Aquatic Plant Diversity in Van Cortlandt Park

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Abstract

Aquatic plants are the basis of almost every aquatic ecosystem since they can photosynthesize and bring energy into their environment. Fertilizers, pesticides and herbicides drastically change aquatic environments. We hypothesized that aquatic plant samples extracted closer to the golf course would exhibit less diversity than samples taken further away from the pesticides, herbicides, and fertilizers used to maintain the grass on the course.

Our hypothesis was supported by the DNA sequences showing that out of the six species collected from Van Cortlandt Lake, all six of the species were unique, whereas only five out of the eight sequences from Tibbett’s Brook were unique.

• One error in our experiment was that the algae PCR primer did not work. Many of the samples collected were algae, and we could not determine the species of the samples of algae that we collected.

• Our results could have implications on the way that the Department of Parks and Recreation manages the Van Cortlandt Park golf course in order to continue their mission to preserve the natural beauty of the third largest park in New York City.

In the future, it would be desirable to collect plant samples in the ponds on the golf course because the aquatic plants in those ponds are certainly affected by the products used to maintain the golf course. It would also be beneficial to collect more samples so our results could be more conclusive.

Introduction

• Aquatic plants are the basis of almost every aquatic ecosystem
  ○ Primary producers
  ○ Photosynthesize to bring energy into ecosystems

Different species indicate different water quality

• Fertilizers, pesticides and herbicides drastically change aquatic environments
  ○ Alter the nitrogen-phosphorus ratio in water¹
  ○ Present on golf courses, including the Van Cortlandt Park Golf Course²

Tibbett’s Brook

• Runs through the Van Cortlandt Park Golf Course and therefore is exposed to pesticides and fertilizers

Empties into Van Cortlandt Lake after draining through mud, grass and forest

We measured the biodiversity of aquatic plants in Tibbett’s Brook and Van Cortlandt Lake to see what effect chemicals from the golf course have on the health of this ecosystem

Materials and Methods

• 27 algae and aquatic samples were collected
  ○ 14 samples from Tibbett’s Brook
  ○ 13 samples from Van Cortlandt Lake

LaMotte Estuary and Marine Monitoring Kit was used to test the water quality at each site

DNA from the samples was isolated and amplified using PCR

PCR products were analyzed using gel electrophoresis and 14 samples were sequenced

Results

Figure 1: Sample Locations in Van Cortlandt Park

Table 1: Species Found At Two Locations in Van Cortlandt Park

<table>
<thead>
<tr>
<th>Species</th>
<th>Van Cortlandt Lake</th>
<th>Tibbett’s Brook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolffia sp.</td>
<td>Zannichella palustris</td>
<td></td>
</tr>
<tr>
<td>Trapa natans</td>
<td>Callitriche cophocarpa</td>
<td></td>
</tr>
<tr>
<td>Nymphoides alba</td>
<td>Zannichella major</td>
<td></td>
</tr>
<tr>
<td>Potamogeton octandrus</td>
<td>Trapa natans</td>
<td></td>
</tr>
<tr>
<td>Nuphar lutea</td>
<td>Potamogeton punctata</td>
<td></td>
</tr>
<tr>
<td>Zannichella punctata</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Water Quality Data

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Temperature °C</th>
<th>Dissolved O2</th>
<th>Nitrate (ppm)</th>
<th>Phosphate (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Cortlandt Lake</td>
<td>6.61</td>
<td>17.33</td>
<td>35%</td>
<td>4.77</td>
<td>0.86</td>
</tr>
<tr>
<td>Tibbett’s Brook</td>
<td>6.75</td>
<td>16</td>
<td>35%</td>
<td>0</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Table 2: There were nine repetitions for the Van Cortlandt Lake tests and three replications for the Tibbett’s Brook tests, this data is the mean.

Figure 2: Phylogenetic Tree of Sequencing Results

Figure 3: Untrimmed Multiple Alignment Created By MUSCLE

Discussion

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References


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