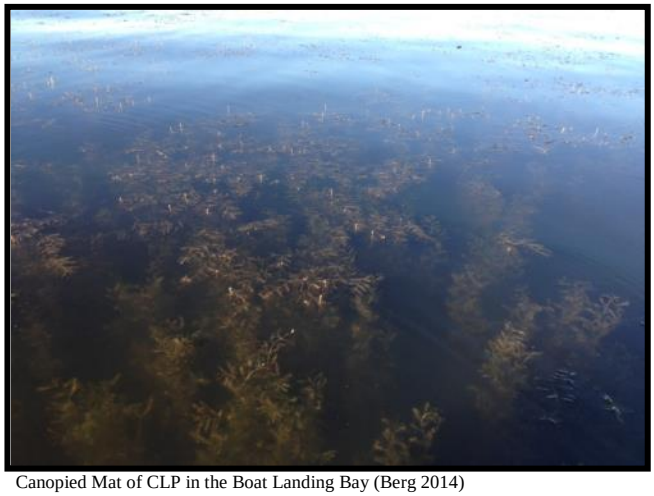
Curly-leaf pondweed (*Potamogeton crispus*) Point-intercept and Bed Mapping Surveys, and Warm-Water Full Lake Point-intercept Plant Survey
Big Chetac Lake – WBIC: 2113300
Sawyer County, Wisconsin

Canopied CLP Beds Surrounding Spikerushes in Bullpen Bay (Berg 2014)

Big Chetac Lake Aerial Photo (2008)

Project Initiated by:
Big Chetac Chain Lake Association, and the
Wisconsin Department of Natural Resources (Grant ACEI-133-13)



Canopied Mat of CLP in the Boat Landing Bay (Berg 2014)

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June 20-22, and July 15-17, 2014

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STUDY SUMMARY

Background, Rational, and Study Objectives:

Big Chetac Lake (WBIC 2113300) is a 1,920 acre eutrophic stratified drainage lake located in southwestern Sawyer County, WI. In 2008, concern over the lake's infestation of Curly-leaf pondweed (*Potamogeton crispus*) (CLP) prompted the Big Chetac Chain Lake Association (BCCLA) to start developing a Wisconsin Department of Natural Resources (WDNR) approved Aquatic Plant Management Plan (APMP) which was completed and adopted in 2010. The 2008 spring survey found CLP dominated approximately 30% of the lake's surface area, and, especially in the lake's muck bottom bays, almost always formed a solid canopy in up to 10ft of water, excluded most native plants, and often made boating difficult. After receiving a three-year exotic species control grant in 2013, it was decided to chemically treat 90 acres in the north bay in both 2013 and 2014.

In anticipation of updating their APMP in 2015, the BCCLA authorized three plant surveys in 2014: CLP point-intercept and CLP bed mapping surveys from June 20-22, and a warm-water point-intercept survey of all macrophytes from July 15-17. The study objectives were to document the density and distribution of CLP in the lake, determine if EWM or any other new exotic plants had invaded the lake, and determine the current density and distribution of native plants species. Although changing annual factors like ice thickness, snow cover, mean temperature, and water chemistry can have significant impacts on year-over-year growing conditions, we also compared the 2008 and 2014 surveys as these data may be useful to the BCCLA in updating their APMP. This report is the summary analysis of these field surveys.

Curly-leaf Pondweed Point-intercept and Bed Mapping Surveys:

The cold-water density survey found CLP at 115 points which extrapolated to 11.9% of the lake – a highly significant decrease over 2008 when we found it at 340 sites (35.1% coverage). In 2014, 80 points (8.2% of the lake) had a significant infestation (rake fullness 2 or 3). This was also a highly significant decline (-71.9%) from 2008 when 285 points (29.4%) had a significant infestation. In 2014, we mapped 16 CLP beds totaling 180.94 acres and covering 9.4% of the lake.

Warm-water Full Lake Plant Survey:

During the July 2014 full lake point-intercept survey, we found macrophytes growing at 148 sites or on approximately 15.3% of the entire lake bottom and in 30.0% of the 14.5ft littoral zone. This represented a highly significant decline from 2008 when we found plants at 269 sites covering 27.3% of the lake and in 68.6% of the then 12.5ft littoral zone.

Overall plant diversity was exceptionally high with a Simpson Diversity Index value of 0.93 – up slightly from 0.90 in 2008. Species richness was moderate with 48 species found growing in and immediately adjacent to the water – up slightly from 46 in 2008. There was an average of 2.71 native species/site with native vegetation – up from 2.49 species/site in 2008. Mean rake fullness at sites with vegetation was down from an estimated 2.02 in 2008 to 1.84 in 2014. Coontail (*Ceratophyllum demersum*), Curly-leaf pondweed, Small pondweed (*Potamogeton pusillus*), and Slender naiad (*Najas flexilis*) were the most common macrophyte species in 2014 being found at 40.54%, 38.51%, 25.00%, and 18.92% of points with vegetation and accounting for 45.96% of the total relative frequency.

In 2008, Curly-leaf pondweed, Small pondweed, Coontail, and Flat-stem pondweed (*Potamogeton zosteriformis*) were the most common species being found at 48.70%, 48.33%, 42.38%, and 18.96% of survey points with vegetation and accounting for 57.73% of the total relative frequency. When comparing 2008 to 2014, in addition to CLP, Small pondweed, Coontail, Flat-stem pondweed, Forked duckweed, and Fries pondweed demonstrated highly significant declines; while Small duckweed, Large duckweed, Fern pondweed, and White water crowfoot experienced significant declines.

Although no species displayed significant increases, those that did increase tended to overwinter as seeds, rhizomes, and/or tubers rather than vegetatively. Northern wild rice (*Zizania palustris*) was present at three points (up from two points in 2008) all of which were in the Bullpen Bay near the creek inlets. Although rice was common in this area, no beds appeared to be dense enough to offer profitable human harvest. Filamentous algae also demonstrated a highly significant decline from 59 points in 2008 to 27 points in 2014.

The 37 native index species found in the rake during the July 2014 survey (up from 34 in 2008) produced a slightly above average mean Coefficient of Conservatism of 5.9 (down from 6.0 in 2008), and a Floristic Quality Index of 35.8 (up from 34.8 in 2008) that was much above the median FQI for this part of the state. Other than CLP, Reed canary grass (*Phalaris arundinacea*) was the only other exotic species found.

Future Management Considerations:

Future management considerations include preserving the lake's native plants (especially the rush beds and floating-leaf species) and the important habitat they provide for the entire lake ecosystem including its excellent fishery; continuing to work on improving water clarity so native plants can reestablish in areas formerly occupied by CLP; continuing the established Clean Boats/Clean Waters watercraft inspection to decrease the chances an Aquatic Invasive Species will be introduced into the lake; and considering monitoring the landings monthly and the entire visible littoral zone at least annually to quickly identify an infestation of Eurasian water milfoil (*Myriophyllum spicatum*) or any other new AIS should one be introduced to the lake.

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INTRODUCTION:

Big Chetac Lake (WBIC 2113300) is a 1,920-acre stratified drainage lake in southwestern Sawyer County, Wisconsin in the Town of Edgewater (T37N R09W S19 NE NE). It reaches a maximum depth of 28ft in the narrows between the islands in the south basin and has an average depth of approximately 14ft (Busch et al. 1967). The lake is eutrophic (nutrient rich) in nature with summer Secchi readings averaging 3.3ft over the past 17 years (WDNR 2014). This poor to very poor water clarity produced a littoral zone that extended to approximately 12ft in the spring of 2014. The bottom substrate is predominately muck in the lake's side bays and throughout the north and south ends, and a mixture of sand and rock along exposed shorelines, the mid-lake narrows, and around the islands (Busch et al. 1967).

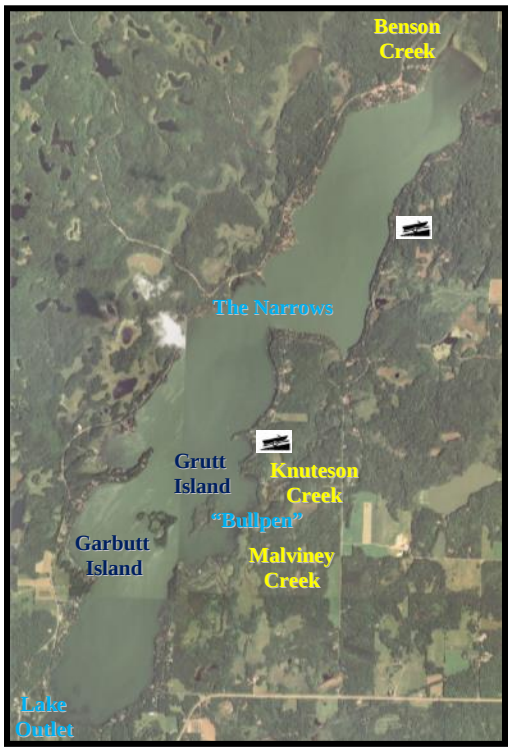


Figure 1: Big Chetac Lake Aerial Photo

In 2008, concern over the lake's significant infestation of Curly-leaf pondweed (*Potamogeton crispus*) (CLP), an exotic invasive species, prompted the Big Chetac Chain Lake Association (BCCLA) to start developing a Wisconsin Department of Natural Resources (WDNR) approved Aquatic Plant Management Plan (APMP) which was completed and adopted in 2010. As a prerequisite to developing this plan, we completed two baseline macrophyte surveys: a spring CLP point-intercept survey and summer full species point-intercept survey. The spring survey found CLP dominated approximately 30% of the lake's surface area, and, especially in the lake's muck bottom bays, almost always formed a solid canopy in up to 10ft of water, excluded most native plants, and often made boating difficult. Because of this, in 2013, the BCCLA applied for and received a three-year WDNR exotic species control grant to begin actively managing CLP chemically and manually. After evaluating the 2008 maps, it was decided to treat 90 acres in the north bay in both 2013 and 2014.

In anticipation of updating their APMP in 2015, the BCCLA authorized three plant surveys in 2014: CLP point-intercept and CLP bed mapping surveys from June 20-22, and a warm-water point-intercept survey of all macrophytes from July 15-17. The study objectives were to document the density and distribution of CLP in the lake, determine if EWM or any other new exotic plants had invaded the lake, and determine the current density and distribution of native plants species. Although changing annual factors like ice thickness, snow cover, mean temperature, and water chemistry can have significant impacts on year-over-year growing conditions, we also compared the 2008 and 2014 surveys as these data may be useful to the BCCLA in updating their APMP. This report is the summary analysis of these field surveys.

METHODS:

Curly-leaf Pondweed Point-intercept Survey:

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth, and total acreage, Jennifer Hauxwell (WDNR) generated a 970 point sampling grid for Big Chetac Lake (Appendix I). Using this grid, we completed a density survey where we sampled for Curly-leaf pondweed at each point in and adjacent to the lake's littoral zone. We located each survey point using a handheld mapping GPS unit (Garmin 76CSx) and used a rake to sample an approximately 2.5ft section of the bottom. When found, CLP was assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also noted visual sightings of CLP within six feet of the sample point.

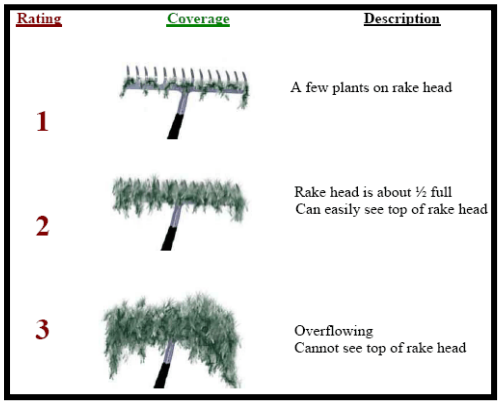


Figure 2: Rake Fullness Ratings (UWEX 2010)

Curly-leaf Pondweed Bed Mapping Survey:

Following the CLP density survey, we used the resulting map coupled with a meandering littoral zone search to locate and delineate all significant beds of CLP on the lake. We defined a bed based on the following two criteria: CLP plants made up greater than 50% of all plants in the area, and the CLP had canopied at the surface or was close enough to the surface that it would likely interfere with normal boat traffic.

Upon finding a bed, we circled around the perimeter and used a GPS unit to record waypoints at regular intervals. We then uploaded these points into ArcMap 9.3.1, created bed shapefiles using the WDNR Forestry Tools Extension, and determined the total acreage of the beds to the nearest hundredth of an acre (Table 1). We also estimated the rake density range and mean rake fullness of the bed (Figure 2), the maximum depth of the bed, whether it was canopied, and the impact it was likely to have on navigation (**none** – easily avoidable with a natural channel around/**minor** – one prop clear to get through or access open water/**moderate** – several prop clears needed to navigate through/**severe** – continuous prop clears and difficult to impossible to row through).

Warm-water Full Point-intercept Macrophyte Survey:

Prior to beginning the July point-intercept survey, we conducted a general boat survey of the lake to regain familiarity with the species present (Appendix II). All plants found were identified (Voss 1996, Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2009; Skawinski 2011), and a data sheet was built from the species present. We again located each survey point with a GPS, recorded a depth reading with a metered pole rake or hand held sonar (Vexilar LPS-1), and took a rake sample. 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.

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 15ft pole rake and a 25ft rope rake for sampling.

Average number of species per site: 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.

Species richness: 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.**

Average rake fullness: This value is the average rake fullness of all species in the rake. It only takes into account those sites with vegetation (Table 2).

Relative frequency: 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 3 and 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, North 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. Big Chetac Lake is in the North Central Hardwood Forests Ecoregion (Tables 5 and 6).

**** 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: We compared data from our 2008 and 2014 CLP point-intercept surveys (Figures 3 and 4) and our warm-water point-intercept survey (Figure 10) (Tables 3 and 4) to see if there were any significant changes in the lake's vegetation. Using the WDNR Pre/Post Survey Sheet, we determined 2008-2014 differences to be significant at $p < .05$, moderately significant at $p < .01$ and highly significant at $p < .005$ (UWEX 2010). It should be noted that depths were not recorded during the June 2008 CLP survey, but, as we found CLP plants to 14ft, we were able to use the 2014 depth data to estimate there were 456 points in this depth range compared to 356 points in the 2014 11ft littoral zone. When comparing the warm-water point-intercept surveys, we again used the number of littoral points as the basis for "sample points" as 2014's 493 points was much higher when compared to 2008's 392 points.

RESULTS:

Curly-leaf Pondweed Point-intercept Survey:

Following the establishment of the June littoral zone at approximately 11.0ft of water, we sampled for Curly-leaf pondweed at all points within three feet of this zone. CLP was present in the rake at 115 sample points which approximated to 11.9% of the entire lake. Of these, we recorded a rake fullness value of 3 at 54 points, a 2 at 26 points, and a value of 1 at 35 points. This extrapolated to 8.2% of the lake having a significant infestation (rake fullness of 2 or 3). We also recorded CLP as a visual at four points (Figure 3) (Appendix III).

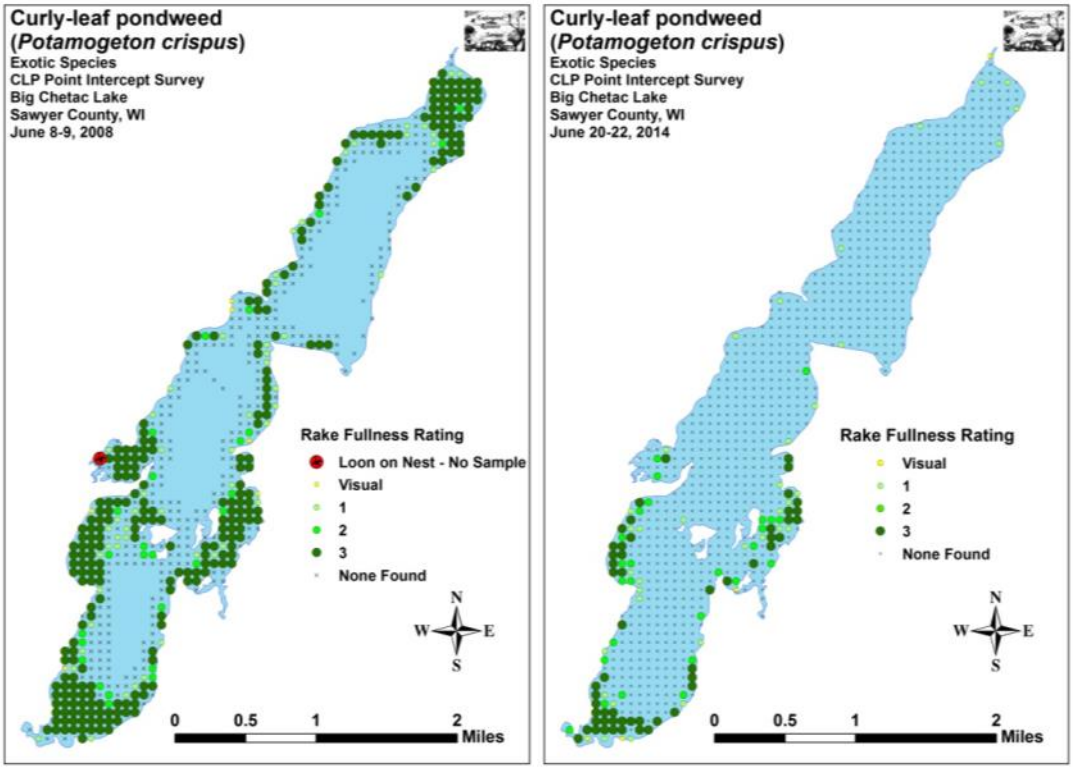
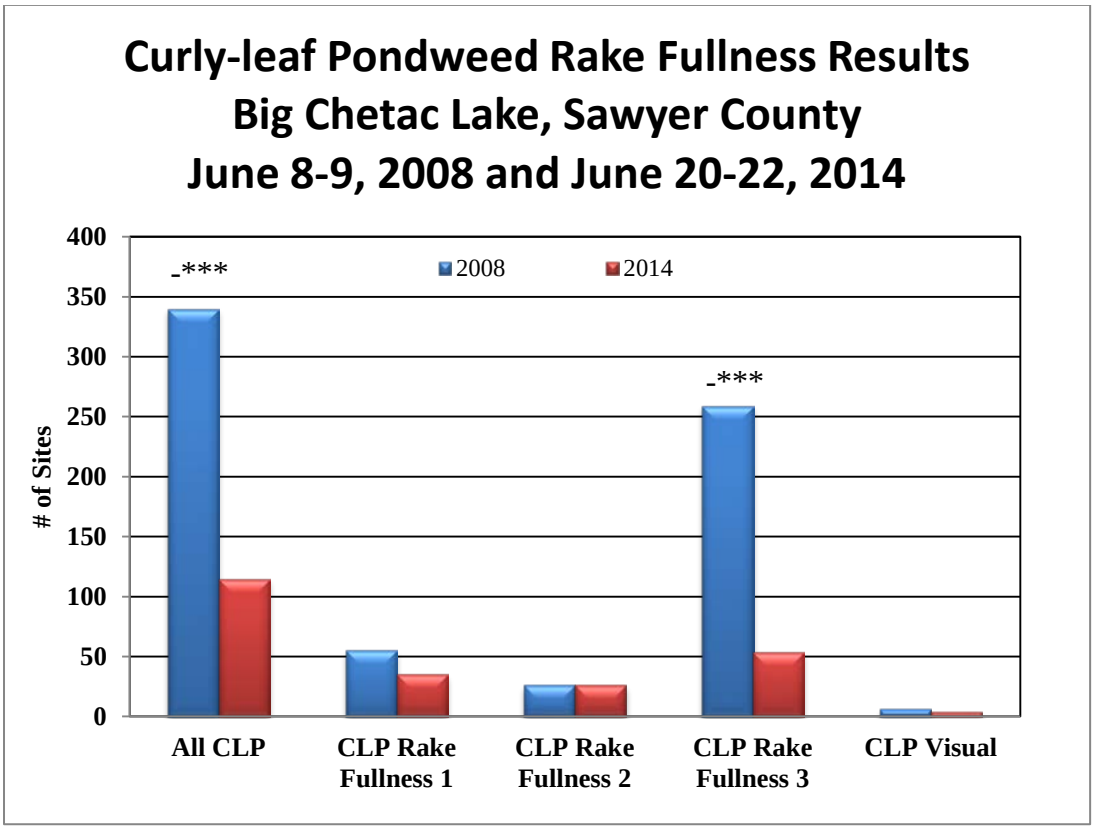


Figure 3: 2008 and 2014 June CLP Density and Distribution

Comparison of CLP in 2008 and 2014:

The June 7-8, 2008 Curly-leaf pondweed survey found CLP at 340 sites which approximated to 35.1% of the entire lake. Of these, we recorded a rake fullness value of 3 at 259 points, a 2 at 26 points, and a value of 1 at 55 points. This extrapolated to 29.4% of the lake having a significant infestation (rake fullness of 2 or 3) (Figure 3). We also noted CLP as a visual at 6 points (Appendix III). Our results suggest that, following two years of active CLP management, there was a highly significant reduction in total CLP coverage and rake fullness 3 (Figure 4), and an 71.9% reduction in nuisance points.



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

Figure 4: 2008 and 2014 Changes in June CLP Rake Fullness

CLP Bed Mapping Survey:

Lakewide, we located and mapped 16 beds totaling 180.94 acres (9.4% of the lake's 1,920 acres) with the biggest being 72.08 acres (Bed 7) and the smallest being 0.18 acre (Beds 2 and 3) (Table 1). Each of these beds was canopied or near canopy, and, although some of them extended to 11.0ft, most dense growth ended abruptly in 8-9ft forming a hard outer edge. The inner edges often extended to 3ft, but tended to be more fragmented as CLP was frequently mixed with at least some native plants near shore (Figure 5) (Appendix III).

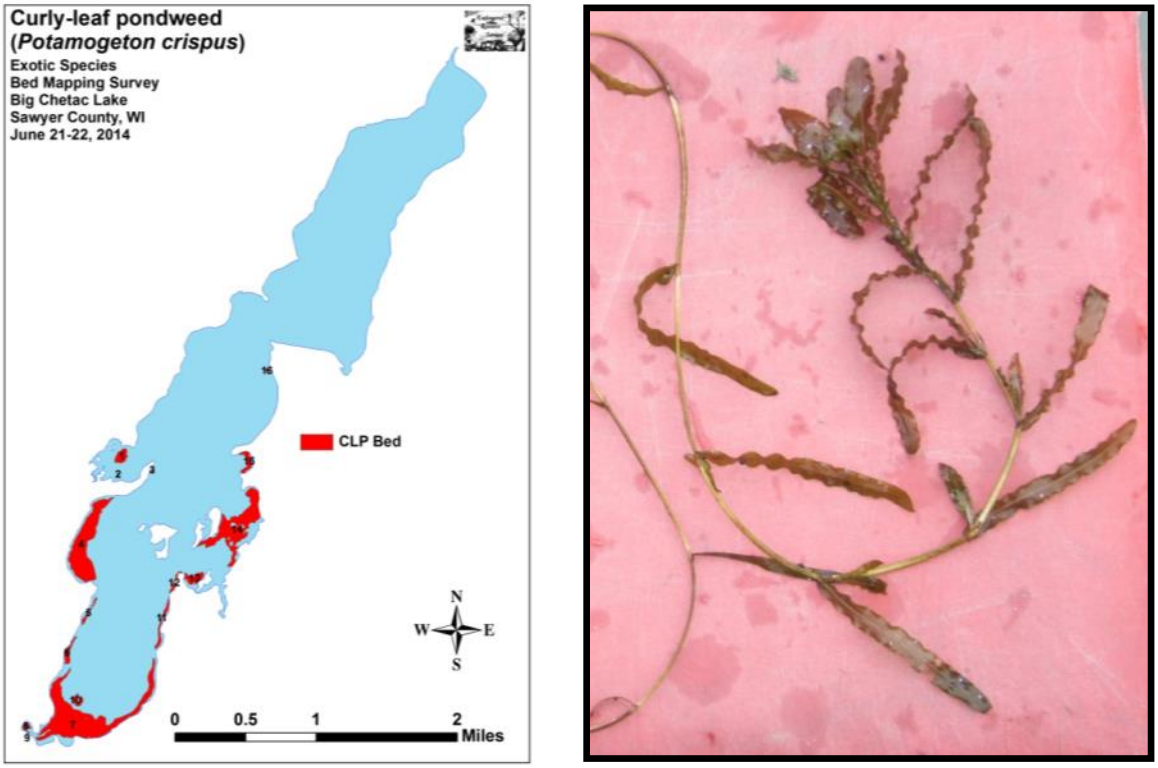


Figure 5: 2014 Curly-leaf Pondweed Beds

Beds 1: Located in front of a resort in the western control bay, Bed 1 was canopied and moderately dense (Figure 6). However, whether it was naturally occurring or the product of regular boat traffic in/out of the resort's docks, there was a reasonable navigation channel to the north of the bed that allowed motorists to avoid it.

Beds 2 and 3: These small beds were moderately dense, but neither was canopied or so big that they couldn't have been easily avoided. Although Bed 3 had few native species near it, Bed 2 was surrounded by the best patches of White-stem pondweed (*Potamogeton praelongus*) found in the whole lake.

Bed 4: This giant 40+ acre bed was canopied to 9ft and extremely dense throughout the majority of the bay (Figure 7). We noticed motor trails crisscrossing throughout the bed as shoreline residents were forced to cut paths to open water as there was no natural navigation channel.

Table 1: CLP Bed Summary
Big Chetac Lake, Sawyer County
June 21-22, 2014

Bed Number	Acreage	Rake Range	Mean Rake Fullness	Max Depth	Canopied	Likely Navigation Impairment Level
1	4.16	1-3	3	7	Yes	Minor
2	0.18	1-3	2	8	No	None
3	0.18	1-3	2	8	No	None
4	42.31	1-3	3	9	Yes	Severe
5	1.63	2-3	3	8	Yes	Minor
6	3.16	2-3	3	8	Yes	Moderate
7	72.08	2-3	3	11	Yes	Severe
8	1.03	1-3	1	6	Yes	None
9	0.22	1-3	2	6	Yes	Minor
10	2.09	2-3	3	8	Yes	None
11	3.51	2-3	3	8	Yes	Minor
12	1.48	2-3	2	8	Yes	Minor
13	4.70	1-3	2	8	Yes	Moderate
14	40.16	1-3	2	9	Yes	Moderate
15	3.75	2-3	3	9	Yes	Moderate
16	0.31	1-3	2	8	No	None
Total Acres	**180.94**					

Figure 6: Bed 1 in the Western Control Bay

Figure 7: Bed 4 - Canopied CLP Facing Garbutt Island/Southeast Point

Beds 5 and 6: Both of these beds were relatively narrow, and, although they were dense and canopied, we noted that most residents would have likely needed only one or two prop clears to access open water. Although monotypic CLP on their outer edges, the beds were mixed with native species near shore as the immediate shoreline in this area was predominantly sand and sandy muck – a habitat that generally does not favor CLP.

Bed 7: This giant 70+ acre bed blanketed the south bay and extended north along the southeastern shoreline. It was the worst remaining area in the lake as CLP formed a solid mat over most of the area (Figure 8), and plants extended to as much as 11ft of water. We noticed that boat traffic to/from the lake outlet had created a navigation channel, but, if boats strayed out of this area, they were forced to motor at idle speed and perform regular prop clears to get through the bed and reach open water.

Beds 8 and 9: These two small beds were located on either side of the outlet channel in the bays east of the bridge. Bed 8 occurred in a bay that had no shoreline access so it seemed unlikely that it would cause issues for anyone. Bed 9 was established in front of a residence, but regular in and out boat traffic seemed to have created a usable channel to get to open water (Figure 9).

Figure 8: Bed 7 CLP Mat Near the Lake Outlet

Figure 9: Beds 8 and 9 - North and South of the Lake Outlet Channel

Bed 10: This horseshoe shaped bed wrapped around a rockbar just north of Bed 7. Although it was dense and canopied, there were natural channels on both sides of it where the bar dropped off into deep water.

Beds 11 and 12: These beds were monotypic on the outer edge, but mixed with at least some native species on the nearshore edge. Similar to Bed 5, we found that these relatively narrow beds were close enough to deep water that most residents would have likely needed one or two prop clears to access open water.

Bed 13: Located on the south end of the Bullpen Bay, this bed was canopied in places, but only moderately dense. Spatterdock (*Nuphar variegata*) and White water lily (*Nymphaea odorata*) were scattered throughout the inner half of the bed, and residents seemed to be keeping navigation channels open with regular in/out boat traffic (Figure 10).

Bed 14: This bed covered much of the northern half of the Bullpen Bay. CLP was canopied and dense, and we noted numerous prop trails throughout the area (Figure 11). On shallow bars that supported beds of rushes, we also observed spawning sunfish, and, other than residents traffic, it appeared the majority of boats were going to/from these beds.

Figure 10: Bed 13 on the South End of the Bullpen Bay

Figure 11: Bed 14 - North End of the Bullpen Bay with Spikerush Beds

Bed 15: CLP in the east side boat landing bay was moderately dense and canopied to 9ft (Figure 12). By this point in the growing season, so many plants had been pulled up by in/out boat traffic that there were numerous channels in the bay. However, we still needed several prop clears to navigate straight through the bed.

Bed 16: In the technical sense, Bed 16 wasn't a bed as it was neither canopied nor likely to interfere with boat traffic. However, it was nearly monotypic and, from what we could tell by rake sampling around the perimeter of the area, moderately dense throughout. The leaves of these plants were orange-tipped, brittle, and unusually dark green. They were also starting to senesce despite showing no sign of turion formation.

North Half of the Lake: We found no evidence of CLP beds anywhere north of the Narrows despite conducting hundreds of both systematic and random rake samples. CLP was rare, and the only plants we found were <6in tall. Most of these appeared to be recent sprouts as they were growing from a single turion (Figure 12 middle picture). However, we noticed some had new growth near a turion that was attached to a root system and a much taller plant that was dead (Figure 12 right picture). It was unclear to us if these plants would have enough energy to survive and set turions.

Figure 12: Bed 15 in Boat Landing Bay-Posttreatment CLP in North Bay

Rush Beds Mapping Survey:

Emergent rush beds provide important habitat, and, because we noticed that the majority of the rush beds on the lake were completely surrounded by CLP, we decided to map these beds as well (Figure 13) (Appendix IV). We felt this data was significant as it would a) produce a more accurate acreage of how much CLP was in the lake and b) provide baseline data for future monitoring as the point-intercept survey did not capture this information. In total, we mapped nine beds covering 2.60 acres (Table 2). Although there were many species of emergents along the shoreline, on the lake's shallow rock and sandbars, we noted Creeping spikerush (*Eleocharis palustris*) and Hardstem bulrush (*Schoenoplectus acutus*) were the only species present (other than a handful of Common reed (*Phragmites australis*) plants in Bed G), and they had little overlap in distribution thus forming nearly monotypic beds.

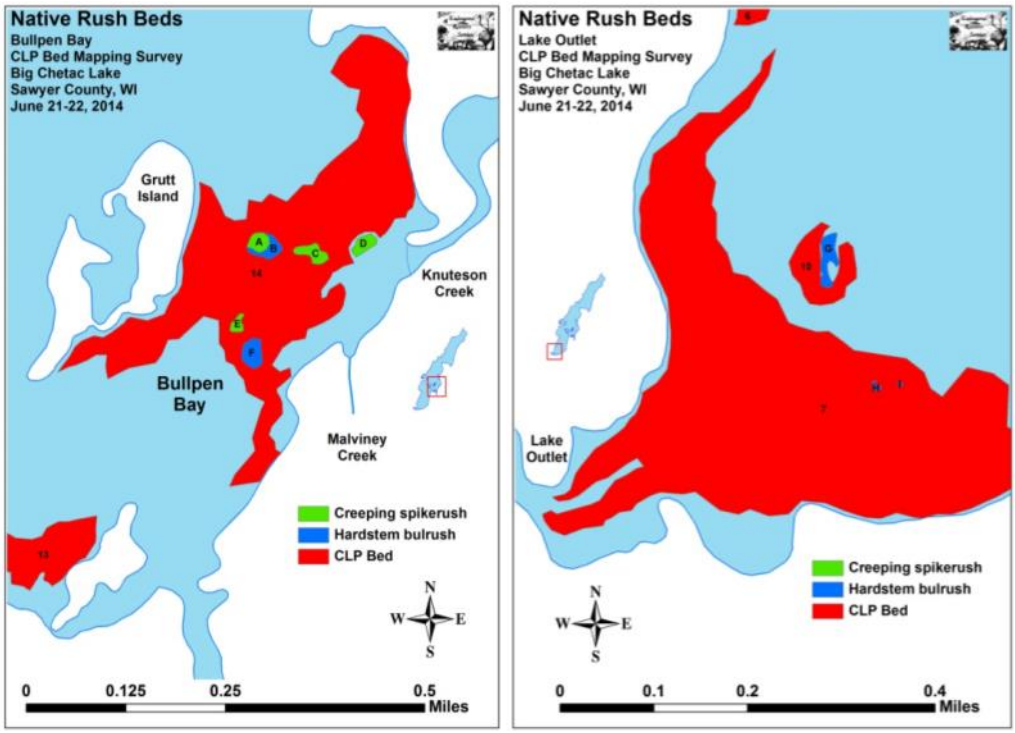


Figure 13: Creeping Spikerush and Hardstem Bulrush Beds

Table 2: Rush Beds Summary
Big Chetac Lake, Sawyer County
June 21-22, 2014

Bed Number	Acreage	Species	Rake Range	Mean Rake Fullness	Field Notes
A	0.33	Creeping spikerush	2-3	3	CLP growing up to, but generally not into the bed.
B	0.35	Hardstem bulrush	<1-1	1	CLP scattered among bulrushes.
C	0.41	Creeping spikerush	1-3	3	CLP growing up to, but generally not into the bed.
D	0.33	Creeping spikerush	2-3	3	Merges into Common bur-reed bed along Knuteson Creek
E	0.18	Creeping spikerush	2-3	3	CLP growing up to, but generally not into the bed.
F	0.49	Hardstem bulrush	1-2	1	CLP scattered among bulrushes.
G	0.46	Hardstem bulrush	1-2	1	CLP growing in horseshoe around rushes; Phragmites mixed in
H	0.04	Hardstem bulrush	1-2	1	CLP scattered among bulrushes; highly fragmented bed
I	0.01	Hardstem bulrush	1-2	1	CLP scattered among bulrushes; highly fragmented bed
Total Acres	**2.60**				

Warm-water Full Point-intercept Macrophyte Survey:

During the July survey, we visited all 970 points (Appendix I) and noted the lake forms a series of three elongated bowls connected by deep channels. The north basin slopes gently from north to south with rapid east/west drop-offs into a 20+ft flat. The central and southern basins are bordered by numerous bays and slope more gradually to flats in the 12-20ft range. The notable exception is the deep channel that runs between the southern islands (Figure 14) (Appendix V).

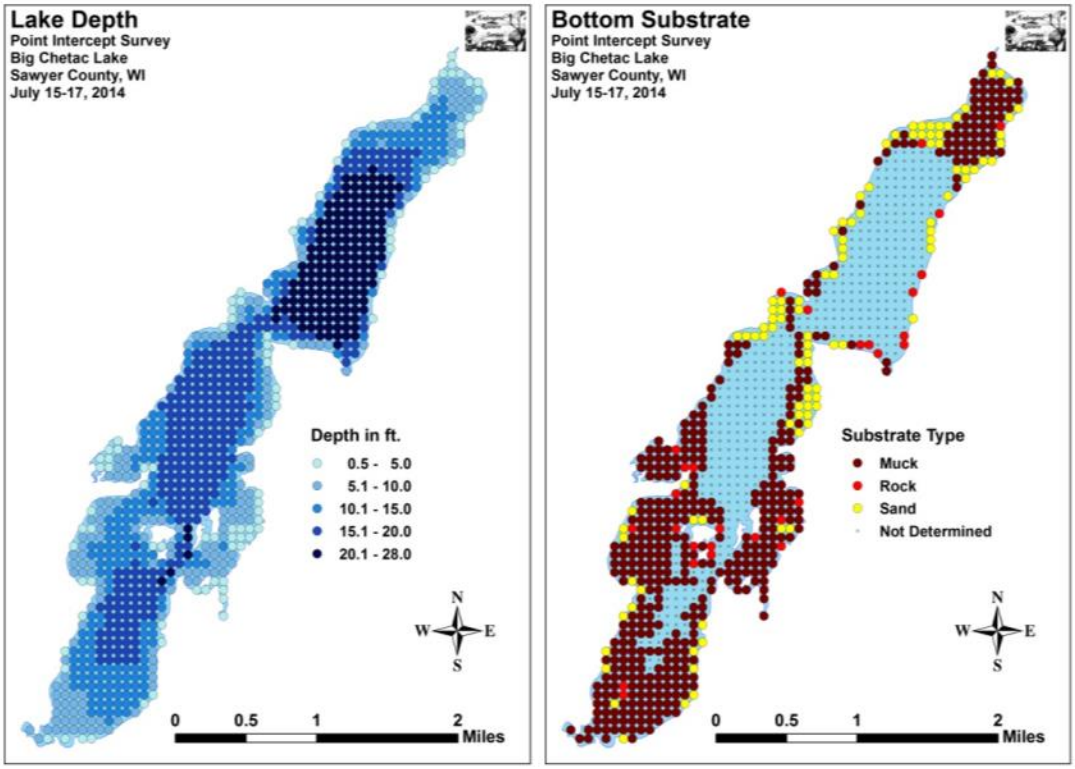


Figure 14: Lake Depth and Bottom Substrate

Of the 570 survey points where we could determine the substrate, 77.4% were muck and sandy muck, 17.5% were pure sand, and the remaining 5.1% were rock. Most pure sand and rock substrate occurred immediately along the shoreline; especially around the northern half of the lake, the Narrows, and around the islands. Nutrient-rich muck covered the majority of the lake's side bays and the midlake bowls (Figure 14) (Appendix V).

We found plants growing at 148 sites or on approximately 15.3% of the entire lake bottom and in 30.0% of the littoral zone (Table 3) (Figure 15). These values demonstrated a highly significant decline in plant coverage since 2008 when we found macrophytes at 269 points (27.3% of the bottom) and in 68.6% of the then 12.5ft littoral zone. In 2014, despite a littoral upper limit of 14.5ft, most plant growth ended in 7-8ft of water (Figure 16). Growth was slightly skewed to deep water as the mean and median depths of plants were 5.4ft and 5.0ft respectively. These values were also both lower than the mean and median depths of 5.9ft and 6.0ft recorded in 2008. This is not surprising as CLP, which was largely absent in the north half of the lake in 2014, was by far the most common deep water species in 2008 (Appendix VI).

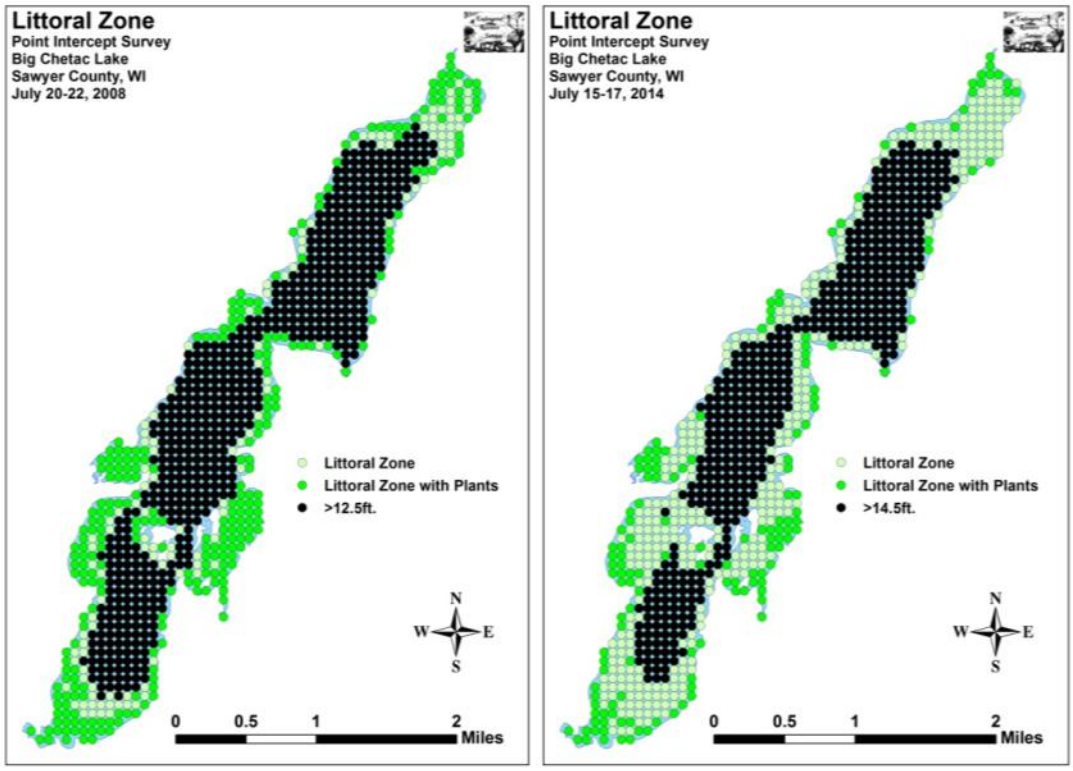


Figure 15: 2008 and 2014 Littoral Zone

Table 3: Aquatic Macrophyte P/I Survey Summary Statistics
Big Chetac Lake, Sawyer County
July 20-22, 2008 and July 15-17, 2014

Summary Statistics:	2008	2014
Total number of points sampled	970	970
Total number of sites with vegetation	269	148
Total number of sites shallower than the maximum depth of plants	392	493
Frequency of occurrence at sites shallower than maximum depth of plants	68.62	30.02
Simpson Diversity Index	0.90	0.93
Maximum depth of plants (ft)	12.5	14.5
Mean depth of plants (ft)	5.9	5.4
Median depth of plants (ft)	6.0	5.0
Number of sites sampled using rake on Rope (R)	0	55
Number of sites sampled using rake on Pole (P)	396	519
Average number of all species per site (shallower than max depth)	1.88	0.80
Average number of all species per site (veg. sites only)	2.74	2.68
Average number of native species per site (shallower than max depth)	1.55	0.69
Average number of native species per site (sites with native veg. only)	2.49	2.71
Species richness	35	39
Species richness (including visuals)	40	42
Species richness (including visuals and boat survey)	46	48
Mean rake fullness (veg. sites only – 2008 estimated)	2.02	1.84

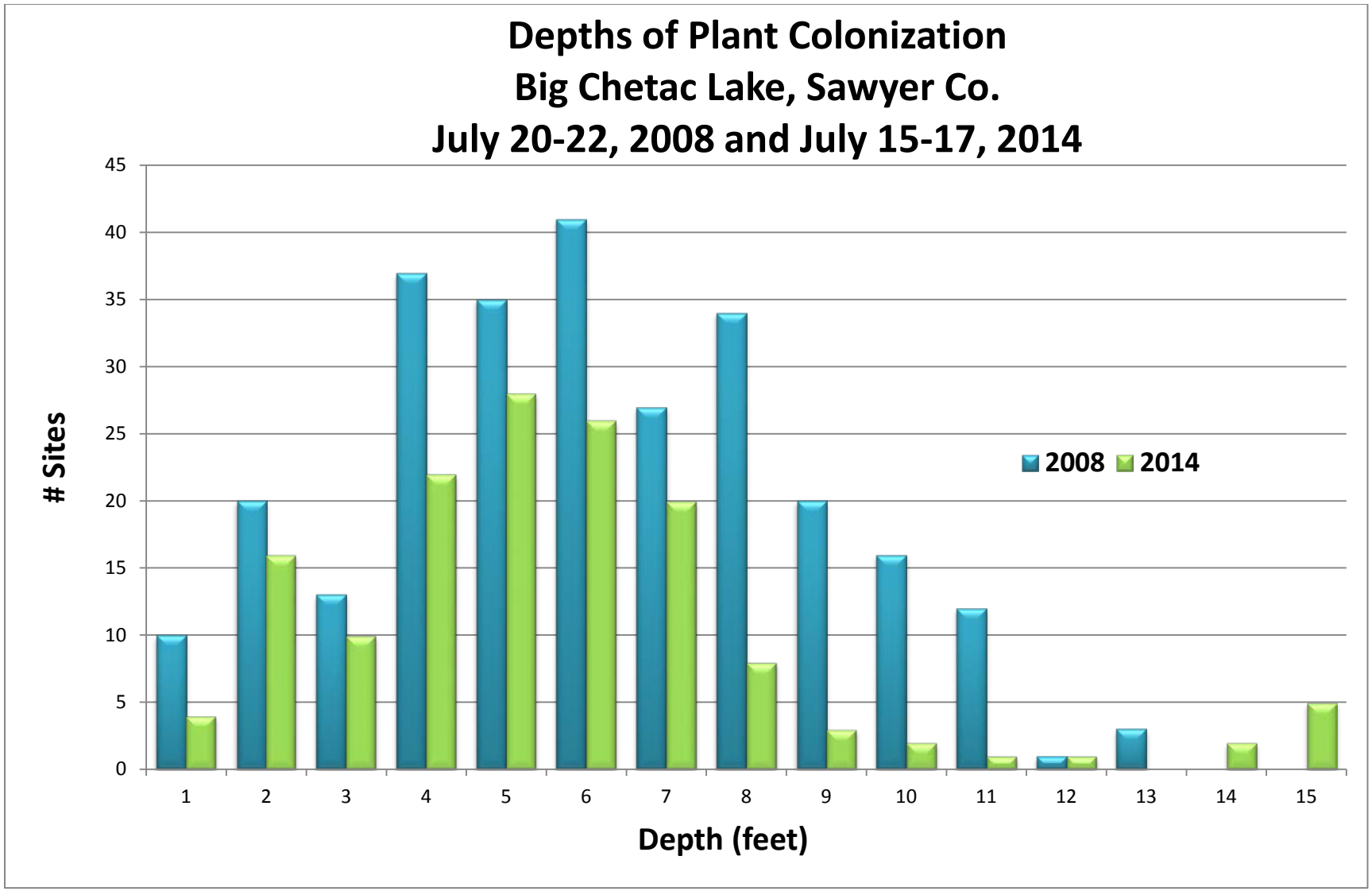


Figure 16: 2008 and 2014 Littoral Zone Plant Distribution

Plant diversity was exceptionally high in 2014 with a Simpson Index value of 0.93 – up slightly from 0.90 in 2008. Richness was moderate for a large lake with 39 species found in the rake (up from 35 in 2008) - this total increased to 48 (up from 46 in 2008) when including visual and boat survey species. Mean native species richness at sites with vegetation was also up from 2.49/site in 2008 to 2.71/site in 2014 (Figure 17). Mean total rake fullness fell from a moderate 2.02 (estimated) in 2008 to a low moderate 1.84 in 2014 (Figure 18) (Appendix VI).

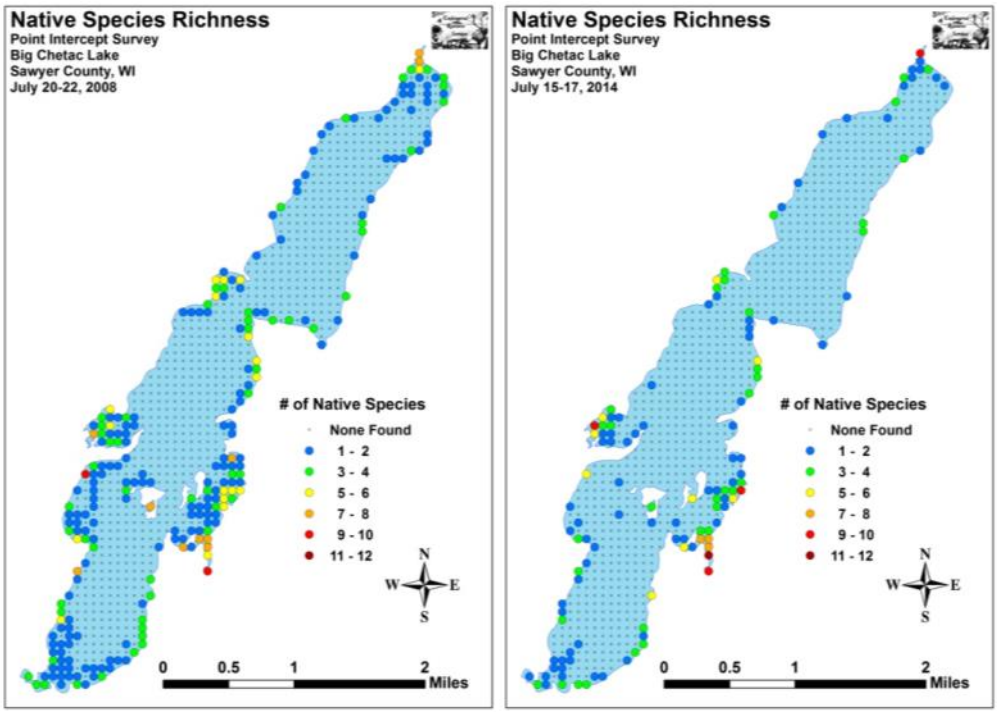


Figure 17: 2008 and 2014 Native Species Richness

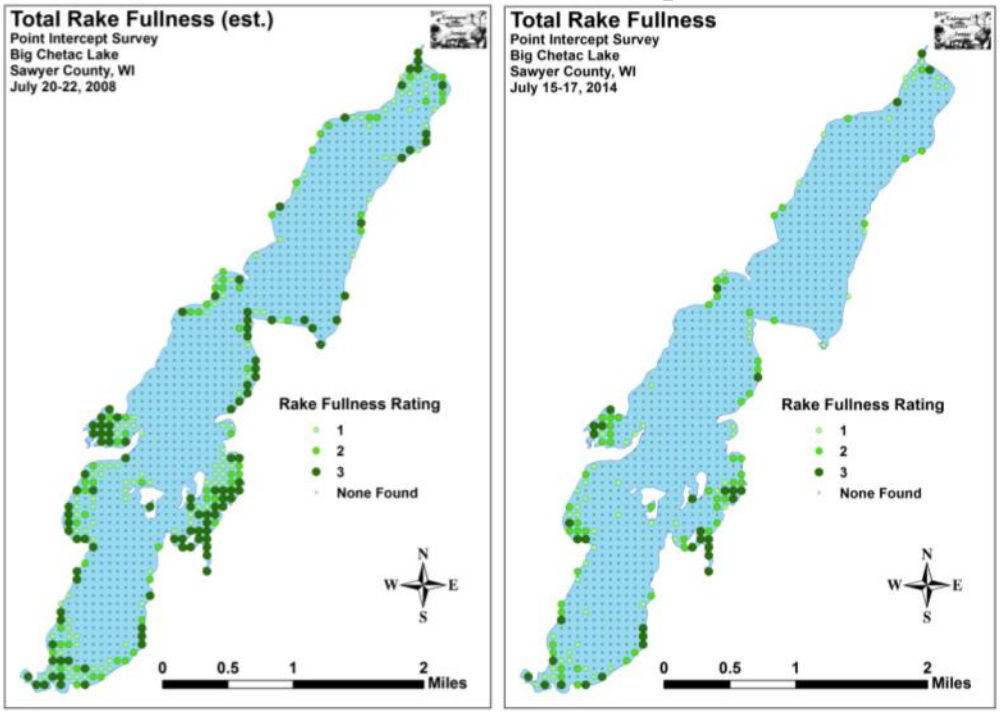


Figure 18: 2008 and 2014 Total Rake Fullness

Big Chetac Lake Plant Community:

The Big Chetac Lake ecosystem is home to a diverse plant community that is typical of high nutrient lakes. 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.

On sand and gravel bars in the southern half of the lake, the emergent community was dominated by Creeping spikerush, Hardstem bulrush, and Common reed. In shoreline areas with sandy muck, especially along the Knuteson Creek Inlet, we found beds of Pickerelweed (*Pontederia cordata*), Softstem bulrush (*Schoenoplectus tabernaemontani*), and Common bur-reed (*Sparganium eurycarpum*). In areas where the soil was a more nutrient rich organic muck, we documented Wild calla (*Calla palustris*), Bottle brush sedge (*Carex comosa*), Marsh cinquefoil (*Comarum palustre*), Three-way sedge (*Dulichium arundinaceum*), Bald spikerush (*Eleocharis erythropoda*), Common arrowhead (*Sagittaria latifolia*), Sessile-fruited arrowhead (*Sagittaria rigida*), Short-stemmed bur-reed (*Sparganium emersum*) and Broad-leaved cattail (*Typha latifolia*). These areas also supported patches of Reed canary grass (*Phalaris arundinacea*) and, in areas surrounding the creek inlets in the Bullpen Bay, Northern wild rice (*Zizania palustris*).

Creeping spikerush (Cremlin 2009)

Pickerelweed and Hardstem bulrush (Berg 2011)

Softstem bulrush (Schwarz 2011)

Common bur-reed (Raymond 2011)

Wild calla (Pierce 2001)

Bottle brush sedge (Penta 2010)

Marsh cinquefoil (Myrhatt 2012)

Common arrowhead (Young 2008)

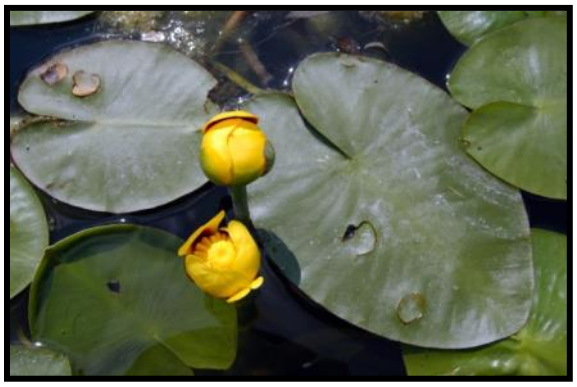
Short-stemmed bur-reed (Gmelin, 2009)

Broad-leaved cattail (Raymond 2011)

Northern wild rice along creek inlet (Berg 2014)

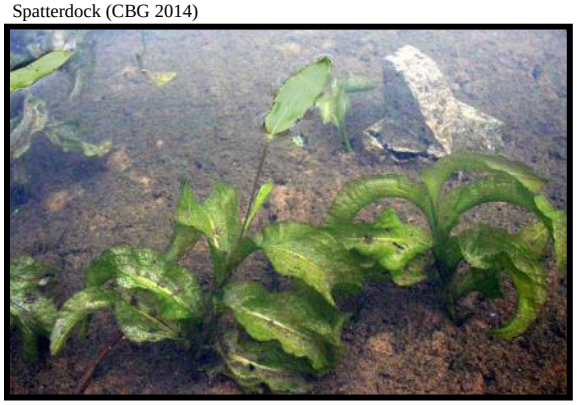
Northern wild rice (Pippen 2008)

Just beyond the emergents, in sheltered muck-bottomed areas in up to 5ft of water, the floating-leaf species Spatterdock and White-water lily were relatively common throughout the lake. However; high value native pondweeds with floating leaves like Large-leaf pondweed (*Potamogeton amplifolius*), Ribbon-leaf pondweed (*Potamogeton epihydrus*), Illinois pondweed (*Potamogeton illinoensis*), and Floating-leaf pondweed (*Potamogeton natans*), where almost exclusively found in the Bullpen Bay in and around the creek inlets. The canopy cover they provide is often utilized by panfish and bass for protection.



Spatterdock (CBG 2014)

White water lily (Falkner 2009)



Large-leaf pondweed (Fewless 2010)

Ribbon-leaf pondweed (Petroglyph 2007)

Illinois pondweed (Hellquist 2014)

Floating-leaf pondweed (Sein 2014)

Growing amongst these floating-leaf species, we also noted the submergent species Coontail (*Ceratophyllum demersum*), Common waterweed (*Elodea canadensis*), Small pondweed (*Potamogeton pusillus*), and, in the creek inlets in the Bullpen bay, Water marigold (*Bidens beckii*) and Whorled water milfoil (*Myriophyllum verticillatum*). In addition to these rooted plants, a large number of "duckweeds" were found floating among both the lilypads and the emergents.

Forked duckweed (Curtis 2010)

Large duckweed (Thomas 2014)

Small duckweed and Common watermeal (Kieron 2010)

Common waterweed (Fischer 2008)

Whorled water milfoil (Hill 2007)

Water marigold (Curtis 2010)

Along with the duckweeds, we also documented a limited number of Common bladderwort (*Utricularia vulgaris*) floating among the lilypads. Rather than drawing nutrients up through roots like other macrophytes, these carnivorous plants trap zooplankton and minute insects in their bladders, digest their prey, and use the nutrients to further their growth.

Common bladderwort flowers among lilypads (Hunt 2010)

Bladders for catching plankton and insect larvae (Wontolla 2007)

Sand and sandy muck bottomed habitats supported few floating-leaf species. In pure sand areas, in water up to 3ft deep, we noted the plant community was dominated by generally finer leaved submergent plants like Autumnal water-starwort (*Callitriche hermaphroditica*), Common water-starwort (*Callitriche palustris*), Muskgrass (*Chara* sp.), Slender naiad (*Najas flexilis*), White water crowfoot (*Ranunculus aquatilis*), and Sago pondweed (*Stuckenia pectinata*). These species tend to form a carpet that stabilizes the bottom.

Autumnal water-starwort (Shou 2012)

Common water-starwort (Cameron 2014)

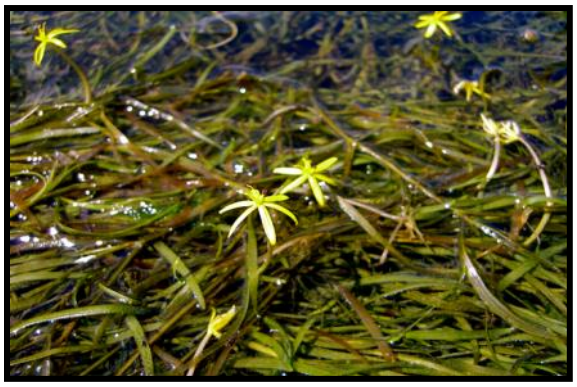
Muskgrass (Penuh 2008)

Slender naiad (Apipp 2009)

White water crowfoot (Wasser 2014)

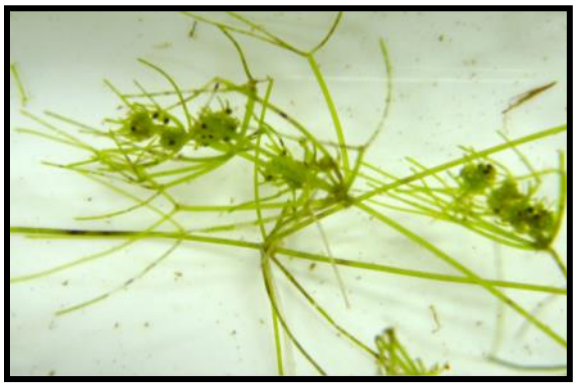
Sago pondweed (Hilty 2012)

Shallow sandy muck areas tended to support slightly broader-leaved species like Water star-grass (*Heteranthera dubia*), Northern water milfoil (*Myriophyllum sibiricum*), Nitella (*Nitella* sp.), Fries' pondweed (*Potamogeton friesii*), Clasping-leaf pondweed (*Potamogeton richardsonii*), 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)

Northern water milfoil (Berg 2008)



Nitella (Green 2002)

Fries pondweed (Koshere 2002)

Clasping-leaf pondweed (Cameron 2014)

Wild celery (Dalvi 2009)

Floating-leaf and many shallow submergent species disappeared on Big Chetac Lake in most water over 4ft. These deeper areas from 5-14ft were dominated by Coontail, Curly-leaf pondweed, White-stem pondweed, Small pondweed, Fern pondweed (*Potamogeton robbinsii*), and Flat-stem pondweed (*Potamogeton zosteriformis*). Predatory fish like the lake's northern pike are often found along the edges of these beds waiting in ambush.

Coontail (Hassler 2011)

Curly-leaf pondweed (Peroti 2012)

Small pondweed (Villa 2011)

White-stem pondweed (Fewless 2005)

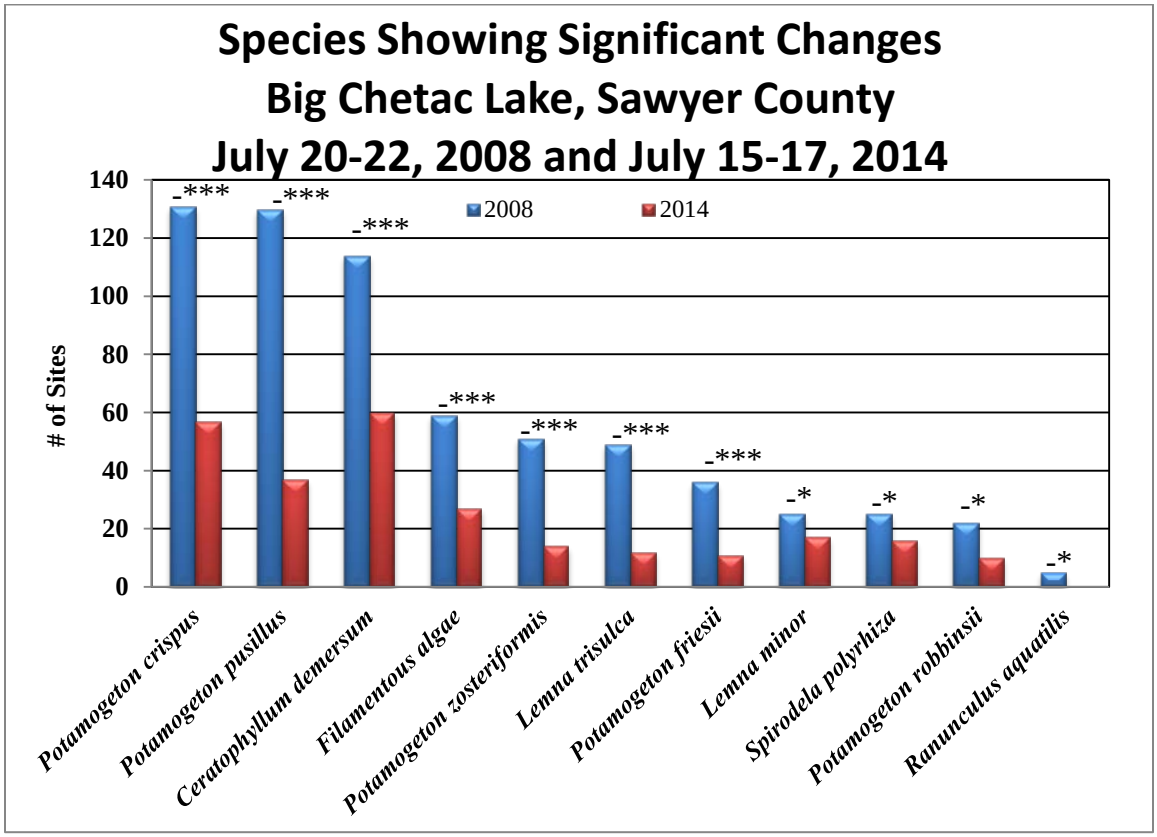
Fern pondweed (Apipp 2011)

Flat-stem pondweed (Fewless 2004)

Comparison of Species in July 2008 and 2014:

In 2008, Curly-leaf pondweed, Small pondweed, Coontail, and Flat-stem pondweed were the most common species during the warm-water survey (Table 4). They were found at 48.70%, 48.33%, 42.38%, and 18.96% of survey points with vegetation respectively and accounted for 57.73% of the total relative frequency. Forked duckweed (*Lemna trisulca*) (6.64) and Fries' pondweed (4.88) were the only other species with a relative frequency above 4.0 (Maps for all species found in July 2008 are located in Appendix VII). In 2014, Coontail, Curly-leaf pondweed, Small pondweed, and Slender naiad were the most common species found at 40.54%, 38.51%, 25.00%, and 18.92% of sites with vegetation (Table 5) and accounted for 45.96% of the total relative frequency. Wild celery (5.56), White water lily (4.55), Small duckweed (*Lemna minor*) (4.29), and Large duckweed (*Spirodela polyrhiza*) (4.04) also had relative frequencies above 4.0 (Species accounts and maps for all plants found in July 2014 can be found in Appendixes VIII and IX). Collectively, these results suggest a more diverse and even plant community existed in 2014 than in 2008.

Lakewide, ten species and filamentous algae showed significant changes from 2008 to 2014; all of which were declines (Figure 19). We noted that most of the species that suffered the biggest declines were those that start growing early in the spring prior to herbicide application (Curly-leaf pondweed, Small pondweed, Flat-stem pondweed, and Fries' pondweed) or those that over winter as vegetation (Coontail and Fern pondweed).



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

Figure 19: Macrophytes Showing Significant Changes from 2008-2014

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 20-22, 2008

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Potamogeton crispus	Curly-leaf pondweed	131	17.75	48.70	33.42	1.31	0
Potamogeton pusillus	Small pondweed	130	17.62	48.33	33.16	1.41	0
Ceratophyllum demersum	Coontail	114	15.45	42.38	29.08	1.98	2
	Filamentous algae	59	*	21.93	15.05	1.76	0
Potamogeton zosteriformis	Flat-stem pondweed	51	6.91	18.96	13.01	1.31	2
Lemna trisulca	Forked duckweed	49	6.64	18.22	12.50	1.29	1
Potamogeton friesii	Fries' pondweed	36	4.88	13.38	9.18	1.92	1
Lemna minor	Small duckweed	25	3.39	9.29	6.38	1.12	0
Spirodela polyrhiza	Large duckweed	25	3.39	9.29	6.38	1.16	0
Najas flexilis	Slender naiad	24	3.25	8.92	6.12	1.75	0
Potamogeton robbinsii	Fern pondweed	22	2.98	8.18	5.61	1.59	0
Vallisneria americana	Wild celery	16	2.17	5.95	4.08	1.50	2
Nymphaea odorata	White water lily	15	2.03	5.58	3.83	1.87	8
Nitella sp.	Nitella	13	1.76	4.83	3.32	1.77	0
Stuckenia pectinata	Sago pondweed	12	1.63	4.46	3.06	2.17	0
Nuphar variegata	Spatterdock	10	1.36	3.72	2.55	2.10	2
Myriophyllum sibiricum	Northern water-milfoil	9	1.22	3.35	2.30	1.44	2
Potamogeton richardsonii	Clasping-leaf pondweed	9	1.22	3.35	2.30	1.56	5
Elodea canadensis	Common waterweed	6	0.81	2.23	1.53	1.50	1
Chara sp.	Muskgrass	5	0.68	1.86	1.28	1.60	0
Potamogeton natans	Floating-leaf pondweed	5	0.68	1.86	1.28	1.80	0
Ranunculus aquatilis	White water crowfoot	5	0.68	1.86	1.28	1.20	0
Heteranthera dubia	Water star-grass	3	0.41	1.12	0.77	1.00	0
Potamogeton praelongus	White-stem pondweed	3	0.41	1.12	0.77	1.33	2

* Excluded from the Relative Frequency Calculation

Table 4 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 20-22, 2008

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Sagittaria rigida	Sessile-fruited arrowhead	3	0.41	1.12	0.77	2.00	2
Utricularia vulgaris	Common bladderwort	3	0.41	1.12	0.77	1.00	0
Callitriche hermaphroditica	Autumnal water-starwort	2	0.27	0.74	0.51	2.00	0
Callitriche palustris	Common water-starwort	2	0.27	0.74	0.51	1.00	0
Typha latifolia	Broad-leaved cattail	2	0.27	0.74	0.51	3.00	0
Zizania palustris	Northern wild rice	2	0.27	0.74	0.51	3.00	2
Calla palustris	Wild calla	1	0.14	0.37	0.26	2.00	0
Carex comosa	Bottle brush sedge	1	0.14	0.37	0.26	1.00	0
Eleocharis erythropoda	Bald spikerush	1	0.14	0.37	0.26	2.00	0
Potamogeton illinoensis	Illinois pondweed	1	0.14	0.37	0.26	2.00	0
Schoenoplectus acutus	Hardstem bulrush	1	0.14	0.37	0.26	2.00	0
Schoenoplectus tabernaemontani	Softstem bulrush	1	0.14	0.37	0.26	2.00	0
	Aquatic moss	1	*	0.37	0.26	3.00	0
Bidens beckii	Water marigold	**	**	**	**	**	1
Myriophyllum verticillatum	Whorled water-milfoil	**	**	**	**	**	2
Potamogeton epihydrus	Ribbon-leaf pondweed	**	**	**	**	**	1
Potamogeton vaseyi	Vasey's pondweed	**	**	**	**	**	2
Utricularia intermedia	Flat-leaf bladderwort	**	**	**	**	**	2
Dulichium arundinaceum	Three-way sedge	***	***	***	***	***	***
Eleocharis palustris	Creeping spikerush	***	***	***	***	***	***
Phalaris arundinacea	Reed canary grass	***	***	***	***	***	***
Pontederia cordata	Pickerelweed	***	***	***	***	***	***
Comarum palustre	Marsh cinquefoil	***	***	***	***	***	***
Sparganium emersum	Short-stemmed bur-reed	***	***	***	***	***	***

** Visual Only *** Boat Survey Only

Table 5: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 15-17, 2014

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Ceratophyllum demersum	Coontail	60	15.15	40.54	12.17	1.53	2
Potamogeton crispus	Curly-leaf pondweed	57	14.39	38.51	11.56	1.32	8
Potamogeton pusillus	Small pondweed	37	9.34	25.00	7.51	1.46	6
Najas flexilis	Slender naiad	28	7.07	18.92	5.68	1.18	0
	Filamentous algae	27	*	18.24	5.48	1.59	0
Vallisneria americana	Wild celery	22	5.56	14.86	4.46	1.68	0
Nymphaea odorata	White water lily	18	4.55	12.16	3.65	1.94	6
Lemna minor	Small duckweed	17	4.29	11.49	3.45	1.24	0
Spirodela polyrhiza	Large duckweed	16	4.04	10.81	3.25	1.31	0
Stuckenia pectinata	Sago pondweed	15	3.79	10.14	3.04	1.67	2
Potamogeton zosteriformis	Flat-stem pondweed	14	3.54	9.46	2.84	1.07	1
Nitella sp.	Nitella	13	3.28	8.78	2.64	1.46	1
Lemna trisulca	Forked duckweed	12	3.03	8.11	2.43	1.00	0
Nuphar variegata	Spatterdock	11	2.78	7.43	2.23	2.36	6
Potamogeton friesii	Fries' pondweed	11	2.78	7.43	2.23	1.55	1
Potamogeton robbinsii	Fern pondweed	10	2.53	6.76	2.03	1.10	0
Potamogeton richardsonii	Clasping-leaf pondweed	8	2.02	5.41	1.62	1.38	5
Myriophyllum sibiricum	Northern water-milfoil	5	1.26	3.38	1.01	1.60	2
Elodea canadensis	Common waterweed	4	1.01	2.70	0.81	1.00	2
Eleocharis erythropoda	Bald spikerush	3	0.76	2.03	0.61	2.33	0
Myriophyllum verticillatum	Whorled water-milfoil	3	0.76	2.03	0.61	2.00	0
Sparganium emersum	Short-stemmed bur-reed	3	0.76	2.03	0.61	1.33	0
Utricularia vulgaris	Common bladderwort	3	0.76	2.03	0.61	1.00	1
Zizania palustris	Northern wild rice	3	0.76	2.03	0.61	1.00	0

* Excluded from the Relative Frequency Calculation

Table 5 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 15-17, 2014

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Calla palustris	Wild calla	2	0.51	1.35	0.41	1.00	0
Carex comosa	Bottle brush sedge	2	0.51	1.35	0.41	2.00	2
Heteranthera dubia	Water star-grass	2	0.51	1.35	0.41	1.50	0
Potamogeton natans	Floating-leaf pondweed	2	0.51	1.35	0.41	1.50	2
Potamogeton praelongus	White-stem pondweed	2	0.51	1.35	0.41	1.50	0
Sagittaria latifolia	Common arrowhead	2	0.51	1.35	0.41	1.00	0
Typha latifolia	Broad-leaved cattail	2	0.51	1.35	0.41	1.00	2
Bidens beckii	Water marigold	1	0.25	0.68	0.20	2.00	0
Callitriche hermaphroditica	Autumnal water-starwort	1	0.25	0.68	0.20	1.00	0
Chara sp.	Muskgrass	1	0.25	0.68	0.20	1.00	0
Comarum palustre	Marsh cinquefoil	1	0.25	0.68	0.20	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	1	0.25	0.68	0.20	1.00	0
Potamogeton illinoensis	Illinois pondweed	1	0.25	0.68	0.20	2.00	0
Schoenoplectus acutus	Hardstem bulrush	1	0.25	0.68	0.20	2.00	0
Schoenoplectus tabernaemontani	Softstem bulrush	1	0.25	0.68	0.20	1.00	2
Wolffia columbiana	Common watermeal	1	0.25	0.68	0.20	1.00	0
Potamogeton epihydrus	Ribbon-leaf pondweed	**	**	**	**	**	1
Ranunculus aquatilis	White water crowfoot	**	**	**	**	**	2
Sagittaria rigida	Sessile-fruited arrowhead	**	**	**	**	**	4
Dulichium arundinaceum	Three-way sedge	***	***	***	***	***	***
Eleocharis palustris	Creeping spikerush	***	***	***	***	***	***
Phalaris arundinacea	Reed canary grass	***	***	***	***	***	***
Phragmites australis	Common reed	***	***	***	***	***	***
Pontederia cordata	Pickerelweed	***	***	***	***	***	***
Sparganium eurycarpum	Common bur-reed	***	***	***	***	***	***

** Visual Only *** Boat Survey Only

Curly-leaf pondweed, despite the majority of plants having senesced by the time of the July surveys, was still the most common species in 2008 and the second most common in 2014 (Figure 20). Although it experienced a highly significant decline in distribution from 131 sites in 2008 to 57 sites in 2014, its mean rake fullness density value was essentially unchanged from 1.31 in 2008 to 1.32 in 2014.

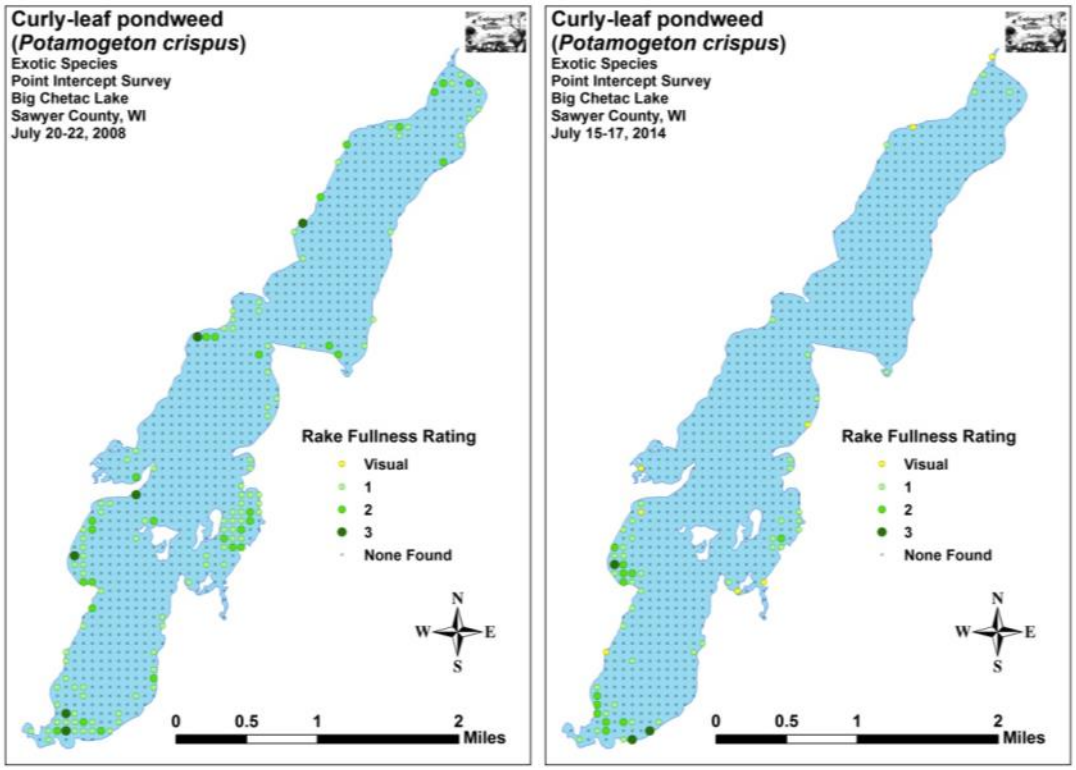


Figure 20: July 2008 and 2014 CLP Density and Distribution

Small pondweed was the second most common species in 2008 (130 sites) and the third most common in 2014 (37 sites). Its highly significant decline in distribution appears to have been a lakewide phenomenon although it was especially pronounced in the northern two-thirds of the lake where it disappeared almost entirely (Figure 21). Despite this decline in distribution, the mean rake fullness increased slightly from 1.41in 2008 to 1.46 in 2014. In 2008, we often found this species at the edge of the littoral zone in low numbers. This was not the case in 2014 when it was almost never found past 7ft – in these shallower areas, it often occurred in significant numbers.

Coontail, the third most common species in 2008, became the most common in 2014. Despite this rise in rank, it suffered a highly significant decline in numbers (114 sites in 2008 to 60 in 2014) that was accompanied by an equally significant decline in density (mean rake fullness of 1.98 in 2008 to 1.53 in 2014). The maps for this species seem to mirror the declines observed for Small pondweed; however, Coontail was found throughout the littoral zone in 2014, and this was similar to its depth distribution in 2008 (Figure 22).

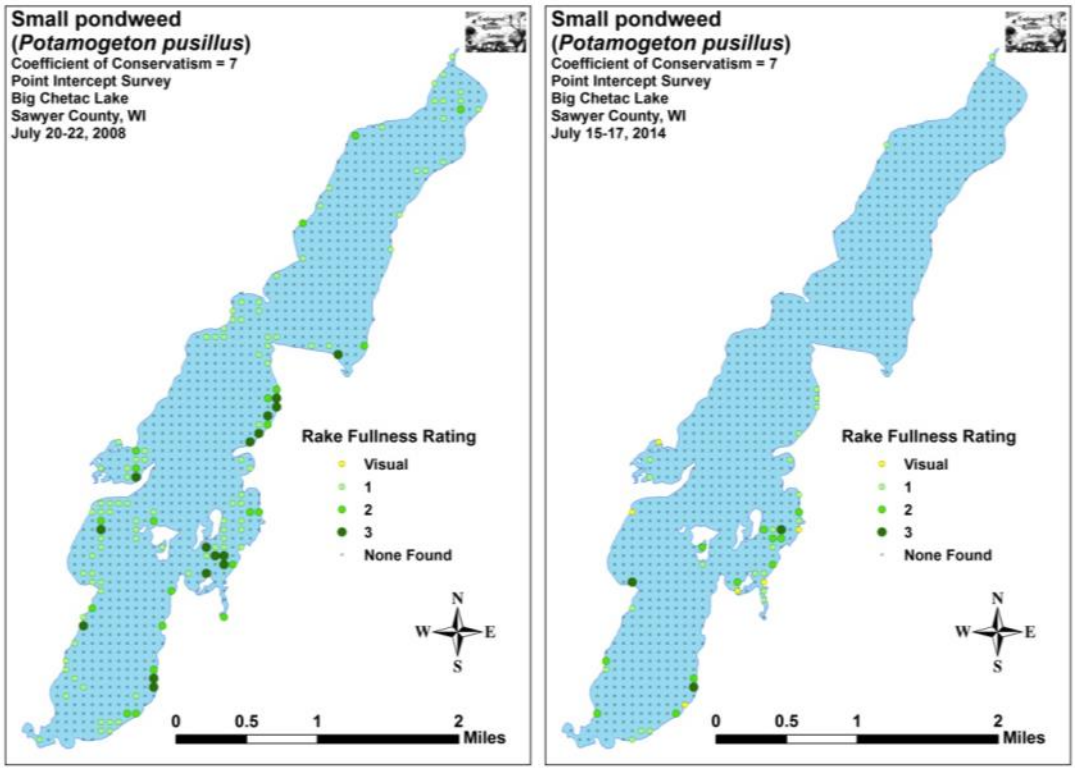


Figure 21: 2008 and 2014 Small Pondweed Density and Distribution

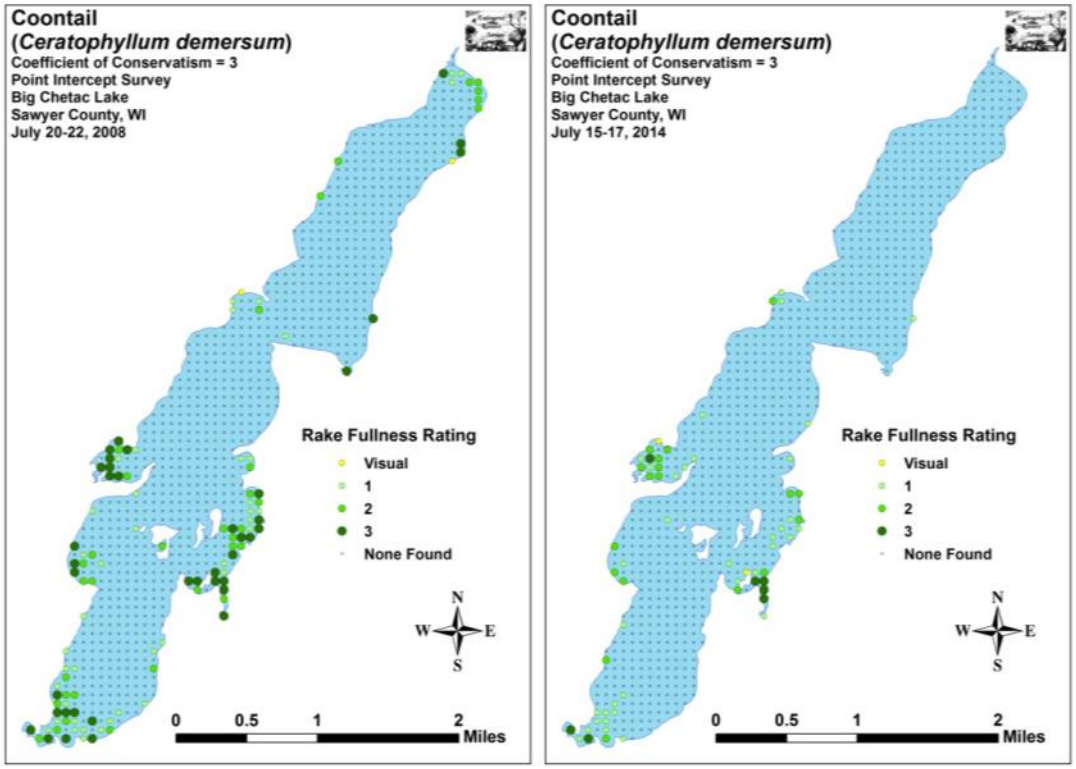


Figure 22: 2008 and 2014 Coontail Density and Distribution

Similar to Small pondweed, Flat-stem pondweed also suffered a highly significant decline. In 2008, we found it to be the fourth most common macrophyte species (51 sites and a mean rake fullness of 1.31), but in 2014 it was only the tenth most common (14 sites and a mean rake fullness of 1.07) (Figure 23).

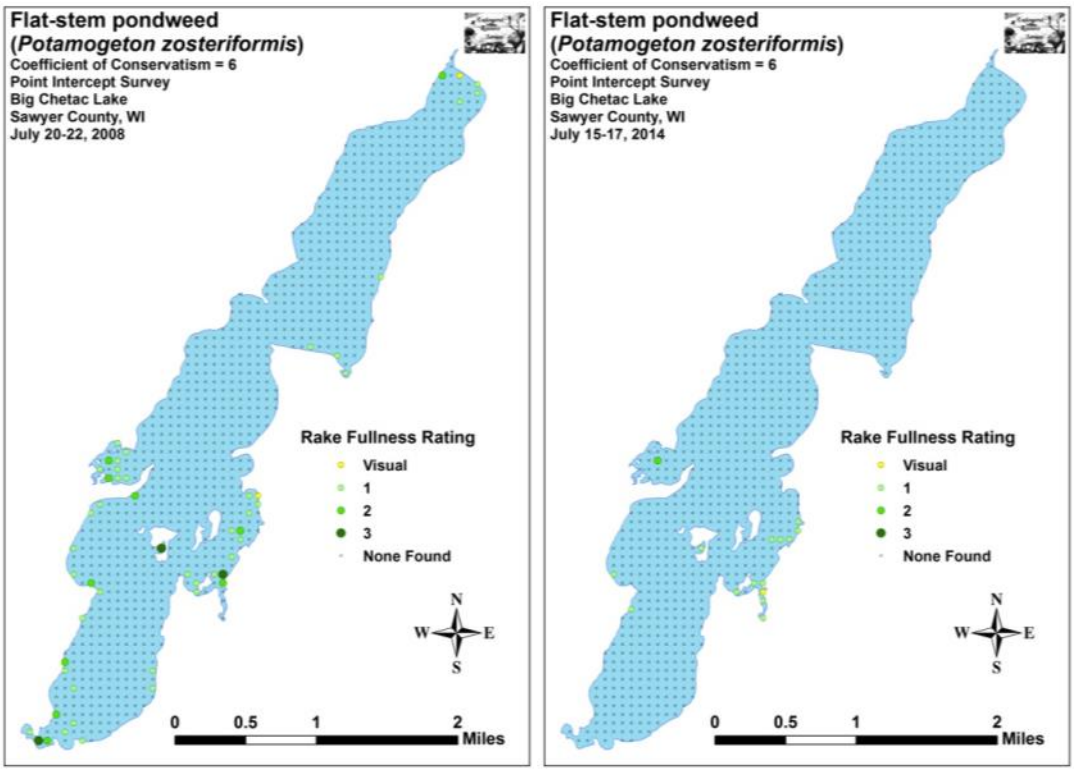


Figure 23: 2008 and 2014 Flat-stem Pondweed Density and Distribution

Although no species showed significant increases, many of those that did show slight increases overwinter as seeds (Slender naiad, White water lily, Spatterdock, Short-stemmed bur-reed), tubers (Sago pondweed and Wild celery) or rhizomes (both water lilies). These species also tend to become active later in the growing season. Especially in the north bay, we noticed this several members of this group; especially Slender naiad and Wild celery, seemed to be expanding into areas formerly occupied by Curly-leaf and Small pondweed.

Comparison of Northern Wild Rice in 2008 and 2014:

Wild rice, a plant of significant wildlife and cultural value, was found at three points during the July 2014 survey (up from two points in 2008) (Figure 24). Although it was common in scattered patches along the creek inlets in the Bullpen Bay, it occurred at low to moderate densities, and we didn't see any areas that would have offered profitable human harvest. The shallow bay that had two points with high rice density in 2008 still had rice, but it was dominated by water lilies and cattails in 2014. Outside of the Bullpen Bay, we did not observe wild rice anywhere else in the system.

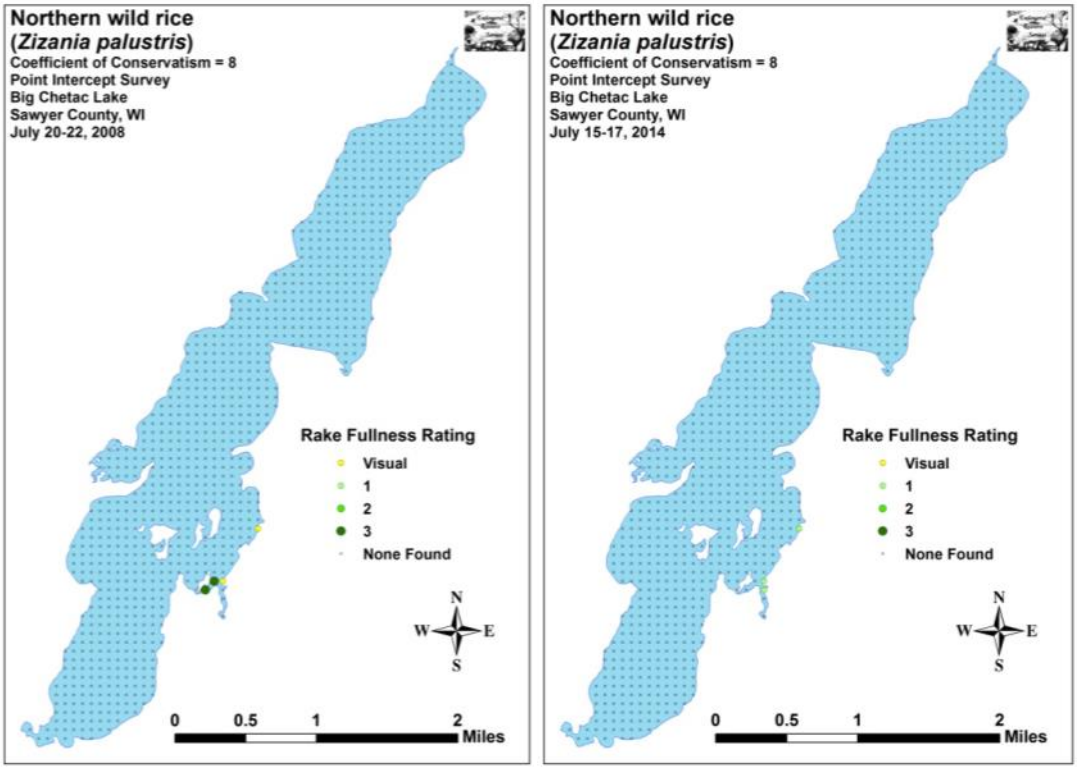


Figure 24: 2008 and 2014 Northern Wild Rice Density and Distribution

Comparison of Filamentous Algae in 2008 an 2014:

Filamentous algae, normally associated with excessive nutrients in the water column, was located at 27 survey points – a highly significant decrease from the 59 points it was found at in 2008 (Figure 25). The mean rake fullness also showed a significant decline from 1.76 in 2008 to 1.59 in 2014. This was especially encouraging as one of the focuses of the original lake planning committee in 2008 was to identify, and then work to reduce, nutrient inputs that were promoting this algal growth (BCABLA 2010).

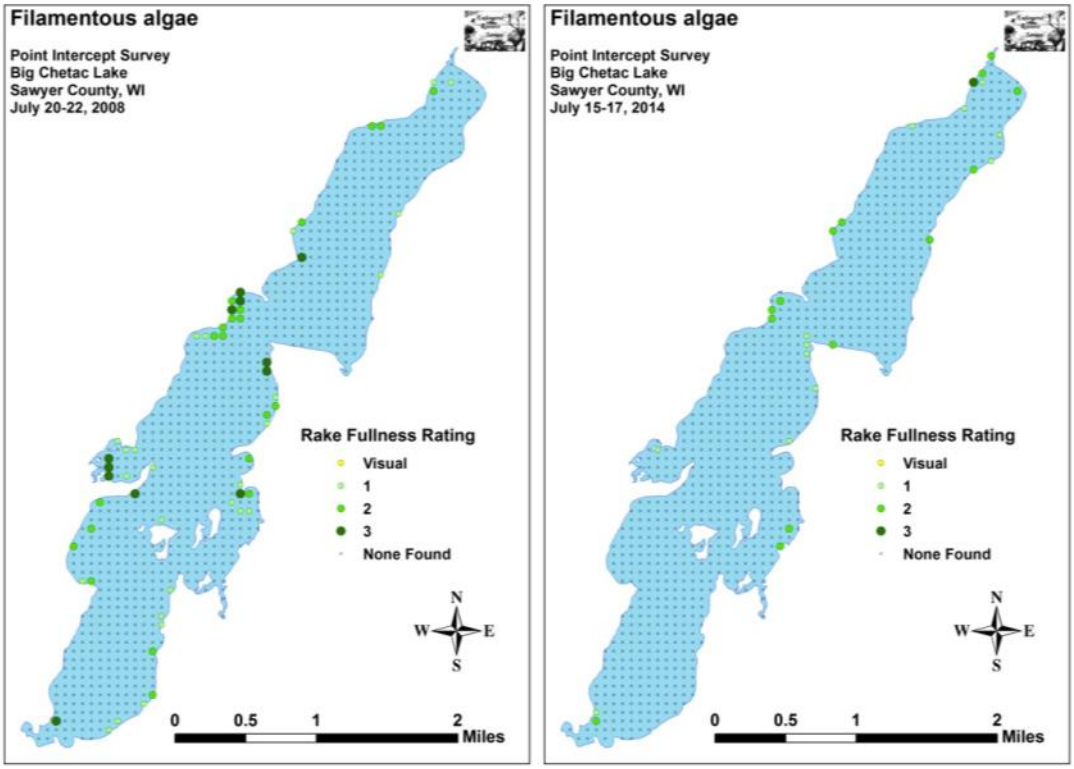


Figure 25: 2008 and 2014 Filamentous Algae Density and Distribution

Comparison of Floristic Quality Indexes in 2008 and 2014:

In 2008, we identified a total of 34 **native index species** in the rake during the point-intercept survey (Table 6). They produced a mean Coefficient of Conservatism of 6.0 and a Floristic Quality Index of 34.8.

Table 6: Floristic Quality Index of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 20-22, 2008

Species	Common Name	C
Calla palustris	Wild calla	9
Callitriche hermaphroditica	Autumnal water-starwort	9
Callitriche palustris	Common water-starwort	8
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis erythropoda	Bald spikerush	3
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Najas flexilis	Slender naiad	6
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Potamogeton friesii	Fries' pondweed	8
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Sagittaria rigida	Sessile-fruited arrowhead	8
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus tabernaemontani	Softstem bulrush	4
Spirodela polyrhiza	Large duckweed	5
Stuckenia pectinata	Sago pondweed	3
Typha latifolia	Broad-leaved cattail	1
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
Zizania palustris	Northern wild rice	8
N		**34**
Mean C		**6.0**
FQI		**34.8**

In 2014, we identified 37 **native index plants** on the rake during the point- intercept survey. They produced a mean Coefficient of Conservatism of 5.9 and a Floristic Quality Index of 35.8 (Table 7). Nichols (1999) reported an Average mean C for the North Central Hardwood Forests Region of 5.6 putting Big Chetac Lake slightly above average for this part of the state. The FQI was also well above the median FQI of 20.9 for the North Central Hardwood Forests Region (Nichols 1999). Nine high value index plants of note included Water marigold (C = 8), Wild calla (C = 9), Autumnal water-starwort (C = 9), Whorled water milfoil (C = 8), Fries' pondweed (C = 8), White-stem pondweed (C = 8), Fern pondweed (C = 8), Short-stemmed bur-reed (C = 8), and Northern wild rice (C = 8). Although not included in the index as they were recorded as visuals or seen during the boat survey, five other high value species found on the lake included Threeway sedge (C = 9), Pickerelweed (C = 8), Ribbon-leaf pondweed (C = 8), White water crowfoot (C = 8), and Sessile-fruited arrowhead (C = 8).

Despite the 2014 survey founding three additional index species, both the mean C and the total FQI were almost identical to the 2008 survey. This insignificant change may indicate minimal changes in annual growing conditions or the lake's habitat, improvements in the detection and identification abilities of the surveyors, or a combination of these factors.

Table 7: Floristic Quality Index of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 15-17, 2014

Species	Common Name	C
Bidens beckii	Water marigold	8
Calla palustris	Wild calla	9
Callitriche hermaphroditica	Autumnal water-starwort	9
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis erythropoda	Bald spikerush	3
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Slender naiad	6
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton friesii	Fries' pondweed	8
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton praelongus	White-stem pondweed	8

Table 7 (cont'): Floristic Quality Index of Aquatic Macrophytes
Big Chetac Lake, Sawyer County
July 15-17, 2014

Species	Common Name	C
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Sagittaria latifolia	Common arrowhead	3
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus tabernaemontani	Softstem bulrush	4
Sparganium emersum	Short-stemmed bur-reed	8
Spirodela polyrhiza	Large duckweed	5
Stuckenia pectinata	Sago pondweed	3
Typha latifolia	Broad-leaved cattail	1
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
Wolffia columbiana	Common watermeal	5
Zizania palustris	Northern wild rice	8
N		**37**
Mean C		**5.9**
FQI		**35.8**

Other Exotic Plant Species:

Other than Curly-leaf pondweed, the only other exotic species we found was Reed canary grass (Figure 26). We noticed scattered patches in adjacent wetlands, and next to mowed and otherwise disturbed shorelines. A ubiquitous plant in the state, there's likely little that can be done about it (For more information on common exotic aquatic invasive plant species, see Appendix X).

Figure 26: Reed Canary Grass

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Native Aquatic Macrophytes:

Native aquatic plants are the basis of a lake's ecosystem and are as important to the aquatic environment as trees are to a forest. They provide habitat for fish and other aquatic organisms, serve as food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve clarity by absorbing excess nutrients from the water.

On Big Chetac Lake, high phosphorus levels have fueled excessive suspended and filamentous algal growth. The resulting poor water clarity has produced a narrow summer littoral zone and resulted in a plant community that covers a relatively low percentage of the lake. Because of this, preserving the native plants that are there should be a top priority for all lake residents. This is especially true of the floating-leaf beds of lilypads and the emergent beds of wild rice, bulrushes, and spikerushes as they provide critical habitat for the lake's fish; especially during their spawning season.

The majority of the lake's species richness and diversity continues to be found in the Bullpen Bay and, to a lesser extent, the western bays midlake, and in Benson Creek. It's likely not coincidental that these areas also have the best water clarity. As management continues to work towards improving clarity lakewide, these areas can serve as important source populations for reestablishing native plants elsewhere in the system.

Curly-leaf pondweed:

Following two years of active management, early-season Curly-leaf pondweed has shown a highly significant lakewide decline; especially in the northern two-thirds of the lake. This management has relieved navigation impairment in this part of the lake, and it is hoped will ultimately lead to a noticeable and significant improvement in water clarity and quality. Although some recolonization of native plants has occurred in the north bay in areas formerly dominated by CLP, it appears that further improvements in water clarity will be needed to facilitate greater expansion of native plants.

Eurasian Water Milfoil:

Eurasian water milfoil continues to expand in Sawyer County, and most lakes with EWM have public landings with significant in/out boat traffic. Because of this, we believe it is important that the lake continues its Clean Boats/Clean Waters program to inspect the high volume of incoming watercraft. We also think that conducting monthly transect surveys near the lake's boat landings throughout the growing season and at least one annual meandering shoreline survey of the lake's entire visible littoral zone are ideas worth considering. These practices decrease the likelihood EWM will be introduced into the lake and could allow for early detection if EWM or another Aquatic Invasive Species is introduced. The sooner an AIS is detected, generally, the greater the chances it can be successfully and economically controlled.

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WDNR. [online]. 2010. Reed canary grass fact sheet. http://dnr.wi.gov/invasives/fact/reed_canary.htm (2010, August).

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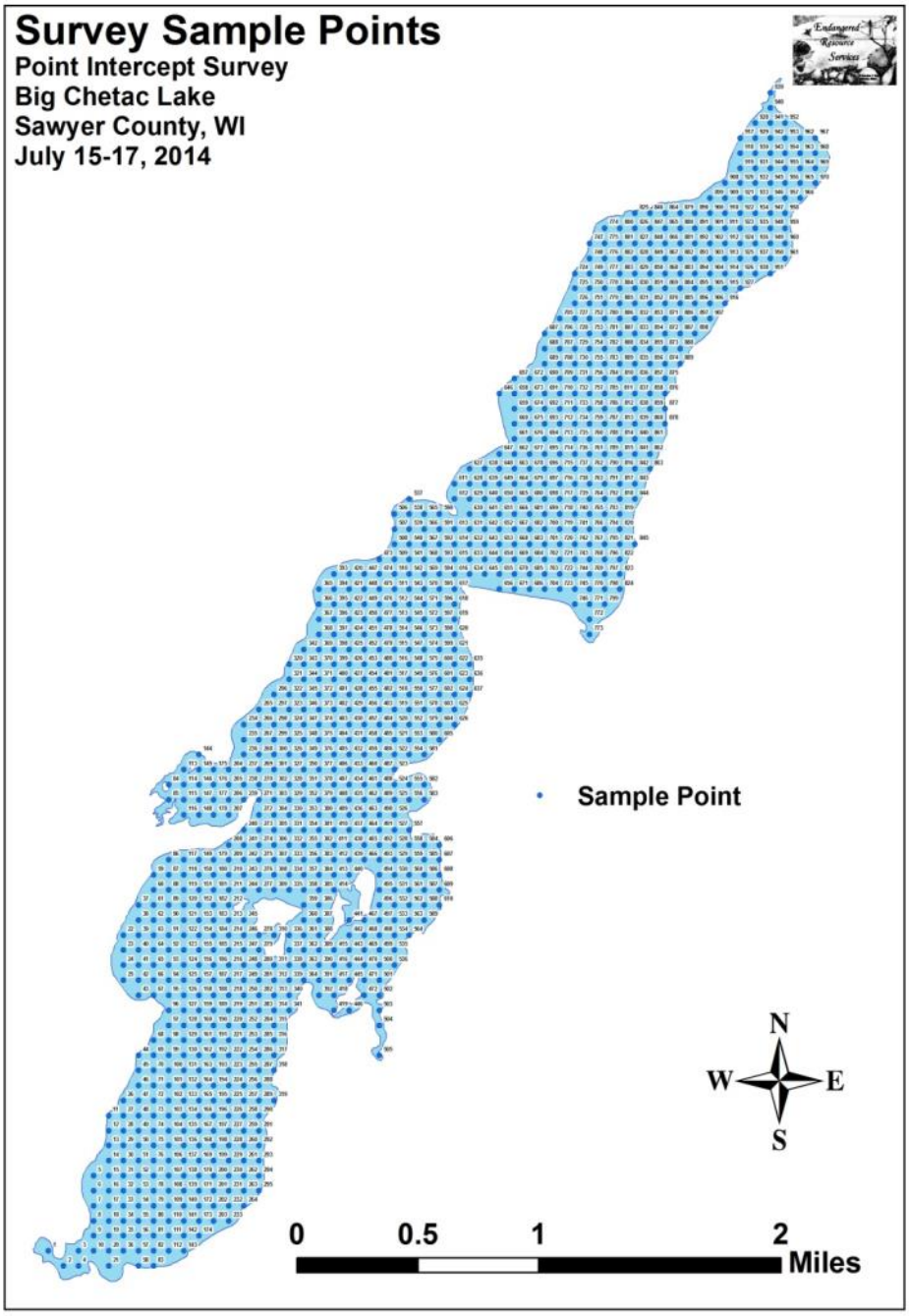
Appendix I: Survey Sample Points Map

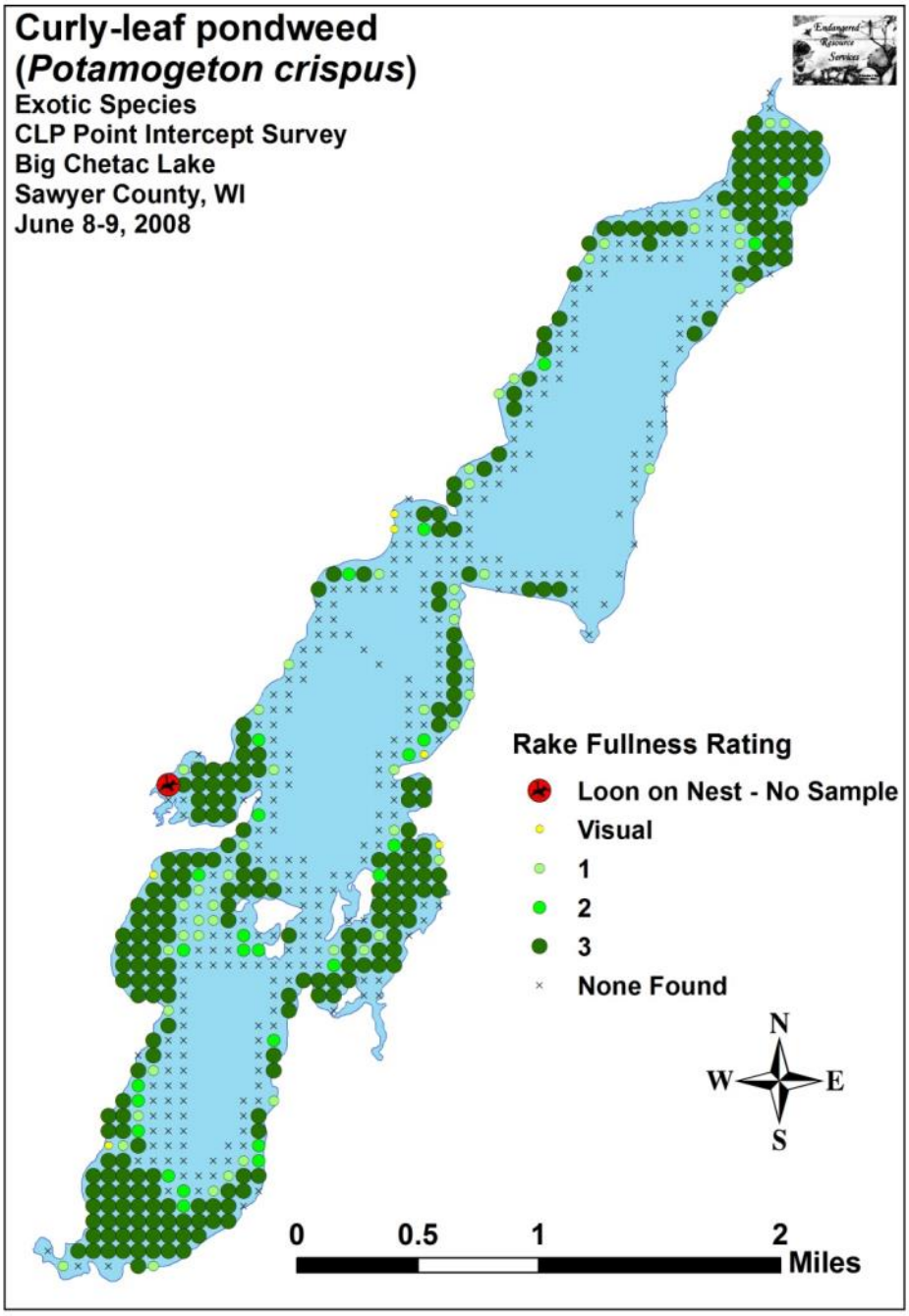

Survey Sample Points
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Endangered Resource Services
Sample Point
N
W
E
S
0
0.5
1
2
Miles

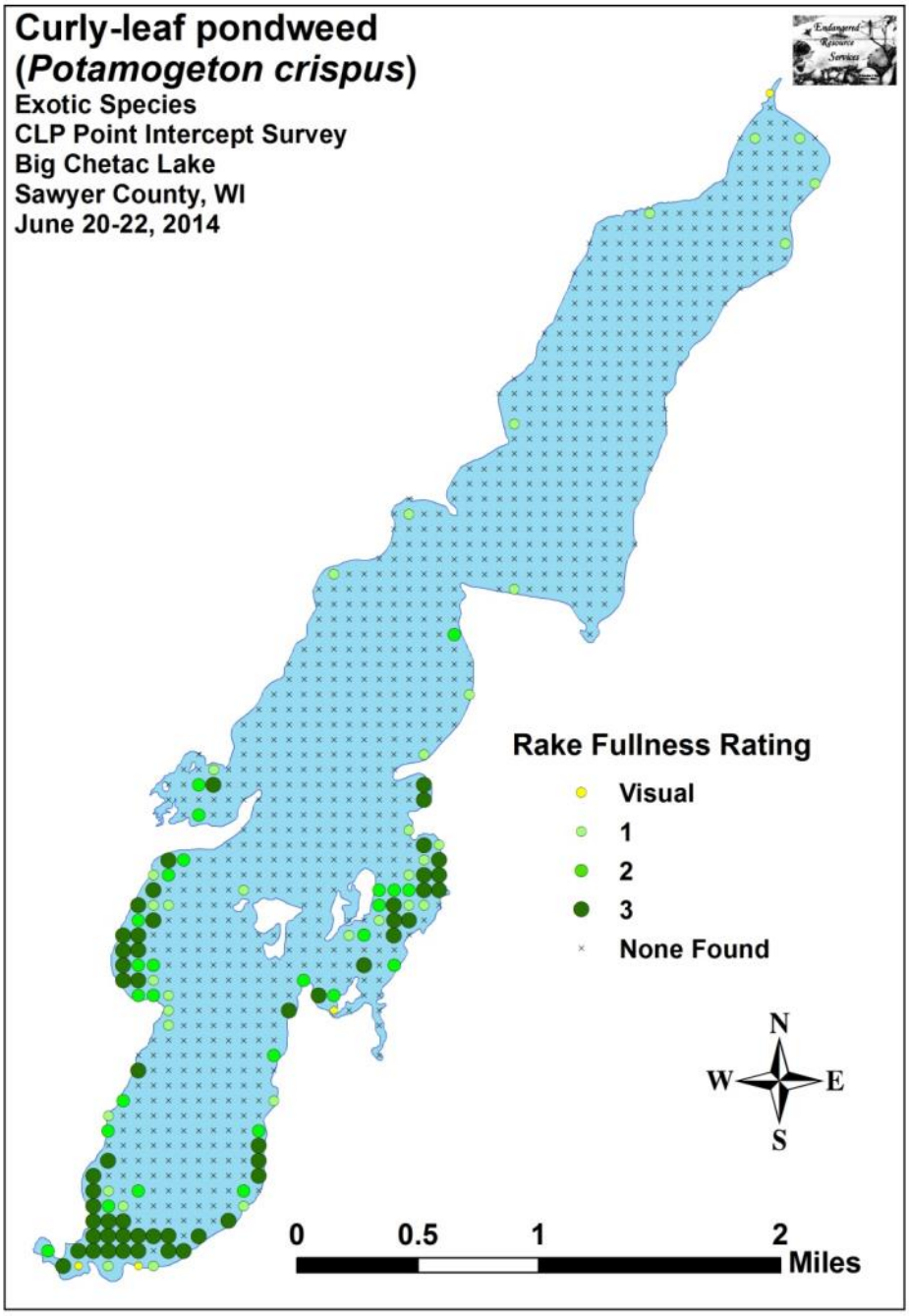
Appendix II: Boat and Vegetative Survey Data Sheets

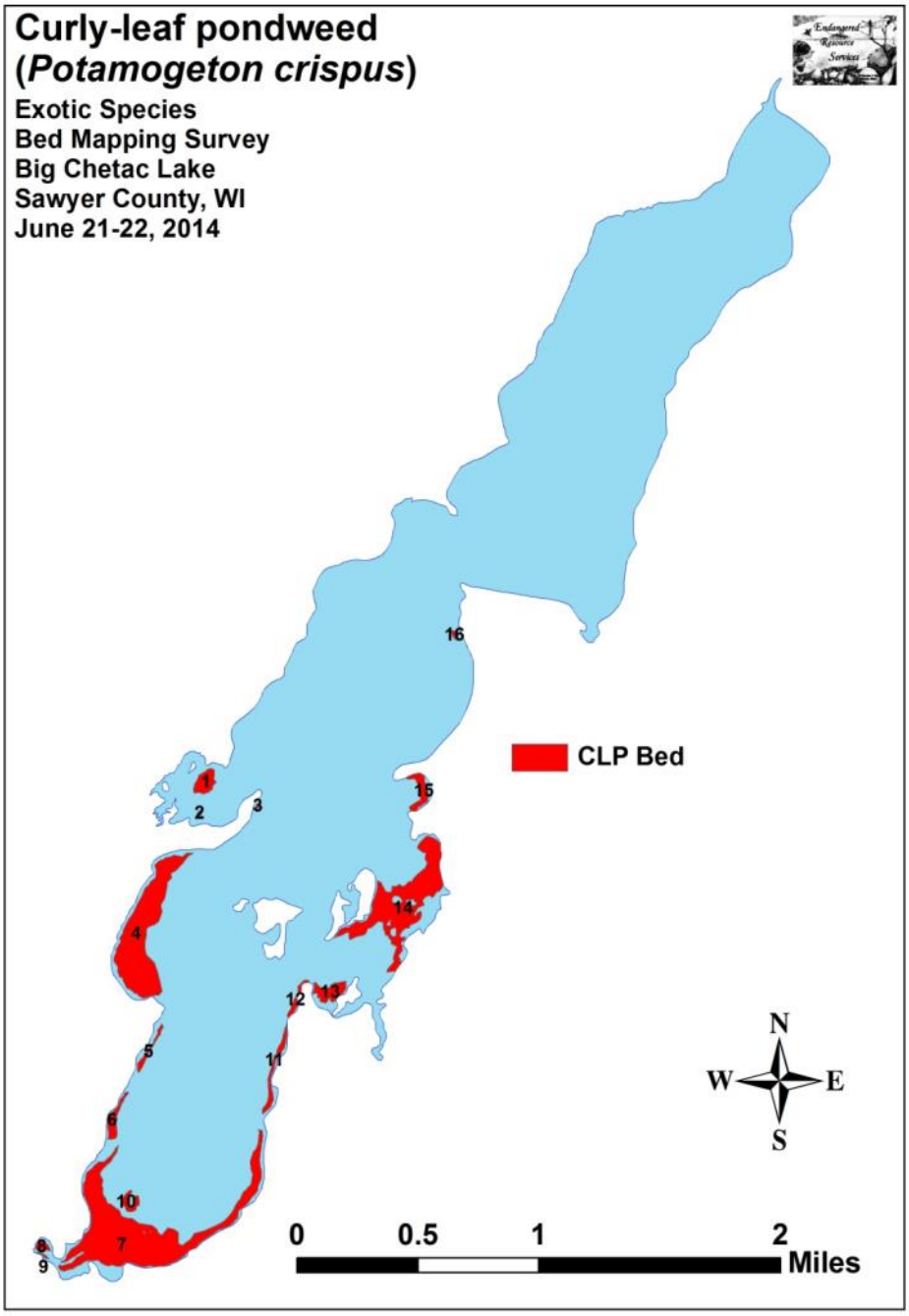
Boat Survey	
Lake Name	
County	
WBIC	
Date of Survey	
(mm/dd/yy)	
workers	
Nearest Point	**Species seen, habitat information**

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	CLP	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																									

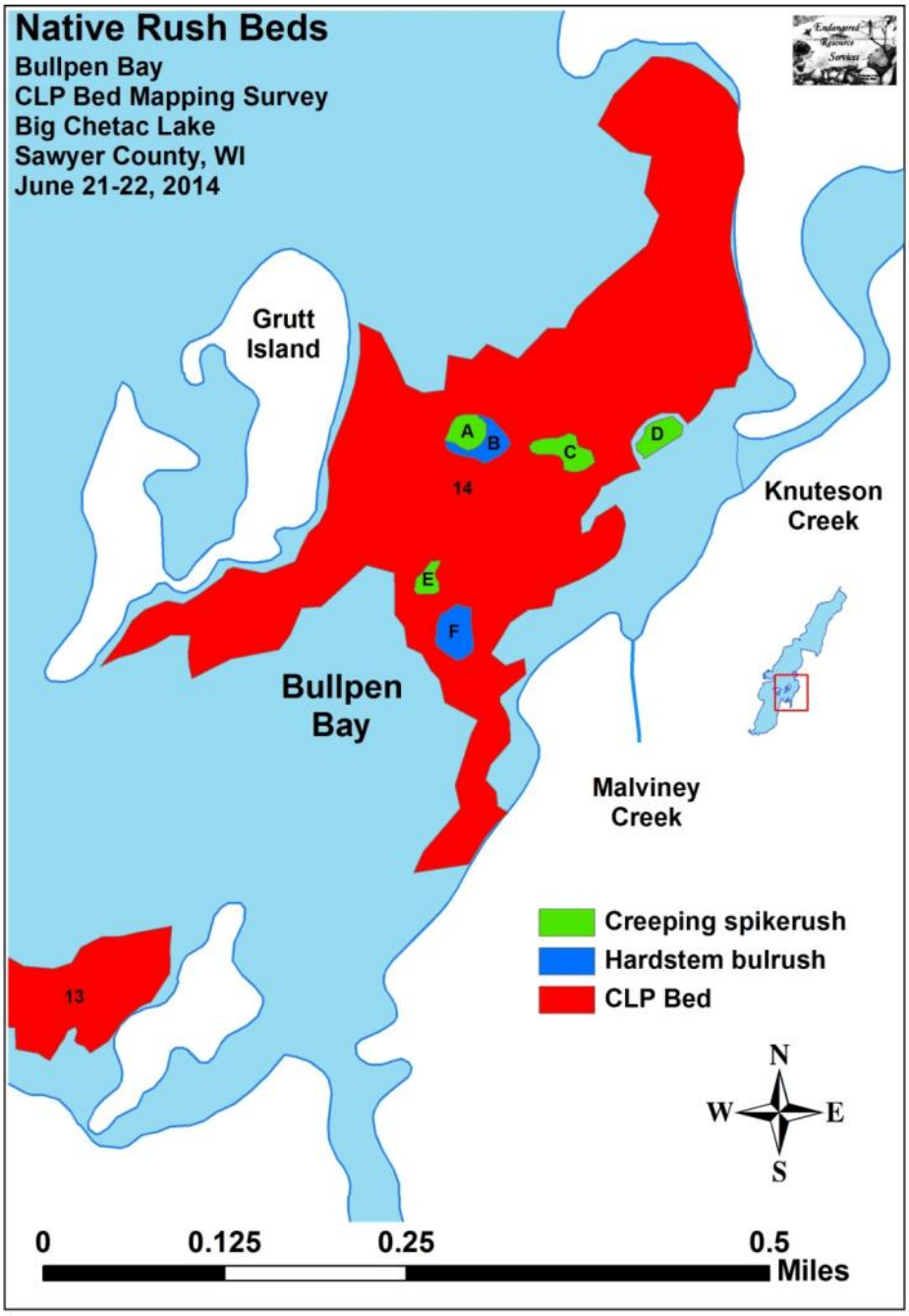
Appendix III: 2008 and 2014 Early Season CLP Density and Distribution and 2014 CLP Bed Maps

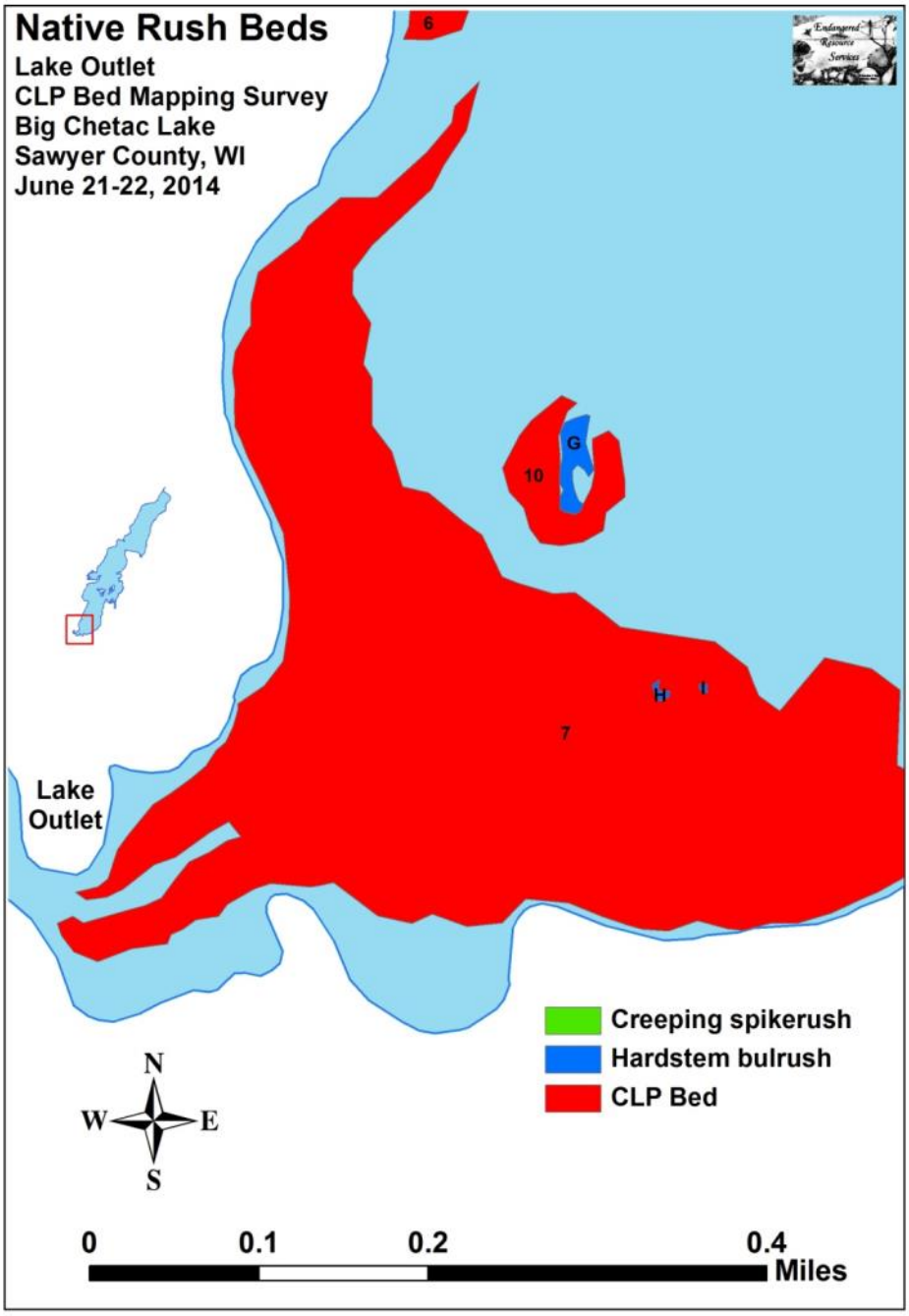

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
June 8-9, 2008
Rake Fullness Rating
Loon on Nest - No Sample
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
June 20-22, 2014
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles

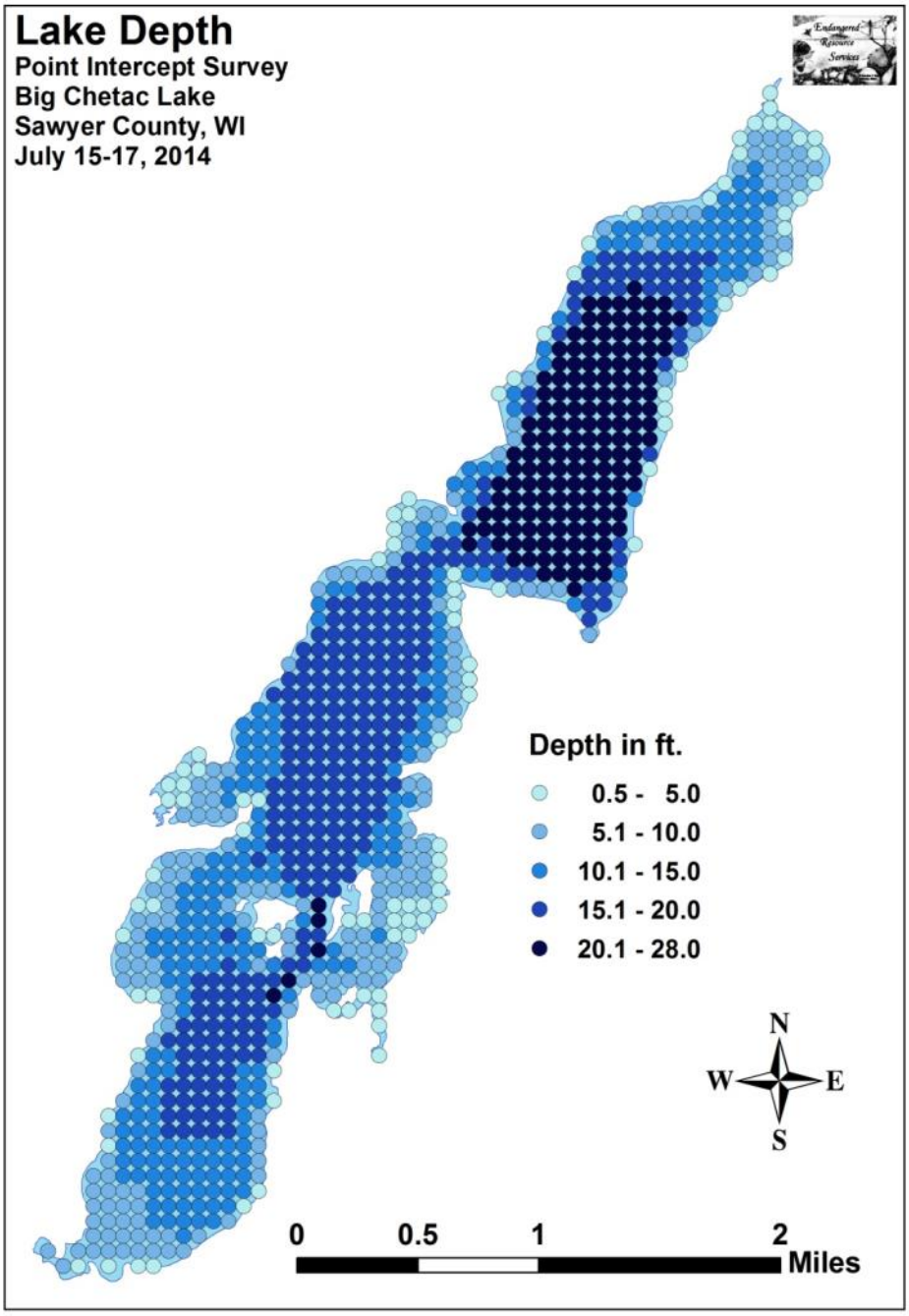

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Bed Mapping Survey
Big Chetac Lake
Sawyer County, WI
June 21-22, 2014
CLP Bed
N
W
E
S
0
0.5
1
2
Miles

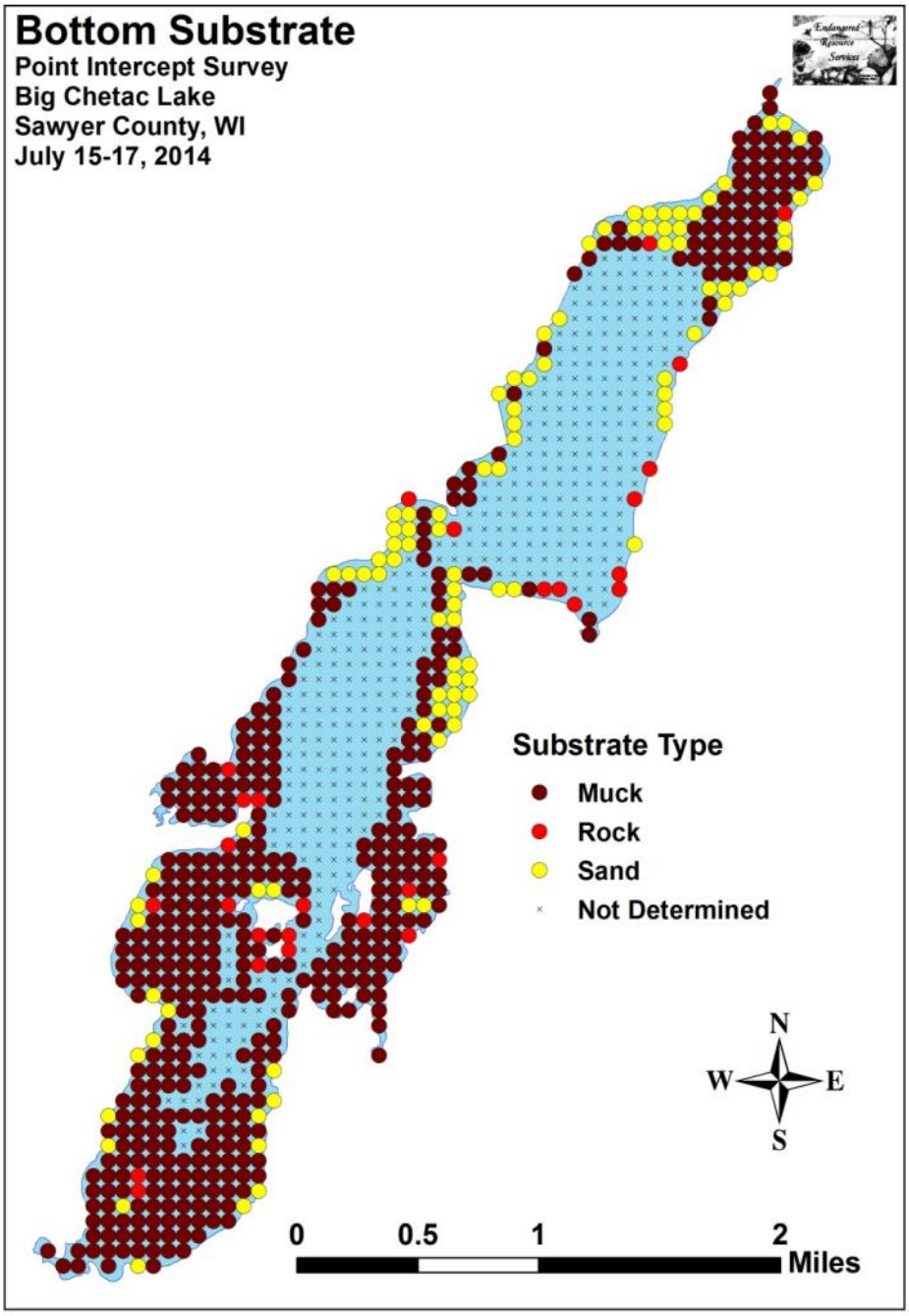
Appendix IV: Native Rush Bed Maps


Native Rush Beds
Bullpen Bay
CLP Bed Mapping Survey
Big Chetac Lake
Sawyer County, WI
June 21-22, 2014
Grutt Island
A
B
C
D
14
E
F
Knuteson Creek
Bullpen Bay
Malviney Creek
13
Creeping spikerush
Hardstem bulrush
CLP Bed
N
W
E
S
0
0.125
0.25
0.5
Miles

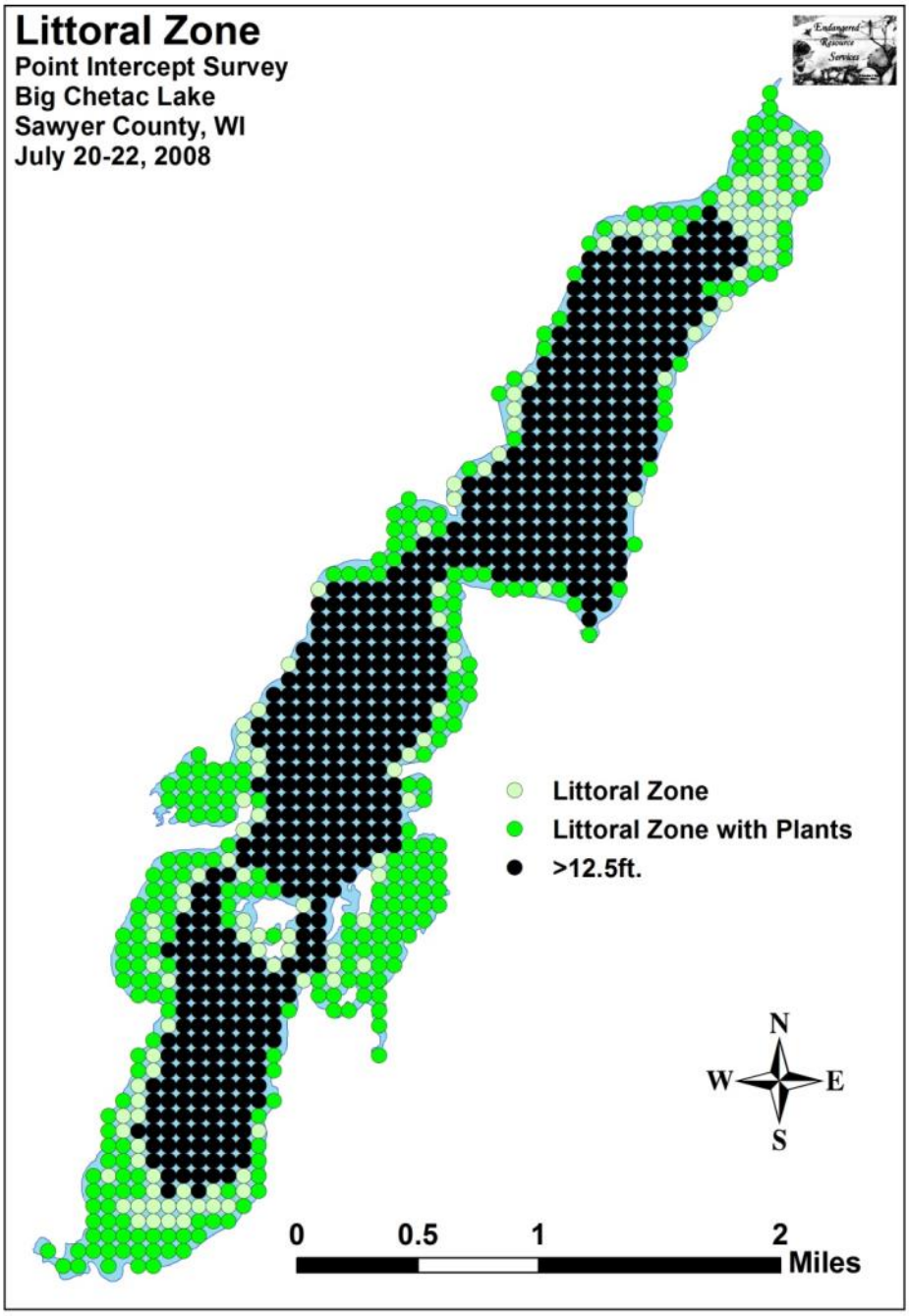

Native Rush Beds
Lake Outlet
CLP Bed Mapping Survey
Big Chetac Lake
Sawyer County, WI
June 21-22, 2014
6
G
10
H
I
7
Lake
Outlet
Creeping spikerush
Hardstem bulrush
CLP Bed
N
W
E
S
0
0.1
0.2
0.4
Miles

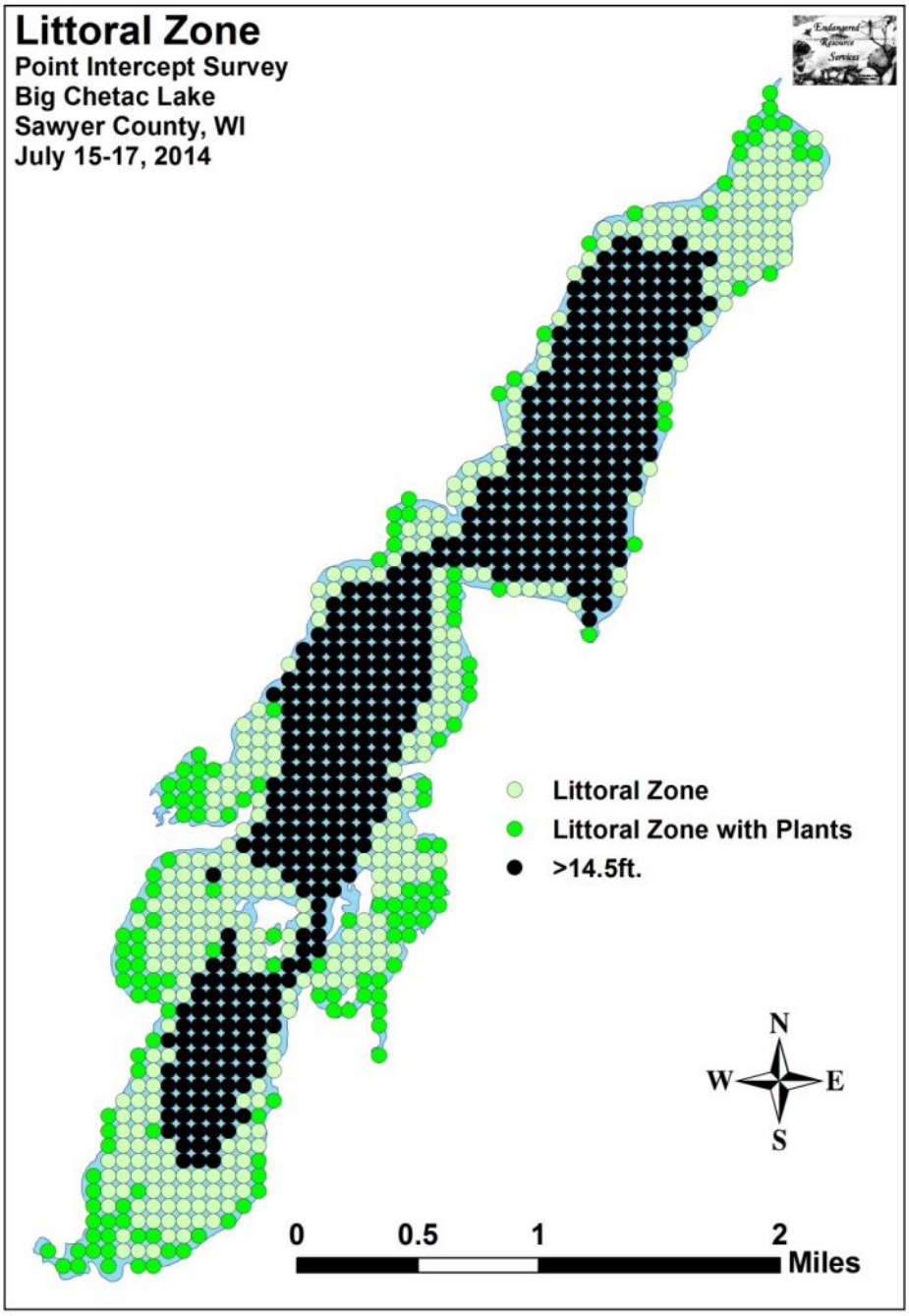
Appendix V: Habitat Variable Maps

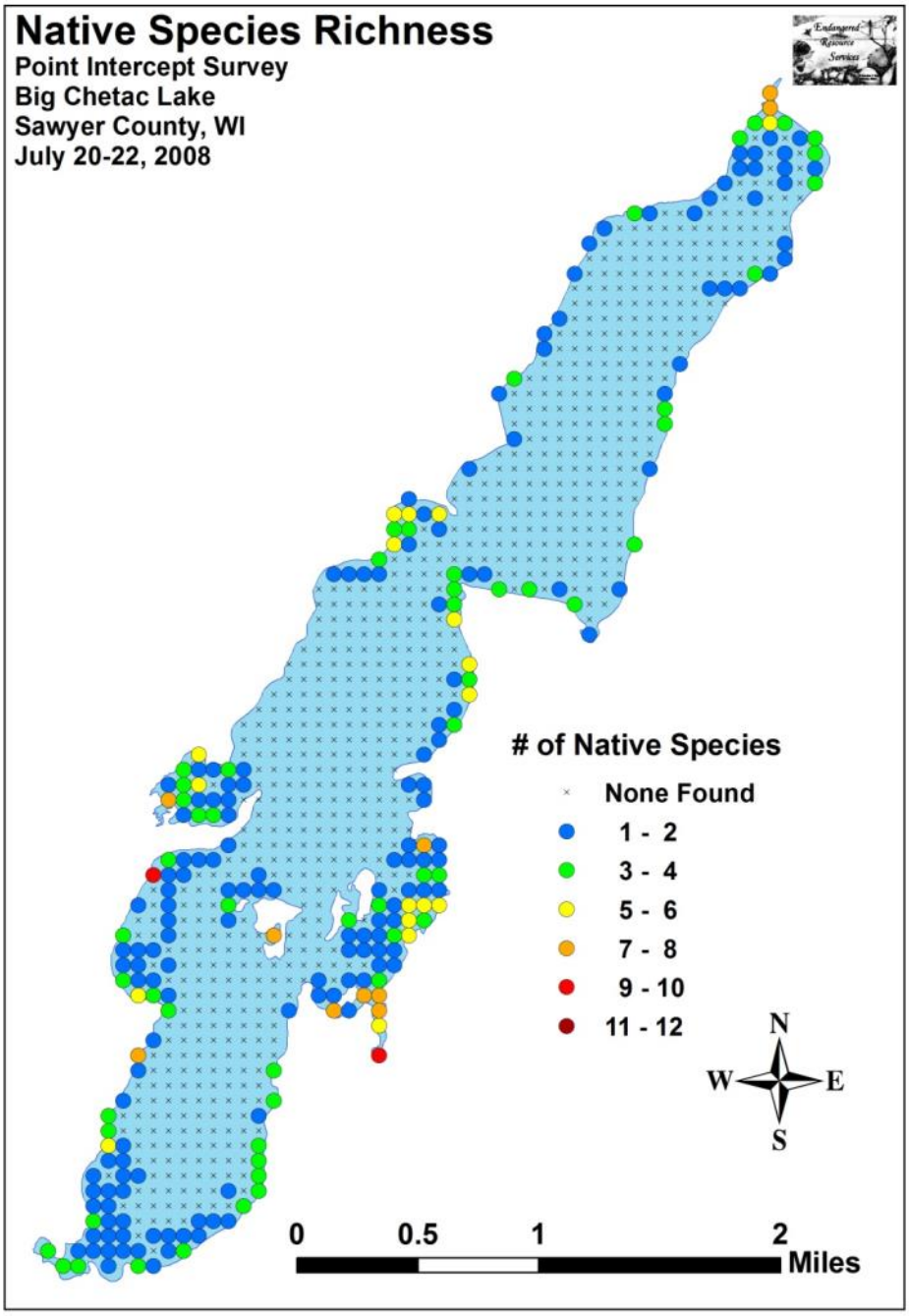

Lake Depth
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Depth in ft.
0.5 - 5.0
5.1 - 10.0
10.1 - 15.0
15.1 - 20.0
20.1 - 28.0
N
W
E
S
0
0.5
1
2
Miles

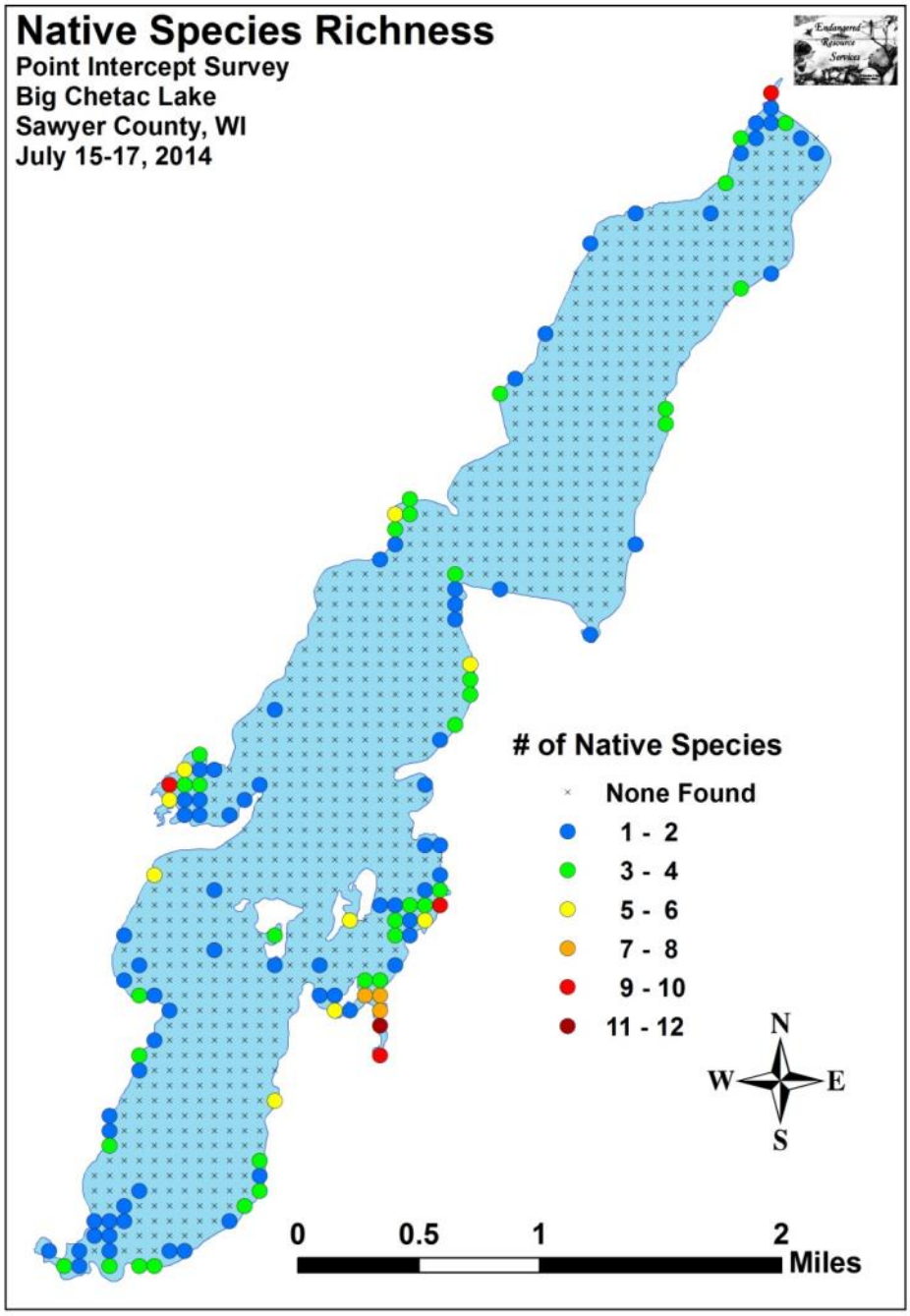

Bottom Substrate
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Substrate Type
Muck
Rock
Sand
Not Determined
N
W
E
S
0
0.5
1
2
Miles

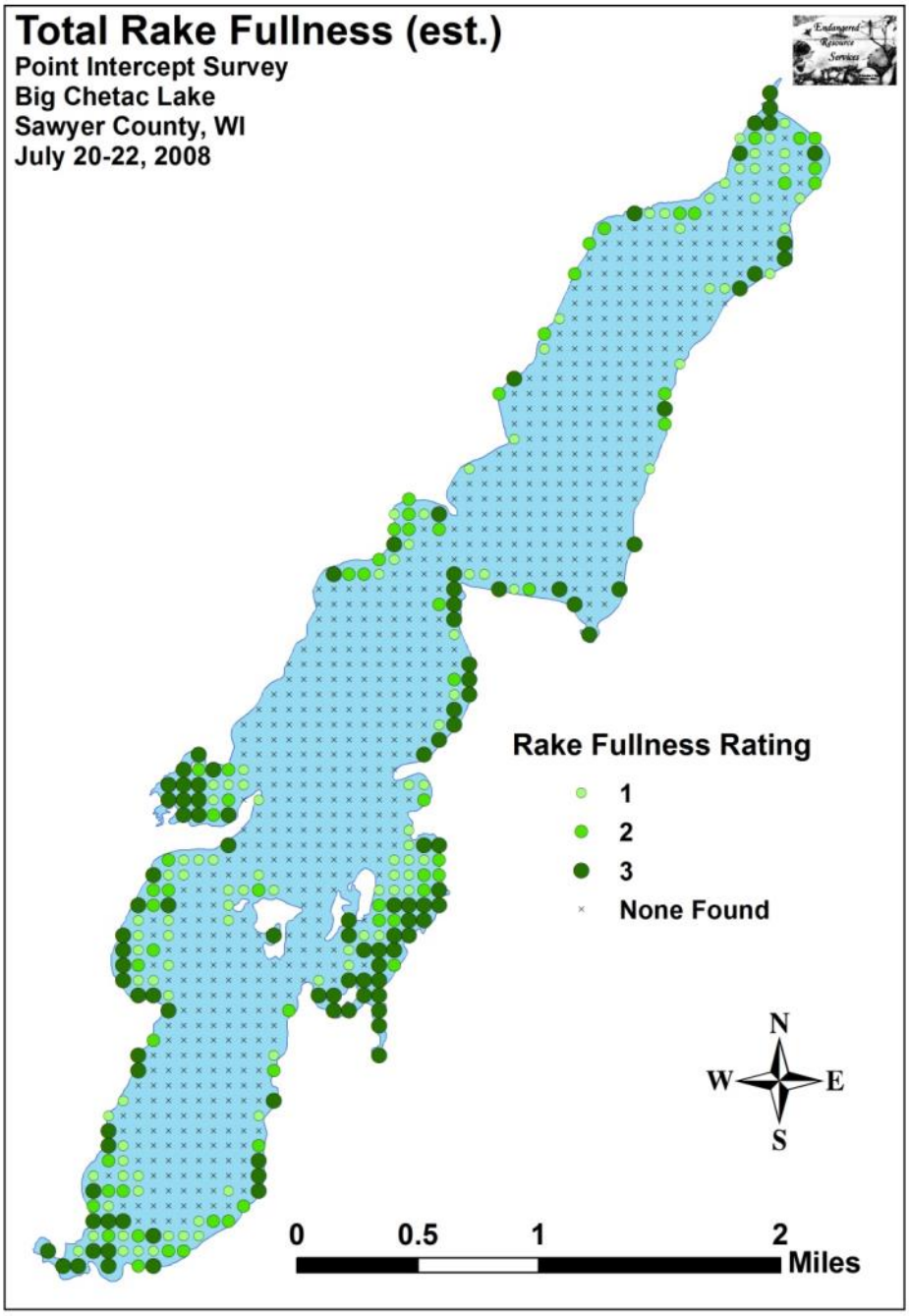
Appendix VI: 2008 and 2014 Littoral Zone, Native Species Richness and Total Rake Fullness Maps

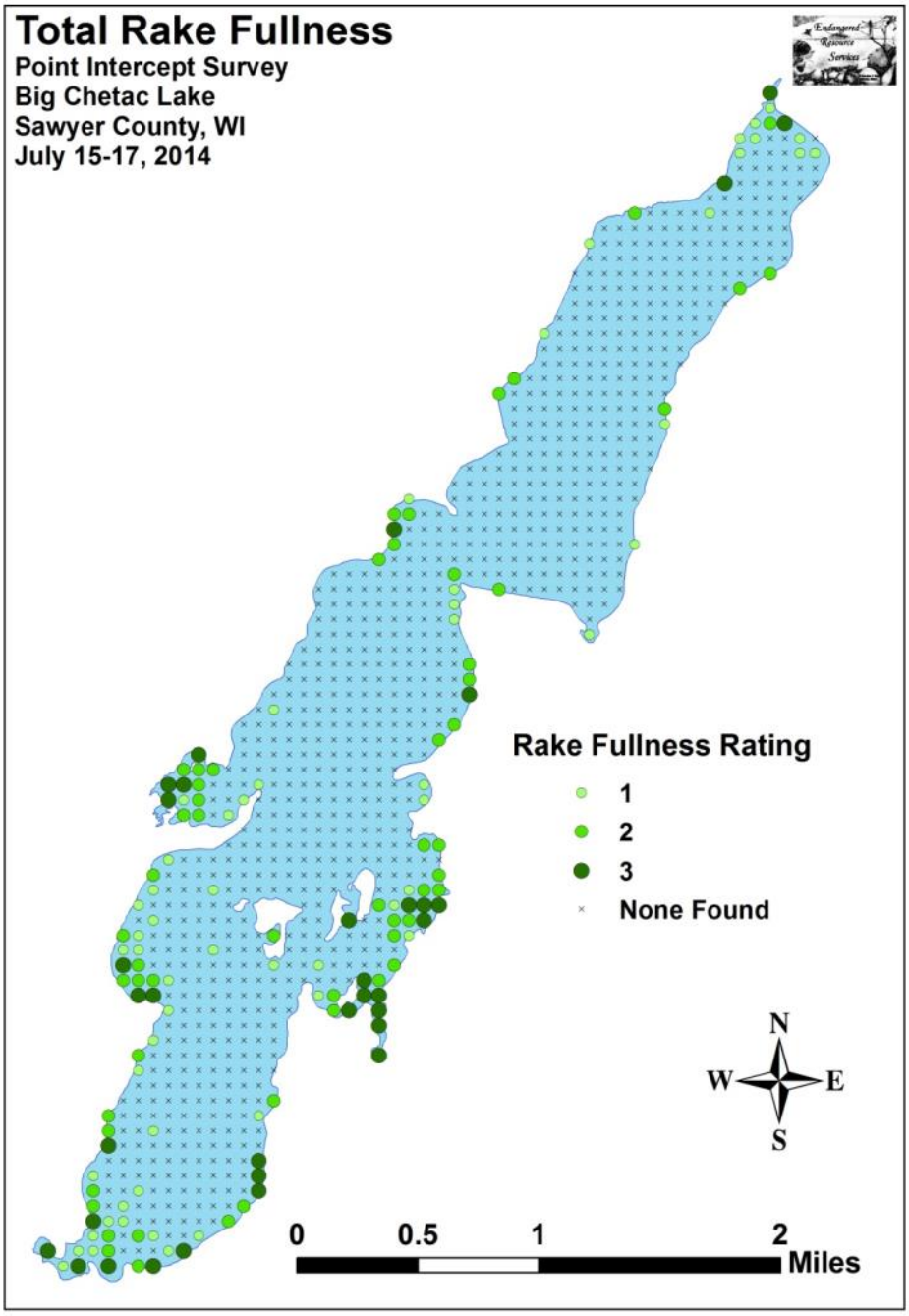

Littoral Zone
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Littoral Zone
Littoral Zone with Plants
>12.5ft.
N
W
E
S
0
0.5
1
2
Miles


Littoral Zone
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Littoral Zone
Littoral Zone with Plants
>14.5ft.
N
W
E
S
0
0.5
1
2
Miles

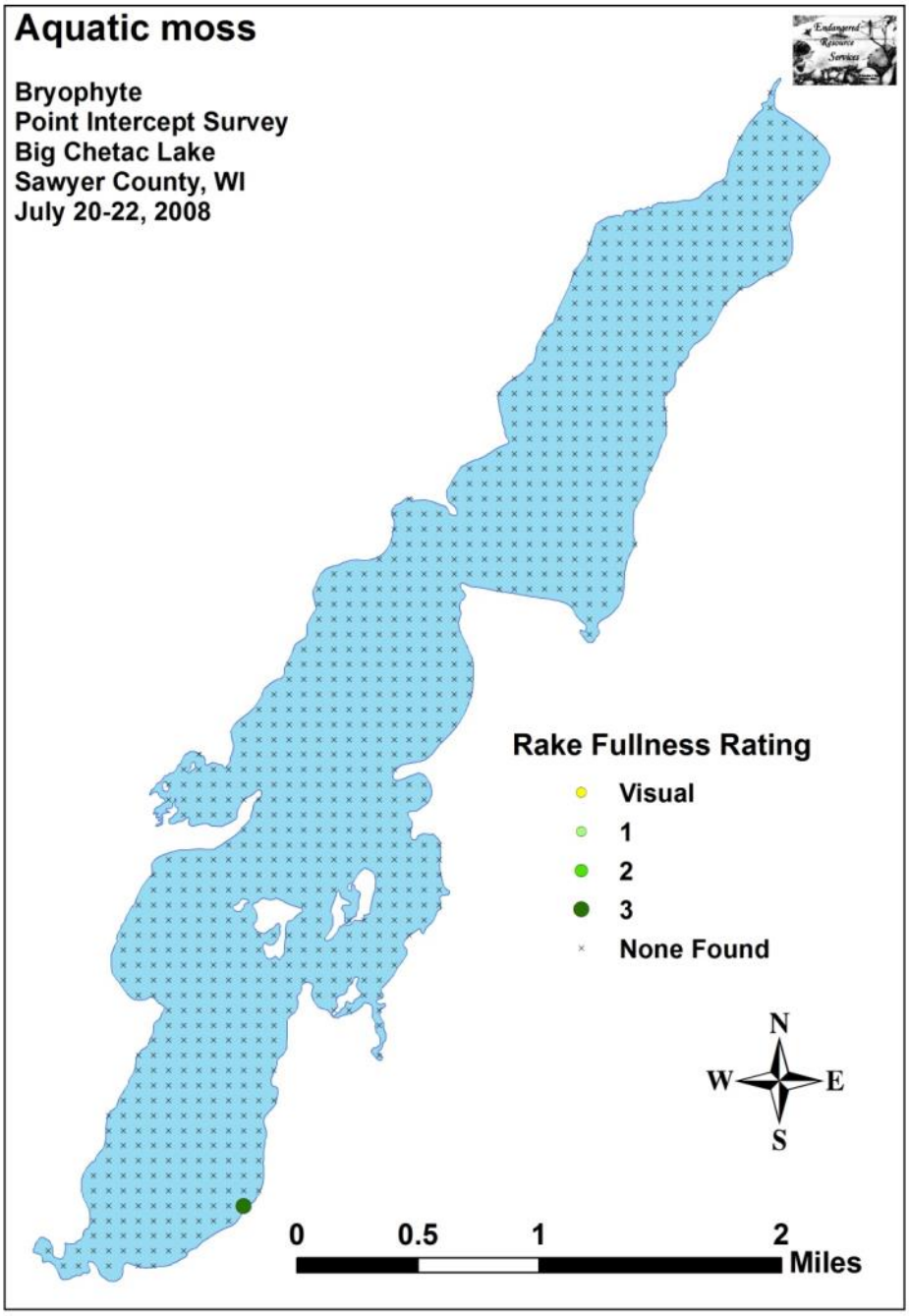

Native Species Richness
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 12
N
W
E
S
0
0.5
1
2
Miles

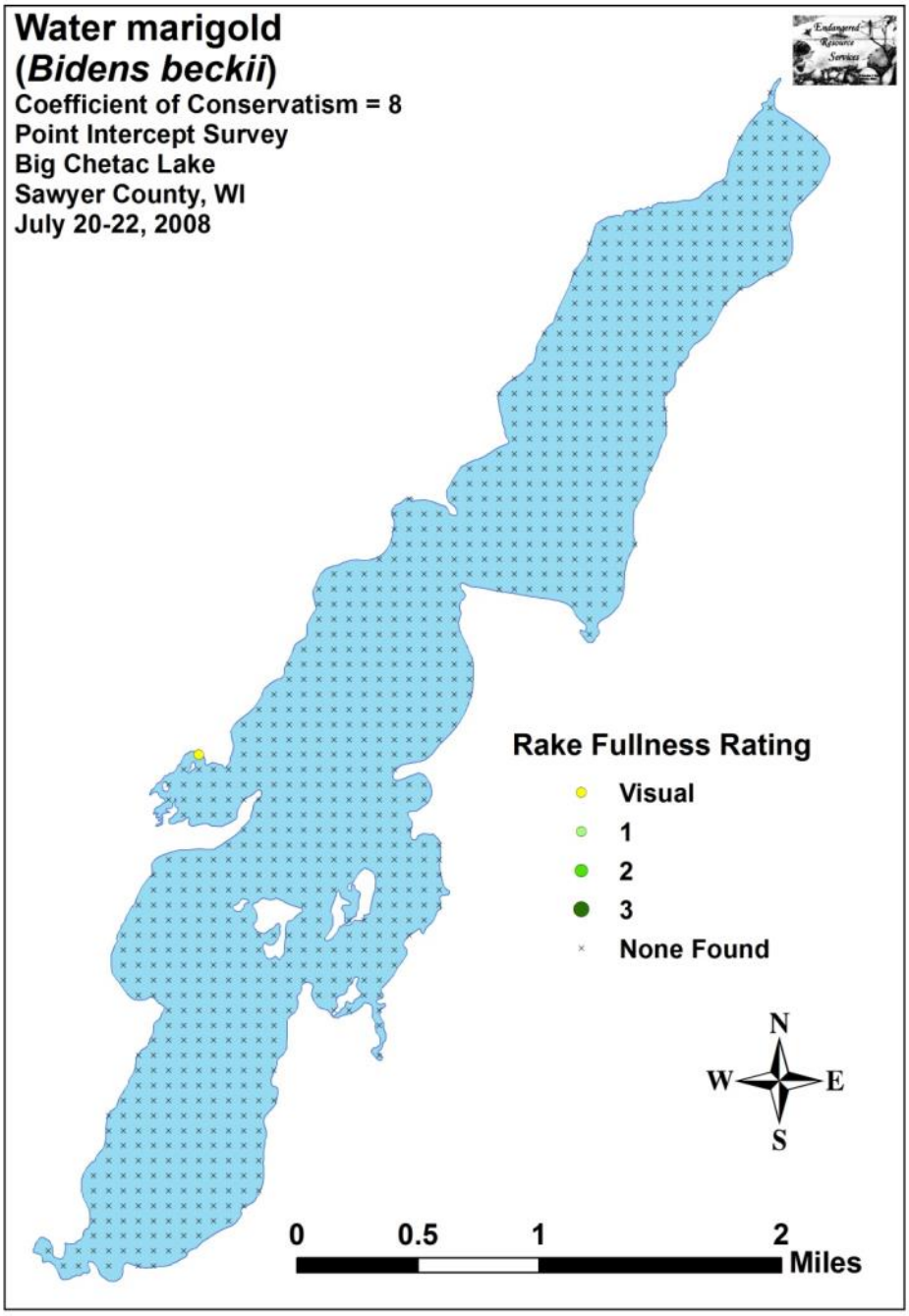

Native Species Richness
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 12
N
W
E
S
0
0.5
1
2
Miles

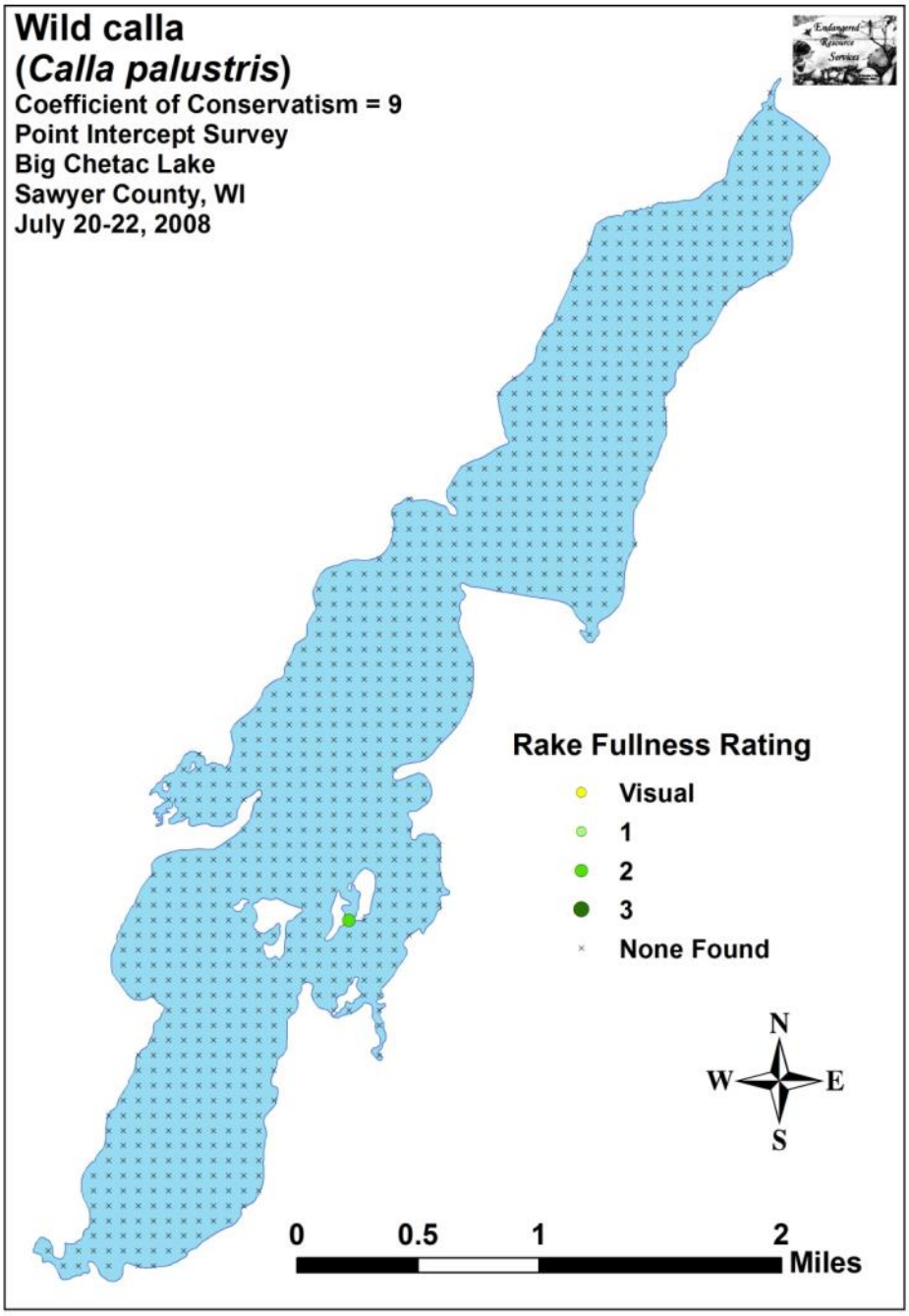

Total Rake Fullness (est.)
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles

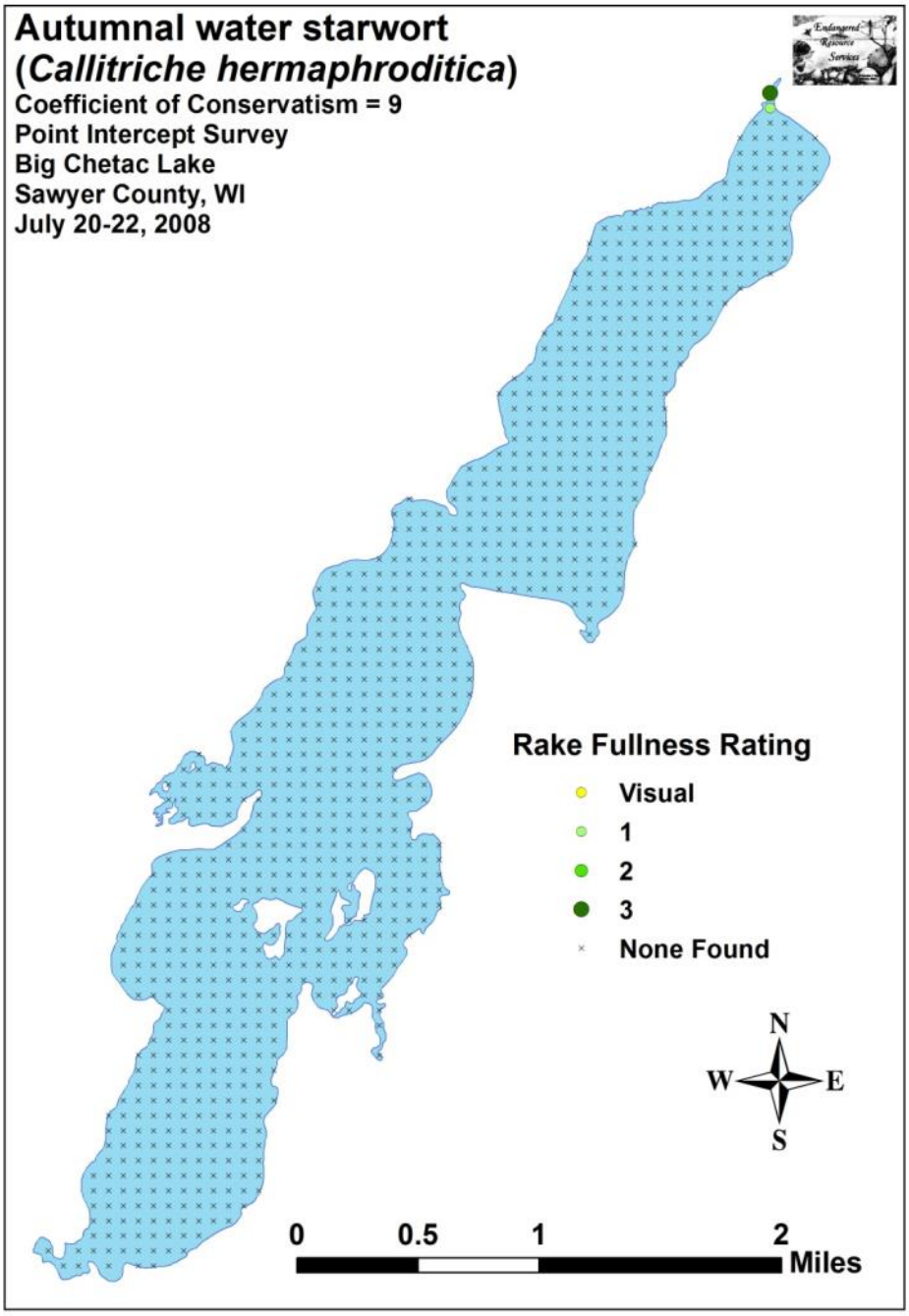

Total Rake Fullness
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles

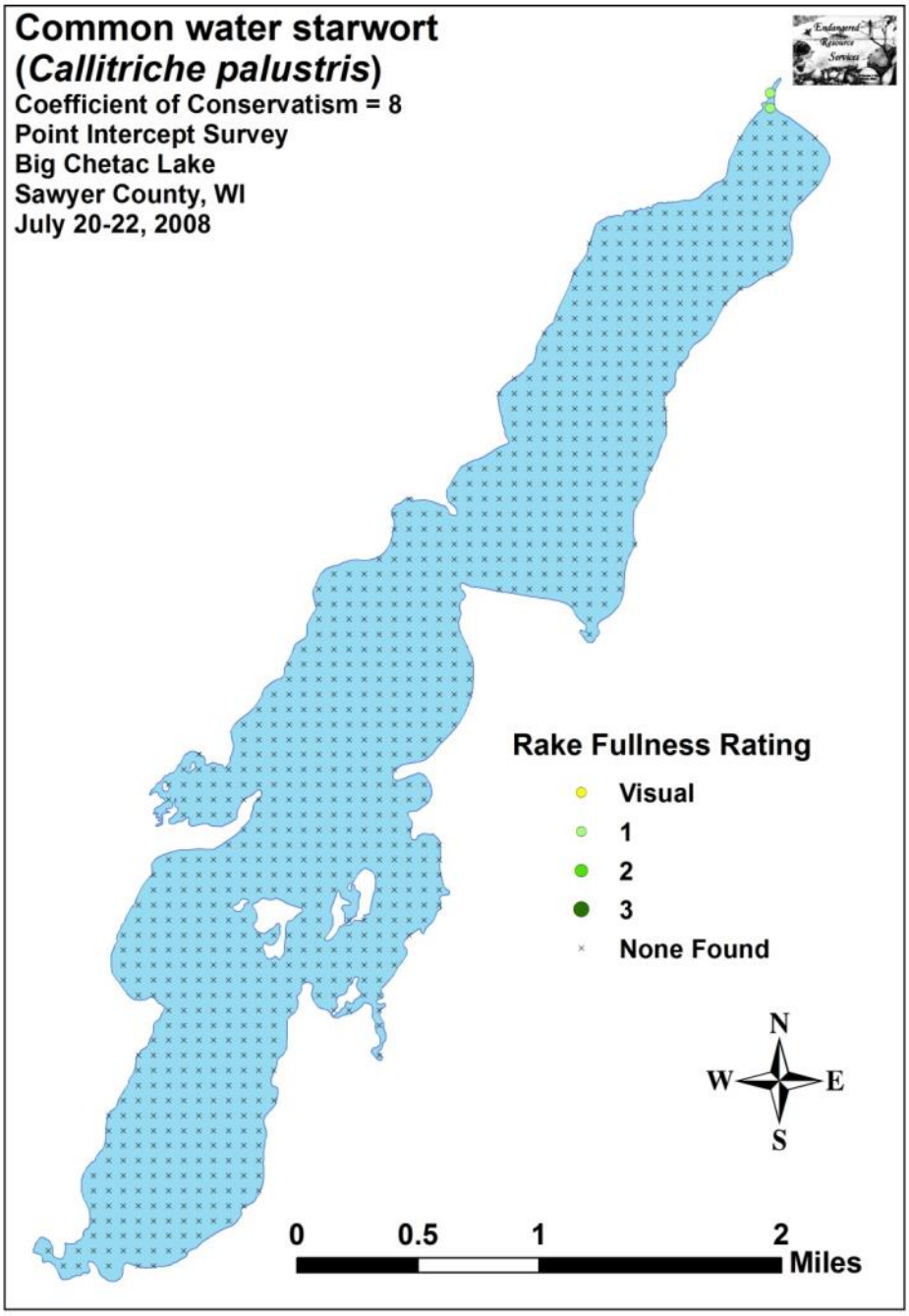
Appendix VII: July 2008 Species Density and Distribution Maps

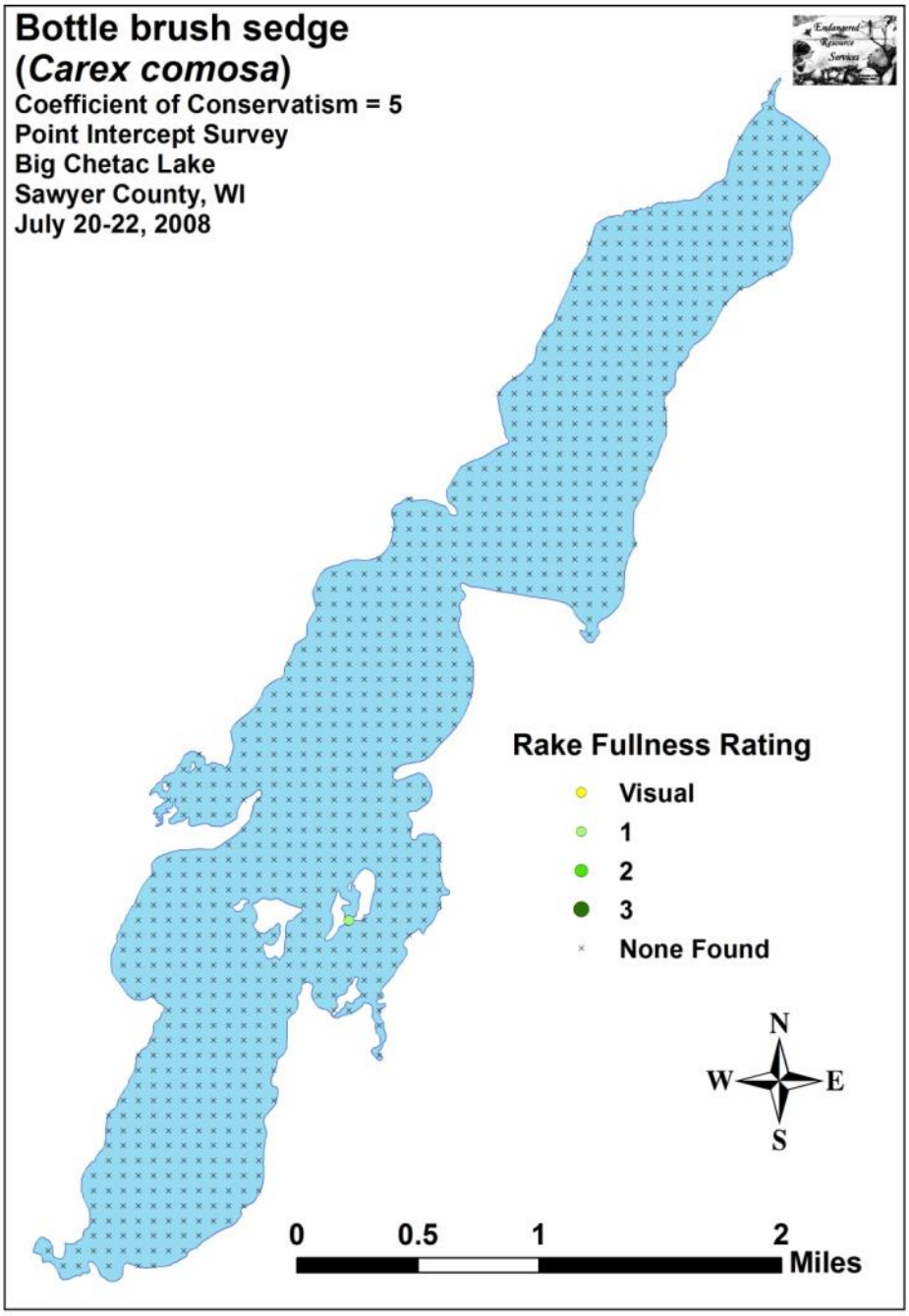

Aquatic moss
Bryophyte
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Wild calla
(Calla palustris)
Coefficient of Conservatism = 9
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Autumnal water starwort
(Callitriche hermaphroditica)
Coefficient of Conservatism = 9
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Common water starwort
(Callitriche palustris)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Bottle brush sedge
(Carex comosa)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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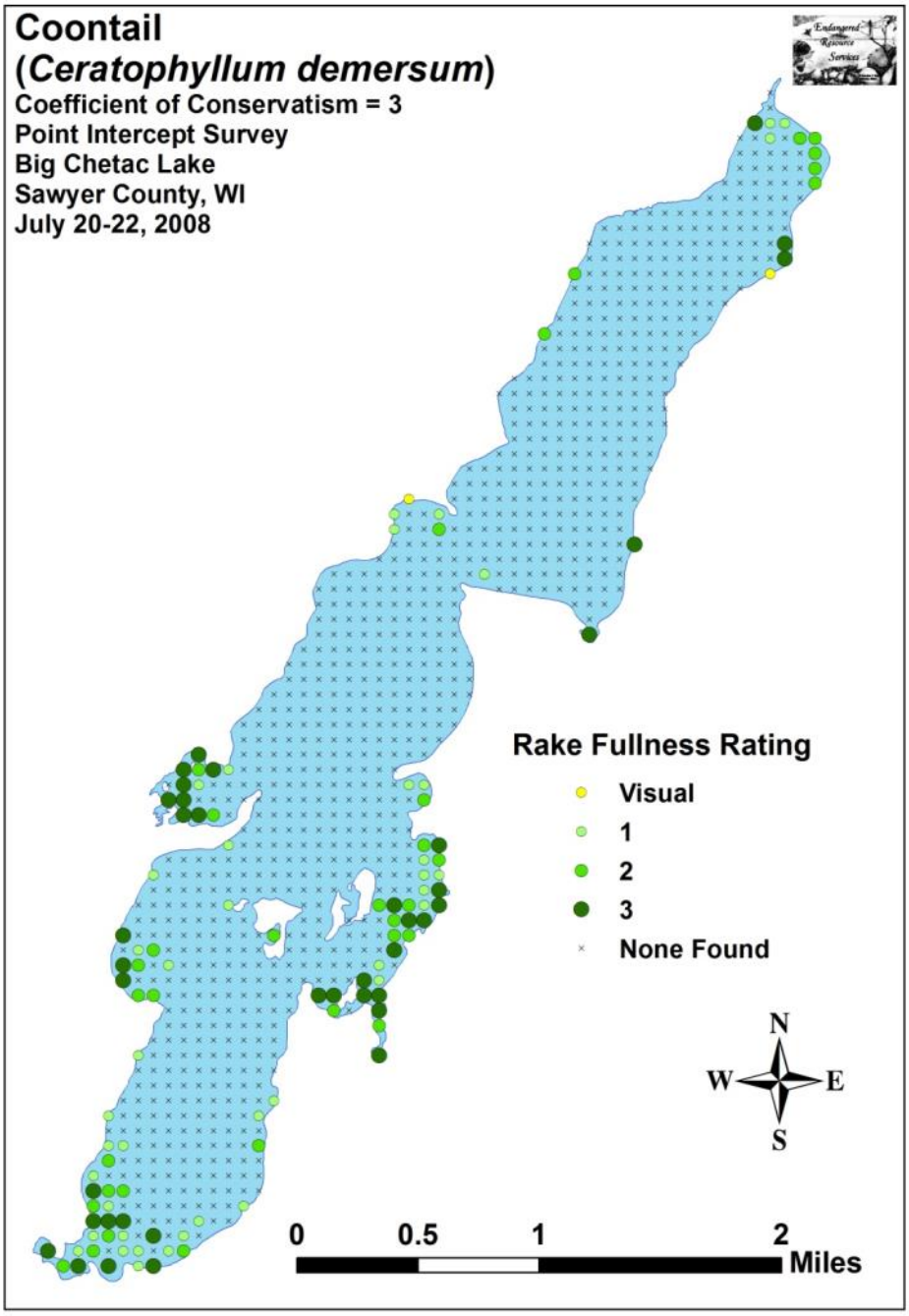
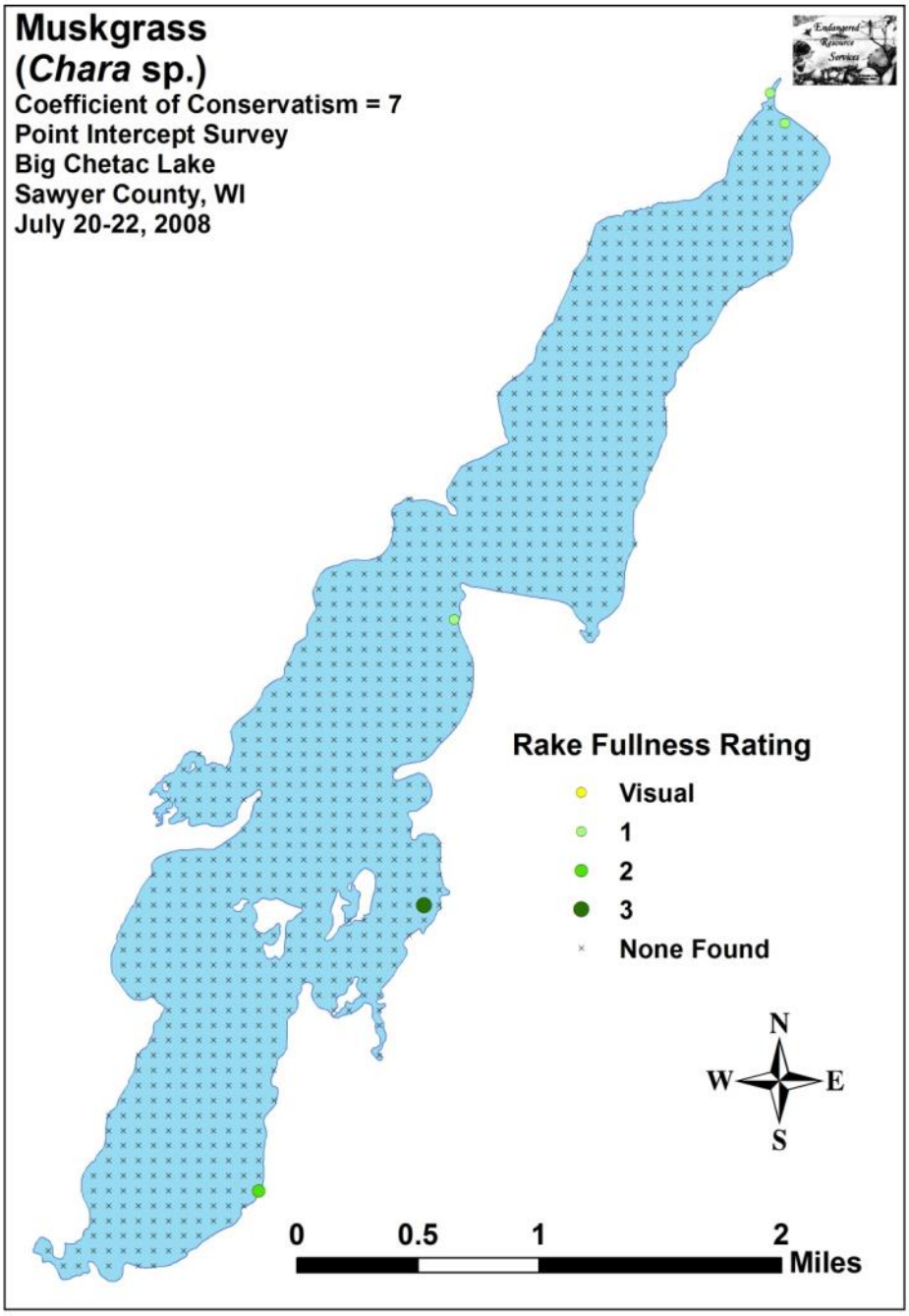
S
0
0.5
1
2
Miles


Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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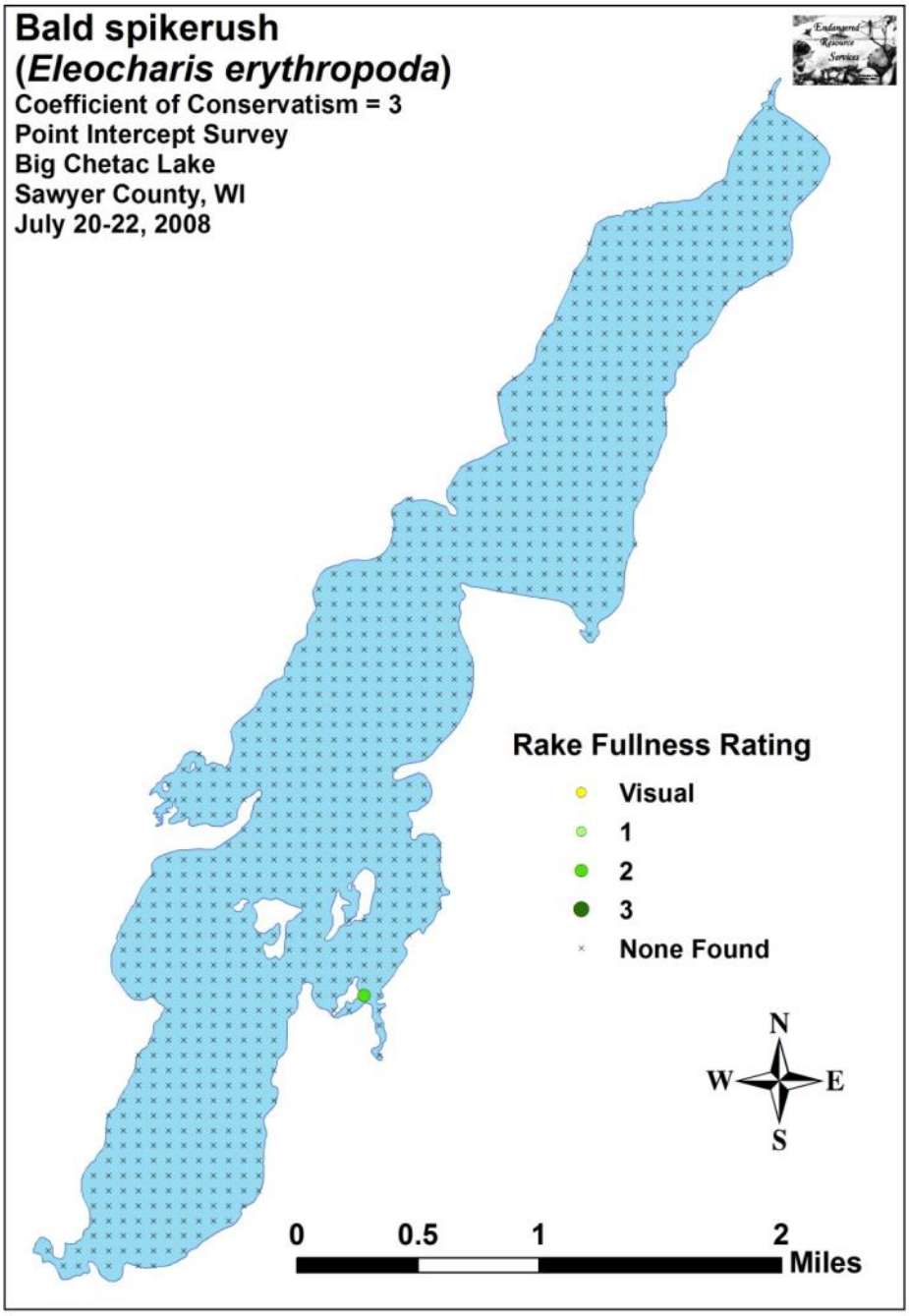
0
0.5
1
2
Miles


Bald spikerush
(Eleocharis erythropoda)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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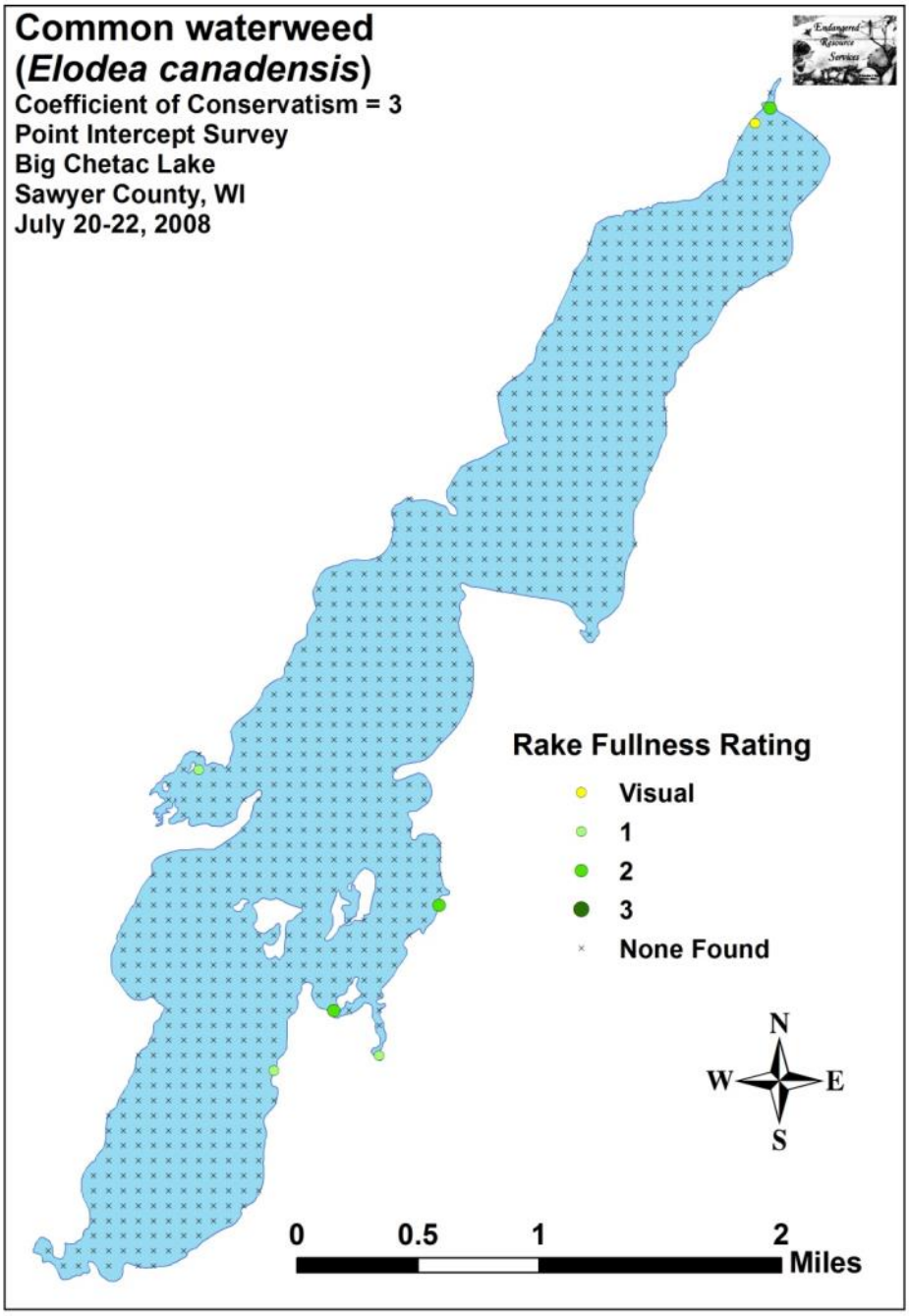
S
0
0.5
1
2
Miles


Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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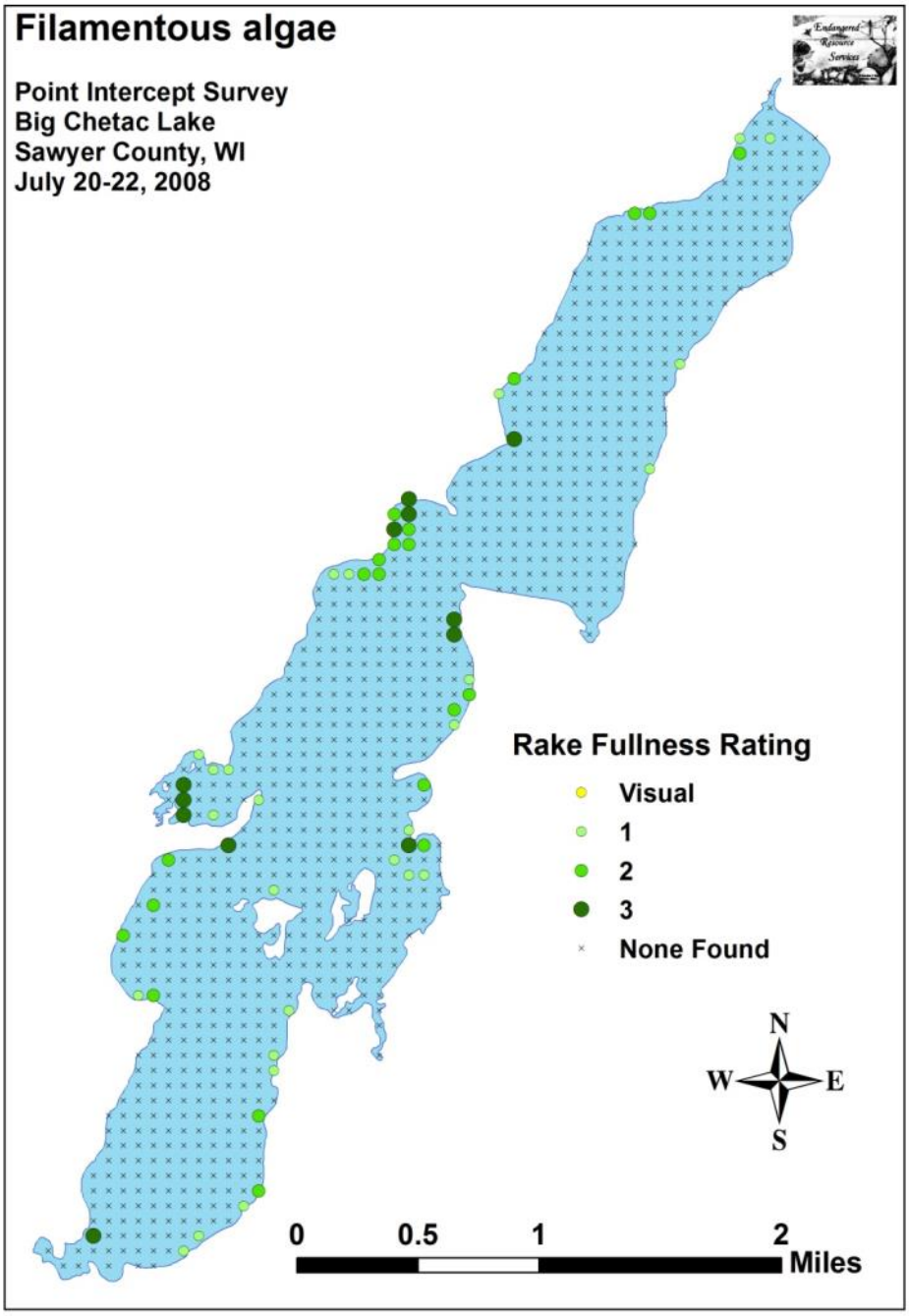
S
0
0.5
1
2
Miles


Filamentous algae
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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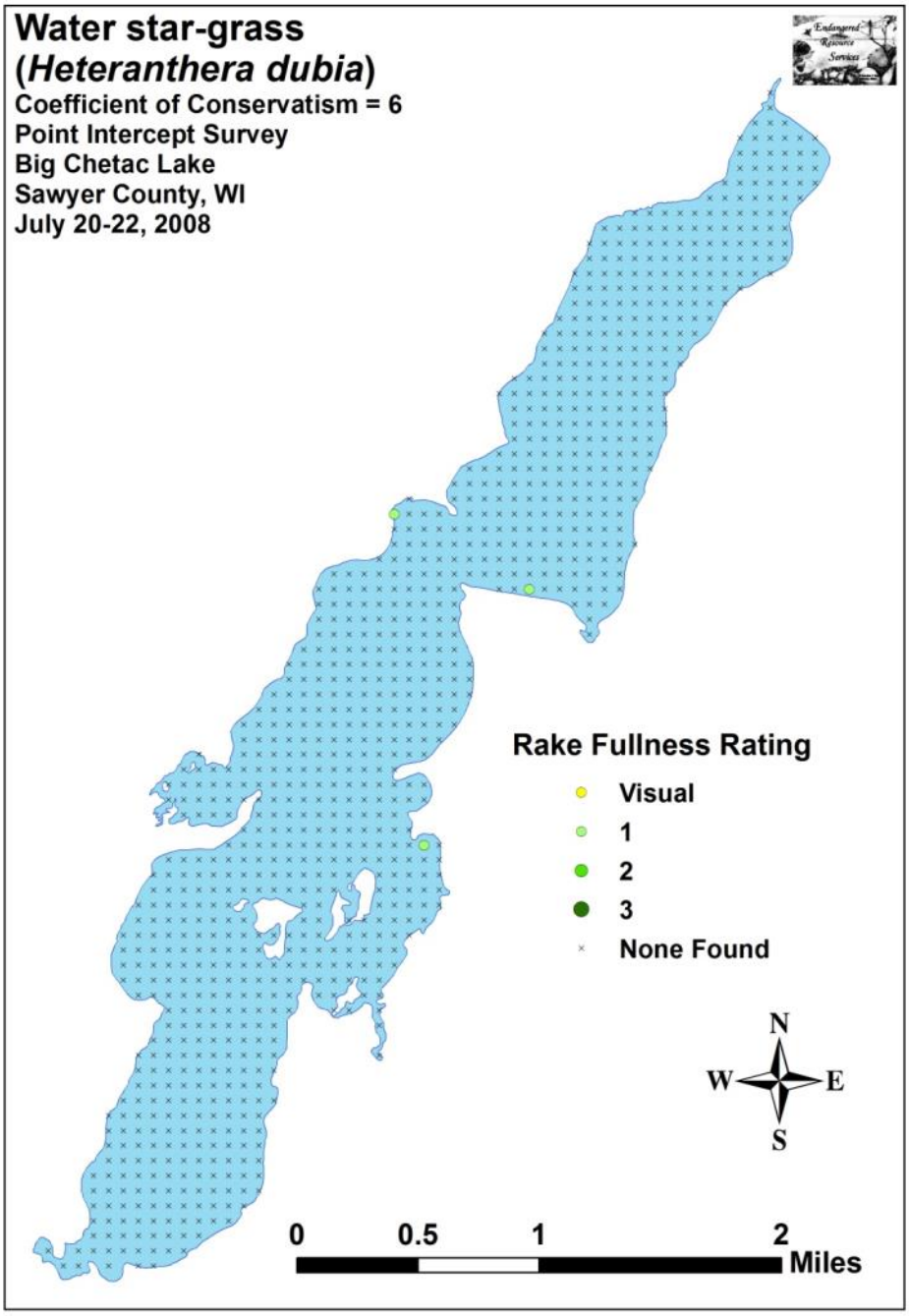
S
0
0.5
1
2
Miles


Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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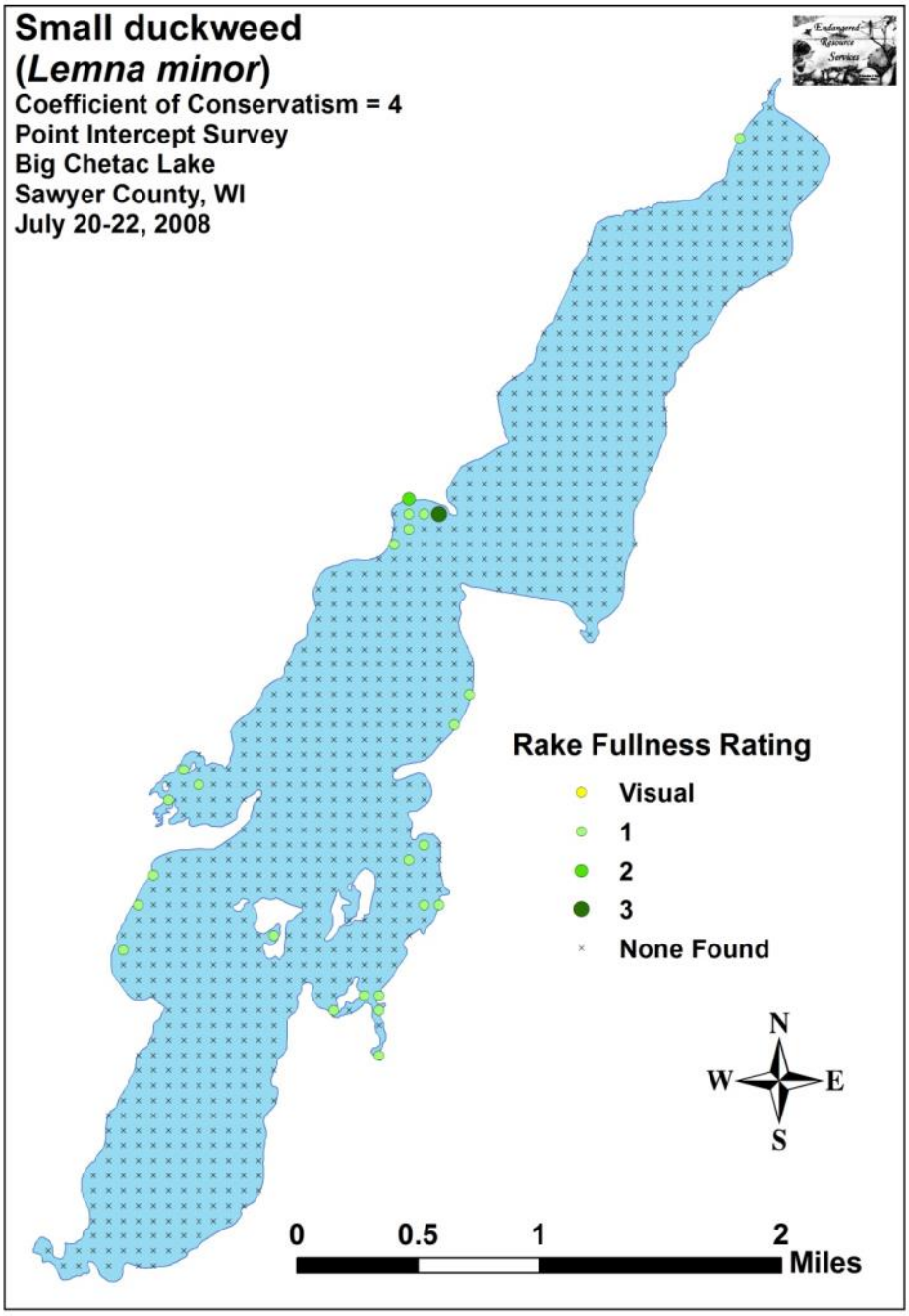
0
0.5
1
2
Miles


Small duckweed
(Lemna minor)
Coefficient of Conservatism = 4
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
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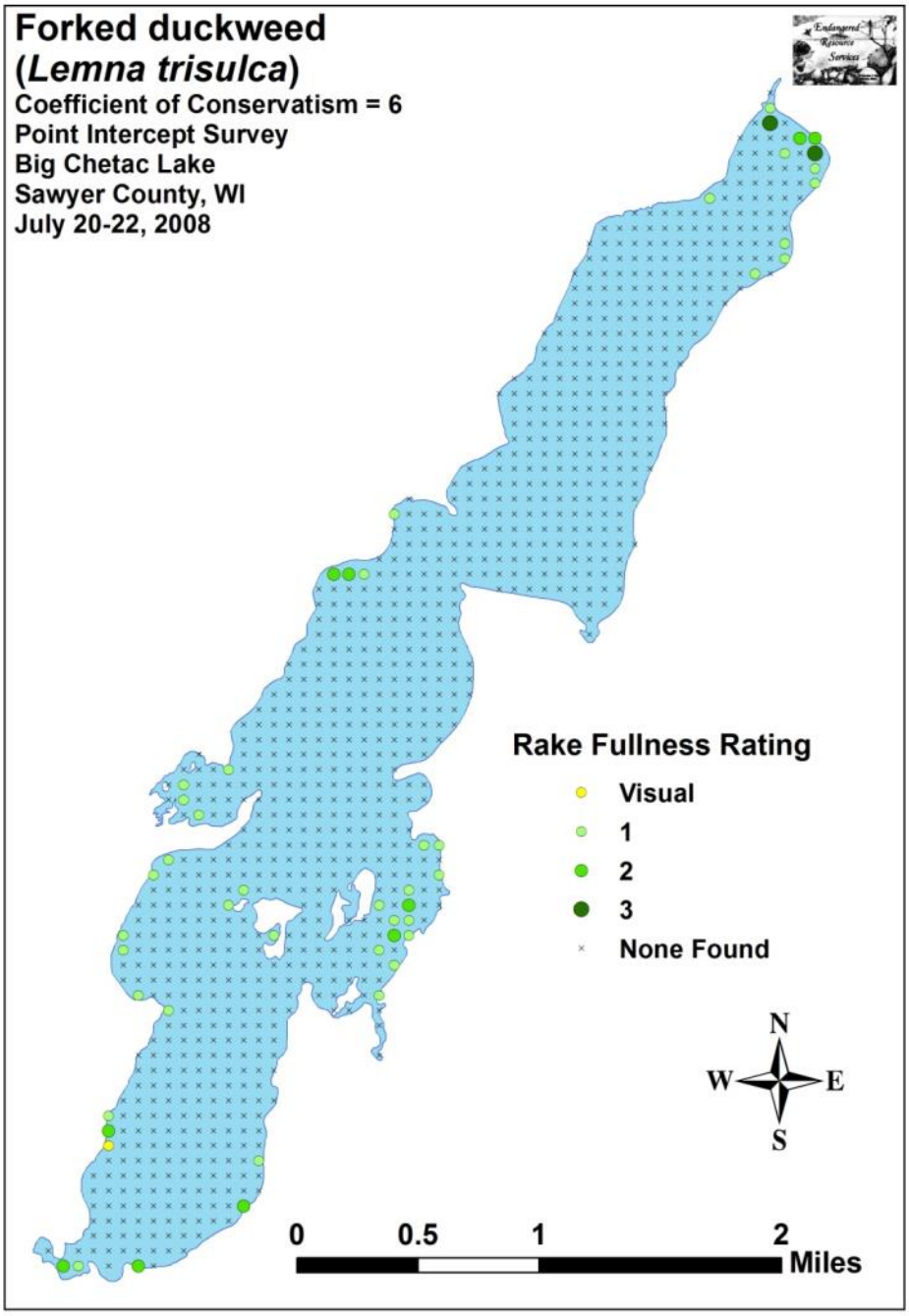
0.5
1
2
Miles


Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
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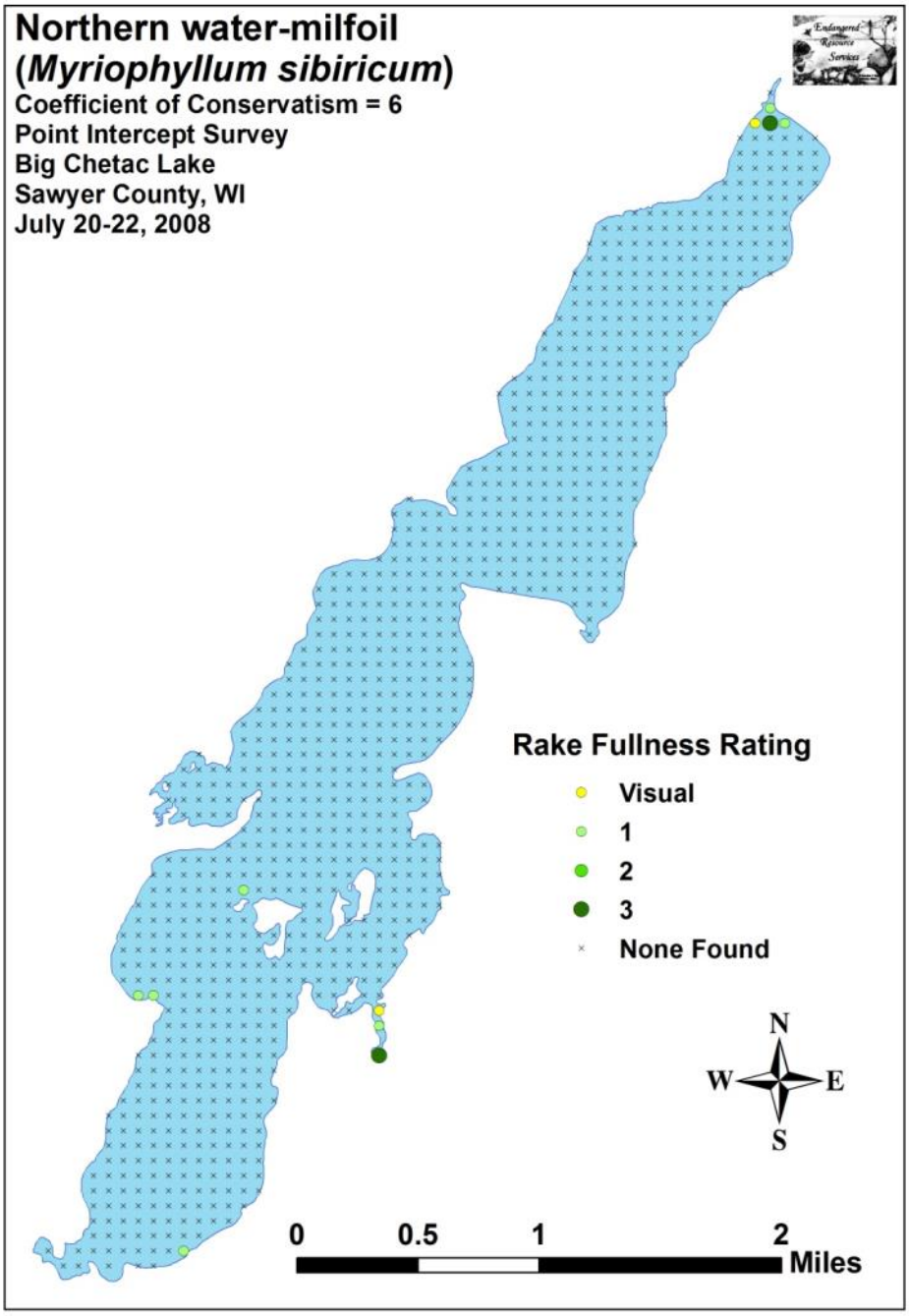
0.5
1
2
Miles


Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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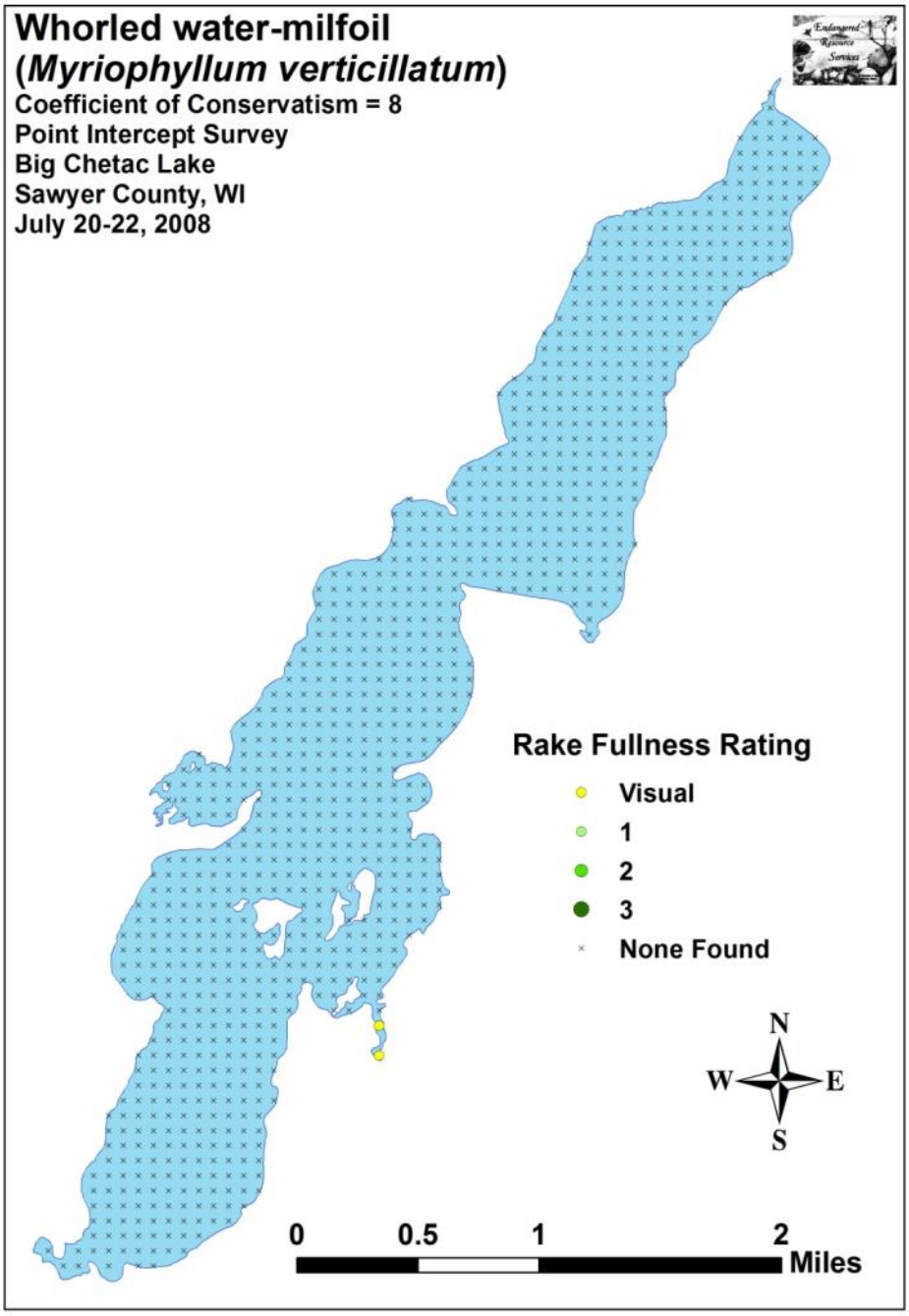
S
0
0.5
1
2
Miles


Whorled water-milfoil
(Myriophyllum verticillatum)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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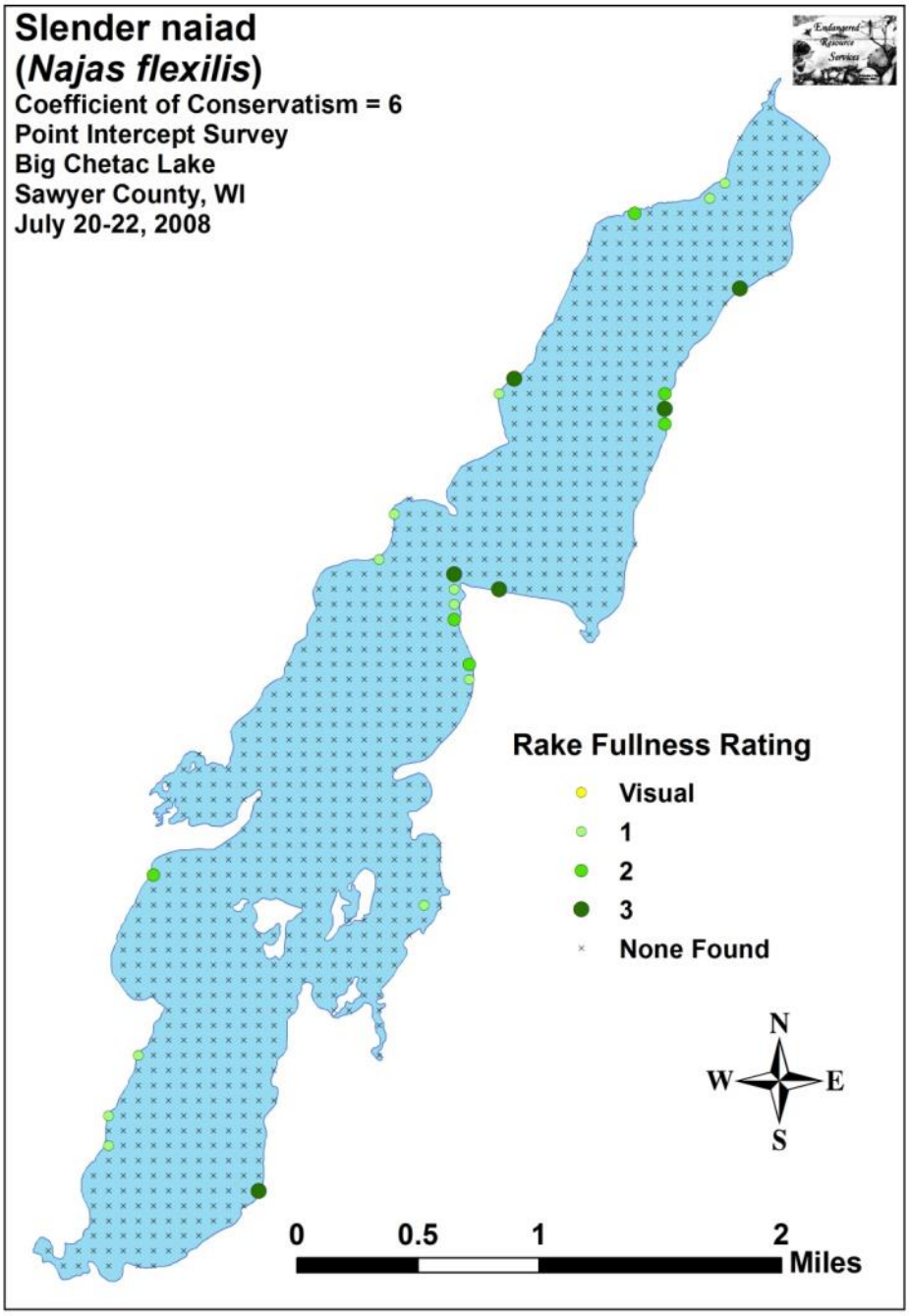
S
0
0.5
1
2
Miles


Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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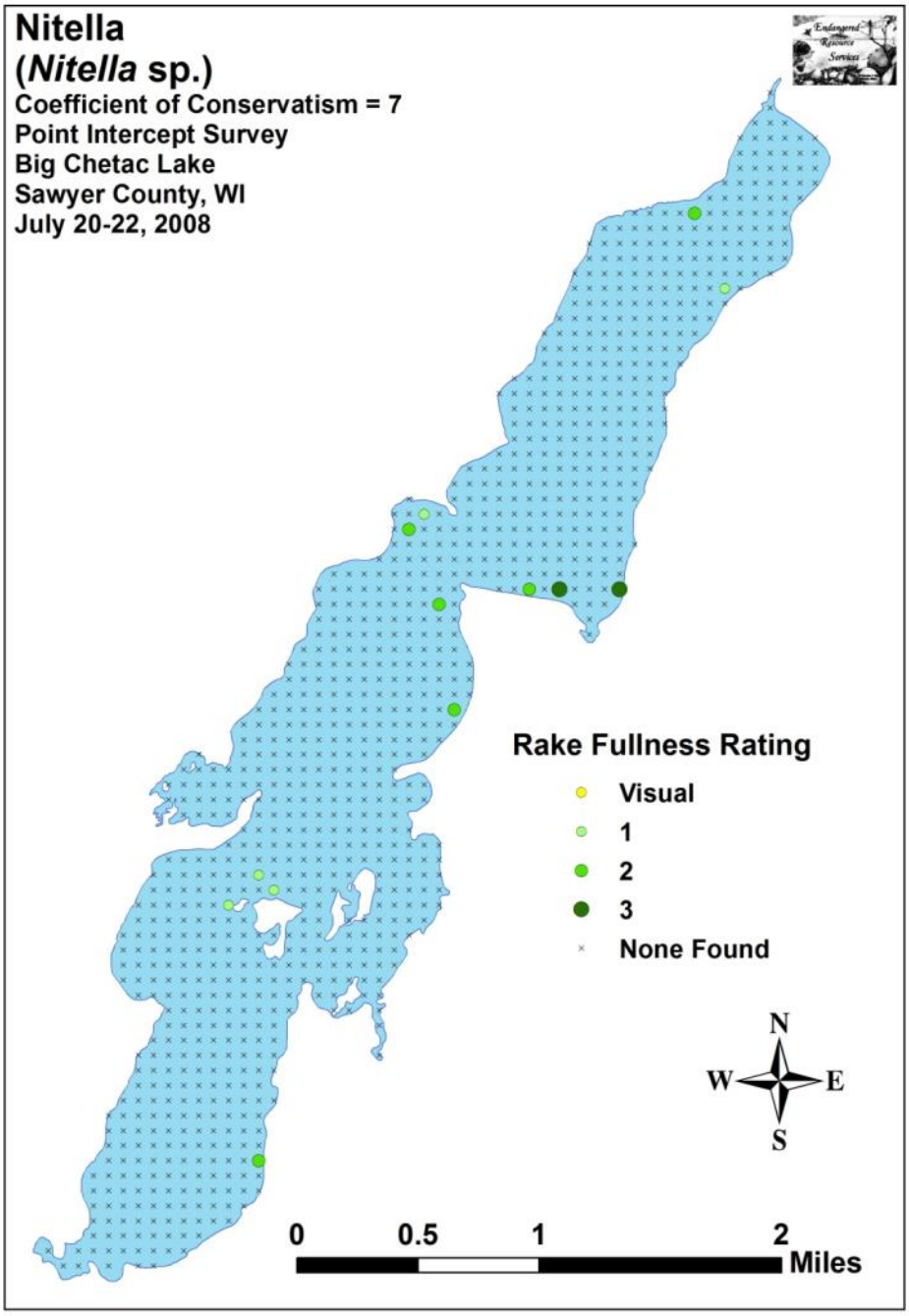
S
0
0.5
1
2
Miles


Nitella
(Nitella sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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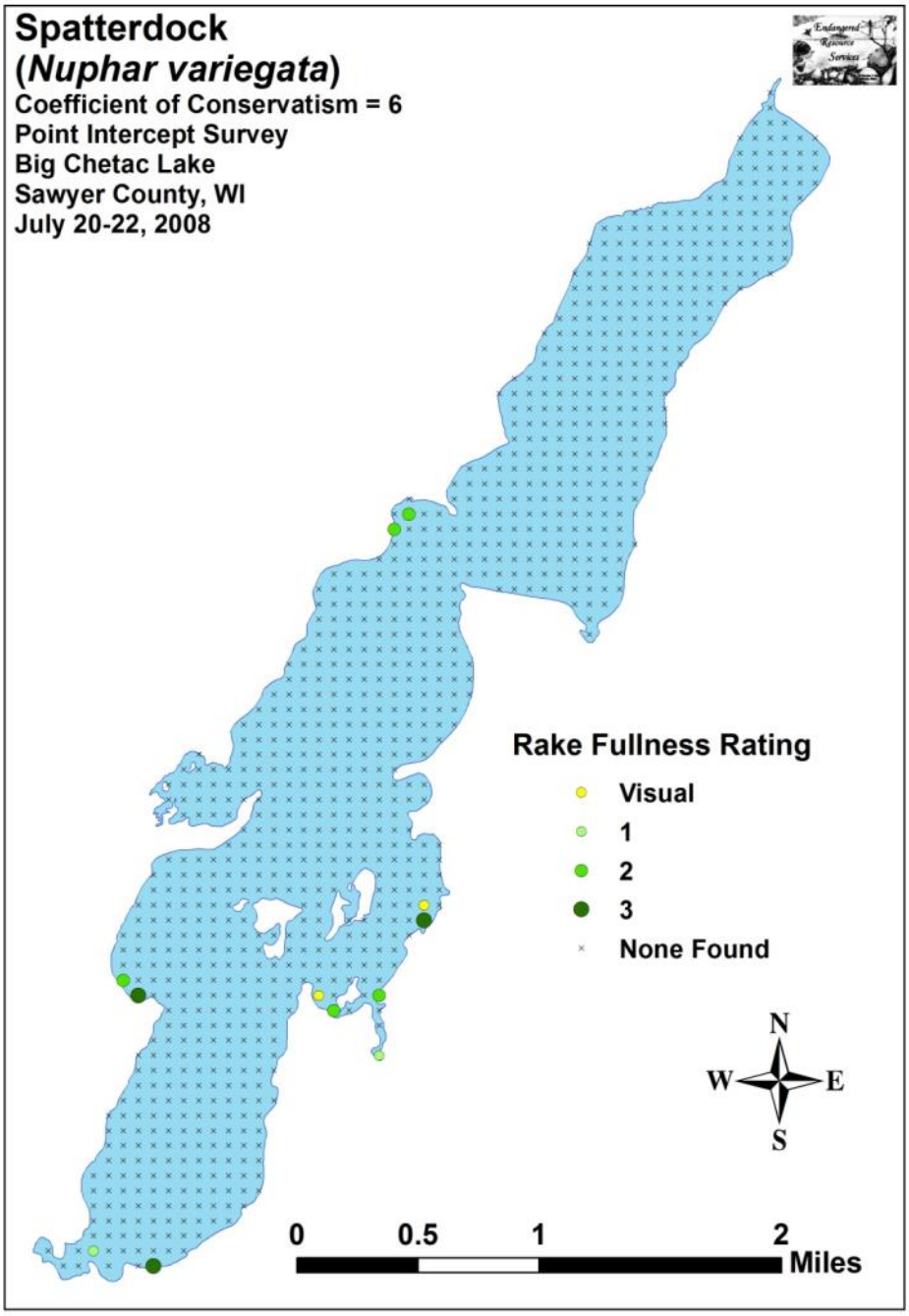
S
0
0.5
1
2
Miles


Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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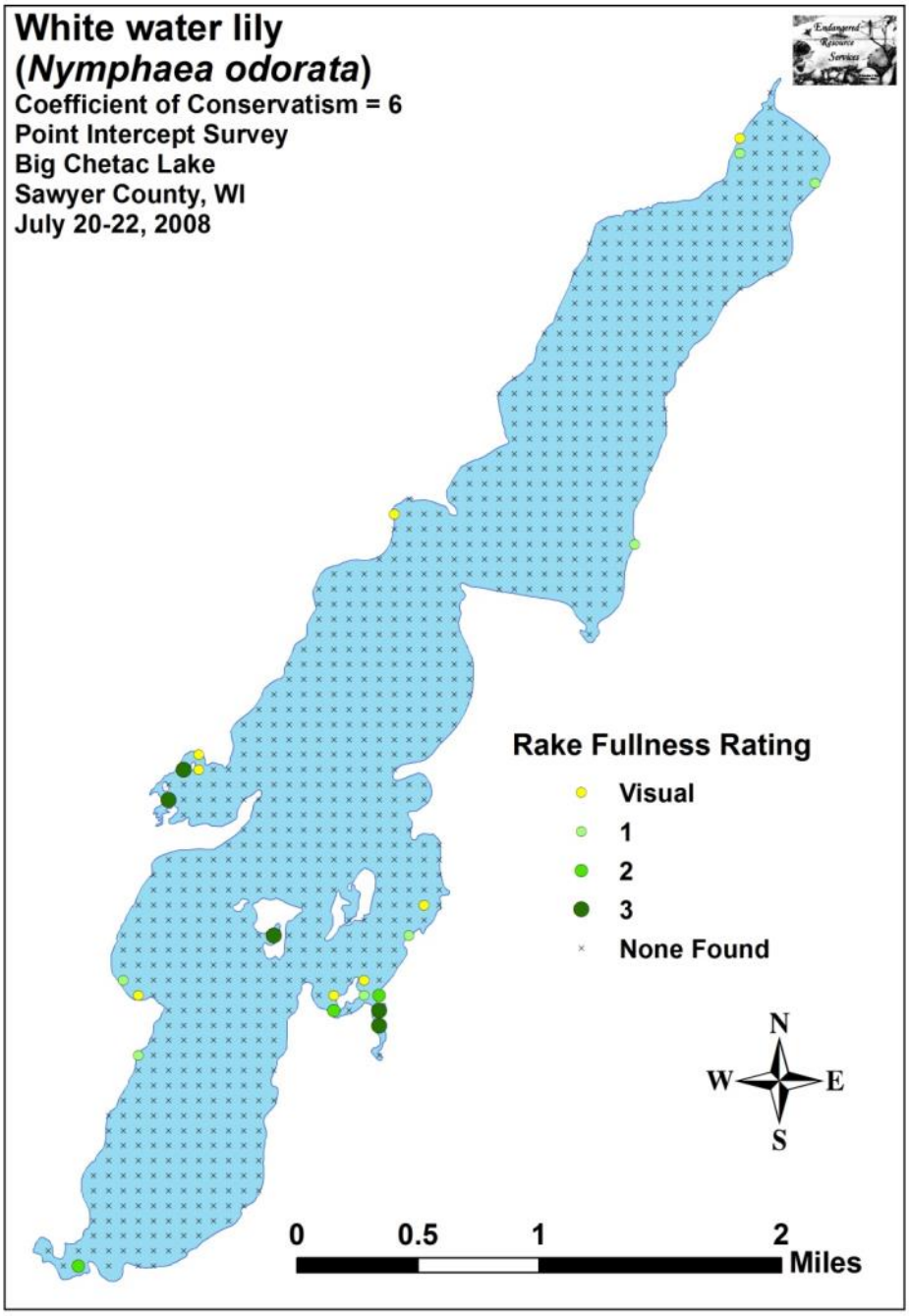
S
0
0.5
1
2
Miles


White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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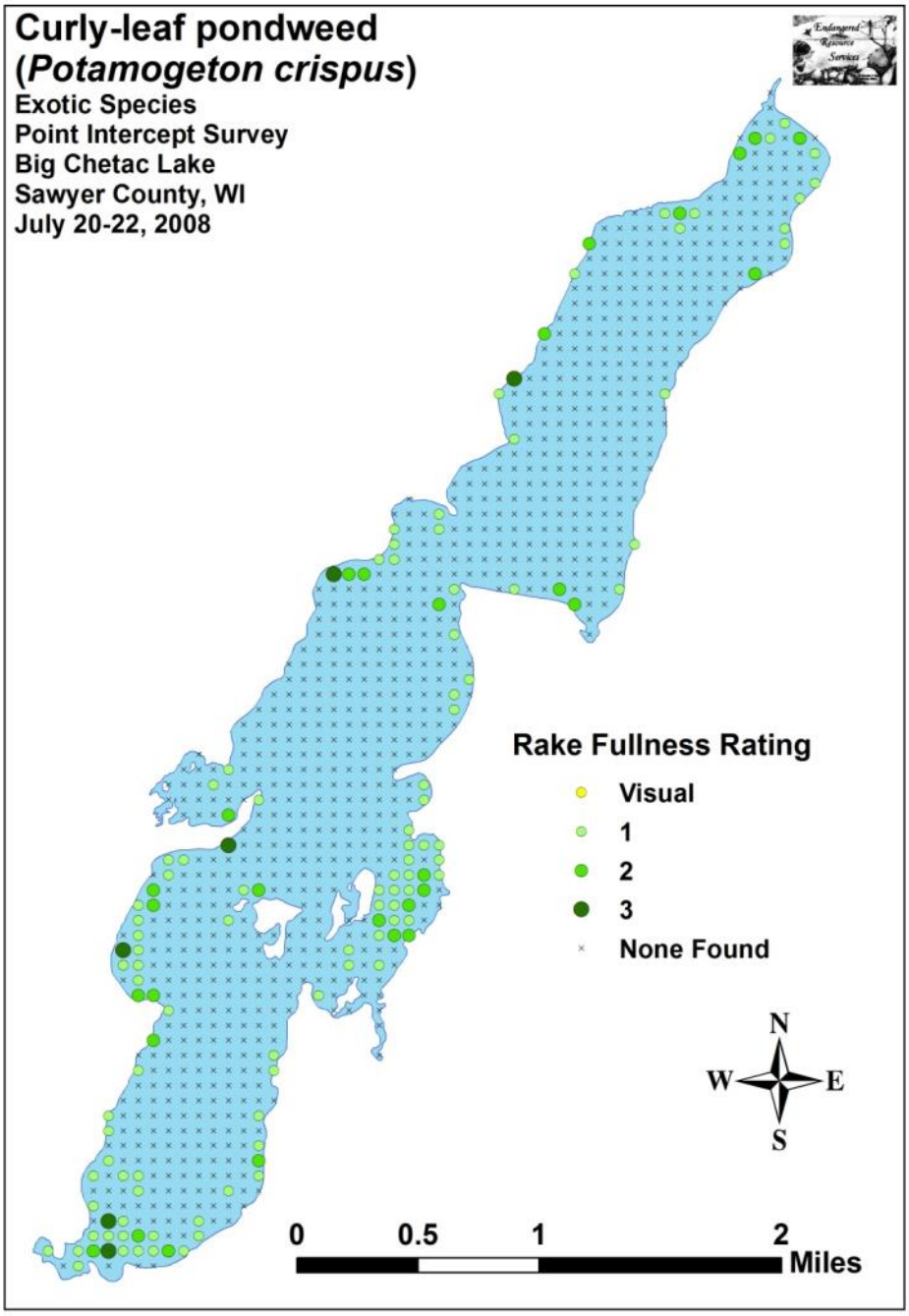
S
0
0.5
1
2
Miles


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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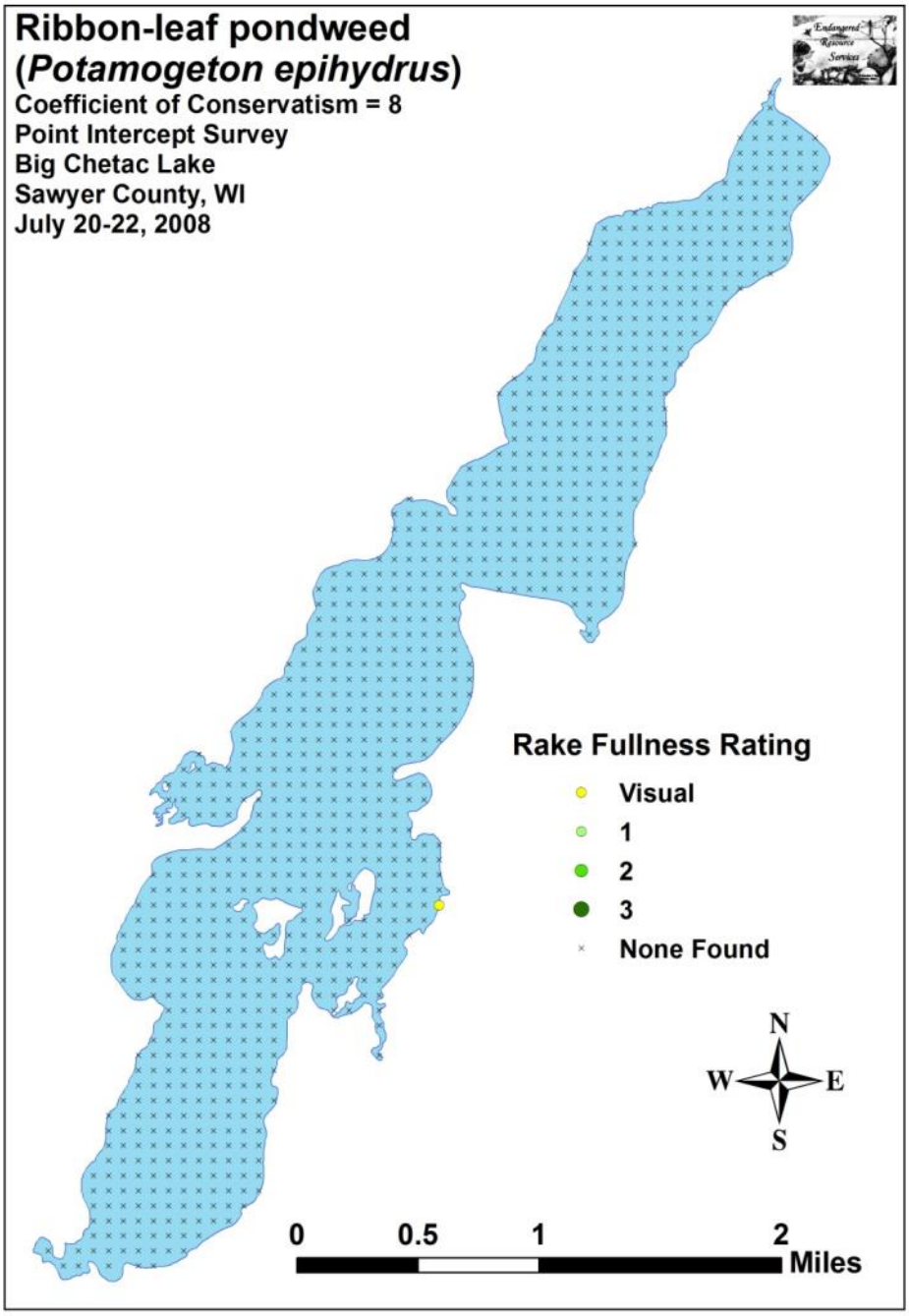
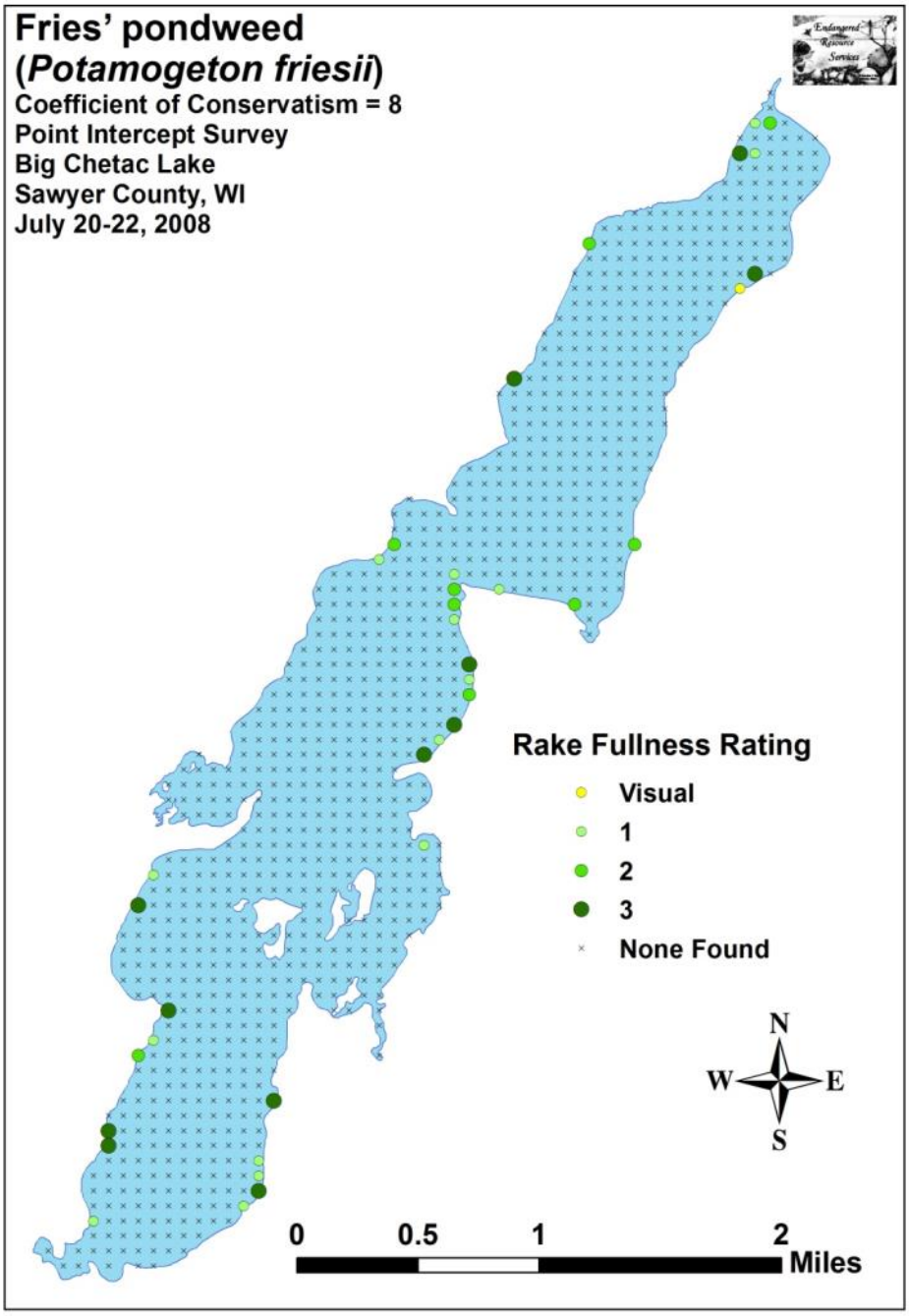
0
0.5
1
2
Miles


Ribbon-leaf pondweed
(Potamogeton epihydrus)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles


Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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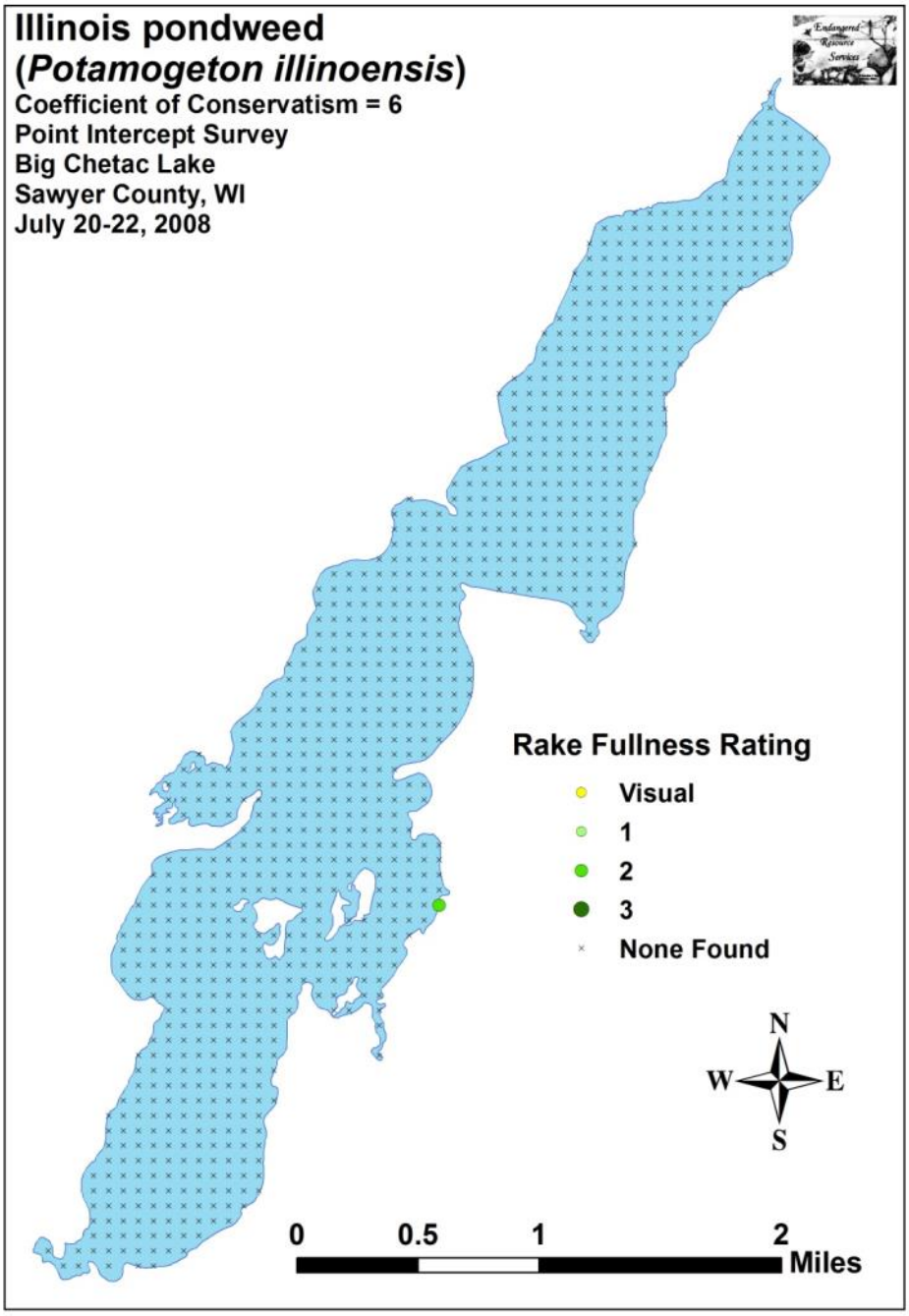
0
0.5
1
2
Miles


Illinois pondweed
(Potamogeton illinoensis)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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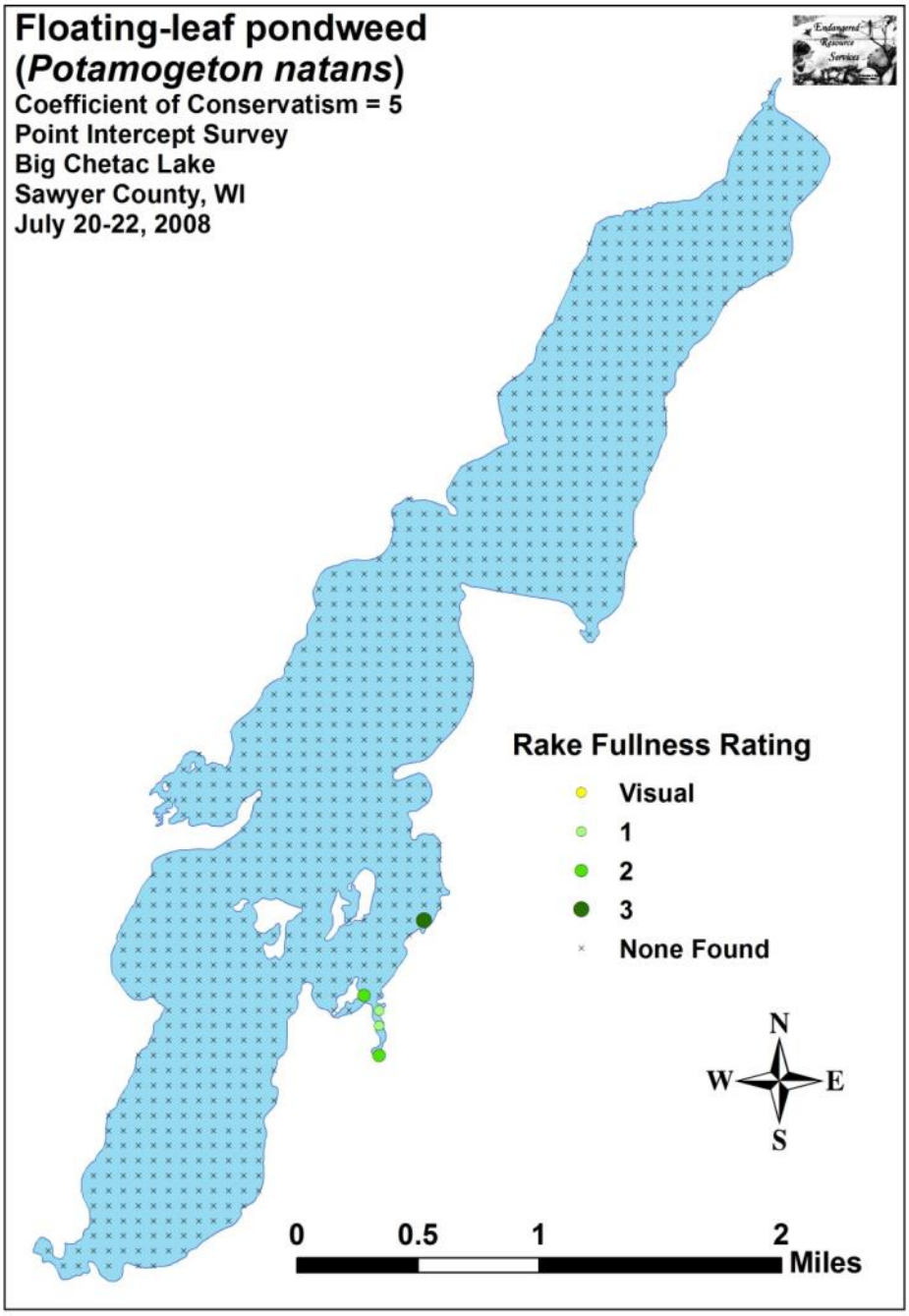
S
0
0.5
1
2
Miles


Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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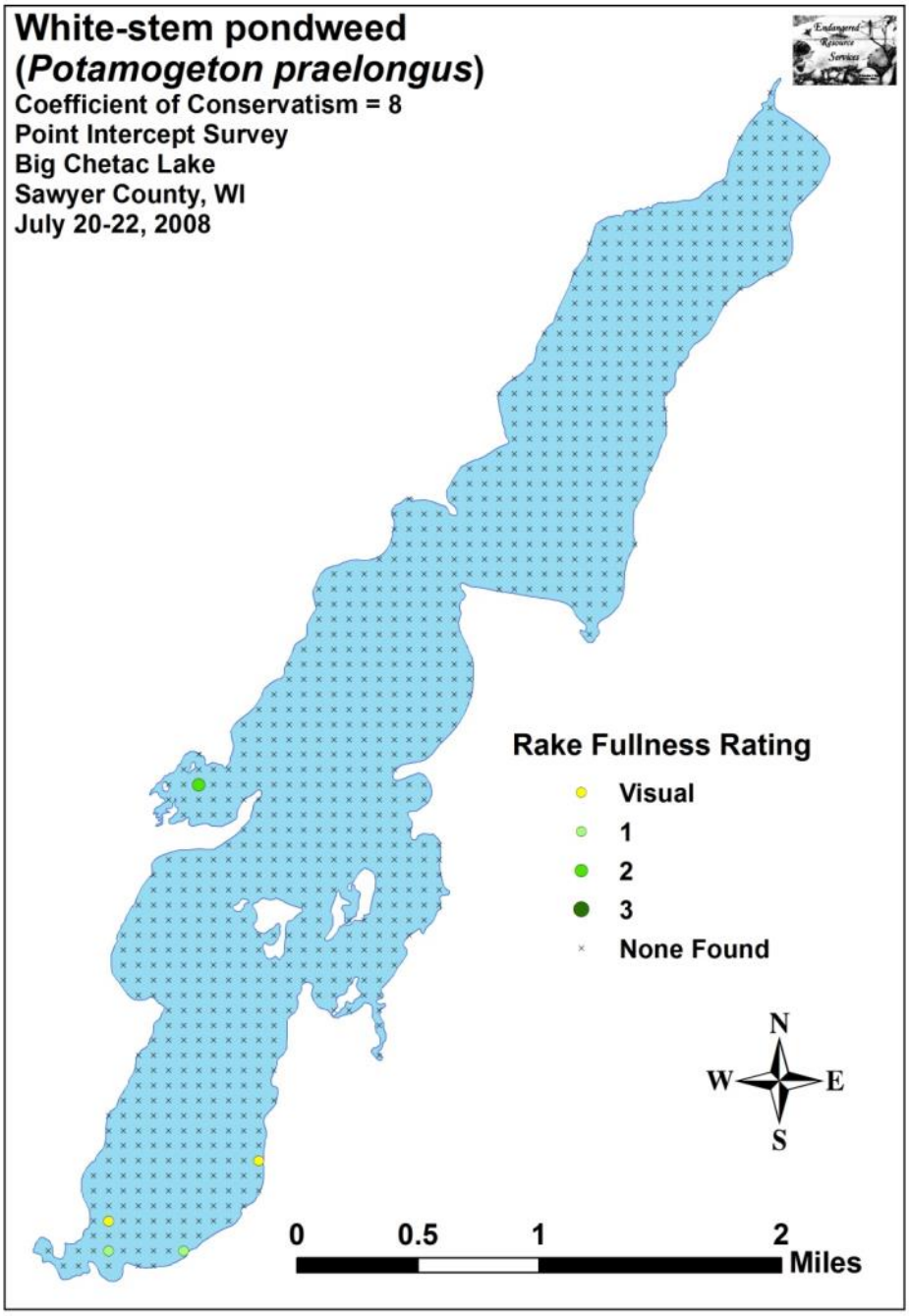
S
0
0.5
1
2
Miles


White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
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3
None Found
N
W
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0.5
1
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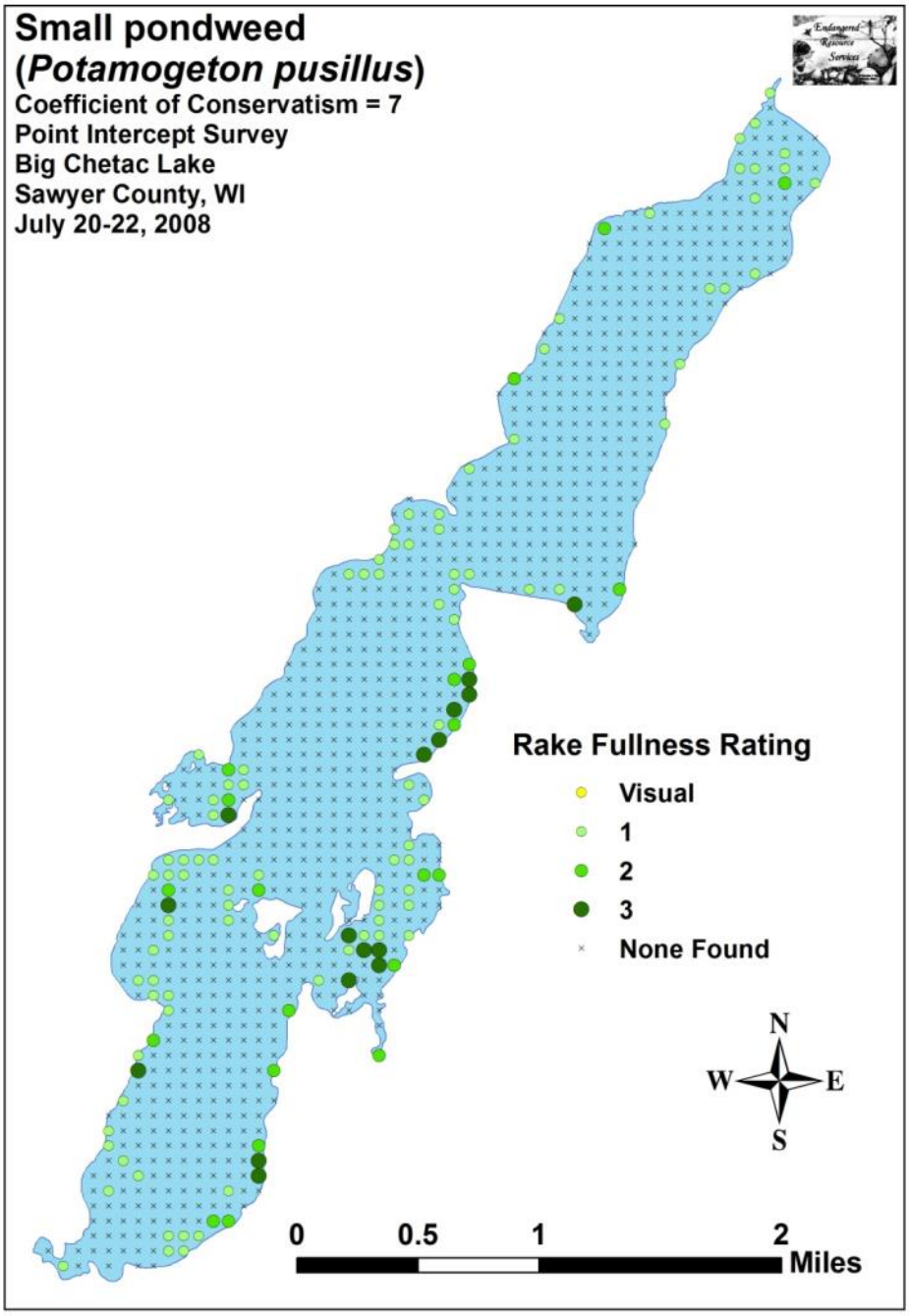
Miles


Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
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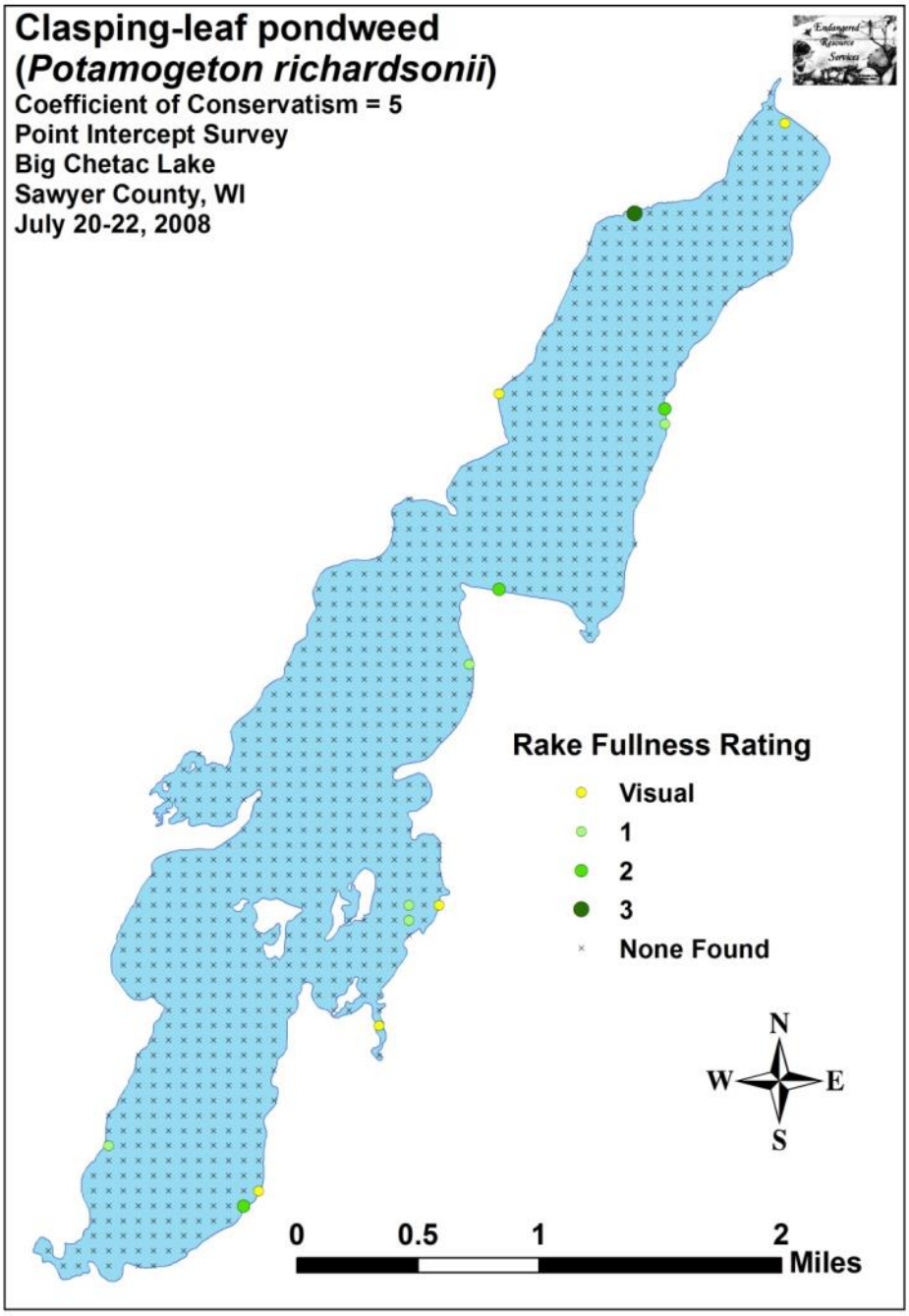
0.5
1
2
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
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3
None Found
N
W
E
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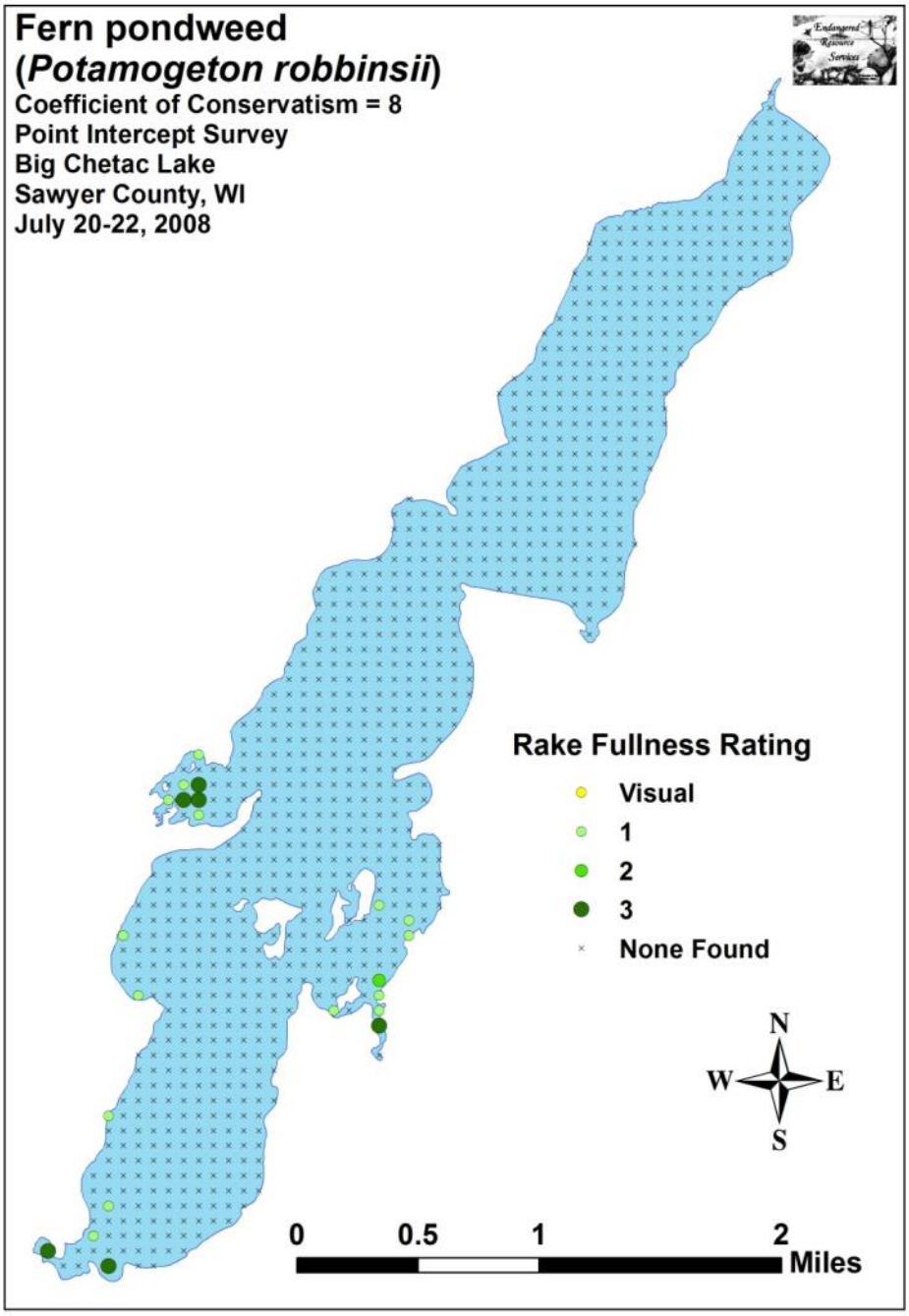
0
0.5
1
2
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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S
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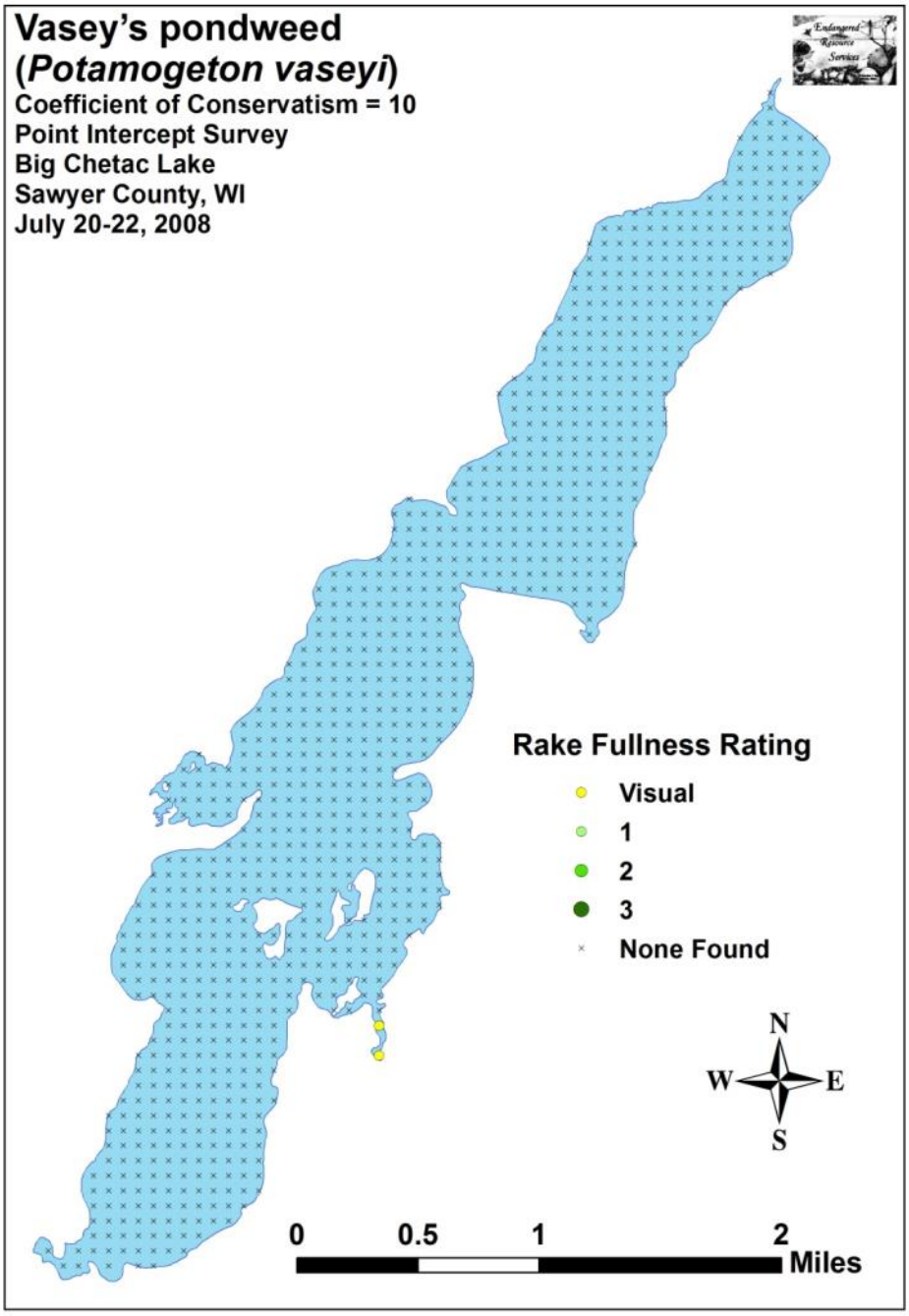
0.5
1
2
Miles


Vasey's pondweed
(Potamogeton vaseyi)
Coefficient of Conservatism = 10
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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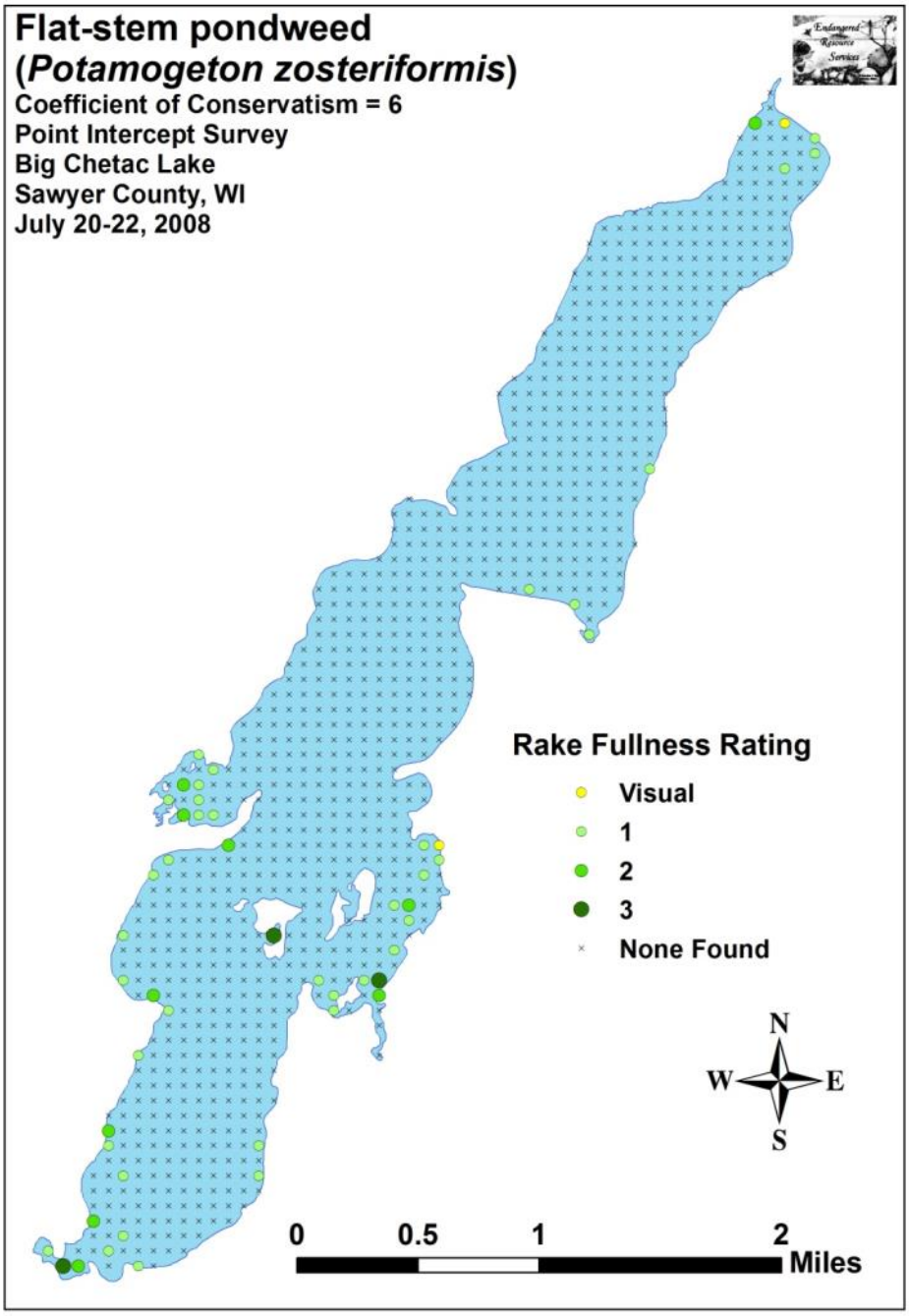
0.5
1
2
Miles


Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
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None Found
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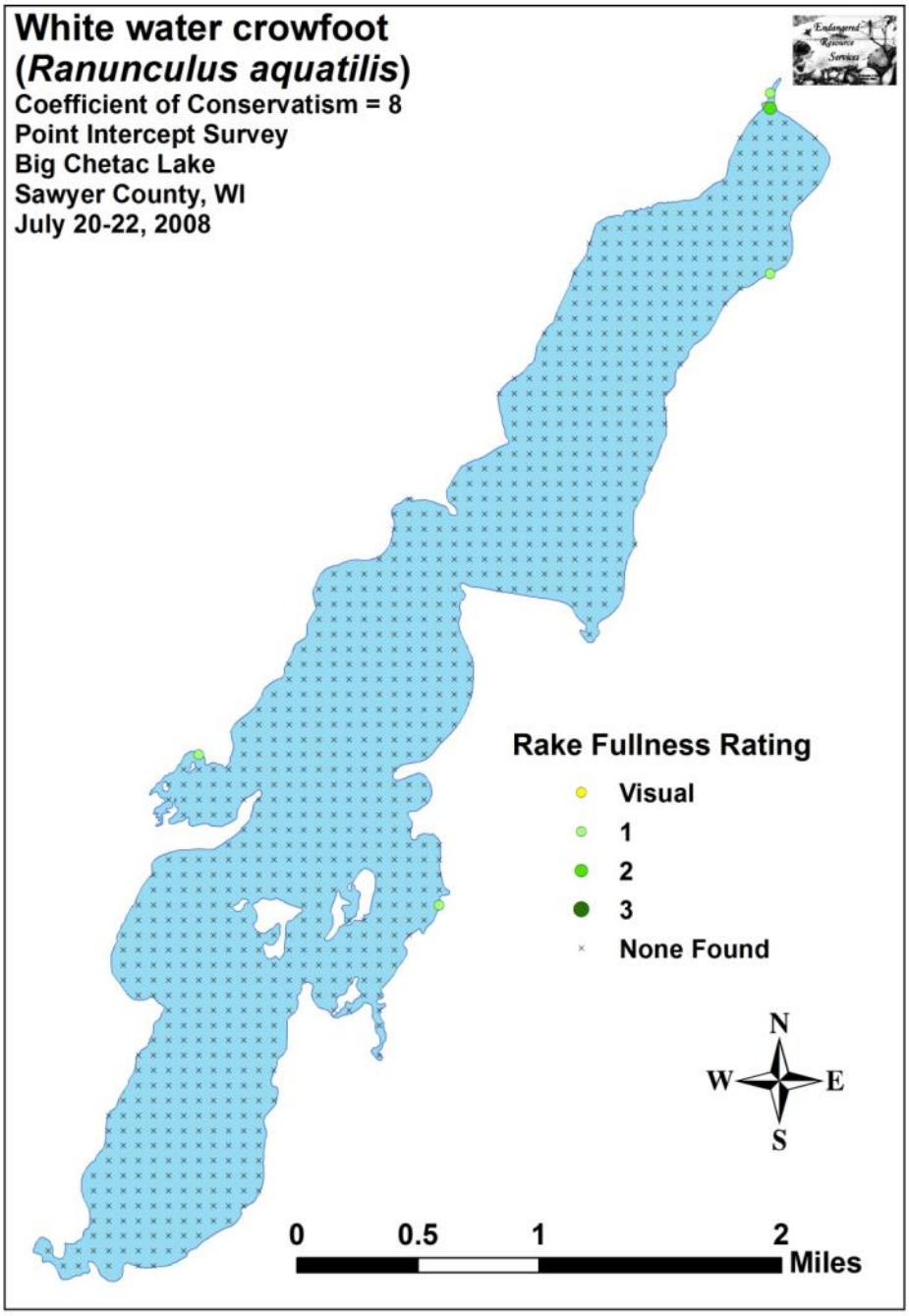
Miles


White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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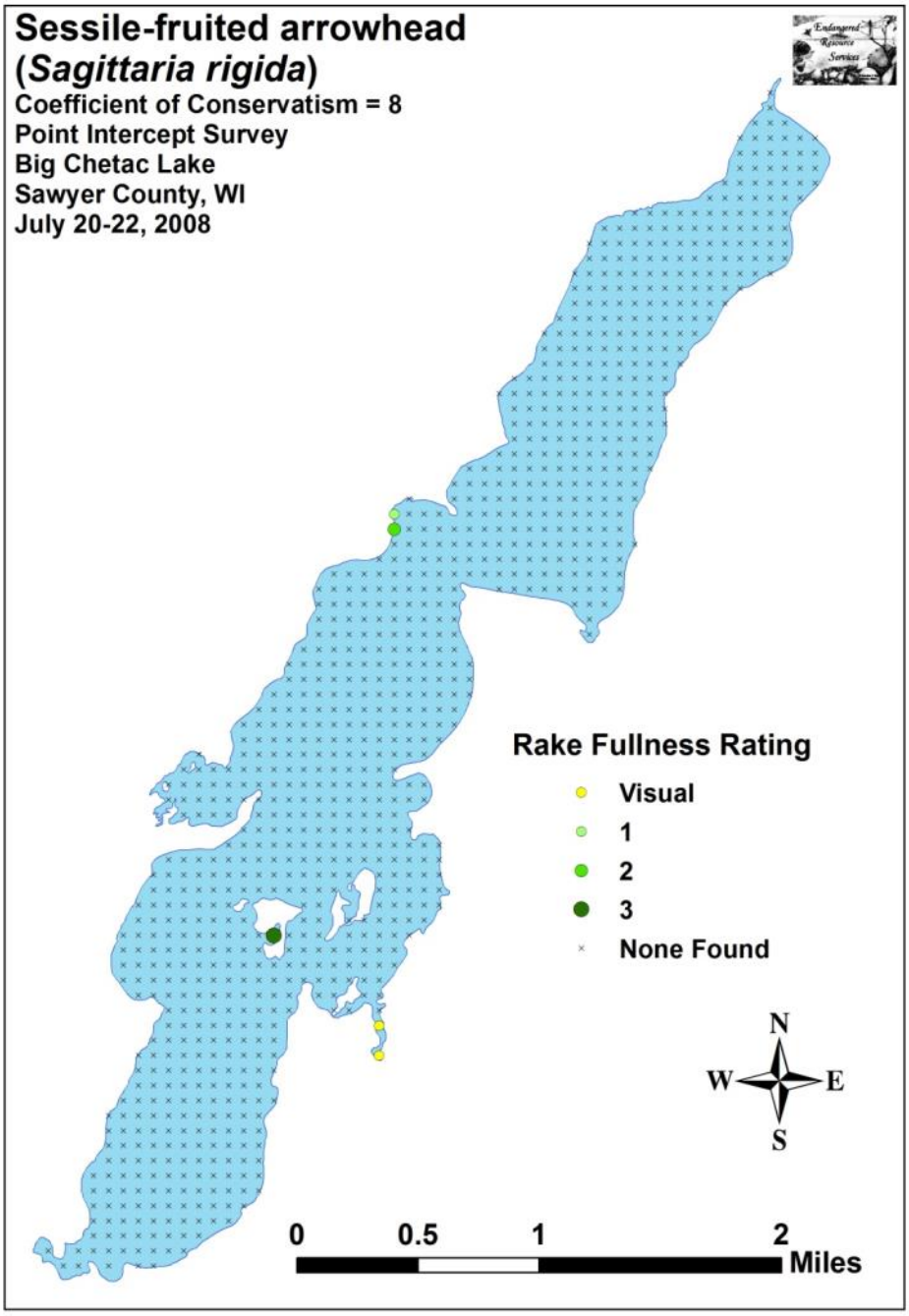
Miles


Sessile-fruited arrowhead
(Sagittaria rigida)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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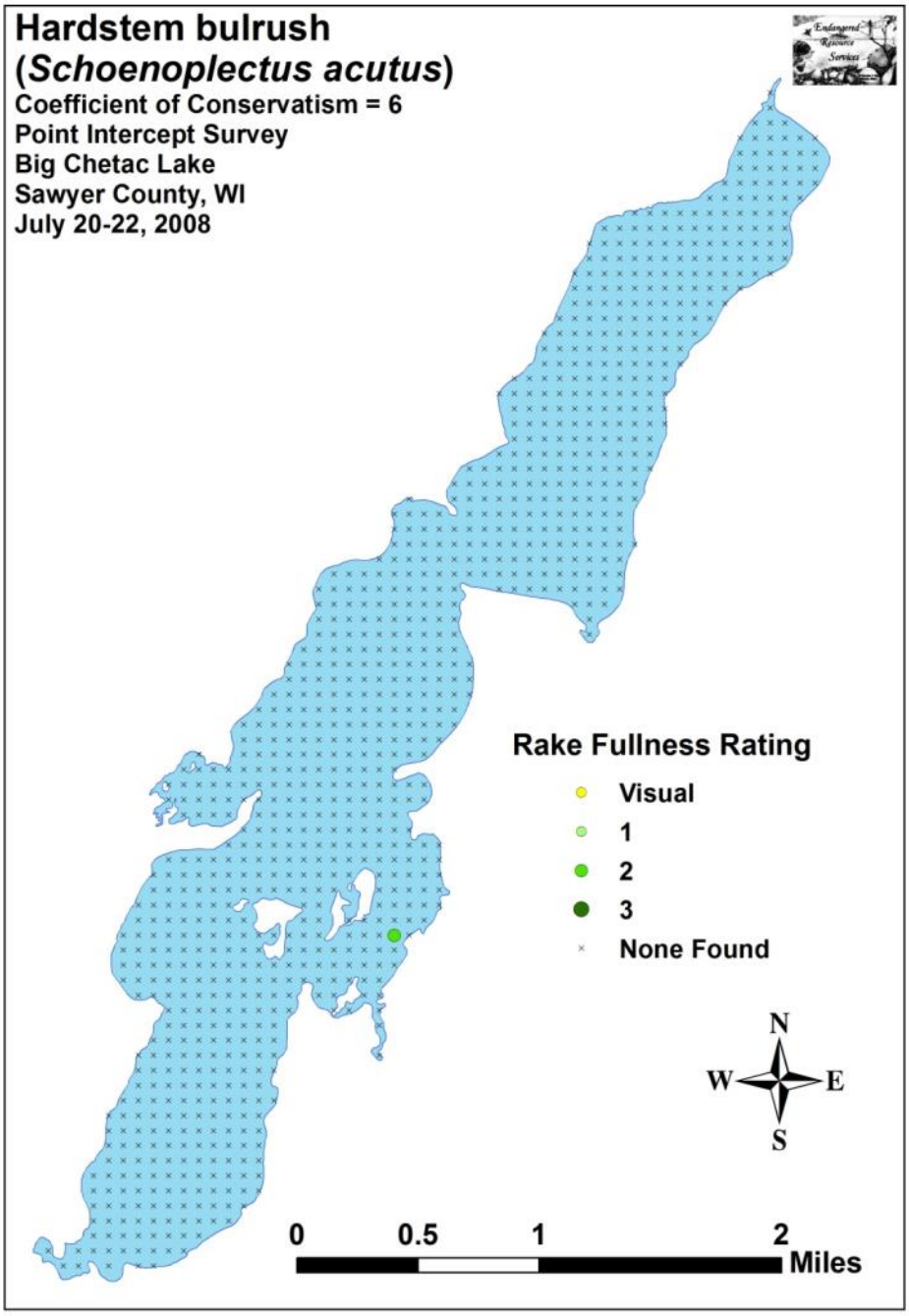
Miles


Hardstem bulrush
(Schoenoplectus acutus)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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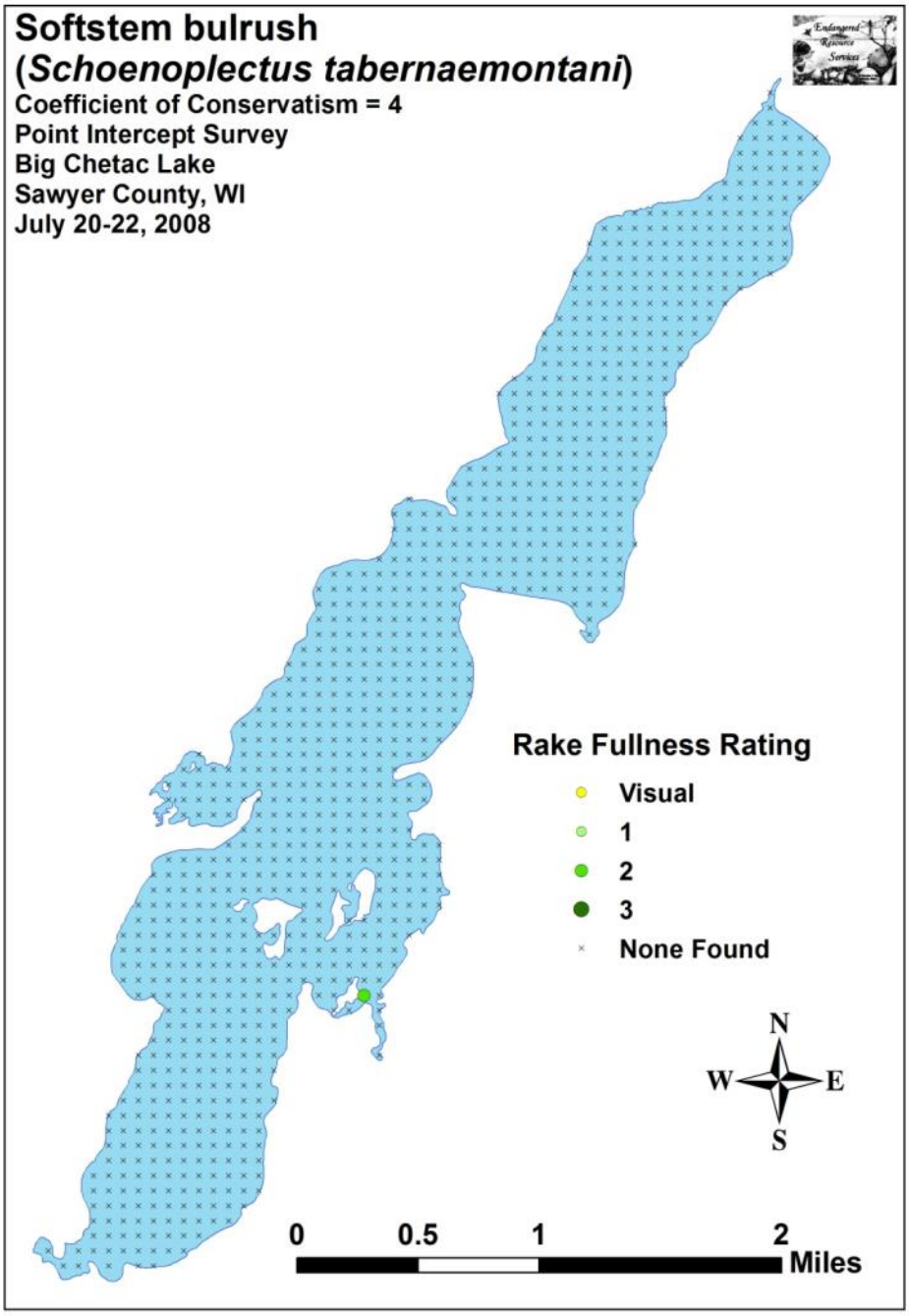
Miles


Softstem bulrush
(Schoenoplectus tabernaemontani)
Coefficient of Conservatism = 4
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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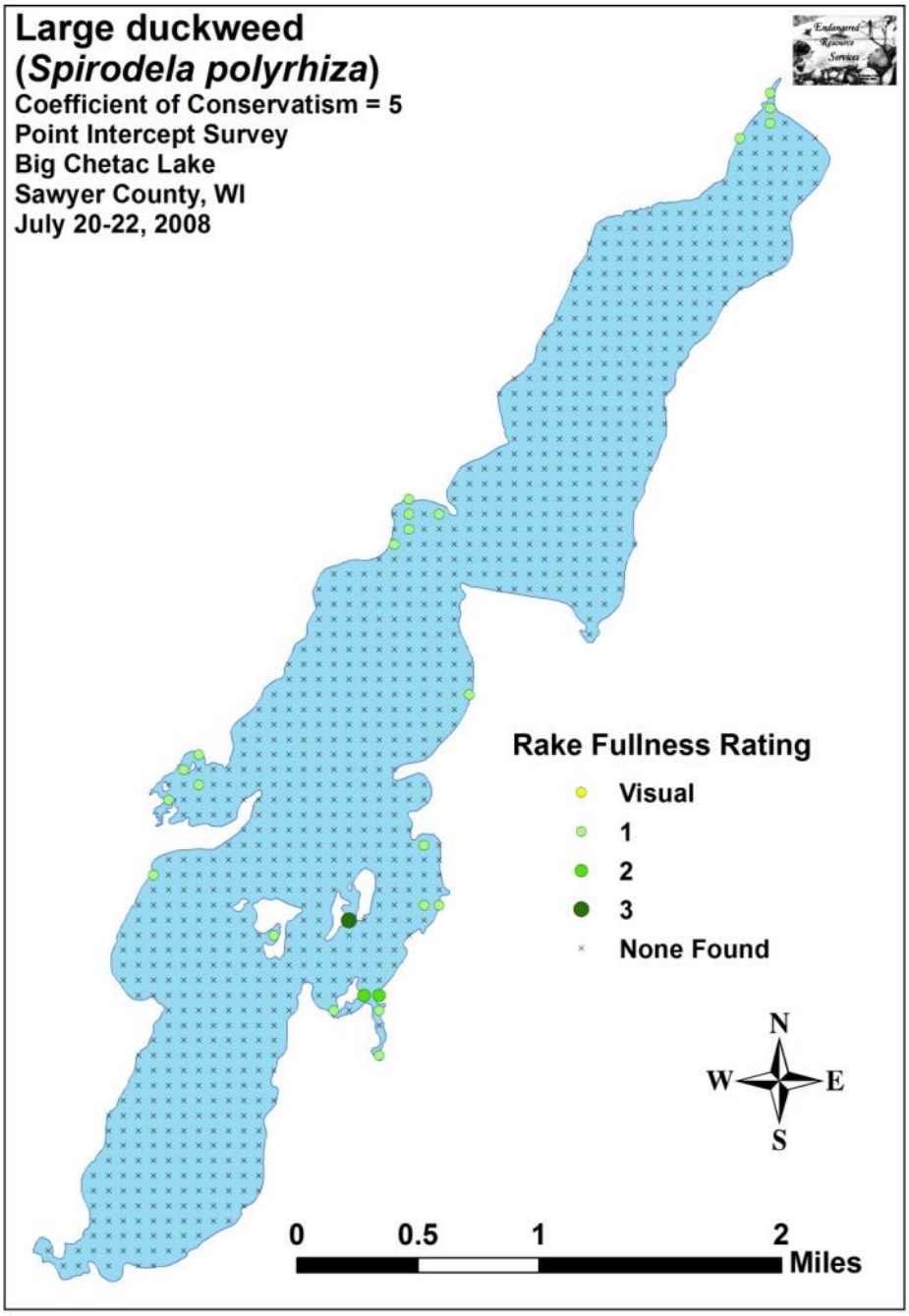
Miles


Large duckweed
(Spirodela polyrhiza)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
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None Found
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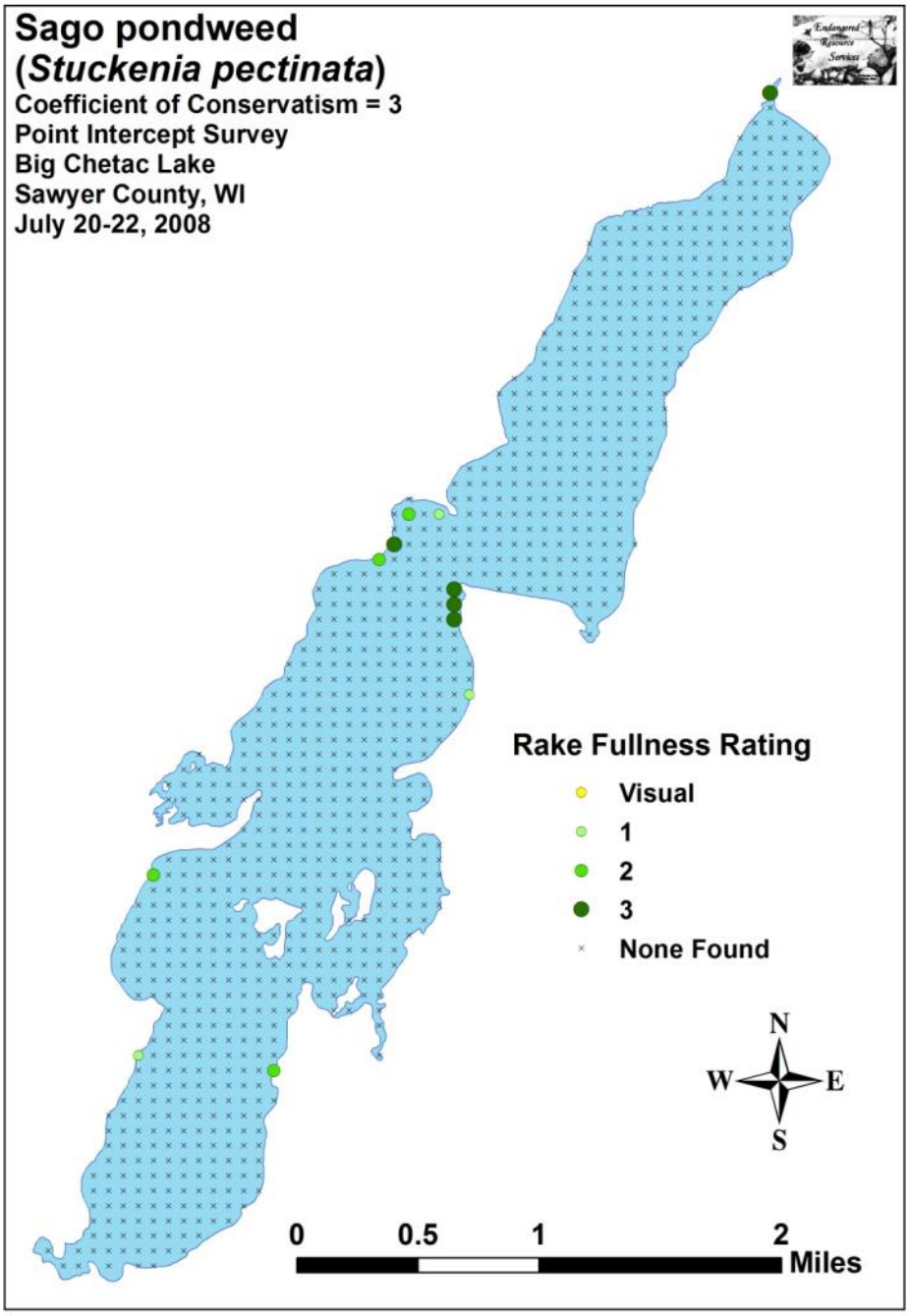
Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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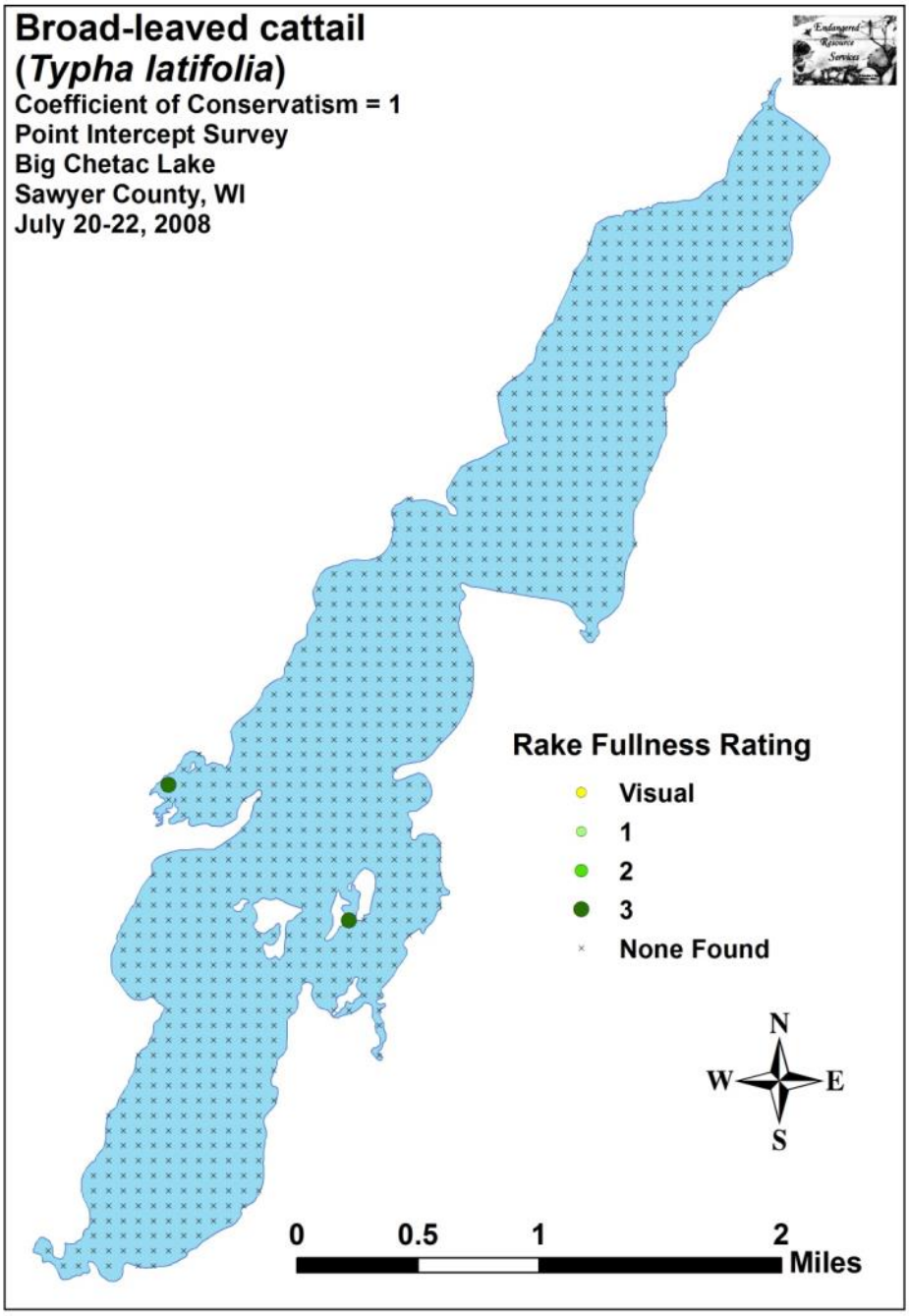
Miles


Broad-leaved cattail
(Typha latifolia)
Coefficient of Conservatism = 1
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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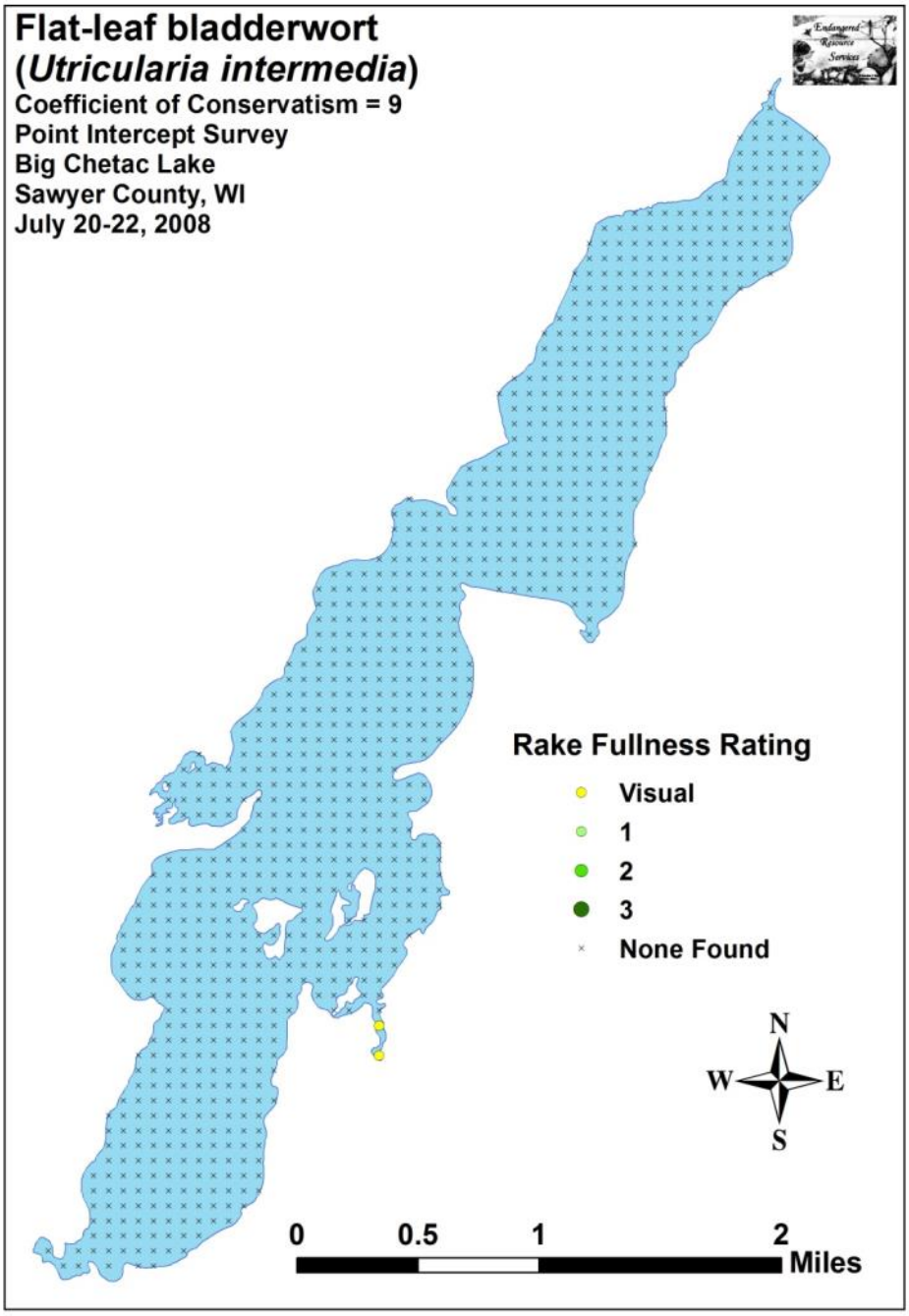
Miles


Flat-leaf bladderwort
(Utricularia intermedia)
Coefficient of Conservatism = 9
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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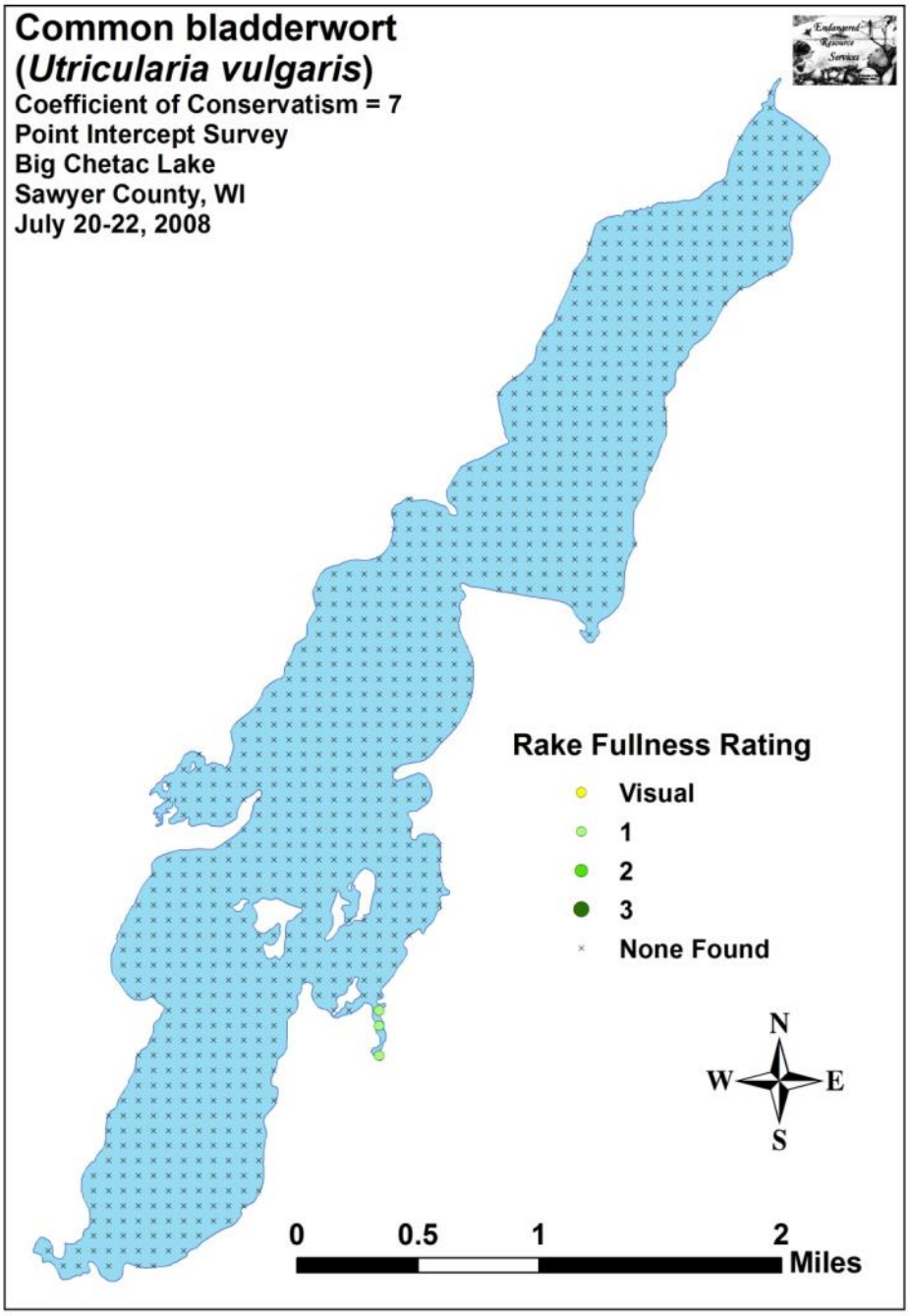
Miles


Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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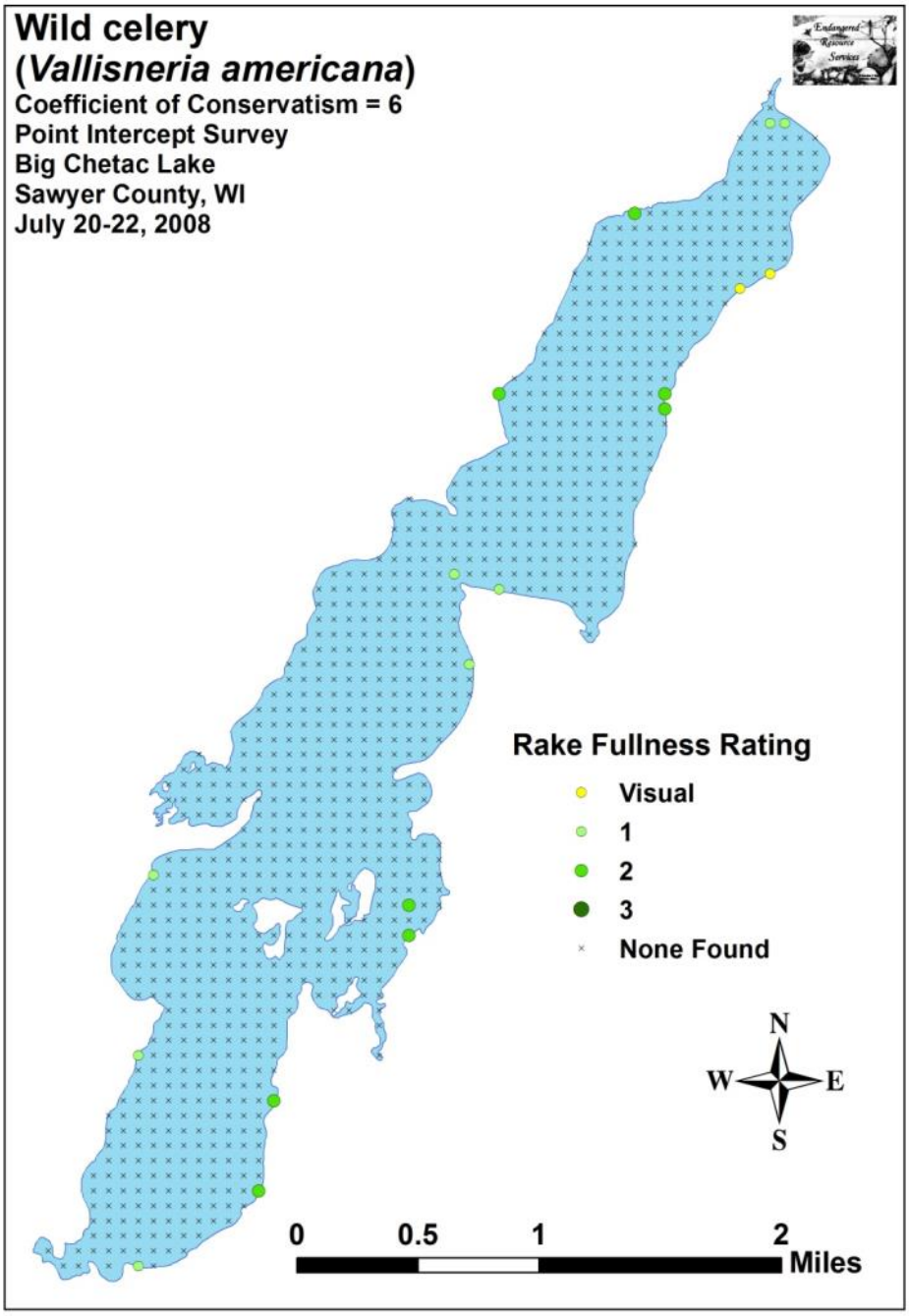
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
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None Found
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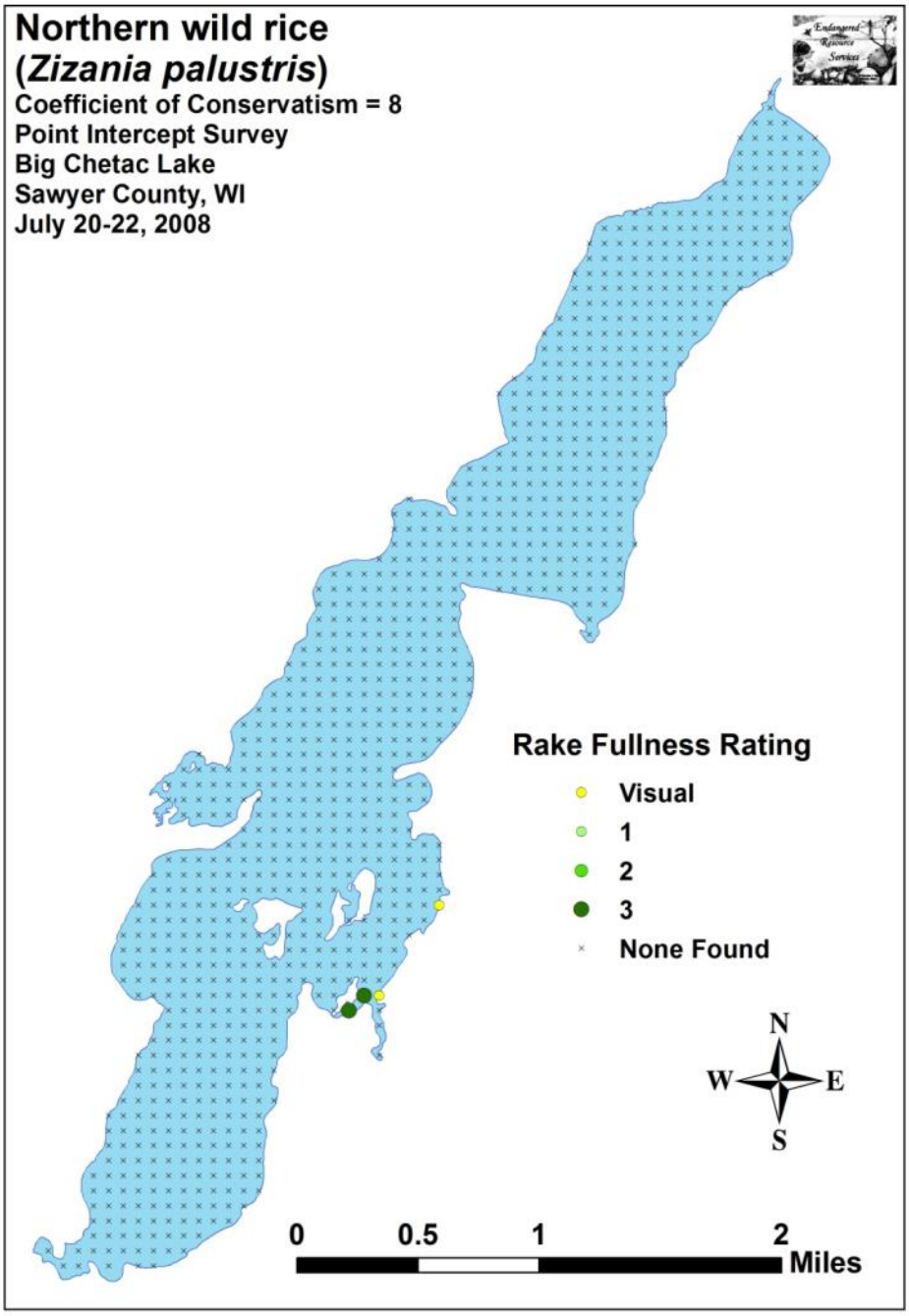
Miles


Northern wild rice
(Zizania palustris)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 20-22, 2008
Rake Fullness Rating
Visual
1
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None Found
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Miles

Appendix VIII: Big Chetac Lake Plant Species Accounts

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: Aquatic moss
Specimen Location: Chetac Lake; N45.68089°, W91.51016°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-101
Habitat/Distribution: Mucky bottoms in 0-1.5 meters. Rare with a few scattered patches near shore in the bays east of the islands, and at a single survey point in the southeast end of the lake.
Common Associates: (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Lemna trisulca*) Forked duckweed, (*Ceratophyllum demersum*) Coontail

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Bidens beckii*) **Water marigold**
Specimen Location: Chetac Lake; N45.70783°, W91.51474°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-115
Habitat/Distribution: A single cluster of plants was found in the west bay in 0.5 m over muck.
Common Associates: (*Nymphaea odorata*) White water lily**,** (*Potamogeton robbinsii*) Fern pondweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton pusillus*) Small pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Calla palustris*) **Water calla**
Specimen Location: Chetac Lake; N45.69811°, W91.50163°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-102
Habitat/Distribution: Muck bottom at the shoreline in 0 – 0.25 meters of water. Rare; only a few scattered individuals were located along shore near the Benson Creek inlet and in the sheltered bays of the islands.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Spirodela polyrhiza*) Large duckweed, (*Carex comosa*) Bottle-brush sedge, (*Comarum palustris*) Marsh cinquefoil

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Callitriche hermaphroditica*) **Autumnal water starwort**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-103
Habitat/Distribution: Muck bottom in shallow water <1m. Rare; found only at the Benson Creek inlet on the north end of the lake. In places, it completely covered the bottom.
Common Associates: (*Callitriche palustris*) Common water starwort, (*Ranunculus aquatilis*) White water crowfoot, (*Chara* sp.) Muskgrass, (*Stuckenia pectinata*) Sago pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Callitriche palustris*) **Common water starwort**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-104
Habitat/Distribution: Muck bottom in shallow water <1m. Rare; found only at the Benson Creek inlet growing among the much more numerous Autumnal water starwort.
Common Associates: (*Callitriche hermaphroditica*) Autumnal water starwort, (*Ranunculus aquatilis*) White water crowfoot, (*Chara* sp.) Muskgrass, (*Stuckenia pectinata*) Sago pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Carex comosa*) **Bottle-brush sedge**
Specimen Location: Chetac Lake; N45.69811°, W91.50163°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-105
Habitat/Distribution: Muck bottom at the shoreline in 0 – 0.25 meters of water. Rare; only a few scattered individuals were located in the sheltered bays of the islands.
Common Associates: (*Calla palustris*) Water calla, (*Typha latifolia*) Broad-leaved cattail, (*Spirodela polyrhiza*) Large duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Ceratophyllum demersum*) **Coontail**
Specimen Location: Chetac Lake; N45.74628°, W91.46564°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-106
Habitat/Distribution: Muck bottom in 0-4 meters. Abundant throughout; especially common in the muck bays in the lower third of the lake. Along with Small and Curly-leaf pondweed, it was the deepest growing macrophyte.
Common Associates: (*Potamogeton crispus*) Curly-leaf pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Lemna trisulca*) Forked duckweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Chara* sp.) **Muskgrass**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-107
Habitat/Distribution: Uncommon in sand/silt bottom areas in water from 0 – 1 meter deep. Species at Benson Creek inlet was different from elsewhere in the lake.
Common Associates: (*Callitriche palustris*) Common water starwort, (*Ranunculus aquatilis*) White water crowfoot, (*Callitriche hermaphroditica*) Autumnal water starwort, (*Stuckenia pectinata*) Sago pondweed, (*Najas flexilis*) Slender naiad

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Comarum palustre*) **Marsh cinquefoil**
Specimen Location: Chetac Lake; N45.748244°, W91.46701°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-135
Habitat/Distribution: Muck bottom at the shoreline in 0 – 0.25 meters of water. Rare with only a few scattered individuals located along the Benson Creek inlet.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Calla palustris*) Water calla

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Dulichium arundinaceum*) **Three-way sedge**
Specimen Location: Chetac Lake; N45.69338°, W91.50003°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-108
Habitat/Distribution: Located at the edge of the water in mucky soil. Uncommon in scattered locations in the muck bays east of the islands.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Calla palustris*) Water calla, (*Eleocharis erythropoda*) Bald spikerush, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Eleocharis erythropoda*) **Bald spikerush**
Specimen Location: Chetac Lake; N45.69363°, W91.50023°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-109
Habitat/Distribution: Located at the edge of the water in mucky soil. Uncommon in scattered locations in the muck bays east of the islands.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Calla palustris*) Water calla, (*Dulichium arundinaceum*) Three-way sedge, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Eleocharis palustris*) **Creeping spikerush**
Specimen Location: Chetac Lake; N45.69726°, W91.49776°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-110
Habitat/Distribution: Mucky to firm bottoms in 0-0.5 meters of water. Found in the bay east of the islands where it formed dense reed beds with Hardstem bulrush.
Common Associates: (*Schoenoplectus acutus*) Hardstem bulrush, (*Potamogeton crispus*) Curly-leaf pondweed, (*Lemna trisulca*) Forked duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Elodea canadensis*) **Common waterweed**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-111
Habitat/Distribution: Muck bottom in 0-1.5 meters of water.
Uncommon in stagnant areas of bays in the south end of the lake and near the Benson Creek inlet.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Potamogeton pusillus*) Small pondweed, (*Spirodela polyrhiza*) Large duckweed, (*Lemna minor*) Small duckweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Nuphar variegata)* Spatterdock

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Heteranthera dubia*) **Water star-grass**
Specimen Location: Chetac Lake; N45.71810°, W91.48675°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-112
Habitat/Distribution: Firm muck bottoms usually in water 0.5-2.5 meters deep. Rare with only scattered individuals throughout and never abundant.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Lemna trisulca*) Forked duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Lemna minor*) **Small duckweed**
Specimen Location: Chetac Lake; N45.72249°, W91.49586°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-113
Habitat/Distribution: Located floating at or just under the surface in sheltered areas. Scattered individuals found interspersed between the lilypads. Wind and current scattered them throughout the lake.
Common Associates: (*Nymphaea odorata*) White water lily, (*Nuphar variegata)* Spatterdock, (*Spirodela polyrhiza*) Large duckweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton pusillus*) Small pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Lemna trisulca*) **Forked duckweed**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-114
Habitat/Distribution: Located entangled in other plants and along the bottom. Common throughout in almost any bottom type in water up to 2.5 meters deep.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Ceratophyllum demersum*) Coontail

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Myriophyllum sibiricum*) **Northern water milfoil**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-116
Habitat/Distribution: Muck to sand bottom in water up to 2 meters. Widespread and relatively common throughout the lake.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Ceratophyllum demersum*) Coontail, (*Ranunculus aquatilis*) White water crowfoot, (*Potamogeton crispus*) Curly-leaf pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Myriophyllum verticillatum*) **Whorled water milfoil**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-117
Habitat/Distribution: Muck bottom in < 1.5 meters of water. Only plants found were in the unnamed creek inlet east of the islands.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Pontederia cordata*) Pickerelweed, (*Potamogeton vaseyi*) Vasey's pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton natans*) Floating-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Najas flexilis*) **Slender naiad**
Specimen Location: Chetac Lake; N45.72905°, W91.47547°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-118
Habitat/Distribution: Found in almost any bottom conditions, but grows best in rock/ sand bottoms in 0.5-1.5 meters of water. Relatively common, and widely distributed throughout.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Vallisneria americana*) Wild celery, (*Stuckenia pectinata*) Sago pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Nitella* sp.) **Nitella**
Specimen Location: Chetac Lake; N45.72249°, W91.49586°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-119
Habitat/Distribution: Primarily muck and sand bottom area in water 2-4 meters deep. Relatively common and widely scattered throughout.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton crispus*) Curly-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Nuphar variegata)* **Spatterdock**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-120
Habitat/Distribution: Muck bottom in 0-1.5 meters of water where it often forms dense canopies. Relatively common in muck bays and sheltered shoreline areas. It prefers a firmer bottom than (*Nymphaea odorata*).
Common Associates: (*Nymphaea odorata*) White water lily, (*Potamogeton natans*) Floating-leaf pondweed, (*Pontederia cordata*) Pickerelweed, (*Ceratophyllum demersum*) Coontail

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Nymphaea odorata*) **White water lily**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-121
Habitat/Distribution: Muck bottom in 0-2 meters where it forms dense canopies with other floating leaf species. Common in calm water bays throughout the lake.
Common Associates: (*Nuphar variegata)* Spatterdock, (*Elodea canadensis*) Common waterweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Spirodela polyrhiza*) Large duckweed, (*Lemna minor*) Small duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Phalaris arundinacea*) **Reed canary grass**
Specimen Location: Chetac Lake; N45.69460°, W91.521844°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-122
Habitat/Distribution: Prefers thick muck soil in and out of water <0.5 meters. Primarily found on shore in undeveloped low areas.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Calla palustris*) Water calla, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 7/17/14
Species: (*Phragmites australis*) **Common reed**
Specimen Location: Chetac Lake; N45.681140°, W91.519783°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2014-116
Habitat/Distribution: Plants were interspersed among bulrushes on the gravel bar near the lake outlet. Most individuals had been cropped by geese.
Common Associates: (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Pontederia cordata*) **Pickerelweed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-123
Habitat/Distribution: Muck bottom in < 1.0 meter of water. Scattered beds in calm southern bays.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Potamogeton vaseyi*) Vasey's pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton natans*) Floating-leaf pondweed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/17/14
Species: (*Potamogeton amplifolius*) **Large-leaf pondweed**
Specimen Location: Chetac Lake; N45.69911°, W91.49395°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2014-117
Habitat/Distribution: Found in mucky bottom conditions in shallow water 0.5-1.5 meter deep. A few clusters of plants was located at the Knuteson Creek inlet.
Common Associates: (*Potamogeton illinoensis*) Illinois pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Ceratophyllum demersum*) Coontail, (*Ranunculus aquatilis*) White water crowfoot, (*Zizania palustris*) Northern wild rice, (*Potamogeton epihydrus*) Ribbon-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Potamogeton crispus*) **Curly-leaf pondweed**
Specimen Location: Chetac Lake; N45.74443°, W91.46945°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-124
Habitat/Distribution: Found in most mucky bottom areas in water from 1-4.5m deep. Abundant to the point of restricting boat traffic early in the season.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Lemna trisulca*) Forked duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Potamogeton epihydrus*) **Ribbon-leaf pondweed**
Specimen Location: Chetac Lake; N45.69911°, W91.49395°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-125
Habitat/Distribution: Found in mucky bottom conditions in shallow water 0.5-1.5 meter deep. A single bed of plants was located at the Knuteson Creek inlet.
Common Associates: (*Potamogeton illinoensis*) Illinois pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Ceratophyllum demersum*) Coontail, (*Ranunculus aquatilis*) White water crowfoot, (*Zizania palustris*) Northern wild rice

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Potamogeton friesii*) **Fries' pondweed**
Specimen Location: Chetac Lake; N45.74443°, W91.46945°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-126
Habitat/Distribution: Found in almost any bottom conditions, but grows best in rock/ sand bottoms in 0.5-2.5 meters of water. Relatively common, and widely distributed in sandy and rocky areas throughout the lake.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Vallisneria americana*) Wild celery, (*Stuckenia pectinata*) Sago pondweed, (*Najas flexilis*) Slender naiad

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Potamogeton illinoensis*) **Illinois pondweed**
Specimen Location: Chetac Lake; N45.69911°, W91.49395°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-127
Habitat/Distribution: Found in mucky bottom conditions in shallow water 0.5-1.5 meter deep. A single bed of plants was located at the Knuteson Creek inlet.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Ranunculus aquatilis*) White water crowfoot, (*Zizania palustris*) Northern wild rice, (*Potamogeton epihydrus*) Ribbon-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Potamogeton natans*) **Floating-leaf pondweed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-128
Habitat/Distribution: Muck bottom in < 1.0 meters of water. Only plants found were in the bay/unnamed creek inlet east of the islands.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Pontederia cordata*) Pickerelweed, (*Potamogeton vaseyi*) Vasey's pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Sparganium emersum*) Short-stemmed bur-reed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Potamogeton praelongus*) **White-stem pondweed**
Specimen Location: Chetac Lake; N45.67813°, W91.51522°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-129
Habitat/Distribution: Variable substrate in 1-2 meters of water. It seems to be most common in areas that had some, but not thick muck over gravel of sand. Rare, found at a handful of scattered locations on the south end of the lake.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water milfoil, (*Potamogeton crispus*) Curly-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Potamogeton pusillus berchtoldii*) **Small pondweed**
Specimen Location: Chetac Lake; N45.74353°, W91.46943°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-130
Habitat/Distribution: Found in almost any bottom conditions, but grows best in rock/ sand bottoms in 0-4 meters of water. Normally it and Coontail, and Curly-leaf pondweed are the deepest growing vascular plant. It is abundant throughout the lake.
Common Associates: (*Potamogeton crispus*) Curly-leaf pondweed, (*Vallisneria americana*) Wild celery, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton friesii*) Fries' pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/17/14
Species: (*Potamogeton pusillus pusillus*) **Small pondweed**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2014-118
Habitat/Distribution: Muck bottom in shallow water <1m. Rare; found only at the Benson Creek inlet growing among the much more numerous Autumnal water starwort. Plants were bright red and blunt tipped as in *P. obtusifolius*, but fruits were not keeled/wrinkled as in this species. Based on the small leaf width, and the fruit characteristics, we believe it is *pusillus pusillus*.
Common Associates: (*Callitriche hermaphroditica*) Autumnal water starwort, (*Ranunculus aquatilis*) White water crowfoot, (*Chara* sp.) Muskgrass, (*Stuckenia pectinata*) Sago pondweed, (*Potamogeton crispus*) Curly-leaf pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Potamogeton richardsonii*) **Clasping-leaf pondweed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-131
Habitat/Distribution: Found in almost any bottom conditions, but grows best in rock/ sand bottoms in 0.5-1.5 meters of water. Relatively common, and widely distributed in sandy and rocky areas throughout the lake.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton friesii*) Fries' pondweed, (*Vallisneria americana*) Wild celery, (*Stuckenia pectinata*) Sago pondweed, (*Najas flexilis*) Slender naiad

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Potamogeton robbinsii*) **Fern pondweed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-132
Habitat/Distribution: Organic muck in 0.5-3 meters of water. Widespread and relatively common in the southern half of the lake, but absent in the northern half.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton crispus*) Curly-leaf pondweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Lemna trisulca*) Forked duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Potamogeton vaseyi*) **Vasey's pondweed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-133
Habitat/Distribution: Muck bottom in < 1.0 meters of water. Only plants found were in the unnamed creek inlet east of the islands. Not seen anywhere in 2014.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Pontederia cordata*) Pickerelweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton natans*) Floating-leaf pondweed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Potamogeton zosteriformis*) **Flat-stem pondweed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-134
Habitat/Distribution: It prefers substrate of thick organic muck. Widely distributed and common in all four lakes where it grows in 0-3 meters of water.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton crispus*) Curly-leaf pondweed**,** (*Lemna trisulca*) Forked duckweed, (*Potamogeton friesii*) Fries' pondweed

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Ranunculus aquatilis*) **White water crowfoot**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-136
Habitat/Distribution: Uncommon at a few widely scattered locations. Found primarily over muck and sandy muck in shallow water <1m deep.
Common Associates: (*Callitriche hermaphroditica*) Autumnal water starwort, (*Callitriche palustris*) Common water starwort, (*Chara* sp.) Muskgrass

County/State: Sawyer County, Wisconsin **Date:** 7/17/14
Species: (*Sagittaria latifolia*) **Common arrowhead**
Specimen Location: Chetac Lake; N45.69338°, W91.50003°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2014-119
Habitat/Distribution: Located at the edge of the water in mucky soil. Uncommon in scattered locations in the muck bays east of the islands.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Calla palustris*) Water calla, (*Eleocharis erythropoda*) Bald spikerush, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Sagittaria rigida*) **Sessile-fruited arrowhead**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-137
Habitat/Distribution: Firm muck bottom in < 0.5 meters of water. Scattered locations; especially in areas that had some water flow.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Pontederia cordata*) Pickerelweed, (*Potamogeton vaseyi*) Vasey's pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton natans*) Floating-leaf pondweed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Schoenoplectus acutus*) **Hardstem bulrush**
Specimen Location: Chetac Lake; N45.69725898°, W91.4977581°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-138
Habitat/Distribution: Mucky to firm bottoms in 0-0.5 meters of water. Found in the bay east of the islands where it formed dense reed beds with Creeping spikerush.
Common Associates: (*Eleocharis palustris*) Creeping spikerush, (*Potamogeton crispus*) Curly-leaf pondweed**,** (*Lemna trisulca*) Forked duckweed

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Schoenoplectus tabernaemontani*) **Softstem bulrush**
Specimen Location: Chetac Lake; N45.69363°, W91.50023°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-139
Habitat/Distribution: Firm muck bottoms in 0-0.5 meter of water. Uncommon; scattered clusters occurred in at the shoreline in bays throughout the south end of the lake.
Common Associates: (*Potamogeton natans*) Floating-leaf pondweed, (*Spirodela polyrhiza*) Large duckweed, (*Eleocharis erythropoda*) Bald spikerush, (*Lemna minor*) Small duckweed, (*Typha latifolia*) Broad-leaved cattail, (*Nymphaea odorata*) White water lily

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Sparganium emersum*) **Short-stemmed bur-reed**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-140
Habitat/Distribution: Muck bottom in < 1.0 meters of water. Only plants found were in the unnamed creek inlet east of the islands.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Pontederia cordata*) Pickerelweed, (*Potamogeton vaseyi*) Vasey's pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Potamogeton natans*) Floating-leaf pondweed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Spirodela polyrhiza*) **Large duckweed**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-141
Habitat/Distribution: Located floating at or just under the surface in stagnant bays. Common, but less so than Small duckweed. Scattered individuals occur interspersed between the lilypads and wild rice beds.
Common Associates: (*Nymphaea odorata*) White water lily, (*Nuphar variegata)* Spatterdock, (*Lemna minor*) Small duckweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton pusillus*) Small pondweed, (*Zizania palustris*) Northern wild rice

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Stuckenia pectinata*) **Sago pondweed**
Specimen Location: Chetac Lake; N45.74806°, W91.46698°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-142
Habitat/Distribution: Found in almost any bottom conditions, but grows best in rock/ sand bottoms in 0.5-1.5 meters of water. Fairly common, especially in the narrows, and along sandy shoreline areas.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton friesii*) Fries's pondweed, (*Vallisneria americana*) Wild celery, (*Najas flexilis*) Slender naiad

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Typha latifolia*) **Broad-leaved cattail**
Specimen Location: Chetac Lake; N45.69811°, W91.50163°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-143
Habitat/Distribution: Muck bottom at the shoreline in 0 – 0.25 meters of water. Relatively common throughout; especially in undeveloped low areas and in sheltered bays.
Common Associates: (*Calla palustris*) Water calla, (*Spirodela polyrhiza*) Large duckweed, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Zizania palustris*) Northern wild rice

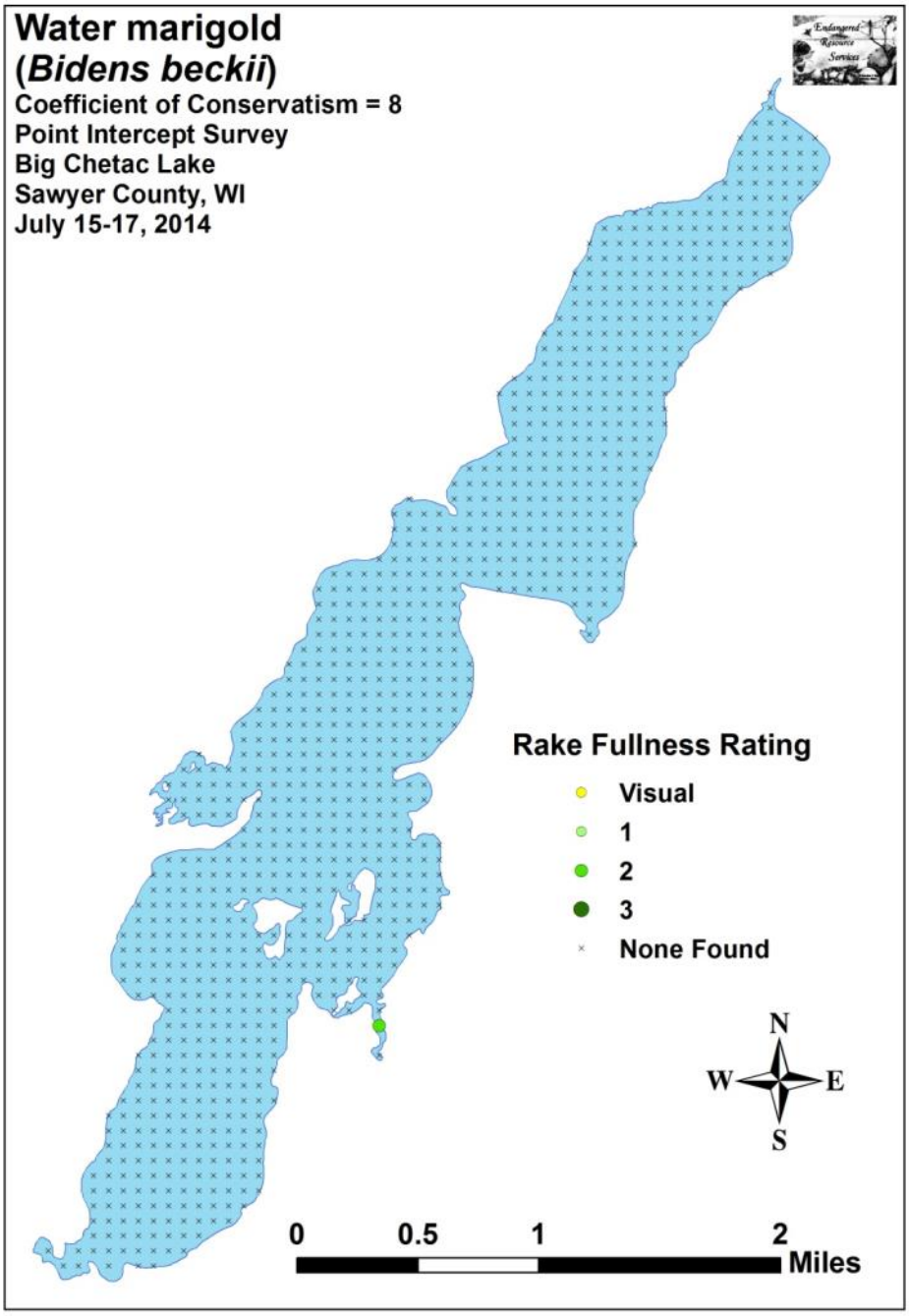
County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Utricularia intermedia*) **Flat-leaf bladderwort**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-144
Habitat/Distribution: Muck bottom in < 1.0 meters of water. Only plants found were in the unnamed creek inlet east of the islands.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Pontederia cordata*) Pickerelweed, (*Potamogeton vaseyi*) Vasey's pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton natans*) Floating-leaf pondweed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Utricularia vulgaris*) **Common bladderwort**
Specimen Location: Chetac Lake; N45.69184°, W91.49890°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-145
Habitat/Distribution: Floating over muck bottoms in < 1.5 meters of water. Only plants found were in the unnamed creek inlet east of the islands and in the bog areas near pt. 114.
Common Associates: (*Utricularia intermedia*) Flat-leaf bladderwort, (*Potamogeton vaseyi*) Vasey's pondweed, (*Sagittaria rigida*) Sessile-fruited arrowhead, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton natans*) Floating-leaf pondweed, (*Myriophyllum verticillatum*) Whorled water milfoil

County/State: Sawyer County, Wisconsin **Date:** 7/20/08
Species: (*Vallisneria americana*) **Wild celery**
Specimen Location: Chetac Lake; N45.72905°, W91.47547°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-146
Habitat/Distribution: Found in almost any bottom conditions, but grows best in rock/ sand bottoms in 0.5-1.5 meters of water. Relatively common, and widely distributed in sandy and rocky areas throughout the lake.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Stuckenia pectinata*) Sago pondweed, (*Najas flexilis*) Slender naiad

County/State: Sawyer County, Wisconsin **Date:** 7/21/08
Species: (*Zizania palustris*) **Northern wild rice**
Specimen Location: Chetac Lake; N45.69911°, W91.49395°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-147
Habitat/Distribution: Thick muck bottom in shallow water 0-1.0 meter deep. Common to abundant in the bay east of the islands.
Common Associates: (*Potamogeton natans*) Floating-leaf pondweed, (*Spirodela polyrhiza*) Large duckweed, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Lemna minor*) Small duckweed, (*Typha latifolia*) Broad-leaved cattail

Appendix IX: 2014 Species Density and Distribution Maps


Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
2
3
None Found
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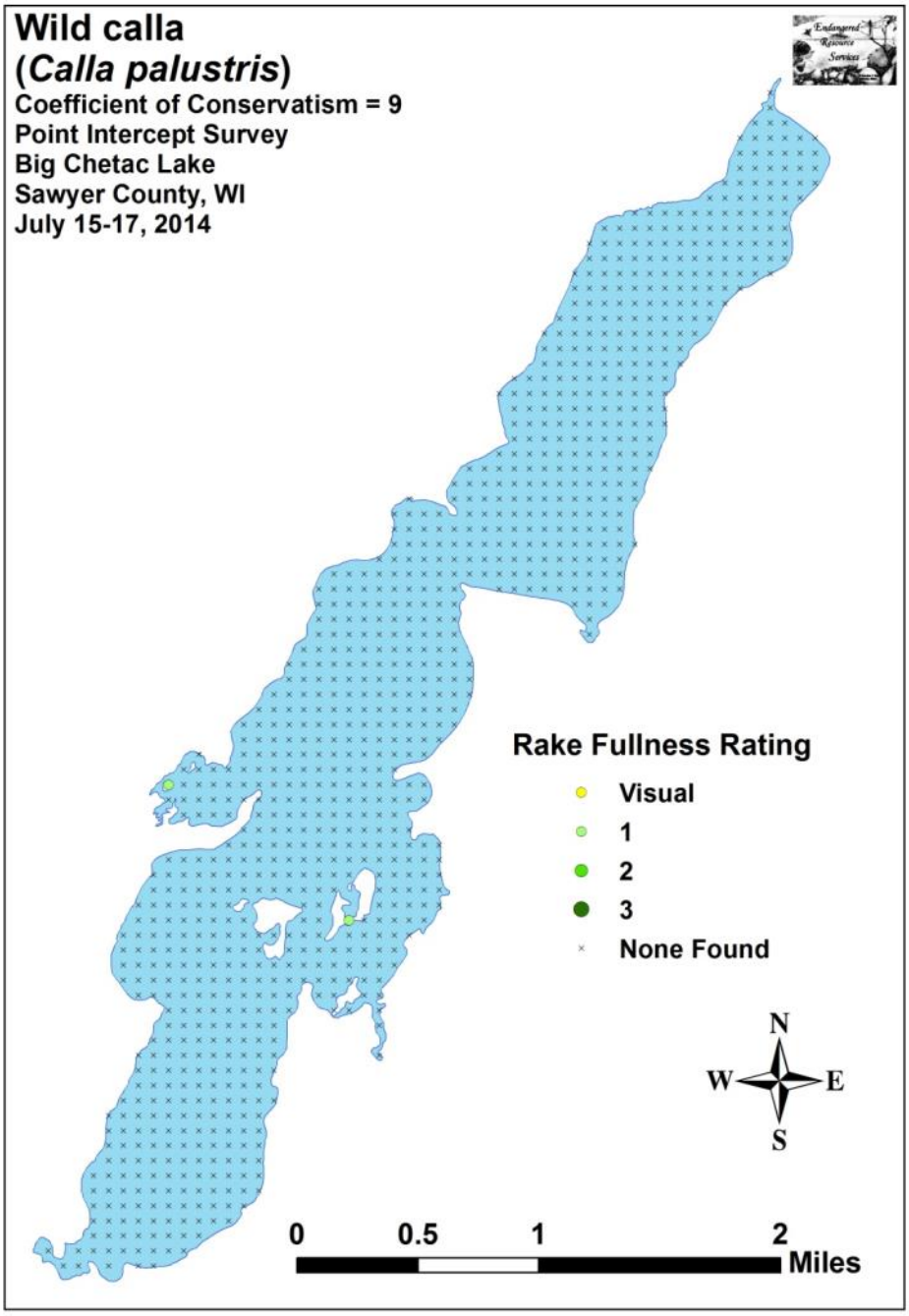
Miles


Wild calla
(Calla palustris)
Coefficient of Conservatism = 9
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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3
None Found
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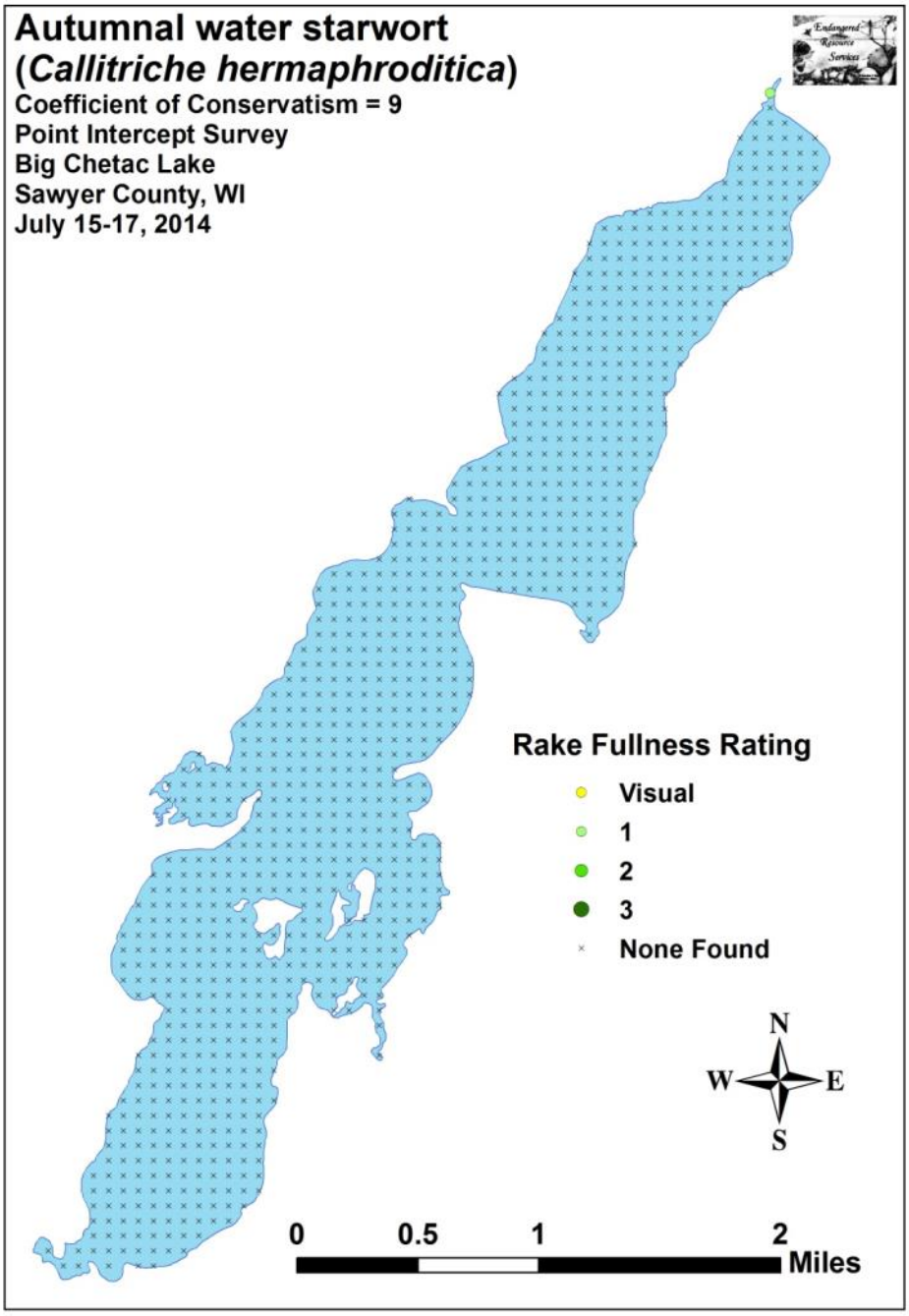
Miles


Autumnal water starwort
(Callitriche hermaphroditica)
Coefficient of Conservatism = 9
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
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None Found
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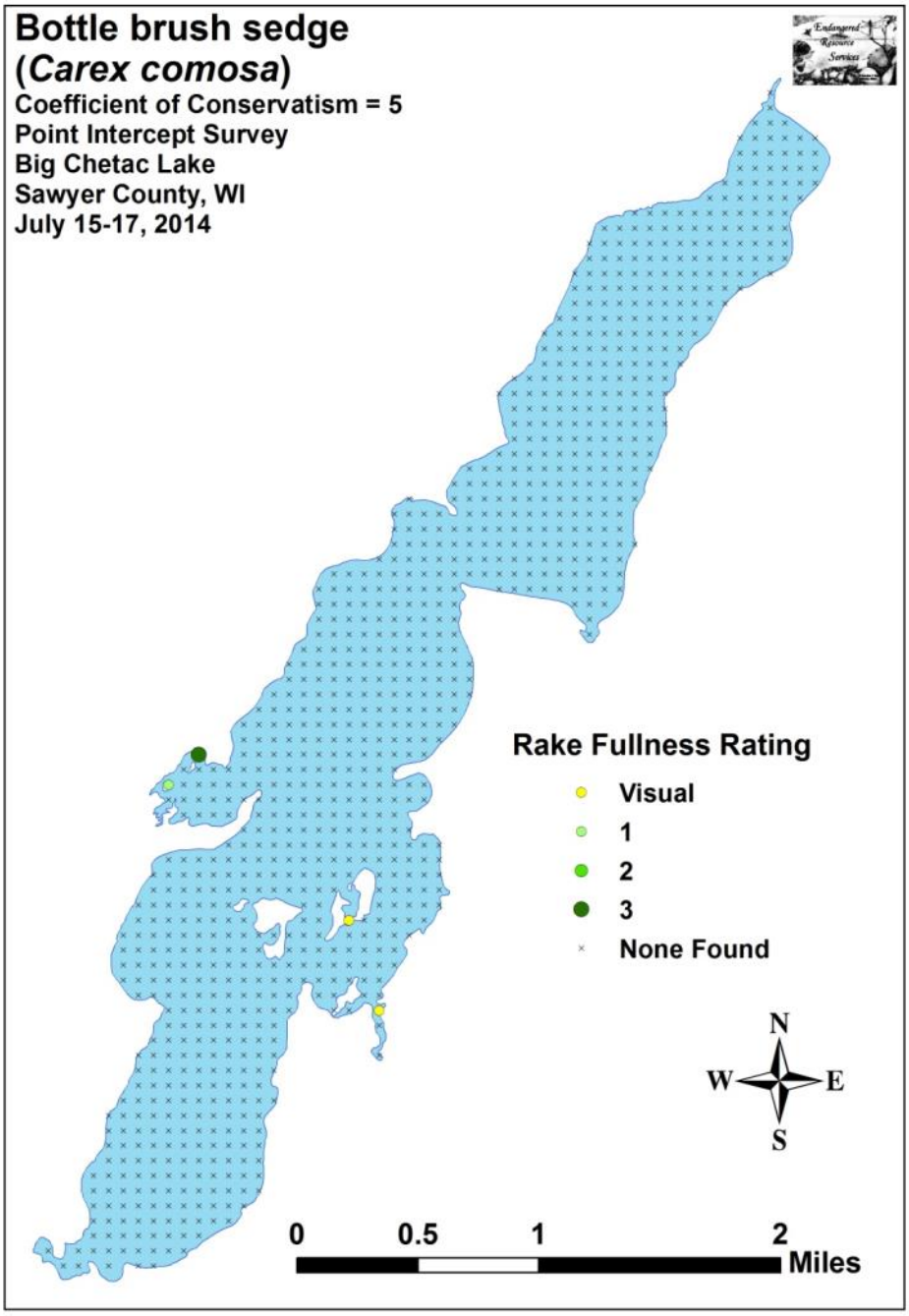
Miles


Bottle brush sedge
(Carex comosa)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
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None Found
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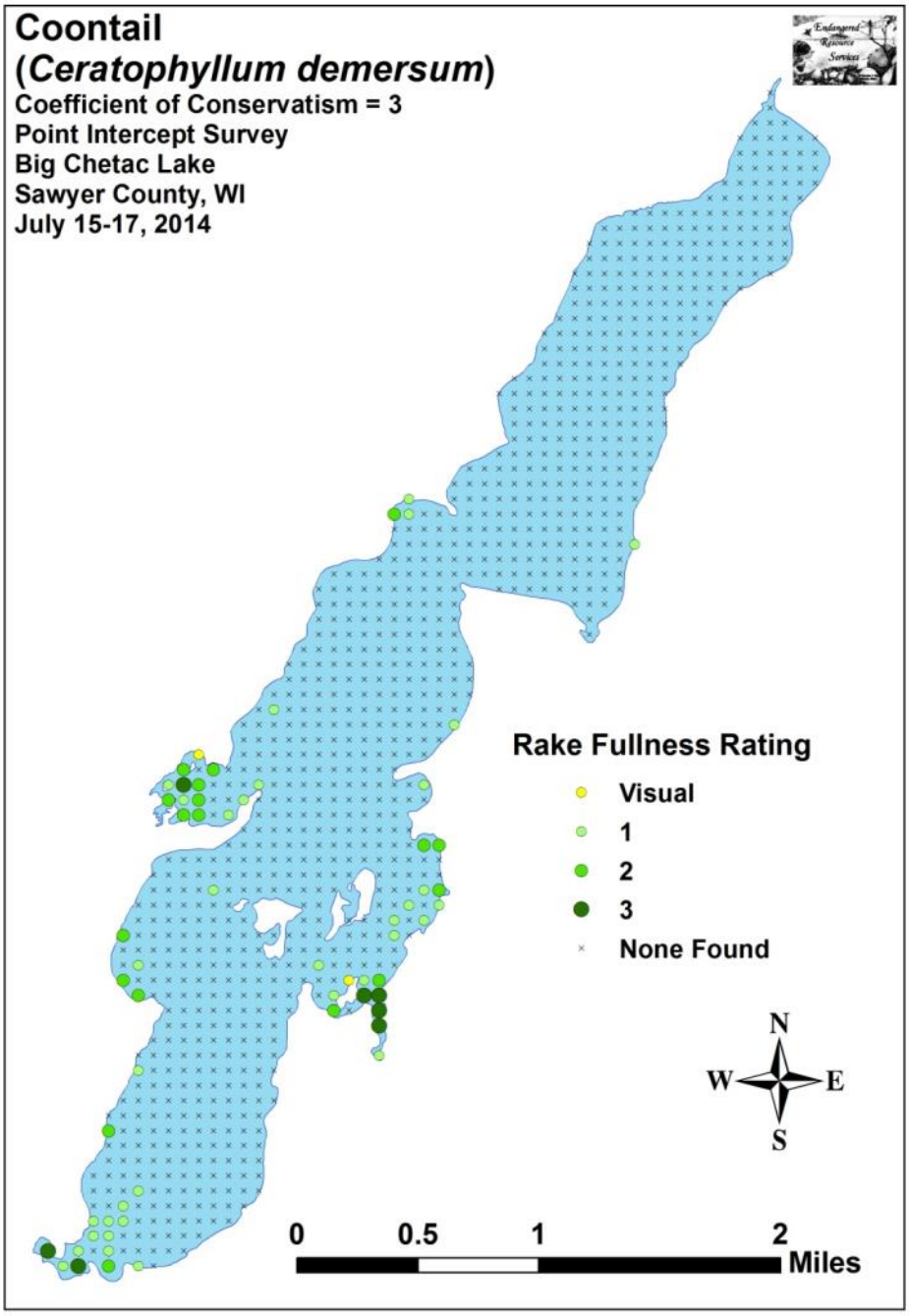
Miles


Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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None Found
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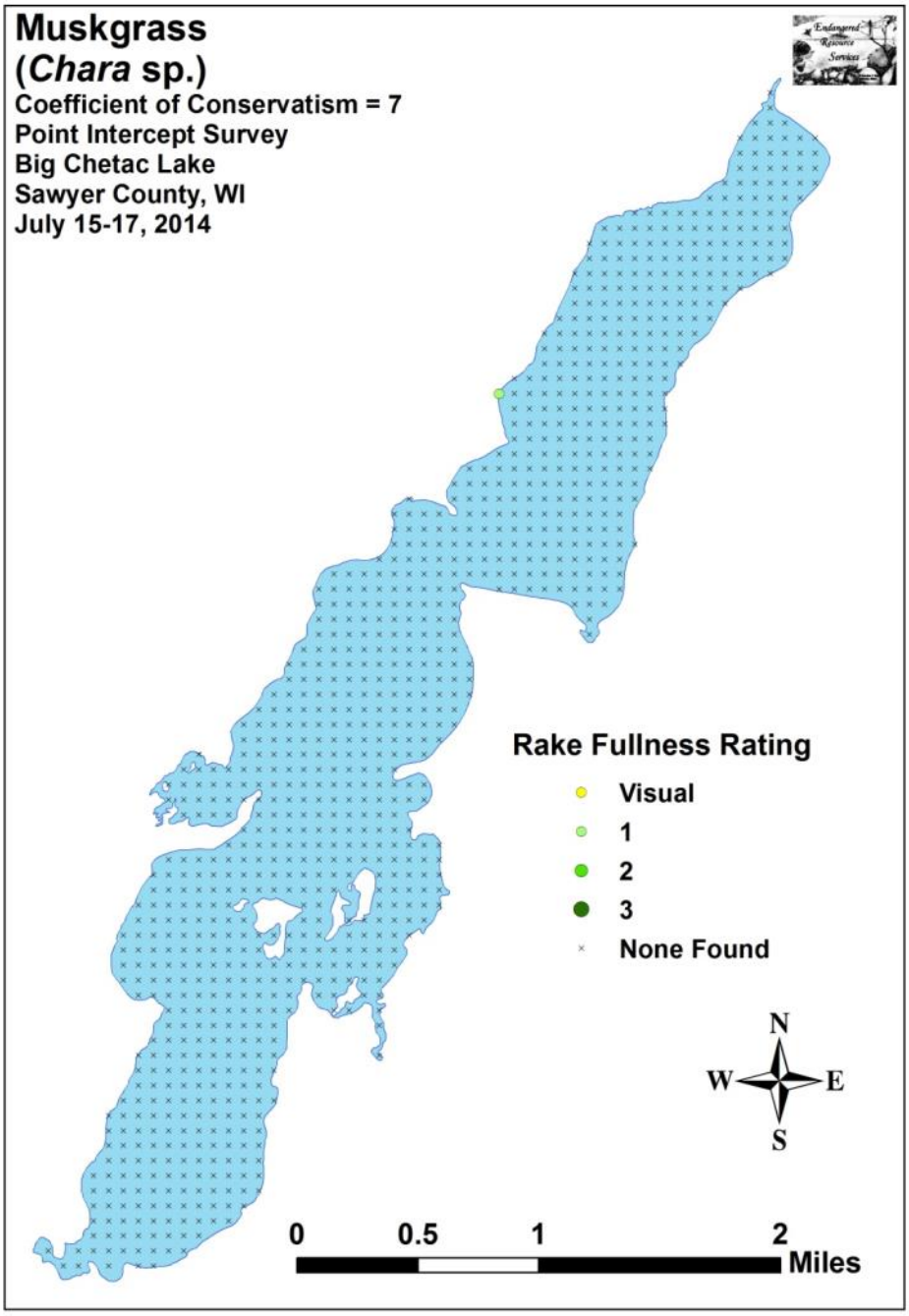
Miles


Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
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None Found
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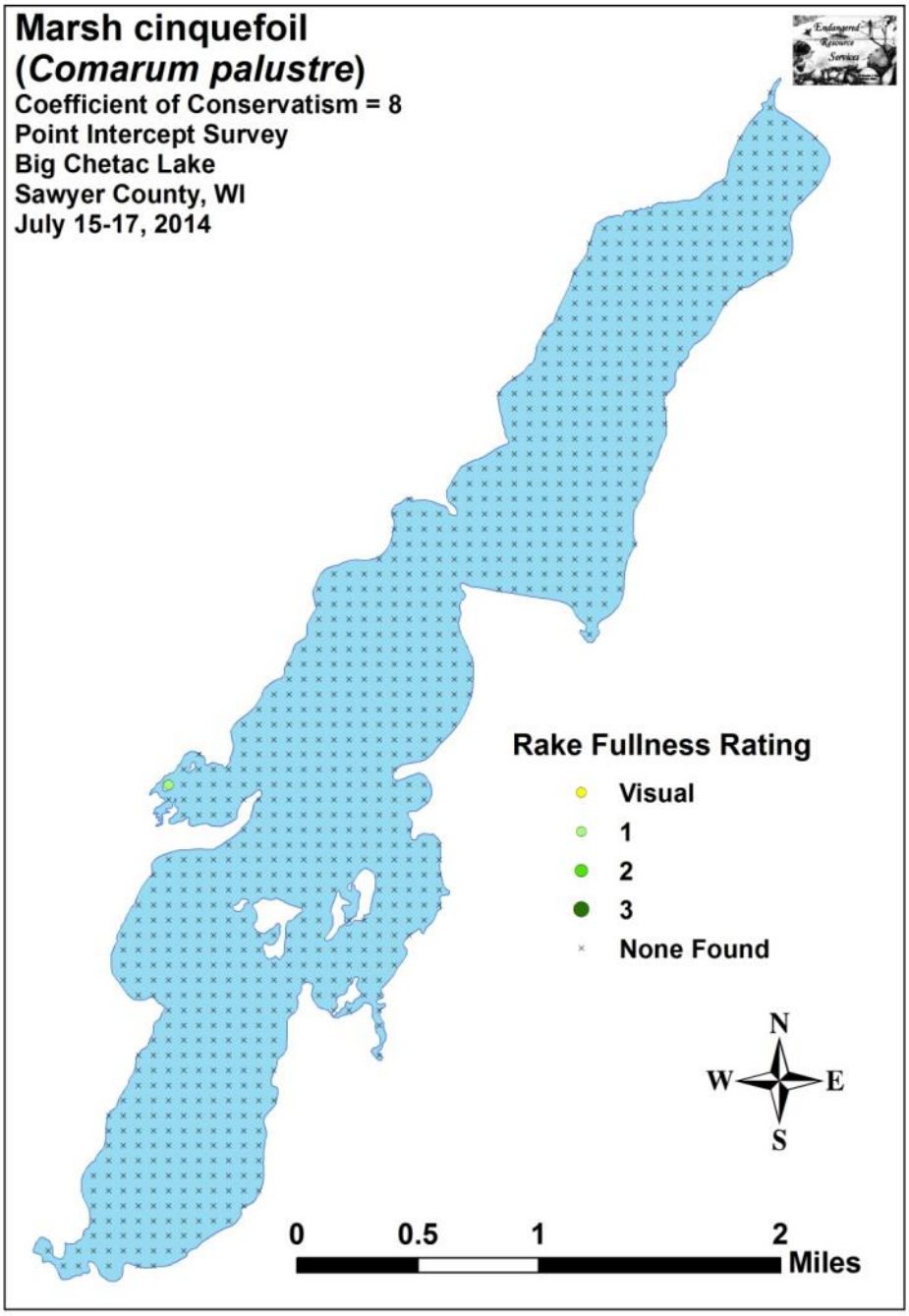
Miles


Marsh cinquefoil
(Comarum palustre)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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None Found
N
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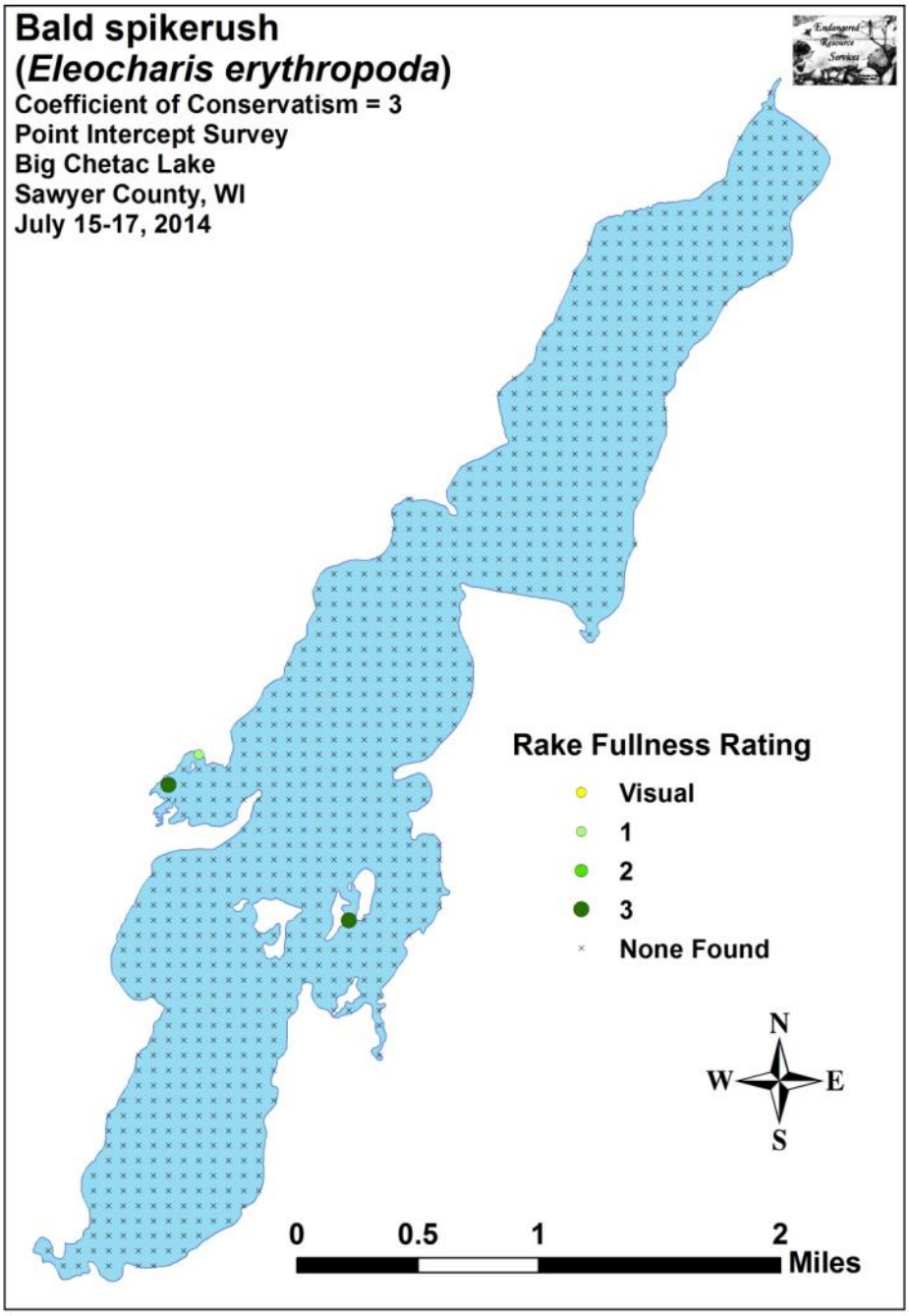
Miles


Bald spikerush
(Eleocharis erythropoda)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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None Found
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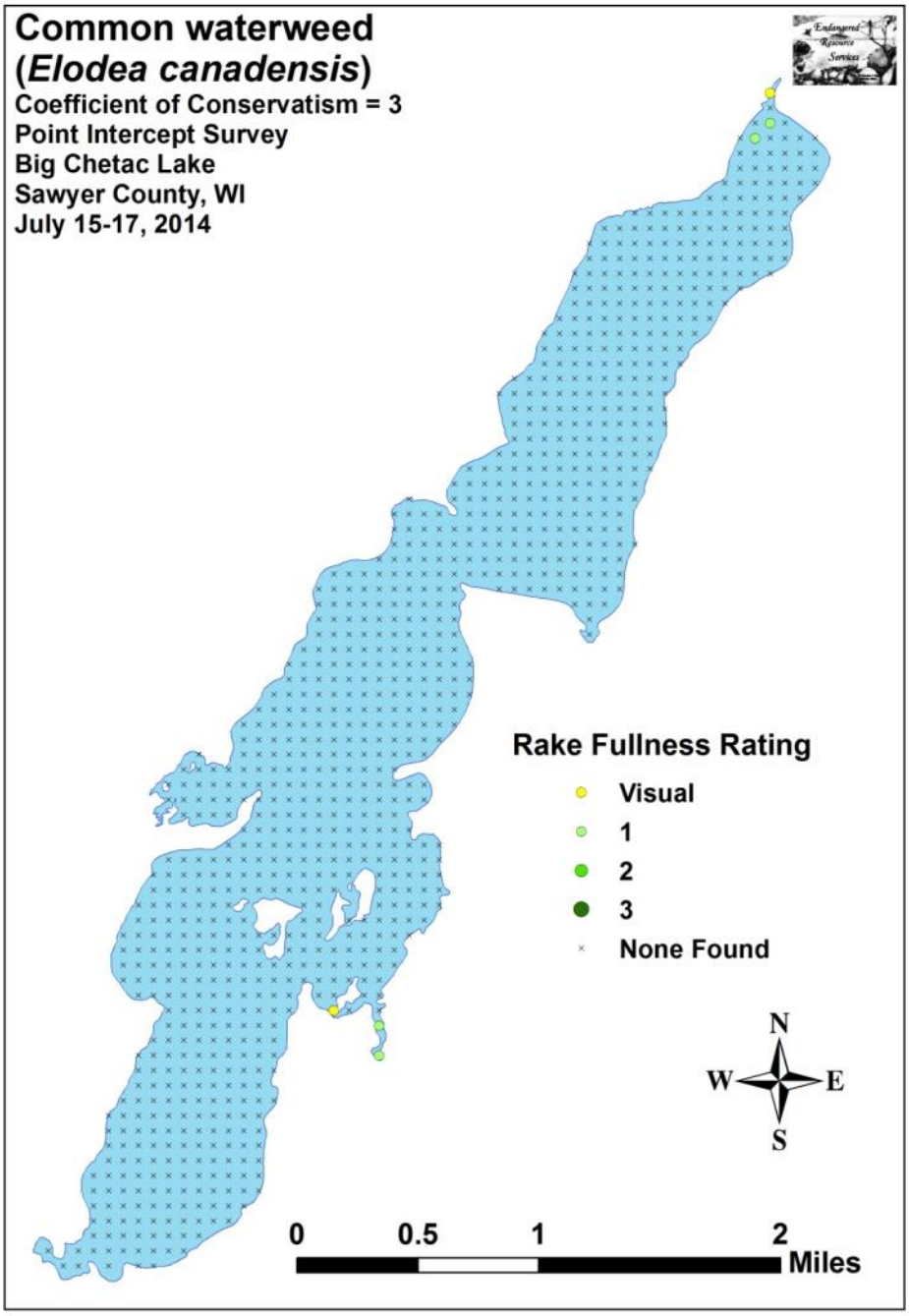
Miles


Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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None Found
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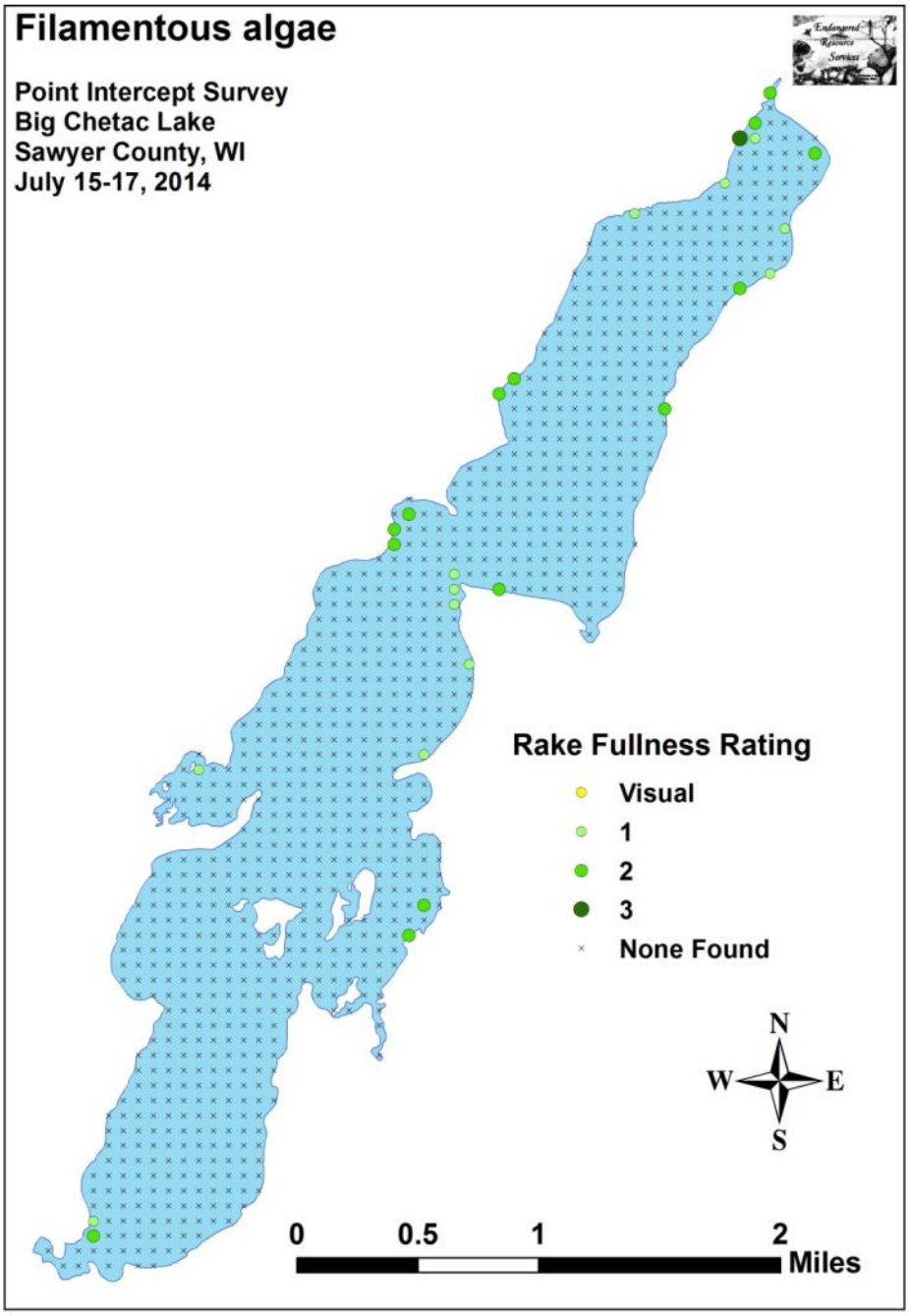
Miles


Filamentous algae
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
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None Found
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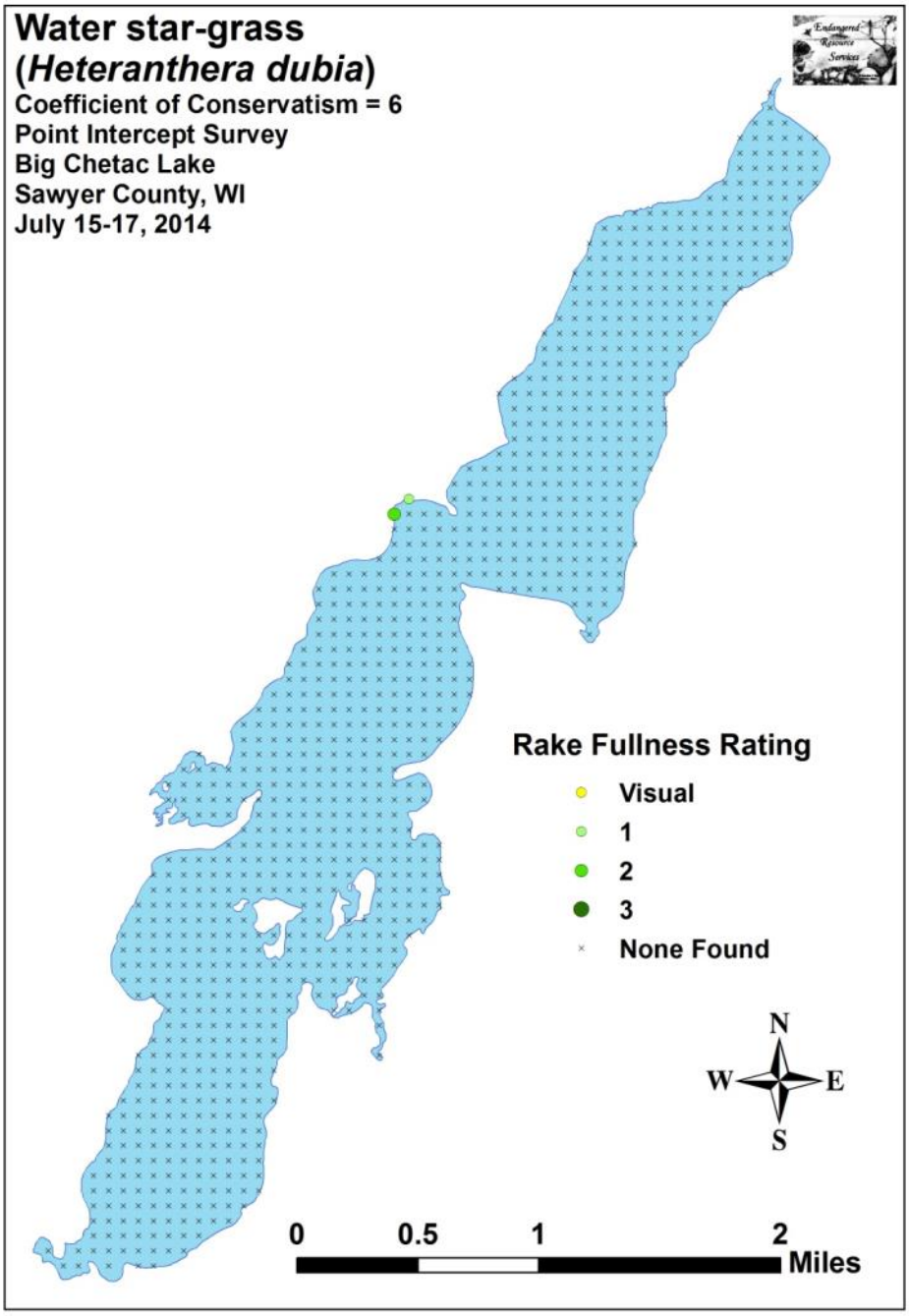
0.5
1
2
Miles


Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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None Found
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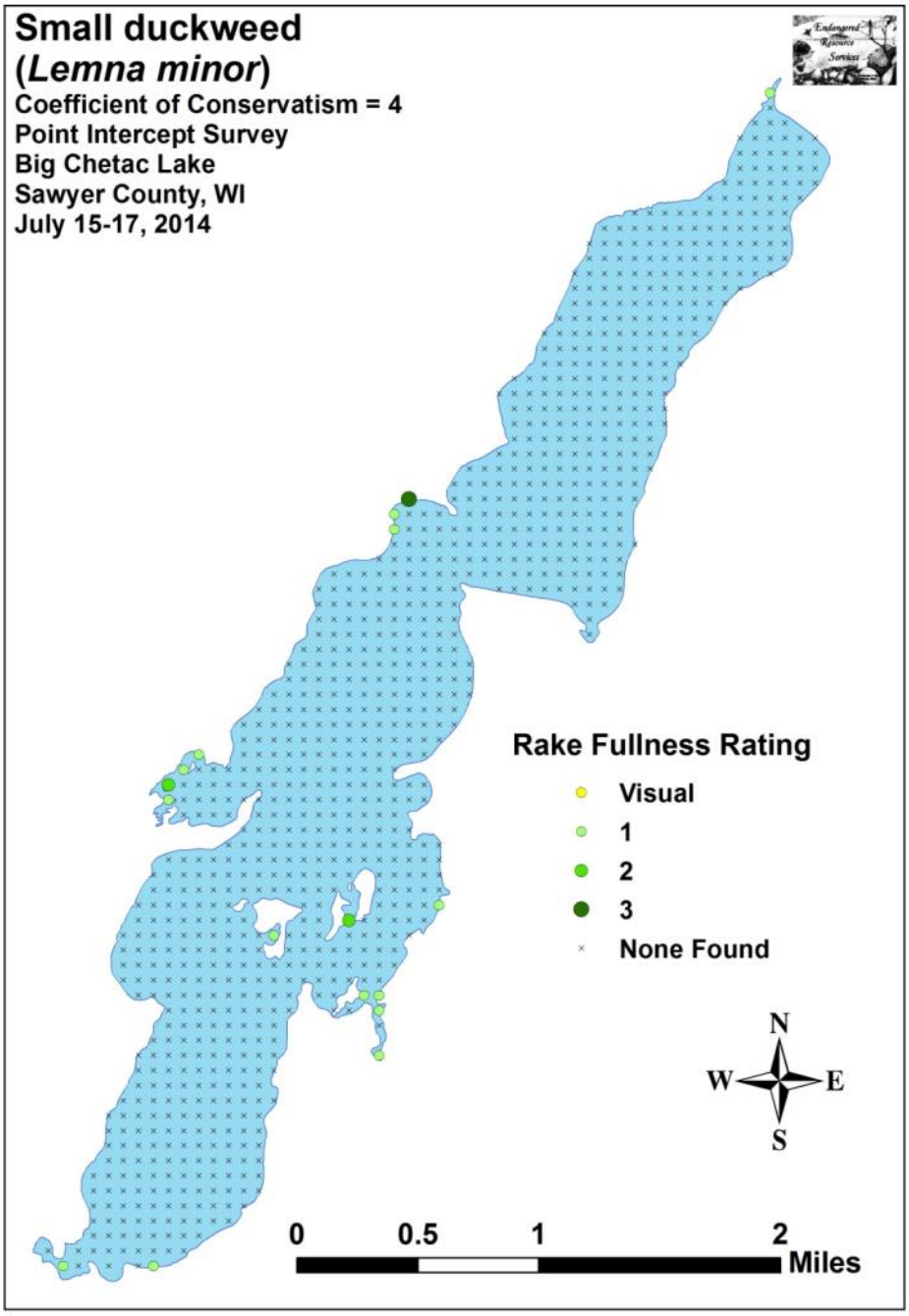
Miles


Small duckweed
(Lemna minor)
Coefficient of Conservatism = 4
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
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None Found
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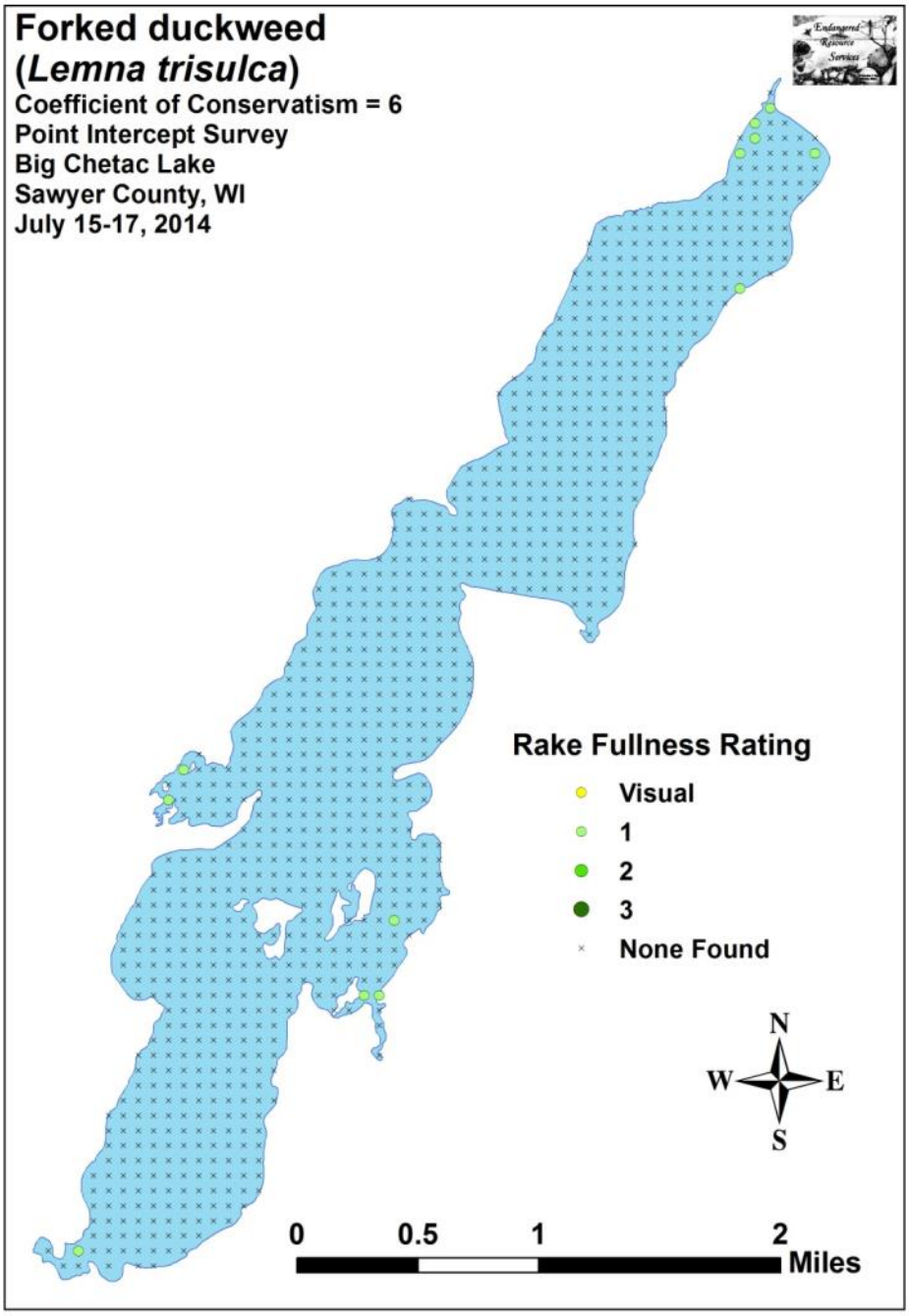
Miles


Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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0
0.5
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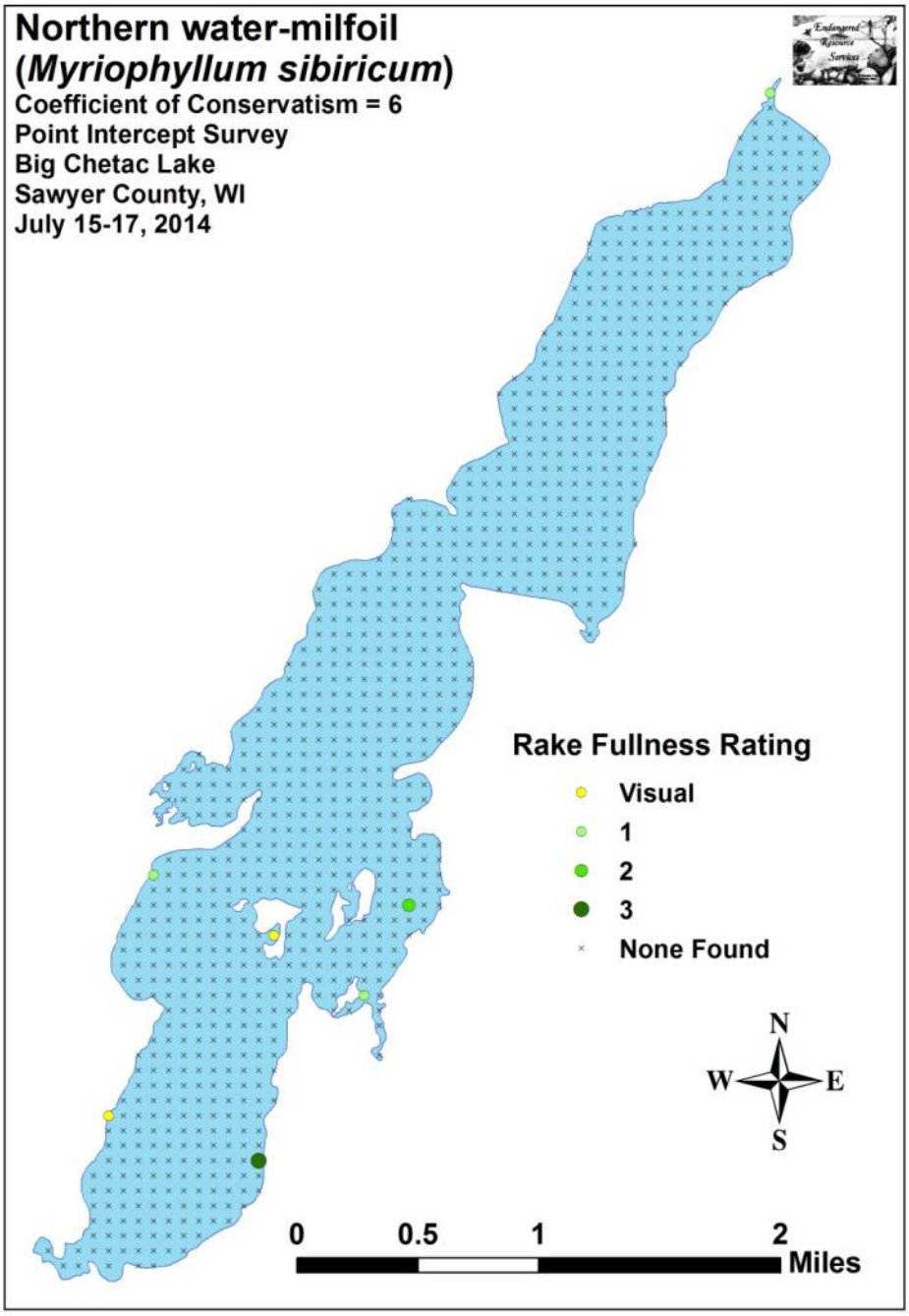
Miles


Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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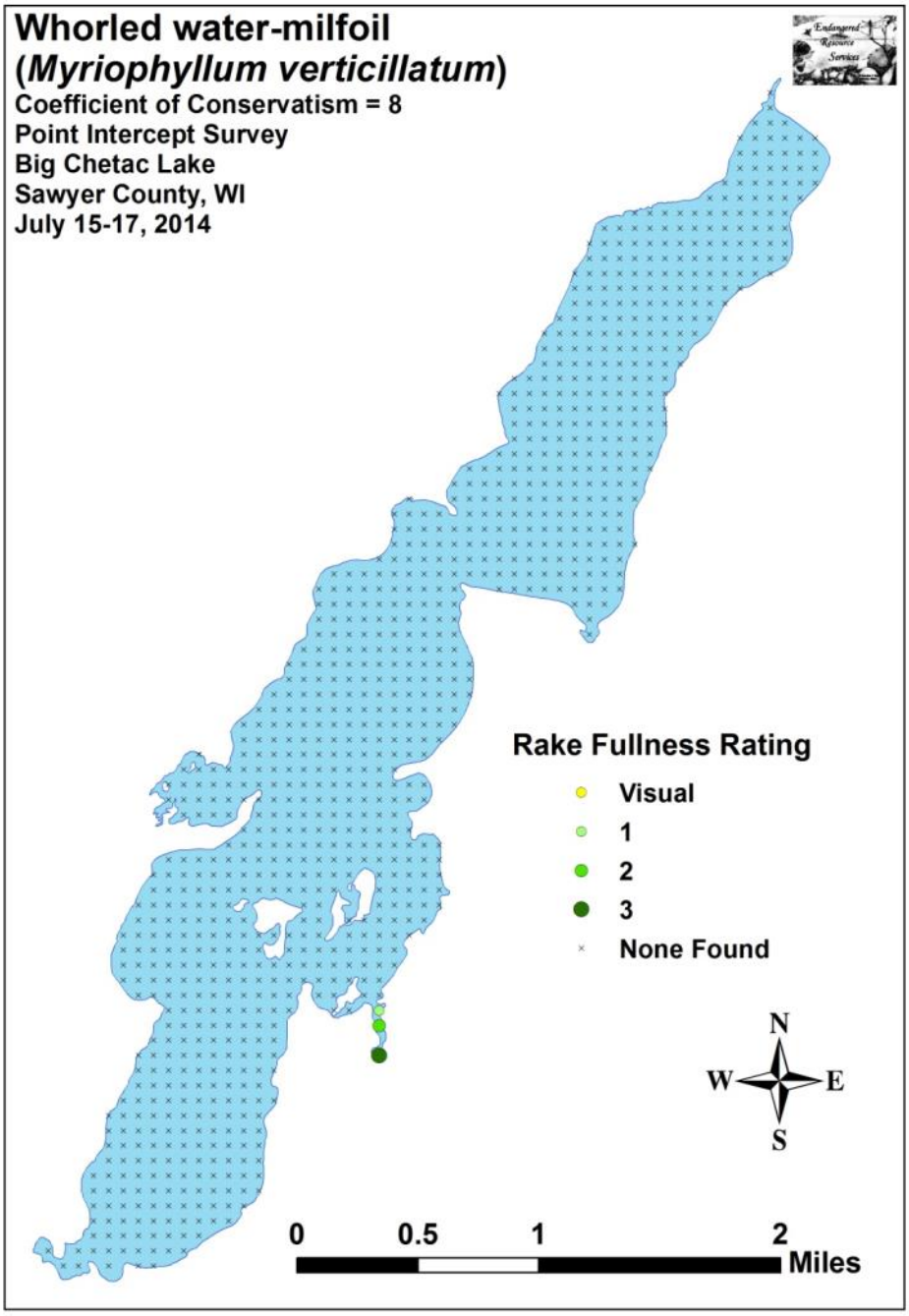
Whorled water-milfoil
(Myriophyllum verticillatum)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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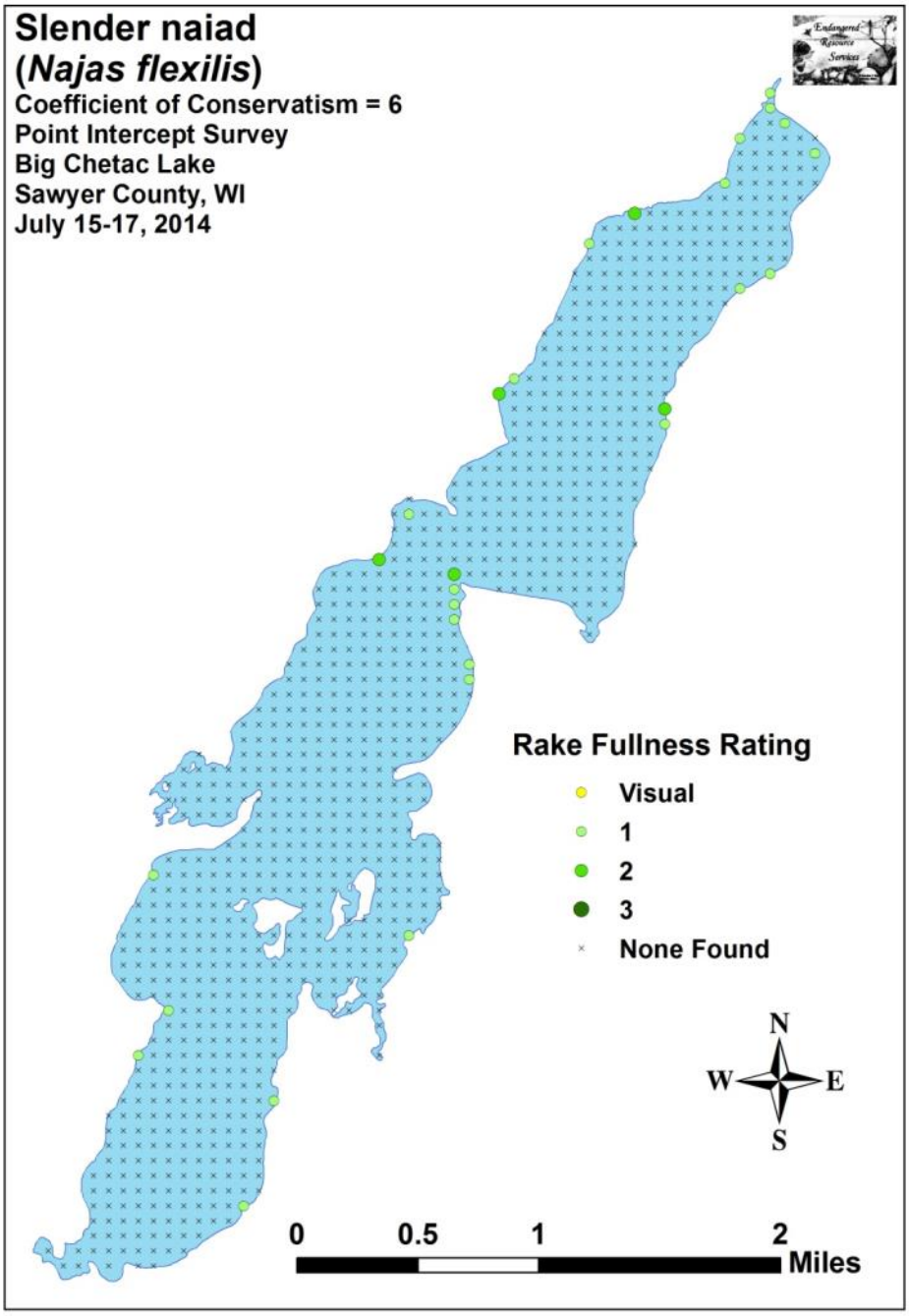
Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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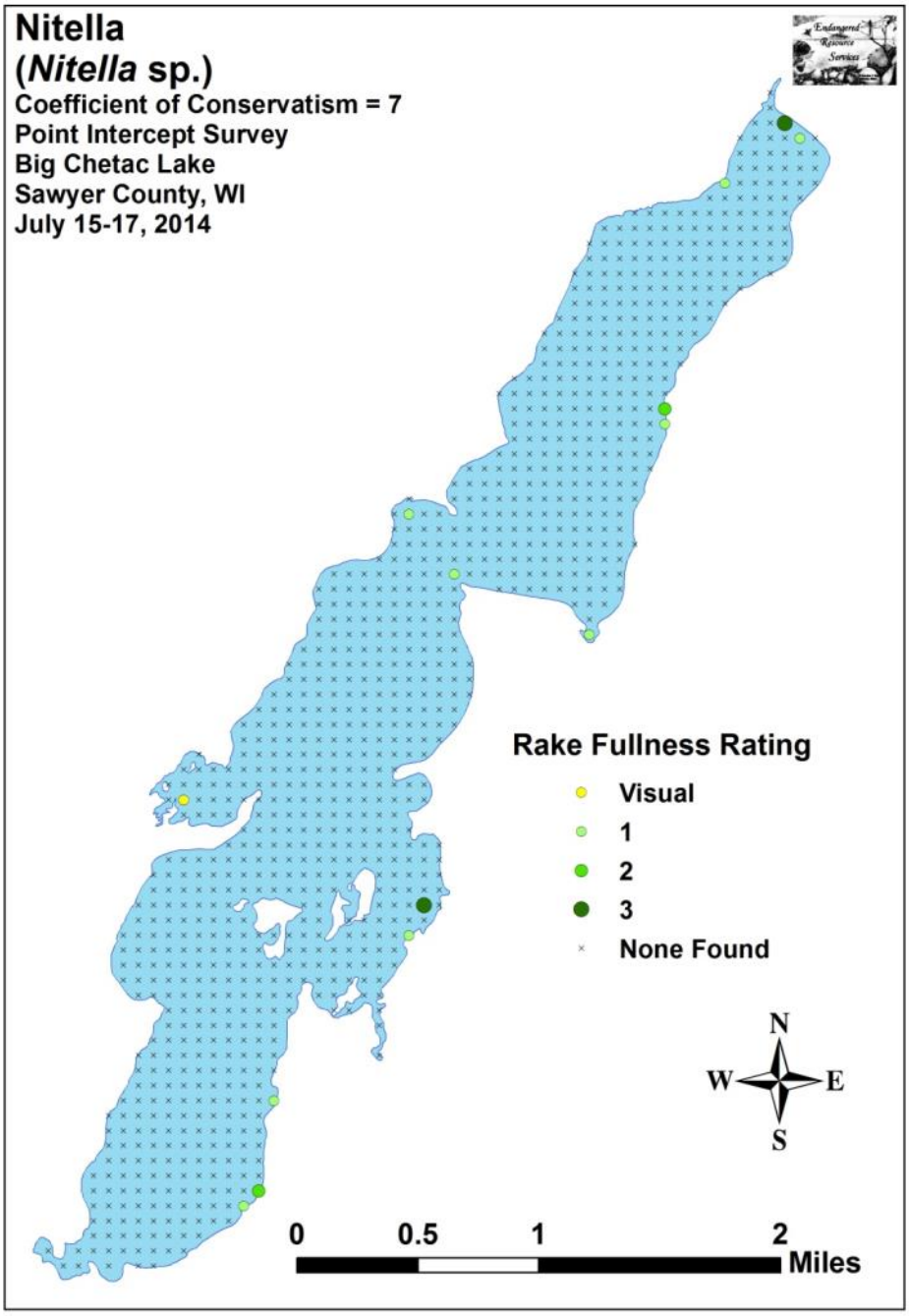
Nitella
(Nitella sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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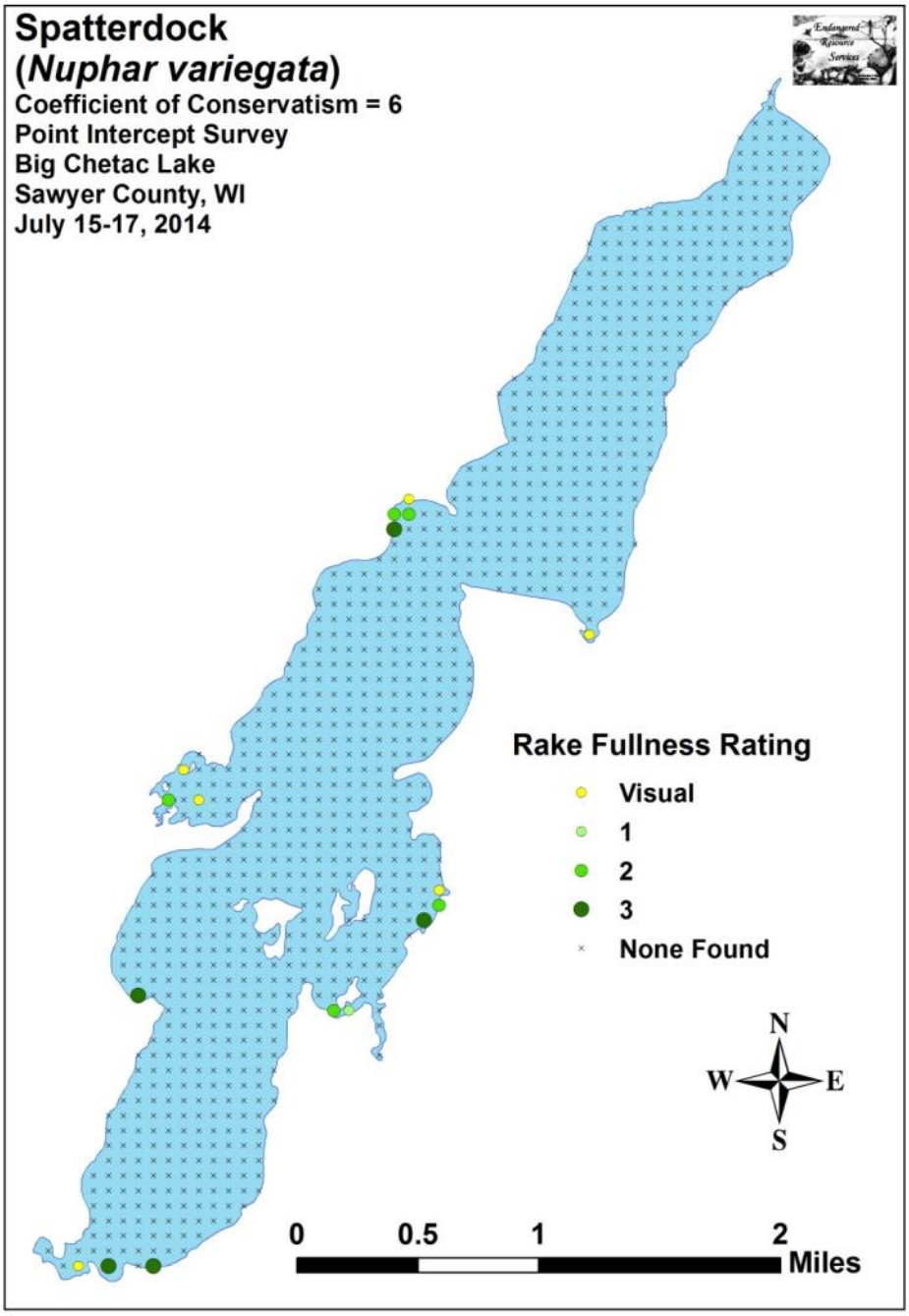
Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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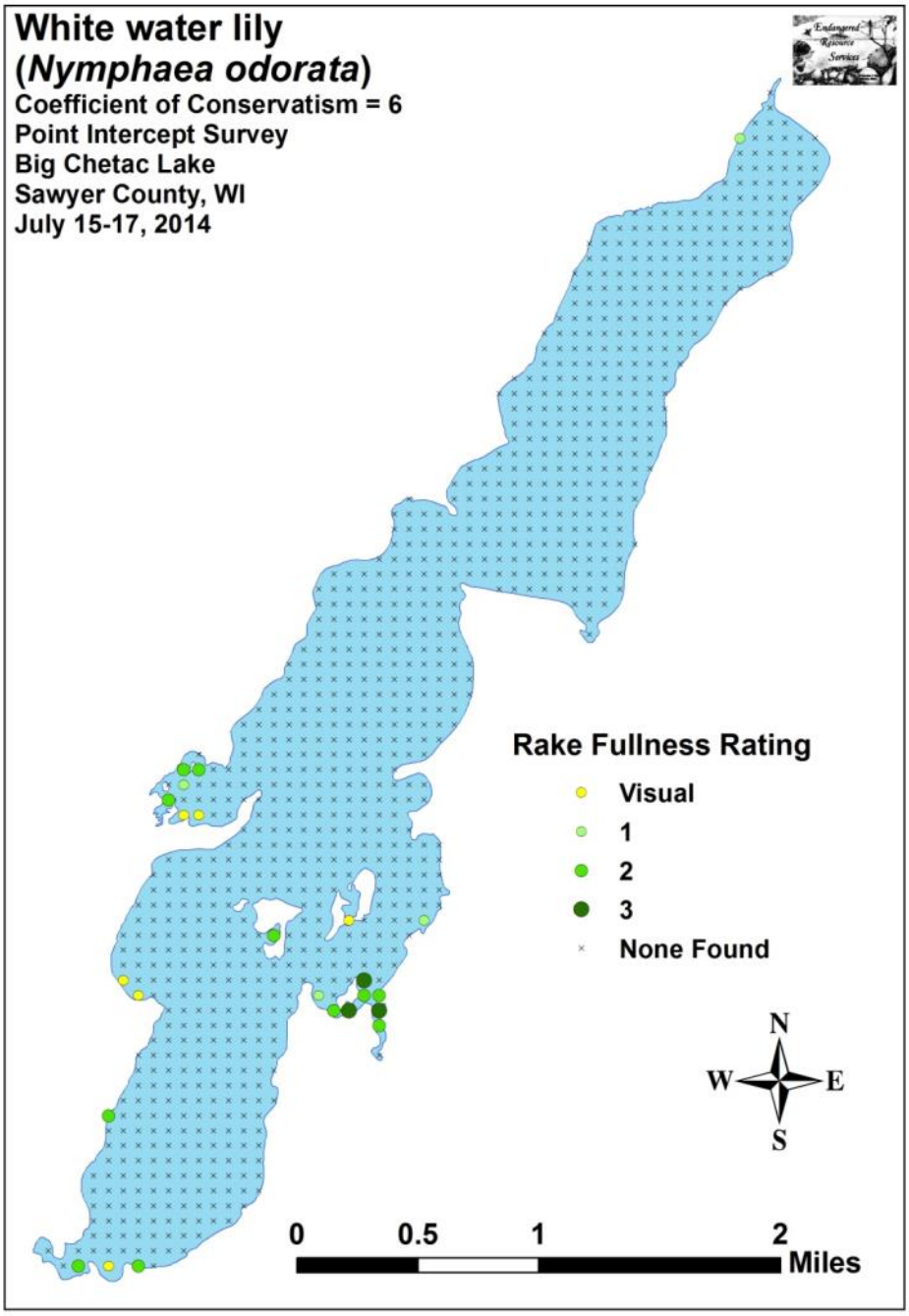
White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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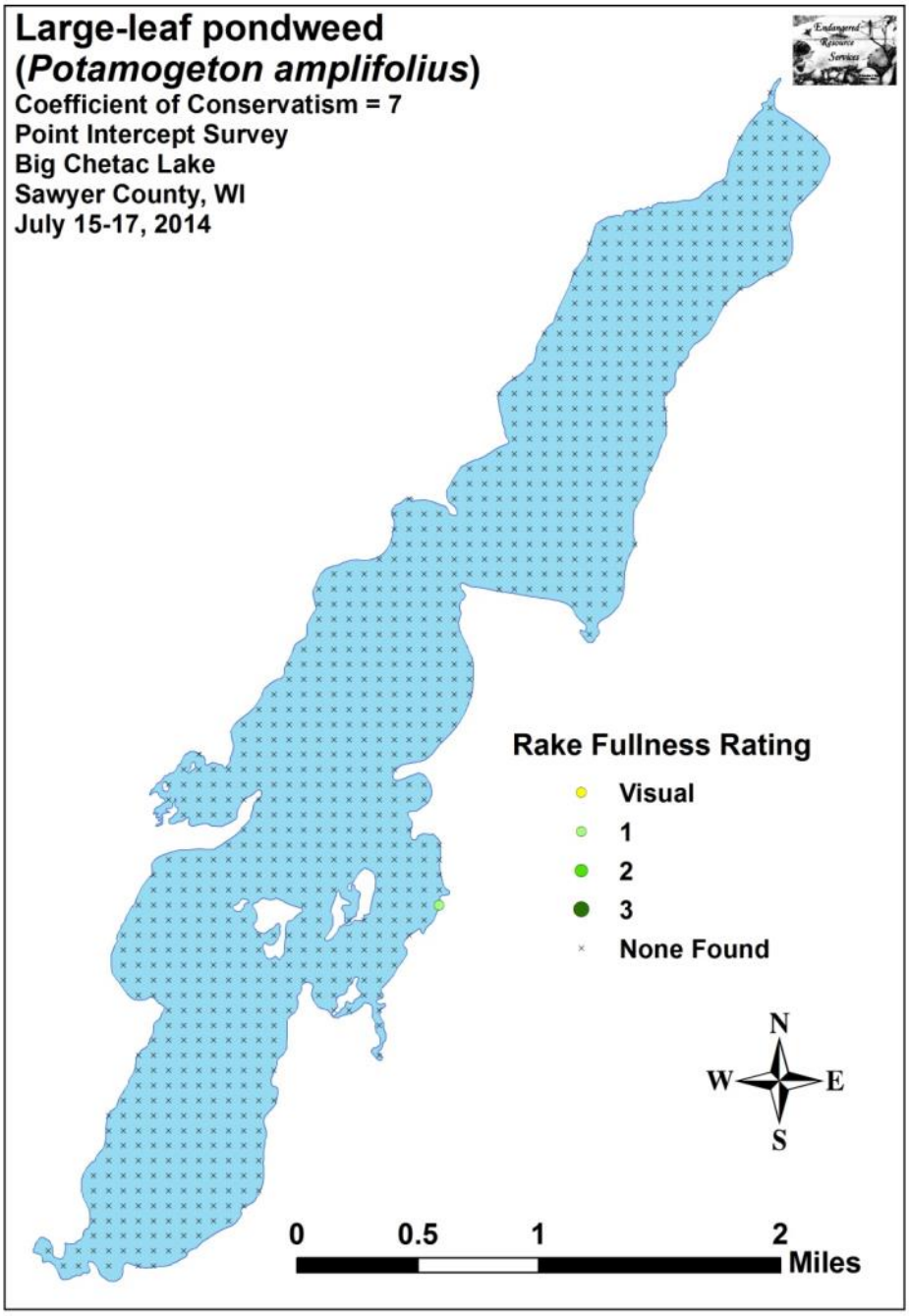
Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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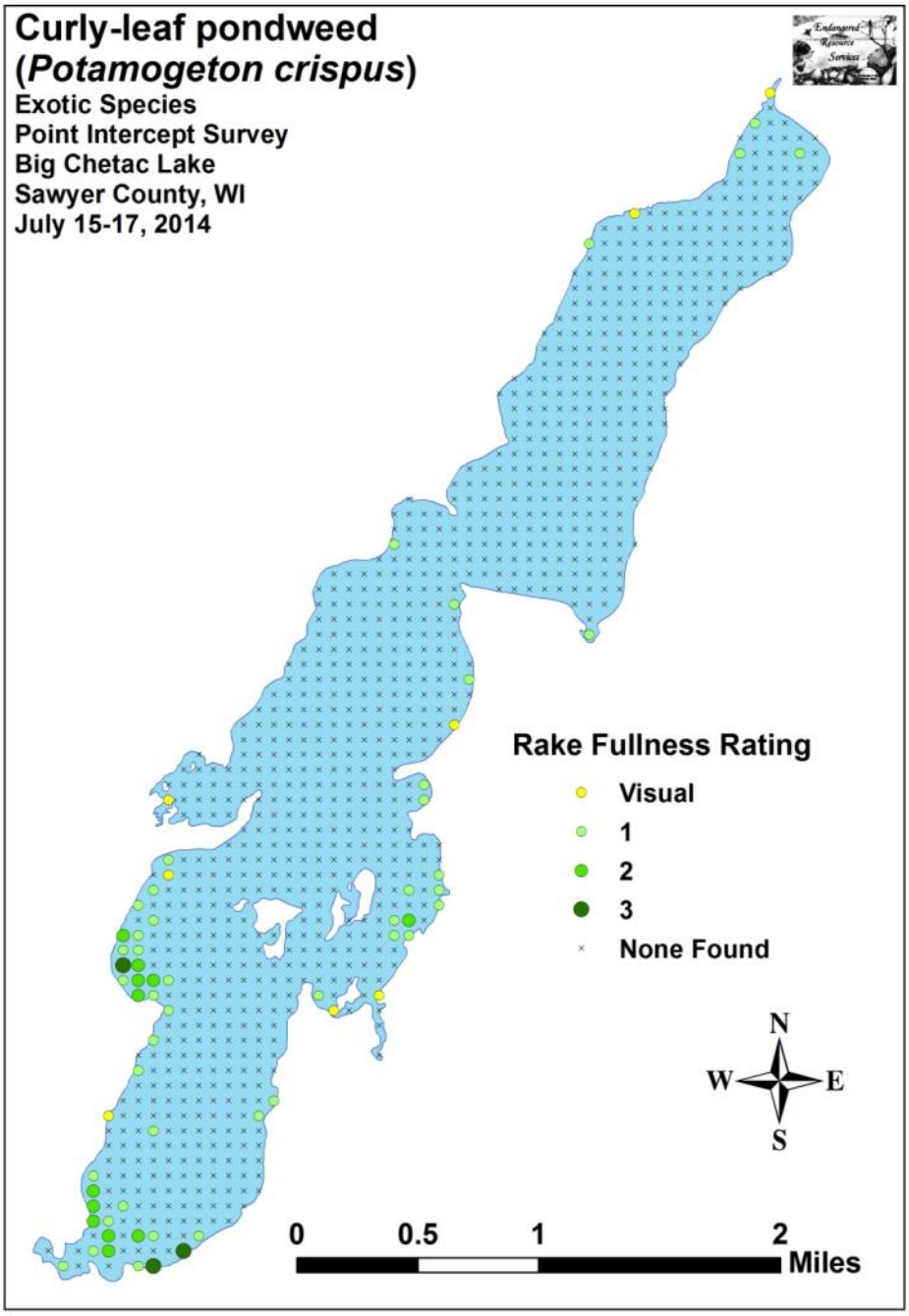
Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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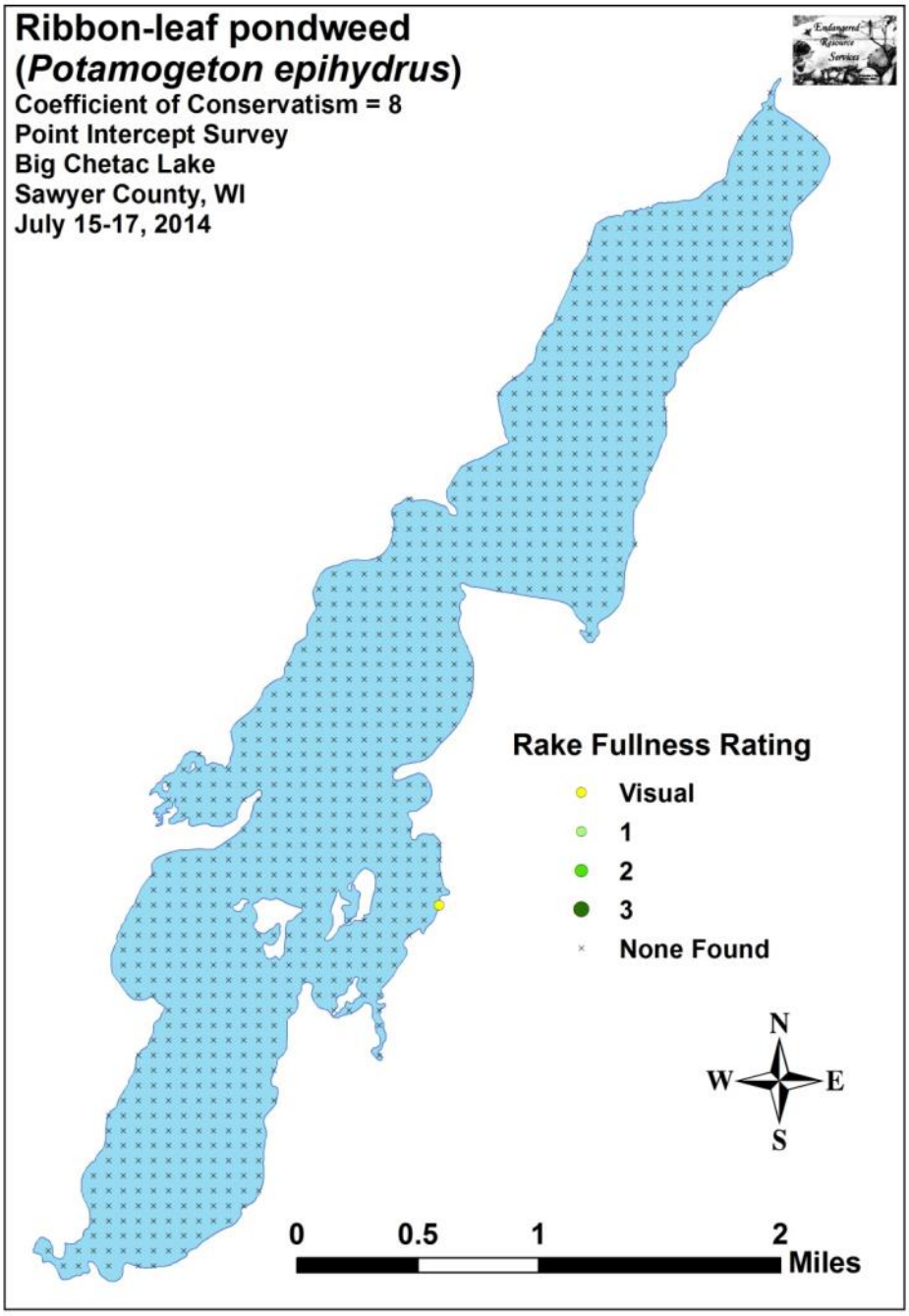
Ribbon-leaf pondweed
(Potamogeton epihydrus)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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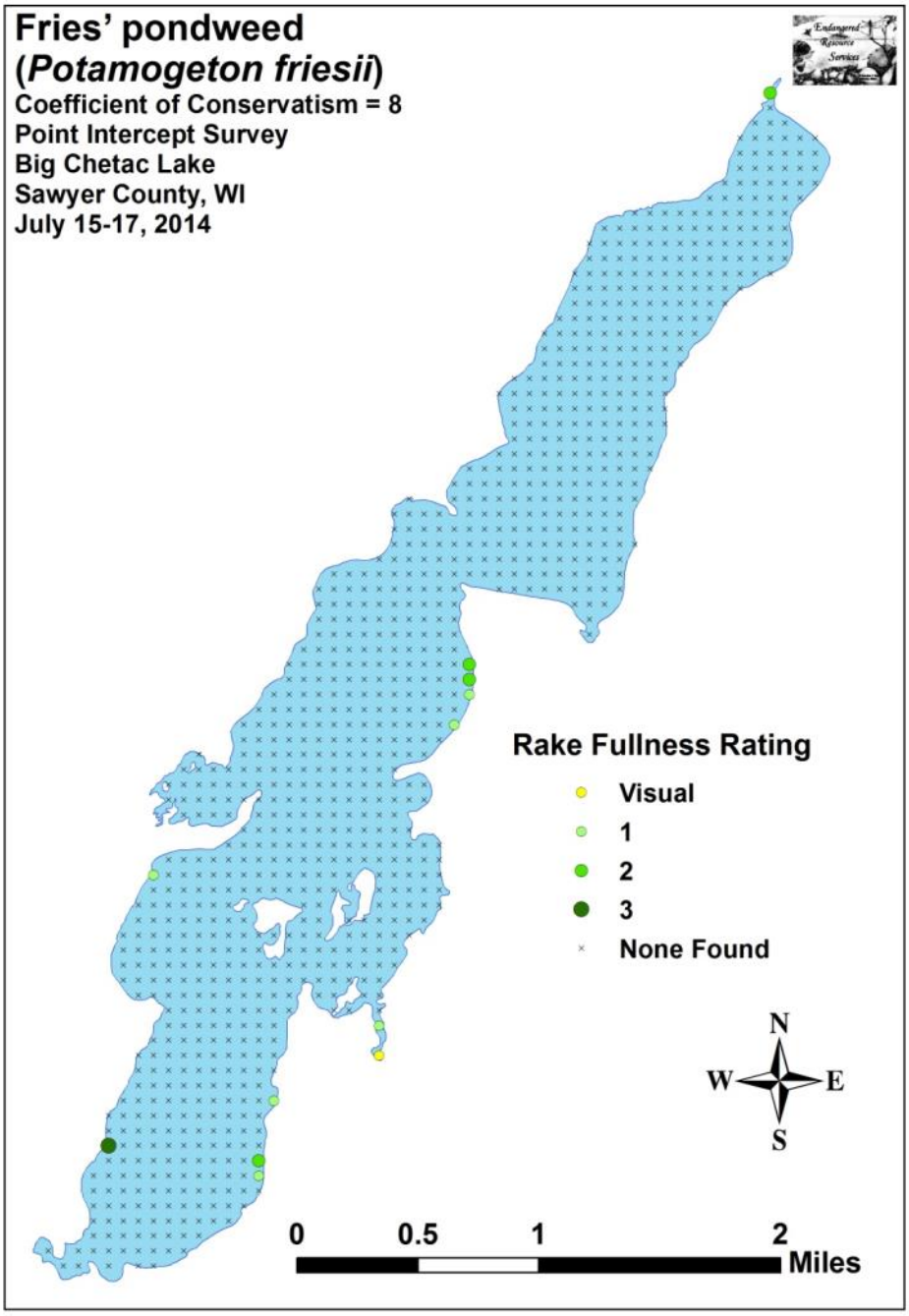
Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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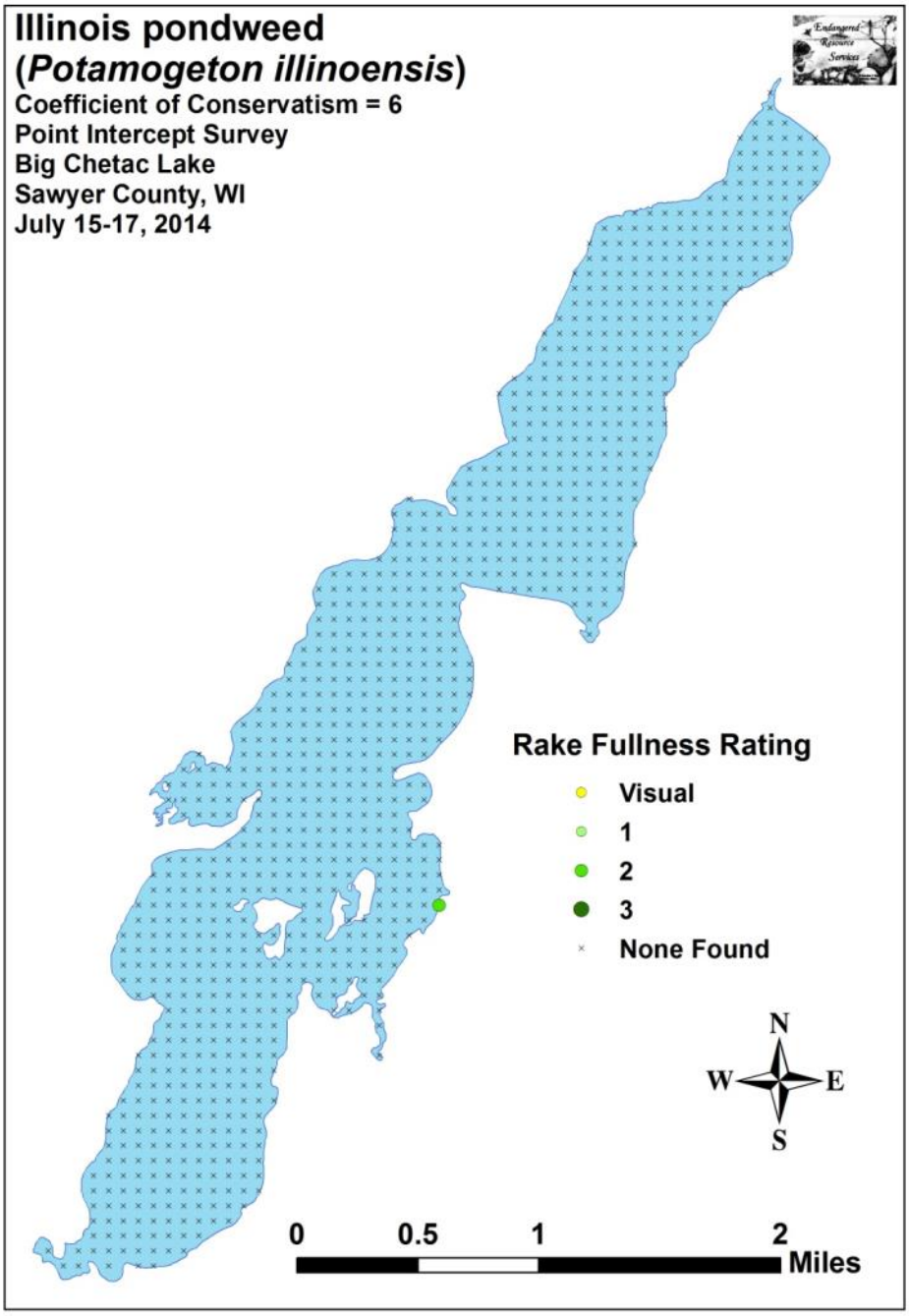
Illinois pondweed
(Potamogeton illinoensis)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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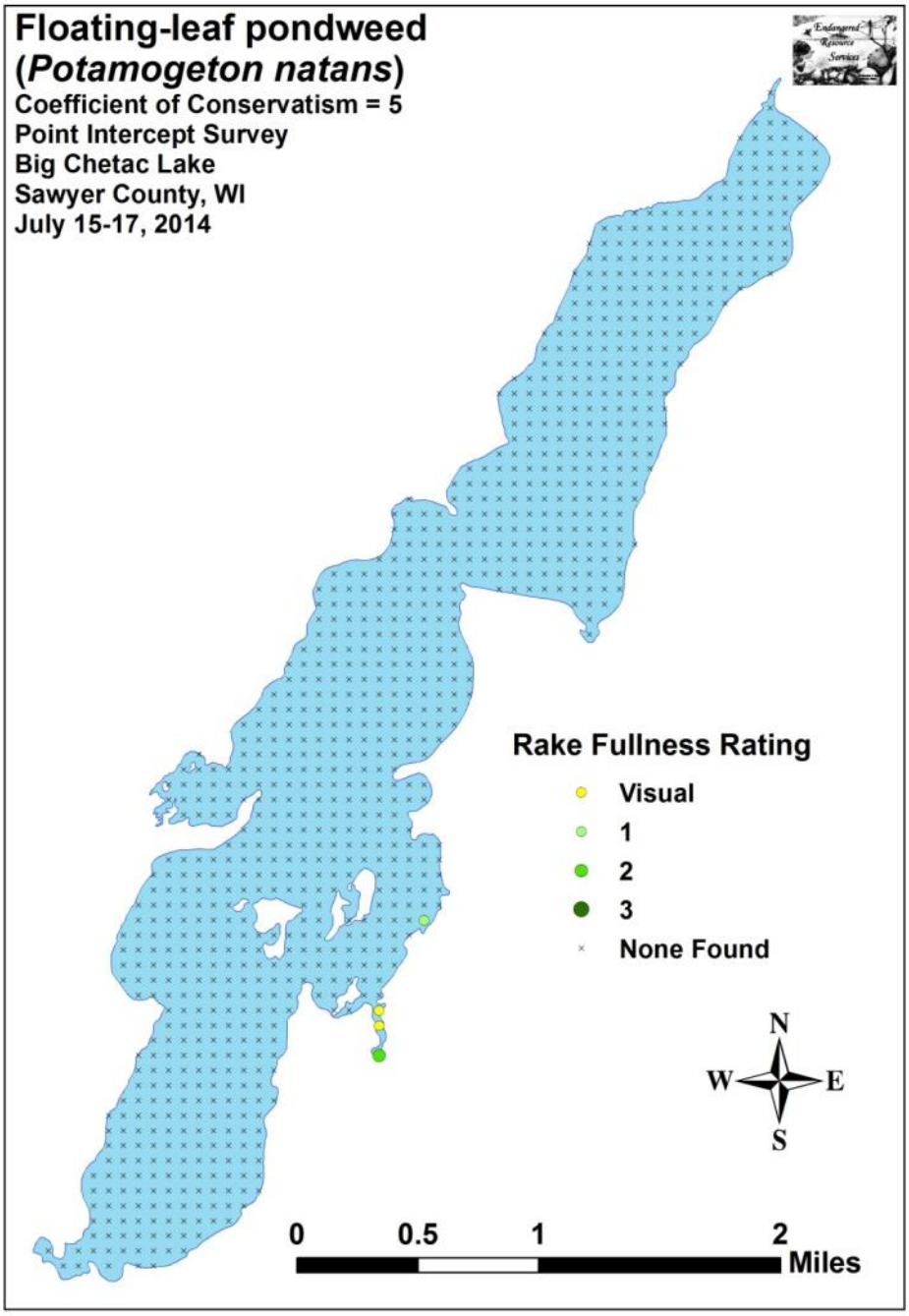
Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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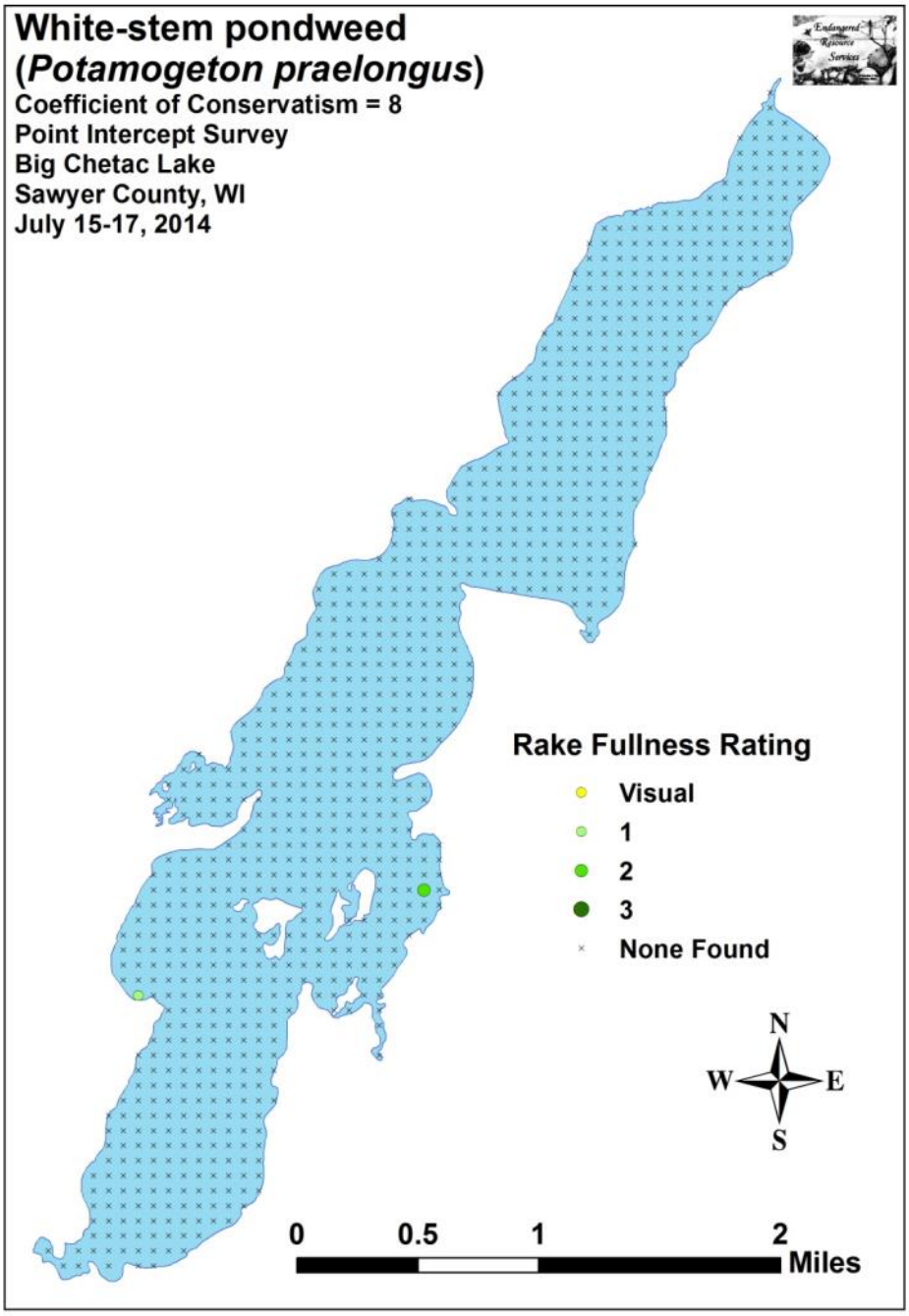
White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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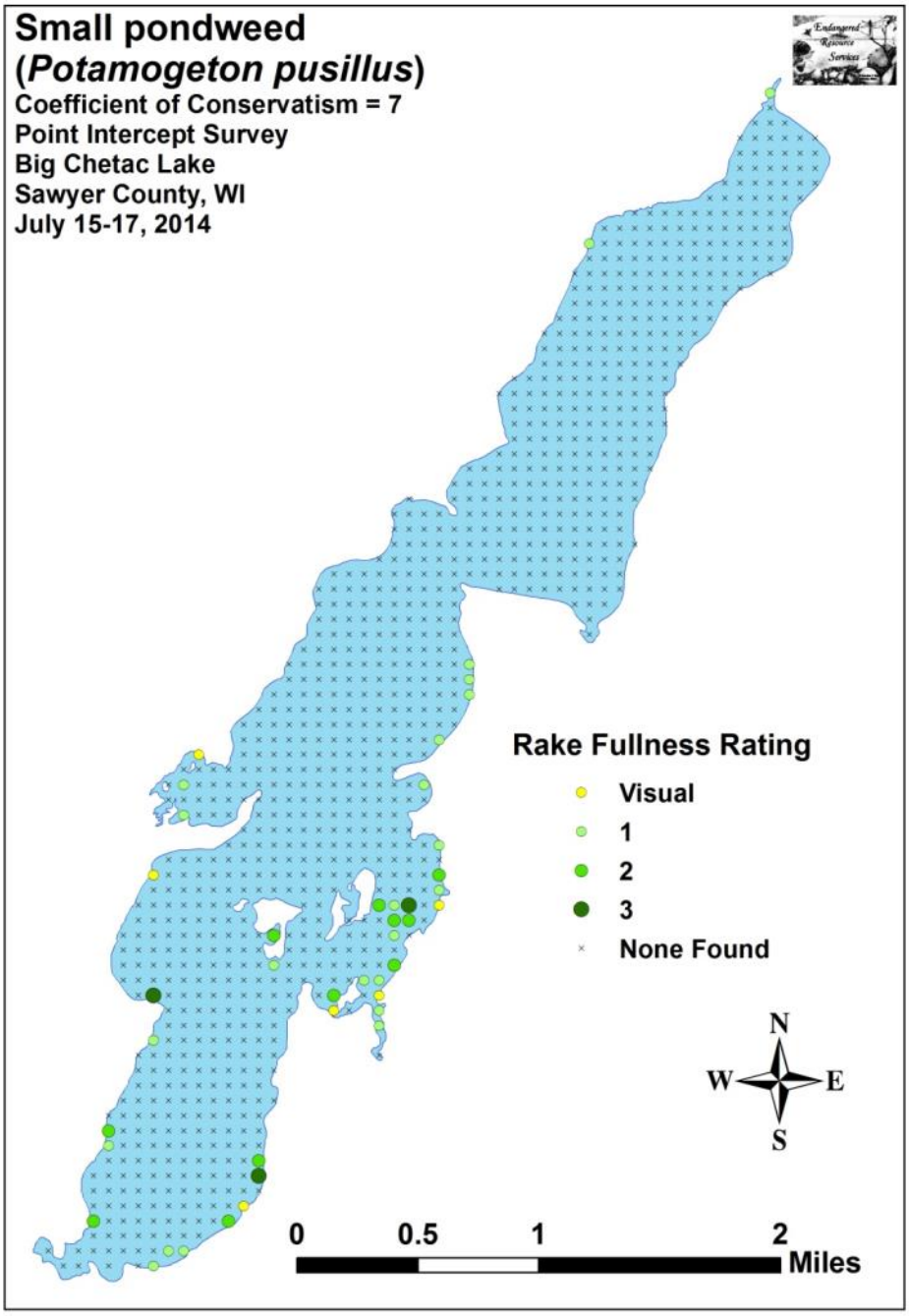
Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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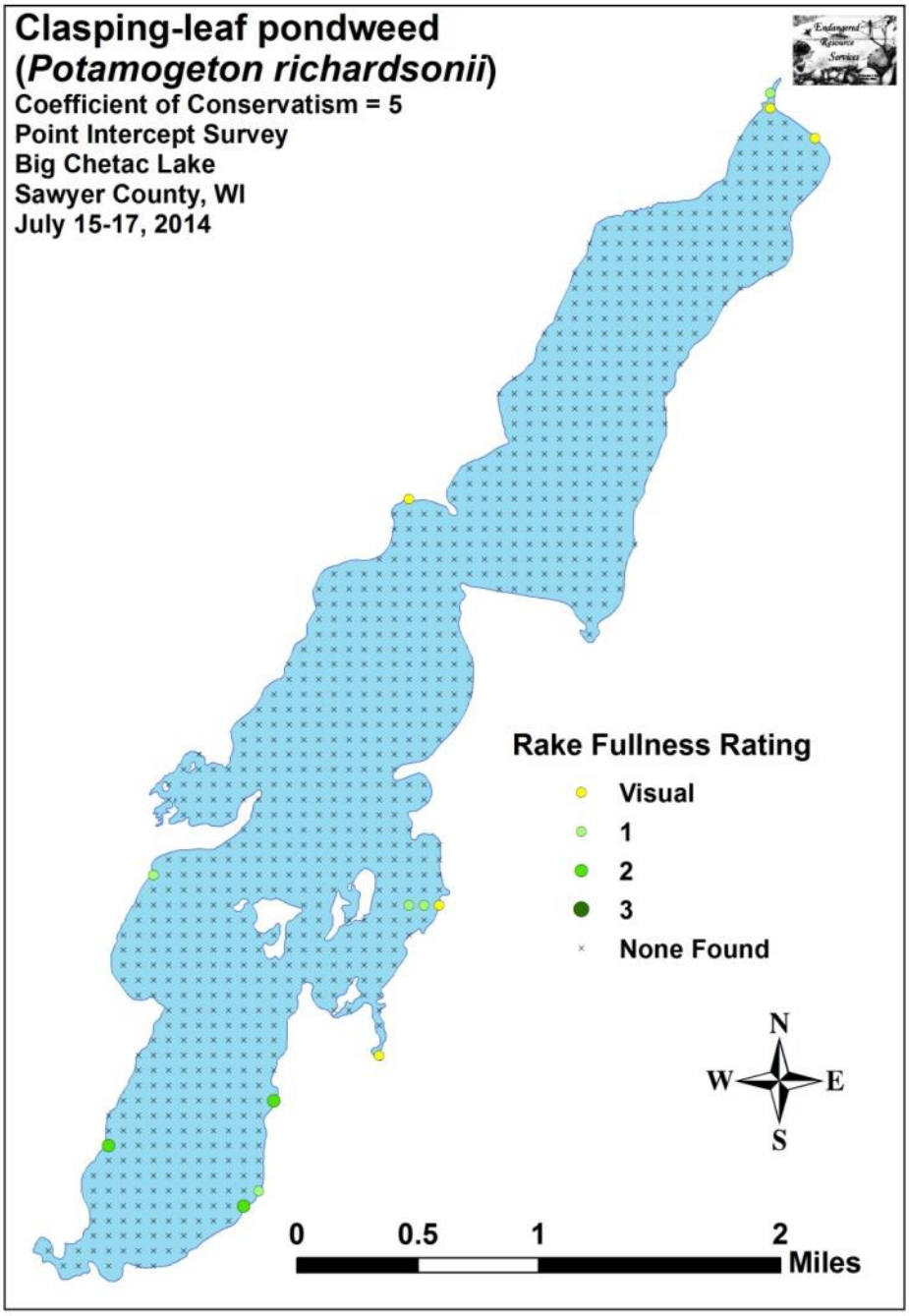
Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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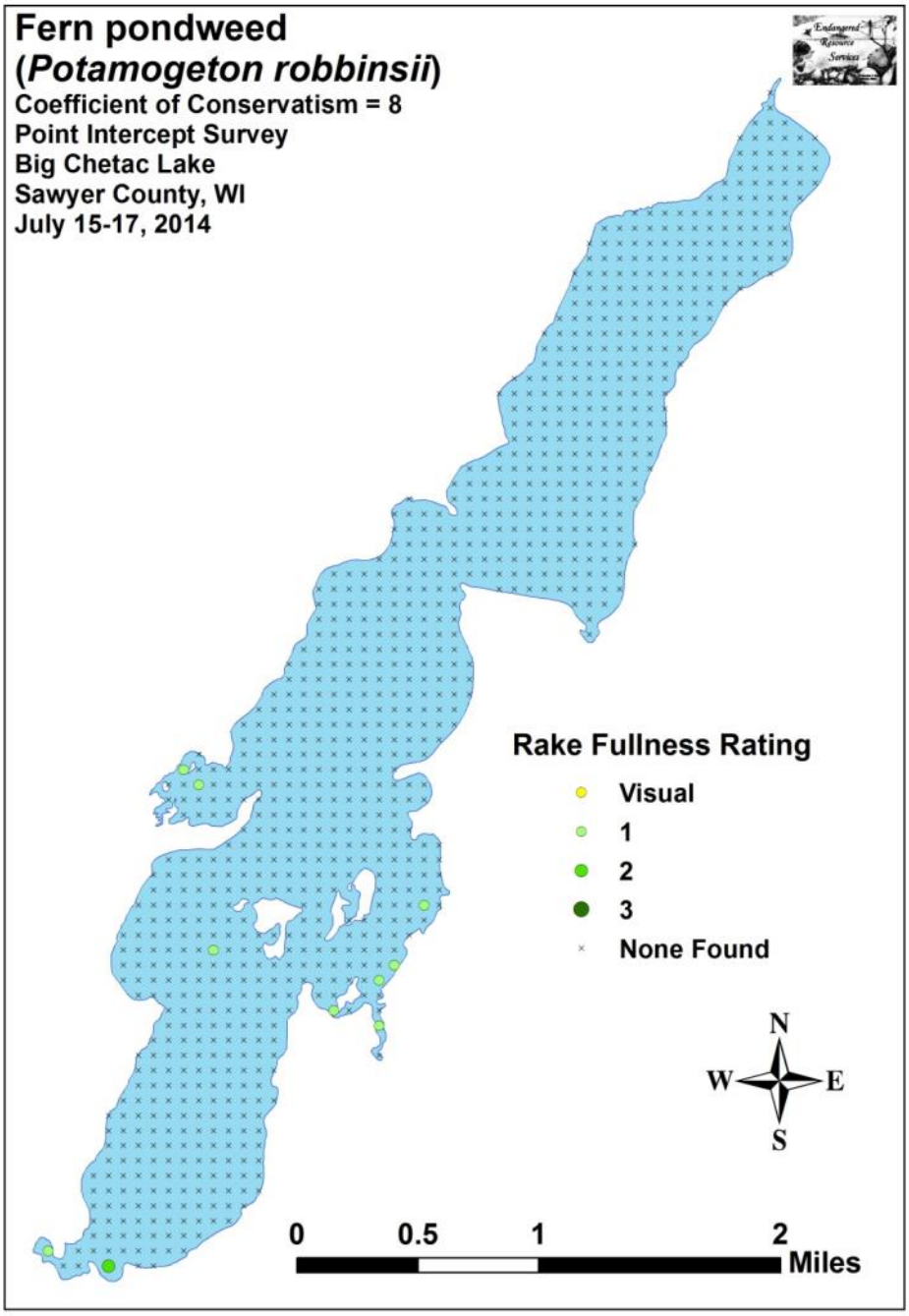
Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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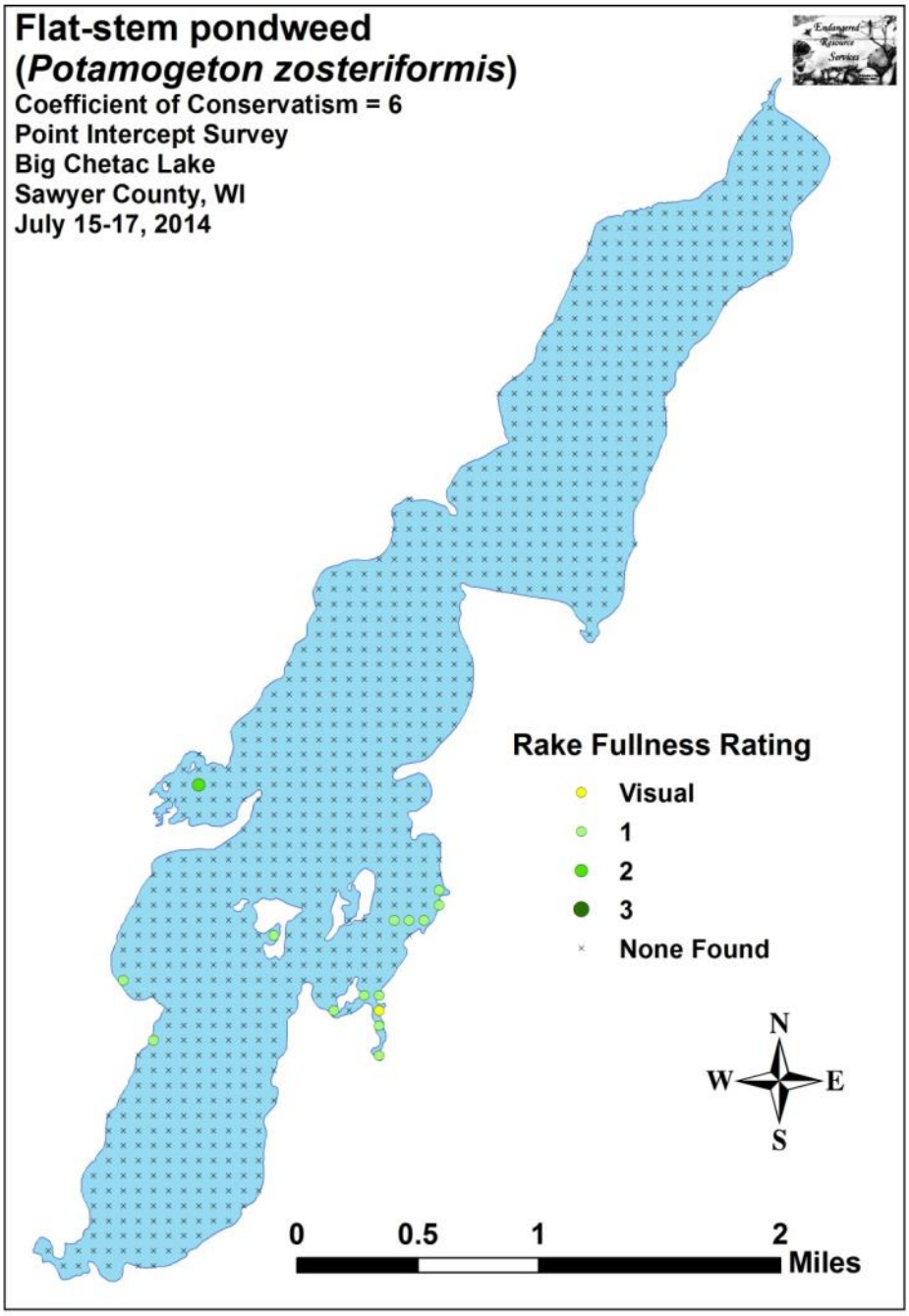
Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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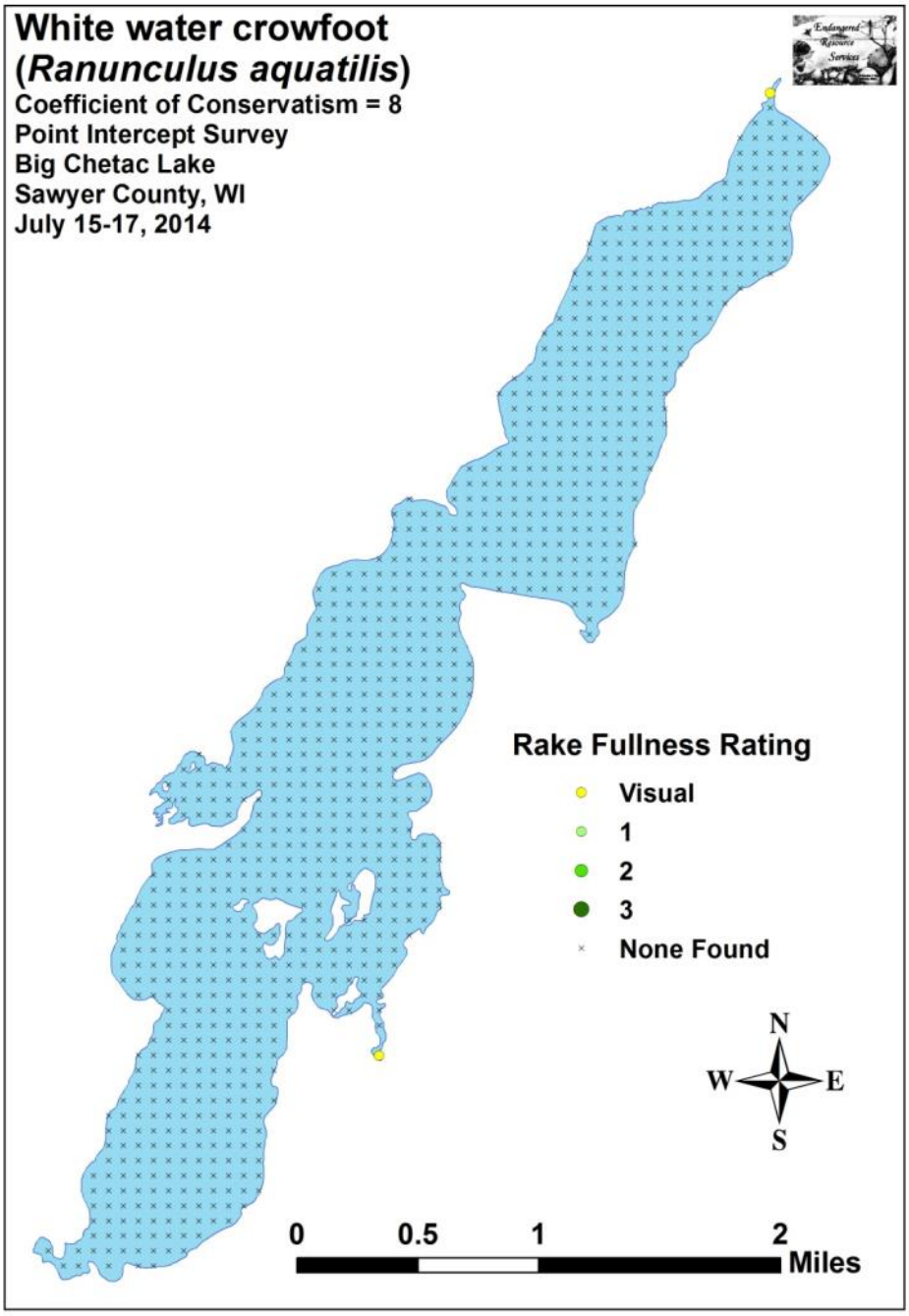
White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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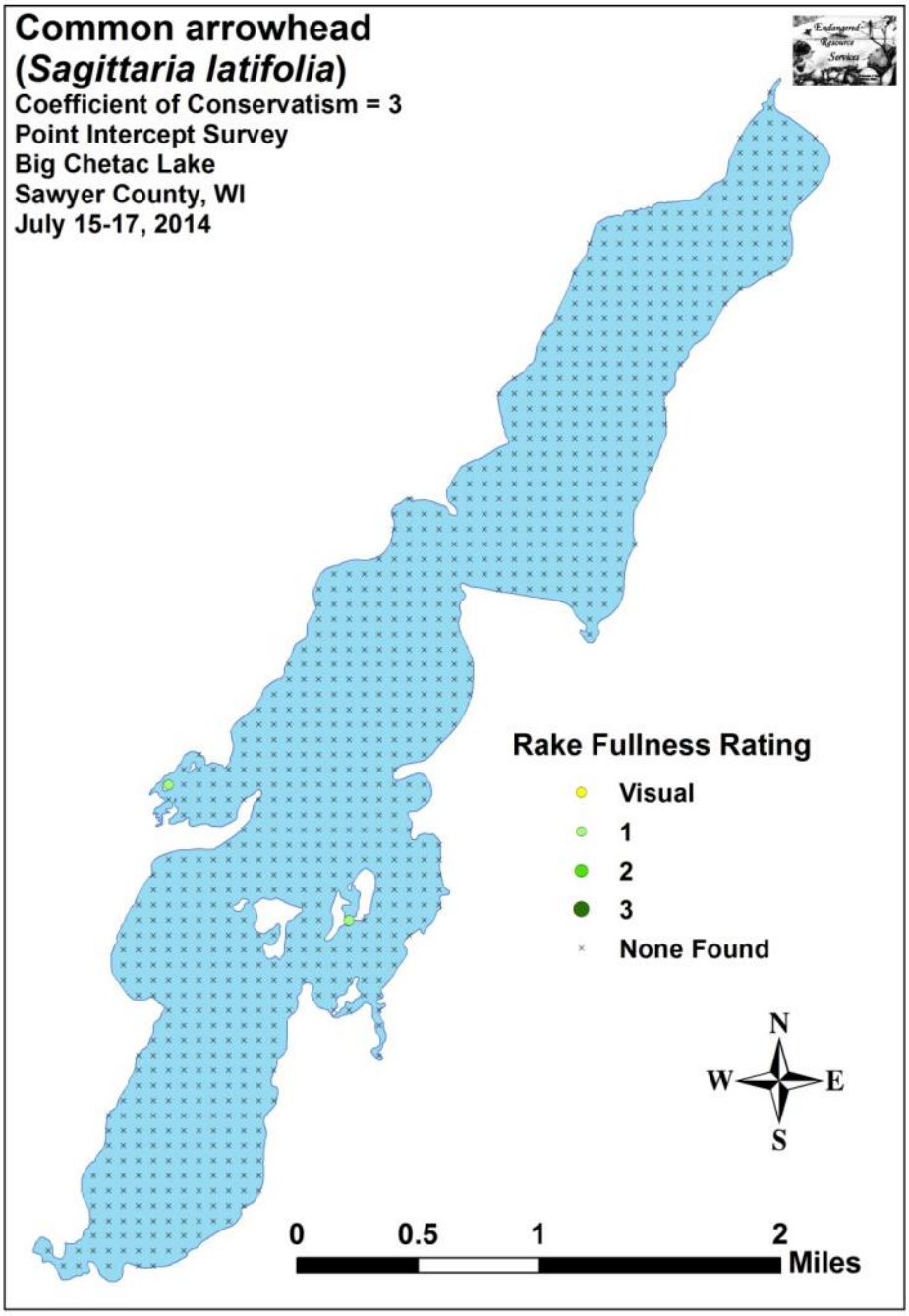
Common arrowhead
(Sagittaria latifolia)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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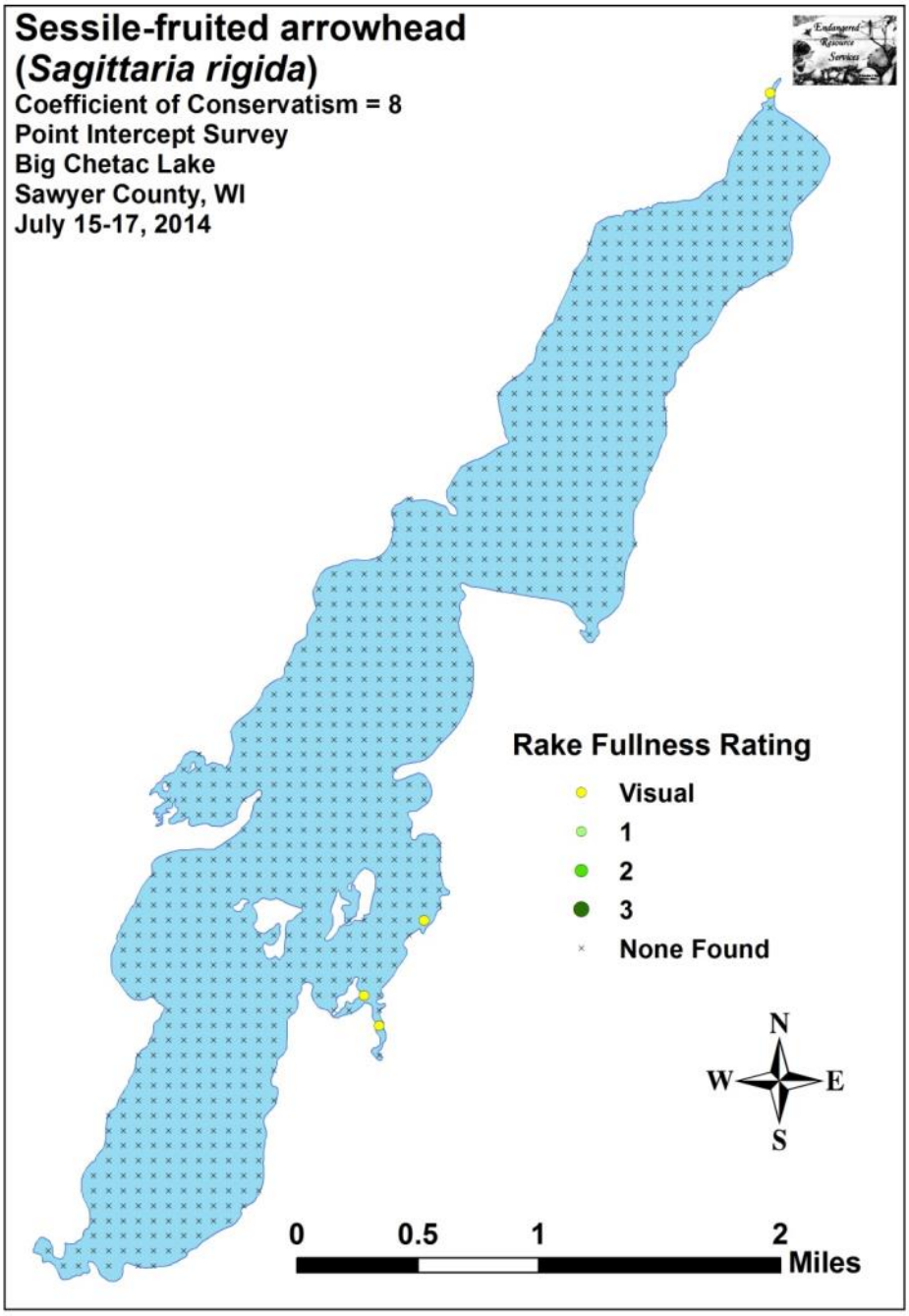
Sessile-fruited arrowhead
(Sagittaria rigida)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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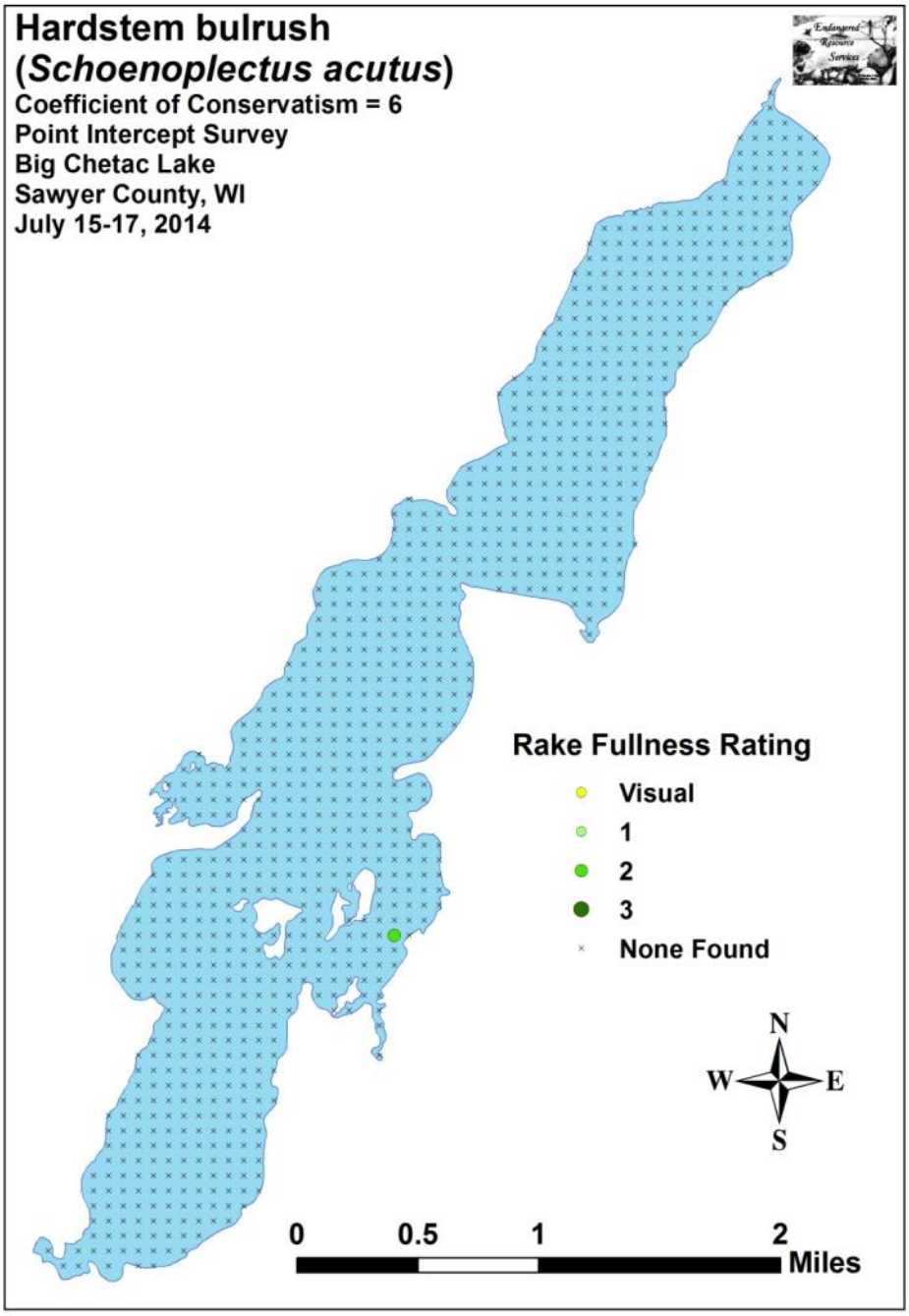
Hardstem bulrush
(Schoenoplectus acutus)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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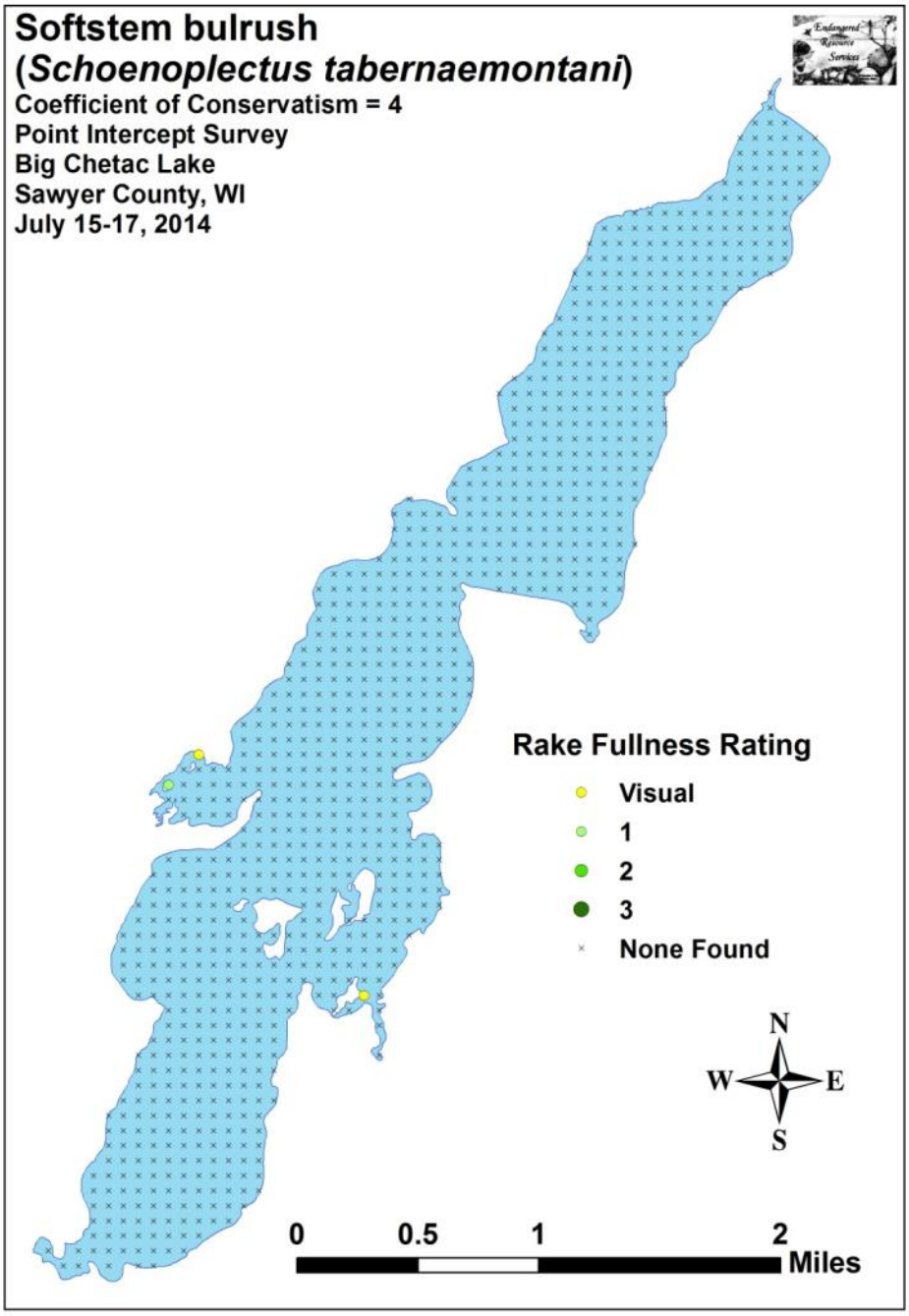
Softstem bulrush
(Schoenoplectus tabernaemontani)
Coefficient of Conservatism = 4
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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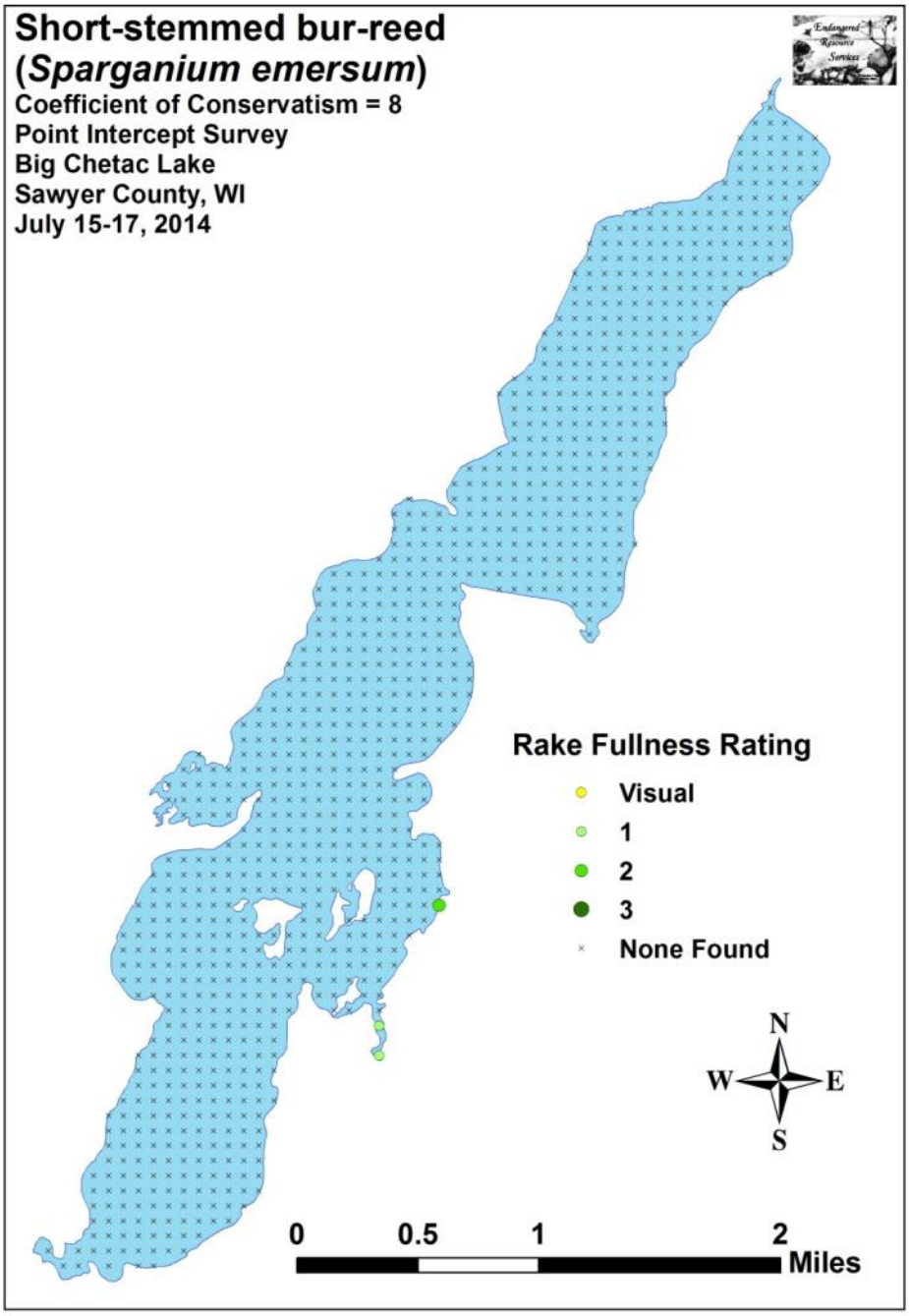
Short-stemmed bur-reed
(Sparganium emersum)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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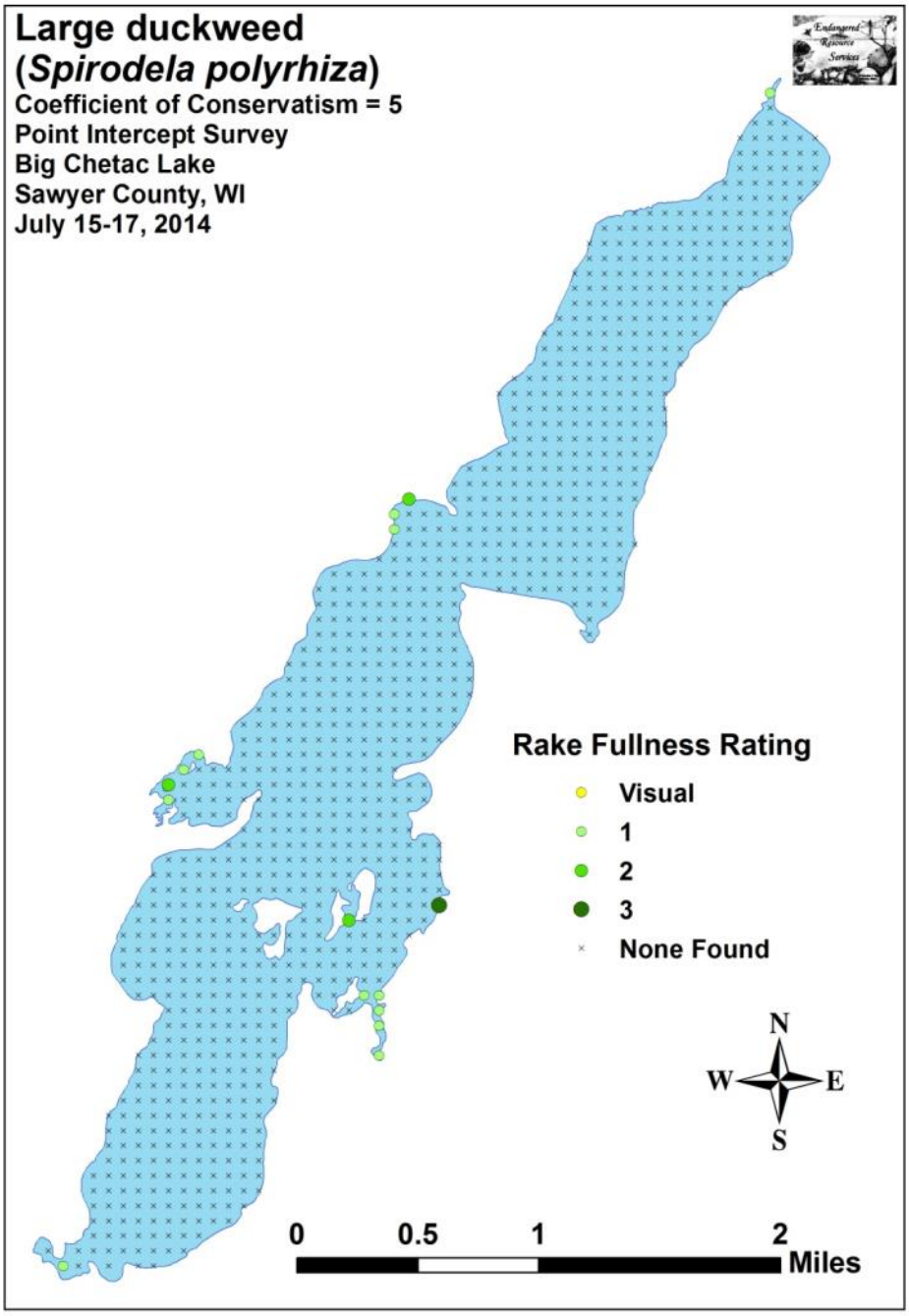
Large duckweed
(Spirodela polyrhiza)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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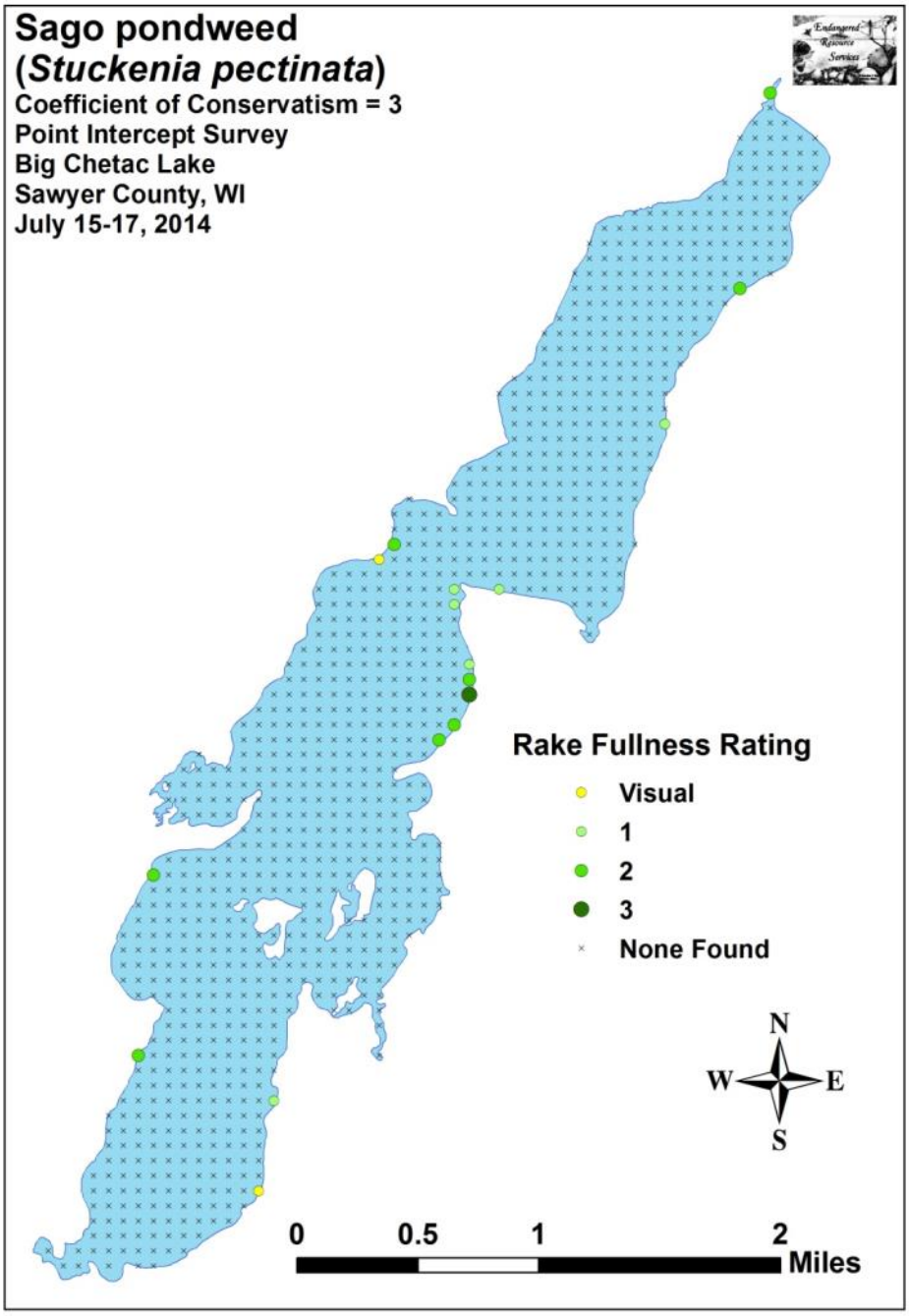
Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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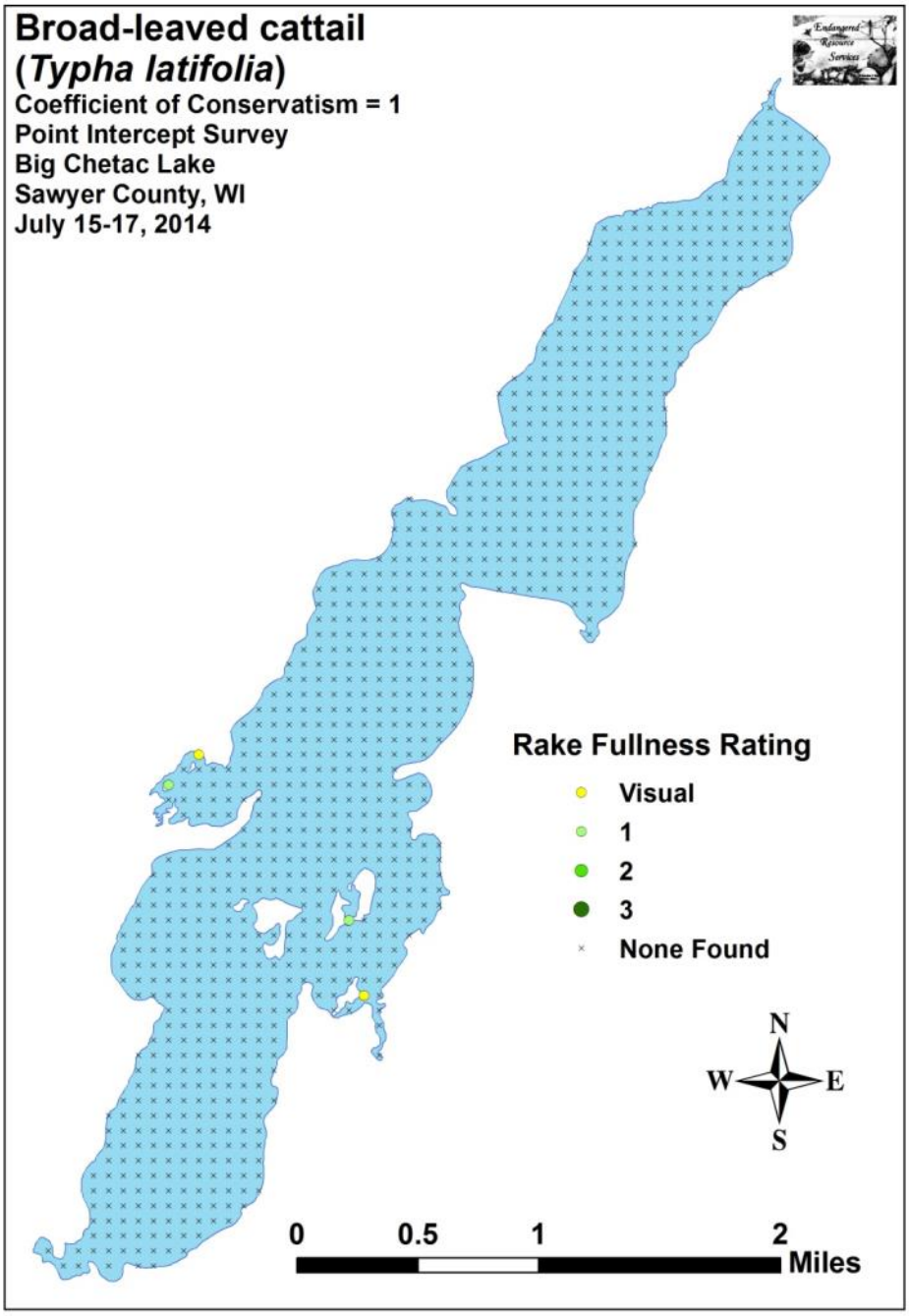
Broad-leaved cattail
(Typha latifolia)
Coefficient of Conservatism = 1
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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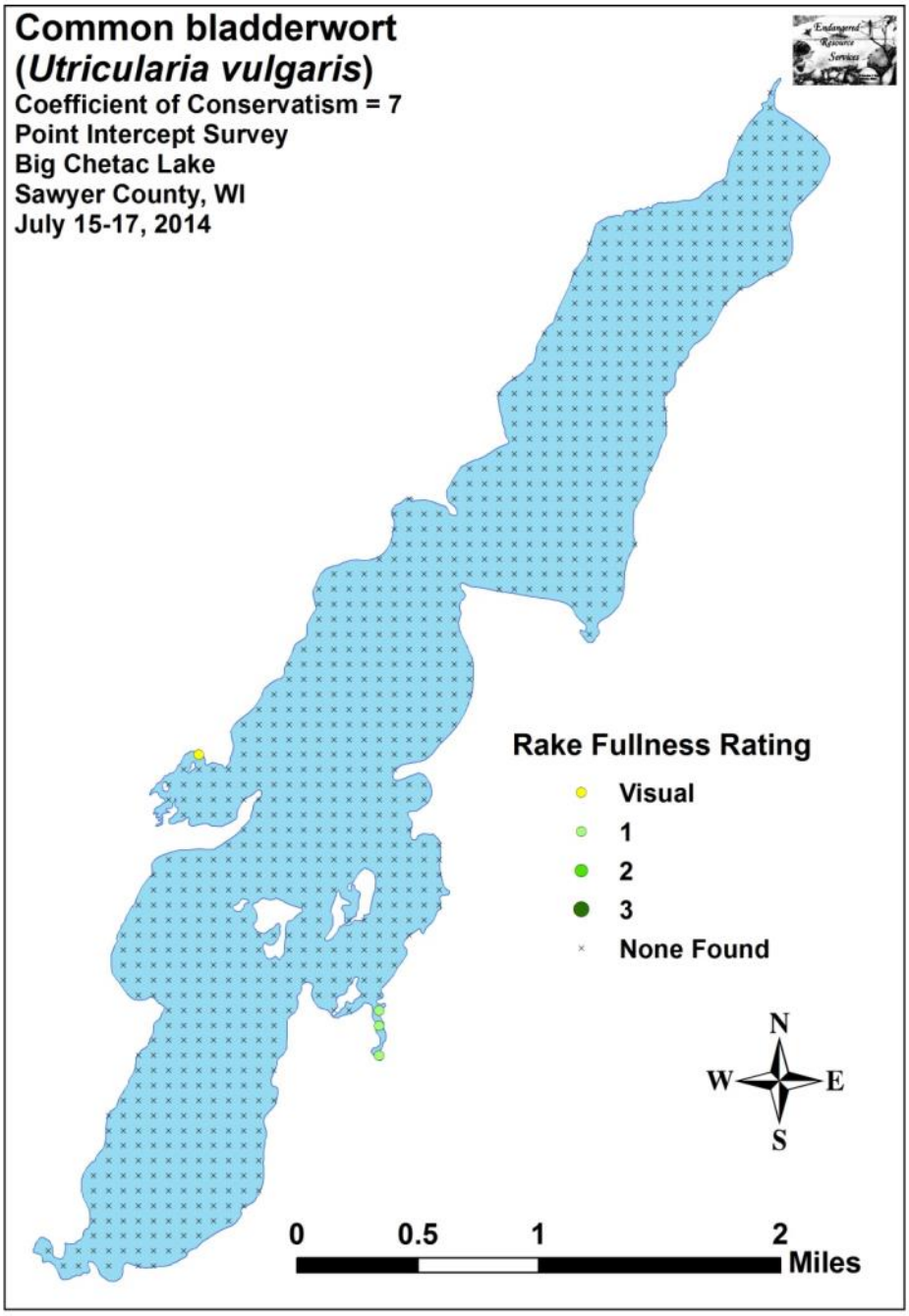
Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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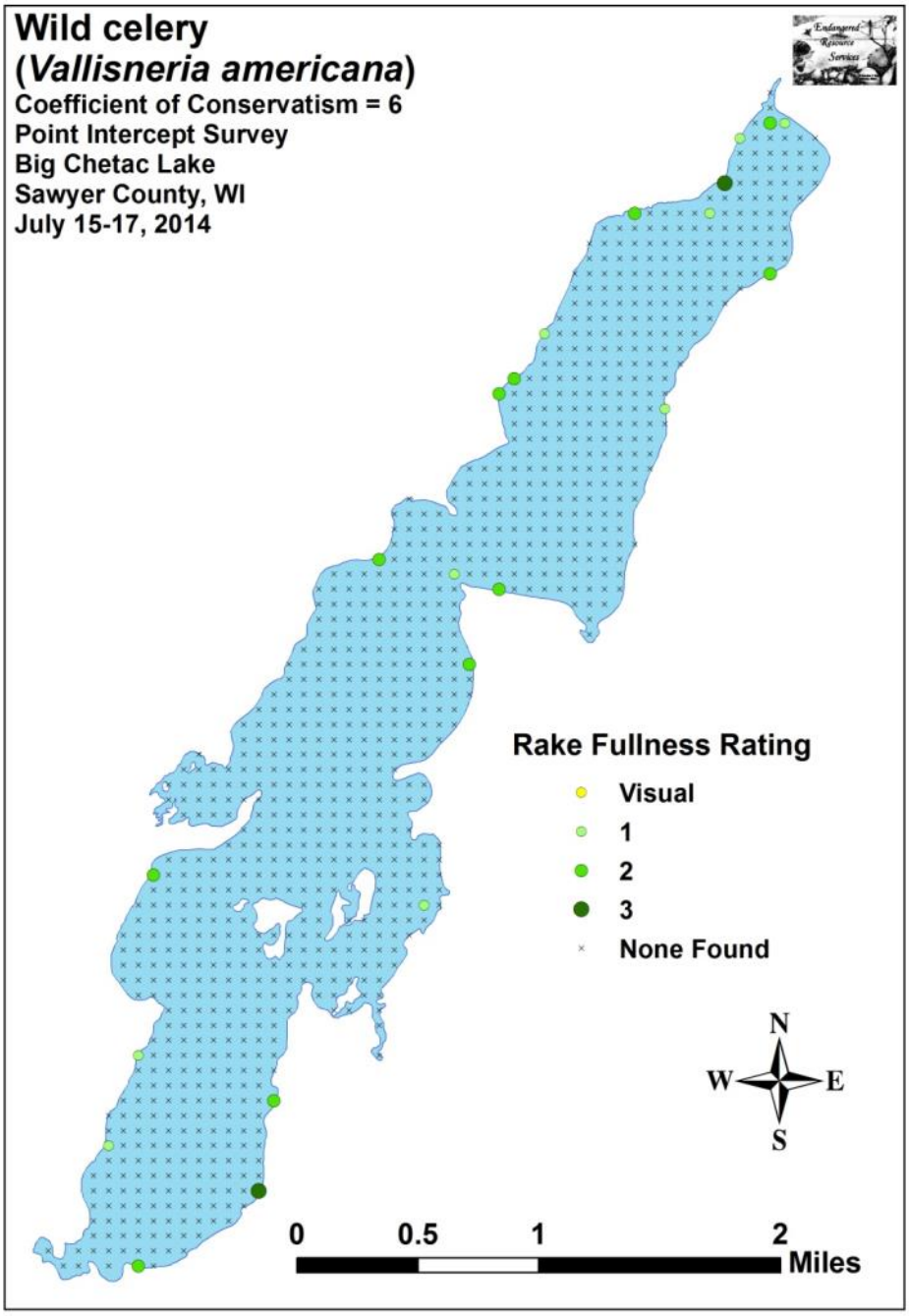
Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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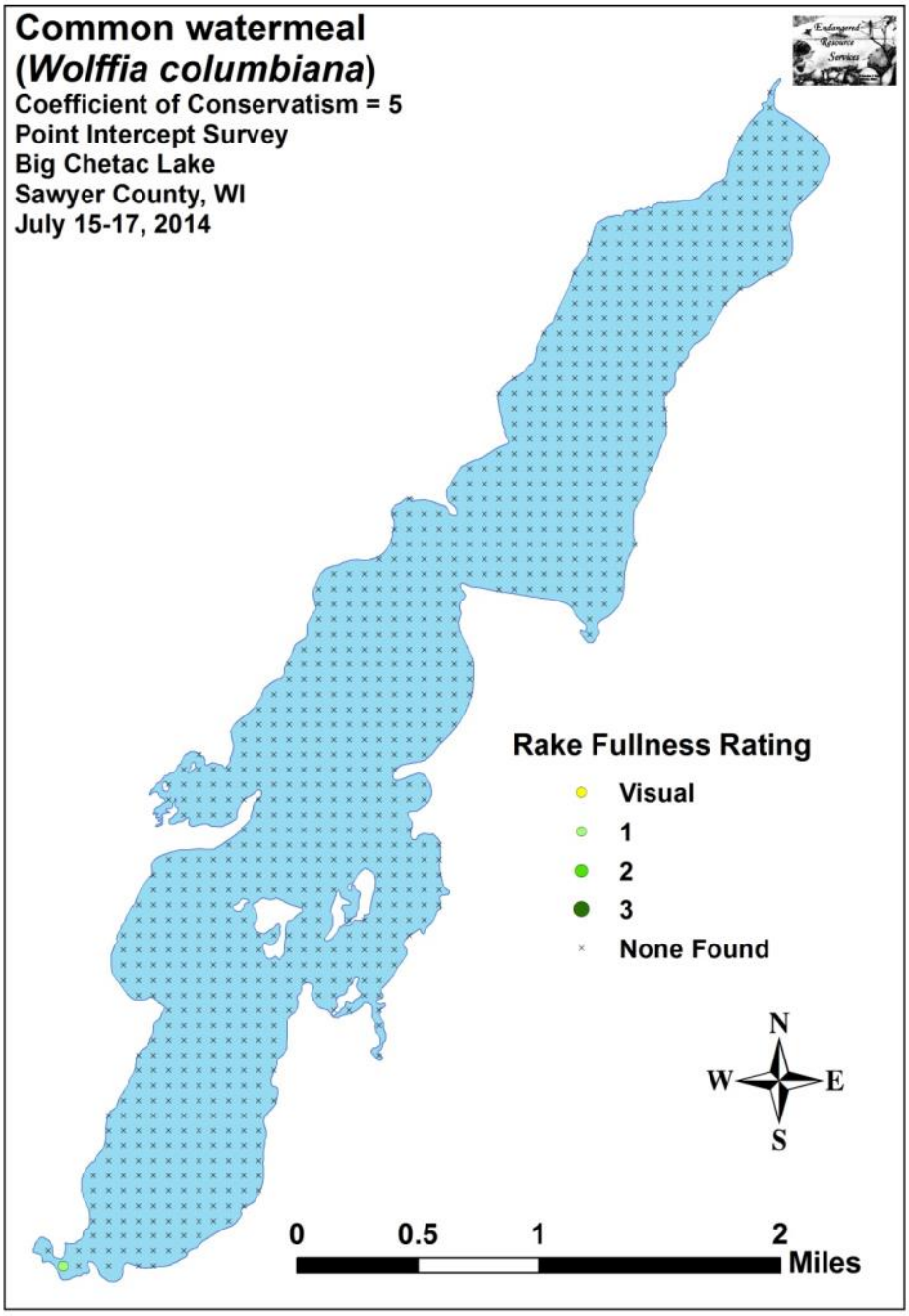
Common watermeal
(Wolffia columbiana)
Coefficient of Conservatism = 5
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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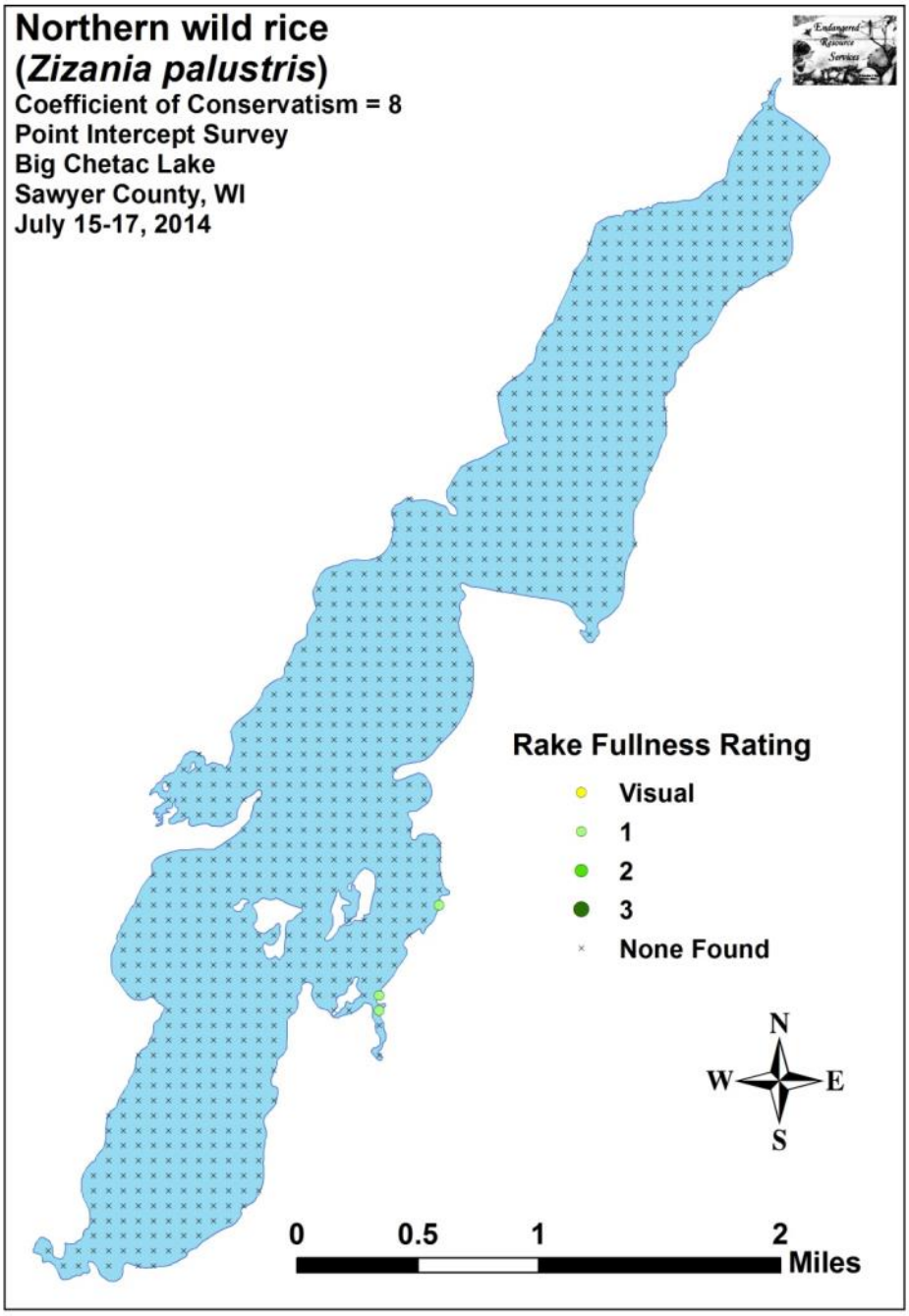
Northern wild rice
(Zizania palustris)
Coefficient of Conservatism = 8
Point Intercept Survey
Big Chetac Lake
Sawyer County, WI
July 15-17, 2014
Rake Fullness Rating
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Appendix X: Aquatic Exotic Invasive Plant Species Information

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, 2014 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, 2014 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, 2014 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, 2014 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: 2014 Raw Data Spreadsheets