Distribution of *Nitellopsis obtusa* (Starry stonewort) in Canadarago Lake, NY

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ABSTRACT

In 2010, a survey of aquatic macrophytes was performed on Canadarago Lake, Richfield, New York (Smith 2011). During that survey an invasive exotic species of macroalgae was found, *Nitellopsis obtusa* or starry stonewort. This current survey was conducted to look at the changes in the distribution of this invasive species. Sampling was conducted using the Point Intercept Rake Toss Relative Abundance Method (PIRTRAM, Lord and Johnson 2006) at 74 sites around the lake. Plants were collected three times at each sample point; data were analyzed to show abundance in the lake. Thus far, starry stonewort has spread in Canadarago Lake, though it remains sparse in areas in which it was not present in 2010.

INTRODUCTION

Canadarago Lake (Figure 1) is located south of Richfield Springs New York, in northern Otsego County. Its watershed is comprised of wooded, rolling hills (~55%) and agricultural fields (~33%) (Albright and Waterfield 2012). The lake measures about 4 miles (6.5 km) long and 1.4 miles (2.2 km) across and drains into Oaks creek at the south end. Recreational usage of the lake is high in the summer due to the lake houses lining the shore; the lake’s primary uses include boating and fishing (Albright and Waterfield 2012). As of 2013, there were about 625 residences (seasonal and permanent) along the lake’s shore (Bailey 2014). As part of an effort to develop a “State of the Lake” report, the aquatic plant community was surveyed during the summer of 2010 (Smith 2011, Albright and Waterfield 2012). The survey from 2010 documented the relative abundance all plants sampled at 13 sites. During that survey an exotic, invasive species of macroalga was discovered, *Nitellopsis obtusa* or starry stonewort, near the north end of the lake. The primary intent of the current (2014) survey was to document changes in the distribution of starry stonewort in the lake. While surveying, we also recorded the presence of *Chara* sp. (muskgrass). Both starry stonewort and *Chara* are multicellular green algae, though their growth form resembles that of vascular macrophytes. The former species reportedly favors more alkaline, hard water conditions while the latter favors more acid, soft water conditions (Penn State 2015). Starry stonewort is an aggressive aquatic nuisance species which often outcompetes *Chara*, as well as most other submerged aquatic plants (Pullman and Crawford 2010). *Chara* and starry stonewort were compared to evaluate a suspicion that the former often displaces the later,

with the two rarely cohabitating (Harman and Albright 2014). All other species collected, taken together, were also evaluated. We conducted this survey using Point Intercept Rake Toss Relative Abundance Method (PIRTRAM; Lord and Johnson 2006), sampling along the littoral zone of the lake at semi-regular intervals.

Figure 1. Bathymetric map of Canadarago Lake, Otsego County, New York. Contours and scale in feet.
METHODS

To utilize the Point Intercept Rake Toss Relative Abundance Method (PIRTRAM), a double-headed garden rake, attached to a cord with the length of about 10m (33 feet), was employed. PIRTRAM is an effective method in approximating relative abundance and frequency of aquatic plants that are submerged (Lord 2006), though does not fully describe the community. The survey was conducted between 11 and 14 August 2014. At each site, samples were collected in triplicate. The rake was tossed, allowed to settle, and pulled back slowly to the boat. For each toss, the rake was thrown in a different direction from the boat to get a more complete survey of plants within the site. Use of a motorized boat and GPS were then used for navigation and site marking along the lake. GPS waypoints were marked and the vegetation from each toss was separated as Chara, starry stonewort and others. Each of these three groups had its abundance estimated according to Table 1 and the three replicate samples were averaged for each site. For mapping purposes, these values were translated into values of 0, 1, 2, 3, or 4, indicating abundance, correlating with total dry weight measurements (Table 1). These data points were then plotted, using GIS, onto the base map of Canadarago Lake. Symbols were assigned to express these abundance categories.

Table 1. Biomass range estimate of plants in g/m², by species, utilized in the rake toss (PIRTRAM) method. Mid values were used as estimates in Figures 2 and 3. * indicates a new category added to PIRTRAM that was needed for the GIS mapping.

<table>
<thead>
<tr>
<th>Abundance Categories</th>
<th>Field Measure</th>
<th>Map Abundance Categories*</th>
<th>Total Dry Weight (g/m²)</th>
<th>Mid</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Z&quot;= No Plants</td>
<td>Nothing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&quot;T&quot;= Trace Plants</td>
<td>Fingerful</td>
<td>1</td>
<td>0.1-2</td>
<td>1</td>
<td>0.1</td>
<td>2</td>
</tr>
<tr>
<td>&quot;S&quot;= Sparse Plants</td>
<td>Handful</td>
<td>2</td>
<td>2-140</td>
<td>71</td>
<td>2</td>
<td>140</td>
</tr>
<tr>
<td>&quot;M&quot;= Medium Plants</td>
<td>Rakeful</td>
<td>3</td>
<td>141-230</td>
<td>185</td>
<td>140</td>
<td>230</td>
</tr>
<tr>
<td>&quot;D&quot;= Dense Plants</td>
<td>Can't bring in Boat</td>
<td>4</td>
<td>230-450+</td>
<td>340</td>
<td>230</td>
<td>450+</td>
</tr>
</tbody>
</table>

RESULTS & DISCUSSION

Figures 2 and 3 both show the 74 sampling sites taken during this survey. In both of these figures, the abundance estimates of starry stonewort are given as circles ranging in shading from white, indicating its absence (category “0”) to black, indicating category “4”. In Figure 2, these circular symbols are embedded in square symbols, which likewise indicate the abundance estimates of Chara. Starry stonewort abundance is presented identically in Figure 3; here, those circular symbols are embedded in hexagonal symbols, which similarly represent the abundance estimates of “all other plants”.
The methodologies employed during the 2010 survey (Smith 2011) were somewhat different than those of 2014. Only thirteen sampling sites were evaluated, and rather than being precise, GPS-derived sites, they represented more general areas of the littoral zone of Canadarago Lake (the intention was to not only evaluate the spatial distribution, but also the temporal distribution. Sampling occurred on six dates between 6 June and 12 July 2010). To compare these distributions to those of 2014, the data were presented as similarly as possible for mapping purposes. Figure 4 presents the distribution and abundance estimates of starry stonewort and Chara in these sampling areas on 12 July 2010 (the date that most closely matched the 2014 effort). Figure 5 compares the same for starry stonewort and “all other plants”.

In both 2010 and 2014, Chara was considerably more widespread and was typically present at higher abundances than was starry stonewort (Figures 2 and 4). In the earlier survey, starry stonewort was confined to the northwestern most region of the lake, where it was quite dense, contributing about 300 g/m² of the total 600+ g/m² of the plant community (Figure 4 and 5). By 2014, while not particularly widespread, starry stonewort was encountered at three additional locations (represented by six sampling locations) (Figures 2 and 3). The densities at those more recently established patches ranged from about 1 g/m² to about 180 g/m². Those new sites are scattered around the perimeter of the lake, and may allow for a speedy advance of this species.

The expansion and establishment of starry stonewort in Canadarago Lake has not been as swift as has been documented elsewhere in central New York. In Moraine Lake, Madison County, from the time that it was first documented in a particular region of the lake until it was overwhelmingly dominant was typically one year (Harman and Albright 2014). The slower expansion seen to date in Canadarago Lake could be due to the luxuriant growth of established plants throughout the lake’s littoral zone. Established plant beds limit the opportunity for the spread because they provide few openings in which starry stonewort can take hold. Note that where Chara is not particularly abundant (Figure 2), “other plants” are (Figure 3).
Figure 2. Canadarago Lake with 74 sampling sites comparing starry stonewort abundances vs. Chara sp. in August 2014. Number category in legend corresponds to Table 1: PIRTRAM chart.
Figure 3. Canadarago Lake with 74 sampling sites comparing starry stonewort abundances vs. “Other” aquatic plants, excluding Chara sp. in August 2014. Number category in legend corresponds to Table 1: PIRTRAM chart.
Figure 4. Abundance estimates of starry stonewort and *Chara* in selected areas of Canadarago Lake on 12 July 2010 (Smith 2011).
Figure 4. Abundance estimates of starry stonewort and all other plants in selected areas of Canadarago Lake on 12 July 2010 (Smith 2011).
REFERENCES


