# Biodiversity of Beetles in Seaman's Neck Park

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## Abstract

The research conducted was intended to examine the beetle population of Seaman's Neck Park in Seaford, NY in relation to geographical features and soil composition of the park. A concerted effort was taken in order to link species of beetle to definitive aspects of the park, such as soil composition and geographical location. The intent of the study was to acquire information on the biodiversity of insects inhabiting Long Island. The compiled results can offer valuable information for the maintenance of its parks. For each specimen extracted, the GPS latitude, longitude and altitude were recorded. From each soil sample that yielded an organism, the composition was documented accompanied by examining the Nitrogen, Phosphorus, pH and soluble Potassium concentration (POTASH). The results conclude that no invasive beetle species was collected from the park. It can be concluded that Seaman's Neck park is not deeply affected by damaging invasive beetles such as the Asian longhorn beetle. The most common beetle collected was the Harpalus Affinis (the common ground beetle), which bodes well for park due to the fact that these beetles are harmless and have no profound impact on the environment. In addition the beetles various other insects such as; the common pavement ant, earwigs and a springtail were identified. One organism is currently unidentified after being sequenced through both the NCBI database and BOLD.

## Results

PHS-021, this specific organism could not be identified on BLAST. Therefore further sequencing was conducted on BOLD. Most of the beetle species were classified under the order Coleoptera. All of these beetle species identified were native to their surrounding environment, except for specimen PHS-005 and PHS-008. Amara Apricaria (PHS-005) is native to Europe, opposed to Selenophorus Pedicularis which inhabits sub-arctic areas and Australia. Both species of beetle have been identified in the United States in the past, however this would be the first time they have been mapped to Long Island, according to the data obtained on the BOLD Canadian database.

Fig 1: A common ground beetle native to all of the united states

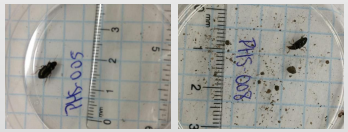

Fig 5: PHS005 and PHS008 Type of ground beetle found in the family of Carabidae

Fig 7: Novel Specimen PHS021 found that is currently unidentified

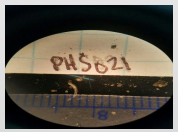


Fig 10: Map of Seamen's Neck Park

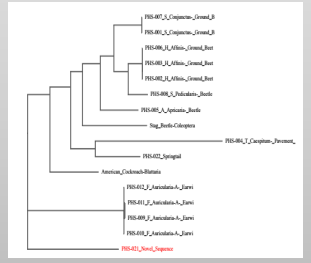

Fig 9: The phylogenic tree created from the specimens collected

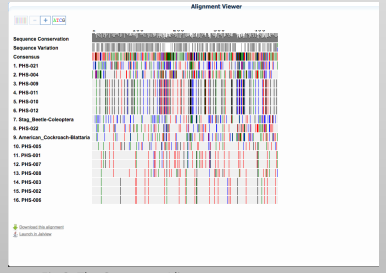


Fig 8: The Sequence Alignment

## Methods

Our goal was to obtain organisms 10mm in size and within 6 inches from a permanent post. Samples were collected on April 17, 2017 after the last seasonal frost, while the organisms were alive and healthy. Soil samples were collected with a shovel up to 6 inches deep and were then placed in labelled zip lock bags to be transported back to the lab. Approximately 12 insects collected were best suited to be sequenced and documented. Our team used forceps, a paint brush and a microscope to remove the samples from the soil. Samples were labelled, photographed and placed in the freezer until they were ready for purification. Prior to DNA barcoding, a visual inspection of the specimen was conducted in effort to identify the genus species of each insect collected. After this, our team followed the process of isolating and purifying the DNA by using a leg of each sample. This includes amplifying each sequence through PCR followed by a gel electrophoresis to validate that the PCR was successful. To extract the DNA, a lysis buffer was added to the tissue sample of the specimen and ground well. The lysis buffer provides access to the mitochondrial DNA by ripping open the cell wall. The sample was then washed multiple times in order to purify the DNA. Once the DNA was properly prepared, a PCR cocktail consisting of the forward and reverse mitochondrial COI primers, loading dye, DNA polymerase beads, and nucleotides was then added to the DNA. Through PCR, the collected DNA sequence was then amplified. A negative control sample of the mixture excluding the DNA was used as well. The sample was then heated to 94 degrees Celsius in order to denature the DNA, followed by a cooling process which brought the temperature down to 54 degrees Celsius. This cooling stage in necessary in order for the primers to anneal. Finally, the mixture was then heated again to 72 degrees Celsius so the polymerase can synthesize new strands of DNA. This process was repeated 30-35 times in order to produce billions of copies of our target DNA.

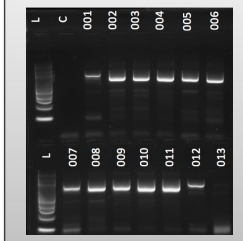


Fig 2: Gel samples 1-13

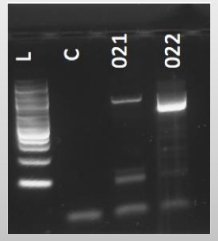


Fig 3: Gel samples 21-22

| Sample ID | Initials | Lattitude | Longitude | Elevation (ft) | Collection | pH Test | N Test | K Test | P Test |
|---|---|---|---|---|---|---|---|---|---|
| PHS-001 | CS | 40.6525 | -73.49 | 37 | 1 | 7.2 Neutral | N2 Adequate | K2 Adequate | P0 Depleted |
| PHS-002 | CS | 40.6525 | -73.49 | 37 | 1 | 7.2 Neutral | N2 Adequate | K2 Adequate | P0 Depleted |
| PHS-003 | CS | 40.6522 | -73.49 | 37 | 1 | 7.2 Neutral | N2 Adequate | K2 Adequate | P0 Depleted |
| PHS-004 | GH | 40.6522 | -73.49 | 18 | 2 | 6.8 Neutral | N2 Adequate | K3 Sufficient | P1 Deficient |
| PHS-005 | GH | 40.6522 | -73.49 | 18 | 2 | 6.8 Neutral | N2 Adequate | K3 Sufficient | P1 Deficient |
| PHS-006 | GH | 40.6522 | -73.49 | 18 | 2 | 6.8 Neutral | N2 Adequate | K3 Sufficient | P1 Deficient |
| PHS-007 | JM | 40.6516 | -73.49 | 27 | 3 | 6.5 Acidic | N1 Deficient | K3 Sufficient | P1 Deficient |
| PHS-008 | JM | 40.6516 | -73.49 | 27 | 3 | 6.5 Acidic | N1 Deficient | K3 Sufficient | P1 Deficient |
| PHS-009 | JM | 40.651 | -73.49 | 26 | 3 | 6.5 Acidic | N1 Deficient | K3 Sufficient | P1 Deficient |
| PHS-010 | GH | 40.651 | -73.49 | 26 | 3 | 6.5 Acidic | N1 Deficient | K3 Sufficient | P1 Deficient |
| PHS-011 | CS | 40.651 | -73.49 | 26 | 3 | 6.5 Acidic | N1 Deficient | K3 Sufficient | P1 Deficient |
| PHS-012 | CS | 40.651 | -73.49 | 26 | 3 | 6.5 Acidic | N1 Deficient | K3 Sufficient | P1 Deficient |
| PHS-021 | GH | 40.651 | -73.49 | 23 | 4 | 6.9 Neutral | N2 Adequate | K2 Adequate | P1 Deficient |
| PHS-022 | GH | 40.651 | 73.27 | 23 | 4 | 6.9 Neutral | N2 Adequate | K2 Adequate | P1 Deficient |

Fig 4: data sheet used during the investigation

## Discussion

After an investigation was conducted on Seaman's Neck Park, it has become evident that the original hypothesis was partially validated. Although there was an abundance of insects in the area, it was a failed attempted to extract any invasive species from the parks bounds. Instead, other non-native organisms were collected, such as specimen PHS-008 (Harpalus pumilus). This insect is commonly located towards the arctic regions of the globe. With the newly obtained information, the vast biodiversity of the park has become more pronounced. The vast majority of the collected insects were extracted from the deciduous sectors of the park. It was rather shocking to discover the plethora of insects that inhabit regions further from the water. This outcome is mostly attributed to the effects of the saltwater penetrating the soil, thus making it unsuitable for insects that favor a dryer soil composition. As for further investigation of the soil, checking during different seasons might be able to yield different results, due to the temperature fluctuation as well as the different life cycles of various organisms. More importantly, further research could be done on specimen PHS-008, due to the fact that it cannot be definitively determined whether or not it is in fact an invasive species that could potentially harm the surrounding environment. It can be inferred that in the coming years, the amount of this invasive species of beetle may rise due to its ability to adapt to different landscapes.

## Acknowledgments

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