Chlorophyll \( a \) and phytoplankton surveys of Cranberry Bog, Burlington, NY, summer 2009

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INTRODUCTION

Cranberry Bog is a 70-acre wetland within the bounds of Greenwoods Conservancy, which encompasses 1200+ acres in the town of Burlington, New York (Figure 1). The bog has characteristics of both bog and fen systems, and as such, supports a unique flora including that of alkaline fens, a \textit{Sphagnum} mat and bog community, marsh and open water.

Algae are non-embryonic, non-vascular, oxygenic photoautotrophs whose primary photoreceptive pigment is chlorophyll \( a \) (Dillard 1999). Aquatic algae inhabit a variety of environments, occupying various niches in a body of water. Phytoplanktonic algae, which are suspended or swim freely in open water, are the focus of this study. The type of algae present and their abundance in an aquatic system can reflect trophic status and may be indicative of contamination from the addition of nutrients from agriculture run-off or sewage (Prescott 1964). Conditions of salinity, size, depth, transparency, nutrient conditions, pH, and pollution effect the composition and abundance of algae present in a body of water (Sheath and Wehr 2003), thus the algal composition is, to some degree, a reflection of the condition of a body of water.

Most phytoplankton are microscopic, making it difficult to quantify the population in terms of absolute numbers of individual algal cells. To get around this, photosynthetic pigments present in such organisms can be quantified in order to estimate the abundance of organisms present within a body of water. All photosynthetic organisms contain pigments that are employed to help absorb specific wavelengths of light from the sun’s color spectrum. These wavelengths provide energy to assist in the electron transport aspect of photosynthesis. This aids in the production of energy for the specific organisms. Chlorophyll \( a \) is a pigment that is found in most photosynthetic organisms, so its quantification is used as an indicator of the amount of photosynthetic material in water bodies.

As described by Stevenson and Smol (2003), surveys to determine the taxonomic composition of algae in the phytoplankton community are a useful means by which to assess biotic integrity and begin to diagnose causes of environmental problems. Changes in assemblage should reflect physical and chemical changes caused by perturbations of the system, whether caused by human actions or changes in the trophic composition. Species presence and success in community assemblages are ultimately constrained by environmental conditions and interactions with other species in the habitat (i.e. grazing by zooplankton and zebra mussels, trophic cascades that impact grazing populations, etc.).

In the summer of 2009 Cranberry Bog was surveyed for both algal composition and chlorophyll \( a \) concentration. The purpose of the research was to characterize the algal

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community composition in Cranberry Bog and establish a baseline of current chlorophyll $a$ concentrations, as the algal community has not been studied previously.

Figure 1. Greenwoods Conservancy, Burlington, New York showing locations of summer 2009 sample sites within Cranberry Bog (★).

**MATERIALS AND METHODS**

Samples were collected at 3 sites on Cranberry Bog on 16 June and 2 July 2009 (Figure 1 and Table 1). Samples were collected from just below the water surface and each was immediately split into subsamples for chlorophyll $a$ and phytoplankton analyses. The methods of sample preservation, storage, and analysis are given in the following sections.

**Chlorophyll $a$**

Samples were kept on ice immediately following collection and during transport. In the lab, two 100mL portions of each sample were run through Whatman GF-A filters in a vacuum assembly. The filters were frozen until further processing. On the day of analysis, the filters were cut into small pieces and placed in a glass tube to which 10 mL of a buffered acetone solution
were added. This mixture was ground to a homogeneous slurry using a power drill with a teflon bit. The slurry was centrifuged at 2,100 rpm for 10 minutes to separate the solution from the filter paper. A fluorometer was used to determine the fluorescence of the supernatant according to the methods of Welschmyer (1994). Reported concentrations for samples run in duplicate represent the average of the concentrations determined for each replicate.

Phytoplankton

100 mL were poured into a separate container and preserved with Lugol’s solution. In the lab, the samples were set aside to settle for at least 24 hours. A total of 5 mL from the settled portion of each sample were surveyed for the following phytoplankton taxa according to Prescott (1954): Chlorophyta, Cyanophyta, Chrysophyta, and Pyrrophyta. For each sample, 1 mL of the settled portion of sample was added to a Palmer-Maloney slide and examined in entirety using a digital compound microscope. This was repeated 5 times so that a total of 5 mL was examined. Prescott (1954) was used as a reference for grouping the algae.

Table 1. The site names and corresponding GPS Coordinates for Cranberry Bog samples (WGS 84 Degrees Decimal Minutes).

<table>
<thead>
<tr>
<th>Site Name</th>
<th>GPS Coordinates (D mm.mmm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW-1</td>
<td>N 42 42.952’, W 75 05.839’</td>
</tr>
<tr>
<td>GW-2</td>
<td>N 42 42.957’, W 75 05.921</td>
</tr>
<tr>
<td>GW-3</td>
<td>N 42 43.183’, W 75 05.872</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

Chlorophyll \( a \) concentrations

Chlorophyll \( a \) concentrations of the surface samples are presented in Figure 2 and Table 2. The highest concentration was observed on 16 June (11.4 ppb) at site GW-3. Concentrations varied between the two sampling dates, most notably at site GW-3 (Figure 2). Concentrations in Cranberry Bog are comparable to those observed in Otsego and Canadarago Lakes in 2009 (Primmer 2010a and 2010b).

Table 2. Average chlorophyll \( a \) (ppb) in surface samples of Cranberry Bog, Burlington, New York, sample sites GW -1, GW -2, and GW -3.

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>GW-1</th>
<th>GW-2</th>
<th>GW-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-Jun</td>
<td>6.34</td>
<td>3.14</td>
<td>11.43</td>
</tr>
<tr>
<td>2-Jul</td>
<td>6.71</td>
<td>5.12</td>
<td>4.98</td>
</tr>
<tr>
<td>Average</td>
<td>6.67</td>
<td>4.12</td>
<td>8.2</td>
</tr>
</tbody>
</table>
Phytoplankton

Figure 3 illustrates the composition of each sample in terms of the relative abundance of each of the four taxonomic groups for each site from samples collected on 2 July 2009. Chlorophyta was the dominant taxon in the community at each site comprising greater than 80% of algal cells counted (Figure 3, Table 3). Cyanophyta was the second-most common group in the algal community. Some samples did not contain individuals from each of the four taxonomic groups; pyrrophytes were not documented at any site. The community composition varied slightly between sample sites, though a clear pattern was not apparent. The total number of cells counted varied considerably between the sites (Table 3). Twenty individuals were counted in 5 mL of concentrate at site GW-2 compared to totals of 133 and 168 individuals at sites GW-1 and GW-3, respectively.

Table 3. Percent composition of four algal groups and the total number of organisms counted in 5 mL of concentrate; Chlorophyta, Cyanophyta, Pyrrophyta and Chrysophyta from Cranberry Bog sites GW-1, GW-2, and GW-3 on 2 July 2009.
Phytoplankton Community Percent Composition of Taxa

![Phytoplankton Community Percent Composition of Taxa](image)

Figure 3. Composition of four different algal groups; Chlorophyta, Cyanophyta, Pyrrophyta and Chrysophyta in surface samples from Cranberry Bog, sample sites GW-1, GW -2, and GW -3, collected on 2 July 2009.

REFERENCES


