Warm-water Aquatic Macrophyte Posttreatment Point-intercept Survey
Clear Lake – WBIC: 1841300
Sawyer County, Wisconsin


Eurasian water-milfoil (Berg 2007)


Clear Lake Aerial Photo (2015)

Project Initiated by:
The Clear Lake Property Owners Association and the
Wisconsin Department of Natural Resources – Grant AIMC-014-16


Littorella from Clear Lake's North Side (Berg 2016)

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ABSTRACT

Clear Lake (WBIC 1841300) is a 76 acre oligotrophic stratified seepage lake located in north-central Sawyer County, WI. Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) was first discovered in the lake in 1999, and the Clear Lake Property Owners Association (CLPOA) has been managing the infestation using a combination of herbicide treatments and manual removal ever since. Following point-intercept surveys by the Wisconsin Department of Natural Resources (WDNR) on June 28-29, 2005 and the WDNR and Sawyer County Land and Water Conservation Department on August 22, 2013, the CLPOA completed a whole-lake herbicide treatment in 2015. To evaluate the effectiveness of this treatment, and to determine what, if any, impact it may have had on the lake's native plant species, the CLPOA and the WDNR requested a posttreatment point-intercept survey on August 22, 2016. During this survey, we found macrophytes growing at 268 sites which approximated to 79.5% of the entire lake bottom and 95.4% of the 26.0ft littoral zone. This was up from 258 sites with plants in 2013 (77.0% of the lake and 88.7% of the then 26.0ft littoral zone). Overall diversity was very high with a Simpson Index value of 0.91 – up slightly from 0.90 in 2013. Species richness was moderate with 31species found in the rake in 2016. This was also up slightly from 28 species found in 2013. When including visuals and species found during the boat survey growing in and immediately adjacent to the water, this total jumped to 54 (60 if including charophyte species) – up significantly from the 37 total species found in 2013. Posttreatment, there was an average of 2.76 native species/site with native vegetation – a slight increase from 2.61/site pretreatment. Total rake fullness experienced a decline from an estimated 2.24 in 2013 to a moderate 1.94 in 2016. During the 2013 pretreatment survey, Wild celery (*Vallisneria americana*), Fern pondweed (*Potamogeton robbinsii*), Common waterweed (*Elodea canadensis*), and Large-leaf pondweed (*Potamogeton amplifolius*) were the most common macrophyte species. They were found at 42.25%, 40.70%, 32.95%, and 31.40% of sites with vegetation and accounted for 55.96% of the total relative frequency. The 2016 posttreatment survey found that Wild celery, Fern pondweed, Common waterweed, and Nitella (*Nitella* sp. – primarily *flexilis*) were the most common macrophyte species being present at 42.16%, 37.31%, 30.60%, and 30.22% of survey points with vegetation and accounting for 50.88% of the total relative frequency. Lakewide, of the 18 native species found in both 2013 and 2016, four species experienced significant changes in distribution: Small pondweed (*Potamogeton pusillus*) saw a highly significant increase, and Muskgrass (*Chara* sp.) had a moderately significant increase. Conversely, Large-leaf pondweed (*Potamogeton amplifolius*) and Northern naiad (*Najas gracillima*) suffered significant declines. Some of these changes may be due to the 2013 surveyors having potentially lumped several similar looking species and hybrids together (vouchers from that survey were lost/several species remained unidentified). Regardless, as all four of these species are either monocots (Large-leaf pondweed, Small pondweed, and Northern naiad) or colonial algae (Muskgrass), it is unlikely that they would be significantly impacted by the herbicide 2-4,D which is expected to only kill dicots like milfoil. The 28 native index species found in the rake during the 2016 posttreatment survey (up from 22 pretreatment in 2013) produced an above average mean Coefficient of Conservatism of 6.9 (up from 6.0 in 2013). The 2016 Floristic Quality Index of 36.5 (up from 27.9 in 2013) was also above the median FQI for this part of the state. Filamentous algae were found at just six sites with a mean rake fullness of 1.17. In 2013, surveyors found EWM in the rake at five points with four having a rake fullness value of 1 and one having a value of 2 for a mean rake fullness of 1.20. EWM was also recorded as a visual at an additional 20 points. The 2016 posttreatment survey didn't find EWM in the rake at any point; however, it was a visual at three points. This overall reduction in EWM (p=0.02) as well as rake fullness 1 (p=0.04) was significant, and the reduction in visual sightings was highly significant (p<0.001). These results suggest the 2015 treatment was highly effective at controlling EWM in the lake. At the request of the CLPOA, we produced a potential 2017 treatment shapefile that estimated the area containing regular EWM plants at 0.68 acre. Other than EWM, Hybrid cattail (*Typha* X *glauca*) was the only other exotic plant species found on the lake.

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INTRODUCTION:

Clear Lake (WBIC 1841300) is a 76 acre oligotrophic stratified seepage lake in north-central Sawyer County, Wisconsin in the Town of Round Lake (T41N R7W S20 NE SE). The lake reaches a maximum depth of 32ft in the central basin and has an average depth of approximately 14ft. The bottom is predominately muck and sandy muck throughout the north basin and bays with pure sand and rocky areas scattered along the immediate shoreline (Figure 1). Summer Secchi readings from 1995-2016 ranged from 12-21ft and averaged 16ft (WDNR 2016). This very good clarity produced a littoral zone that reached 26ft in 2016.

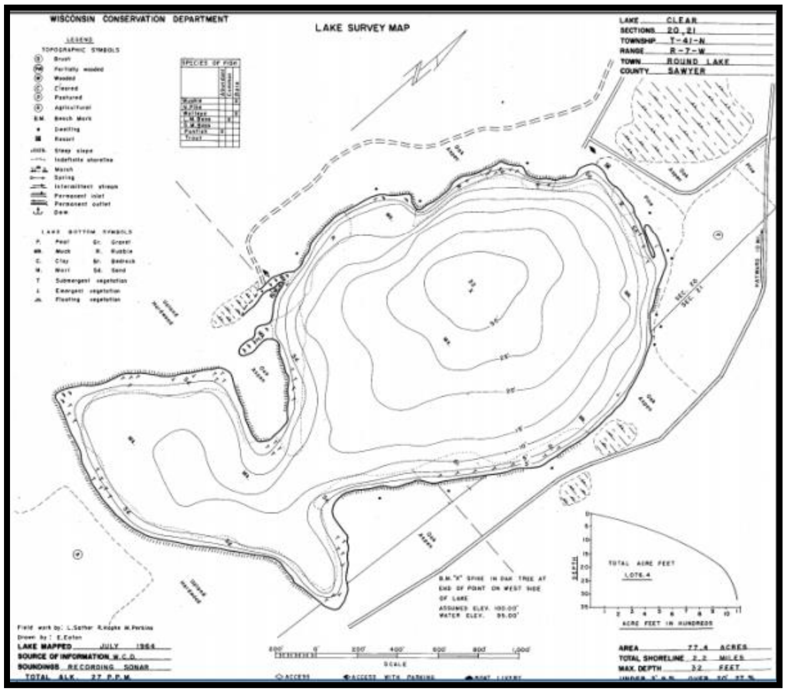


Figure 1: Clear Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM), a highly invasive exotic plant species, was first confirmed in Clear Lake in 1999. In an effort to minimize its impact on the lake's native plant community, and to prevent navigation impairment, the Clear Lake Property Owners Association (CLPOA) embarked on an active management program using small-scale and whole-lake herbicide treatments of EWM beds, as well as manual and dive removal of individual plants and smaller beds.

In 2005, the Wisconsin Department of Natural Resources (WDNR) conducted an initial point-intercept macrophyte survey on June 28-29 to gather baseline data on the lake's native plants, as well as to determine the prevalence of EWM in the lake. A follow-up survey by the WDNR and the Sawyer County Land and Water Conservation Department (SCLWCD) on August 22, 2013 was also used as a pretreatment survey for the 2015 whole-lake herbicide application. Following this treatment, the CLPOA applied for and received a WDNR grant to evaluate the herbicide's effectiveness at controlling EWM, and to determine what, if any, impact it may have had on the lake's native plants. This report is the summary analysis of that point-intercept survey conducted on August 22, 2016.

METHODS:

Warm-water Full Point-intercept Survey:

Using a standard formula that takes into account the shoreline shape and distance, water clarity, depth, and total acreage, Jennifer Hauxwell (WDNR) generated the original 337 point sampling grid at 30m resolution used on Clear Lake in both 2005 and 2013 (Appendix I). Using this same grid, we located each point using a handheld mapping GPS unit (Garmin 76CSx), recorded a depth reading with a metered pole rake or hand held sonar (Vexilar LPS-1), and used a rake to sample an approximately 2.5ft section of the bottom. All plants on the rake, as well as any that were dislodged by the rake, were identified and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of all plants within six feet of the sample point not found in the rake. In addition to a rake rating for each species, a total rake fullness rating was also noted. Substrate (bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake.

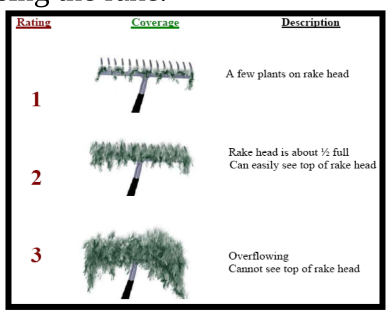


Figure 2: Rake Fullness Ratings (UWEX 2010)

Prior to beginning the August point-intercept survey, we conducted a general boat survey of the lake to gain familiarity with the species present (Appendix II). All plants found were identified (Voss 1996, Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006, Skawinski 2014), and two vouchers were pressed and mounted for herbarium specimens – one to be retained by the CLPOA, and one to be sent to the state herbarium in Stevens Point for identification confirmation.

DATA ANALYSIS:

We entered all data collected into the standard APM spreadsheet (Appendix II) (UWEX 2010). From this, we calculated the following:

Total number of sites visited: This included the total number of points on the lake that were accessible to be surveyed by boat.

Total number of sites with vegetation: These included all sites where we found vegetation after doing a rake sample. For example, if 20% of all sample sites have vegetation, it suggests that 20% of the lake has plant coverage.

Total number of sites shallower than the maximum depth of plants: This is the number of sites that are in the littoral zone. Because not all sites that are within the littoral zone actually have vegetation, we use this value to estimate how prevalent vegetation is throughout the littoral zone. For example, if 60% of the sites shallower than the maximum depth of plants have vegetation, then we estimate that 60% of the littoral zone has plants.

Frequency of occurrence: The frequency of all plants (or individual species) is generally reported as a percentage of occurrences within the littoral zone. It can also be reported as a percentage of occurrences at sample points with vegetation.

> Frequency of occurrence example:
>
> Plant A is sampled at 70 out of 700 total littoral points = 70/700 = .10 = 10%
> This means that Plant A's frequency of occurrence = 10% when considering the entire littoral zone.
>
> Plant A is sampled at 70 out of 350 total points with vegetation = 70/350 = .20 = 20%
> This means that Plant A's frequency of occurrence = 20% when only considering the sites in the littoral zone that have vegetation.
>
> From these frequencies, we can estimate how common each species was at depths where plants were able to grow, and at points where plants actually were growing. Note the second value will be greater as not all the points (in this example, only ½) had plants growing at them.

Simpson's Diversity Index: A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's Diversity Index, the index value represents the probability that two individual plants (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be **more resistant** to invasion by exotic species.

Maximum depth of plants: This indicates the deepest point that vegetation was sampled. In clear lakes, plants may be found at depths of over 20ft, while in stained or turbid locations, they may only be found in a few feet of water. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.

Mean and median depth of plants: The mean depth of plants indicates the average depth in the water column where plants were sampled. Because a few samples in deep water can skew this data, median depth is also calculated. This tells us that half of the plants sampled were in water shallower than this value, and half were in water deeper than this value.

Number of sites sampled using rope/pole rake: This indicates which rake type was used to take a sample. As is standard protocol, we use a 20ft pole rake and a 35ft rope rake for sampling.

<u>Average number of species per site:</u> This value is reported using four different considerations. 1) **shallower than maximum depth of plants** indicates the average number of plant species at all sites in the littoral zone. 2) **vegetative sites only** indicate the average number of plants at all sites where plants were found. 3) **native species shallower than maximum depth of plants** and 4) **native species at vegetative sites only** excludes exotic species from consideration.

<u>Species richness:</u> This value indicates the number of different plant species found in and directly adjacent to (on the waterline) the lake. Species richness alone only counts those plants found in the rake survey. The other two values include those seen at a sample point during the survey but not found in the rake, and those that were only seen during the initial boat survey or inter-point. **Note: Per DNR protocol, filamentous algae, freshwater sponges, aquatic moss and the aquatic liverworts *Riccia fluitans* and *Ricciocarpus natans* are excluded from these totals.**

<u>Average rake fullness:</u> This value is the average rake fullness of all species in the rake. It only takes into account those sites with vegetation (Table 1).

<u>Relative frequency:</u> This value shows a species' frequency relative to all other species. It is expressed as a percentage, and the total of all species' relative frequency will add up to 100%. Organizing species from highest to lowest relative frequency value gives us an idea of which species are most important within the macrophyte community (Tables 2-4).

Relative frequency example:

Suppose that we sample 100 points and found 5 species of plants with the following results:

Plant A was located at 70 sites. Its frequency of occurrence is thus 70/100 = 70%
Plant B was located at 50 sites. Its frequency of occurrence is thus 50/100 = 50%
Plant C was located at 20 sites. Its frequency of occurrence is thus 20/100 = 20%
Plant D was located at 10 sites. Its frequency of occurrence is thus 10/100 = 10%

To calculate an individual species' relative frequency, we divide the number of sites a plant is sampled at by the total number of times all plants were sampled. In our example that would be 150 samples (70+50+20+10).

Plant A = 70/150 = .4667 or 46.67%
Plant B = 50/150 = .3333 or 33.33%
Plant C = 20/150 = .1333 or 13.33%
Plant D = 10/150 = .0667 or 6.67%

This value tells us that 46.67% of all plants sampled were Plant A.

Floristic Quality Index (FQI): This index measures the impact of human development on a lake's aquatic plants. The 124 species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the Point-intercept survey**, and multiplying it by the square root of the total number of plant species (N) in the lake ($FQI=(\Sigma(c1+c2+c3+\ldots cn)/N)*\sqrt{N}$). Statistically speaking, the higher the index value, the healthier the lake's macrophyte community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Clear Lake is in the Northern Lakes and Forests Ecoregion (Tables 5-7).

**** Species that were only recorded as visuals or during the boat survey, and species found in the rake that are not included in the index are excluded from FQI analysis.**

Comparison to Past Surveys: Using the WDNR Pre/Post Survey Sheet, we compared data from the WDNR June 2005 point-intercept survey with the WDNR/SCLWCD 2013 results to see if there were any significant changes in the lake's vegetation. We also compared the 2013 results with our 2016 data. Differences were determined to be significant at $p < .05$, moderately significant at $p < .01$ and highly significant at $p < .005$ (UWEX 2010).

Several factors made these comparisons problematic, and they should likely be viewed as informative rather than definitive. Specifically, the 2005 survey was conducted in June rather than August like the 2013 and 2016 surveys. Because most species expand their coverage and density as the growing season progresses, any significant year-over-year increases are potentially at least partially due to normal summer growth. After analyzing the raw data from these past surveys, we noted that several locations on the 2005 sheet were left blank, and other points in both 2005 and 2013 were reported to be on land. To best account for these differences in sampling effort, we used the number of littoral points visited as the basis for "sample points". We also found that the 2013 raw datasheet had multiple entries for 21 survey points. These duplicate points had similar and often identical data suggesting that the two teams independently surveyed the same area. Because of this, we determined the "least bad" option from a statistical comparison standpoint was to merge data for these points of overlap. Fortunately, it seemed to have minimal impact on the overall averages. Finally, two pondweed species (*Potamogeton* spp.) and three additional species (unknowns 1-3) were never identified in 2013, and the vouchers were lost (Kristi Maki, pers. comm.). After considering all these factors, we decided to excluded analysis of species not found in consecutive surveys.

RESULTS:
Warm-water Full Point-intercept Macrophyte Survey:

Depth soundings taken at Clear Lake's 337 survey points revealed the northern basin was a generally uniform deep bowl that dropped off rapidly from the shoreline to over 10ft before descending more gradually to 20ft+. The lake's southern bays were much shallower and bottomed out at just over 12ft (Figure 3) (Appendix III). Water levels in the lake were up almost 2ft when compared to the 2013 survey, and we noticeably alders (*Alnus incana*) and other saplings at the shoreline were underwater, and, in many cases dead or dying.

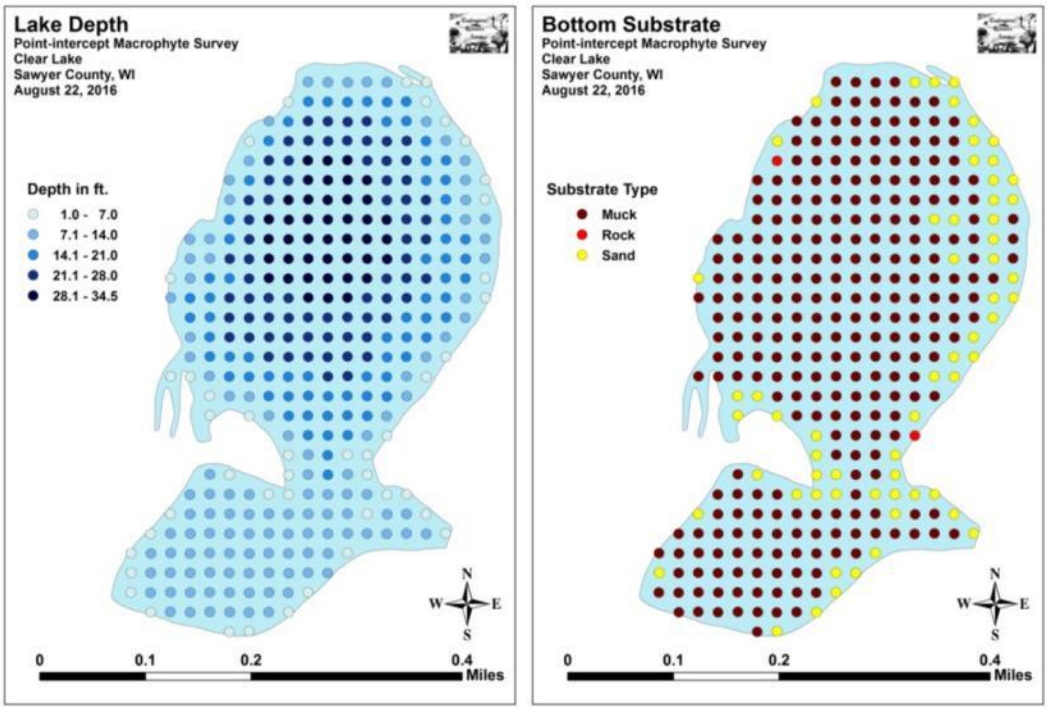


Figure 3: Lake Depth and Bottom Substrate

Sand and rock dominated the majority of the nearshore lake bottom as well as along the channel to the southern bay (Figure 3). Away from the immediate shoreline, the majority of these areas quickly transitioned to a nutrient poor sandy muck with the only thick organic rich muck occurring in the tiny finger bays near the west side public boat landing. Of the lake's 337 survey sites, we categorized the bottom as 81.3% sandy and organic muck (274 points), 18.1% pure sand (61 points), and just 0.6% rock and gravel (2 points) (Appendix III).

At the time of the survey, Secchi disc readings were around 17ft. This very good water clarity produced a littoral zone that extended to 26.0ft with the mean and median depths of plants at 13.7ft and 12.5ft respectively (Table 1) (Figure 4). These values were all up from 2005 when surveyors found plants to 23.3ft with mean/median depths of 12.0ft and 11.0ft. In 2013, plants were also found to 26.0ft, but again had lower mean and median depths at 12.2ft and 11.5ft. In 2016, plants covered 79.5% of the total lake bottom and 95.4% of the littoral zone. These values were again both higher than in 2005 when 72.4% of the total bottom and 91.7% of the littoral zone were colonized. It was also higher than in 2013 when plants covered 77.0% of the bottom and 88.7% of the littoral zone (Appendix IV).

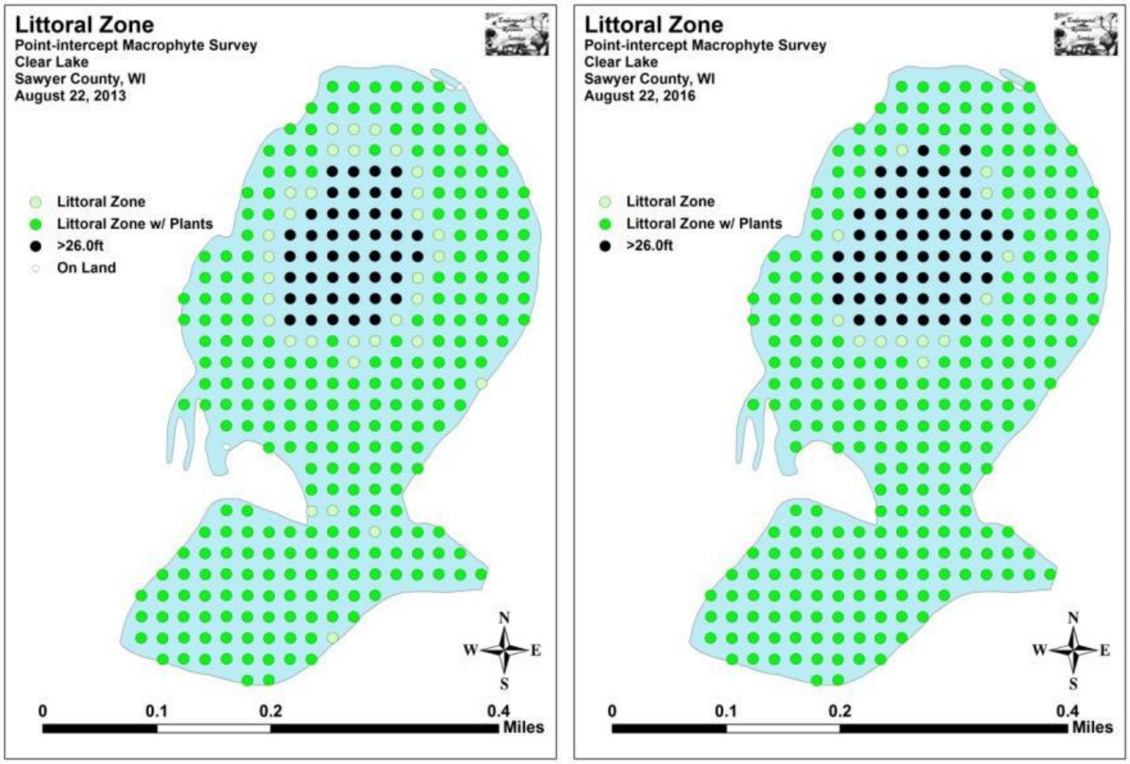


Figure 4: 2013 and 2016 Littoral Zone

Table 1: Aquatic Macrophyte P/I Survey Summary Statistics
Clear Lake, Sawyer County
June 28-29, 2005, August 22, 2013, and August 22, 2016

Summary Statistics:	2005	2013	2016
Total number of points sampled	291	335	337
Total number of sites with vegetation	244	258	268
Total number of sites shallower than the maximum depth of plants	266	291	281
Frequency of occurrence at sites shallower than max. depth of plants	91.73	88.66	95.37
Simpson Diversity Index	0.86	0.90	0.91
Maximum depth of plants (ft)	23.3	26.0	26.0
Mean depth of plants (ft)	12.0	12.2	13.7
Median depth of plants (ft)	11.0	11.5	12.5
Average number of all species per site (shallower than max depth)	2.05	2.33	2.63
Average number of all species per site (veg. sites only)	2.24	2.63	2.76
Average number of native species per site (shallower than max depth)	2.05	2.32	2.63
Average number of native species per site (veg. sites only)	2.24	2.61	2.76
Species richness	22	28	31
Species richness (including visuals)	23	37	34
Species richness (including visuals and boat survey)	23	37	54
Mean total rake fullness (veg. sites only)	n. m.	2.24 (est.)	1.94

n. m. = not measured

Overall diversity in the lake is very high. In 2016, our data produced a Simpson Index value of 0.91 that was almost unchanged from the 2013 pretreatment survey's value of 0.90. Both of these numbers were slightly higher than the 0.86 reported from the original 2005 survey. The 31 species found in the rake in 2016 was also up slightly from 28 species in 2013; however, it represented a significantly increase from the 22 species found in 2005. When including plants recorded as visuals or during the boat survey, this total jumped to54 species growing in and immediately adjacent to the lake (up from 37 in 2013 and 23 in 2005). Although the WDNR worksheet doesn't account for these differences, after dividing out the lake's abundant charophytes from genus (*Chara* spp and *Nitella* spp.) down to species, this total increased even further to at least 60 total species. Interestingly, preliminary analysis from the New York Botanical Garden indicates several of them are potentially uncommon to rare in Wisconsin (K. Karol person. comm).

Mean species richness was moderate with 2.76 native species found at sites with vegetation (up from 2.61/site in 2013 and 2.24/site in 2005). Around the central basin, localized richness dropped rapidly with increased depth, and few sites over 10ft had more than two species present (Figure 5). Lakewide, high diversity/richness areas of note included the northeast and western finger bays as well as areas around the margins of the south bay. In general, we found that the more nutrient rich organic muck an area had, the greater both the richness and overall density of plant growth was. Outside these areas, the lake's nutrient poor substrates tended to support fewer species and only moderate density. A notable exception to this was the thick tangles of colonial green algae (Charophytes) found at the outer edge of the littoral zone around the central basin. Overall, plant density was moderate with a mean rake fullness of 1.94 at sites with vegetation (down from an estimated 2.24 during the pretreatment survey in 2013) (Figure 6) (Appendix IV).

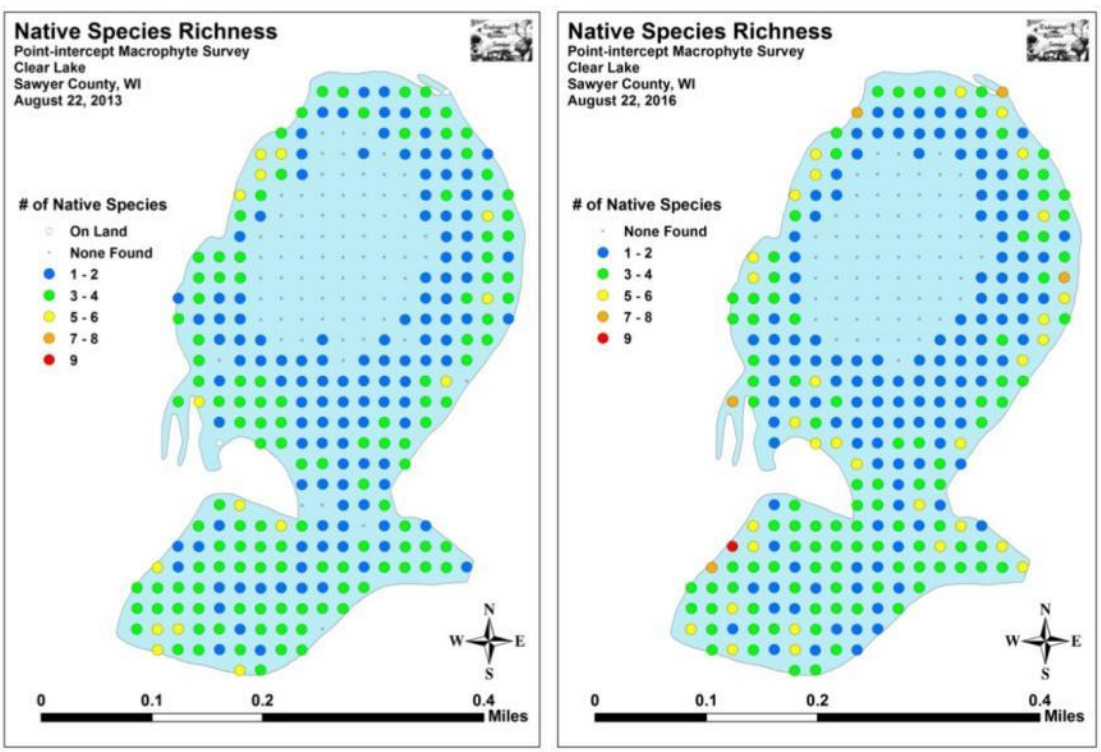
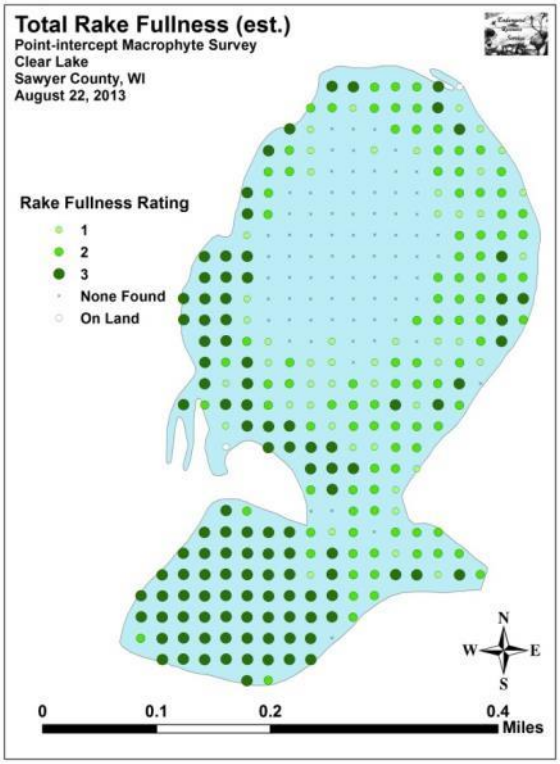


Figure 5: 2013 and 2016 Native Species Richness



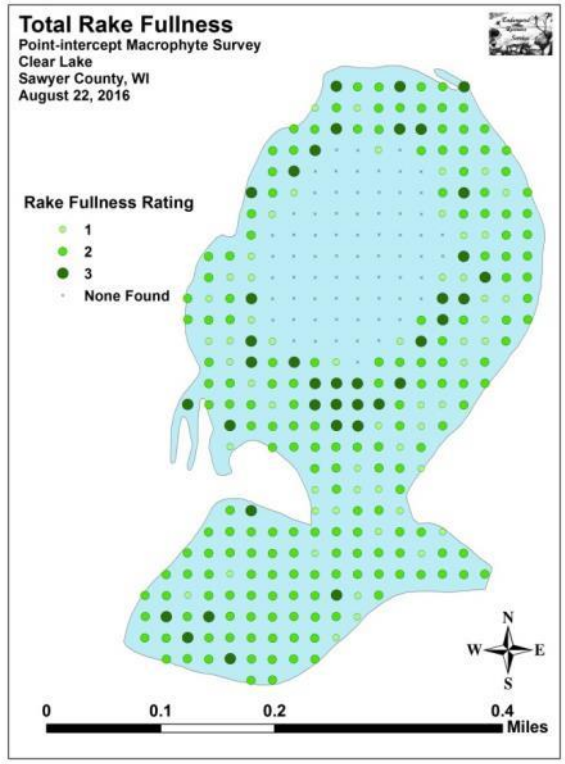


Figure 6: 2013 and 2016 Total Rake Fullness Rating

Clear Lake Plant Community:

The Clear Lake ecosystem is home to a rich and diverse plant community that is typical of low to moderate nutrient lakes with very good water clarity and quality. This community can be subdivided into four distinct zones (emergent, shallow submergent, floating-leaf, and deep submergent) with each zone having its own characteristic functions in the aquatic ecosystem. Depending on the local bottom type (sand, rock, sandy muck, or nutrient rich organic muck), these zones often had somewhat different species present.

In shallow areas, beds of emergent plants prevent erosion by stabilizing the lakeshore, break up wave action, provide a nursery for baitfish and juvenile gamefish, offer shelter for amphibians, and give waterfowl and predatory wading birds like herons a place to hunt. These areas also provide important habitat for invertebrates like dragonflies and mayflies.

Along sandy and rocky shorelines and over shallow flats, the limited emergent community was dominated by Creeping spikerush (*Eleocharis palustris*) and Softstem bulrush (*Schoenoplectus tabernaemontani*). At the shoreline, the emergent community over sandy muck was especially diverse. In this environment, we found Bottle brush sedge (*Carex comosa*), Crawford's sedge (*Carex crawfordii*), False bottle brush sedge (*Carex pseudocyperus*), Three-way sedge (*Dulichium arundinaceum*), Rattlesnake manna-grass (*Glyceria canadensis*), Narrow-panicle rush (*Juncus brevicaudatus*), Canada rush (*Juncus canadensis*), Common rush (*Juncus effusus*), Rice cut-grass (*Leersia oryzoides*), and Hybrid cattail (*Typha* X *glauca*).

Creeping spikerush (Legler 2016)

Softstem bulrush (Schwarz 2011)

Bottle brush sedge (Penta 2010)

Crawford’s sedge with Perigynium (Teasre 2016 and USDA 1998)

Three-way sedge (GMNRI 2016)

Rattlesnake manna-grass (2016)

Narrow-panicle rush (Gyekis 2016)

Canada rush (Eggers 2007)

Common rush (Lovit 2016)

Rice cut-grass (Vid 2016)

In the boggy areas of the boat landing area finger bays and along the northeast finger bay, the nutrient rich organic muck substrates supported stands of Narrow-leaved woolly sedge (*Carex lasiocarpa*) and scattered patches of Marsh cinquefoil (*Comarum palustre*), Woolgrass (*Scirpus cyperinus*), Short-stemmed bur-reed (*Sparganium emersum*), and Broad-leaved cattail (*Typha latifolia*).

Narrow-leaved woolly sedge (Navratil 2016)

Marsh cinquefoil (Myrhatt 2012)

Woolgrass (Colby 2012)

Short-stemmed bur-reed (Cameron 2016)

Shallow organic muck-bottomed areas were the rarest habitat in the lake. Because of this, floating-leaf species like Watershield (*Brasenia schreberi*), Spatterdock (*Nuphar variegata*), Water smartweed (*Polygonum amphibium*), Large-leaf pondweed (*Potamogeton amplifolius*), Ribbon-leaf pondweed (*Potamogeton epihydrus*), and Floating-leaf pondweed (*Potamogeton natans*) that require this type of substrate were also generally uncommon. The protective canopy cover this group provides is often utilized by panfish and bass.

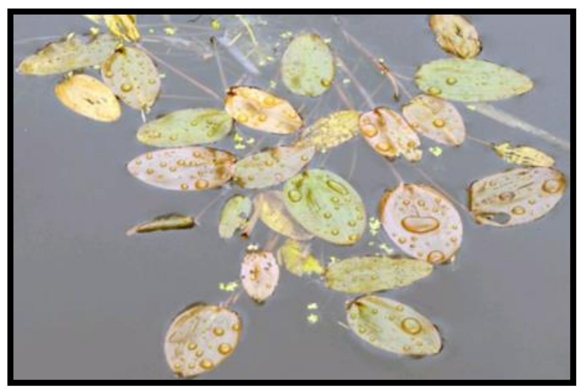

Watershield (Gmelin 2009)


Spatterdock (CBG 2014)


Water smartweed (Someya 2009)


Large-leaf pondweed (Fewless 2010)


Ribbon-leaf pondweed (Petroglyph 2007)

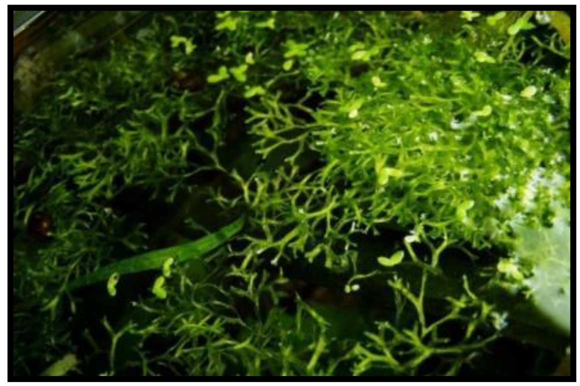

Floating-leaf pondweed (Petroglyph 2007)

Growing amongst these floating-leaved species, we also encounter Water marigold (*Bidens beckii*) and Leafy pondweed (*Potamogeton foliosus*). In addition to these larger rooted species, we documented limited numbers of Muskgrass (*Chara* sp.), Spiny hornwort (*Ceratophyllum echinatum*), Small duckweed (*Lemna minor*), Nitella (*Nitella furcata* – likely), Slender riccia (*Riccia fluitans*) and the carnivorous species Creeping bladderwort (*Utricularia gibba*), Flat-leaf bladderwort (*Utricularia intermedia*), and Common bladderwort (*Utricularia vulgaris*) floating among both the lilypads and the emergents. Rather than drawing nutrients up through roots like other plants, bladderworts trap zooplankton and minute insects in their bladders, digest their prey, and use the nutrients to further their growth.

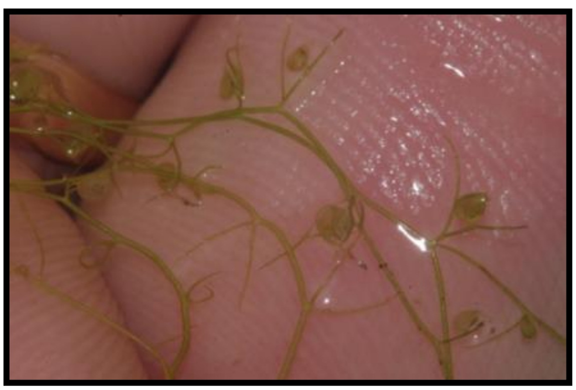
Water marigold (Dziuk 2012)

Keeled nutlets of Leafy pondweed (Kleinman 2009)

Spiny hornwort (Skawinski 2010)



Small duckweed and Slender riccia - liverwort (Martin 2013)



Creeping bladderwort (Eyewed 2010)

Flat-leaf bladderwort (Woods 2012)

Common bladderwort flowers among lilypads (Hunt 2010)

Bladders for catching plankton and insect larvae (Wontolla 2007)

Just beyond the emergents, in water up to 5ft deep, shallow sugar sand areas tended to have low total biomass as these nutrient poor substrates provide habitat most suited to fine-leaved "isoetid" turf forming species like Muskgrass (*Chara* sp.), Needle spikerush (*Eleocharis acicularis*), Brown-fruited rush (*Juncus pelocarpus*), Littorella** (*Littorella uniflora*), Dwarf water-milfoil (*Myriophyllum tenellum*), Northern naiad (*Najas gracillima*), Dwarf stonewort (*Nitella tennuissima*), and Crested arrowhead (*Sagittaria cristata*). These species, along with the emergents, work to stabilize the bottom and prevent wave action erosion.

Muskgrass (Penuh 2007)

Needle spikerush (Fewless 2005)

Brown-fruited rush (Koshere 2002)

Clear Lake Littorella (Berg 2016)

Dwarf water-milfoil (Koshere 2002)

Northern naiad (Kallor 2016)

Dwarf stonewort (Oyadomari 2010)

Crested arrowhead (Fewless 2004)

Sand and sandy muck areas in water <5ft deep supported fewer and narrower-leaved floating-leaf species than organic muck areas. In this environment, we found widely scattered patches of Northern manna-grass (*Glyceria borealis*), Variable pondweed (*Potamogeton gramineus*), Spiral-fruited pondweed (*Potamogeton spirillus*), and **Vasey's pondweed (*Potamogeton vaseyi*).

** Littorella and Vasey's pondweed are listed as **state species of special concern**. They are not currently threatened or endangered, but they are uncommon to rare in the state. Because they are so sensitive to pollution/human disturbance, there is concern they will become threatened or endangered in the future.

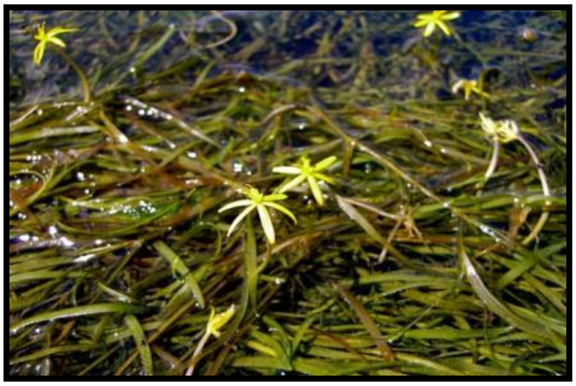
Northern manna-grass (Fewless 2010)

Variable pondweed (Koshere 2002)

Spiral-fruited pondweed (Koshere 2002)

Vasey's pondweed (Cameron 2016)

Sandy muck areas in water from 5-10ft deep tended to support slightly broader-leaved species like Water star-grass (*Heteranthera dubia*), Eurasian water-milfoil, Slender naiad (*Najas flexilis*), large morph Variable pondweed, Large-leaf pondweed and its hybrids (*Potamogeton* X *scoliophyllus* – likely), Small pondweed (*Potamogeton pusillus pusillus*), and Wild celery (*Vallisneria americana*). The roots, shoots, and seeds of these species are heavily utilized by both resident and migratory waterfowl for food. They also provide important habitat for the lake's fish throughout their lifecycles, as well as a myriad of invertebrates like scuds, dragonfly and mayfly nymphs, and snails.

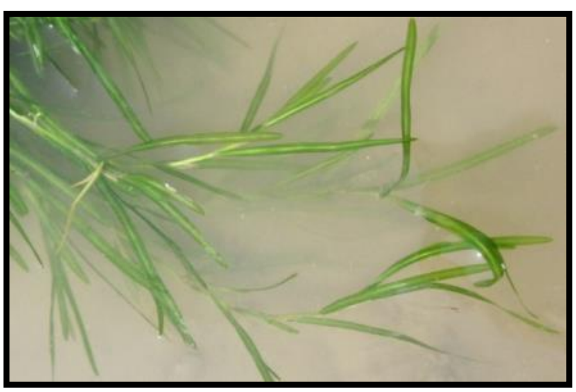


Water star-grass (Mueller 2010)

Eurasian water-milfoil (Berg 2007)

Slender naiad (Apipp 2009)

Large-leaf pondweed (Martin 2002)



Small pondweed (Villa 2011)

Wild celery (Dalvi 2009)

Areas from 10-20ft over sandy muck were dominated by Muskgrass, Common waterweed (*Elodea canadensis*), Southern naiad (*Najas guadalupensis*), Small pondweed (*Potamogeton pusillus berchtoldii*), Fern pondweed (*Potamogeton robbinsii*), and Flat-stem pondweed (*Potamogeton zosteriformis*). Predatory fish like the lake's Musky are often found along the edges of these beds waiting in ambush.

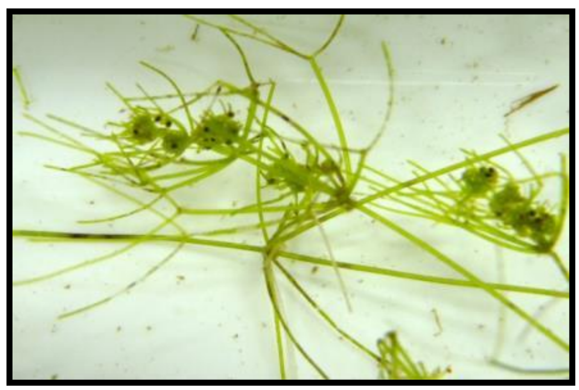
Muskgrass (Abdul 2016)

Common waterweed (Pinkka 2013)

Southern naiad (Cameron 2016)

Fern pondweed (Apipp 2011)

Flat-stem pondweed (Fewless 2004)



Nitella (USGS 2008)

Growing deeper than any other plants, the colonial charophytes Slender nitella (*Nitella flexilis*) and, to a much lesser extent, Muskgrass (*Chara* sp. – likely *globularis*) ringed the lake bottom at the edge of the littoral zone from 18-26ft. Although individuals are small, in their preferred habitat these species often formed dense "underwater hay stacks" that provide excellent habitat for invertebrates as well as fish.

In 2005, WDNR biologist found Muskgrass, Fern pondweed, Nitella, and Wild celery to be the most common species (Table 2). They were present at 55.33%, 35.66%, 26.64%, and 26.23% of survey points with vegetation respectively, and accounted for a very high 64.29% of the total relative frequency (Figure 7). Large-leaf pondweed (11.36), Variable pondweed (8.06), and Flat-stem pondweed (4.95) were the only other species that had relative frequencies over 4% (Distribution maps for all native species found in 2005 are located in Appendix V).

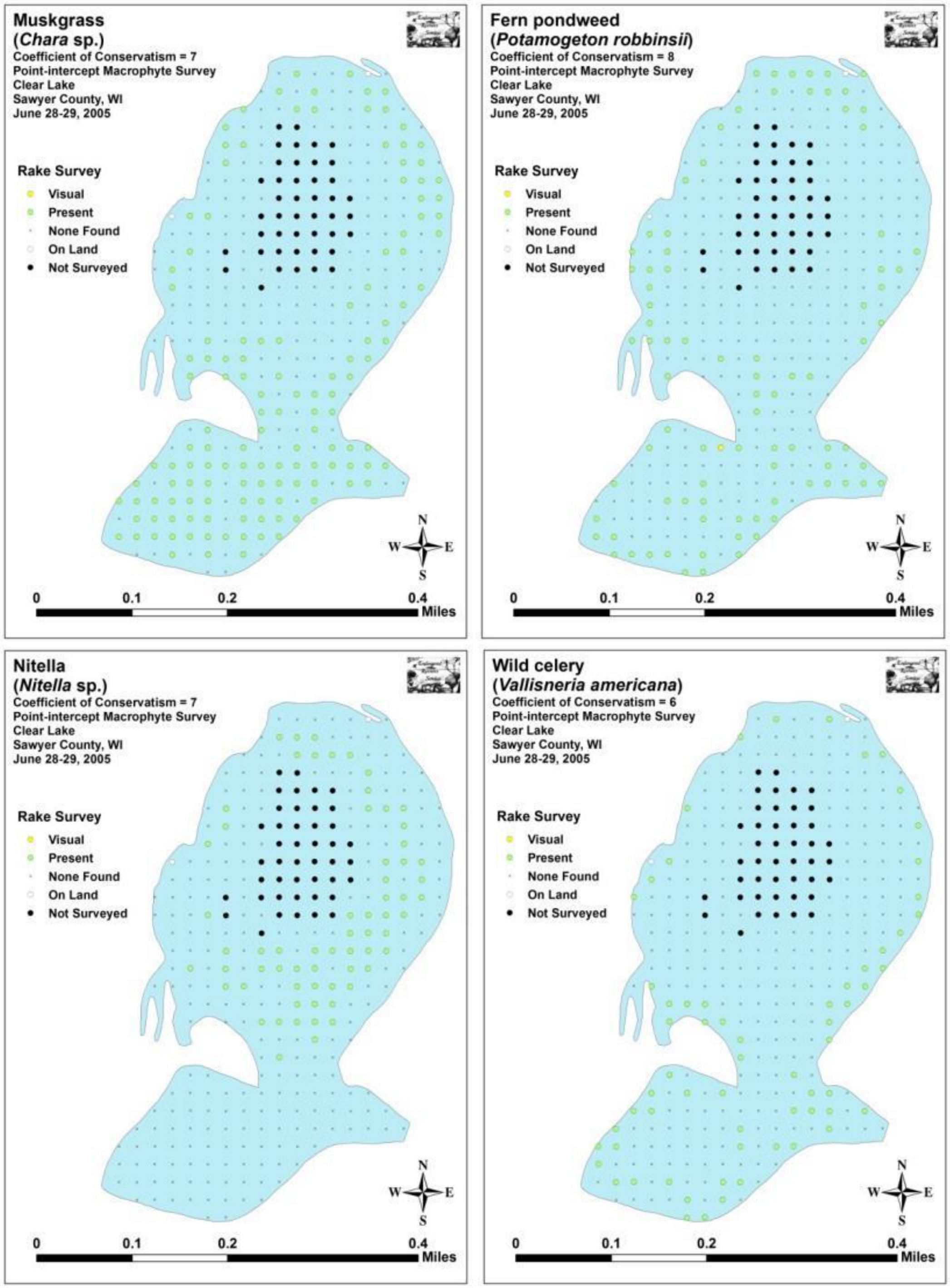


Figure 7: Clear Lake's Most Common Species in 2005

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Clear Lake, Sawyer County
June 28-29, 2005

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Chara sp.	Muskgrass	135	24.73	55.33	50.75	1.00	0
Potamogeton robbinsii	Fern pondweed	87	15.93	35.66	32.71	1.00	1
Nitella sp.	Nitella	65	11.90	26.64	24.44	1.00	0
Vallisneria americana	Wild celery	64	11.72	26.23	24.06	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	62	11.36	25.41	23.31	1.00	6
Potamogeton gramineus	Variable pondweed	44	8.06	18.03	16.54	1.00	0
Potamogeton zosteriformis	Flat-stem pondweed	27	4.95	11.07	10.15	1.00	1
Heteranthera dubia	Water star-grass	21	3.85	8.61	7.89	1.00	3
Potamogeton pusillus	Small pondweed	8	1.47	3.28	3.01	1.00	0
Eleocharis acicularis	Needle spikerush	7	1.28	2.87	2.63	1.00	0
	Aquatic moss	6	*	2.46	2.26	1.00	0
Najas flexilis	Slender naiad	5	0.92	2.05	1.88	1.00	0
Myriophyllum tenellum	Dwarf water-milfoil	4	0.73	1.64	1.50	1.00	0
Potamogeton obtusifolius	Blunt-leaf pondweed	4	0.73	1.64	1.50	1.00	0
Potamogeton foliosus	Leafy pondweed	3	0.55	1.23	1.13	1.00	0
Nuphar variegata	Spatterdock	2	0.37	0.82	0.75	1.00	2
Sagittaria sp.	Arrowhead	2	0.37	0.82	0.75	1.00	0
Brasenia schreberi	Watershield	1	0.18	0.41	0.38	1.00	1
Carex lasiocarpa	Narrow-leaved woolly sedge	1	0.18	0.41	0.38	1.00	0
Eleocharis palustris	Creeping spikerush	1	0.18	0.41	0.38	1.00	0
Juncus effusus	Common rush	1	0.18	0.41	0.38	1.00	0
Najas gracillima	Northern naiad	1	0.18	0.41	0.38	1.00	0
Schoenoplectus pungens	Three-square bulrush	1	0.18	0.41	0.38	1.00	0
Myriophyllum spicatum	Eurasian water-milfoil	**	**	**	**	**	3

* Excluded from the Relative Frequency Calculation ** Visual Only

During the August 2013 survey, WDNR/SCLWCD biologists found Wild celery, Fern pondweed, Common waterweed, and Large-leaf pondweed were the most common species (Table 3). Present at 42.25%, 40.70%, 32.95%, and 31.40% of survey points with vegetation, these species accounted for 55.96% of the total relative frequency (Figure 8). Nitella (9.72), an unidentified pondweed (7.22), Variable pondweed (5.74), Muskgrass (5.30), and Northern water-milfoil (5.30) also had relative frequencies over 4% (Distribution maps for all native species found in 2013 are located in Appendix VI).

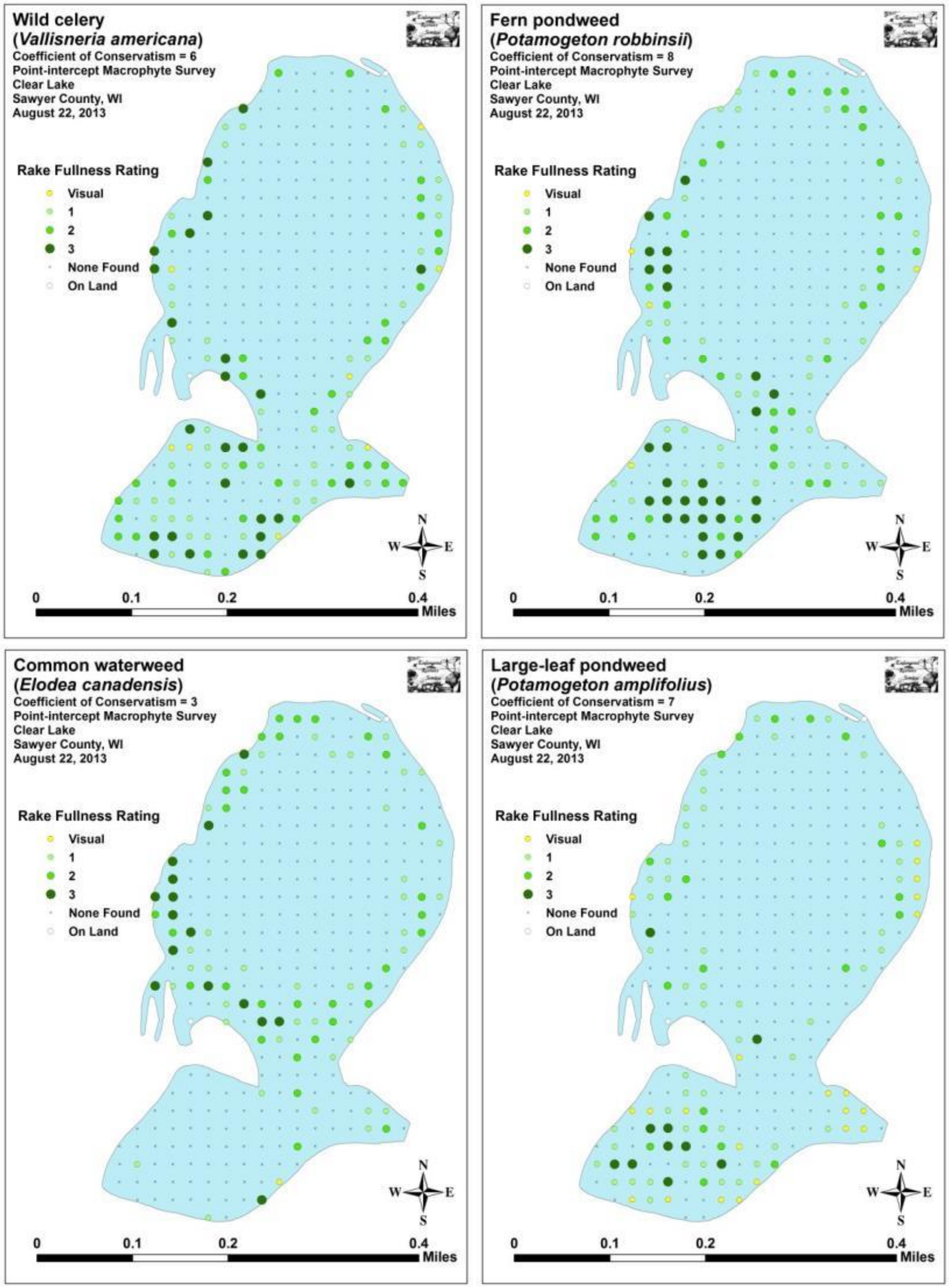


Figure 8: Clear Lake's Most Common Species in 2013

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2013

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Vallisneria americana	Wild celery	109	16.05	42.25	37.59	1.80	8
Potamogeton robbinsii	Fern pondweed	105	15.46	40.70	36.21	1.94	4
Elodea canadensis	Common waterweed	85	12.52	32.95	29.31	1.73	1
Potamogeton amplifolius	Large-leaf pondweed	81	11.93	31.40	27.93	1.49	22
Nitella sp.	Nitella	66	9.72	25.58	22.76	1.64	0
Potamogeton sp.	Pondweed sp. 1	49	7.22	18.99	16.90	2.18	0
Potamogeton gramineus	Variable pondweed	39	5.74	15.12	13.45	1.74	3
Chara sp.	Muskgrass	36	5.30	13.95	12.41	1.56	0
Najas gracillima	Northern naiad	36	5.30	13.95	12.41	1.75	0
Potamogeton zosteriformis	Flat-stem pondweed	23	3.39	8.91	7.93	1.22	1
Heteranthera dubia	Water star-grass	8	1.18	3.10	2.76	1.00	0
Potamogeton pusillus	Small pondweed	6	0.88	2.33	2.07	1.33	0
Myriophyllum spicatum	Eurasian water milfoil	5	0.74	1.94	1.72	1.20	20
Myriophyllum tenellum	Dwarf water-milfoil	5	0.74	1.94	1.72	1.20	0
Najas flexilis	Slender naiad	5	0.74	1.94	1.72	1.60	1
Eleocharis acicularis	Needle spikerush	4	0.59	1.55	1.38	1.50	0
Brasenia schreberi	Watershield	3	0.44	1.16	1.03	2.67	3
Juncus pelocarpus f. submersus	Brown-fruited rush	3	0.44	1.16	1.03	1.33	1
Elodea nuttallii	Slender waterweed	2	0.29	0.78	0.69	1.50	0
Carex lasiocarpa	Narrow-leaved woolly sedge	1	0.15	0.39	0.34	3.00	1
Ceratophyllum demersum	Coontail	1	0.15	0.39	0.34	1.00	0
Polygonum amphibium	Water smartweed	1	0.15	0.39	0.34	1.00	2
Potamogeton richardsonii	Clasping-leaf pondweed	1	0.15	0.39	0.34	1.00	1
Potamogeton sp.	Pondweed sp. 2	1	0.15	0.39	0.34	1.00	0

* Excluded from the Relative Frequency Calculation

Table 3 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2013

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Schoenoplectus tabernaemontani	Softstem bulrush	1	0.15	0.39	0.34	1.00	1
Typha latifolia	Broad-leaved cattail	1	0.15	0.39	0.34	1.00	1
	Unknown sp. 1	1	0.15	0.39	0.34	3.00	0
	Unknown sp. 3	1	0.15	0.39	0.34	1.00	0
Dulichium arundinaceum	Three-way sedge	**	**	**	**	**	1
Eleocharis palustris	Creeping spikerush	**	**	**	**	**	1
Isoetes sp.	Quillwort	**	**	**	**	**	1
Nuphar variegata	Spatterdock	**	**	**	**	**	1
Nymphaea odorata	White water lily	**	**	**	**	**	2
Sagittaria sp.	Arrowhead	**	**	**	**	**	1
Schoenoplectus acutus	Hardstem bulrush	**	**	**	**	**	1
Utricularia vulgaris	Common bladderwort	**	**	**	**	**	1
	Unknown sp. 2	**	**	**	**	**	1

** Visual Only

During our 2016 survey, we found Wild celery, Fern pondweed, Common waterweed, and Nitella to be the most common species (Table 4). Present at 42.16%, 37.31%, 30.60%, and 30.22% of survey points with vegetation respectively, these species accounted for 50.88% of the total relative frequency (Figure 9). Muskgrass (8.53), Southern naiad (8.12), Large-leaf X Illinois pondweed (7.04), Large-leaf pondweed (5.82), Variable pondweed (5.82), and Small pondweed (4.19) also had relative frequencies over 4% (Complete species accounts and distribution maps for all native species found in 2016 are located in Appendixes VII and VIII).

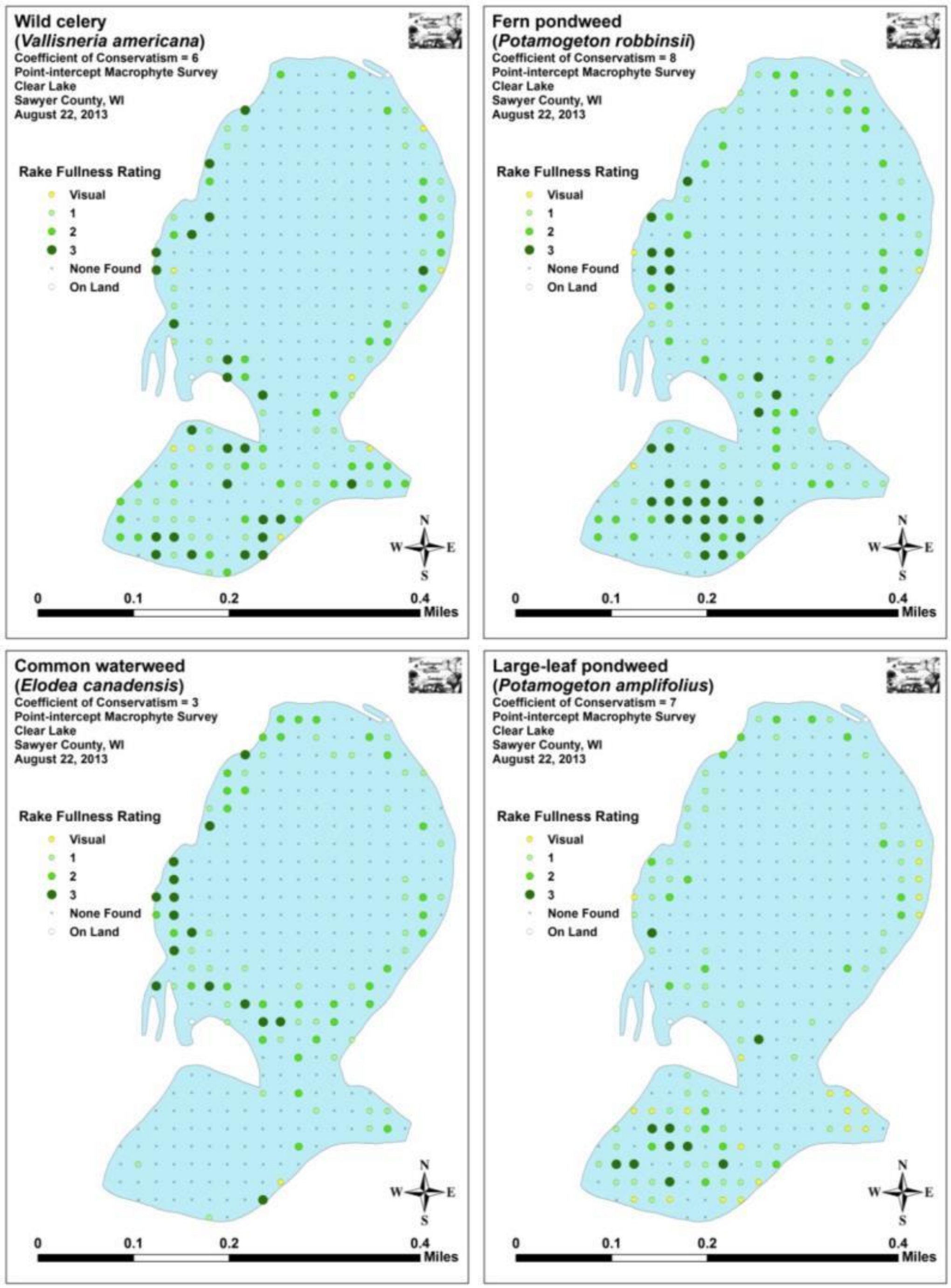


Figure 9: Clear Lake's Most Common Species in 2016

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2016

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Vallisneria americana	Wild celery	113	15.29	42.16	40.21	1.65	3
Potamogeton robbinsii	Fern pondweed	100	13.53	37.31	35.59	1.45	3
Elodea canadensis	Common waterweed	82	11.10	30.60	29.18	1.26	0
Nitella sp.	Nitella	81	10.96	30.22	28.83	1.88	1
Chara sp.	Muskgrass	63	8.53	23.51	22.42	1.41	0
Najas guadalupensis	Southern naiad	60	8.12	22.39	21.35	1.50	0
Potamogeton X scoliophyllus	Large-leaf X Illinois pondweed	52	7.04	19.40	18.51	1.21	3
Potamogeton amplifolius	Large-leaf pondweed	43	5.82	16.04	15.30	1.33	2
Potamogeton gramineus	Variable pondweed	43	5.82	16.04	15.30	1.28	1
Potamogeton pusillus	Small pondweed	31	4.19	11.57	11.03	1.06	1
Potamogeton zosteriformis	Flat-stem pondweed	18	2.44	6.72	6.41	1.06	3
Eleocharis acicularis	Needle spikerush	7	0.95	2.61	2.49	1.14	0
Najas flexilis	Slender naiad	6	0.81	2.24	2.14	1.17	1
	Filamentous algae	6	*	2.24	2.14	1.17	0
Najas gracillima	Northern naiad	5	0.68	1.87	1.78	1.00	0
Potamogeton foliosus	Leafy pondweed	5	0.68	1.87	1.78	1.20	0
Heteranthera dubia	Water star-grass	4	0.54	1.49	1.42	1.00	4
Myriophyllum tenellum	Dwarf water-milfoil	4	0.54	1.49	1.42	2.50	0
Bidens beckii	Water marigold	3	0.41	1.12	1.07	1.33	1
Utricularia gibba	Creeping bladderwort	3	0.41	1.12	1.07	1.00	0
Nuphar variegata	Spatterdock	2	0.27	0.75	0.71	1.50	1
Polygonum amphibium	Water smartweed	2	0.27	0.75	0.71	1.50	0
Potamogeton vaseyi	Vasey's pondweed	2	0.27	0.75	0.71	1.00	0
Sparganium emersum	Short-stemmed bur-reed	2	0.27	0.75	0.71	2.00	0

* Excluded from the Relative Frequency Calculation

Table 4 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2016

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Brasenia schreberi	Watershield	1	0.14	0.37	0.36	3.00	0
Carex comosa	Bottle brush sedge	1	0.14	0.37	0.36	2.00	1
Carex lasiocarpa	Narrow-leaved woolly sedge	1	0.14	0.37	0.36	2.00	0
Ceratophyllum echinatum	Spiny hornwort	1	0.14	0.37	0.36	1.00	0
Juncus effusus	Common rush	1	0.14	0.37	0.36	1.00	1
Potamogeton epihydrus	Ribbon-leaf pondweed	1	0.14	0.37	0.36	1.00	0
Potamogeton natans	Floating-leaf pondweed	1	0.14	0.37	0.36	1.00	1
Utricularia vulgaris	Common bladderwort	1	0.14	0.37	0.36	1.00	1
	Aquatic moss	1	*	0.37	0.36	1.00	0
Dulichium arundinaceum	Three-way sedge	**	**	**	**	**	1
Myriophyllum spicatum	Eurasian water milfoil	**	**	**	**	**	3
Scirpus cyperinus	Woolgrass	**	**	**	**	**	1
Calamagrostis canadensis	Bluejoint	***	***	***	***	***	***
Carex crawfordii	Crawford's sedge	***	***	***	***	***	***
Carex pseudocyperinus	False bottle brush sedge	***	***	***	***	***	***
Comarum palustre	Marsh cinquefoil	***	***	***	***	***	***
Eleocharis palustris	Creeping spikerush	***	***	***	***	***	***
Glyceria borealis	Northern manna-grass	***	***	***	***	***	***
Glyceria canadensis	Rattlesnake manna-grass	***	***	***	***	***	***
Juncus brevicaudatus	Narrow-panicle rush	***	***	***	***	***	***
Juncus canadensis	Canada rush	***	***	***	***	***	***
Juncus pelocarpus	Brown-fruited rush	***	***	***	***	***	***
Leersia oryzoides	Rice cut-grass	***	***	***	***	***	***
Lemna minor	Small duckweed	***	***	***	***	***	***

* Excluded from the Relative Frequency Calculation   ** Visual Only   *** Boat Survey Only

Table 4 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2016

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Littorella uniflora	Littorella	***	***	***	***	***	***
Potamogeton spirillus	Spiral-fruited pondweed	***	***	***	***	***	***
Riccia fluitans	Slender riccia	***	***	***	***	***	***
Sagittaria cristata	Crested arrowhead	***	***	***	***	***	***
Schoenoplectus tabernaemontani	Softstem bulrush	***	***	***	***	***	***
Typha latifolia	Broad-leaved cattail	***	***	***	***	***	***
Typha X *glauca*	Hybrid cattail	***	***	***	***	***	***
Utricularia intermedia	Flat-leaf bladderwort	***	***	***	***	***	***

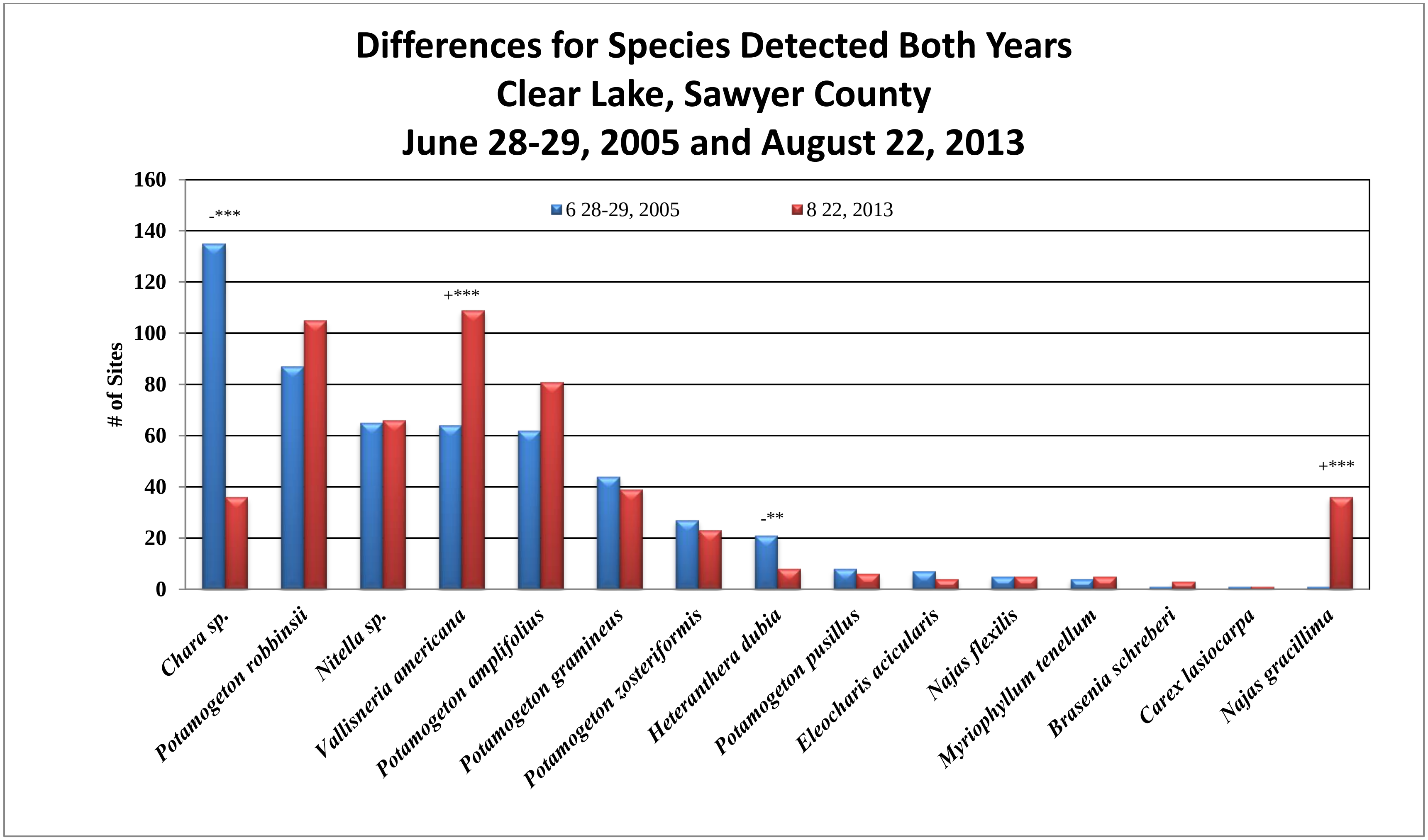
*** Boat Survey Only

Comparison of Native Macrophyte Species in 2005 and 2013:

Lakewide, 15 native species were found in the rake during both the June 2005 and August 2013 surveys (Figure 10). Of these, four showed significant changes: Muskgrass experienced a highly significant decline, and Water star-grass experienced a moderately significant decline. Conversely, both Wild celery and Northern naiad experienced highly significant increases. Although the reason for these declines is unclear, it is possible, and perhaps likely that the significant increases are simply the product of normal growing season expansion as Wild celery sprouts from overwintering tubers that often don't start growing until late May or early June. Because Northern naiad overwinters as a seed and is a small plant to begin with, it is also often difficult to find and identify before July.

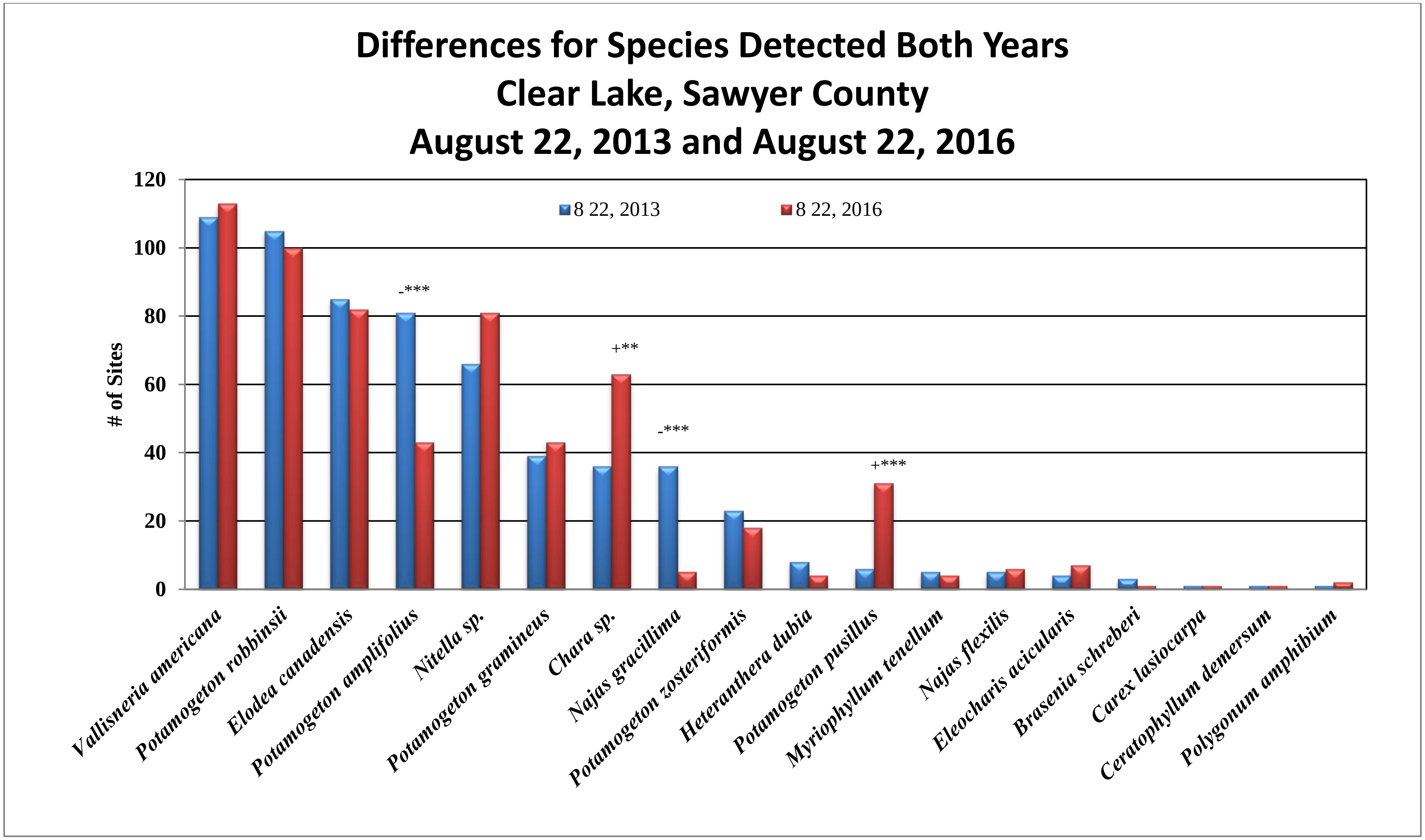
Comparison of Native Macrophyte Species in 2013 and 2016:

Eighteen native species were found in the rake during both the August 2013 pretreatment survey and the August 2016 posttreatment survey with four of these demonstrating significant changes in distribution (Figure 11). Small pondweed saw a highly significant increase, and Muskgrass experienced a moderately significant increase. Large-leaf pondweed and Northern naiad were the only species that had a significant decline posttreatment. In the case of Large-leaf pondweed, it's possible and perhaps likely that this "change" is the result of previous surveyors lumping Large-leaf and its hybrids together whereas we chose to separate them. Similarly, we noted that previous surveyors did not record Southern naiad on the lake, but we found it to be a very common species. It's possible that they lumped Northern and Southern naiad together as well. Regardless, as all four of these species are either monocots (Large-leaf pondweed, Small pondweed, and Northern naiad) or colonial algae (Muskgrass), it is unlikely that they would be significantly impacted by the herbicide 2-4,D which is expected to only kill dicots like milfoil.



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

Figure 10: Macrophyte Changes for Species Found in Both 2005 and 2013



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

Figure 11: Macrophyte Changes for Species Found in Both 2013 and 2016

Floristic Quality Index Comparisons:

During the lake's June 2005 initial point-intercept survey, WDNR biologists identified a total of 19 **native index species** in the rake. They produced a mean Coefficient of Conservatism of 6.7 and a Floristic Quality Index of 29.1 (Table 5). Nichols (1999) reported an average mean C for the Northern Lakes and Forest Region of 6.7 putting Clear Lake exactly average; however, the FQI was slightly above the median of 24.3 for this part of the state (Nichols 1999).

Table 5: Floristic Quality Index of Aquatic Macrophytes
Clear Lake, Sawyer County
June 28-29, 2005

Species	Common Name	C
Brasenia schreberi	Watershield	6
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Eleocharis palustris	Creeping spikerush	6
Heteranthera dubia	Water star-grass	6
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas flexilis	Slender naiad	6
Najas gracillima	Northern naiad	7
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton foliosus	Leafy pondweed	6
Potamogeton gramineus	Variable pondweed	7
Potamogeton obtusifolius	Blunt-leaf pondweed	9
Potamogeton pusillus	Small pondweed	7
Potamogeton robbinsii	Fern pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Schoenoplectus pungens	Three-square bulrush	5
Vallisneria americana	Wild celery	6
N		19
Mean C		6.7
FQI		29.1

WDNR/SCLWCD biologists found 22 **native index species** in the rake during the August 2013 pretreatment point-intercept survey. They produced a mean Coefficient of Conservatism of 6.0 and a Floristic Quality Index of 27.9 (Table 6). Both of these values were down from the 2005 survey.

Table 6: Floristic Quality Index of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2013

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Elodea canadensis	Common waterweed	3
Elodea nuttallii	Slender waterweed	7
Heteranthera dubia	Water star-grass	6
Juncus pelocarpus	Brown-fruited rush	8
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas flexilis	Slender naiad	6
Najas gracillima	Northern naiad	7
Nitella sp.	Nitella	7
Polygonum amphibium	Water smartweed	5
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton gramineus	Variable pondweed	7
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Schoenoplectus tabernaemontani	Softstem bulrush	4
Typha latifolia	Broad-leaved cattail	1
Vallisneria americana	Wild celery	6
N		22
Mean C		6.0
FQI		27.9

In 2016, we identified a total of 28 **native index species** in the rake during the August point-intercept posttreatment survey. They produced a mean Coefficient of Conservatism of 6.9 and a Floristic Quality Index of 36.5 (Table 7). Both of these values were significant increases over the 2013 pretreatment survey and the highest of any of the three surveys.

Exceptionally high value index plants of note included Spiny hornwort (C = 10), Dwarf water-milfoil (C = 10), the State Species of Special Concern Vasey's pondweed (C = 10), and Creeping bladderwort (C = 9). Five additional high value species found were either not part of the index (Narrow-leaved woolly sedge (C = 9)), were only recorded as visuals (Three-way sedge (C = 9) and Crested arrowhead (C = 9)), or were only seen during the boat survey (Littorella (C = 10) and Flat-leaf bladderwort (C = 9)).

Table 7: Floristic Quality Index of Aquatic Macrophytes
Clear Lake, Sawyer County
August 22, 2016

Species	Common Name	C
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Carex comosa	Bottle brush sedge	5
Ceratophyllum echinatum	Spiny hornwort	10
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water star-grass	6
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas flexilis	Slender naiad	6
Najas gracillima	Northern naiad	7
Najas guadalupensis	Southern naiad	8
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Polygonum amphibium	Water smartweed	5
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton foliosus	Leafy pondweed	6
Potamogeton gramineus	Variable pondweed	7
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton pusillus	Small pondweed	7
Potamogeton robbinsii	Fern pondweed	8
Potamogeton vaseyi	Vasey's pondweed	10
Potamogeton zosteriformis	Flat-stem pondweed	6
Sparganium americanum	American bur-reed	8
Utricularia gibba	Creeping bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		28
Mean C		6.9
FQI		36.5

Filamentous Algae:

Filamentous algae are normally associated with excess nutrients in the water column. We found them at just six sites which approximated to 2% of the littoral points. They also had a very low average rake fullness value of 1.17 with most samples being little more than a few strands entangled in the rake. These points were scattered throughout the lake, and we didn't notice any correlation with residences. This suggested to us that these growths were likely the product of localized nutrient recycling rather than generalized high nutrient levels or point-source runoff (Figure 12).

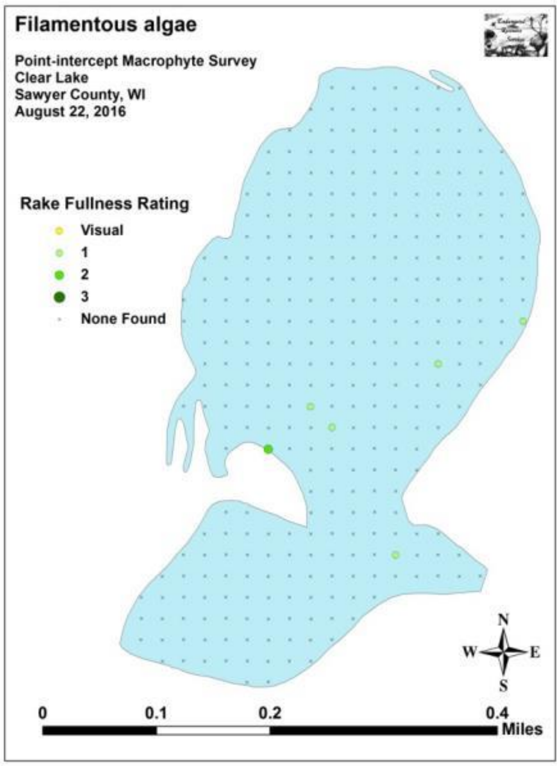


Figure 12: Filamentous Algae Density and Distribution

Comparison of Eurasian Water-milfoil in 2005 and 2013:

During the original 2005 survey, WDNR surveyors did not find Eurasian water-milfoil in the rake at any point, although they did record it as a visual at two sites in the south bay and another along the northeastern shoreline. The 2013 survey found EWM in the rake at five points with a mean rake fullness of 1.20. It was also recorded as a visual at 20 additional points scattered throughout the lake (Figure 13). This change represented a significant increase in total EWM (p=0.03), and a highly significant increase in visual sightings (p<0.001) (Figure 14) (Appendix IX).

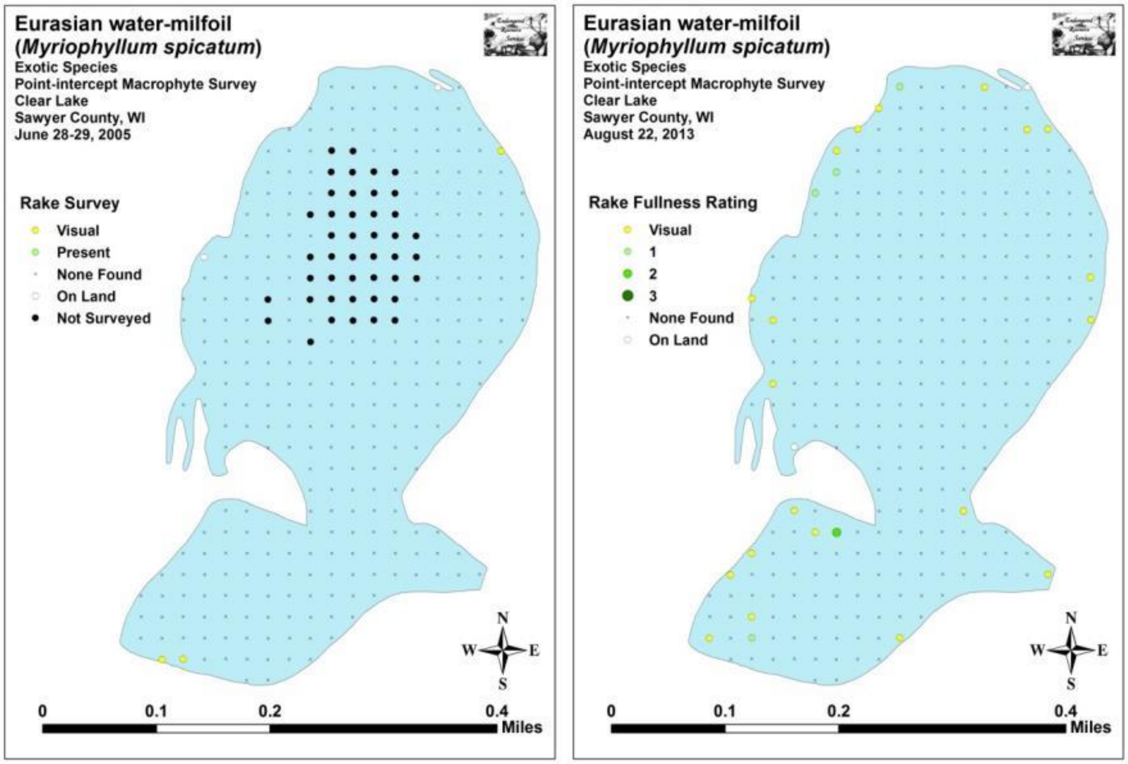


Figure 13: 2005 and 2013 EWM Density and Distribution

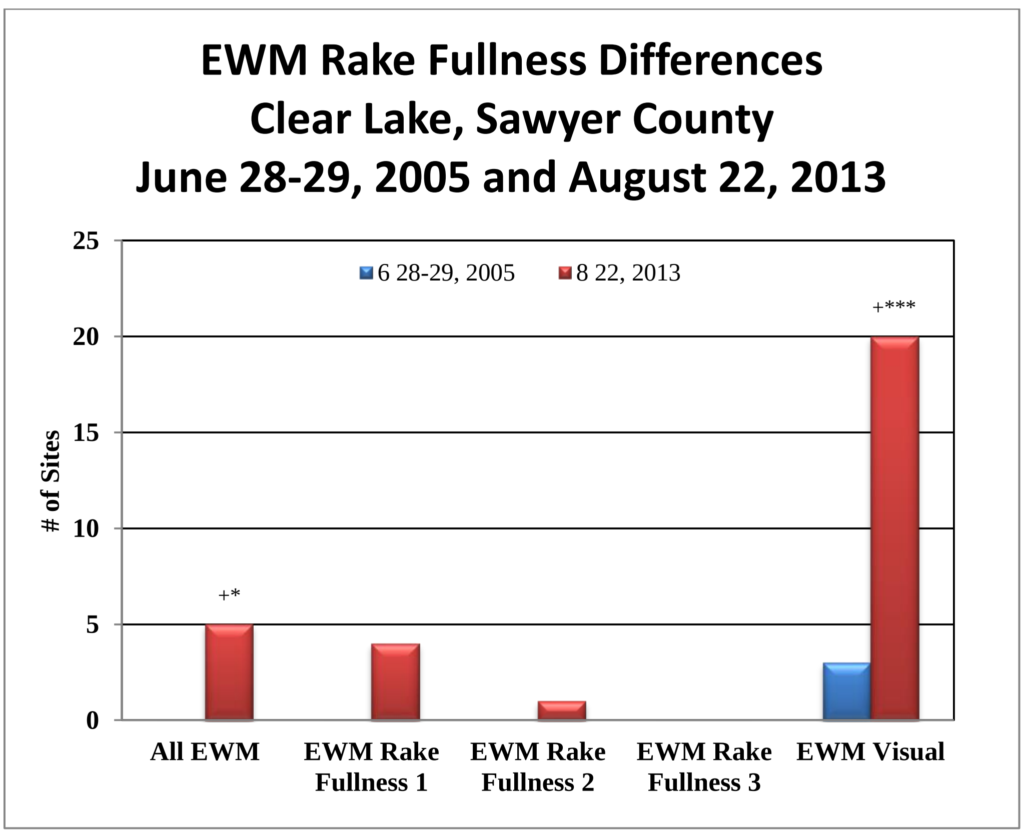


Figure 14: 2005-2013 EWM Rake Fullness Changes

Comparison of Eurasian Water-milfoil in 2013 and 2016:

During the 2016 posttreatment survey, we didn't find Eurasian water-milfoil in the rake at any point; however, it was a visual at three points (Figure 15) (Appendix IX). Compared to the 2013 pretreatment survey, the overall reduction in EWM (p=0.02) as well as rake fullness 1 (p=0.04) was significant, and the reduction in visual sightings was highly significant (p<0.001) (Figure 16). These results suggest the 2015 treatment was highly effective at controlling EWM in the lake.

During the 2016 survey, we found that EWM was scattered throughout the lake in water from 2-12ft. It was most often found over sandy muck, but was also observed growing in almost pure sand; albeit at much lower densities. In general, we noted that EWM was relatively uncommon, and, especially along the eastern shoreline and the south bay, plants tended to be widely scattered and were seldom represented by more than a few individual stems. Most of these plants had shallow root systems that were poorly developed suggesting to us that they were likely new colonizers. Because of this, we were able to rake remove most EWM plants we encountered in these areas with little trouble. In the northwest bay, EWM was more common, and we located a number of small canopied clusters that appeared to be trending toward beds. These plants were older and better established than elsewhere in the lake as they contained multiple stems, expansive root systems that were much more difficult to extract, and were producing high numbers of vegetative fragments. At the request of the CLPOA (K. Kishel), we produced a potential 2017 treatment shapefile that estimated the area containing regular EWM plants at 0.68 acre (Figure 15).

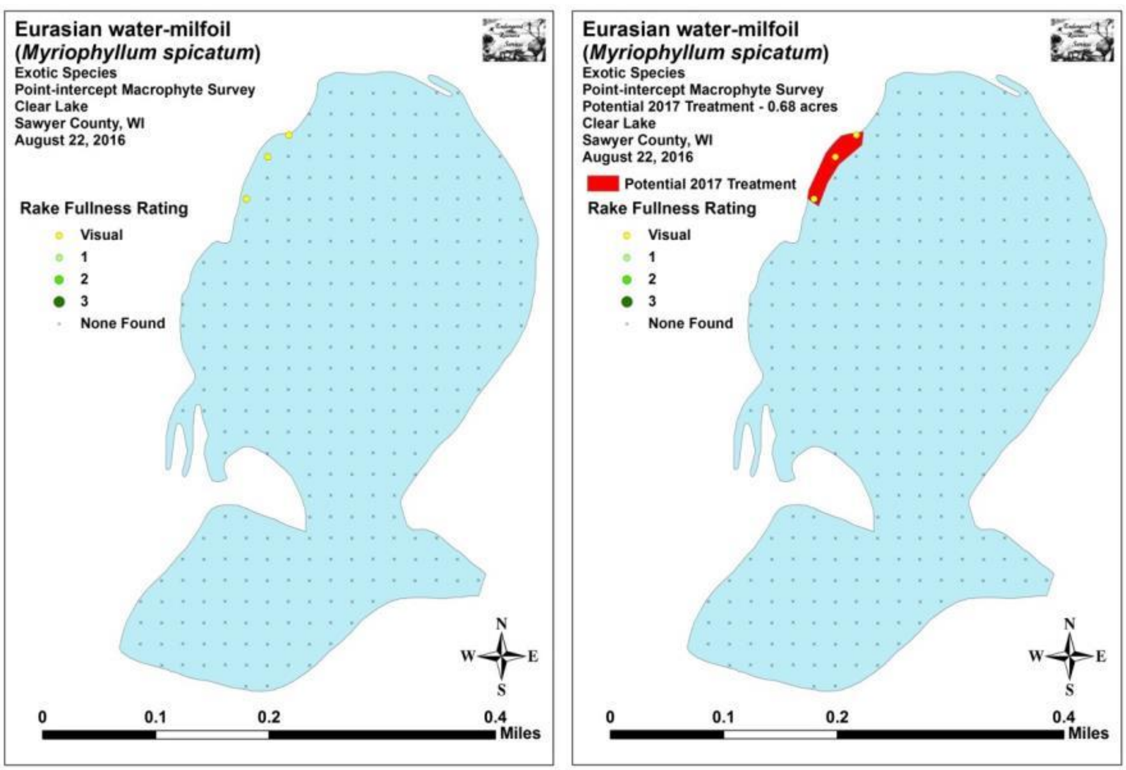


Figure 15: 2016 EWM Density and Distribution and Potential 2017 Treatment Area

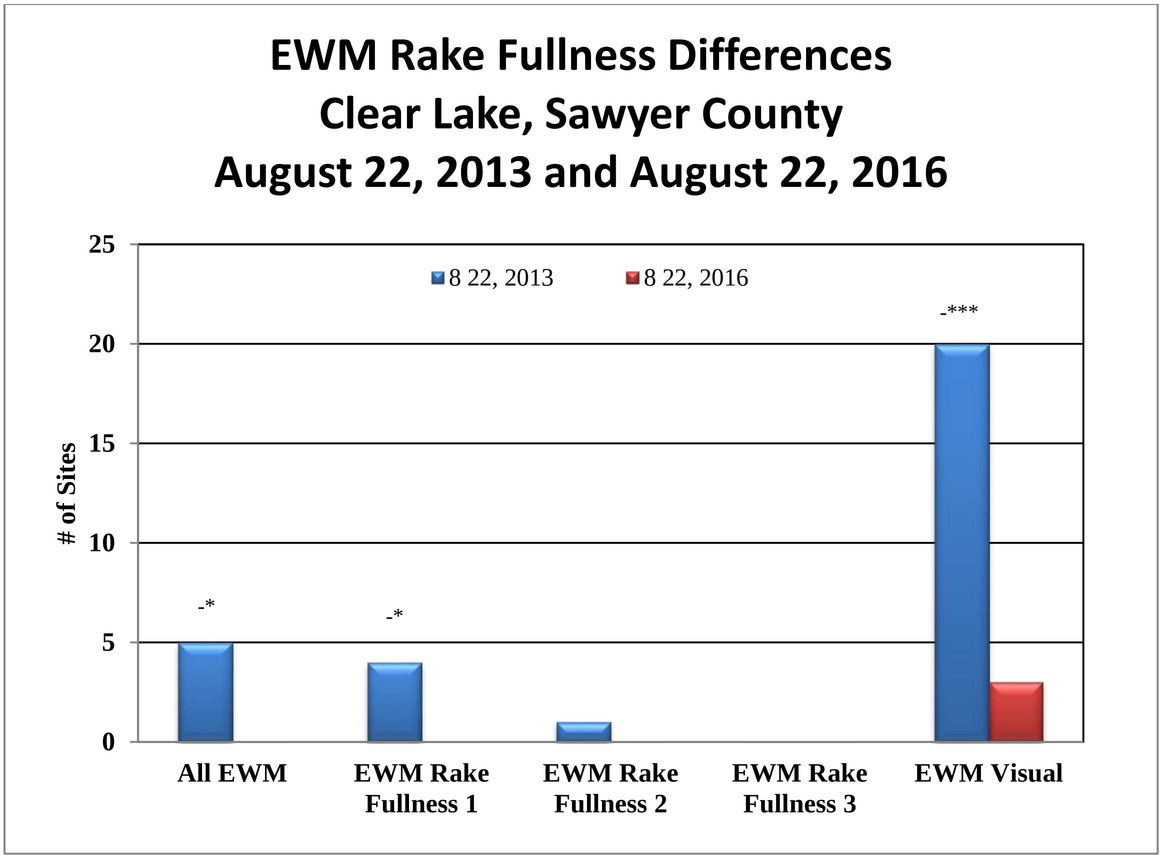


Figure 16: 2013 Pretreatment/2016 Posttreatment EWM Rake Fullness Changes

Other Exotic Species:

Native to southern but not northern Wisconsin, Narrow-leaved cattail (*Typha angustifolia*) and its hybrids with Broad-leaved cattail are becoming increasingly common in northern Wisconsin where they also tend to be invasive. We found a few small stands of these hybrids scattered along the north shoreline where they appeared to be expanding over sandy muck in shallow water and crowding out other emergent species.

Besides having narrower leaves, these plants can be told from our native cattails by having a relatively narrower and longer "hotdog-shaped" tan female cattail flowers whereas our native species tends to produce a fatter and shorter "bratwurst-shaped" dark chocolate colored female flower. Narrow-leaved cattail and its hybrids also have a male flower that is separated from the female flower by a thin green stem while the native Broad-leaved cattail has its male and female flowers connected (Figure 17) (For more information on a sampling of aquatic exotic invasive plant species, see Appendix X).

Figure 17: Exotic Hybrid and Native Broad-leaved Cattail Identification

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Water Clarity and the Role of Native Macrophytes:

Like trees in a forest, a lake's native plants are the basis of the aquatic ecosystem. They capture the sun's energy and turn it into usable food, "clean" the water of excess nutrients, and provide habitat for other organisms like the lake's fish populations. Because of this, preserving them is critical to maintaining the lake's overall health.

Clear Lake currently has a diverse, rich, and healthy native plant community that included nine high value/sensitive species in 2016. Their presence suggests a history of good water quality and lakeshore owner stewardship. Our observations during our time on the lake also supported this as we noted that many property owners were practicing sound shoreline conservation. Despite this positive majority, there is always room for improvement.

Because excess phosphorus and nitrogen in the water column promote algal growth and can lead to declines in both water clarity and quality, residents should evaluate how their shoreline practices may be impacting the lake. Simple things like establishing a buffer strip of native vegetation along the lakeshore to prevent erosion (Figure 18), bagging grass clippings, switching to a phosphorus-free fertilizer or preferably eliminating fertilizer near the lake altogether, collecting pet waste, and disposing of the ash from fire pits away from the lakeshore can all significantly reduce the amount of nutrients entering the lake. Hopefully, a greater understanding of how individual property owners can have lake-wide impacts will result in more people taking appropriate conservation actions to promote improved water clarity and quality for all.

Figure 18: Model Natural Shoreline vs. Mowed and Eroding Shoreline on a Nearby Sawyer County Lake

Eurasian water-milfoil:

Like many exotic species, Eurasian water-milfoil has the ability to rapidly exploit disturbances in an ecosystem. Lakeshore residents can help minimize EWM's opportunities to spread by maintaining the lake's native plants. To accomplish this, residents should refrain from removing rooted plants from the lake unless absolutely necessary as these barren patches of substrate not only release nutrients into the water column, but also give EWM a place to establish where it has a competitive advantage. Avoiding motor start ups in water <5ft deep would also help limit EWM's spread by not clipping or uprooting vegetation. This would also work to keep nutrients out of the water column as the lake's soft sediments are easily stirred up by prop wash.

Although it is unlikely EWM will ever be eliminated from the lake, the current management program has been successful at keeping EWM levels low, and it currently occupies a minor place in the overall plant community. It's especially encouraging that the 2015 treatment was so successful. Hopefully, with continued small-scale management, the CLPOA can maintain or even further reduce EWM from its current low levels while simultaneously minimizing the impact on the lake's native plants. By continuing to work together to help limit EWM's spread, Clear Lake can remain what it is today – a unique and valuable resource for both wildlife and people to enjoy.

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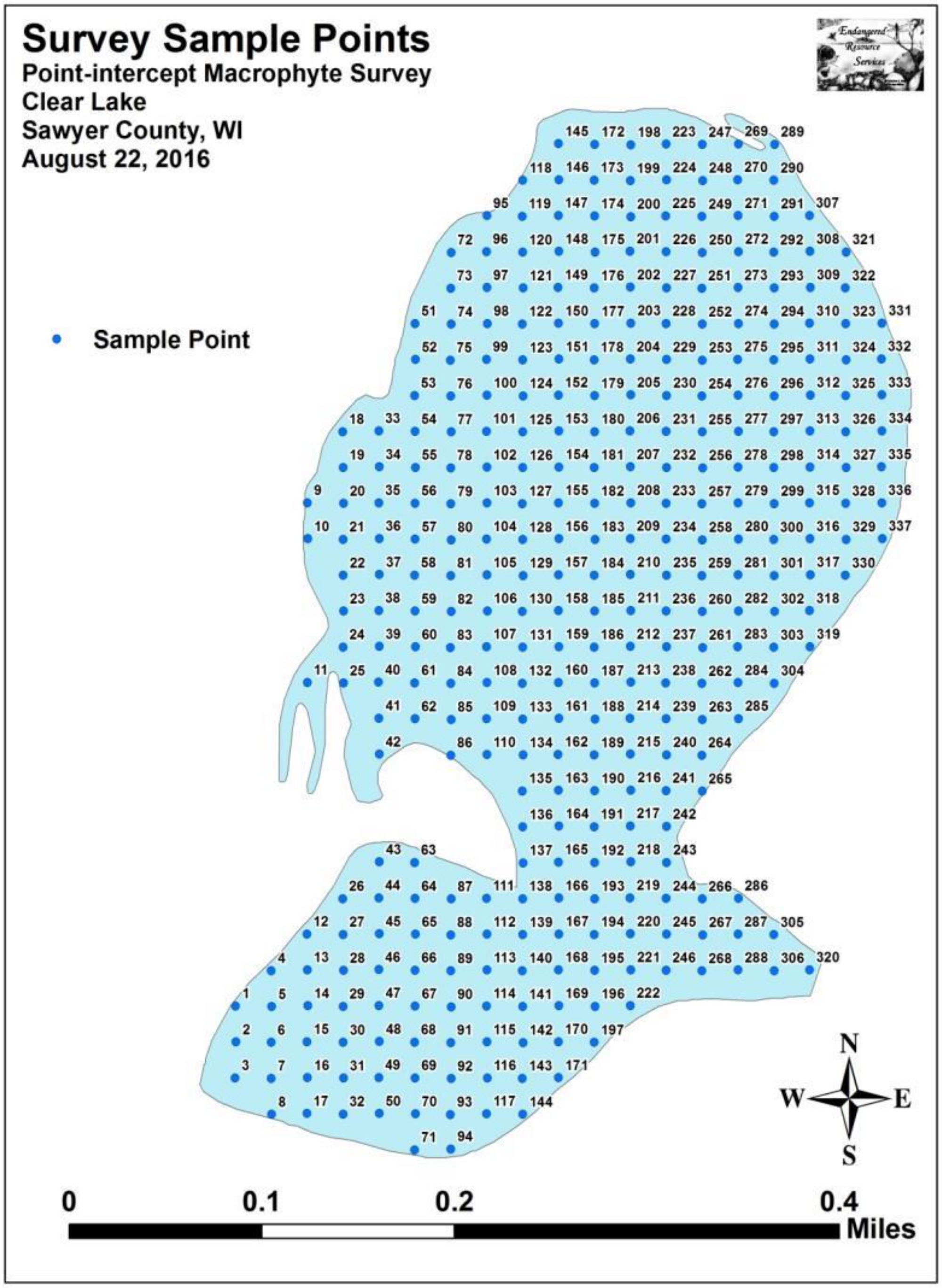
Appendix I: Survey Sample Points Map



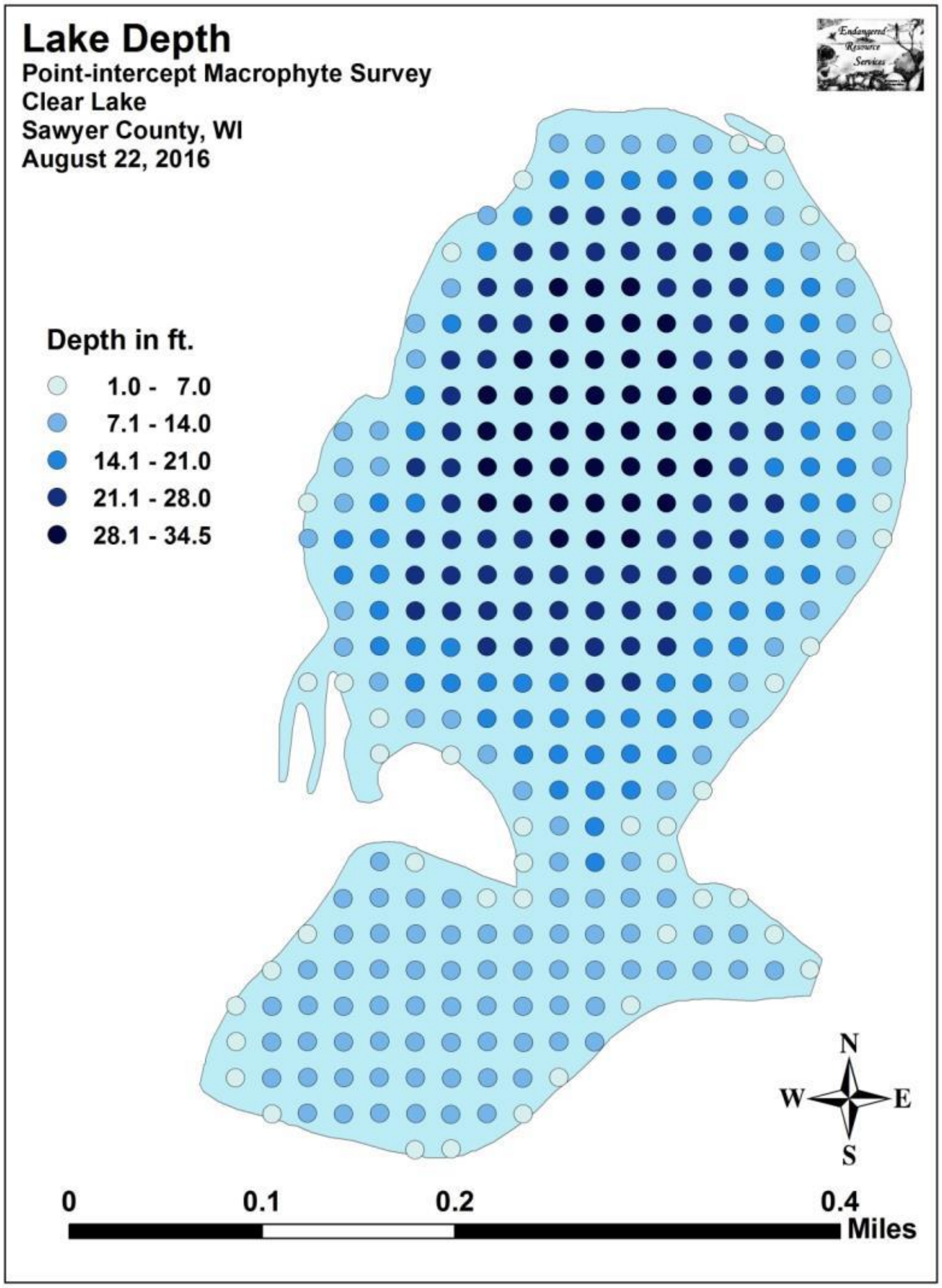
Survey Sample Points
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Sample Point
N
W
E
S
0
0.1
0.2
0.4
Miles

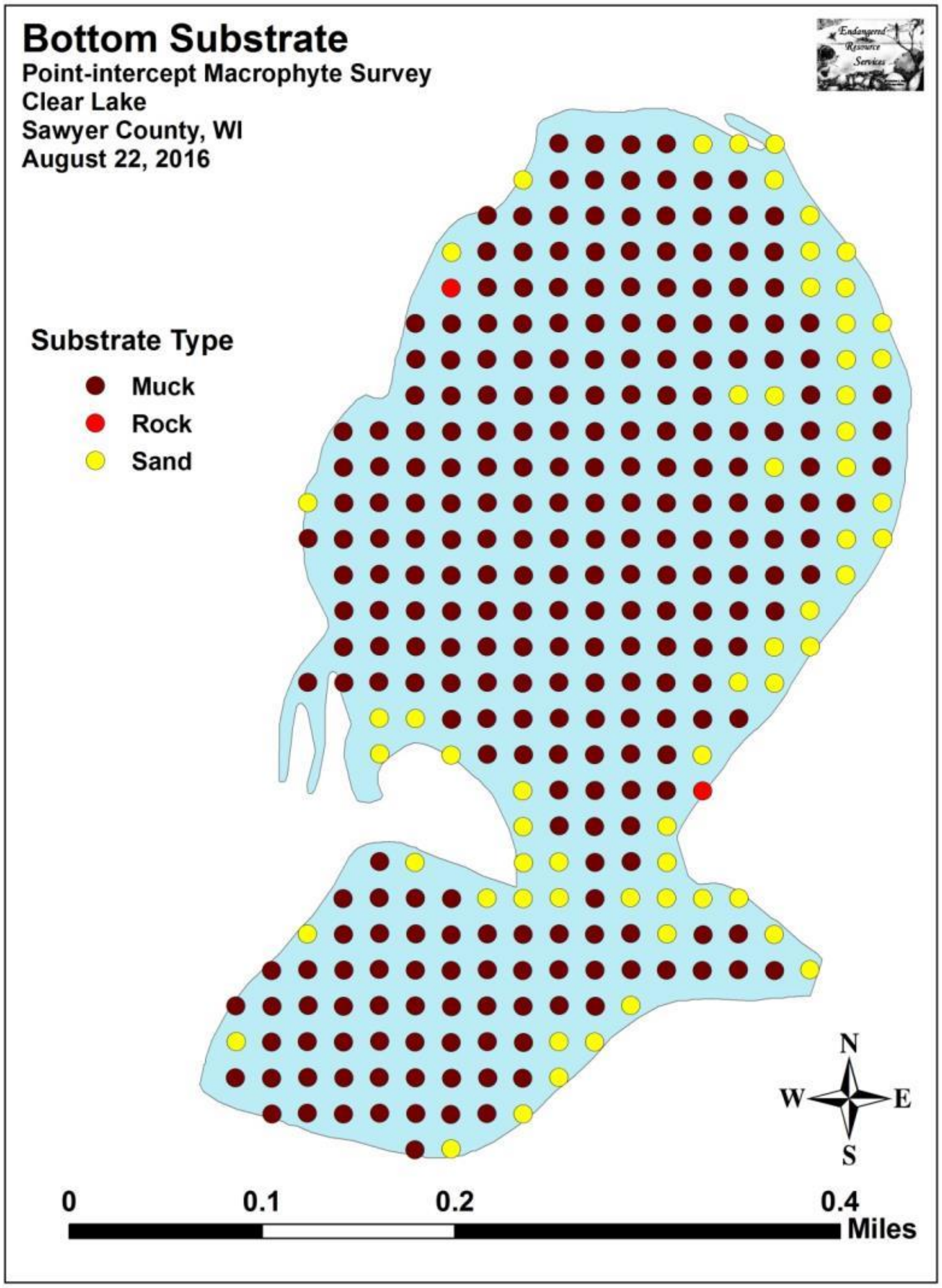
Appendix II: Boat and Vegetative Survey Data Sheets

Boat Survey	
Lake Name	
County	
WBIC	
Date of Survey	
(mm/dd/yy)	
workers	
Nearest Point	**Species seen, habitat information**

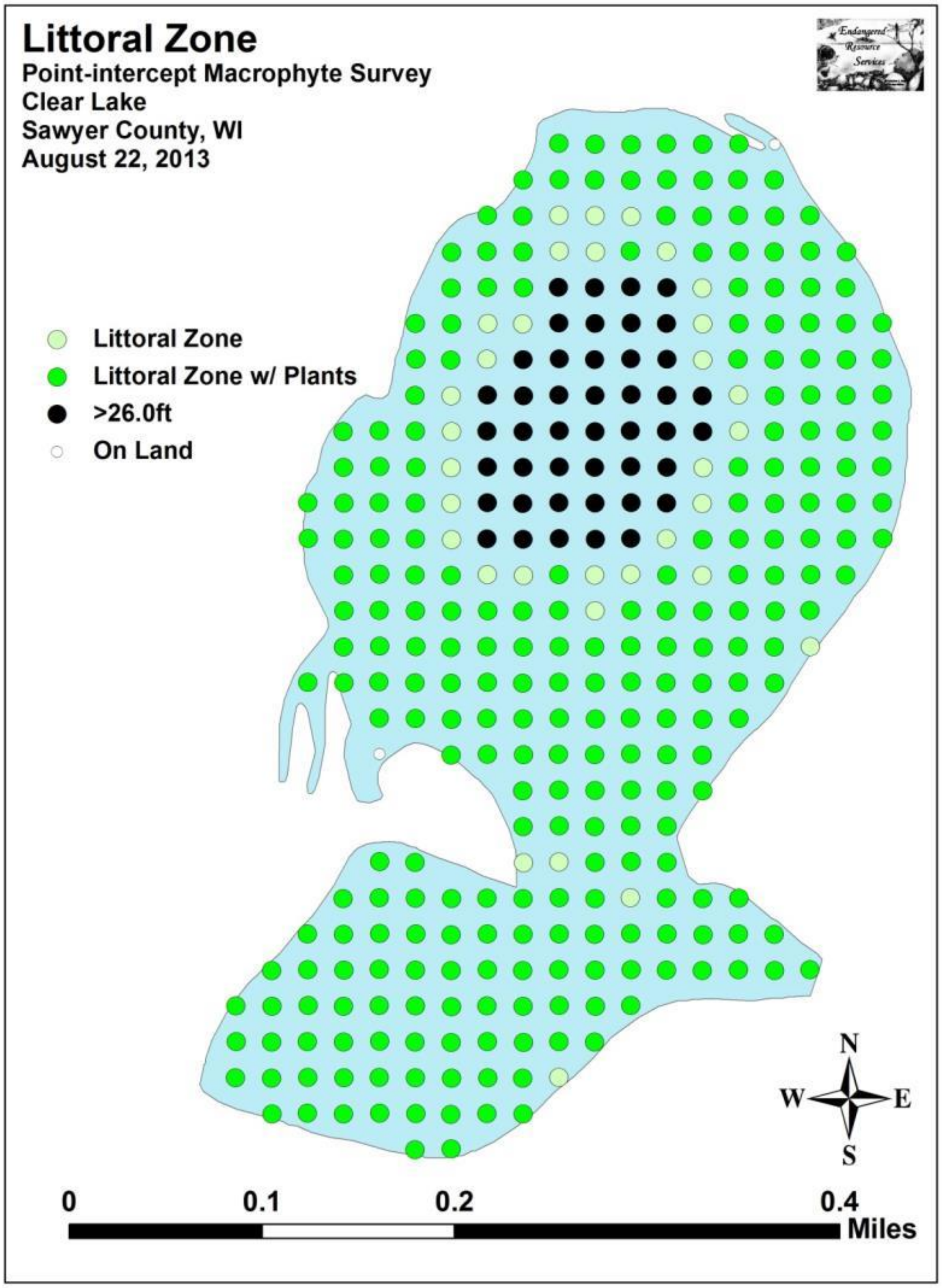
Observers for this lake: names and hours worked by each:																									
Lake:									**WBIC**									**County**						**Date:**	
Site #	**Depth (ft)**	**Muck (M), Sand (S), Rock (R)**	**Rake pole (P) or rake rope (R)**	**Total Rake Fullness**	**EWM**	**EWM**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									

Appendix III: Habitat Variable Maps

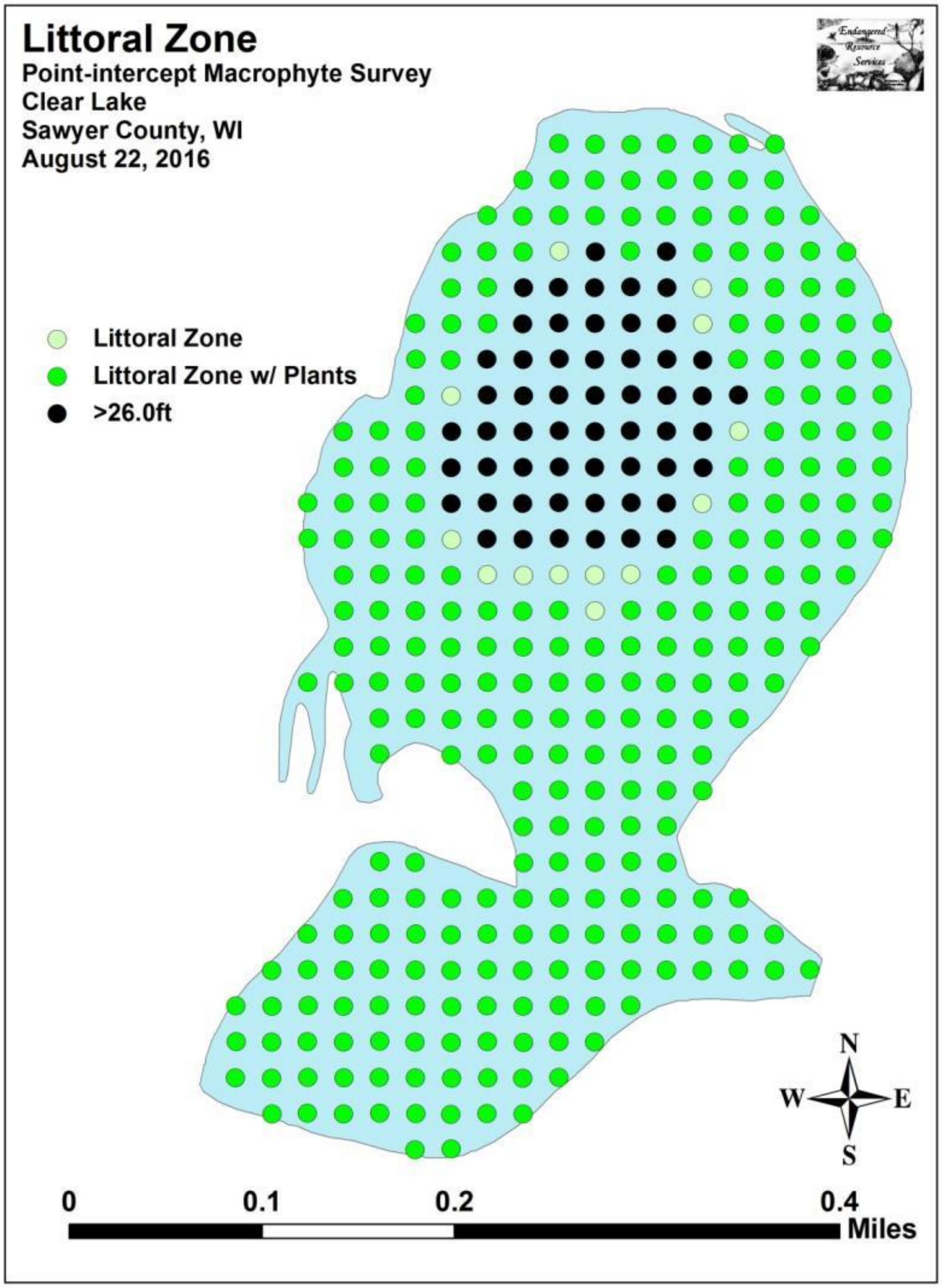

Lake Depth
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Depth in ft.
1.0 - 7.0
7.1 - 14.0
14.1 - 21.0
21.1 - 28.0
28.1 - 34.5
N
W
E
S
0
0.1
0.2
0.4
Miles

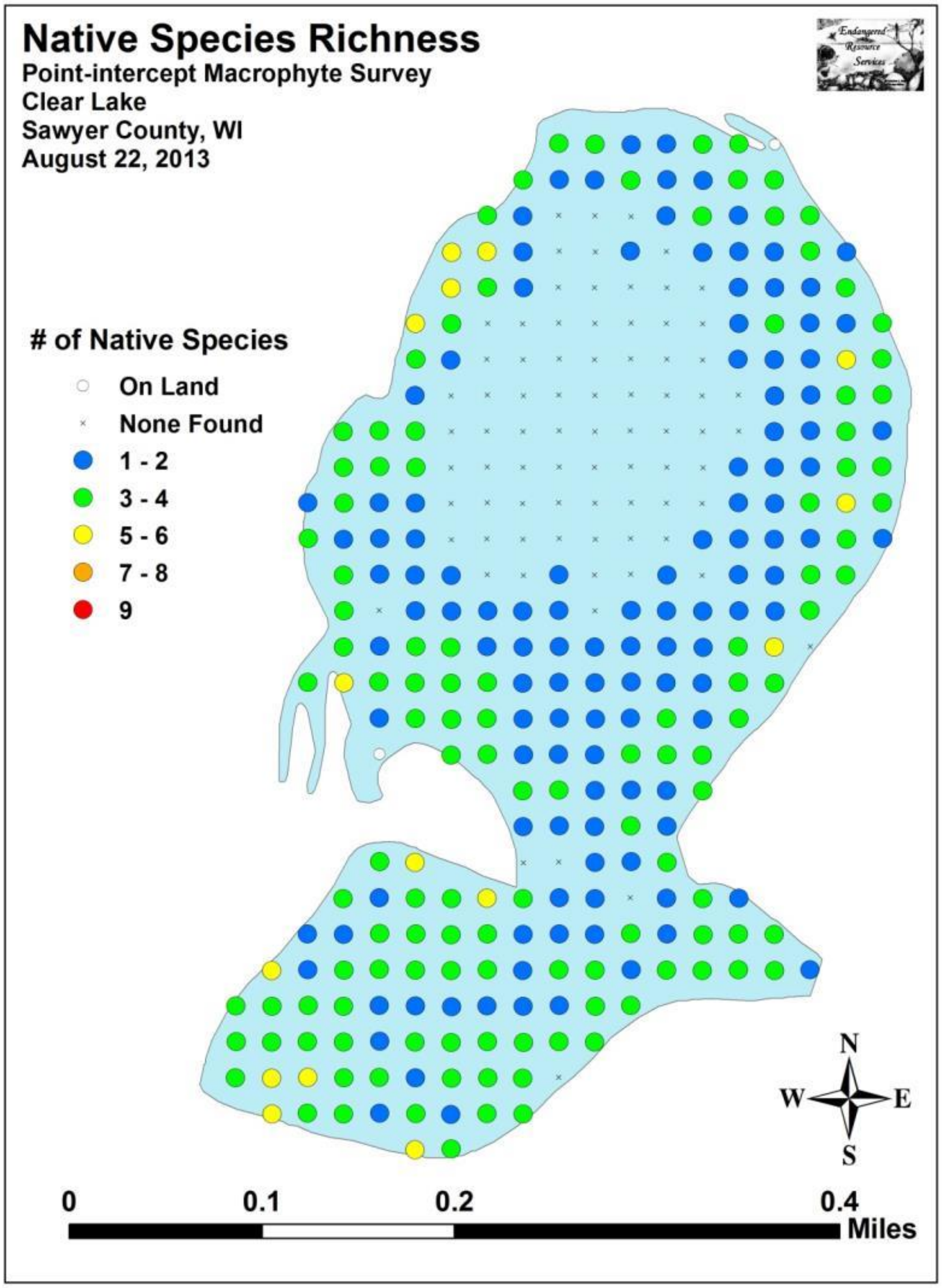

Bottom Substrate
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
N
W
E
S
0
0.1
0.2
0.4
Miles

Appendix IV: 2013 and 2016 Littoral Zone, Native Species Richness, and Total Rake Fullness Maps

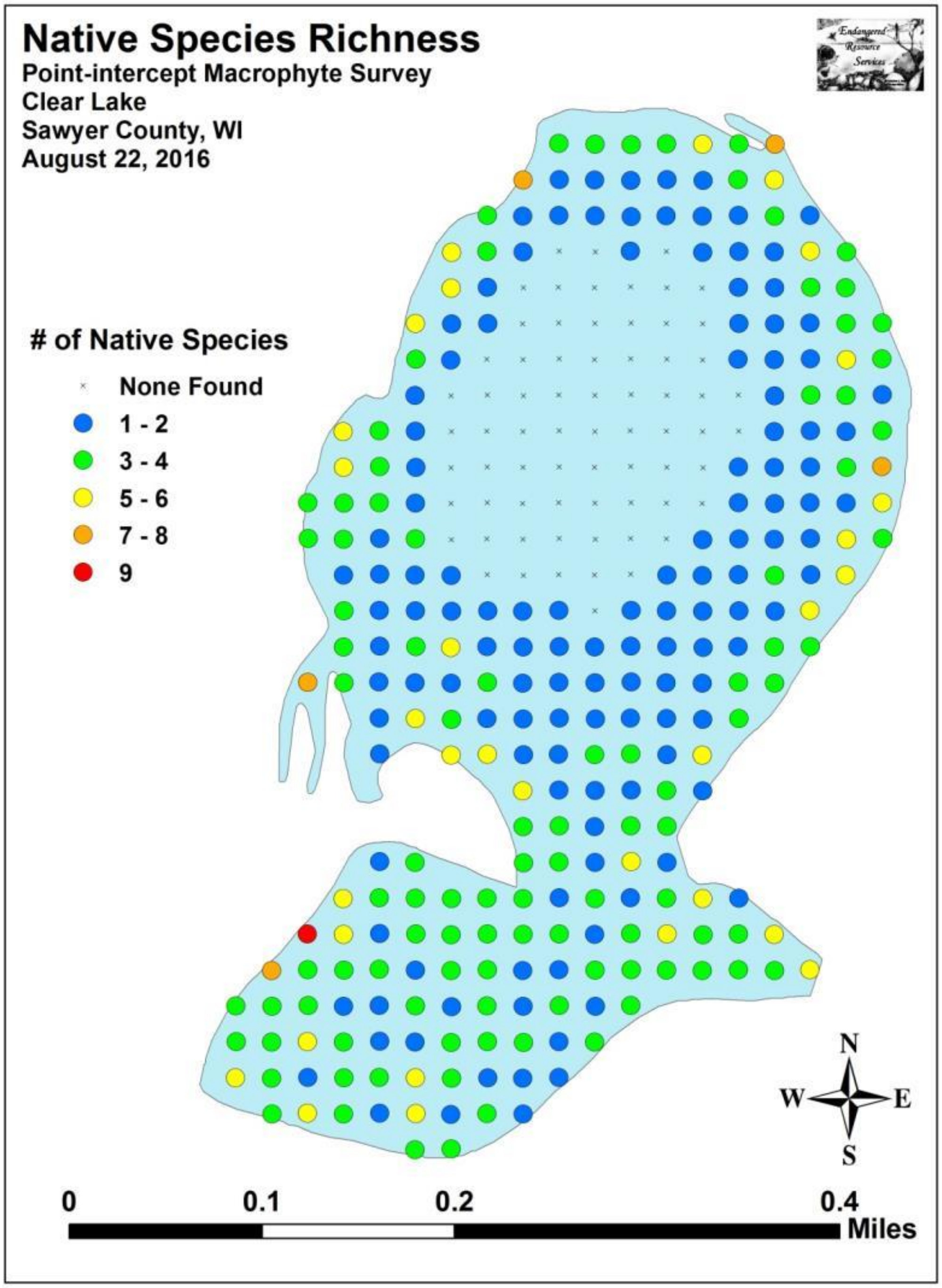


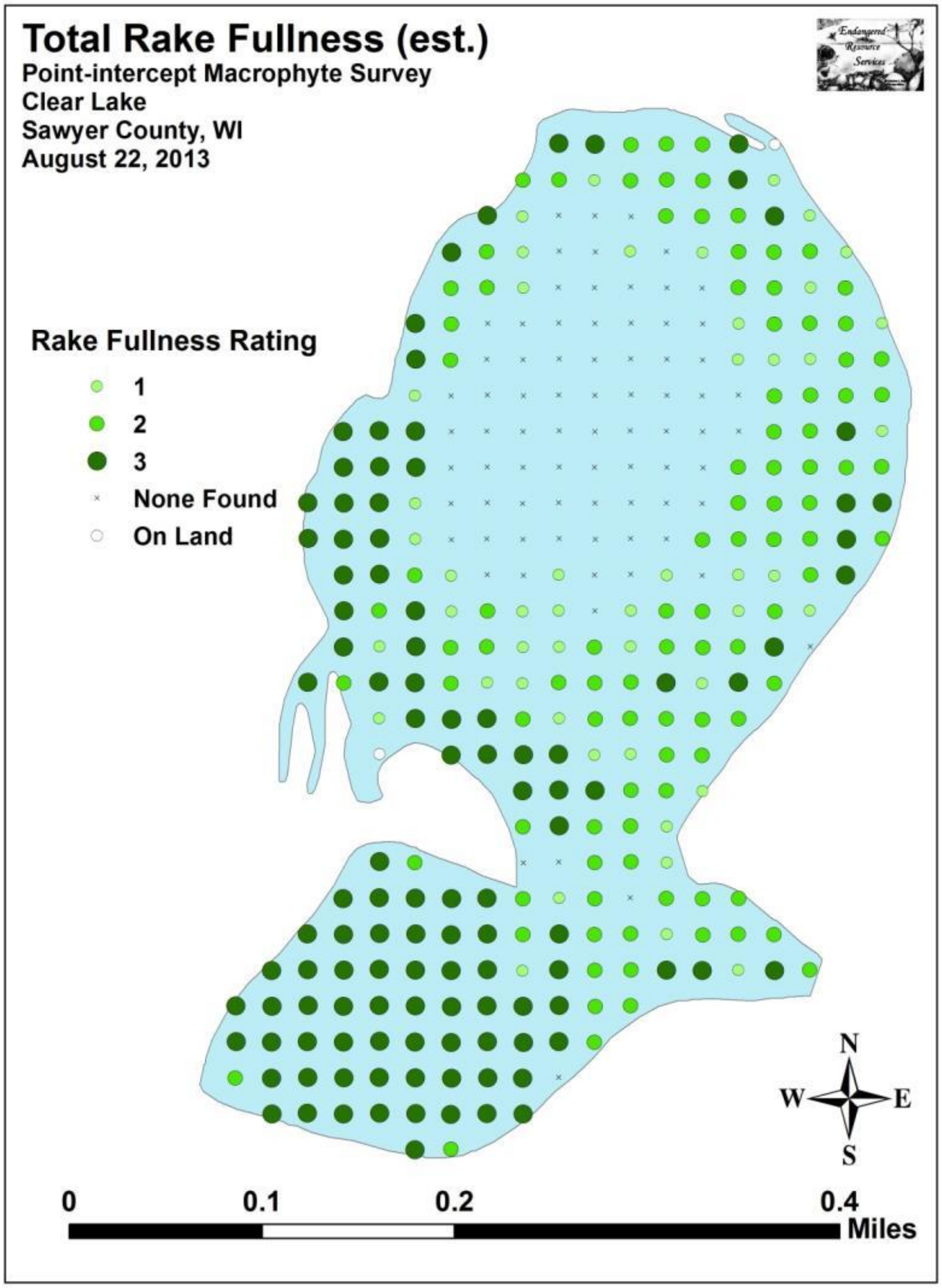
Littoral Zone
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Littoral Zone
Littoral Zone w/ Plants
>26.0ft
On Land
N
W
E
S
0
0.1
0.2
0.4
Miles

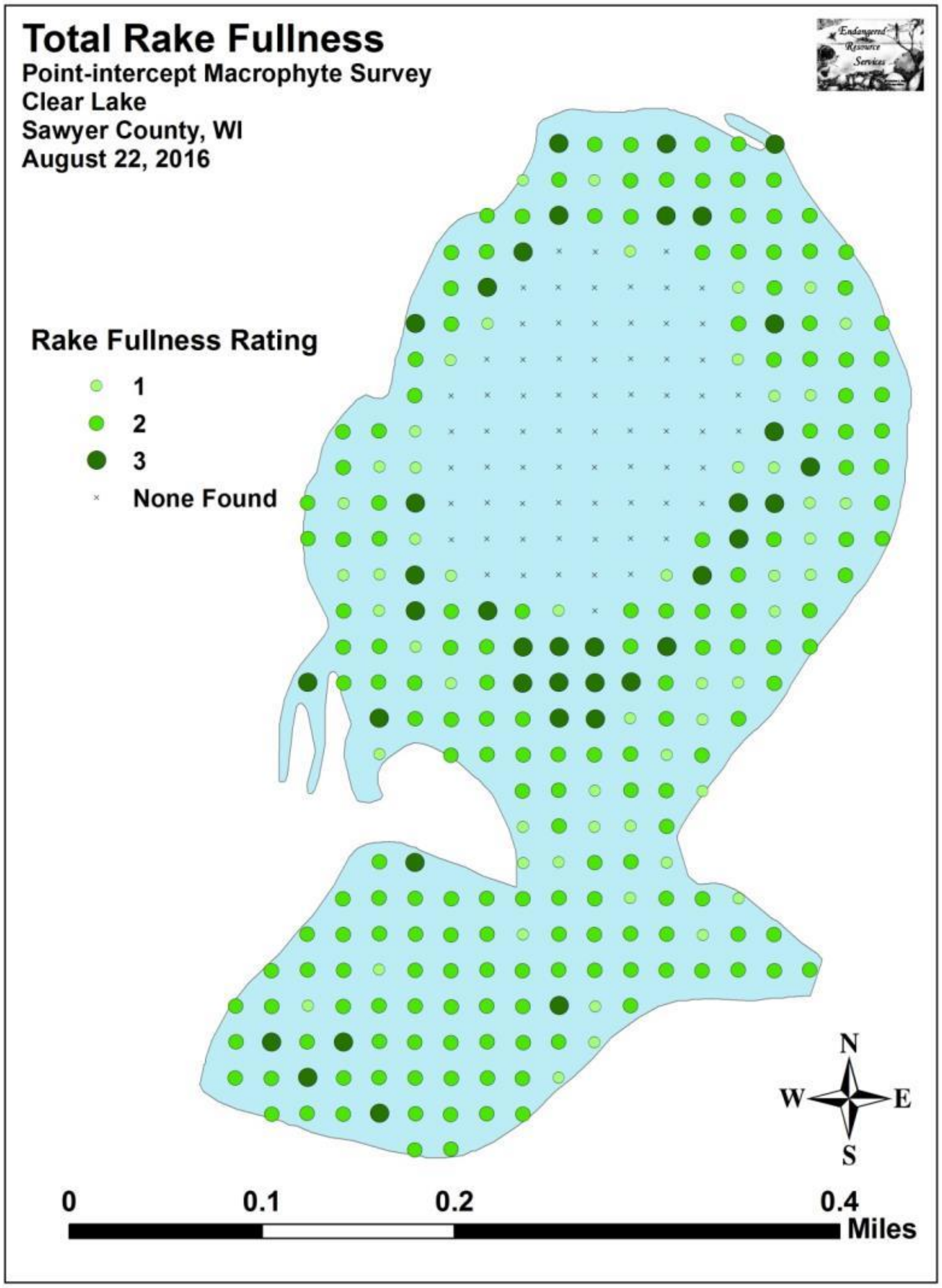

Littoral Zone
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Littoral Zone
Littoral Zone w/ Plants
>26.0ft
N
W
E
S
0
0.1
0.2
0.4
Miles



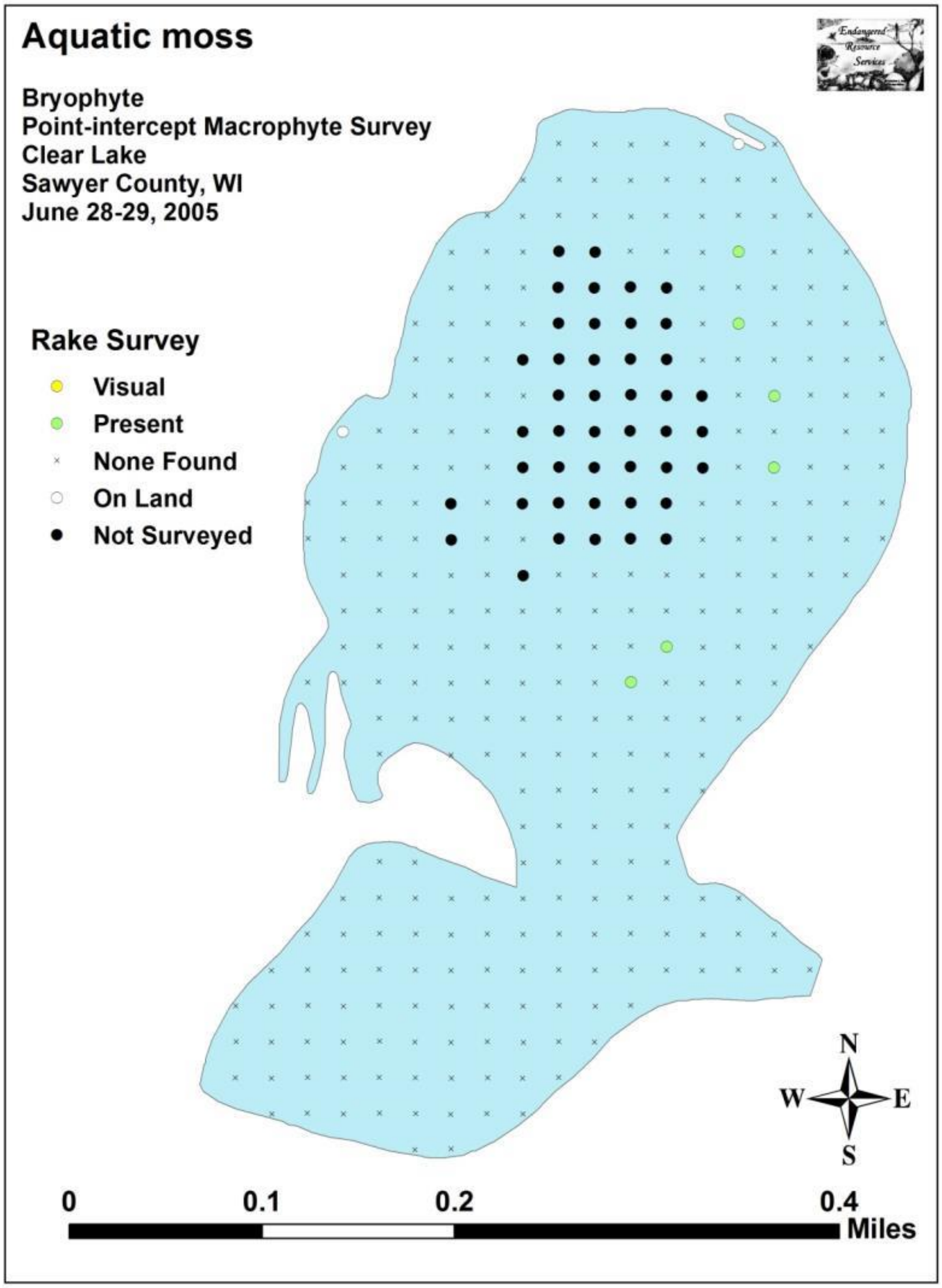
Native Species Richness
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
# of Native Species
On Land
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9
N
W
E
S
0
0.1
0.2
0.4
Miles

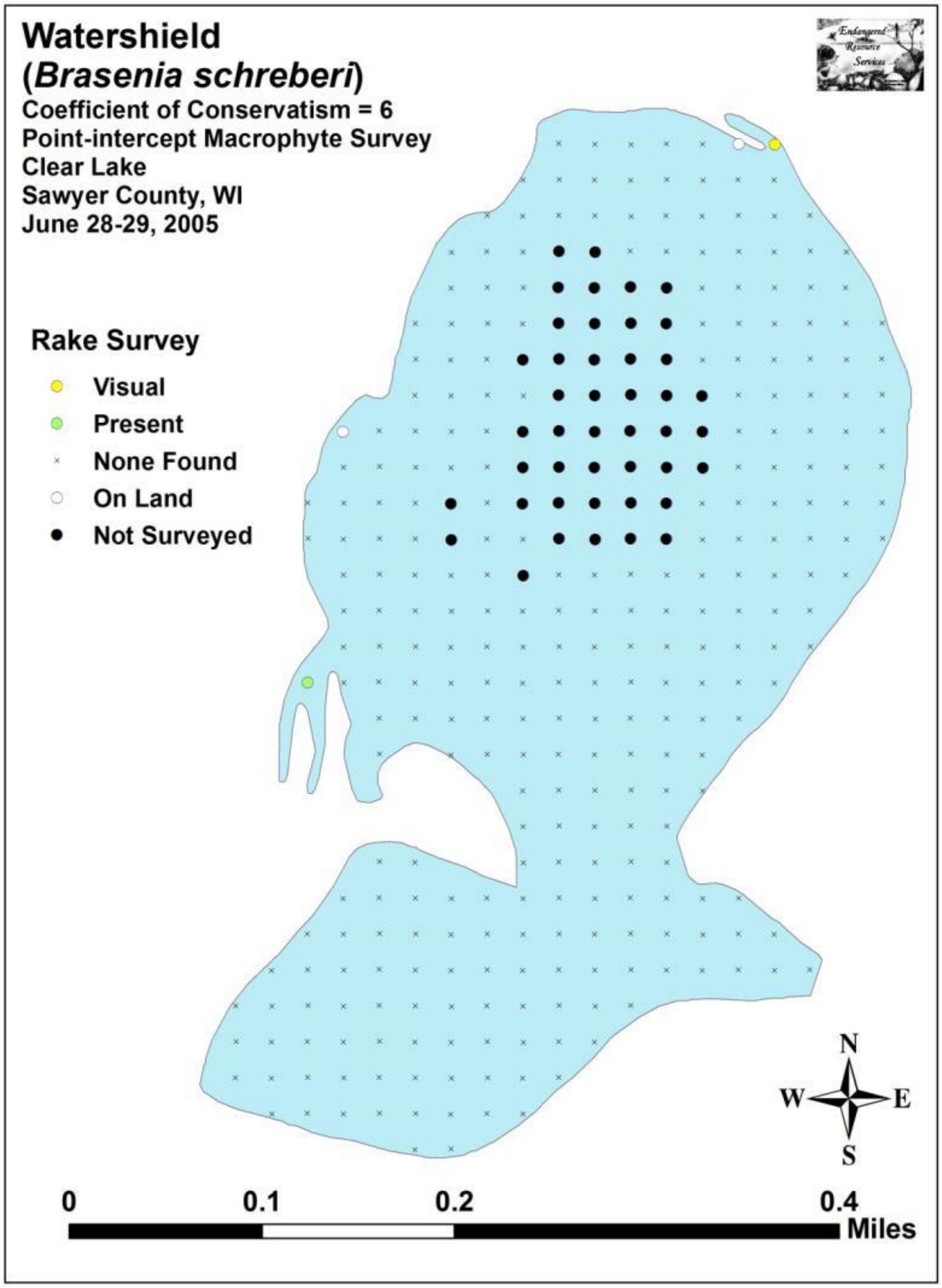

Native Species Richness
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9
N
W
E
S
0
0.1
0.2
0.4
Miles

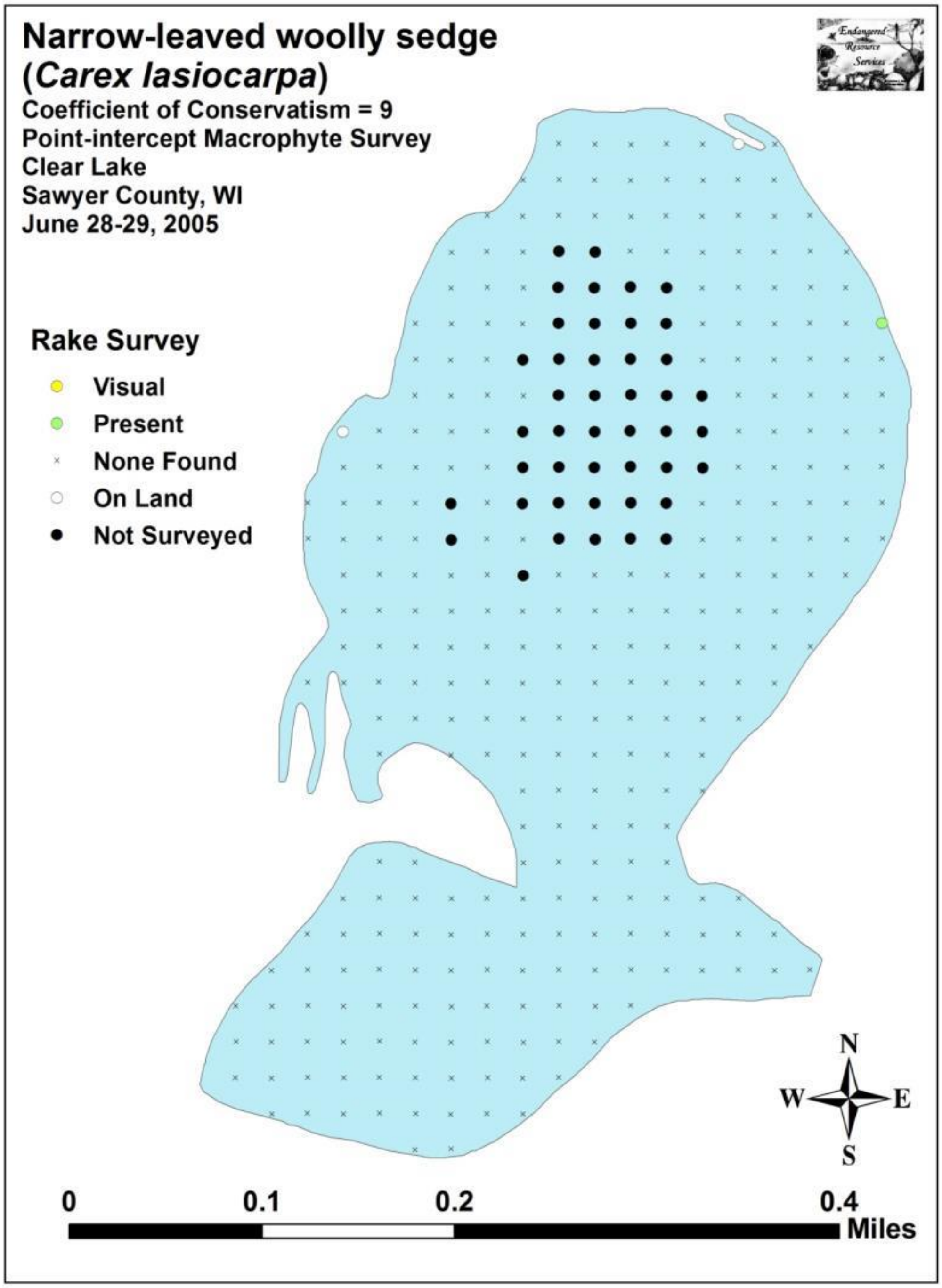

Total Rake Fullness (est.)
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
1
2
3
None Found
On Land
N
W
E
S
0
0.1
0.2
0.4
Miles

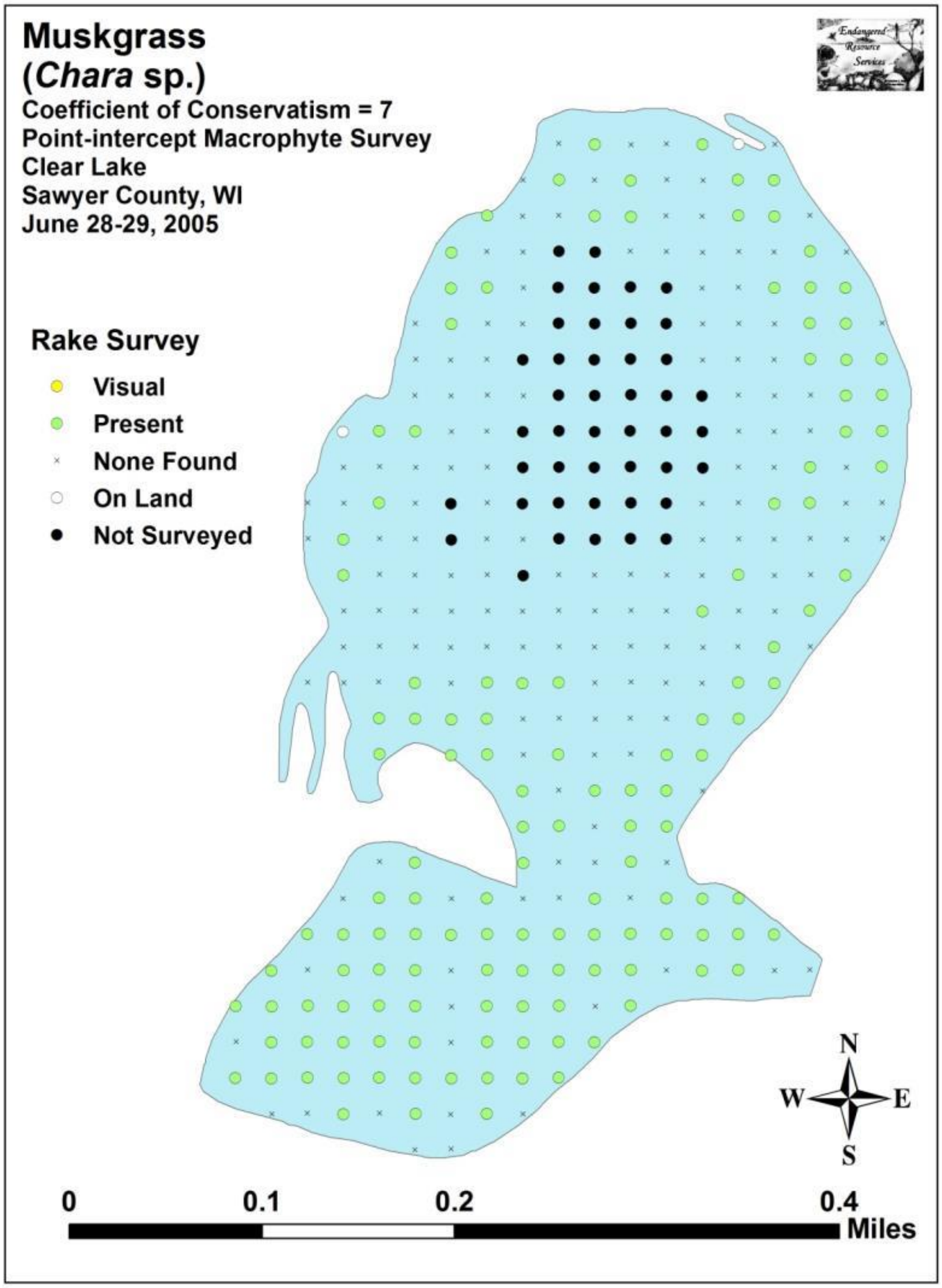

Total Rake Fullness
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.1
0.2
0.4
Miles

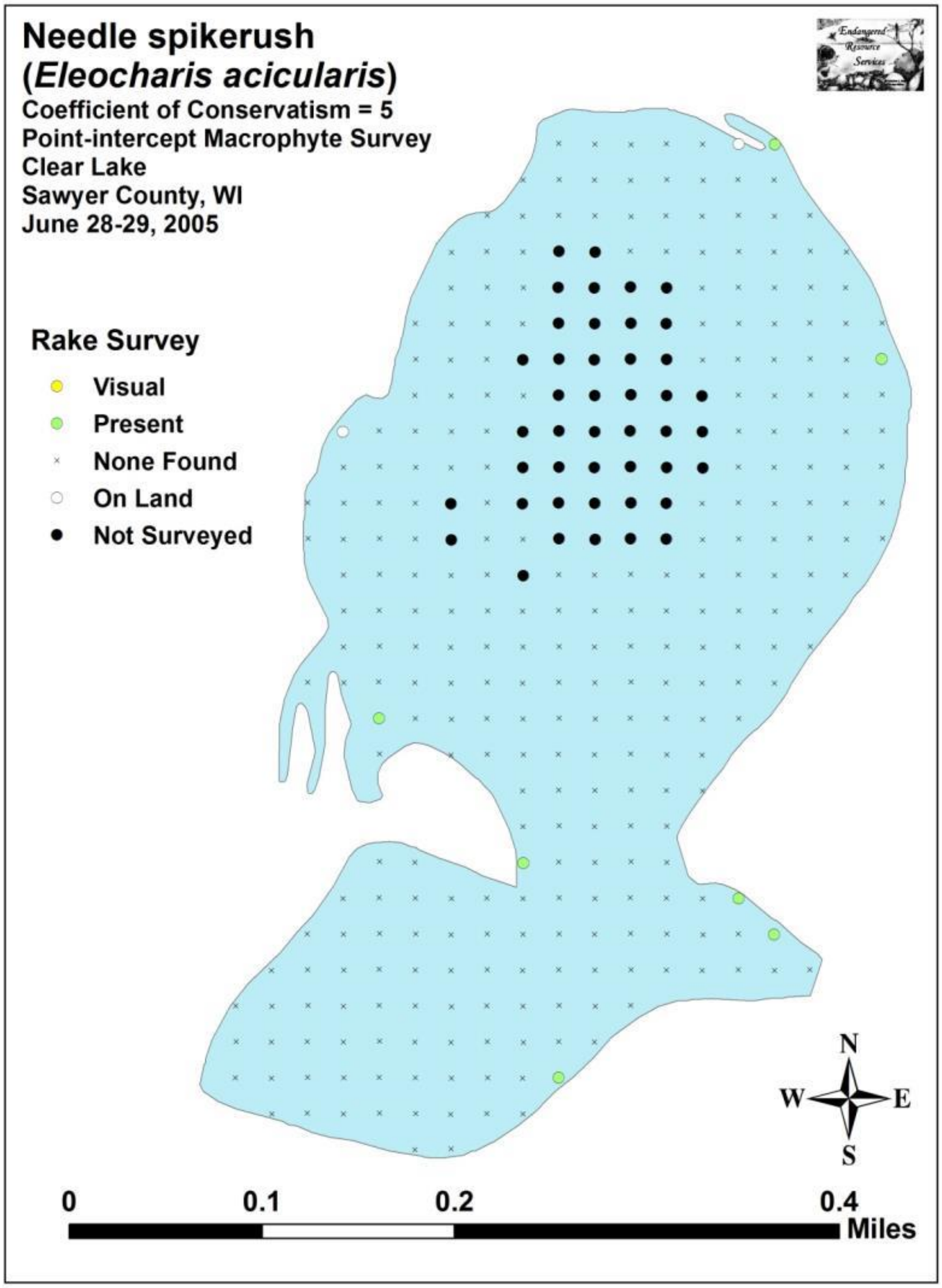
Appendix V: 2005 WDNR June Point-intercept Survey Native Species Density and Distribution Maps

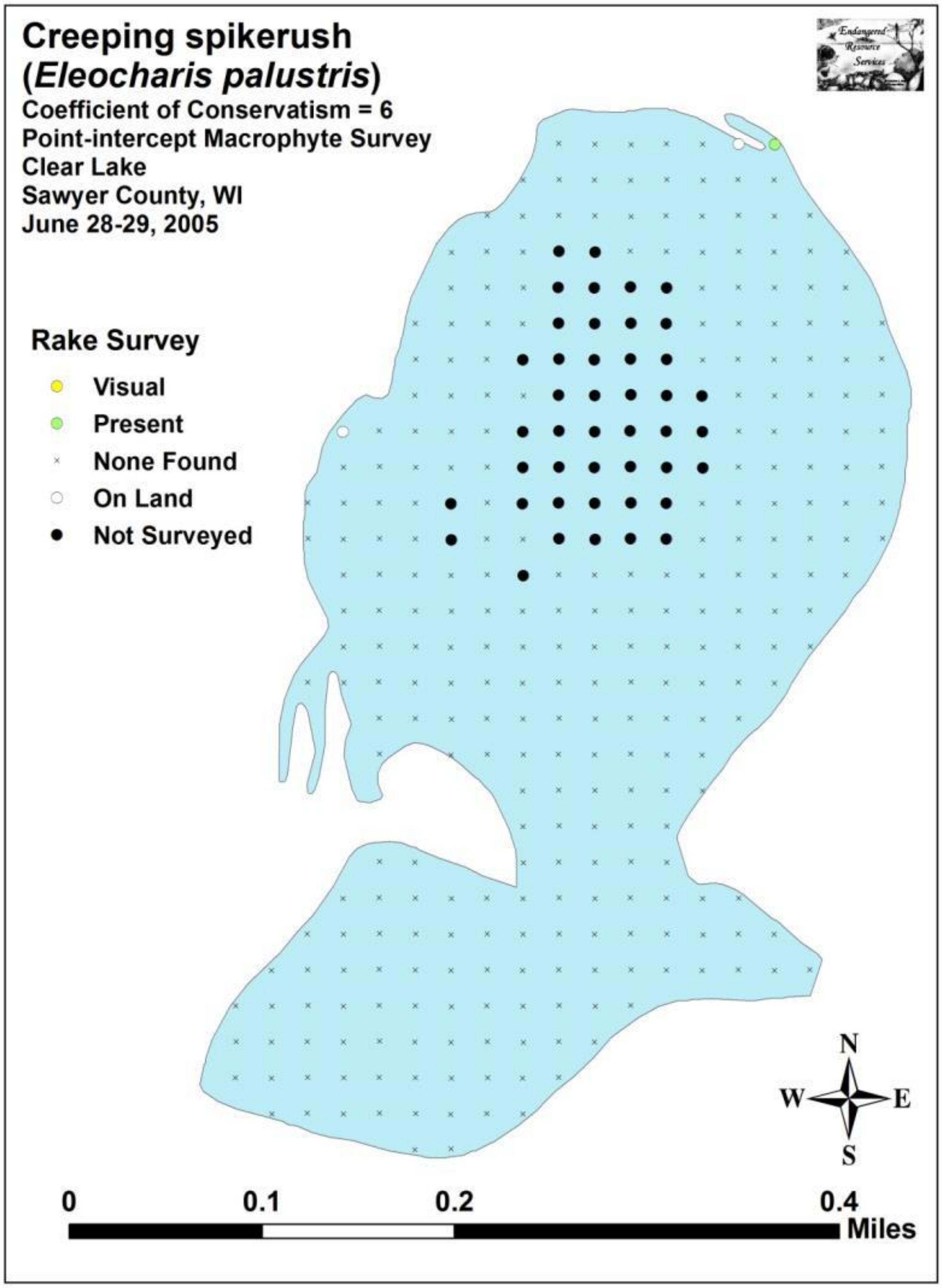

Aquatic moss
Bryophyte
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles

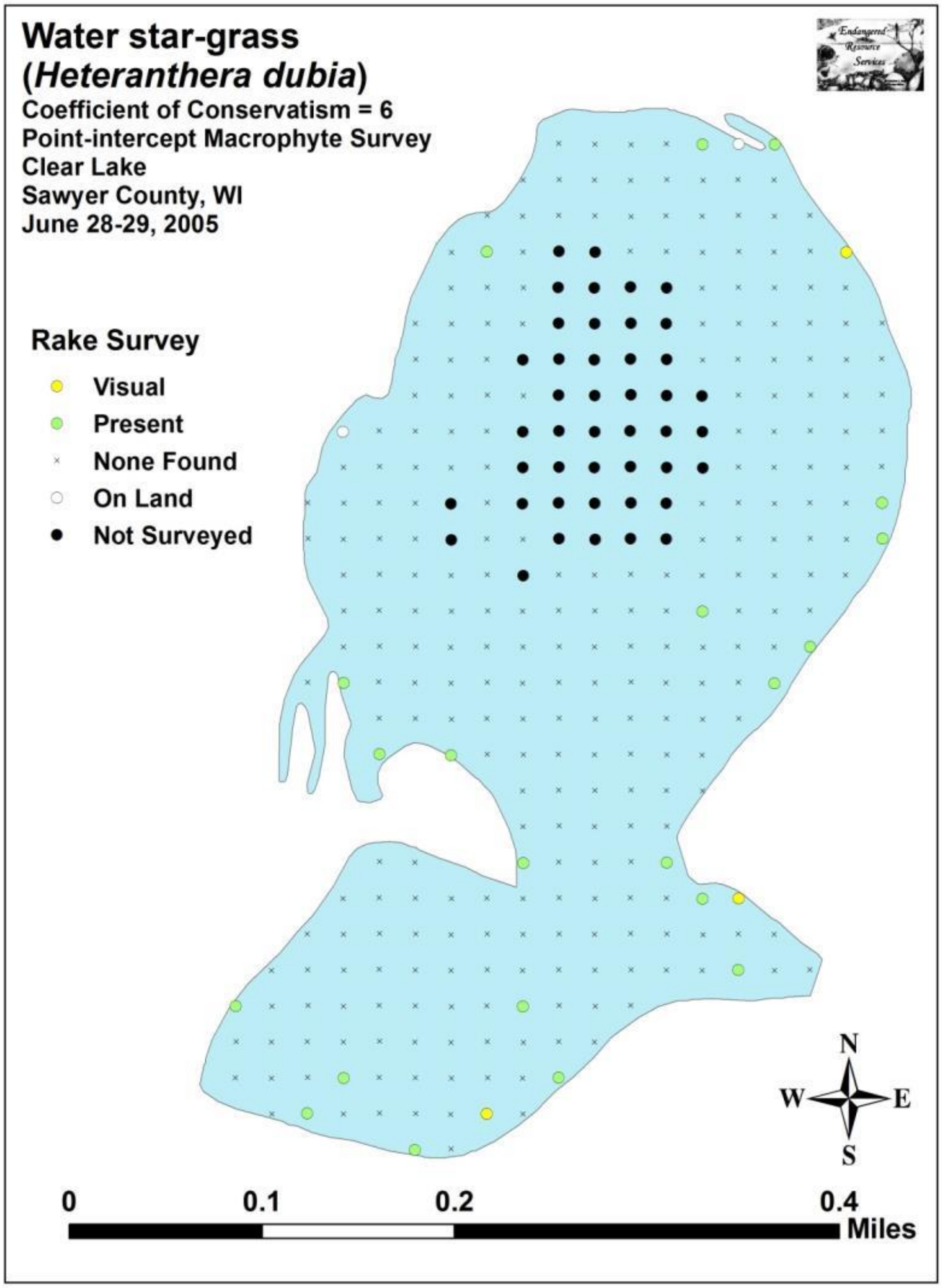

Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles

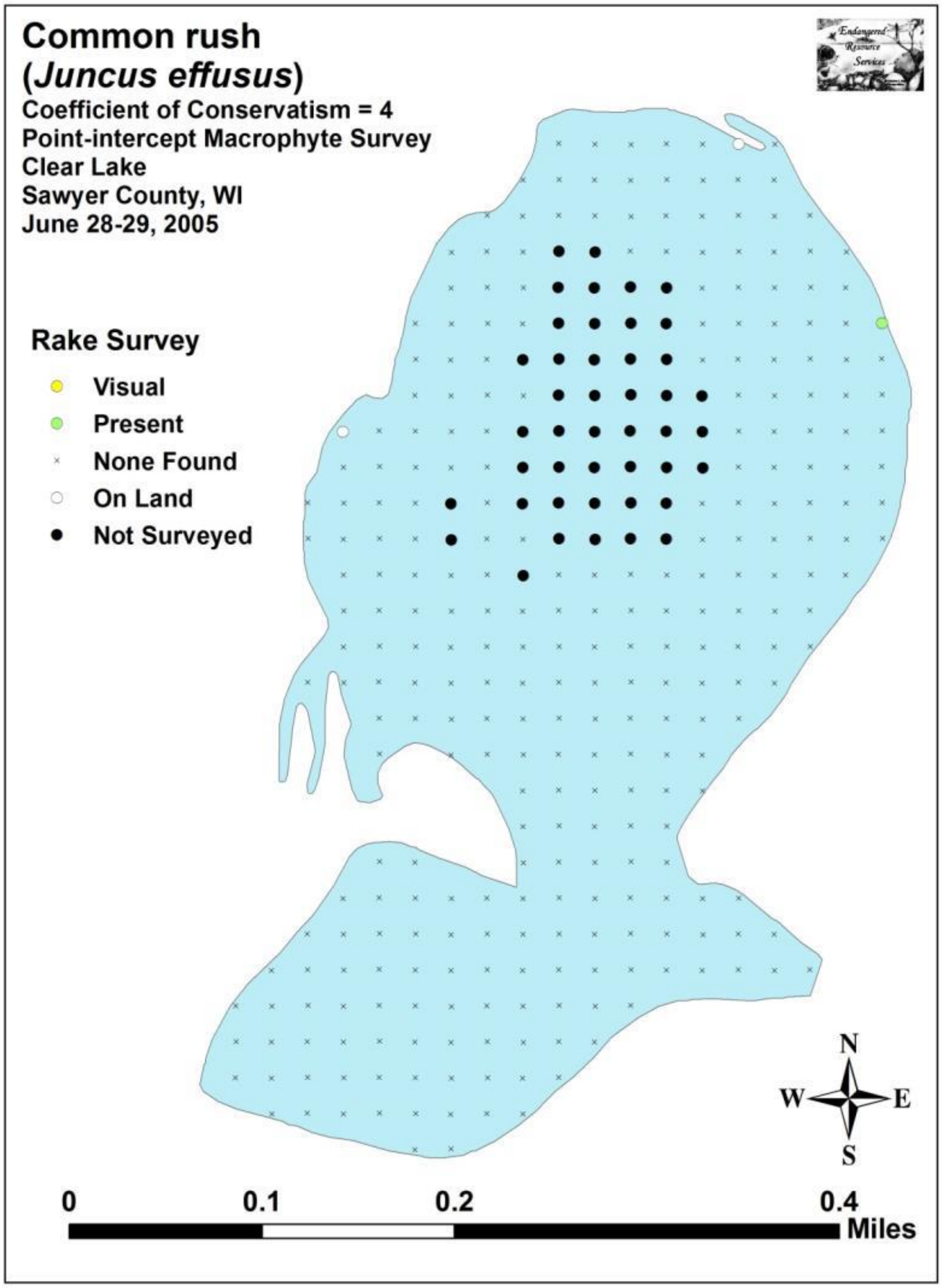

Narrow-leaved woolly sedge
(*Carex lasiocarpa*)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles

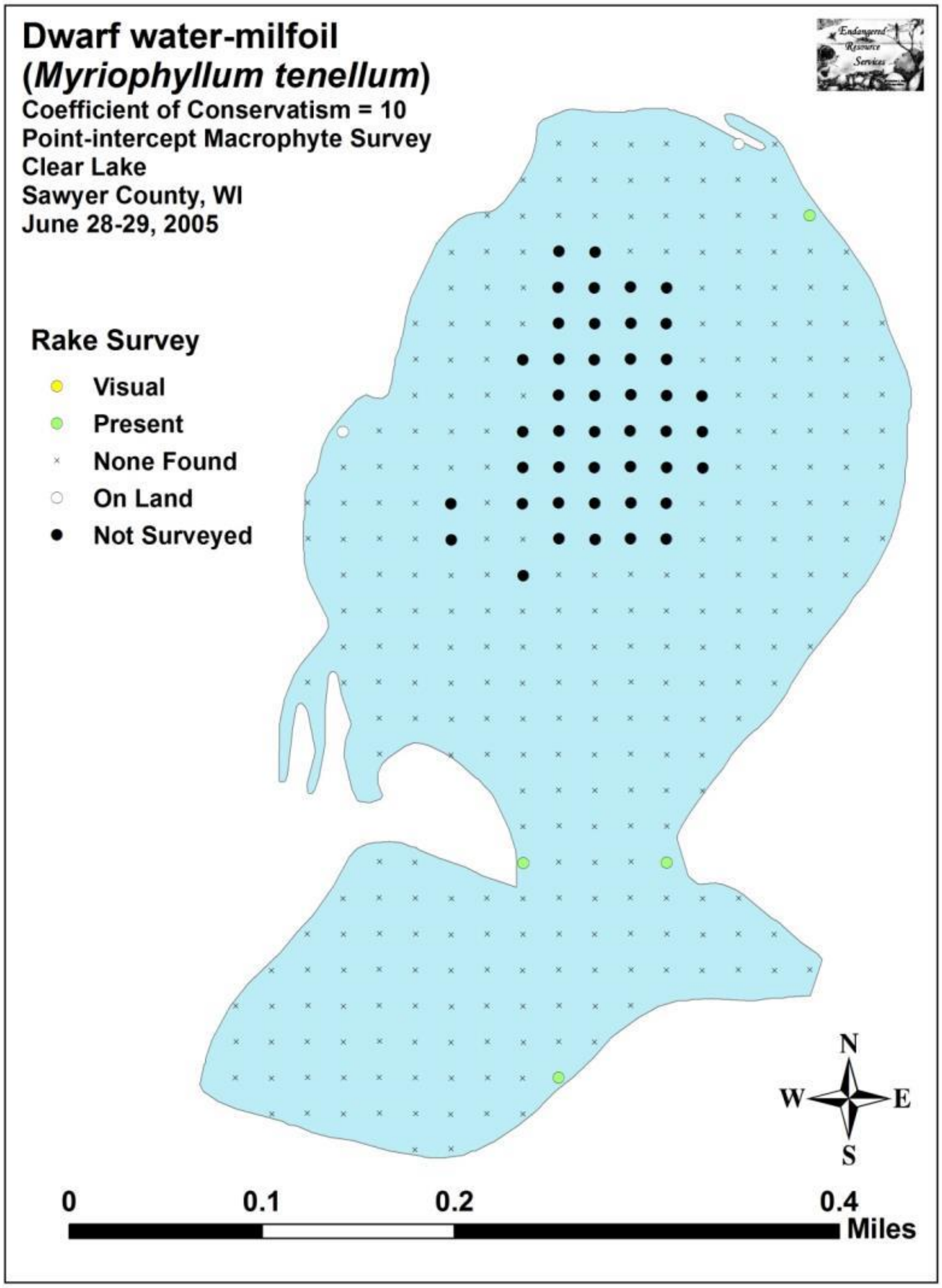

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles

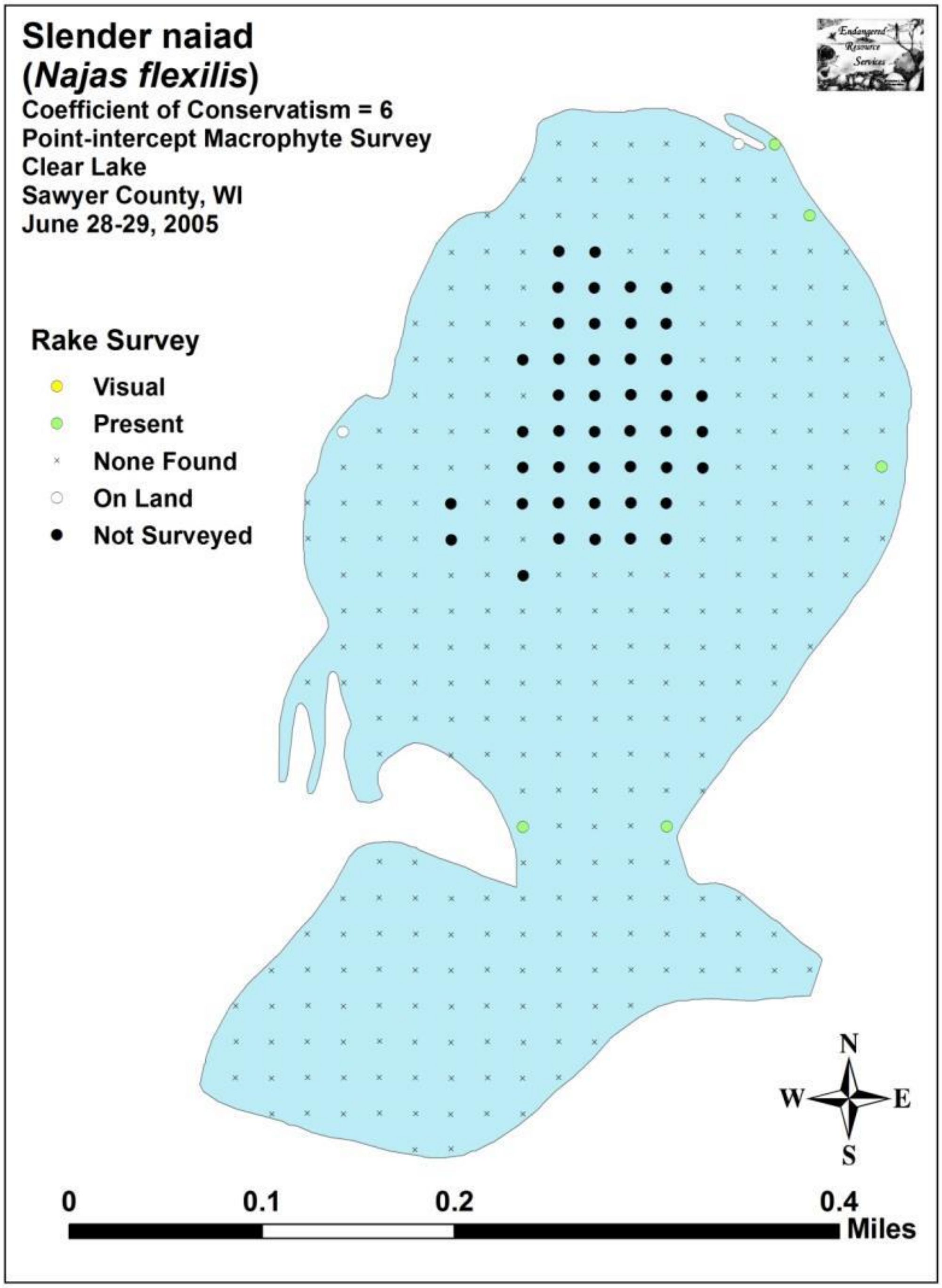

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles

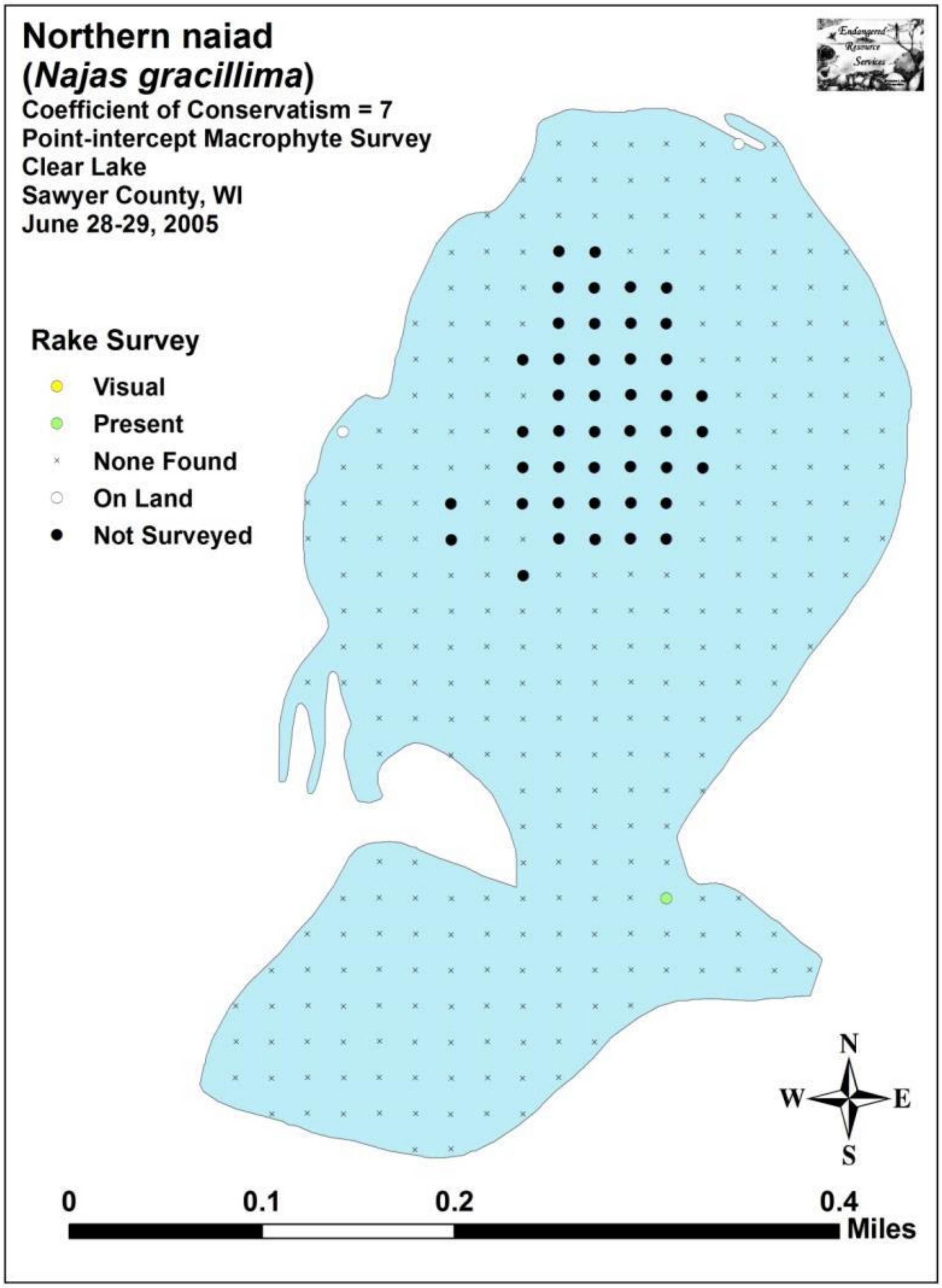

Creeping spikerush
(*Eleocharis palustris*)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles

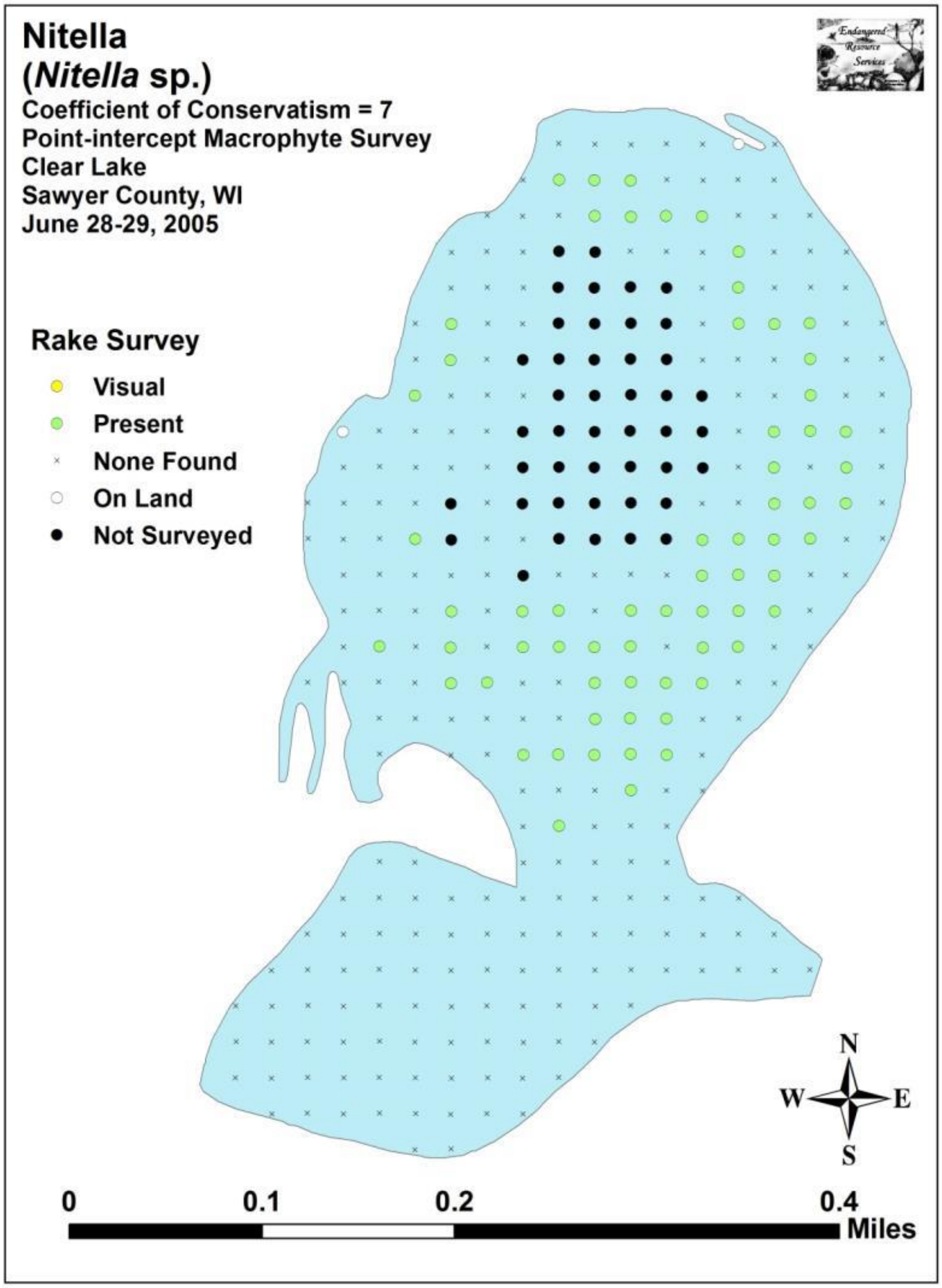

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles


Common rush
(*Juncus effusus*)
Coefficient of Conservatism = 4
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles


Dwarf water-milfoil
(*Myriophyllum tenellum*)
Coefficient of Conservatism = 10
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles


Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles


Northern naiad
(*Najas gracillima*)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
W
E
S
0
0.1
0.2
0.4
Miles


Nitella
(Nitella sp.)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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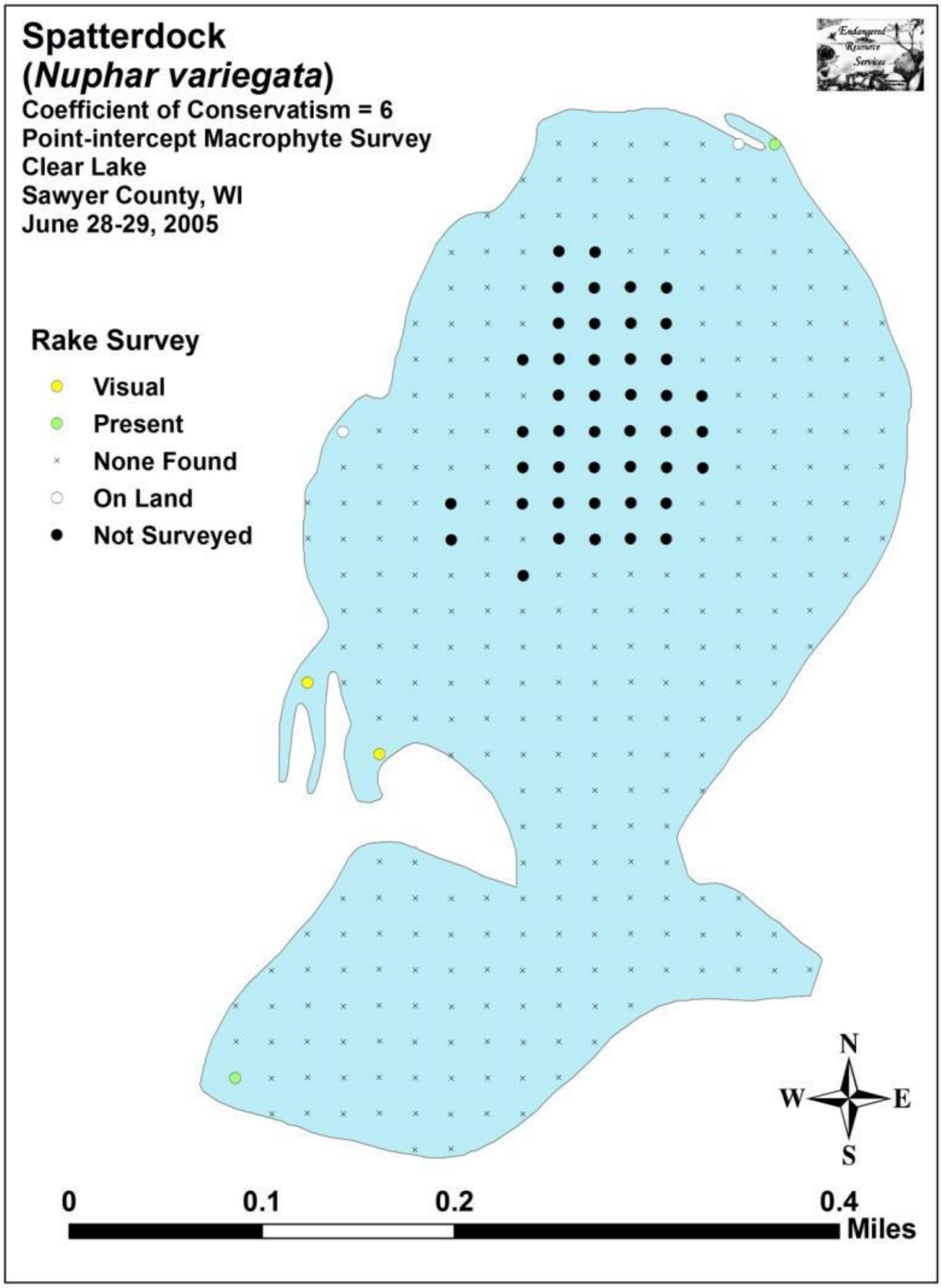
Miles


Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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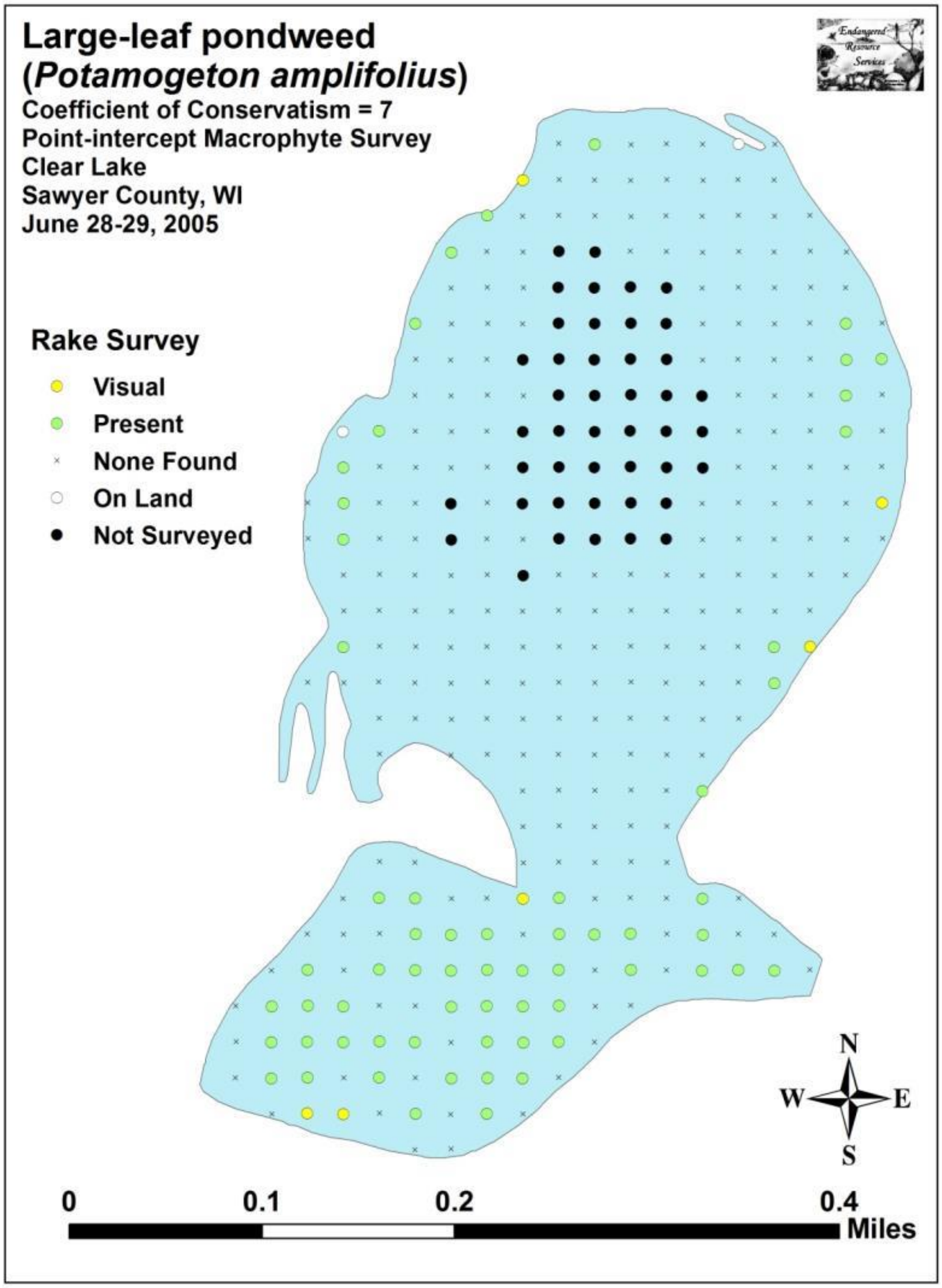
Miles


Large-leaf pondweed
(*Potamogeton amplifolius*)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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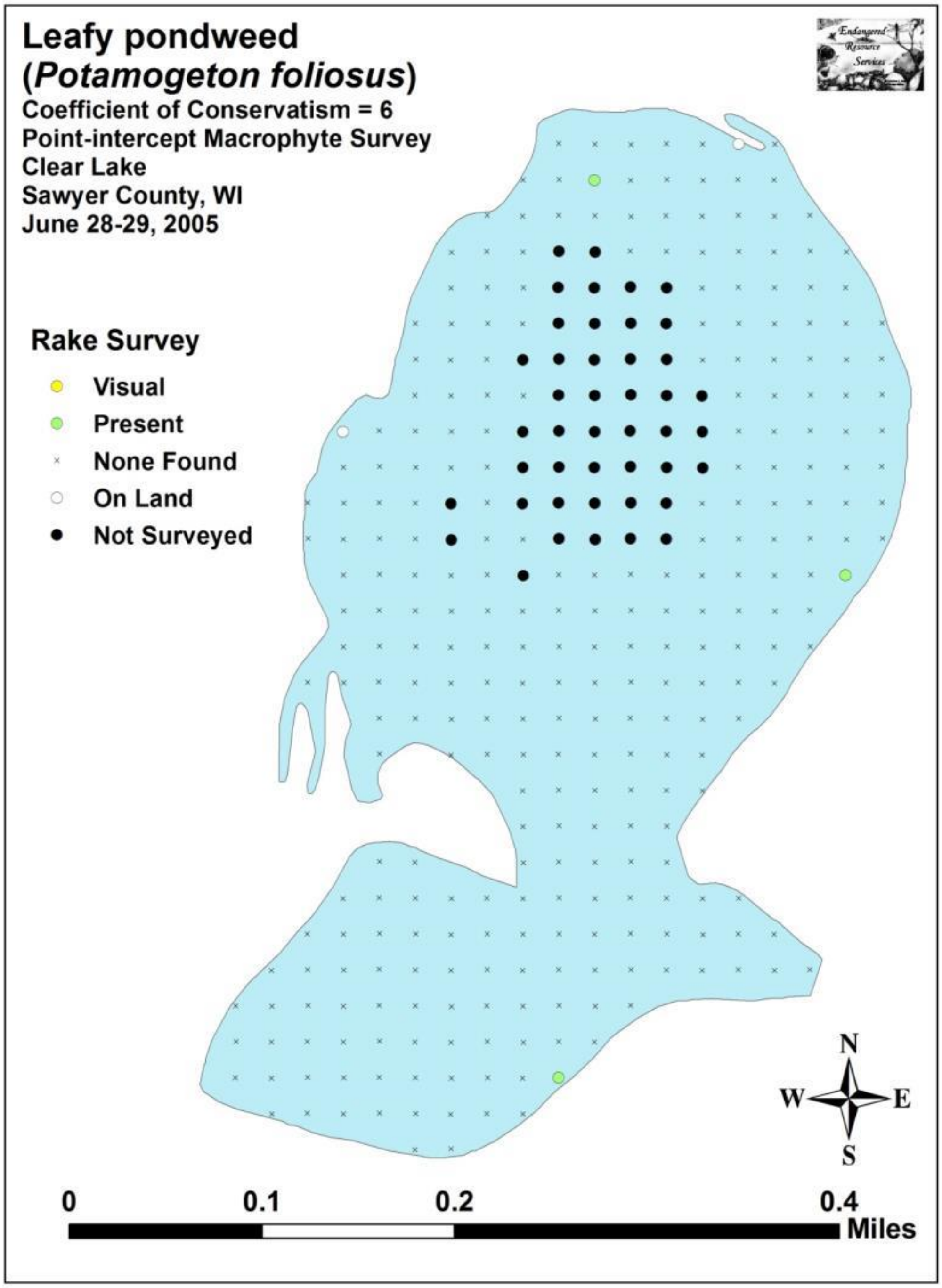
Miles


Leafy pondweed
(Potamogeton foliosus)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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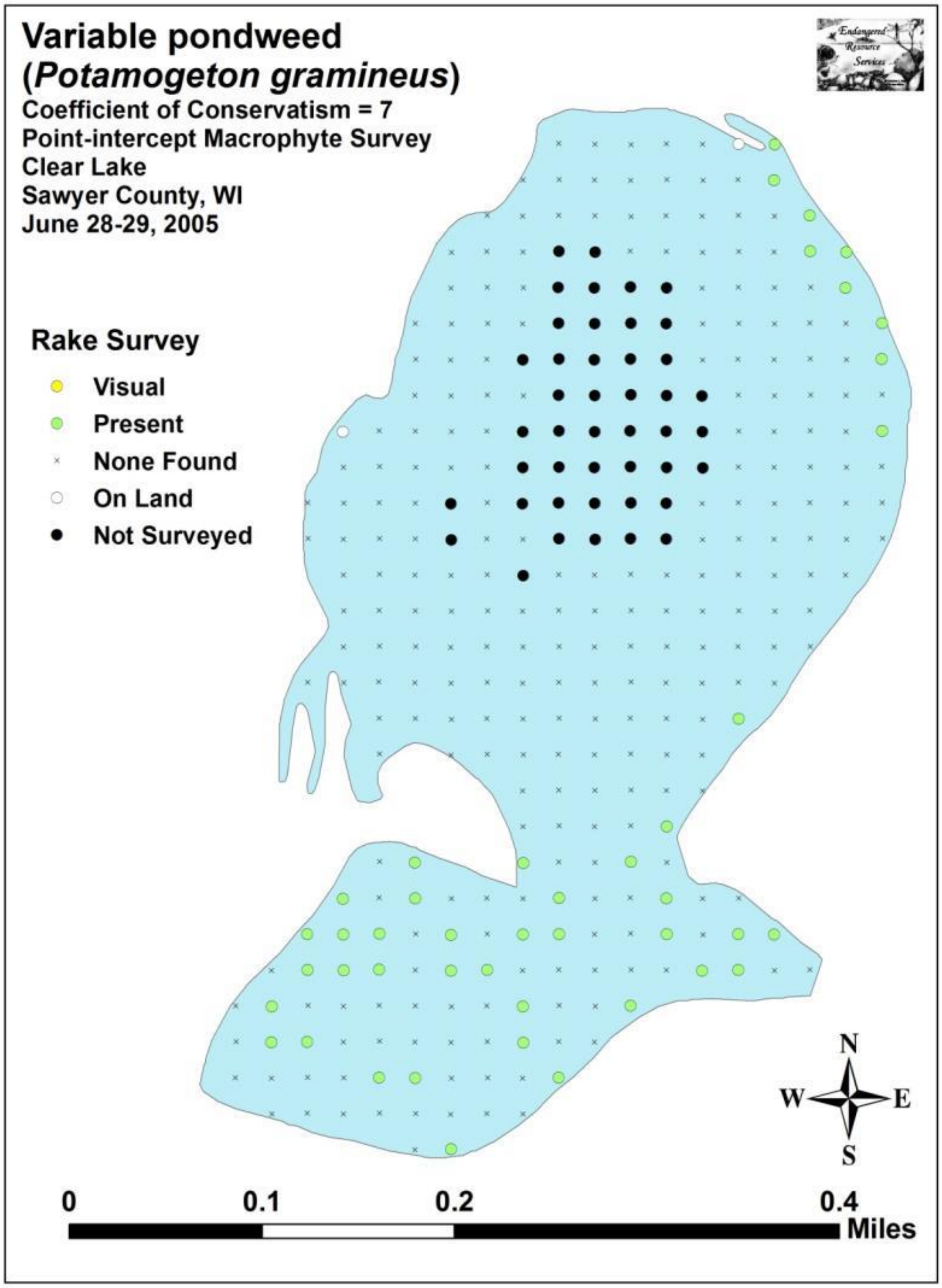
Miles



Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
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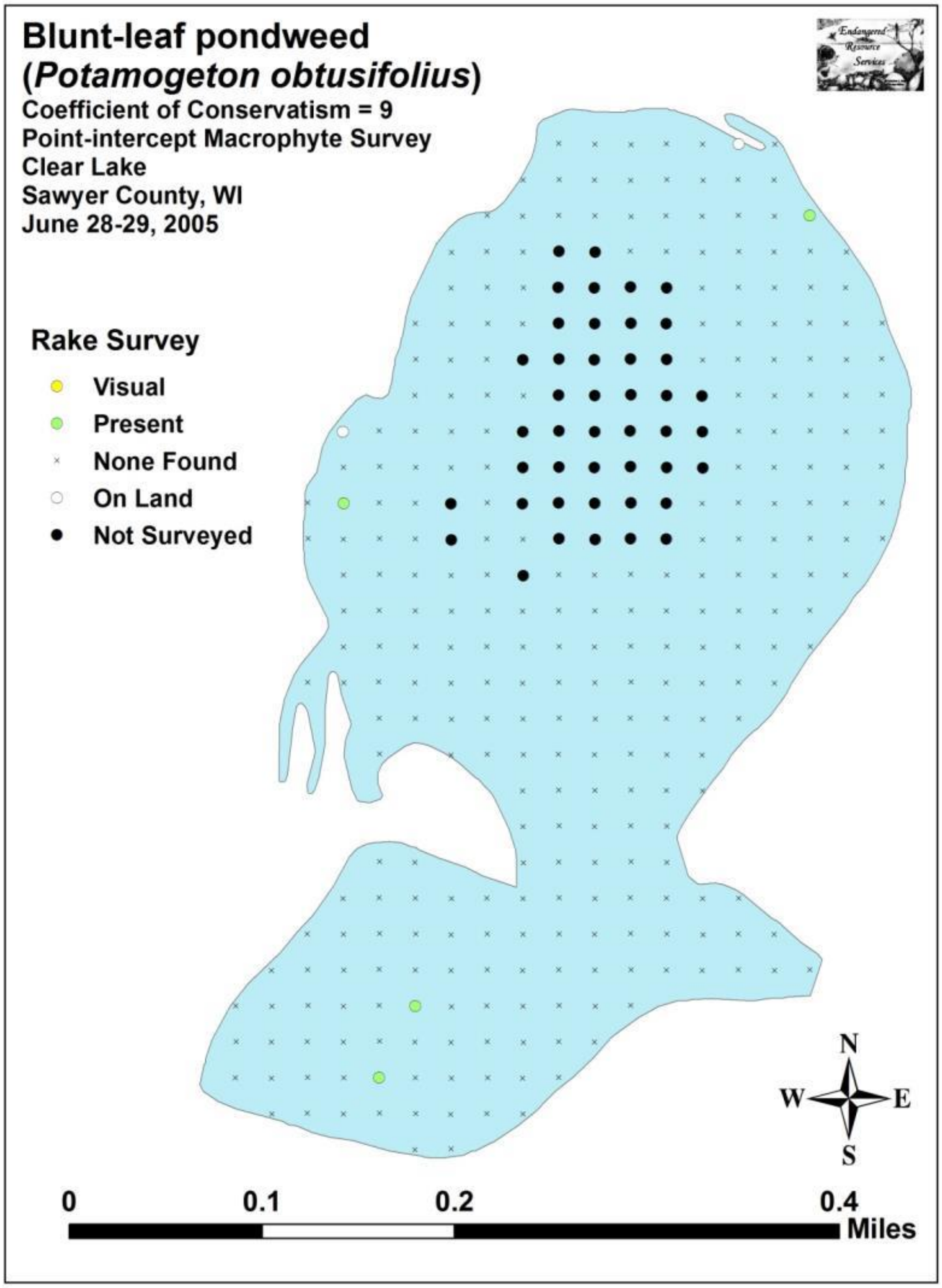
Miles


Blunt-leaf pondweed
(Potamogeton obtusifolius)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
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On Land
Not Surveyed
N
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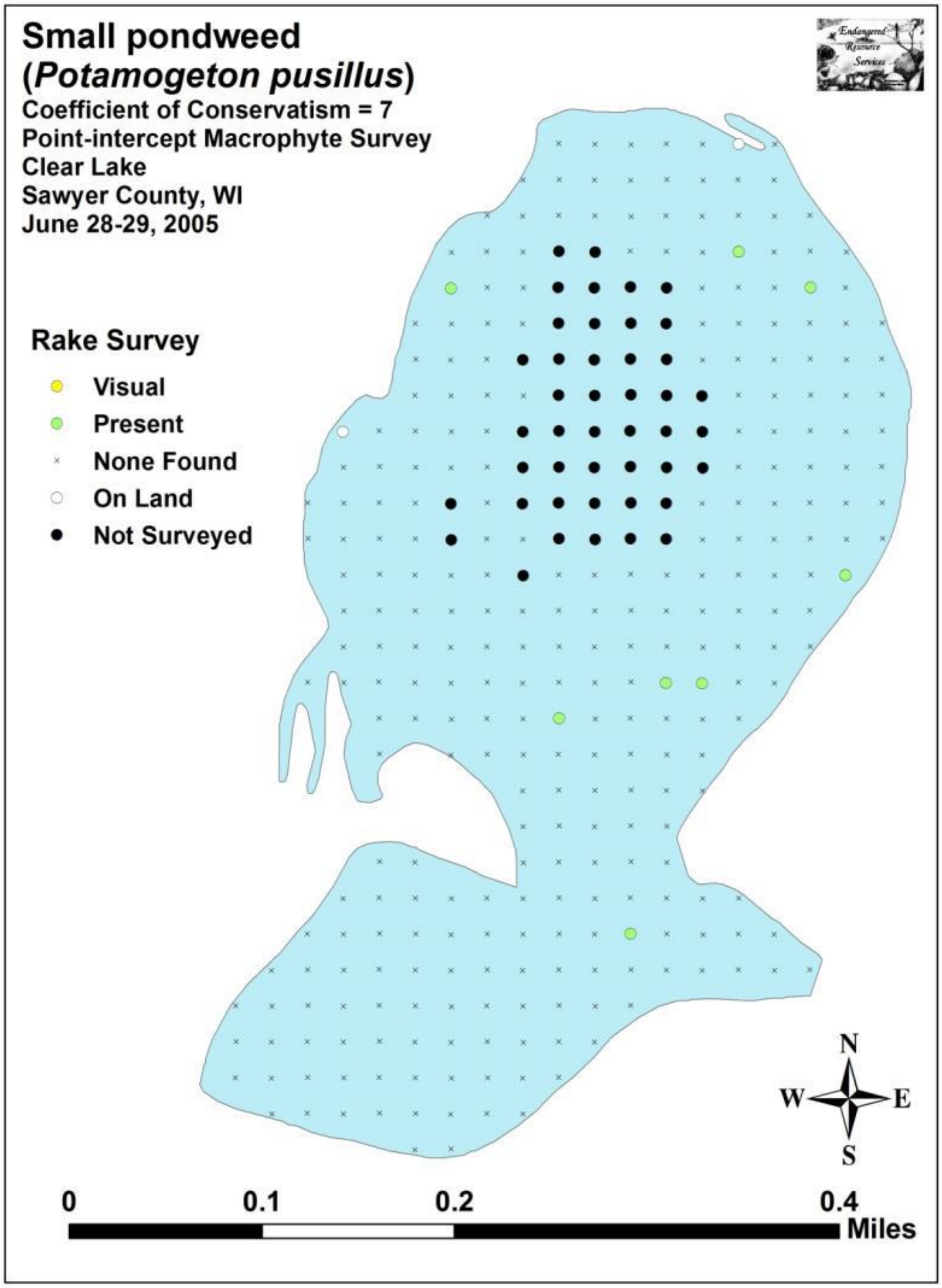
Miles


Small pondweed
(*Potamogeton pusillus*)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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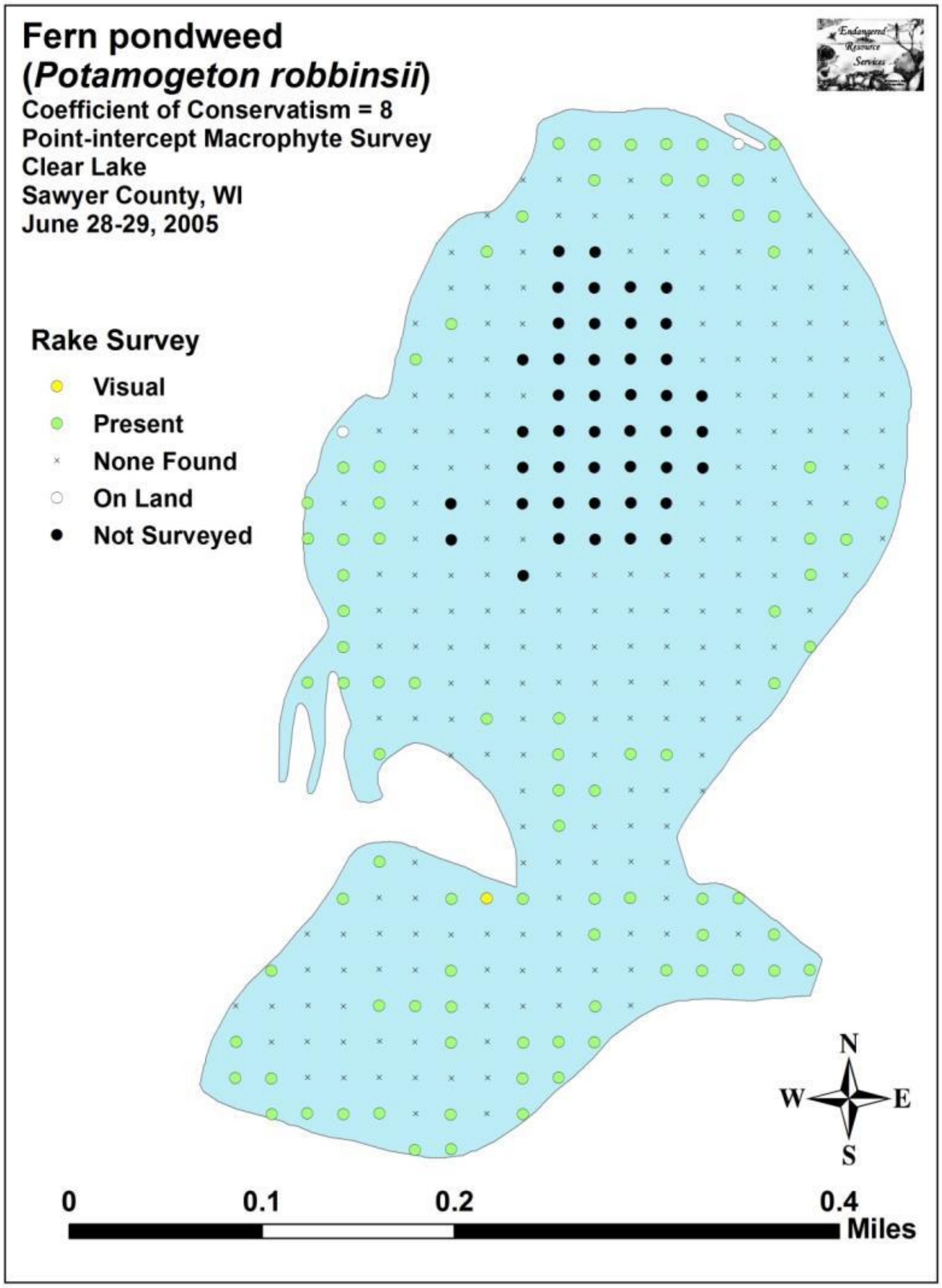
Miles


Fern pondweed
(*Potamogeton robbinsii*)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
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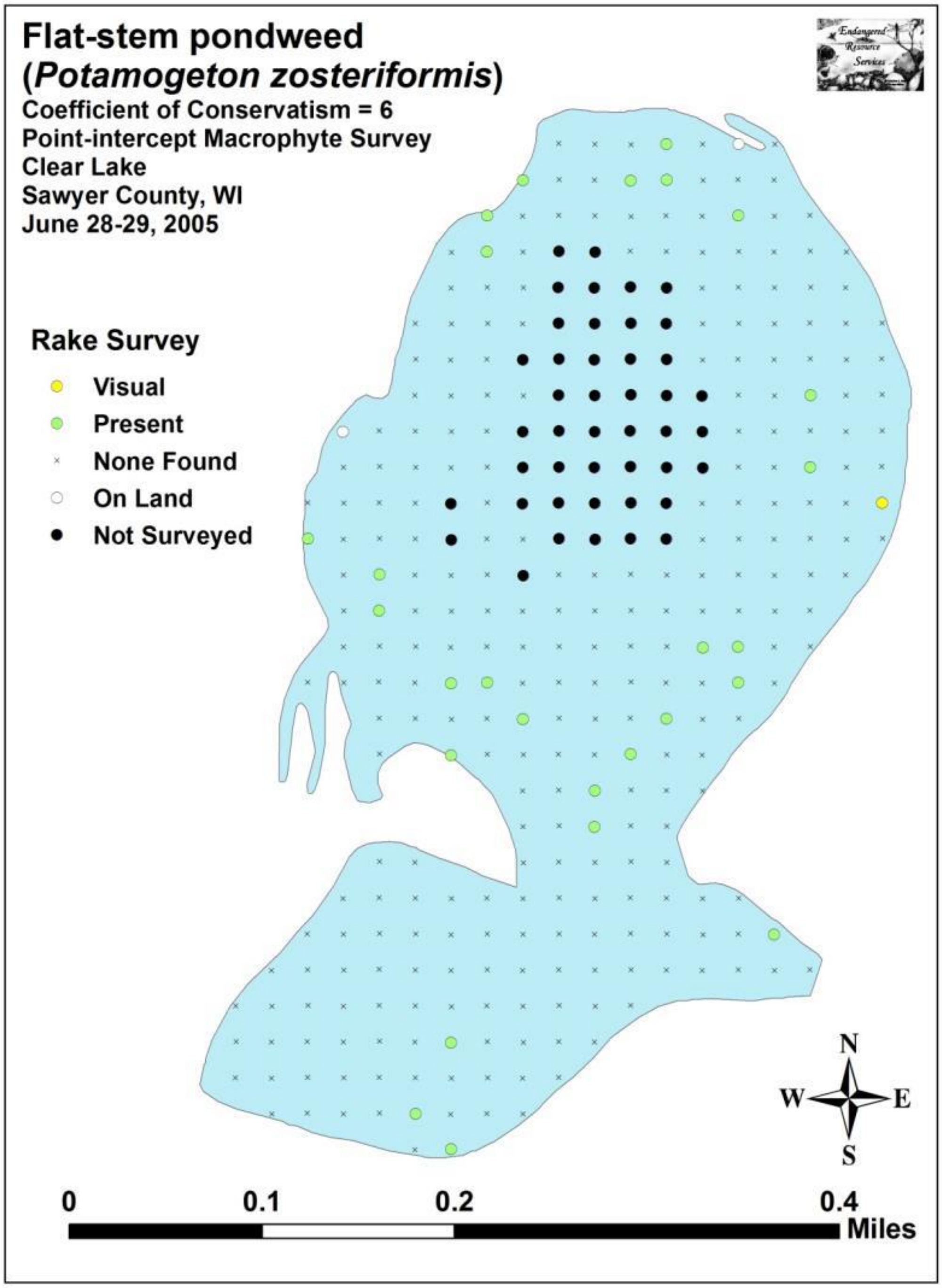
Miles


Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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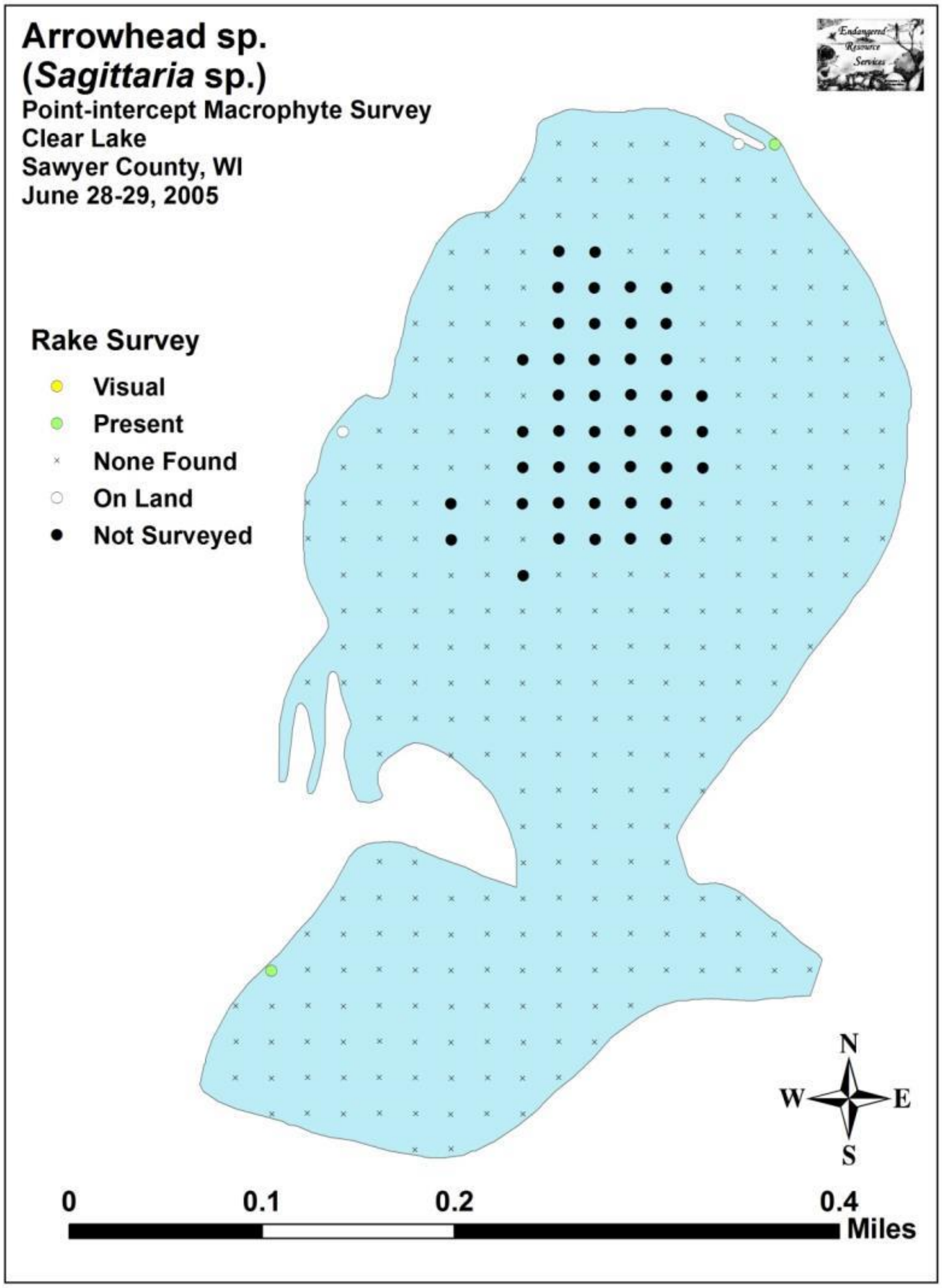
Miles



Arrowhead sp.
(*Sagittaria* sp.)
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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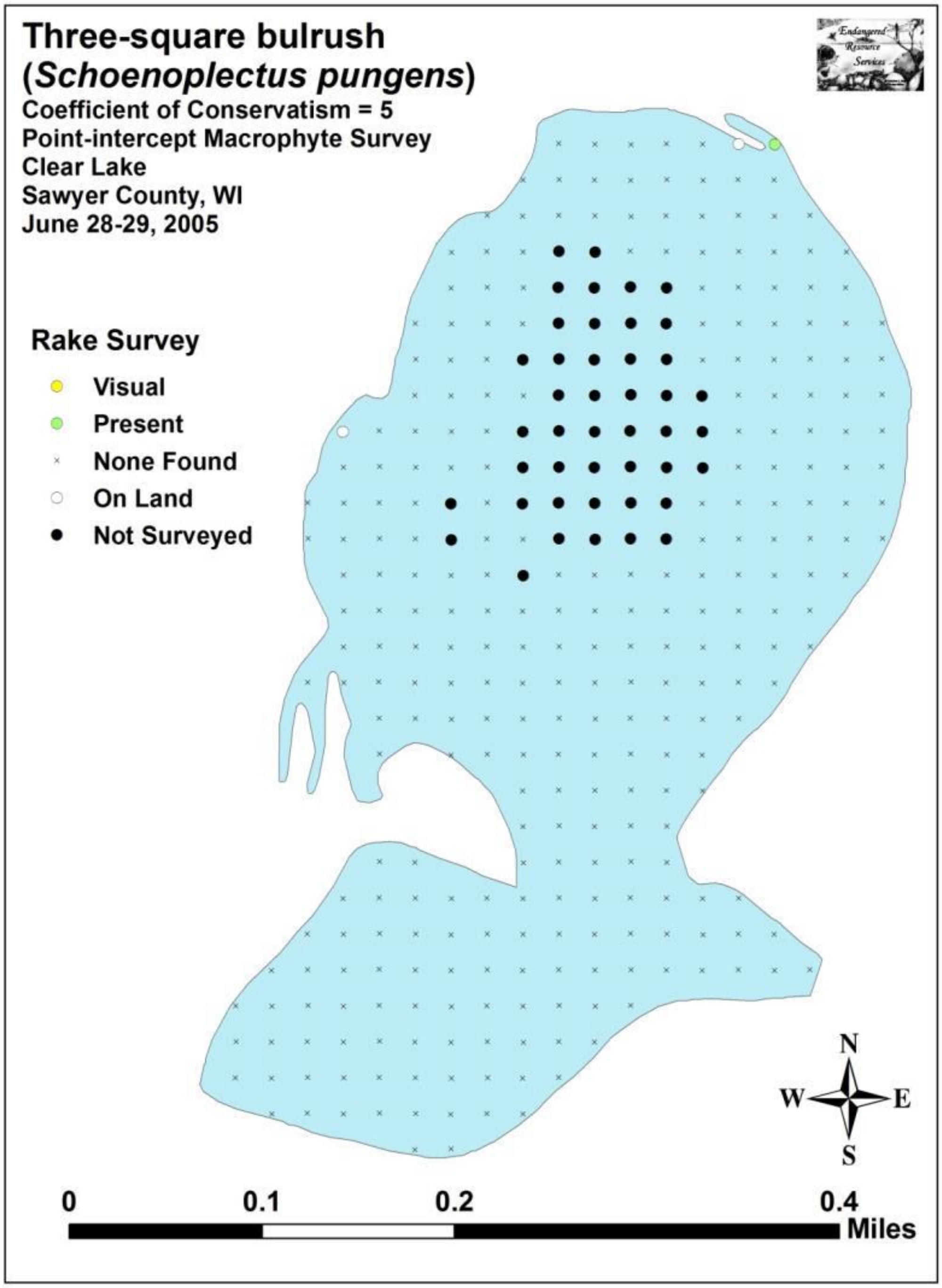
Miles


Three-square bulrush
(Schoenoplectus pungens)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
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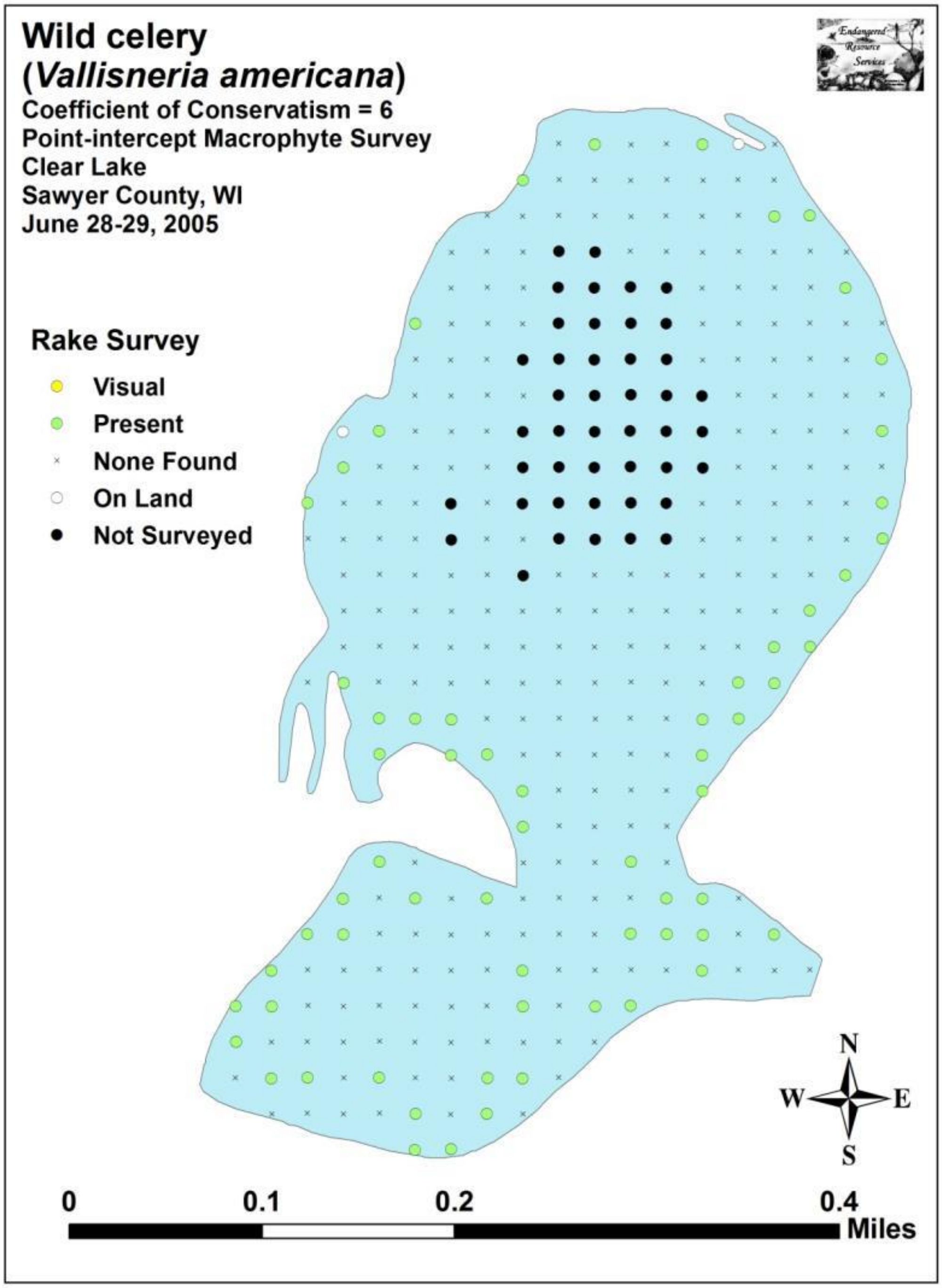
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
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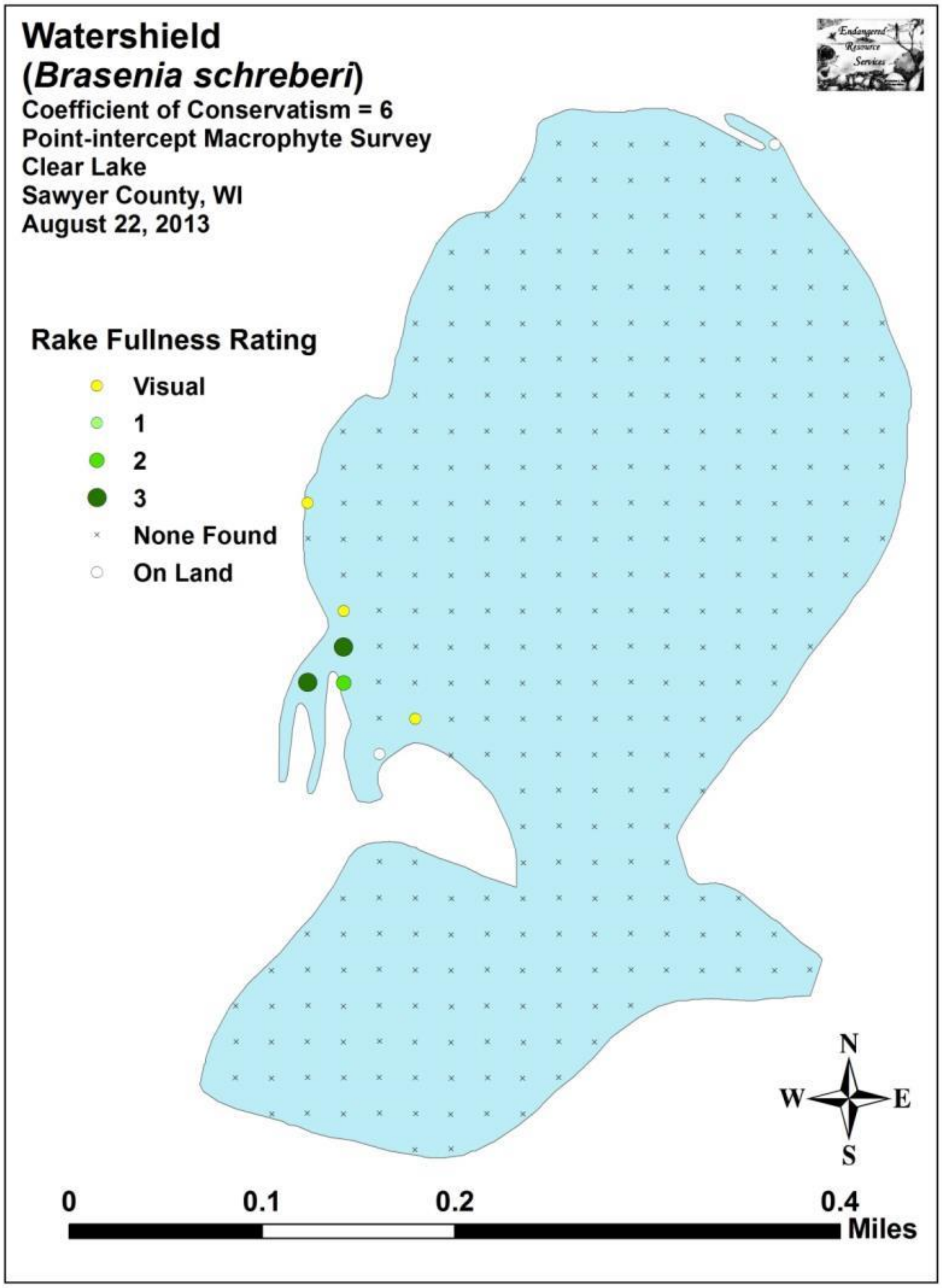
Miles

Appendix VI: 2013 WDNR/SCLWCD August Point-intercept Survey Native Species Density and Distribution Maps


Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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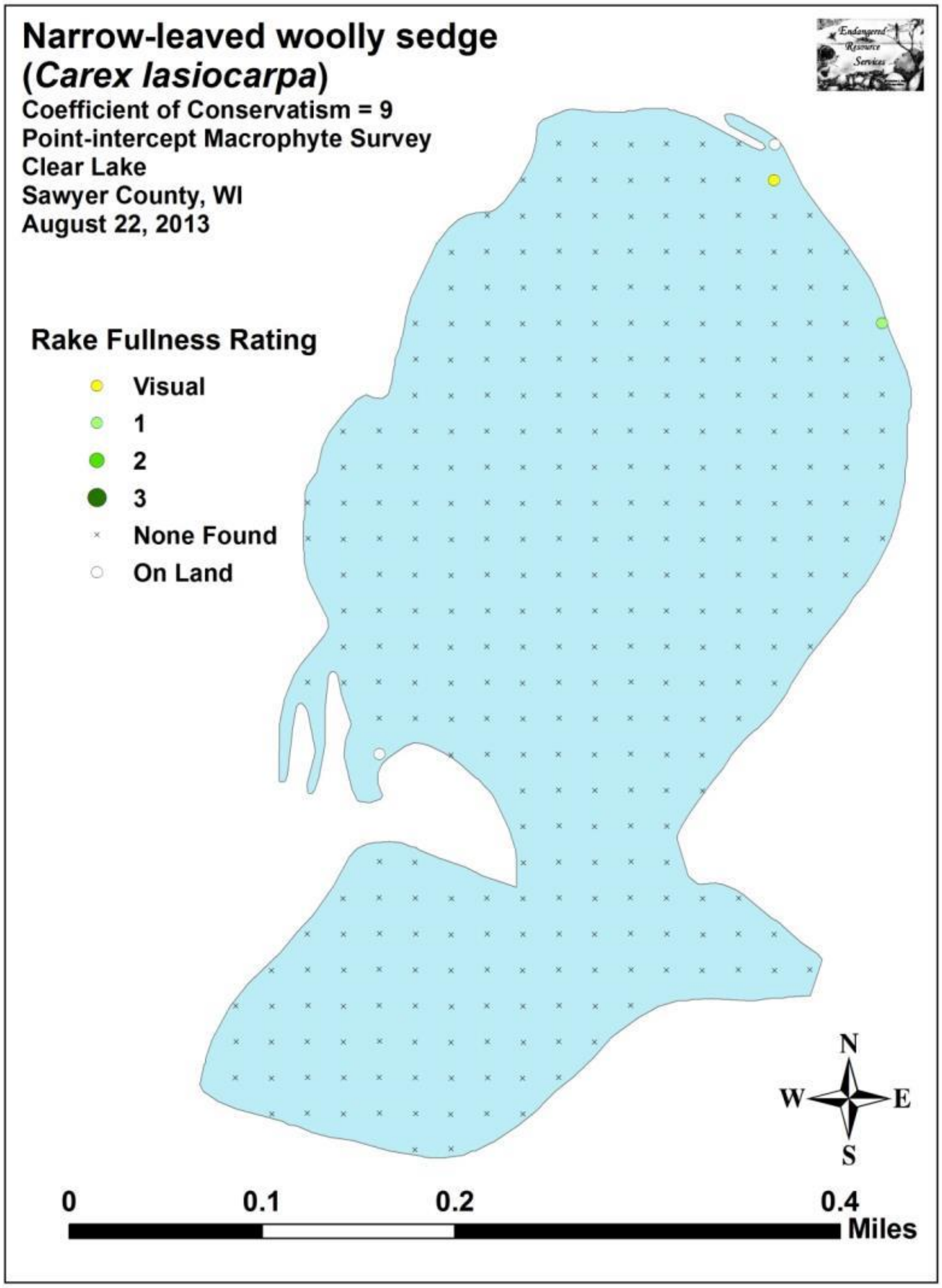
Miles


Narrow-leaved woolly sedge
(Carex lasiocarpa)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
1
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None Found
On Land
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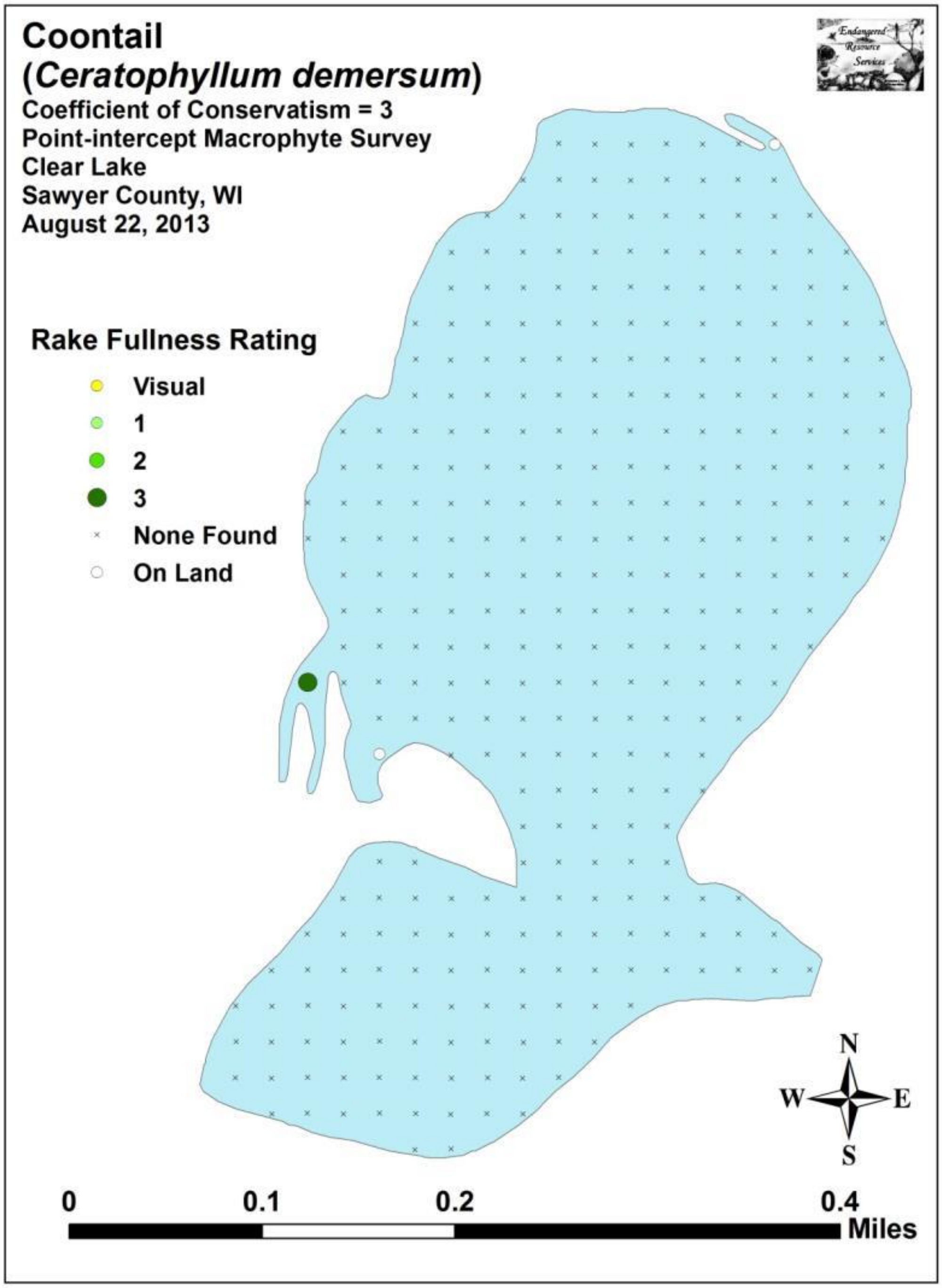
Miles


Coontail
(*Ceratophyllum demersum*)
Coefficient of Conservatism = 3
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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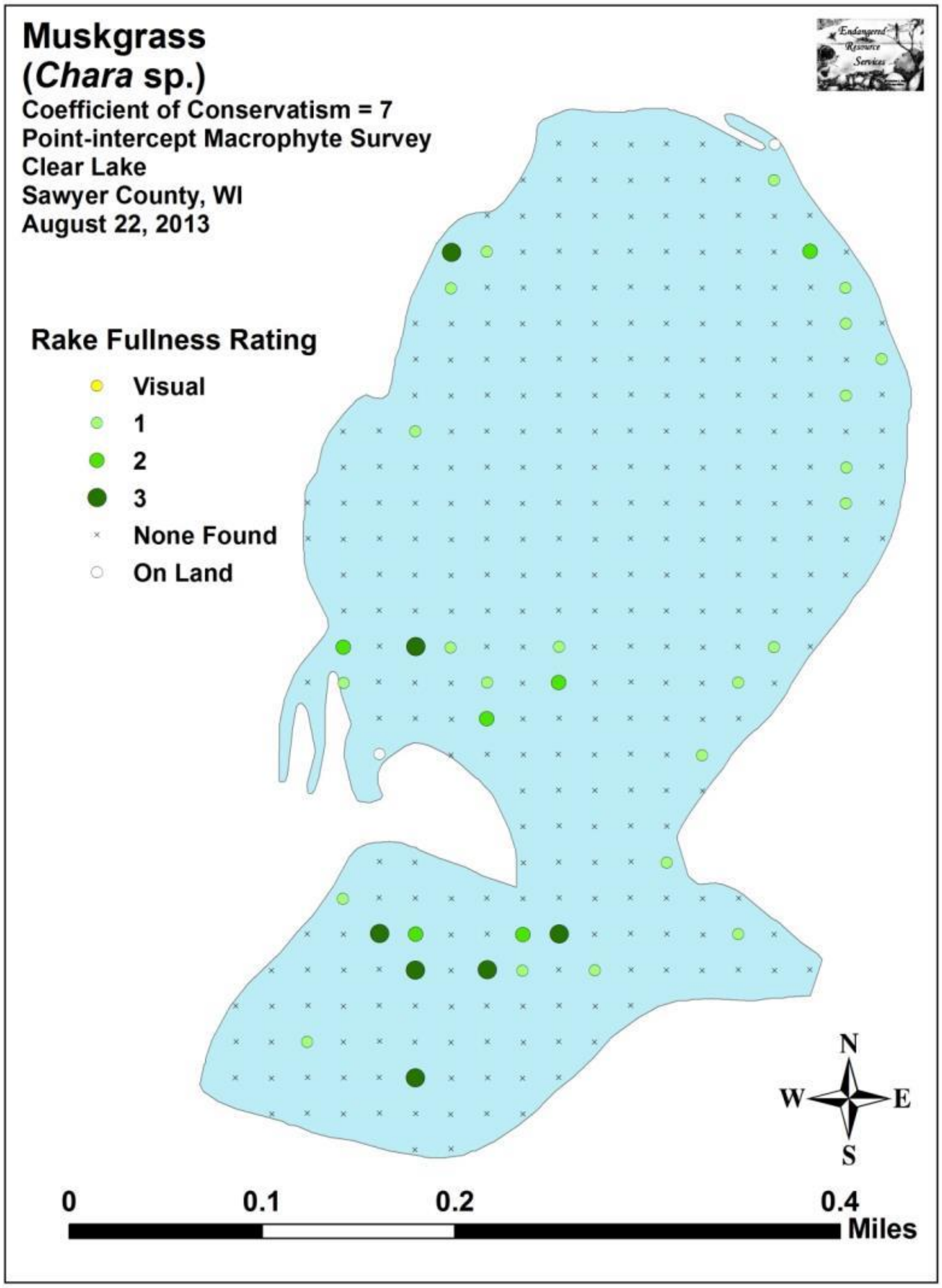
Miles



Muskgrass
(*Chara* sp.)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
On Land
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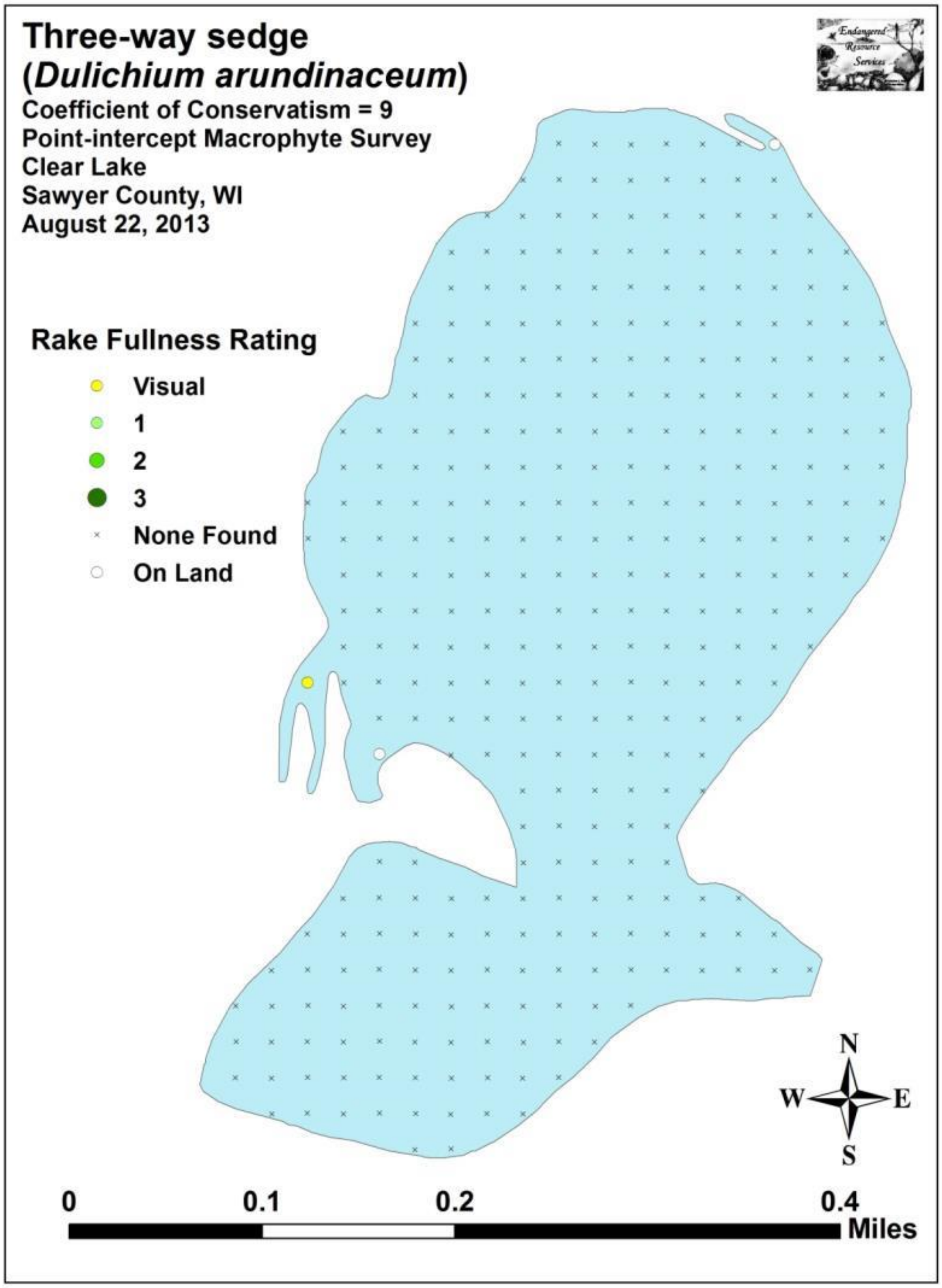
Miles



Three-way sedge
(*Dulichium arundinaceum*)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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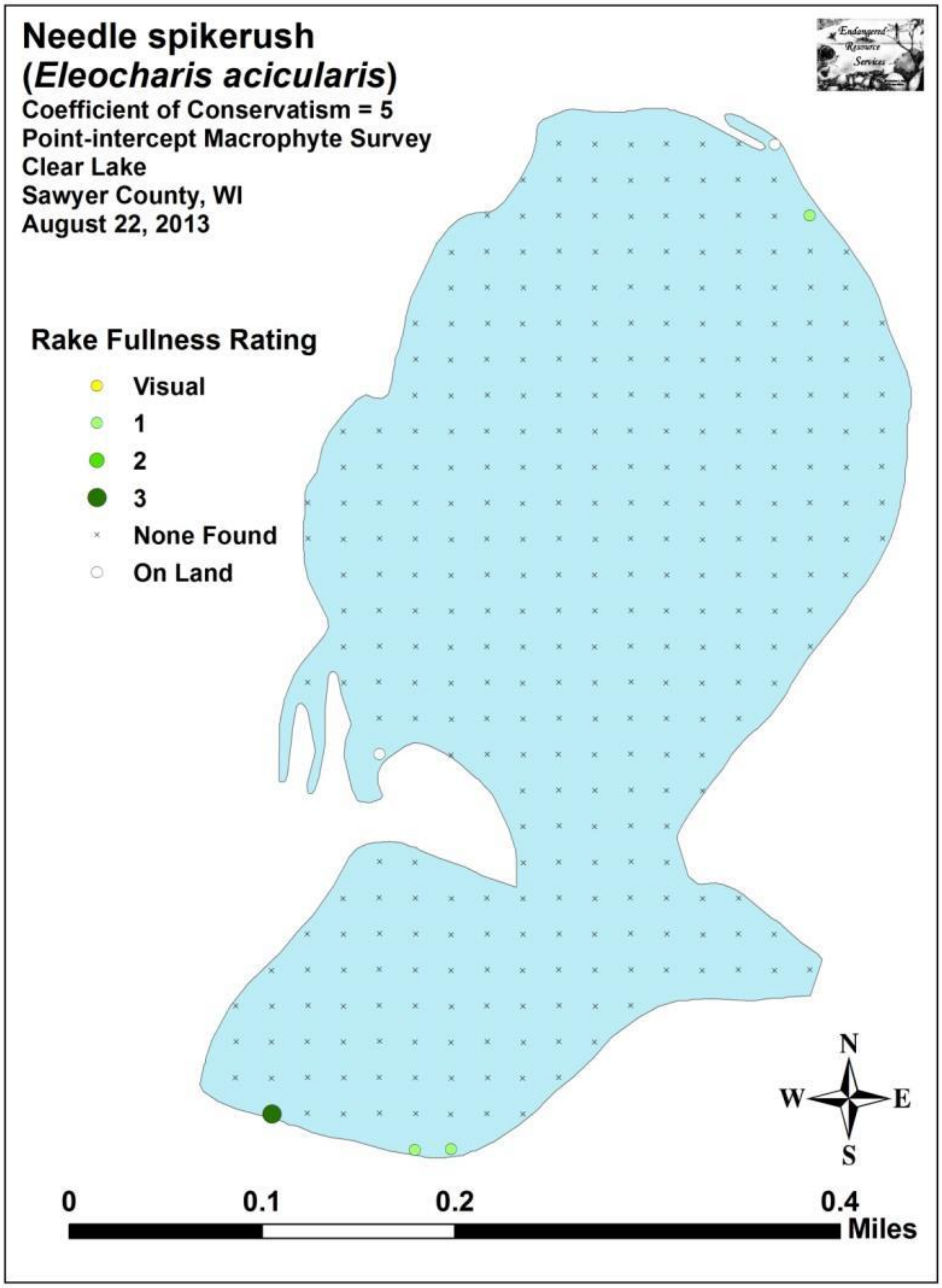
Miles


Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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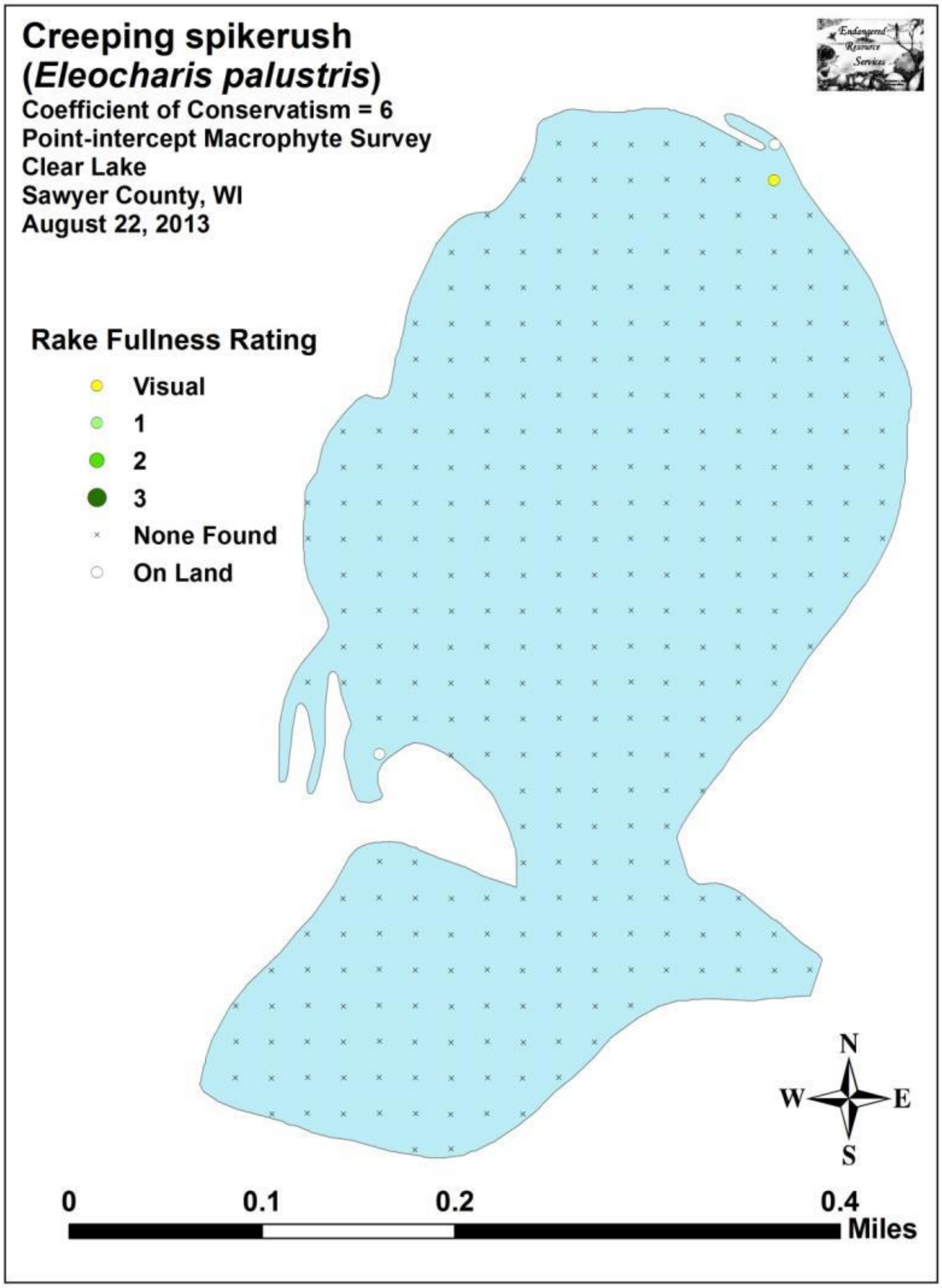
Miles



Creeping spikerush
(Eleocharis palustris)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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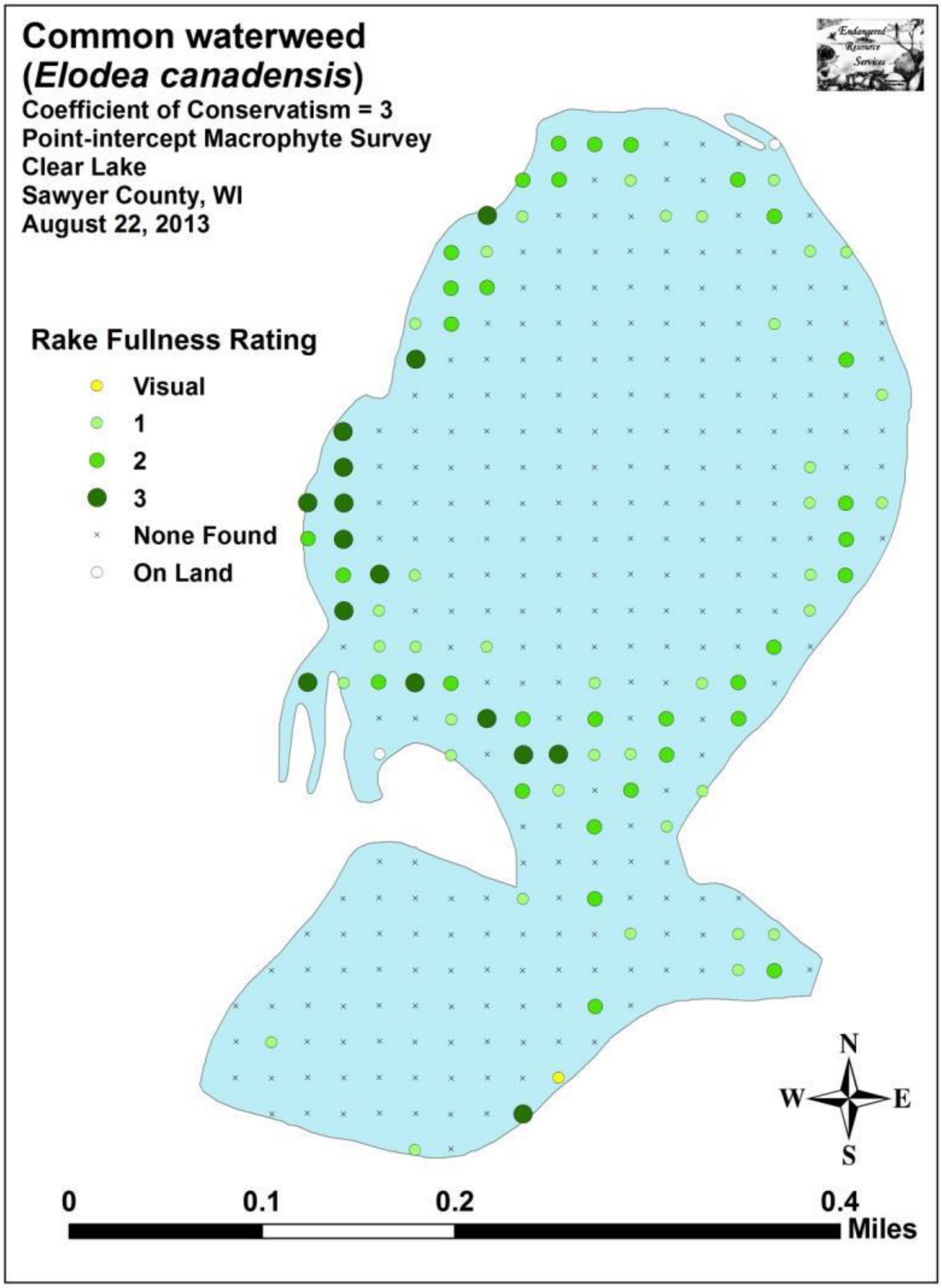
Miles


Common waterweed
(*Elodea canadensis*)
Coefficient of Conservatism = 3
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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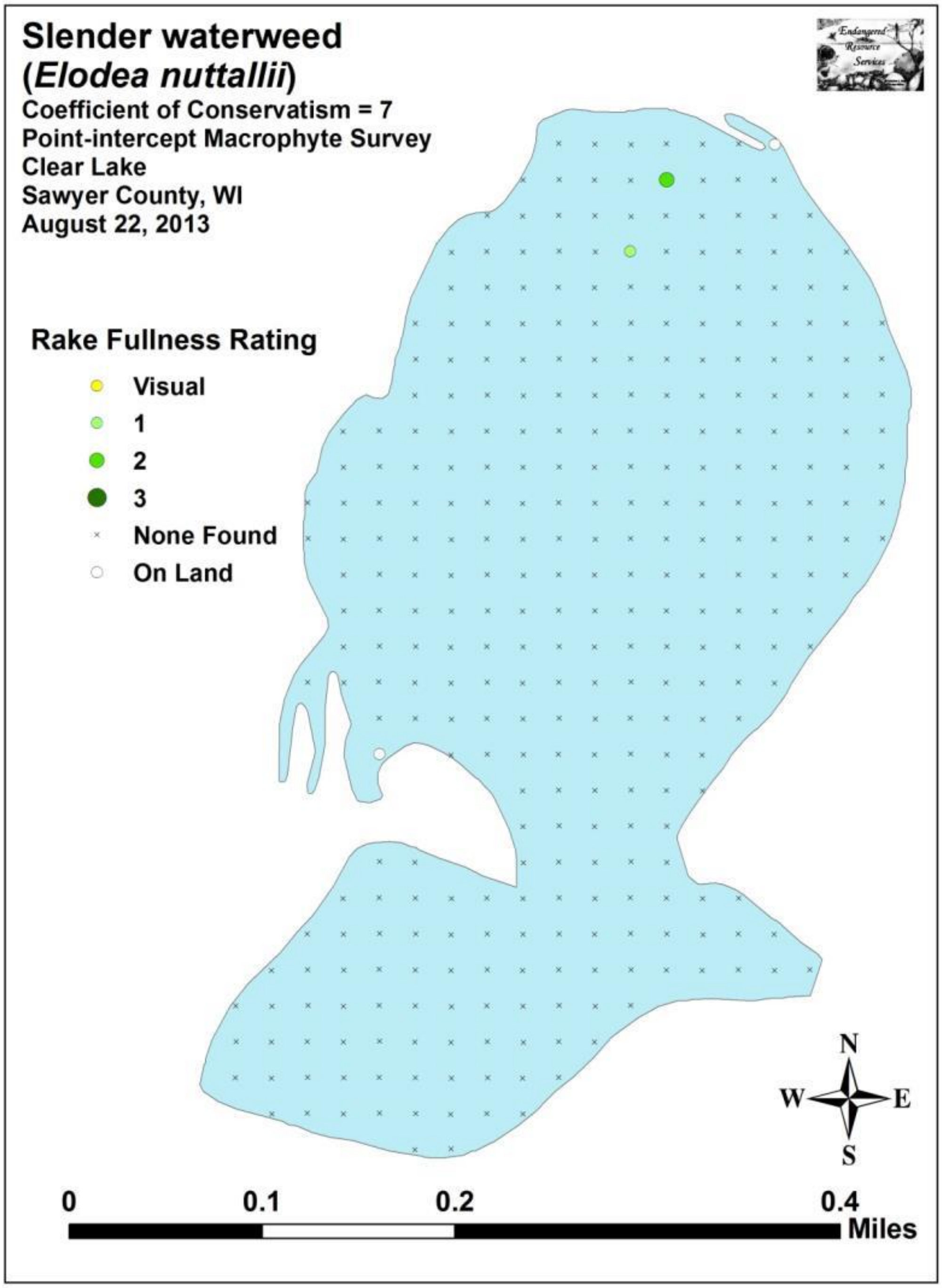
Miles


Slender waterweed
(Elodea nuttallii)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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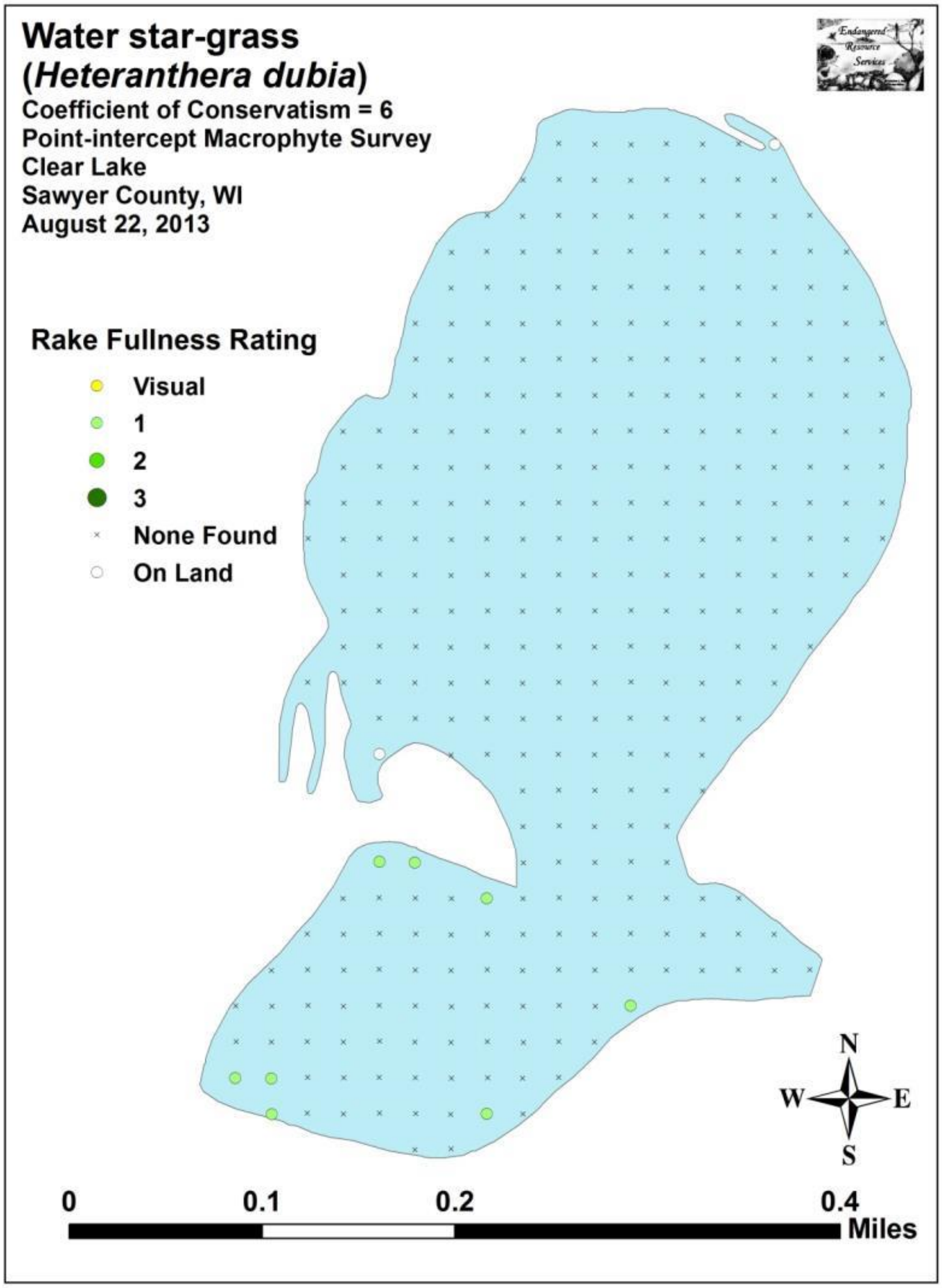
Miles


Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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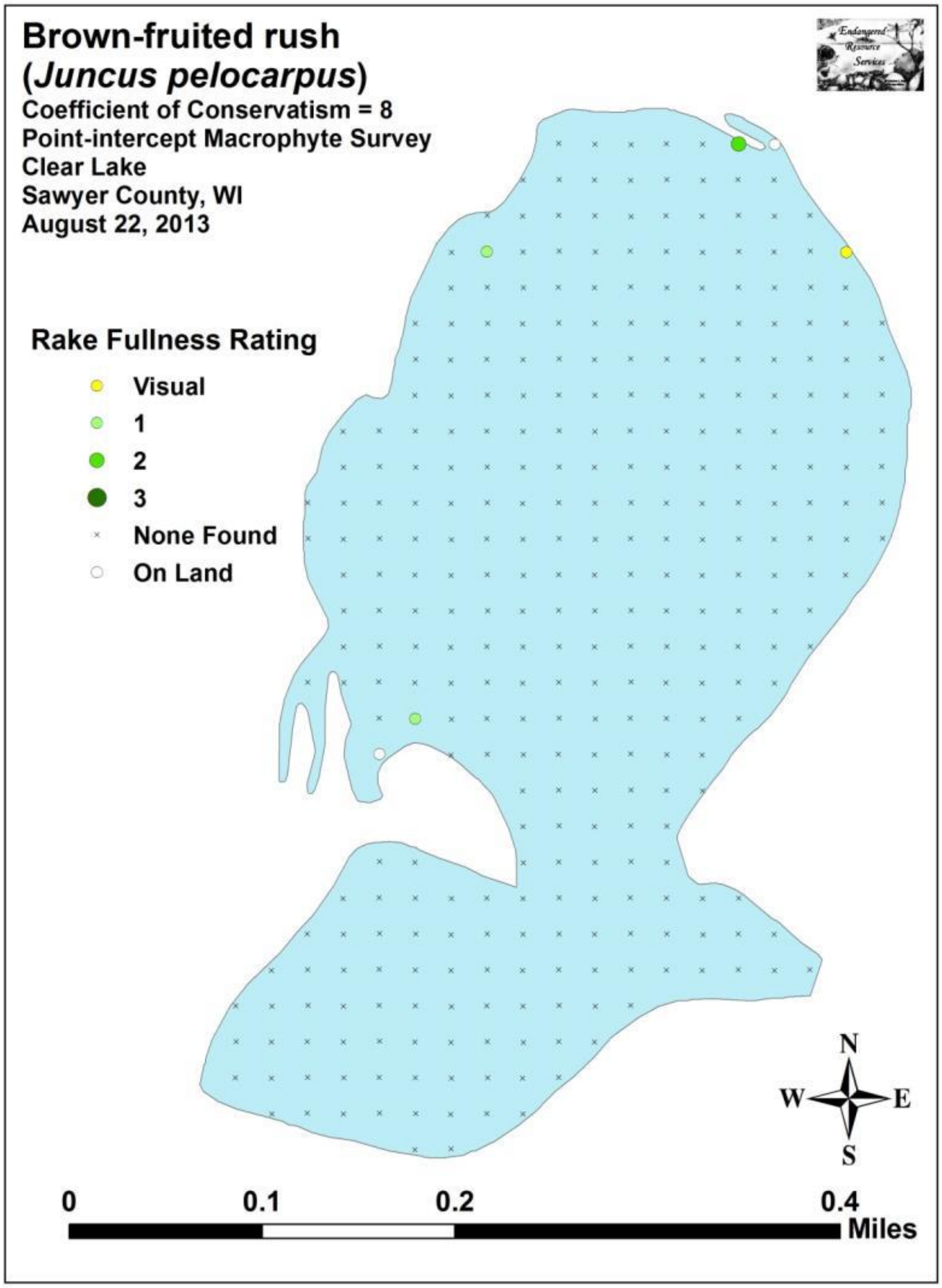
Miles



Brown-fruited rush
(Juncus pelocarpus)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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0.2
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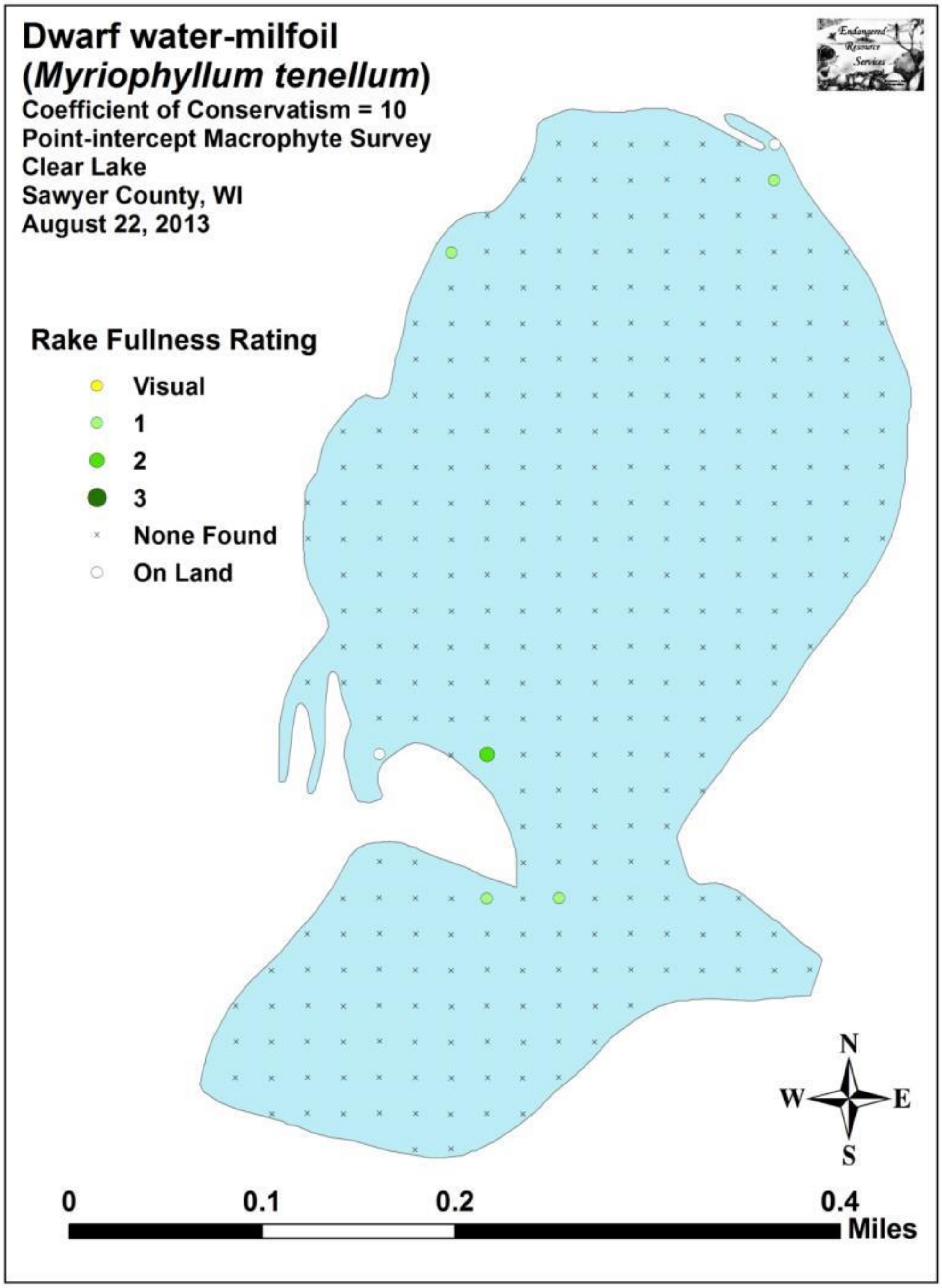
Miles


Dwarf water-milfoil
(*Myriophyllum tenellum*)
Coefficient of Conservatism = 10
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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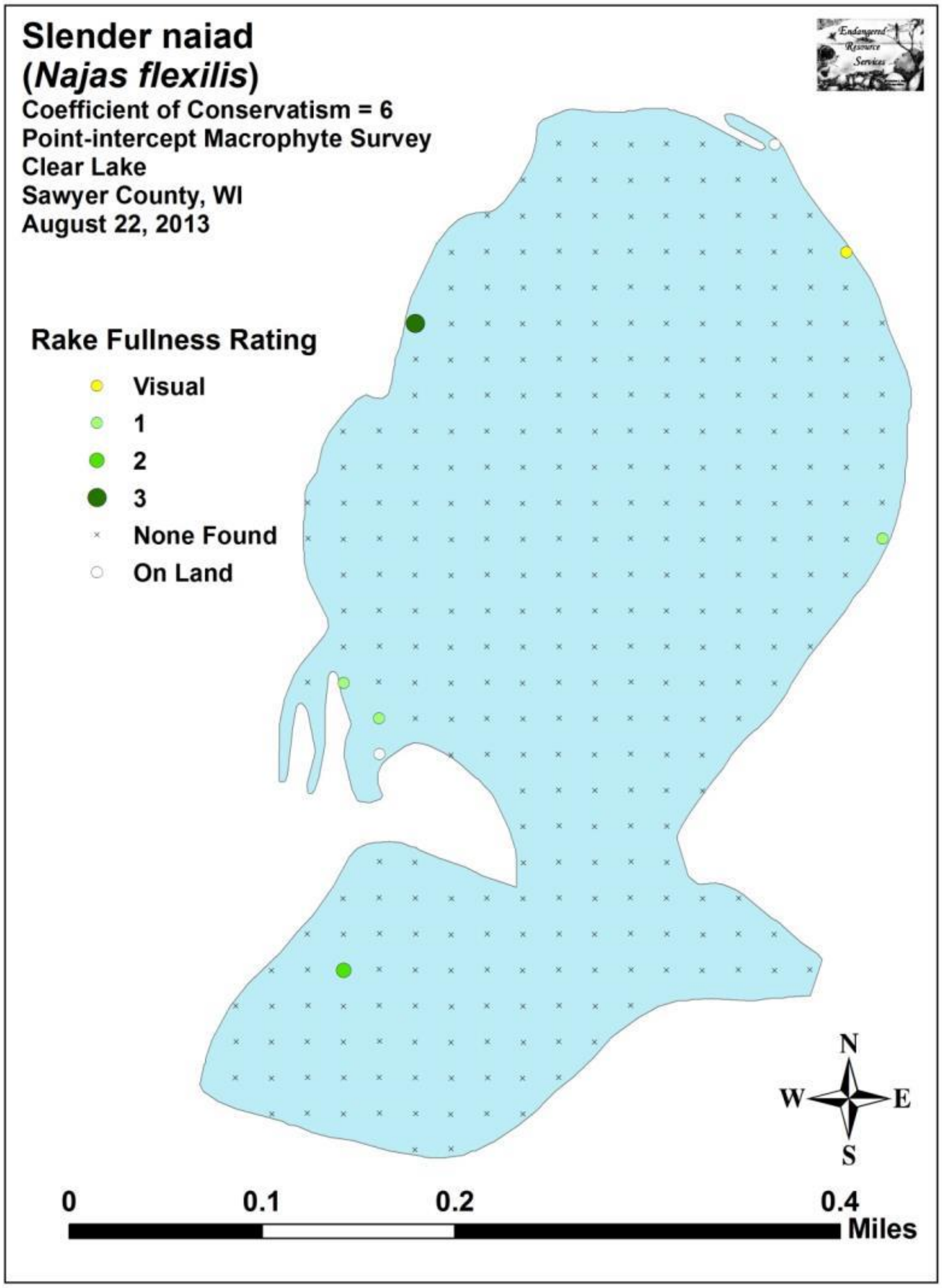
Miles



Slender naiad
(*Najas flexilis*)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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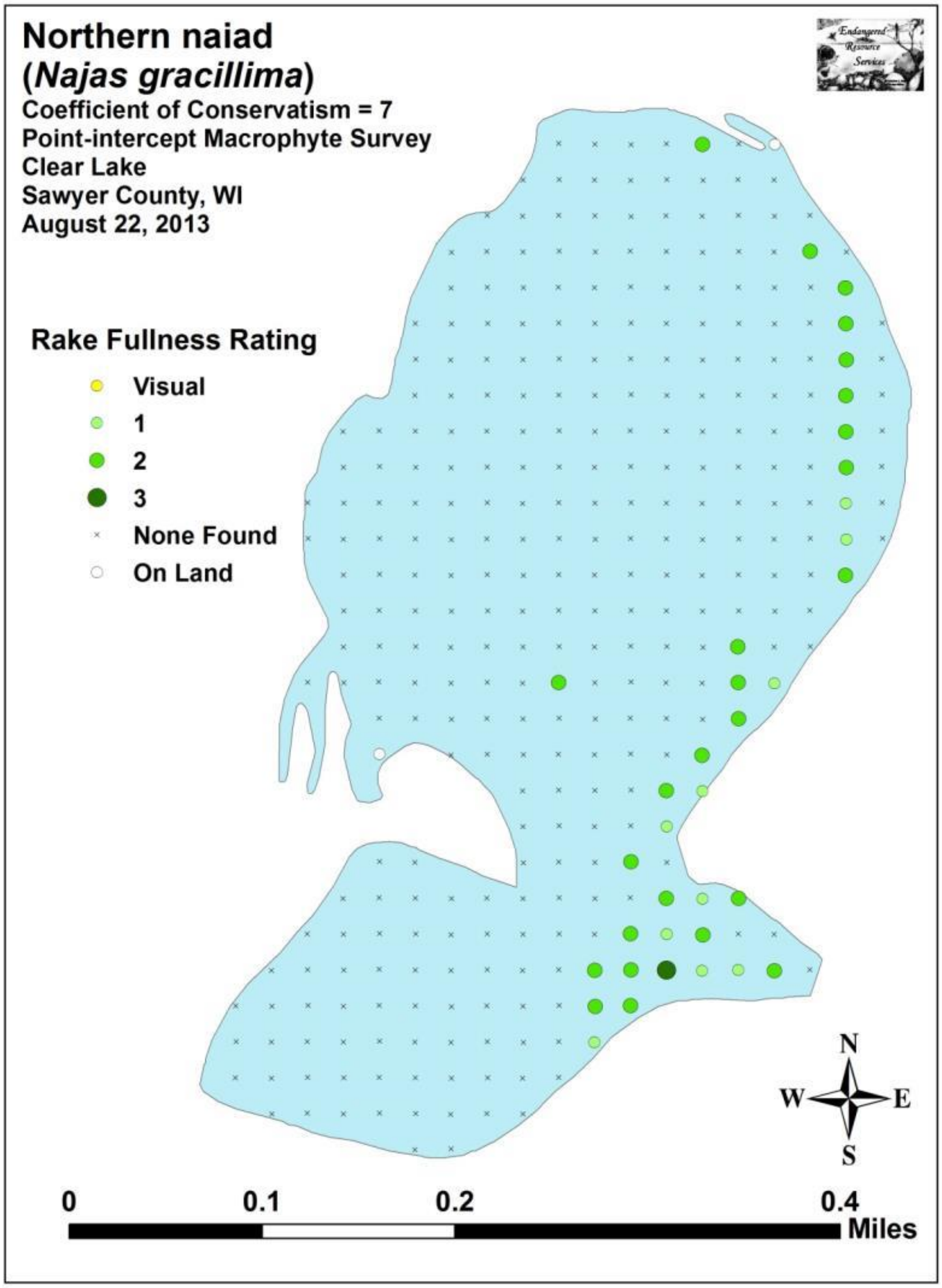
Miles


Northern naiad
(Najas gracillima)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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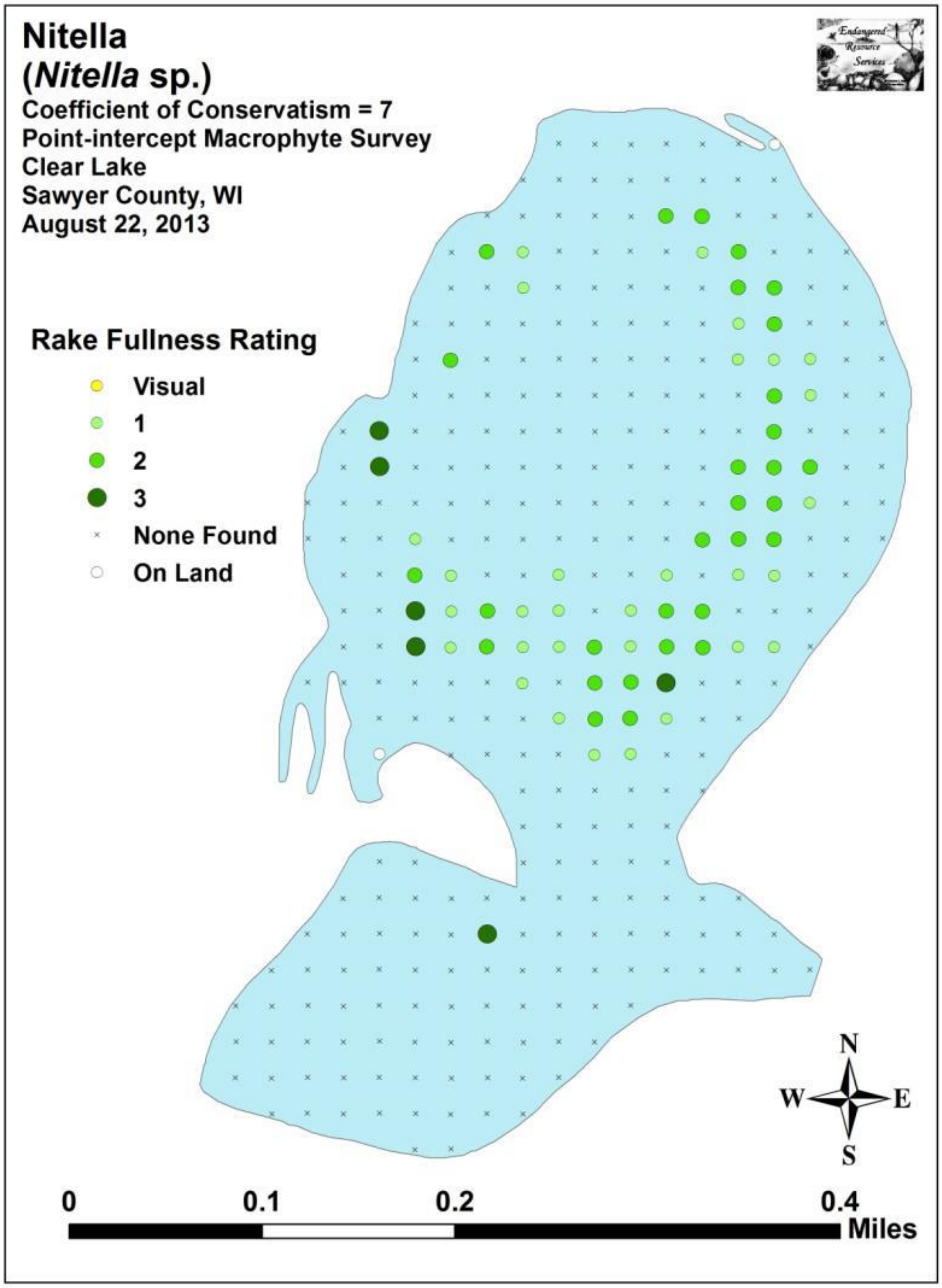
Miles


Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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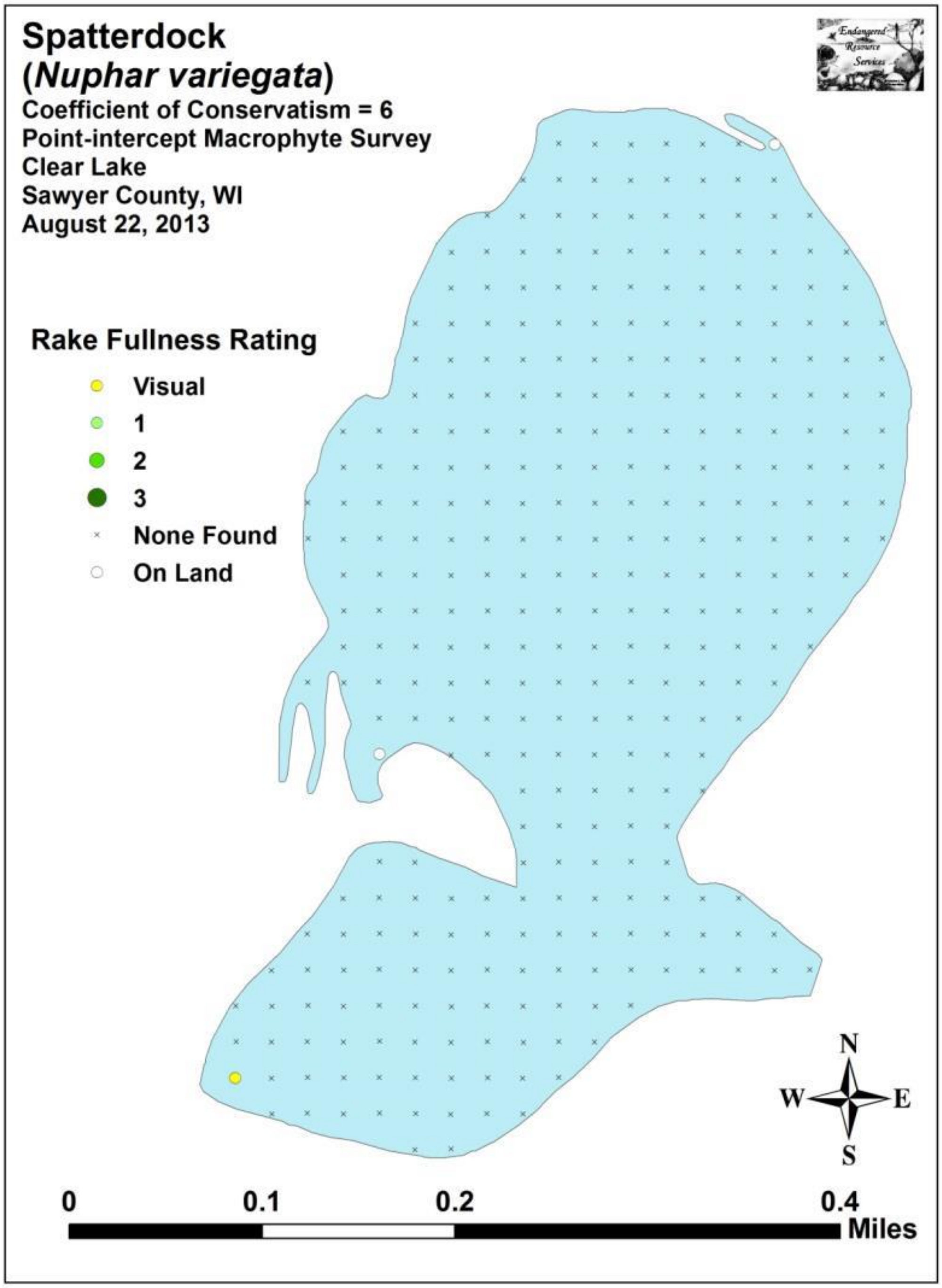
Miles


Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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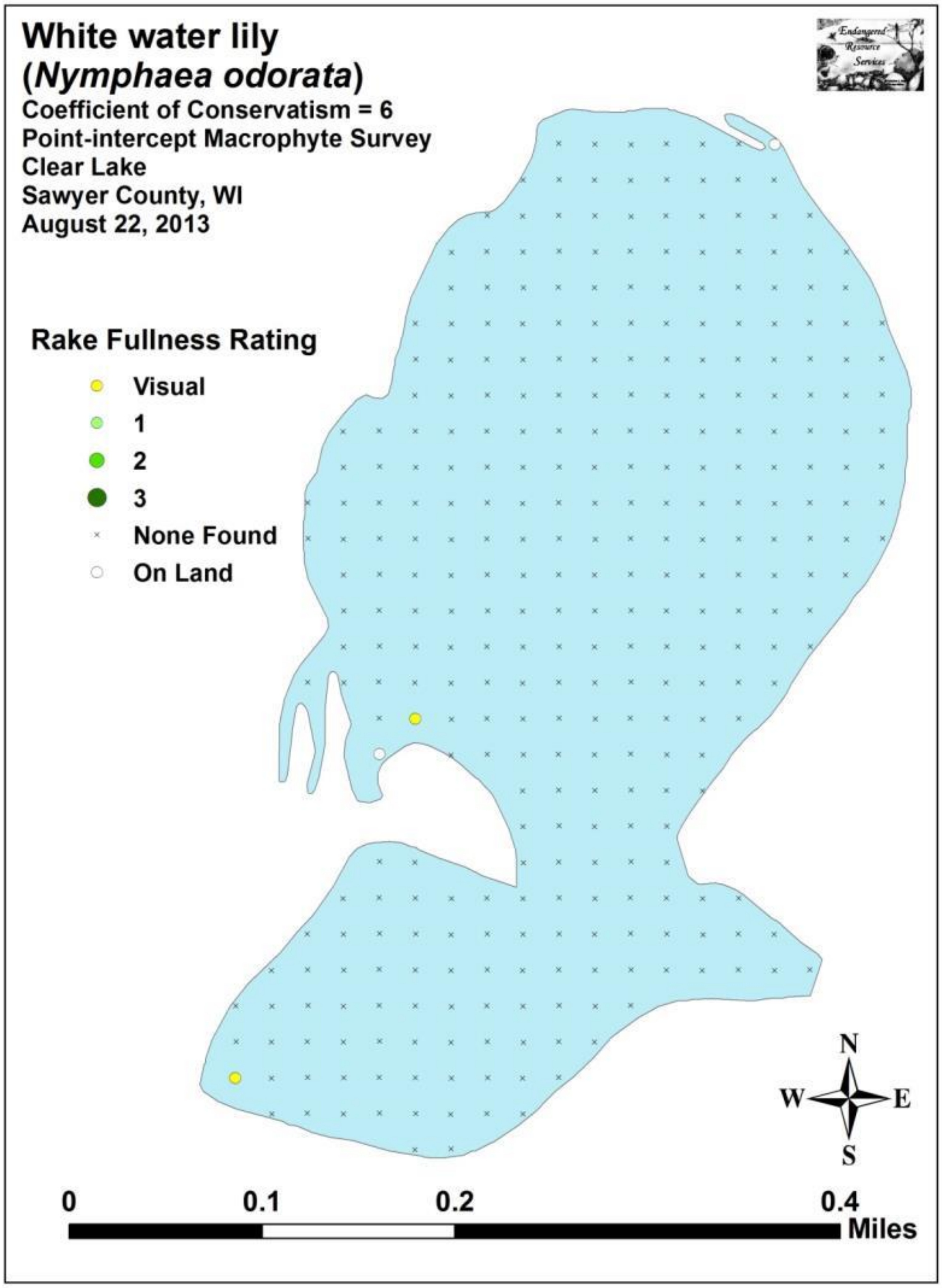
Miles


White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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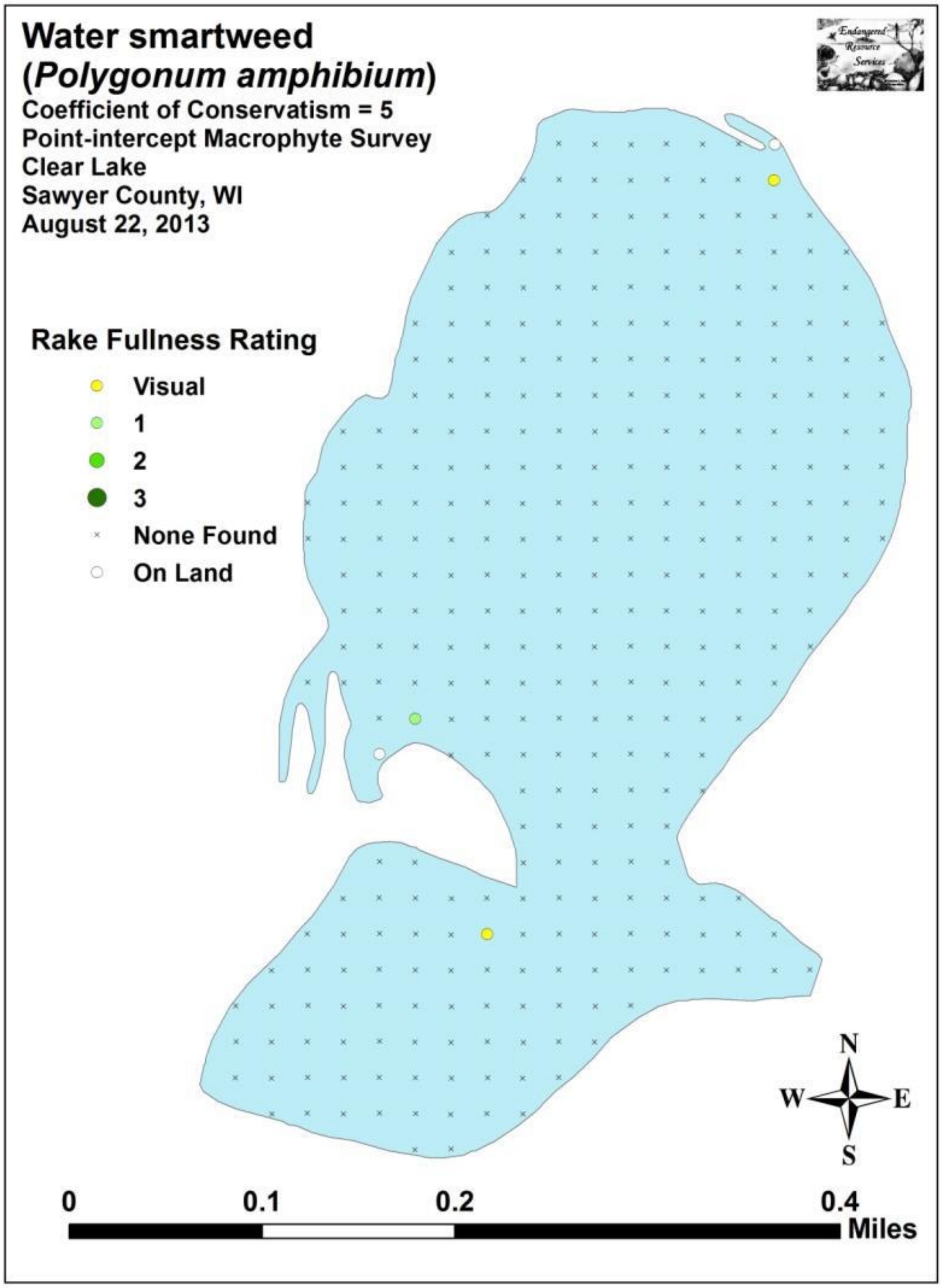
Miles



Water smartweed
(Polygonum amphibium)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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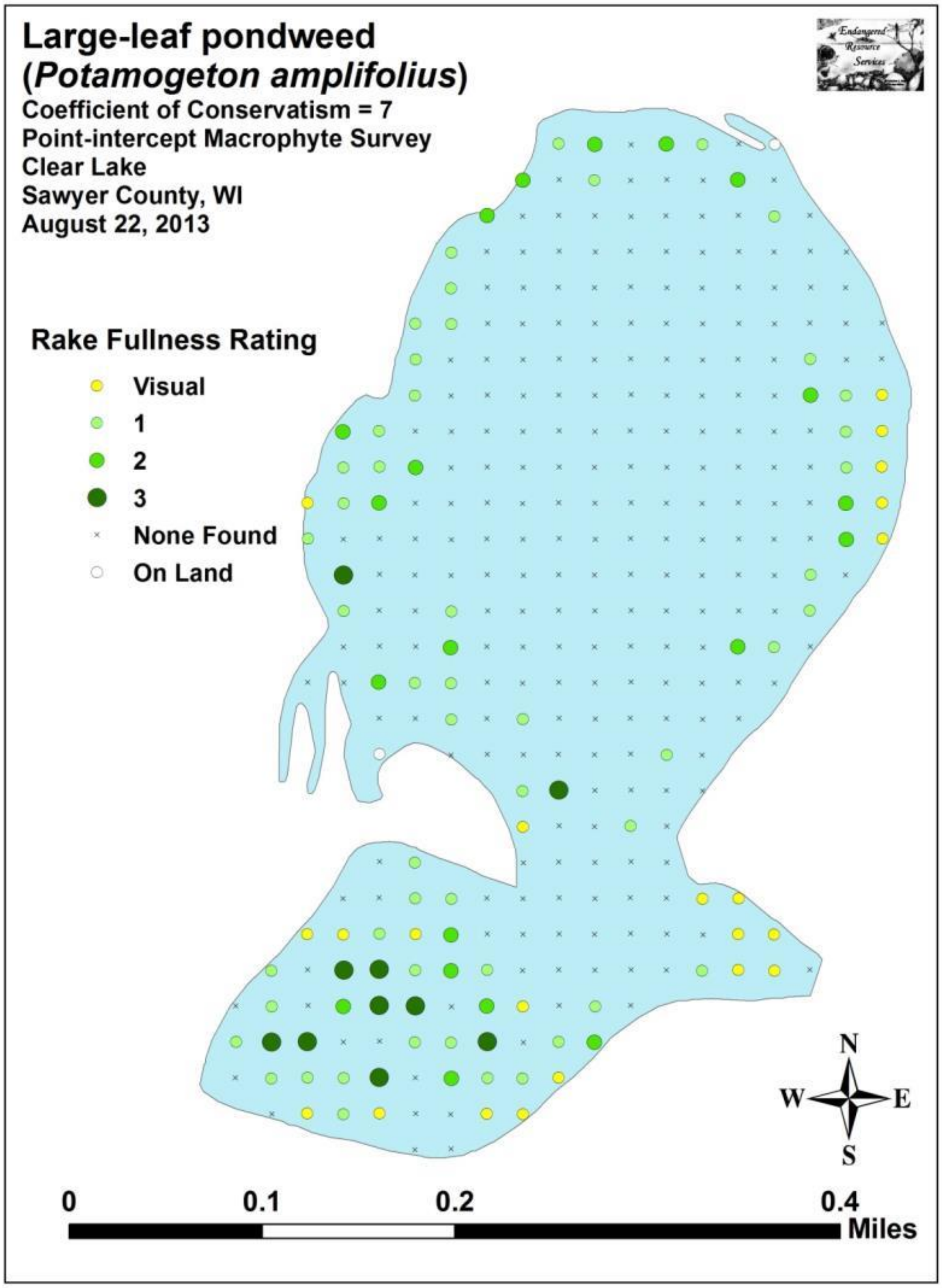
Miles


Large-leaf pondweed
(*Potamogeton amplifolius*)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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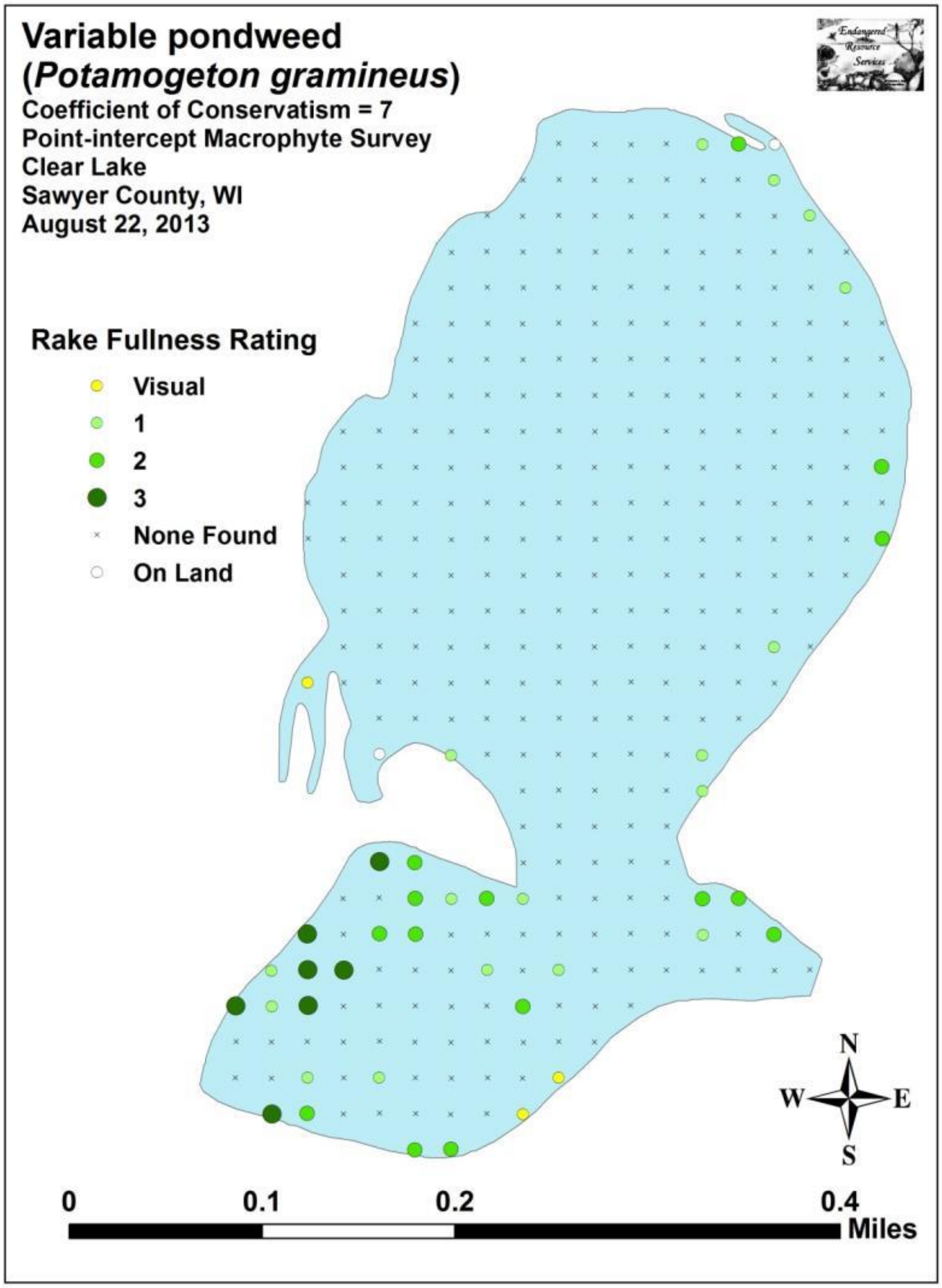
Miles


Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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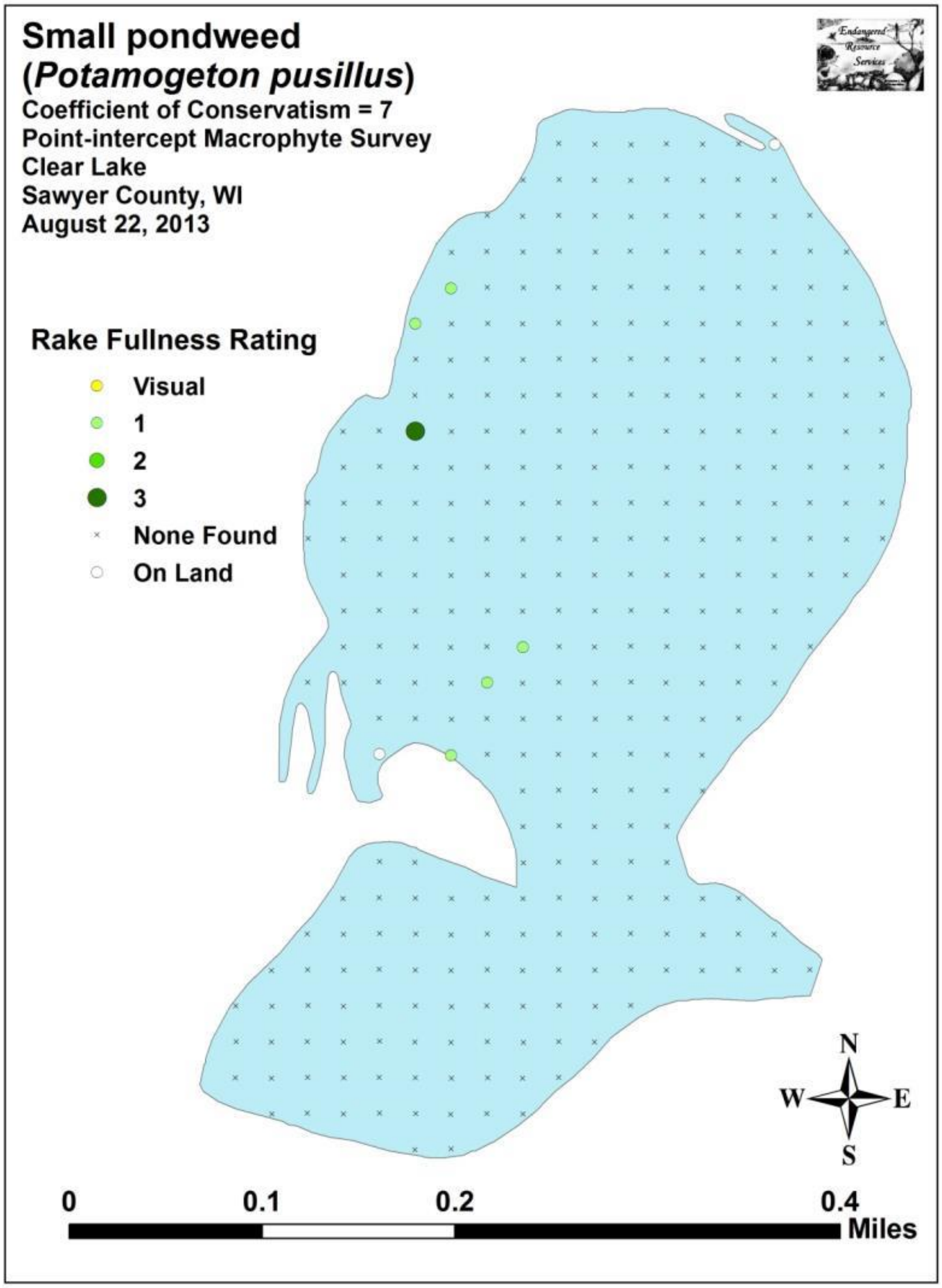
Miles


Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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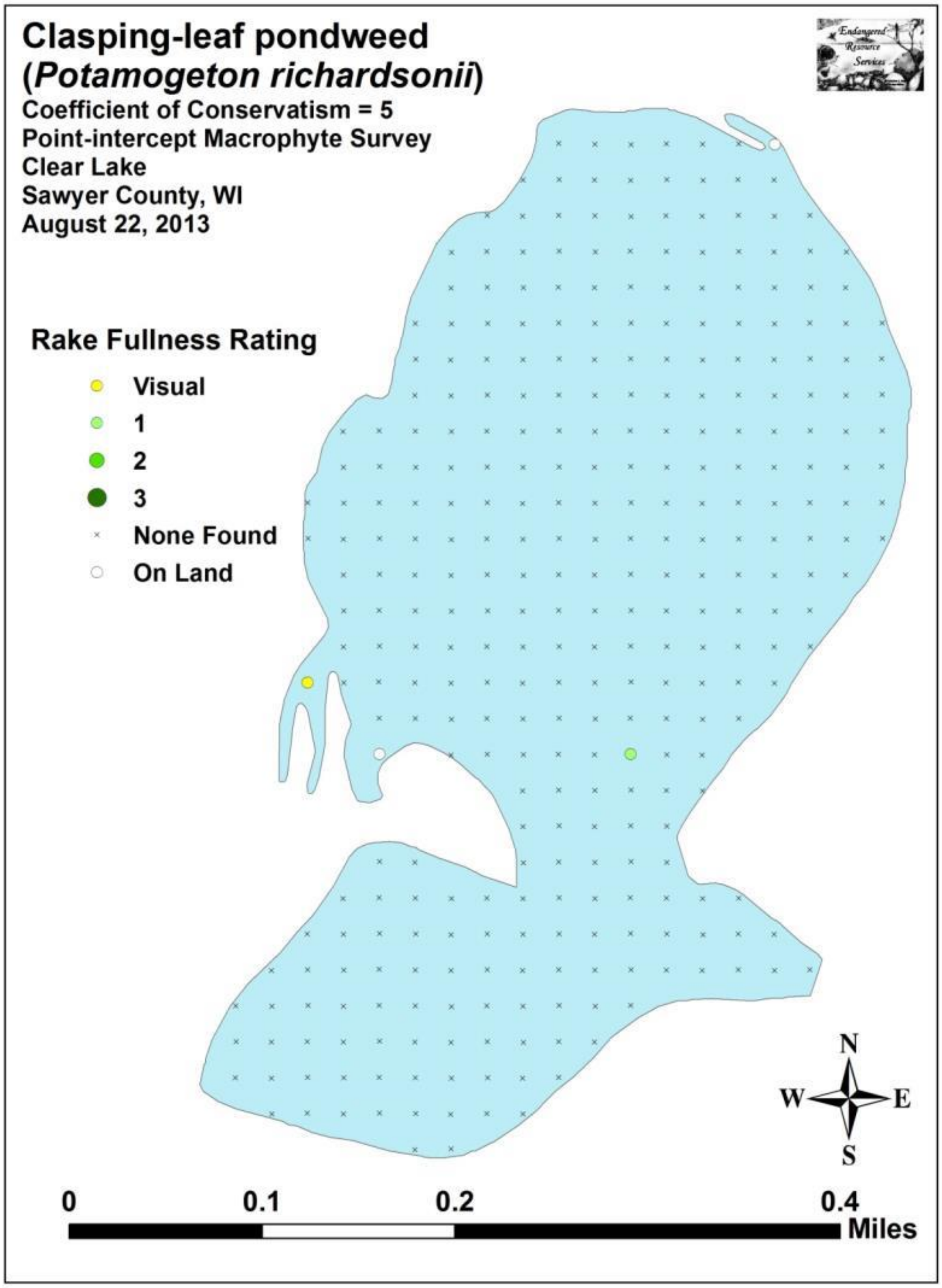
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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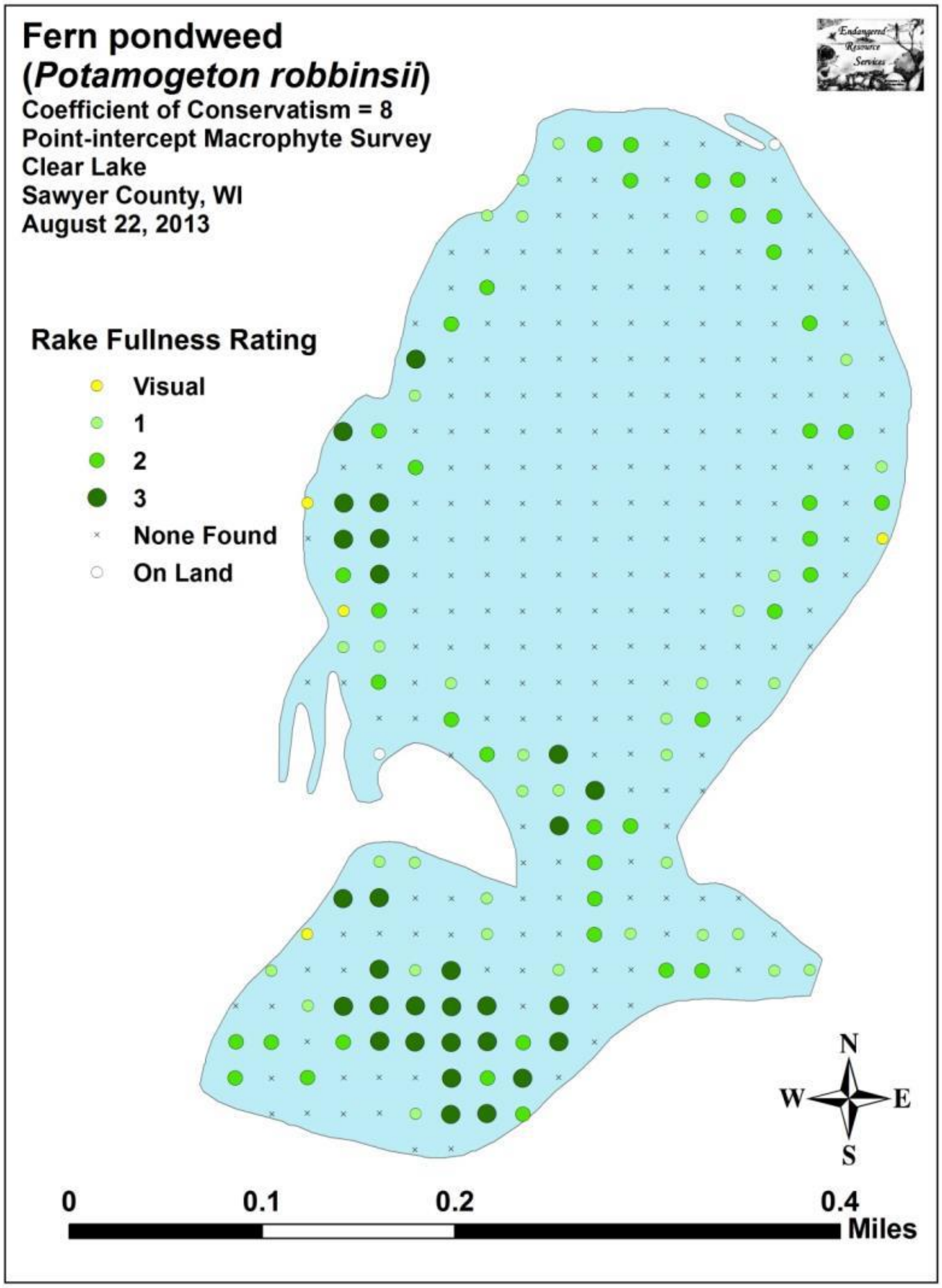
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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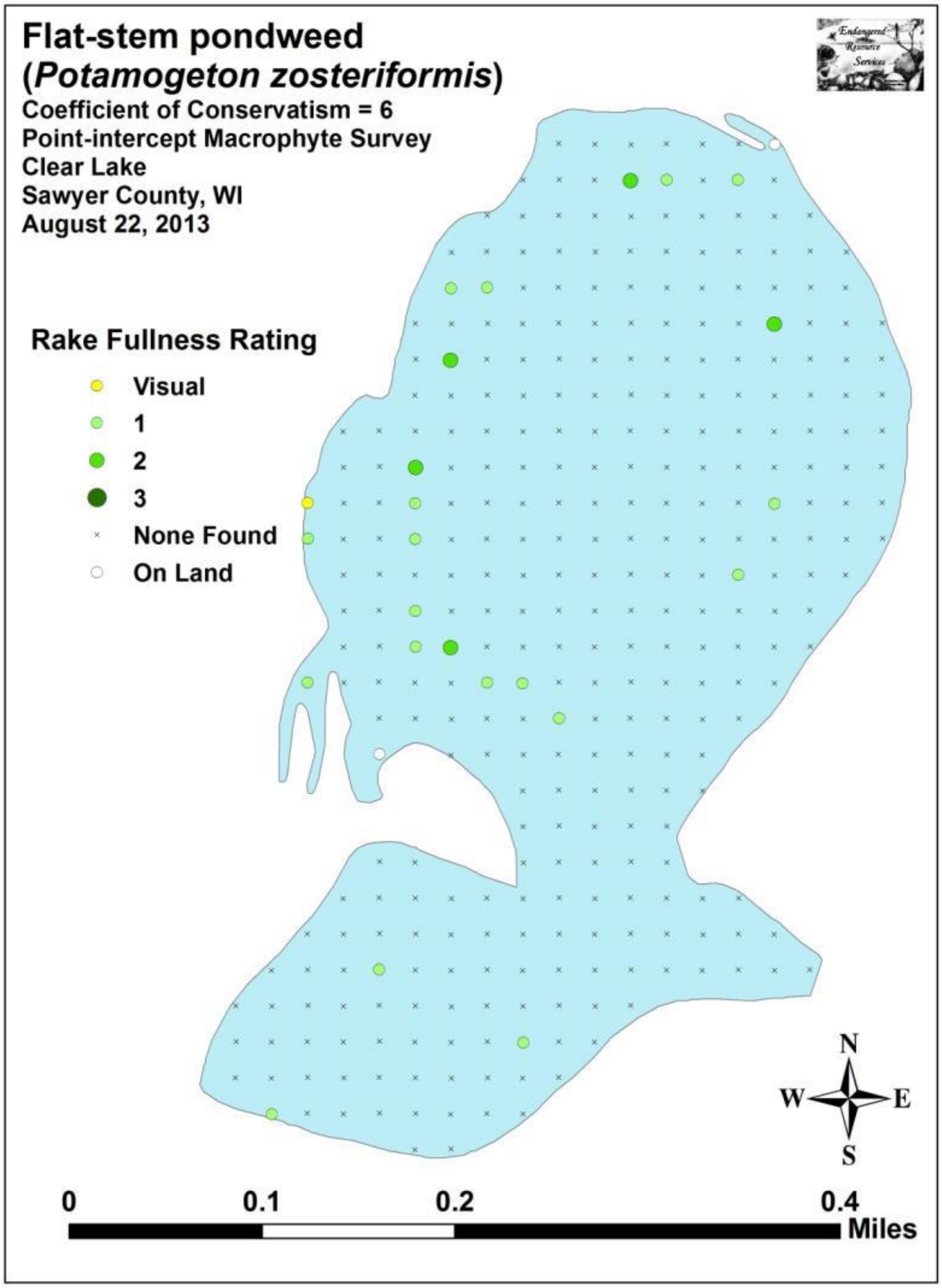
Miles


Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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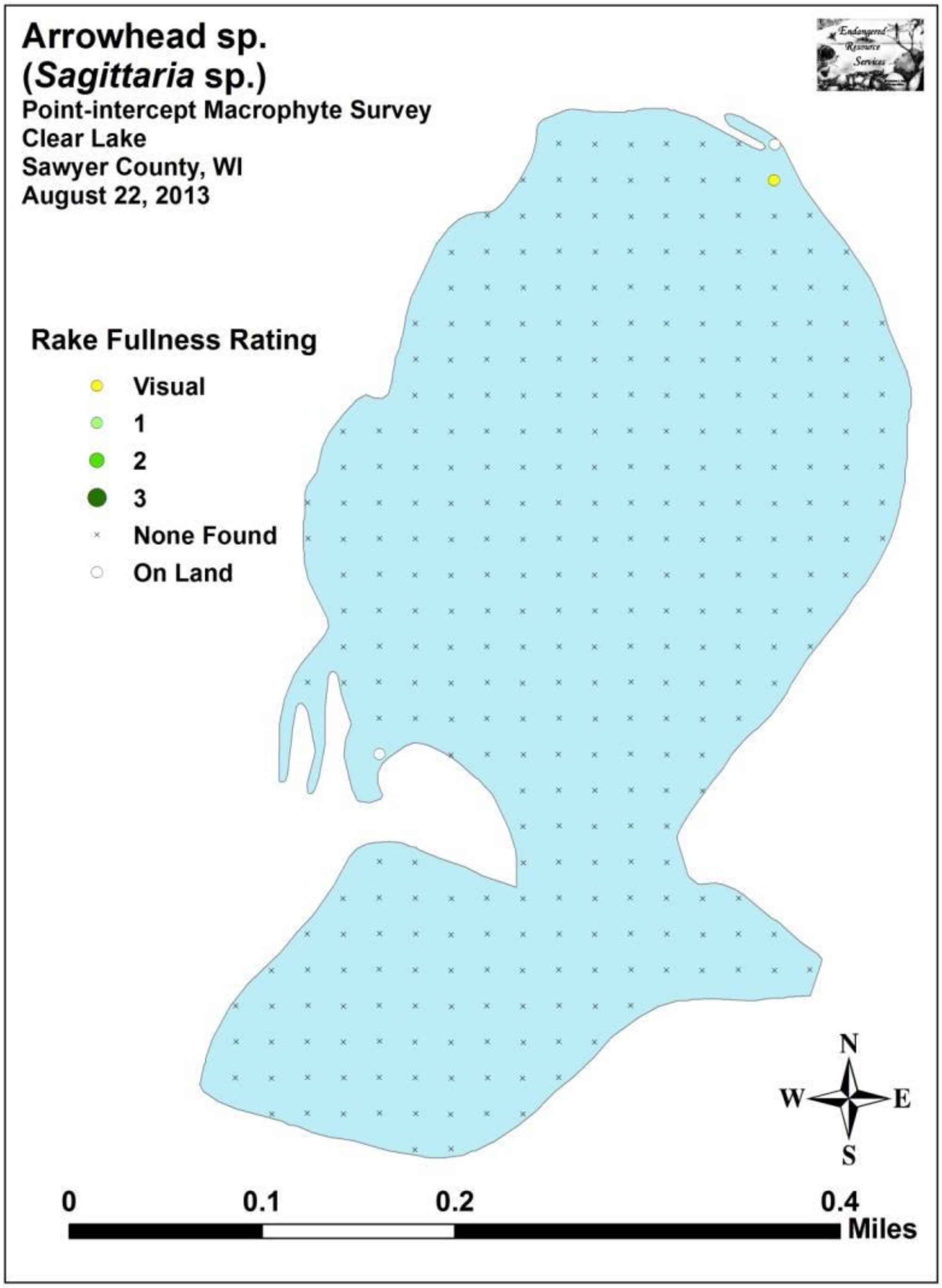
Miles


Arrowhead sp.
(*Sagittaria* sp.)
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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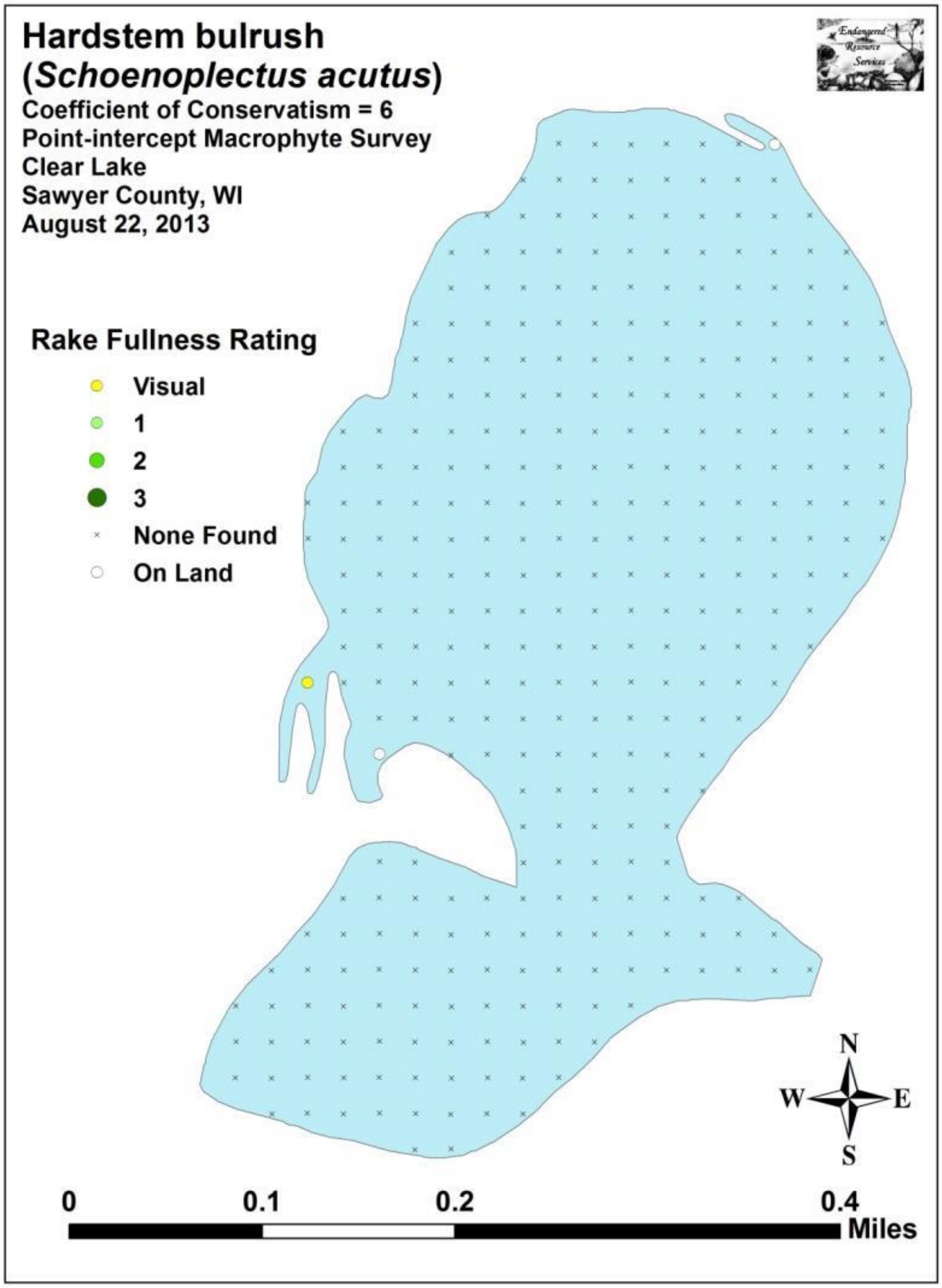
Miles


Hardstem bulrush
(Schoenoplectus acutus)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
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None Found
On Land
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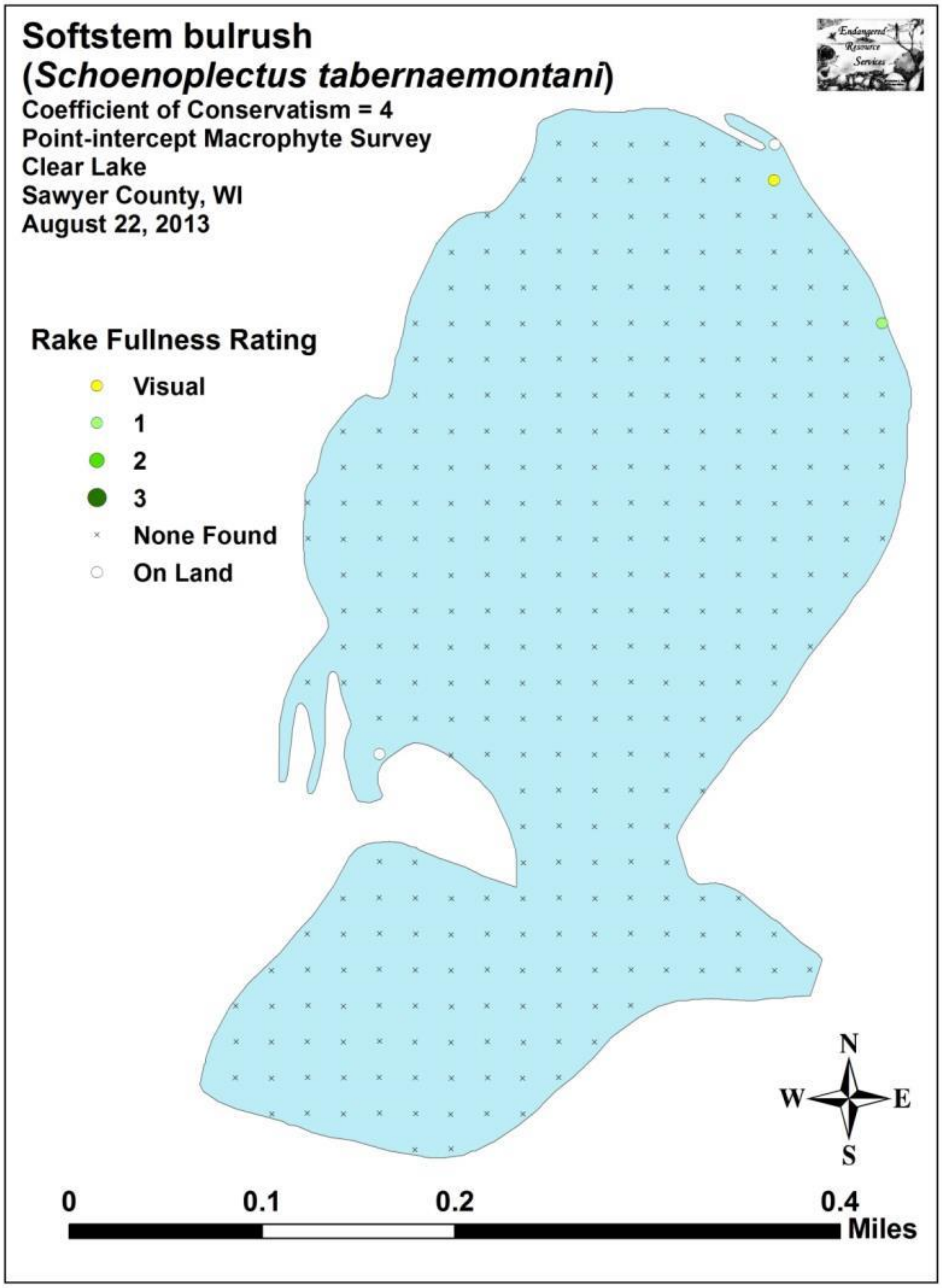
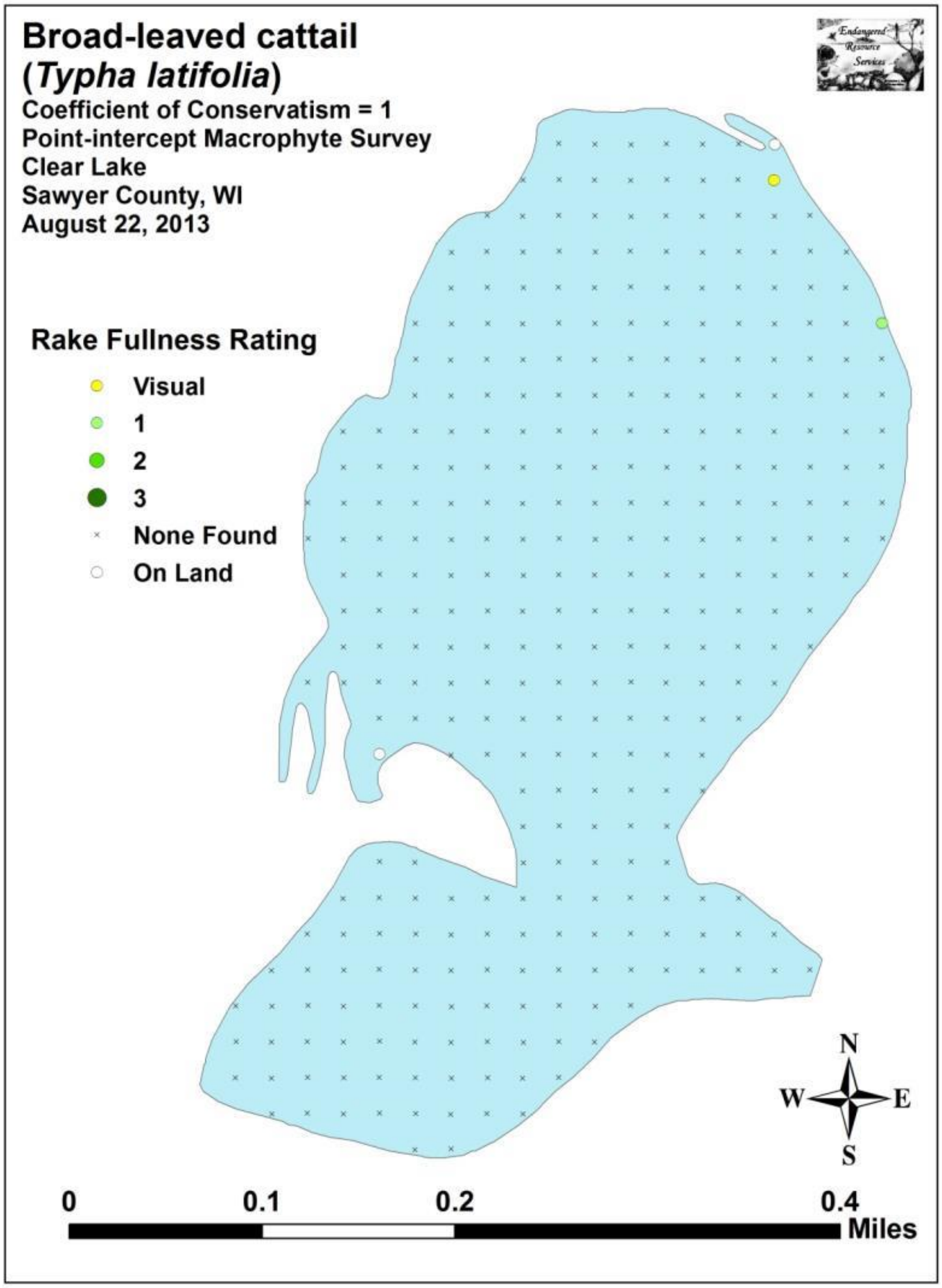
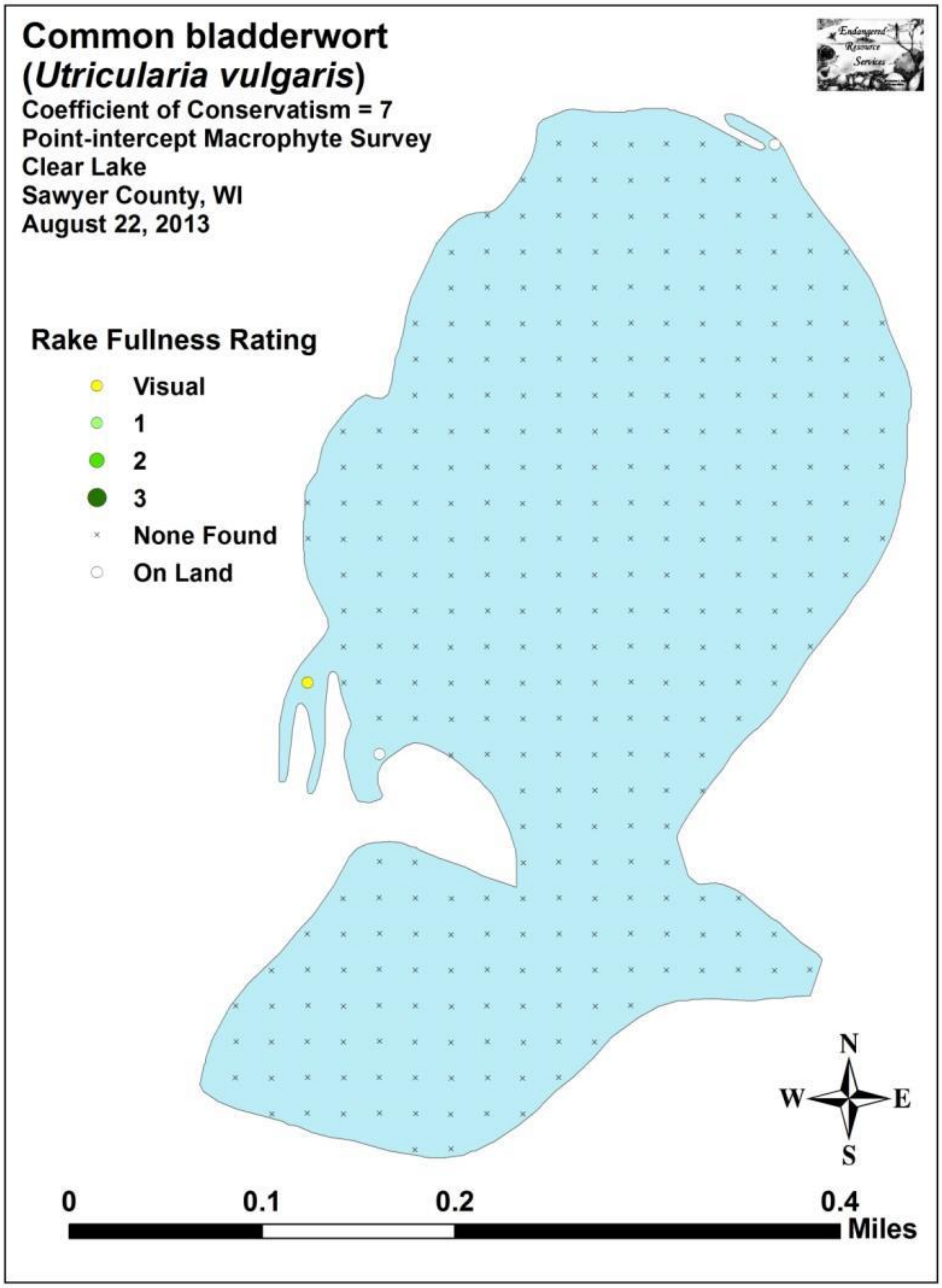
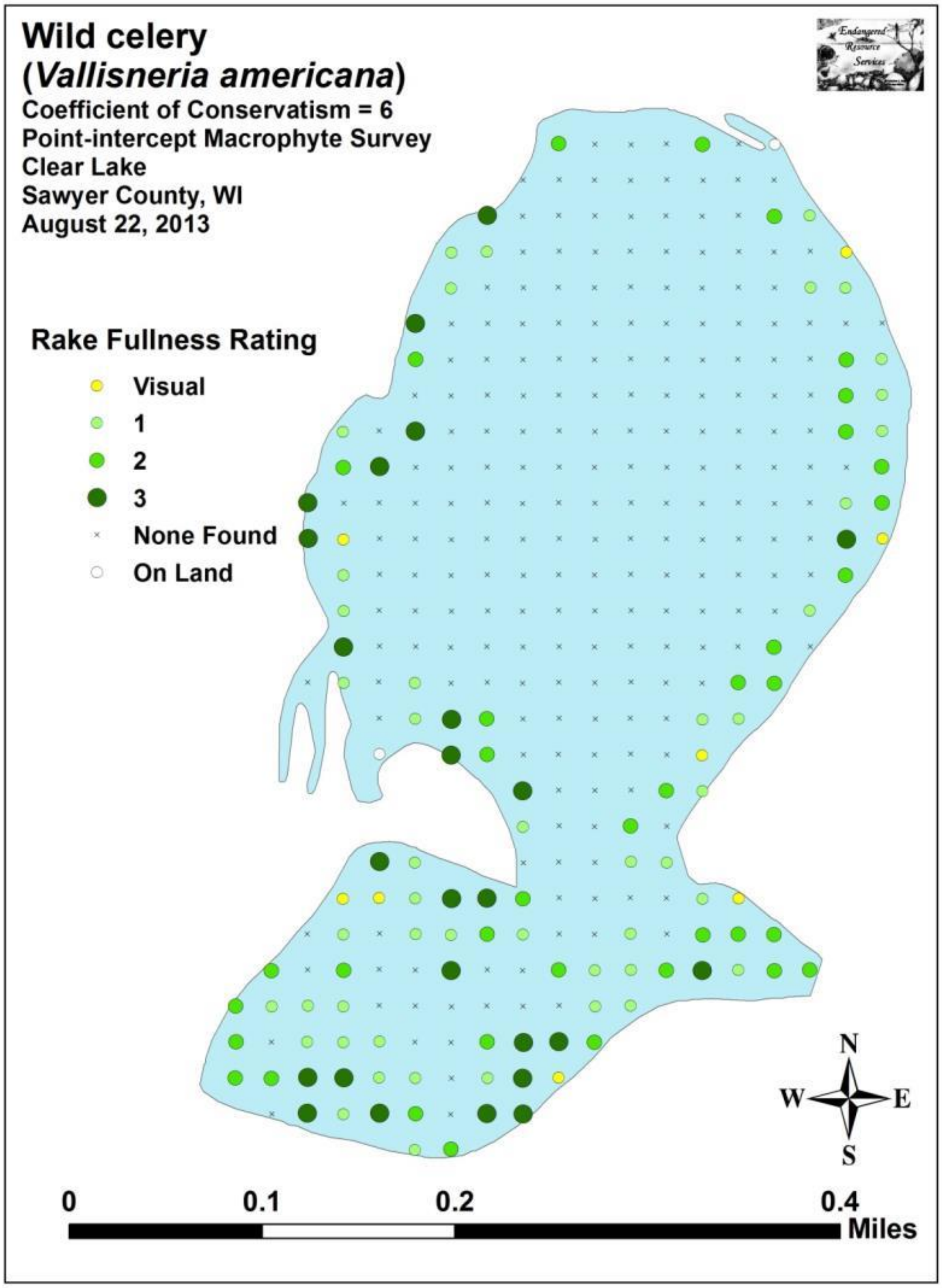
E
S
0
0.1
0.2
0.4
Miles


Softstem bulrush
(Schoenoplectus tabernaemontani)
Coefficient of Conservatism = 4
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
N
W
E
S
0
0.1
0.2
0.4
Miles


Broad-leaved cattail
(*Typha latifolia*)
Coefficient of Conservatism = 1
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
N
W
E
S
0
0.1
0.2
0.4
Miles


Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
N
W
E
S
0
0.1
0.2
0.4
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
N
W
E
S
0
0.1
0.2
0.4
Miles

Appendix VII: 2016 Clear Lakes Plant Species Accounts

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: **Aquatic moss**
Specimen Location: Clear Lake; N46.02111 W91.26573
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-001
Habitat/Distribution: Rare; a single individual was found over muck in approximately 7 meters of water.
Common Associates: (*Nitella flexilis*) Slender nitella

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Bidens beckii*) **Water marigold**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-002
Habitat/Distribution: Scattered locations in 1-3 meters of water over organic and sandy muck.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Potamogeton robbinsii*) Fern pondweed, (*Sparganium emersum*) Short-stemmed bur-reed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Brasenia schreberi*) **Watershield**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-003
Habitat/Distribution: Rare; a few small beds occurred mixed with Spatterdock in the finger bays and in the boat landing channel in <1 meter of water over sandy and organic muck.
Common Associates: (*Bidens beckii*) Water marigold, (*Elodea canadensis*) Common waterweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Sparganium emersum*) Short-stemmed bur-reed, (*Nuphar variegata*) Spatterdock, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Calamagrostis canadensis*) **Bluejoint**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-004
Habitat/Distribution: Plants were scattered around the shoreline in the boat landing bay.
Common Associates: (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus effusus*) Common rush, (*Juncus canadensis*) Canada rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Carex comosa*) **Bottle brush sedge**
Specimen Location: Clear Lake; N46.02359 W91.26152
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-005
Habitat/Distribution: Relatively common scattered along the immediate shoreline in water <0.25m over sand and sandy muck.
Common Associates: (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus canadensis*) Canada rush, (*Juncus effusus*) Common rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Carex crawfordii*) **Crawford's sedge**
Specimen Location: Clear Lake; N46.02359 W91.26152
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-006
Habitat/Distribution: Relatively common scattered along the shoreline in the boat landing bay in water <0.25 over sand and sandy muck.
Common Associates: (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus canadensis*) Canada rush, (*Juncus effusus*) Common rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Carex lasiocarpa*) **Narrow-leaved wooly sedge**
Specimen Location: Clear Lake; N46.02439 W91.26270
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-007
Habitat/Distribution: Abundant on the east/west peninsula due south of the northeastern finger bay in <0.5 meter of water over firm sand.
Common Associates: (*Eleocharis palustris*) Creeping spikerush, (*Glyceria borealis*) Northern manna-grass, (*Typha latifolia*) Broad-leaved cattail

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Carex pseudocyperinus*) **False bottle brush sedge**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-008
Habitat/Distribution: We found a few plants at the immediate shoreline in the boat landing bay.
Common Associates: (*Juncus effusus*) Common rush, (*Juncus canadensis*) Canada rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Ceratophyllum echinatum*) **Spiny hornwort**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-009
Habitat/Distribution: Rare; most plants were scattered in the boat landing channel outlet in water <1 meter deep over muck. A single individual was also found in 6.5meters of water due east of the channel.
Common Associates: (*Chara braunii*) Braun's stonewort, (*Nitella furcata*) Nitella, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Potamogeton spirillus*) Spiral-fruited pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Chara braunii*) **Braun's stonewort**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-010
Habitat/Distribution: Uncommon; most plants seen were near the outlet of the boat landing channel in <1 meter over organic muck.
Common Associates: (*Nitella furcata*) Nitella, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Potamogeton spirillus*) Spiral-fruited pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Chara* sp. possibly *globularis*) **Muskgrass**
Specimen Location: Clear Lake; N46.02142 W91.26263
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-011
Habitat/Distribution: Locally abundant in water from 2-5 meters over sandy muck. Scattered individuals were often found (smelt!) within dense areas of Slender Nitella, although it also occurred in monotypic stands near the edge of the littoral zone.
Common Associates: (*Najas guadalupensis*) Southern naiad, (*Nitella flexilis*) Slender nitella, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Chara* sp.) **Muskgrass**
Specimen Location: Clear Lake; N46.019903 W91.265951
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-012
Habitat/Distribution: Most common in sand/rock bottom areas (especially on exposed points) in water from 0 – 1 meter deep. The common encrusted Chara found along almost the entire shoreline of the lake.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton gramineus*) Variable pondweed, (*Najas flexilis*) Slender naiad, (*Juncus pelocarpus*) Brown-fruited rush

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Comarum palustre*) **Marsh cinquefoil**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-013
Habitat/Distribution: Rare; only plants seen were in the western finger bay immediately south of the boat landing channel in water <1 meter over thick organic muck.
Common Associates: (*Bidens beckii*) Water marigold, (*Brasenia schreberi*) Watershield, (*Elodea canadensis*) Common waterweed, (*Sparganium emersum*) Short-stemmed bur-reed, (*Nuphar variegata*) Spatterdock, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Dulichium arundinaceum*) **Three-way sedge**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-014
Habitat/Distribution: Uncommon scattered along the shoreline in <0.5 meters of water over muck and sandy muck.
Common Associates: (*Bidens beckii*) Water marigold, (*Brasenia schreberi*) Watershield, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Eleocharis acicularis*) **Needle spikerush**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-015
Habitat/Distribution: Relatively common scattered throughout the lake over sand and gravel in water from 1-2.5 meters deep.
Common Associates: (*Chara* sp.) Muskgrass, (*Najas guadalupensis*) Southern naiad, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton pusillus*) Small pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Eleocharis palustris*) **Creeping spikerush**
Specimen Location: Clear Lake; N46.02438 W91.26348
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-016
Habitat/Distribution: A low density bed was present in <1 meter of water over sand and gravel in the north bay near the entrance to the northeast finger bay.
Common Associates: (*Carex lasiocarpa*) Narrow-leaved wooly sedge, (*Eleocharis acicularis*) Needle spikerush, (*Glyceria borealis*) Northern manna-grass, (*Juncus pelocarpus*) Brown-fruited rush

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Elodea canadensis*) **Common waterweed**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-017
Habitat/Distribution: Common throughout much of the littoral zone in 1-5 meters of water over muck and sandy muck
Common Associates: (*Bidens beckii*) Water marigold, (*Najas guadalupensis*) Southern naiad, (*Potamogeton* X *scoliophyllus*) Large-leaf X Illinois pondweed hybrid, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Glyceria borealis*) **Northern manna-grass**
Specimen Location: Clear Lake; N46.02439 W91.26231
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-018
Habitat/Distribution: Rare; a few plants were found in north bay over sand and gravel in <1 meter of water. Unfortunately, no individuals were in fruit.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Eleocharis palustris*) Creeping spikerush, (*Juncus pelocarpus*) Brown-fruited rush

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Glyceria canadensis*) **Rattlesnake manna-grass**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-019
Habitat/Distribution: Plants scattered around the shoreline in the boat landing bay.
Common Associates: (*Juncus effusus*) Common rush, (*Juncus canadensis*) Canada rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Heteranthera dubia*) **Water star-grass**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-020
Habitat/Distribution: Uncommon, but widely scattered throughout the lake growing over sand and sandy muck in water usually < 1.5 meters deep.
Common Associates: (*Chara* sp.) Muskgrass, (*Potamogeton pusillus*) Small pondweed, (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Juncus brevicaudatus*) **Narrow-panicle rush**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-021
Habitat/Distribution: Plants were scattered around the immediate shoreline in the boat landing bay.
Common Associates: (*Juncus effusus*) Common rush, (*Glyceria canadensis*) Rattlesnake manna-grass, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Juncus canadensis*) **Canada rush**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-022
Habitat/Distribution: Plants were scattered around the immediate shoreline in the boat landing bay.
Common Associates: (*Juncus effusus*) Common rush, (*Glyceria canadensis*) Rattlesnake manna-grass, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Juncus effusus*) **Common rush**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-023
Habitat/Distribution: Relatively common scattered along the shoreline of the entire lake in water <0.25m over sand and sandy muck.
Common Associates: (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus canadensis*) Canada rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Juncus pelocarpus*) **Brown-fruited rush**
Specimen Location: Clear Lake; N46.02439 W91.26231
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-024
Habitat/Distribution: Rare; a few plants were found in the north bay over sand/gravel in <1 meter of water.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Eleocharis palustris*) Creeping spikerush, (*Glyceria borealis*) Northern manna-grass, (*Littorella uniflora*) Littorella

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Leersia oryzoides*) **Rice cut-grass**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-025
Habitat/Distribution: A few plants were scattered around the immediate shoreline in the boat landing bay.
Common Associates: (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus effusus*) Common rush, (*Juncus canadensis*) Canada rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Lemna minor*) **Small duckweed**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-026
Habitat/Distribution: Rare; the only plants seen were scattered among emergents in <1 meter over muck in the boat landing bay.
Common Associates: (*Chara braunii*) Braun's stonewort, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Potamogeton spirillus*) Spiral-fruited pondweed, (*Riccia fluitans*) Slender riccia

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Littorella uniflora*) **Littorella**
Specimen Location: Clear Lake; N46.02426 W91.26243
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-027
Habitat/Distribution: Rare; perhaps 10-15 total plants found in north bay over sand and gravel in <1 meter of water.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Eleocharis palustris*) Creeping spikerush, (*Glyceria borealis*) Northern manna-grass, (*Juncus pelocarpus*) Brown-fruited rush

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Myriophyllum spicatum*) **Eurasian water-milfoil**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified : Matthew S. Berg **Col. #:** MSB-2016-028
Habitat/Distribution: Uncommon in water from 2-3 meters over muck and sand bottoms. Most plants seen were in the northwest bay although widely scattered individuals occurred throughout the lake; especially in the south bay.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Myriophyllum tenellum*) **Dwarf water-milfoil**
Specimen Location: Clear Lake; N46.02439 W91.26231
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-029
Habitat/Distribution: Uncommon but widely scattered throughout over sand in 1-2.5 meters of water.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Potamogeton gramineus*) Variable pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Najas flexilis*) **Slender naiad**
Specimen Location: Clear Lake; N46.01925 W91.26336
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-030
Habitat/Distribution: Regularly encountered scattered over sand in water from 0.5-1.5 meters.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Najas gracillima*) **Northern naiad**
Specimen Location: Clear Lake; N46.02116 W91.26147
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-031
Habitat/Distribution: Scattered throughout the lake in 1.5-3.0 meters of water mainly over sand.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Najas guadalupensis*) **Southern naiad**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-032
Habitat/Distribution: Common and widely distributed throughout the lake over sand and sandy muck in 1-4 meters in depth. Broadest leaves >1mm, and olive color differentiate it from less common *N. flexilis*.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Nitella furcata* – likely) **Nitella**
Specimen Location: Clear Lake; N46.020412 W91.267280
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-033
Habitat/Distribution: Rare; the only plants seen were near the outlet from the boat landing channel in water <1 meter over organic muck.
Common Associates: (*Chara braunii*) Braun's stonewort, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton spirillus*) Spiral-fruited pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Nitella flexilis*) **Slender nitella**
Specimen Location: Clear Lake; N46.02142 W91.26263
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-034
Habitat/Distribution: Abundant throughout the main basin where it was found over sandy muck in 2-5 meters of water. It was the deepest growing plant in the lake, and was often monotypic at the edge of the littoral zone where it frequently grew in dense beds up to a meter thick.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton* X *scoliophyllus*) Large-leaf X Illinois pondweed hybrid, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Nitella tennuissima*) **Dwarf nitella**
Specimen Location: Clear Lake; N46.01976 W91.26647
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-035
Habitat/Distribution: Uncommon; a few scattered individuals were found over sand and gravel in <1 meter of water along the shoreline.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton pusillus*) Small pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Nuphar variegata*) **Spatterdock**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-036
Habitat/Distribution: Uncommon over sandy muck in 0.5-2 meters of water. Most beds were in the finger bays and along the western shoreline of the south bay.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Polygonum amphibium*) **Water smartweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-037
Habitat/Distribution: Scattered beds occurred along the shoreline over firm sand in water <1 meter deep.
Common Associates: (*Najas guadalupensis*) Southern naiad, (*Potamogeton gramineus*) Variable pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton amplifolius*) **Large-leaf pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-038
Habitat/Distribution: Common throughout the lake over muck and sandy muck 1-4 meters. Half-moon shaped leaves and leaf veins >25 were diagnostic in separating this parent species from the very similar looking hybrids which generally had 23 veins.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton* X *scoliophyllus*) Large-leaf X Illinois pondweed hybrid, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton epihydrus*) **Ribbon leaf pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-039
Habitat/Distribution: Rare; most plants were in the boat landing outlet channel over organic muck in <1m of water.
Common Associates: (*Bidens beckii*) Water marigold, (*Brasenia schreberi*) Watershield, (*Elodea canadensis*) Common waterweed, (*Nuphar variegata*) Spatterdock, (*Potamogeton natans*) Floating-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton spirillus*) Spiral-fruited pondweed, (*Sparganium emersum*) Short-stemmed bur-reed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton foliosus*) **Leafy pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-040
Habitat/Distribution: Found scattered throughout the lake over sand and sandy muck in water from 1-2.5 meters.
Common Associates: (*Najas guadalupensis*) Southern naiad, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton gramineus*) **Variable pondweed**
Specimen Location: Clear Lake ; N46.01845 W91.26218
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-041
Habitat/Distribution: Fairly common over sand and sandy muck in 0.5-3.5 meters of water.
Common Associates: (*Chara* sp.) Muskgrass, (*Najas guadalupensis*) Southern naiad, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton natans*) **Floating-leaf pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-042
Habitat/Distribution: Rare; most plants were in the boat landing outlet channel over organic muck in <1m of water.
Common Associates: (*Bidens beckii*) Water marigold, (*Brasenia schreberi*) Watershield, (*Elodea canadensis*) Common waterweed, (*Nuphar variegata*) Spatterdock, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton spirillus*) Spiral-fruited pondweed, (*Sparganium emersum*) Short-stemmed bur-reed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton pusillus berchtoldii*) **Small pondweed**
Specimen Location: Clear Lake; N46.02246 W91.26615
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-043
Habitat/Distribution: Scattered throughout the lake, ranging in depths from 4-6 meters with muck bottom. Told from *pusillus* by the capitate flower/fruit clusters in the axles of the leaves.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Nitella flexilis*) Slender nitella

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton pusillus pusillus*) **Small pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-044
Habitat/Distribution: Scattered throughout the lake, ranging in depths from 1-2.5 meters mainly over sandy bottoms. Told from *berchtoldii* by the terminal flowers/fruit in divided whorls.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton robbinsii*) **Fern pondweed**
Specimen Location: Clear Lake; N46.02142 W91.26263
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-045
Habitat/Distribution: A dominant species found throughout the lake over sandy and organic muck in 1-5 meters of water.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton* X *scoliophyllus*) Large-leaf X Illinois pondweed hybrid, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton spirillus*) **Spiral-fruited pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-046
Habitat/Distribution: Rare; only plants seen were in the boat landing channel in water <1 meter deep over organic muck.
Common Associates: (*Chara braunii*) Braun's stonewort, (*Lemna minor*) Small duckweed, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton natans*) Floating-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton vaseyi*) **Vasey's pondweed**
Specimen Location: Clear Lake; N46.02439 W91.26231
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-047
Habitat/Distribution: Rare; a few individuals were found in the rake with diagnostic micro turions and single central vein. No individuals had floating leaves. Plants were growing over sandy muck in water from 1-2 meters deep.
Common Associates: (*Bidens beckii*) Water marigold**,** (*Potamogeton pusillus*) Small pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton natans*) Floating-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton* X *scoliophyllus*)
Large-leaf X Illinois pondweed hybrid (likely)
Specimen Location: Clear Lake; N46.02170 W91.26148
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-048
Habitat/Distribution: Abundant throughout the lake over sand and sandy muck in water from 2-5.0 meters. Plant definitely has *amplifolius* as a parent species based on the half-moon shape of some leaves. Most individuals have leaf vein counts of 23 (21-25) which is exactly between the two presumed parent species.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Potamogeton zosteriformis*) **Flat-stem pondweed**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-049
Habitat/Distribution: Scattered throughout the lake over sandy muck in water from 2-6 meters deep.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Nitella flexilis*) Slender nitella, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton* X *scoliophyllus*) Large-leaf X Illinois pondweed hybrid, (*Potamogeton robbinsii*) Fern pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Riccia fluitans*) **Slender riccia**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-050
Habitat/Distribution: Rare; the only plants seen were in the boat landing channel in water <1 meter over organic muck mixed-in among the emergents.
Common Associates: (*Carex comosa*) Bottle brush sedge, (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus canadensis*) Canada rush, (*Lemna minor*) Small duckweed, (*Potamogeton spirillus*) Spiral-fruited pondweed, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Sagittaria cristata*) **Crested arrowhead**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-051
Habitat/Distribution: Uncommon, but widely scattered throughout the lake in shoreline areas in water <1.5m deep.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Myriophyllum tenellum*) Dwarf water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Schoenoplectus tabernaemontani*) **Softstem bulrush**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-052
Habitat/Distribution: Scattered shoreline locations over sand and sandy muck in <0.25m of water.
Common Associates: (*Carex comosa*) Bottle brush sedge, (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus canadensis*) Canada rush, (*Juncus effusus*) Common rush, (*Scirpus cyperinus*) Woolgrass

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Scirpus cyperinus*) **Woolgrass**
Specimen Location: Clear Lake; N46.02164 W91.26729
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-053
Habitat/Distribution: Scattered shoreline locations over sand and sandy muck in <0.25m of water.
Common Associates: (*Carex comosa*) Bottle brush sedge, (*Glyceria canadensis*) Rattlesnake manna-grass, (*Juncus effusus*) Common rush, (*Juncus canadensis*) Canada rush, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Sparganium emersum*) **Short-stemmed bur-reed**
Specimen Location: Clear Lake; N46.02439 W91.26270
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-054
Habitat/Distribution: Uncommon; found in sandy muck in <1meter of water in the boat landing channel and in the finger bay in the northeast corner. Achene beaks were mostly 4-5mm in length and strongly curved. The bottom of the achene was heavily spotted.
Common Associates: (*Potamogeton robbinsii*) Fern pondweed, (*Bidens beckii*) Water marigold, (*Potamogeton natans*) Floating-leaf pondweed, (*Elodea canadensis*) Common waterweed, (*Nuphar variegata*) Spatterdock, (*Utricularia vulgaris*) Common bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Typha latifolia*) **Broad-leaved cattail**
Specimen Location: Clear Lake; N46.02439 W91.26270
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-055
Habitat/Distribution: Scattered individuals occurred among the sedges on the bog island in the north bay.
Common Associates: (*Carex lasiocarpa*) Narrow-leaved wooly sedge

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Typha* X *glauca*) **Hybrid Cattail**
Specimen Location: Clear Lake; N46.02437 W91.26425
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-056
Habitat/Distribution: Scattered small beds occurred along the northwest and north shorelines.
Common Associates: (*Juncus effusus*) Common rush

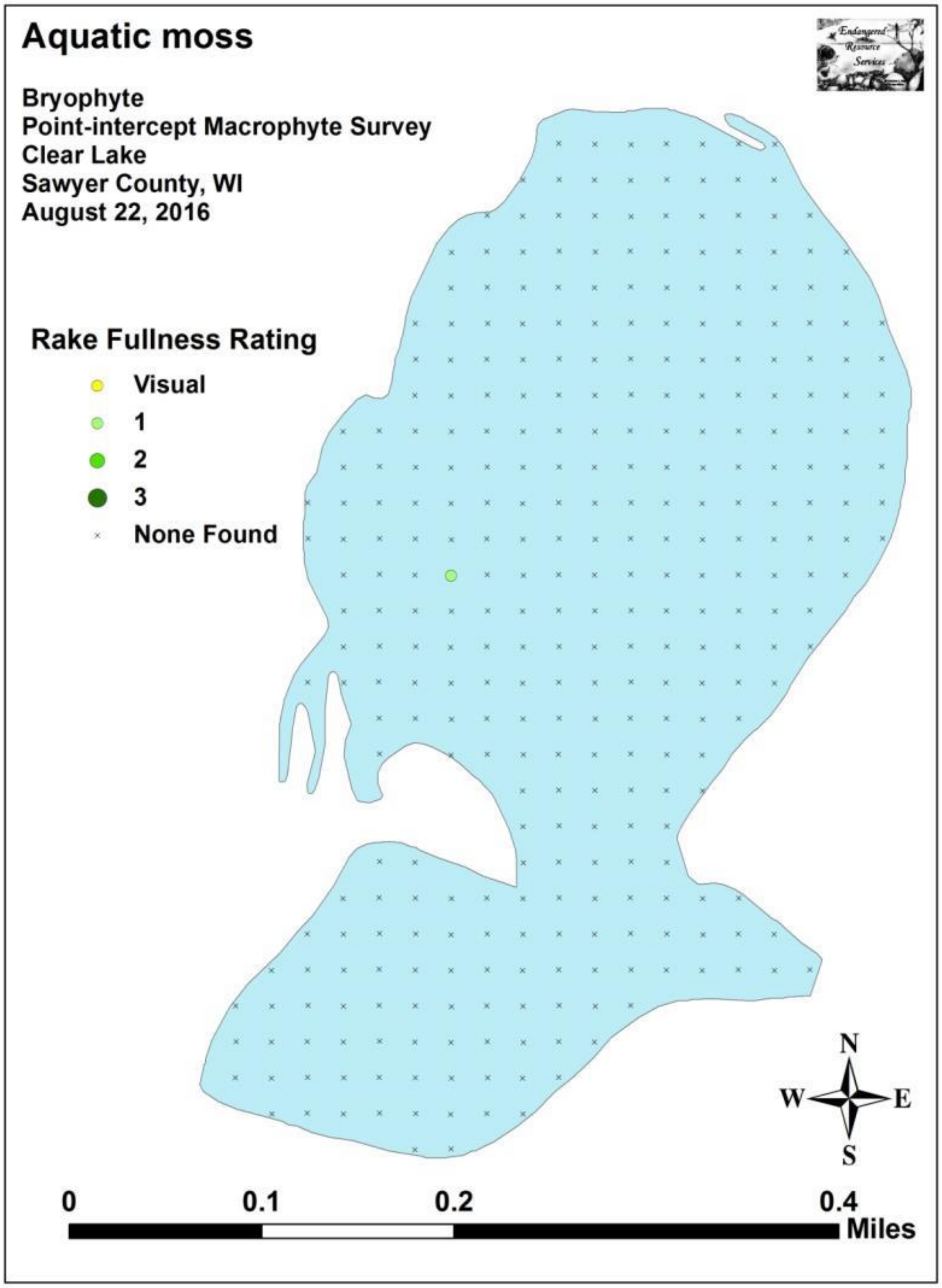
County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Utricularia gibba*) **Creeping bladderwort**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-057
Habitat/Distribution: Uncommon throughout the lake at a depth of 2-3.5 meters over muck. Plants were either on the bottom or entangled in other species.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Utricularia intermedia*) **Flat-leaf bladderwort**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-058
Habitat/Distribution: Rare; the only plants seen were in the western finger bay immediately south of the boat landing channel in water <1 meter over thick organic muck.
Common Associates: (*Sparganium emersum*) Short-stemmed bur-reed, (*Nuphar variegata*) Spatterdock, (*Utricularia vulgaris*) Common bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Utricularia vulgaris*) **Common bladderwort**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-059
Habitat/Distribution: Locally abundant, although the only plants seen were in the three finger bays in water <1 meter deep over thick organic muck.
Common Associates: (*Bidens beckii*) Water marigold, (*Brasenia schreberi*) Watershield, (*Elodea canadensis*) Common waterweed, (*Sparganium emersum*) Short-stemmed bur-reed, (*Nuphar variegata*) Spatterdock, (*Utricularia intermedia*) Flat-leaf bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/22/16
Species: (*Vallisneria americana*) **Wild celery**
Specimen Location: Clear Lake; N46.02029 W91.26726
Collected/Identified by: Matthew S. Berg **Col. #:** MSB-2016-060
Habitat/Distribution: The most widely distributed plant in the lake, it was abundant over sandy muck in .5-4.5m of water.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton* X *scoliophyllus*) Large-leaf X Illinois pondweed hybrid

Appendix VIII: 2016 August Point-intercept Survey Native Species Density and Distribution Maps


Aquatic moss
Bryophyte
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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None Found
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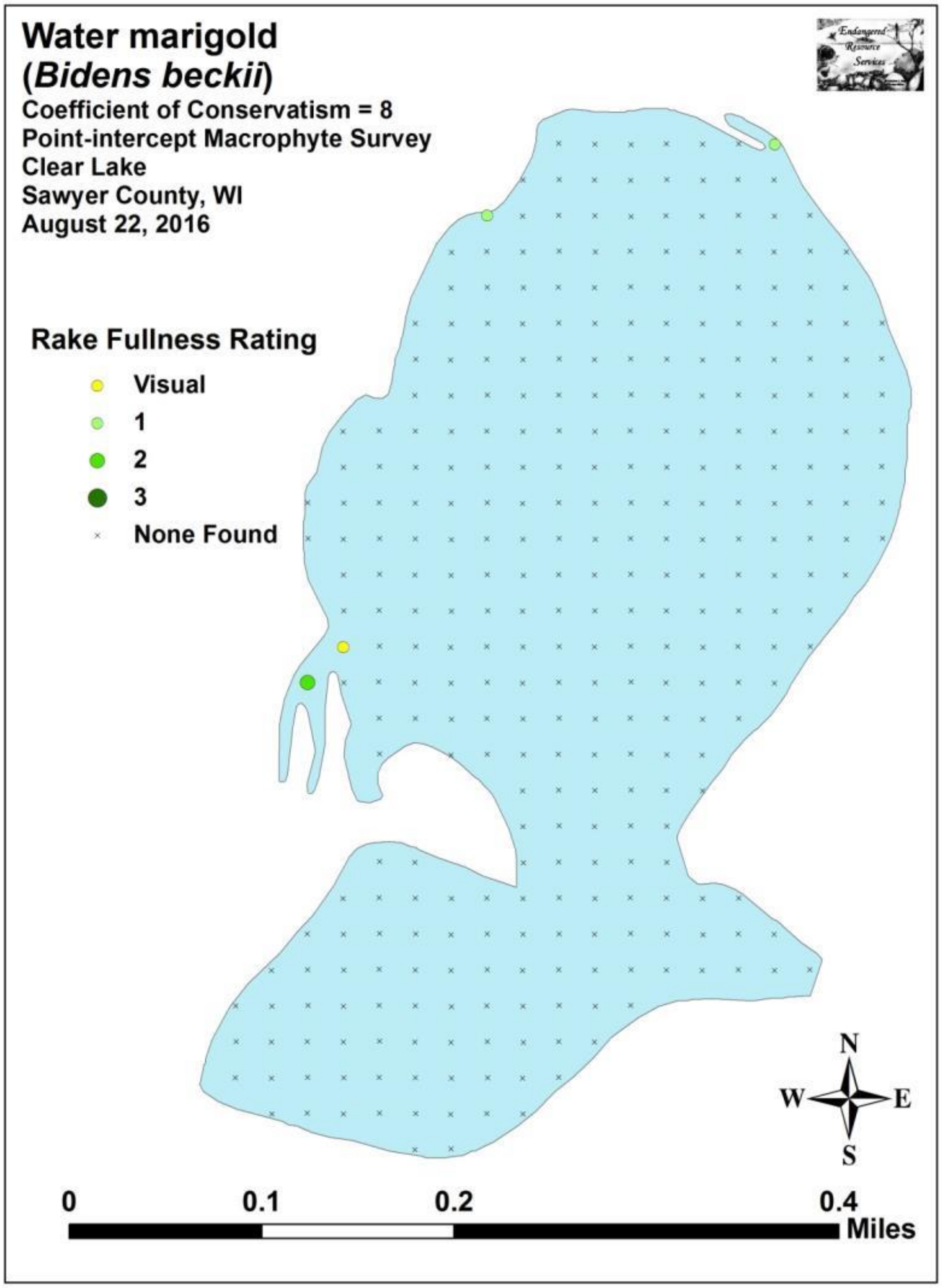
0.4
Miles


Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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None Found
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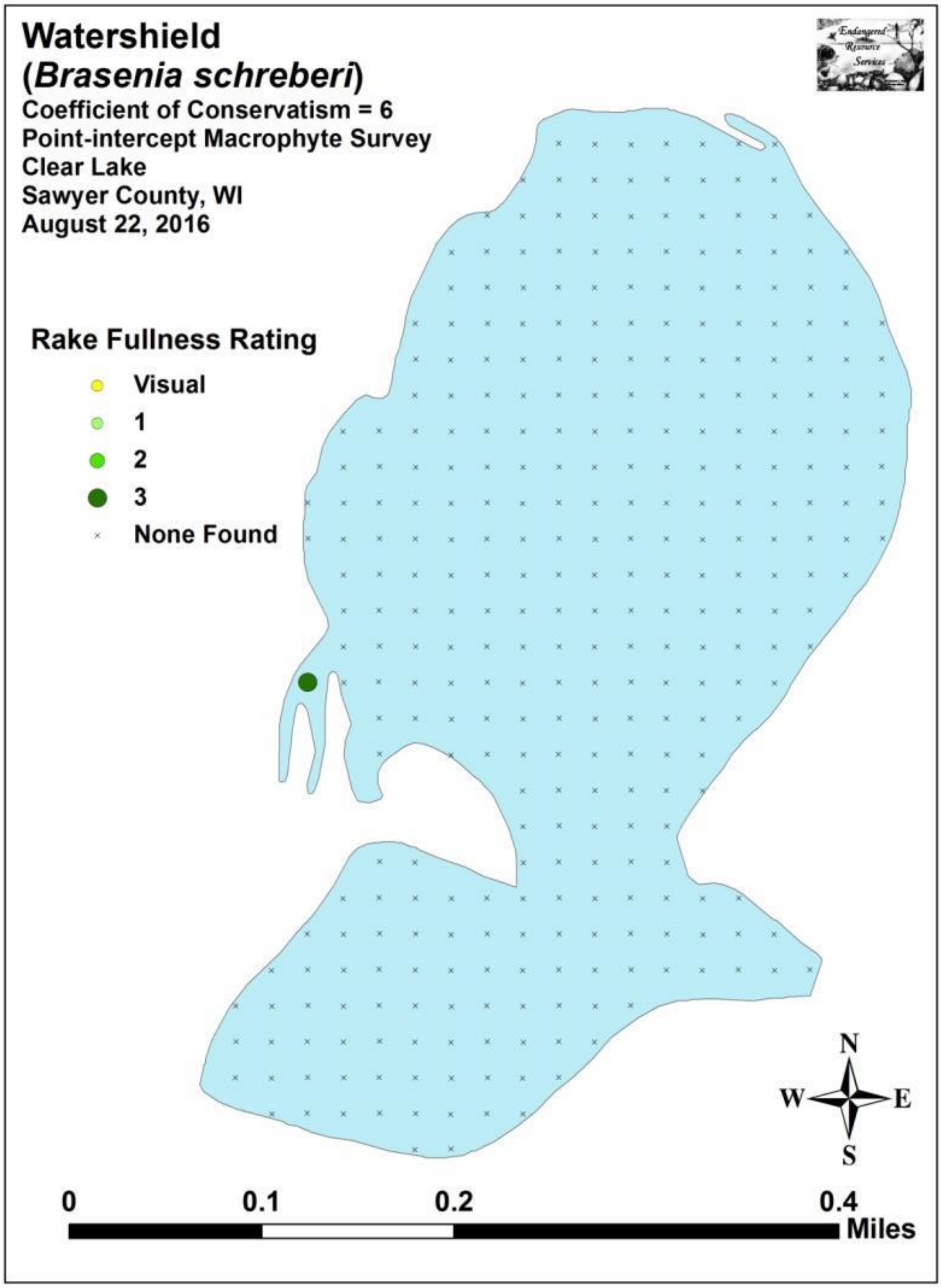
Miles


Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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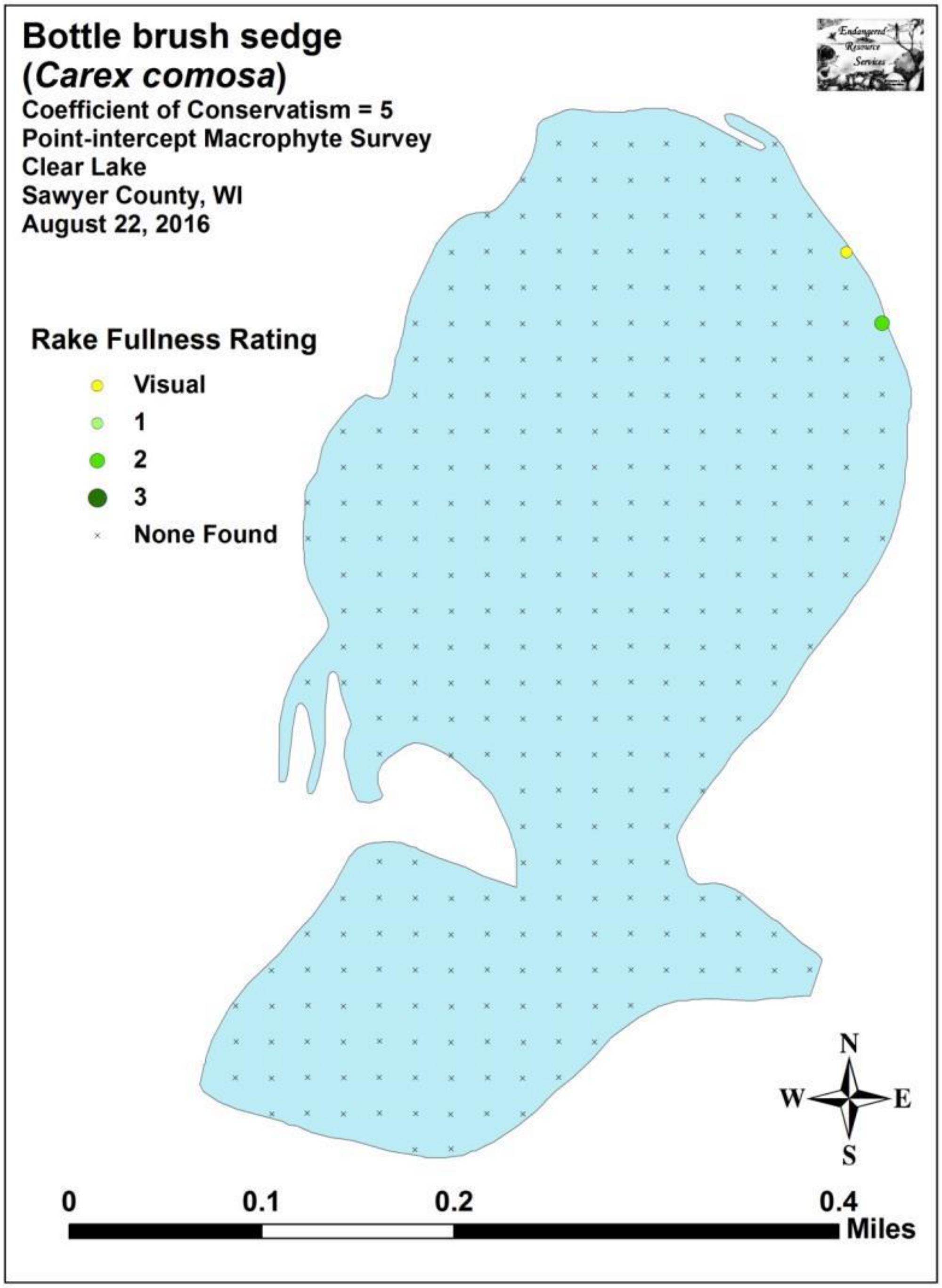
Miles



Bottle brush sedge
(*Carex comosa*)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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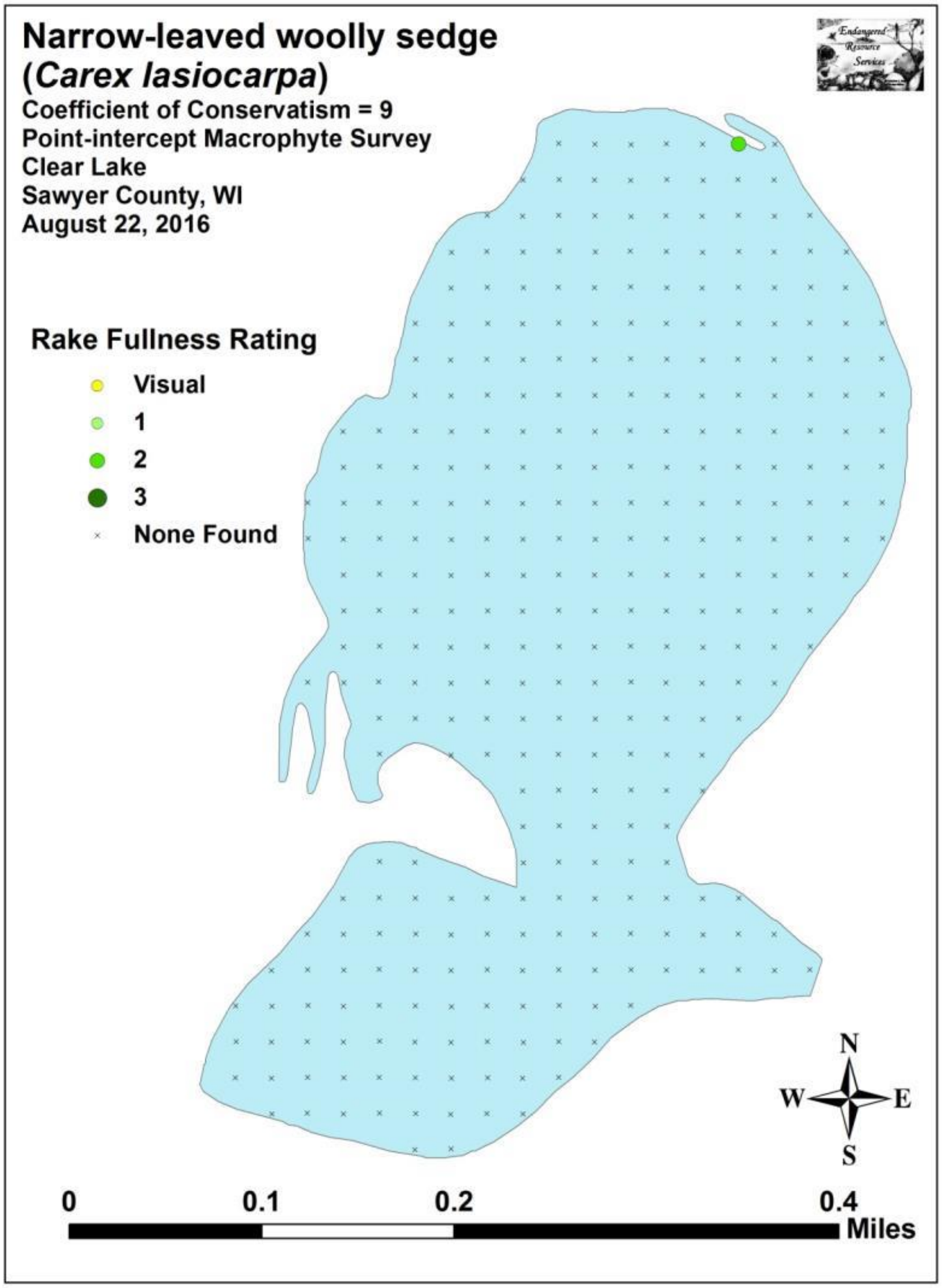
Miles


Narrow-leaved woolly sedge
(Carex lasiocarpa)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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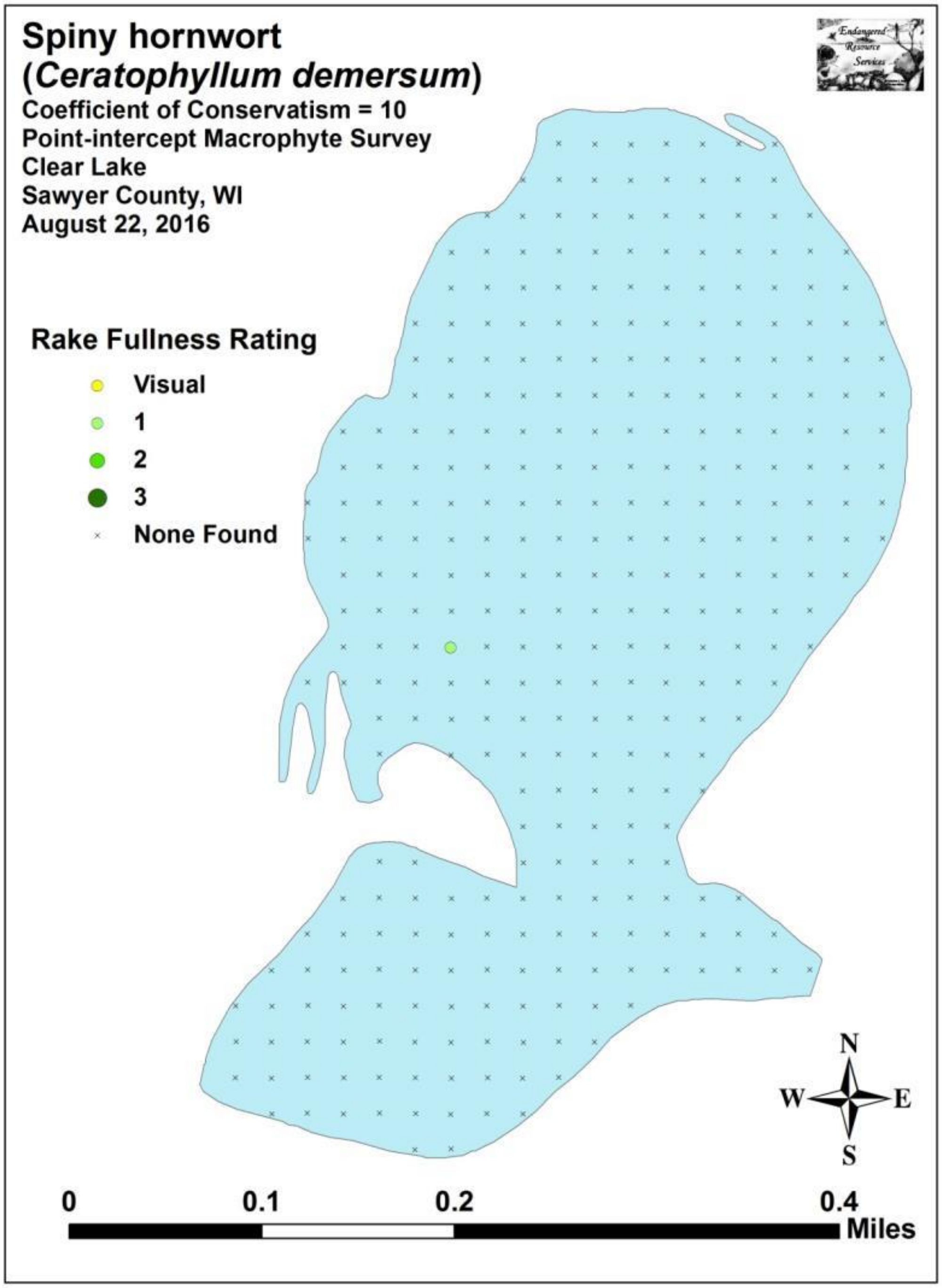
Miles


Spiny hornwort
(Ceratophyllum demersum)
Coefficient of Conservatism = 10
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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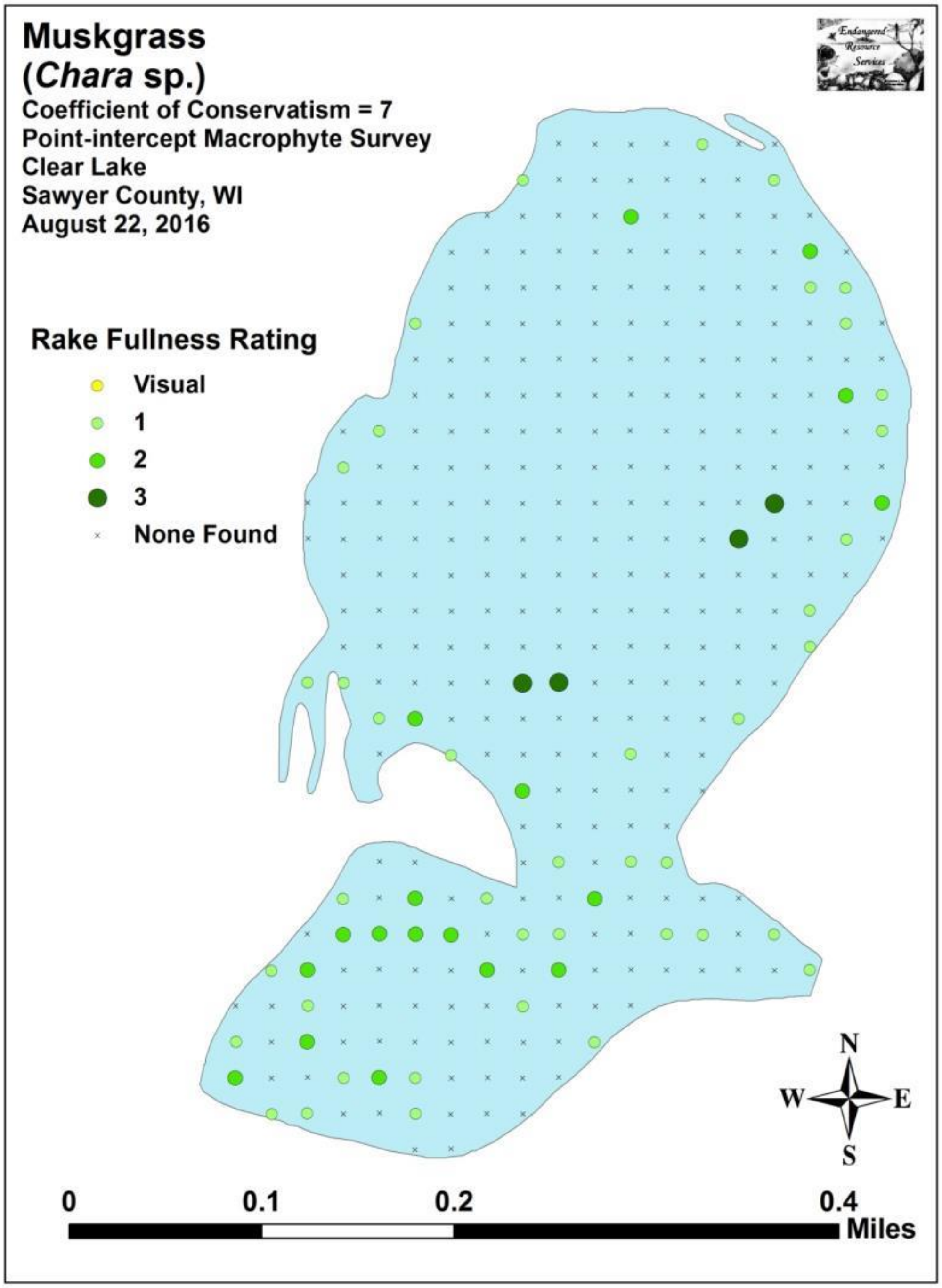
Miles



Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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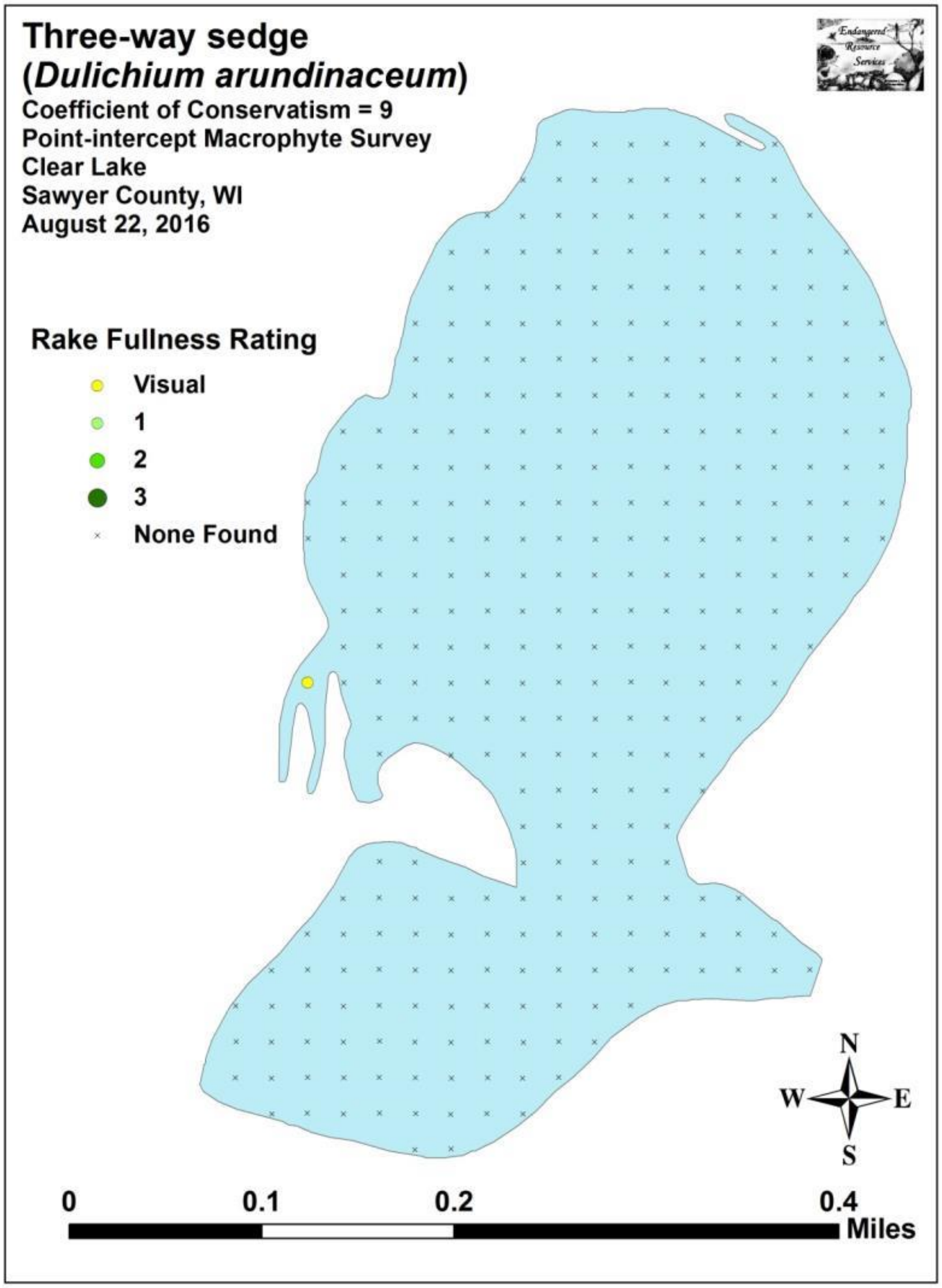
Miles


Three-way sedge
(Dulichium arundinaceum)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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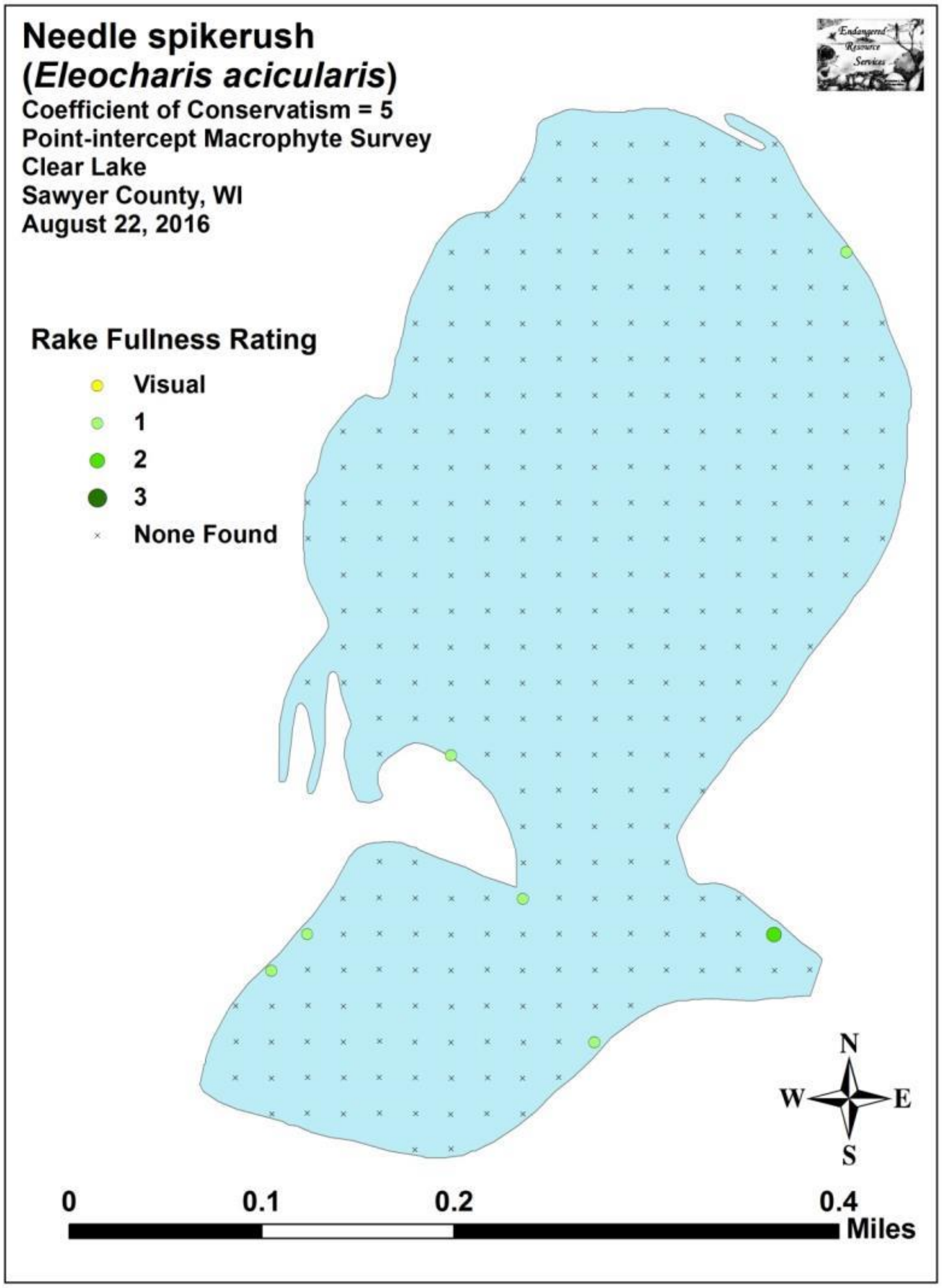
Miles


Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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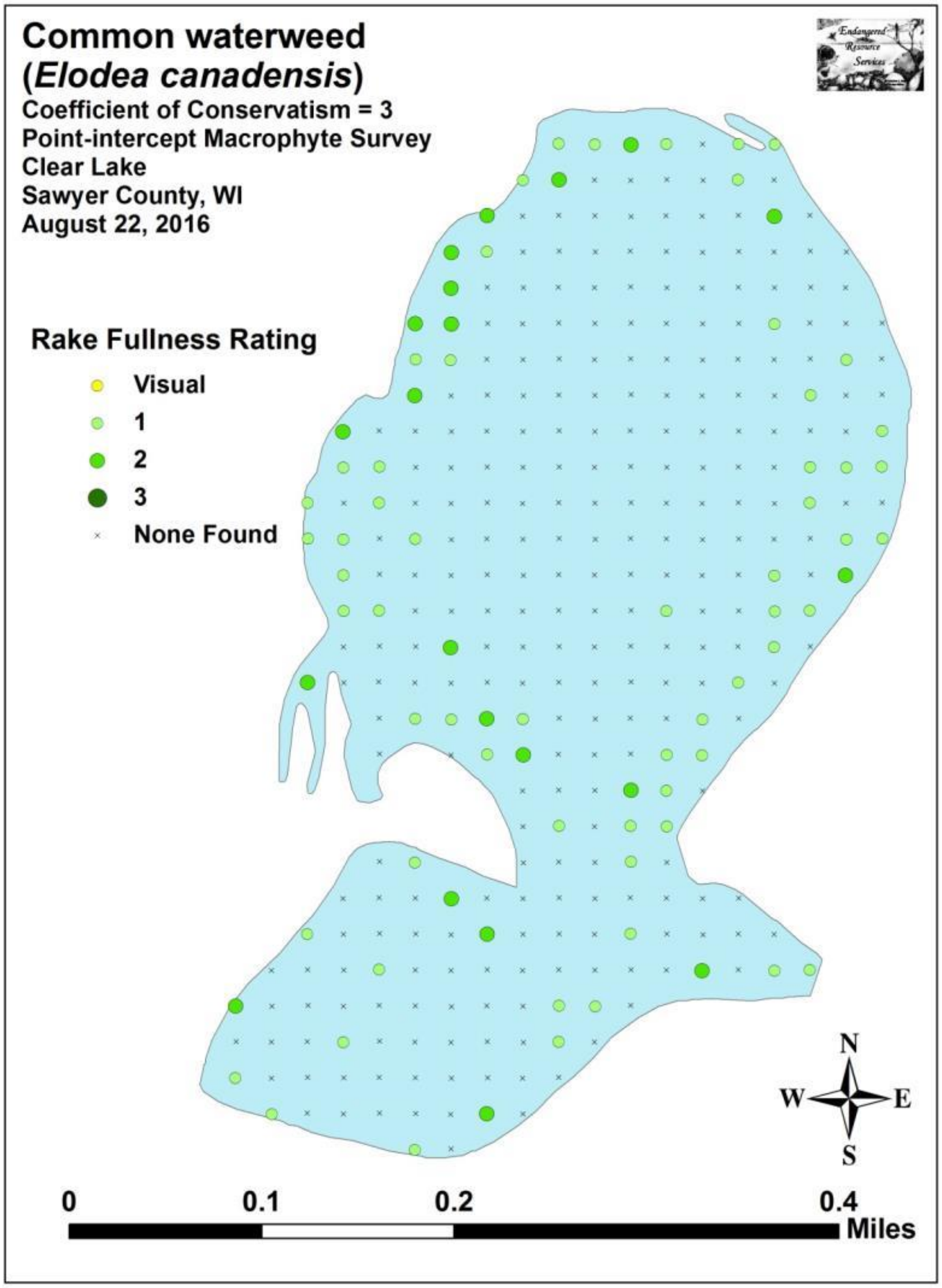
Miles


Common waterweed
(*Elodea canadensis*)
Coefficient of Conservatism = 3
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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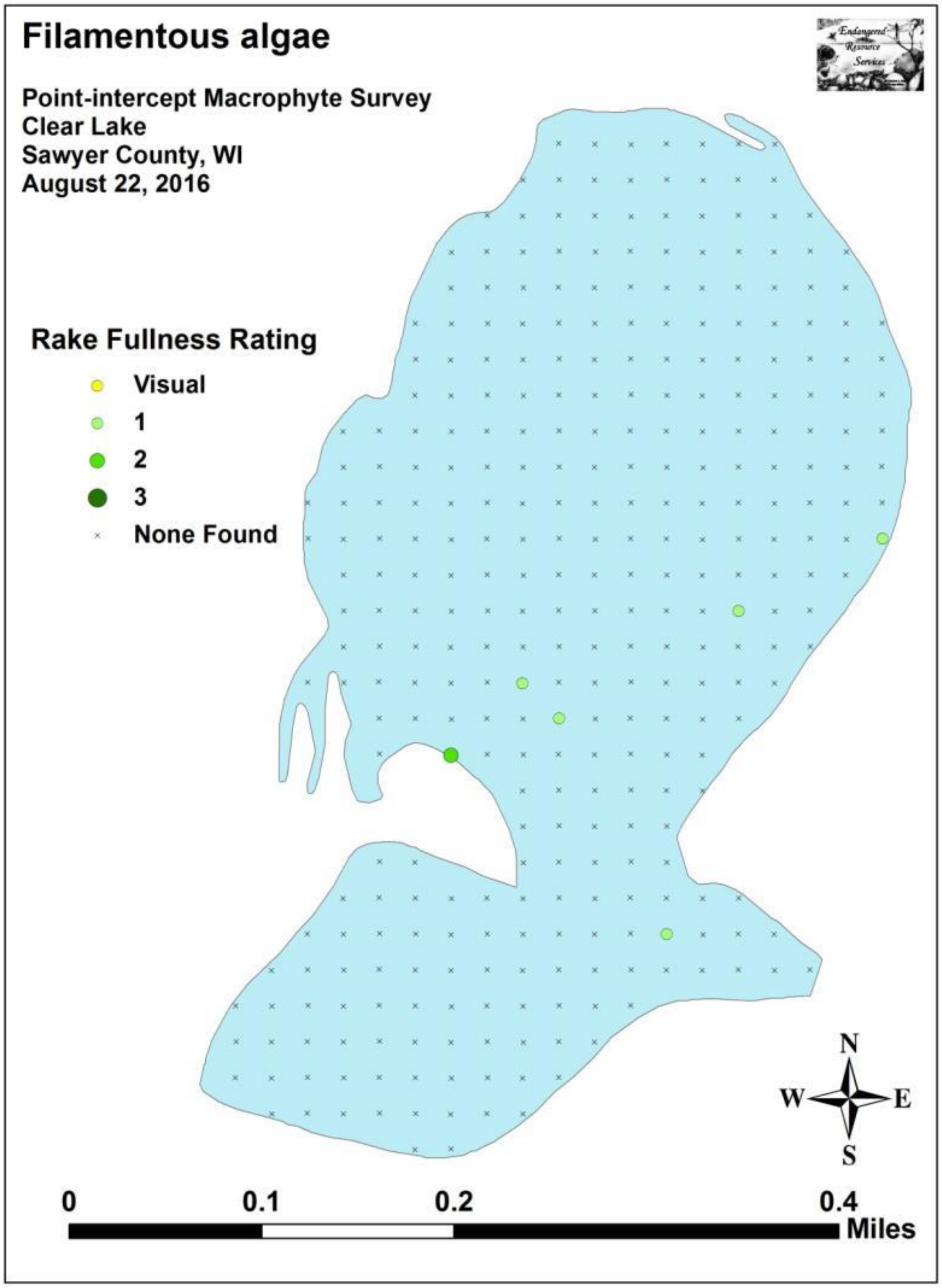
Miles



Filamentous algae
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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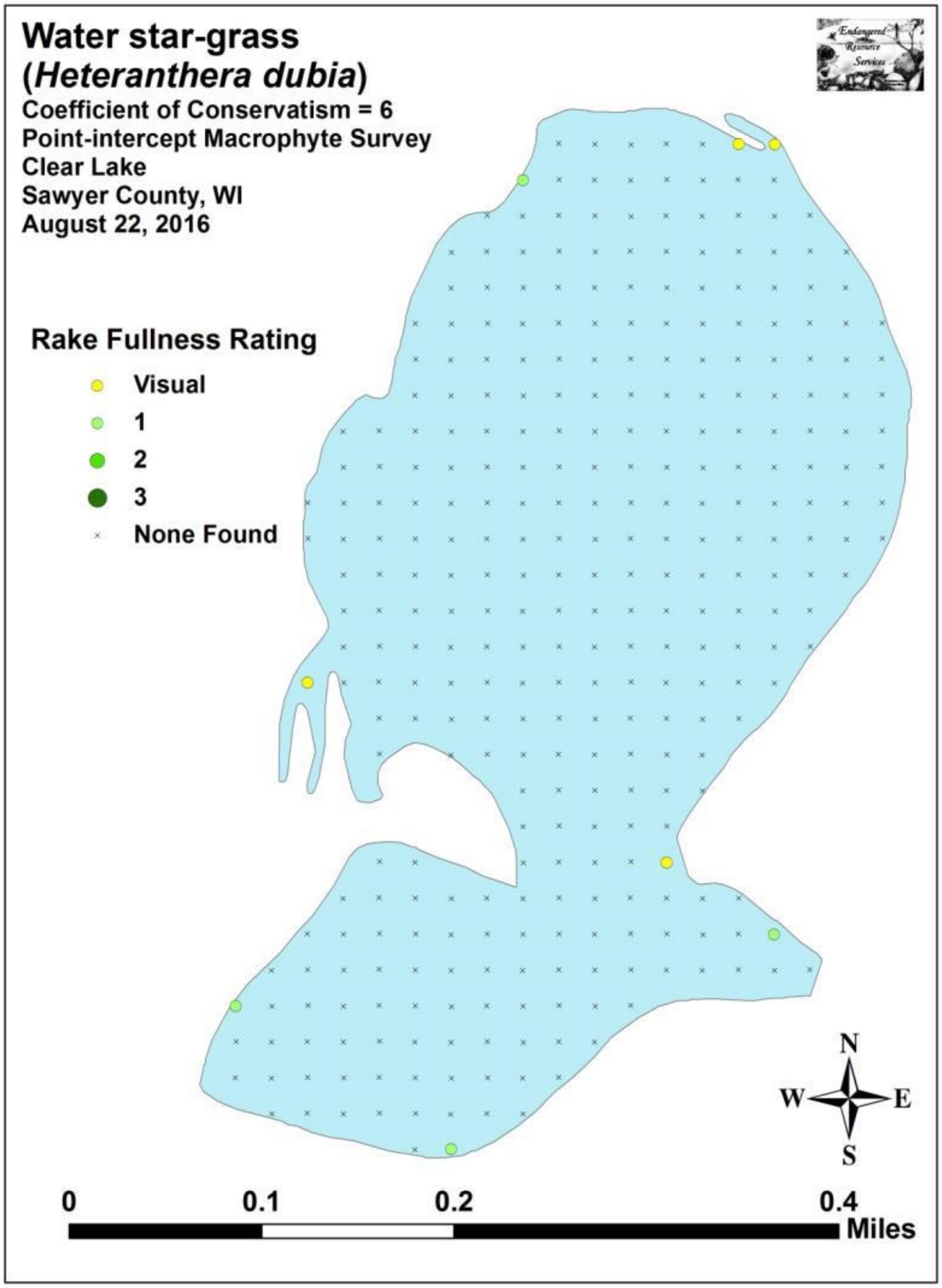
Miles


Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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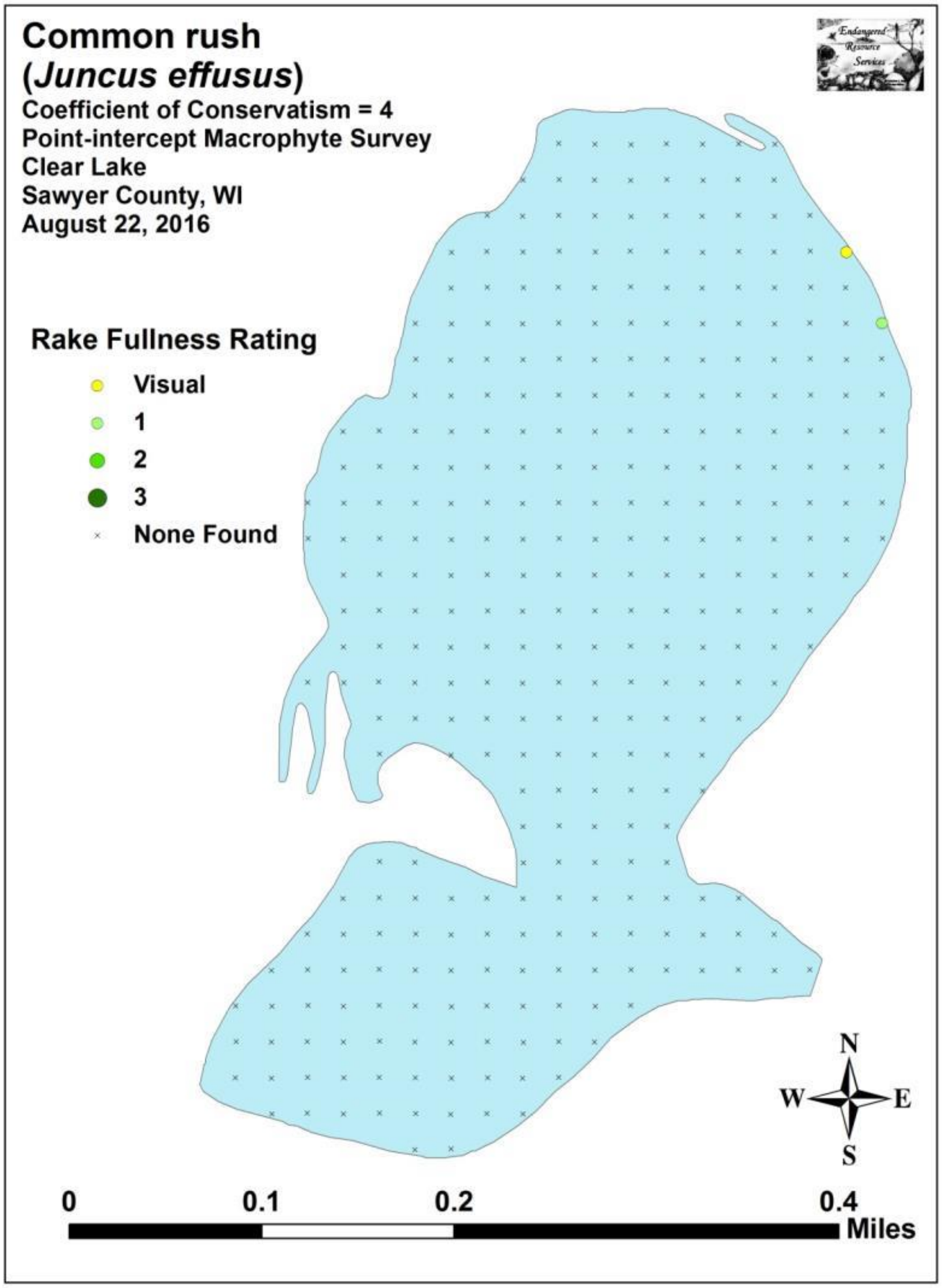
Miles



Common rush
(*Juncus effusus*)
Coefficient of Conservatism = 4
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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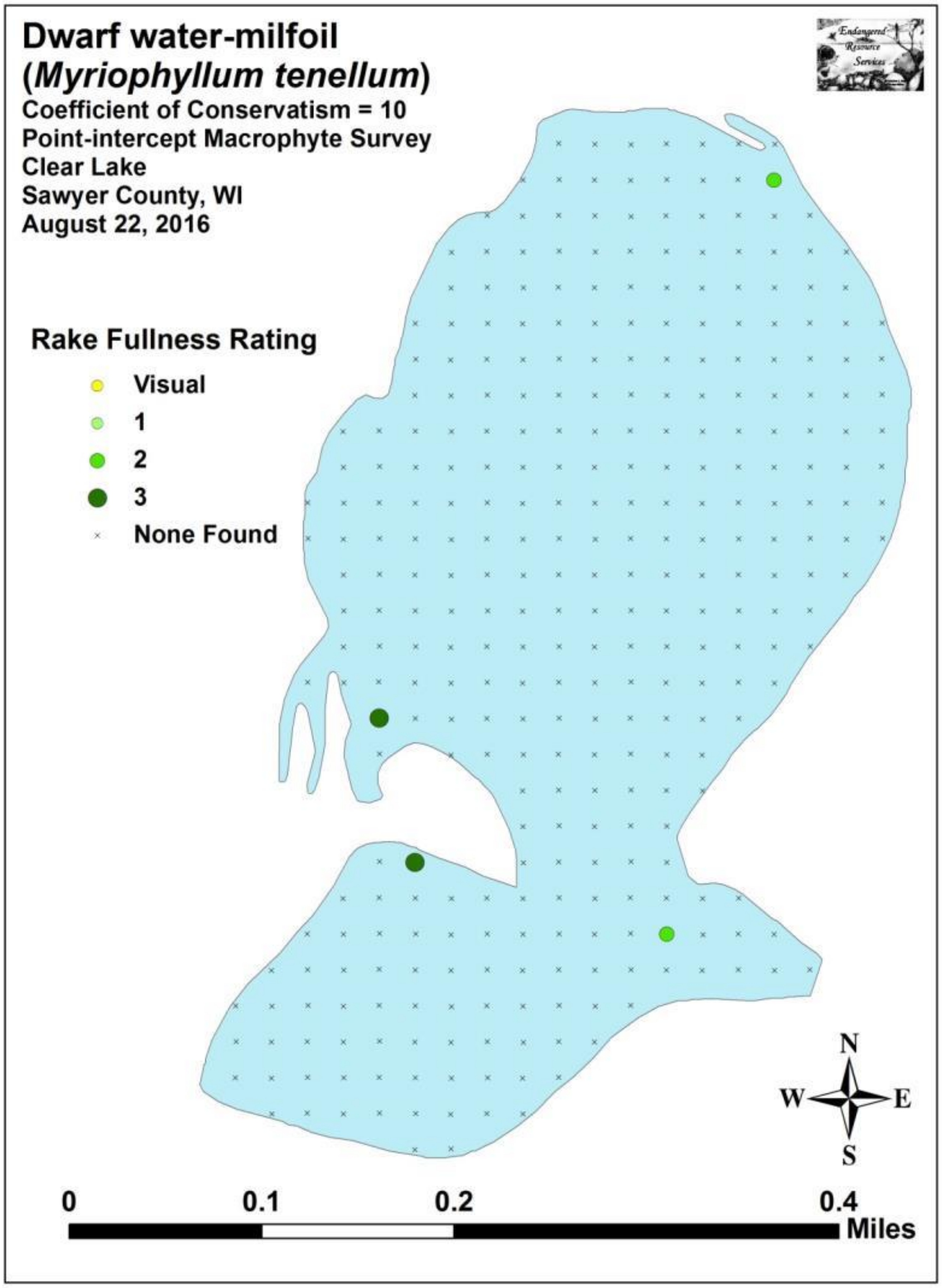
Miles


Dwarf water-milfoil
(*Myriophyllum tenellum*)
Coefficient of Conservatism = 10
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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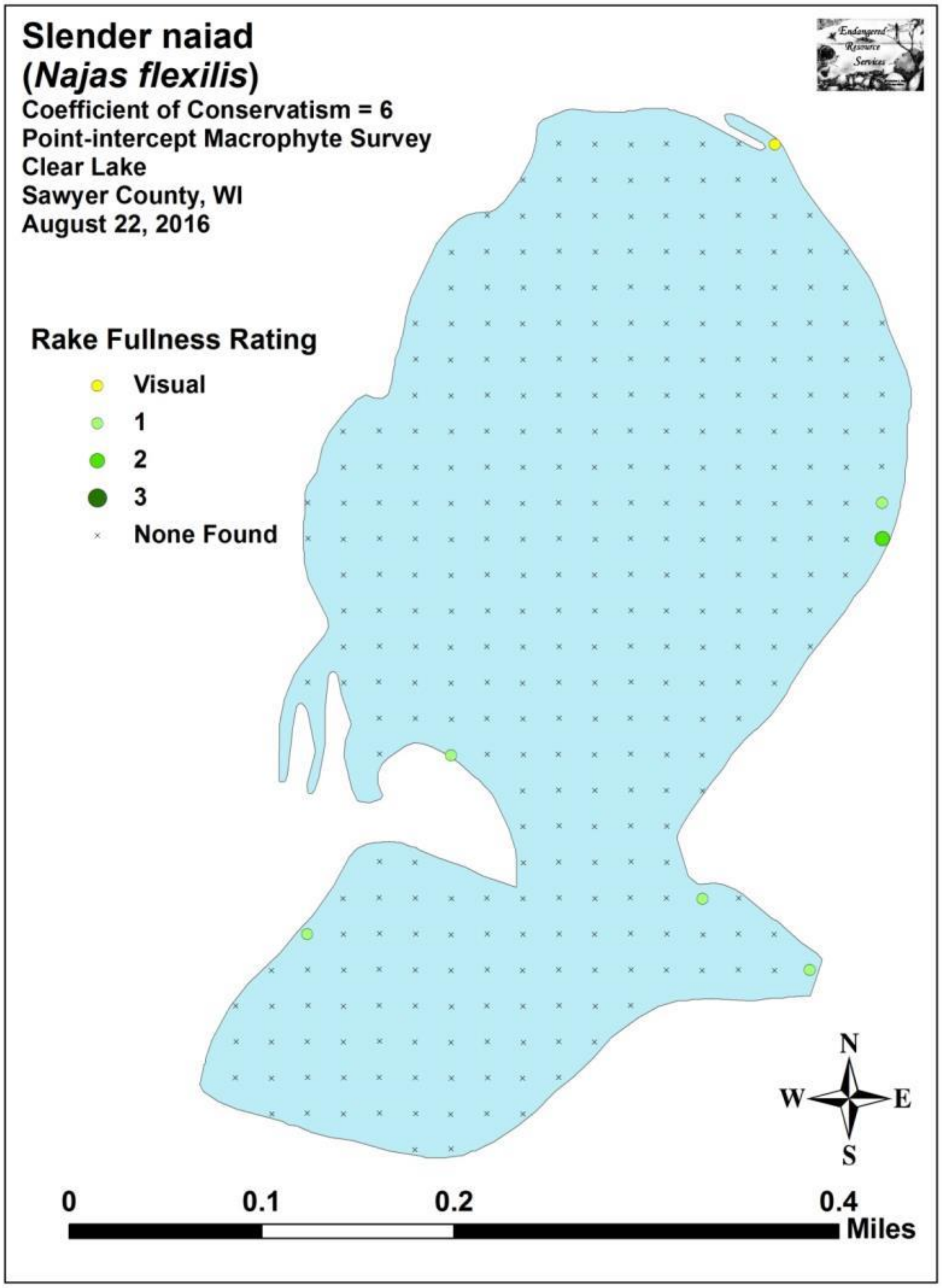
Miles


Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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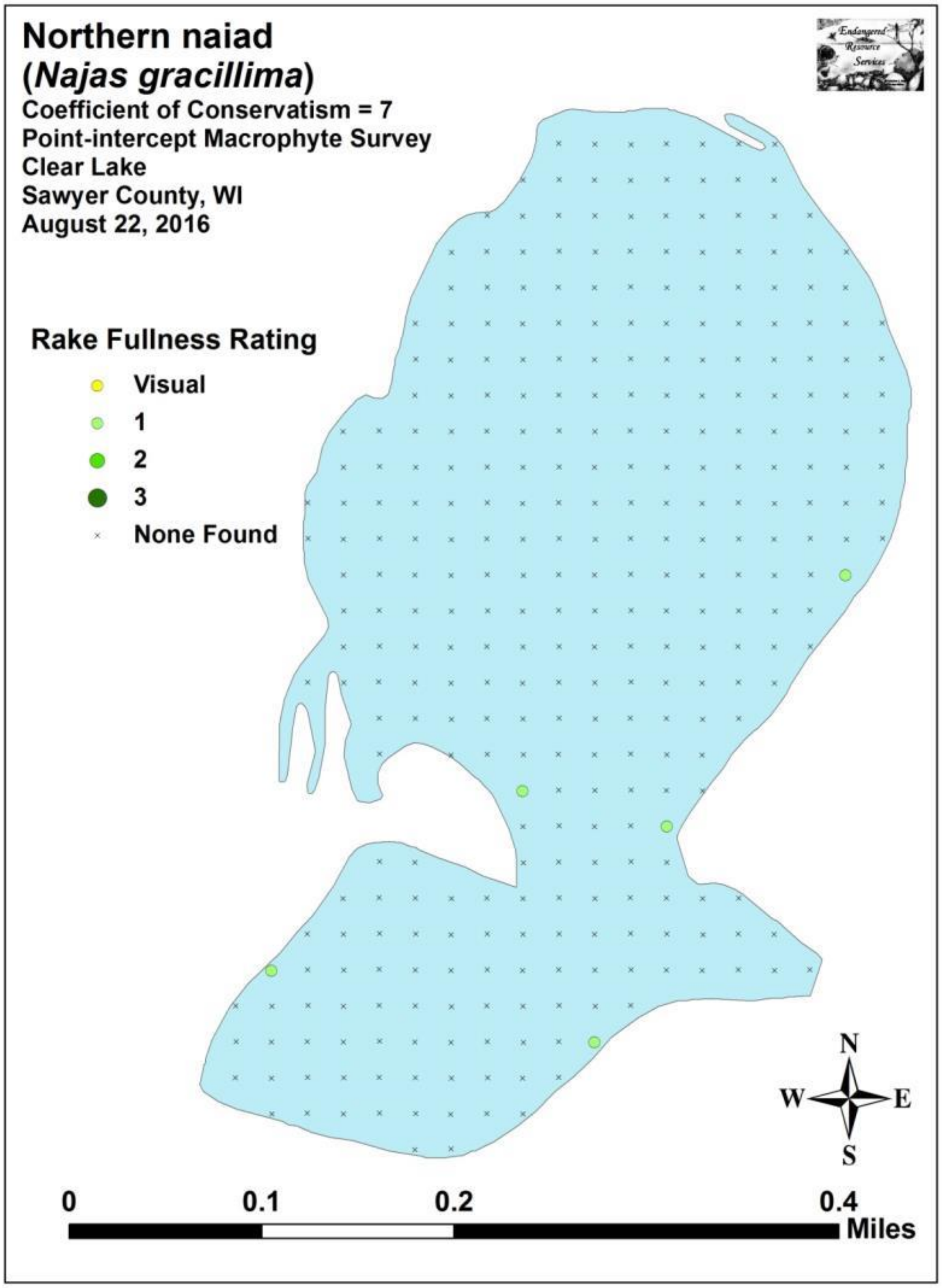
Miles



Northern naiad
(Najas gracillima)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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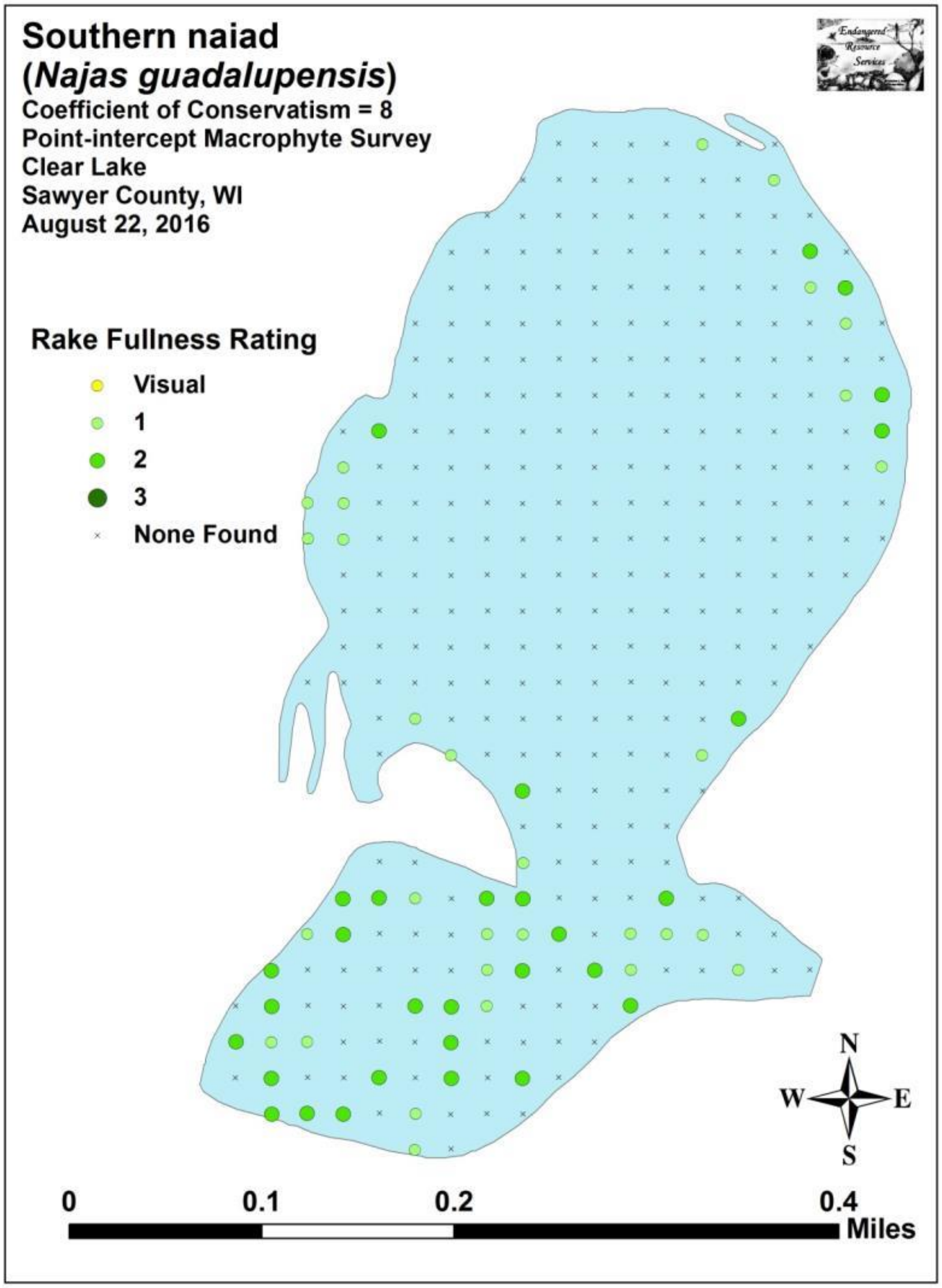
Miles


Southern naiad
(*Najas guadalupensis*)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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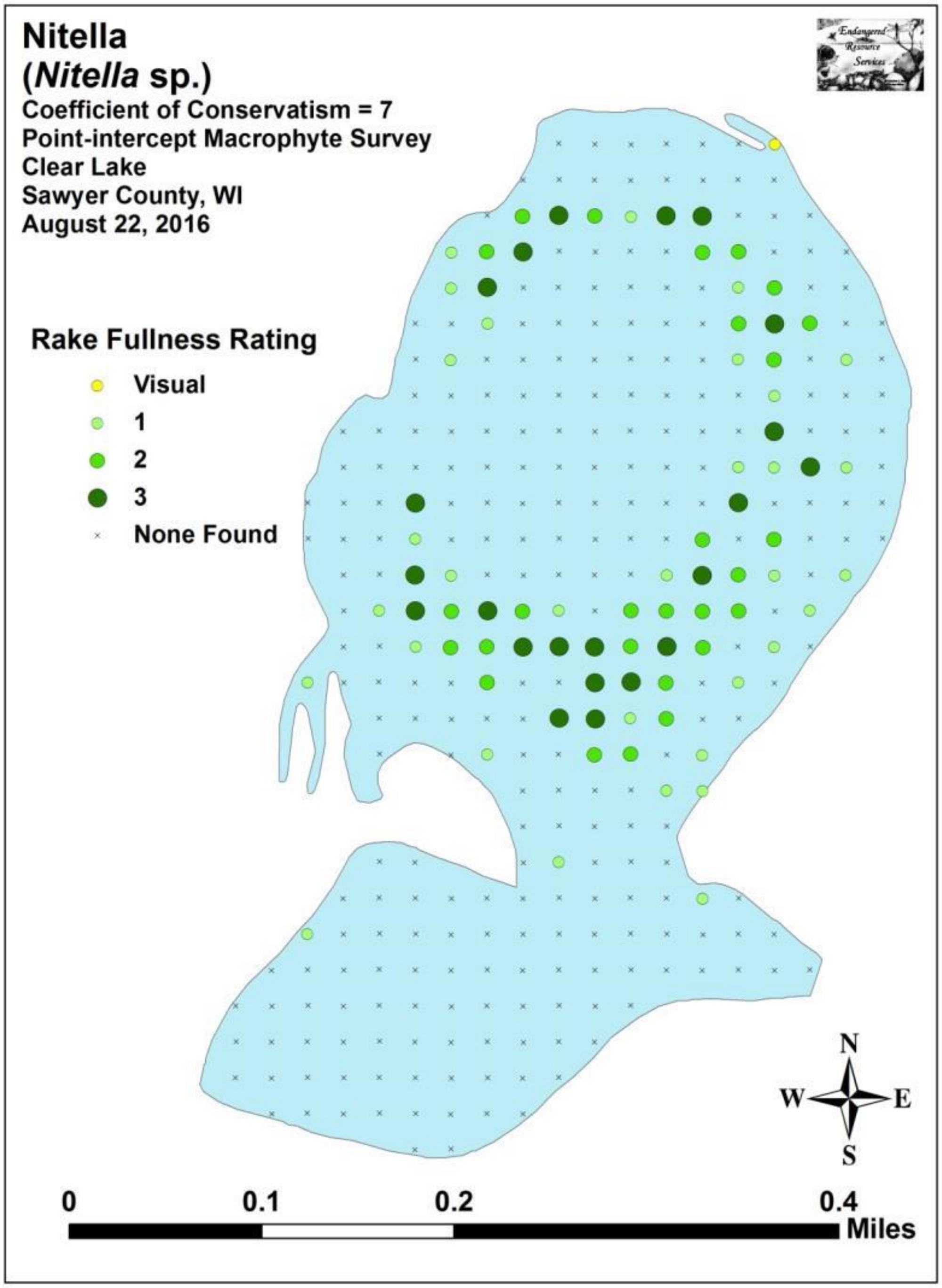
Miles



Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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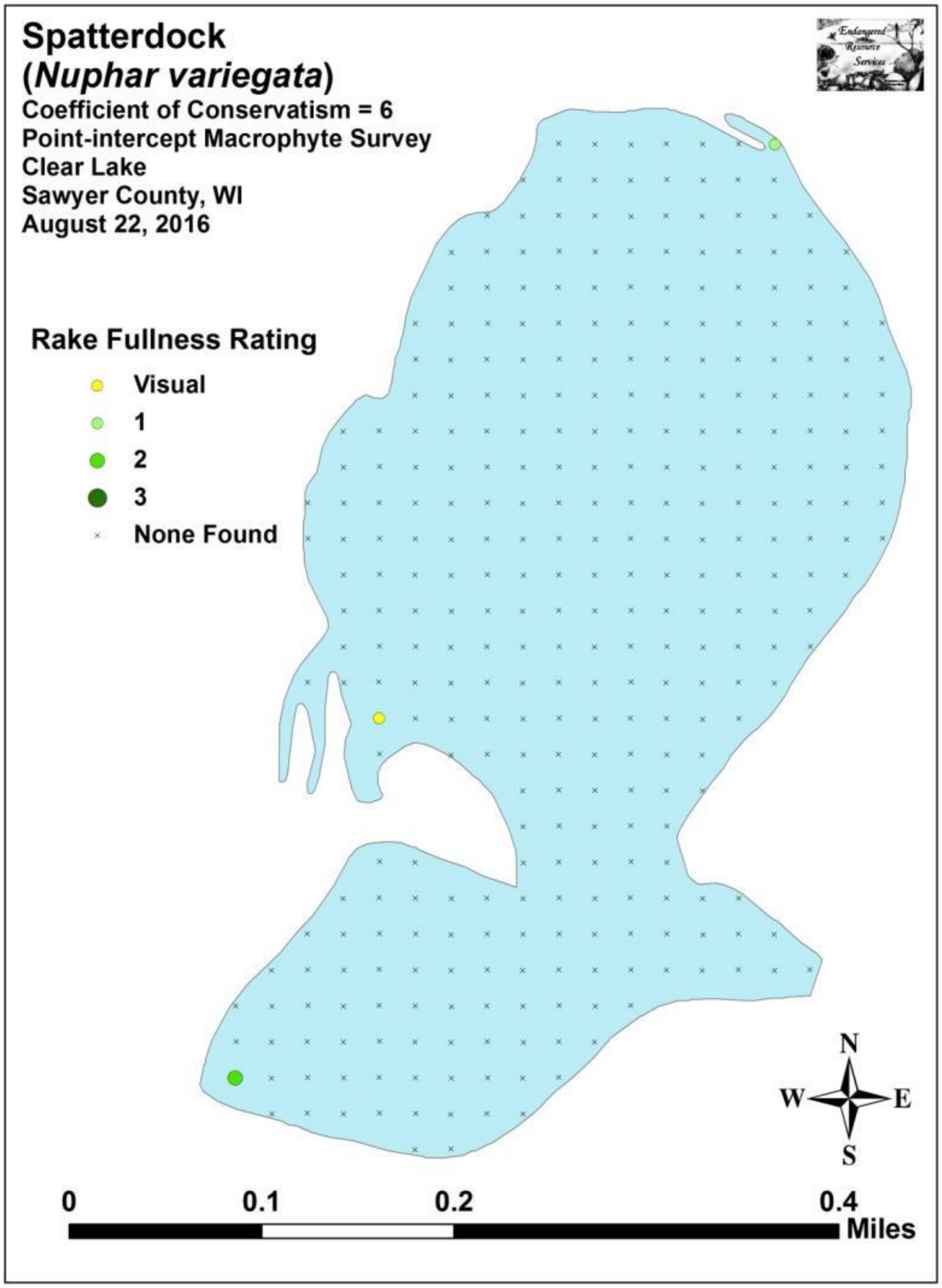
Miles



Spatterdock
(*Nuphar variegata*)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
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None Found
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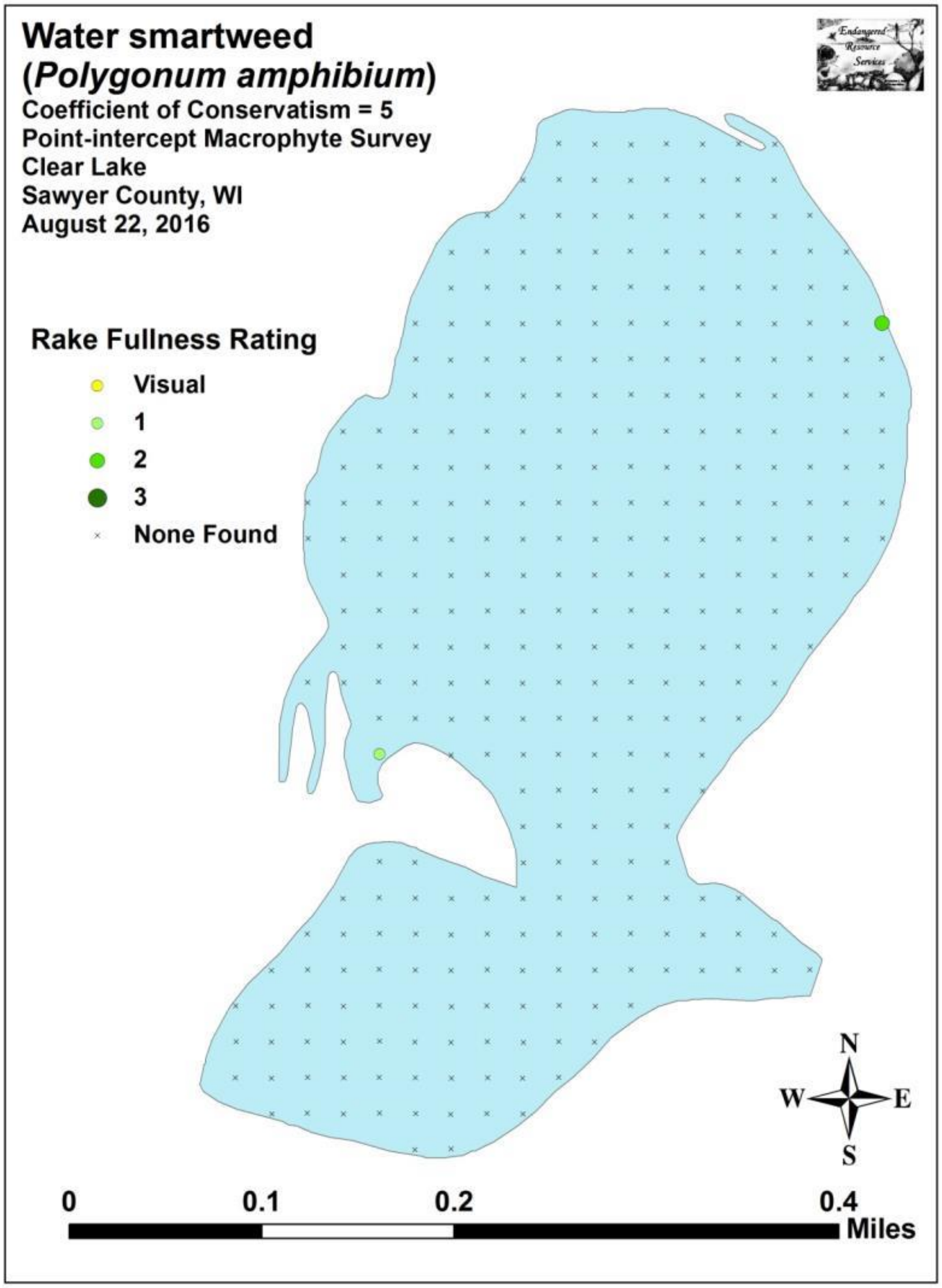
Miles


Water smartweed
(Polygonum amphibium)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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3
None Found
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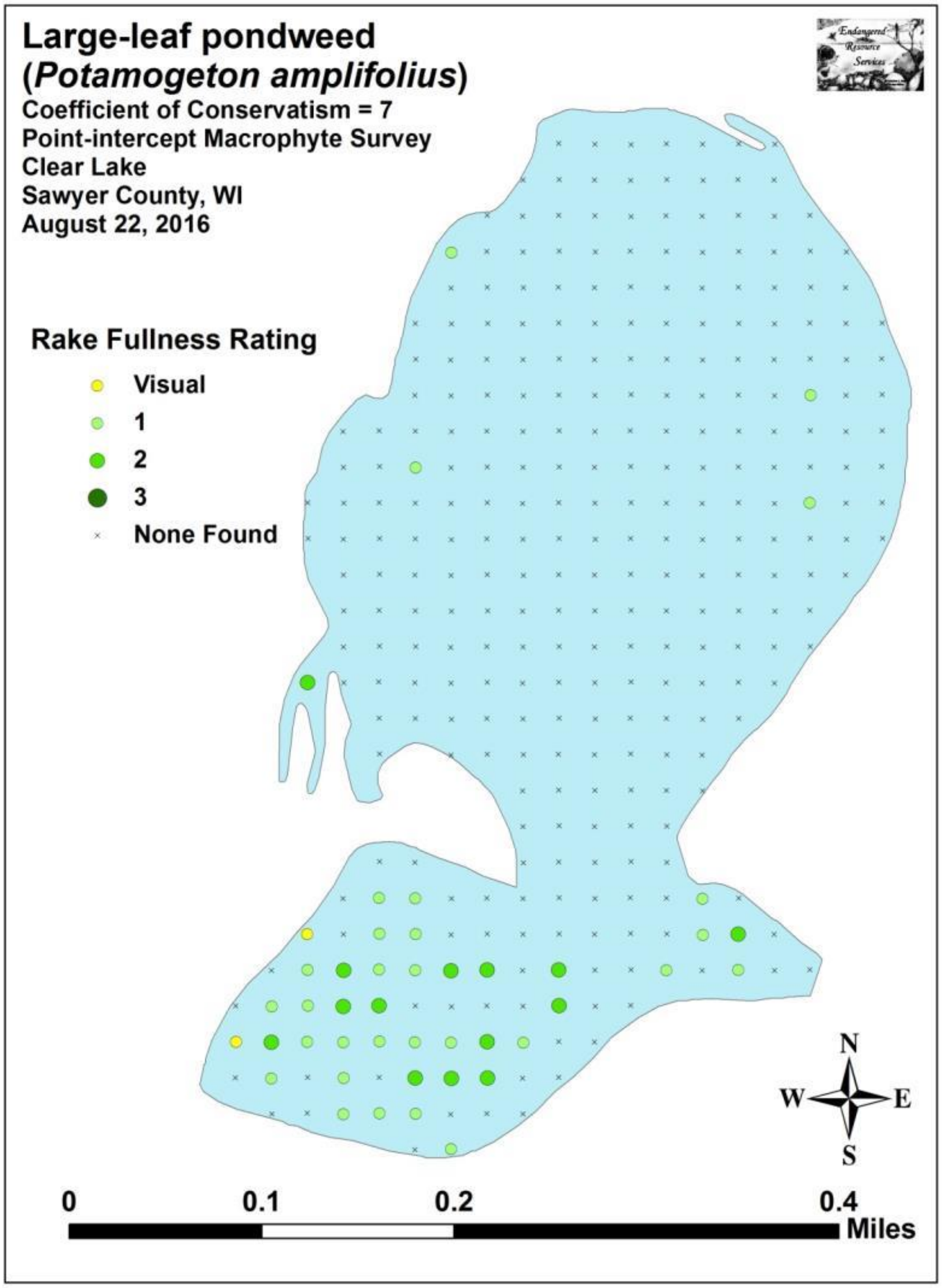
0.4
Miles


Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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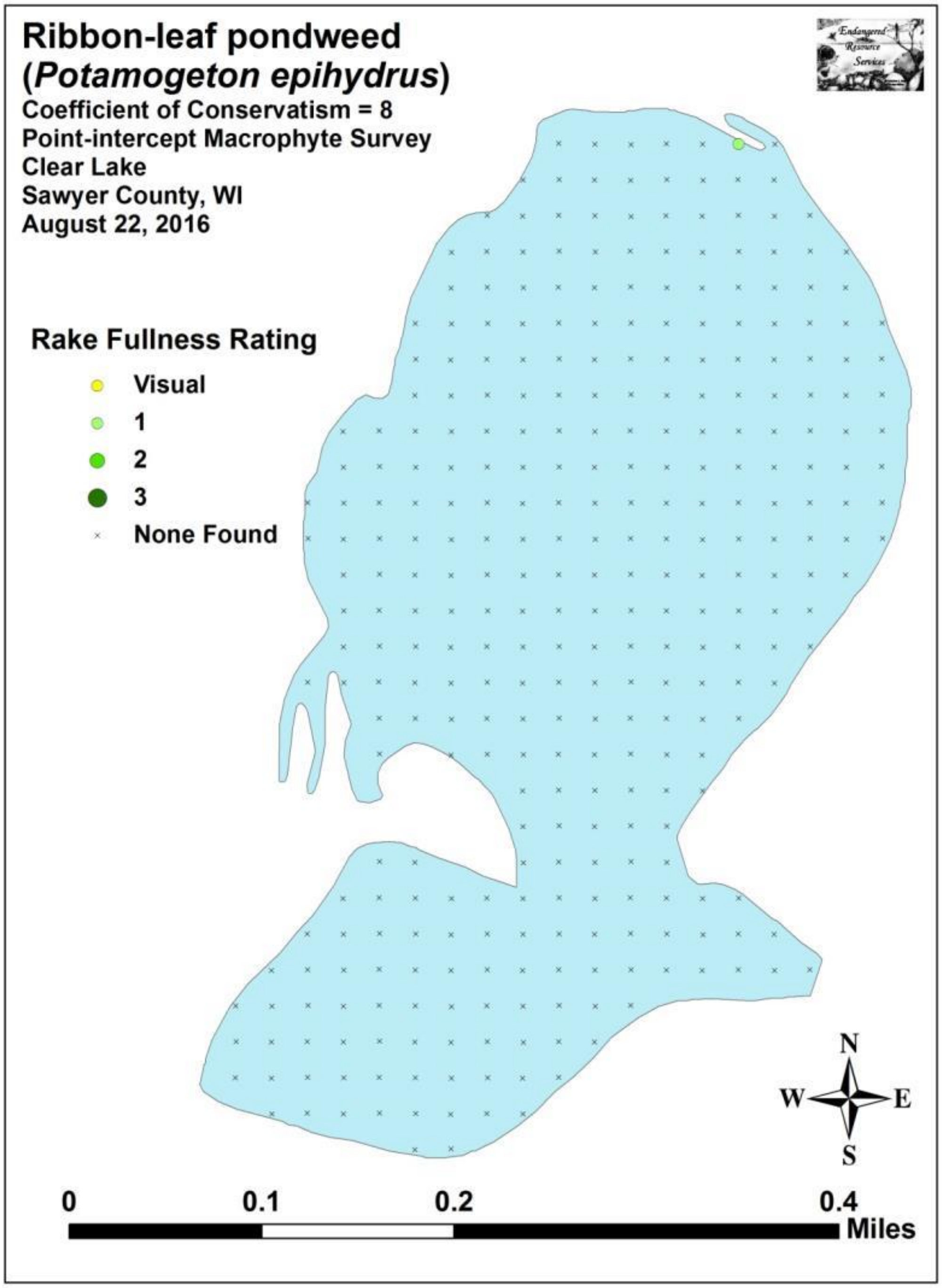
S
0
0.1
0.2
0.4
Miles



Ribbon-leaf pondweed
(*Potamogeton epihydrus*)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
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0.1
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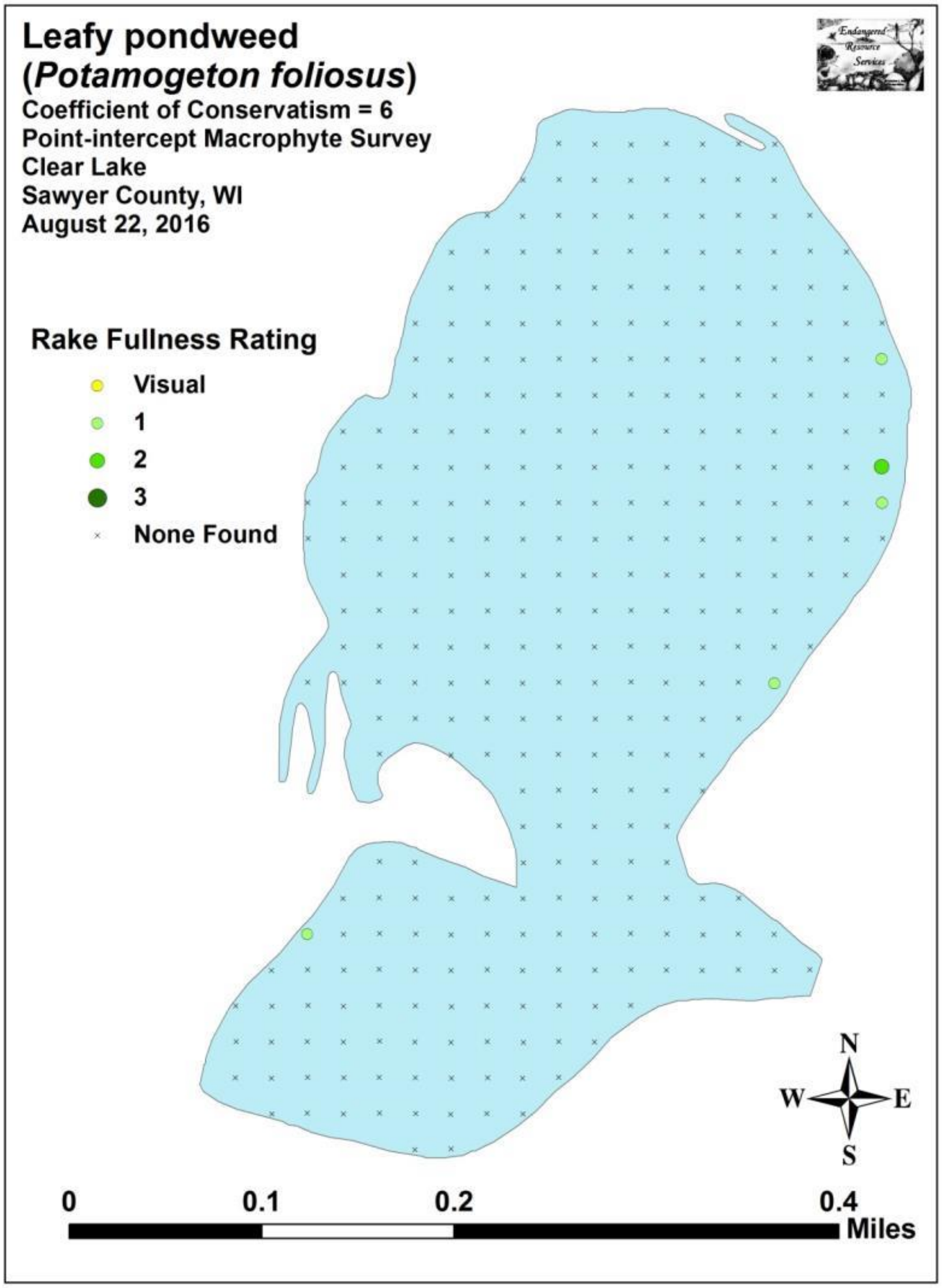
Miles


Leafy pondweed
(*Potamogeton foliosus*)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
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0.1
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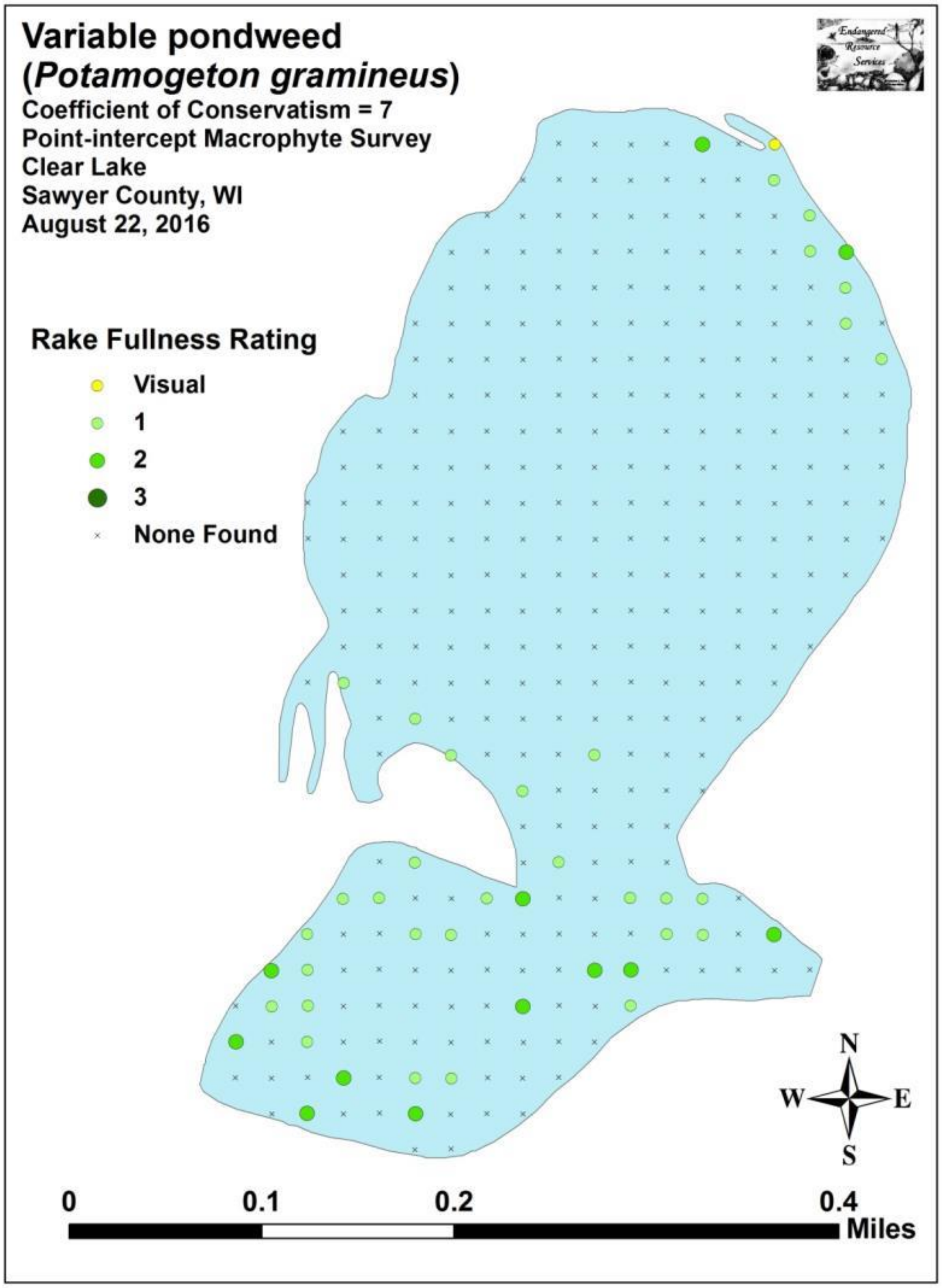
Miles


Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
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0.2
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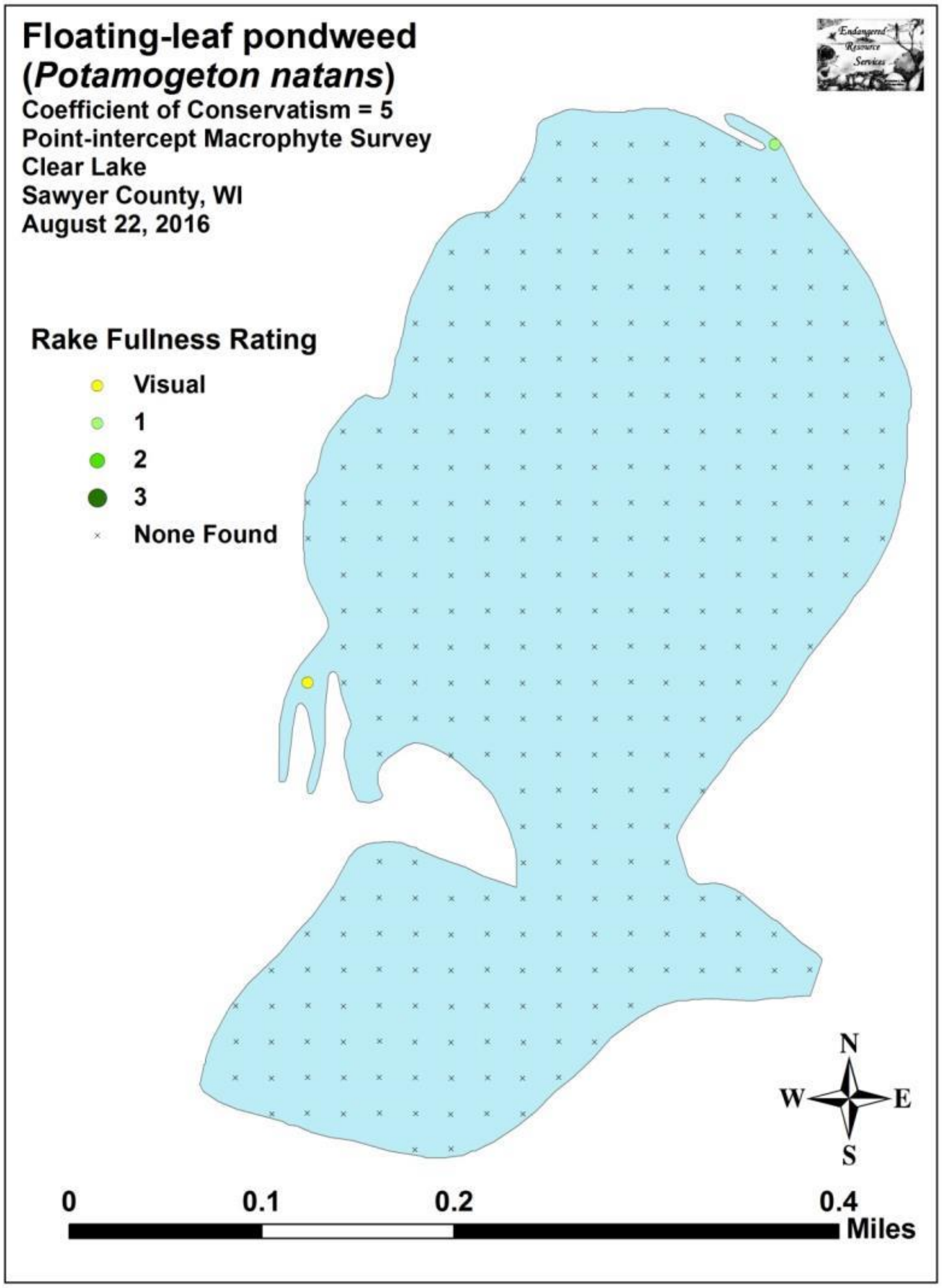
Miles



Floating-leaf pondweed
(*Potamogeton natans*)
Coefficient of Conservatism = 5
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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None Found
N
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0.2
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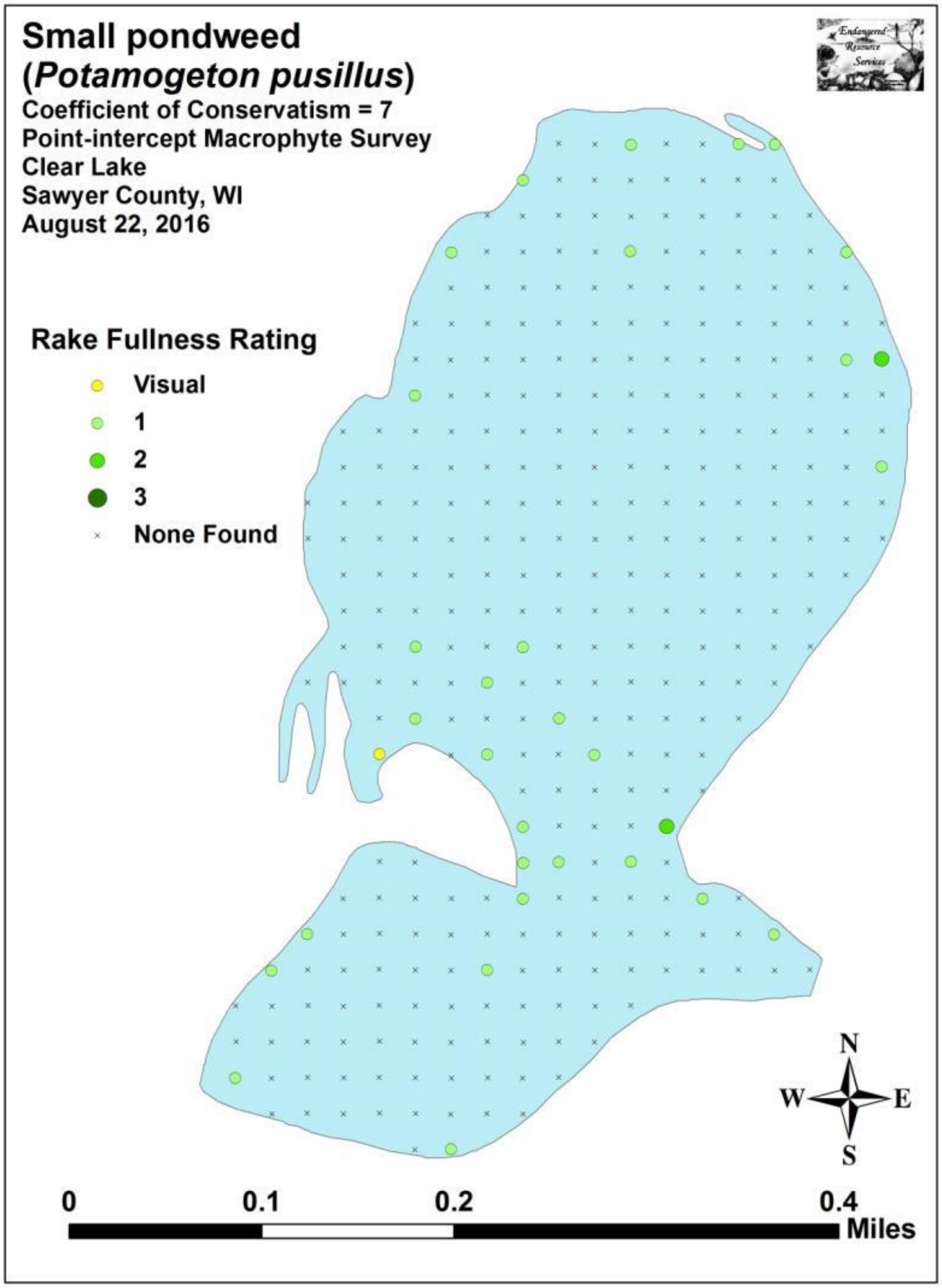
Miles



Small pondweed
(*Potamogeton pusillus*)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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None Found
N
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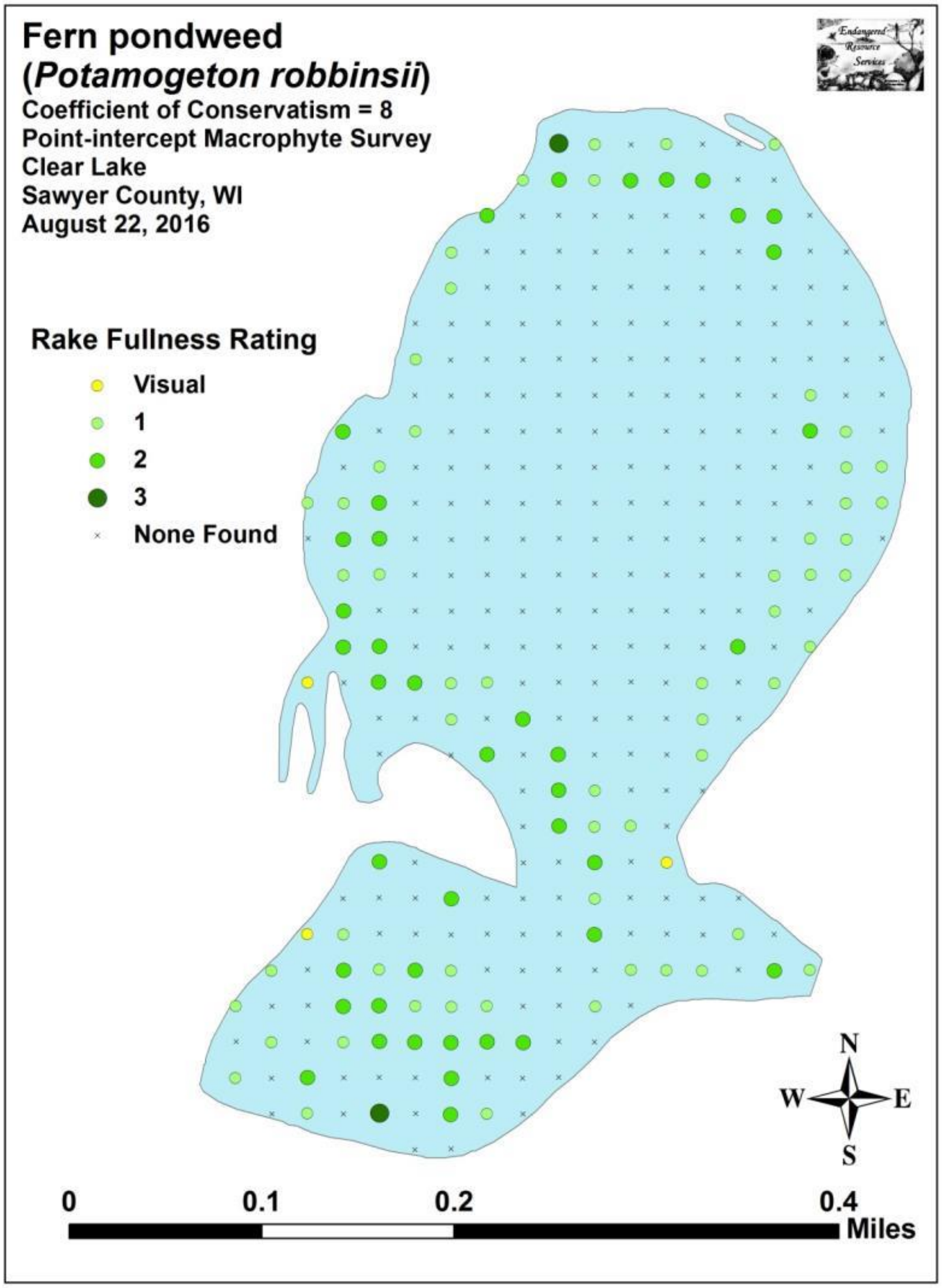
0.2
0.4
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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3
None Found
N
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0.1
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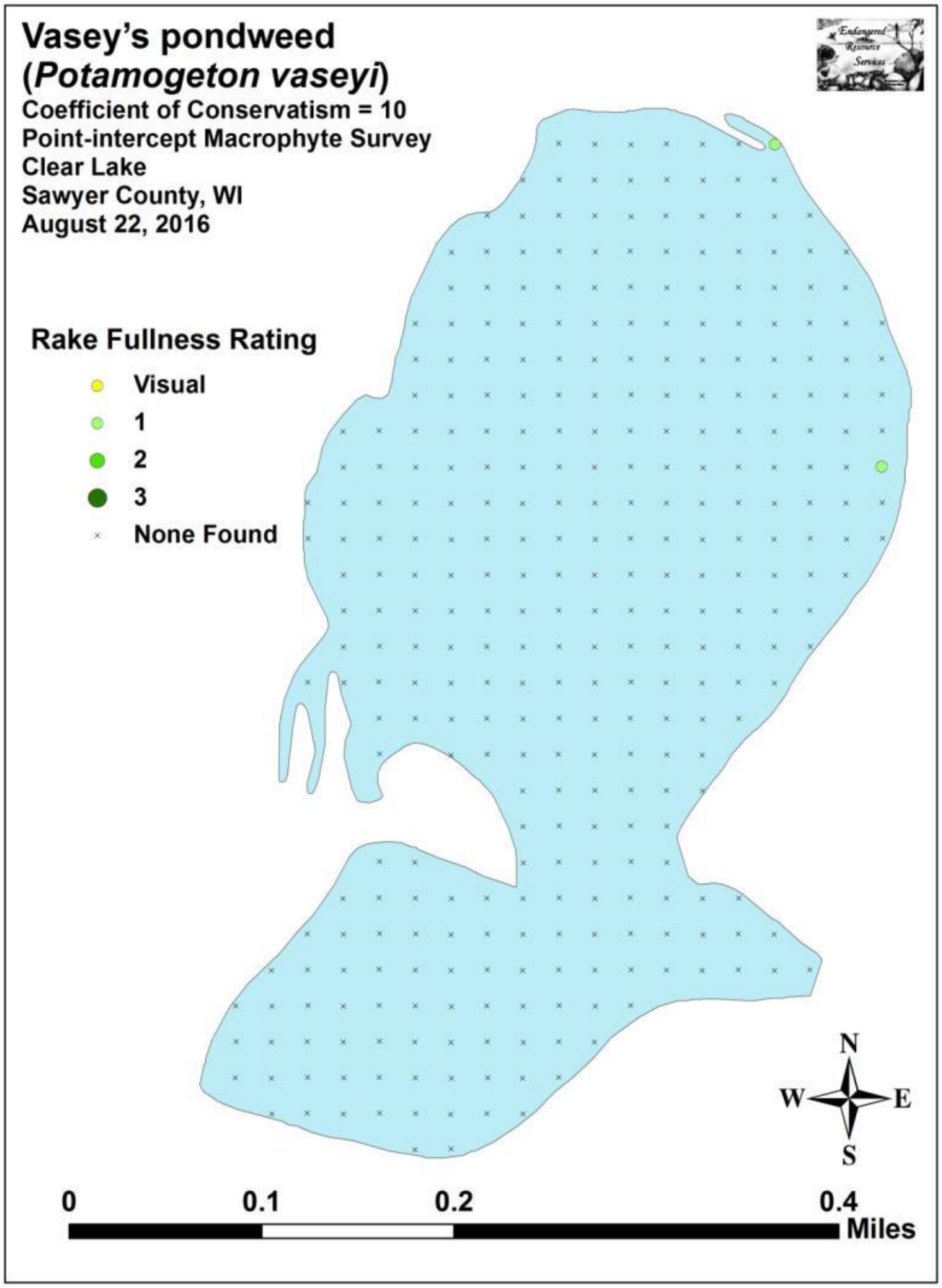
0.4
Miles


Vasey's pondweed
(Potamogeton vaseyi)
Coefficient of Conservatism = 10
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
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0.1
0.2
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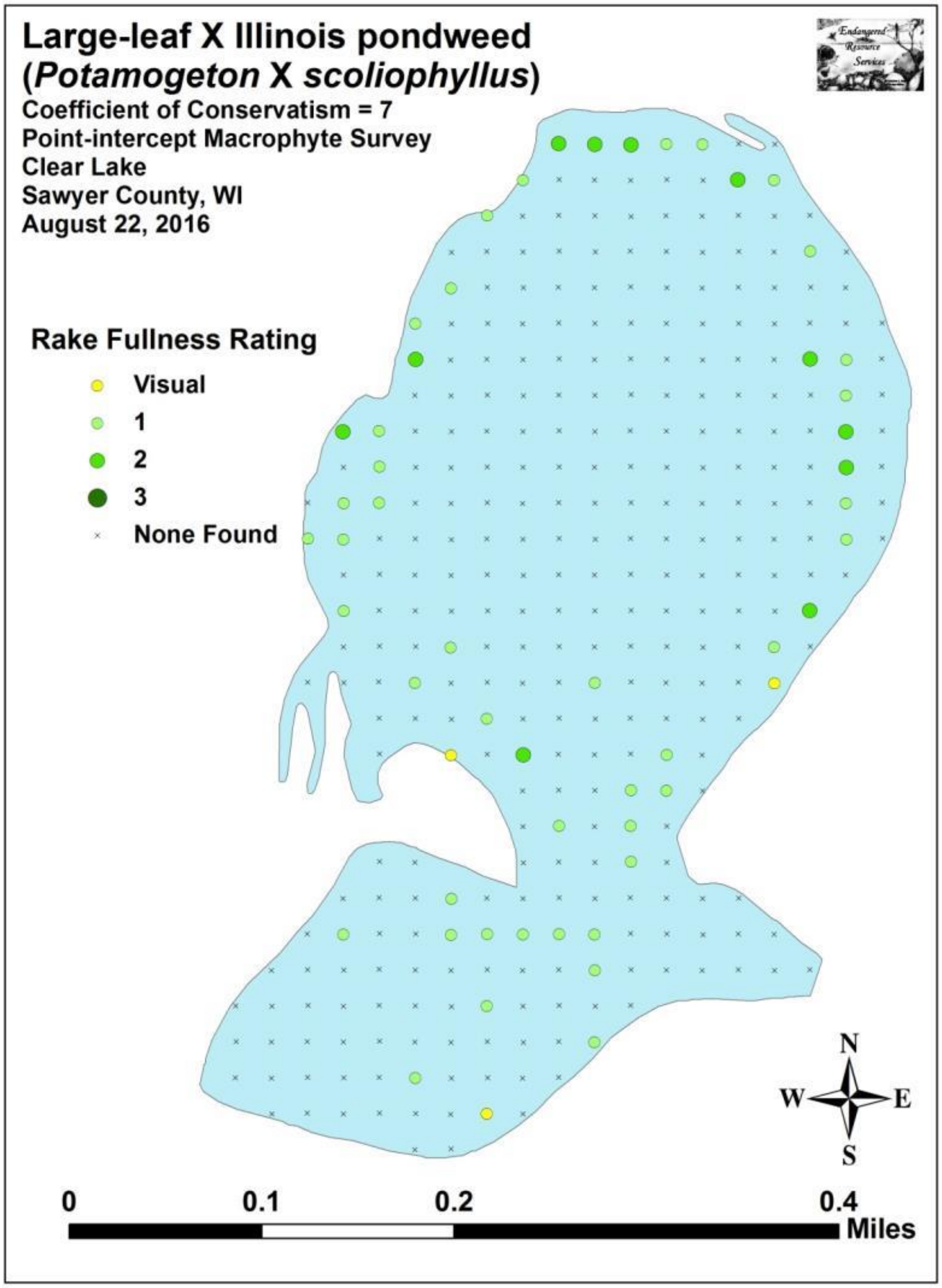
Miles



Large-leaf X Illinois pondweed
(*Potamogeton* X *scoliophyllus*)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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None Found
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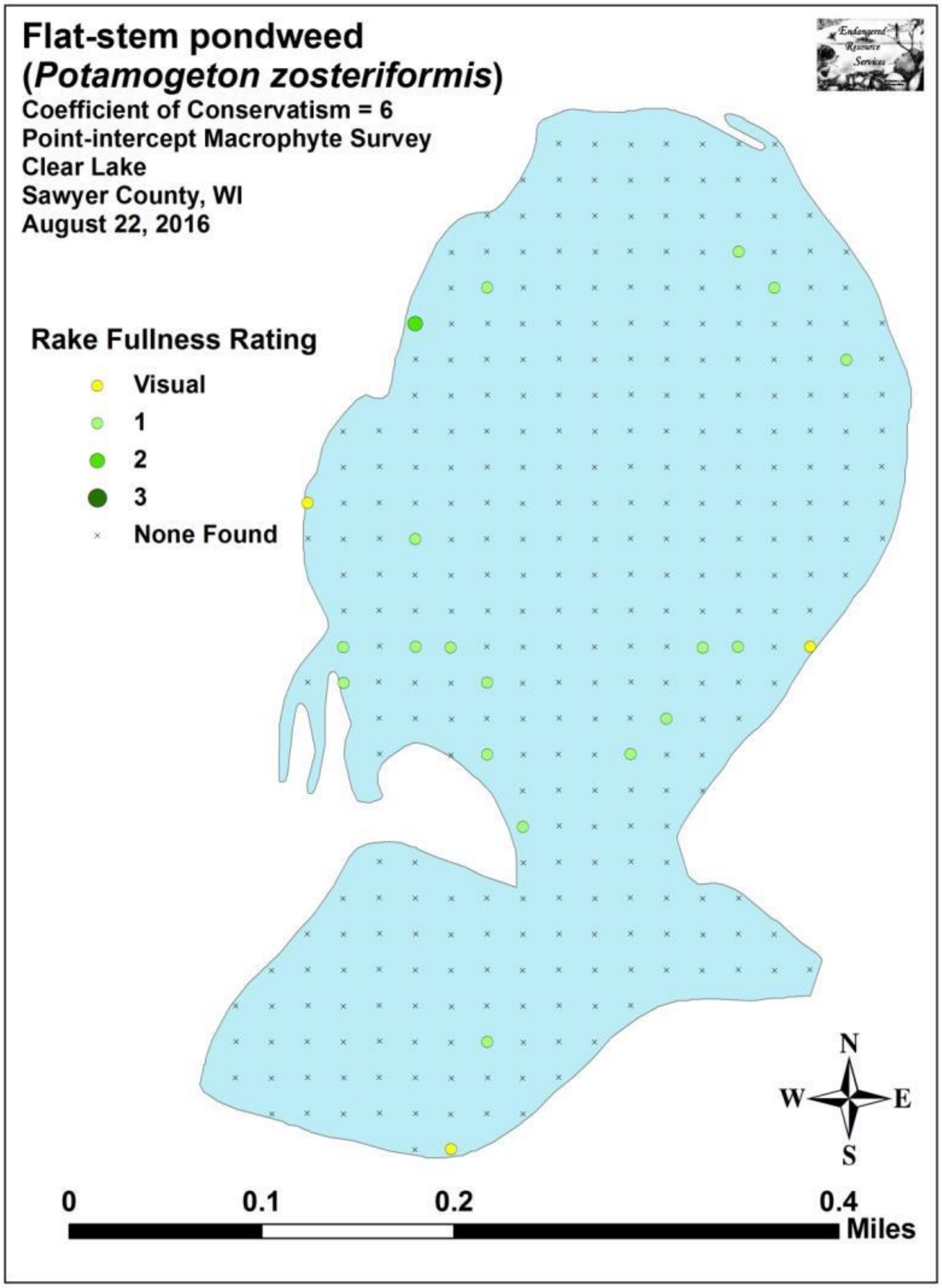
0.1
0.2
0.4
Miles


Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
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0.1
0.2
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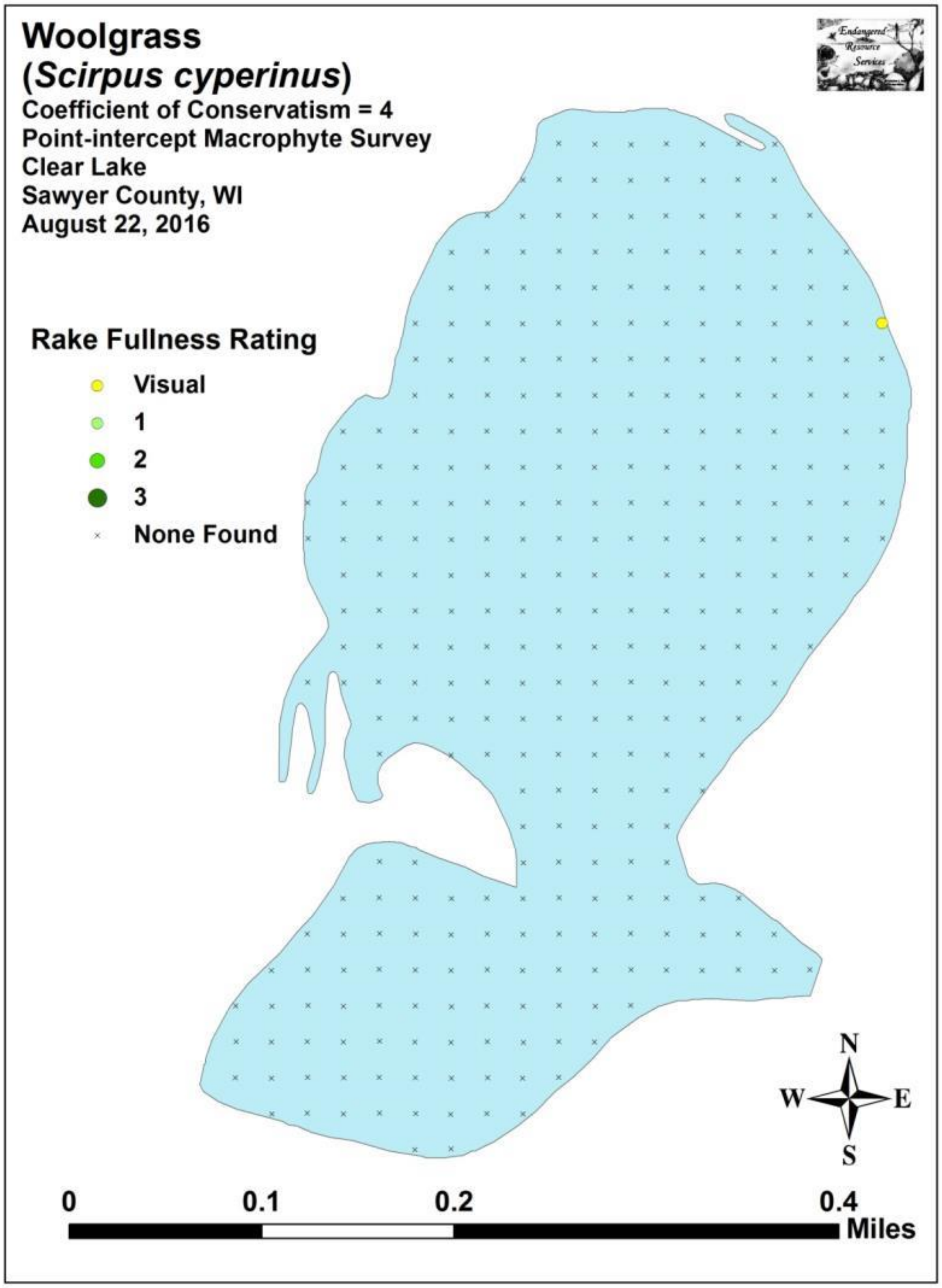
Miles



Woolgrass
(Scirpus cyperinus)
Coefficient of Conservatism = 4
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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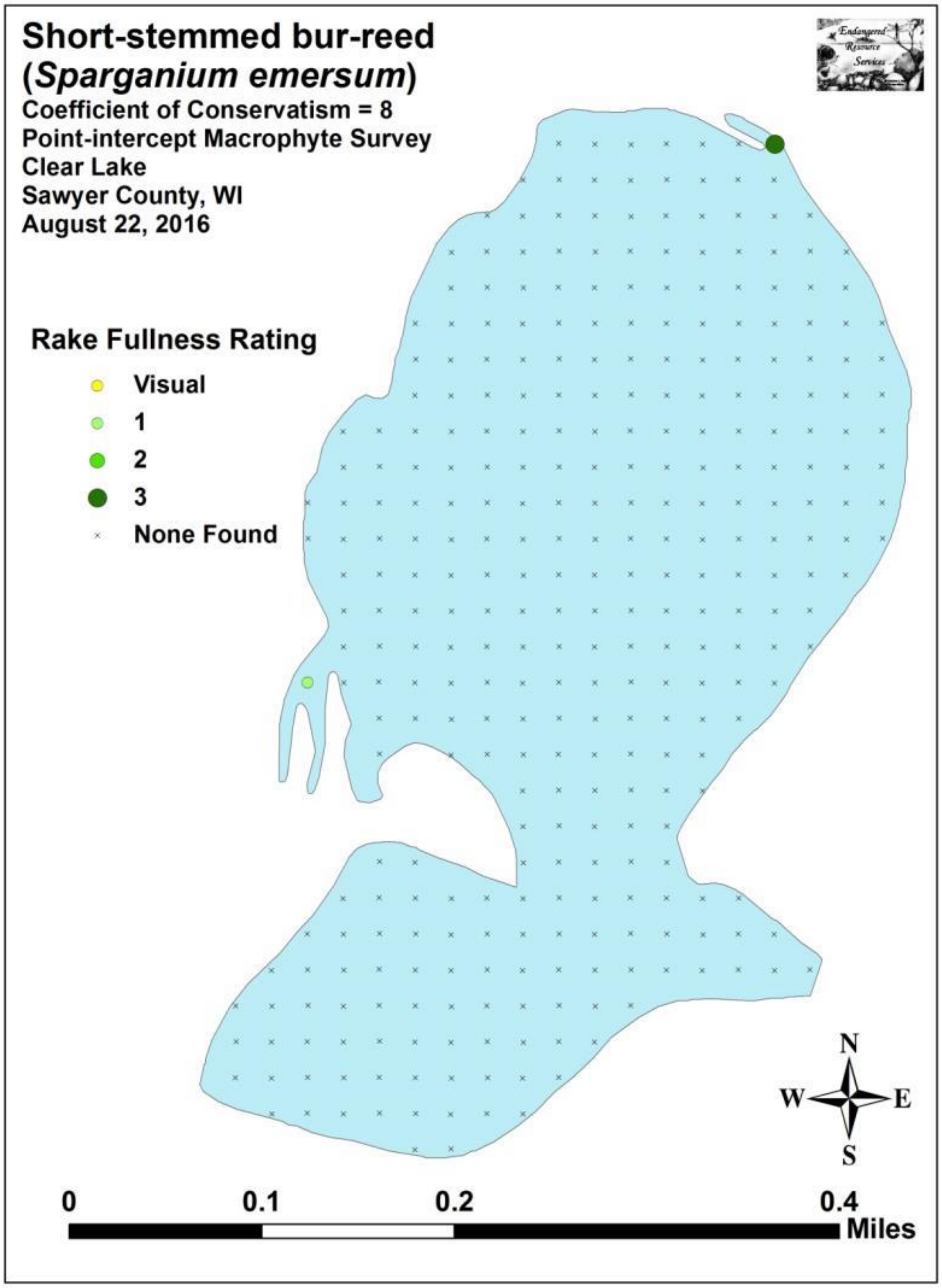
0
0.1
0.2
0.4
Miles


Short-stemmed bur-reed
(*Sparganium emersum*)
Coefficient of Conservatism = 8
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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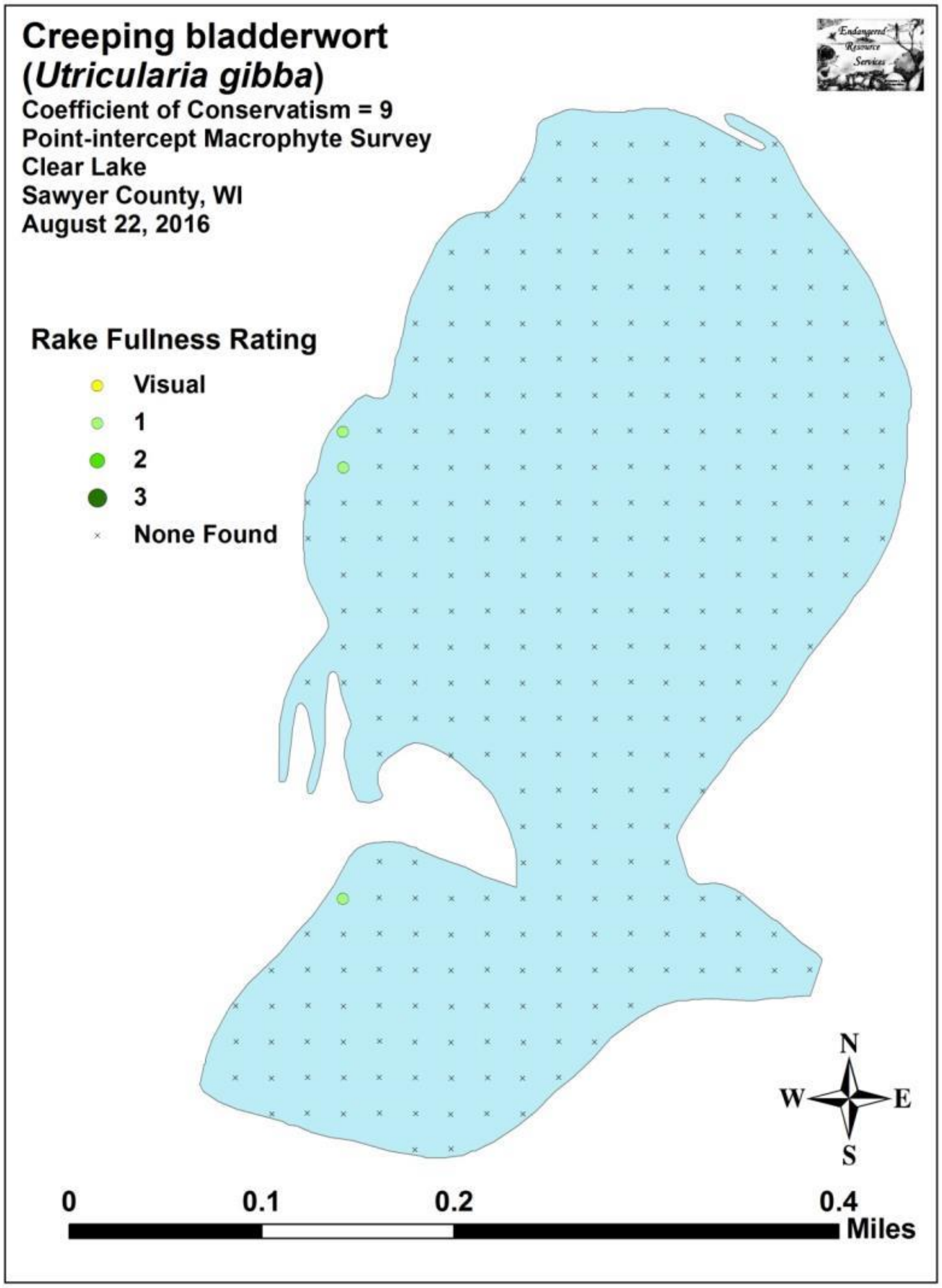
0.1
0.2
0.4
Miles



Creeping bladderwort
(Utricularia gibba)
Coefficient of Conservatism = 9
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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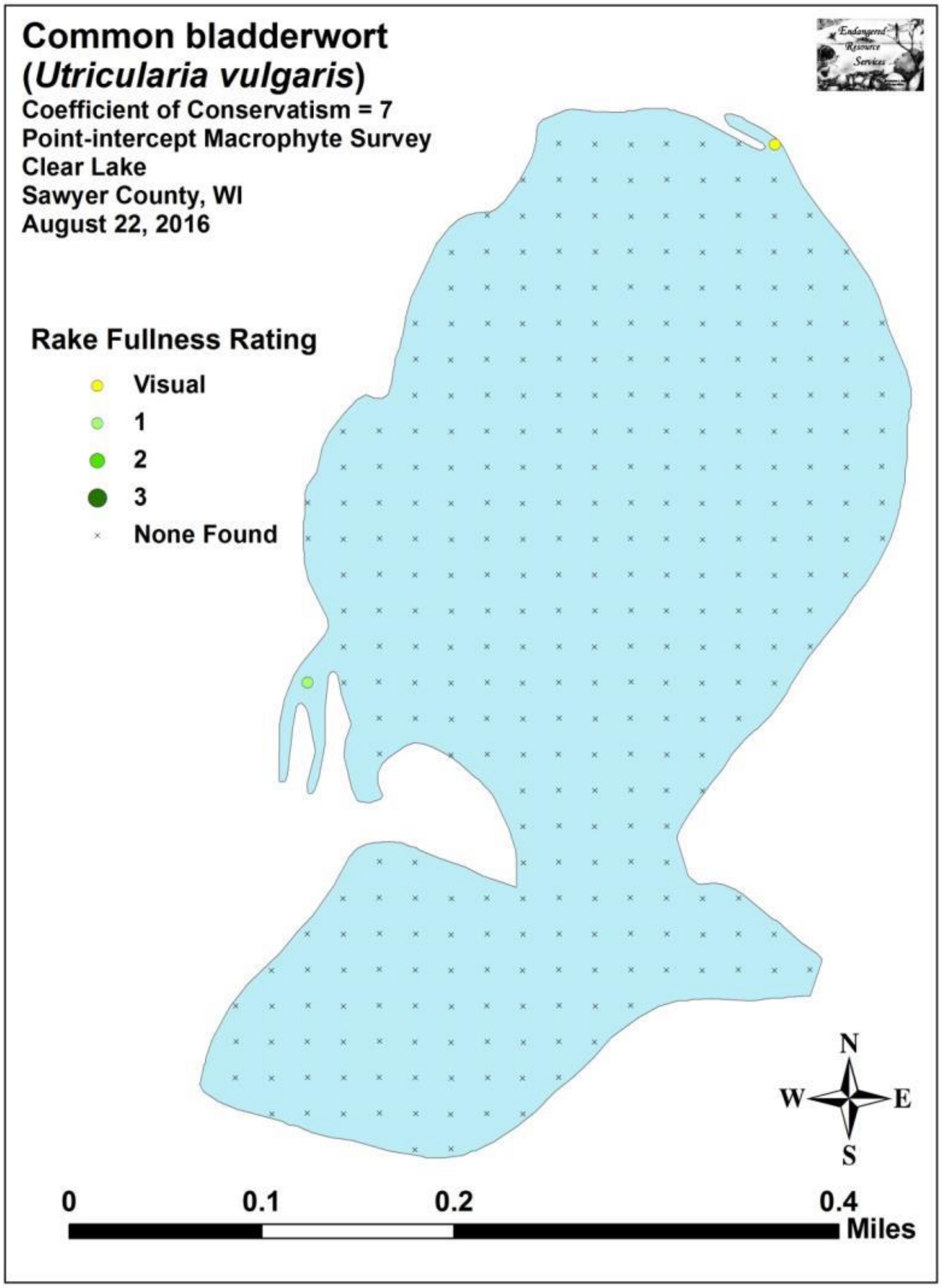
0
0.1
0.2
0.4
Miles


Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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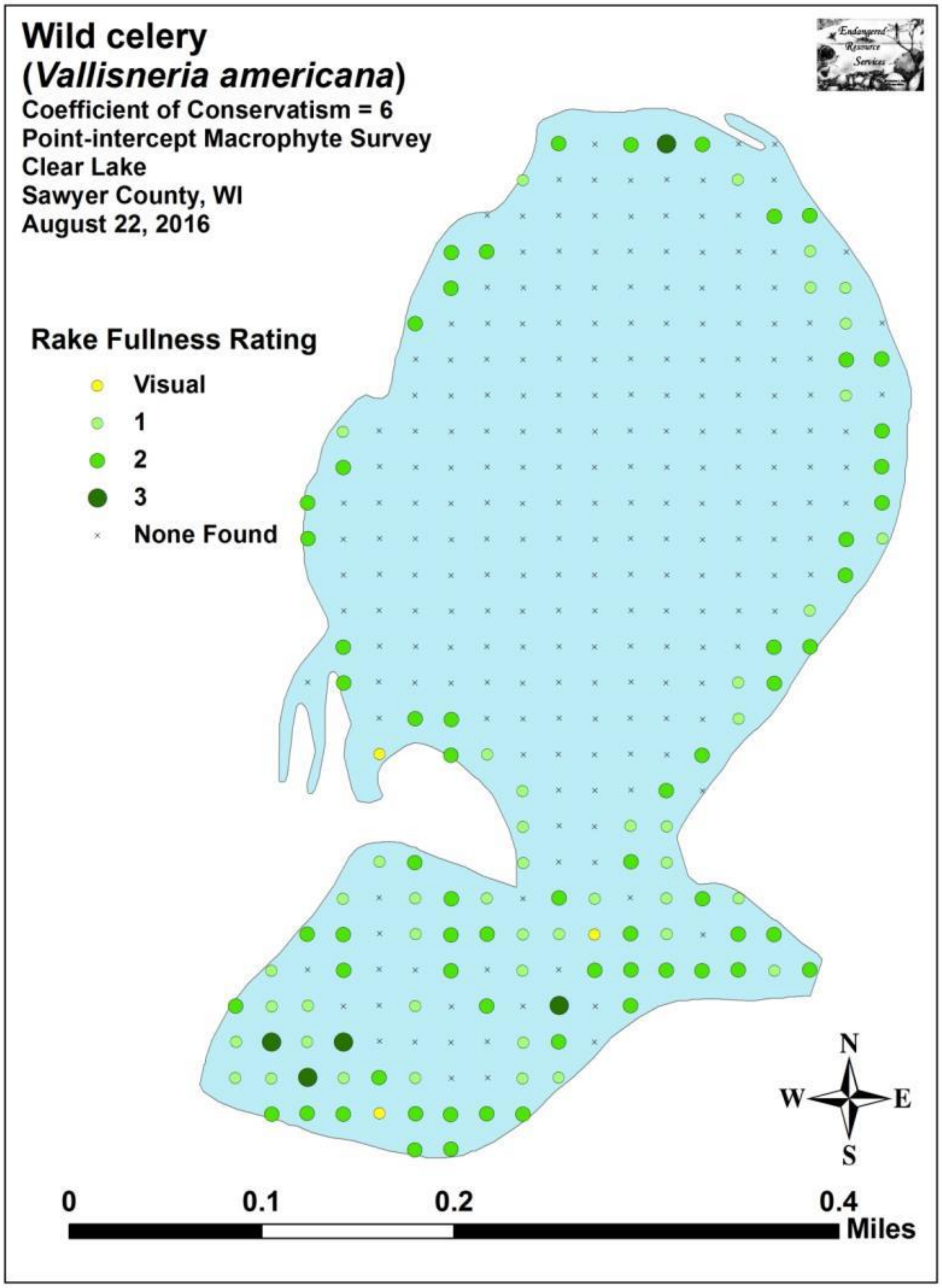
S
0
0.1
0.2
0.4
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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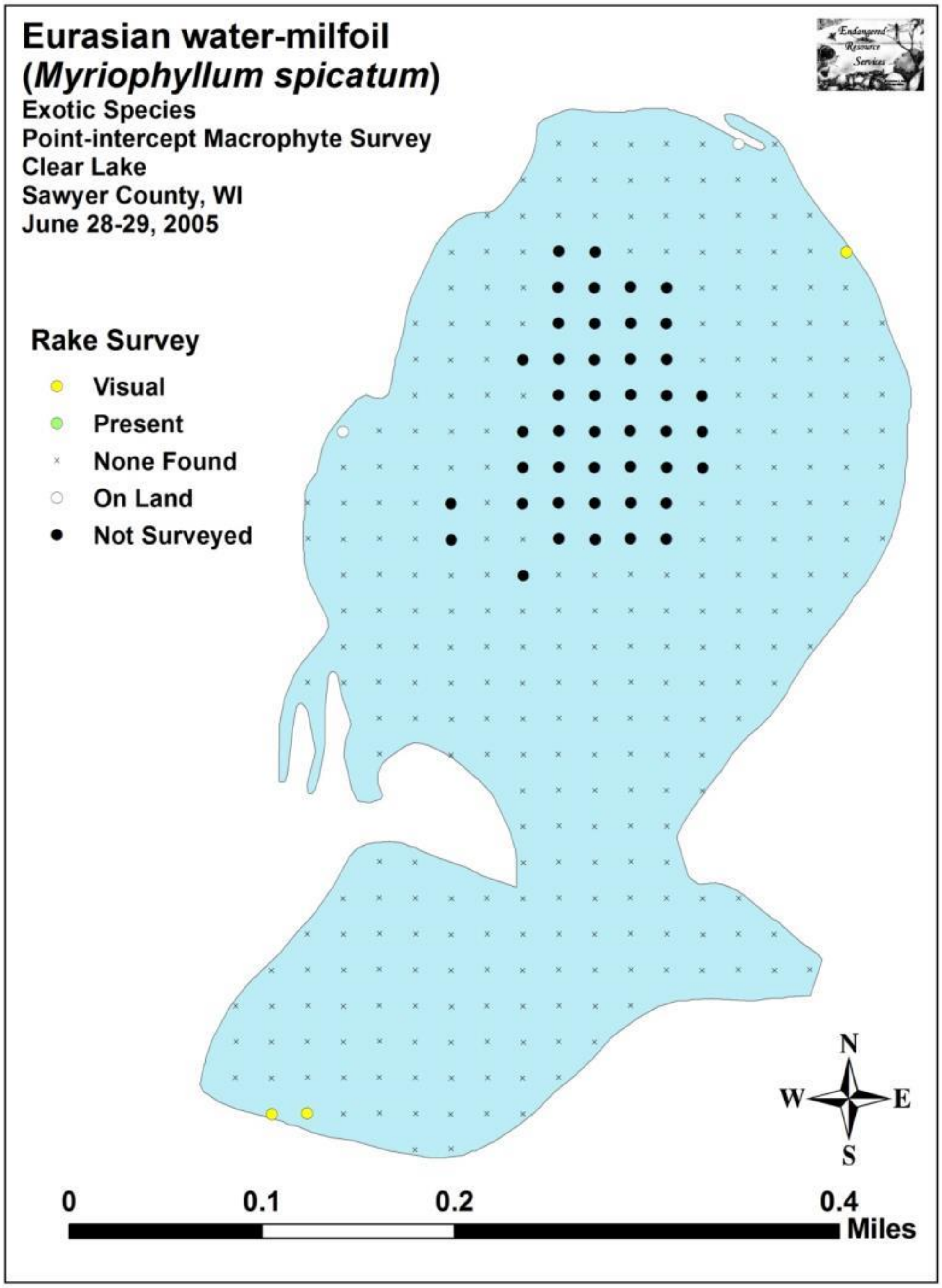
0
0.1
0.2
0.4
Miles

Appendix IX: 2005, 2013, and 2016 EWM Density and Distribution Maps



Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
June 28-29, 2005
Rake Survey
Visual
Present
None Found
On Land
Not Surveyed
N
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0.1
0.2
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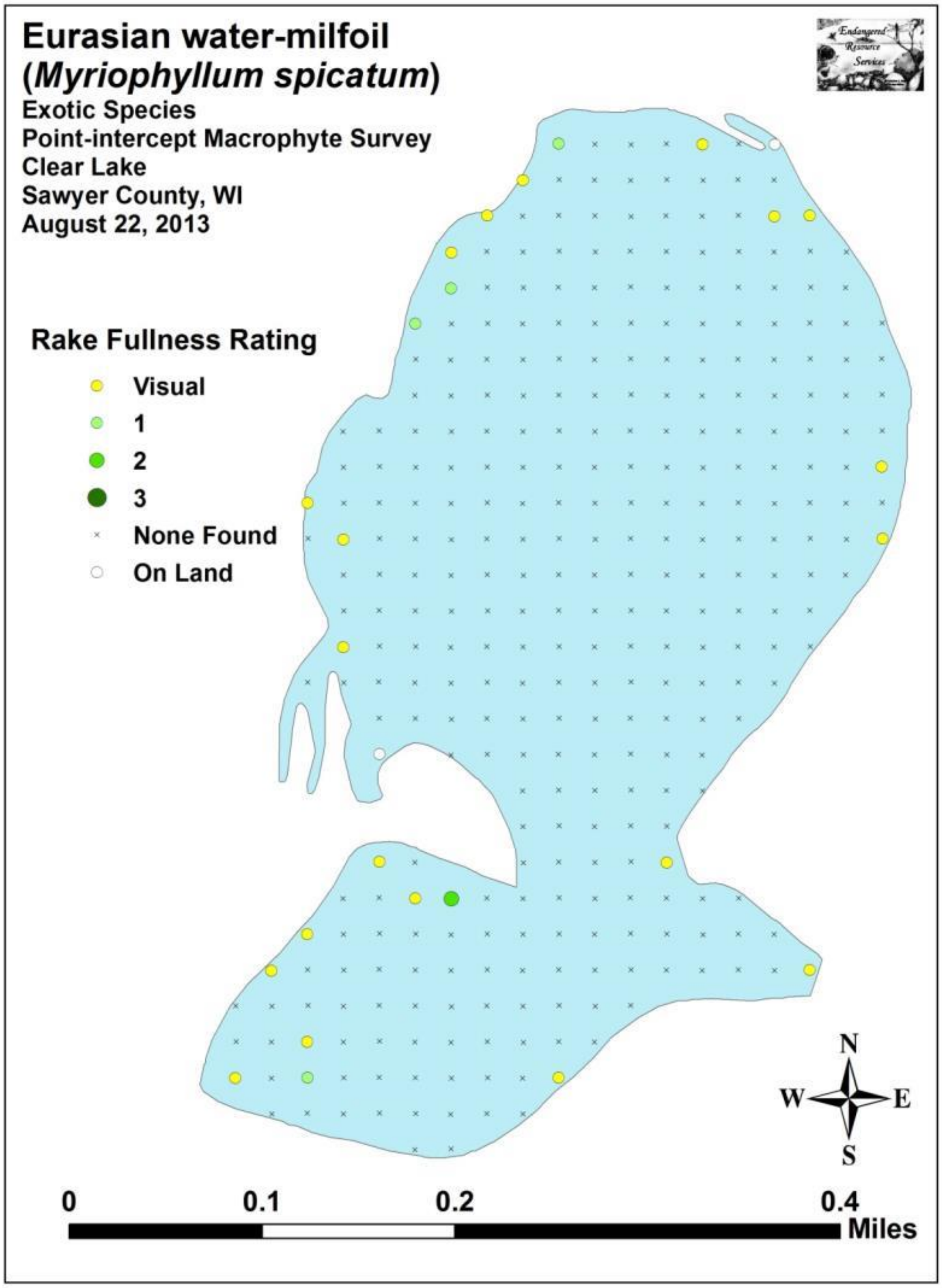
Miles



Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
N
W
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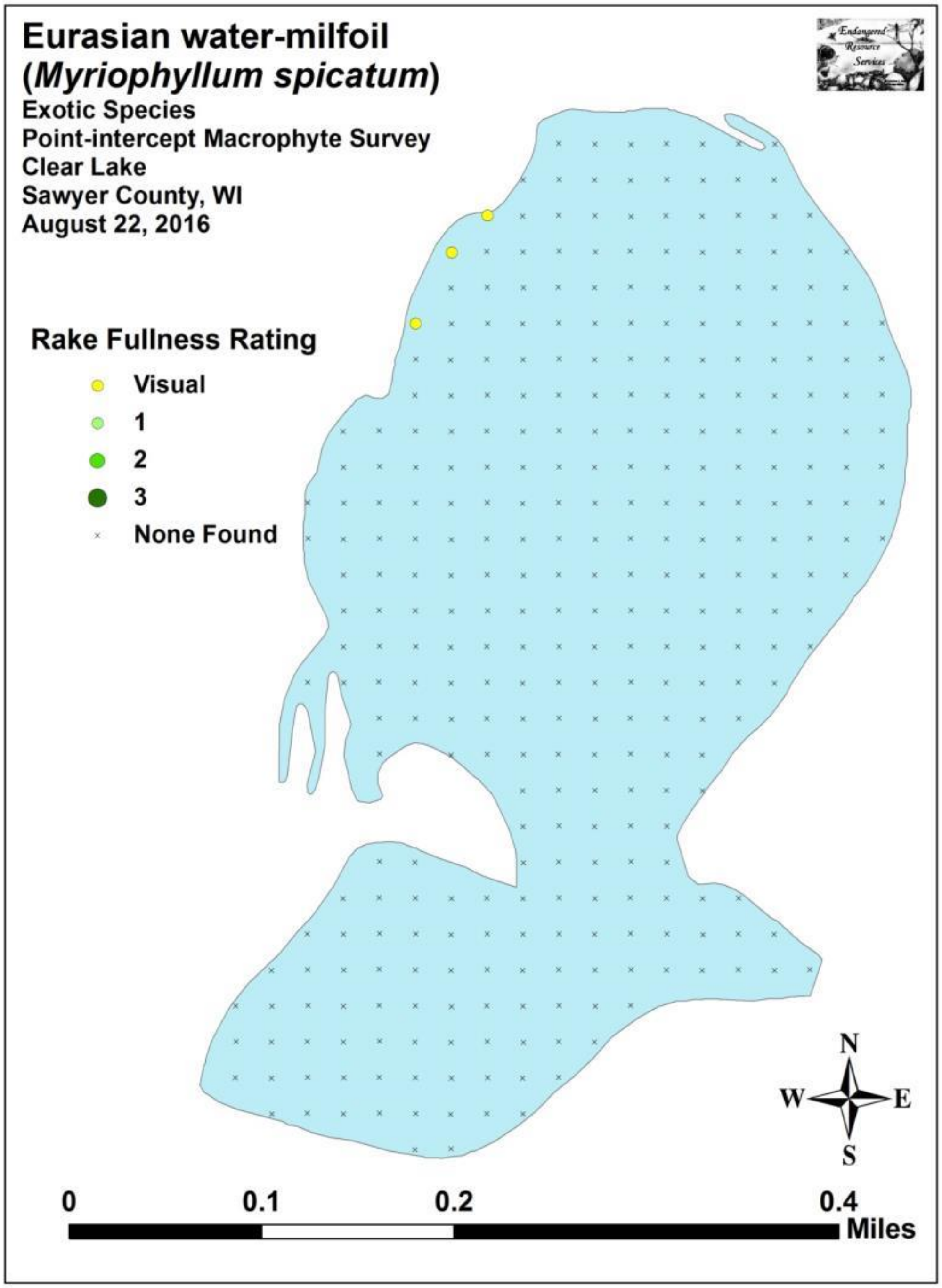
0.1
0.2
0.4
Miles


Eurasian water-milfoil
(*Myriophyllum spicatum*)
Exotic Species
Point-intercept Macrophyte Survey
Clear Lake
Sawyer County, WI
August 22, 2016
Rake Fullness Rating
Visual
1
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None Found
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0.2
0.4
Miles

Appendix X: Aquatic Exotic Invasive Plant Species Information

Eurasian water-milfoil

DESCRIPTION: Eurasian water-milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water-milfoil is nearly impossible to distinguish from Northern water-milfoil. Eurasian water-milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

DISTRIBUTION AND HABITAT: Eurasian milfoil first arrived in Wisconsin in the 1960's. During the 1980's, it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. As of 1993, Eurasian milfoil was common in 39 Wisconsin counties (54%) and at least 75 of its lakes, including shallow bays in Lakes Michigan and Superior and Mississippi River pools.

Eurasian water-milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

LIFE HISTORY AND EFFECTS OF INVASION: Unlike many other plants, Eurasian water-milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water-milfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water-milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water-milfoil may lead to deteriorating water quality and algae blooms of infested lakes. (Taken in its entirety from WDNR, 2010 http://www.dnr.state.wi.us/invasives/fact/milfoil.htm)

Curly-leaf pondweed

DESCRIPTION: Curly-leaf pondweed is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early August

DISTRIBUTION AND HABITAT: Curly-leaf pondweed is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine

LIFE HISTORY AND EFFECTS OF INVASION: Curly-leaf pondweed spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making Curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring.

It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out compete native plants in the spring. In mid-summer, when most aquatic plants are growing, Curly-leaf pondweed plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. Curly-leaf pondweed forms surface mats that interfere with aquatic recreation. (Taken in its entirety from WDNR, 2010 http://www.dnr.state.wi.us/invasives/fact/curlyleaf_pondweed.htm)

Reed canary grass

DESCRIPTION: Reed canary grass is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The lead ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others. Ensure positive identification before attempting control.

DISTRIBUTION AND HABITAT: Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as bergs and spoil piles.

LIFE HISTORY AND EFFECTS OF INVASION: Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. (Taken in its entirety from WDNR, 2010 http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm)

Purple loosestrife
(Photo Courtesy Brian M. Collins)

DESCRIPTION: Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from August to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

This species may be confused with the native wing-angled loosestrife (*Lythrum alatum*) found in moist prairies or wet meadows. The latter has a winged, square stem and solitary paired flowers in the leaf axils. It is generally a smaller plant than the Eurasian loosestrife.

By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Distribution and Habitat: Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Life History and Effects of Invasion: Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2010 http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm)

Appendix XI: Glossary of Biological Terms
(Adapted from UWEX 2010)

Aquatic:
organisms that live in or frequent water.

Cultural Eutrophication:
accelerated eutrophication that occurs as a result of human activities in the watershed that increase nutrient loads in runoff water that drains into lakes.

Dissolved Oxygen (DO):
the amount of free oxygen absorbed by the water and available to aquatic organisms for respiration; amount of oxygen dissolved in a certain amount of water at a particular temperature and pressure, often expressed as a concentration in parts of oxygen per million parts of water.

Diversity:
number and evenness of species in a particular community or habitat.

Drainage lakes:
Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

Ecosystem:
a system formed by the interaction of a community of organisms with each other and with the chemical and physical factors making up their environment.

Eutrophication:
the process by which lakes and streams are enriched by nutrients, and the resulting increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients--mostly nitrates and phosphates--from natural erosion and runoff from the surrounding land basin. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Exotic:
a non-native species of plant or animal that has been introduced.

Habitat:
the place where an organism lives that provides an organism's needs for water, food, and shelter. It includes all living and non-living components with which the organism interacts.

Limnology:
the study of inland lakes and waters.

Littoral:
: the near shore shallow water zone of a lake, where aquatic plants grow.

Macrophytes:
: Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Nutrients:
: elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth.

Organic Matter:
: elements or material containing carbon, a basic component of all living matter.

Photosynthesis:
: the process by which green plants convert carbon dioxide (CO2) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base, and is an important source of oxygen for many lakes.

Phytoplankton:
: microscopic plants found in the water. Algae or one-celled (phytoplankton) or multicellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Plankton:
: small plant organisms (phytoplankton and nanoplankton) and animal organisms (zooplankton) that float or swim weakly though the water.

ppm:
: parts per million; units per equivalent million units; equal to milligrams per liter (mg/l)

Richness:

number of species in a particular community or habitat.

Rooted Aquatic Plants:

(macrophytes) Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Runoff:

water that flows over the surface of the land because the ground surface is impermeable or unable to absorb the water.

Secchi Disc:

An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days.

Seepage lakes:

Lakes without a significant inlet or outlet, fed by rainfall and groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long, residence times. and lake levels fluctuate with local groundwater levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

Turbidity:

degree to which light is blocked because water is muddy or cloudy.

Watershed:

the land area draining into a specific stream, river, lake or other body of water. These areas are divided by ridges of high land.

Zooplankton:

Microscopic or barely visible animals that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. For many fish, they are the primary source of food.

Appendix XII: 2016 Raw Data Spreadsheets