Eurasian water milfoil (*Myriophyllum spicatum*) Pre/Post Herbicide and Fall Bed Mapping Surveys Sand Lake - WBIC: 2661100 Barron County, Wisconsin

EWM (Berg 2007)

2013 EWM Treatment Areas

Project Initiated by:

Sand Lake Management District, Short Elliott Hendrickson Inc, and the Wisconsin Department of Natural Resources

Bed Mapping Fall EWM

Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin

June 14, August 11, and October 13, 2013

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INTRODUCTION:

Sand Lake (WBIC 2661100) is a 322 acre drainage lake in northwestern Barron County, Wisconsin in the Town of Maple Plain (T36N R14W S17 NW NE). It reaches a maximum depth of 57ft in the south basin and has an average depth of approximately 30ft. Sand Lake is mesotrophic bordering on oligotrophic in nature with good water clarity. From 1988 to 2013, summer Secchi readings have ranged from 10-18ft with an average of 13.6ft (WDNR 2013). The bottom substrate is predominately sand and sandy muck with scattered gravel primarily along the shoreline. Some areas of thick organic muck occur in bays on the west side of the lake and at the far north and south ends (Miller et al. 1965).

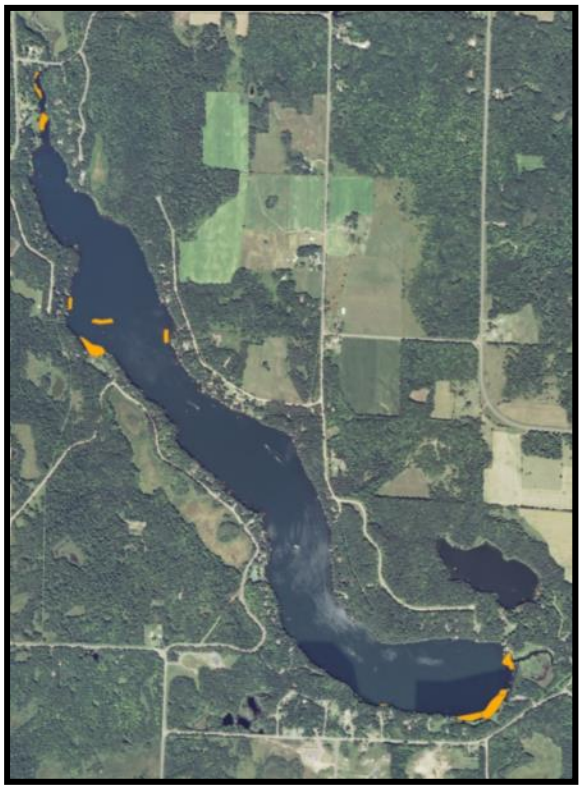


Figure 1: 2013 Spring EWM Treatment Areas

Eurasian water milfoil (*Myriophyllum spicatum*) (EWM) was discovered in the lake in 2002, and the Sand Lake Management District (SLMD) is engaged in active management to control this invasive exotic species. Following the 2012 fall EWM bed mapping survey that found EWM plants scattered throughout the lake, the SLMD, under the direction of Short Elliott Hendrickson Inc (SEH), decided to chemically treat 12 areas in 2013. Collectively, they totaled 7.02 acres or 2.2% of the lake's surface area (Figure 1).

On June 14th, we conducted a pretreatment survey to gather baseline data and to allow SEH biologists to finalize treatment plans. Following the July 8th herbicide application, we completed an August 11th posttreatment survey to evaluate the effectiveness of the treatment. We also conducted an October 13th EWM bed mapping survey to determine where EWM control might be considered in 2014. This report is the summary analysis of these three field surveys.

METHODS:

Pre/Post Herbicide Survey:

SEH biologists generated 200 pre/post survey points. Of these, 55 occurred within the treatment areas with the other "exploratory points" falling in areas that formerly supported EWM growth. These points equated to approximately 7.5pts/treatment acre which was well within the 4-10pts/acre required by WDNR protocol (Appendix I).

Following the establishment of these points, we located them using a handheld mapping GPS unit (Garmin 76CSx) and used a rake to sample an approximately 2.5ft section of the bottom. All plants on the rake were assigned a rake fullness value of 1-3 as an estimation of abundance, and a total rake fullness for all species was also recorded (Figure 2). Visual sightings of EWM were noted if they occurred within 6ft of the point. In addition to plant data, we recorded the lake depth using a hand held sonar (Vexilar LPS-1) and the bottom substrate (bottom type) when we could see it or reliably determine it with the rake.
We entered all data collected into the standard APM spreadsheet (Appendix II). These data were then analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet (UWEX 2010). Pre/post treatment differences were determined to be significant at p <.05, moderately significant at p <.01, and highly significant at p<.005.

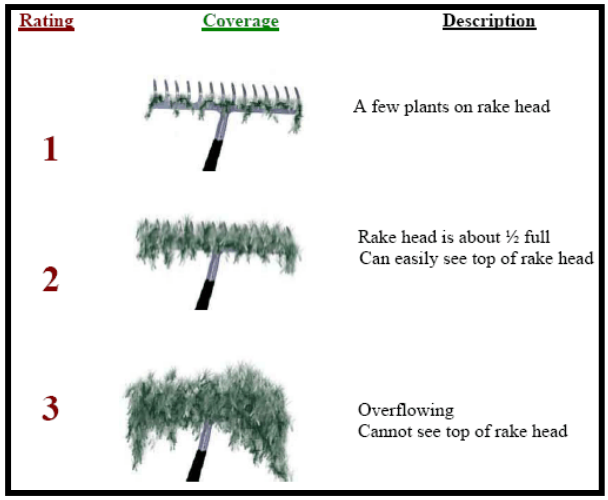


Figure 2: Rake Fullness Ratings

Fall Eurasian Water Milfoil Bed Mapping:

On October 13th, we searched the entire visible littoral zone of the lake and mapped all known beds of EWM. A "bed" was determined to be any area where we visually estimated that EWM made up >50% of the area's plants and was generally continuous with clearly defined borders. After we located a bed, we motored around the perimeter of the area, took GPS coordinates at regular intervals, and estimated the average rake fullness rating of EWM within the bed. Using the WDNR's Forestry Tool's Extension to ArcGIS 9.3.1, we used these coordinates to generate bed shapefiles and determine the acreage to the nearest hundredth of an acre.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat 12 areas totaling 7.02 acres with liquid or granular 2, 4-D (Navigate) at a concentration of 1.5-3ppm (Figure 3) (Appendix I). The pretreatment survey revealed that, although EWM was patchy, it was found on point or inter-point in all areas. Because of this, it was decided to maintain all treatment areas as initially proposed (Table 1). This treatment was conducted by Northern Aquatics Services (Dale Dressel) on July 8th.

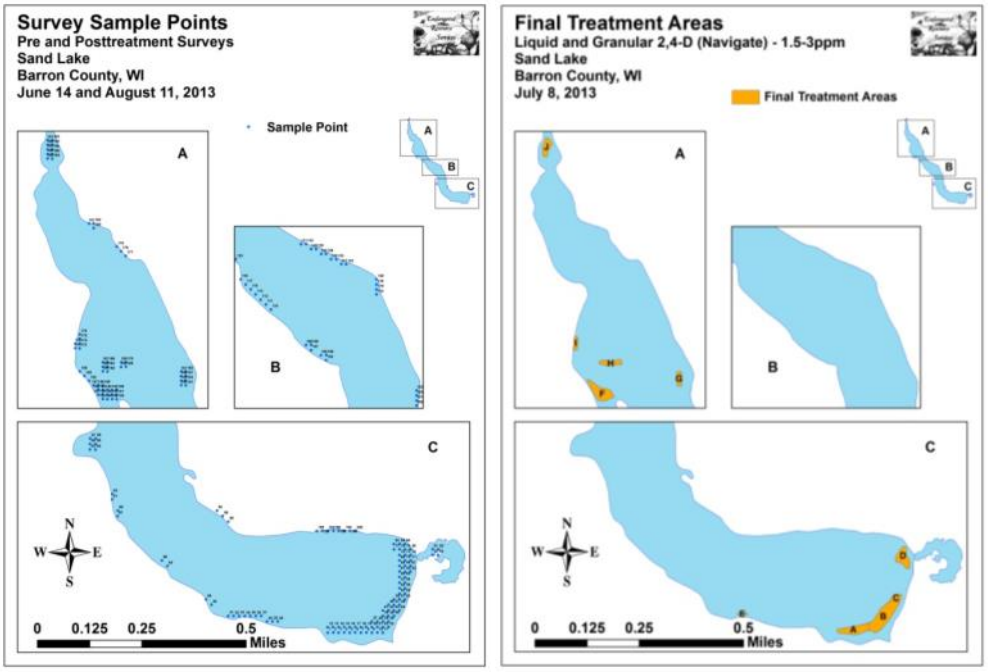


Figure 3: 2013 Survey Sample Points and Final Treatment Areas

Table 1: Spring EWM Treatment Summary
Sand Lake – July 8, 2013

Bed Number	Proposed Acreage	Final Acreage	Difference +/-
A	0.82	0.82	0
B	1.62	1.62	0
C	0.24	0.24	0
D	0.69	0.69	0
E	0.07	0.07	0
F	1.34	1.34	0
G	0.38	0.38	0
H	0.54	0.54	0
I	0.29	0.29	0
J	0.62	0.62	0
K	0.30	0.30	0
L	0.11	0.11	0
Total Acres	**7.02**	**7.02**	**0.00**

EWM Pre/Post Herbicide Survey:

The lake's littoral zone extended to a maximum of 12.5ft during the pretreatment survey and 10.0ft during the posttreatment survey. Mean and median depths for all plants were 6.2ft and 6.0ft respectively during the pretreatment survey before declining slightly to 5.7ft and 5.5ft in the posttreatment survey (Table 2). Most EWM was established over organic and sandy muck in 4-10ft of water (Figure 4) (Appendix III).

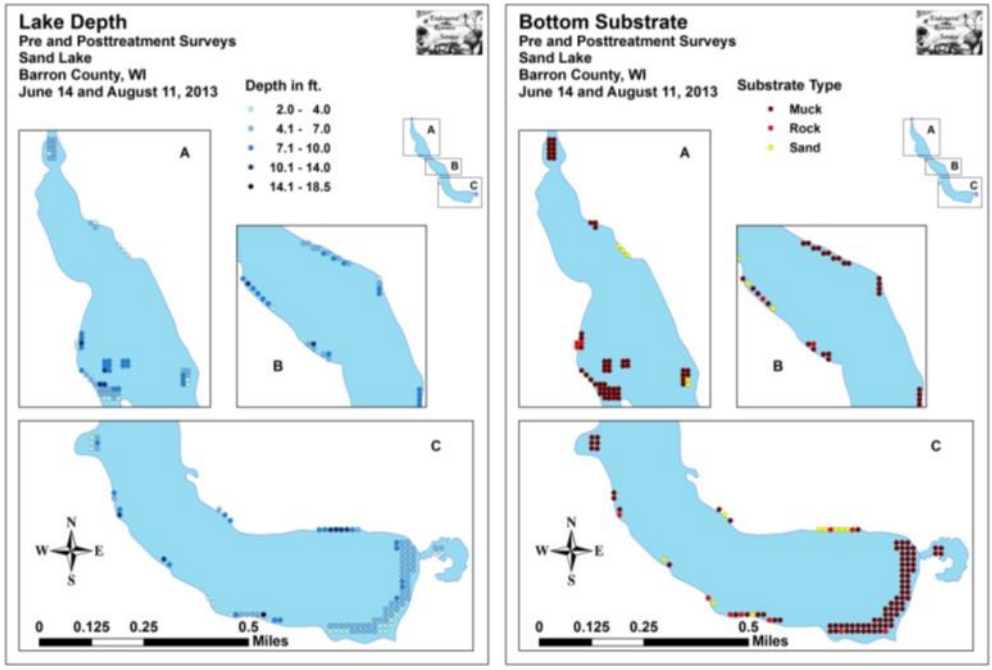


Figure 4: Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Sand Lake, Barron County
June 14 and August 11, 2013

Summary Statistics:	Pre	Post
Total number of points sampled	200	200
Total number of sites with vegetation	187	190
Total number of sites shallower than the maximum depth of plants	198	196
Frequency of occurrence at sites shallower than maximum depth of plants	94.44	96.94
Simpson Diversity Index	0.84	0.88
Floristic Quality Index	25.9	29.4
Maximum depth of plants (ft)	12.5	10.0
Mean depth of plants (ft)	6.2	5.7
Median depth of plants (ft)	6.0	5.5
Average number of all species per site (shallower than max depth)	2.18	3.01
Average number of all species per site (veg. sites only)	2.31	3.11
Average number of native species per site (shallower than max depth)	2.13	2.96
Average number of native species per site (veg. sites only)	2.26	3.06
Species richness	19	24
Mean rake fullness (veg. sites only)	1.50	2.17

Initial diversity within the beds was moderately high with a Simpson Diversity Index of 0.84. This value increased slightly to 0.88 posttreatment. Mean native species richness at sites with vegetation was 2.26/site pretreatment, and this value also increased to 3.06/site posttreatment (Figure 5). Mean total rake fullness at sites with vegetation increased from a low/moderate 1.50 pretreatment to a moderate 2.17 posttreatment (Figure 6) (Appendix IV).

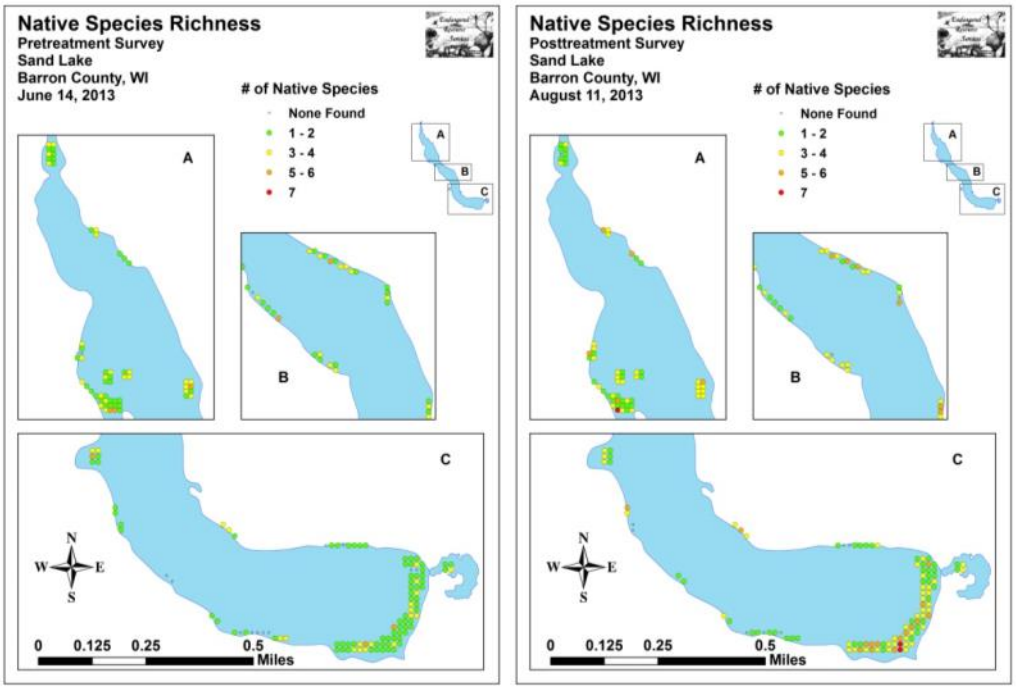


Figure 5: Pre/Post Native Species Richness

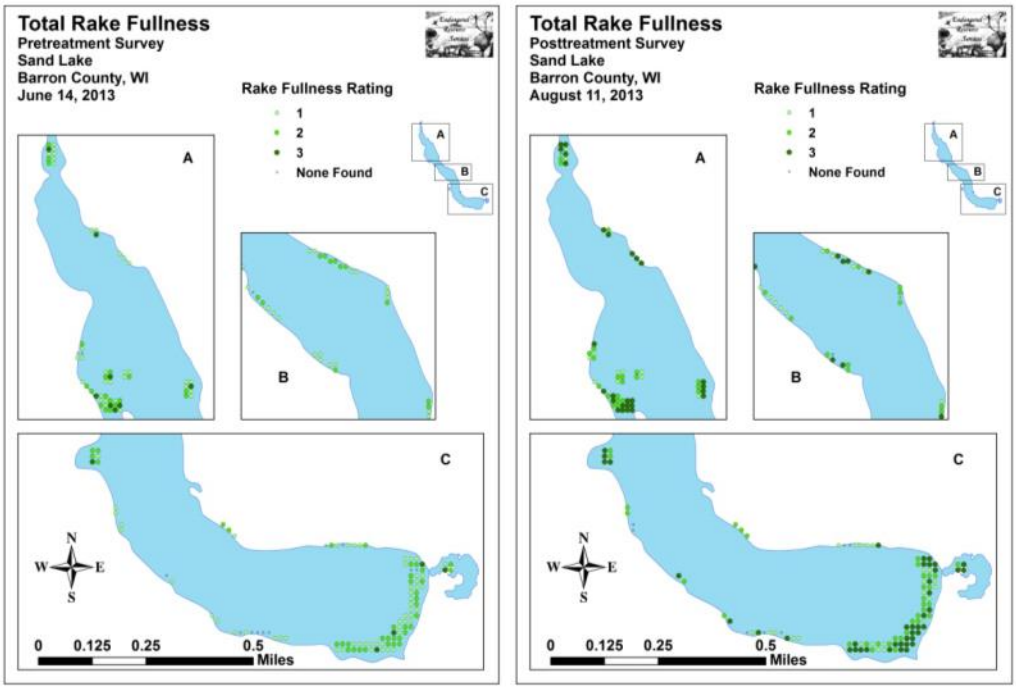


Figure 6: Pre/Post Total Rake Fullness

We found EWM at 11sites during the pretreatment survey. These sites had an average rake fullness of 1.27 as one rated a 3, one was a two, and the remaining nine had a rake fullness rating of 1. We also recorded EWM as a visual at 14 points. During the posttreatment survey, we found EWM at nine sites that averaged a rake fullness of 1.22. None rated a 3, two were a 2, and seven were a 1 with two additional visual records (Figure 7) (Appendix V). None of these changes suggested the herbicide treatment had a significant impact on the Eurasian water milfoil population (Figure 8).

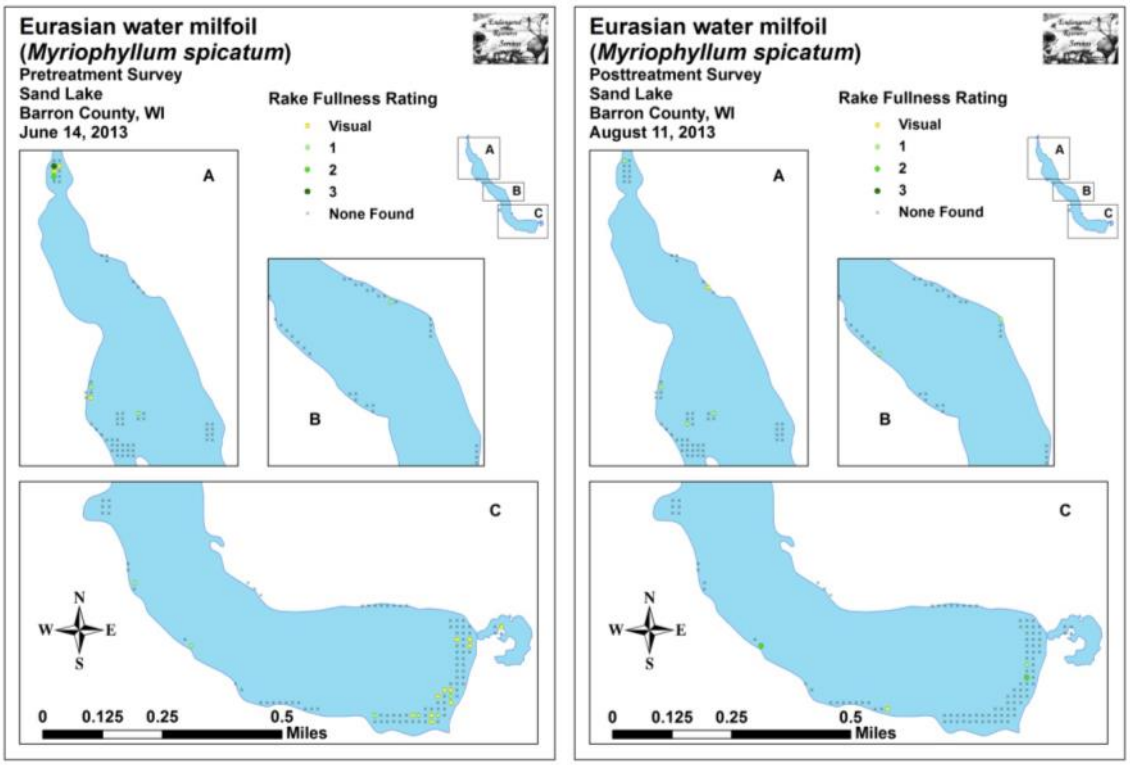
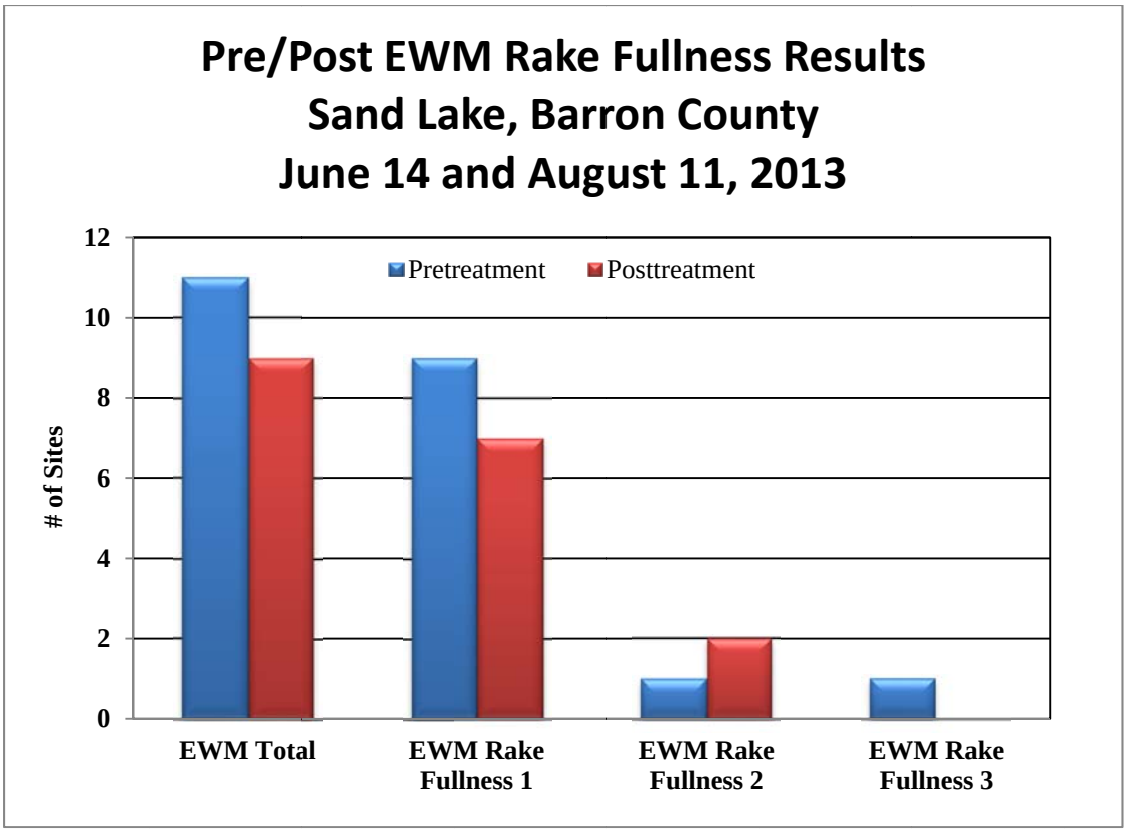


Figure 7: Pre/Post EWM Density and Distribution



Significant differences = * p <. 05, ** p <. 01, *** p <. 005

Figure 8: Pre/Post Changes in EWM Rake Fullness

Coontail (*Ceratophyllum demersum*) and Flat-stem pondweed (*Potamogeton zosteriformis*) were the two most common native species in both the pre and posttreatment surveys, and, although Coontail showed no significant change, Flat-stem pondweed demonstrated a highly significant increase posttreatment (Tables 3 and 4) (Figures 9 and 10). Interestingly, only Fries' pondweed showed a significant decline posttreatment (Figure 11). This is likely due to this species' tendency to senesce in early August. In addition to Flat-stem pondweed, Northern water milfoil (*Myriophyllum sibiricum*), Filamentous algae, and Wild celery (*Vallisneria americana*) demonstrated highly significant increases posttreatment; Muskgrass (*Chara* sp.), Slender naiad (*Najas flexilis*), and White water lily (*Nymphaea odorata*) showed moderately significant increases; and Sago pondweed (*Stuckenia pectinata*), Clasping-leaf pondweed (*Potamogeton richardsonii*), and Floating-leaf pondweed (*Potamogeton natans*) showed significant increases. All of these changes are likely due to normal expansion over the growing season (Maps for all native species from the pre and posttreatment surveys are available in Appendixes VI and VII).

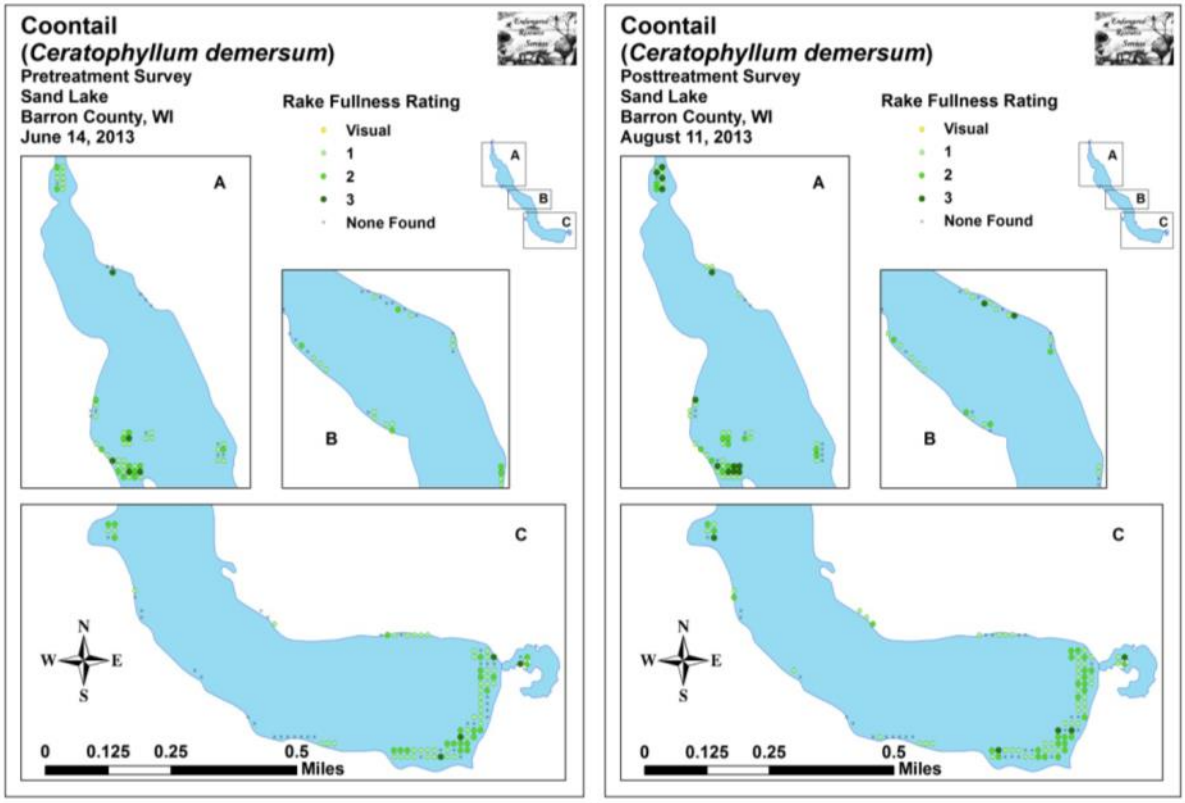


Figure 9: Pre/Post Coontail Density and Distribution

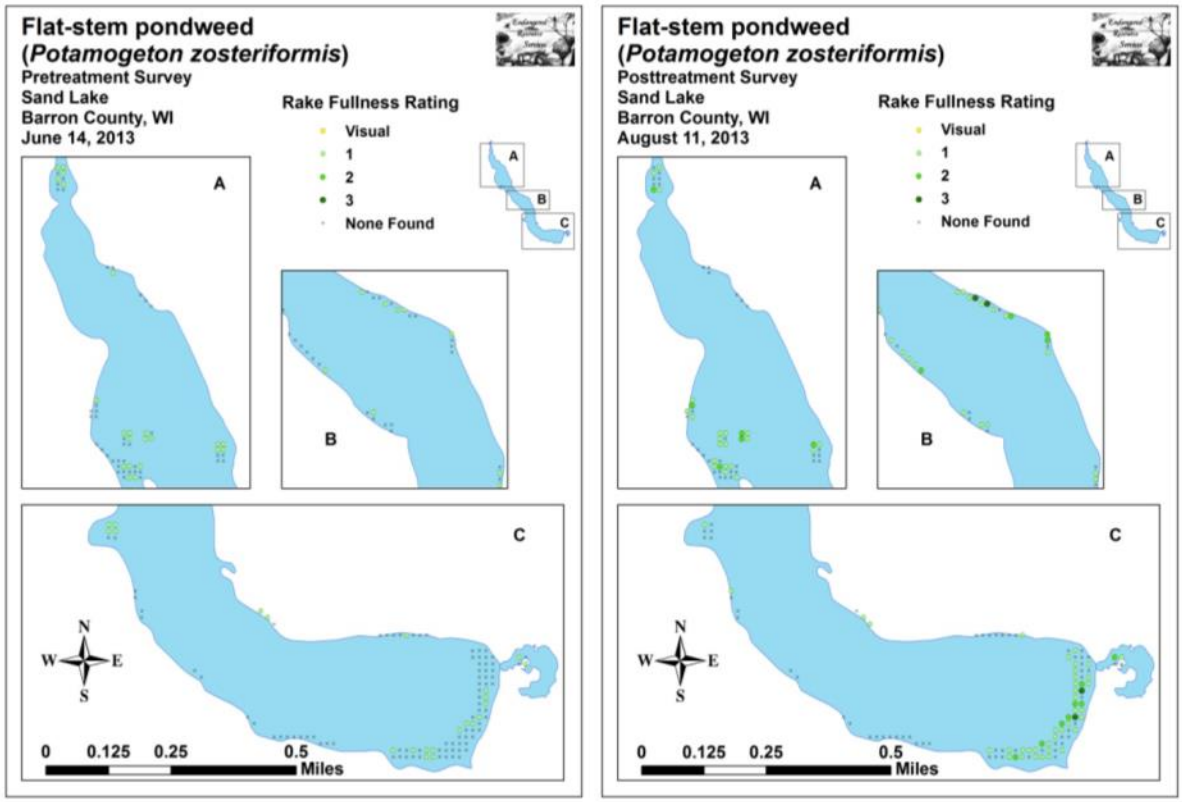


Figure 10: Pre/Post Flat-stem Pondweed Density and Distribution

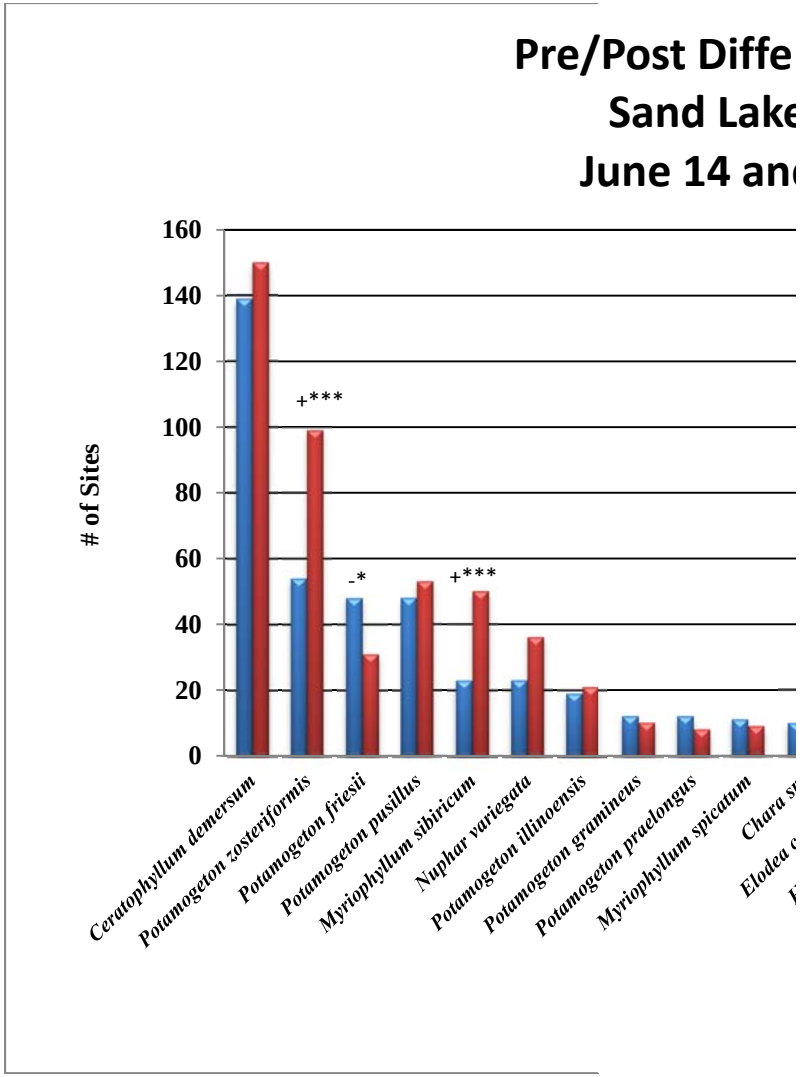


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Figure 11: Pre/P