Dragonfly Diversity in Van Cortlandt Park

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Abstract

This experiment examined the biodiversity of dragonfly and damselfly nymphs in Van Cortlandt Park using DNA sequencing. Dragonfly and damselfly nymphs were collected from Van Cortlandt Lake and Tibbett's Brook. The DNA of the specimens was extracted and then amplified using PCR. The samples were then sequenced, from which two species were identified: *Pachydiplax longipennis* and *Enallagma civile. Pachydiplax longipennis* is a type of dragonfly while *Enallagma civile* is a damselfly. Both are native species that were found in Van Cortlandt Lake.

Introduction

- Dragonflies and damselflies are important predators of waterway ecosystems.
  - Predators stabilize the food chain and keep the populations of prey from growing too large (Friends of Van Cortlandt Park, 2018).
- Dragonflies and damselflies are both part of the order Odonata (Britannica, 2018).
- There are 194 recorded species of dragonflies and damselflies in New York State (White et al. 2010).
- Most species of dragonflies and damselflies attach their eggs to substrates at or above the water's surface, and larvae, also known as nymphs or naiads, are aquatic (Sabet-Peyman, 2000).
  - It is difficult to visually distinguish between nymphs of dragonflies and damselflies.
- Van Cortlandt Park is a perfect home for dragonflies and damselflies, with Tibbett's Brook running through the center of the park into a large lake near the southern edge of the park, Van Cortlandt Lake.
  - Van Cortlandt Park is a 1,146 acre park in Northern Bronx, the third largest park in all of New York City (NYC Parks, 2018).
  - Tibbett's Brook is a slow moving and muddy stream, while Van Cortlandt Lake is still. Nymphs were collected from both locations.
- This experiment attempted to compare biodiversity of Van Cortlandt Lake and Tibbett's Brook and contribute to an increased understanding of each location's ecosystem.

Results

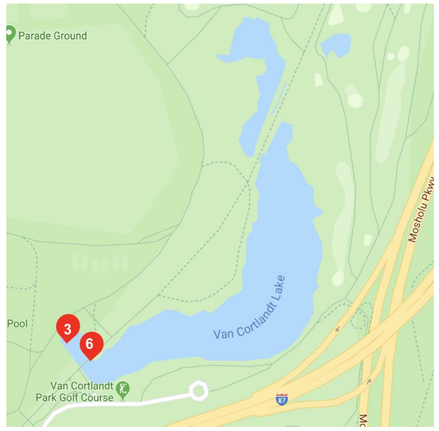

Figure 1: Sample Locations in Van Cortlandt Park. Map of Van Cortlandt Park with pinpoints to indicate where each specimen was collected. All specimen were taken from the southern part of Van Cortlandt Lake. Image of the map was taken from Google maps.

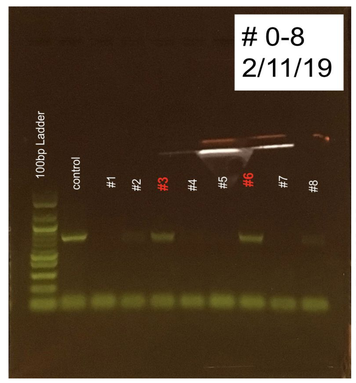

Figure 3: Gel Electrophoresis of Identified Specimen. Shown is a photo of the gel electrophoresis of the PCR products of the identified specimens (highlighted in red) before they were sent for sequencing.

Sample 3	*Pachydiplax longipennis*
Sample 6	*Enallagma civile*

Table 1: DNA Barcoding Results. The DNA extracted from samples 3 and 6 was amplified using PCR, and sent to Genewiz for sequencing.

Location	pH	Temperature (°C)	Dissolved O_2	Nitrates (ppm)	Phosphate (ppm)
Van Cortlandt Lake	6.61	17.33	35%	4.77	0.86
Tibbett's Brook	6.75	18	35%	0	0.46

Table 2: Water Quality Data. There were nine repetitions for the Van Cortlandt Lake tests and three repetitions for the Tibbett's Brook tests; this data is the mean.

Fig 2a: Image of Sample 3.
This figure shows two images of sample 3. The sample was alive in the photo on the right and dead in the photo on the left.

Figure 2b: Image of Sample 6.
This figure shows two images of sample 6. The sample was alive in the photo on the right, and dead in the photo on the left.

Materials & Methods

- 30 samples were collected in Van Cortlandt Park, 6 from Tibbett's Brook and 24 from Van Cortlandt Lake.
- Water quality was tested at each site using a Lamotte water quality testing kit.
- All samples were photographed.
- Individual specimen were placed in a 1.5 ml test tube of 95% ethanol
  - Ethanol preserved and killed the sample.
- The samples were stored in a -20°C freezer.
- Each sample's DNA was extracted using lysis solution, wash buffer, and silica resin.
- DNA was amplified via PCR, using the UBP COI primer set LCO1490 / HC02198.
- The samples were analyzed using gel electrophoresis.
- Eight samples were sent to Genewiz for sequencing
  - Two of the samples came back with accurate sequences.
- Results were put into the BLAST program in order to identify the species of the samples.

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Discussion

- Two of the thirty collected dragonfly samples were successfully sequenced.
- The first was found to be the *Pachydiplax longipennis,* or Blue Dasher.
  - They are the most common dragonflies in the United States, and can be found throughout North America.
  - They are found in freshwater bodies and are major predators in their ecosystems.
- The other specimen was an *Enallagma civile*, or Bluet.
  - They are found in both short and long term freshwater areas, such as puddles, lakes, or rivers.
  - They can inhabit many areas no matter the vegetation or salinity.
  - Bluets moved North from more southern parts of America in the past century.
- Why many species might have been unidentified:
  - Most samples were quite small, and so only a leg was used to extract DNA.
  - Because their exoskeletons are made of chitin, the flesh was fairly inaccessible.
  - It is possible that for some samples, the DNA was never fully accessed.
  - The two samples used were both relatively small, meaning more of their bodies were used for extraction, possibly making the DNA extraction and amplification more favorable.
- Repeating this experiment in future years would help continue to grow understanding of the dragonfly populations within Van Cortlandt Park, and being careful to use the fleshy midsections of dragonflies could help to gain more results.

Acknowledgements

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