DARRIN
Fresh Water Institute

Lake George, New York
Adirondack Field Station at Bolton Landing

Saratoga Lake Aquatic Plant Survey – 2007

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Background

Quantitative aquatic plant surveys were undertaken in 2007 for Saratoga Lake, New York as part of a cooperative effort between Aquatic Control Technologies (ACT) and the Darrin Fresh Water Institute, and supported by the Saratoga Lake Protection and Improvement District (SLPID). The post-treatment aquatic plant assessment included a quantitative survey of existing aquatic plant communities and the extent of exotic species infestation. The Point-Intercept Rake Toss method presently required by NYS DEC for Tier III Lakes was employed. The survey was designed to be comparable to pre-treatment data collected by the author in 2004 (Eichler and Boylen 2004) to evaluate a treatment program based on application of the herbicide fluridone (SONAR^{TM}) in 2007 to control Eurasian watermilfoil (*Myriophyllum spicatum*).

The survey area encompassed both an untreated (control) site and an expanded southern treatment area (treatment area plus 20-25%). The control site consisted of an area with similar plant assemblages to the treatment area, but remote from treatment effects. The assessment was designed to generate the information necessary to review effectiveness of aquatic plant management efforts, meet all permit requirements and provide data for comparison of post-treatment conditions to prior survey information. The project consisted of three components: 1) collection of herbarium specimens throughout the lake for compilation of a species list, 2) point-intercept frequency and depth data for points distributed within the treatment area, and 3) point-intercept frequency and depth data for points distributed within an untreated (control) area of the lake.

Introduction

Survey Site

Saratoga Lake is located in Saratoga County, New York in the towns of Saratoga, Stillwater, Round Lake, and Malta. The lake has a surface area of approximately 3765 acres and a surface elevation of 203 ft amsl. Saratoga Lake has a single outlet, Fish Creek, draining to the Hudson River. Average water depth is reported to be 25 ft, with a maximum depth of 95 ft (Mikol and Polsinelli 1985). Hydraulic retention time is reported to be 0.4 years and lake volume is 381,000,000 m^3. Transparency via secchi disk in 2003 was reported to be 4.1 m (SLPID 2003).

An aquatic plant survey of Saratoga Lake in 1932 (NYS DEC 1932) indicated that the lake was quite free of "weeds" except in a few protected bays, primarily along the south and west shores. Common species included *Ceratophyllum demersum, Elodea canadensis, Vallisneria americana* and the pondweeds; *Potamogeton amplifolius, P. praelongus, P. nodosus,* and *P. compressus*. One exotic species, *Potamogeton crispus* was reported. In 1969, the NYS DEC pesticides unit did a more extensive mapping of aquatic plants in Saratoga Lake. They reported a healthy native plant community with 13 submersed species, 2 native rooted floating-leaf species, 3 native emergent species and 3 free floating species (Dean 1969). *Myriophyllum spicatum* populations

were first confirmed in the mid-1970's and reported to be the dominant aquatic plant species in the lake by the early-1980's (Hardt et al. 1983). Additional data collections by the US EPA Clean Lakes Program reported 14 submersed species, 2 floating-leaved species, 2 emergent species and 3 free floating species in 1981-82 (Hardt et al. 1983). Both *Myriophyllum spicatum* and *Potamogeton crispus* were reported as occurring as dense growth. In 1994, the Saratoga Lake aquatic plant community included 23 submersed species, 3 native rooted floating-leaf species, 2 native emergent species and 1 free floating species (Eichler and Boylen 1995). *Myriophyllum spicatum* was the most common plant species, present in 68 percent of survey points. Two other exotic aquatic plant species were reported, *Potamogeton crispus* and *Trapa natans*.

Nuisance aquatic plant growth has posed problems for Saratoga Lake for the past two decades. Excessive aquatic plant growth is reported to impact water-based recreation, aesthetic quality, environmental issues related to loss of habitat diversity, exclusion of native plant and animal species, and hydrodynamics. Nuisance growth of aquatic plants in Saratoga Lake is mainly attributable to three non-native species: Eurasian watermilfoil (*Myriophyllum spicatum),* Curly-leaf Pondweed (*Potamogeton crispus),* and Waterchestnut (*Trapa natans),* with the majority of effort devoted to the management of Eurasian watermilfoil.

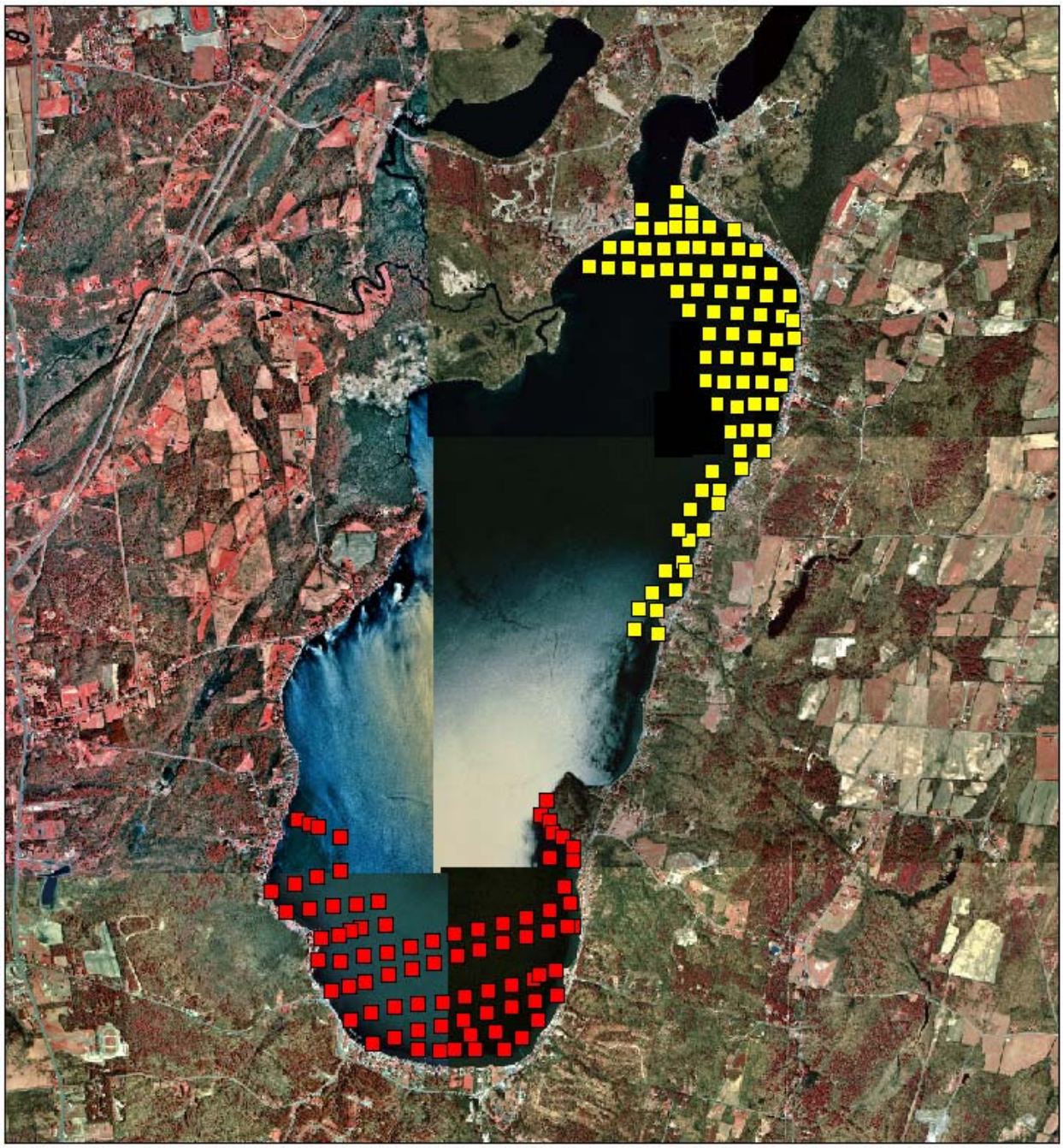
In 1994, an aquatic plant survey of Saratoga Lake was conducted by the Darrin Fresh Water Institute to evaluate ongoing aquatic plant harvesting and lake level drawdown programs for the control of *Myriophyllum spicatum* and *Potamogeton crispus*. Volunteer efforts were also employed to hand harvest scattered growth of *Trapa natans*. These aquatic plant management efforts were instituted in 1984 and continue on an annual basis. Results of the 1994 survey indicated a diverse population of native aquatic plants dominated by the exotic invasive *Myriophyllum spicatum*. While mechanical harvesting provided access to the open waters of the lake for recreational use, this technology was not having an appreciable long-term effect on the density of growth of *Myriophyllum spicatum*. Winter draw-down and the resultant ice scour in shallow waters (depth less than 1 meter) was determined to be negatively effecting the growth of *Myriophyllum spicatum*. In 2000 and 2003, two additional aquatic plant management tools were evaluated on an experimental basis, biological control agents (weevils) and herbicide (SONAR) application. Biocontrol agents, while promising, continue to be experimental. Surveys conducted in 2004 (Eichler and Boylen 2004) indicated that native species richness in the herbicide treated areas had increased, however Eurasian watermilfoil was still the dominant species.

Methods

Species List and Herbarium Specimens. As the lake was surveyed, the occurrence of each aquatic plant species observed was recorded and adequate herbarium specimens collected. The herbarium specimens were pressed, dried, and mounted (Hellquist 1993) at the Darrin Fresh Water Institute Laboratory in Bolton Landing, NY, where they became part of the permanent collection.

Point Intercept Survey. The frequency and diversity of aquatic plant species were evaluated using a point intercept method (Madsen 1999). At each grid point intersection, all species located at that point were recorded, as well as water depth. Species were located by a visual inspection of the point and by deploying a rake to the bottom, and examining the plants retrieved. A differential global positioning system (Garmin GPSmap 168) was used to navigate to each point for the survey observation. Point intercept plant frequencies were surveyed between August 15 and 17, 2007 at the time of maximum aquatic plant abundance. Based on an 80 m grid and excluding the majority of points outside the littoral zone, we surveyed a total of 160 points, 80 each for the treatment and control plots on Saratoga Lake. The point intercept method allows a large number of discrete observations in a short period of time facilitating statistical analysis and comparisons. Point intercept methods also allow for production of distribution maps for all species listed. (Figure 1).

Figure 1. Distribution of point intercept survey points for Saratoga Lake aquatic plant survey. The northeast group (yellow) are the control points and the southern group (red) are the treatment area.



Results and Discussion

In August of 2007, the aquatic plant community of Saratoga Lake included 18 submersed species, 3 floating-leaved species, 2 floating species and 2 emergent species for a total of 25 species. A total of 21 species were collected in the point intercept portion of the previous survey in 2004. Three exotic species, *Myriophyllum spicatum, Potamogeton crispus* and *Trapa natans* were reported; however, both *Potamogeton crispus* and *Trapa natans* were limited to only a few specimens. *Myriophyllum spicatum* dominated the aquatic plant community. Species richness was quite high, with a large number of species occurring in more than 10% of survey points (Table 2). While Eurasian watermilfoil was by far the most widely distributed plant (80% of control points and 20% of treatment points), a number of native species were also commonly observed. A list of species observed for Saratoga Lake is provided in Table 1.

Table 1. **Aquatic plant species present in Saratoga Lake in recent surveys.**

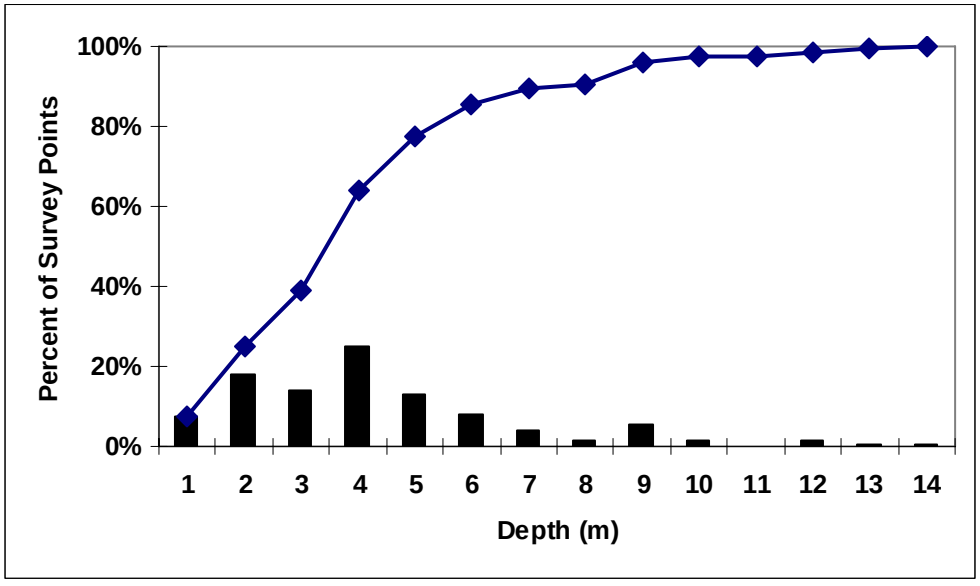
Species	**Common Name**	**1994**	**2004**	**2007**
Ceratophyllum demersum L.	coontail	**x**	**x**	**x**
Chara/Nitella sp.	muskgrass, chara	**x**	**x**	**x**
Eleocharis acicularis (L.) Roemer and Schultes	needle spike-rush	**x**	**x**	
Elodea canadensis Michx.	elodea	**x**	**x**	**x**
Heteranthera dubia Jacq. (currently Zosterella dubia)	water stargrass	**x**	**x**	**x**
Lemna minor L.	duckweed	**x**	**x**	**x**
Lemna trisulca	duckweed		**x**	**x**
Megalodonta beckii formerly (Bidens beckii Torr.)	water marigold	**x**	**x**	**x**
Myriophyllum spicatum L.	Eurasian watermilfoil	**x**	**x**	**x**
Najas flexilis (Willd.) Rostk. and Schmidt.	bushy pondweed	**x**	**x**	**x**
Najas guadalupensis (Spreng.) Magnus	Southern naiad	**x**	**x**	**x**
Nuphar luteum (Ait.) Ait. f.	yellow pondlily	**x**	**x**	**x**
Nymphaea odorata	fragrant water lily		**x**	**x**
Pontederia cordata	pickerelweed		**x**	**x**
Potamogeton amplifolius Tuckerm.	large-leaf pondweed	**x**	**x**	**x**
Potamogeton crispus L.	curly-leaf pondweed	**x**	**x**	**x**
Potamogeton epihydrus Raf.	ribbon-leaf pondweed	**x**		
Potamogeton gramineus L.	variable-leaf pondweed	**x**	**x**	**x**
Potamogeton illinoensis L.	Illinois pondweed		**x**	**x**
Potamogeton perfoliatus L	Clasping-leaved Pondweed	**x**	**x**	**x**
Potamogeton praelongus Wulfen	white-stem pondweed	**x**	**x**	**x**
Potamogeton pusillus L.	small pondweed	**x**	**x**	**x**

Species	**Common Name**	**1994**	**2004**	**2007**
Potamogeton richardsonii (Ar. Benn.) Rydb.	Richardsons' pondweed		**x**	
Potamogeton zosteriformis Fern.	flat-stem pondweed	**x**	**x**	**x**
Ranunculus longirostris Godron	white watercrowfoot	**x**	**x**	
Sagittaria graminea Michx.	arrowhead	**x**	**x**	
Spirodela polyrhiza (L.) Schlieden	great duckweed	**x**		
Stuckenia pectinata L. formerly *Potamogeton pectinatus* L.	sago pondweed	**x**	**x**	**x**
Trapa natans L.	waterchestnut	**x**	**x**	**x**
Typha	cattail	**x**	**x**	**x**
Utricularia vulgaris L.	great bladderwort	**x**		
Vallisneria americana L.	wild celery	**x**	**x**	**x**

Maximum Depth of Colonization

Maximum depth of colonization by rooted aquatic plant growth extended to a depth of 6 meters. Calculated maximum depth of colonization (MDOC) by macrophytes ranged from 4.3 to 4.9 meters in 2004 (Eichler and Boylen 2004), and was comparable to 1994 records (Eichler and Boylen 1995). Specimens of *Ceratophyllum demersum*, *Najas guadalupensis* and *Myriophyllum spicatum* were found between 5 and 6 meters depth in 2007. Thus, 6 meters is the maximum extent of the littoral zone, representing an increase of approximately 1 meter in depth from 1994 estimates (Eichler and Boylen 1995) and comparable to depth records for 2004 (Eichler and

Figure 2. Depth Distribution of Saratoga Lake sampling points in 1 meter depth classes.



Boylen 2004). Depth distribution of sampling points (Figure 2) was equitable throughout the littoral zone in 2007.

Species Richness and Distribution

A total of 25 species were observed in open lake surveys of Saratoga Lake in 2007 (Table 1). Fifteen species were found in samples from the treated area and 14 species were reported in the control samples. These results are comparable to previous surveys in 2004 (21 species, Eichler and Boylen 2004), 1994 (22 species, Eichler and Boylen 1995), 1982 (21 species, Hardt et al. 1983) and 1969 (20 species, Dean 1969). The limited occurrence of *Potamogeton crispus* can be attributed to the timing of the current survey (August), rather than an actual decline in the abundance of this species. *Potamogeton crispus* generally reaches peak abundance in June and July, and then undergoes senescence. Species absent from the 2007 survey but present in prior surveys were generally either present in only a single survey year or relatively uncommon in prior surveys (<1% of survey points).

Maps of the distribution of aquatic plant species and groups of species (i.e. Broad-leaf Pondweeds) for Saratoga Lake are included in Appendix A. *Myriophyllum spicatum* was the most abundant species, present in 80% of all samples collected in the untreated (control) area and 20% of all samples collected in the treated area (Table 2). In the control area, common native species for Saratoga Lake included *Ceratophyllum demersum* (54% of survey points), *Zosterella dubia* (44%), *Vallisneria americana* (26%), *Najas guadalupensis* (15%), *Elodea canadensis* (14%), *Chara/Nitella* (10%), *Potamogeton zosteriformis* (11%) and *Potamogeton perfoliatus* (10%). With the exception of Eurasian watermilfoil, the treated area had a comparable assemblage of species, including *Ceratophyllum demersum* (51% of survey points), *Zosterella dubia* (25%), *Vallisneria americana* (20%), *Najas guadalupensis* (11%), *Elodea canadensis* (7%), *Chara/Nitella* (8%), *Potamogeton zosteriformis* (12%) and *Potamogeton perfoliatus* (6%). With this diversity and distribution of native species, the test for selectivity should be sensitive to a number of species, and the probability of native plant restoration in areas formerly inhabited by Eurasian watermilfoil should be high following management efforts.

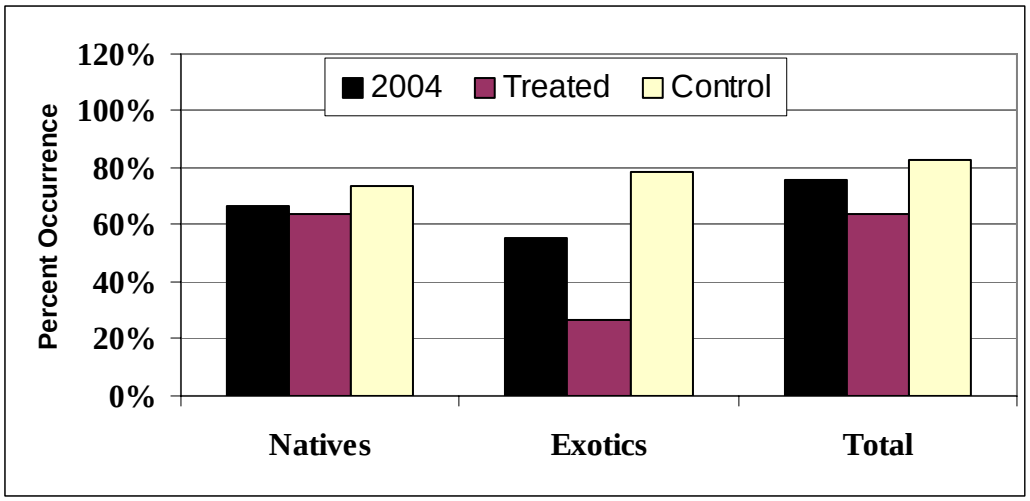
In 2007, 74% of survey points in the control area and 64% in the treated area supported native species. Sixty-seven percent of whole lake sampling points were vegetated by native plant species in 2004 (Figure 3). In depths less than 6 m, representing the littoral zone, 78% of survey points contained native species and 89% of survey points less than 2 meters depth yielded native aquatic plants in 2007. Eurasian watermilfoil was present in 54% of whole lake survey points, and 59% of survey points within the littoral zone or zone of aquatic plant growth. From Figure 4, it is apparent that exotic species, dominated by Eurasian watermilfoil, were clearly more abundant in the control area (80% of survey points) than the treated area (28%).

For survey points within the littoral zone, water depth less than 6 m (Figure 4), results similar to

Table 2. Percent frequency of occurrence of aquatic plant species in Saratoga Lake in treated and control areas.

Species	**Treated**	**Control**
Ceratophyllum demersum	51%	54%
Chara sp.	8%	10%
Elodea canadensis	7%	14%
Megalodonta beckii	1%	0%
Myriophyllum spicatum	20%	80%
Najas flexilis	1%	3%
Najas guadalupensis	11%	15%
Potamogeton crispus	8%	4%
Potamogeton gramineus	0.3%	0%
Potamogeton illinoensis	1%	1%
Potamogeton perfoliatus	6%	10%
Potamogeton praelongus	4%	0%
Potamogeton pusillus	0%	10%
Potamogeton zosteriformes	12%	11%
Trapa natans	0%	2%
Vallisneria americana	20%	26%
Zosterella dubia	25%	44%

Figure 3. Saratoga Lake frequency of occurrence summaries for sampling points of all water depths. Treated and control results are from August, 2007.



whole lake surveys are reported. The impact of the herbicide treatment is even more apparent on the relative abundance of exotic species when comparing treated (33% of survey points) and control sites (93%). Eurasian watermilfoil declined from 58% of littoral zone survey points within the treatment area in 2004 to 25% of comparable survey point post-treatment in 2007. The expected relationship of greater frequency of occurrence of aquatic plants with shallower water depth is consistent with that reported by Eichler and Boylen (1995) where frequency of occurrence values in the littoral zone ranged from 78 to 87% of survey points.

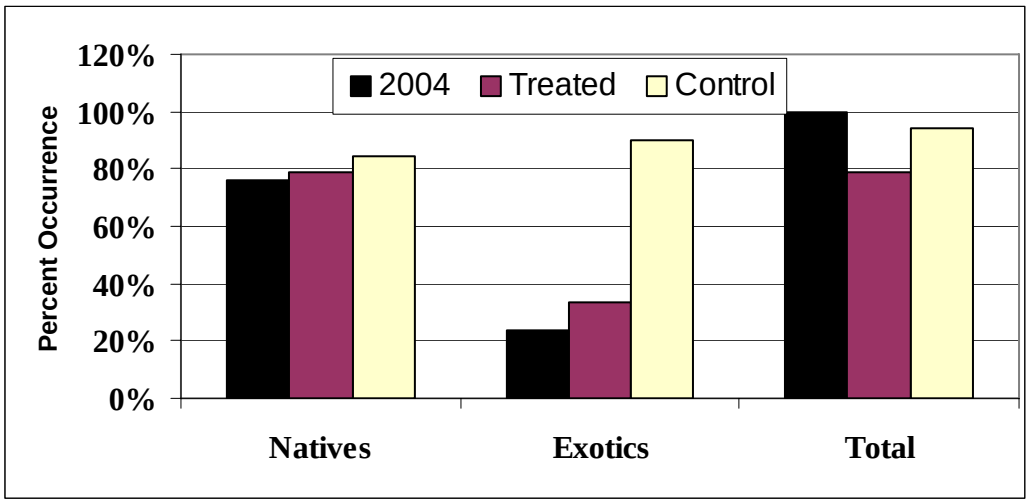


Figure 4. Saratoga Lake frequency of occurrence summaries for sampling points less than 6 meters water depth. Treated and control results are from August, 2007.

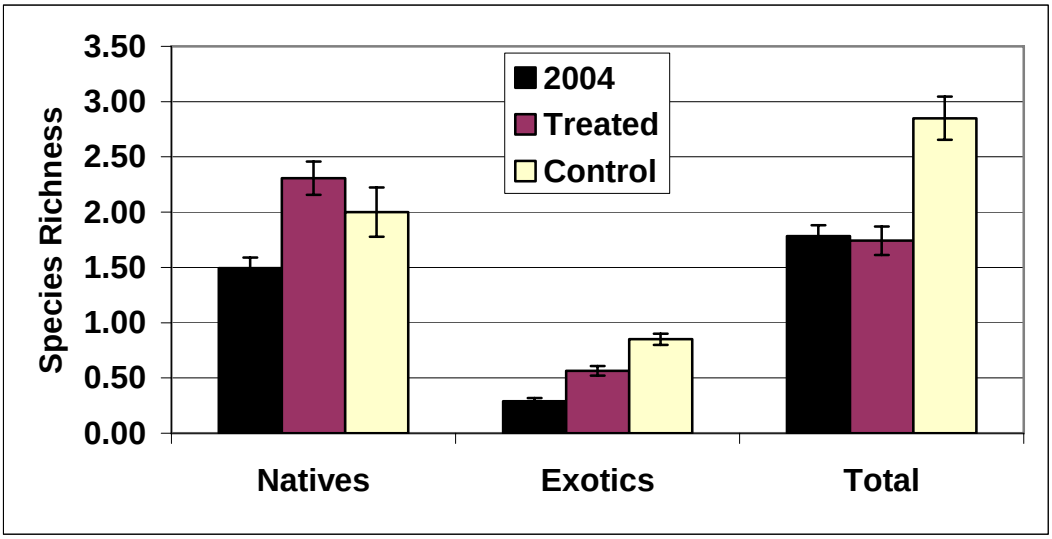
Species richness results for the point intercept survey are presented in Table 3 and Figure 5. In 2004 whole lake species richness was 2.00 ± 0.10 species per survey point. By 2007, whole lake species richness had increased to 2.31 ± 0.15. For survey points exclusively within the littoral zone (depths less than 6 meters) species richness in 2004 increased to 2.31 ± 0.10 species per sample and the shallow end of the littoral zone (depths less than 2 meters) yielded 3.04 ± 0.21 species per sample point. In comparison, littoral (<6m depth) species richness in 2007 was 2.74 ± 0.15, and the shallow fringe (<2m depth) species richness in 2007 was 4.31 ± 0.26.

Native species richness was 2.07 ± 0.14 species per survey point in 2007 for the entire littoral zone (depths less than 6 meters), exceeding the 2004 littoral, native species richness of 1.65 ± 0.09 species per survey point. Whole lake native species richness was 1.43 ± 0.08 species per sample in 2004 and 1.74 ± 0.13 species per sample in 2007. In the shallow portion of the littoral zone, depths less than 2 meters, species richness was 2.47 ± 0.18 native species per sample in 2004 and 3.54 ± 0.23 native species per sample in 2007. As expected, species richness in the littoral zone and its shallow fringe was higher than whole lake species richness. Lack of a Eurasian watermilfoil canopy in water depths less than 2 meters may also allow for greater

Table 3. Saratoga Lake species richness for the point intercept survey.

Plant Grouping	Water Depth Class	Statistic	2004	Treated	Control
Native plant species	Whole Lake (all depths)	Mean	1.43	1.78	2.85
		N	325	80	80
		Std. Error	0.08	0.19	0.22
	Points with depths <6m	Mean	1.65	1.84	2.29
		N	274	67	70
		Std. Error	0.09	0.18	0.20
	Points with depths <2m	Mean	2.47	3.07	3.80
		N	80	14	25
		Std. Error	0.18	0.44	0..24
All plant Species	Whole Lake (all depths)	Mean	2.00	1.49	1.98
		N	325	80	80
		Std. Error	0.10	0.17	0.19
	Points with depths <6m	Mean	2.31	2.19	3.26
		N	274	67	70
		Std. Error	0.10	0.20	0.21
	Points with depths <2m	Mean	3.04	3.36	4.84
		N	80	14	25
		Std. Error	0.21	0.50	0.25

Figure 5. Saratoga Lake species richness.
Error bars are standard error of the mean.



species richness. The negative impact of a canopy of Eurasian watermilfoil on species richness of native plants has been well documented (Madsen et al. 1989; 1991). Conversely, species richness increases in areas where Eurasian watermilfoil growth is reduced (Boylen et al. 1996).

Species richness in the control area exceeded that in the treated area, but generally by less than 1 species per survey point. The elimination of Eurasian watermilfoil from many of the survey points in the treated area accounts for the majority of the difference.

Summary

Quantitative aquatic plant surveys were undertaken in 2007 for Saratoga Lake, New York as part of a cooperative effort between Aquatic Control Technologies (ACT) and the Darrin Fresh Water Institute, and supported by the Saratoga Lake Protection and Improvement District (SLPID). The project was designed to obtain data to evaluate current aquatic plant management efforts and review potential new strategies. The project consisted of three components: 1) collection of herbarium specimens throughout the lake for compilation of a species list, 2) point-intercept frequency and depth data for points distributed in an untreated area (Franklins Beach), and 3) point-intercept frequency and depth data for points distributed in an herbicide treated area (South End).

In Saratoga Lake, Eurasian watermilfoil (*Myriophyllum spicatum*) expanded rapidly after an initial invasion in the 1970's. *Myriophyllum spicatum* populations were first confirmed in the mid-1970's and reported to be the dominant aquatic plant species in the lake by the early-1980's (Hardt et al. 1983). In 1994, the Saratoga Lake aquatic plant community contained 23 submersed species, 3 native rooted floating-leaf species, 2 native emergent species and 1 free floating species (Eichler and Boylen 1995). *Myriophyllum spicatum* was the most common plant species, present in 68 percent of survey points. Two other exotic aquatic plant species were reported, *Potamogeton crispus* and *Trapa natans*. *Potamogeton crispus* is seasonally abundant, forming a dense band at the deep margins of Eurasian watermilfoil growth in the spring and early summer. *Trapa natans* has been reported as scattered individuals on the delta of Kayadeross Creek and in Mannings Cove. In August of 2007, the aquatic plant community of Saratoga Lake included 18 submersed species, 3 floating-leaved species, 2 floating species and 2 emergent species for a total of 25 species. These results are comparable to previous surveys in 2004 (21 species, Eichler and Boylen 2004), 1994 (22 species, Eichler and Boylen 1994), 1982 (21 species, Hardt et al. 1983) and 1969 (20 species, Dean 1969). Comparing the two areas surveyed in 2007, the herbicide treated area produced 14 submersed species, while the control area supported 13 submersed species and one floating leaved species. The timing of the 2007 survey (August) may have led to under-reporting the relative abundance of *Potamogeton crispus*, since this species generally reaches peak abundance in June and July, and then undergoes senescence. *Myriophyllum spicatum* dominated the aquatic plant community, occurring throughout the littoral zone of Saratoga Lake and present from the waters edge to a depth of 5.5 meters. Eurasian watermilfoil reached its maximum abundance in waters of 2 to 4 meters depth. While Eurasian watermilfoil was by far the most widely distributed plant (54% of survey points), a number of native species were also commonly observed. Species richness within the littoral zone was quite high (2.74 ± 0.15), with a large number of species occurring in more than

10% of survey points. Species richness for all species within the littoral zone averaged 2.31 ± 0.10 species per sample in 2004. For the survey points exclusively within the treatment area, the 2004 survey reported 2.01 ± 0.19 species per sample. The post-treatment surveys in 2007 reported 2.19 ± 0.20 species per sample. Thus, species richness lake-wide and in the treatment zone was higher post-treatment in 2007 than during 2004 (pre-treatment).

Myriophyllum spicatum was the most abundant species, present in 80% of all samples collected in the untreated (control) area and 20% of all samples collected in the treated area. In the control area, common native species for Saratoga Lake included *Ceratophyllum demersum* (54% of survey points), *Zosterella dubia* (44%), *Vallisneria americana* (26%), *Najas guadalupensis* (15%), *Elodea canadensis* (14%), *Chara/Nitella* (10%), *Potamogeton zosteriformis* (11%) and *Potamogeton perfoliatus* (10%). With the exception of Eurasian watermilfoil, the treated area had a comparable assemblage of species, including *Ceratophyllum demersum* (51% of survey points), *Zosterella dubia* (25%), *Vallisneria americana* (20%), *Najas guadalupensis* (11%), *Elodea canadensis* (7%), *Chara/Nitella* (8%), *Potamogeton zosteriformis* (12%) and *Potamogeton perfoliatus* (6%).

Principal areas of Eurasian watermilfoil expansion in 2004 were reported in the northeast at Franklins Beach and the southwest in the area of Rileys Cove. Franklins Beach was selected as the control (untreated) area for 2007 while the south end of the lake and Browns Beach area were treated with herbicide (Figure 7). Substantial reduction in Eurasian watermilfoil frequency of occurrence was observed in the treated area between 2004 (pre-treatment) and 2007 (post-treatment) while the control area increased from 74% to 80%.

Lakewide aquatic plants were found to cover 74% of the lake bottom in the littoral zone, a slight increase over 2004 (67%), but not indicative of any major change in the aquatic plant population. Eurasian watermilfoil abundance declined from 66% of littoral zone survey points in 2004 to 59% of survey points in 2007. In the 2007 survey, Eurasian watermilfoil was present in 54% of whole lake survey points, and 59% of survey points less than 6 m water depth, representing the littoral zone or zone of aquatic plant growth. Exotic species, dominated by Eurasian watermilfoil, were clearly more abundant in the control area (80% of survey points) than the treated area (28%). The impact of the herbicide treatment is even more apparent on the relative abundance of exotic species when comparing littoral zone results for treated (33% of survey points) and control sites (93%). Eurasian watermilfoil abundance declined from 58% of littoral zone survey points within the treatment area in 2004 to 25% of comparable survey points post-treatment in 2007. In the control area, Eurasian watermilfoil abundance increased from 74% of survey points in 2004 to 80% of comparable survey points in 2007.

The littoral zone or maximum depth of colonization (MDOC) by aquatic plants was calculated to extend to a depth of 4.9 meters based on transparency data. *Ceratophyllum demersum* and *Najas guadalupensis*, however were commonly found between 5 and 6 meters depth, with occasional

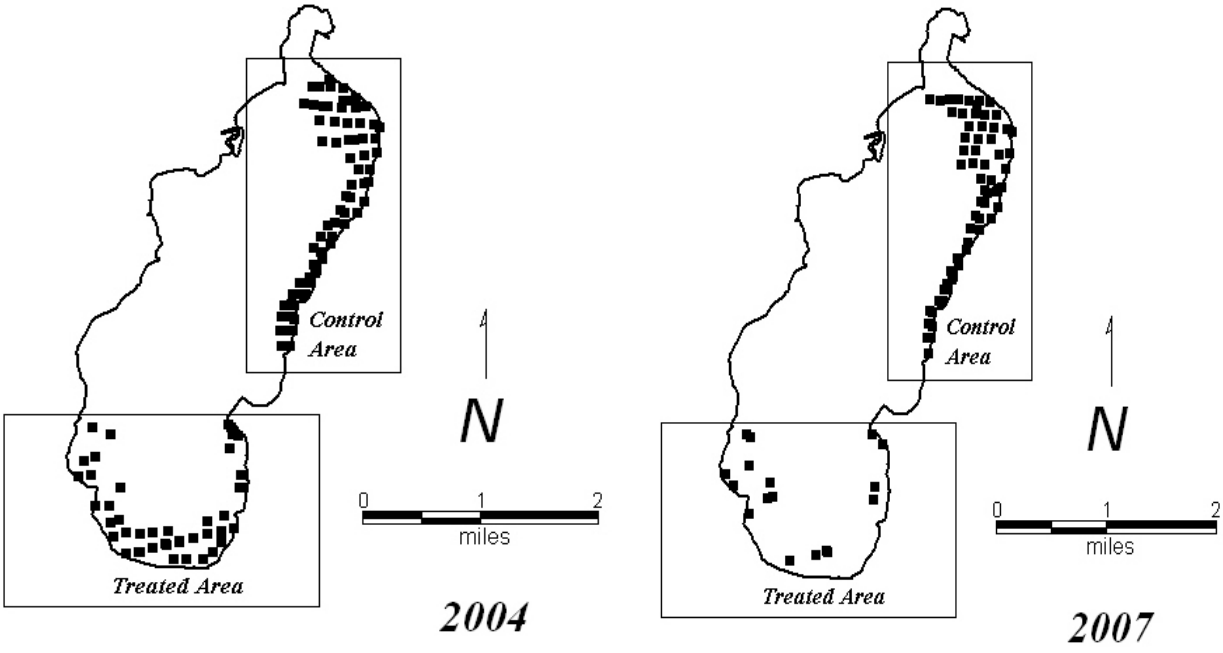


Figure 6. A comparison of the distribution of Eurasian watermilfoil (*Myriophyllum spicatum*) growth in selected areas of Saratoga Lake in 2004 and 2007.

Myriophyllum spicatum specimens also encountered, suggesting a littoral zone maximum depth of approximately 6 meters, 1.0 meter greater than reported in 1994. Suppression of canopy formation through mechanical harvesting may allow for light penetration and thus the survival of native plant species in areas of dense Eurasian watermilfoil growth. Changing water clarity may also be a by-product of the invasion of Saratoga Lake by zebra mussels (*Dreissena polymorpha*) in the mid-1990's. Improved water clarity is frequently reported following zebra mussel invasions due to their ability to filter large volumes of phytoplankton from the water column. Reduced Eurasian watermilfoil density in shallow waters as a result of winter draw-down and ice scouring has also provided areas for colonization of native species resistant to winter draw-down.

Evidence continues to suggest that a native species, Water Stargrass (*Zosterella dubia*) is replacing Eurasian watermilfoil at the shallow end of its range. The frequency of occurrence of *Zosterella dubia* has increased substantially, reported in 19% of samples in 1994, 47% of samples in 2004 and currently occurring in 44% of samples in the control area. The operators of the mechanical harvesters report that *Zosterella dubia* has become a prevalent species in their harvested materials. Survey results indicate that this species is found growing densely in waters of 1 to 1.5 meters depth at the inner margins of dense Eurasian watermilfoil growth. The growth habit of this species may be a consideration in future management efforts.

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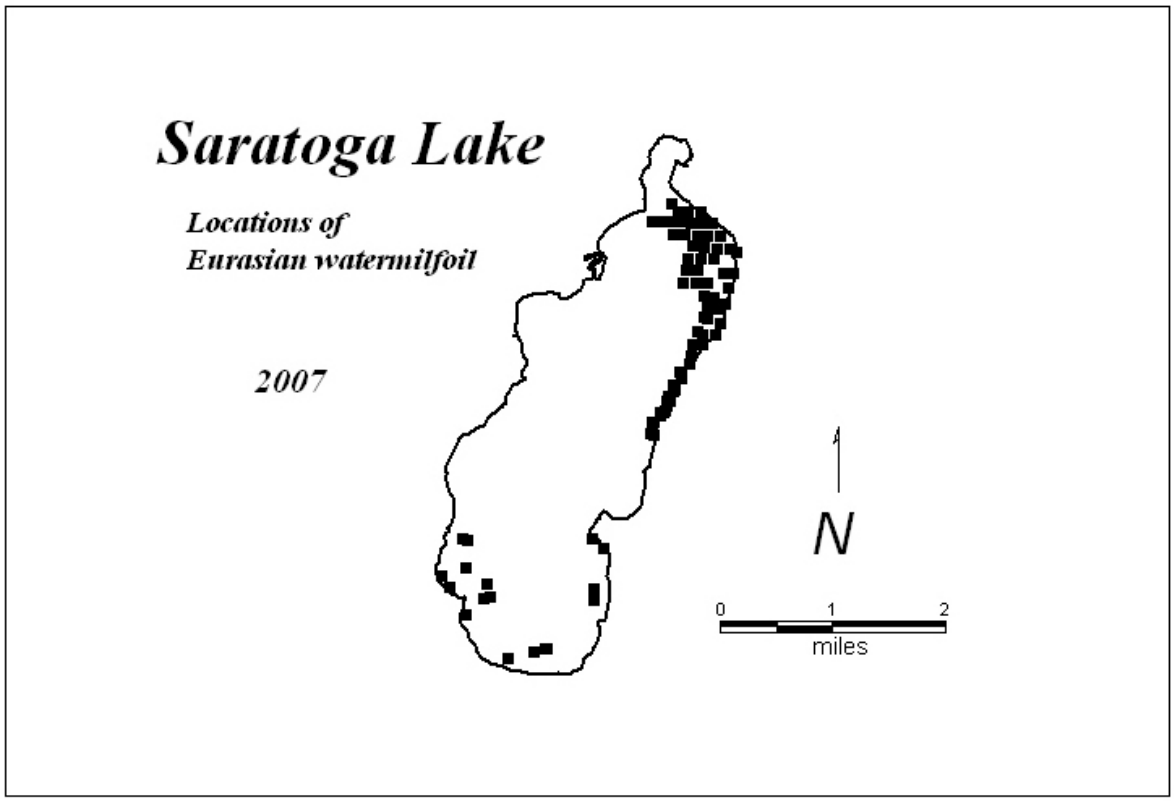
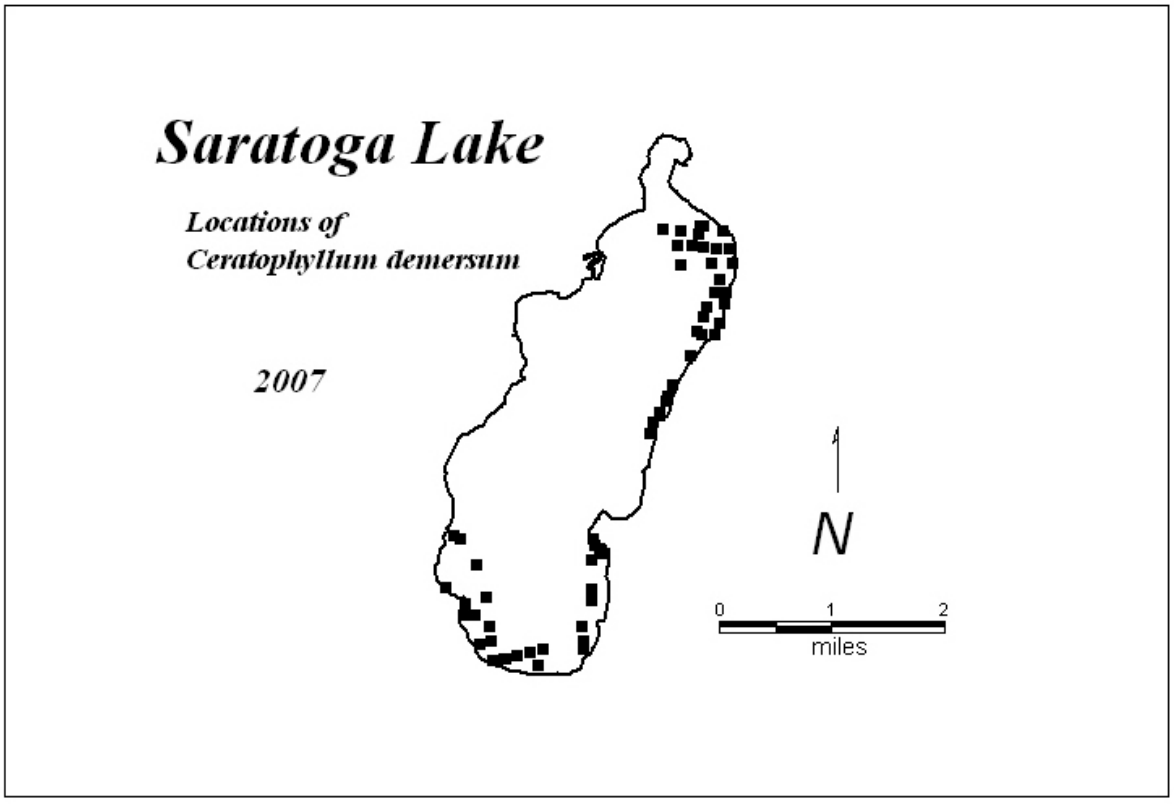
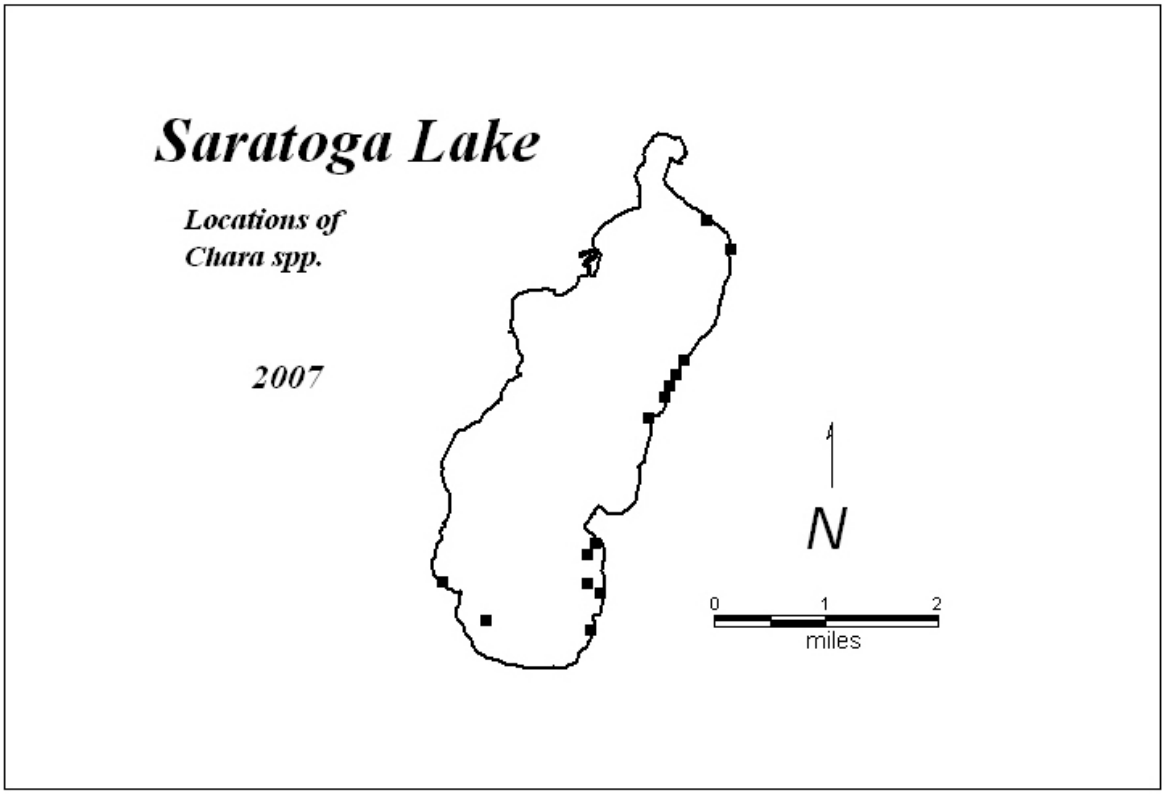
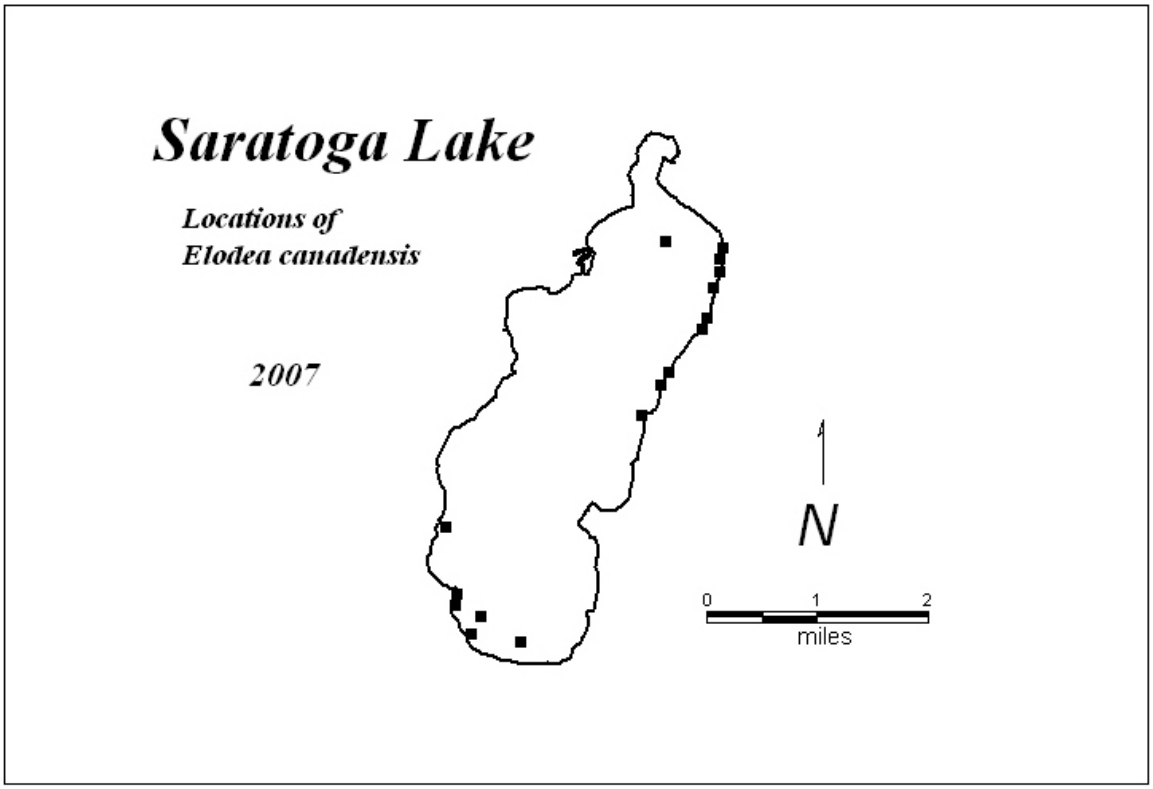
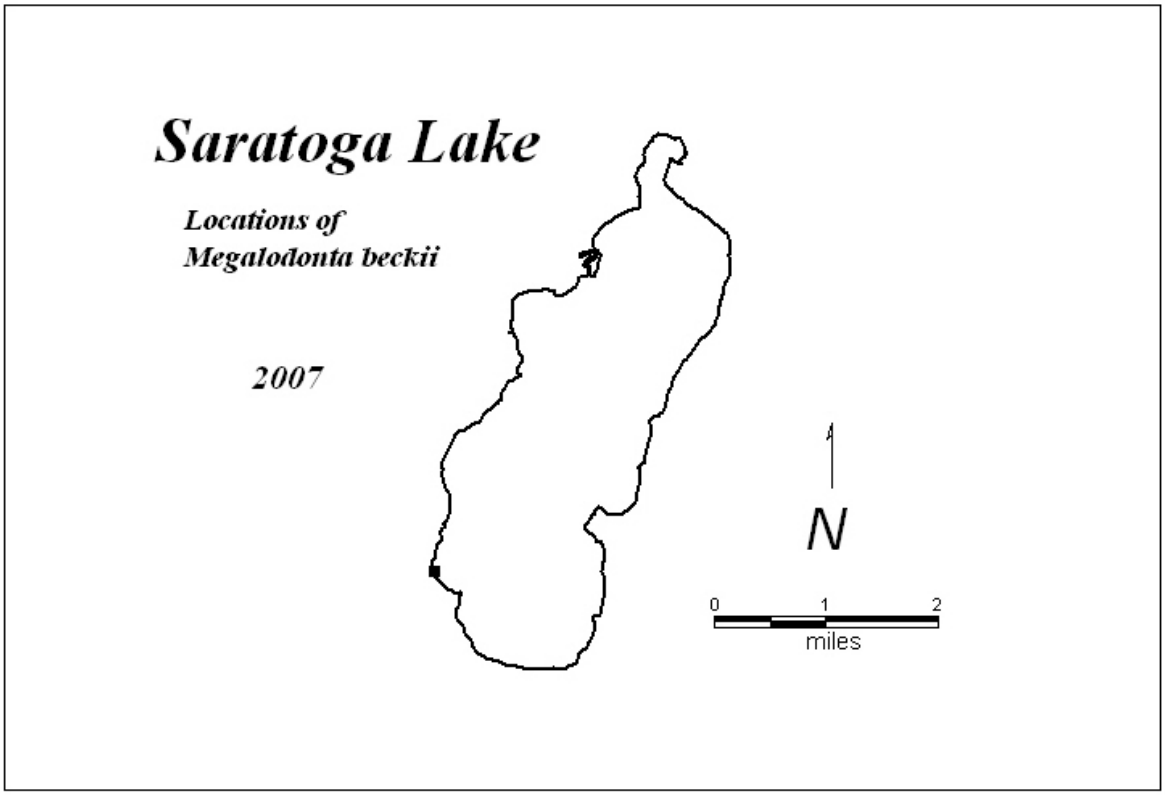
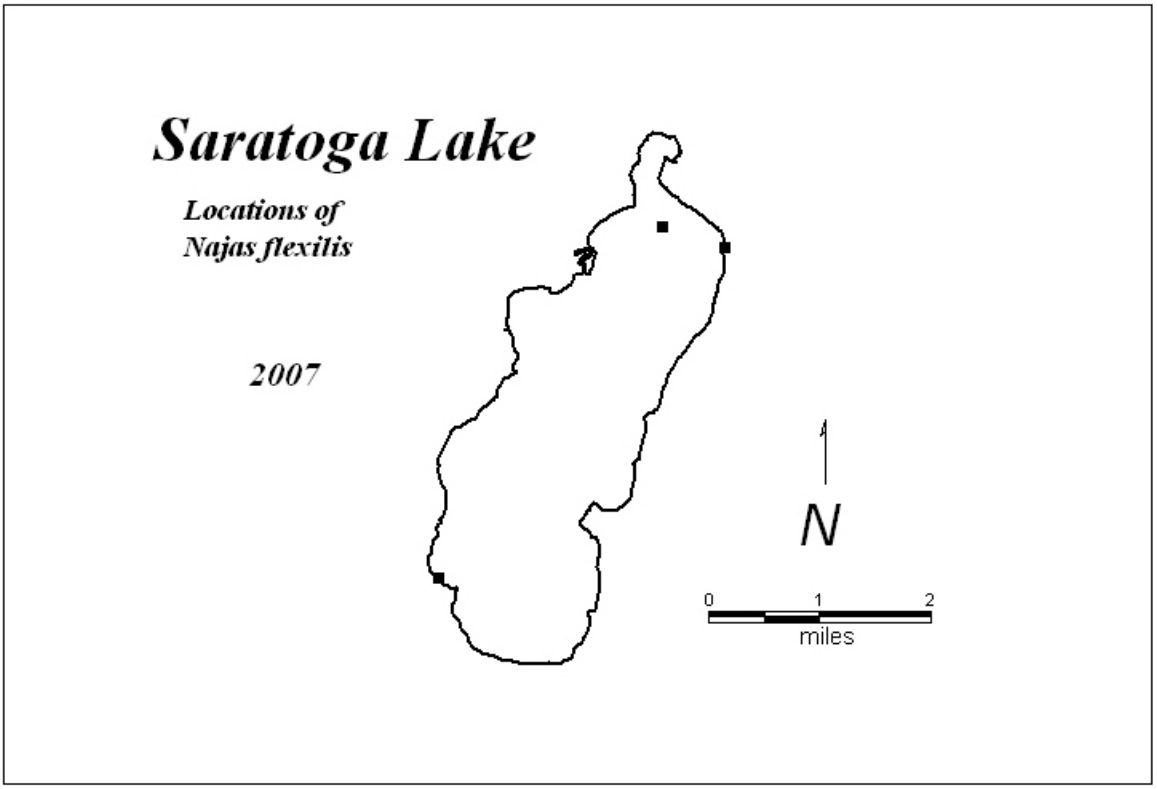

Saratoga Lake
Locations of
Eurasian watermilfoil
2007
N
0
1
2
miles

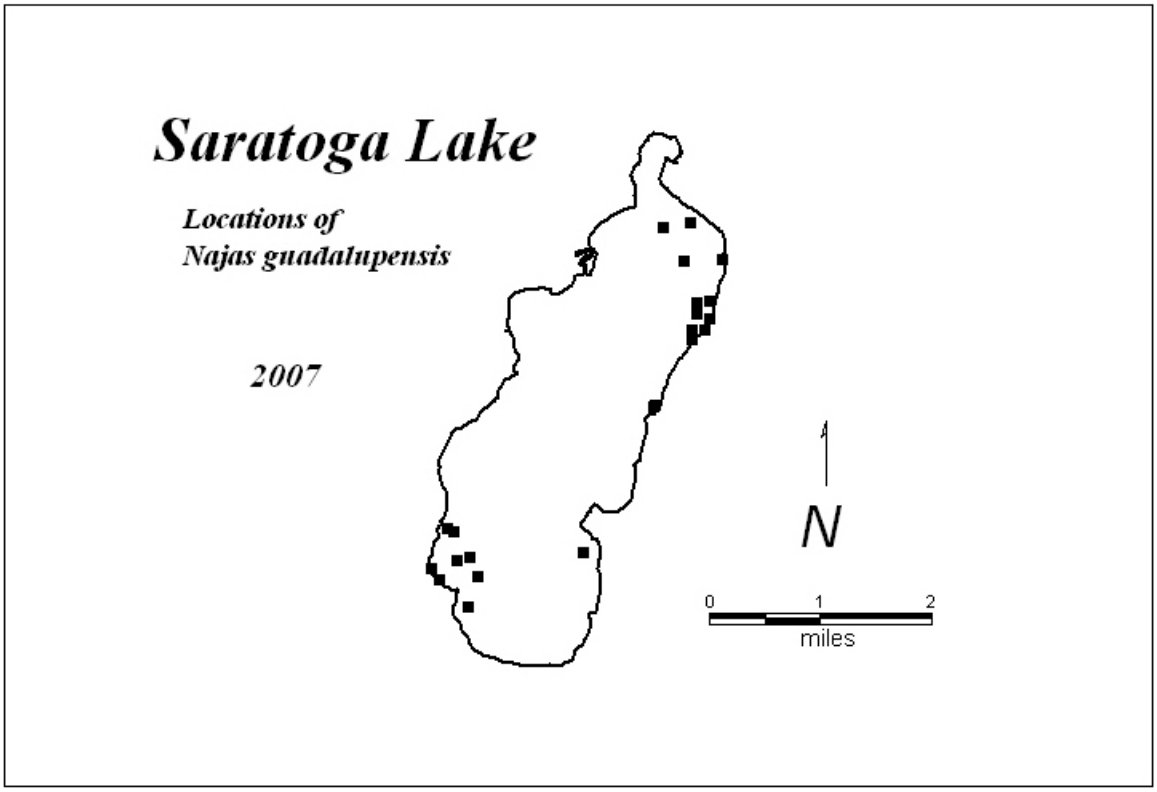

Saratoga Lake
Locations of
Ceratophyllum demersum
2007
N
0
1
2
miles

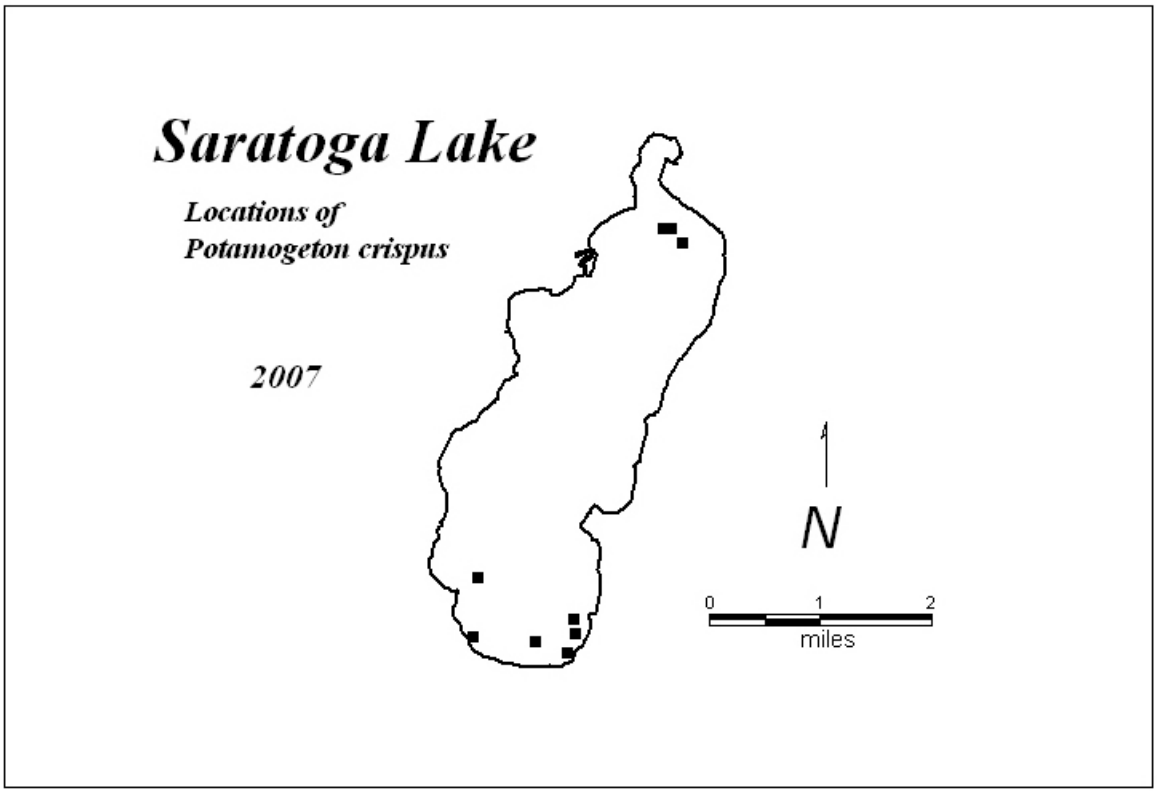

Saratoga Lake
Locations of
Chara spp.
2007
N
0
1
2
miles

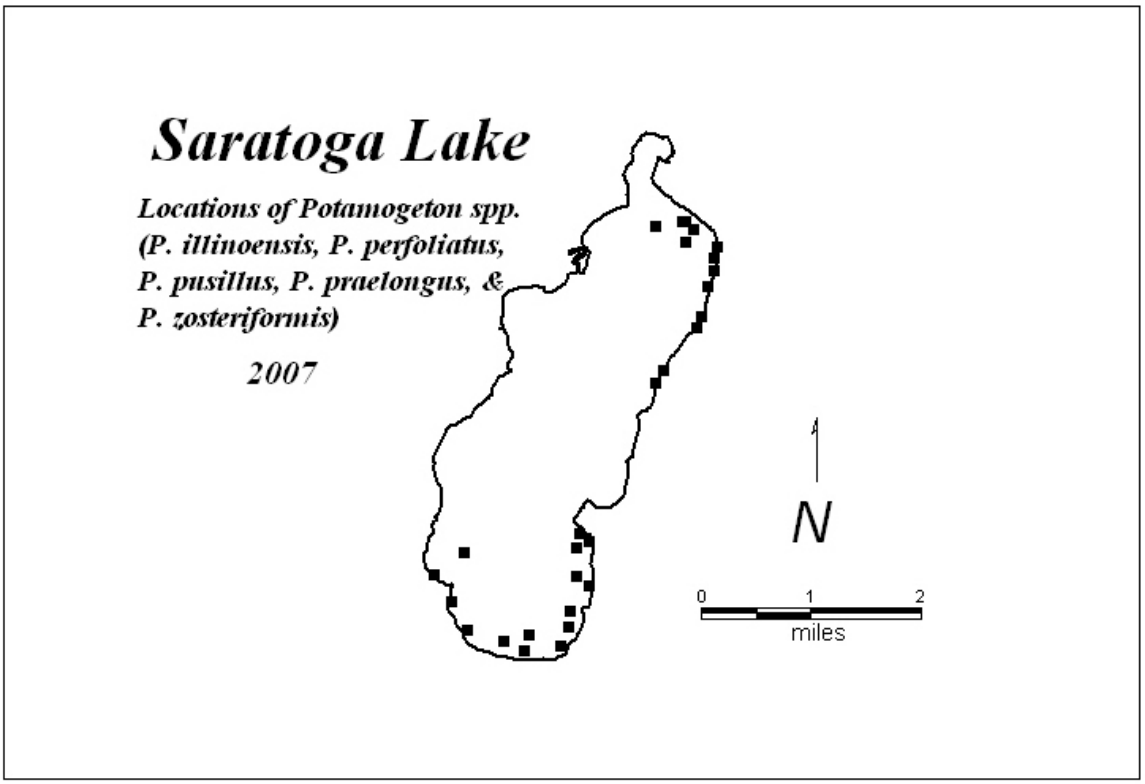

Saratoga Lake
Locations of
Elodea canadensis
2007
N
0
1
2
miles

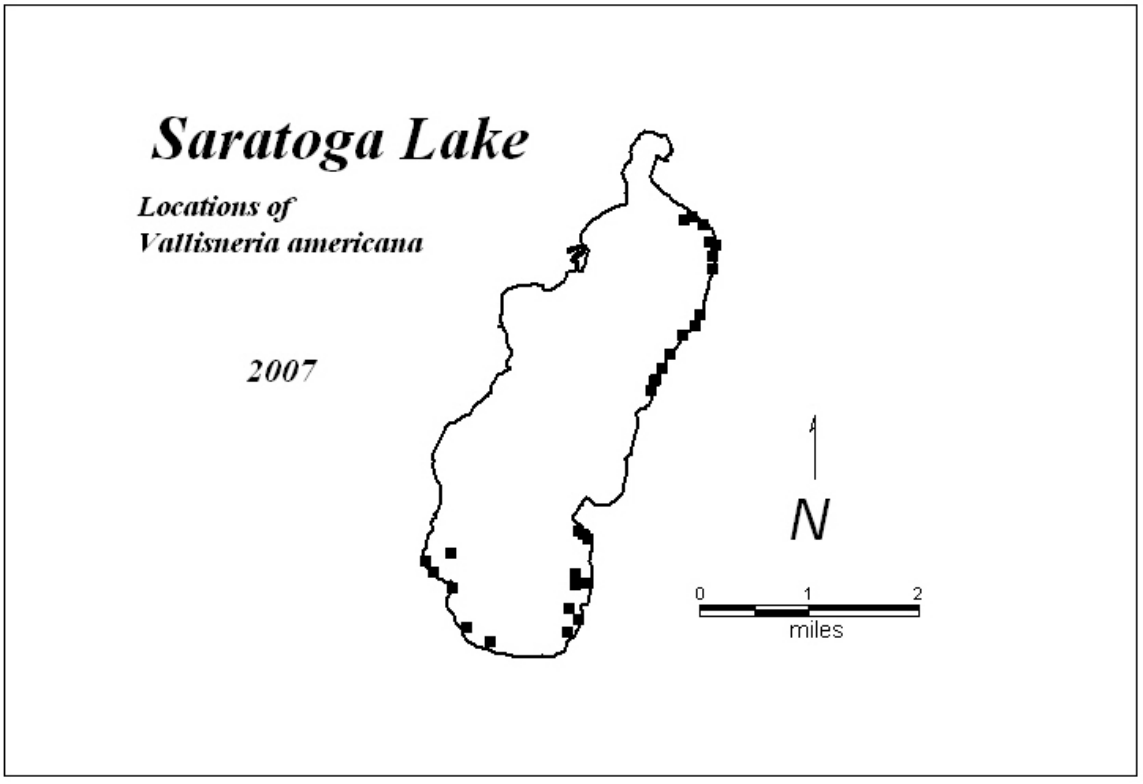

Saratoga Lake
Locations of
Megalodonta beckii
2007
N
0
1
2
miles

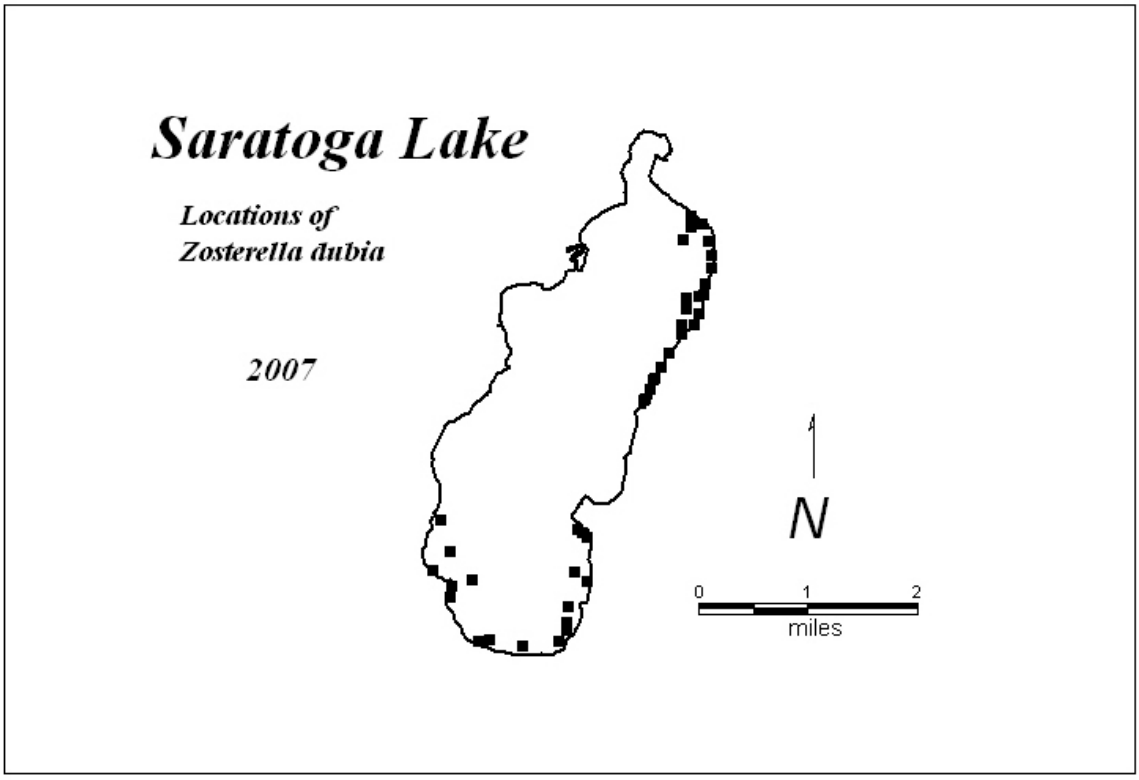

Saratoga Lake
Locations of
Najas flexilis
2007
N
0
1
2
miles


Saratoga Lake
Locations of
Najas guadalupensis
2007
N
0
1
2
miles


Saratoga Lake
Locations of
Potamogeton crispus
2007
N
0
1
2
miles


Saratoga Lake
Locations of Potamogeton spp.
(P. illinoensis, P. perfoliatus,
P. pusillus, P. praelongus, &
P. zosteriformis)
2007
N
0
1
2
miles


Saratoga Lake
Locations of
Vallisneria americana
2007
N
0
1
2
miles


Saratoga Lake
Locations of
Zosterella dubia
2007
N
0
1
2
miles