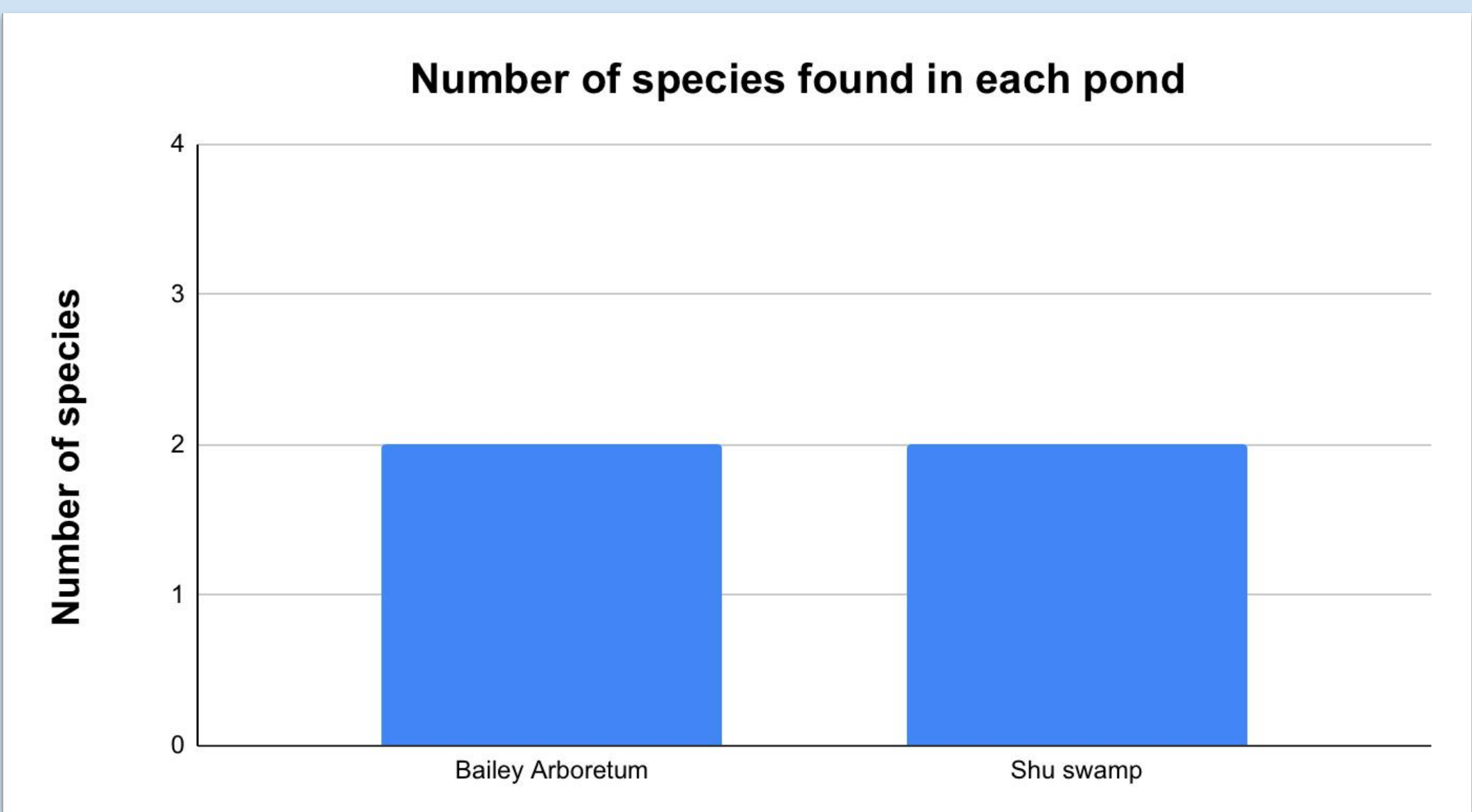


Figure 4- Number of macroinvertebrate species found in the two ponds

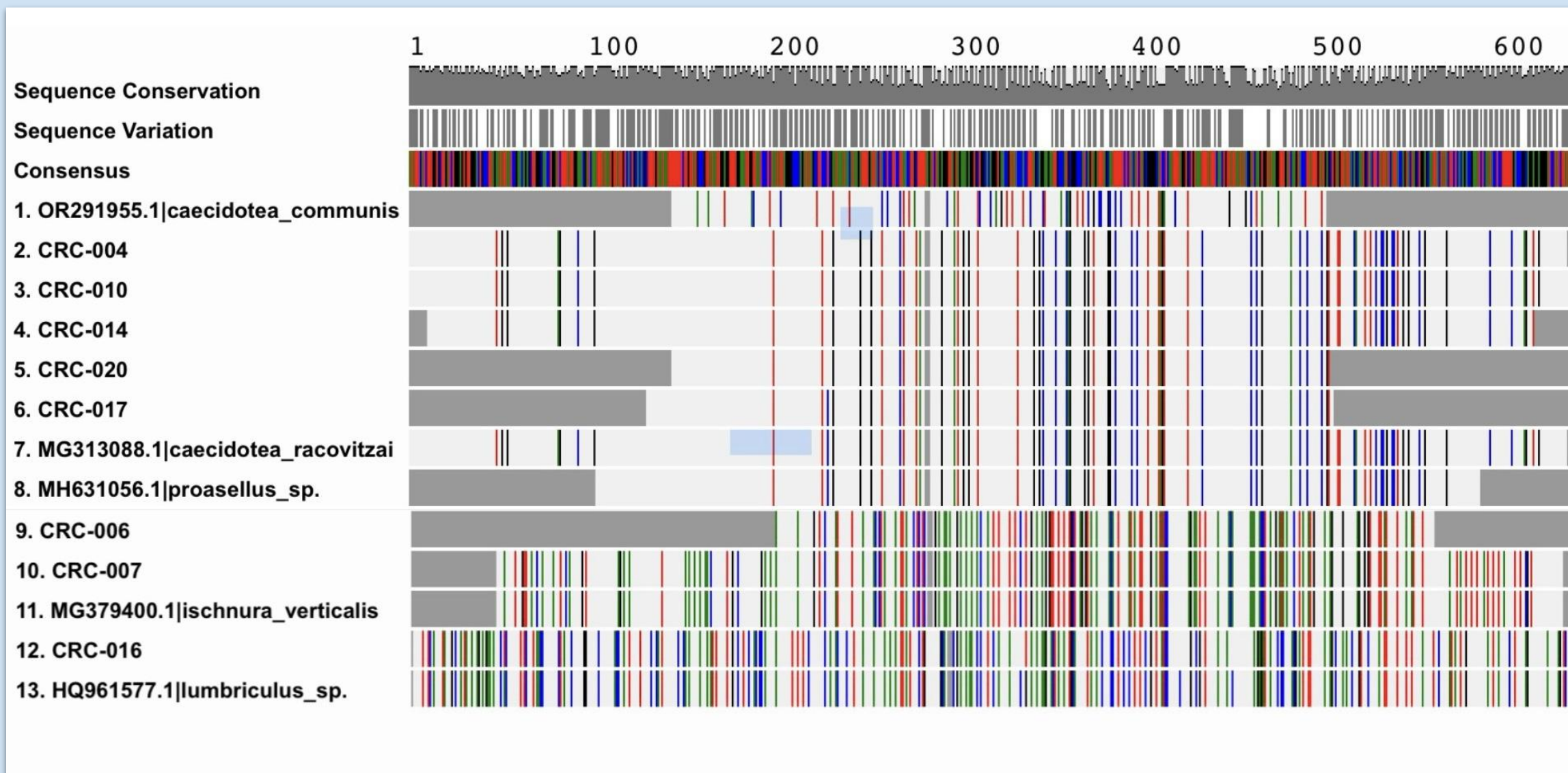


Figure 5- MUSCLE Sequence Alignment image of macroinvertebrate samples

DISCUSSION

Our research identified two species in the aerated pond and two in the non-aerated pond. These results suggest that there is no difference in macroinvertebrate diversity when comparing the two ponds. This means that aerators will not have any impact on a pond’s macroinvertebrate biodiversity. However, our limited data does not allow us to draw any definitive conclusions. After sequencing, only eight samples came back successfully. Many samples could not be used because the DNA was not successfully extracted or duplicated. Others had to be discarded due to contamination with human or bacterial DNA. Future studies would need to collect more samples from different areas and depths around each of the ponds and successfully sequence them to better support a conclusion. Our findings were not consistent with our hypothesis that aerated ponds would have greater biodiversity; however, further research is needed to truly determine the benefits of aeration on biodiversity and the ecosystem as a whole.