

# Testing for the Dissolved Oxygen and Nitrogen Levels in Bailey Arboretum and Shu Swamp Through the Presence of Aquatic Insect Larvae



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## Abstract

Our team answered the research inquiry, “How do dissolved oxygen levels and water quality of freshwater ponds in the North Shore of Long Island correlate with the biodiversity of aquatic insect larvae found in Bailey Arboretum and Shu Swamp?” On top of observing biodiversity through DNA barcoding, we also used water testing kits to record the dissolved oxygen and nitrogen levels of the ponds. Our results indicated that both ponds were oligotrophic due to the high dissolved oxygen and low nitrogen presence. The water quality, in addition to the diverse aquatic life, suggest that both ponds are suitable for life. Through the testing of our local regions, we hope to show that human disturbance and water pollution on the North Shore have not impacted the biodiversity of aquatic life.

## Introduction

High dissolved oxygen levels and presence of nitrogen in water can indicate an unhealthy ecosystem within the body of water. Some species of aquatic invertebrates are bioindicators of water pollution, their presence or absence, can indicate the health of a freshwater system. We examined the link between dissolved oxygen levels, nitrogen levels, and the biodiversity of the invertebrates. We initially hypothesized that the ponds were undergoing eutrophication, but this opinion was later proved to be incorrect. The objective of this research project was to check on the water quality of the ponds in order to determine whether or not the ecosystems were dying.

## Materials & Methods

Our team collected water and invertebrate samples from Bailey Arboretum and North Shore Wildlife Sanctuary. We used a sweep net to collect organisms, placed our samples into buckets and collected water samples. Later, we used pipettes to pick out the invertebrate from the debris. For our first laboratory protocol, we took pictures to document each sample, extracted the DNA from our samples using the silica protocol, performed PCR in order to amplify a segment of the mitochondrial CO1 gene by using CO1 primers, and used gel electrophoresis in order to affirm that successful extraction and amplification of that region in our samples’ DNA. After the last step, we had 12 samples left for further identification. We sent these to Genewiz for sequencing, and used the DNA Subway program in order to find the identities of each invertebrate. Despite the loss of data, we were still able to yield substantial results.

Sample ID and Locations	BLAST Results	Sample Images
PXP-001 Shu Swamp	<i>Podura aquatica</i>	
PXP-002 Shu Swamp	<i>Cymbiodyta vindicata</i>	
PXP-003 Shu Swamp	<i>Cymbiodyta sp.</i>	
PXP-005 Shu Swamp	<i>Neoporus undulatus</i>	
PXP-011 (Forward) Shu Swamp	<i>Crangonyx pseudogracilis</i>	
PXP-013 Shu Swamp	<i>Chironominae sp.</i>	
PXP-014 Shu Swamp	<i>Lepidostoma vernale</i>	
PXP-016 Bailey Arboretum	<i>Proasellus sp.</i>	
PXP-019 Bailey Arboretum	<i>Amphipoda sp.</i>	
PXP-020 Bailey Arboretum	<i>Lumbriculus sp.</i>	
PXP-021 Bailey Arboretum	<i>Proasellus sp.</i>	
PXP-022 (Forward) Bailey Arboretum	<i>Proasellus sp.</i>	

**Figure 2.**

Documentation of each sample we successfully barcoded, along with their results from our BLAST hits

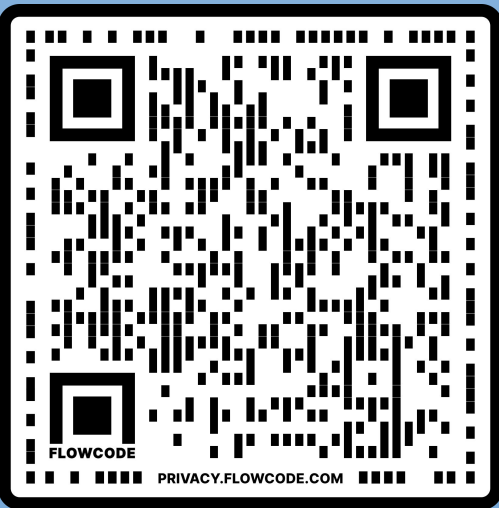
## Results

The pond in Bailey Arboretum had 0 mg/L of nitrite, 0 mg/L of nitrate, and 14 ppm of dissolved oxygen. The pond in Shu Swamp had 0 mg/L of nitrate, 0 mg/L of nitrate, and 17.5 ppm of dissolved oxygen.

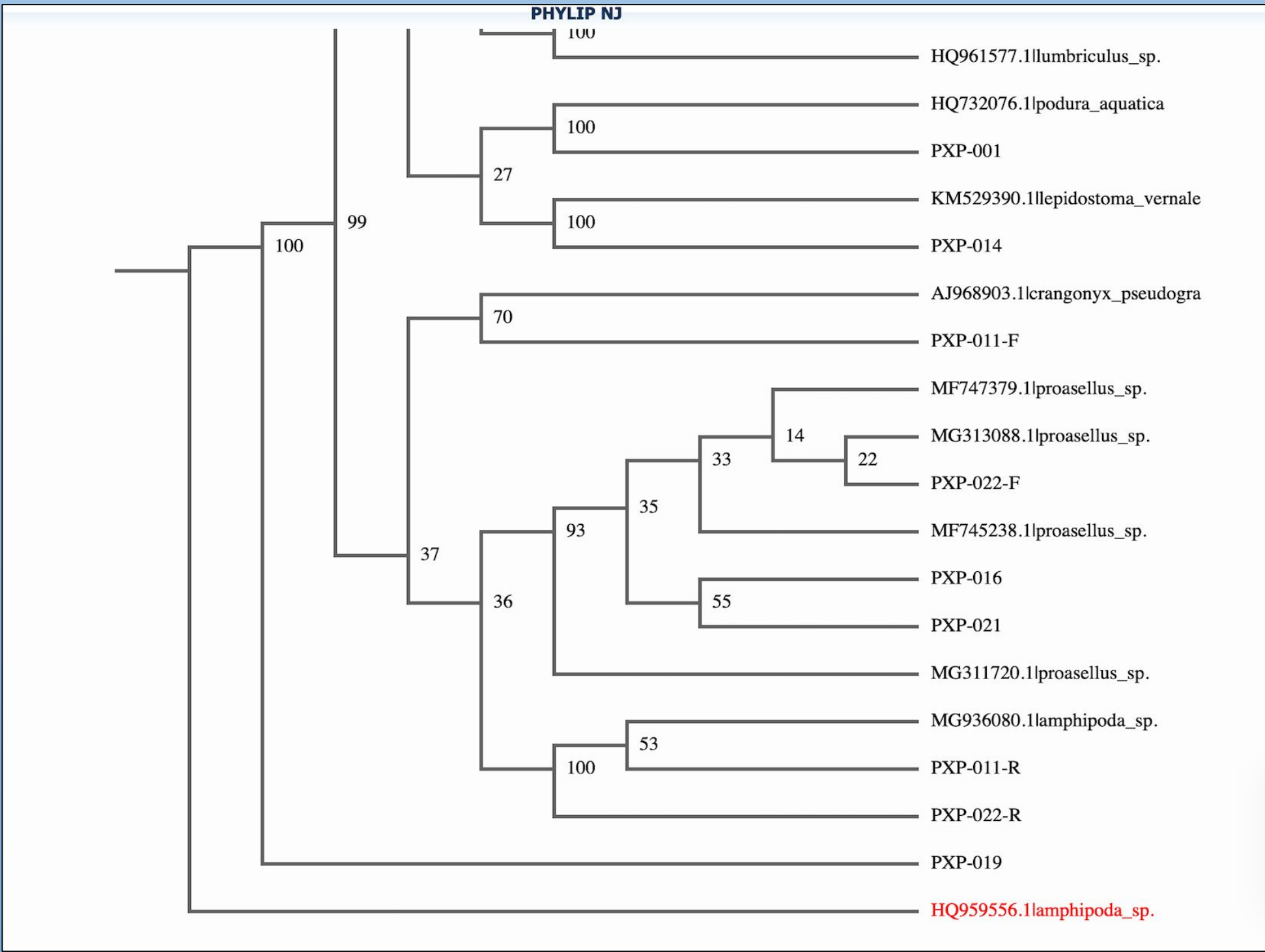
## Discussion

In Shu Swamp, we found a caddisfly and two aquatic beetles. These organisms thrive in well-oxygenated environments; this conclusion correlates with the high level of dissolved oxygen (17.5 ppm) at Shu Swamp. The foul smell at Shu Swamp indicates the presence of decomposing bacteria, which release hydrogen sulfide and cause the sulfurous smell. At Bailey Arboretum, we found a blackworm; these invertebrates only survive in clean water due to their intolerance of pollution. We also found *Planaria torva* in the Bailey Arboretum pond; since planaria breathe through their skin, their presence indicates good water quality. We concluded that both ponds have good water quality, enough to support the livelihood of sensitive aquatic invertebrates.

## References



**Figure 1.** CSHL DNALC-generated map for all documented samples



**Figure 3.** A phylogenetic tree with BLAST results; shows the evolutionary relationships between the invertebrates and the percentage of genes each organism on the right side of the tree shares with the chosen outgroup, *Amphipoda sp.*