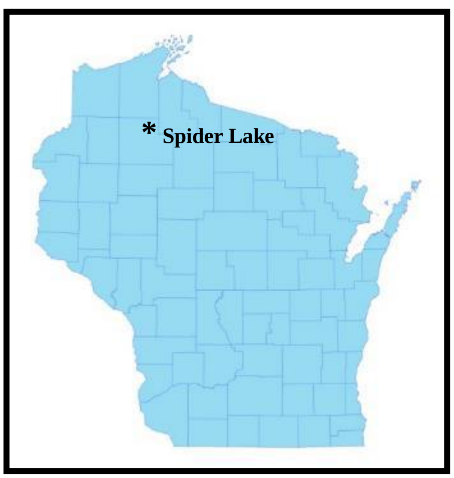
Curly-leaf pondweed (*Potamogeton crispus*) Point-intercept and Bed Mapping Surveys, and Warm-water Macrophyte Point-intercept Survey Spider Lake (Big and Little) – Spider Chain (WBIC: 2435700) - Sawyer County, WI

Spider Lake Aerial Photo (2015)

Yellow Iris Clusters – Little Spider 6/17/17

Project Initiated by:

Spider Chain of Lakes Association, and the
Wisconsin Department of Natural Resources



Hybrid Cattails along the Big Spider Lake Shoreline – 8/5/17

Surveys Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 15-17 and August 4-5, 2017

TABLE OF CONTENTS

ABSTRACT

Spider Lake (WBIC 2435700) is a 1,194-acre stratified drainage lake located in north-central Sawyer County, WI. In 2005, Curly-leaf pondweed (*Potamogeton crispus*) (CLP), an exotic invasive plant species, was discovered in the Spider Chain. After two initial herbicide treatments in 2010 and 2011, the Wisconsin Department of Natural Resources (WDNR) and the Spider Chain of Lakes Association (SCLA), under the direction of Dave Blumer (then Short, Elliot, Hendrickson, Inc. – now Lake Education and Planning Services, LLC), requested the original point-intercept surveys in 2012 as a prerequisite to developing the chain's initial Aquatic Plant Management Plan. As a prerequisite to updating this plan in 2018 and to compare how the lake's vegetation may have changed since the last point-intercept surveys, the SCLA and the WDNR authorized CLP density and bed mapping surveys from June 15-17th, and a full point-intercept survey for all aquatic macrophytes on August 4-5, 2017. In 2017, we mapped 31 CLP beds. Totaling 35.77 acres (3.0% coverage), they represented a 23.71 acre increase (+197%) over our 2012 bed mapping survey (26 beds – 12.06 acres – 1.0% coverage), and a 26.55 acre increase (+288%) over our 2013 survey (28 beds – 9.22 acres – 0.8% coverage). In addition to CLP, we found eight areas with clusters of Yellow iris (*Iris pseudacorus*), another exotic species, throughout Big and Little Spider. During the August 2017 full point-intercept survey, we found macrophytes growing at 499 points which approximated to 43.7% of the entire lake bottom and 70.8% of the 15.5ft littoral zone. This was a highly significant decline **($p<0.001$)** from the 2012 survey when we found plants growing at 612 points (53.6% of the bottom and 77.3% of the then 18.5ft littoral zone). Overall diversity was exceptionally high with a Simpson Index value of 0.94 – identical to 2012. Species richness was moderately high with 61 species found growing in and immediately adjacent to the water (up from 57 species in 2012). Despite this, the 2.89 native species/site with native vegetation represented a significant decline **($p=0.04$)** from the 3.08 species/site in 2012. Total rake fullness also experienced a highly significant decline **($p<0.001$)** from a moderate 2.02 in 2012 to 1.75 in 2017. Fern pondweed (*Potamogeton robbinsii*), Slender naiad (*Najas flexilis*), Common waterweed (*Elodea canadensis*), and Large-leaf pondweed (*Potamogeton amplifolius*) were the most common macrophyte species in 2017. They were found at 34.67%, 28.86%, 24.65%, and 24.25% of sites with vegetation, and accounted for 38.50% of the total relative frequency. In 2012, Common waterweed, Slender naiad, Fern pondweed, and Wild celery (*Vallisneria americana*) were the most common species (30.23%, 28.59%, 27.94%, and 24.84% of survey points with vegetation /36.06% of the total relative frequency). Lakewide, from 2012-2017, 13 species showed significant changes in distribution: Coontail (*Ceratophyllum demersum*), White-stem pondweed (*Potamogeton praelongus*), and Clasping-leaf pondweed (*Potamogeton richardsonii*) suffered highly significant declines; Common waterweed, Variable pondweed (*Potamogeton gramineus*), and Water star-grass (*Heteranthera dubia*) experienced moderately significant declines; and Wild celery, Needle spikerush (*Eleocharis acicularis*), Stiff pondweed (*Potamogeton strictifolius*), and Creeping spearwort (*Ranunculus flammula*) demonstrated significant declines. Conversely, Small pondweed (*Potamogeton pusillus*) and Illinois pondweed (*Potamogeton illinoensis*) showed highly significant increases; and Spatterdock (*Nuphar variegata*) saw a moderately significant increase. In addition to these changes in distribution, several important habitat-producing species also saw significant changes in density: Common waterweed and Wild celery experienced moderately significant declines in mean rake fullness **($p=0.006/0.008$)**, and Fern pondweed and Nitella (*Nitella* sp.) suffered highly significant declines **($p<0.001$)**. The 47 native index species found in the rake during the August 2017 survey (down from 50 in 2012) produced an above average mean Coefficient of Conservatism of 7.0 (identical to 2012). The Floristic Quality Index of 47.7 (down from 49.6 in 2012) was also well above the median FQI for this part of the state. Filamentous algae were present at six points with a mean rake of 1.50 (up from two points with a mean rake of 1.50 in 2012). Late summer CLP was still present at 15 points with a mean rake fullness of 1.00 (similar to 2012's 13 points and mean rake of 1.00). In addition to CLP and Yellow iris, other exotic species found included Purple loosestrife (*Lythrum salicaria*) and Hybrid cattail (*Typha* X *glauca*). Working to limit algal and CLP growth by reducing nutrient inputs along the lakeshore; taking a cautious and limited approach to active CLP management; and manually removing Purple loosestrife and Yellow iris anywhere they are found are management ideas for the SCLA to consider as they work to update their Aquatic Plant Management Plan.

LIST OF FIGURES

Page

LIST OF TABLES

Page

INTRODUCTION:

Spider Lake (WBIC 2435700) is a 1,194-acre stratified drainage lake located in the Town of Spider Lake in north-central Sawyer County (T42N R7W). The lake reaches a maximum depth of 64ft in the deep hole in Big Spider just north of the channel to Little Spider, and it has an average depth of approximately 14ft (Figure 1). The lake is mesotrophic in nature with Secchi readings from 1989-2017 averaging 11.3ft in Big Spider and 10.5ft in Little Spider (WDNR 2017). This good water clarity produced a littoral zone that reached 16.5ft in 2017. The lake's bottom substrate is predominantly sandy/marly muck in Little Spider and nutrient-rich organic muck in Big Spider. Most sand and gravel areas occur along the shoreline, on midlake bars, and around the lake's numerous islands (Roth et al. 1969).

Figure 1: Spider Chain Aerial Photo

BACKGROUND AND STUDY RATIONALE:

The Spider Chain of Lakes Association (SCLA) has historically conducted aquatic plants surveys as a way of documenting the lakes' long-term health. The surveys also provide an opportunity to look for new exotic invasive species such as Eurasian water-milfoil (*Myriophyllum spicatum*) – a species which has invaded many other lakes in the Hayward area, but has never been found in the Spider Chain. Curly-leaf pondweed (*Potamogeton crispus*) (CLP), another exotic species, was first documented in the Spider Lakes in 2005 (WDNR 2017). Herbicides were initially applied to CLP beds in 2010 and 2011, and the SCLA), under the direction of Dave Blumer (then Short, Elliot, Hendrickson, Inc. – now Lake Education and Planning Services, LLC), and the Wisconsin Department of Natural Resources (WDNR) authorized the first CLP and full point-intercept surveys on the chain in 2012 to develop both a better understanding of the level of infestation as well as to gather baseline information on the lakes' native plants. These surveys found CLP was largely confined to Big Spider with a single small bed found in Little Spider. Fortunately, at that time, no CLP was found in Clear, Fawn, or North Lakes. The data from these surveys was used to develop an initial WDNR approved Aquatic Plant Management Plan (APMP) which outlined the further use of herbicides to control CLP. However, because the initial applications produced little change in CLP coverage and because the cost to expand the program was deemed too expensive, the SCLA decided to abandon herbicide treatments altogether and take a wait-and-see approach.

Per WDNR expectations, plant surveys are normally repeated every five to seven years to remain current (Pamela Toshner/Alex Smith, WDNR – pers. comm.). In anticipation of updating their plan in 2018, the SCLA and WDNR authorized three lakewide surveys on Spider Lake in 2017. From June 15-17th, we conducted an early-season CLP point-intercept survey and a littoral zone CLP bed mapping survey, and on August 4-5th we completed a warm-water point-intercept survey of all macrophytes. The surveys' objectives were to document the current levels of CLP; determine if Eurasian water-milfoil or any other new exotic plants had invaded the lake; and to compare data from the original 2012 surveys with the 2017 data to identify any significant changes in the lake's vegetation over this time. This report is the summary analysis of these three field surveys.

METHODS:

Curly-leaf Pondweed Point-intercept Survey:

Using a standard formula that takes into account the shoreline shape and distance, water clarity, depth, islands, and total acreage, Michelle Nault (WDNR) generated the original 1,143 point sampling grid for Spider Lake (Appendix I) in 2012. Using this same grid in 2017, we completed a density survey where we sampled for Curly-leaf pondweed at each littoral point in the lake. We located survey points 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.

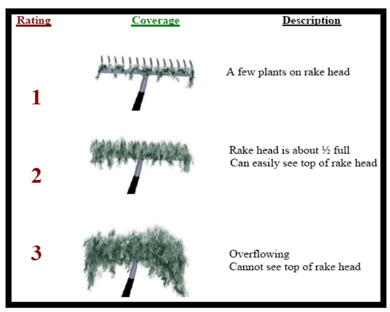


Figure 2: Rake Fullness Ratings (UWEX 2010)

Curly-leaf Pondweed Bed Mapping Survey:

During the bed mapping survey, we searched the lake's visible littoral zone. By definition, a "bed" was determined to be any area where we visually estimated that CLP made up >50% of the area's plants, was generally continuous with clearly defined borders, and was canopied, or close enough to being canopied that it would likely interfere with boat traffic. After we located a bed, we motored around the perimeter of the area taking GPS coordinates at regular intervals. 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 or narrow enough to motor through/**minor** – one prop clear to get through or access open water/**moderate** – several prop clears needed to navigate through/**severe** – multiple prop clears and difficult to impossible to row through). These data were then mapped using ArcMap 9.3.1, and we used the WDNR's Forestry Tools Extension to determine the acreage of each bed to the nearest hundredth of an acre (Table 1).

Warm-water Full Point-intercept Macrophyte Survey:

Prior to beginning the August point-intercept survey, we conducted a general boat survey to regain familiarity with the lake's macrophytes (Appendix II). All plants found were identified (Voss 1996, Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2012; Skawinski 2014), and a datasheet was built from the species present. We again located each survey point with a GPS, recorded a depth reading with a metered pole or handheld 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. We use a 20ft pole rake and a 35ft 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 frequencies 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. Spider Lake is in the Northern Lakes and 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 2012 and 2017 Curly-leaf pondweed and warm-water point-intercept surveys (Figures 4 and 14) (Tables 3 and 4) to see if there were any significant changes in the lake's vegetation. For individual plant species as well as count data, we used the Chi-square analysis on the WDNR Pre/Post survey worksheet. For comparing averages (mean species/point and mean rake fullness/point), we used t-tests. Differences were considered significant at $p<0.05$, moderately significant at $p<0.01$ and highly significant at $p<0.001$ (UWEX 2010). It should be noted that we used the number of littoral points as the basis for "sample points" when comparing both the early-season (740 in 2012/726 in 2017) and the warm-water surveys (792 in 2012/705 in 2017).

RESULTS:

Curly-leaf Pondweed Point-intercept Survey:

The April 2012 Curly-leaf pondweed survey found CLP at 53 sites which approximated to 4.6% of the entire lake and 7.2% of the then 17.0ft spring littoral zone. Of these, we recorded a rake fullness value of 3 at six points, a 2 at 16 points, and a value of 1 at 31 points for a mean rake fullness of 1.53. We didn't record CLP as a visual at any point (Figure 3) (Appendix III). The combined 22 points with a rake fullness of 2 or 3 extrapolated to 1.9% of the entire lake and 3.0% of the littoral zone having a significant infestation.

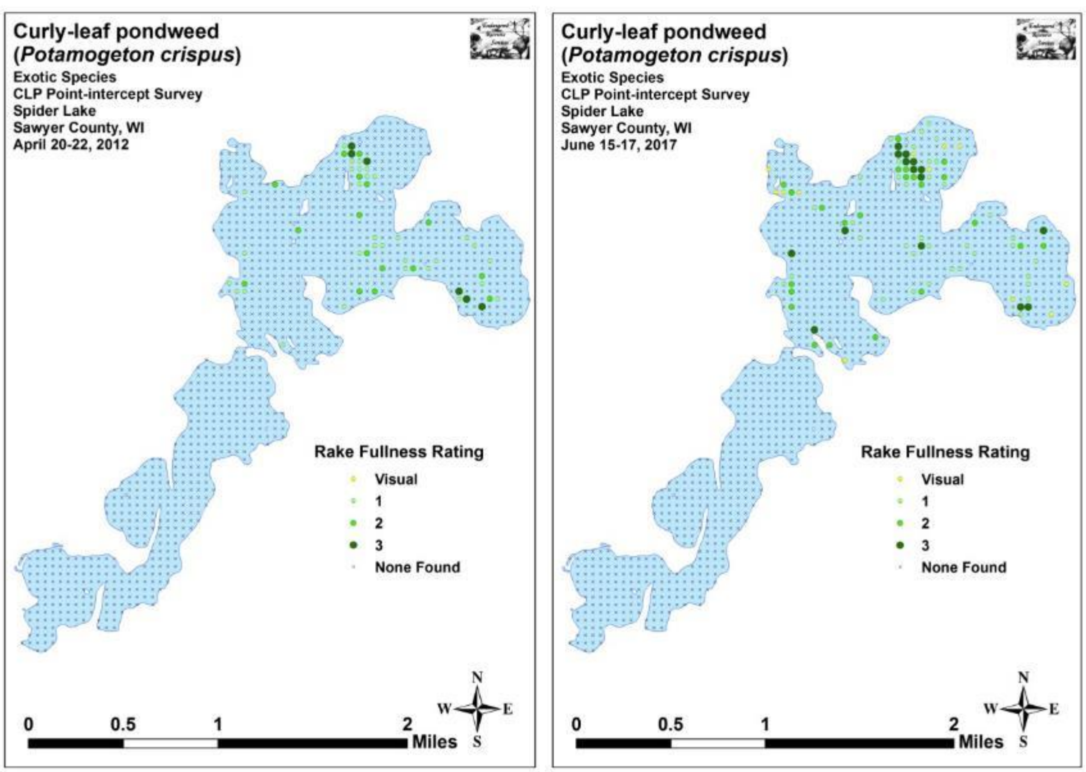
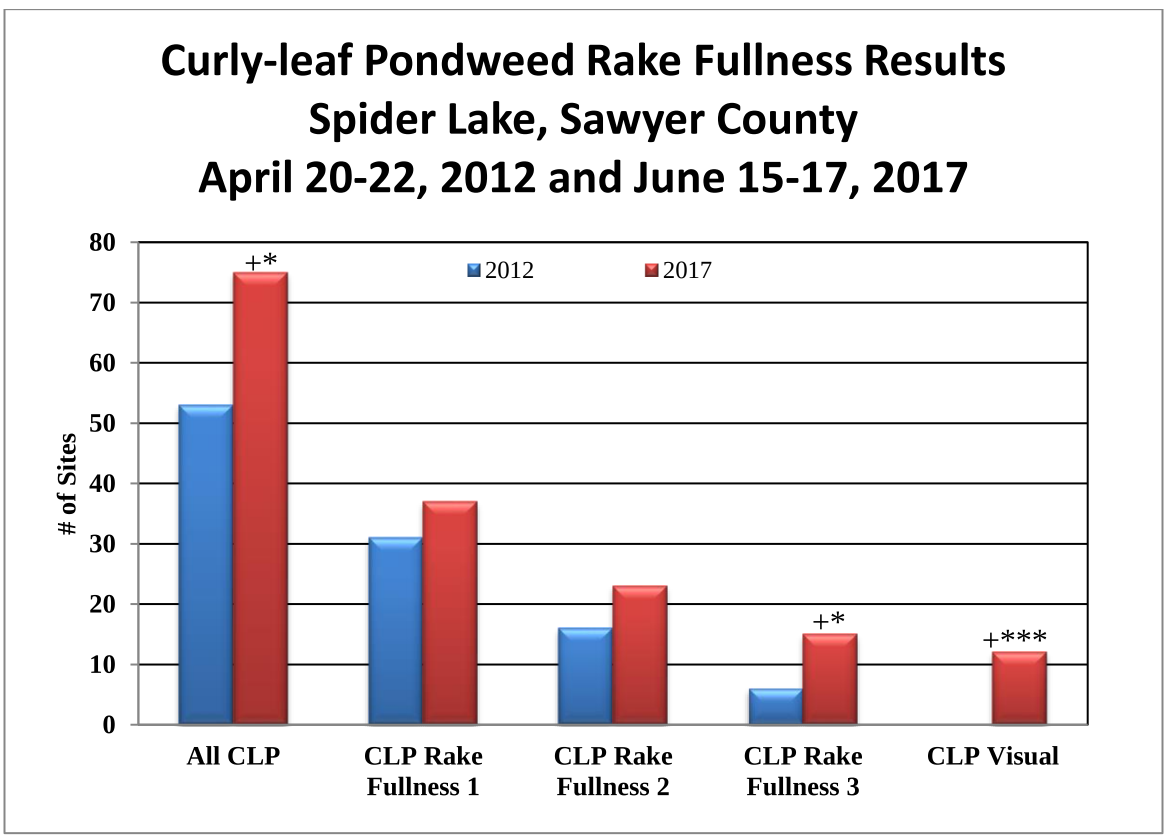


Figure 3: 2012 and 2017 Early-season Curly-leaf Pondweed Density and Distribution

In 2017, because Curly-leaf pondweed was found growing to 16.5ft (down slightly from 17.0ft in 2012), we rake sampled every point in the lake <20ft during the early-season point-intercept survey. CLP was present at 75 points which approximated to 6.6% of the entire lake and 10.3% of the 2017 spring littoral zone. Of these, we recorded a rake fullness value of 3 at 15 points, a 2 at 23 points, and a 1 at 37 points for a mean rake fullness of 1.71. We also noted CLP as a visual at 12 points (Figure 3) (Appendix III). The combined 38 points with a rake fullness of a 2 or a 3 extrapolated to 3.3% of the entire lake and 5.2% of the spring littoral zone having a significant infestation.

Comparison of Curly-leaf Pondweed in 2012 and 2017:

Collectively, from 2012-2017, there was a 41.5% increase in total CLP coverage as well as a 72.7% increase in areas where the infestation was significant enough to likely be considered a nuisance. When comparing the individual rake samples from the two surveys, our results suggested there was a significant increase in total CLP **(p=0.03)** as well as rake fullness 3 **(p=0.04)**. There was also a highly significant increase in visual sightings **(p<0.001)**; however, the increase in the combined mean rake fullness was not significant (p=0.09) (Figure 4). It should be noted that, in 2012, it was requested that we conduct the Curly-leaf pondweed survey in April with the idea that the results would aid in determining if/where a chemical treatment might occur. **The extremely early date for the original survey undoubtedly explains at least some of the increases we documented in both CLP's density and distribution.**



Significant differences = * p<0.05, ** p<0.01, *** p<0.001

Figure 4: 2012 and 2017 Changes in Early-season CLP Rake Fullness

In addition to Curly-leaf pondweed, we also found eight areas with clusters of Yellow iris (*Iris pseudacorus*) (Figure 5). This exotic invasive species was not seen anywhere on the lake during the original 2012 surveys suggesting it is a recent introduction. Unfortunately, we found that it is now well-established throughout both Big and Little Spider; and it appears to be spreading rapidly as most large clusters had satellite plants radiating out in all directions. An attractive species, we noticed that many shoreline owners – not understanding its potential to invade native wetlands – were mowing around the plant rather than removing it (Appendix III).

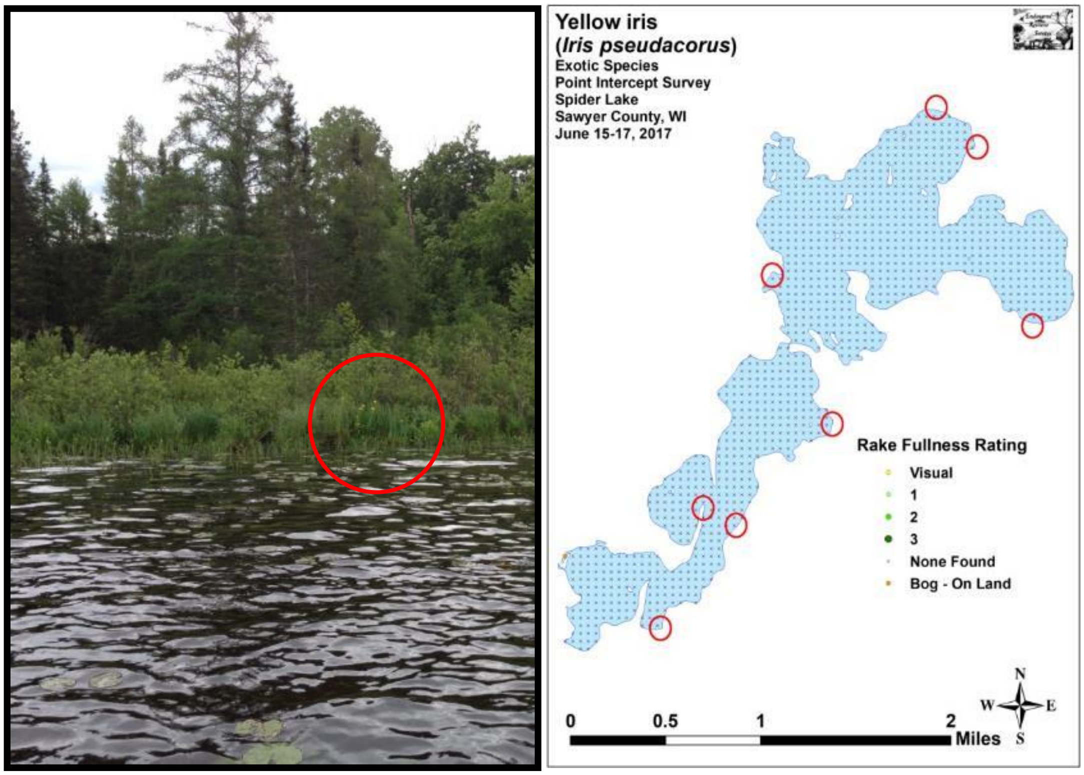


Figure 5: 2017 Early-season Yellow Iris Density and Distribution

Curly-leaf Pondweed Bed Mapping Survey:

In 2012, when we returned to Spider Lake on May 28th and June 3rd to map Curly-leaf pondweed beds, we found that searching Big Spider's 10ft bathymetric ring in areas over organic muck consistently produced CLP plants that were either canopied or nearing canopy. However, we were left with the opinion that, despite being an exotic species, CLP was seldom invasive to the point that it impeded navigation or excluded native vegetation. For the most part, CLP was acting like "just another plant" interspersed among other native species. Ultimately, we located and mapped 26 small areas that met the bed criteria or were at least close to it (Figure 6). The biggest (Bed 23) was 4.23 acres, and only two others (Bed 2 and 21) were over an acre (Table 1). Collectively, they covered 12.06 acres and accounted for 1.0% of the lake's approximately 1,194 total acres (Appendix IV).

The 2013 survey found similar results with 28 beds totaling 9.22 acres (0.8% coverage) (Table 1) (Figure 6). Bed 23 was again the biggest (2.57 acres), and only one other (Bed 21 – 1.59 acres) was over an acre. As there was no active management on the lake in 2013, the decline in total acreage (**-23.55%**) from 2012 can be attributed to simple variations based on changes in annual growing conditions.

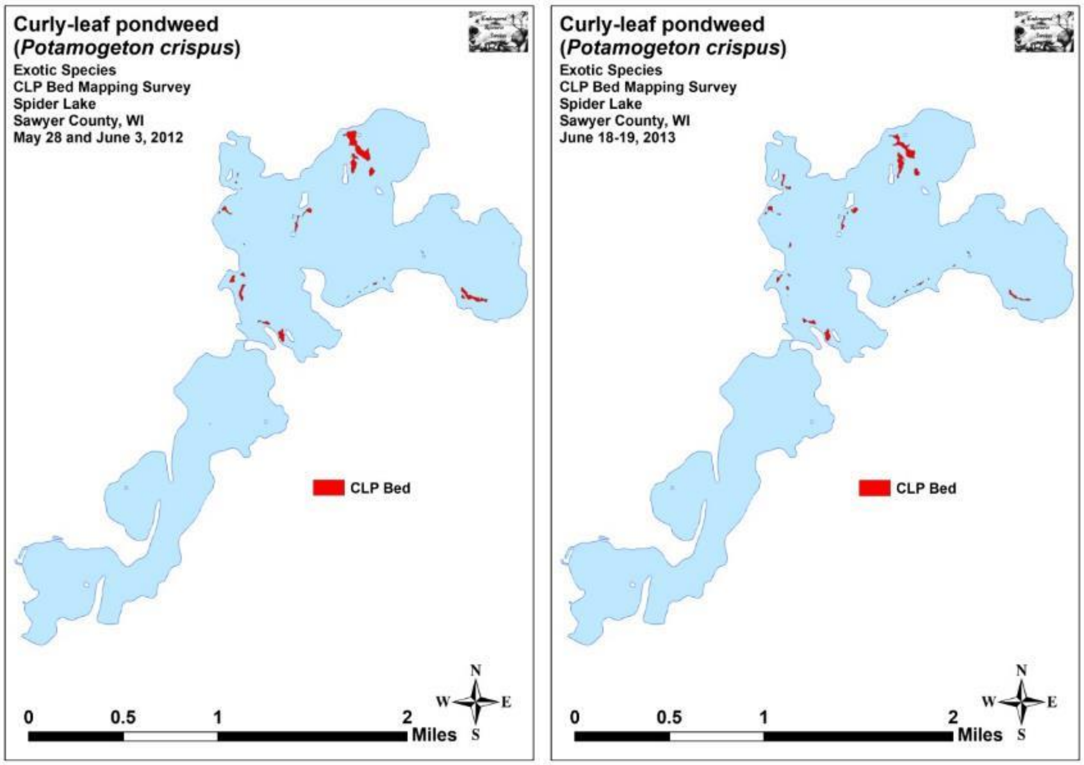


Figure 6: 2012 and 2013 Spring Curly-leaf Pondweed Beds

The spring of 2017 brought near record early ice-out in late March and early April followed by prolonged cool weather that kept lake temperatures in the 40's and 50's through May. These conditions appeared to benefit Curly-leaf pondweed, and we found exceptionally high levels on many of the lakes we surveyed. This was definitely the case on Spider Lake where we mapped 31 beds totaling 35.77 acres (3.0% of the lake's surface area) (Table 1). This represented a 23.71 acre increase (+197%) over our 2012 bed mapping survey, and a 26.55 acre increase (+288%) over our 2013 survey (Figure 7) (Appendix IV).

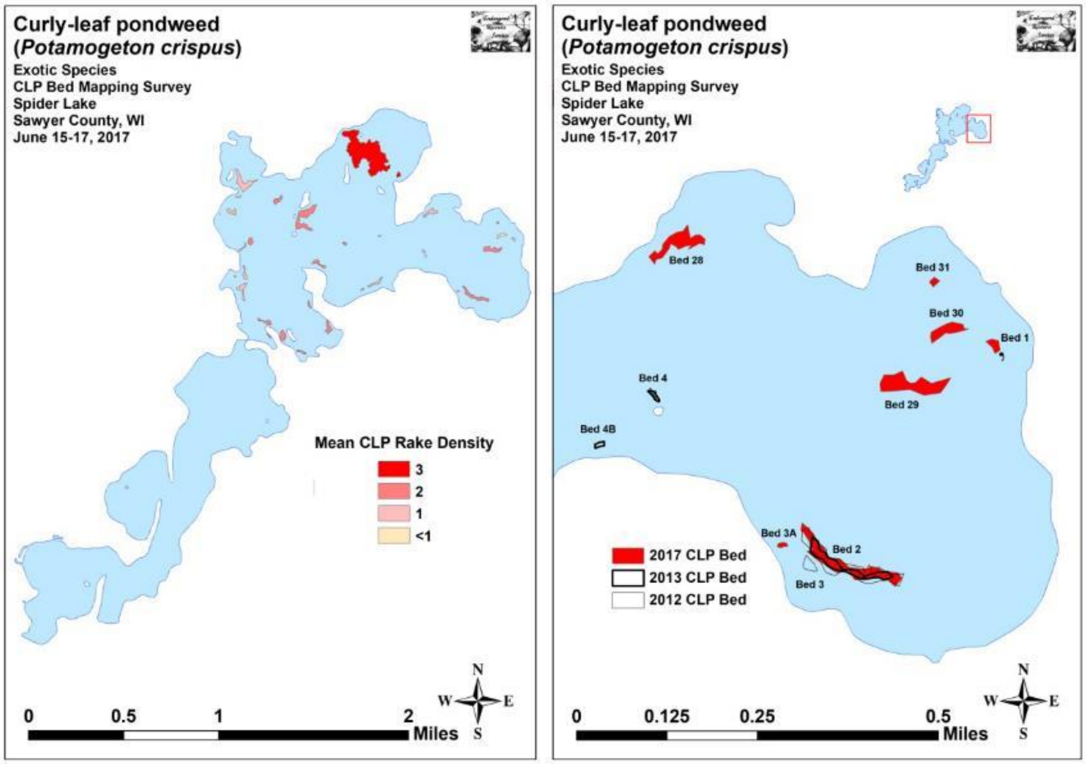


Figure 7: 2017 Spring Curly-leaf Pondweed Beds/CLP Beds 1-4B and 28-31

Descriptions of Past and Present Curly-leaf Pondweed Beds:

Bed 1 – More of a high density area than a true bed, CLP in Bed 1 was mixed with many high-value native pondweeds. Specifically, we noted several broad-leaved habitat-producing species like Large-leaf pondweed (*Potamogeton amplifolius*), Illinois pondweed (*Potamogeton illinoensis*), White-stem pondweed (*Potamogeton praelongus*), and Clasping-leaf pondweed (*Potamogeton richardsonii*) were especially common in this part of East Bay (Figure 7).

Bed 2 – One of the largest beds on the lake, CLP was easily the dominant species in its preferred 7-11ft depth range; however, outside of this microhabitat, CLP became increasingly less dense. Regardless of the depth, native plants, including many species of pondweed, were mixed in throughout the area. Although the CLP was moderately dense, the narrowness of the bed likely meant it was only a minor impairment to watercraft navigation.

Beds 3 and 3A – We found CLP scattered throughout this part of the bay, but the area formerly covered by Bed 3 didn't have continuous CLP. Just north of this area, a canopied patch was dense enough to be mapped; however, due to its small size, it was unlikely to have much impact on navigation.

Beds 4 and 4B – The areas formerly covered by these beds had only a handful of scattered CLP plants.

Beds 5-9B – This bay had continuous low density Curly-leaf pondweed that followed the 10ft depth contour. In from this depth, CLP became very fragmented; and, in the case of Beds 5, 9, and 9B, there were so few plants that it wasn't possible to delineate a border (Figure 8).

Beds 9C, 9D, 9E, and 9F – Each of these areas had CLP during the 2012 and 2013 surveys; but at that time plants were few in number, scattered, and not canopied making it impossible to map them. In 2017, CLP dominated the 7-12ft bathy ring around the bay; however, because the bottom drops off so rapidly and there was little habitat for CLP to grow in, these narrow beds likely caused little or no navigation impairment.

Bed 10 – Bed 10 was again established over muck in the channel on the south side of the island. Unlike most other beds in the lake, CLP at this location was nearly monotypic.

Beds 11 and 11A – These beds were established in a relatively narrow band in 8-12ft over sandy muck that had scattered rock mixed in. As expected in this type of low-nutrient habitat, CLP was not dense and often patchy which likely made it a non-issue in regards to navigation.

Beds 12-14 – The "beds" in this bay were more high density areas than true beds as the CLP was often patchy and only sporadically canopied. High-value native pondweeds, especially Large-leaf pondweed and White-stem pondweed, were common throughout the area (Figure 8).

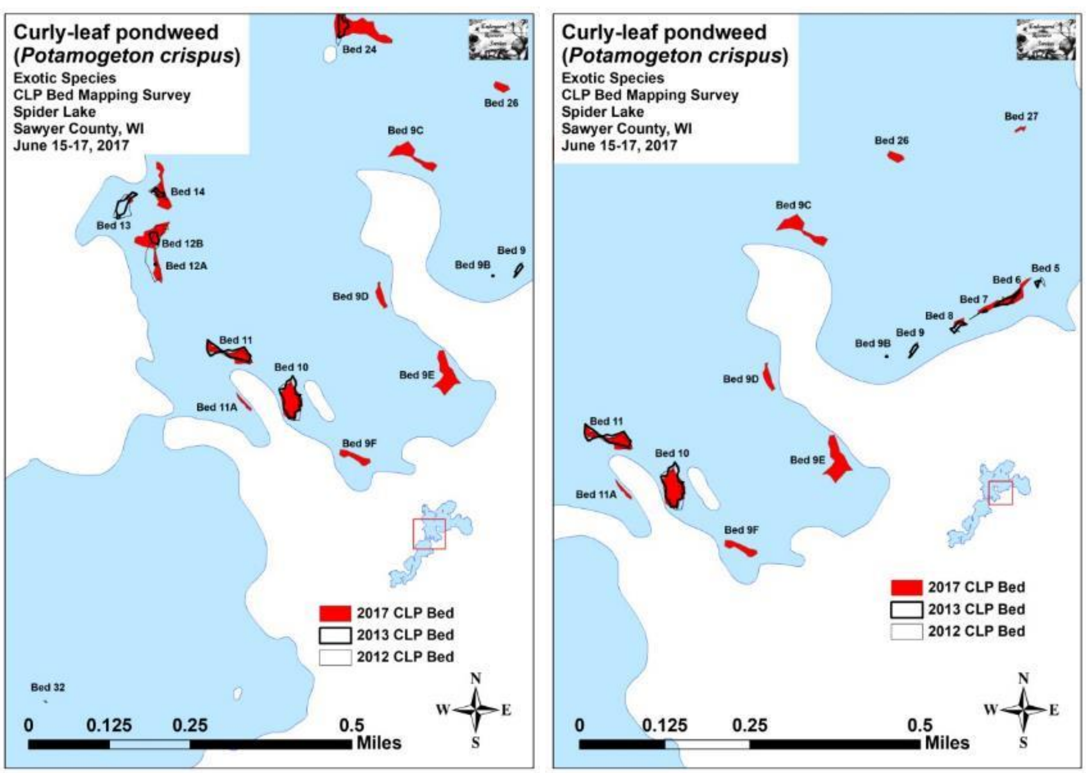


Figure 8: CLP Beds 5-11A, 12-14, 26-27, and 32

Beds 15 and 15A – Curly-leaf pondweed in these beds was established on a small rock bar/rock hump with sharp drop-offs into 20ft+ on three sides. Although Bed 15A was canopied and moderately dense, it occurred away from the immediate shoreline and likely would have been only a minor navigation impairment for local residents (Figure 9).

Beds 16, 17 (A and B) and 18A – These beds were better described as high density areas as they were established over sand, sandy muck, and gravel which resulted in patchy (mean rake fullness of <1-1) distributions. Likely not more than a minor navigation impairment, they also had significant numbers of native species like Northern water milfoil (*Myriophyllum sibiricum*) mixed in.

Beds 18-20 – These three formerly small beds merged into a single nearly monotypic bed in 2017. Although it was canopied, it was generally low density and there was a natural navigation channel around it suggesting it was likely only a minor navigation impairment.

Bed 20A – Located on a midlake rock bar, this bed had CLP in the past, but it was never canopied. In 2017, a moderately dense bed topped out in 9ft+. Despite this, the bed's small size and distance from shore likely meant it wasn't more than a minor impairment.

Beds 21-23 – In 2017, these areas merged into an 18+ acre canopied "super bed" that blanketed much of the north bay - a broad, gently-sloping mucky flat that was in the 8-12ft range that CLP favors (Figure 9). There were numerous prop-trails through the bed, and, unlike almost every other area with CLP on the lake, was a potentially severe impairment to navigation. Following this explosion in the spring CLP population, we were relieved to again find how resilient the bay's many high-value native species were after CLP's senesced in late June. Specifically, we documented high numbers of Common waterweed (*Elodea canadensis*), Large-leaf pondweed, White-stem pondweed, Small pondweed (*Potamogeton pusillus*), Fern pondweed (*Potamogeton robbinsii*), and Flat-stem pondweed (*Potamogeton zosteriformis*) in this area during our August survey.

Bed 22A – This area was also very dense, and it might have actually been connected to the rest of the bed in the north bay if it wasn't for residents keeping a channel open as they motored out to the main lake. Even though it was dense, the surviving bed was likely not more than a minor impairment as it was small and away from the immediate shoreline.

Beds 24-25 (A and B) – These two beds were established over muck in 8-10ft of water east of the midlake islands. In 2017, they merged to become a single moderately dense bed that covered almost 3.5 acres. Because of the rare and sensitive native plant species that occur around these islands and nowhere else in the system, **we strongly discourage active management in this area.**

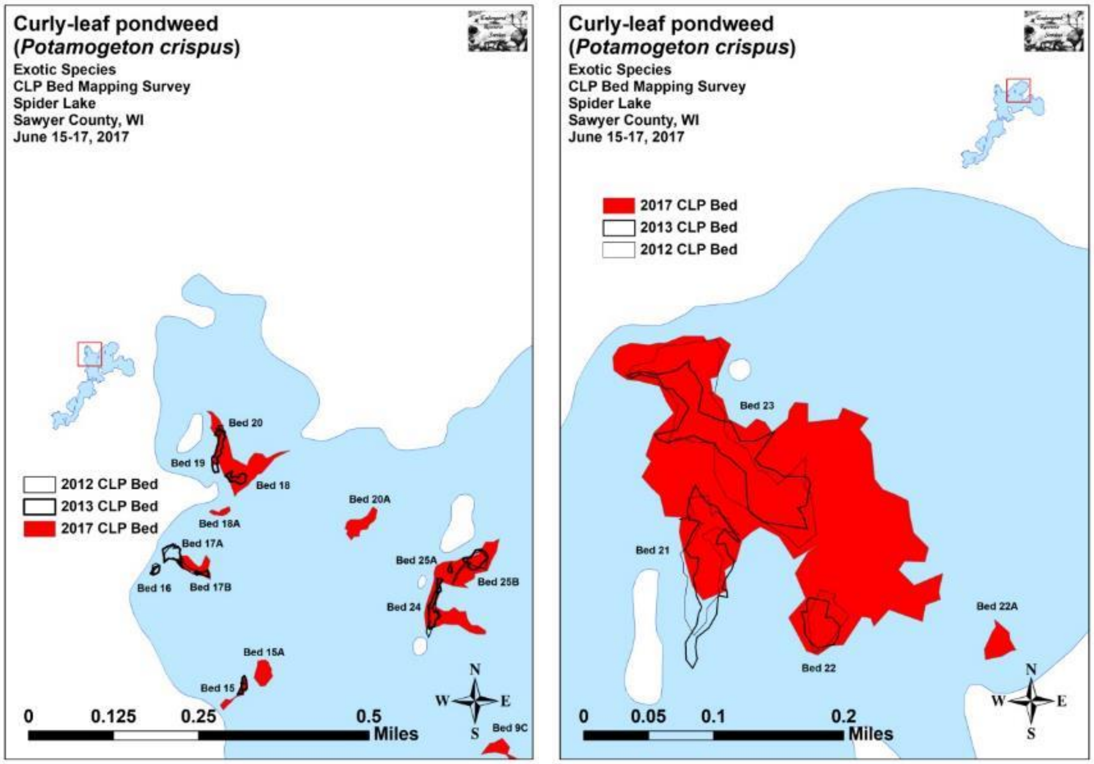


Figure 9: CLP Beds 15-20A, 21-23, and 24-25B

Beds 26-27 – These two beds in the middle of the entrance to East Bay occurred on the edges of rock bars (Figure 8). Because of their small size, they were easily avoided and likely not an issue for navigation.

Beds 28-31 – The East Bay had CLP scattered throughout during the 2012 and 2013 surveys, but few of these areas canopied or were dense enough to be considered beds at that time (Figure 7). In 2017, most CLP still occurred at low to moderate densities, but we felt justified in including these areas in the total acreage as they now had relatively discrete borders and most plants in them were canopied or close to it.

Bed 32 – In 2012, this tiny bed was little more than 10ft^2 and numbered 10's not 100's of plants (Figure 8). It contained the only CLP found in Little Spider in 2012, and we didn't see CLP plants or beds anywhere else in either 2013 or 2017. During the 2017 survey, we crisscrossed the former "bed" raking at random intervals as we couldn't see any plants from the surface. This finally turned up just a handful of spindly CLP plants that were only a couple of feet tall, lime-green in color, and appeared to be barely alive. The surrounding area was again dominated by dense beds of high-value native pondweed species including White-stem pondweed, Large-leaf pondweed, Illinois pondweed, and Clasping-leaf pondweed.

Table 1: Curly-leaf Pondweed Bed Summary
Spider Lake – Spider Chain, Sawyer County – June 15-17, 2017

Bed Number	2017 Acreage	2013 Acreage	2012 Acreage	2013-2017 Change in Acres	Rake Range; Est. Mean Rake Full.	Depth Range; Mean Depth	Estimated Navigation Impairment	Other Field Notes
1	0.14	0.00	0.01	0.14	<<1-2; 1	3-6; 5	Minor	Easily avoided/away from shore
2	1.43	0.65	1.58	0.78	<1-3; 2	7-11; 9	Minor	Moderately dense, but narrow.
3 and 3A	0.05	0.00	0.15	0.05	<<1-3; 1	6-9; 7	Minor	Small/easily avoided
4 and 4B	0.00	0.09	0.03	-0.09	<<<1	-	None	Only widely scattered plants
5	0.00	0.02	0.02	-0.02	<<<1	-	None	Only widely scattered plants
6 and 7	0.48	0.14	0.10	0.34	<<1-2; 1	7-10; 8	Minor	Narrow/easily avoided
8	0.07	0.08	0.02	-0.01	<<1-2	1	Minor	Narrow/easily avoided
9 and 9B	0.00	0.05	0.01	-0.05	<<<1	-	None	Only widely scattered plants
9C	0.56	0.00	0.00	0.56	<1-3; 2	6-12; 6	Minor	Narrow/easily avoided
9D	0.20	0.00	0.00	0.20	1-3; 2	8-10; 9	Minor	Narrow/easily avoided
9E	0.77	0.00	0.00	0.77	1-3; 2	7-11; 9	Minor	Narrow/easily avoided
9F	0.28	0.00	0.00	0.28	<<1-3; 2	7-9; 8	Minor	Narrow/easily avoided
10	0.84	0.77	0.89	0.07	1-3; 2	7-11; 9	Minor	Monotypic/Nav. channels around
11	0.55	0.51	0.36	0.04	<1-3; 2	7-12; 9	Minor	Narrow/easily avoided
11A	0.08	0.00	0.00	0.08	<<1-2; 1	6-11; 8	Minor	Narrow/easily avoided
12A and B	0.90	0.13	0.75	0.77	<1-2; 1	7-13; 10	Minor	Fragmented; esp. in deep water
13	0.05	0.27	0.43	-0.22	<<1-1; <1	6-10; 8	None	Patchy and narrow; likely non-issue
14	0.52	0.06	0.21	0.46	<1-2; 1	6-12; 9	Minor	Narrow/somewhat patchy
15	0.23	0.10	0.01	0.13	<1-2; 1	6-12; 9	None	Patchy and narrow/likely non-issue
15A	0.48	0.00	0.00	0.48	1-3; 2	8-13; 10	Minor	Easily avoided/away from shore
16	0.01	0.06	0.04	-0.05	<<1-1; <1	6-12; 9	None	Patchy and narrow/likely non-issue
17A and B	0.56	0.38	0.38	0.18	<1-2; 1	5-12; 9	None	Patchy and narrow/likely non-issue
18A	0.13	0.00	0.00	0.13	<<1-2; <1	5-11; 8	None	Patchy and narrow/likely non-issue
18, 19, and 20	2.41	0.49	0.10	1.92	<1-3; 1	6-13; 8	Minor	Patchy/natural channel around
20A	0.61	0.00	0.00	0.61	1-3; 2	7-13; 9	Minor	Away from shore/easily avoided

Table 1 (cont'): Curly-leaf Pondweed Bed Summary
Spider Lake – Spider Chain, Sawyer County – June 15-17, 2017

Bed Number	2017 Acreage	2013 Acreage	2012 Acreage	2013-2017 Change in Acres	Rake Range; Est. Mean Rake Full.	Depth Range; Mean Depth	Estimated Navigation Impairment	Other Field Notes
21, 22, and 23	18.17	4.64	6.17	13.53	<<1-3; 3	4-13; 10	Moderate	Canopied to 12ft/some gaps to nav.
22A	0.26	0.00	0.00	0.26	2-3; 3	7-13; 10	Minor	Dense, but easily avoided
24, 25A and 25B	3.45	0.74	0.80	2.71	1-3; 2	6-12; 10	Minor	Most narrow/not in front of residenc.
26	0.16	0.00	0.00	0.16	1-3; 2	6-10; 8	None	Away from shore/natives mixed in
27	0.04	0.00	0.00	0.04	<<1-2; <1	6-12; 9	None	Microbed
28	0.77	0.00	0.00	0.77	<<1-2; 1	5-12; 9	None	Patchy/natural channel around
29	1.10	0.00	0.00	1.10	<<1-3; 2	7-13; 10	Minor	Middle of bay/easily avoidable
30	0.40	0.00	0.00	0.40	<<1-3; <1	3-6; 5	Minor	Middle of bay/easily avoidable
31	0.06	0.00	0.00	0.06	<1-3; 2	3-5; 4	None	Middle of bay/easily avoidable
32 (Little Spider)	0.00	0.00	0.01	0.00	<<<1	8-9; 9	None	We raked up a few spindly plants.
Total Acres	**35.77**	**9.22**	**12.06**	**+26.55**				

Warm-water Full Point-intercept Macrophyte Survey:

Depth soundings taken at Spider Lake's 1,142 accessible points (1 survey point was located on a bog) showed that the main basin in Little Spider was bordered by shallow bays (<10ft) that sloped gradually into a steep-sided 20ft+ trench running north and south. On the north side of Little Spider, a shallow bar projected north into the trench, topped out at 4ft, and then fell off rapidly into a deep basin that reached 30ft.

In general, Big Spider had a much more varied underwater topography with numerous islands, sunken islands, bars, humps, exposed points, and multiple basins. The deepest areas occurred in the large basin west of Atkins Island where the lake bottomed out at over 64ft just north of the channel to Little Spider (Figure 10) (Appendix V).

Nutrient-poor sandy and marly muck dominated the lake bottom throughout Little Spider, while most nearshore areas in the eastern bays on Big Spider were covered with a more nutrient-rich organic muck. Collectively, these muck-bottomed areas covered 78.6% of the 806 survey points where we could reliably determine the substrate. Most rock (12.7% of survey points) and sand (9.2% of survey points) areas were located along the immediate shoreline, scattered around islands, or found on sunken islands, bars, and humps (Figure 10) (Appendix V).

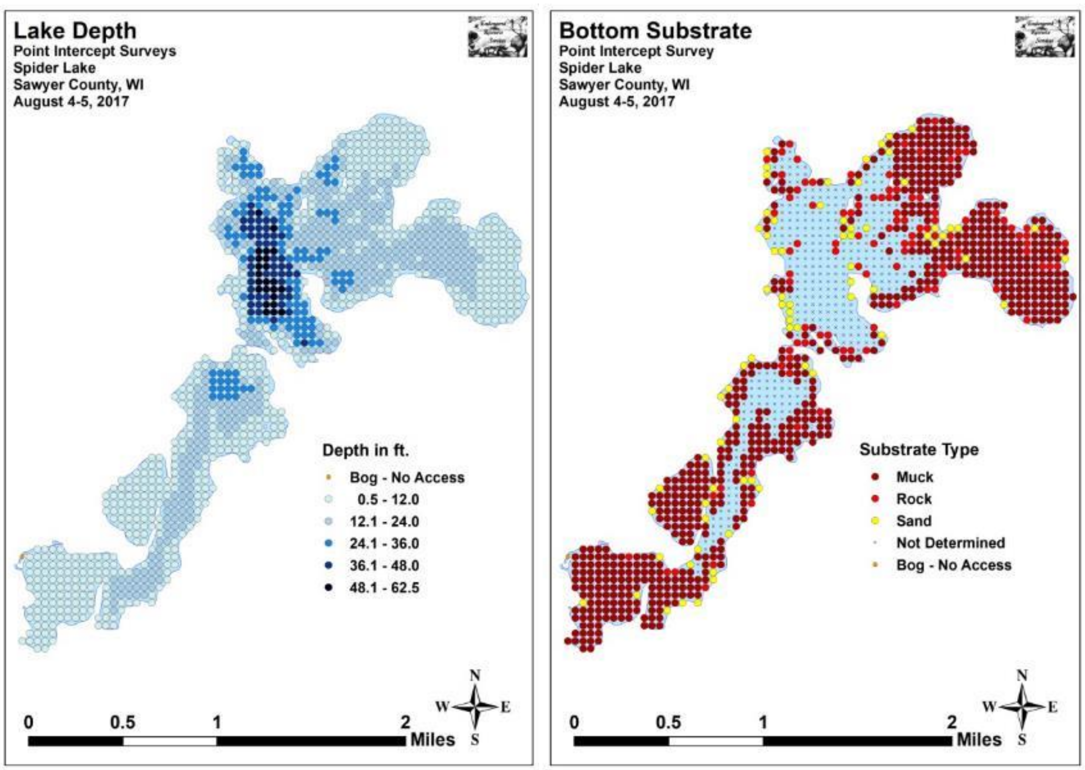


Figure 10: Lake Depth and Bottom Substrate

In 2017, we found plants growing to 15.5ft (down from 18.5ft in 2012) (Figure 11). The 499 points with vegetation (approximately 43.7% of the entire lake bottom and 70.8% of the littoral zone) represented a highly-significant decline **(*p*<0.001)** from the 2012 survey when we found plants growing at 612 points (53.6% of the bottom and 77.3% of the littoral zone) (Appendix VI). Growth in 2017 was slightly skewed to deeper water as the mean plant depth of 6.3ft was greater than the median depth of 5.5ft (down from a mean of 7.3ft and a median of 6.0ft in 2012) (Table 2).

Table 2: Aquatic Macrophyte P/I Survey Summary Statistics
Big and Little Spider Lakes – Spider Chain, Sawyer County
August 8-11, 2012 and August 4-5, 2017

Summary Statistics:	2012	2017
Total number of points sampled	1,142	1,142
Total number of sites with vegetation	612	499
Total number of sites shallower than the maximum depth of plants	792	705
Frequency of occurrence at sites shallower than maximum depth of plants	77.3	70.8
Simpson Diversity Index	0.94	0.94
Maximum depth of plants (ft)	18.5	15.5
Mean depth of plants (ft)	7.3	6.3
Median depth of plants (ft)	6.0	5.5
Average number of all species per site (shallower than max depth)	2.39	2.07
Average number of all species per site (veg. sites only)	3.09	2.92
Average number of native species per site (shallower than max depth)	2.38	2.05
Average number of native species per site (sites with native veg. only)	3.08	2.89
Species richness	53	50
Species richness (including visuals)	54	56
Species richness (including visuals and boat survey)	57	61
Mean rake fullness (veg. sites only)	2.02	1.75

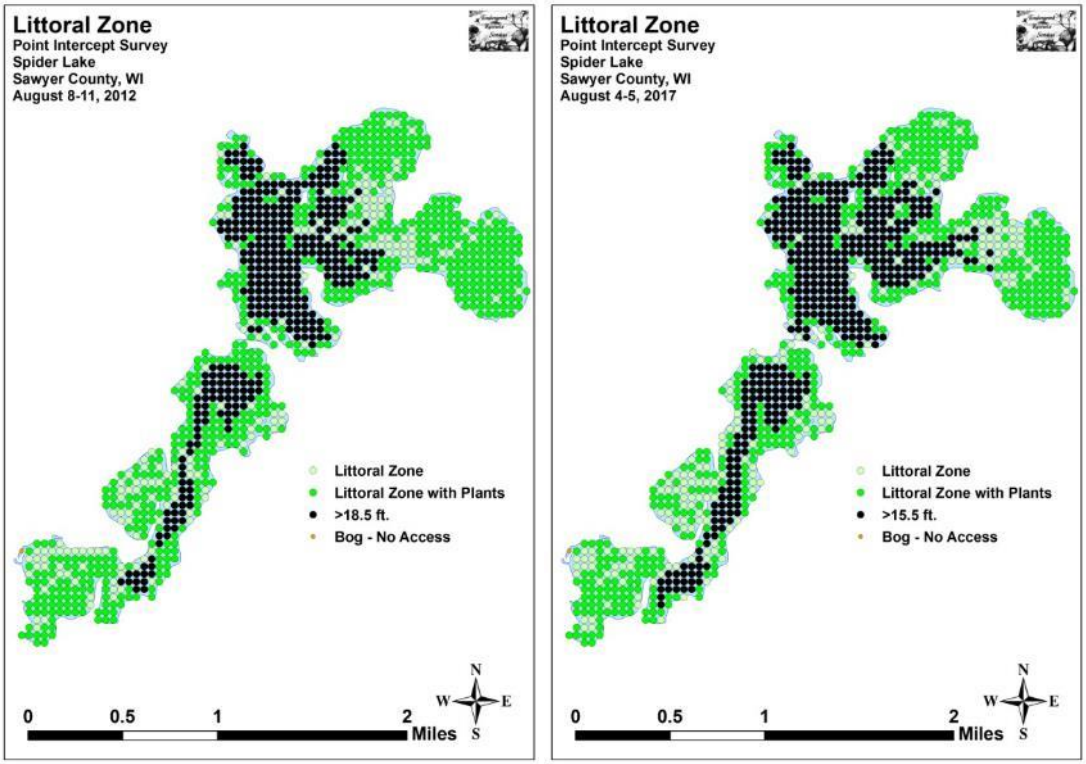


Figure 11: 2012 and 2017 Littoral Zone

Plant diversity was exceptionally high in 2017 with a Simpson Index value of 0.94 – identical to 2012. Species richness was moderately high with 50 species found in the rake (down from 53 in 2012). This total increased to 61 species when including visuals and plants seen during the boat survey (up from 57 in 2012). Despite the increase in overall richness, mean native species richness at sites with vegetation experienced a significant decline **(*p*=0.04)** from 3.08 species/site in 2012 to 2.89/site in 2017 (Figure 12) (Appendix VI). Interestingly, total rake fullness also experienced a highly significant decline **(*p*<0.001)** from a moderate 2.02 in 2012 to 1.75 in 2017 (Figure 13) (Appendix VI). Visual analysis of both the richness and density maps showed these declines were widespread although the declines in density were especially notable in East Bay on Big Spider where thick beds of Nitella (*Nitella* sp.) were present at the edge of the littoral zone in 2012, but absent in 2017.

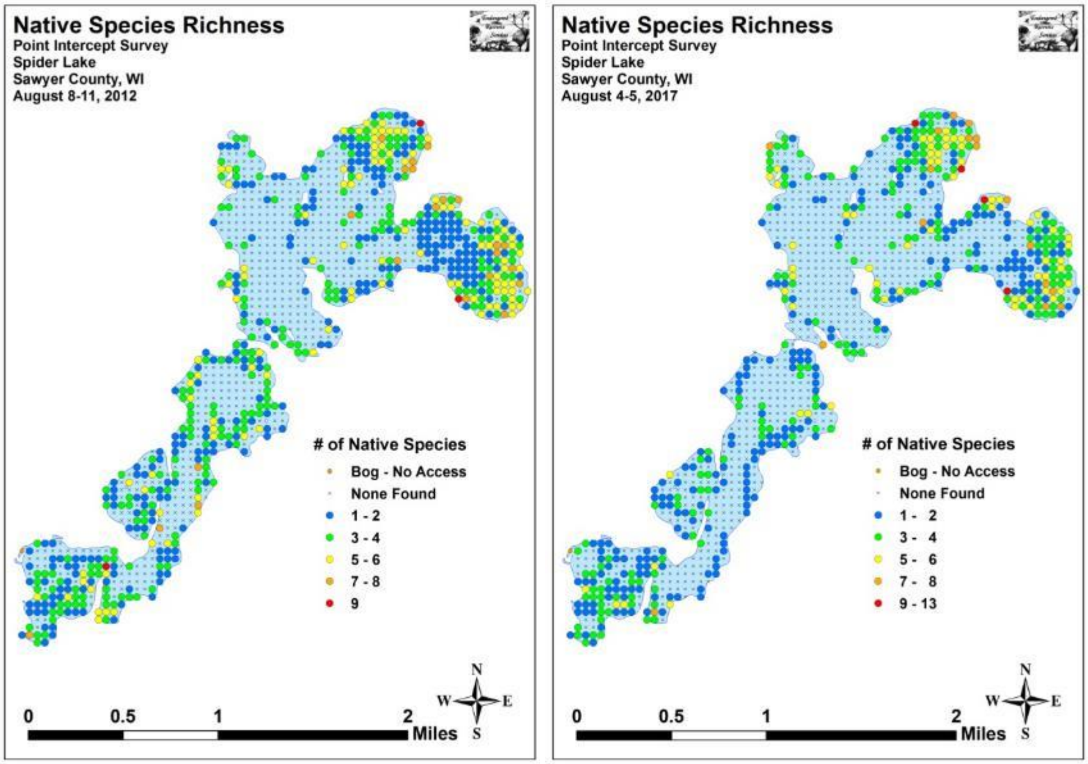


Figure 12: 2012 and 2017 Native Species Richness

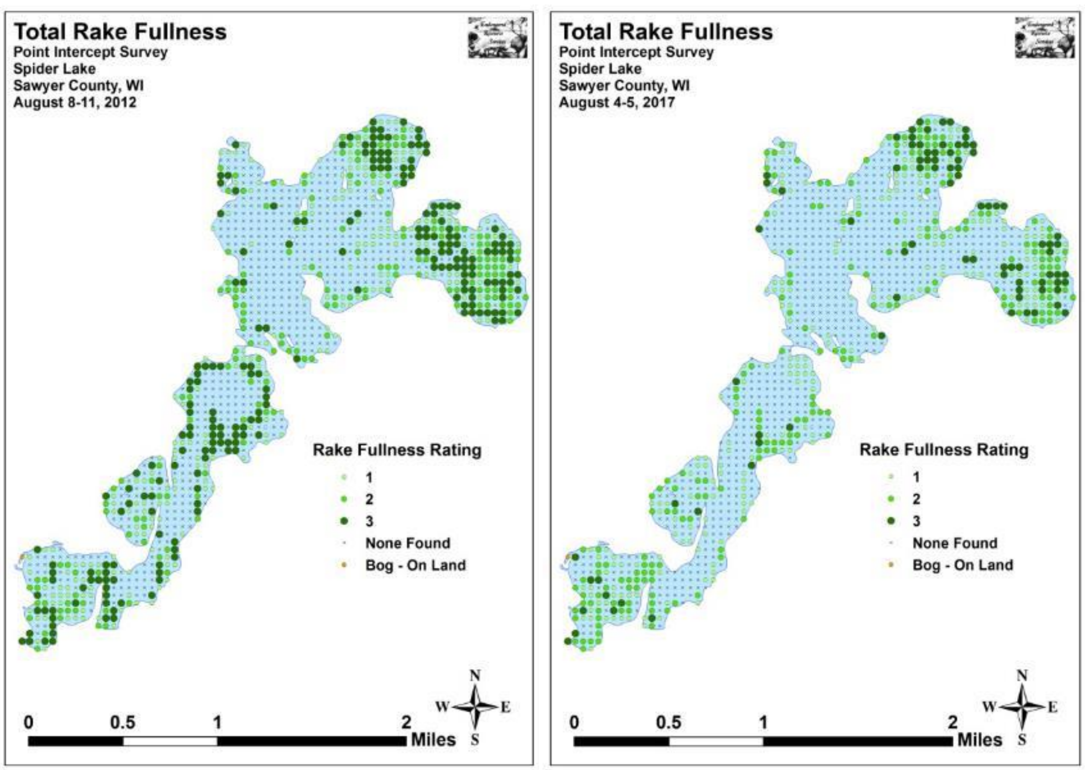


Figure 13: 2012 and 2017 Total Rake Fullness

Spider Lake Plant Community:

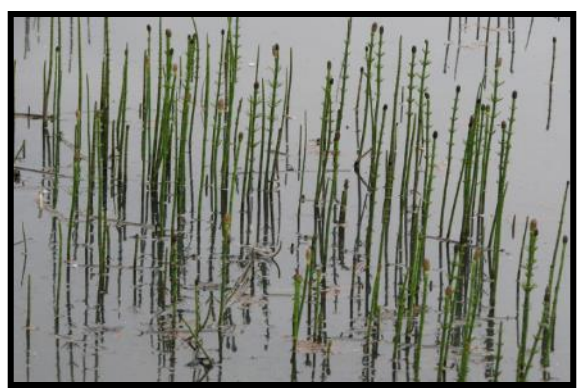
The Spider Lake ecosystem is home to an exceptionally rich and diverse plant community that contains many rare plants we seldom find growing together in northwest Wisconsin. These species tend to occupy one of four distinct zones (emergent, floating-leaf, shallow submergent, and deep submergent) with each zone having its own characteristic functions in the lake ecosystem. Depending on the local bottom type (rock, sand, or muck), these zones often had somewhat different species present.

In shallow areas, beds of emergent plants stabilize 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 Spider Lake, we found Hardstem bulrush dominated shallow sunken islands, rock bars, and sandy or gravelly points in water up to 3ft deep. These areas also supported lesser amounts of Water horsetail (*Equisetum fluviatile*), Pickerelweed (*Pontederia cordata*), and Creeping spikerush (*Eleocharis palustris*). In scattered nearshore areas over firm muck in water <1ft deep, we documented limited numbers of Blue-joint (*Calamagrostis canadensis*), Yellow iris, Rice cut-grass (*Leersia oryzoides*), Purple loosestrife (*Lythrum salicaria*), and Cattails (*Typha* spp.). Softy muck near Tamarack bogs or flowing water tended to have the highest emergent diversity as we found dense stands of Narrow-leaved woolly sedge (*Carex lasiocarpa*), Lake sedge (*Carex lacustris*), Threeway sedge (*Dulichium arundinacea*), Water bulrush (*Schoenoplectus subterminalis*), Short-stemmed bur-reed (*Sparganium emersum*), and the State Species of Special Concern **Robbins spikerush (*Eleocharis robbinsii*) scattered throughout the lake in these areas.

** "Special concern" species are those species about which some problem of abundance or distribution is suspected, but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

Hardstem bulrush bed in Big Spider's East Bay (Berg 2012)



Water horsetail (Elliot 2007)


Pickerelweed (Wright 2012)


Creeping spikerush (Crenlins 2009)


Water bulrush (Fewless 2005)

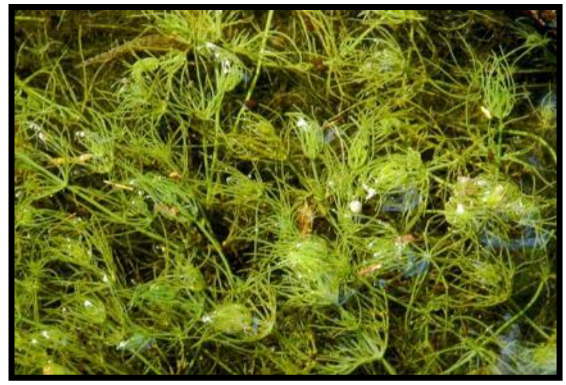

Short-stemmed bur-reed (Sullman 2010)


Narrow-leaved woolly sedge (O'Brien 2011)


Robbins spikerush (Berg 2008)

Just beyond these emergents, the lake's shallow sugar sand and gravel areas tended to have low total biomass as these nutrient-poor substrates provided habitat most suited to fine-leaved "isoetid" turf-forming species like the State Species of Special Concern **Littorella (*Littorella uniflora*), Muskgrass (*Chara* sp.), Waterwort (*Elatine minima*), Needle spikerush (*Eleocharis acicularis*), Brown-fruited rush (*Juncus pelocarpus*), Pipewort (*Eriocaulon aquaticum*), Spiny-spored quillwort (*Isoetes echinospora*), Creeping spearwort (*Ranunculus flammula*), and Dwarf water-milfoil (*Myriophyllum tenellum*). These shallow submergent species, along with the emergents, work to stabilize the bottom and prevent wave action erosion.

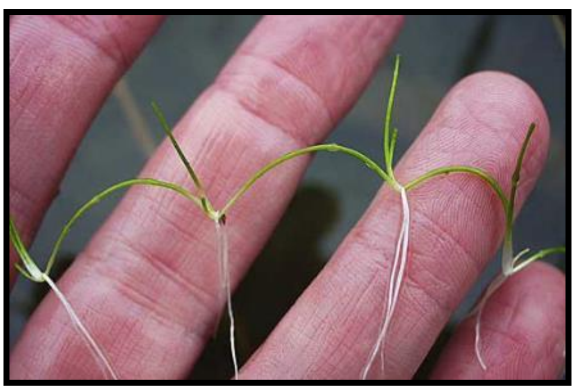
Littorella (Read 2010)



Muskgrass (Ivanov 2006)

Needle spikerush (Fewless 2005)

Brown-fruited rush (Koshere 2002)



Creeping spearwort “stolons” (Fewless 2005)

Dwarf water milfoil (Koshere 2002)

Shallow sandy-muck areas in water from 3-8ft deep supported moderately thick-leaved species such as Crested arrowhead (*Sagittaria cristata*), Slender naiad (*Najas flexilis*), Southern naiad (*Najas guadalupensis*), Northern water milfoil, Water star-grass (*Heteranthera dubia*), Clasping-leaf pondweed, Stiff pondweed (*Potamogeton strictifolius*), Wild celery (*Vallisneria americana*), Sago pondweed (*Stuckenia pectinata*), and Variable pondweed (*Potamogeton gramineus*). The roots, shoots, and seeds of these plants are heavily utilized by 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.

Crested arrowhead (Fewless 2004)

Slender naiad (Apipp 2009)

Southern naiad (Fewless 2004)

Stiff pondweed (Andrews 2012)

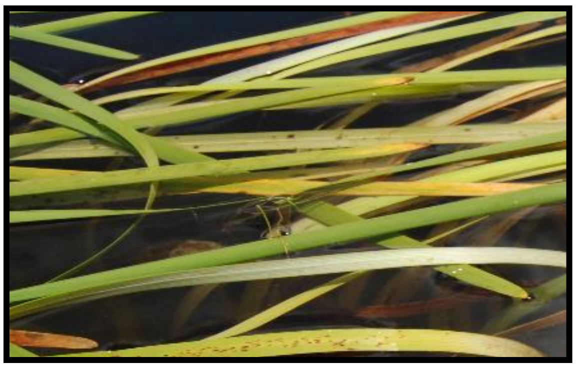
Wild celery (Dalvi 2009)

Variable pondweed (Koshere 2002)

Shallow areas that had more nutrient-rich muck supported floating-leaf species like White-water lily (*Nymphaea odorata*), Spatterdock (*Nuphar variegata*), Watershield (*Brasenia schreberi*), Narrow-leaved bur-reed (*Sparganium angustifolium*), Floating-leaved bur-reed (*Sparganium fluctuans*), Ribbon-leaf pondweed (*Potamogeton epihydrus*), Large-leaf pondweed, and Floating-leaf pondweed (*Potamogeton natans*). The protective canopy cover these species provide is often utilized by panfish and bass, and mature gamefish are often found prowling around the edges of these beds.

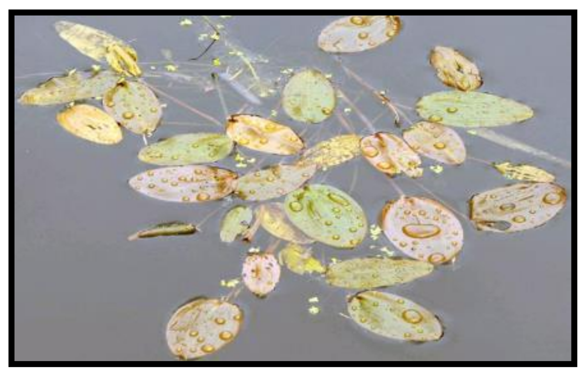

Spatterdock and White water lily (Falkner 2009)


Watershield (Gmelin 2009)

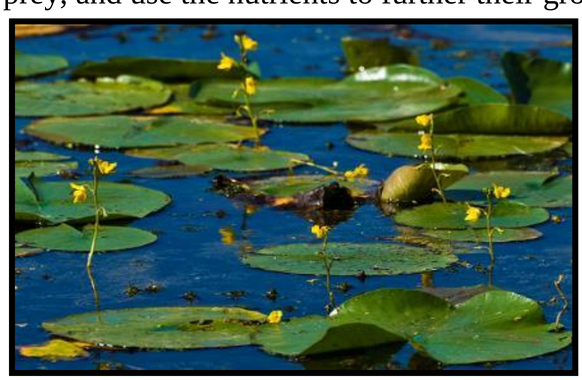

Floating-leaved bur-reed (Sullman 2010)


Ribbon-leaf pondweed (Petroglyph 2007)


Water smartweed (Someya 2009)


Floating-leaf pondweed (Apipp 2007)

Growing among the floating-leaf canopy, we also encountered numerous species of Bladderworts (*Utricularia* spp.). Rather than drawing nutrients up through roots like other plants, bladderworts trap zooplankton and minute insects in their bladders, digest their prey, and use the nutrients to further their growth.


Common bladderwort flowers among lilypads (Hunt 2010)


Bladders for catching plankton and insect larvae (Wontolla 2007)

Deeper areas from 8-15ft over thicker muck were dominated by generally broader-leaved species such as Large-leaf pondweed, Fern pondweed, Common waterweed, Illinois pondweed, Clasping-leaf pondweed, Water marigold (*Bidens beckii*), White-stem pondweed, Coontail (*Ceratophyllum demersum*), Curly-leaf pondweed, Small pondweed, Fries pondweed (*Potamogeton friesii*), Leafy pondweed (*Potamogeton foliosus*), and Flat-stem pondweed. Beyond 15ft, the only plant we regularly encountered was Nitella. All of these species offer prime habitat for mature gamefish like the lake's trophy muskies.


Large-leaf pondweed (Martin 2002)


Fern pondweed (Apipp 2011)


Common waterweed (Fischer 2007)

Illinois pondweed (Cameron 2012)


White-stem pondweed (Fewless 2005)

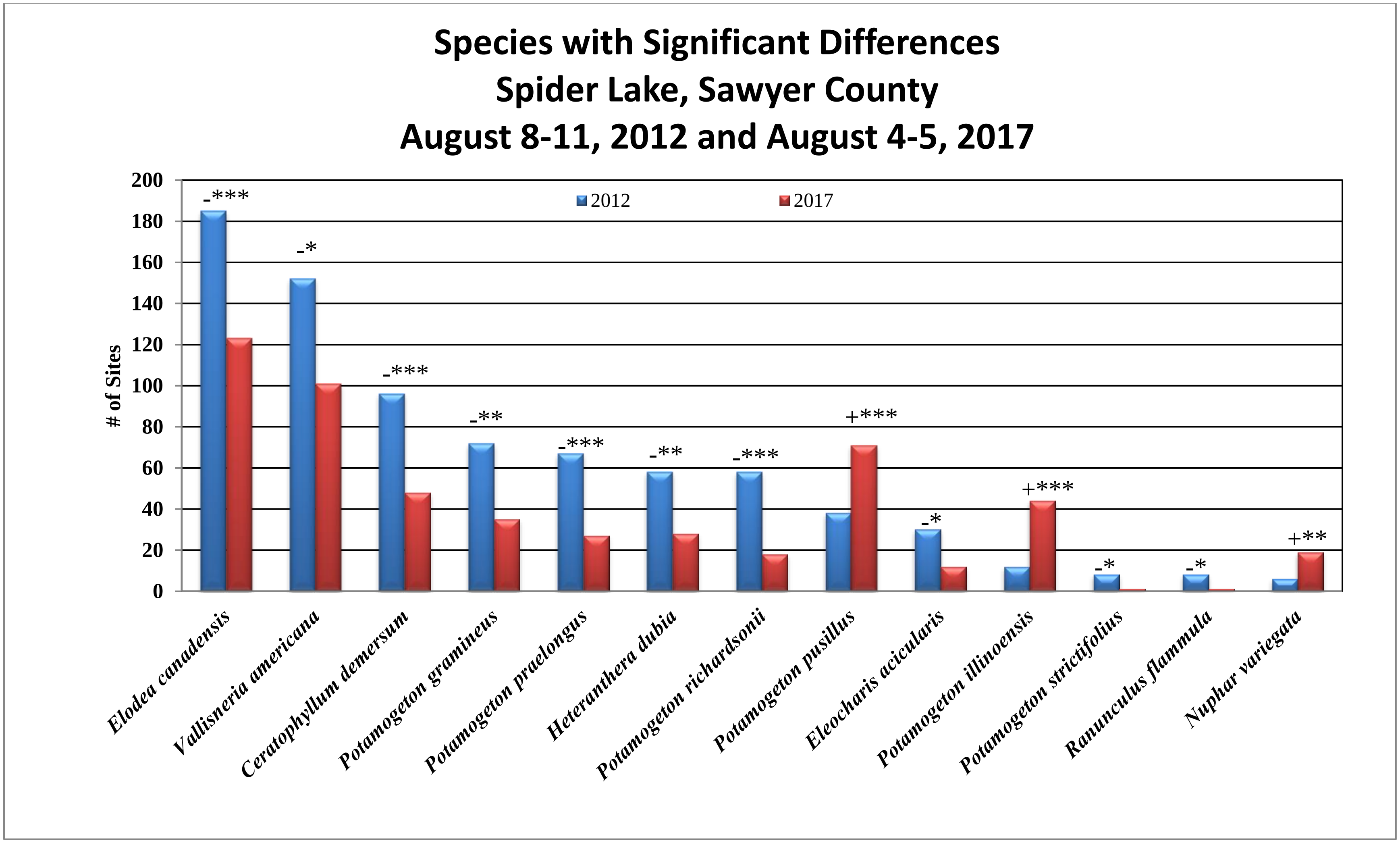

Flat-stem pondweed (Fewless 2004)

Comparison of Native Macrophyte Species in 2012 and 2017:

In August 2012, Common waterweed, Slender naiad, Fern pondweed, and Wild celery were the most common macrophyte species. They were present at 30.23%, 28.59%, 27.94%, and 24.84% of survey points with vegetation respectively, and accounted for 36.06% of the total relative frequency (Table 3). Large-leaf pondweed (7.18), Coontail (5.07), Southern naiad (4.75), and Flat-stem pondweed (4.59) also had relative frequency over 4.0 (Maps for all species found in August 2012 are located in Appendix VII).

In 2017, we found Fern pondweed, Slender naiad, Common waterweed, and Large-leaf pondweed were the four most common species. Present at 34.67%, 28.86%, 24.65%, and 24.25% of sites with vegetation, they accounted for 38.50% of the total relative frequency (Table 4). Wild celery (6.93), Muskgrass (5.35), Small pondweed (4.87), and Southern naiad (4.12) were the only other species with relative frequencies of more than 4.0 (Species accounts for all species found in the Spider Chain in 2012 and 2017, and maps for all plants found in Big and Little Spider Lakes in August 2017 can be found in Appendixes VIII and IX).

Throughout Spider Lake, 13 species showed significant changes in distribution from 2012 to 2017 (Figure 14). Coontail, White-stem pondweed, and Clasping-leaf pondweed suffered highly significant declines; Common waterweed, Variable pondweed, and Water star-grass experienced moderately significant declines; and Wild celery, Needle spikerush, Stiff pondweed, and Creeping spearwort demonstrated significant declines. Conversely, Small pondweed and Illinois pondweed showed highly significant increases; and Spatterdock saw a moderately significant increase.



Significant differences = * *p*<0.05, ** *p*<0.01, * *p*<0.001**

Figure 14: Macrophytes Showing Significant Changes from 2012-2017

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big and Little Spider Lakes – Spider Chain, Sawyer County
August 8-11, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sightings
Elodea canadensis	Common waterweed	185	9.77	30.23	23.36	1.54	0
Najas flexilis	Slender naiad	175	9.24	28.59	22.10	1.19	0
Potamogeton robbinsii	Fern pondweed	171	9.03	27.94	21.59	1.98	2
Vallisneria americana	Wild celery	152	8.03	24.84	19.19	1.39	4
Potamogeton amplifolius	Large-leaf pondweed	136	7.18	22.22	17.17	1.47	15
Ceratophyllum demersum	Coontail	96	5.07	15.69	12.12	1.31	0
Najas guadalupensis	Southern naiad	90	4.75	14.71	11.36	1.51	1
Potamogeton zosteriformis	Flat-stem pondweed	87	4.59	14.22	10.98	1.21	8
Chara sp.	Muskgrass	75	3.96	12.25	9.47	1.09	0
Potamogeton gramineus	Variable pondweed	72	3.80	11.76	9.09	1.14	7
Myriophyllum sibiricum	Northern water-milfoil	69	3.64	11.27	8.71	1.28	14
Potamogeton praelongus	White-stem pondweed	67	3.54	10.95	8.46	1.30	16
Heteranthera dubia	Water star-grass	58	3.06	9.48	7.32	1.16	1
Potamogeton richardsonii	Clasping-leaf pondweed	58	3.06	9.48	7.32	1.38	9
Nitella sp.	Nitella	53	2.80	8.66	6.69	2.45	0
Potamogeton pusillus	Small pondweed	38	2.01	6.21	4.80	1.13	2
Nymphaea odorata	White water lily	36	1.90	5.88	4.55	1.56	8
Brasenia schreberi	Watershield	35	1.85	5.72	4.42	1.66	9
Eleocharis acicularis	Needle spikerush	30	1.58	4.90	3.79	1.07	0
Sagittaria cristata	Crested arrowhead	28	1.48	4.58	3.54	1.14	0
Bidens beckii	Water marigold	23	1.21	3.76	2.90	1.09	4
Myriophyllum tenellum	Dwarf water-milfoil	20	1.06	3.27	2.53	1.35	0
Potamogeton natans	Floating-leaf pondweed	14	0.74	2.29	1.77	1.36	4
Potamogeton crispus	Curly-leaf pondweed	13	0.69	2.12	1.64	1.00	0

Table 3 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big and Little Spider Lakes – Spider Chain, Sawyer County
August 8-11, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sightings
Potamogeton illinoensis	Illinois pondweed	12	0.63	1.96	1.52	1.08	2
Utricularia gibba	Creeping bladderwort	9	0.48	1.47	1.14	1.11	0
Juncus pelocarpus f. submersus	Brown-fruited rush	8	0.42	1.31	1.01	1.13	0
Potamogeton strictifolius	Stiff pondweed	8	0.42	1.31	1.01	1.00	1
Ranunculus flammula	Creeping spearwort	8	0.42	1.31	1.01	1.38	0
Schoenoplectus acutus	Hardstem bulrush	7	0.37	1.14	0.88	1.57	0
Nuphar variegata	Spatterdock	6	0.32	0.98	0.76	1.33	5
Pontederia cordata	Pickerelweed	6	0.32	0.98	0.76	1.33	2
Potamogeton friesii	Fries' pondweed	6	0.32	0.98	0.76	1.00	0
Eriocaulon aquaticum	Pipewort	4	0.21	0.65	0.51	1.75	0
Potamogeton foliosus	Leafy pondweed	4	0.21	0.65	0.51	1.00	0
Ranunculus aquatilis	White water crowfoot	4	0.21	0.65	0.51	1.00	0
Sparganium fluctuans	Floating-leaf bur-reed	4	0.21	0.65	0.51	1.75	0
Sparganium angustifolium	Narrow-leaved bur-reed	3	0.16	0.49	0.38	1.67	0
Utricularia vulgaris	Common bladderwort	3	0.16	0.49	0.38	1.00	1
Carex lasiocarpa	Narrow-leaved woolly sedge	2	0.11	0.33	0.25	3.00	0
Eleocharis palustris	Creeping spikerush	2	0.11	0.33	0.25	1.50	1
Polygonum amphibium	Water smartweed	2	0.11	0.33	0.25	1.00	0
Potamogeton epihydrus	Ribbon-leaf pondweed	2	0.11	0.33	0.25	1.00	2
Schoenoplectus subterminalis	Water bulrush	2	0.11	0.33	0.25	1.50	0
Sparganium emersum	Short-stemmed bur-reed	2	0.11	0.33	0.25	1.00	0
Utricularia minor	Small bladderwort	2	0.11	0.33	0.25	1.00	0
	Filamentous algae	2	*	0.33	0.25	1.50	0

* Excluded from Relative Frequency Analysis

Table 3 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big and Little Spider Lakes – Spider Chain, Sawyer County
August 8-11, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sightings
Eleocharis robbinsii	Robbins' spikerush	1	0.05	0.16	0.13	2.00	1
Equisetum fluviatile	Water horsetail	1	0.05	0.16	0.13	1.00	0
Isoetes echinospora	Spiny spored-quillwort	1	0.05	0.16	0.13	1.00	0
Lemna minor	Small duckweed	1	0.05	0.16	0.13	1.00	0
Littorella uniflora	Littorella	1	0.05	0.16	0.13	2.00	0
Typha latifolia	Broad-leaved cattail	1	0.05	0.16	0.13	1.00	0
Utricularia intermedia	Flat-leaf bladderwort	1	0.05	0.16	0.13	1.00	0
	Freshwater sponge	1	*	0.16	0.13	1.00	0
Leersia oryzoides	Rice cut-grass	**	**	**	**	**	1
Calamagrostis canadensis	Blue-joint	***	***	***	***	***	***
Carex lacustris	Lake sedge	***	***	***	***	***	***
Lythrum salicaria	Purple Loosestrife	***	***	***	***	***	***
Nymphaea odorata	White water lily - pink morph	***	***	***	***	***	***

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

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big and Little Spider Lake – Spider Chain, Sawyer County
August 4-5, 2017

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sightings
Potamogeton robbinsii	Fern pondweed	173	11.87	34.67	24.54	1.57	2
Najas flexilis	Slender naiad	144	9.88	28.86	20.43	1.28	7
Elodea canadensis	Common waterweed	123	8.44	24.65	17.45	1.34	0
Potamogeton amplifolius	Large-leaf pondweed	121	8.30	24.25	17.16	1.55	36
Vallisneria americana	Wild celery	101	6.93	20.24	14.33	1.24	3
Chara sp.	Muskgrass	78	5.35	15.63	11.06	1.13	0
Potamogeton pusillus	Small pondweed	71	4.87	14.23	10.07	1.11	3
Najas guadalupensis	Southern naiad	60	4.12	12.02	8.51	1.30	0
Myriophyllum sibiricum	Northern water-milfoil	57	3.91	11.42	8.09	1.25	11
Potamogeton zosteriformis	Flat-stem pondweed	57	3.91	11.42	8.09	1.14	15
Ceratophyllum demersum	Coontail	48	3.29	9.62	6.81	1.17	0
Potamogeton illinoensis	Illinois pondweed	44	3.02	8.82	6.24	1.18	15
Nymphaea odorata	White water lily	36	2.47	7.21	5.11	1.56	13
Potamogeton gramineus	Variable pondweed	35	2.40	7.01	4.96	1.06	8
Nitella sp.	Nitella	33	2.26	6.61	4.68	1.61	0
Brasenia schreberi	Watershield	29	1.99	5.81	4.11	1.62	9
Bidens beckii	Water marigold	28	1.92	5.61	3.97	1.04	2
Heteranthera dubia	Water star-grass	28	1.92	5.61	3.97	1.11	4
Potamogeton praelongus	White-stem pondweed	27	1.85	5.41	3.83	1.33	32
Nuphar variegata	Spatterdock	19	1.30	3.81	2.70	1.63	4
Sagittaria cristata	Crested arrowhead	19	1.30	3.81	2.70	1.37	2
Potamogeton richardsonii	Clasping-leaf pondweed	18	1.24	3.61	2.55	1.11	12
Potamogeton crispus	Curly-leaf pondweed	15	1.03	3.01	2.13	1.00	0
Eleocharis acicularis	Needle spikerush	12	0.82	2.40	1.70	1.00	0

Table 4 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big and Little Spider Lake – Spider Chain, Sawyer County
August 4-5, 2017

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sightings
Myriophyllum tenellum	Dwarf water-milfoil	11	0.75	2.20	1.56	1.27	0
Potamogeton natans	Floating-leaf pondweed	9	0.62	1.80	1.28	1.11	5
Utricularia vulgaris	Common bladderwort	8	0.55	1.60	1.13	1.13	2
Pontederia cordata	Pickerelweed	7	0.48	1.40	0.99	2.14	4
Potamogeton friesii	Fries' pondweed	6	0.41	1.20	0.85	1.00	1
Schoenoplectus acutus	Hardstem bulrush	6	0.41	1.20	0.85	2.17	3
	Filamentous algae	6	*	1.20	0.85	1.50	0
Eriocaulon aquaticum	Pipewort	4	0.27	0.80	0.57	1.75	0
Sparganium fluctuans	Floating-leaf bur-reed	4	0.27	0.80	0.57	2.00	3
Juncus pelocarpus f. submersus	Brown-fruited rush	3	0.21	0.60	0.43	1.67	1
Sparganium emersum	Short-stemmed bur-reed	3	0.21	0.60	0.43	1.00	1
Utricularia intermedia	Flat-leaf bladderwort	3	0.21	0.60	0.43	1.00	1
Sparganium angustifolium	Narrow-leaved bur-reed	2	0.14	0.40	0.28	1.00	0
Utricularia gibba	Creeping bladderwort	2	0.14	0.40	0.28	1.00	1
Carex lasiocarpa	Narrow-leaved woolly sedge	1	0.07	0.20	0.14	3.00	2
Eleocharis palustris	Creeping spikerush	1	0.07	0.20	0.14	1.00	3
Eleocharis robbinsii	Robbins' spikerush	1	0.07	0.20	0.14	2.00	0
Equisetum fluviatile	Water horsetail	1	0.07	0.20	0.14	1.00	0
Lemna minor	Small duckweed	1	0.07	0.20	0.14	1.00	0
Polygonum amphibium	Water smartweed	1	0.07	0.20	0.14	1.00	2
Potamogeton epihydrus	Ribbon-leaf pondweed	1	0.07	0.20	0.14	2.00	0
Potamogeton foliosus	Leafy pondweed	1	0.07	0.20	0.14	1.00	0
Potamogeton strictifolius	Stiff pondweed	1	0.07	0.20	0.14	1.00	0
Ranunculus flammula	Creeping spearwort	1	0.07	0.20	0.14	1.00	1

* Excluded from Relative Frequency Analysis

Table 4 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Big and Little Spider Lake – Spider Chain, Sawyer County
August 4-5, 2017

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sightings
Schoenoplectus subterminalis	Water bulrush	1	0.07	0.20	0.14	2.00	0
Stuckenia pectinata	Sago pondweed	1	0.07	0.20	0.14	1.00	0
Utricularia minor	Small bladderwort	1	0.07	0.20	0.14	1.00	1
	Freshwater sponge	1	*	0.20	0.14	1.00	0
Dulichium arundinaceum	Three-way sedge	**	**	**	**	**	1
Iris pseudacorus	Yellow iris	**	**	**	**	**	1
Littorella uniflora	Littorella	**	**	**	**	**	1
Lythrum salicaria	Purple loosestrife	**	**	**	**	**	1
Myriophyllum verticillatum	Whorled water-milfoil	**	**	**	**	**	1
Typha X *glauca*	Hybrid cattail	**	**	**	**	**	1
Calamagrostis canadensis	Blue-joint	***	***	***	***	***	***
Carex lacustris	Lake sedge	***	***	***	***	***	***
Elatine minima	Waterwort	***	***	***	***	***	***
Leersia oryzoides	Rice cut-grass	***	***	***	***	***	***
Typha latifolia	Broad-leaved cattail	***	***	***	***	***	***

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

Common waterweed, the most common species in 2012 and the third most common in 2017, occurred throughout much of Big Spider; especially in nutrient-rich areas of the north bays (Figure 15). Both its decline in distribution **(*p*=0.005)** (185 sites in 2012/123 sites in 2017) and the accompanying drop in density (mean rake fullness of 1.54 in 2012 to 1.34 in 2017) were moderately significant **(*p*=0.006)**.

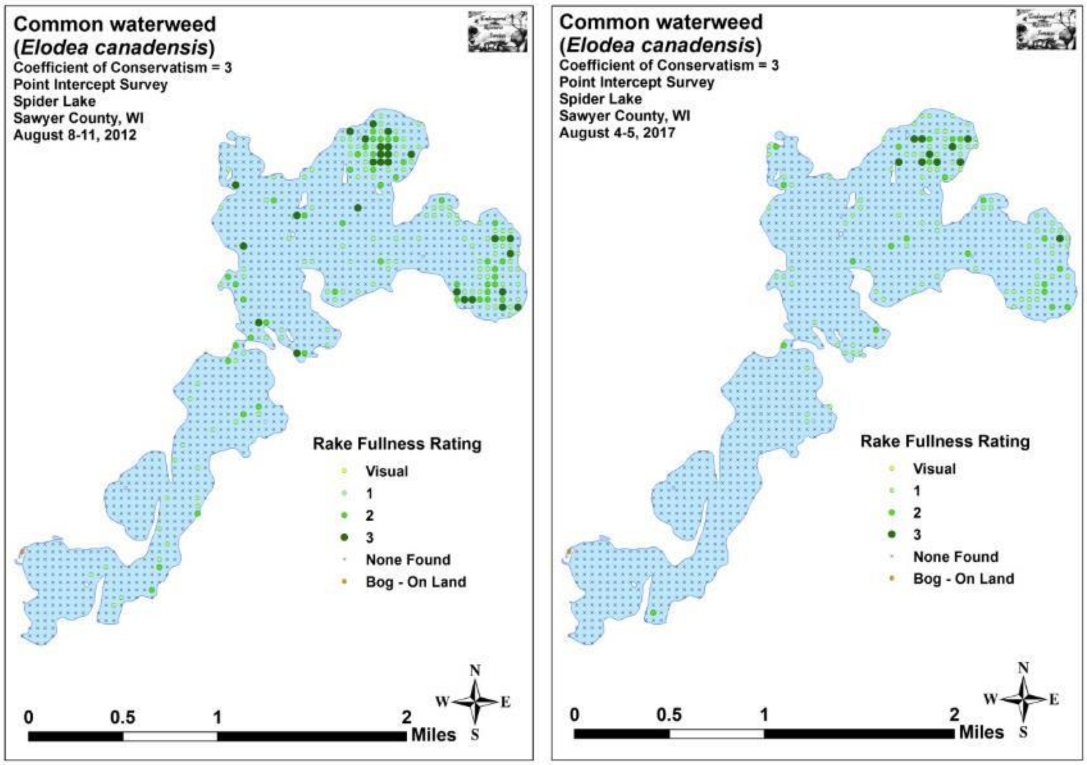


Figure 15: 2012 and 2017 Common Waterweed Density and Distribution

After being the third most widely distributed species in 2012, Fern pondweed jumped into the top spot in 2017. Although the total number of points it was found at was essentially unchanged (171 sites in 2012/173 sites in 2017), the species actually expanded in Big Spider while simultaneously contracting in Little Spider. Much of the highly significant decline **(*p*<0.001)** in density (mean rake fullness of 1.98 in 2012 to 1.57 in 2017) also occurred in Little Spider (Figure 16). Large-leaf pondweed, another important broad-leaved habitat producing species that was the fifth most common species in 2012 (136 sites with a mean rake fullness of 1.47) and the fourth most common in 2017 (121 sites/mean rake fullness of 1.55) experienced similar expansion in Big Spider and contraction in Little Spider (Figure 17). Because these changes offset, none of the lakewide changes were significant.

Wild celery, the fourth most common species in 2012 (152 sites/mean rake of 1.39) and the fifth most common in 2017 (101 sites/mean rake of 1.24) experienced a significant decline in distribution **(*p*=0.01)** and a moderately significant decline in density **(*p*=0.008)** (Figure 18). This generalized decline was typical of what we observed for many of the lake's most important deep water habitat-producing plants. These changes on the edge of the littoral zone were perhaps best illustrated by Nitella. Although its decline in distribution (53 sites in 2012 /33 in 2017) was not significant (*p*=0.10), the decline in density from a mean rake fullness of 2.45 in 2012 to 1.61 in 2017 was highly significant **(*p*<0.001)** (Figure 19).

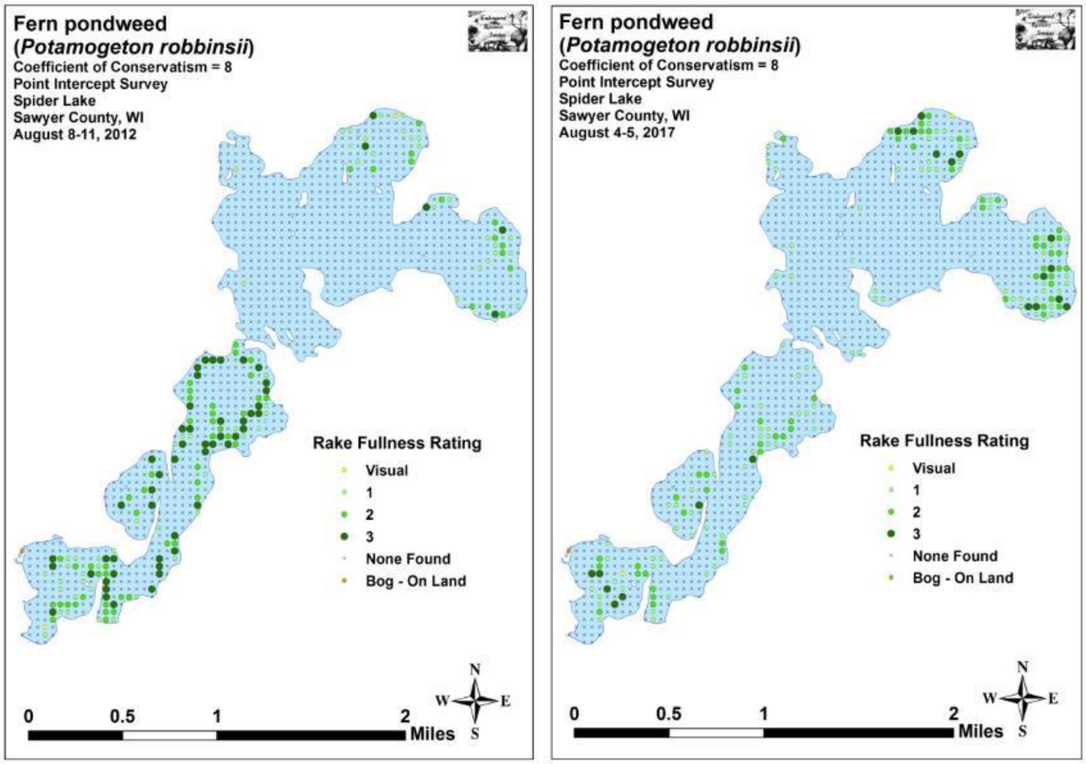


Figure 16: 2012 and 2017 Fern Pondweed Density and Distribution

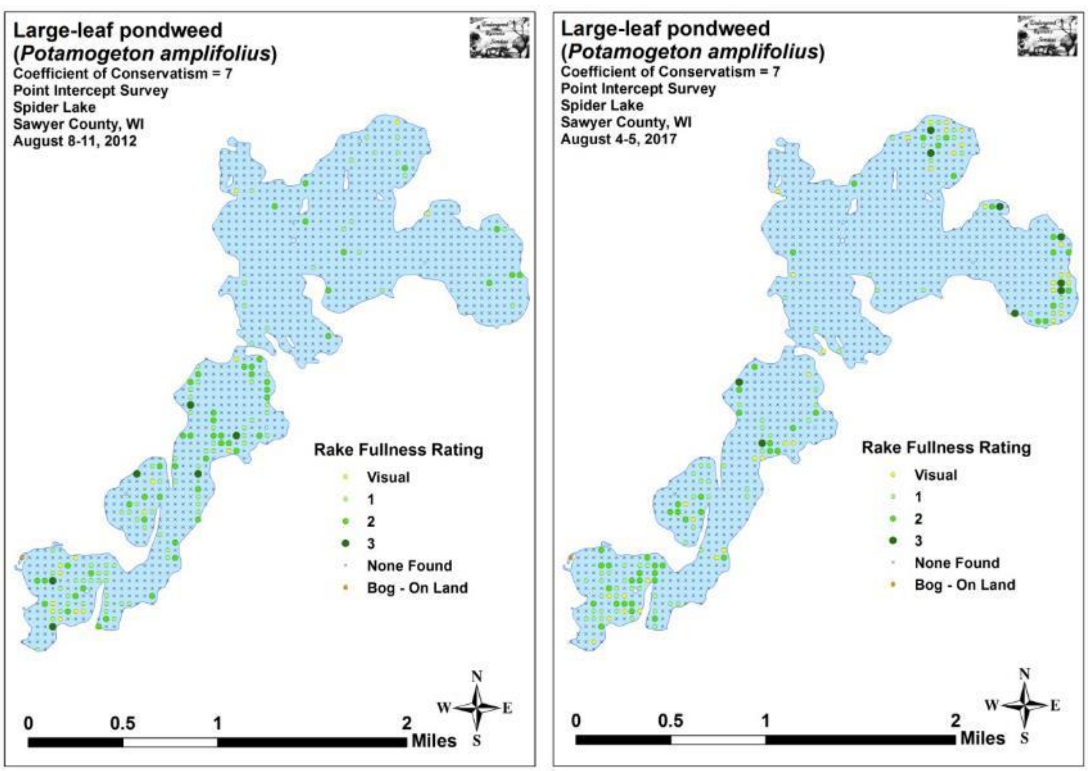


Figure 17: 2012 and 2017 Large-leaf Pondweed Density and Distribution

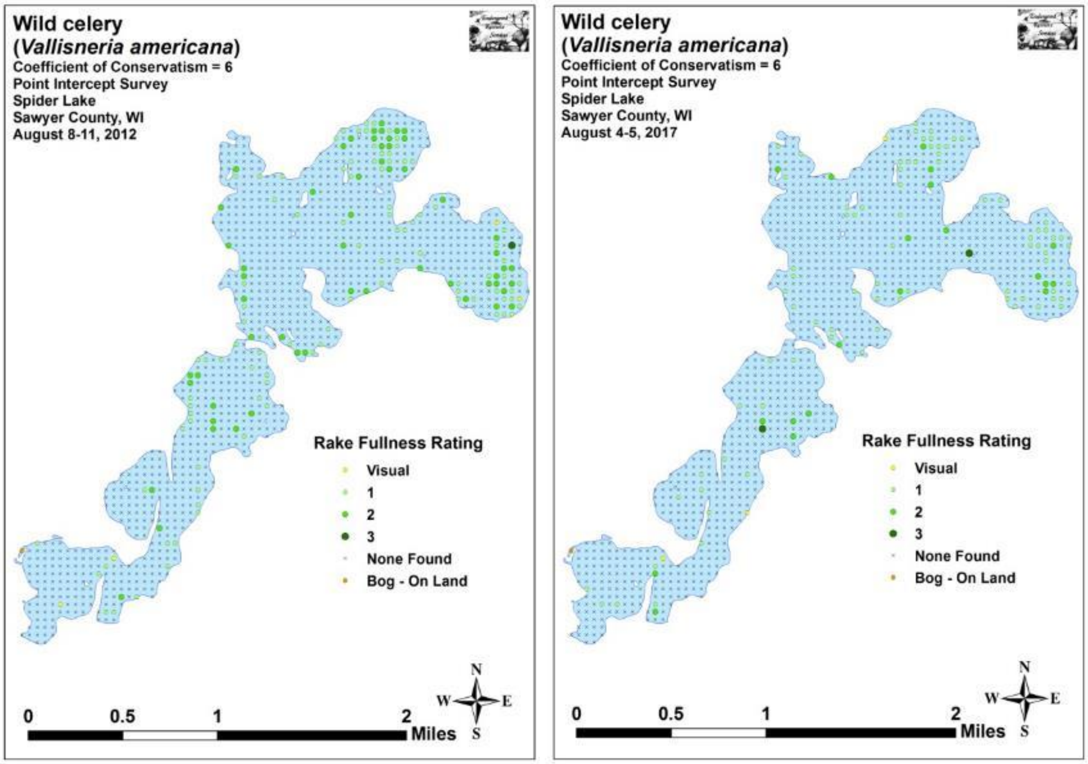


Figure 18: 2012 and 2017 Wild Celery Density and Distribution

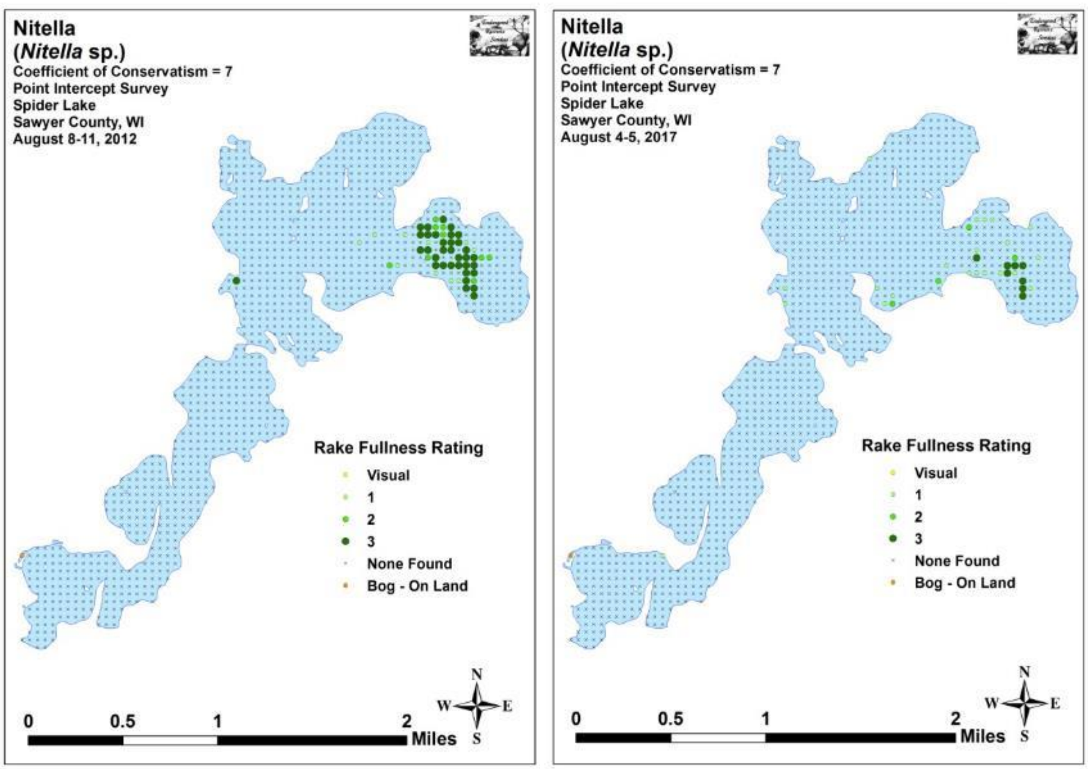


Figure 19: 2012 and 2017 Nitella Density and Distribution

Comparison of Floristic Quality Indexes in 2012 and 2017:

In 2012, we identified a total of 50 **native index species** in the rake during the point-intercept survey (Table 5). They produced a mean Coefficient of Conservatism of 7.0 and a Floristic Quality Index of 49.6.

Table 5: Floristic Quality Index of Aquatic Macrophytes
Big and Little Spider Lake – Spider Chain, Sawyer County
August 8-11, 2012

Species	Common Name	C
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Eleocharis palustris	Creeping spikerush	6
Elodea canadensis	Common waterweed	3
Equisetum fluviatile	Water horsetail	7
Eriocaulon aquaticum	Pipewort	9
Heteranthera dubia	Water star-grass	6
Isoetes echinospora	Spiny-spored quillwort	8
Juncus pelocarpus	Brown-fruited rush	8
Lemna minor	Small duckweed	4
Littorella uniflora	Littorella	10
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas flexilis	Slender naiad	6
Najas guadalupensis	Southern naiad	8
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton foliosus	Leafy pondweed	6
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
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 strictifolius	Stiff pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Ranunculus flammula	Creeping spearwort	9

Table 5 (cont'): Floristic Quality Index of Aquatic Macrophytes Big and Little Spider Lake – Spider Chain, Sawyer County August 8-11, 2012

Species	Common Name	C
Sagittaria cristata	Crested arrowhead	9
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus subterminalis	Water bulrush	9
Sparganium angustifolium	Narrow-leaved bur-reed	9
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium fluctuans	Floating-leaf bur-reed	10
Typha latifolia	Broad-leaved cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		50
Mean C		7.0
FQI		49.6

In 2017, we found 47 **native index plants** in the rake during the point-intercept survey. They produced a mean Coefficient of Conservatism of 7.0 and a Floristic Quality Index of 47.7 (Table 6). Nichols (1999) reported an average mean C for the Northern Lakes and Forest Region of 6.7 putting Spider Lake just above average for this part of the state. However, the exceptional FQI was nearly double the median FQI of 24.3 for the Northern Lakes and Forest Region (Nichols 1999).

Table 6: Floristic Quality Index of Aquatic Macrophytes Big and Little Spider Lake – Spider Chain, Sawyer County August 4-5, 2017

Species	Common Name	C
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Eleocharis acicularis	Needle spikerush	5
Eleocharis palustris	Creeping spikerush	6
Elodea canadensis	Common waterweed	3
Equisetum fluviatile	Water horsetail	7
Eriocaulon aquaticum	Pipewort	9
Heteranthera dubia	Water star-grass	6
Juncus pelocarpus f. submersus	Brown-fruited rush	8
Lemna minor	Small duckweed	4

Table 6 (cont'): Floristic Quality Index of Aquatic Macrophytes
Big and Little Spider Lake – Spider Chain, Sawyer County
August 4-5, 2017

Species	Common Name	C
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas flexilis	Slender naiad	6
Najas guadalupensis	Southern naiad	8
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton foliosus	Leafy pondweed	6
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
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 strictifolius	Stiff pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus flammula	Creeping spearwort	9
Sagittaria cristata	Crested arrowhead	9
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus subterminalis	Water bulrush	9
Sparganium angustifolium	Narrow-leaved bur-reed	9
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium fluctuans	Floating-leaf bur-reed	10
Stuckenia pectinata	Sago pondweed	3
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		**47**
Mean C		**7.0**
FQI		**47.7**

Comparison of Filamentous Algae in 2012 and 2017:

Filamentous algae, normally associated with excessive nutrients in the water column, continue to be rare on Spider Lake. In 2017, they were present at six survey points with a mean rake fullness of 1.50. This was a non-significant increase (p=0.11) in distribution from the two points they were found at in 2012 (identical mean rake fullness of 1.50) (Figure 20).

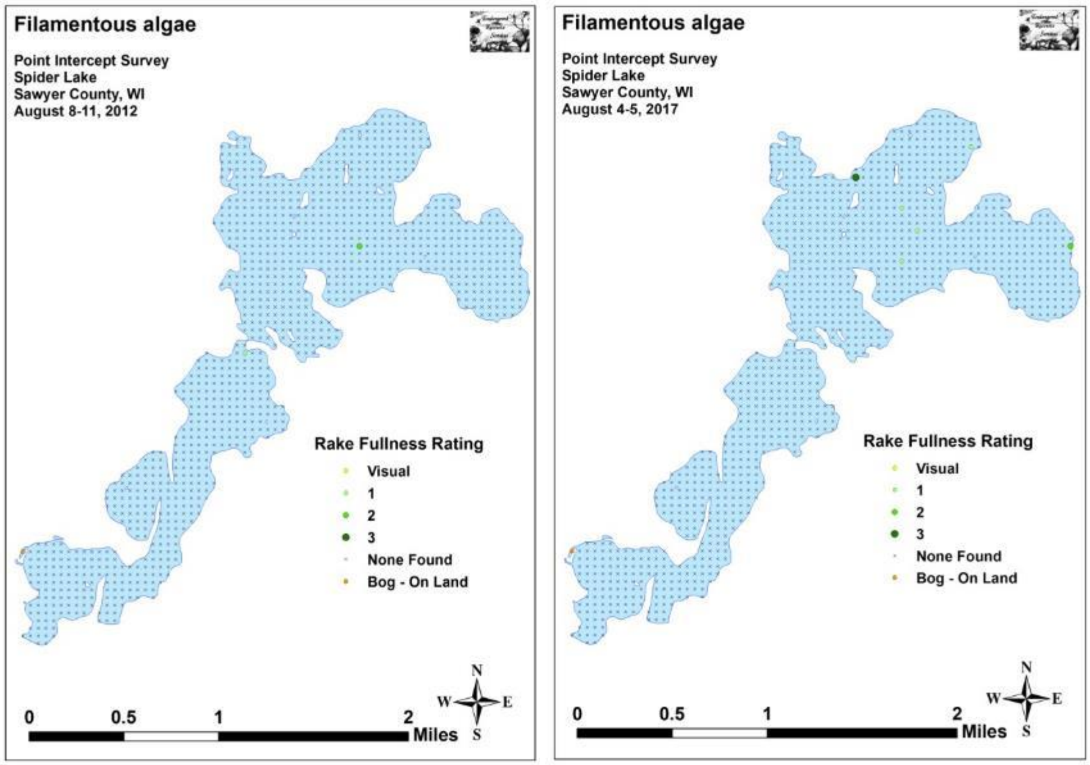


Figure 20: 2012 and 2017 Filamentous Algae Density and Distribution

Comparison of Midsummer Curly-leaf Pondweed in 2012 and 2017:

Curly-leaf pondweed normally completes its annual life cycle by late June, and most plants have set turions and senesced by early July. In August 2012, CLP was still present at 13 points with a mean rake fullness of 1.00 (Figure 21). The August 2017 survey found CLP at 15 points with an identical mean rake fullness of 1.00. We noted most samples had a single CLP plant in them, and they were usually a recent turion sprout that was often only a few inches tall. Because this late summer distribution and density was essentially unchanged from the previous survey, it suggests that, despite the exceptional spring growing season for CLP in 2017, the species true distribution within the lake is little changed.

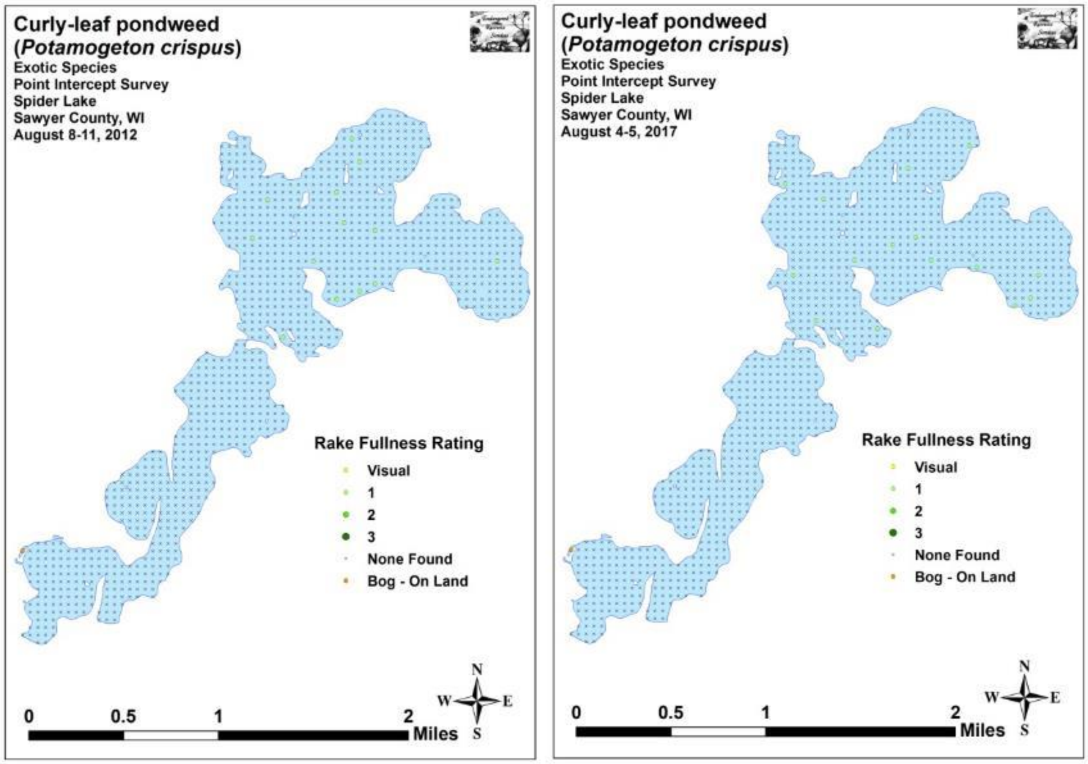


Figure 21: 2012 and 2017 Midsummer CLP Density and Distribution

Other Exotic Plant Species:

As with the June survey, we did **NOT** find any evidence of Eurasian water-milfoil in Spider Lake. However, in addition to the Yellow iris seen in June, we located two other exotic species growing adjacent to the shoreline during the August survey: Purple loosestrife and Narrow-leaved cattail. Purple loosestrife was scattered around the shoreline of Big Spider; especially around East Bay. Unlike near the landing on Clear Lake, we didn't see any plants that showed evidence of Galerucella beetle (*Galerucella* spp.) herbivory (Figure 22).

Figure 22: Purple loosestrife/Galerucella Beetles

Native to southern but not northern Wisconsin, Narrow-leaved cattail and its hybrids with Broad-leaved cattail are becoming increasingly common in northern Wisconsin where they also tend to be invasive. We found a few significant beds that appeared to be expanding in shallow water and potentially crowding out other native emergent species in Brewer's Bay on Little Spider and along the north and northwest shorelines of Big Spider. At least at one location on Big Spider, this species' expansion will likely cause difficulty accessing open water (Figure 23).

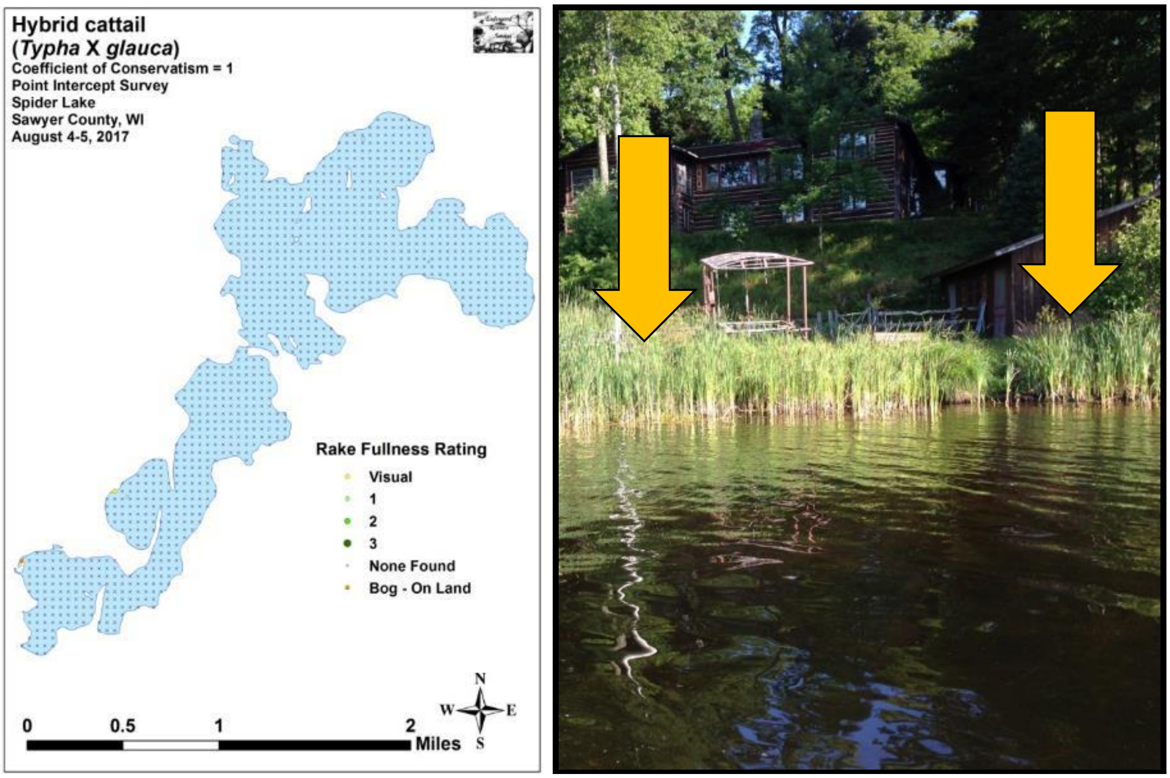


Figure 23: 2017 Hybrid Cattail Distribution/NW Bay of Big Spider

Besides having narrower leaves, the exotics can be told from our native cattails by having a relatively narrower and longer "hotdog-shaped" tan female cattail flower, whereas our native species tends to produce a fatter and shorter "bratwurst-shaped" dark chocolate colored female flower. Narrow-leaved cattail and its hybrids also have a male flower that is separated from the female flower by a thin green stem while the native Broad-leaved cattail has its male and female flowers connected (Figure 24) (For more information on a sampling of aquatic exotic invasive plant species, see Appendix X).

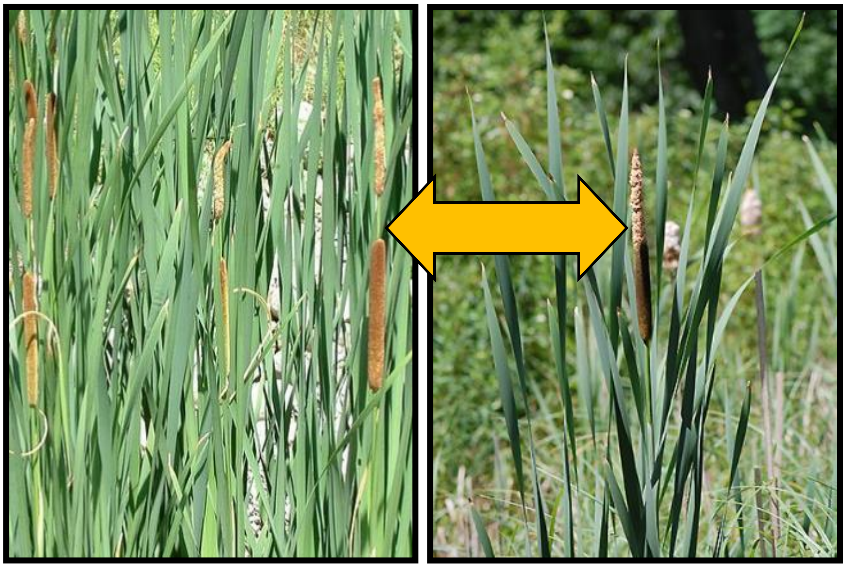


Figure 24: Exotic Hybrid and Native Broad-leaved Cattail Identification

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Water Clarity, Nutrient Inputs, and the Role of Native Macrophytes:

Like trees in a forest, a lake's native plants are the basis of the aquatic ecosystem. They capture the sun's energy and turn it into usable food, "clean" the water of excess nutrients, and provide habitat for other organisms like aquatic invertebrates and the lake's fish populations. Because of this, preserving them is critical to maintaining the lake's overall health. Unfortunately, when phosphorus and nitrogen levels exceed what the lake's macrophytes can utilize, it tends to promote algae blooms which impact sensitive native species as well as general lake esthetics.

Soil erosion and runoff can be significant contributors to a lake's overall nutrient load. Because of this, all residents have the opportunity to help reduce the lake's phosphorus levels by evaluating how their shoreline practices may be impacting the lake. Simple things like establishing or maintaining their own buffer strip of native vegetation along the lakeshore to prevent erosion, building rain gardens, bagging grass clippings, switching to a phosphorus-free fertilizer or preferably eliminating fertilizer near the lake altogether, collecting pet waste, and disposing of the ash from fire pits away from the lakeshore can all significantly reduce the amount of nutrients entering the system. Hopefully, a greater understanding of how all property owners can have lakewide impacts will result in more people taking appropriate conservation actions to not only help improved water clarity and quality, but also to benefit the lake's many rare and sensitive native plant species which depend on these pristine conditions.

The quality of Spider Lake's native macrophyte community cannot be overstated as it continues to be one of the most diverse aquatic ecosystems we have ever surveyed. The lake boasts at least 13 extremely high value/sensitive species with C values of 9 or 10. It also has populations of several species that are regionally rare meaning they are not only uncommon in Wisconsin, but the entire upper Midwest. Their presence suggests a history of good water quality and lakeshore owner stewardship.

In 2017, we documented a lakewide decline in many of Spider Lake's top habitat producing species. Much of this decline occurred on the outer edge of the littoral zone with deep water beds being less dense and less rich than they were during the 2012 survey. Although this may appear troubling, it was similar to what we observed on many of the other deep water lakes we surveyed in 2017. Base of this observation, we believe these declines are likely temporary - the byproduct of the unusually early but cool spring, rather than some fundamental change in Spider Lake itself.

Curly-leaf Pondweed Management:

Curly-leaf pondweed thrives in lakes where there are excess nutrients in the water column. Because of this, the simplest management practice may be to focus on reducing nutrient inputs and starving CLP of the phosphorus that gives it a competitive advantage. In our experience, we have noticed that healthy lakes with robust native plant communities often find that CLP is "just another plant" in the overall lake environment. In these systems, although scattered plants and small patches of CLP may be found throughout the littoral zone, monotypic beds tend to only consistently form on the deep water edge beyond the limit where most native rooted species can grow. In this environment, CLP is less likely to cause navigation issues as it seldom canopies (except during years that provide ideal growing conditions like those seen in 2017) and can actually benefit the lake by providing early-season vertical habitat for fish. This tendency to occur on the outer edge of the rooted littoral zone is definitely the case on Big Spider where, during the 2012, 2013, and 2017 surveys, we primarily found CLP in the 5-13ft range with the vast majority of individual plants and most monotypic beds occurring from 8-12ft. Outside of this zone, CLP was seldom truly invasive, and even within this preferred habitat, we almost always found evidence of native plant regrowth after CLP completed its natural late June senescence.

Curly-leaf pondweed also thrives in disturbed environments. If the lake association decides on a course of active management in the future, we encourage a limited and cautious approach that focuses on relieving navigation impairment as opposed to wide-scale control. Currently, Big Spider's plant community is dominated by Coontail, Common waterweed, and "pondweeds" which are all sensitive to Endothall – the most common chemical used to kill CLP. This means there is a high probability of at least some unintended collateral damage with a herbicide treatment program. The resulting barren substrate from this type of treatment is exactly the kind of disturbance the CLP is so good at exploiting. The upshot is that overly aggressive management followed by no management can ultimately make things worse instead of better when dealing with this species.

Mechanical harvesting is another common strategy for dealing with Curly-leaf pondweed. Although the initial startup costs tend to be greater than herbicide treatments, there is less risk of collateral damage to native plants. One of the challenges to harvesting on Big Spider, besides the upfront expense and the need for annual maintenance and storage, is the lack of multiple public access points that would be needed to offload what would likely be 10's of dump truck loads of vegetation in high CLP years like we witnessed in 2017. This strategy would require cooperation from private individuals with improved landings. Ultimately, the level of CLP growth the SCLAD is comfortable with will determine how much and what kind of management, if any, occurs on the lake.

Purple Loosestrife:

Purple Loosestrife is uncommon but widely established around Big Spider's shoreline. Because it occurs at such low levels, there likely aren't enough plants to support a *Galerucella* beetle population at this time. This means that manual removal will be necessary to keep the current population in check. Unfortunately, likely because the plants are so pretty, we noticed that several residents were mowing around them. To prevent this, we encourage the SCLA to send out annual notices that remind people to look for and remove any loosestrife plants they find, bag plants to prevent seed dispersal, and dispose of them away from the lake. August and September are the best times to do this as the bright fuchsia candle-shaped flower spikes are easily seen. Because loosestrife has an extensive root system, care should be taken to remove the entire plant as even small root fragments can survive and produce new plants the following year.

Yellow Iris:

The presence and apparent rapid spread of Yellow iris in the Spider Chain is troubling. Unlike Purple loosestrife, there are currently no biological control agents for Yellow iris. Because of this, we STRONGLY encourage residents to continue to eliminate plants on their property before a minor problem becomes a significant one. Similar to loosestrife, iris plants and pods should be bagged to prevent seed dispersal, and then disposed of well away from the lake or any other wetland. June is the best month to look for this species as the bright yellow fleur-de-lis are most common at this time of year (Figure 25). When not in bloom, its leaves could be confused with Northern blue flag (*Iris versicolor*) – a native and non-invasive iris species.

Figure 25: Yellow Iris Flower/Iris Cluster and Seed Pods Hanging in Water

Exotic Cattails:

All of Wisconsin's cattails have wildlife value as many bird species nest in them, and muskrats and a variety of insects use them as food. Because Narrow-leaved cattail and its hybrids can be invasive along the shoreline to the point that they interfere with lake access, property owners may want to remove pioneering individuals before they become a bed. However, unless they are interfering with lake access or other human activity, removing previously established stands is probably unnecessary and unlikely to be ecologically beneficial. Because cattail seeds are transported by the wind, the continued expansion of this species in northern Wisconsin is likely inevitable.

Aquatic Invasive Species Prevention:

Aquatic Invasive Species (AIS) such as Eurasian water-milfoil are an increasing problem in the lakes of northern Wisconsin in general, and several nearby lakes in Sawyer County in particular. Continuing to work to prevent their introduction into the Spider Chain with proactive measures is strongly encouraged. The lake's active Clean Boats/Clean Water Program appears to be a model as there were diligent workers on duty every time we launched on the lake. In addition to the education they offer, the physical checking of incoming/outgoing boats provides an important safeguard for the lake.

Conducting monthly visual inspections of the lake immediately out from the public boat landing on the south end of Little Spider throughout the growing season and at least one annual meandering shoreline survey of the lake's entire visible littoral zone are further suggestions to consider as these surveys can result in early detection if a new AIS (especially Eurasian water-milfoil) is introduced into the lake. The sooner an infestation is detected, the greater the chances it can be successfully and economically controlled.

LITERATURE CITED

Borman, S., R. Korth, and J. Temte 1997. Through the Looking Glass…A Field Guide to Aquatic Plants. Wisconsin Lakes Partnership. DNR publication FH-207-97.

Chadde, Steve W. 2002. A Great Lakes Wetland Flora: A complete guide to the aquatic and wetland plants of the Upper Midwest. Pocketflora Press; 2nd edition

Crow, G. E., C. B. Hellquist. 2012. Aquatic and Wetland Plants of Northeastern North America, Volume I + II: A Revised and Enlarged Edition of Norman C. Fassett's A Manual of Aquatic Plants. University of Wisconsin Press.

Nichols, Stanley A. 1999. Floristic Quality Assessment of Wisconsin Lake Plant communities with Example Applications. Journal of Lake and Reservoir Management 15 (2): 133-141.

Roth, J., C. Busch, C. Belter, and S. Johannes. [online]. 1969. Spider Lake Bathymetric Map. http://dnr.wi.gov/lakes/maps/DNR/2435700a.pdf (2017, December).

Skawinski, Paul. 2014. Aquatic Plants of the Upper Midwest: A photographic field guide to our underwater forests. 2nd Edition, Wausau, WI.

Sullman, Josh. [online] 2010. Sparganium of Wisconsin Identification Key and Description. Available from University of Wisconsin-Madison http://www.botany.wisc.edu/jsulman/Sparganium%20identification%20key%20and%20description.htm (2012, July).

UWEX Lakes Program. [online]. 2010. Pre/Post Herbicide Comparison. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/Aquatic%20Plants/Appendix-D.pdf (2017, November).

UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/ecology/aquaticplants/default.aspx (2017, November).

Voss, Edward G. 1996. Michigan Flora Vol I-III. Cranbrook Institute of Science and University of Michigan Herbarium.

WDNR. [online]. 2017. Citizen Lake Monitoring Water Quality Data Report for Spider Lake. http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2435700&page=waterquality (2017, December)

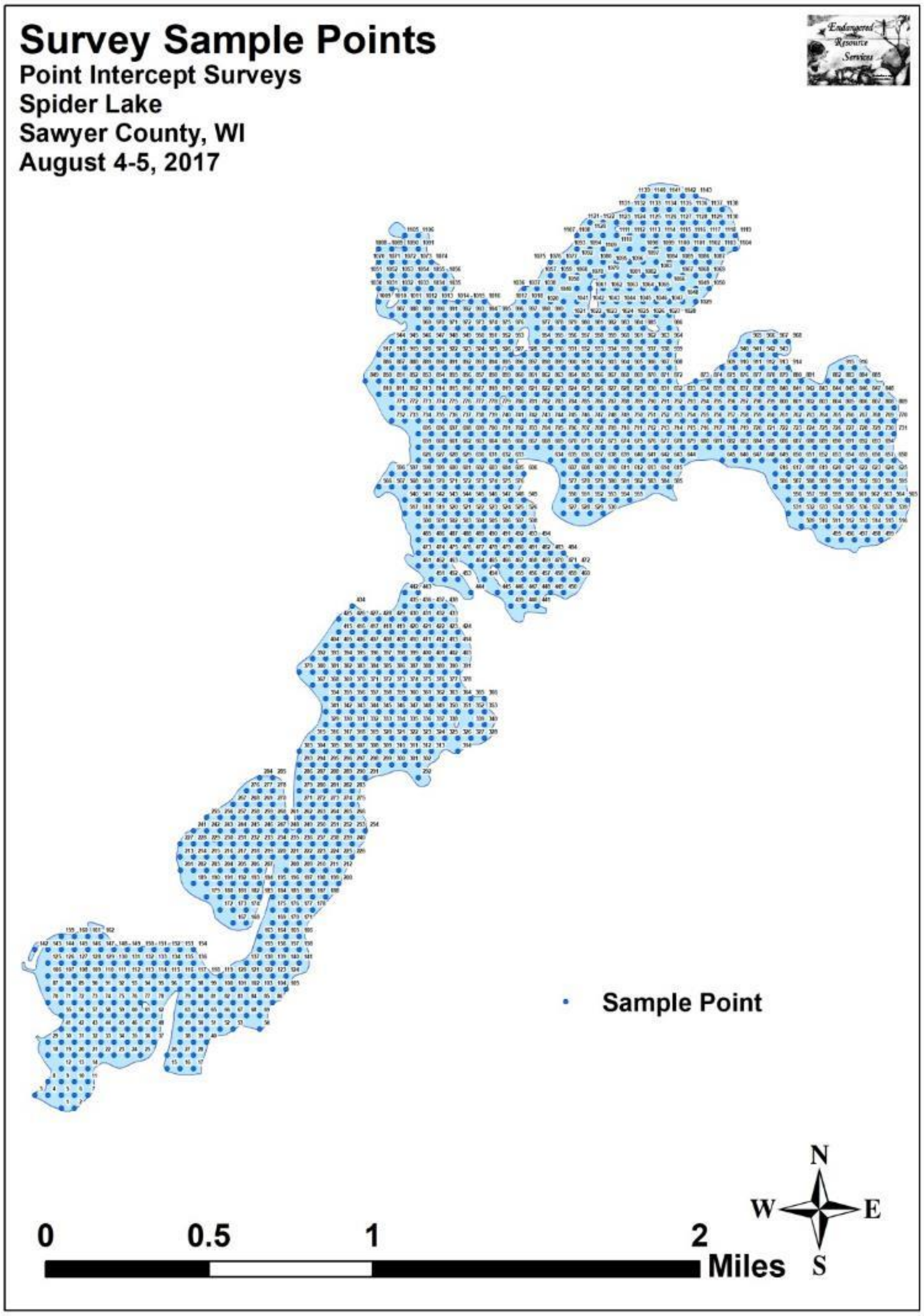
WDNR. [online]. 2010. Curly-leaf pondweed fact sheet. http://dnr.wi.gov/invasives/fact/curlyleaf_pondweed.htm (2010, August).

WDNR. [online]. 2010. Eurasian Water-milfoil fact sheet. http://dnr.wi.gov/invasives/fact/milfoil.htm (2010, August).

WDNR. [online]. 2010. Purple loosestrife fact sheet. http://dnr.wi.gov/invasives/fact/loosestrife.htm (2010, August).

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

Appendix I: Survey Sample Points Map

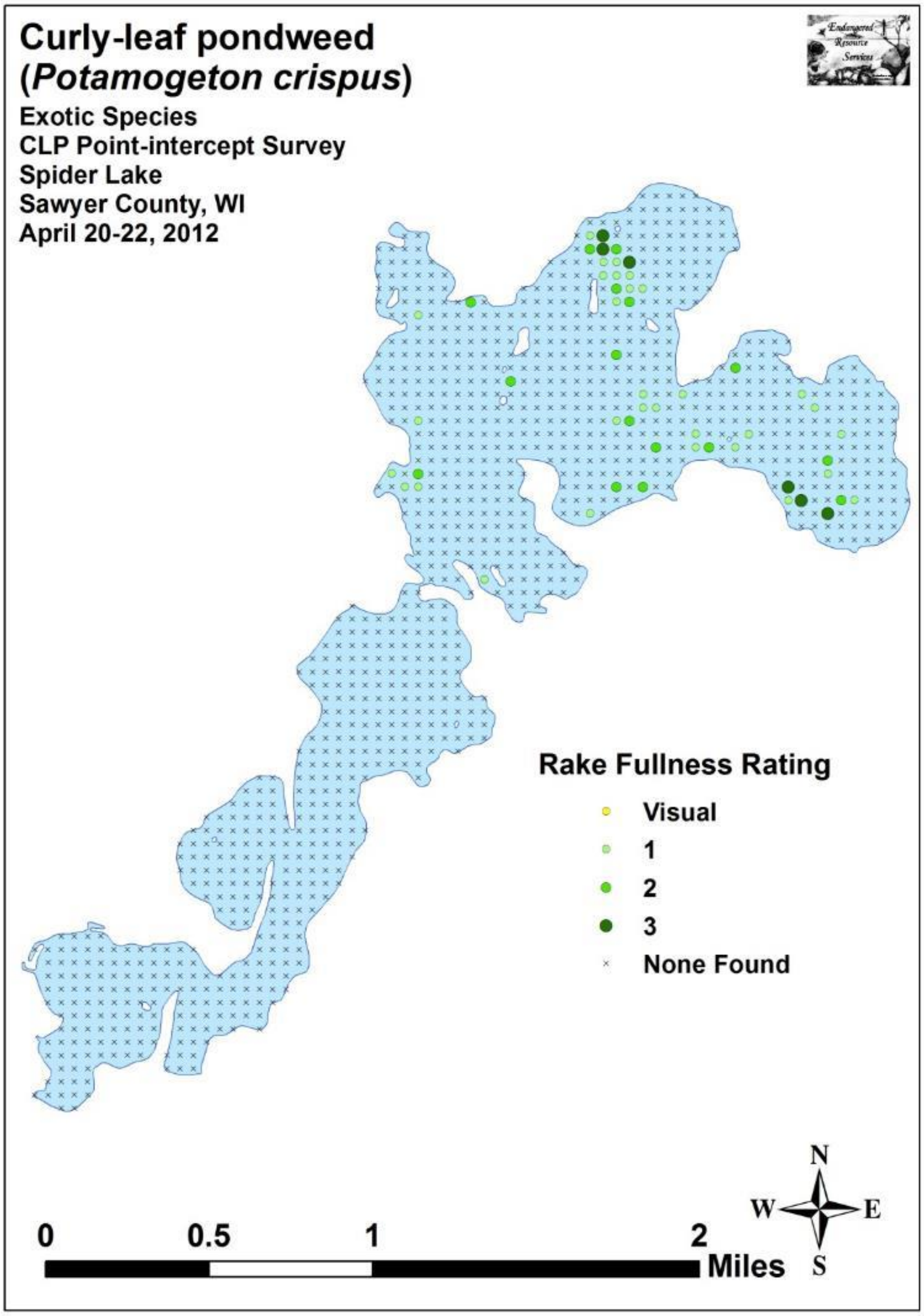

Survey Sample Points
Point Intercept Surveys
Spider Lake
Sawyer County, WI
August 4-5, 2017
Sample Point
0
0.5
1
2
Miles
N
W
E
S

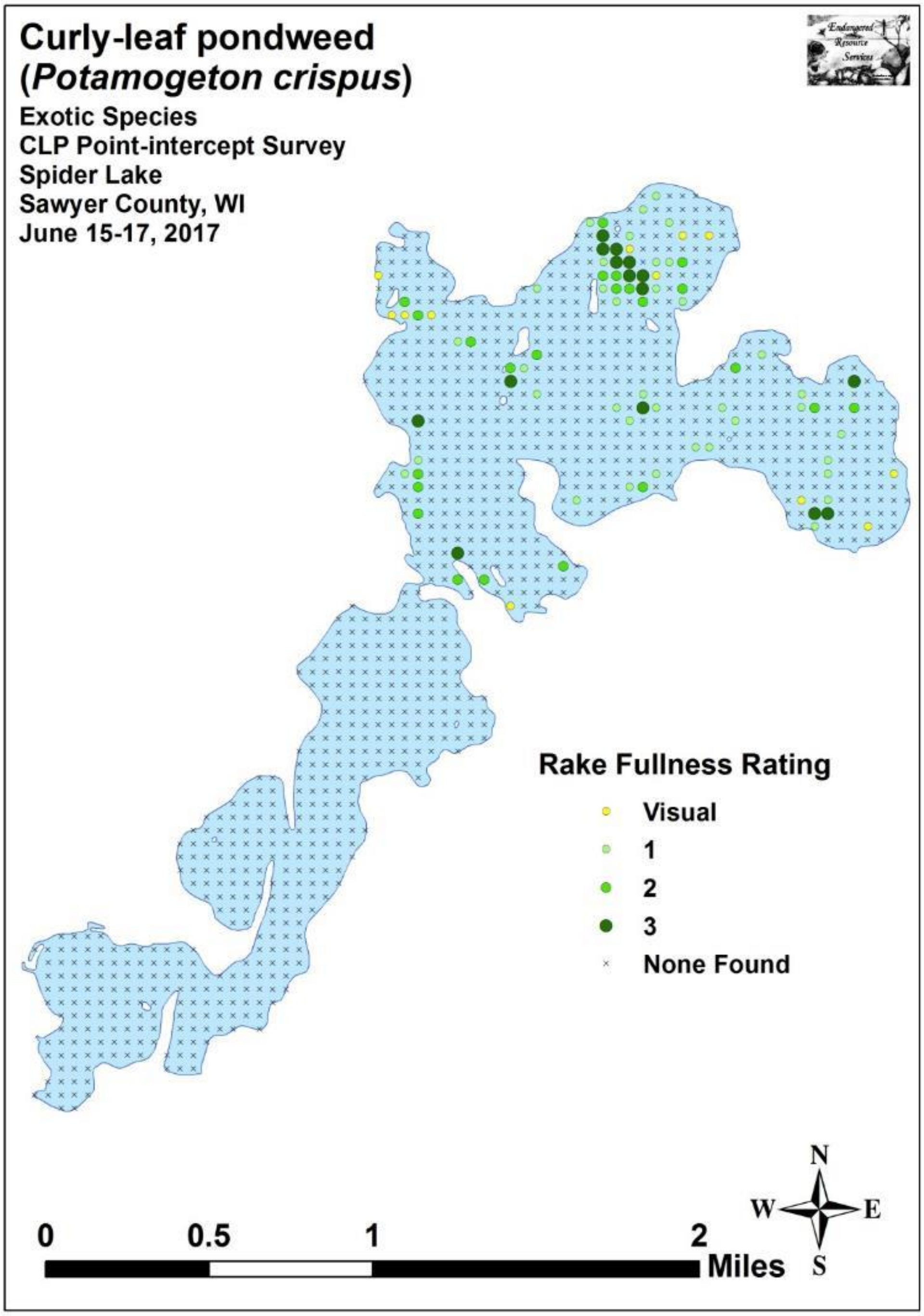
Appendix II: Boat and Vegetative Survey Data Sheets

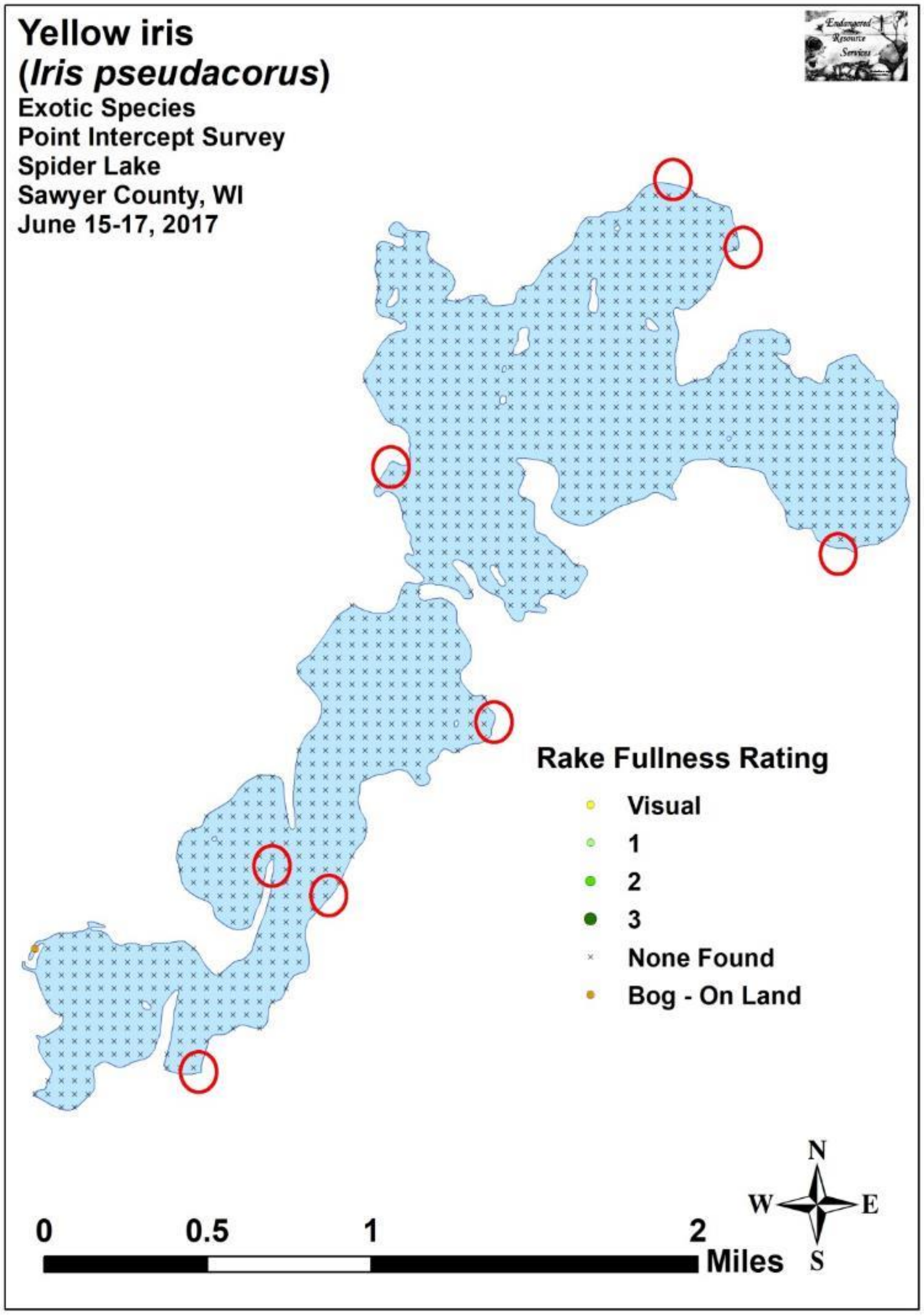
Boat Survey	
Lake Name	
County	
WBIC	
Date of Survey	
(mm/dd/yy)	
workers	
Nearest Point	**Species seen, habitat information**

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																									

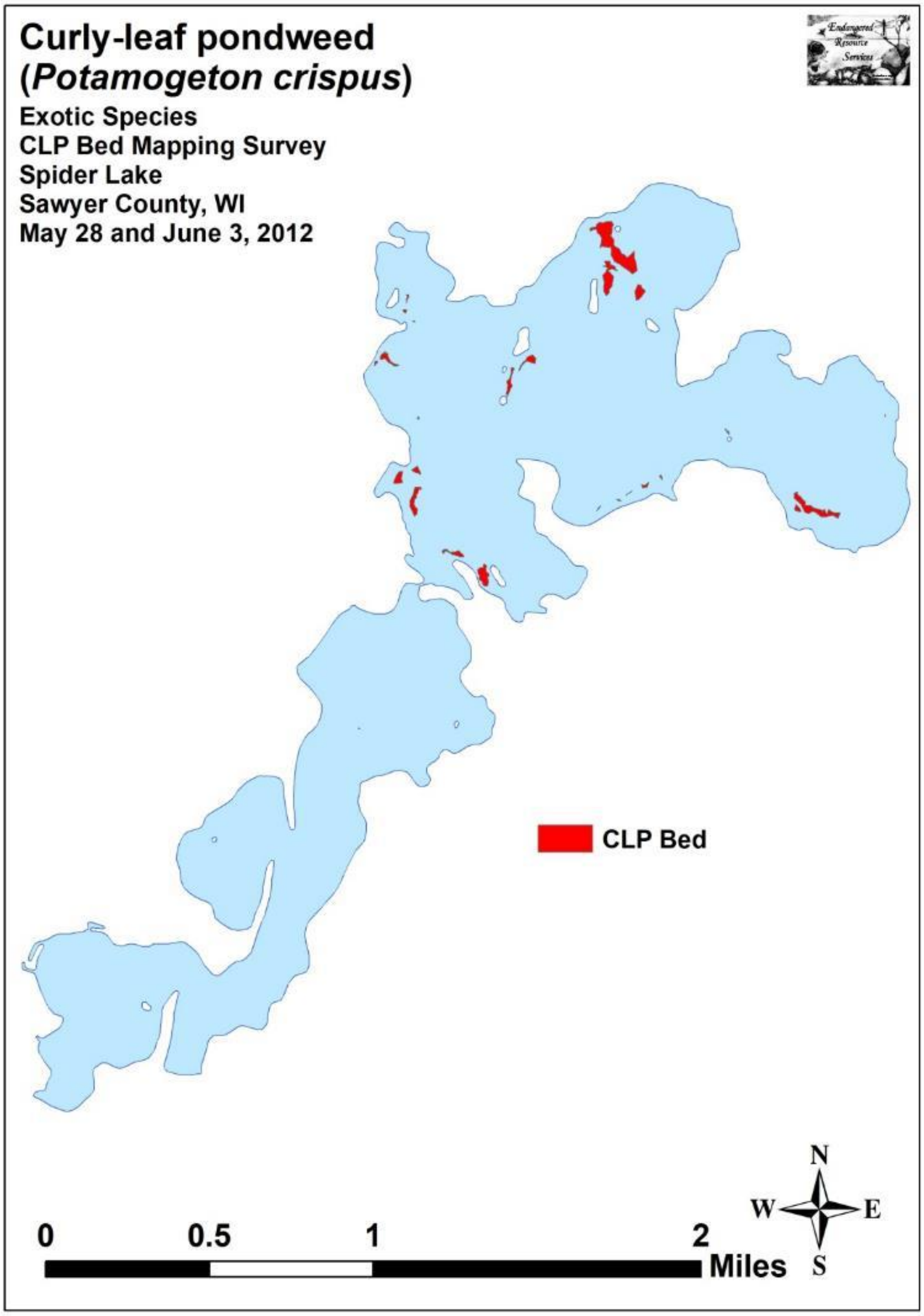
Appendix III: 2012 and 2017 Early-season Curly-leaf Pondweed and Yellow Iris Density and Distribution Maps

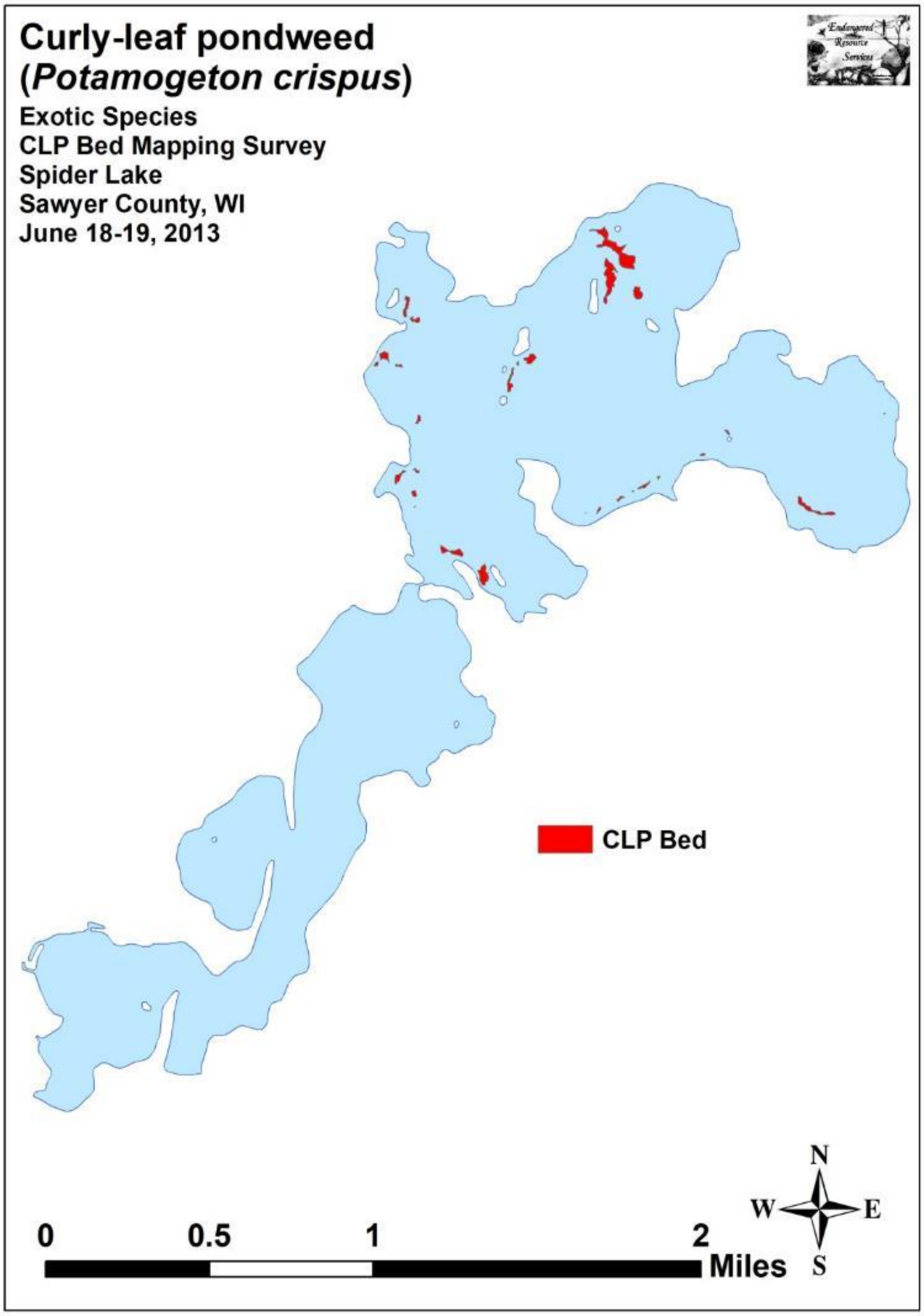

Curly-leaf pondweed
(*Potamogeton crispus*)
Exotic Species
CLP Point-intercept Survey
Spider Lake
Sawyer County, WI
April 20-22, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.5
1
2
Miles
N
W
E
S


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Point-intercept Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.5
1
2
Miles

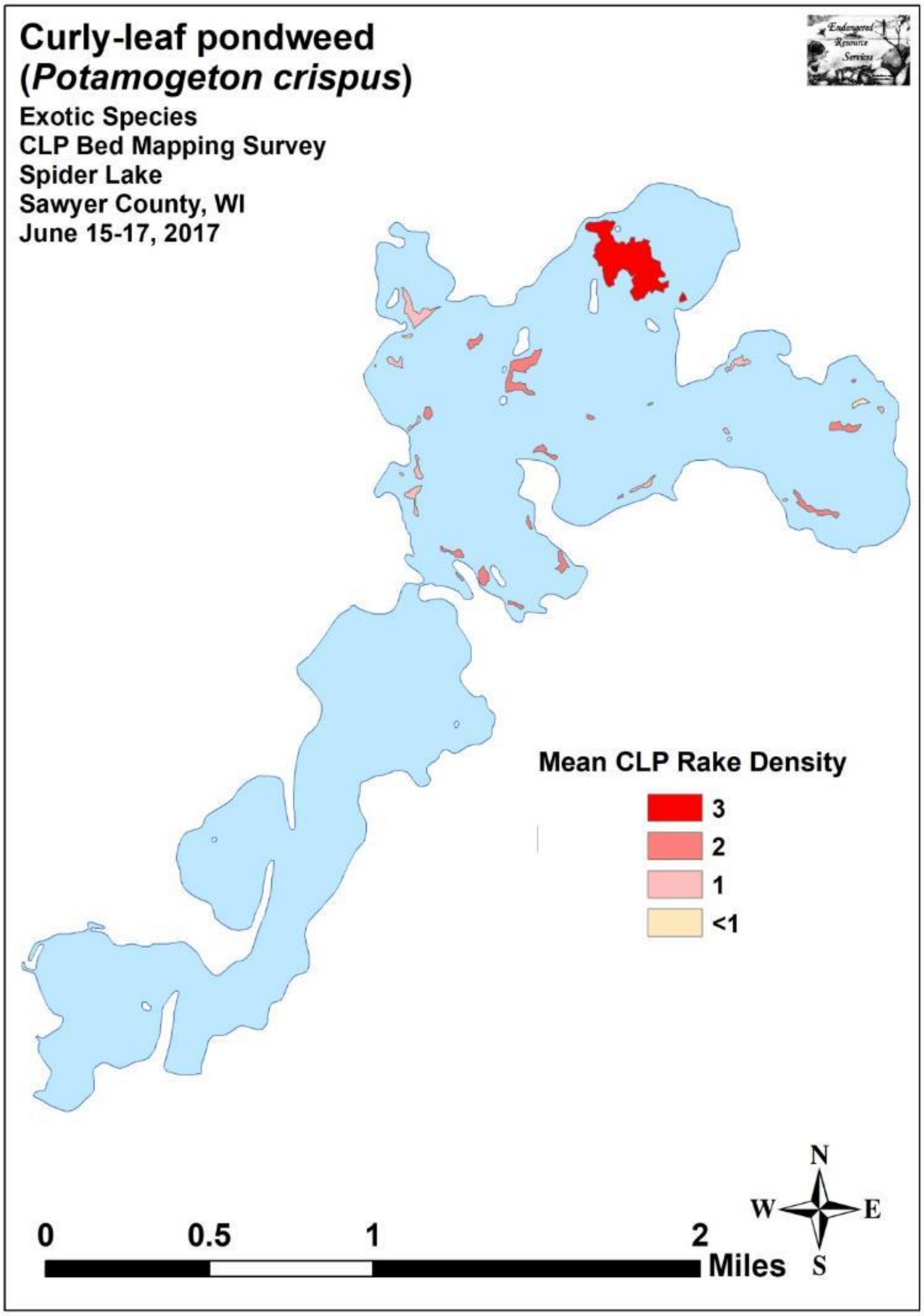

Yellow iris
(Iris pseudacorus)
Exotic Species
Point Intercept Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

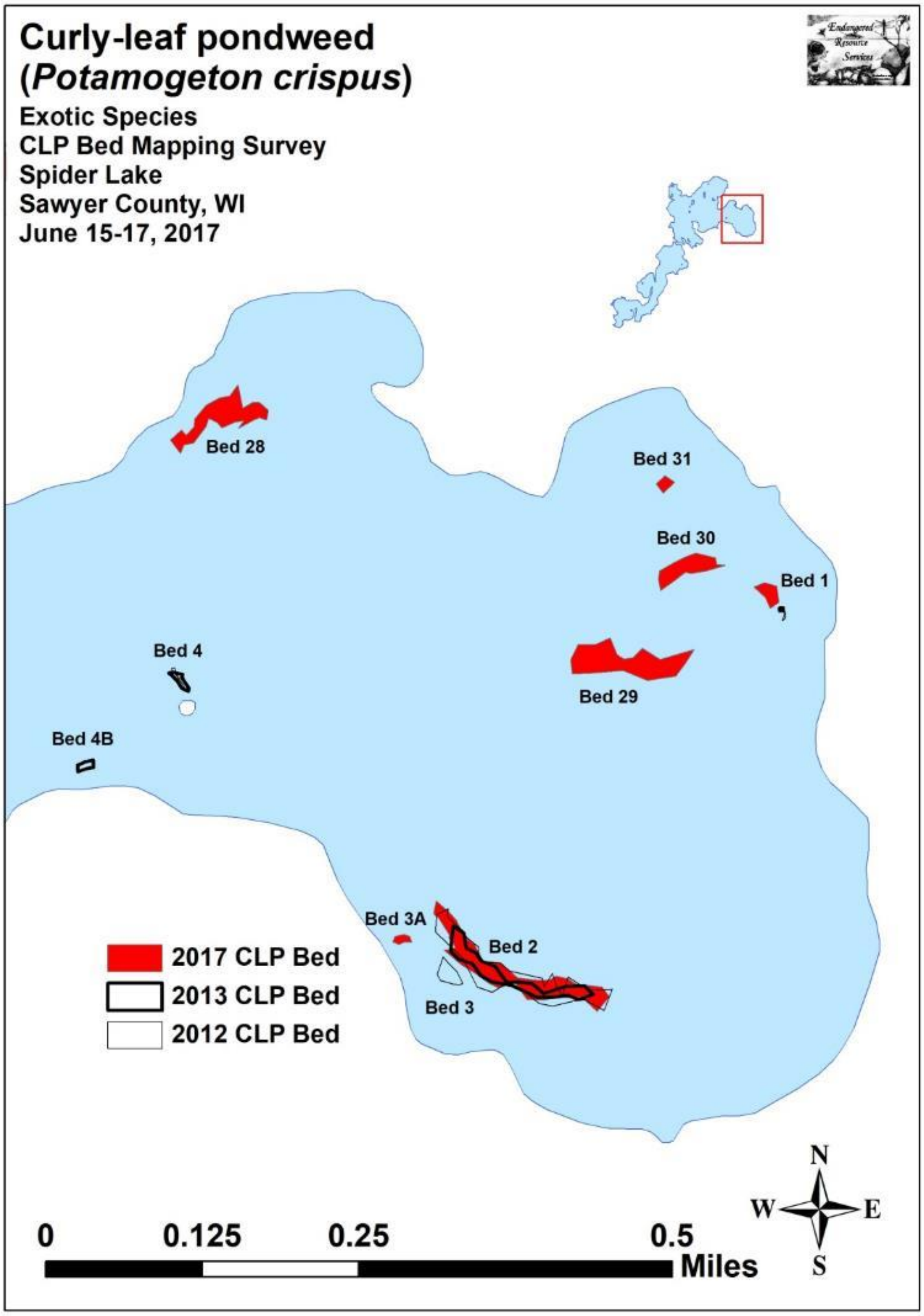
Appendix IV: 2012, 2013, and 2017 Curly-leaf Pondweed Bed Maps

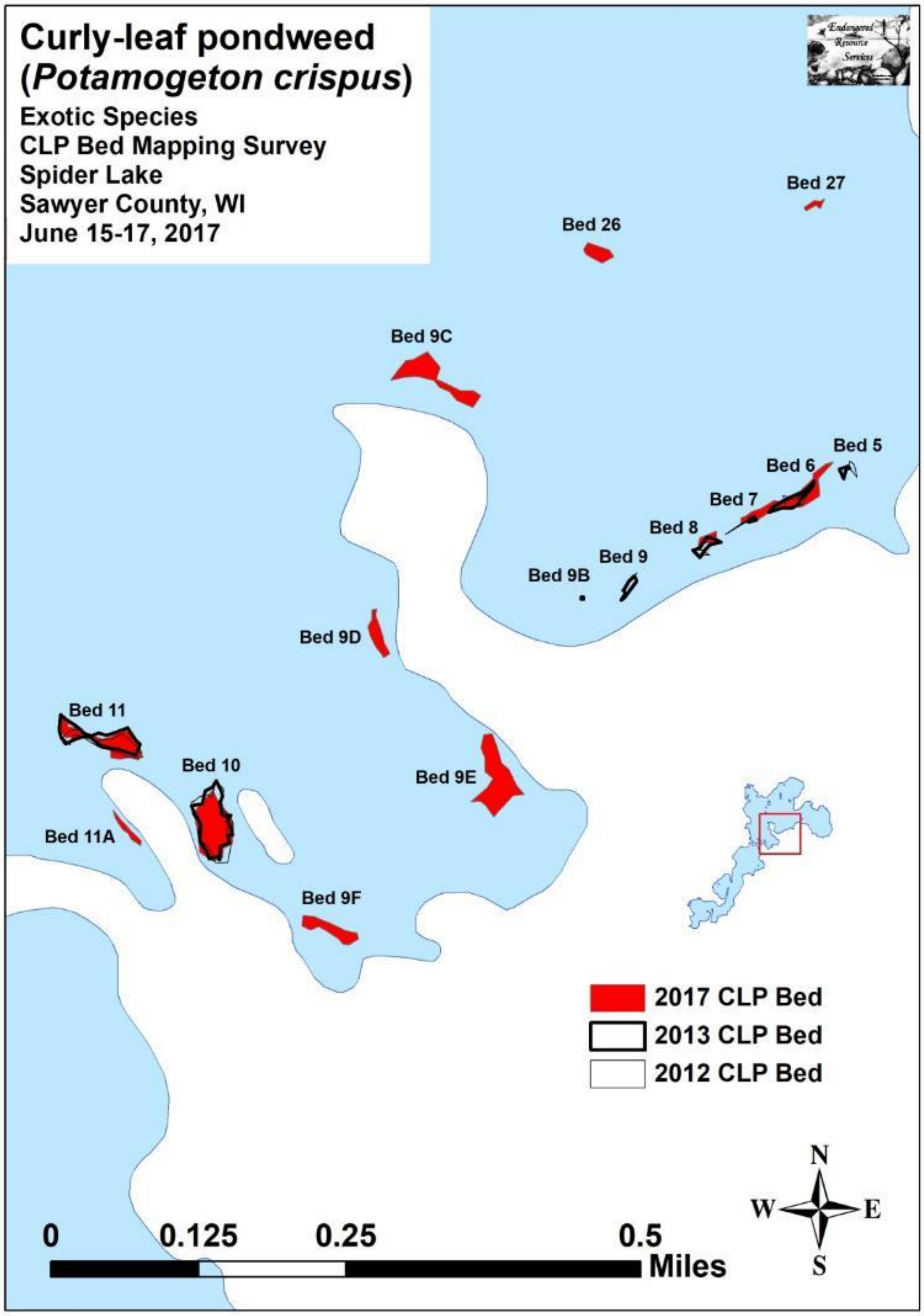

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
May 28 and June 3, 2012
CLP Bed
0
0.5
1
2
Miles
N
W
E
S



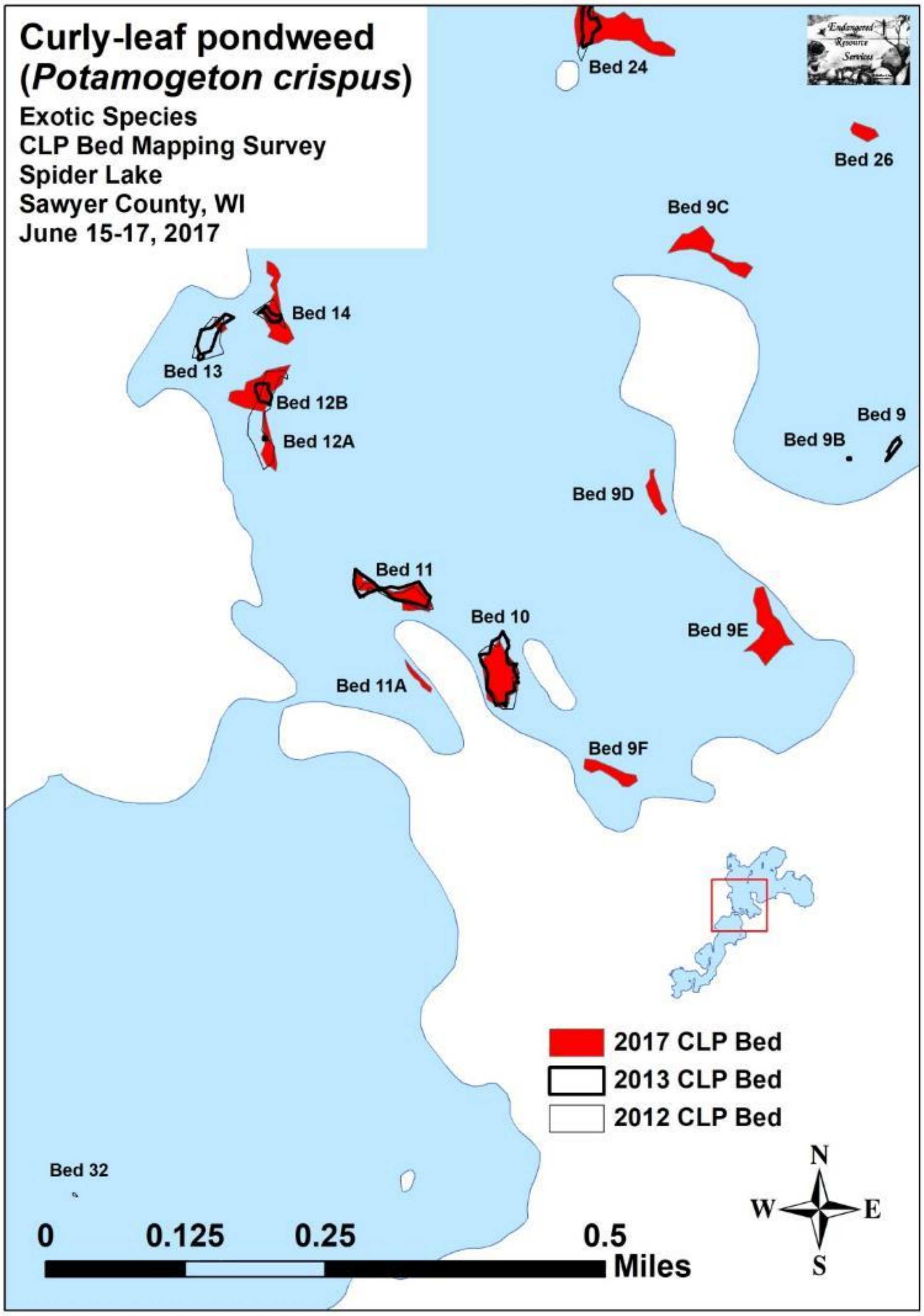
Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 18-19, 2013
CLP Bed
0
0.5
1
2
Miles
N
W
E
S


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Mean CLP Rake Density
3
2
1
<1
N
W
E
S
0
0.5
1
2
Miles

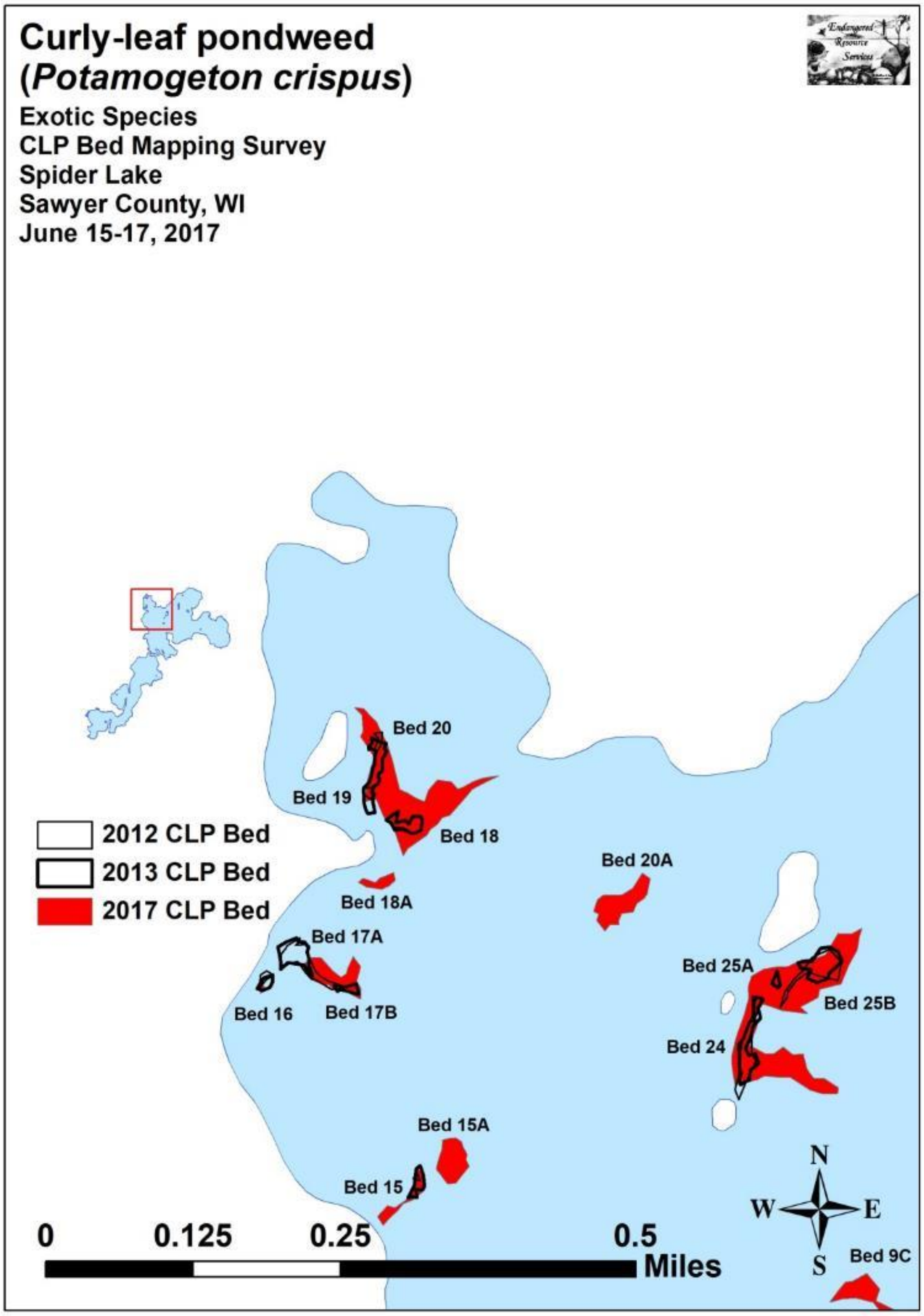

Curly-leaf pondweed
(*Potamogeton crispus*)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Bed 28
Bed 31
Bed 30
Bed 1
Bed 4
Bed 29
Bed 4B
Bed 3A
Bed 2
Bed 3
2017 CLP Bed
2013 CLP Bed
2012 CLP Bed
N
W
E
S
0
0.125
0.25
0.5
Miles

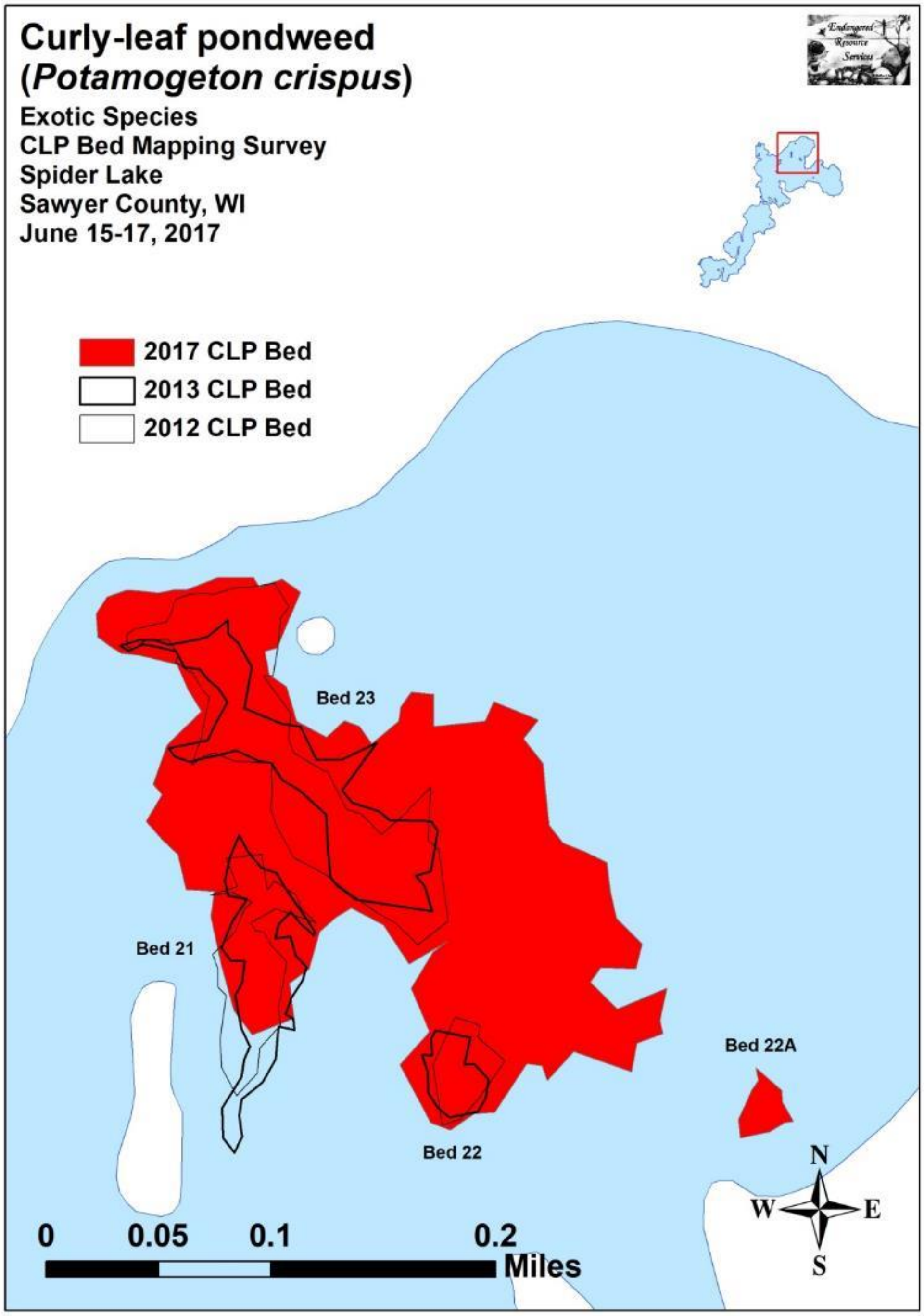


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Bed 27
Bed 26
Bed 9C
Bed 5
Bed 6
Bed 7
Bed 8
Bed 9
Bed 9B
Bed 9D
Bed 11
Bed 10
Bed 9E
Bed 11A
Bed 9F
2017 CLP Bed
2013 CLP Bed
2012 CLP Bed
N
W
E
S
0
0.125
0.25
0.5
Miles

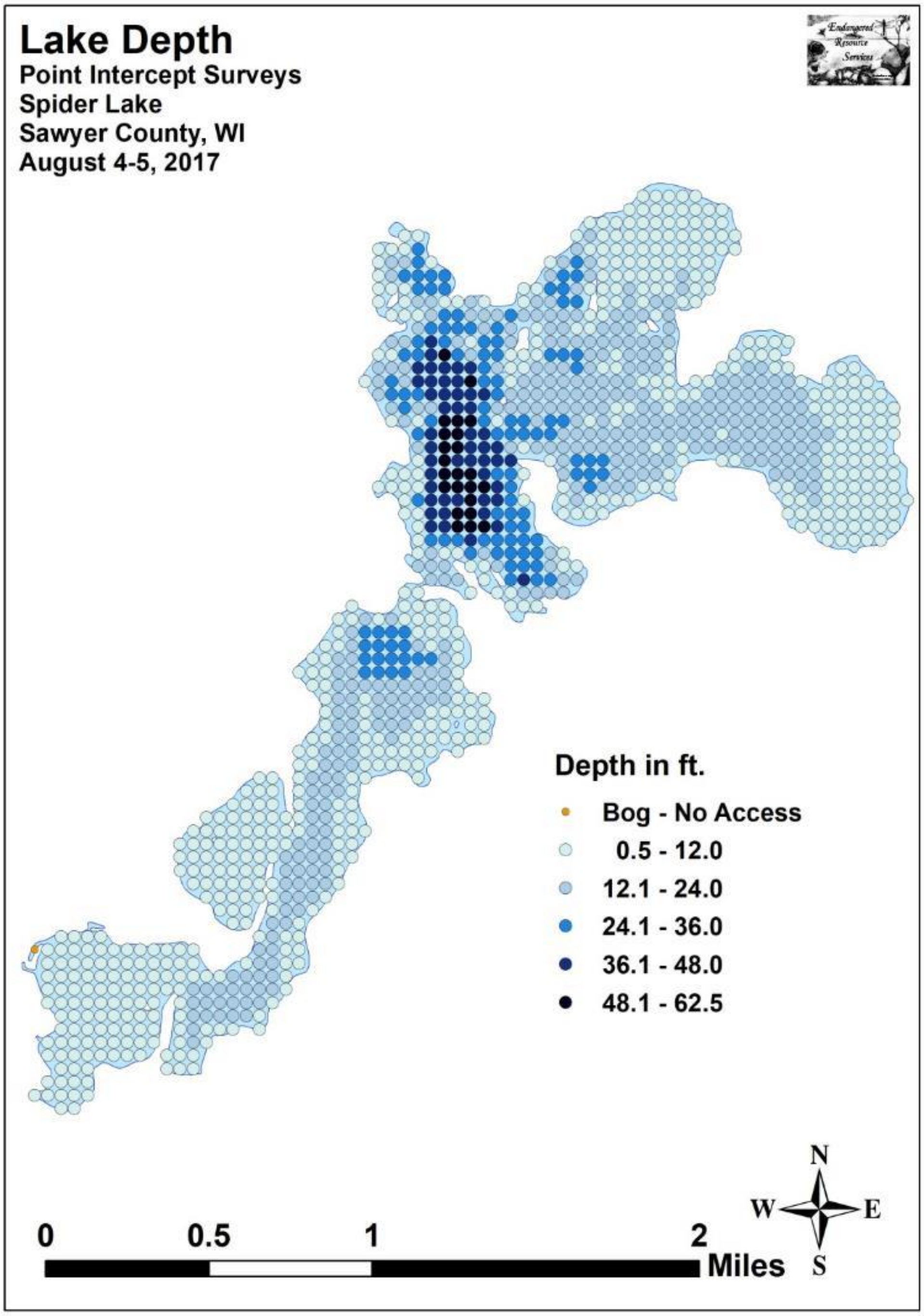


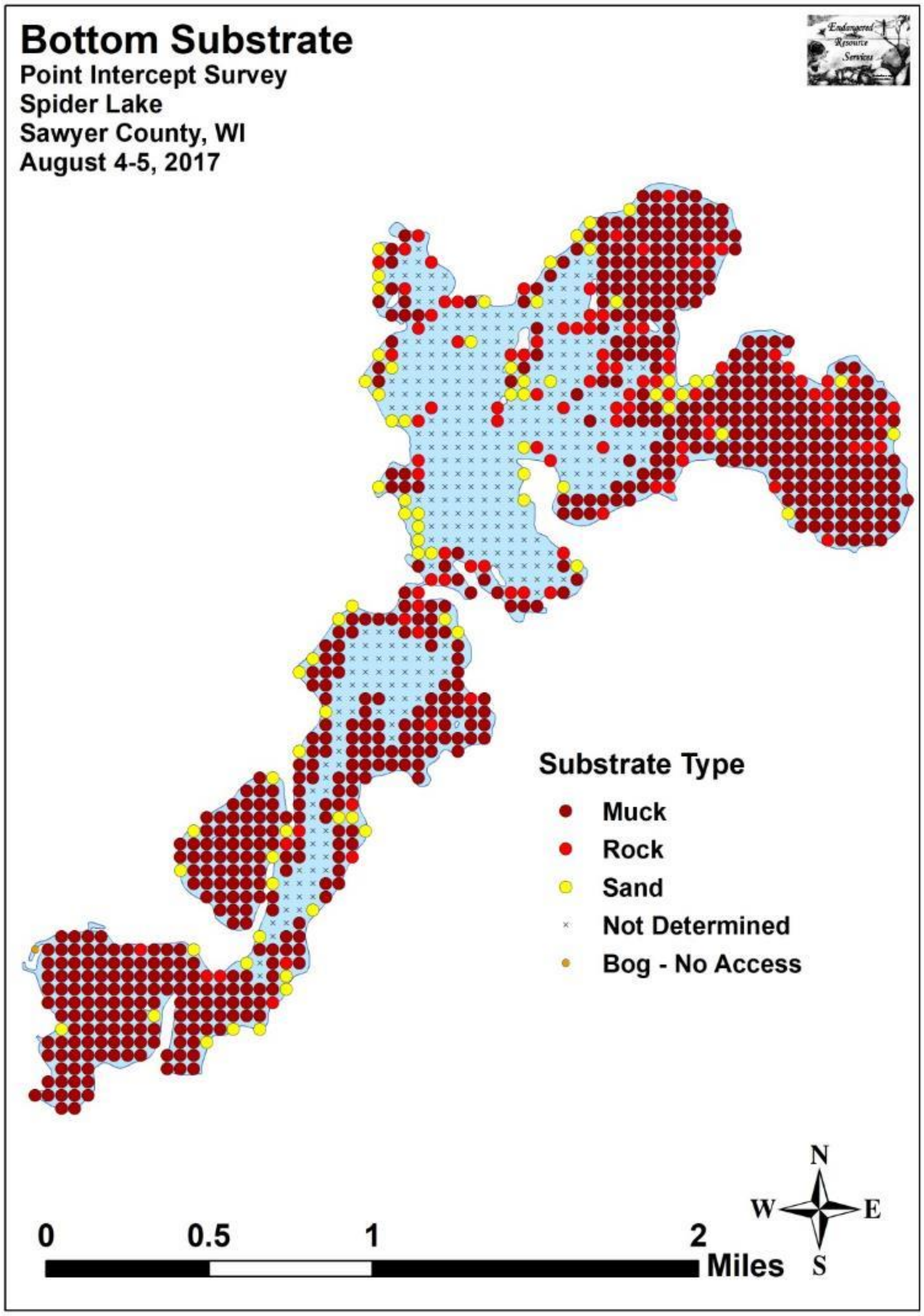
Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Bed 24
Bed 26
Bed 9C
Bed 14
Bed 13
Bed 12B
Bed 12A
Bed 9
Bed 9B
Bed 9D
Bed 11
Bed 10
Bed 9E
Bed 11A
Bed 9F
2017 CLP Bed
2013 CLP Bed
2012 CLP Bed
Bed 32
N
W
E
S
0
0.125
0.25
0.5
Miles


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
Bed 20
Bed 19
Bed 18
Bed 18A
Bed 20A
Bed 17A
Bed 16
Bed 17B
Bed 25A
Bed 25B
Bed 24
Bed 15A
Bed 15
Bed 9C
2012 CLP Bed
2013 CLP Bed
2017 CLP Bed
N
W
E
S
0
0.125
0.25
0.5
Miles


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Spider Lake
Sawyer County, WI
June 15-17, 2017
2017 CLP Bed
2013 CLP Bed
2012 CLP Bed
Bed 23
Bed 21
Bed 22
Bed 22A
N
W
E
S
0
0.05
0.1
0.2
Miles

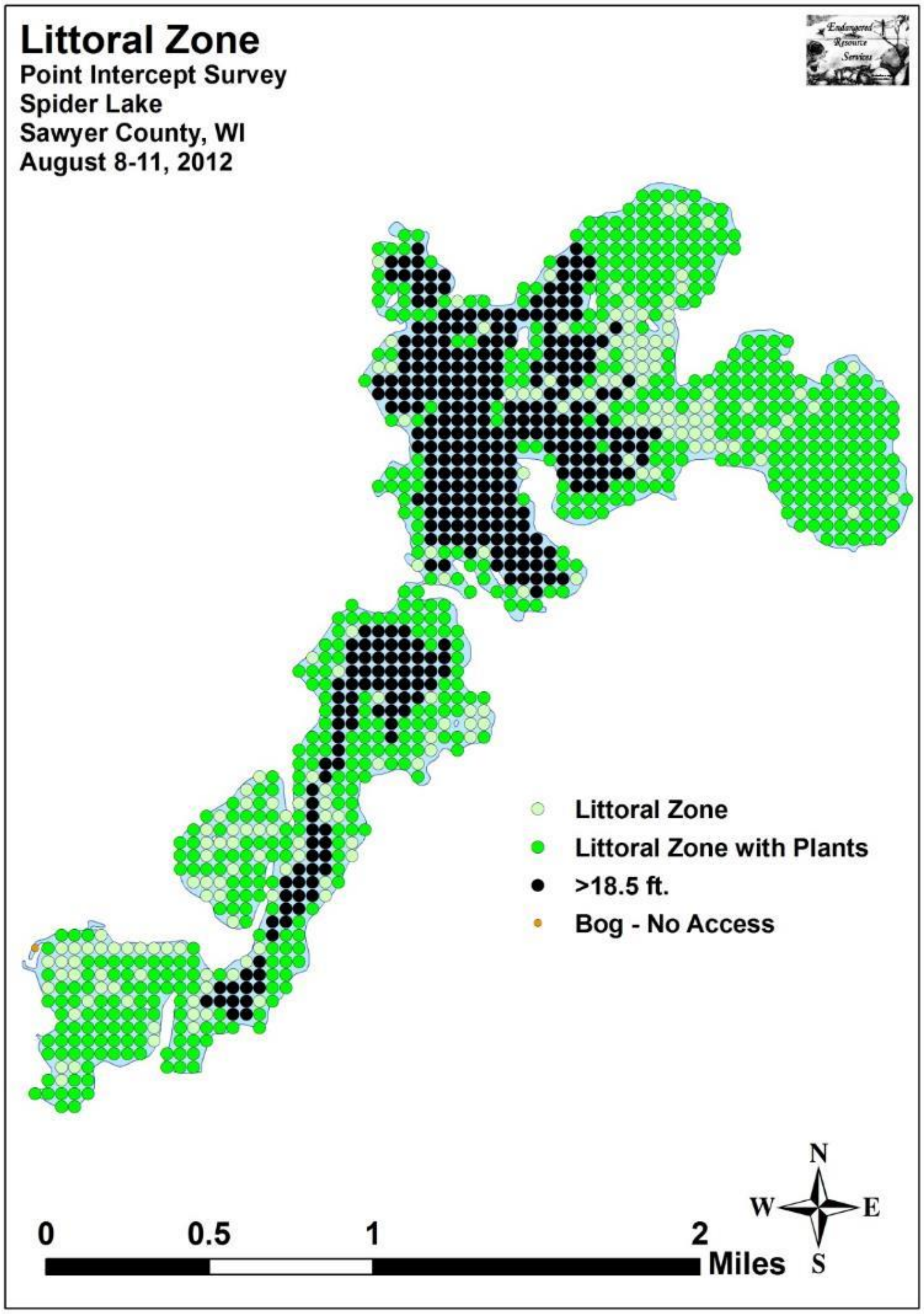
Appendix V: Habitat Variable Maps

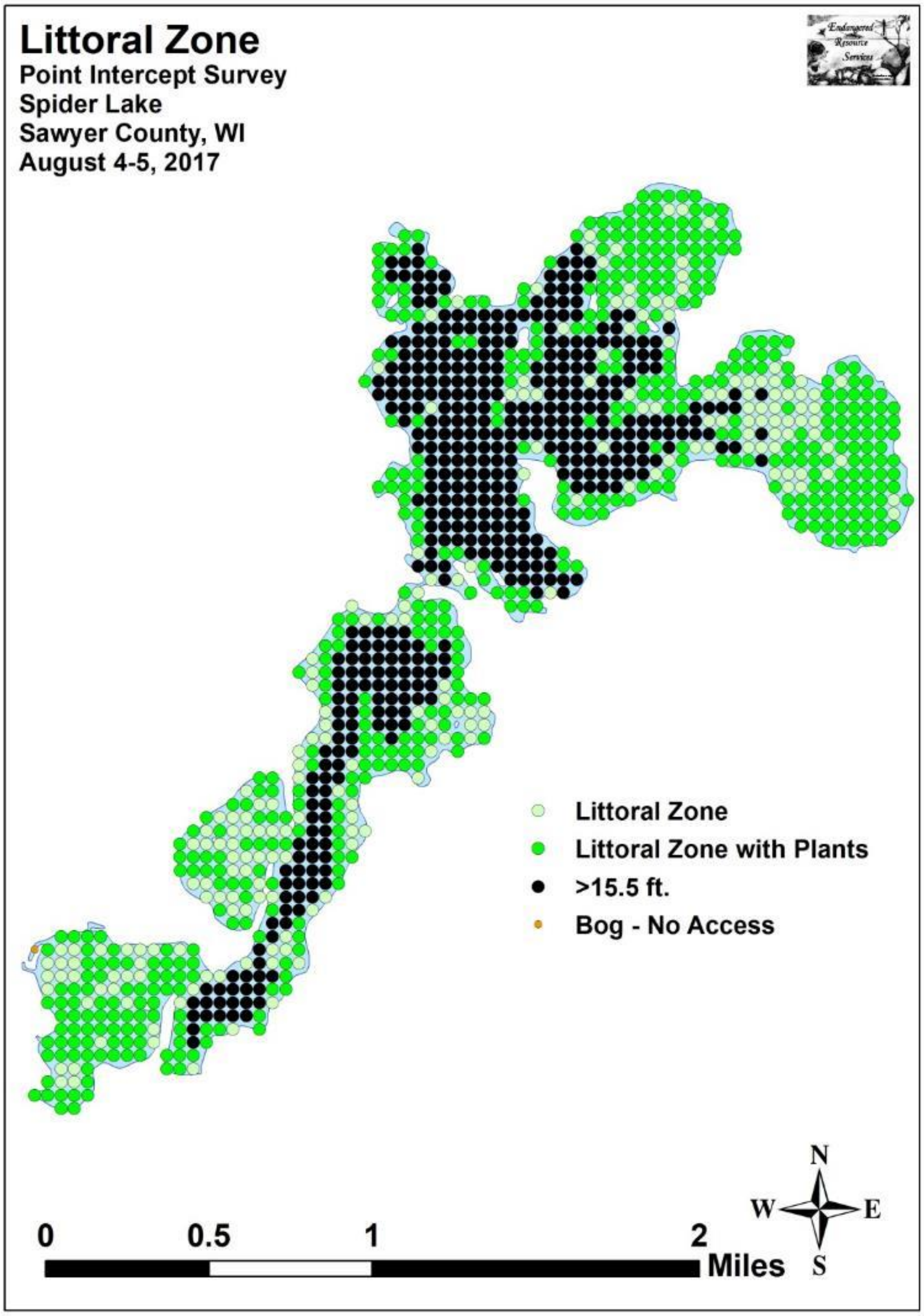

Lake Depth
Point Intercept Surveys
Spider Lake
Sawyer County, WI
August 4-5, 2017
Depth in ft.
Bog - No Access
0.5 - 12.0
12.1 - 24.0
24.1 - 36.0
36.1 - 48.0
48.1 - 62.5
N
W
E
S
0
0.5
1
2
Miles



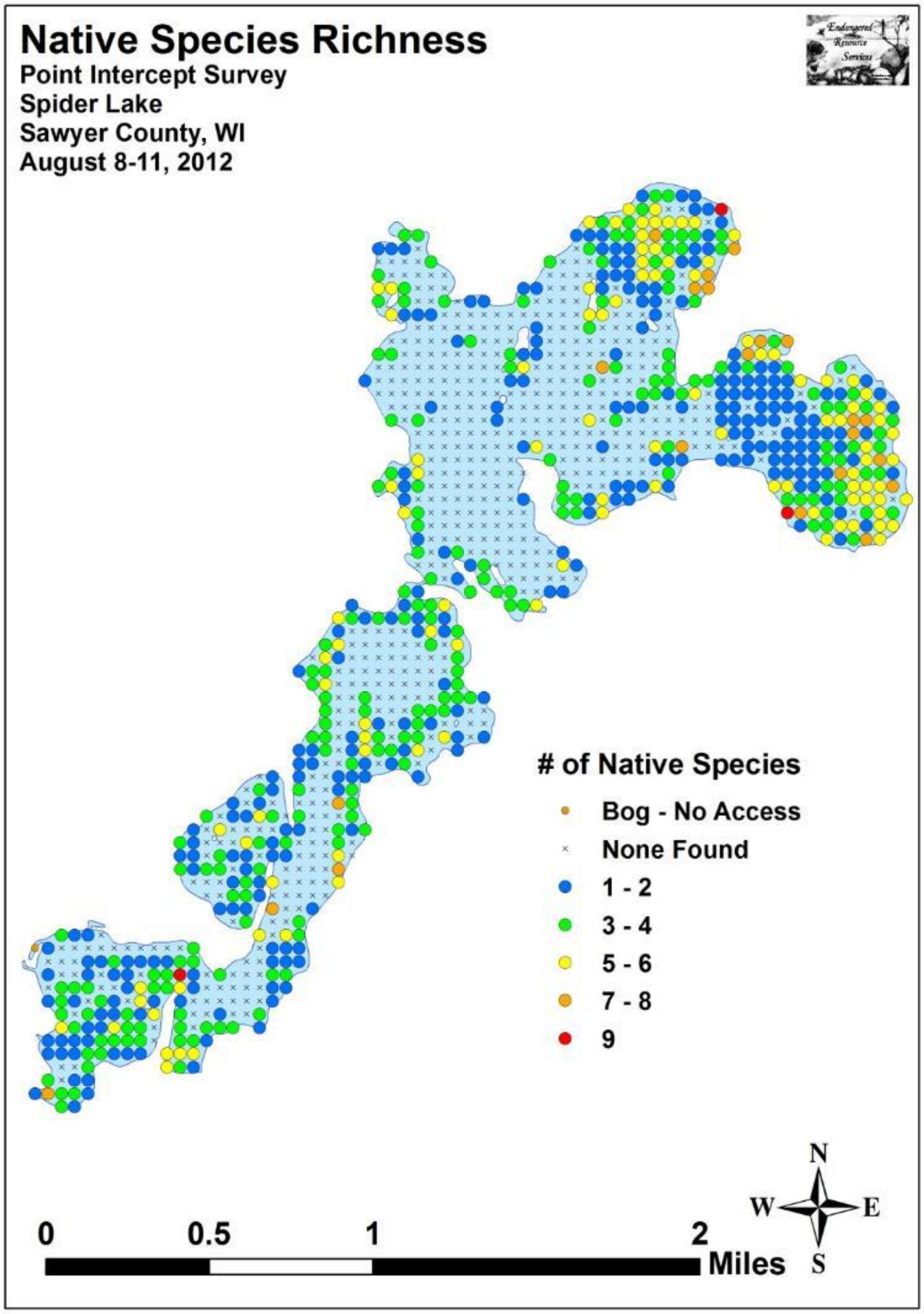
Bottom Substrate
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
Not Determined
Bog - No Access
N
W
E
S
0
0.5
1
2
Miles

Appendix VI: 2012 and 2017 Littoral Zone, Native Species Richness and Total Rake Fullness Maps

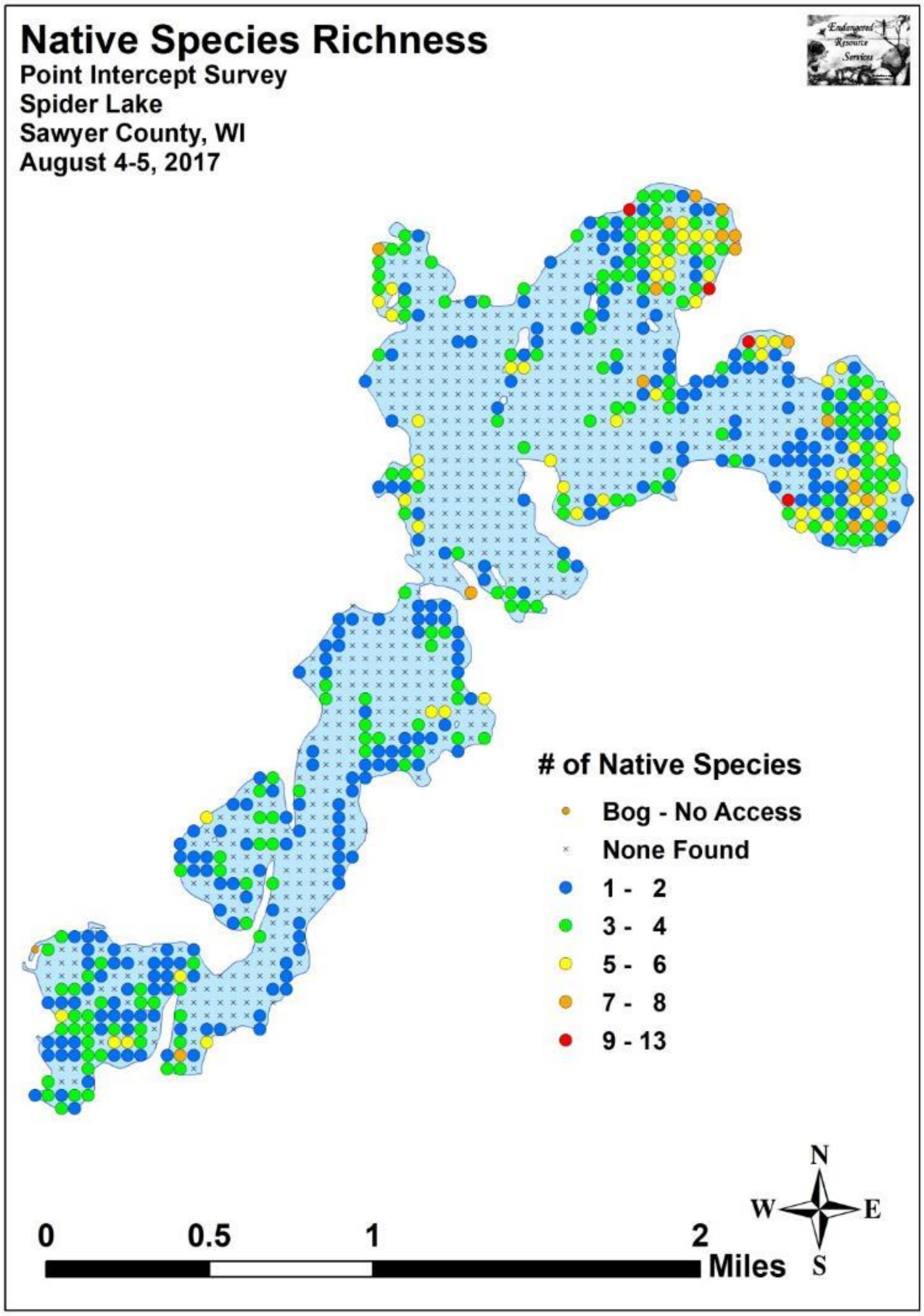

Littoral Zone
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Littoral Zone
Littoral Zone with Plants
>18.5 ft.
Bog - No Access
N
W
E
S
0
0.5
1
2
Miles

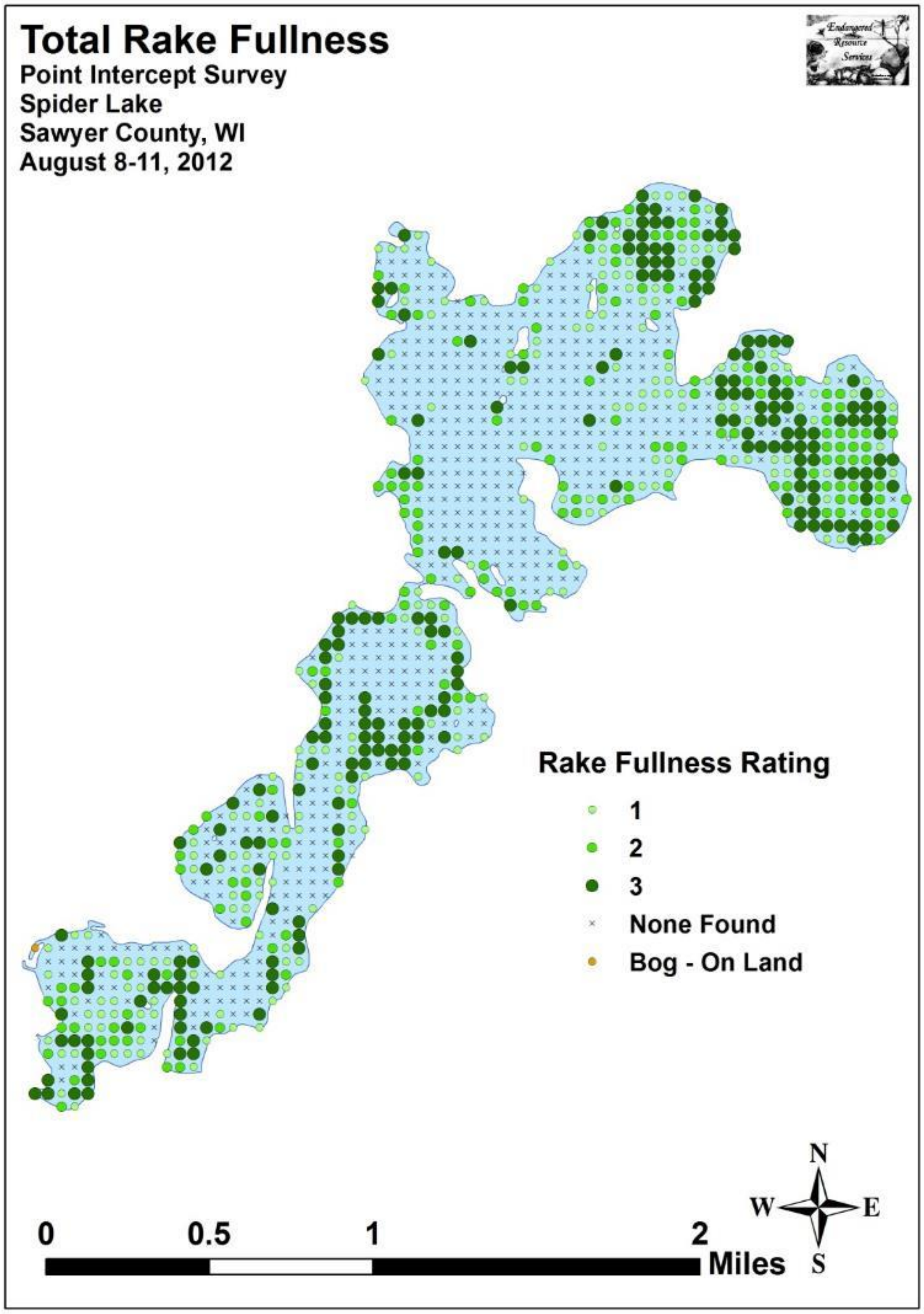


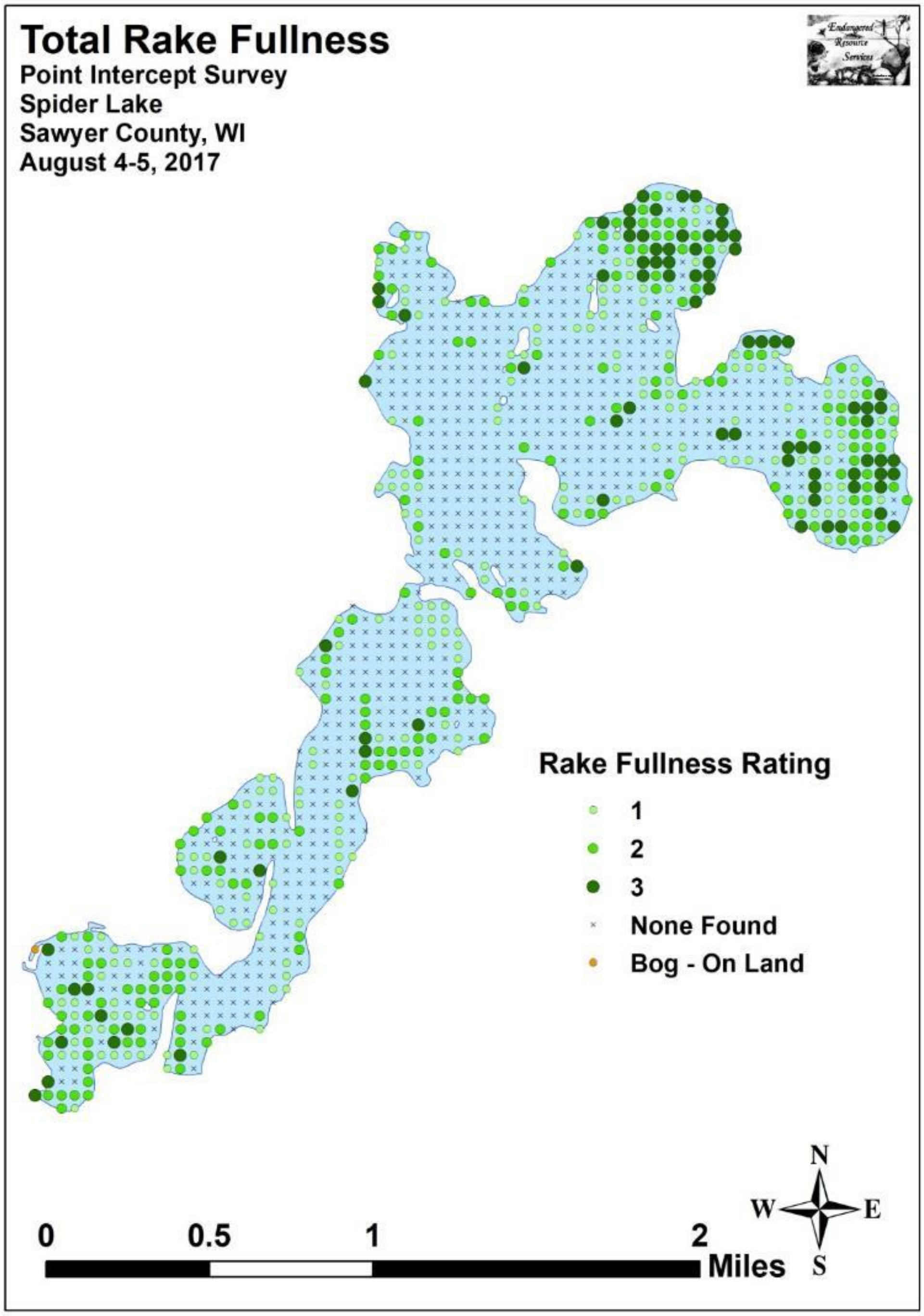
Littoral Zone
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Littoral Zone
Littoral Zone with Plants
>15.5 ft.
Bog - No Access
0
0.5
1
2
Miles
N
W
E
S



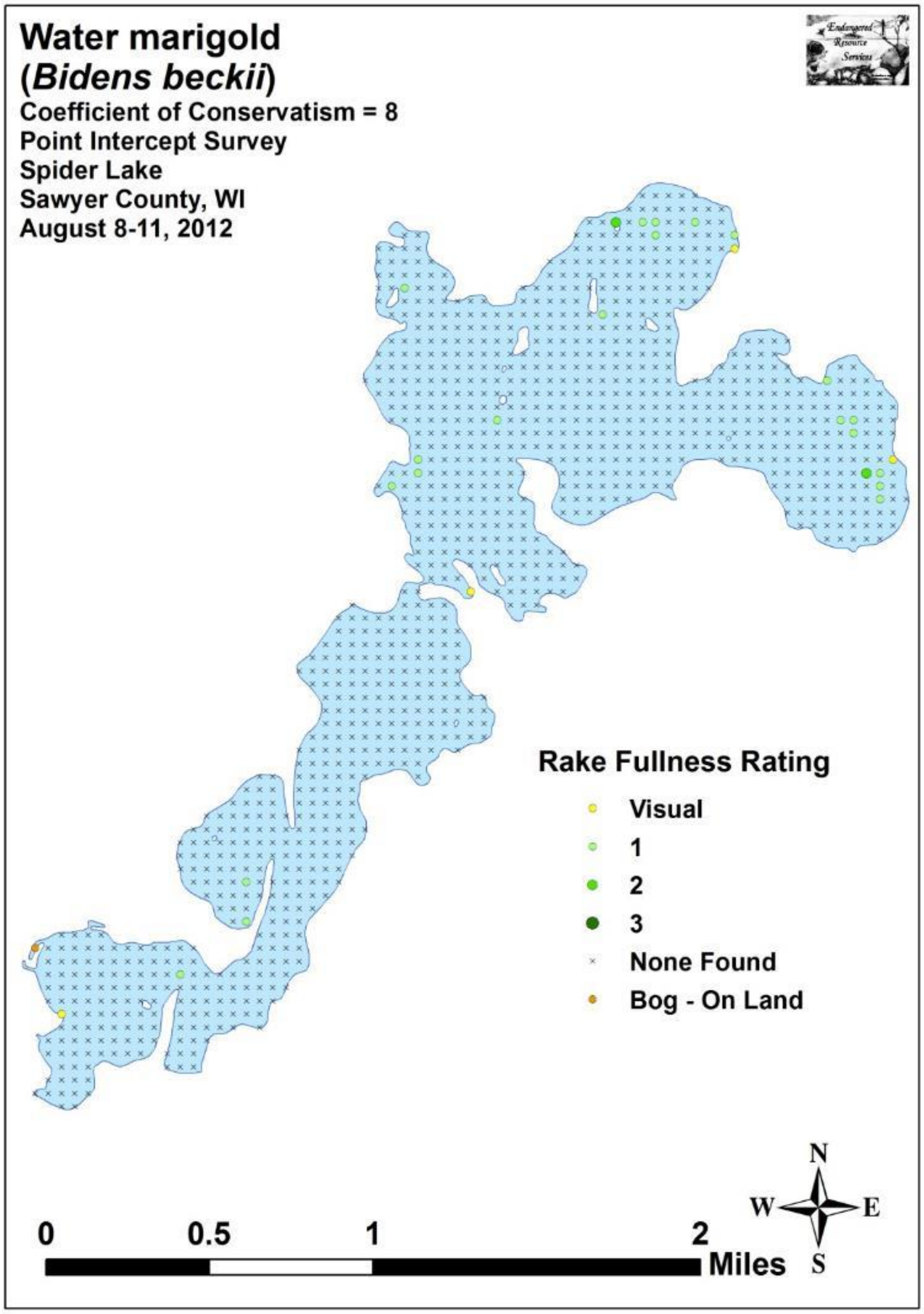
Native Species Richness
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
# of Native Species
Bog - No Access
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9
0
0.5
1
2
Miles
N
W
E
S

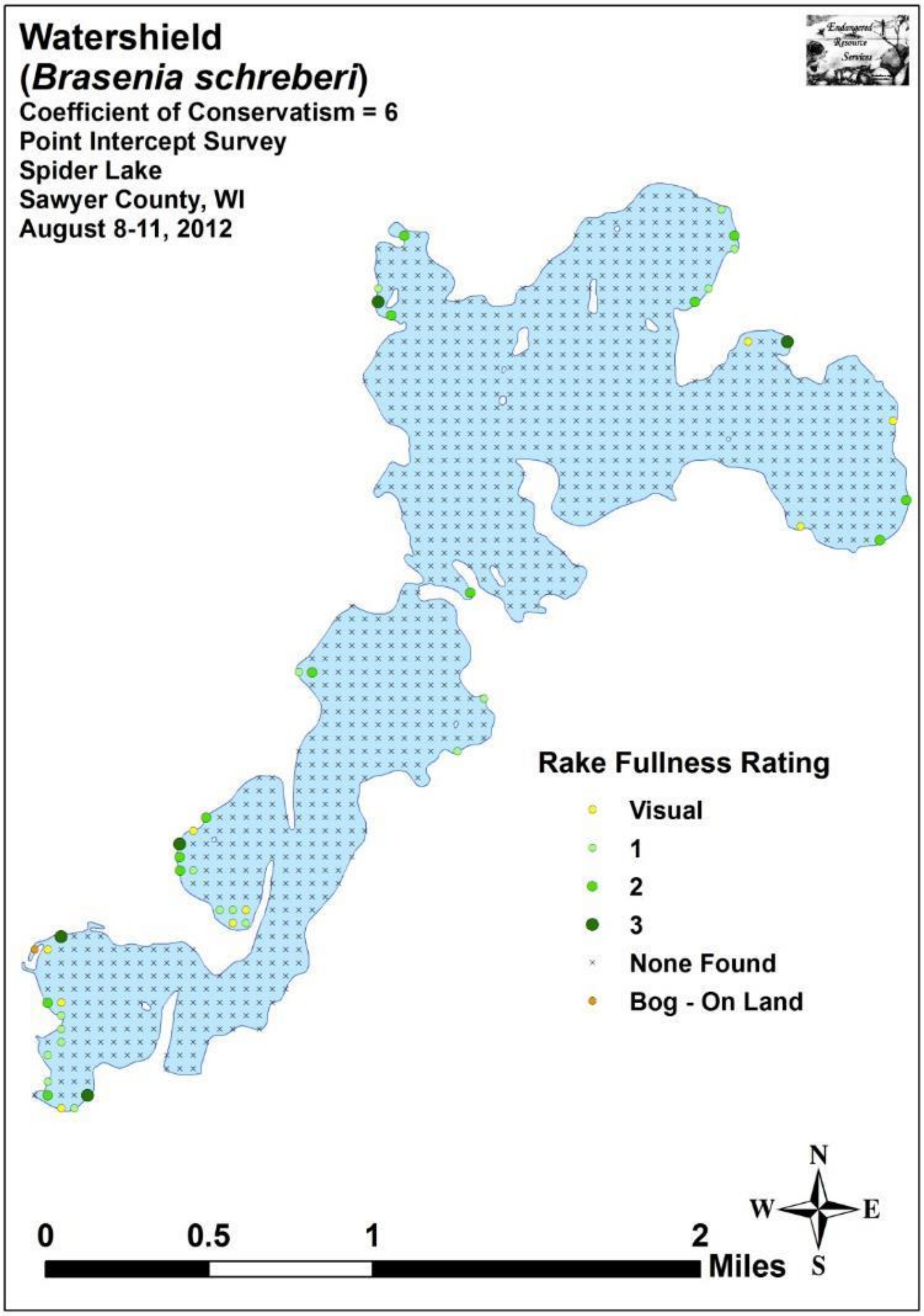

Native Species Richness
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
# of Native Species
Bog - No Access
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 13
N
W
E
S
0
0.5
1
2
Miles

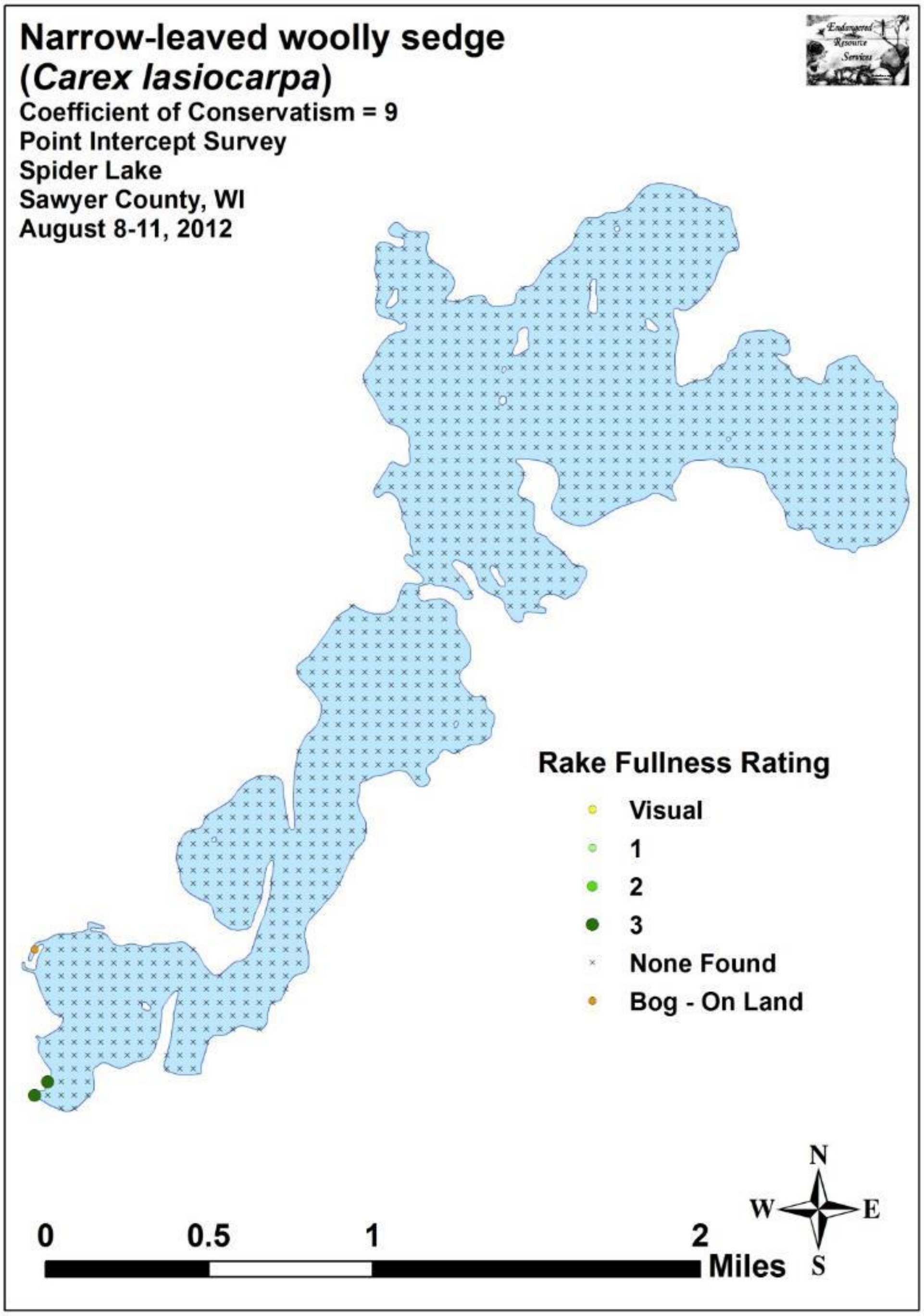

Total Rake Fullness
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

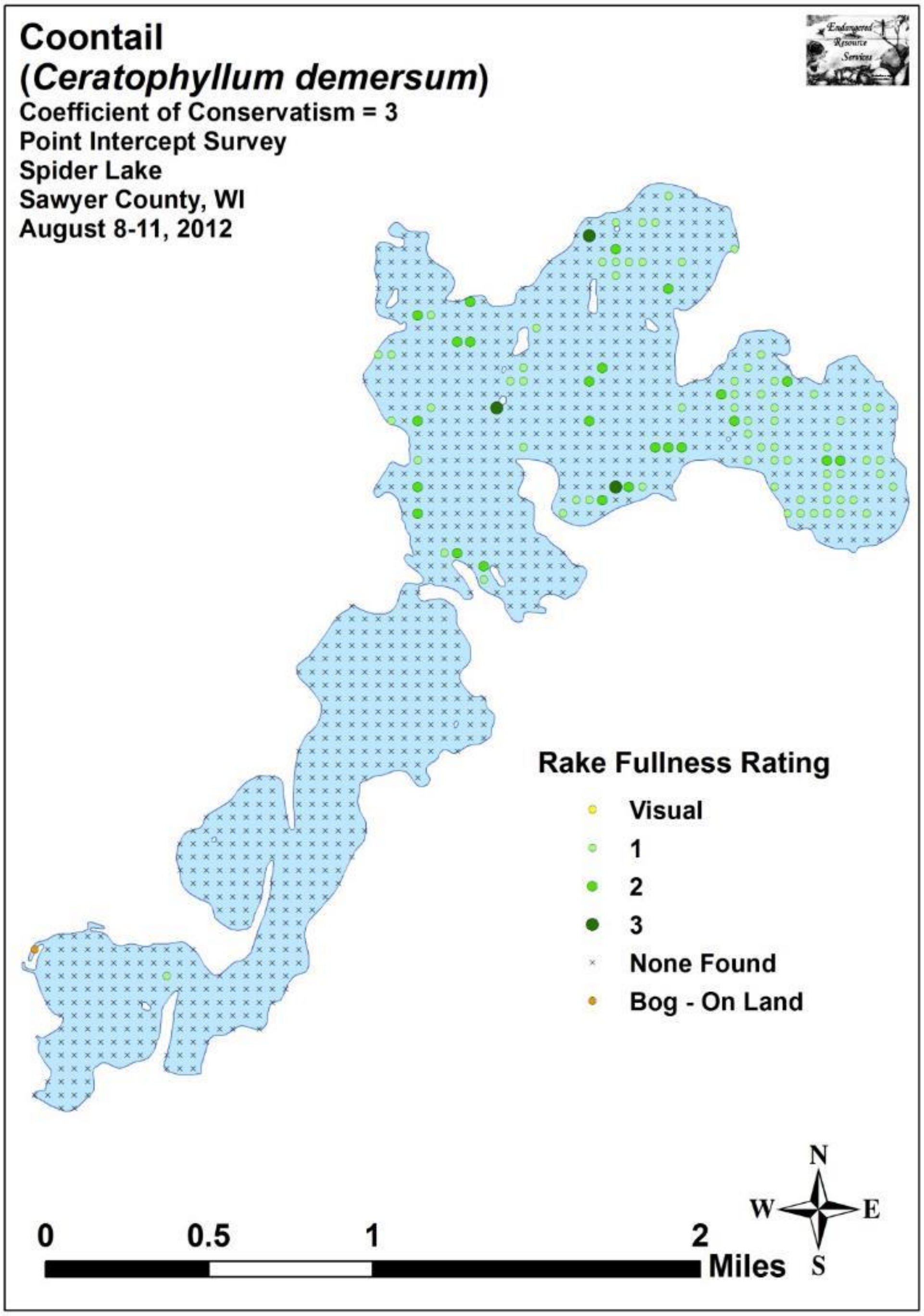

Total Rake Fullness
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

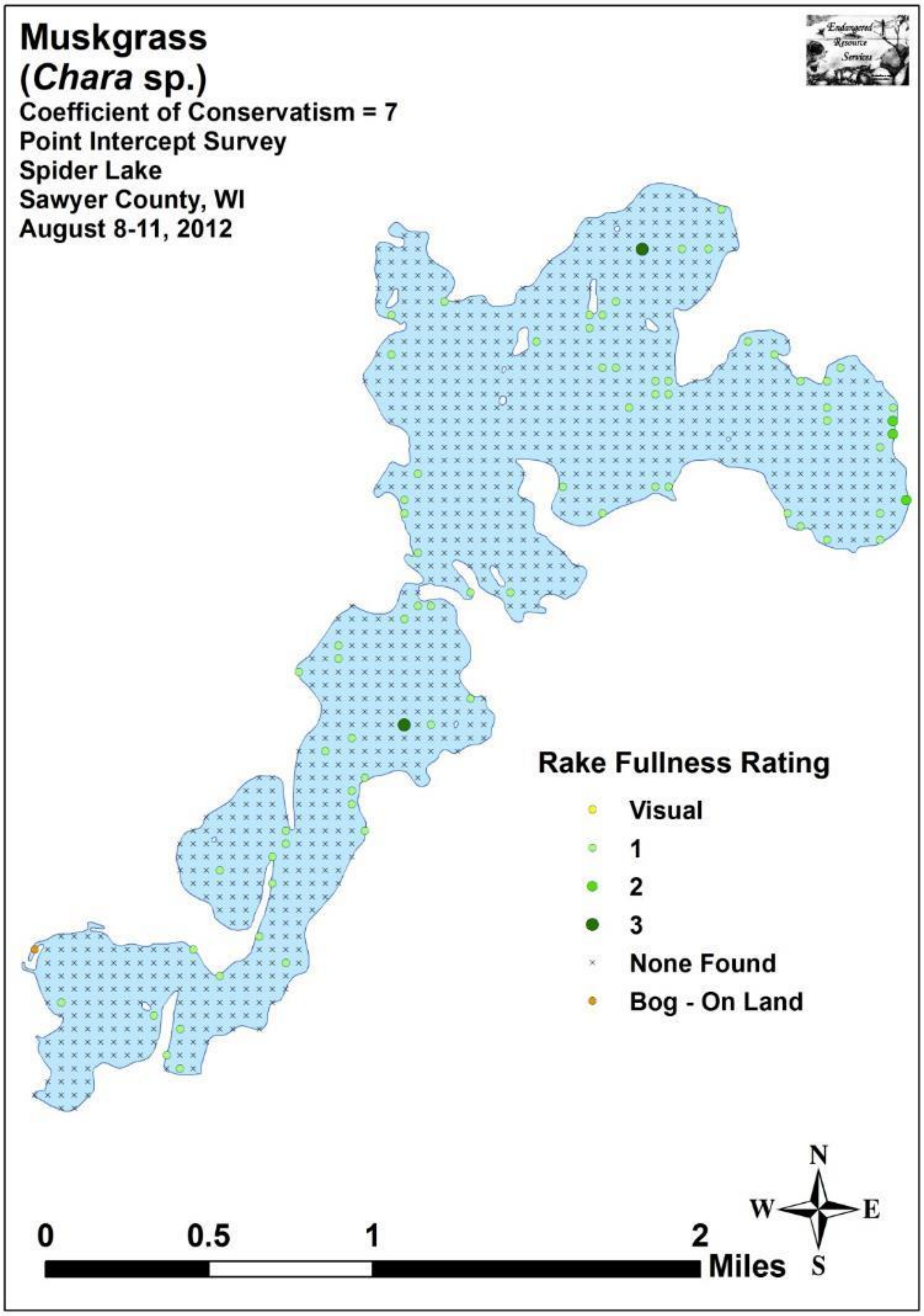
Appendix VII: August 2012 Species Density and Distribution Maps

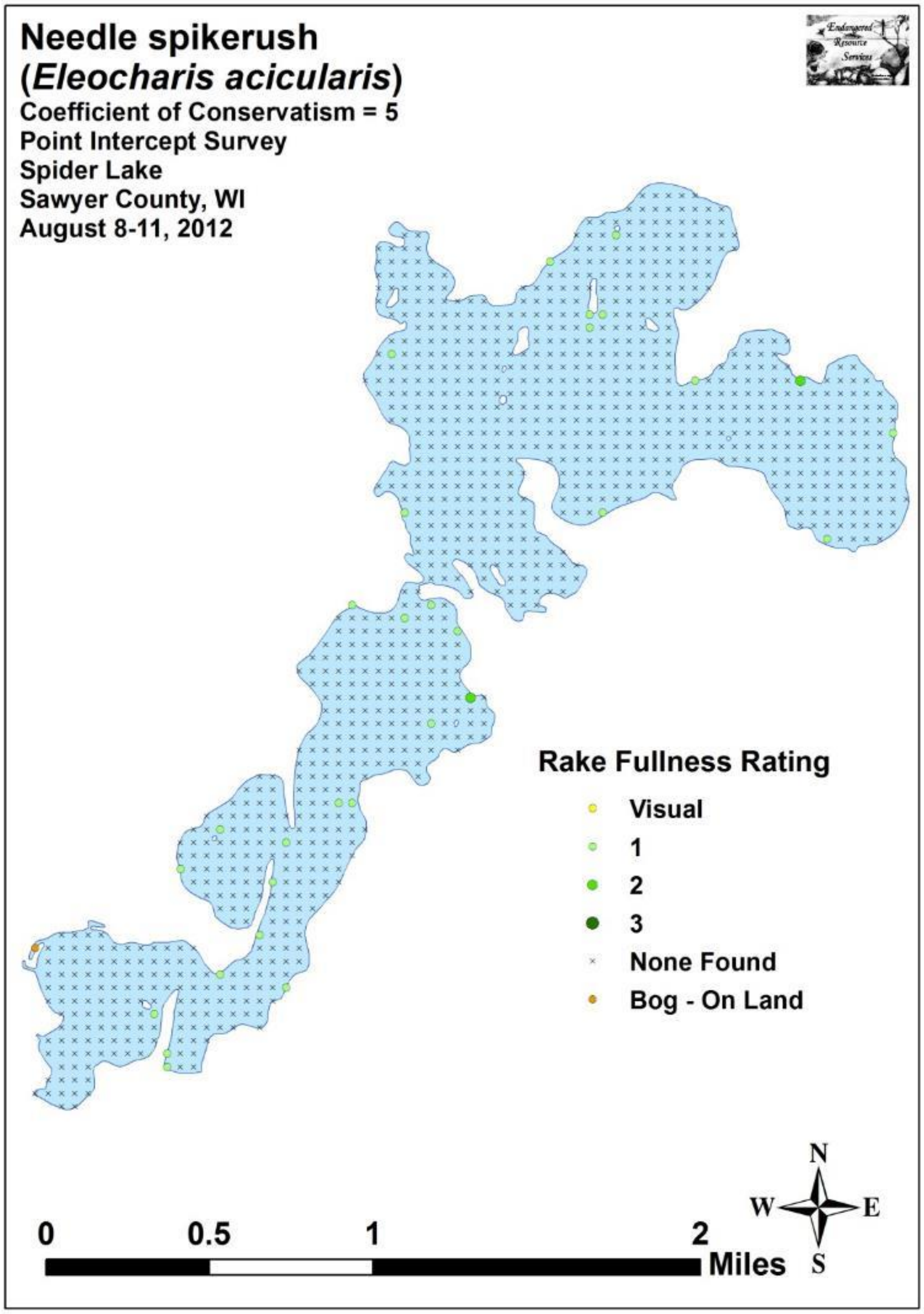

Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

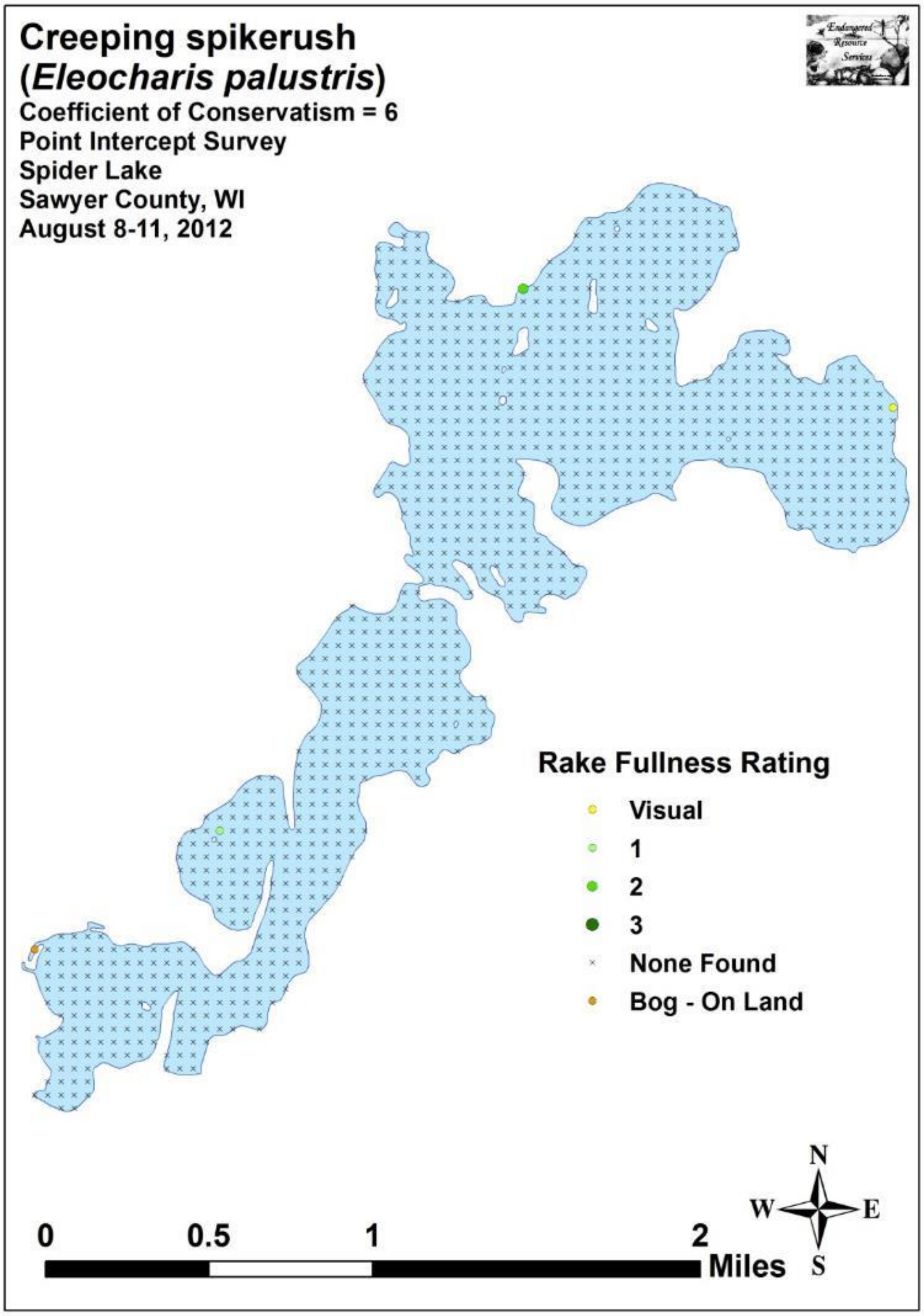

Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

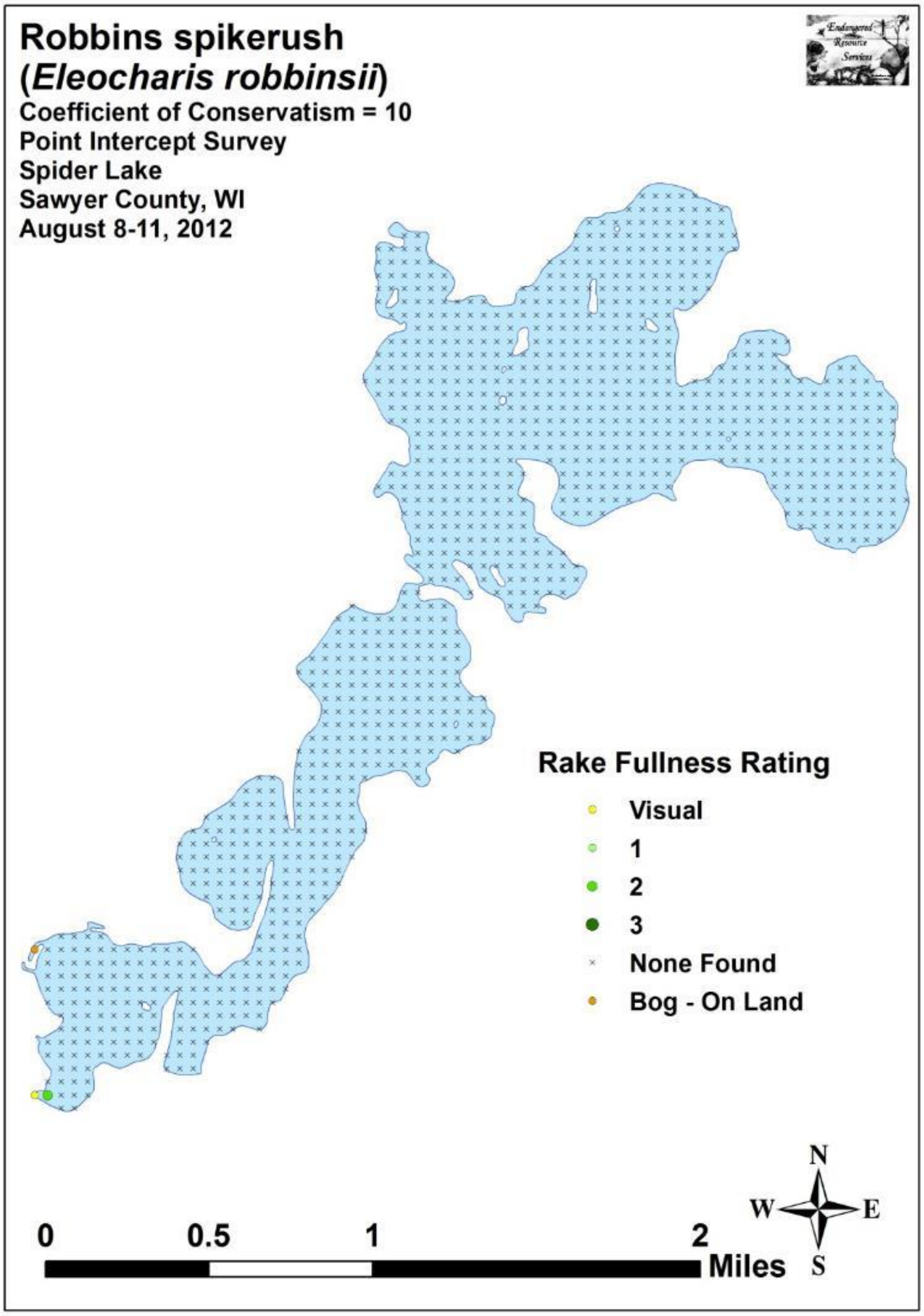

Narrow-leaved woolly sedge
(*Carex lasiocarpa*)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

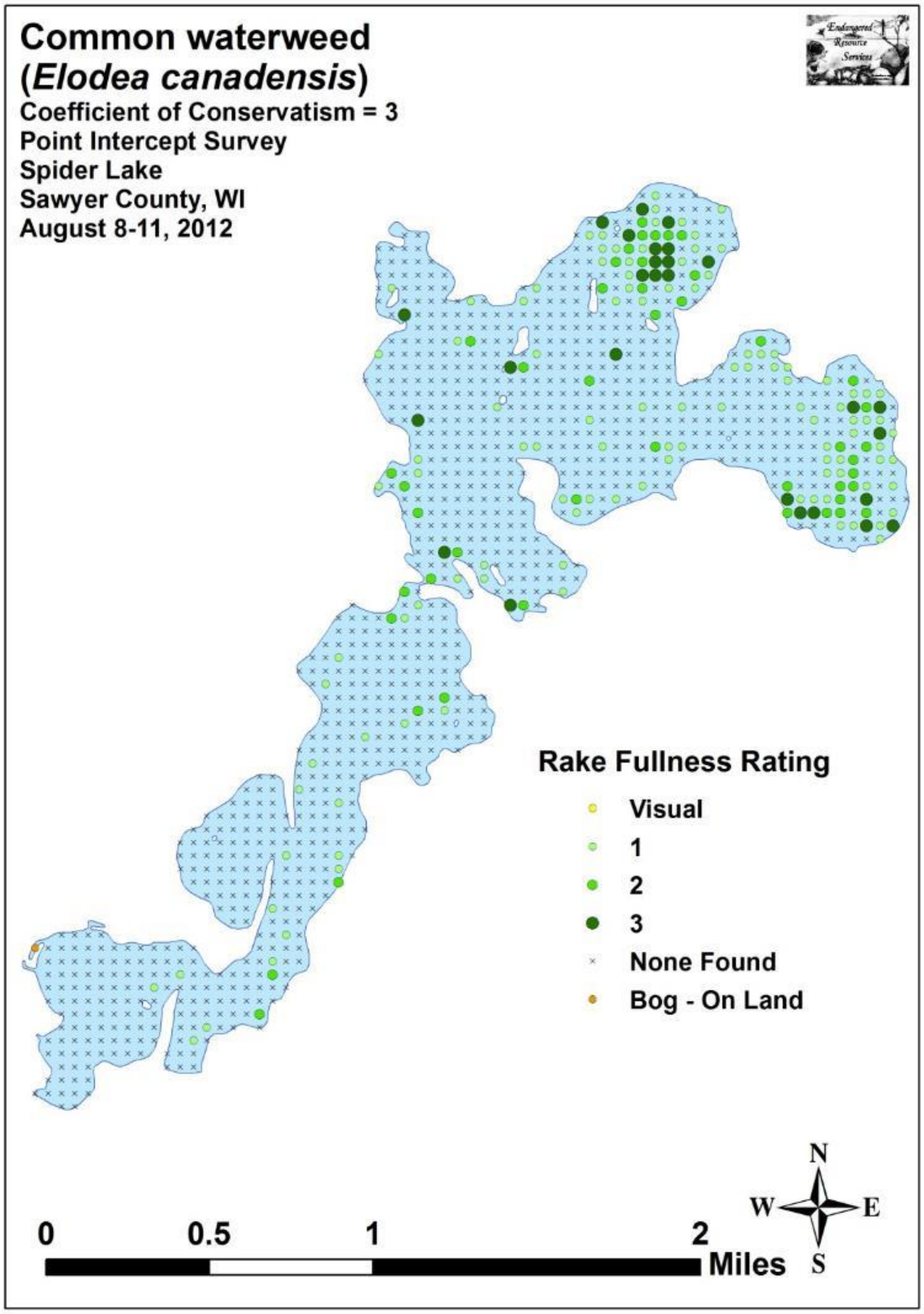

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

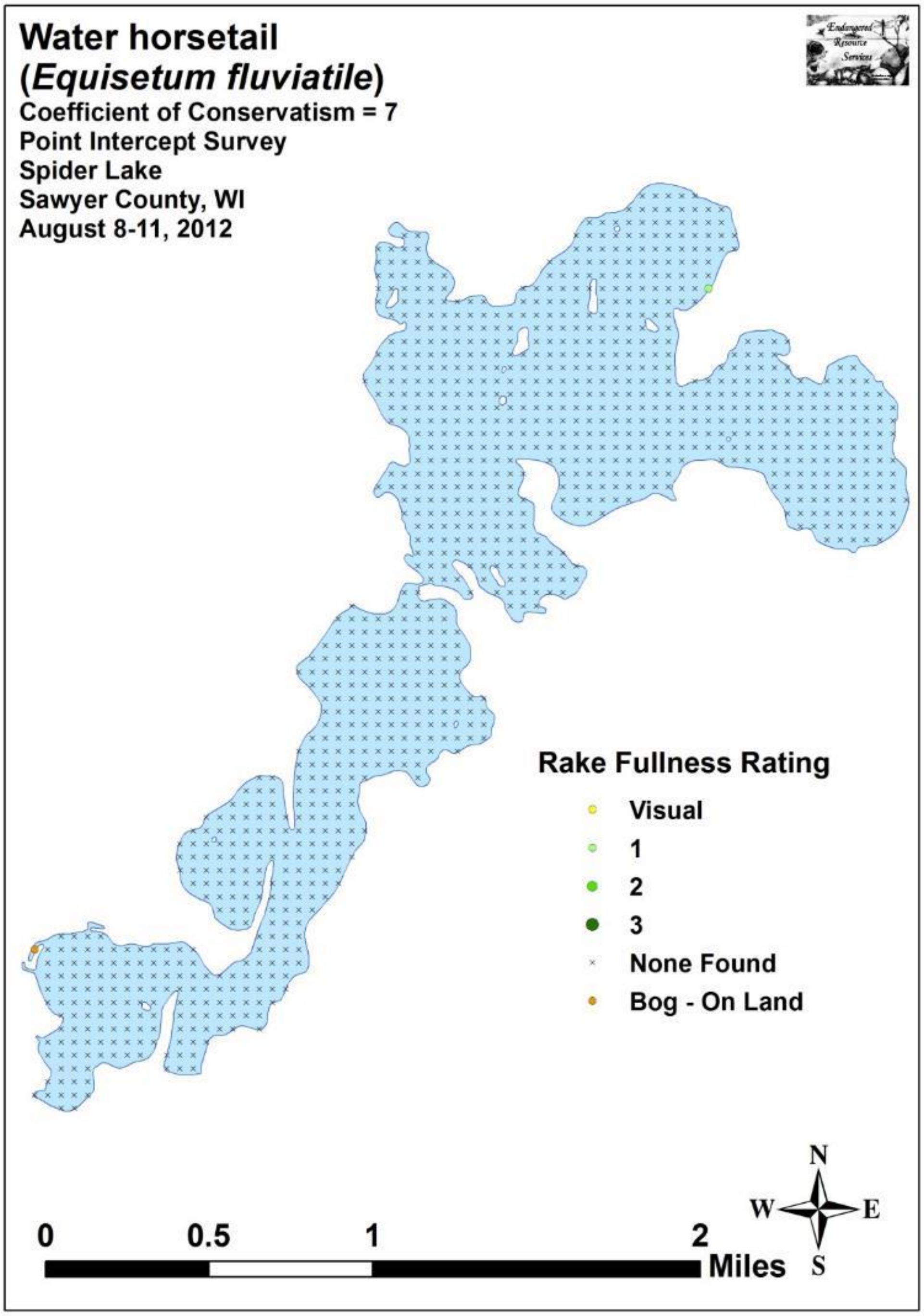

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

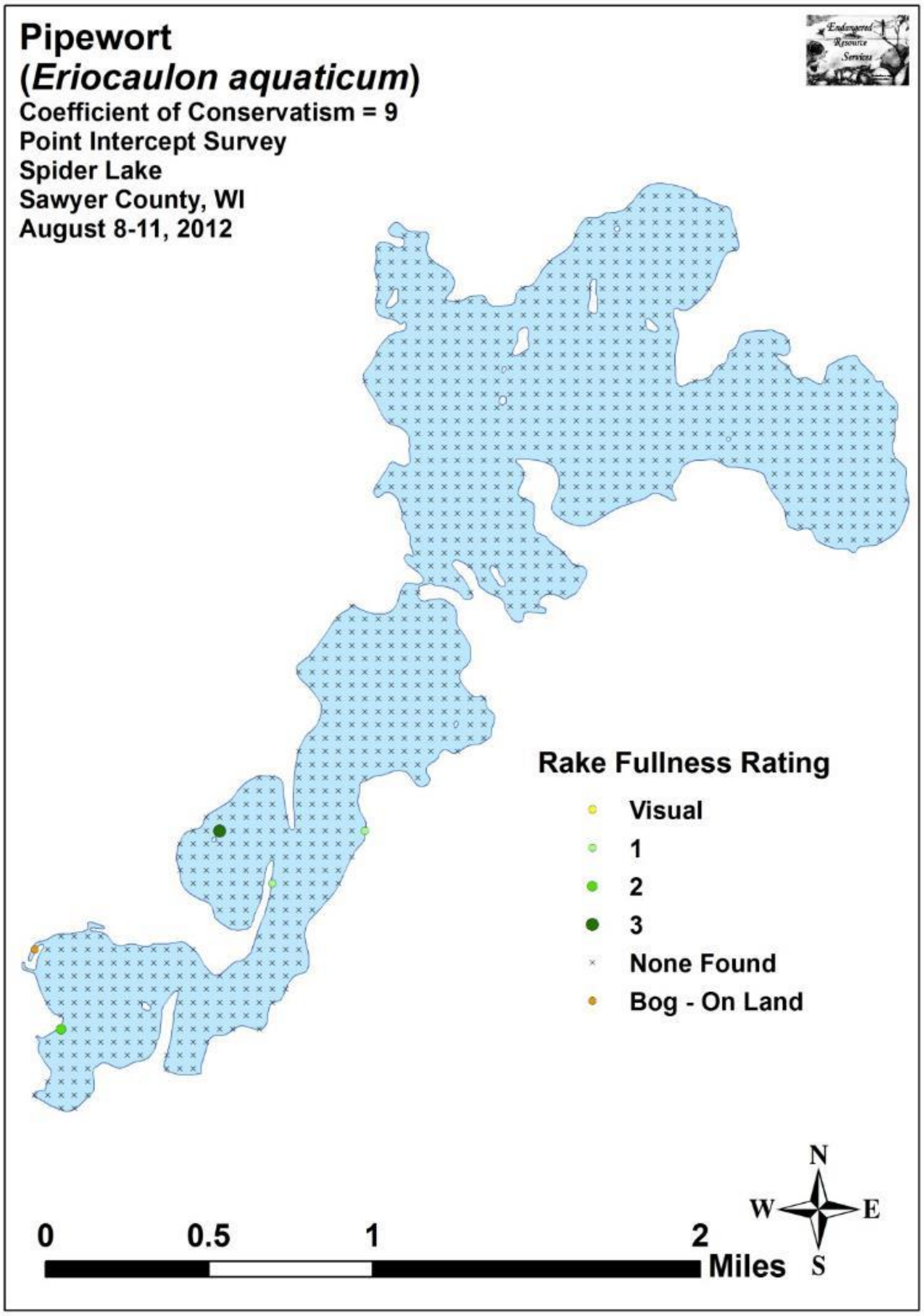

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

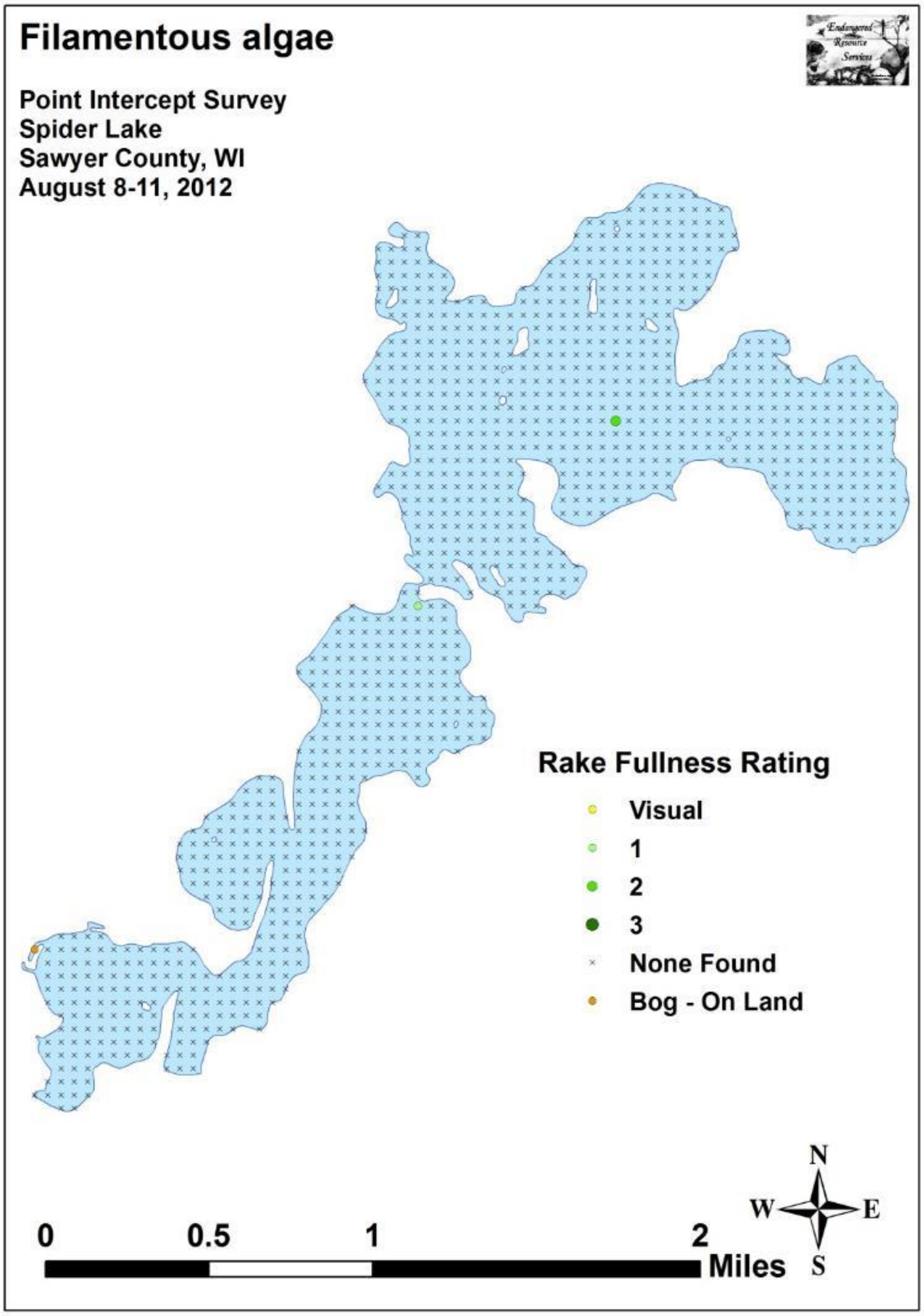

Creeping spikerush
(Eleocharis palustris)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

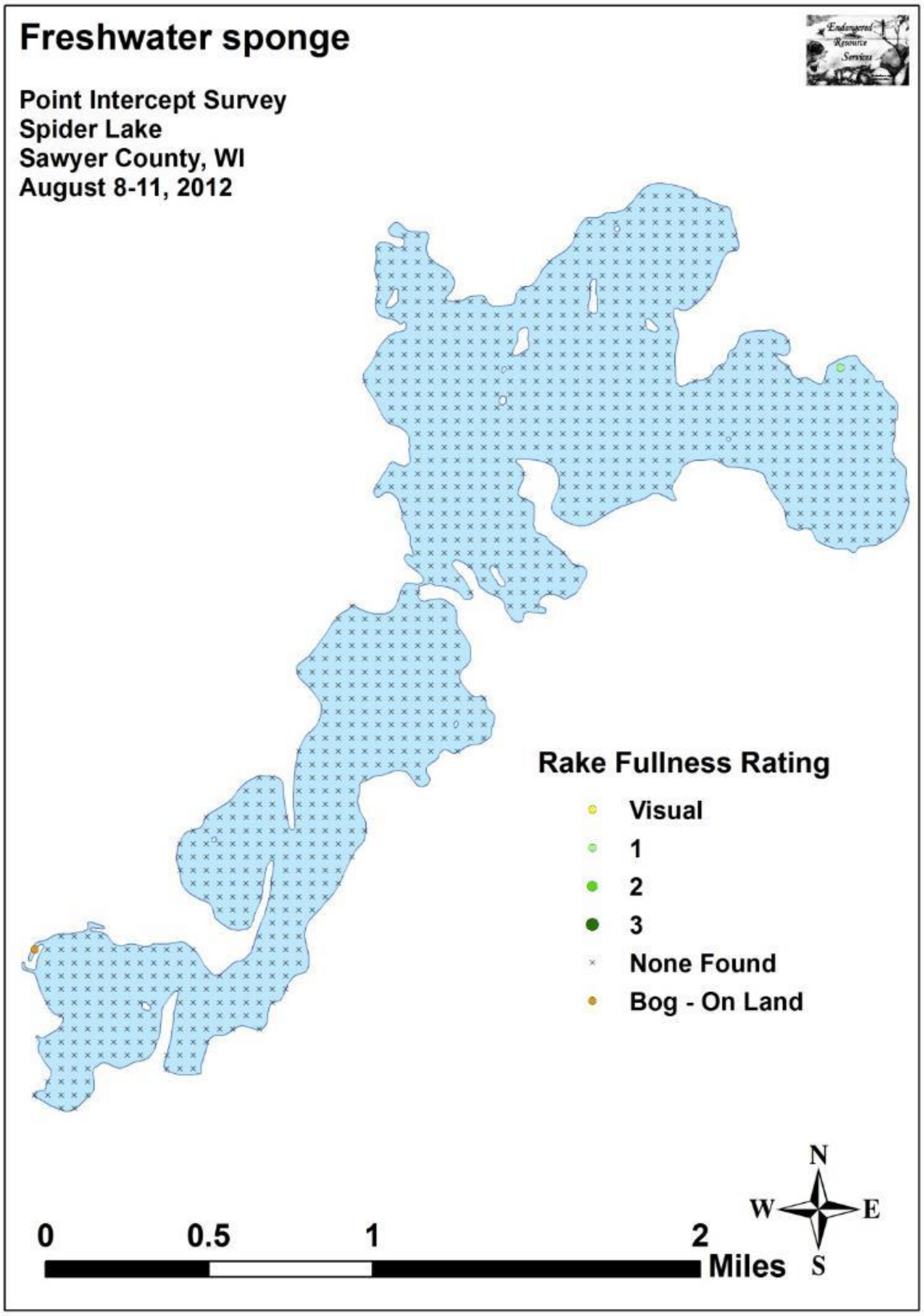

Robbins spikerush
(Eleocharis robbinsii)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

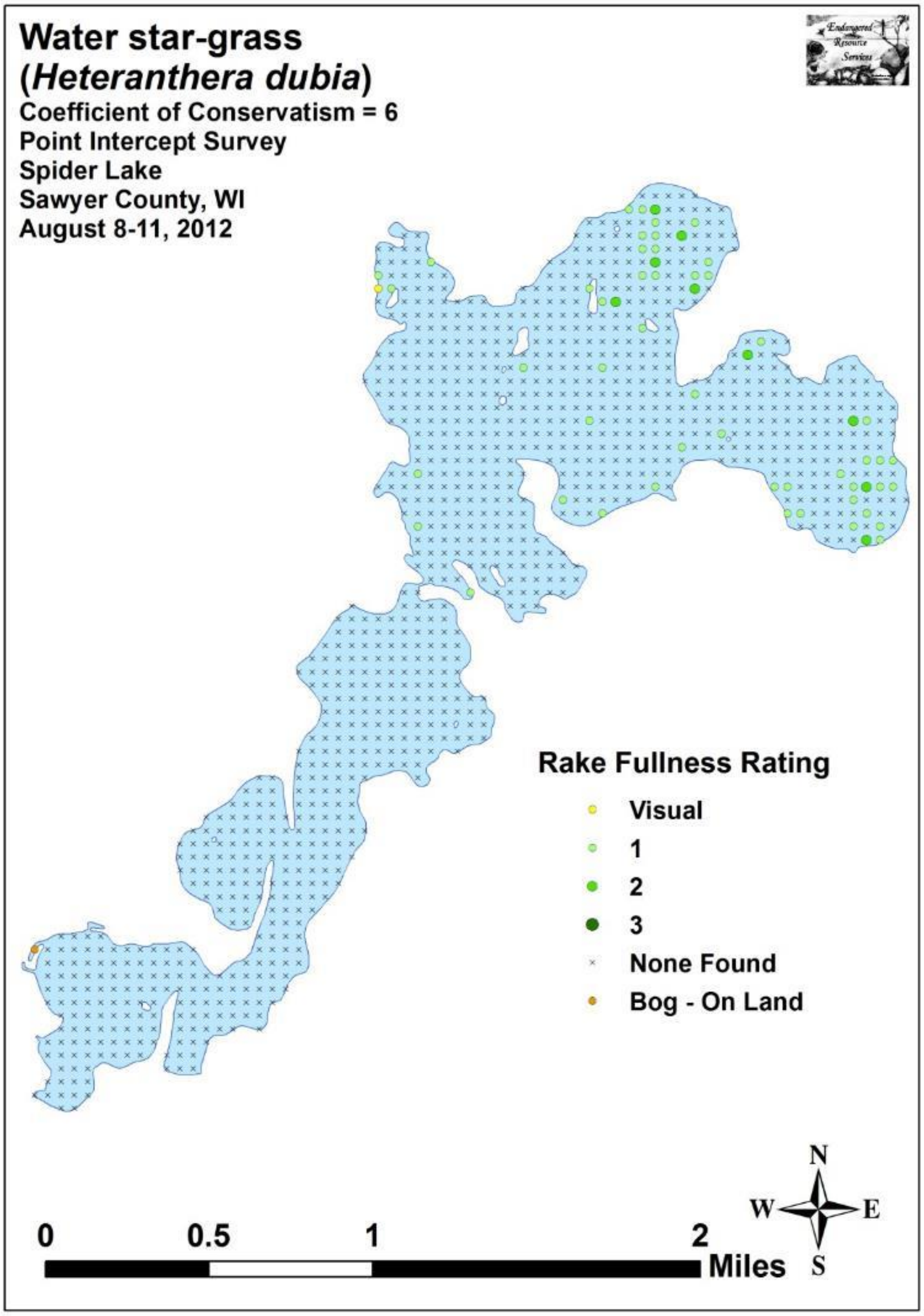

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

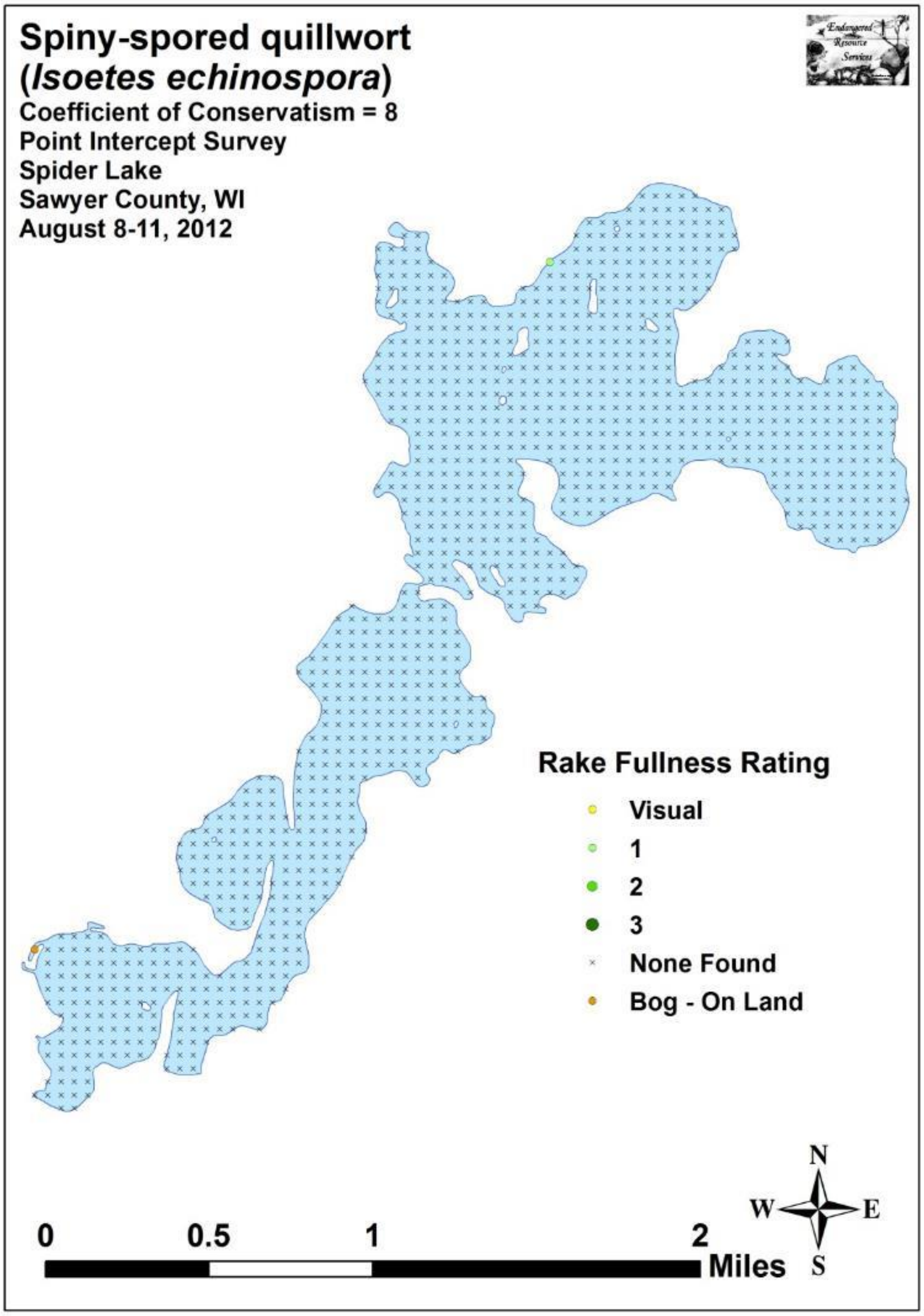

Water horsetail
(Equisetum fluviatile)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

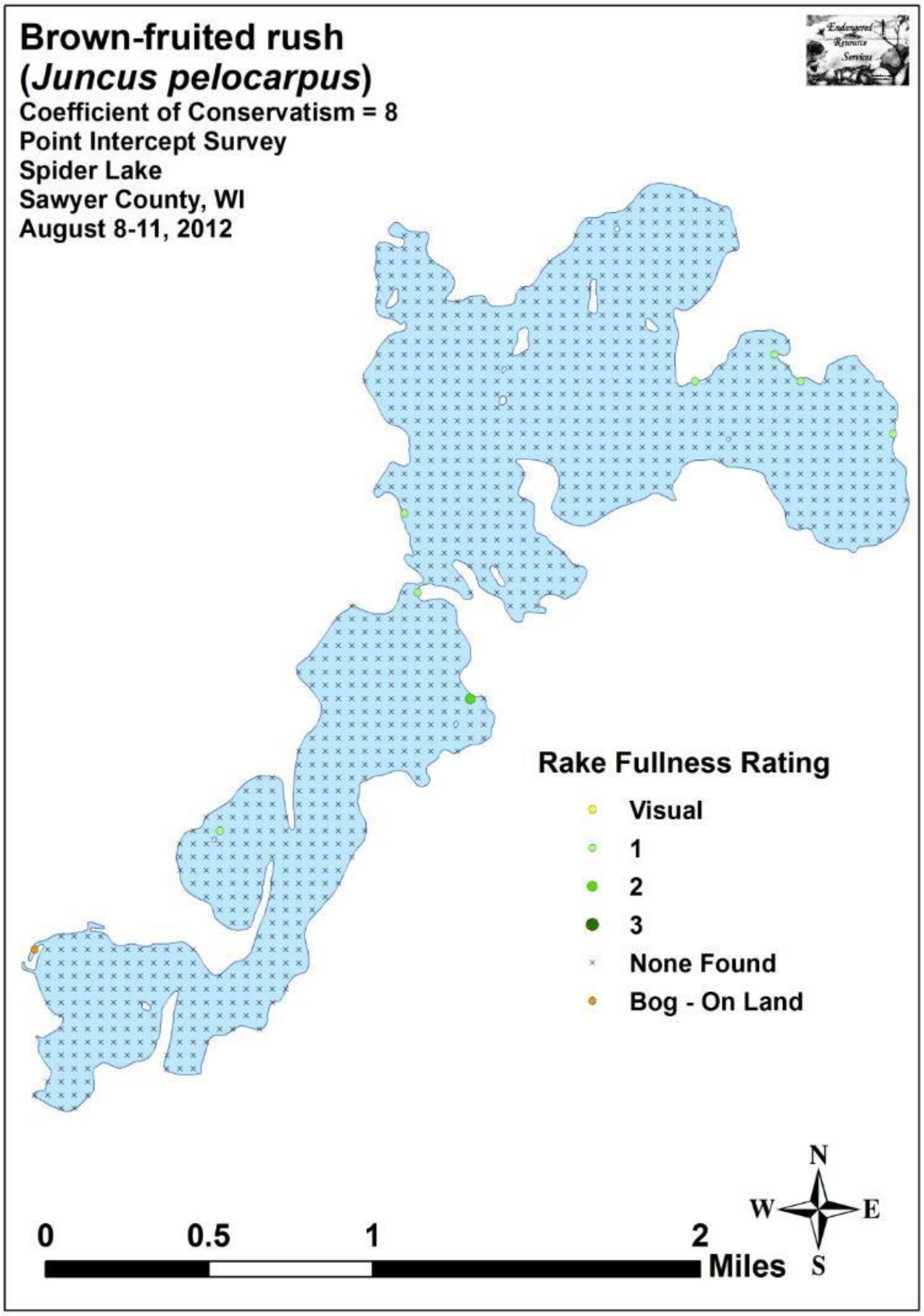

Pipewort
(*Eriocaulon aquaticum*)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

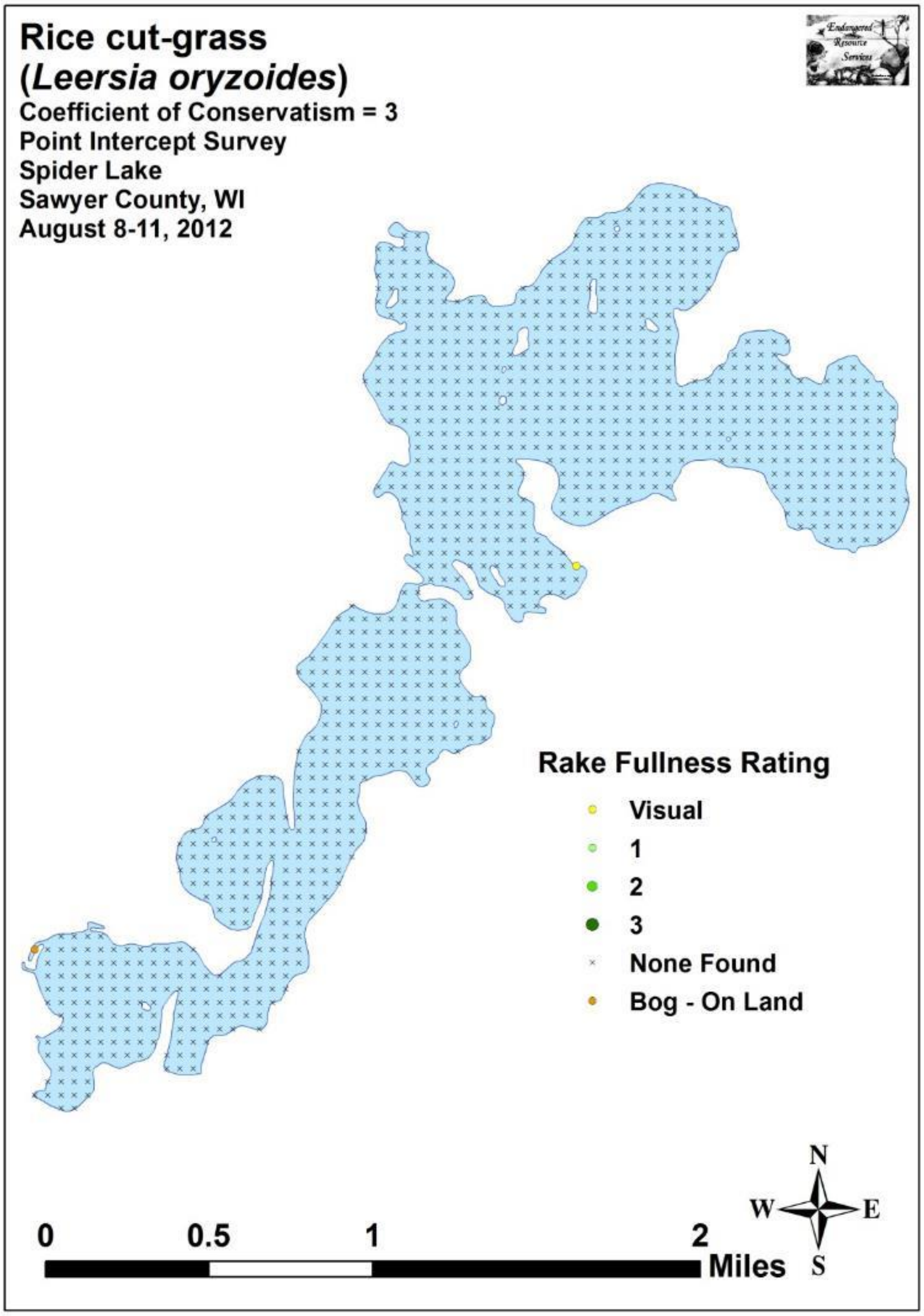

Filamentous algae
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Freshwater sponge
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

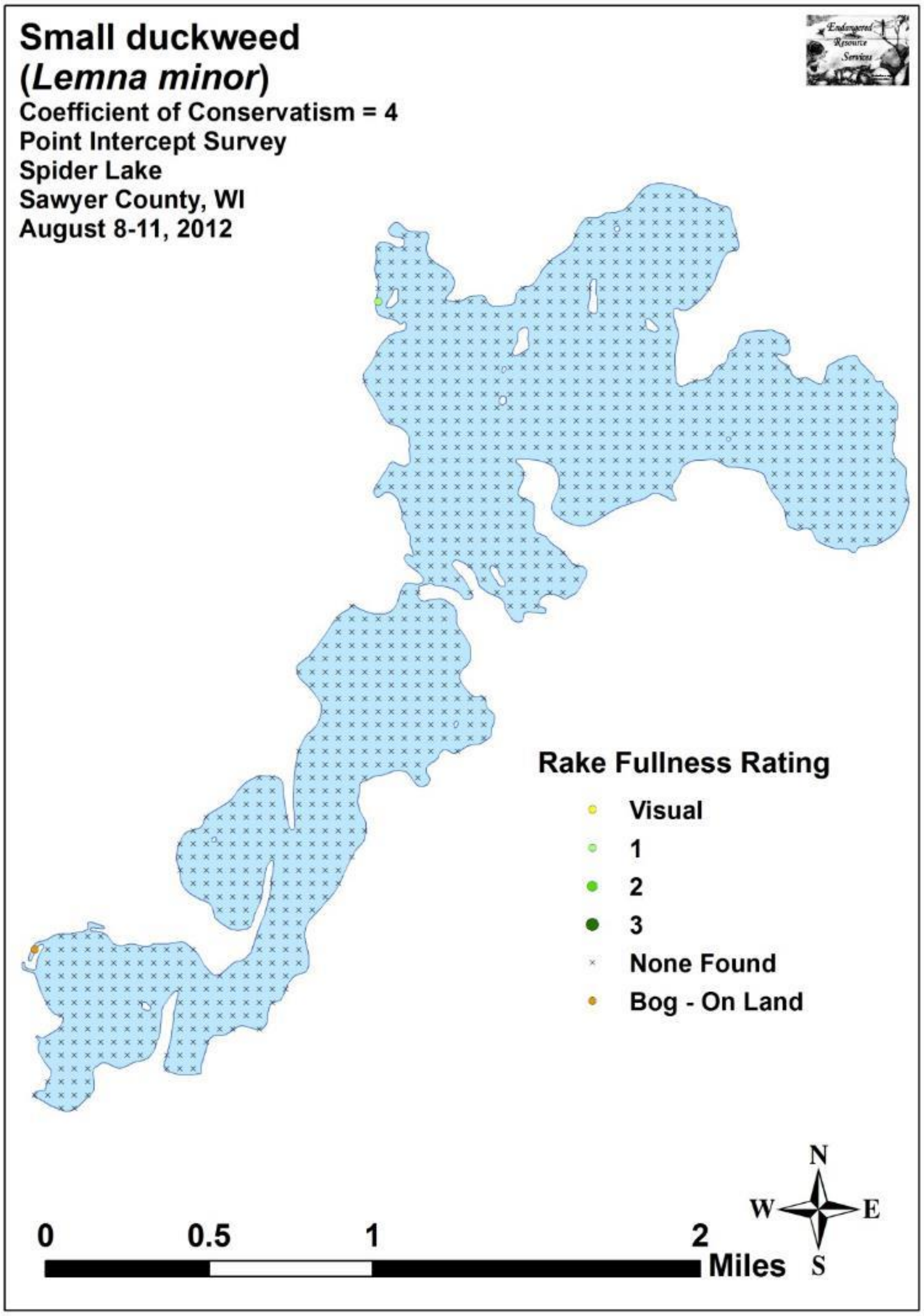

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

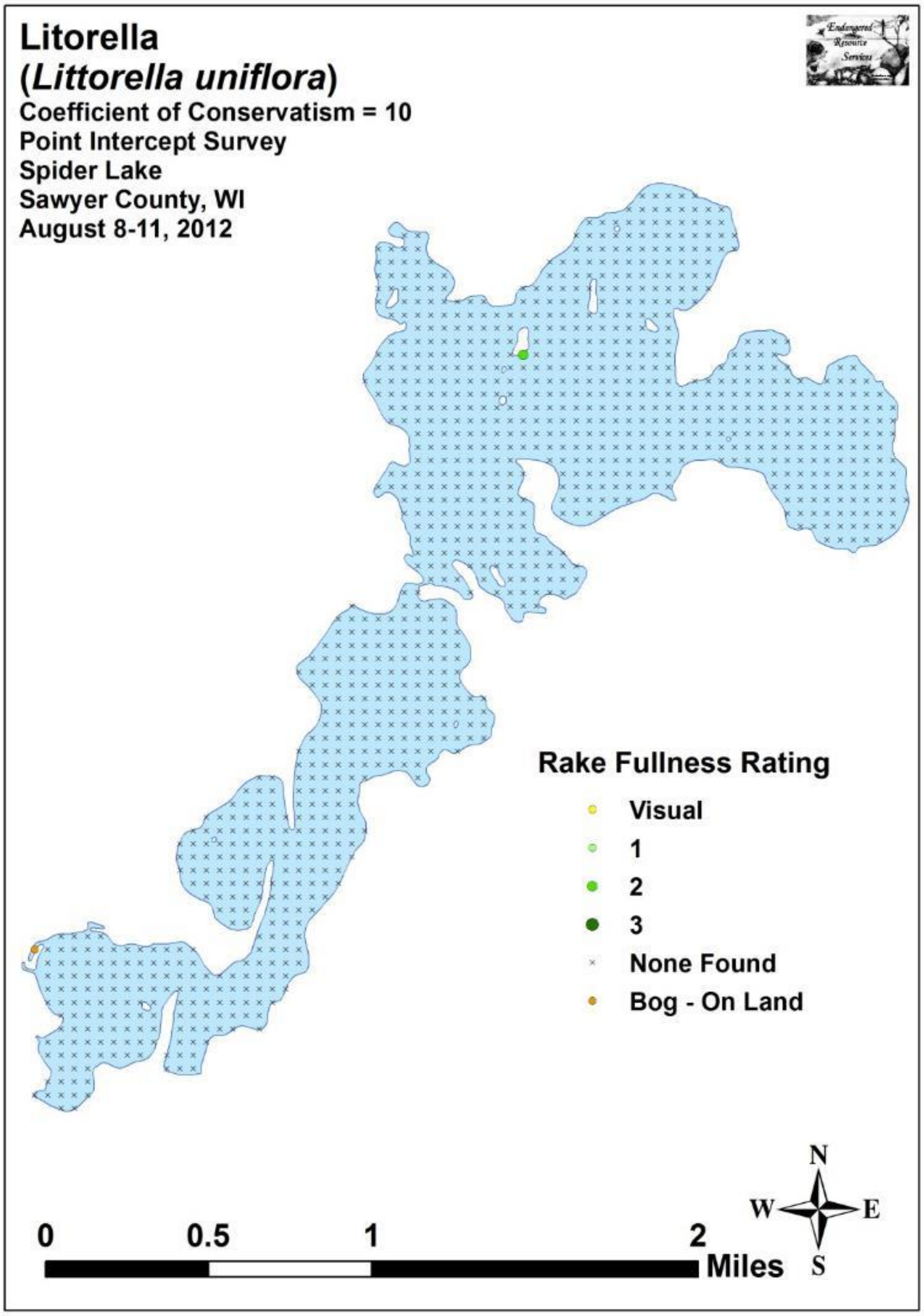

Spiny-spored quillwort
(Isoetes echinospora)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Brown-fruited rush
(Juncus pelocarpus)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

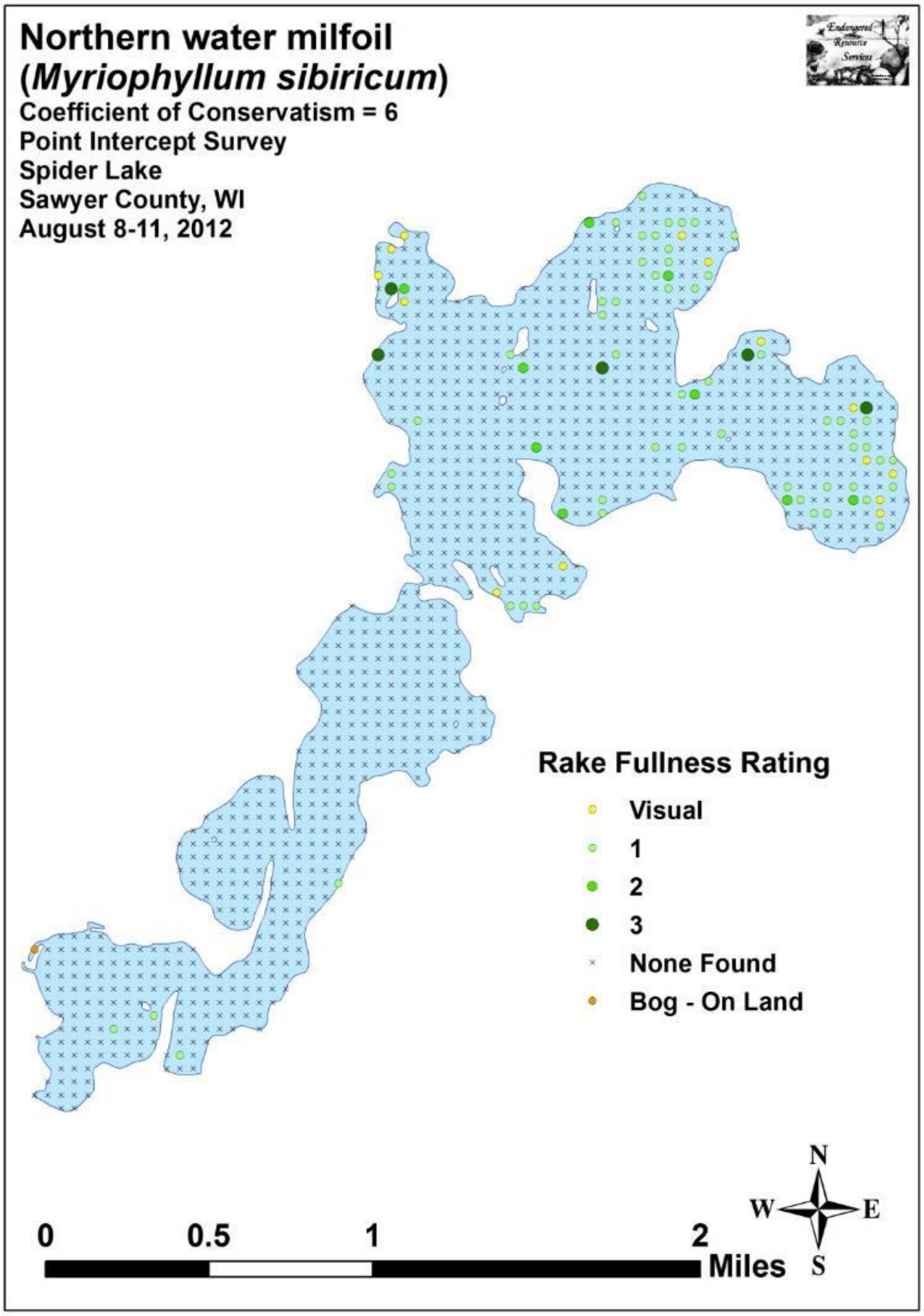


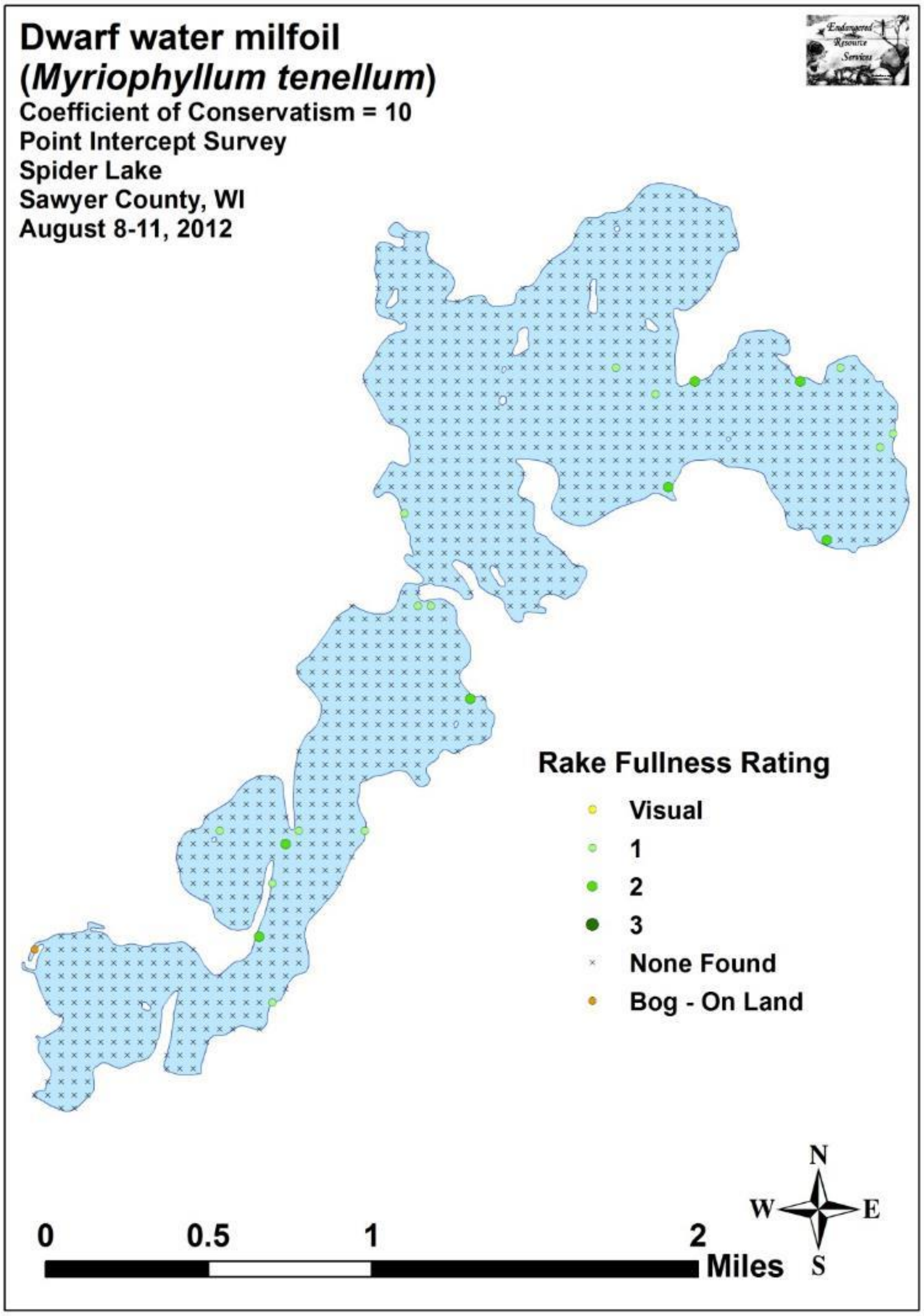
Rice cut-grass
(Leersia oryzoides)
Coefficient of Conservatism = 3
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

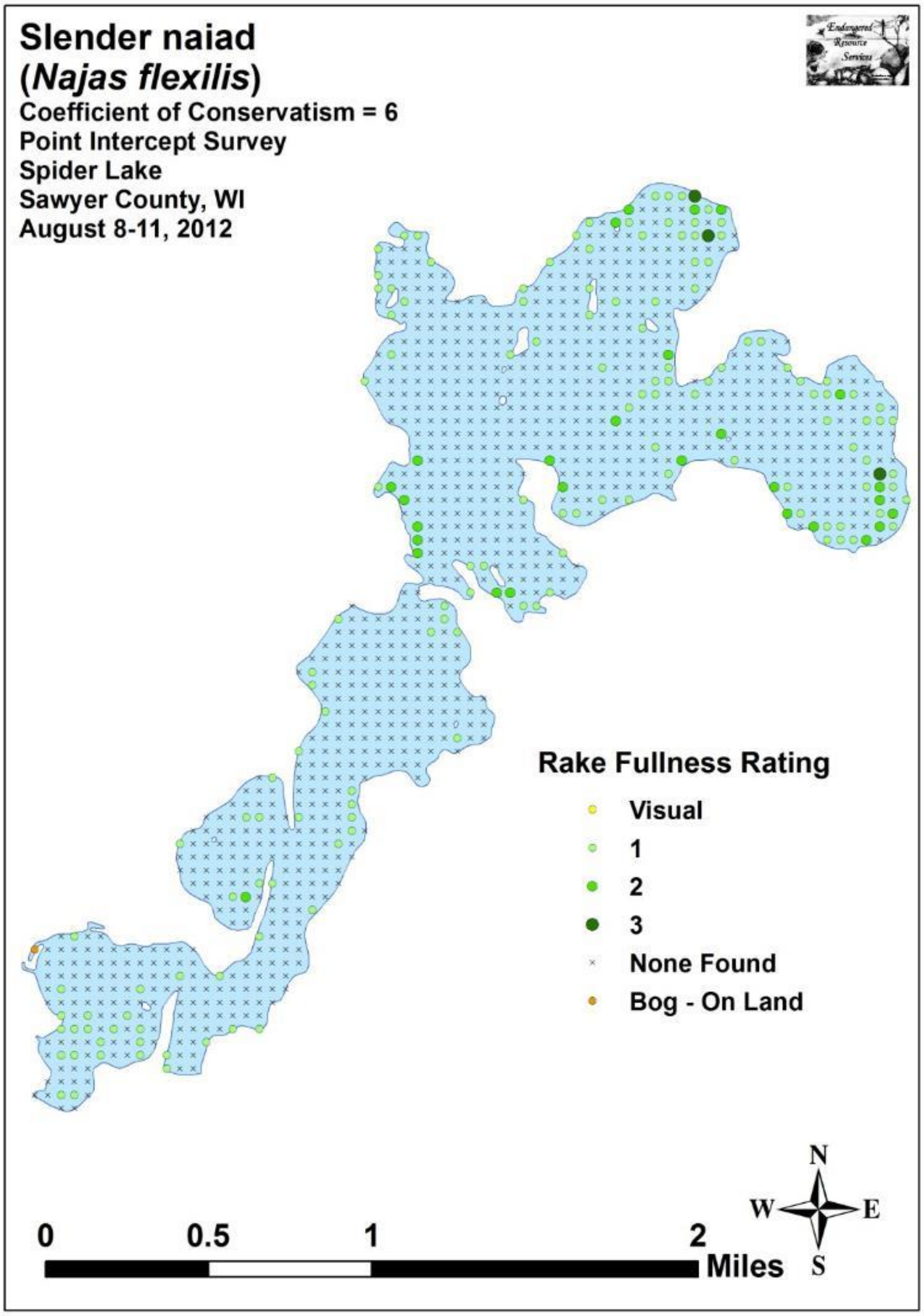

Small duckweed
(Lemna minor)
Coefficient of Conservatism = 4
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

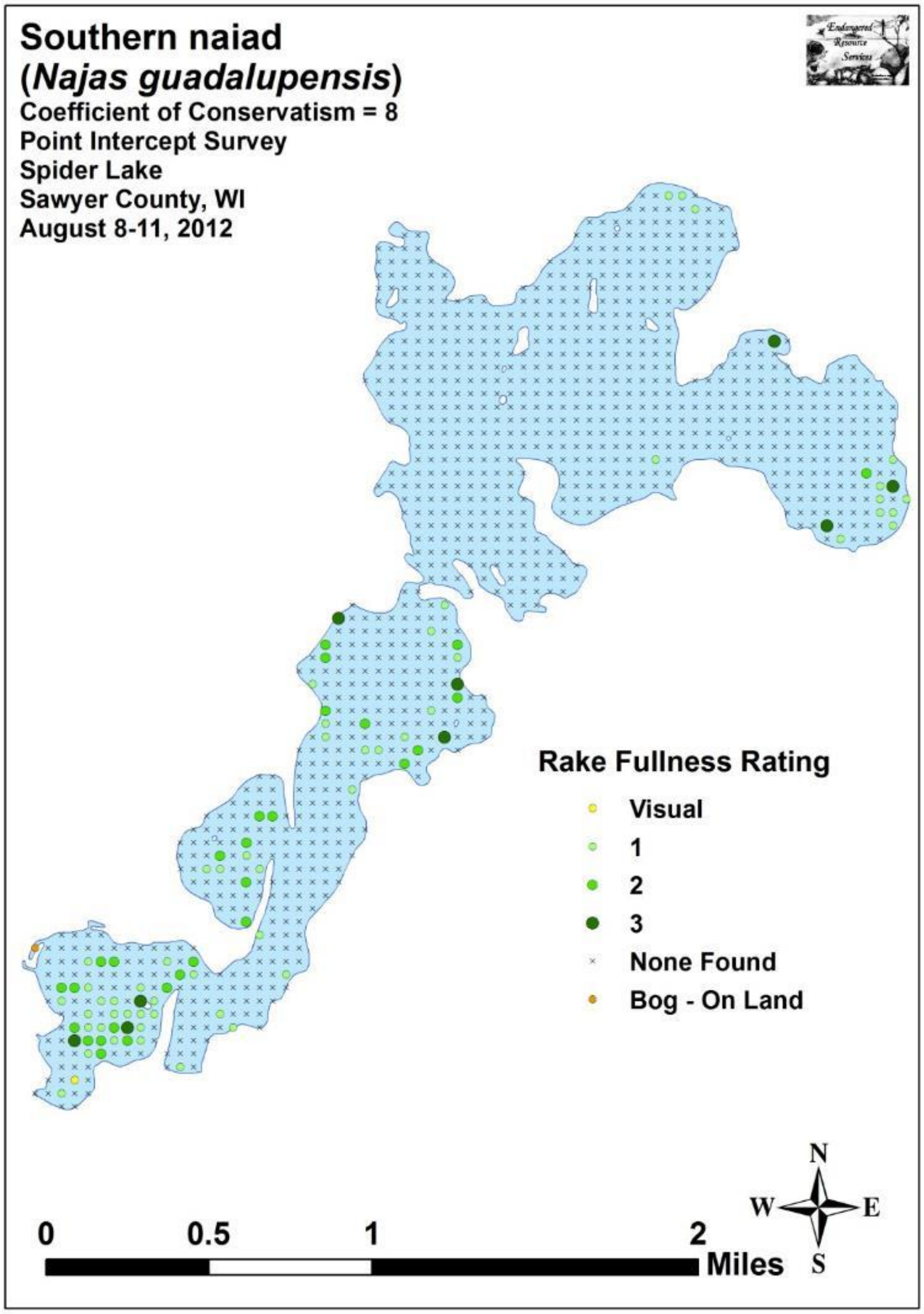


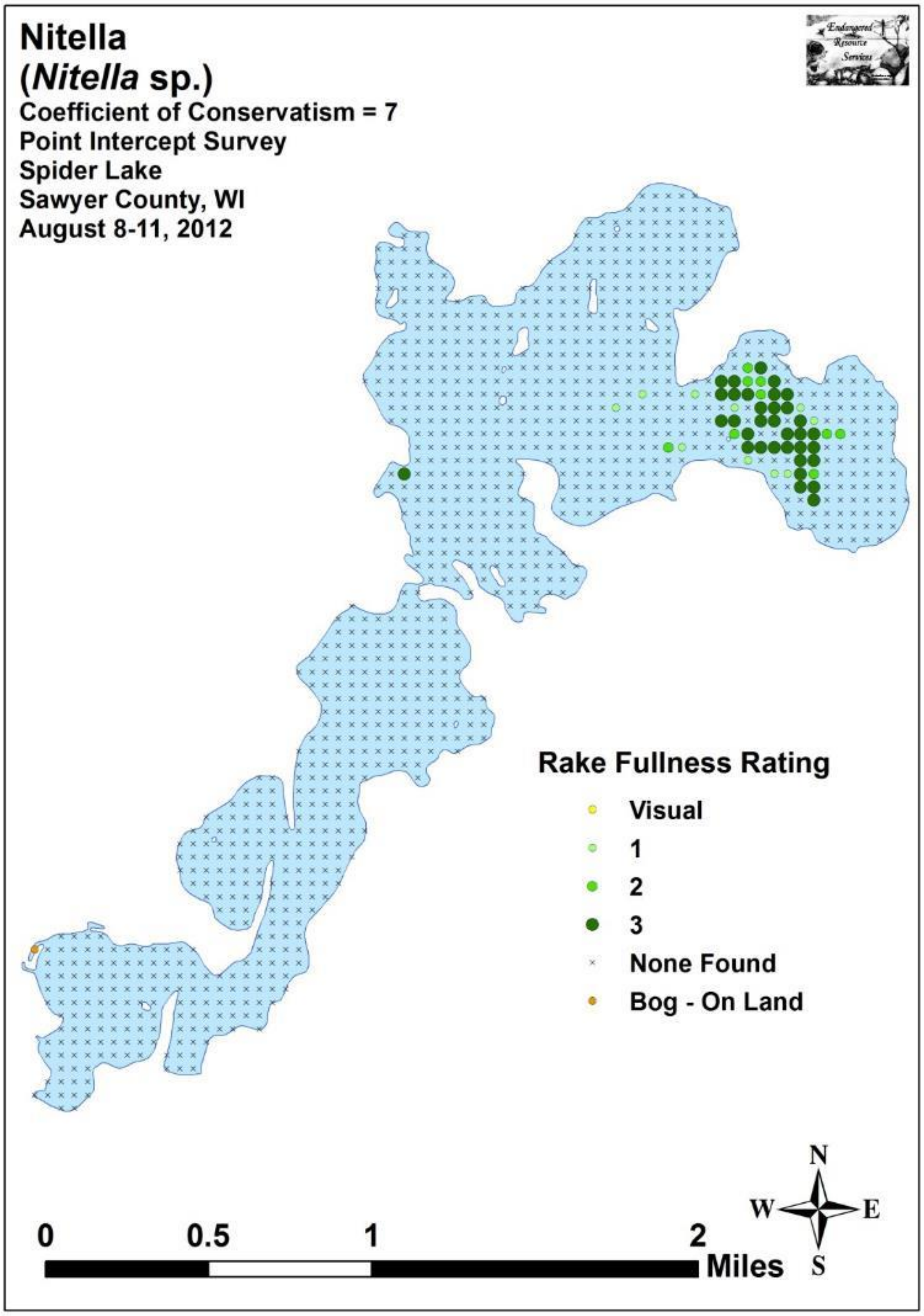
Litorella
(*Littorella uniflora*)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

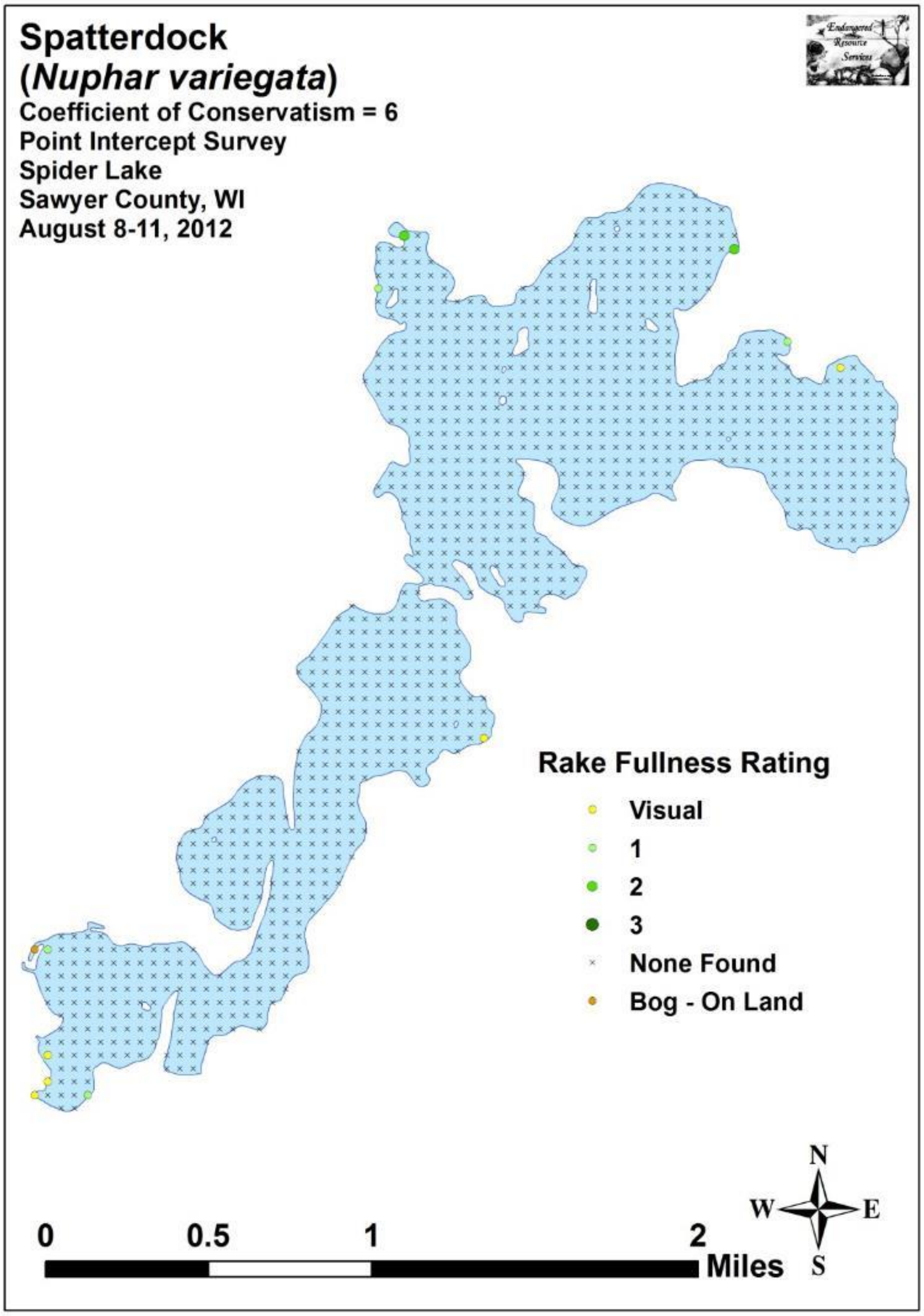

Northern water milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

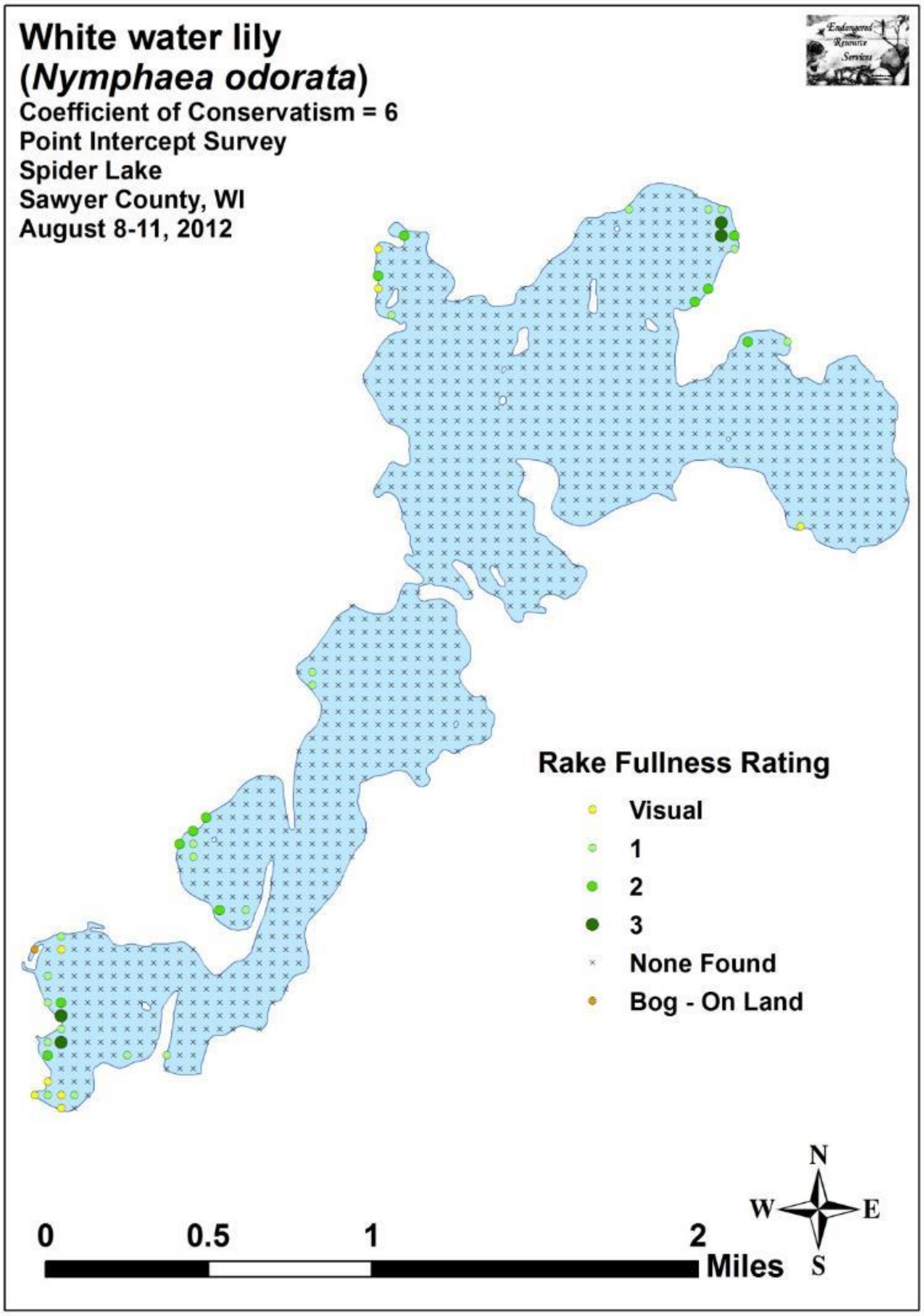

Dwarf water milfoil
(*Myriophyllum tenellum*)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

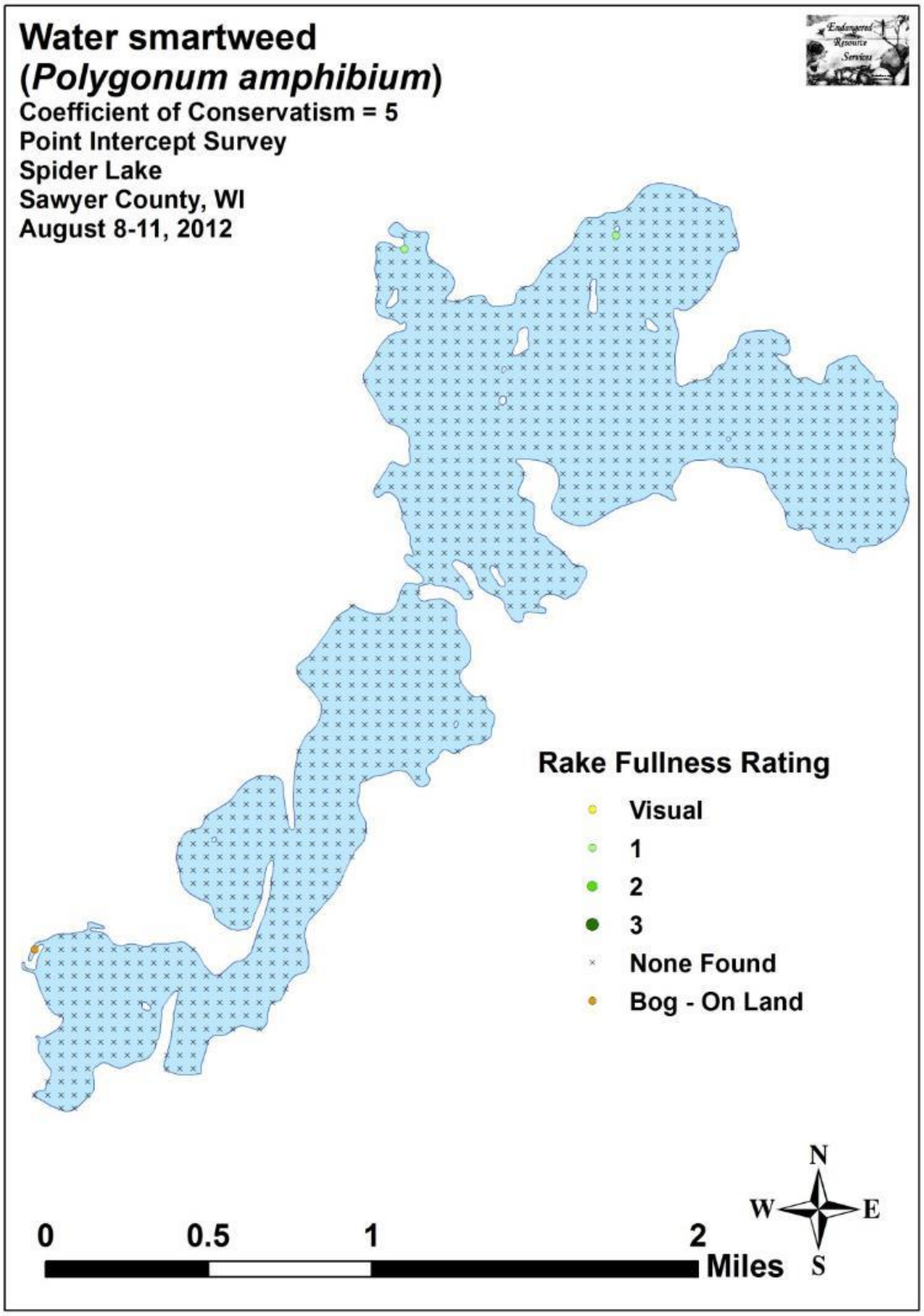

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Southern naiad
(*Najas guadalupensis*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

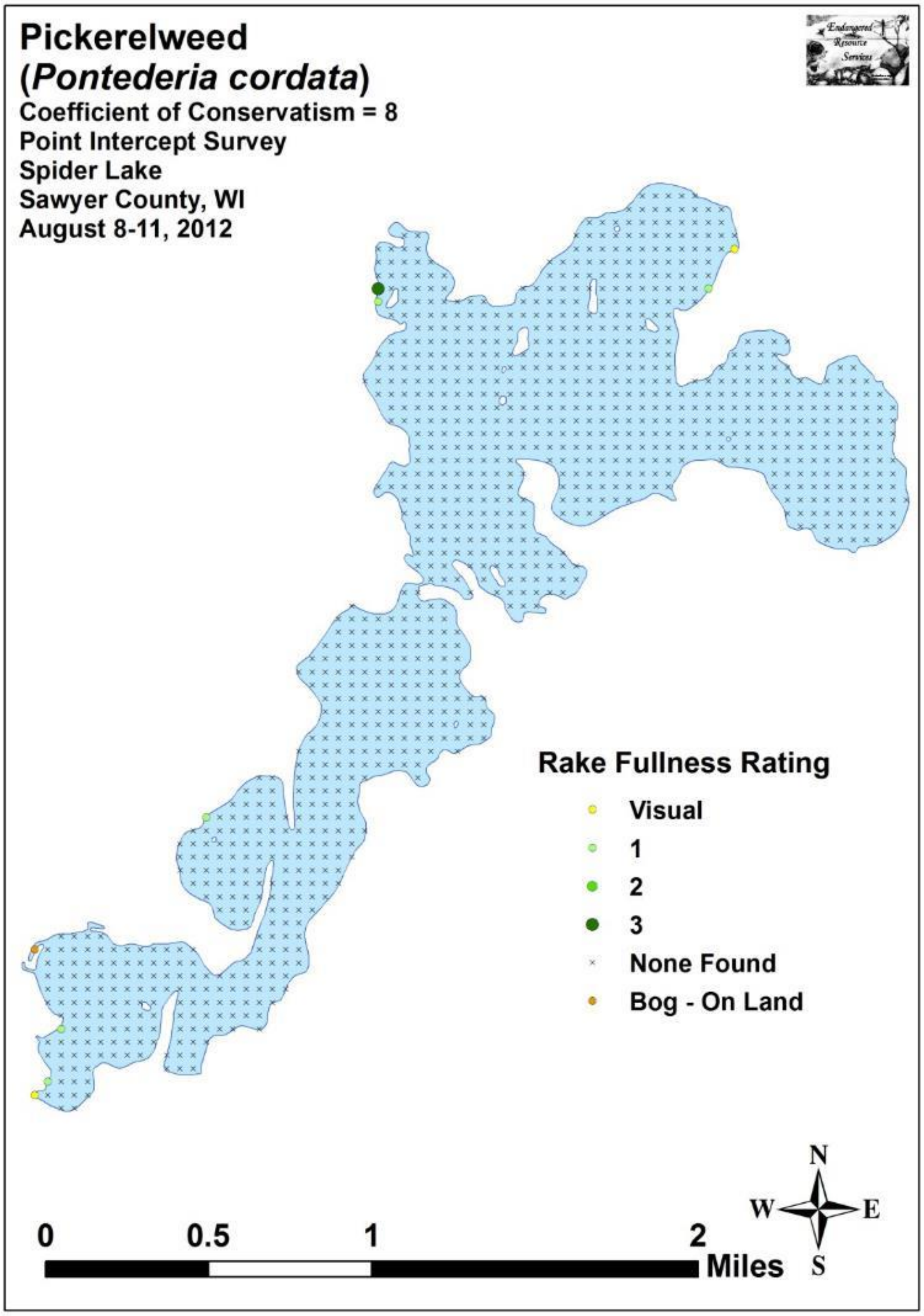

Nitella
(Nitella sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

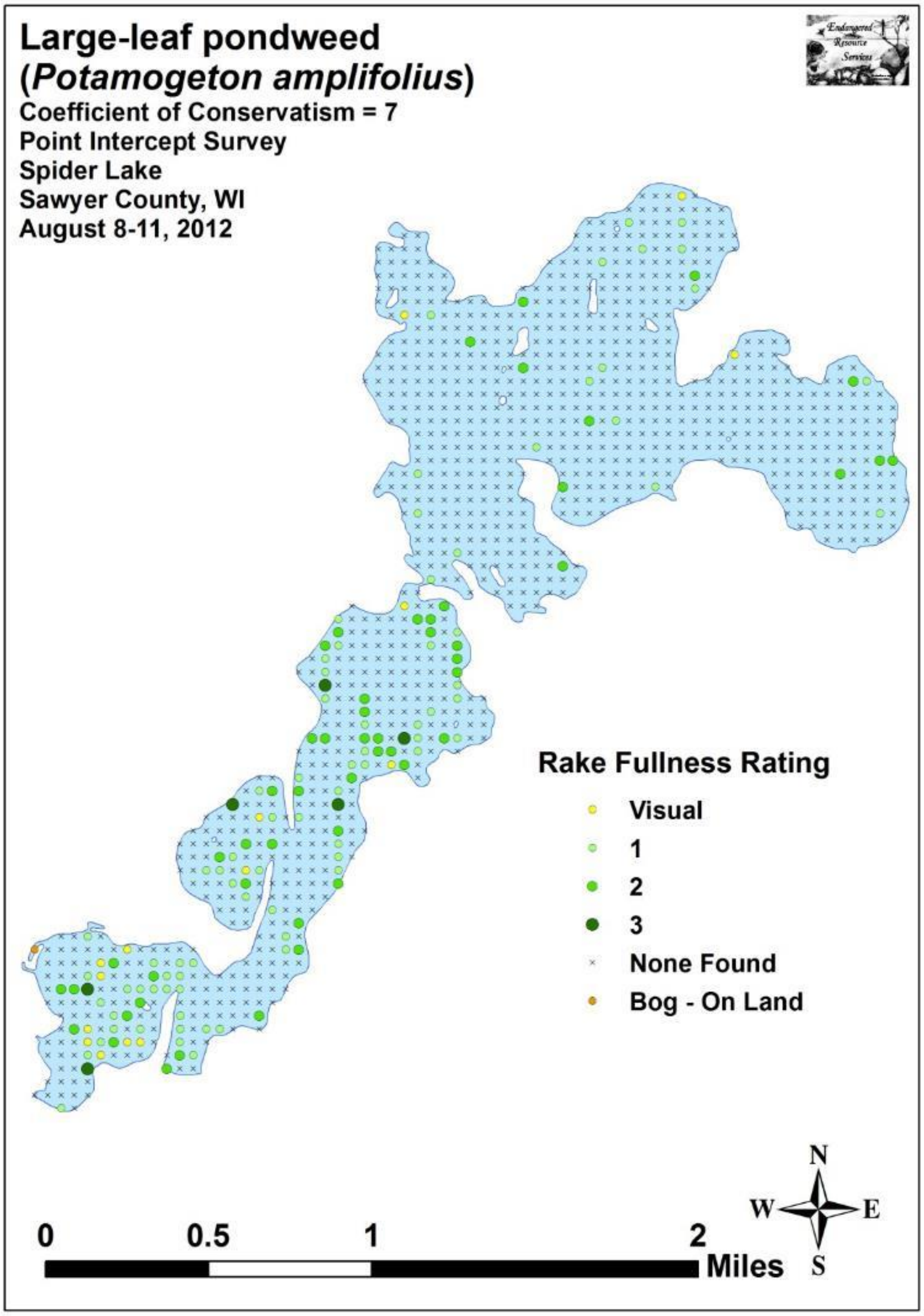

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

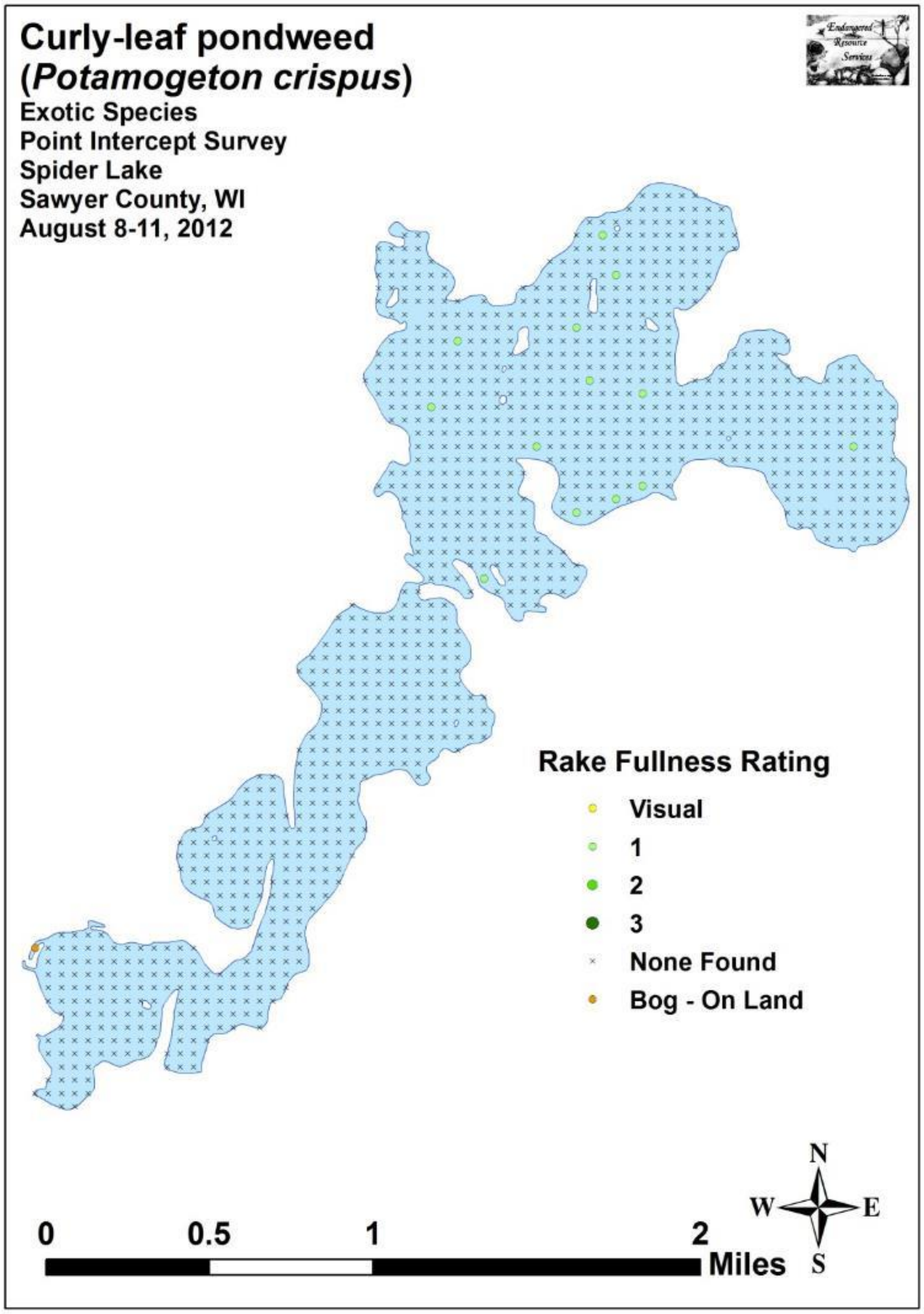

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

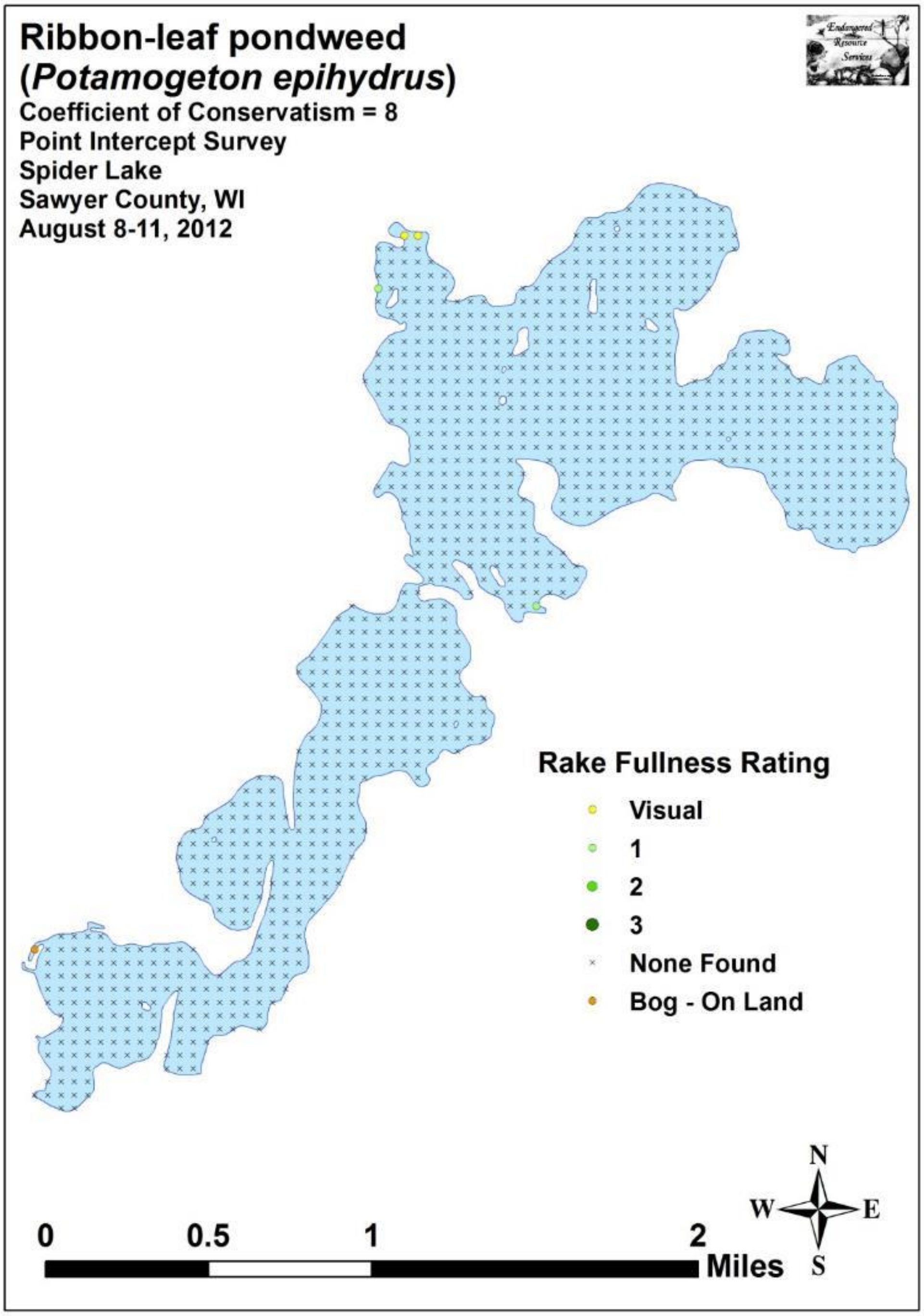


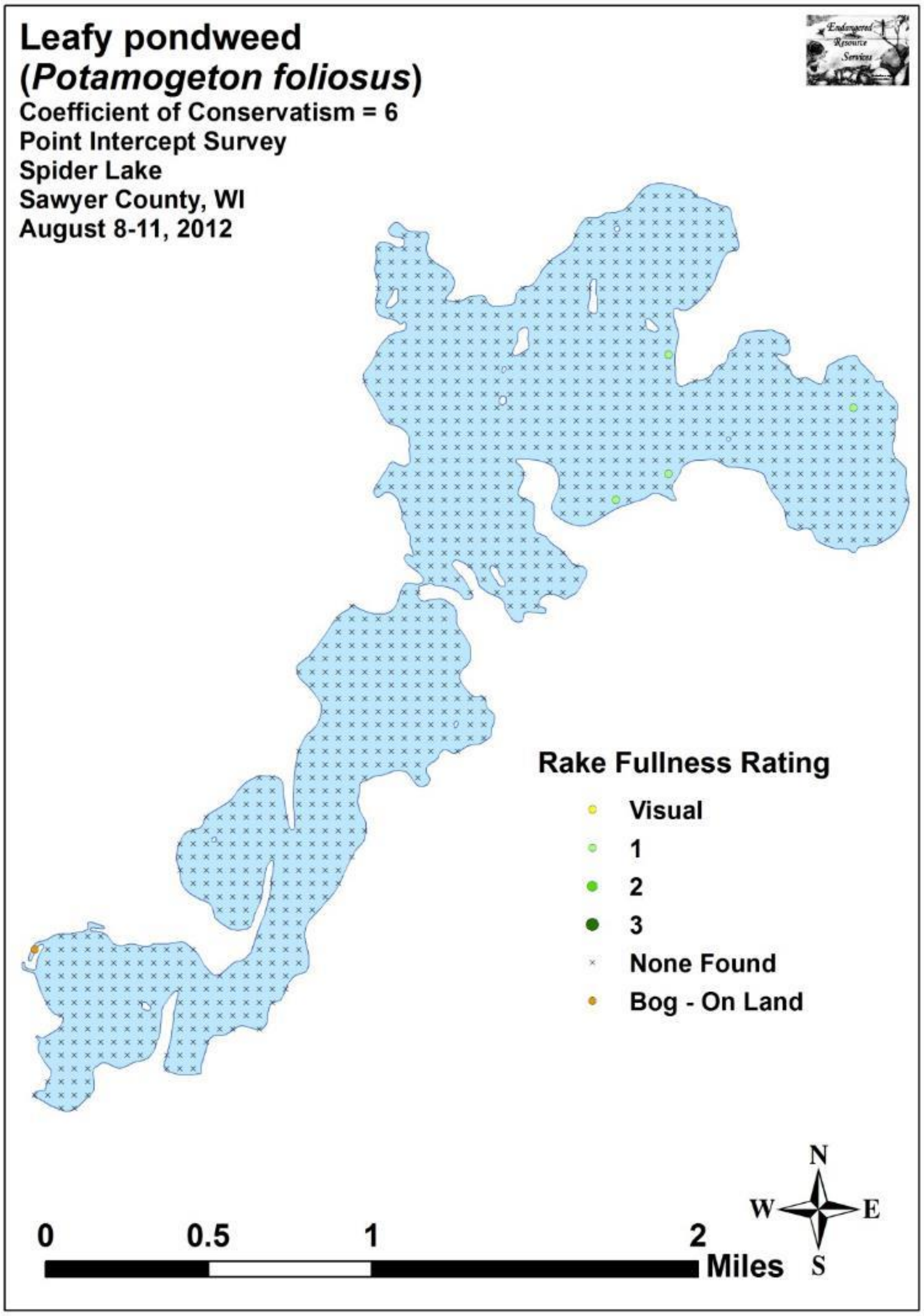
Water smartweed
(Polygonum amphibium)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

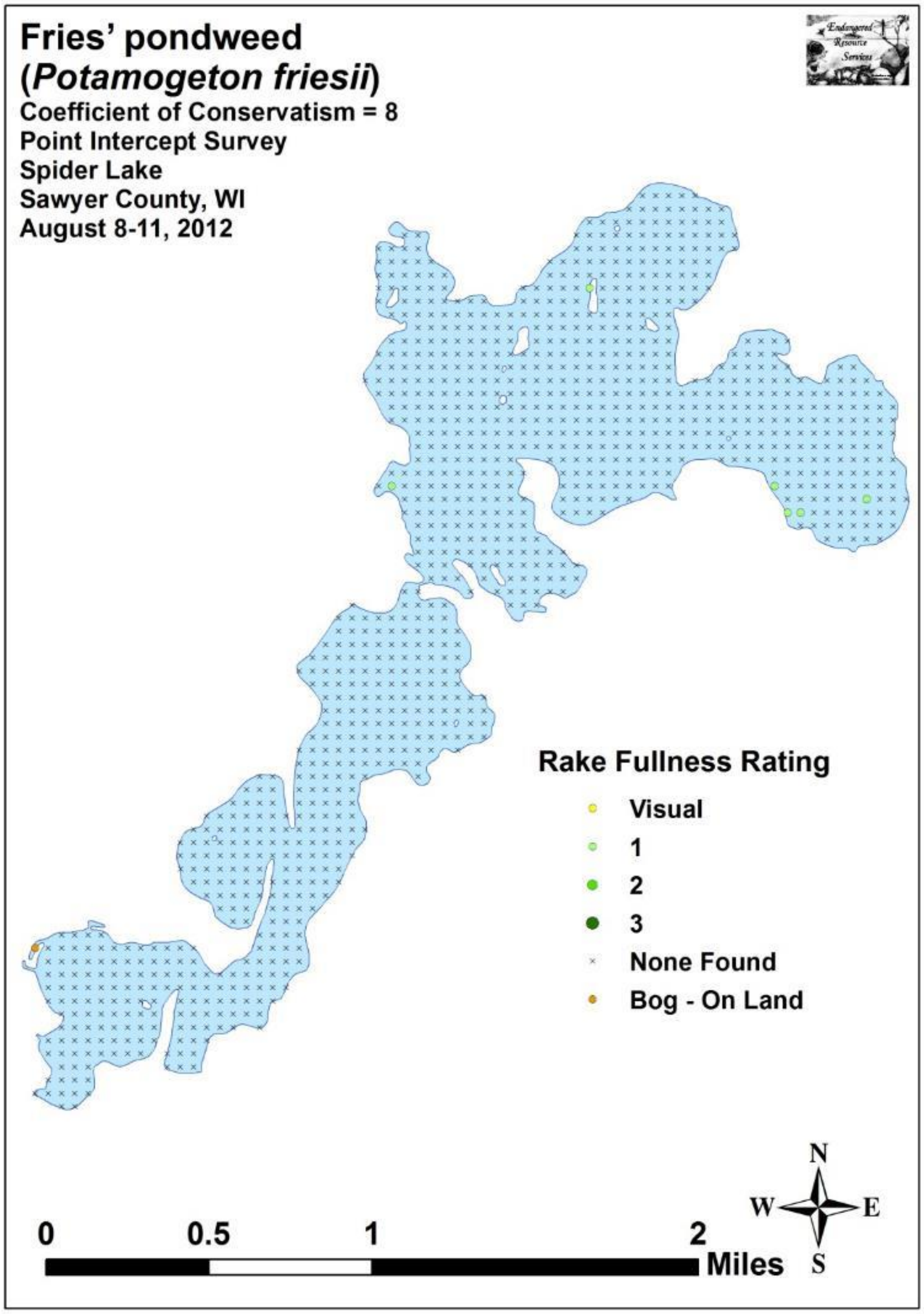

Pickerelweed
(*Pontederia cordata*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

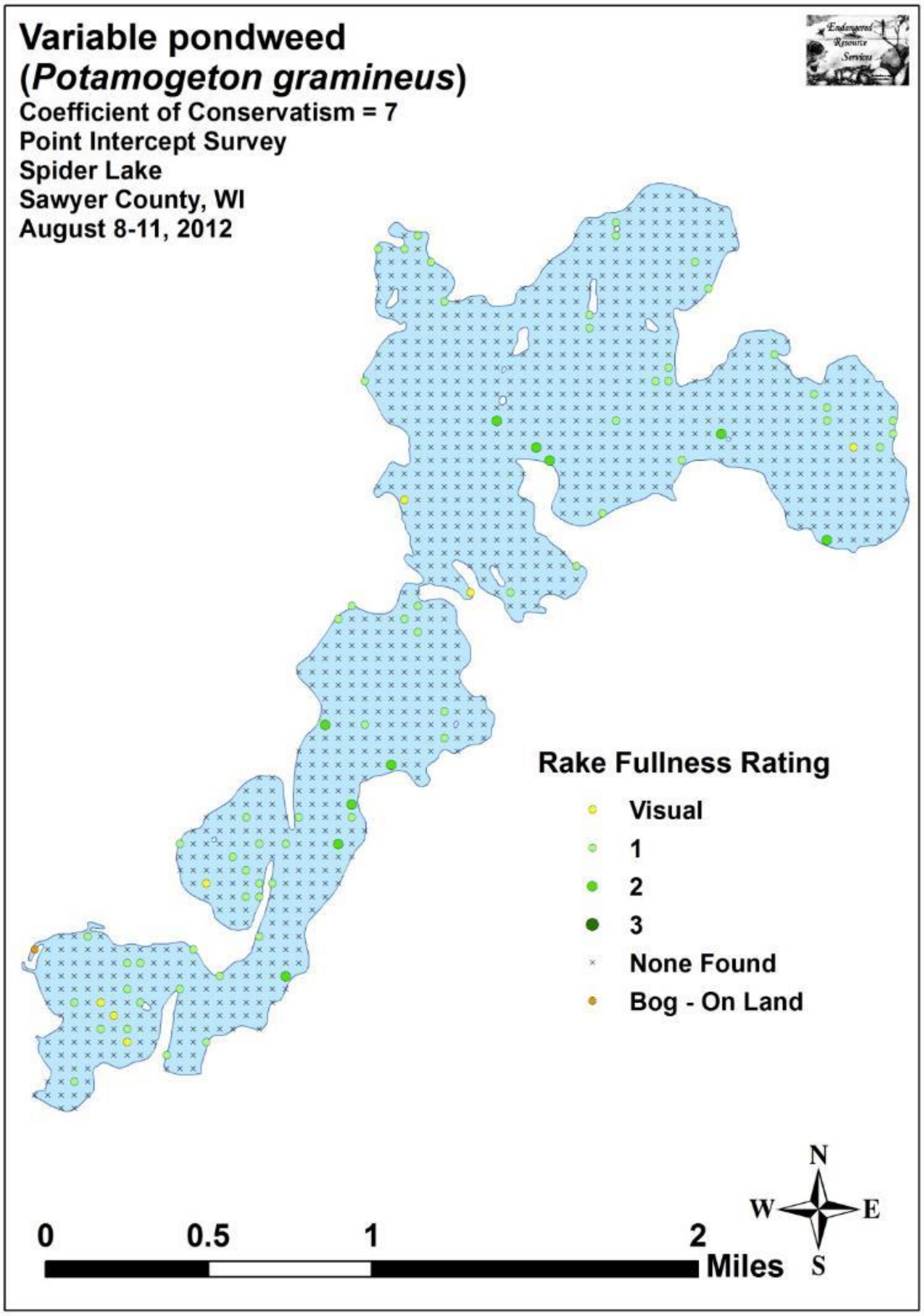

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Curly-leaf pondweed
(*Potamogeton crispus*)
Exotic Species
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

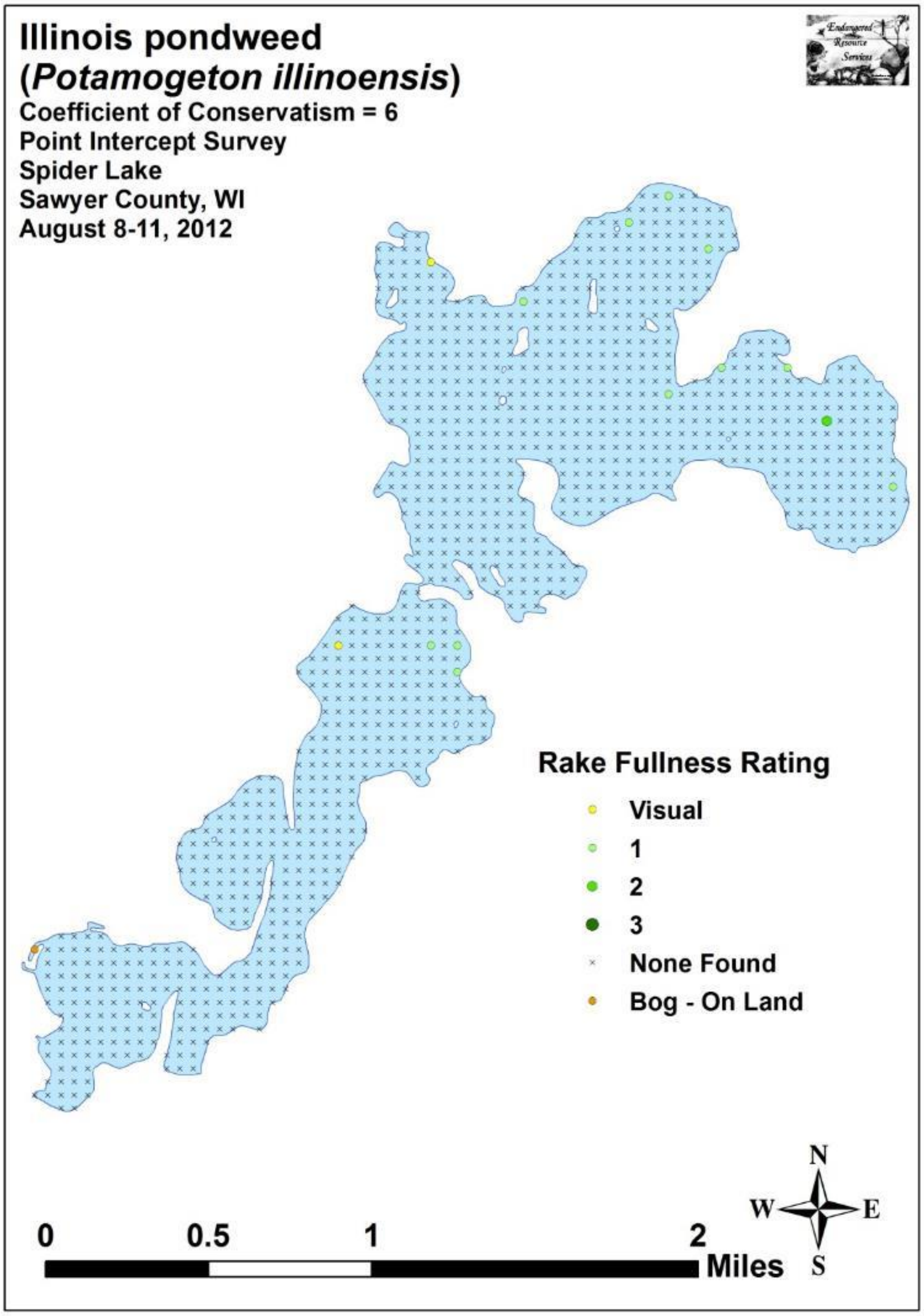

Ribbon-leaf pondweed
(Potamogeton epihydrus)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Leafy pondweed
(*Potamogeton foliosus*)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

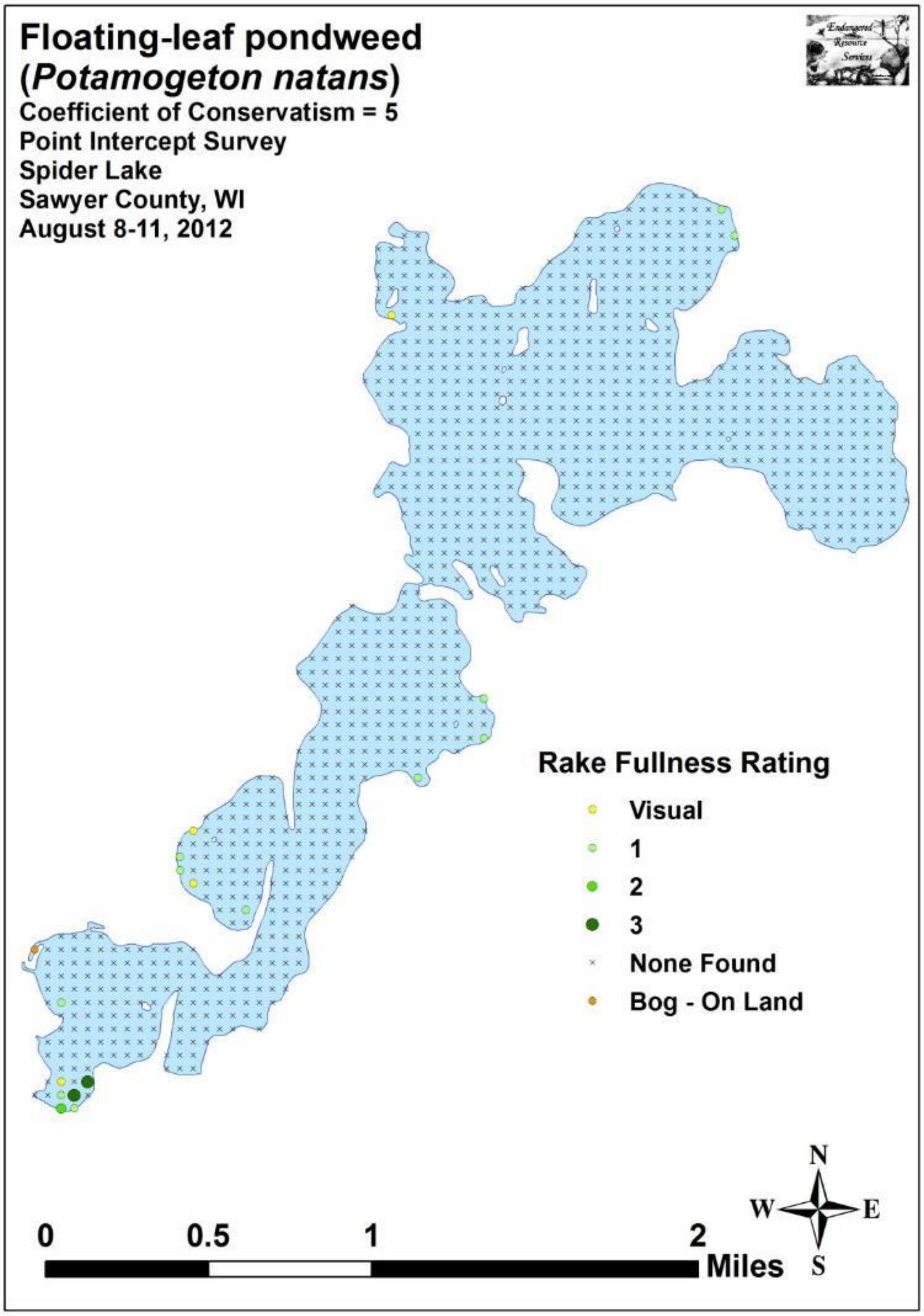

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

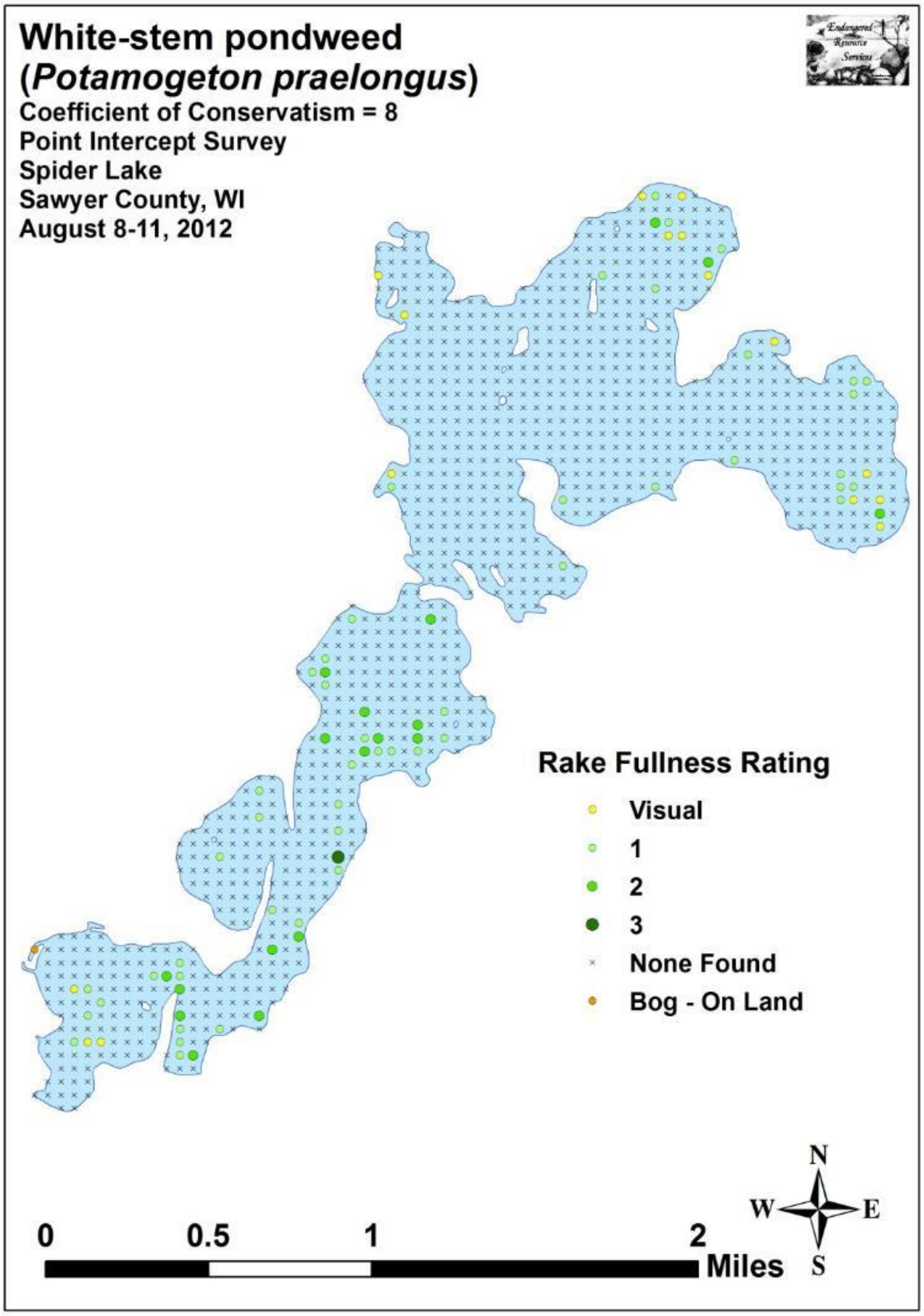


Variable pondweed
(*Potamogeton gramineus*)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

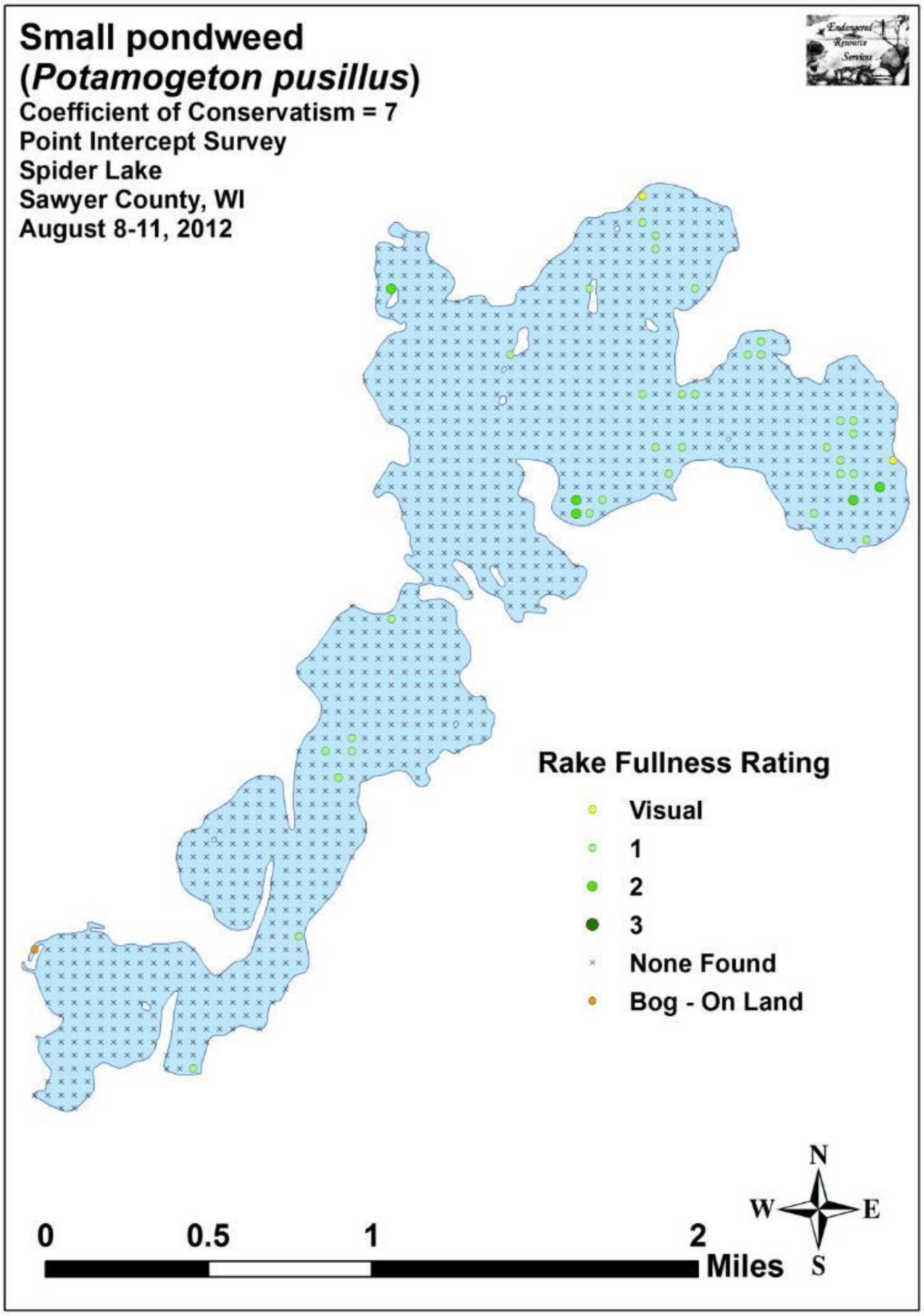


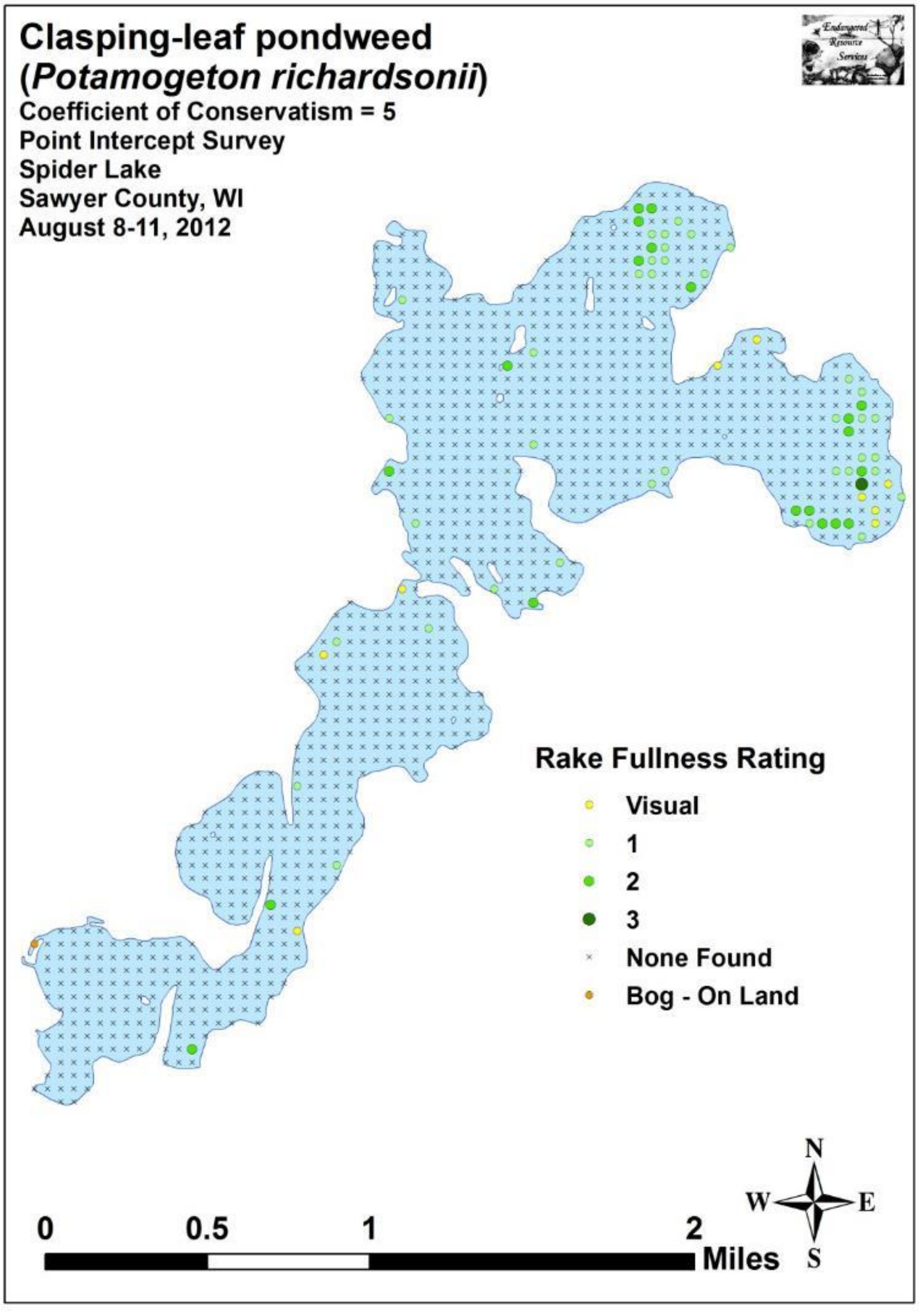
Illinois pondweed
(Potamogeton illinoensis)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

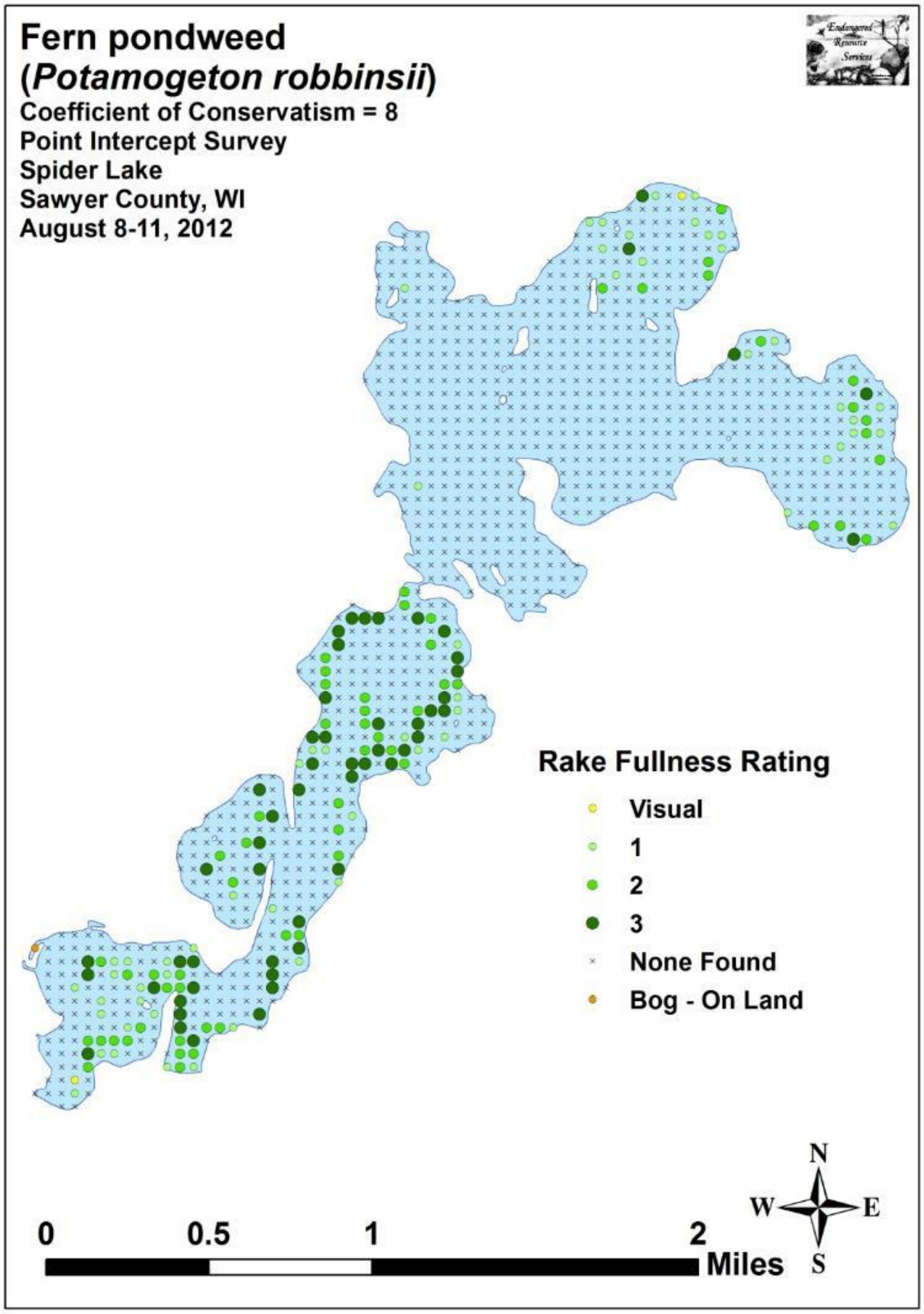

Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

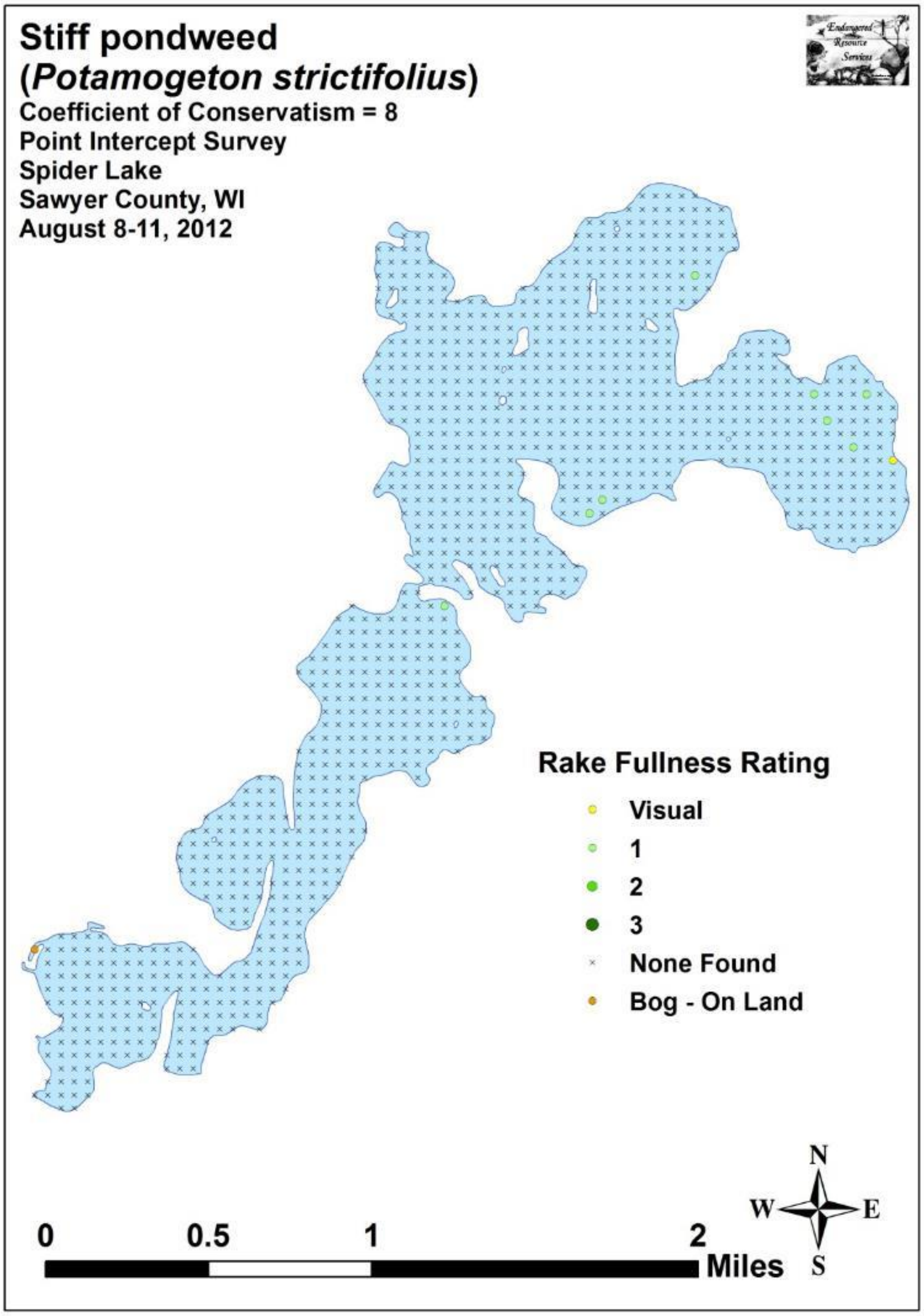


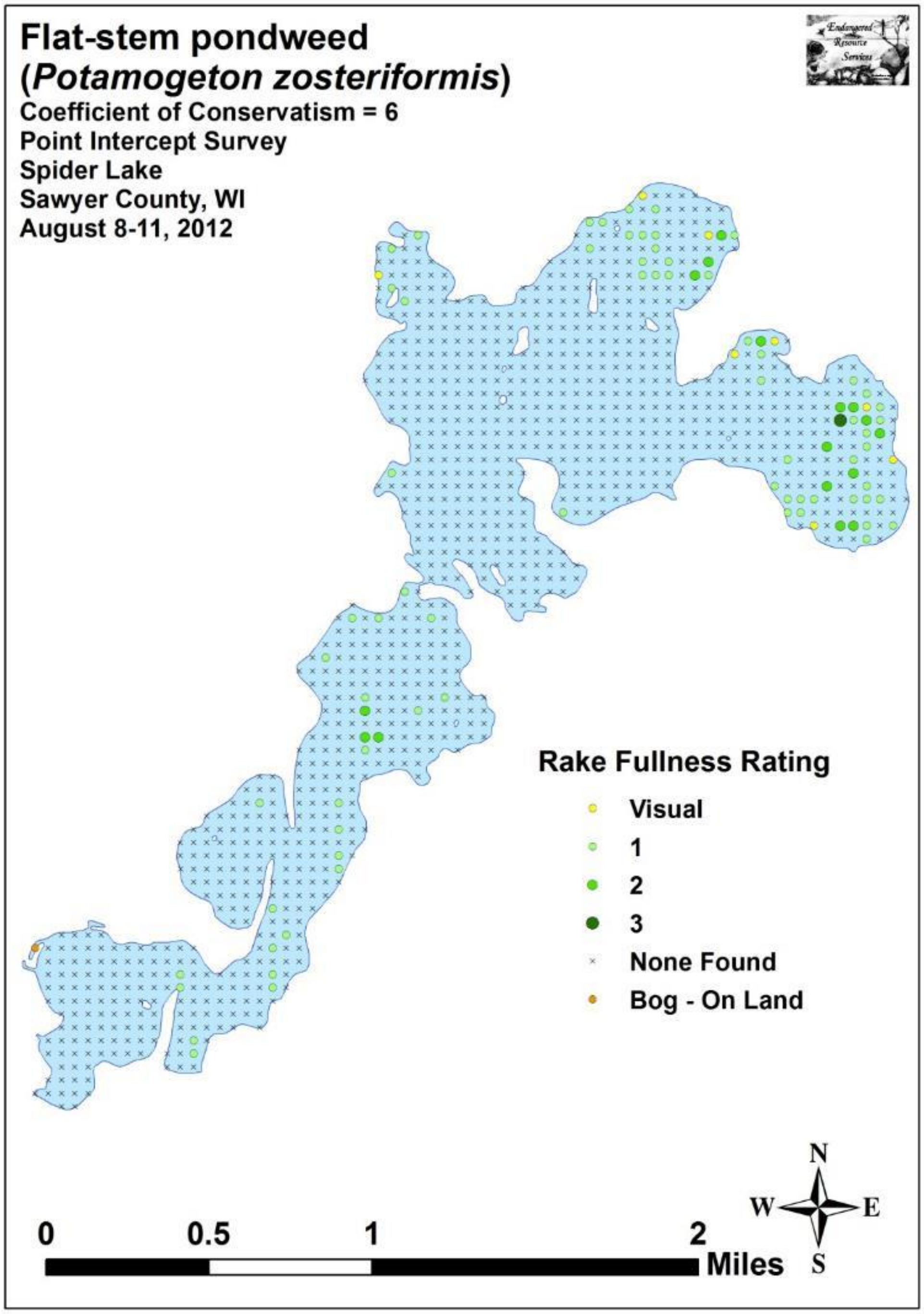
White-stem pondweed
(*Potamogeton praelongus*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

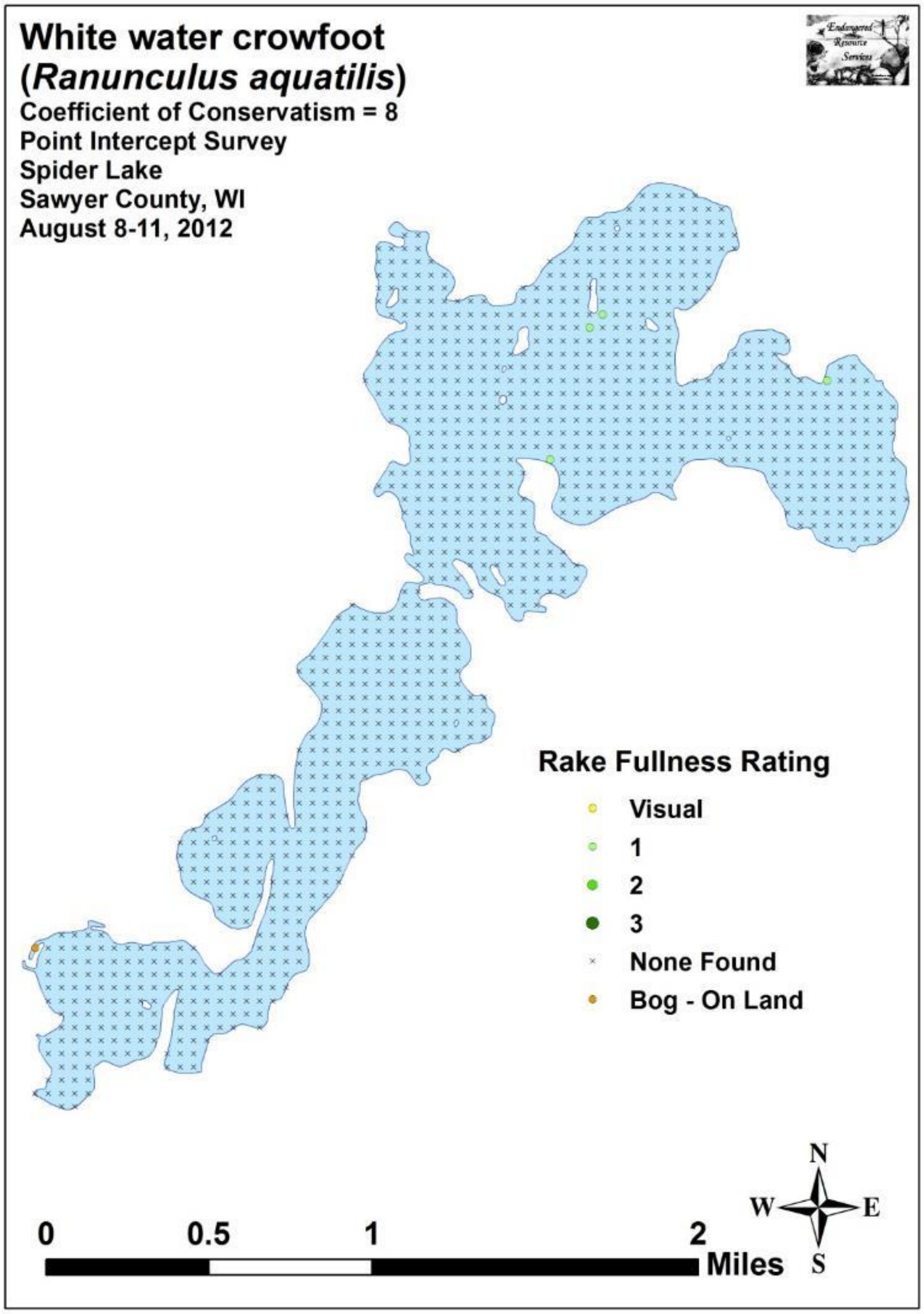

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

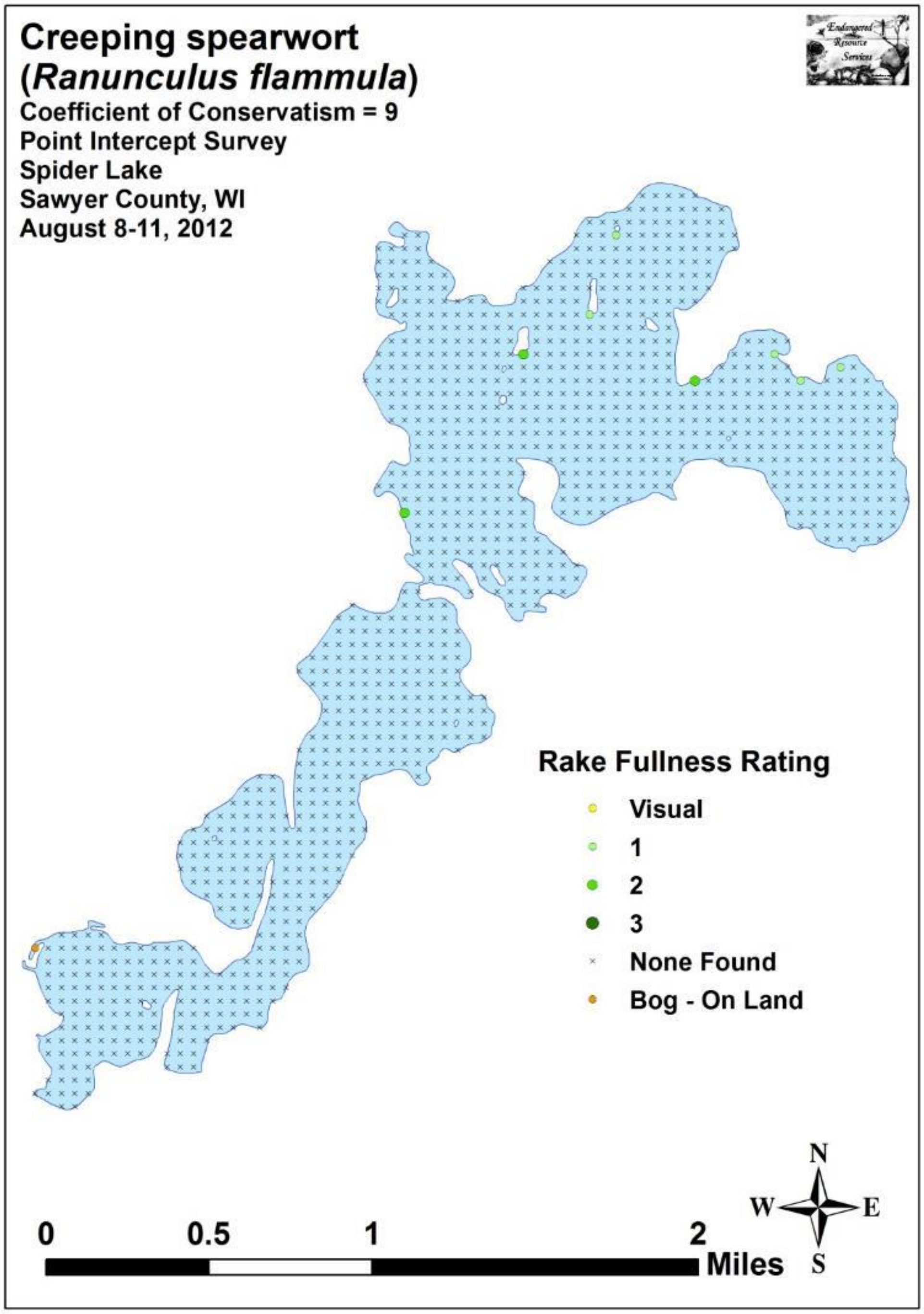

Clasping-leaf pondweed
(*Potamogeton richardsonii*)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

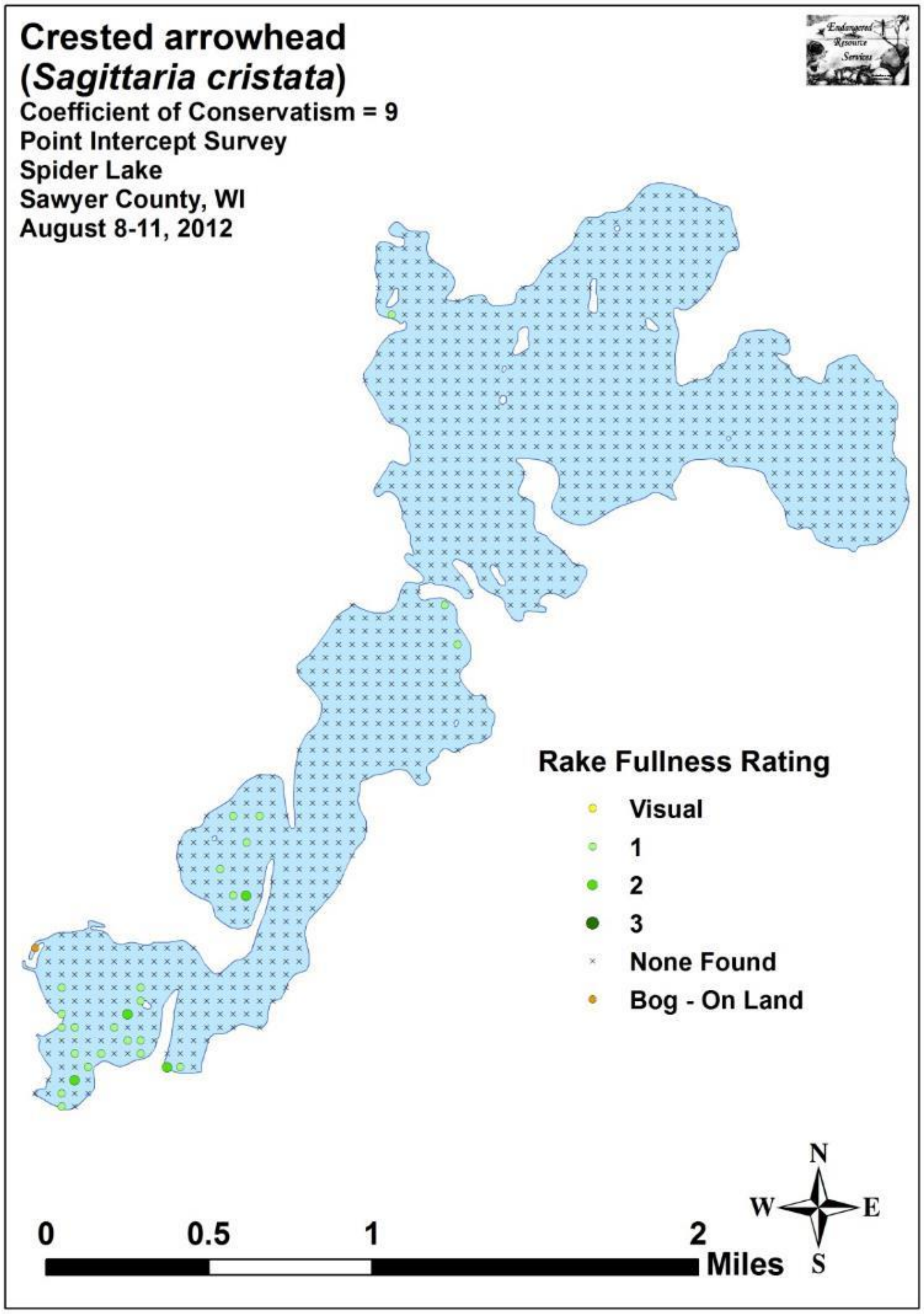

Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Stiff pondweed
(*Potamogeton strictifolius*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

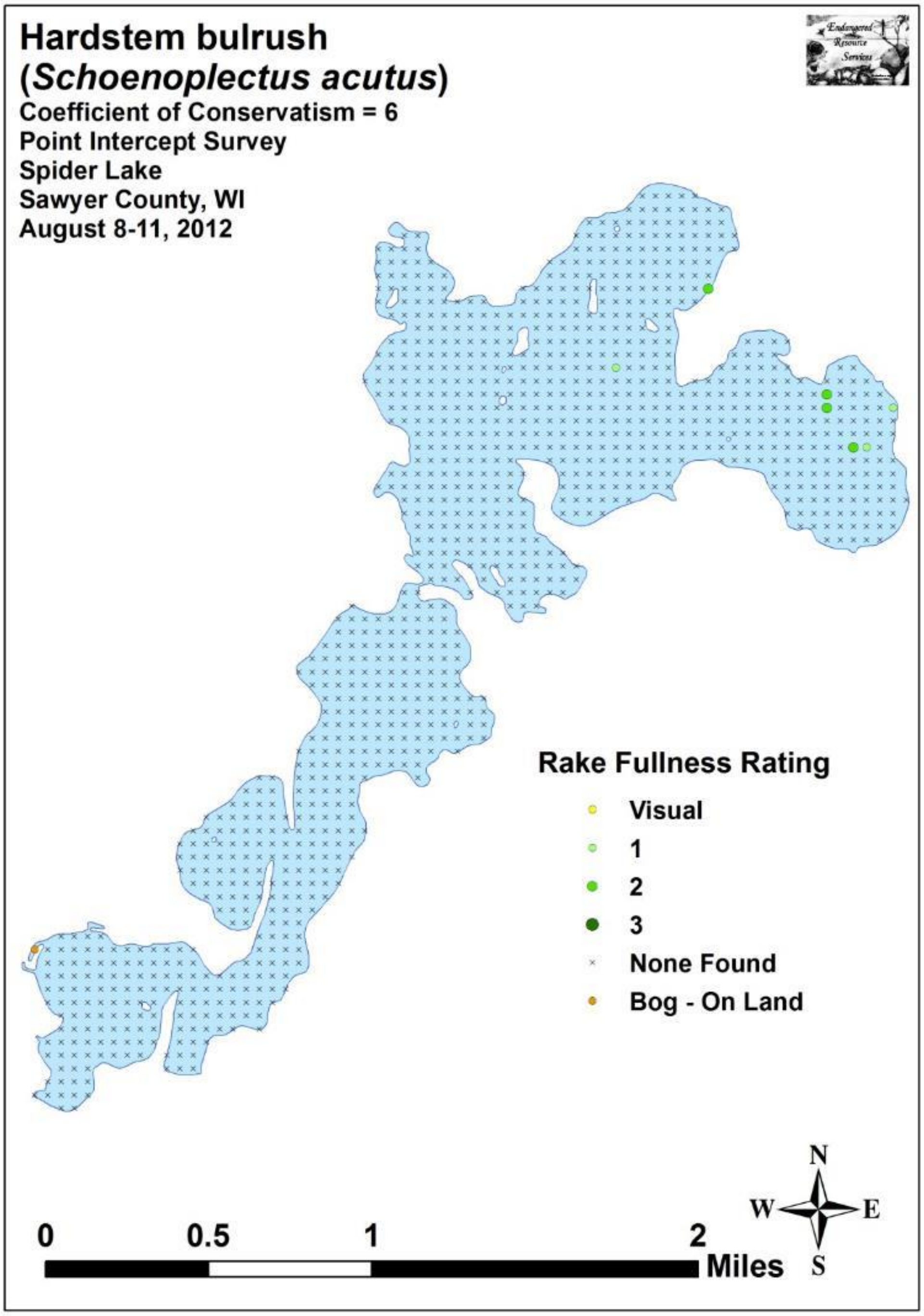

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

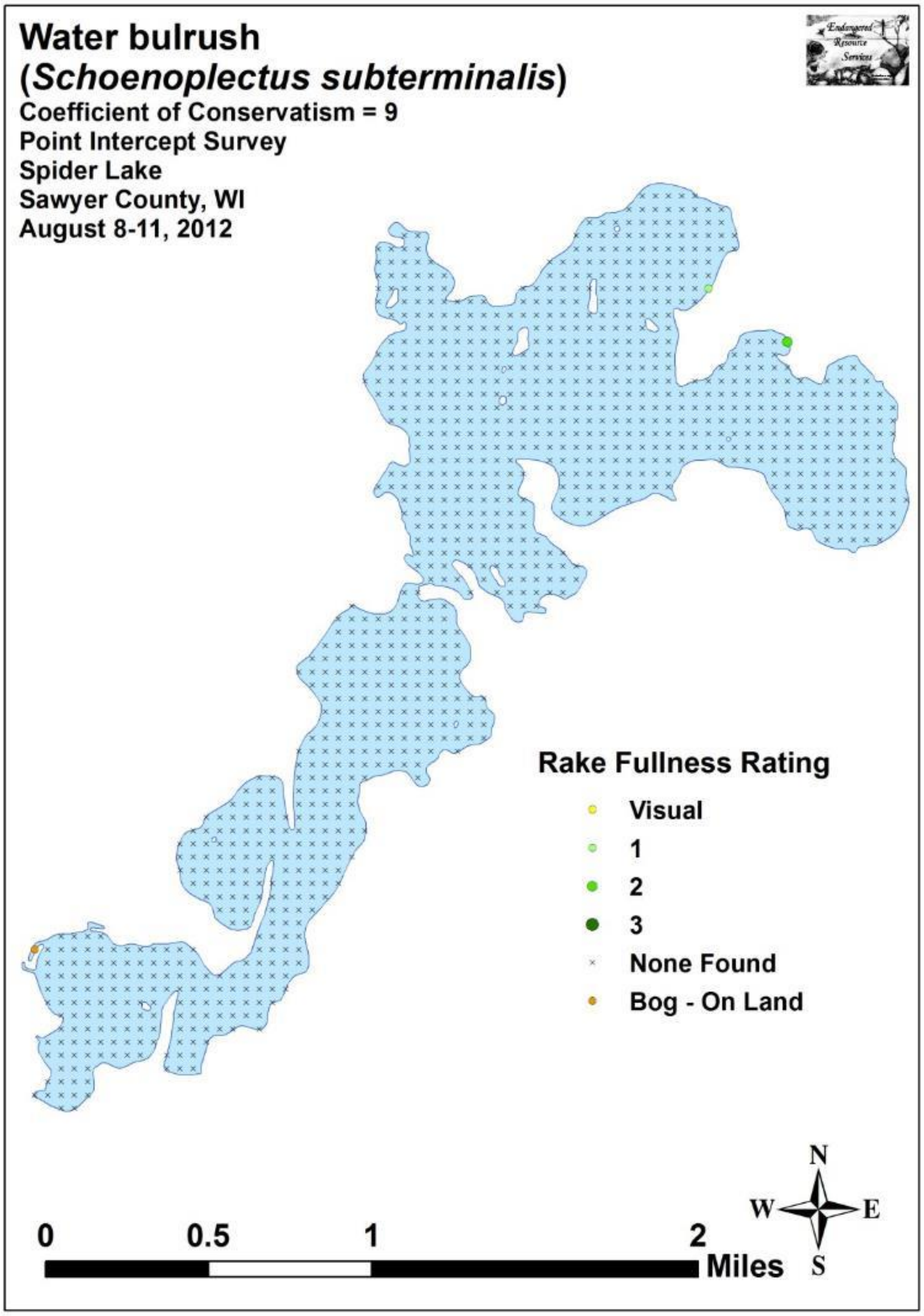

White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

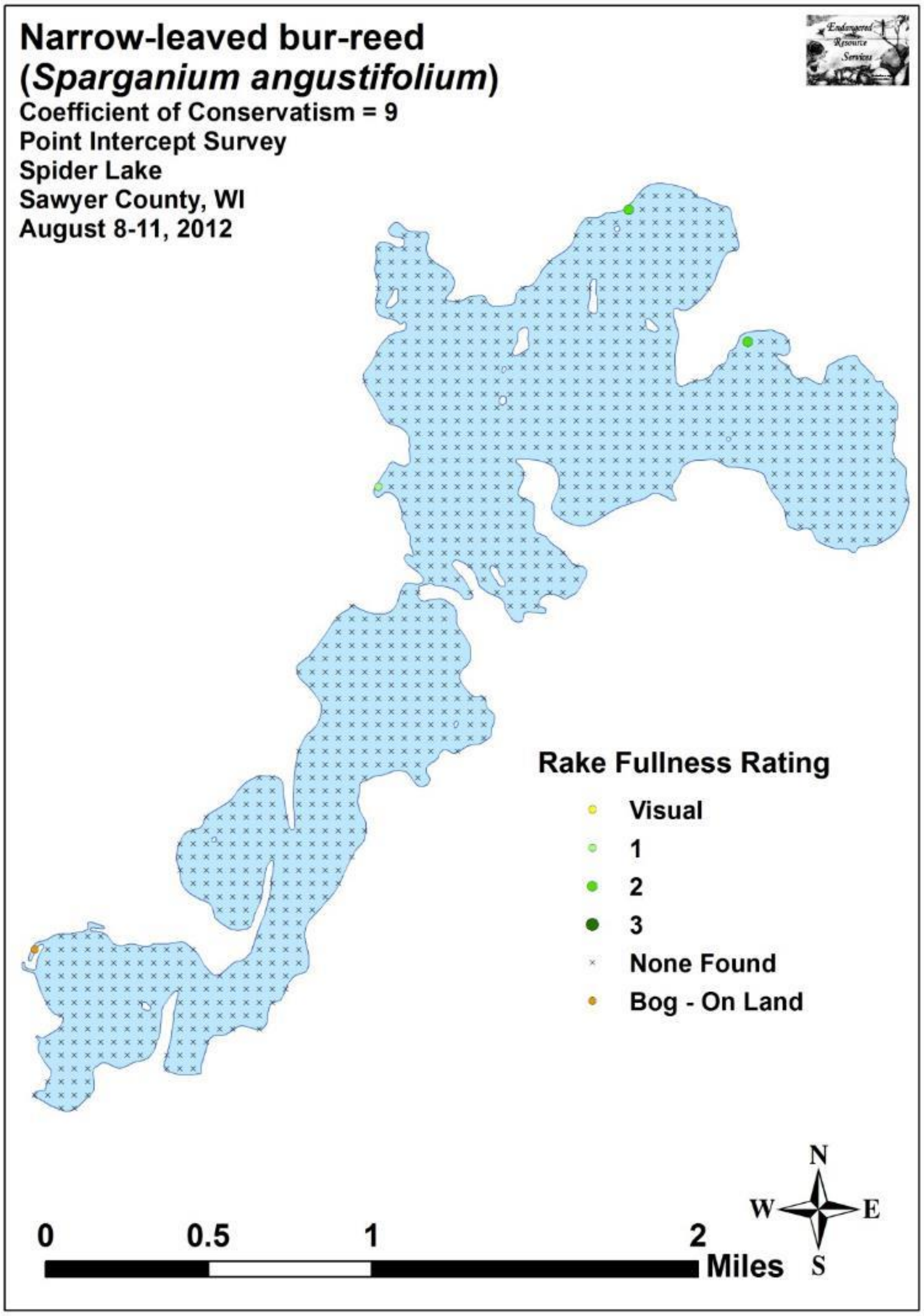

Creeping spearwort
(Ranunculus flammula)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

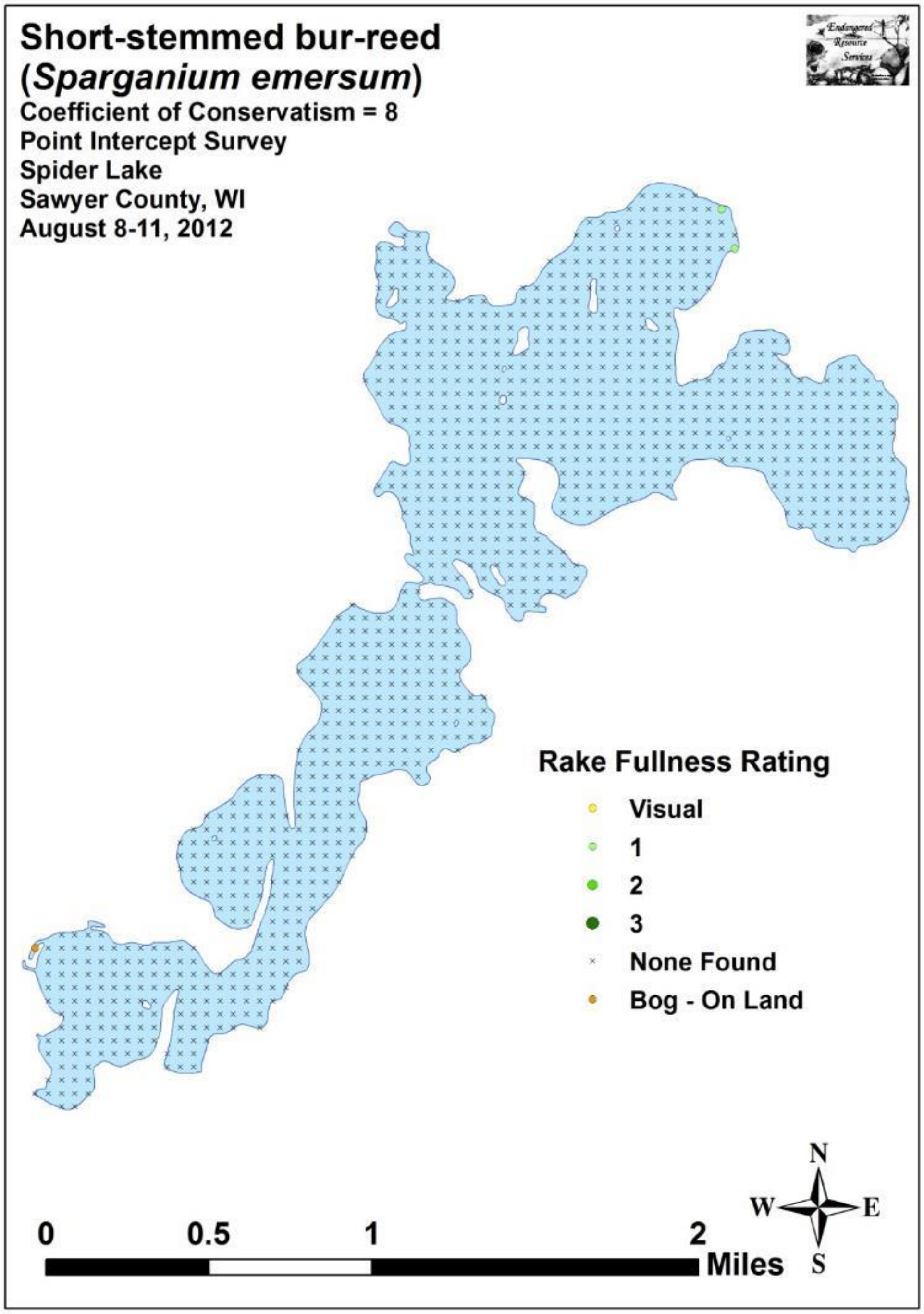


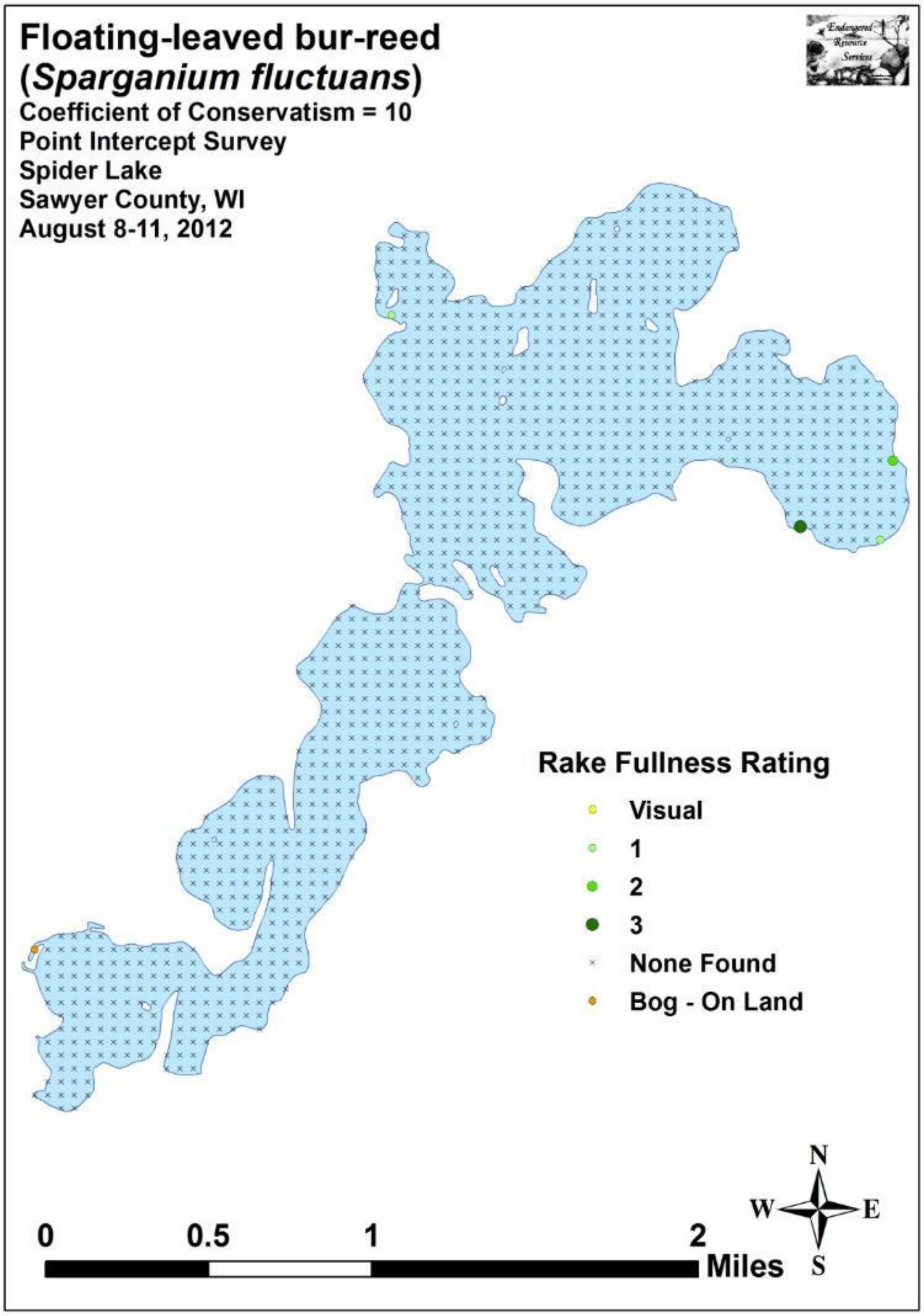
Crested arrowhead
(Sagittaria cristata)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

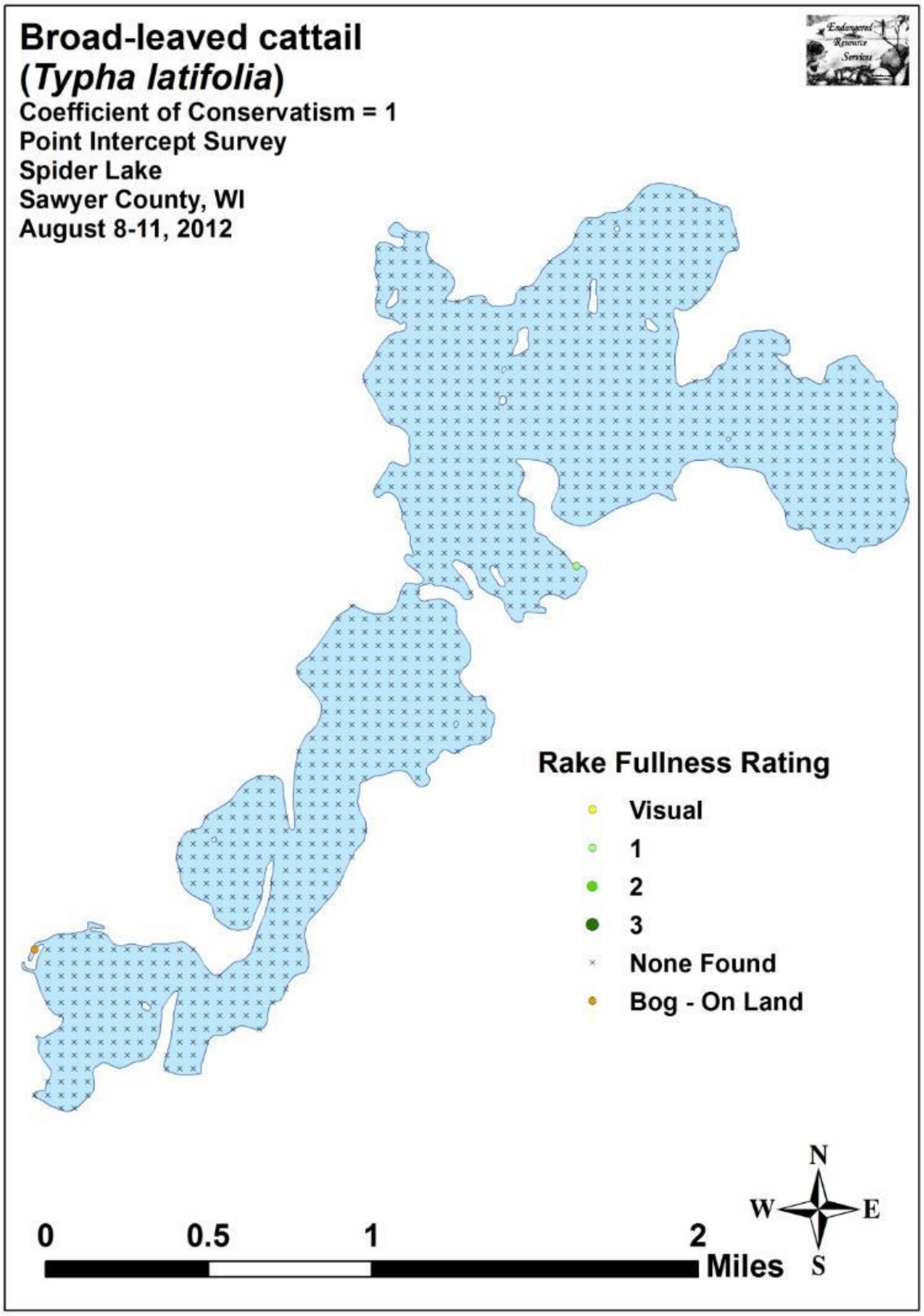

Hardstem bulrush
(Schoenoplectus acutus)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

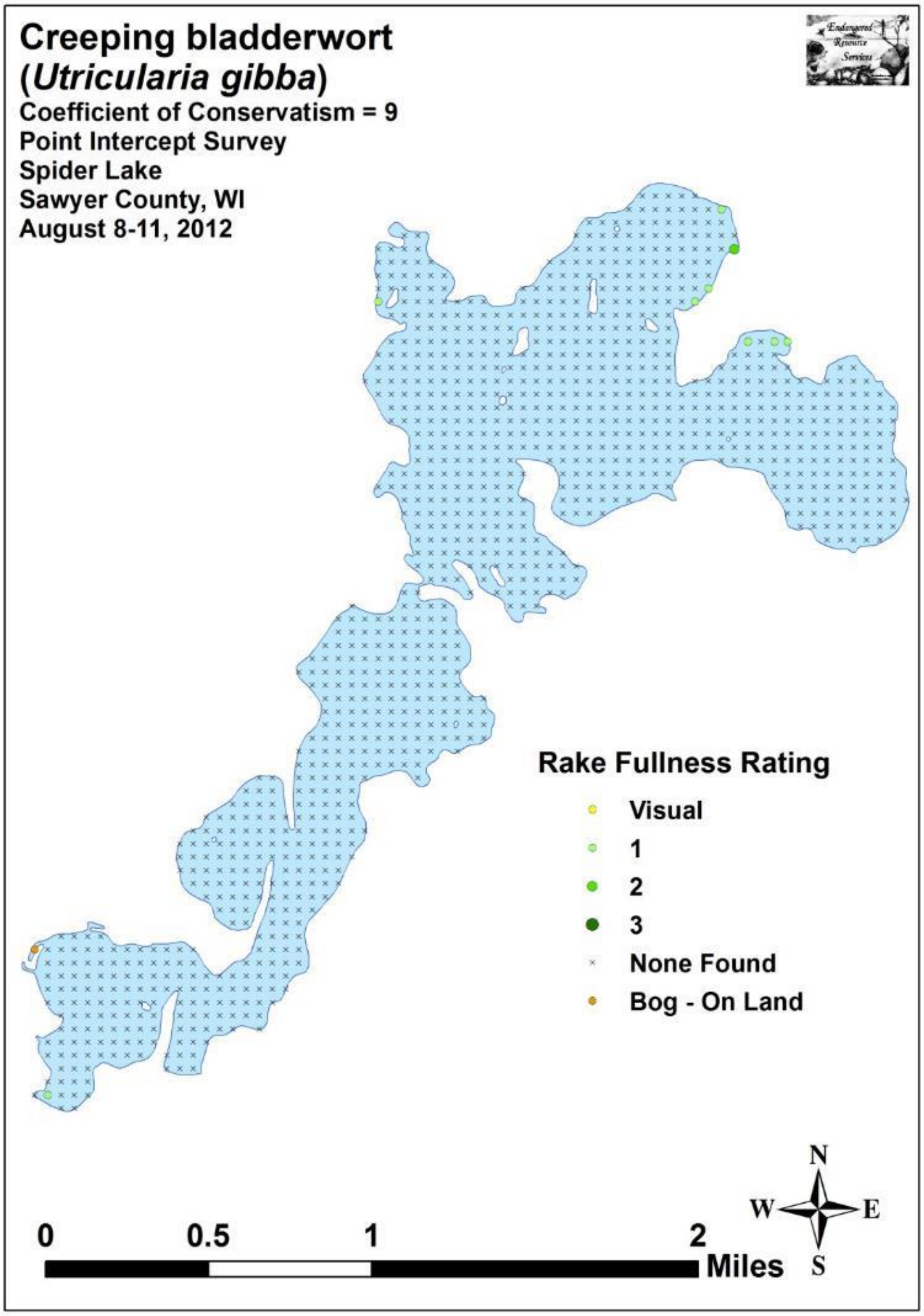

Water bulrush
(Schoenoplectus subterminalis)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

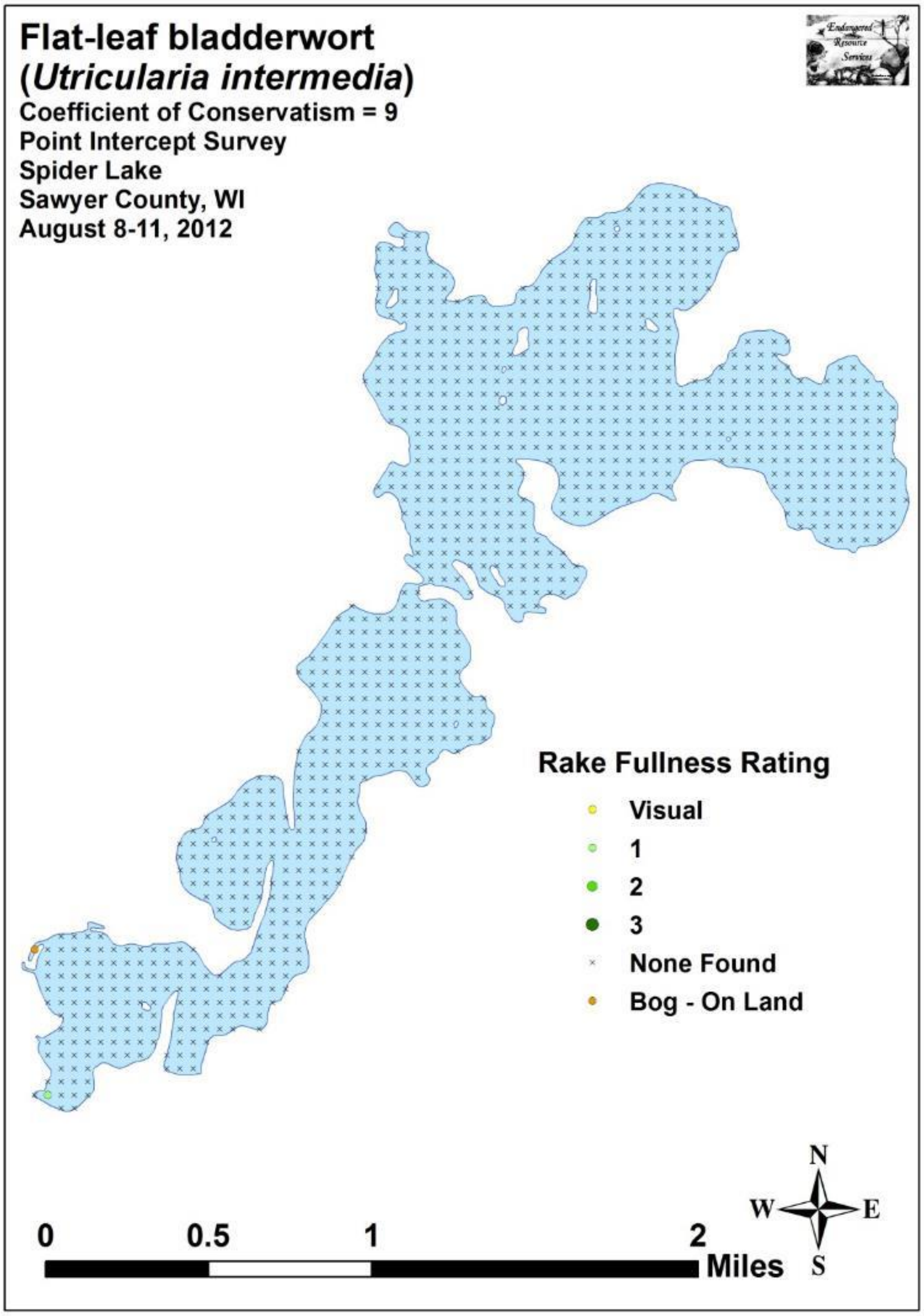

Narrow-leaved bur-reed
(*Sparganium angustifolium*)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

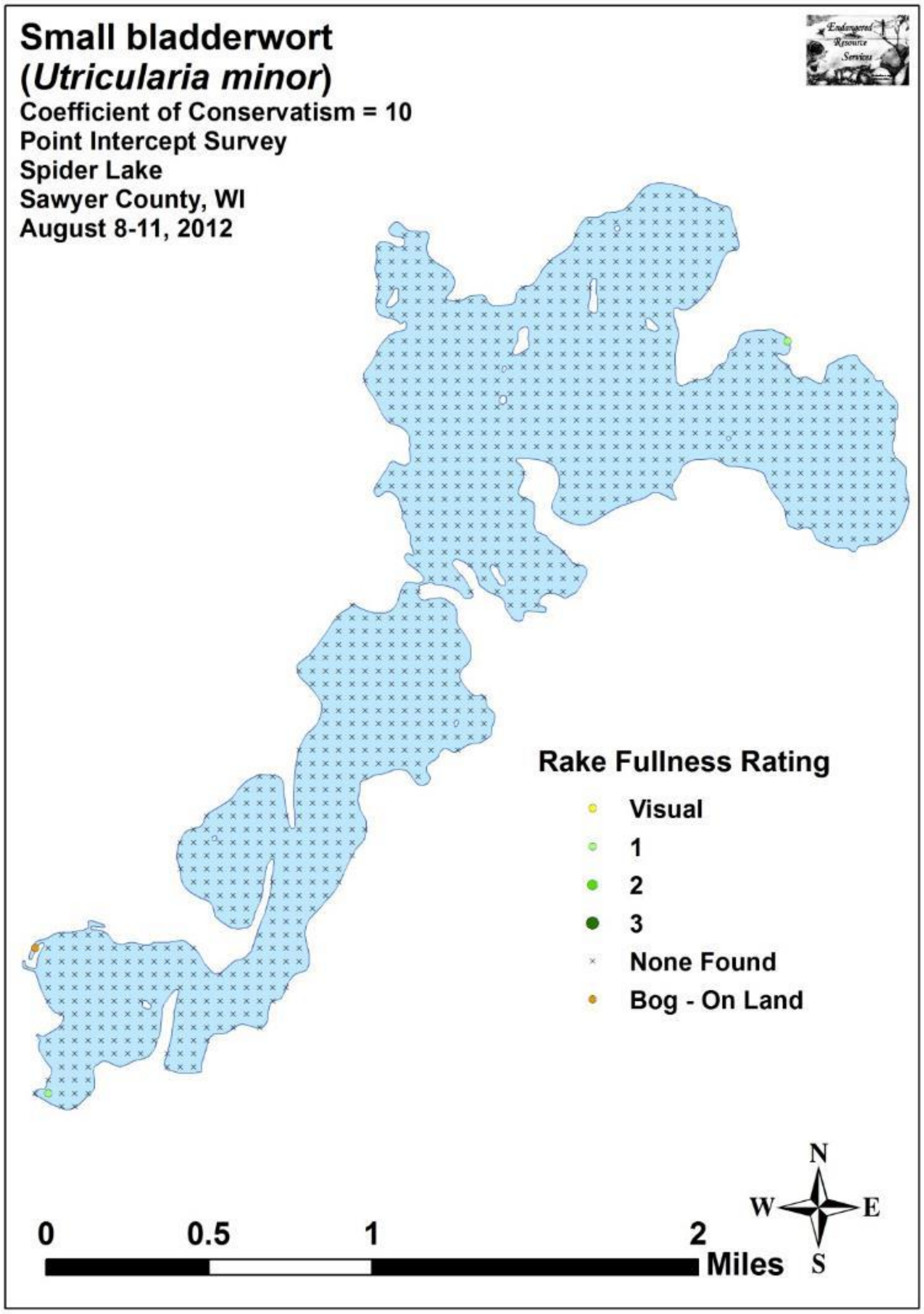

Short-stemmed bur-reed
(Sparganium emersum)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

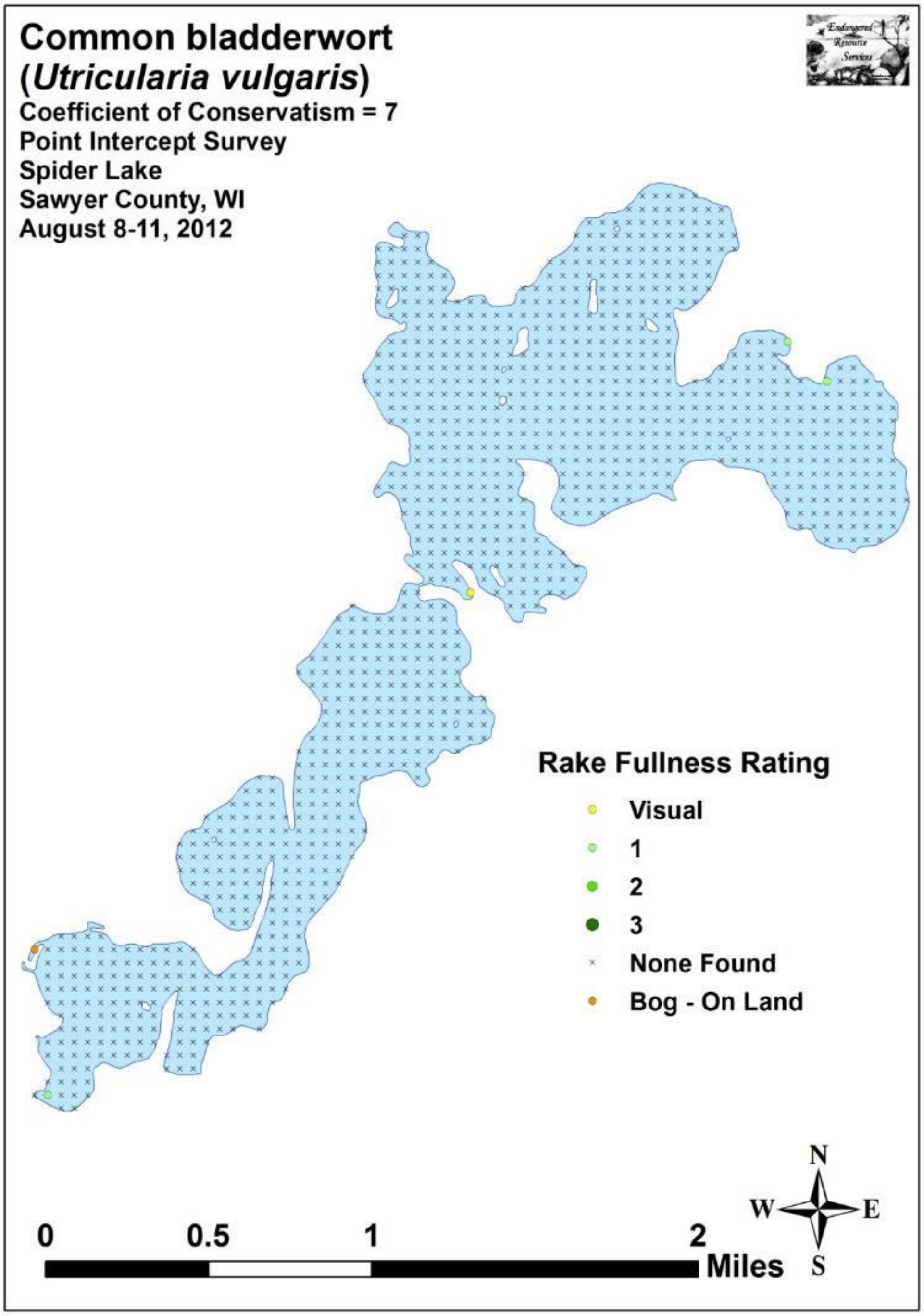

Floating-leaved bur-reed
(Sparganium fluctuans)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

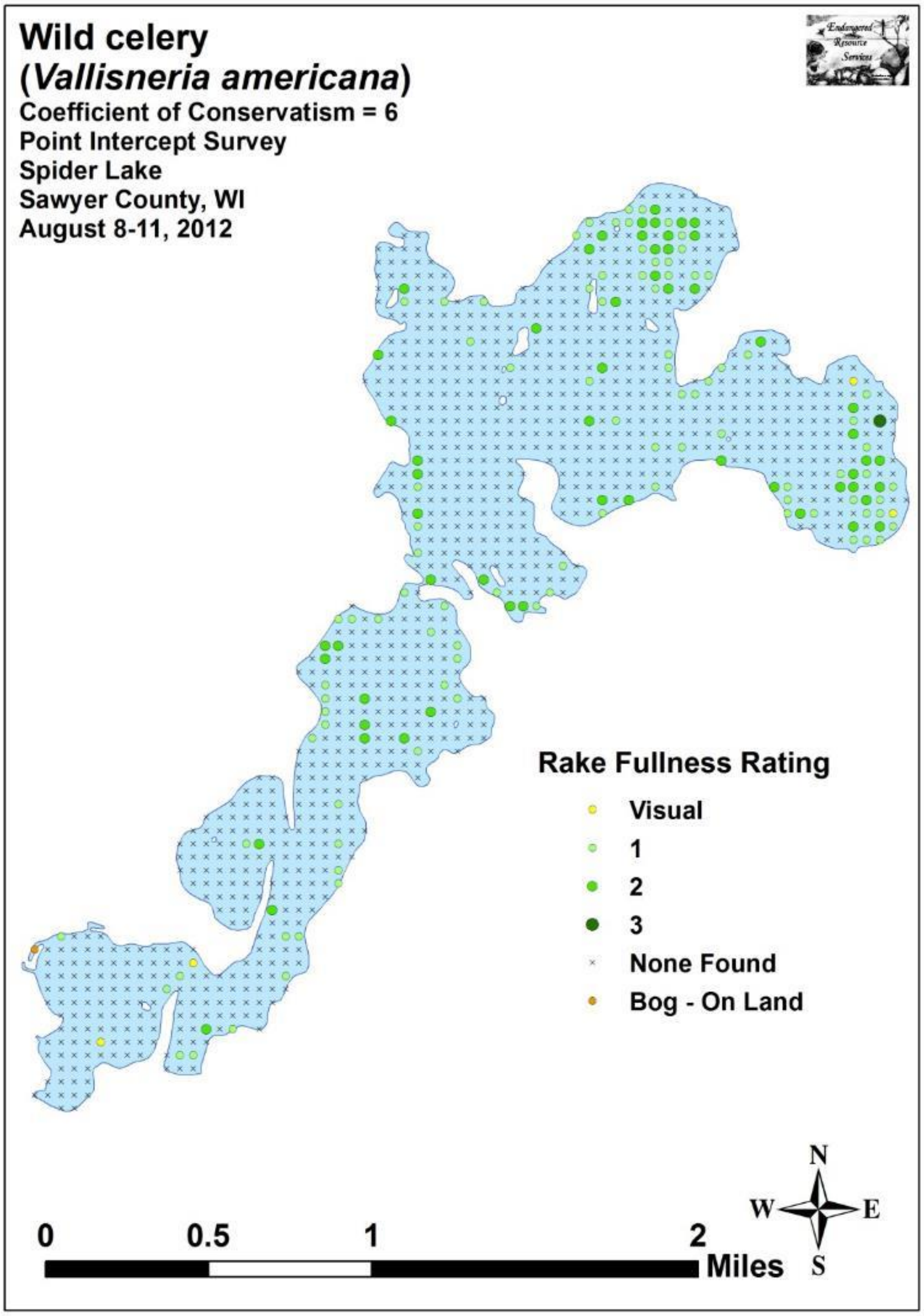

Broad-leaved cattail
(Typha latifolia)
Coefficient of Conservatism = 1
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Creeping bladderwort
(*Utricularia gibba*)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Flat-leaf bladderwort
(Utricularia intermedia)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Small bladderwort
(*Utricularia minor*)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 8-11, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

Appendix VIII: Spider Chain Plant Species Accounts

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Bidens beckii*) **Water marigold**
Specimen Location: Clear Lake; N46.09775°, W91.23184°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-277
Habitat/Distribution: Muck bottom in 0.5-2.5 meters of water.
Widely scattered throughout all four lakes; especially common in Spider's north and north east bays.
Common Associates: (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton pusillus*) Small pondweed, (*Elodea canadensis*) Common waterweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Brasenia schreberi*) **Watershield**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-278
Habitat/Distribution: Muck and mucky sand bottom in 0.5-1.5 meters. Common to abundant in nutrient rich organic muck bottom bays.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Potamogeton natans*) Floating-leaf pondweed, (*Pontederia cordata*) Pickerelweed, (*Utricularia vulgaris*) Common bladderwort, (*Utricularia gibba*) Creeping bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Calamagrostis canadensis*) **Blue joint**
Specimen Location: Clear Lake; N46.09305°, W91.23599°
Also found in: Spider Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-279
Habitat/Distribution: Muck and mucky sand bottom at the shoreline. Relatively common and widely distributed in open canopy shoreline areas.
Common Associates: (*Phalaris arundinacea*) Reed canary grass, (*Sagittaria latifolia*) Common arrowhead, (*Juncus effusus*) Common rush, (*Carex comosa*) Bottlebrush sedge

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Calla palustris*) **Wild calla**
Specimen Location: Clear Lake; N46.09947°, W91.22945°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-280
Habitat/Distribution: Muck soil at the shoreline. Plants were growing on/near the bogs in the north bays of Clear Lake.
Common Associates: (*Carex lasiocarpa*) Narrow-leaved woolly sedge, (*Comarum palustre*) Marsh cinquefoil, (*Brasenia schreberi*) Watershield

State: Sawyer County, Wisconsin **Date:** 8/8/12
Species: (*Carex lacustris*) **Lake sedge**
Specimen Location: Spider Lake; N46.07646°, W91.23740°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-283
Habitat/Distribution: Sandy muck at the shoreline. A large bed occurred near the Spider Creek Outlet/South boat landing on the west shoreline. A single individual was found in fruit at this late date, and it was sent to the herbarium.
Common Associates: (*Pontederia cordata*) Pickerelweed, (*Schoenoplectus acutus*) Hardstem bulrush

State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Carex comosa*) **Bottle brush sedge**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-281
Habitat/Distribution: Muck and mucky sand bottom at the shoreline. Relatively common and widely distributed in open canopy shoreline areas.
Common Associates: (*Phalaris arundinacea*) Reed canary grass, (*Sagittaria latifolia*) Common arrowhead, (*Juncus effusus*) Common rush, (*Calamagrostis canadensis*) Blue joint

State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Carex lasiocarpa*) **Narrow-leaved woolly sedge**
Specimen Location: Clear Lake; N46.09947°, W91.22945°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-282
Habitat/Distribution: Muck soil at the shoreline. Plants were common to abundant in bog margins of all four lakes.
Common Associates: (*Nymphaea odorata*) White water lily, (*Comarum palustre*) Marsh cinquefoil, (*Brasenia schreberi*) Watershield, (*Calla palustris*) Water calla, (*Schoenoplectus subterminalis*) Water bulrush, (*Eleocharis robbinsii*) Robbins' spikerush

State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Carex utriculata*) **Common yellow lake sedge**
Specimen Location: Clear Lake; N46.09696°, W91.22635°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-284
Habitat/Distribution: Muck bottom along the shoreline. Fairly common on the west and southwest shorelines near the public boat landing.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Lythrum salicaria*) Purple loosestrife, (*Carex lasiocarpa*) Narrow-leaved woolly sedge, (*Sagittaria latifolia*) Common arrowhead

County/State: Sawyer County, Wisconsin **Date:** 8/8/12
Species: (*Ceratophyllum demersum*) **Coontail**
Specimen Location: Spider Lake; N46.10130°, W91.21189°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-285
Habitat/Distribution: Muck bottom in 0-5+ meters. Common and widely distributed in all three lakes although seldom abundant or monotypic.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Nymphaea odorata*) White water lily, (*Elodea canadensis*) Common waterweed, (*Myriophyllum sibiricum*) Northern water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Chara* sp.) **Muskgrass**
Specimen Location: Clear Lake; N46.09609°, W91.22876°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg/Paul M. Skawinski Col. #: MSB-2012-286
Habitat/Distribution: *C. vulgaris* was most common in sand/rock bottom areas (especially on exposed points), while *C. braunii* (North Lake only) and *C. globularis* were more common over muck. The later in water from 0 – 5+ meters deep.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton gramineus*) Variable pondweed, (*Najas flexilis*) Slender naiad, (*Elodea canadensis*) Common waterweed, (*Ceratophyllum demersum*) Coontail, (*Nitella* sp.) Nitella

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Dulichium arundinaceum*) **Three-way sedge**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Fawn Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-287
Habitat/Distribution: Located at the edge of the water in mucky soil. Scattered locations on the edges of boggy areas.
Common Associates: (*Nymphaea odorata*) White water lily, (*Eleocharis palustris*) Creeping spikerush, (*Brasenia schreberi*) Watershield, (*Pontederia cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Equisetum fluviatile*) Water horsetail

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Elatine minima*) **Waterwort**
Specimen Location: Clear Lake; N46.09090°, W91.23959°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-288
Habitat/Distribution: Rare; only plants were found in Clear Lake, and almost all of them were on the south and west side of Butternut island. Plants were growing over sand/gravel in water <1m deep.
Common Associates: (*Chara* sp.) Muskgrass, (*Potamogeton gramineus*) Variable pondweed, (*Utricularia resupinata*) Small purple bladderwort, (*Najas flexilis*) Slender naiad, (*Myriophyllum tenellum*) Dwarf water-milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Eleocharis acicularis*) Needle spikerush

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Eleocharis acicularis*) **Needle spikerush**
Specimen Location: Clear Lake; N46.09644°, W91.23546°
Also found in: Spider and North Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-289
Habitat/Distribution: Common in sand/rock bottom areas usually in water from 0 – 2 meters deep. Widespread in Clear and Spider, but rare in North where it primarily grew as an emergent on floating muck mats.
Common Associates: (*Chara* sp.) Muskgrass, (*Potamogeton gramineus*) Variable pondweed, (*Ranunculus flammula*) Creeping spearwort, (*Najas flexilis*) Slender naiad, (*Myriophyllum tenellum*) Dwarf water-milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Utricularia resupinata*) Small purple bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/8/12
Species: (*Eleocharis robbinsii*) **Robbins' spikerush**
Specimen Location: Spider Lake; N46.07401°, W91.24743°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-290
Habitat/Distribution: Thick muck bottom in 0-0.5 meters of water. Plants were abundant in the spring inlet found in the southwest corner of the southwest bay of Little Spider.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Potamogeton natans*) Floating-leaf pondweed, (*Pontederia cordata*) Pickerelweed, (*Brasenia schreberi*) Watershield, (*Utricularia vulgaris*) Common bladderwort, (*Utricularia gibba*) Creeping bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Eleocharis palustris*) **Creeping spikerush**
Specimen Location: Clear Lake; N46.09262°, W91.23720°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-291
Habitat/Distribution: Firm, rocky bottoms in 0-1 meter of water. Scattered individuals were found growing in Hardstem bulrush beds or in larger monotypic stands.
Common Associates: (*Schoenoplectus acutus*) Hardstem bulrush, (*Eleocharis palustris*) Creeping spikerush, (*Equisetum fluviatile*) Water horsetail, (*Chara* sp.) Muskgrass, (*Potamogeton gramineus*) Variable pondweed

County/State**:** Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Elodea canadensis*) **Common waterweed**
Specimen Location: Clear Lake; N46.09775°, W91.23184°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-292
Habitat/Distribution: Muck bottom in 0-6 meters of water.
Common and widespread, but only abundant in the north and northeast bays of Big Spider.
Common Associates: (*Potamogeton crispus*) Curly-leaf pondweed**,** (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Vallisneria americana*) Wild celery

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Equisetum fluviatile*) **Water horsetail**
Specimen Location: Clear Lake; N46.08962°, W91.24078°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-293
Habitat/Distribution: Sandy and firm muck bottoms in 0-.5m of water. Widely scattered locations throughout all four lakes. Most plants were found on exposed points or next to bogs.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Schoenoplectus acutus*) Hardstem bulrush, (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Eleocharis palustris*) Creeping spikerush

County/State**:** Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Eriocaulon aquaticum*) **Pipewort**
Specimen Location: Clear Lake; N46.09609°, W91.22876°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-294
Habitat/Distribution: Firm sand and sandy muck bottoms in water <1.5m deep. Common and widespread in Clear, but largely restricted to the southern bays in Little Spider.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Eleocharis acicularis*) Needle spikerush, (*Utricularia resupinata*) Small purple bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: (*Heteranthera dubia*) **Water star-grass**
Specimen Location: Spider Lake; N46.11361°, W91.20963°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-295
Habitat/Distribution: Firm nutrient rich organic muck and sand bottoms in water up to 4m. Widespread and common throughout Big Spider; scattered in Fawn and North; absent from the marl/muck of Little Spider and Clear.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/4/17
Species: (*Iris pseudacorus*) **Yellow iris**
Specimen Location: Spider Lake; N46.07486°, W91.23793°
Also found in: Clear and North Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2017-011
Habitat/Distribution: Firm sand and muck bottom at the shoreline. Common and spreading on both Big and Little Spider. Much less common on North Lake and Clear Lakes.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 8/11/12
Species: (*Isoetes echinospora*) **Spiny-spored quillwort**
Specimen Location: Spider Lake; N46.11120°, W91.21631°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-296
Habitat/Distribution: Firm sand bottoms in water <1m deep. Only plants found were at the point.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Eleocharis acicularis*) Needle spikerush

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Isoetes lacustris*) **Lake quillwort**
Specimen Location: Clear Lake; N46.10024°, W91.23676°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-297
Habitat/Distribution: Sandy muck bottom in water <1.5m deep. A single plant was found at the point.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Utricularia resupinata*) Small purple bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Juncus effusus*) **Common rush**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-298
Habitat/Distribution: Rocky to sandy bottoms at the shoreline. Plants were scattered along the western shoreline north of the boat landing.
Common Associates: (*Lythrum salicaria*) Purple loosestrife, (*Typha latifolia*) Broad-leaved cattail, (*Phalaris arundinacea*) Reed canary grass, (*Sagittaria latifolia*) Common arrowhead

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Juncus pelocarpus*) **Brown-fruited rush**
Specimen Location: Clear Lake; N46.10109°, W91.23617°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-299
Habitat/Distribution: Rocky to sandy bottoms in < 1 meter of water. Common throughout Clear; widely scattered throughout Spider.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Myriophyllum tenellum*) Dwarf water-milfoil, (*Elatine minima*) Waterwort, (*Ranunculus flammula*) Creeping spearwort, (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Chara* sp.) Muskgrass, (*Littorella uniflora*) Littorella, (*Utricularia resupinata*) Small purple bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/10/12
Species: (*Leersia oryzoides*) **Rice cut-grass**
Specimen Location: Spider Lake; N46.09777°, W91.21433°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-300
Habitat/Distribution: Located at the shoreline over sand and firm sandy muck.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Pontederia cordata*) Pickerelweed

County/State: Sawyer County, Wisconsin **Date:** 8/11/12
Species: (*Lemna minor*) **Small duckweed**
Specimen Location: Spider Lake; N46.10935°, W91.22552°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-301
Habitat/Distribution: Located floating at or just under the surface in sheltered areas. Only plants found were at the point.
Common Associates: (*Pontederia cordata*) Pickerelweed, (*Utricularia gibba*) Creeping bladderwort, (*Brasenia schreberi*) Watershield

County/State: Sawyer County, Wisconsin **Date:** 8/10/12
Species: (*Littorella uniflora*) **Littorella**
Specimen Location: Spider Lake; N46.10709°, W91.21790°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-302
Habitat/Distribution: Only plants found were around the point where a small bed (few 1,000's of plants max) was established on the south shore of the island in water <1m deep.
Common Associates: (*Ranunculus flammula*) Creeping spearwort, (*Juncus pelocarpus*) Brown-fruited rush

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Lythrum salicaria*) **Purple loosestrife**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-303
Habitat/Distribution: Most plants were located near the Clear Lake boat landing. Another handful of plants were found in Spider on the north shoreline of the northeast bay.
Common Associates: (*Juncus effusus*) Common rush, (*Typha latifolia*) Broad-leaved cattail, (*Carex lasiocarpa*) Narrow-leaved woolly sedge, (*Phalaris arundinacea*) Reed canary grass

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Myriophyllum sibiricum*) **Northern water-milfoil**
Specimen Location: Clear Lake; N46.11699°, W91.21664°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-304
Habitat/Distribution: Nutrient rich organic muck bottoms in water up to 4 meters deep. Widespread and common throughout Big Spider and Clear; scattered in Fawn; absent or rare in the marl/nutrient poor muck of Little Spider and Clear.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton pusillus*) Small pondweed, (*Vallisneria americana*) Wild celery, (*Heteranthera dubia*) Water star-grass

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Myriophyllum tenellum*) **Dwarf water-milfoil**
Specimen Location: Clear Lake; N46.09609°, W91.22876°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-305
Habitat/Distribution: Rocky to sandy bottoms in 0-2 meters of water. Common and widely distributed in Clear, but rare in Big Spider on exposed island points and shorelines.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Elatine minima*) Waterwort, (*Ranunculus flammula*) Creeping spearwort, (*Utricularia resupinata*) Small purple bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/11/12
Species: (*Myriophyllum verticillatum*) **Whorled water-milfoil**
Specimen Location: North Lake; N46.11636°, W91.21477°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-306
Habitat/Distribution: Mucky bottoms in 0-1 meter of water. Rare; Restricted to the southeast end of the east bay where it was abundant among the many small muck bogs that were floating to the surface.
Common Associates: (*Zizania palustris*) Northern wild rice, (*Sparganium emersum*) Short-stemmed bur-reed, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort, (*Brasenia schreberi*) Watershield

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Najas flexilis*) **Slender naiad**
Specimen Location: Clear Lake; N46.10027°, W91.23312°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-307
Habitat/Distribution: Found in almost any bottom conditions in 0.5-4.0 meters of water. Widely distributed and common throughout.
Common Associates: (*Chara* sp.) Muskgrass, (*Potamogeton gramineus*) Variable pondweed, (*Vallisneria americana*) Wild celery, (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Najas guadalupensis*) Southern naiad

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Najas guadalupensis var. olivacea*) **Southern naiad**
Specimen Location: Clear Lake; N46.09607°, W91.23120°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg/Dr. Donald Les, UCONN
Col. #: MSB-2012-308
Habitat/Distribution: Abundant over marl and muck bottoms in 0.5-5.5 meters of water at the point. Told from *N. flexilis* by the dark green color, brittle nature of stems, and blunt leaf tips that don't taper. Plants dominated many areas in the bays and shallow flats of Little Spider and Clear Lake.
Common Associates: (*Potamogeton gramineus*) Variable pondweed, (*Sagittaria cristata*) Crested arrowhead, (*Najas flexilis*) Slender naiad, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Nitella* sp.) **Nitella**
Specimen Location: Spider Lake; N46.10149°, W91.19423°
Also found in: North Lake
Collected/Identified by: Matthew S. Berg/Paul M. Skawinski Col. #: MSB-2012-309
Habitat/Distribution: Muck bottom area in water generally from 3-5 meters. *N. flexilis* dominated the bottom in the northeast finger bay of Big Spider while *N. acuminata?* was common scattered throughout North Lake.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Elodea canadensis*) Common waterweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Nuphar variegata*) **Spatterdock**
Specimen Location: Clear Lake; N46.09947°, W91.22945°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-310
Habitat/Distribution: Muck/Marl/Sand bottoms in 0.5-2 meters of water where it often forms dense canopies. Less common than White water lily in muck bays and along sheltered shorelines.
Common Associates: (*Nymphaea odorata*) White water lily, (*Potamogeton natans*) Floating-leaf pondweed, (*Pontederia cordata*) Pickerelweed, (*Brasenia schreberi*) Watershield

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Nymphaea odorata*) **White water lily**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-311
Habitat/Distribution: Muck bottom in 0-2 meters where it often formed dense canopies with other floating-leaf species. Common to abundant in calm water bays throughout all four lakes.
Common Associates: (*Nuphar variegata*) Spatterdock,
(*Brasenia schreberi*) Watershield, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Utricularia vulgaris*) Common bladderwort, (*Pontederia cordata*) Pickerelweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Nymphaea odorata*) **White water lily – pink morph**
Specimen Location: Spider Lake; N46.08664°, W91.23642°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-312
Habitat/Distribution: Muck bottom in 0.5-1.5 meters where a few hundred bright pink flowers/dark maroon lilypads was found scattered with normal White water lilies. Restricted to shoreline southwest of the North Star Boy Camp in Little Spider.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Elodea canadensis*) Common waterweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Utricularia vulgaris*) Common bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: (*Polygonum amphibium*) **Water smartweed**
Specimen Location: Spider Lake; N46.09771°, W91.21937°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-313
Habitat/Distribution: Rare; A few clusters of plants were located over rock and sand near the shore in 1meter of water in Big Spider.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton gramineus*) Variable pondweed, (*Najas flexilis*) Slender naiad, (*Ranunculus flammula*) Creeping spearwort

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Pontederia cordata*) **Pickerelweed**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-314
Habitat/Distribution: Silt to muck bottom over firm substrate in 0-1.5 meters of water. Common in emergent beds throughout all four lakes; especially in sheltered bays.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Eleocharis palustris*) Creeping spikerush

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton amplifolius*) **Large-leaf pondweed**
Specimen Location: Clear Lake; N46.09608°, W91.22937°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-315
Habitat/Distribution: Found in most muck bottom areas in water from 1-5m deep. Common and widely distributed throughout all four lakes; especially common over marl/muck areas in Little Spider and Clear.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Ceratophyllum demersum*) Coontail, (*Najas guadalupensis*) Southern naiad

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton crispus*) **Curly-leaf pondweed**
Specimen Location: Spider Lake; N46.09712°, W91.22020°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-316
Habitat/Distribution: Widely distributed throughout Big Spider/represented by a handful of plants in Little Spider. Seldom invasive, CLP occupied a fairly narrow ecological niche in 8-12ft of water over thick organic rich muck.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Heteranthera dubia*) Water stargrass

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton epihydrus*) **Ribbon-leaf pondweed**
Specimen Location: Clear Lake; N46.09091°, W91.23838°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-317
Habitat/Distribution: Found in mucky bottom conditions in water from 0.5-3 meters deep. Uncommon to rare, but widely distributed.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Najas flexilis*) Slender naiad, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton foliosus*) **Leafy pondweed**
Specimen Location: Spider Lake; N46.10192°, W91.20853°
Also found in: Fawn Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-318
Habitat/Distribution: Rare in 1-3.5m over muck; a few individuals were found in Big Spider and Fawn.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton pusillus*) Small pondweed, (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: (*Potamogeton friesii*) **Fries' pondweed**
Specimen Location: Spider Lake; N46.10115°, W91.22618°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-319
Habitat/Distribution: Uncommon over muck in water 1-3 meters deep. All location represented by a few plants. This early maturing species may have been more common earlier in the growing season.
Common Associates: (*Najas flexilis*) Slender naiad, (*Vallisneria americana*) Wild celery, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern Pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton gramineus*) **Variable pondweed**
Specimen Location: Clear Lake; N46.09644°, W91.23546°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-320
Habitat/Distribution: Compact morph most common in sandy/muck/marl bottom conditions in shallow water 0.5-1 meter deep, with the larger morph found to 4 meters. Deeper water specimens merged morphologically with *P. illinoensis*, and it seems likely there may be some gene flow between the two species on the lake. Abundant in Clear and Spider; rare in North and Fawn.
Common Associates: (*Najas flexilis*) Slender naiad, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Najas guadalupensis*) Southern naiad, (*Sagittaria cristata*) Crested arrowhead

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: (*Potamogeton illinoensis*) **Illinois pondweed**
Specimen Location: Clear Lake; N46.09301°, W91.22179°
Also found in: Spider and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-321
Habitat/Distribution: Muck, sand and rock bottom in 0.5-4m of water. Most common in more nutrient rich organic muck area in Big Spider and Fern. Also found on rock bars in the upper 1/3rd of Little Spider. Submerged leaves had 15-17 veins on most leaves, and plants had large keeled stipules. Morphology was continuous with deep water *P. gramineus*, and it seems there is likely some gene flow between the species.
Common Associates: (*Najas flexilis*) Slender naiad, (*Vallisneria americana*) Wild celery, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern Pondweed, (*Potamogeton strictifolius*) Stiff Pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton natans*) **Floating-leaf pondweed**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider and North Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-322
Habitat/Distribution: Muck and sand bottoms in <1.5meters of water. Scattered beds occurred in all three lakes; especially common near floating muck bogs in North Lake.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Utricularia vulgaris*) Common bladderwort, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Pontederia cordata*) Pickerelweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton praelongus*) **White-stem pondweed**
Specimen Location: Clear Lake; N46.09608°, W91.22937°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-323
Habitat/Distribution: Muck and marl bottom in <4.5meters of water. Common and widespread in all four lakes.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Najas flexilis*) Slender naiad, (*Najas guadalupensis*) Southern naiad, (*Potamogeton praelongus*) White-stem pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton pusillus*) **Small pondweed**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-324
Habitat/Distribution: Nutrient rich organic muck bottoms in 1-6 meters of water. A single cluster was seen in Clear Lake and it was rare in Little Spider, but plants were common and widely distributed in Big Spider, Fawn and North Lakes.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Elodea canadensis*) Common waterweed, (*Najas flexilis*) Slender naiad, (*Myriophyllum sibiricum*) Northern water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton richardsonii*) **Clasping-leaf pondweed**
Specimen Location: Clear Lake; N46.09775°, W91.23184°
Also found in: Spider and North Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-325
Habitat/Distribution: Found in sand and muck bottom conditions in water 1-3.5 meters deep. Common and widespread in North and Big Spider; Uncommon and local in Fawn, Little Spider and Clear Lakes.
Common Associates: (*Potamogeton amplifolius*) Large-leaf pondweed, (*Najas flexilis*) Slender naiad, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Elodea canadensis*) Common waterweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton robbinsii*) **Fern pondweed**
Specimen Location: Clear Lake; N46.09898°, W91.23552°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-326
Habitat/Distribution: Often dominant in its preferred habitat of organic muck in 2-4 meters of water – found from 1-6m. Plants were abundant in the "deep hole" in Clear and throughout Little Spider, and common in the boggy north/northeast bays of Big Spider and throughout Fawn and North Lakes.
Common Associates: (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton crispus*) Curly-leaf pondweed, (*Ceratophyllum demersum*) Coontail, (*Elodea canadensis*) Common waterweed, (*Myriophyllum sibiricum*) Northern water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: *(Potamogeton strictifolius)* **Stiff pondweed**
Specimen Location: Spider Lake; N46.10556°, W91.19600°
Also found in: Fawn Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-327
Habitat/Distribution: Uncommon over thin muck and rock in 1-3.5m of water. Most plants were most common in the northeast bay of Big Spider, but were also regularly encountered in the shallow flats and rock bars in the north and northeast bays of Little Spider. A single cluster was found in Fawn Lake.
Common Associates: (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Najas flexilis*) Slender naiad, (*Elodea canadensis*) Common waterweed, (*Potamogeton gramineus*) Variable pondweed, (*Vallisneria americana*) Wild celery, (*Myriophyllum sibiricum*) Northern water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Potamogeton zosteriformis*) **Flat-stem pondweed**
Specimen Location: Clear Lake; N46.09817°, W91.23185°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-328
Habitat/Distribution: Thick nutrient rich organic muck bottom areas in water from 1-5.5m deep. Widely distributed and common in North, Fawn, and Big Spider; uncommon to rare in Little Spider and Clear Lakes.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Elodea canadensis*) Common waterweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Najas flexilis*) Slender naiad, (*Myriophyllum sibiricum*) Northern water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: *(Ranunculus aquatilis)* **White water crowfoot**
Specimen Location: Spider Lake; N46.10243°, W91.21611°
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-329
Habitat/Distribution: Rare; plants were scattered along rock/gravel bars and exposed points in water <1.5. Located at only four points in Big Spider.
Common Associates: (*Schoenoplectus acutus*) Hardstem bulrush, (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Chara* sp.) Muskgrass

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: *(Ranunculus flammula)* **Creeping spearwort**
Specimen Location: Clear Lake; N46.10024°, W91.23676°
Also found in: Spider Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-330
Habitat/Distribution: Sand and sandy muck along undeveloped shorelines in water <1m deep. Scattered locations in both lakes; especially common along islands.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Myriophyllum tenellum*) Dwarf water-milfoil, (*Elatine minima*) Waterwort, (*Utricularia resupinata*) Small purple bladderwort, (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Chara* sp.) Muskgrass, (*Littorella uniflora*) Littorella, (*Juncus pelocarpus*) Brown-fruited rush

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Sagittaria cristata*) **Crested arrowhead**
Specimen Location: Clear Lake; N46.09607°, W91.23120°
Also found in: Spider Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-331
Habitat/Distribution: Marl and muck in water <2m deep. Plants were common in Clear Lake and the marl bottomed southern bays of Little Spider. In many areas of these broad sterile flats, *S. cristata* was the only plant present.
Common Associates: (*Potamogeton gramineus*) Variable pondweed, (*Najas guadalupensis*) Southern naiad, (*Najas flexilis*) Slender naiad, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Sagittaria latifolia*) **Common arrowhead**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Fawn Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-332
Habitat/Distribution: Relatively common in undeveloped shoreline areas with firm muck bottom in 0-0.25m of water.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Phalaris arundinacea*) Reed canary grass, (*Dulichium arundinaceum*) Three-way sedge, (*Lythrum salicaria*) Purple loosestrife, (*Carex comosa*) Bottle brush sedge

County/State: Sawyer County, Wisconsin **Date:** 8/9/12
Species: (*Schoenoplectus acutus*) **Hardstem bulrush**
Specimen Location: Spider Lake; N46.10554°, W91.19852°
Also found in: North Lake
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-333
Habitat/Distribution: Rocky and sandy bottoms in 0-1.5 meters of water. Common in scattered reed beds on rock bars/shallow sunken islands and along shore; especially on exposed points of Big Spider.
Common Associates: (*Eleocharis palustris*) Creeping spikerush, (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Pontederia cordata*) Pickerelweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: *(Schoenoplectus subterminalis)* **Water bulrush**
Specimen Location: Clear Lake; N46.10153°, W91.23436°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg** **Col. #:** MSB-2012-334
Habitat/Distribution: Muck bottoms in <1.5m of water. Uncommon in boggy bays and near/on floating muck mats on Spider, North and Clear; however, plants were abundant in the outlet channel to Spider from Fawn.
Common Associates: (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Brasenia schreberi*) Watershield, (*Utricularia gibba*) Creeping bladderwort, (*Pontederia cordata*) Pickerelweed, (*Potamogeton gramineus*) Variable pondweed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Schoenoplectus tabernaemontani*) **Softstem bulrush**
Specimen Location: Clear Lake; N46.09350°, W91.23418°
Also found in: North Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-335
Habitat/Distribution: Firm muck bottoms in 0.5-1.0 meter of water. Scattered individuals were located on the northeast end of the eastern side of Butternut island.
Common Associates: (*Calamagrostis canadensis*) Blue joint**,** (*Eleocharis palustris*) Creeping spikerush, (*Dulichium arundinaceum*) Three-way sedge

County/State: Sawyer County, Wisconsin **Date:** 8/11/12
Species: (*Scirpus cyperinus*) **Woolgrass**
Specimen Location: Fawn Lake; N46.11358°, W91.22146°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-336
Habitat/Distribution: Firm muck bottoms in 0-0.25 meter of water. Scattered individuals were located on the western shore of Fawn.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Sparganium emersum*) Short-stemmed bur-reed**,** (*Sagittaria latifolia*) Common arrowhead, (*Dulichium arundinaceum*) Three-way sedge, (*Carex lasiocarpa*) Narrow-leaved woolly sedge

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: *(Sparganium angustifolium)* **Narrow-leaved bur-reed**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-337
Habitat/Distribution: Sand and sandy muck in water <1.5m. More common than the survey indicated in Clear Lake where small beds were encountered in many shoreline areas; especially on the western shoreline. In Big Spider, it was rare being only seen at three locations.
Common Associates: (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Najas flexilis*) Slender naiad, (*Utricularia gibba*) Creeping bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/10/12
Species: (*Sparganium emersum*) **Short-stemmed bur-reed**
Specimen Location: Spider Lake; N46.11191°, W91.20455°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-338
Habitat/Distribution: Firm muck in water <1m deep. Plants were common in the creek inlet on the far northeast end of the north bay on Big Spider, the channels entering/exiting Fawn, and mixed with rice in the eastern bay of North Lake.
Common Associates: (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Zizania palustris*) Northern wild rice, (*Utricularia vulgaris*) Common bladderwort, (*Myriophyllum verticillatum*) Whorled water-milfoil

County/State: Sawyer County, Wisconsin **Date:** 8/10/12
Species: (*Sparganium fluctuans*) **Floating-leaf bur-reed**
Specimen Location: Spider Lake; N46.10266°, W91.19425°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-339
Habitat/Distribution: Firm muck bottoms in water from 1-1.5m. Beds were scattered throughout Big Spider's northeast and northwest bays.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia gibba*) Creeping bladderwort, (*Chara* sp.) Muskgrass, (*Heteranthera dubia*) Water star-grass

County/State: Sawyer County, Wisconsin **Date:** 8/4/17
Species: (*Typha angustifolia*) **Narrow-leaved cattail**
Specimen Location: Clear Lake; N46.09305°, W91.23599°
Also found in: Spider Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2017-012
Habitat/Distribution: Sand and sandy muck soil in and out of the water <0.25 meter deep. Uncommon south of Butternut Island and in the north bay of Big Spider.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Leersia oryzoides*) Rice cut-grass, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Typha latifolia*) **Broad-leaved cattail**
Specimen Location: Clear Lake; N46.09805°, W91.24279°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-340
Habitat/Distribution: Thick muck soil in and out of water <0.25 meter deep. Uncommon in scattered undeveloped shoreline areas throughout.
Common Associates: (*Lythrum salicaria*) Purple loosestrife, (*Phalaris arundinacea*) Reed canary grass, (*Leersia oryzoides*) Rice cut-grass, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Sawyer County, Wisconsin **Date:** 8/8/12
Species: (*Utricularia gibba*) **Creeping bladderwort**
Specimen Location: Spider Lake; N46.11636°, W91.21477°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-341
Habitat/Distribution: Muck bottom in 0-3m of water. Plants were especially common in North Lake where they were often found interspersed/wrapped around the stems of other plants.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia minor*) Small bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort

County/State: Sawyer County, Wisconsin **Date:** 8/8/12
Species: (*Utricularia intermedia*) **Flat-leaf bladderwort**
Specimen Location: Spider Lake; N46.11636°, W91.21477°
Also found in: North and Fawn Lakes
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-342
Habitat/Distribution: Muck bottom in shallow water 0-1.5 meters deep. Relatively common in boggy bays throughout all three lakes.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia gibba*) Creeping bladderwort, (*Zizania palustris*) Northern wild rice, (*Sparganium emersum*) Short-stemmed bur-reed

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: *(Utricularia resupinata)* **Small purple bladderwort**
Specimen Location: Clear Lake; N46.10024°, W91.23676°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2012-343
Habitat/Distribution: Sand and sandy muck bottom in shallow water 0-1.5 meters deep. Relatively common throughout Clear where it often carpeted the bottom with other "isoetids". Surprisingly absent from other similar looking habitat in Little Spider.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Myriophyllum tenellum*) Dwarf water-milfoil, (*Elatine minima*) Waterwort, (*Ranunculus flammula*) Creeping spearwort, (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Chara* sp.) Muskgrass, (*Juncus pelocarpus*) Brown-fruited rush

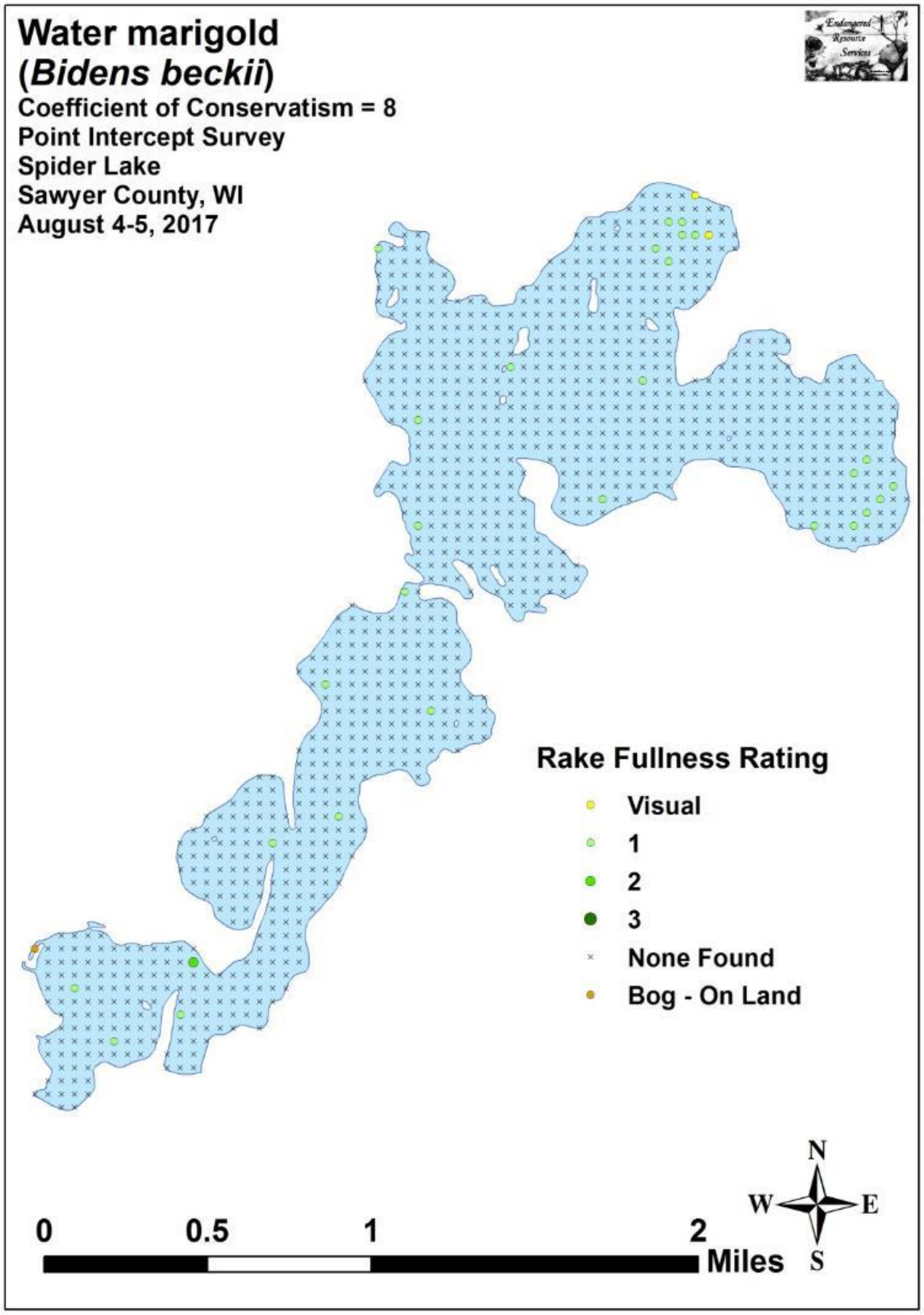
County/State: Sawyer County, Wisconsin **Date:** 8/8/12
Species: (*Utricularia minor*) **Small bladderwort**
Specimen Location: Spider Lake; N46.11636°, W91.21477°
Also found in: North and Fawn Lakes
Collected/Identified by: **Matthew S. Berg Col. #:** MSB-2012-344
Habitat/Distribution: Muck bottoms in shallow water 0.25-1.5 meters deep. Relatively common in boggy bays in all three lakes.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia gibba*) Creeping bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort

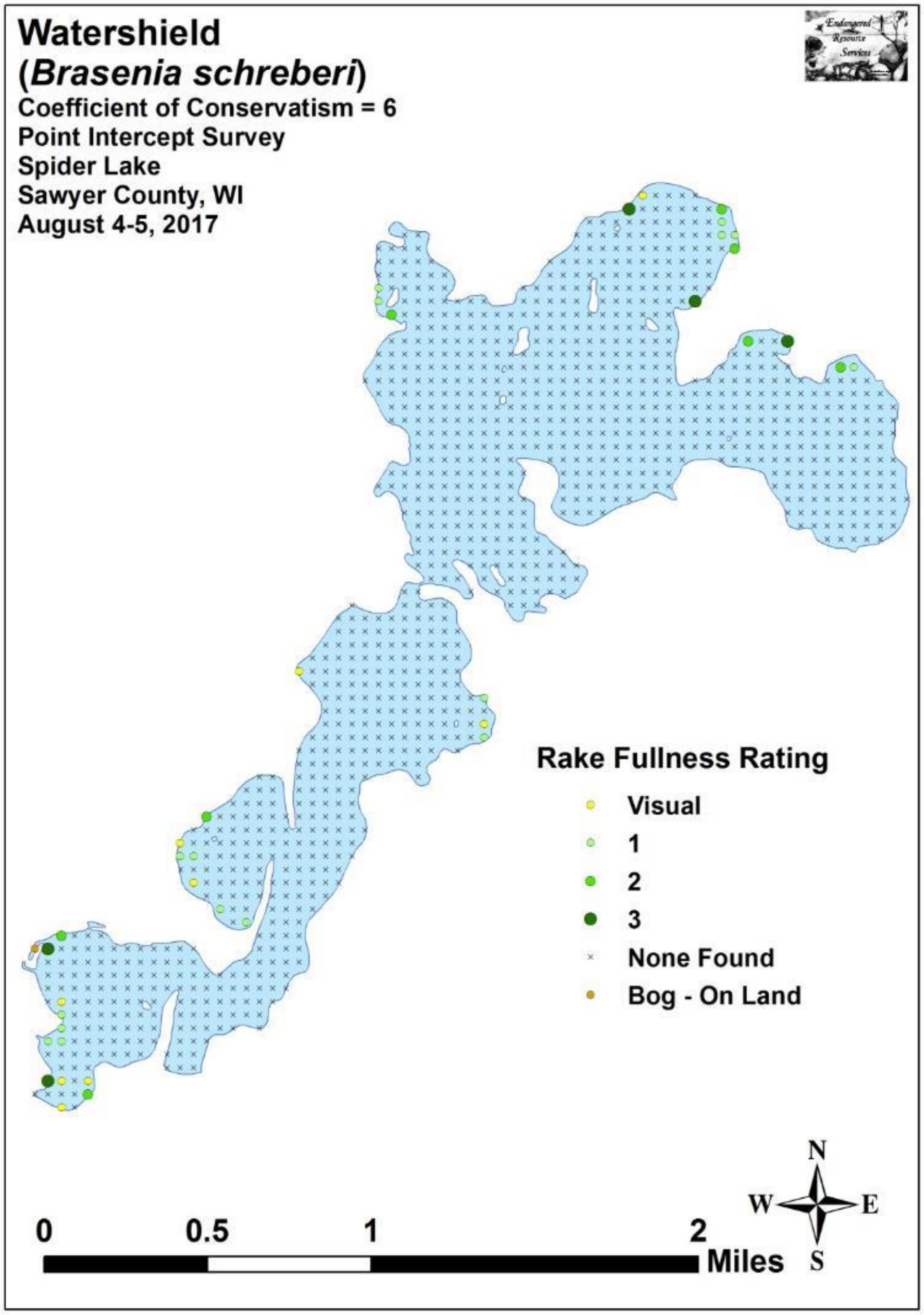
County/State**:** Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Utricularia vulgaris*) **Common bladderwort**
Specimen Location: Clear Lake; N46.09947°, W91.22945°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg Col. #:** MSB-2012-345
Habitat/Distribution: Muck bottoms in shallow water 0-2.5 meters deep. Relatively common in boggy bays in all four lakes.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia gibba*) Creeping bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort

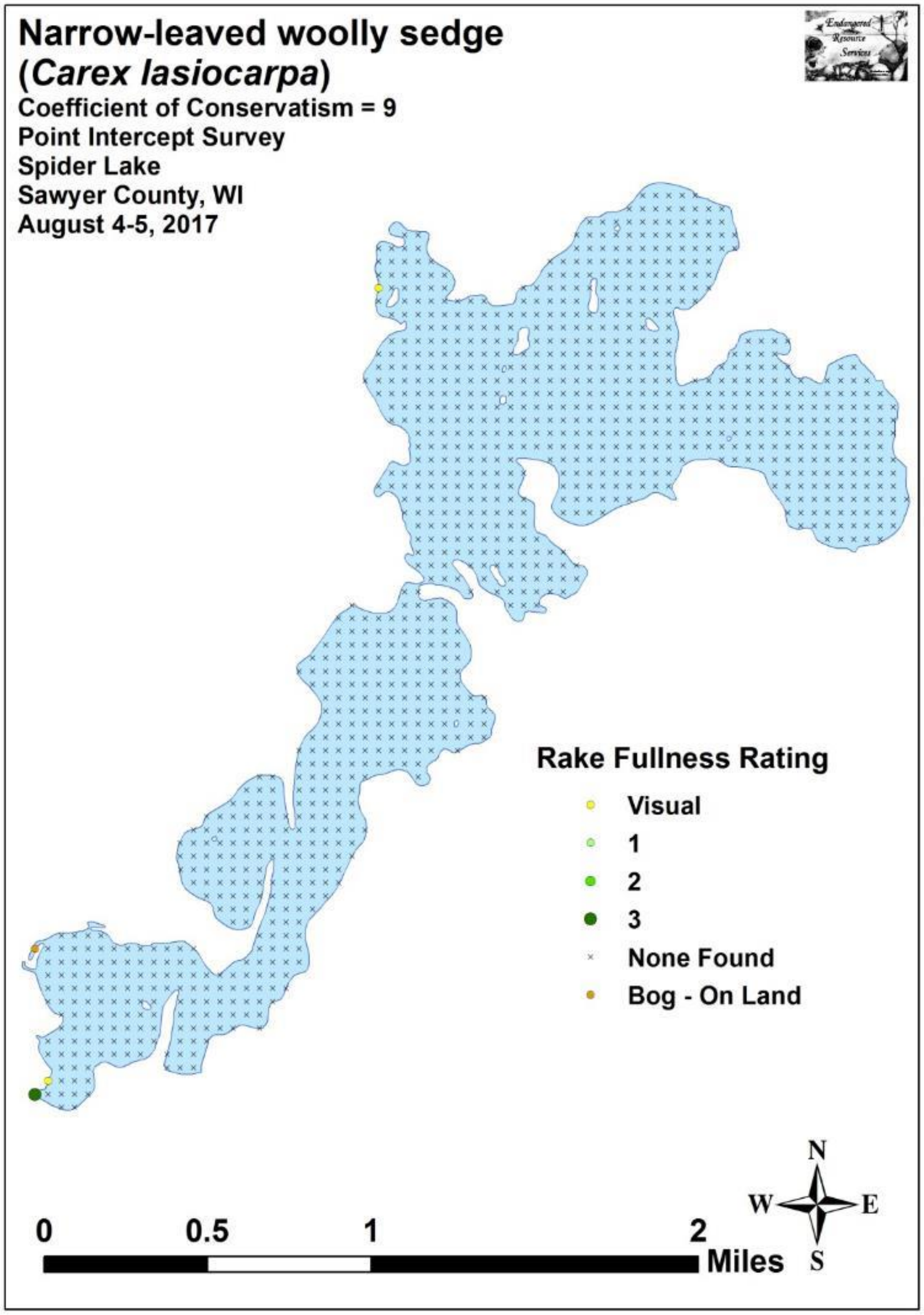
County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Vallisneria americana*) **Wild celery**
Specimen Location: Clear Lake; N46.09734°, W91.23062°
Also found in: Spider, North, and Fawn Lakes
Collected/Identified by: **Matthew S. Berg Col. #:** MSB-2012-346
Habitat/Distribution: Found in 0.5-4.5 meters of water in almost any bottom conditions. Most plants were in sandy to sand/muck bottoms. Relatively common and widely distributed throughout all four lakes.
Common Associates: (*Potamogeton pusillus*) Small pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Ceratophyllum demersum*) Coontail, (*Najas flexilis*) Slender naiad, (*Elodea canadensis*) Common waterweed, (*Heteranthera dubia*) Water star-grass

County/State: Sawyer County, Wisconsin **Date:** 8/7/12
Species: (*Zizania palustris*) **Northern wild rice**
Specimen Location: North Lake; N46.11636°, W91.21477°
Collected/Identified by: **Matthew S. Berg Col. #:** MSB-2012-347
Habitat/Distribution: Found in water <1m deep over thick organic muck. Uncommon; scattered individuals were interspersed between the lilypads in the eastern bay south of the peninsula on North Lake. Not seen anywhere else in the chain.
Common Associates: (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Utricularia vulgaris*) Common bladderwort, (*Sparganium emersum*) Short-stemmed bur-reed, (*Utricularia gibba*) Creeping bladderwort

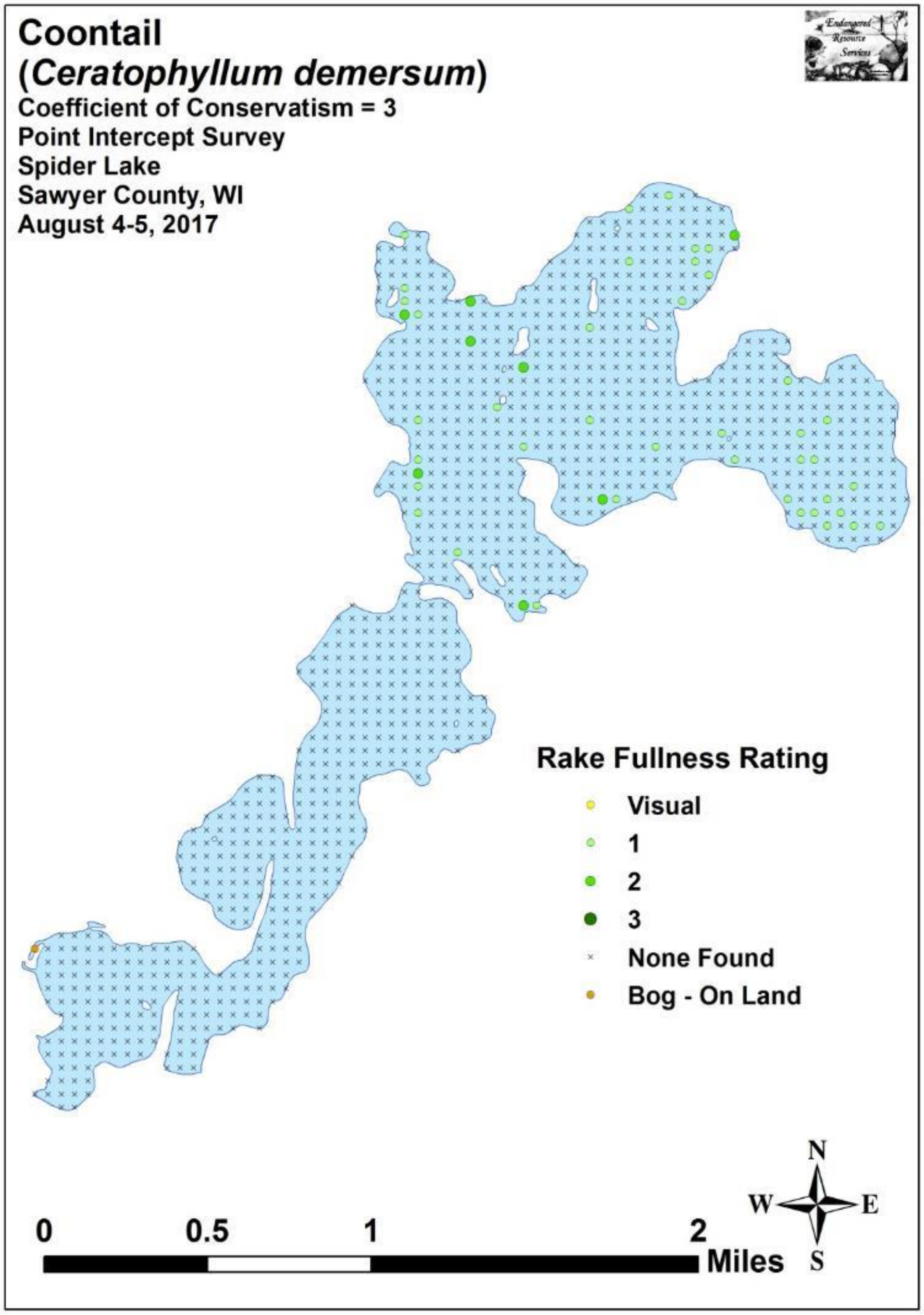
Appendix IX: August 2017 Species Density and Distribution Maps

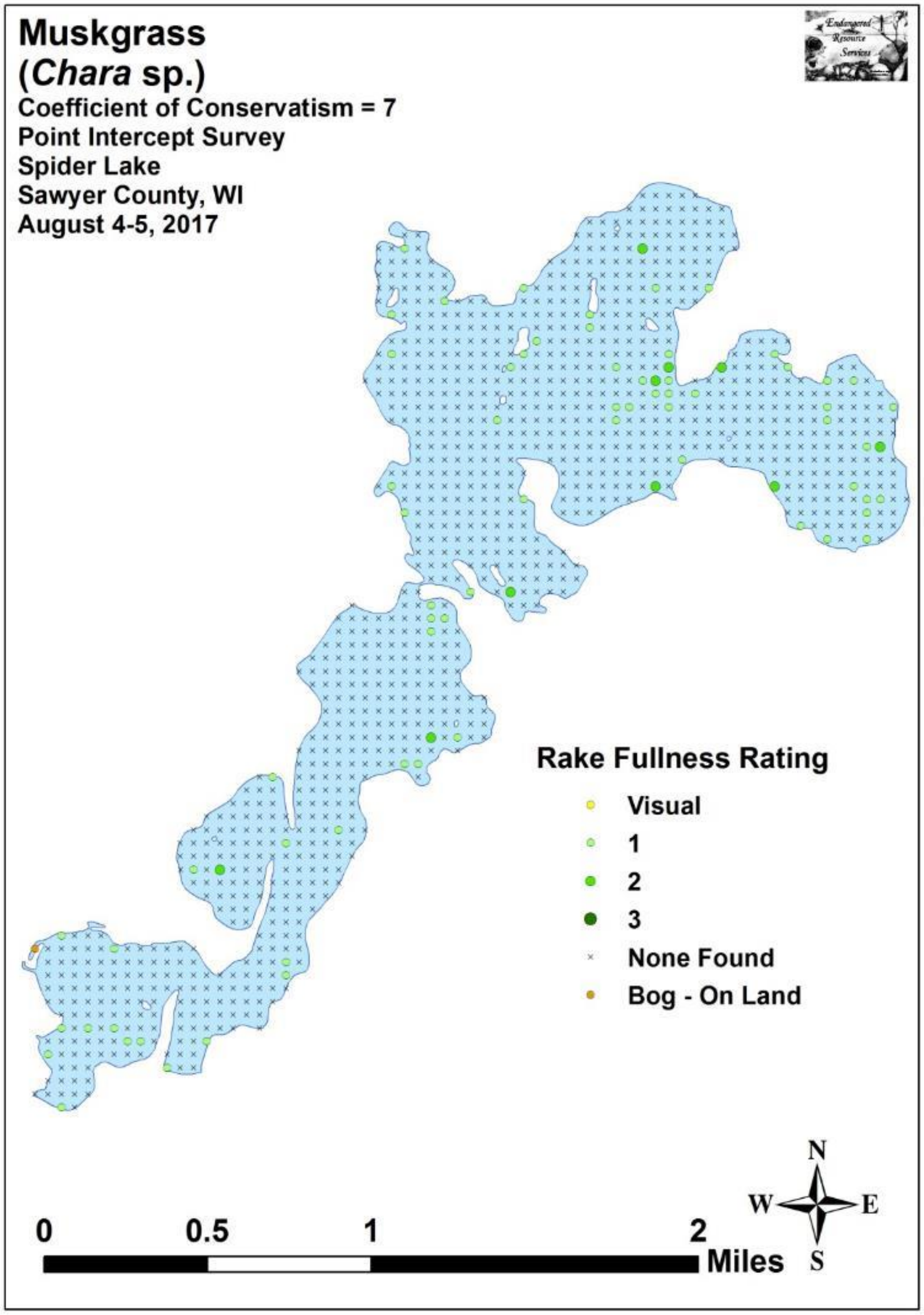

Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

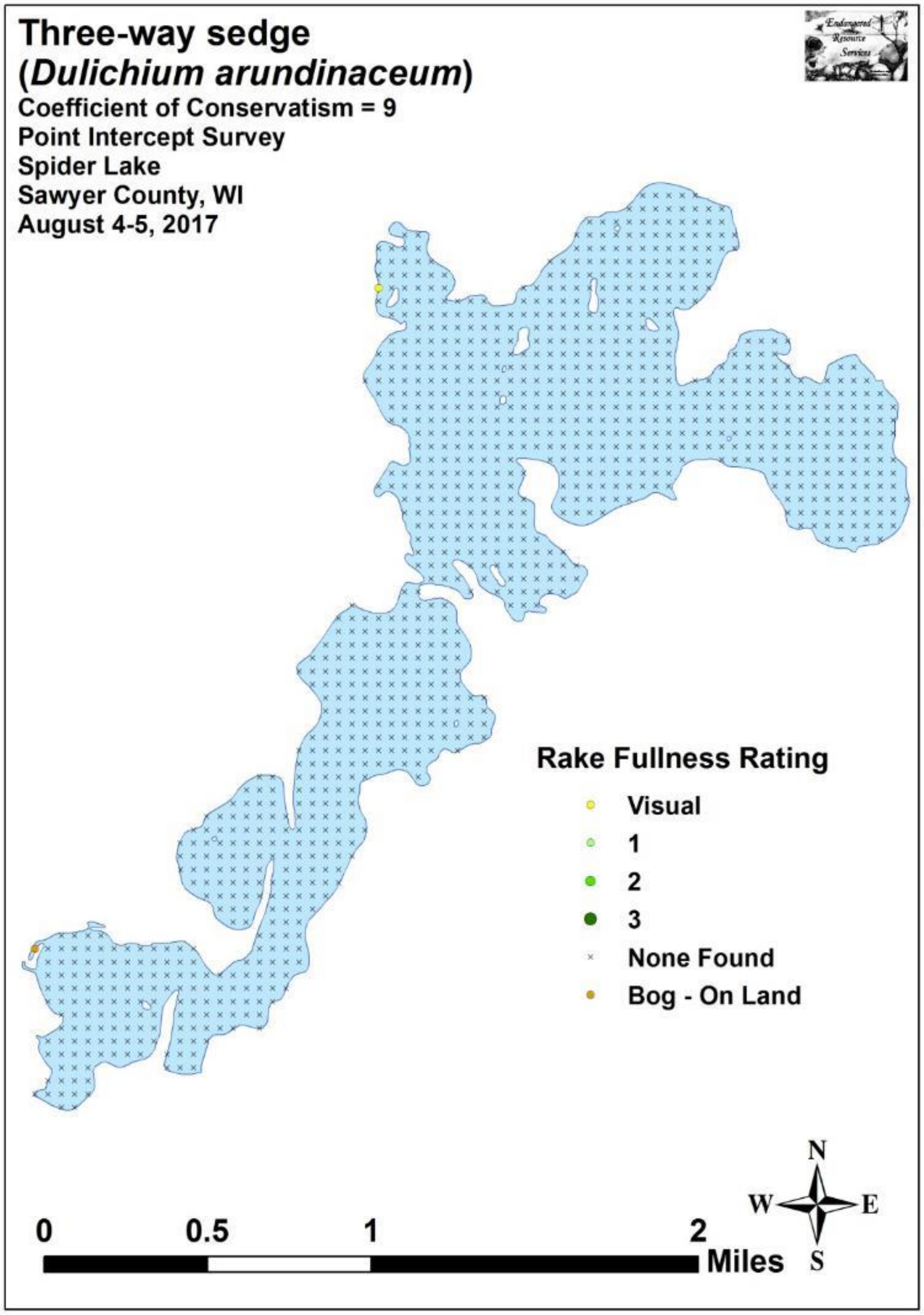

Watershield
(*Brasenia schreberi*)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

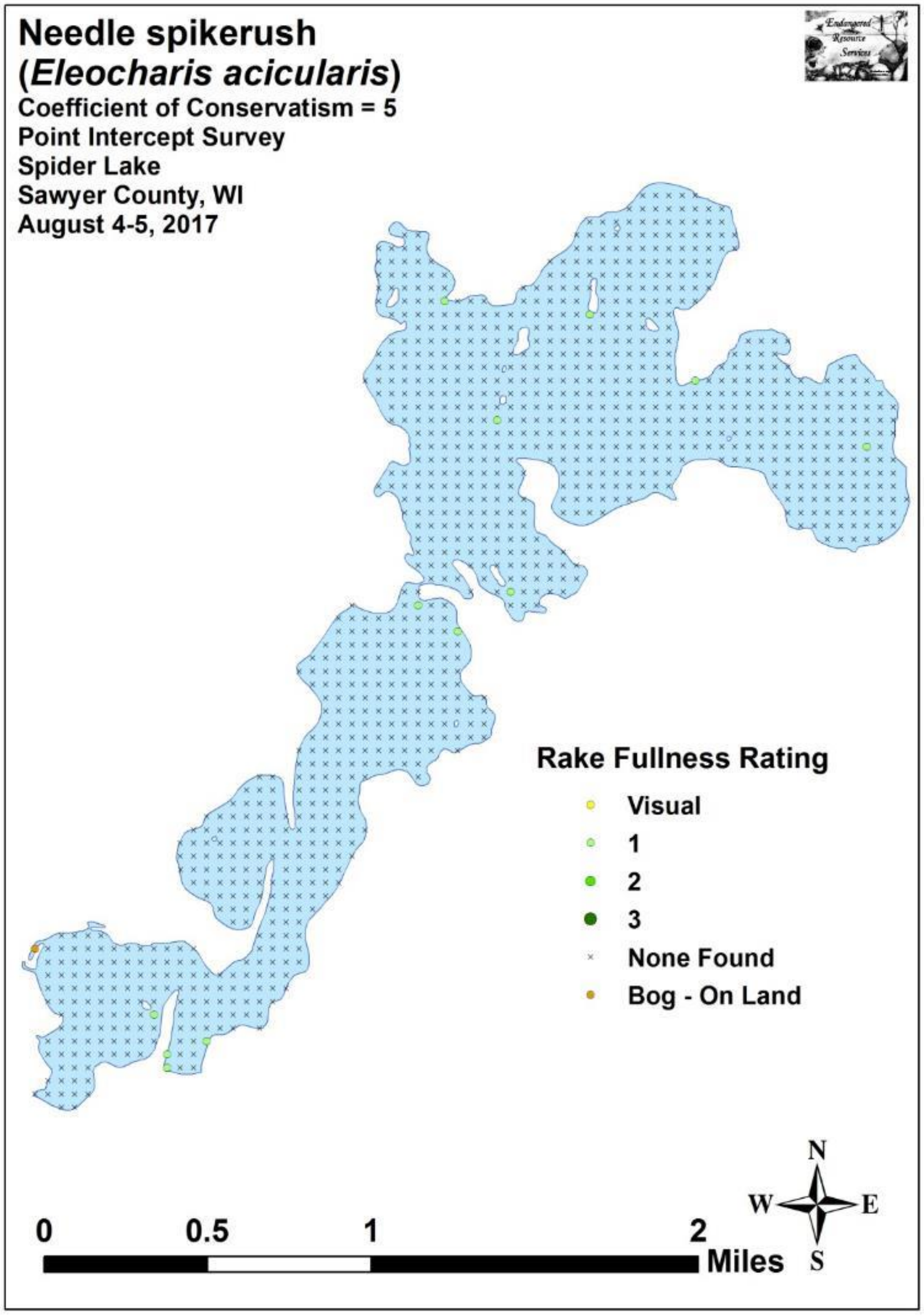


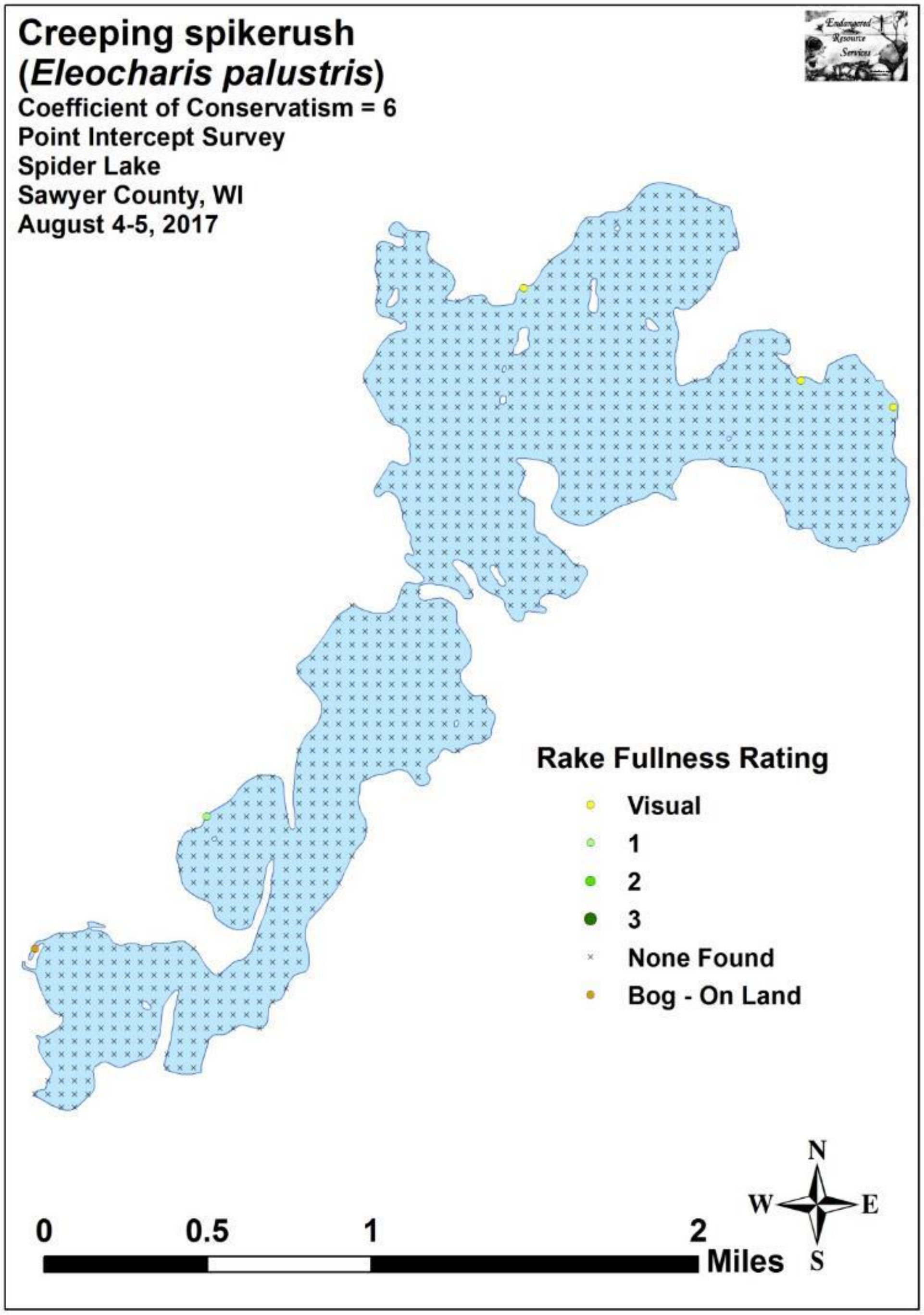
Narrow-leaved woolly sedge
(Carex lasiocarpa)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

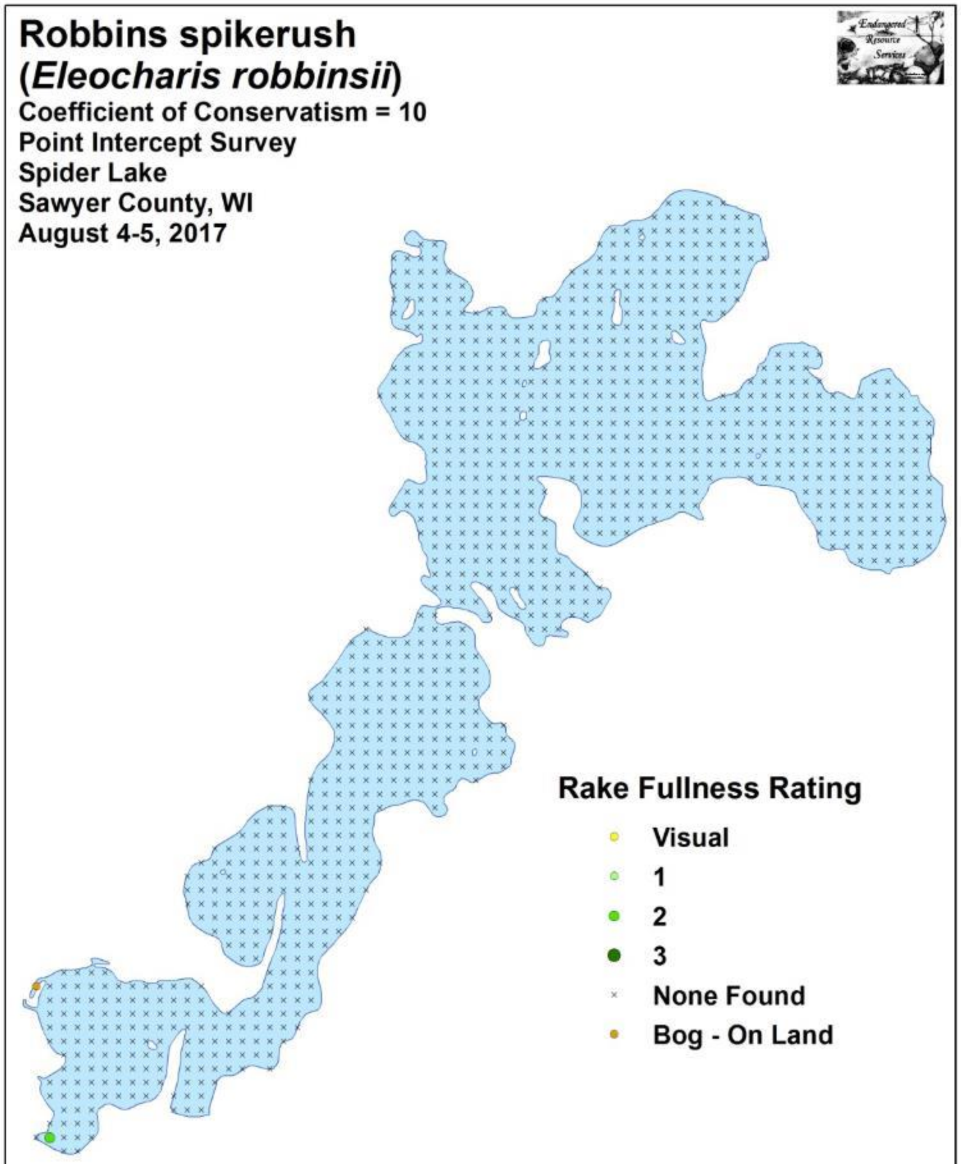

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

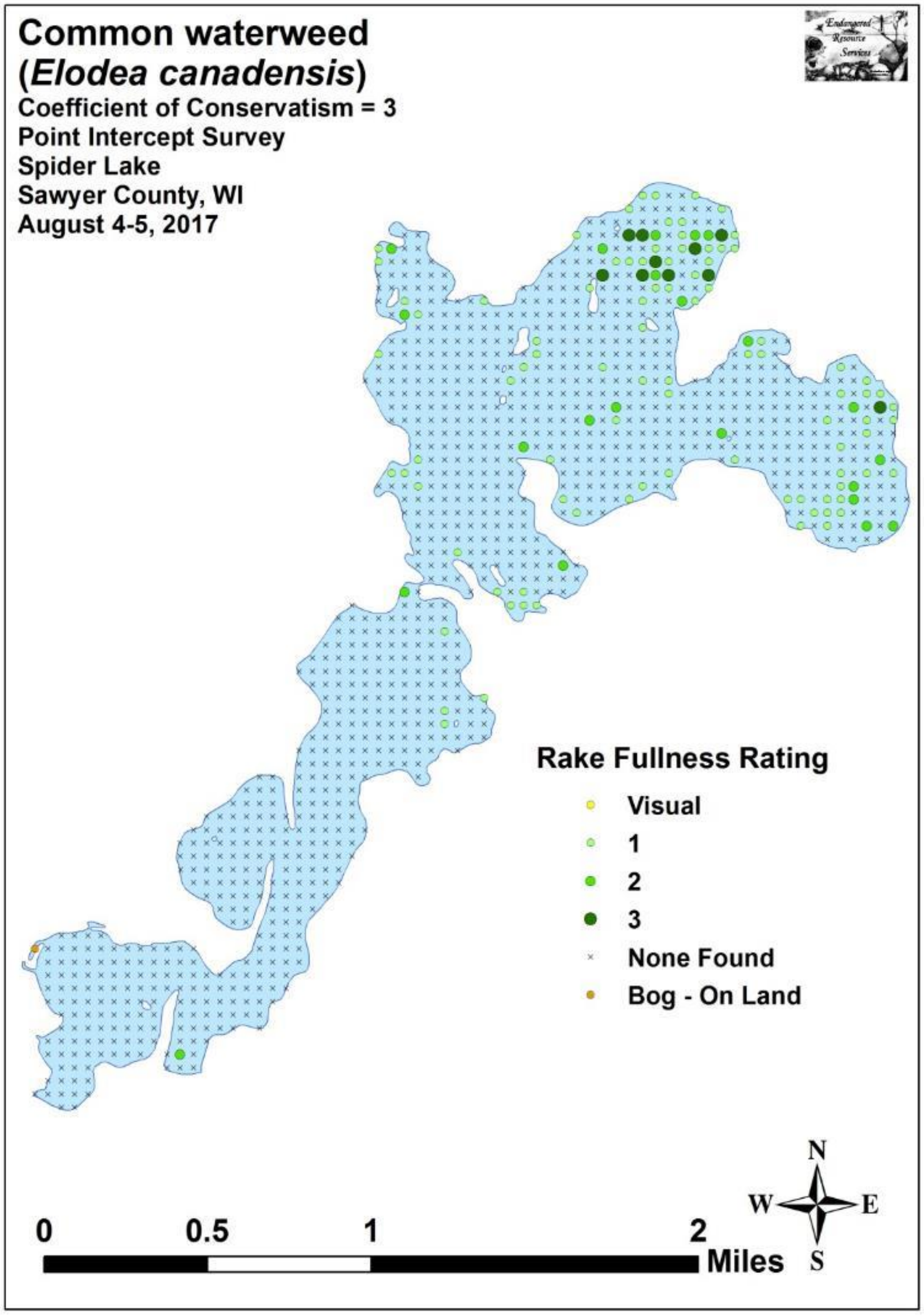

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

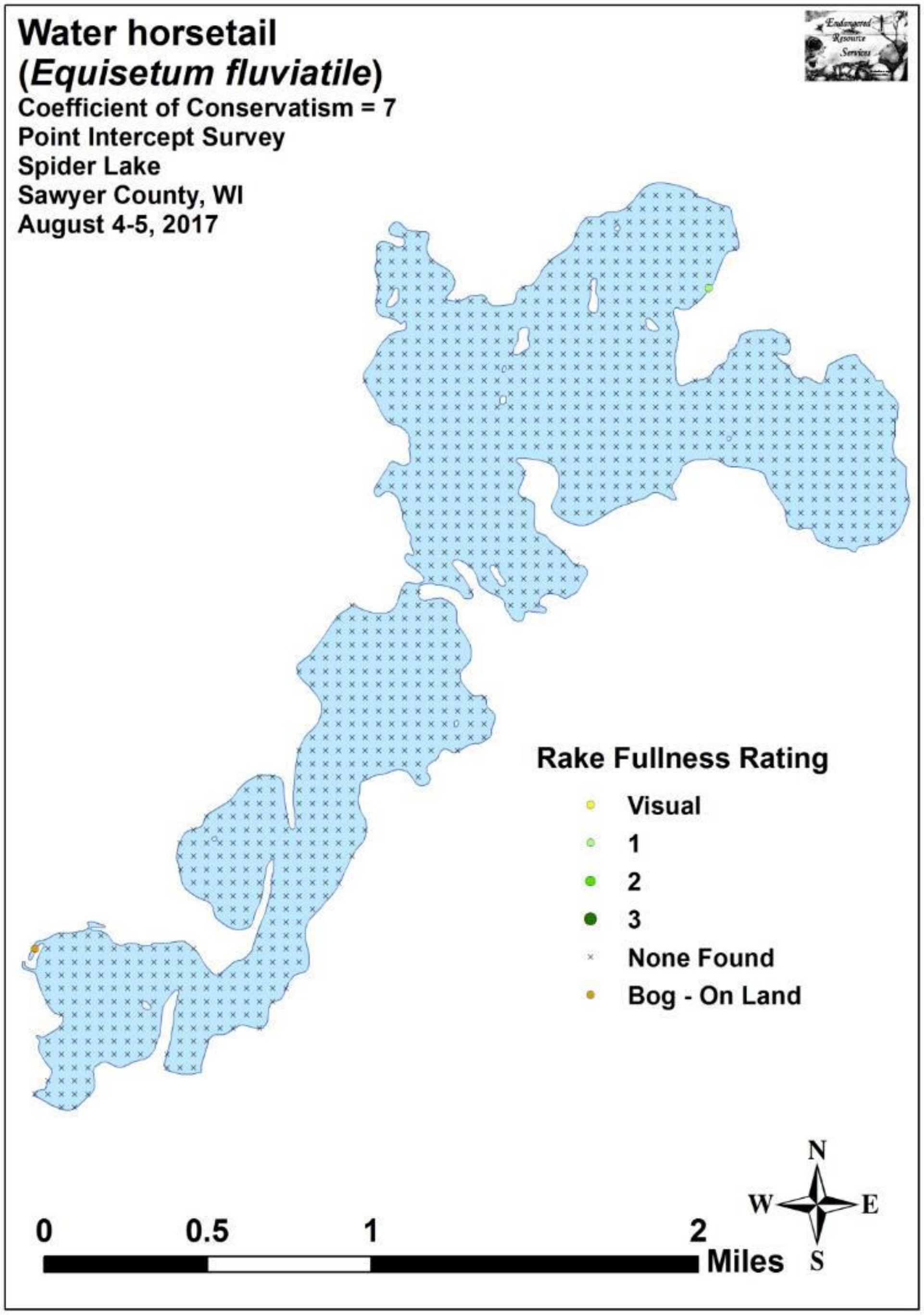

Three-way sedge
(Dulichium arundinaceum)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

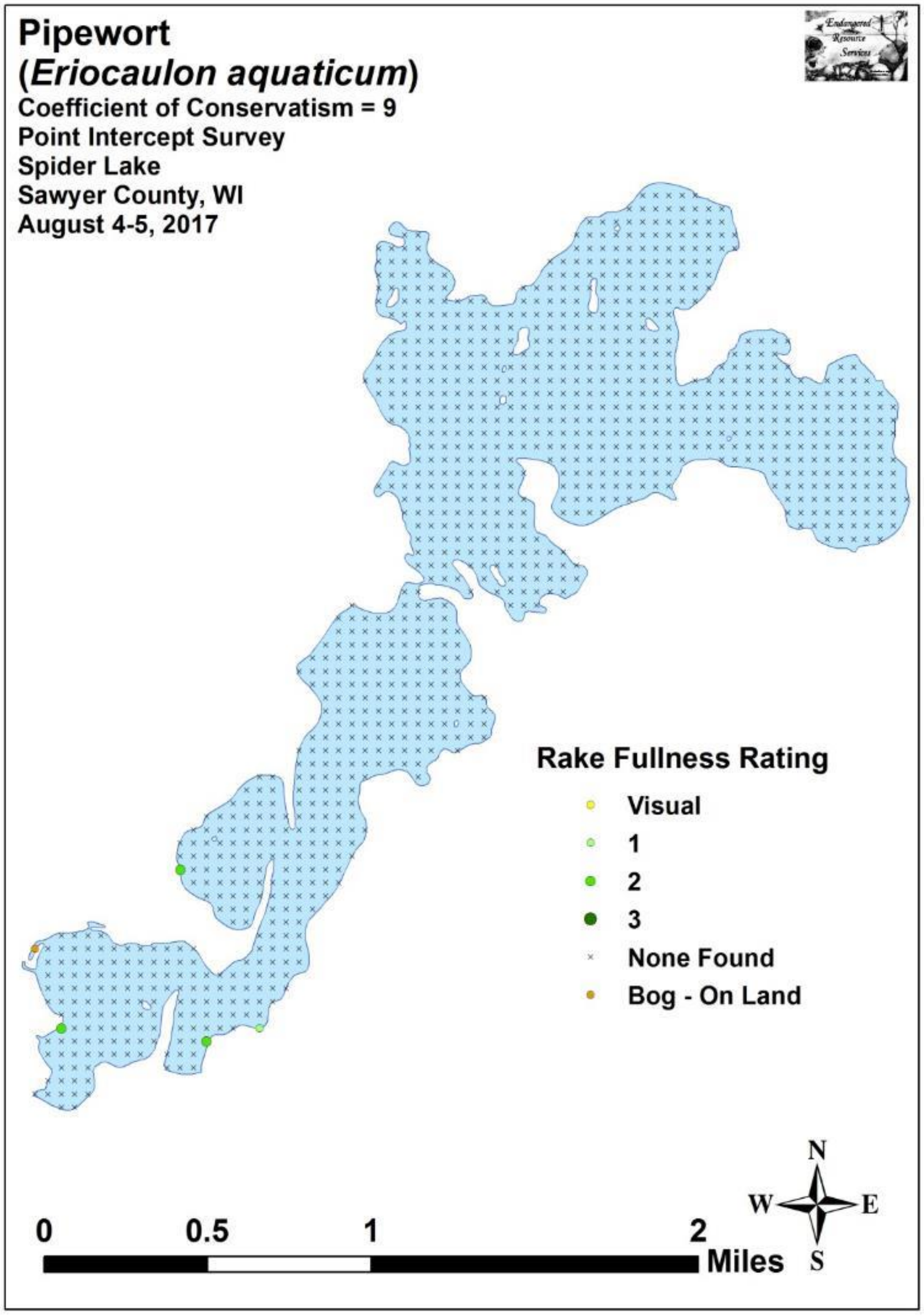

Needle spikerush
(*Eleocharis acicularis*)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

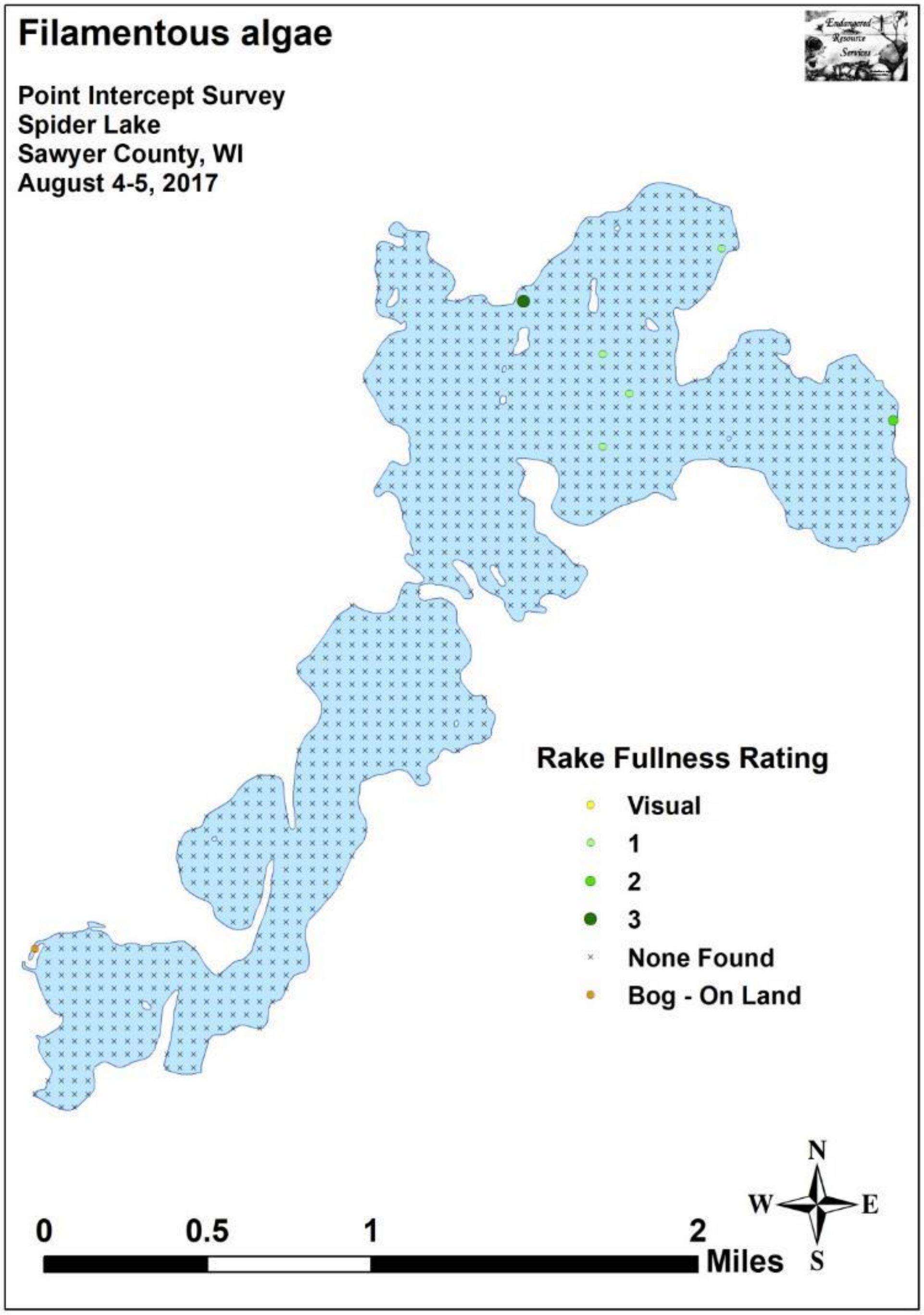

Creeping spikerush
(Eleocharis palustris)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

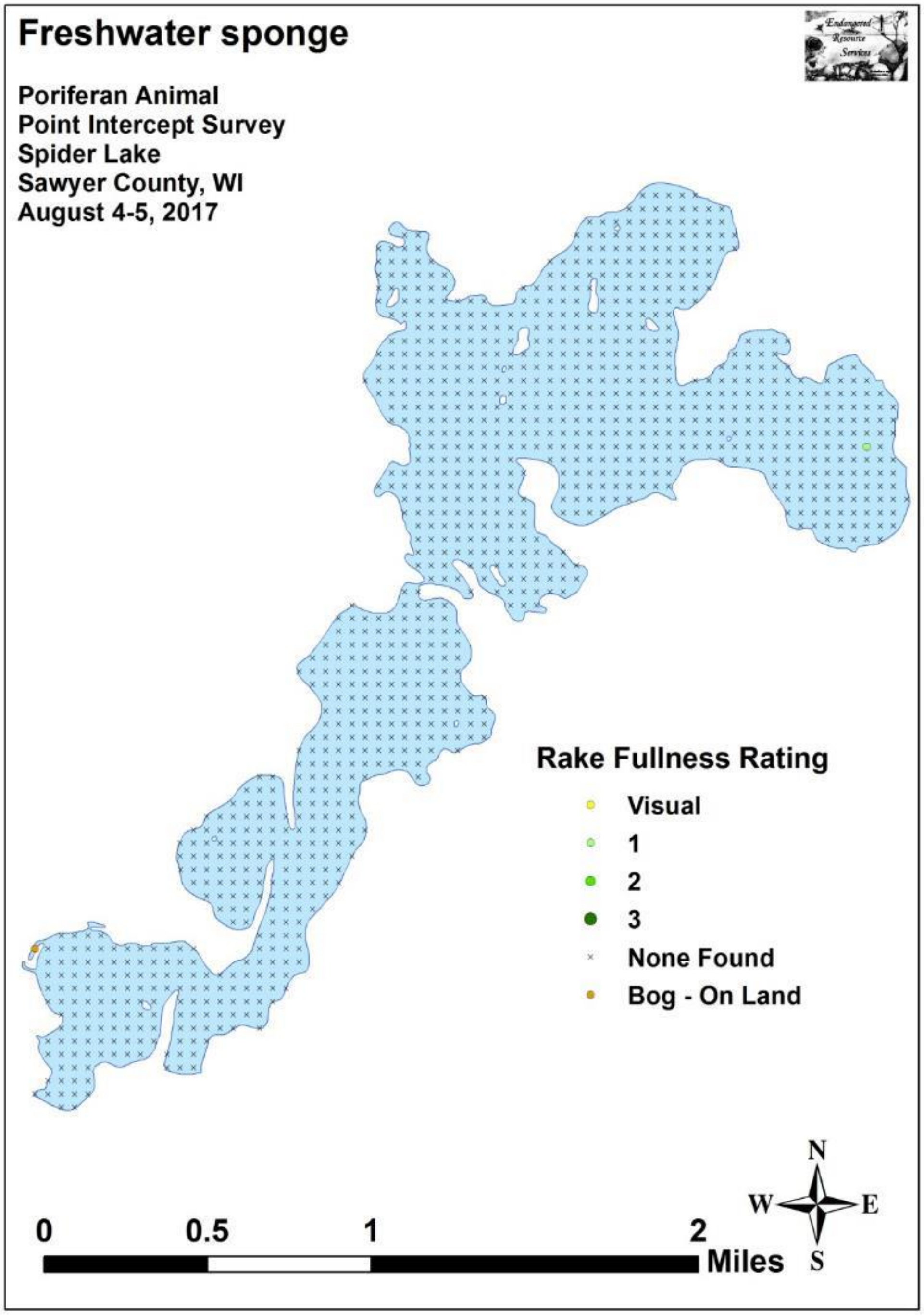

Robbins spikerush
(*Eleocharis robbinsii*)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

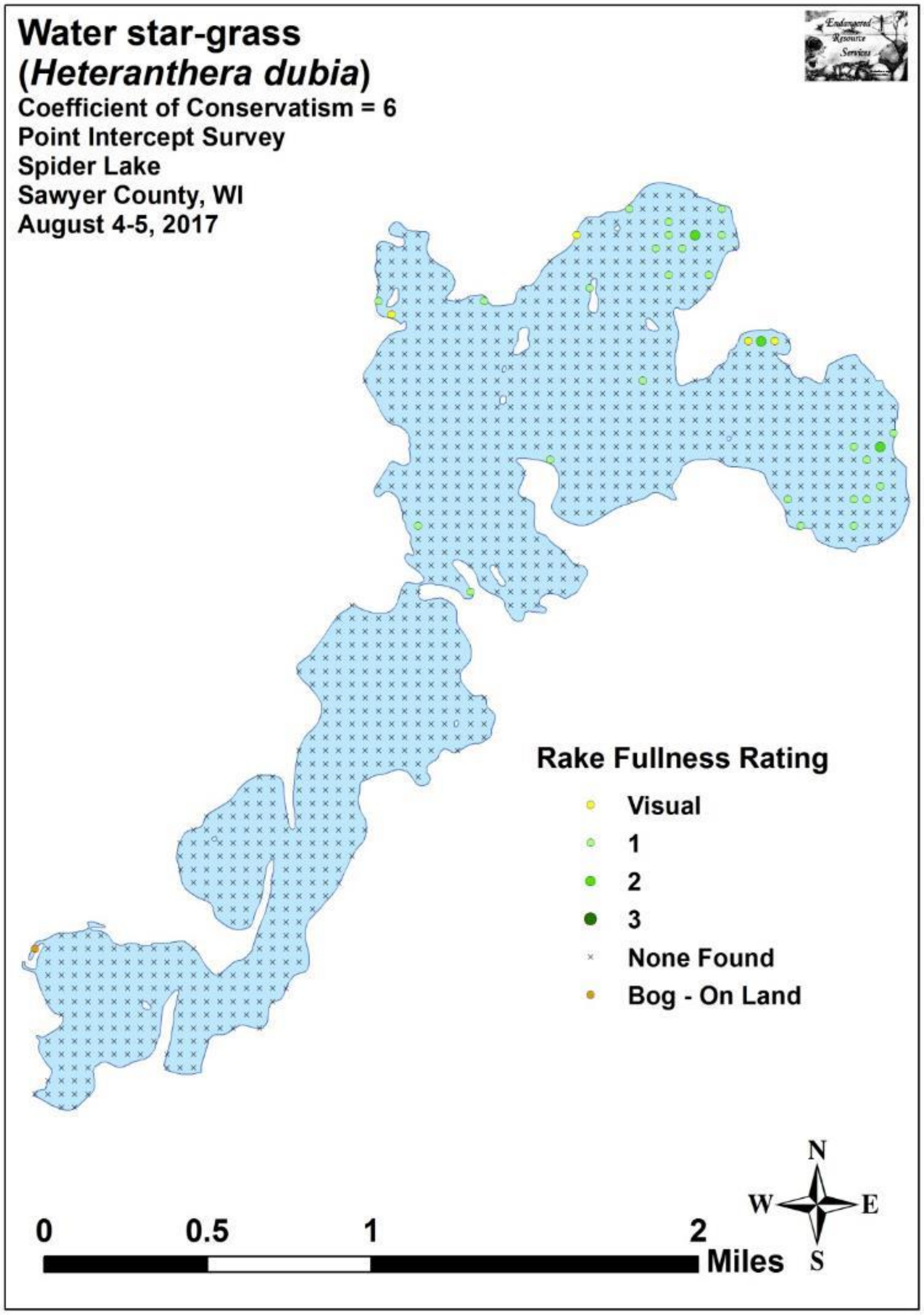

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

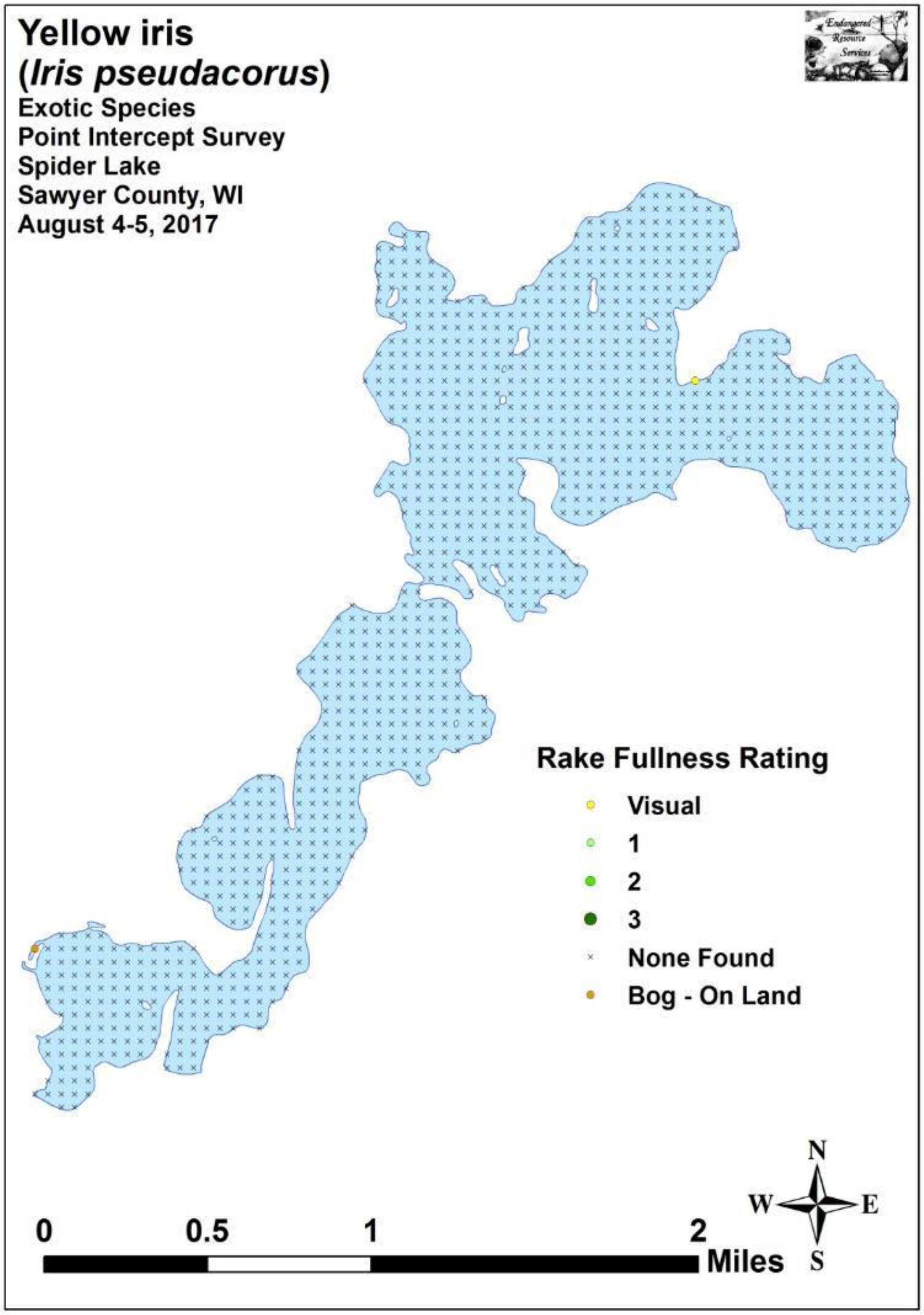

Water horsetail
(Equisetum fluviatile)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

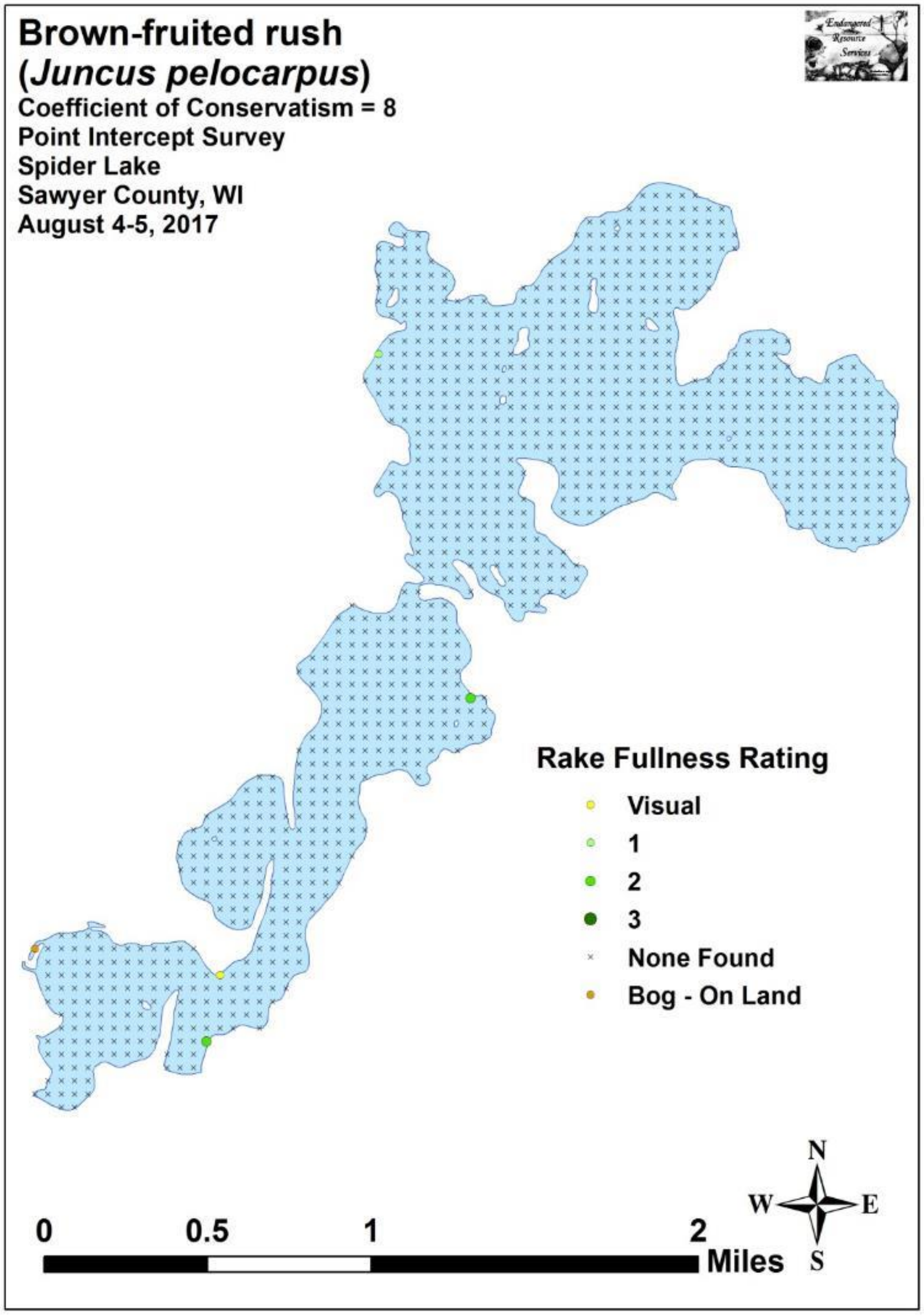

Pipewort
(Eriocaulon aquaticum)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Filamentous algae
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

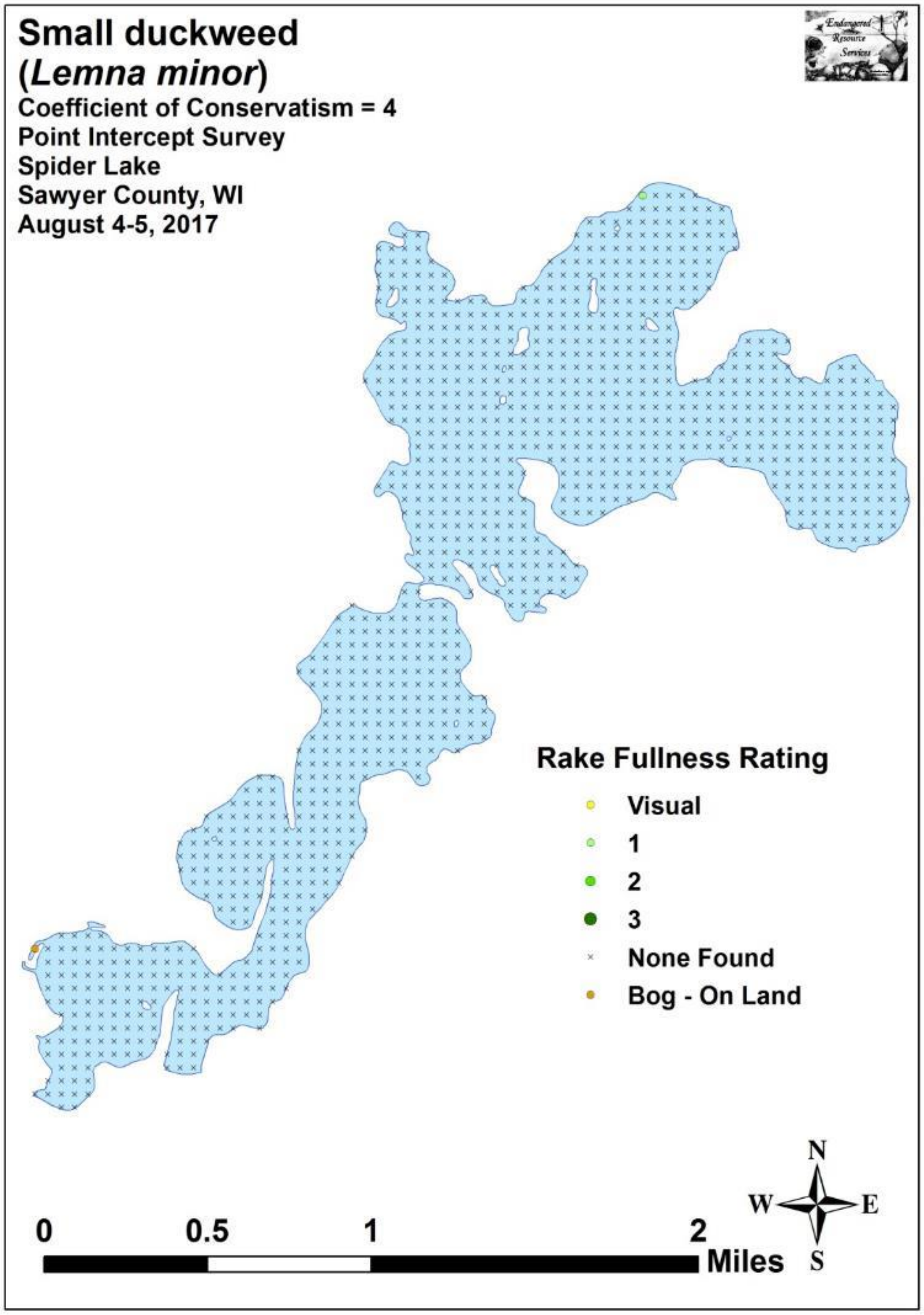

Freshwater sponge
Poriferan Animal
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

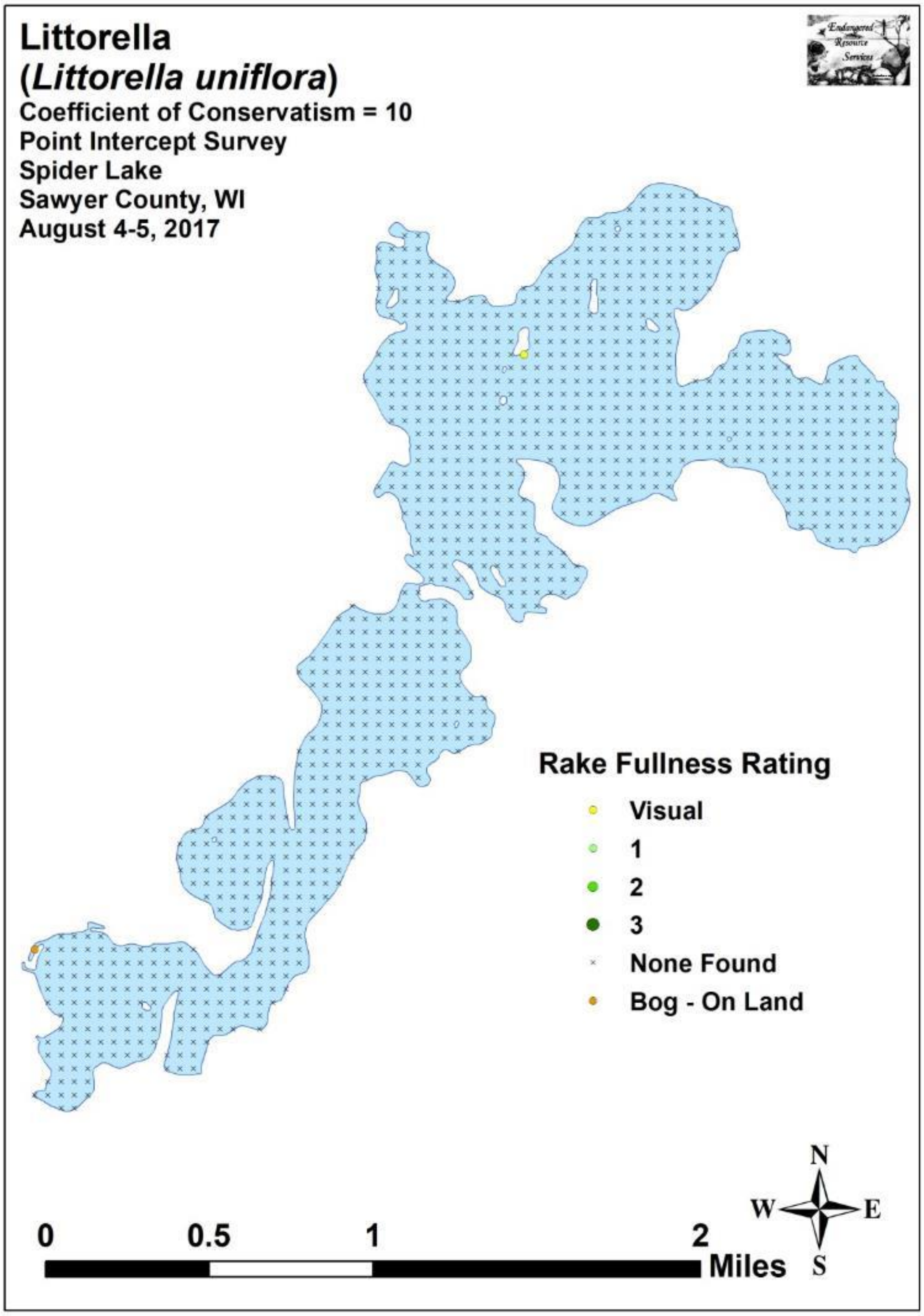

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

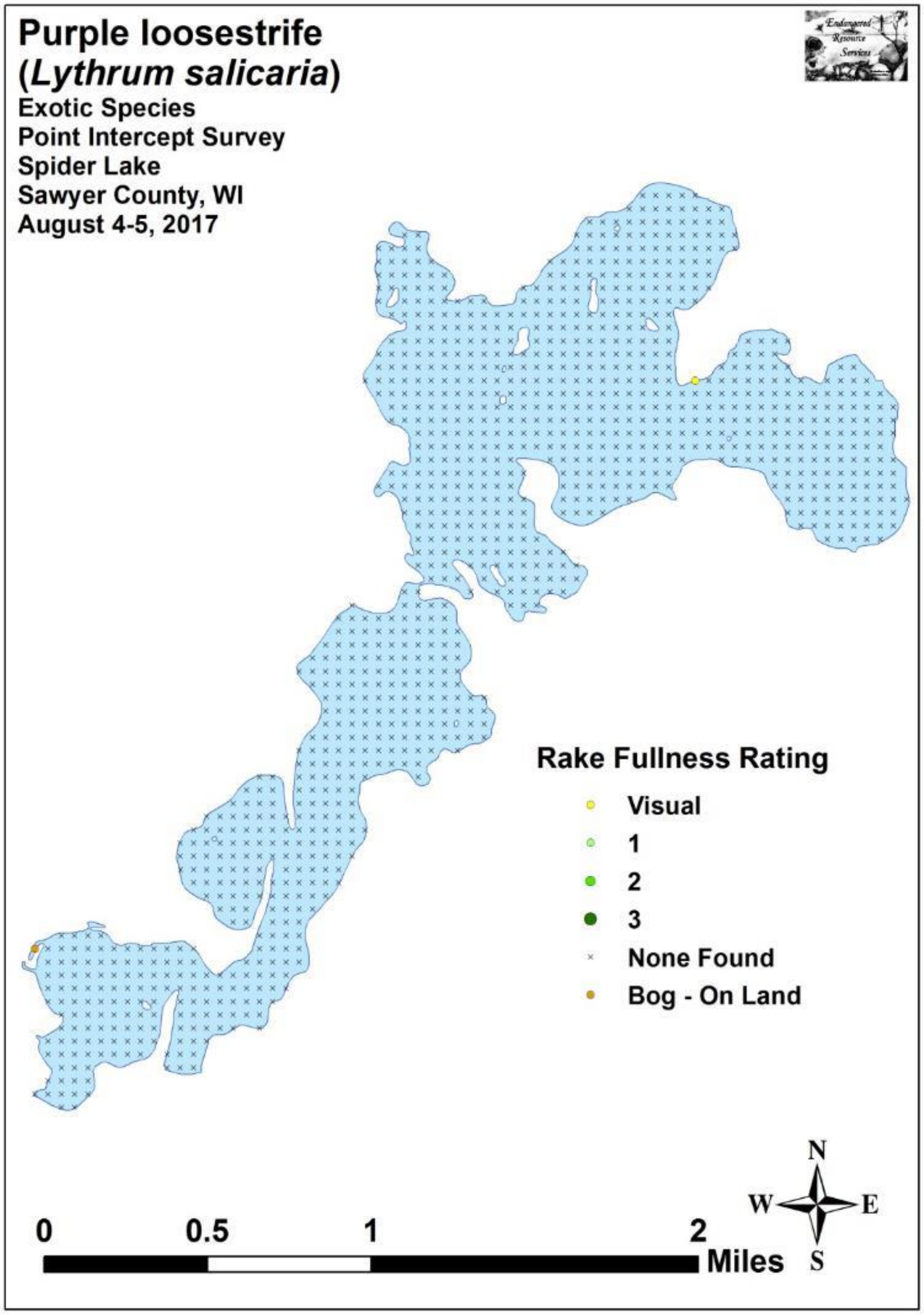

Yellow iris
(*Iris pseudacorus*)
Exotic Species
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles



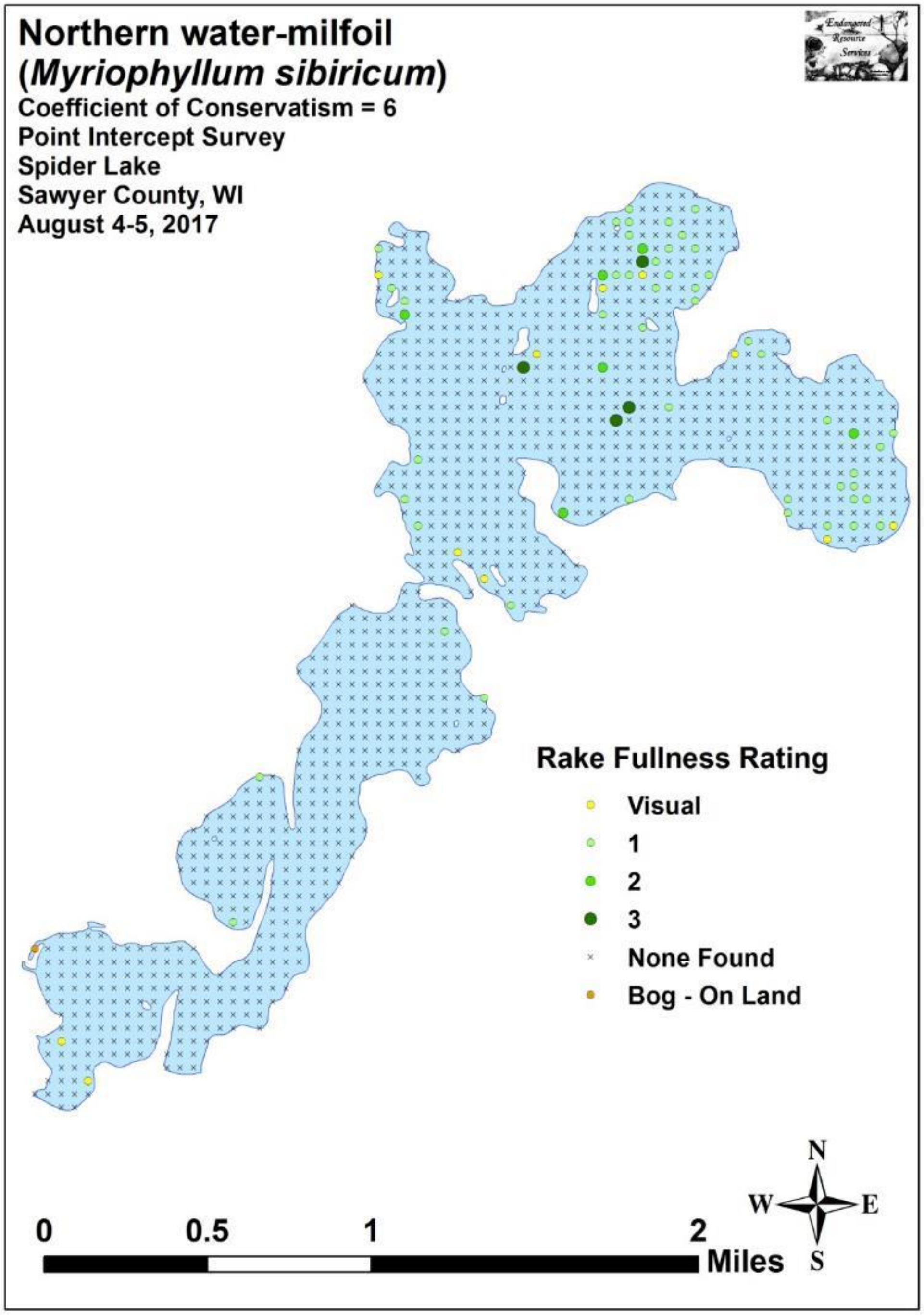
Brown-fruited rush
(Juncus pelocarpus)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

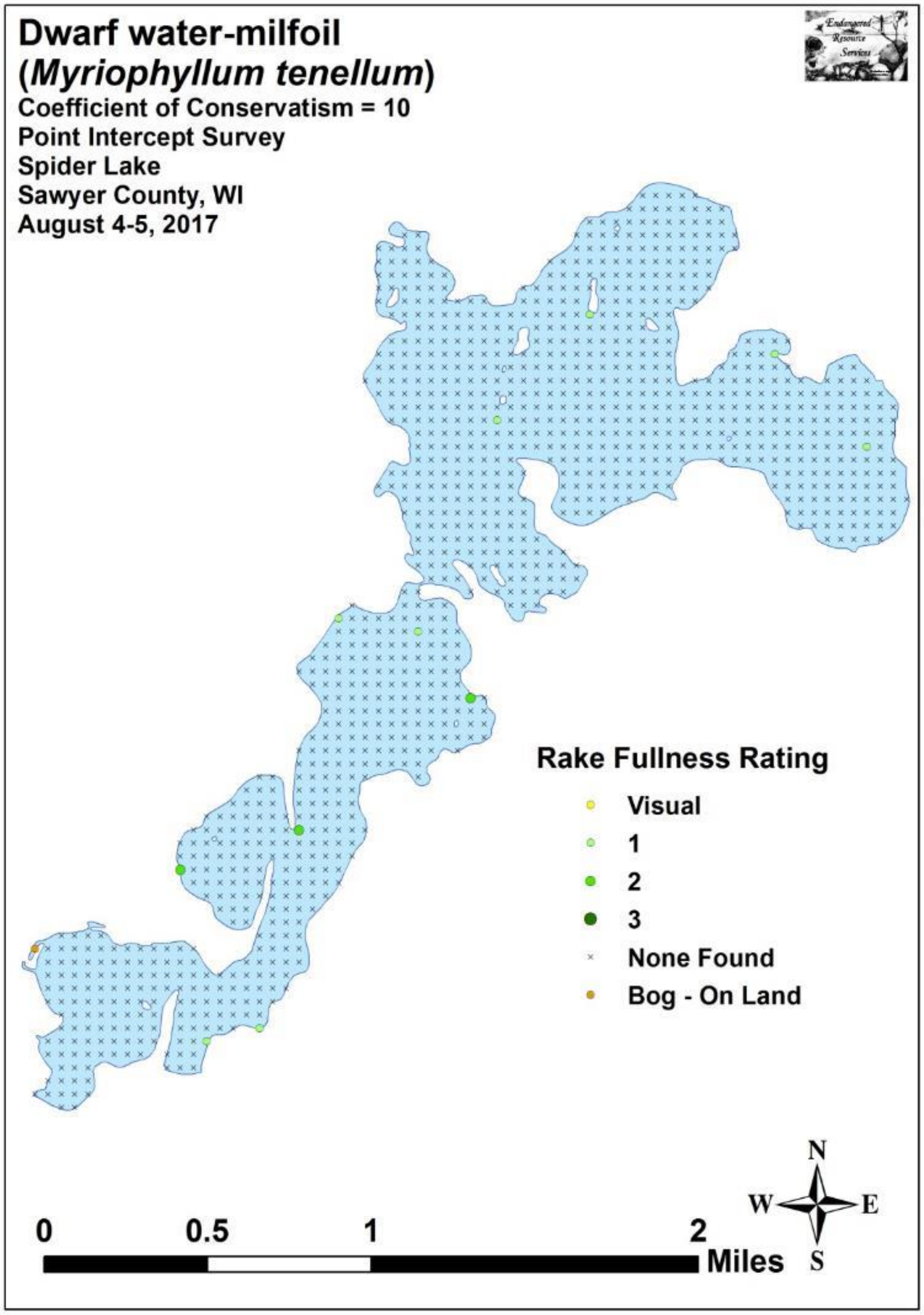

Small duckweed
(Lemna minor)
Coefficient of Conservatism = 4
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

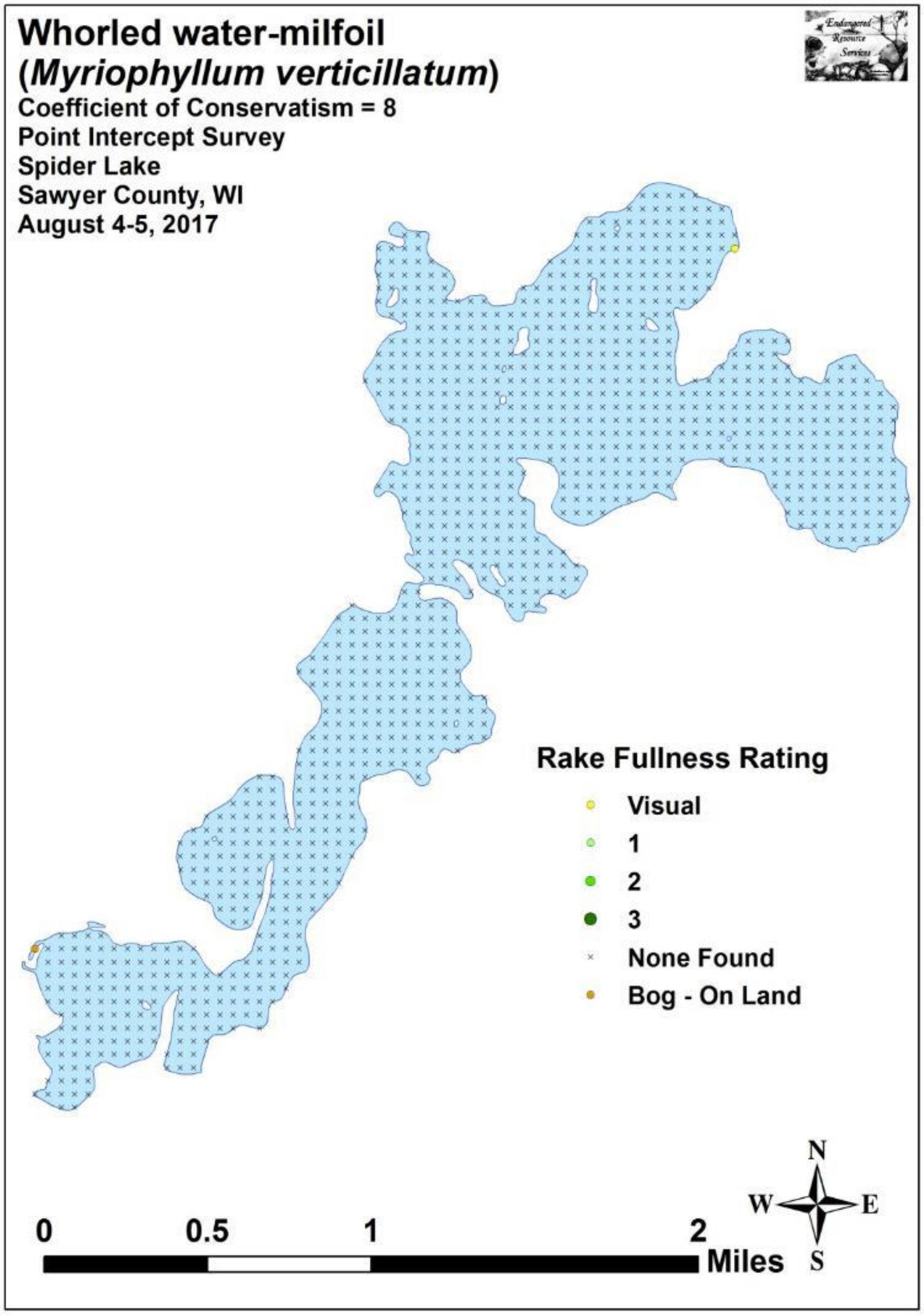

Littorella
(Littorella uniflora)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles



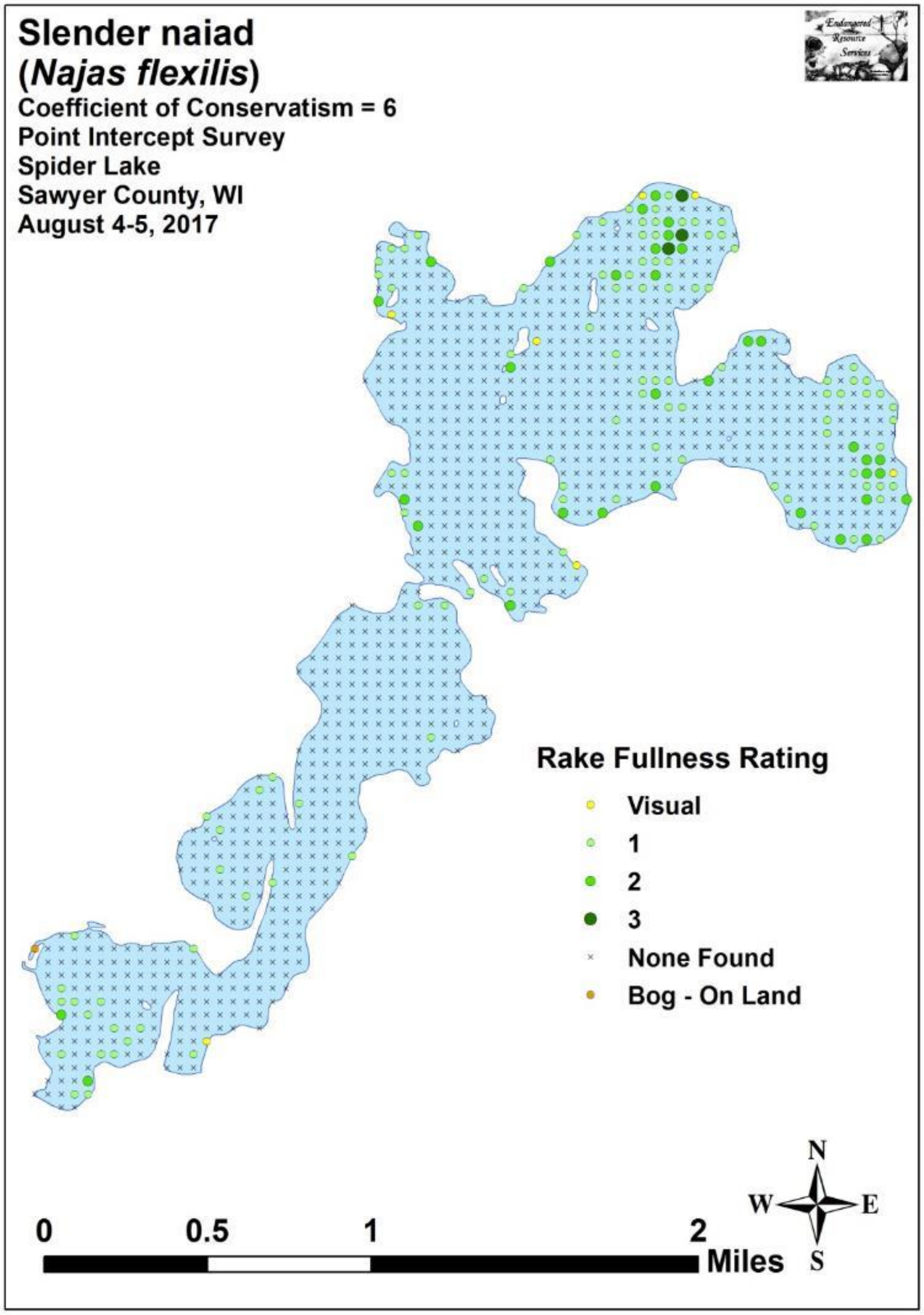
Purple loosestrife
(Lythrum salicaria)
Exotic Species
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

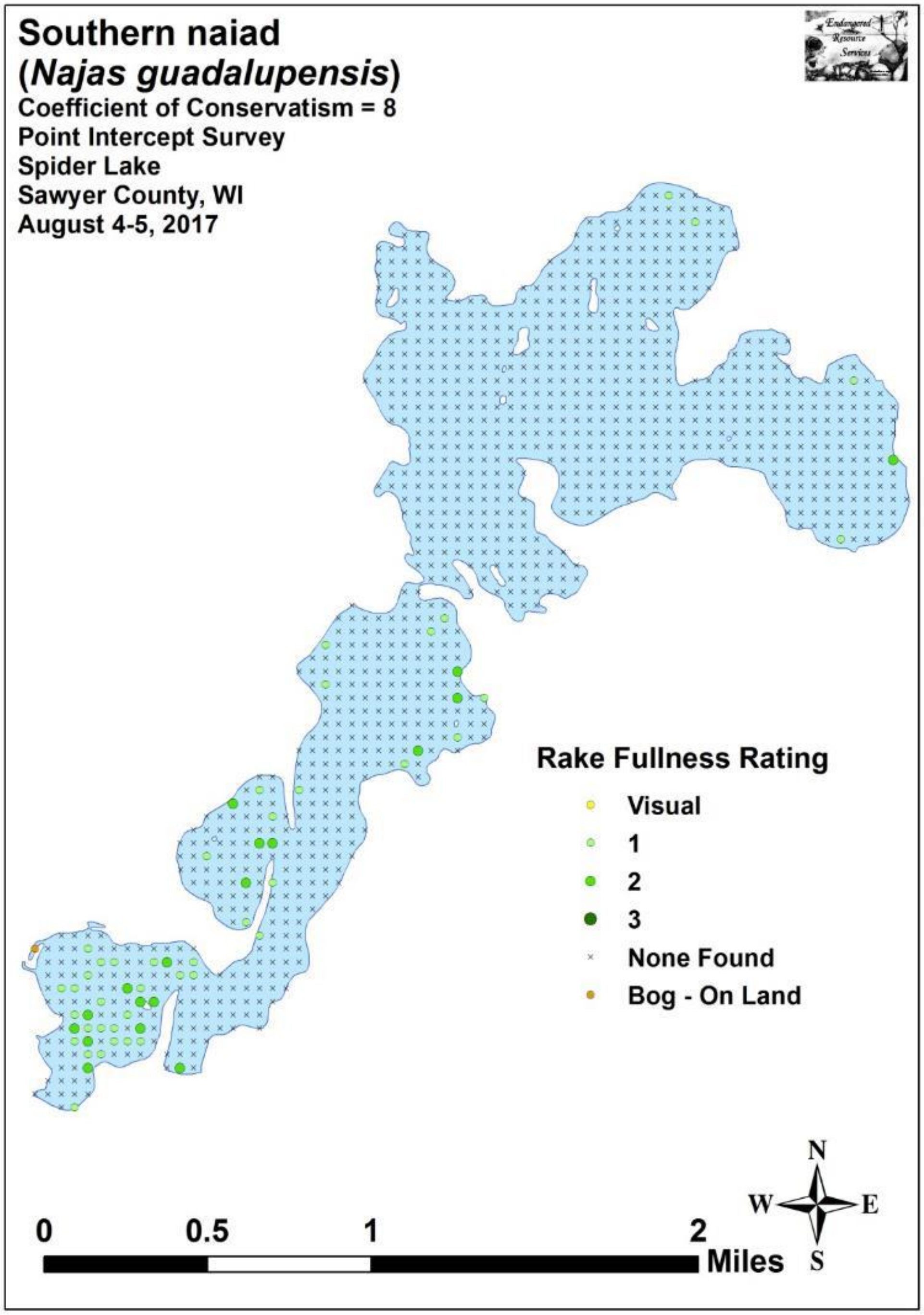

Northern water-milfoil
(*Myriophyllum sibiricum*)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Dwarf water-milfoil
(Myriophyllum tenellum)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

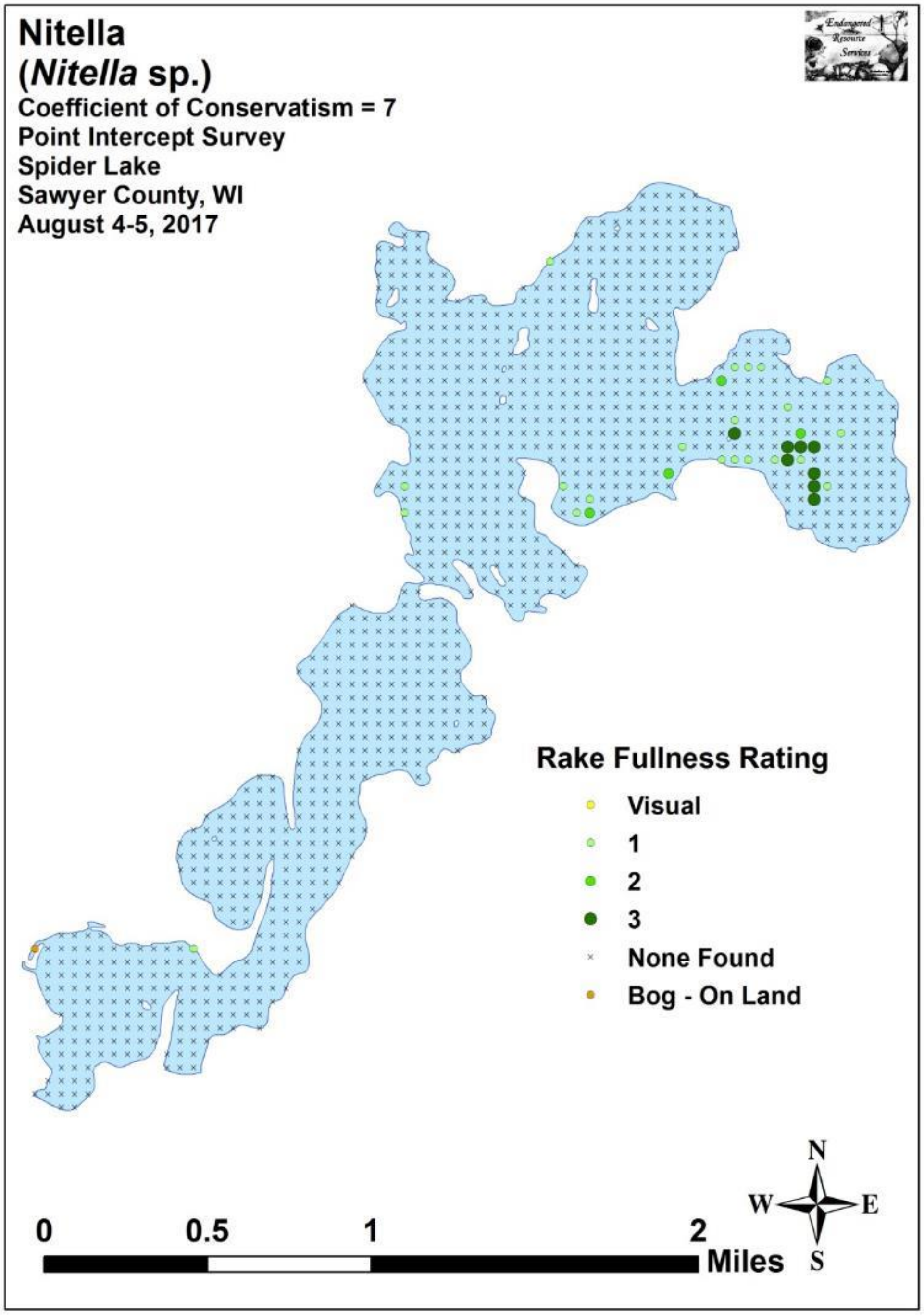


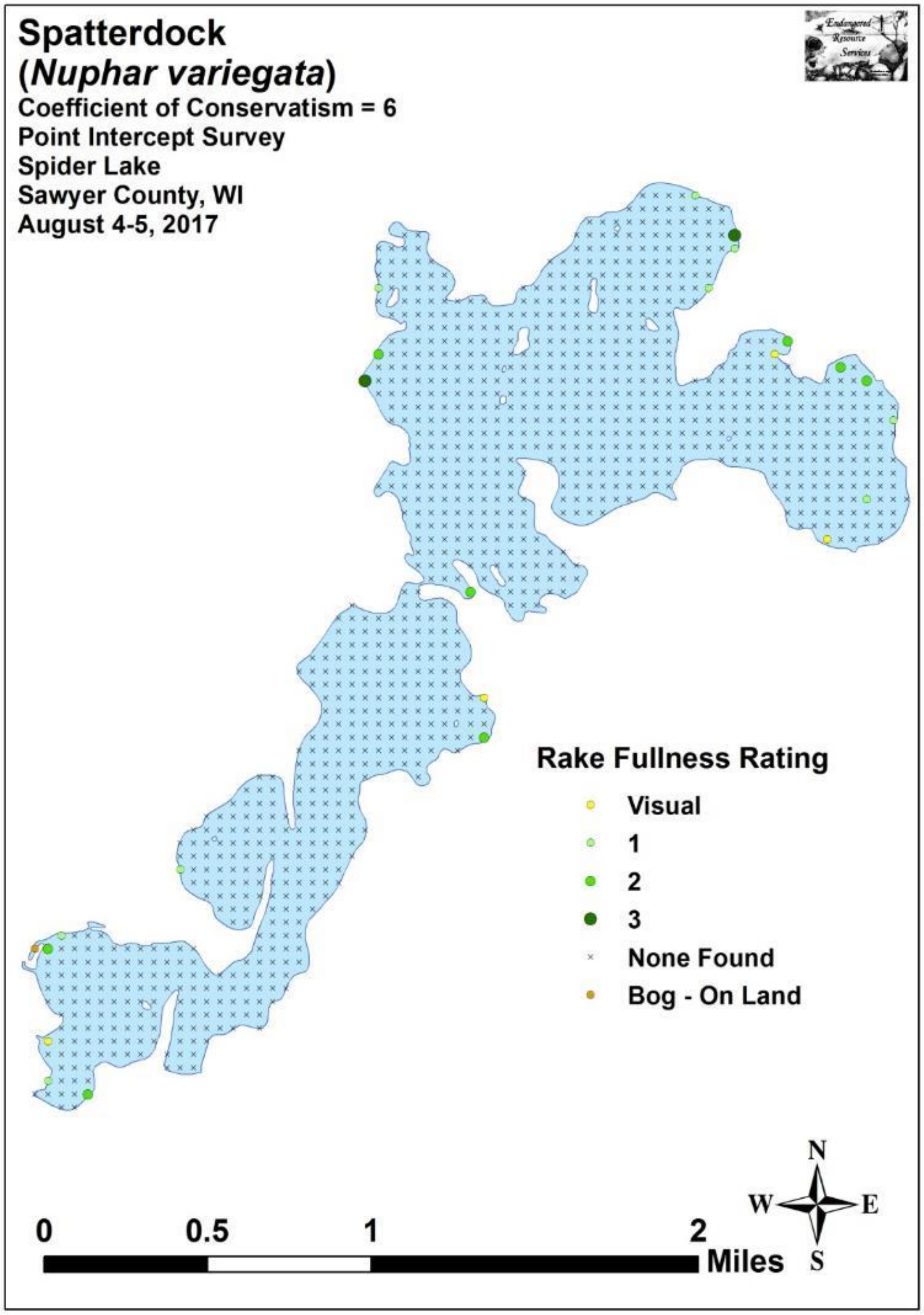
Whorled water-milfoil
(*Myriophyllum verticillatum*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

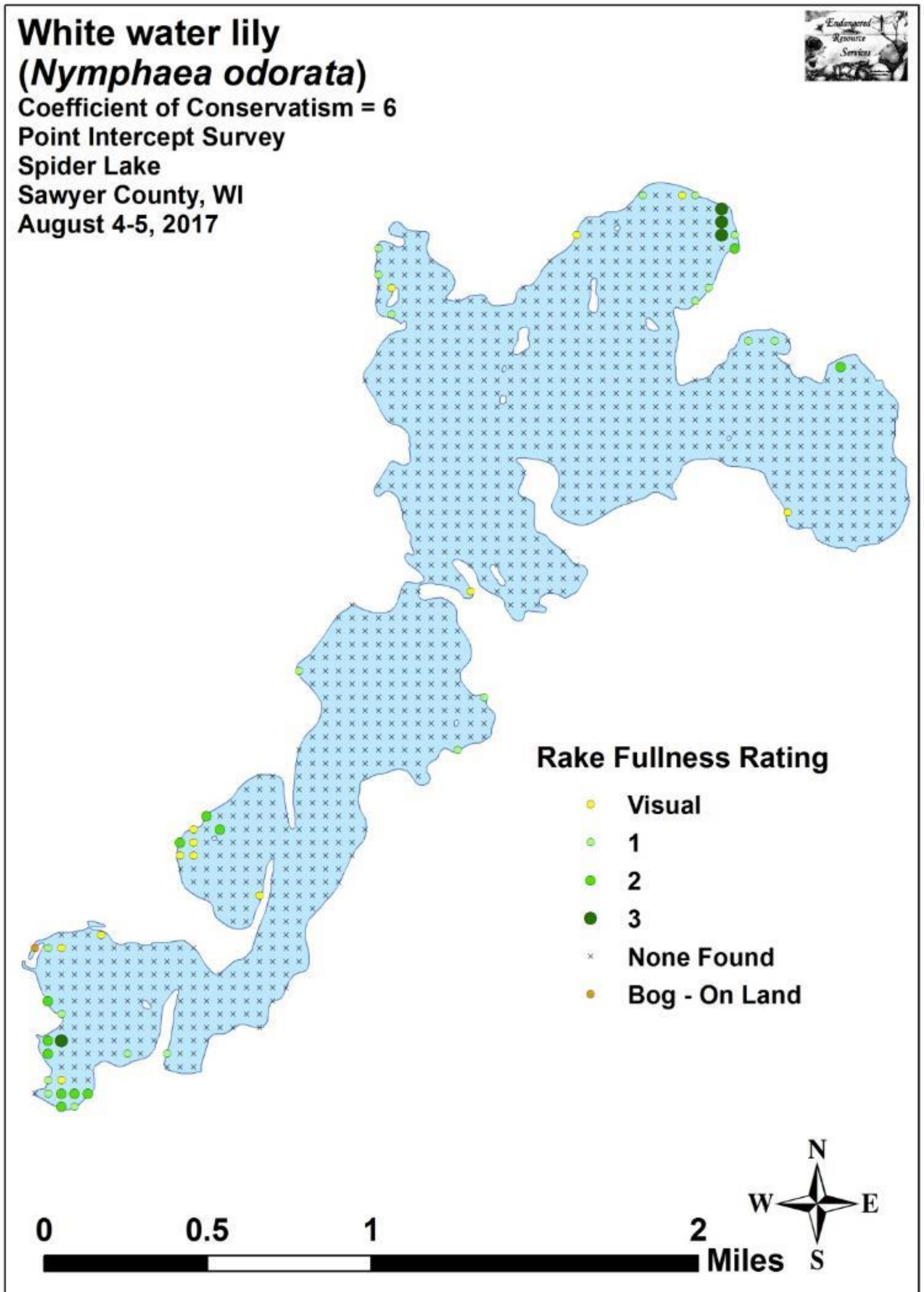

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

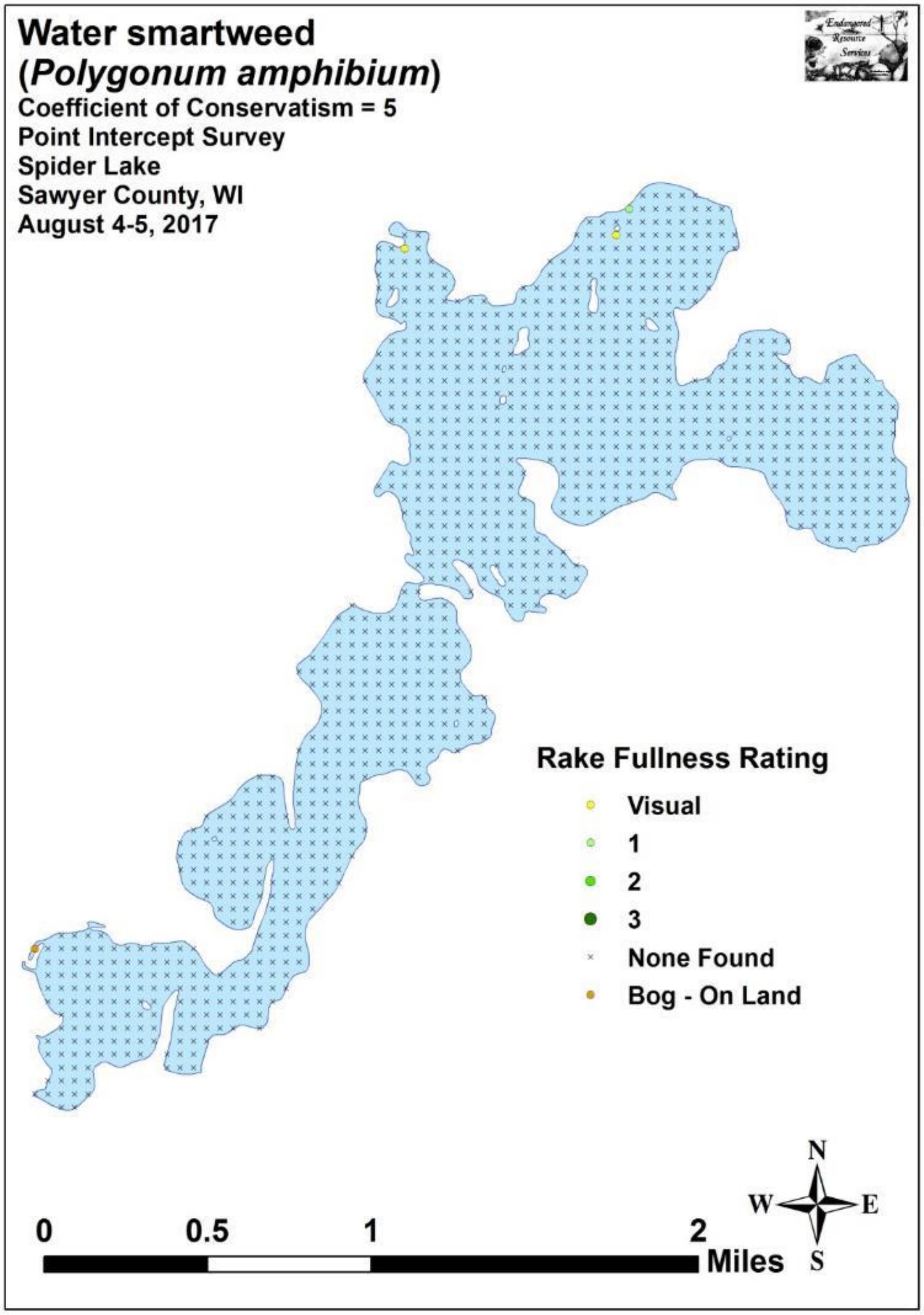


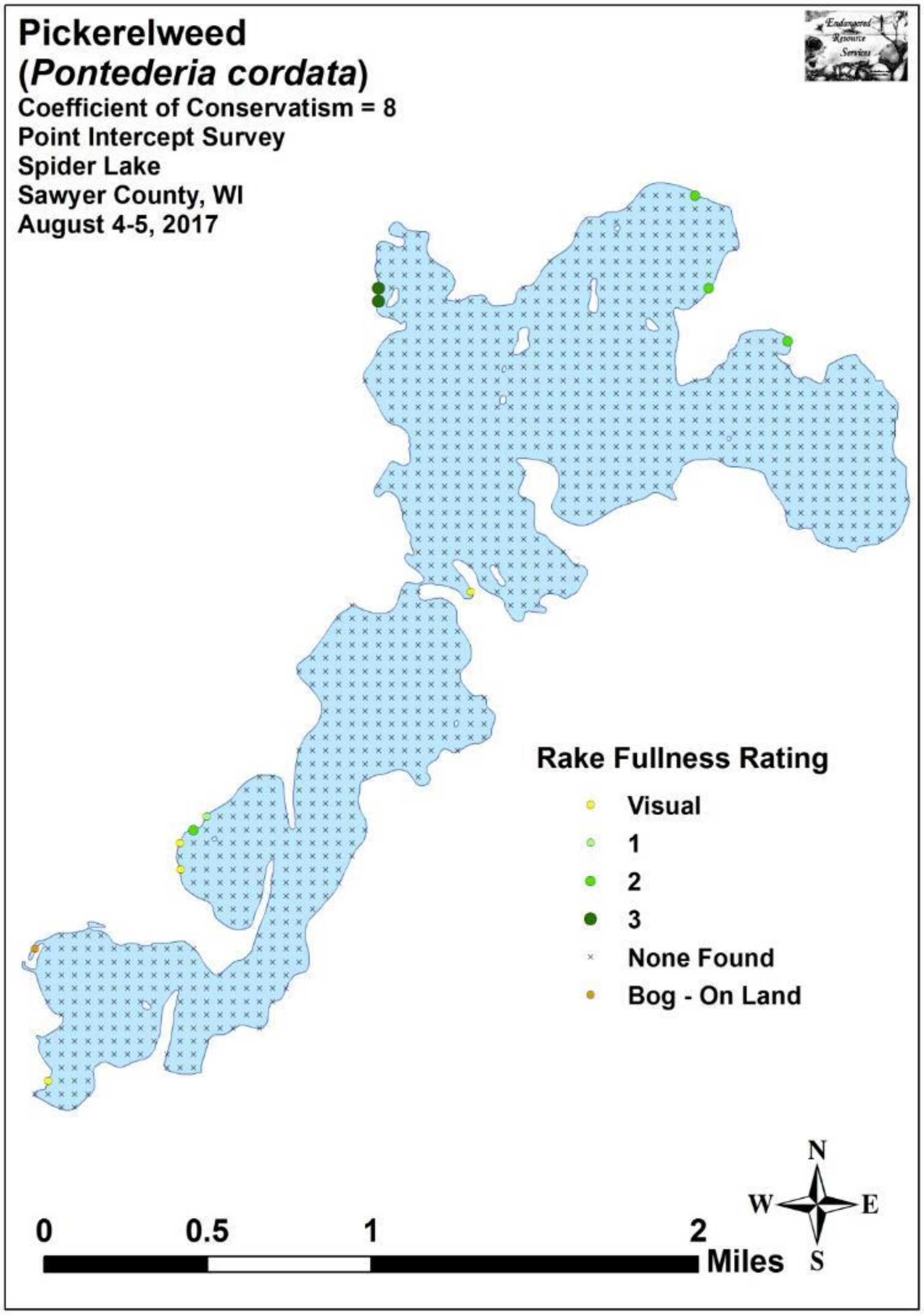
Southern naiad
(*Najas guadalupensis*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

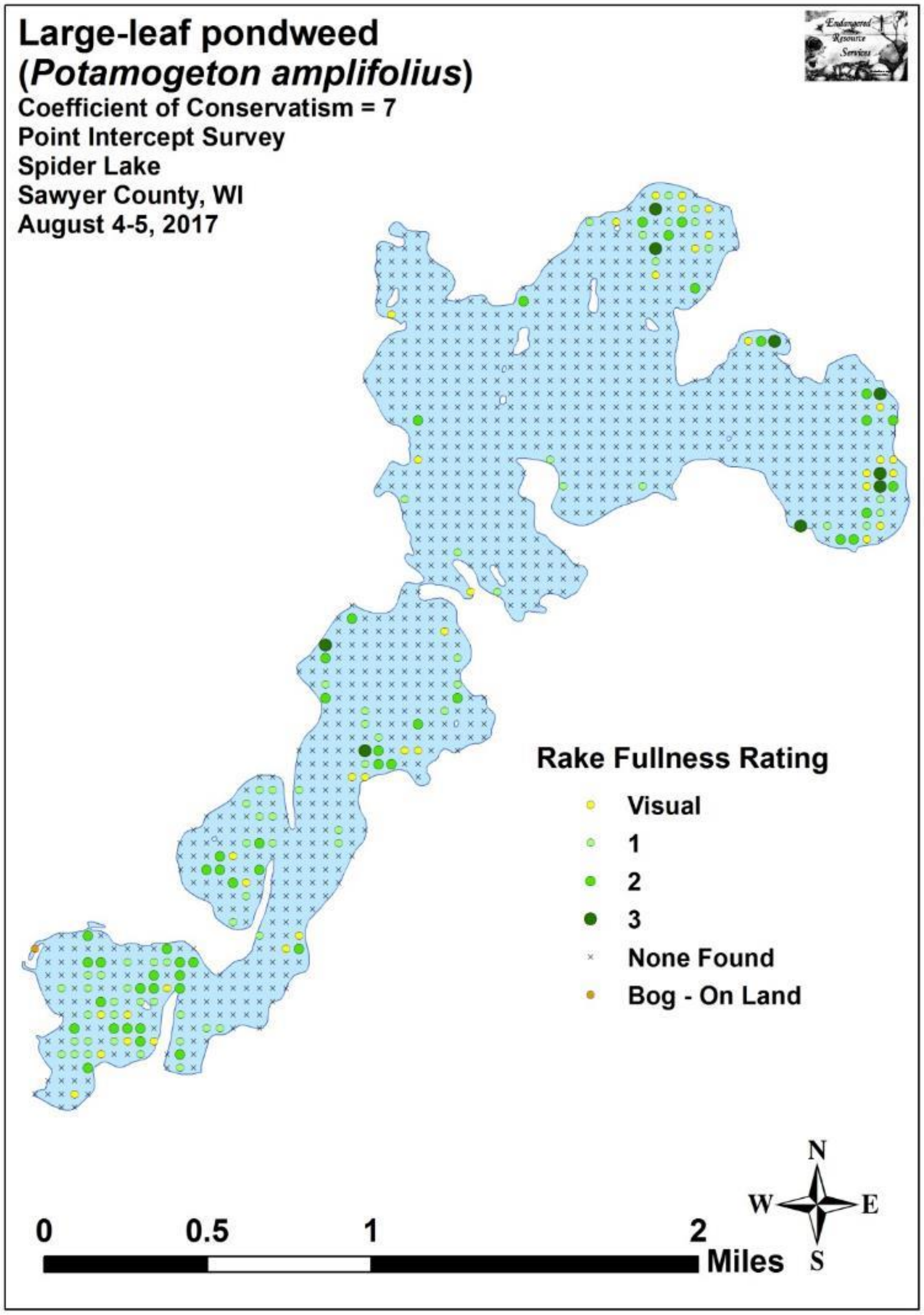

Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

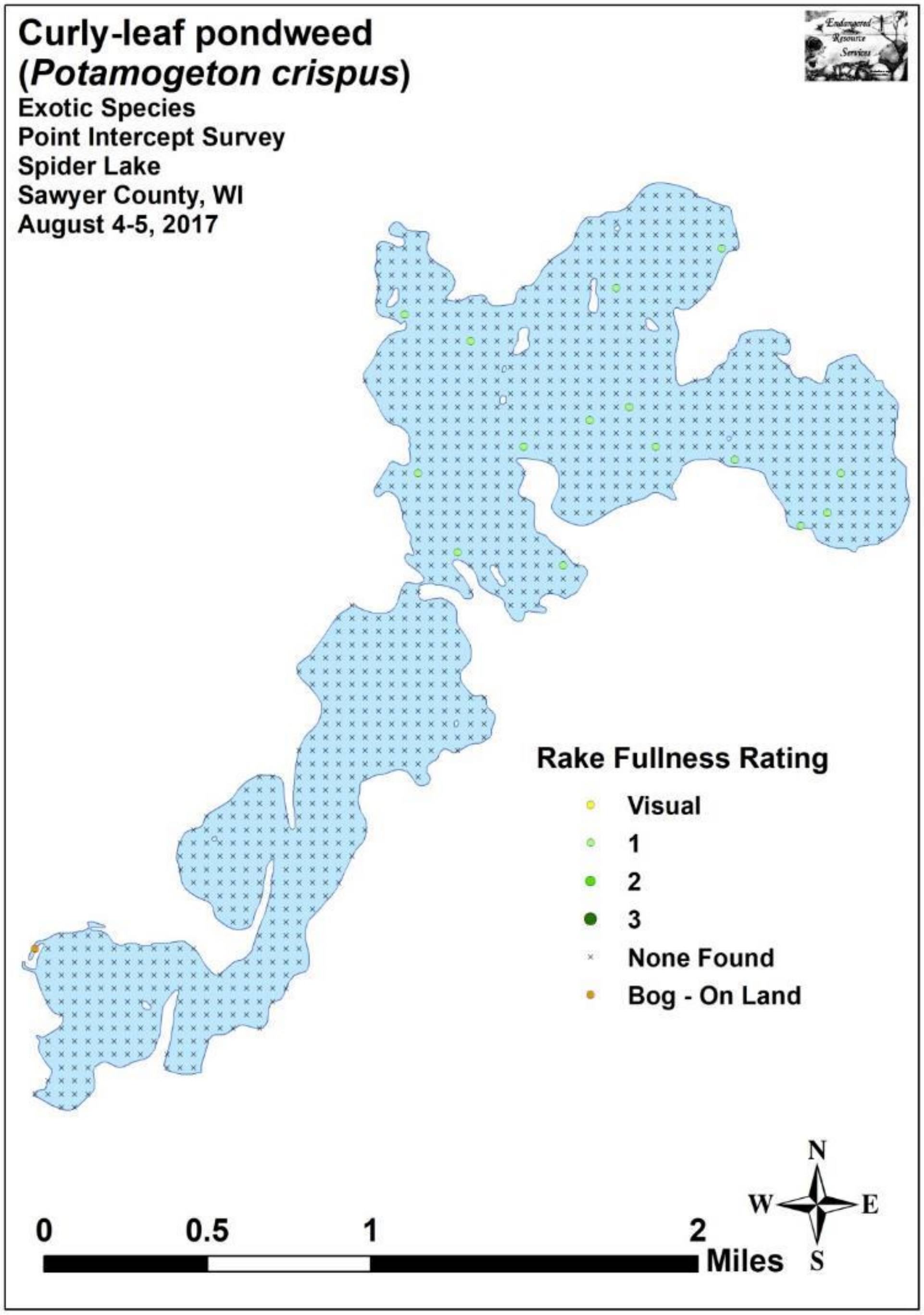

Spatterdock
(*Nuphar variegata*)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

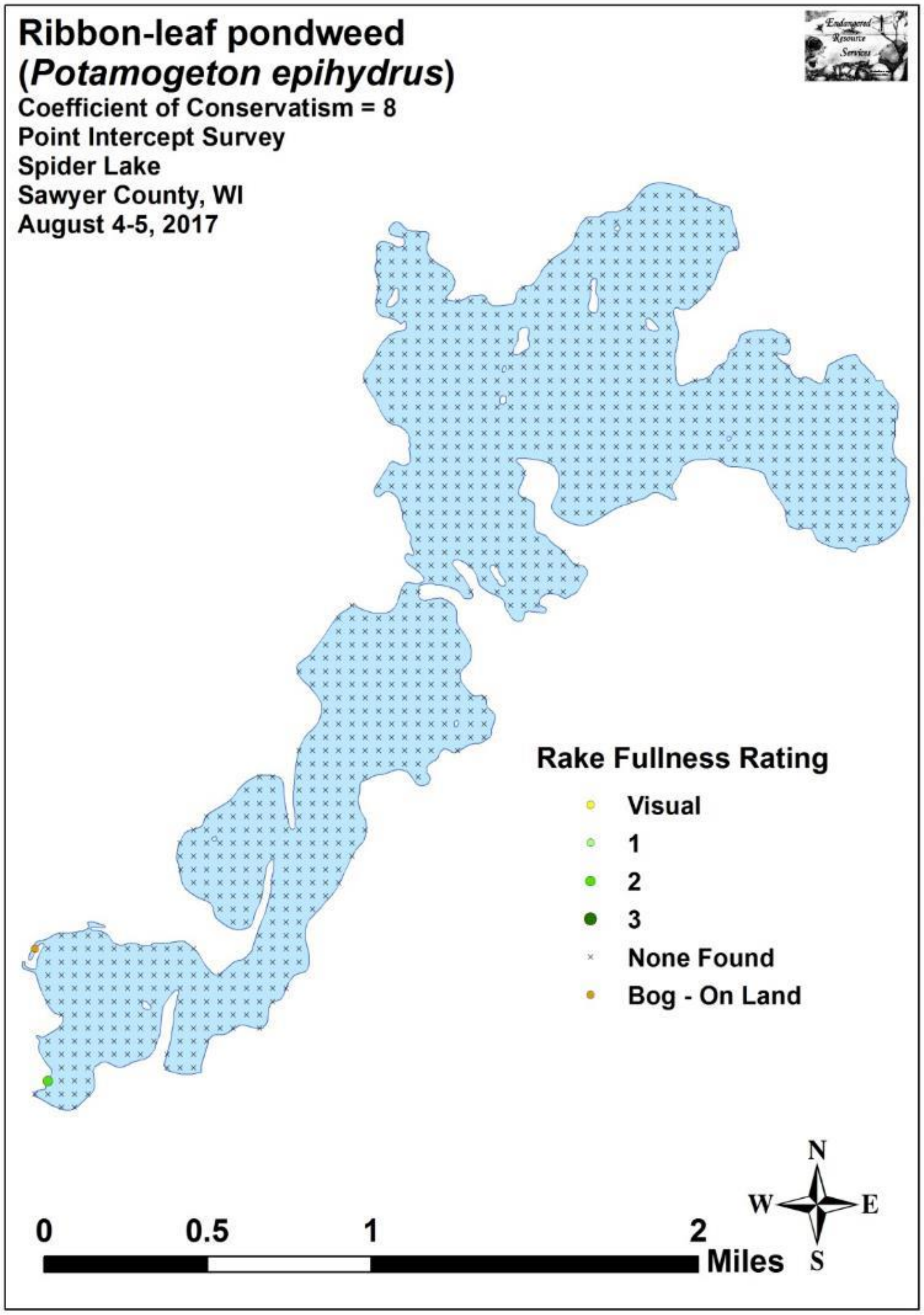

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Water smartweed
(Polygonum amphibium)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

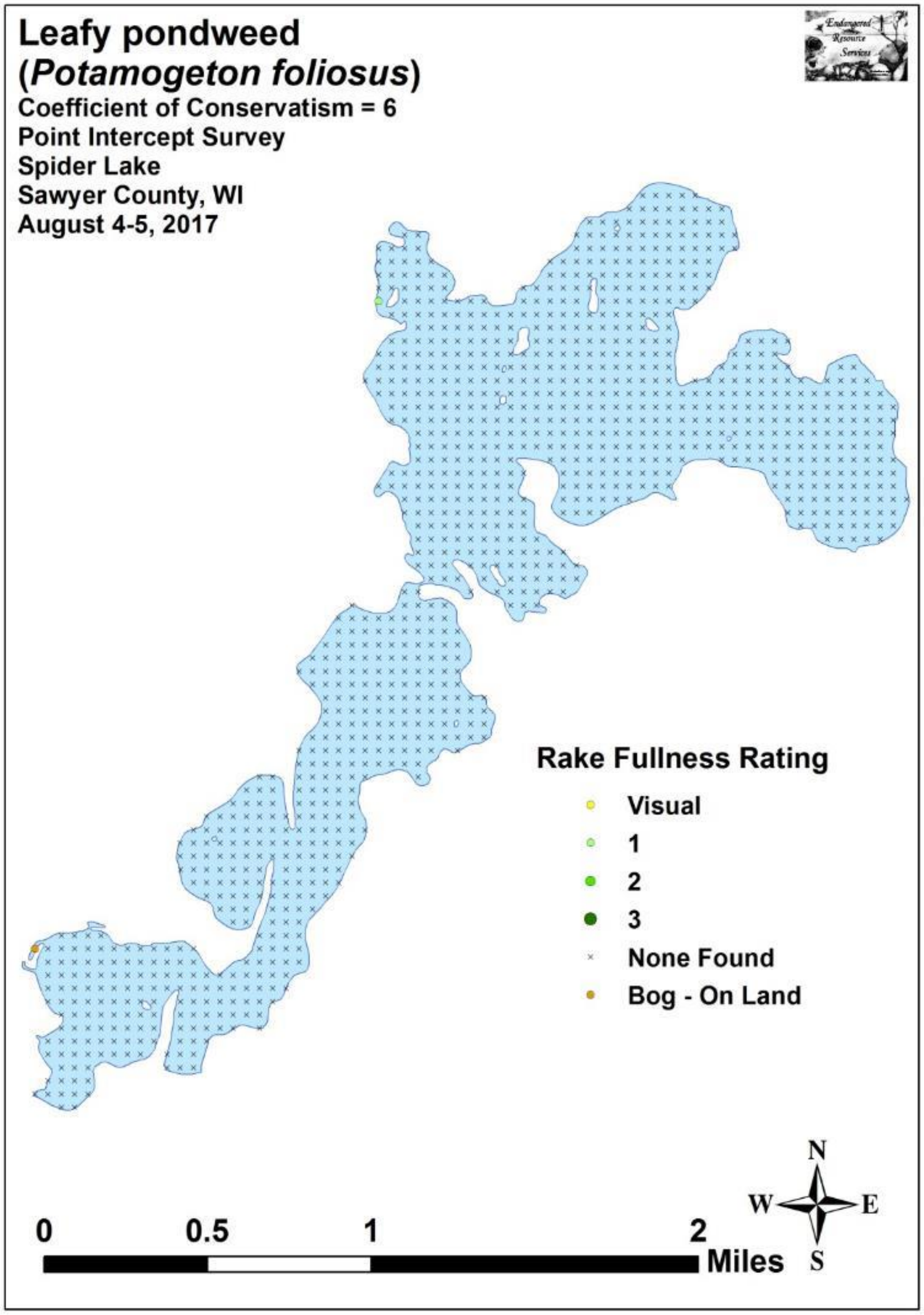

Pickerelweed
(Pontederia cordata)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

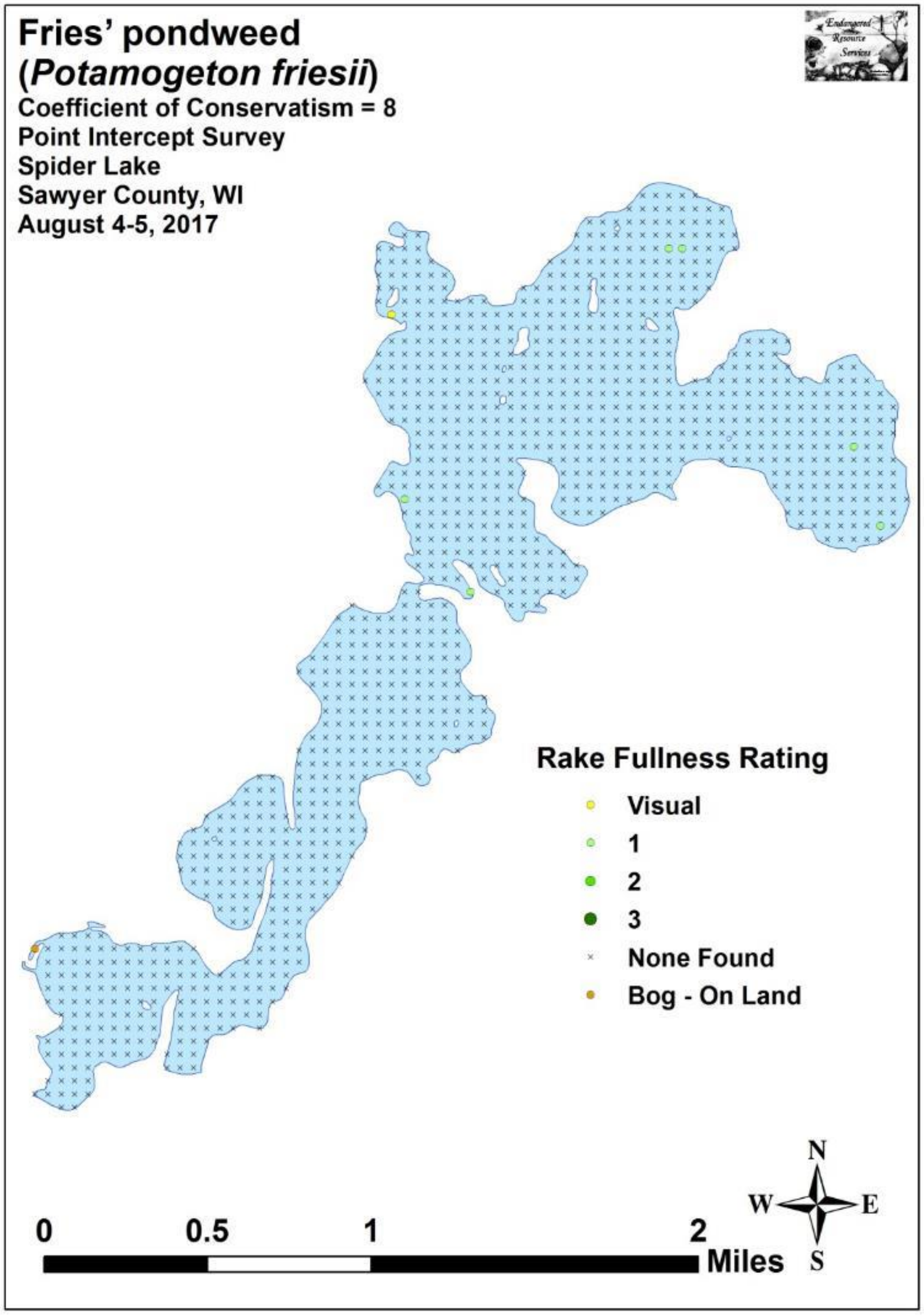

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

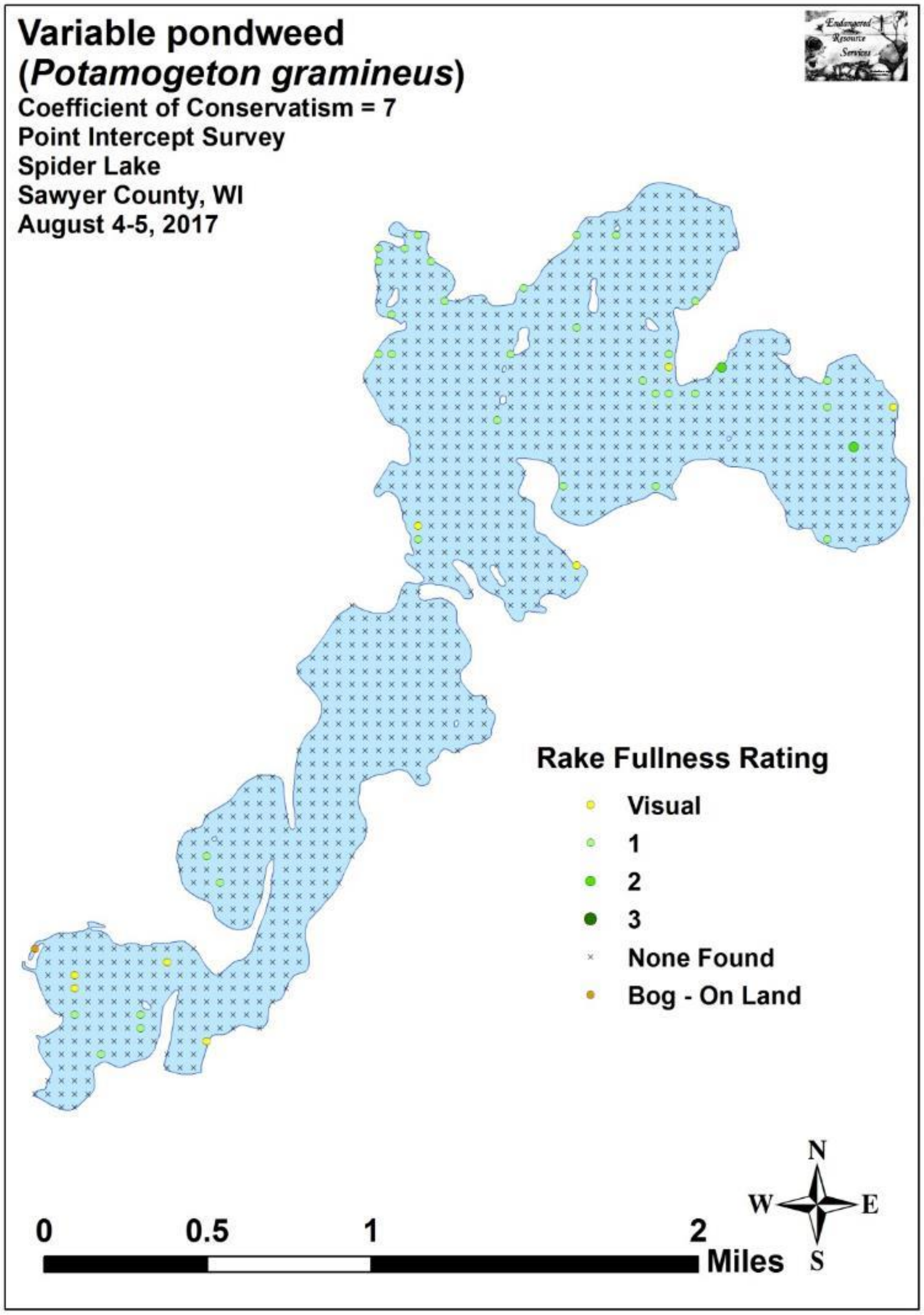

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

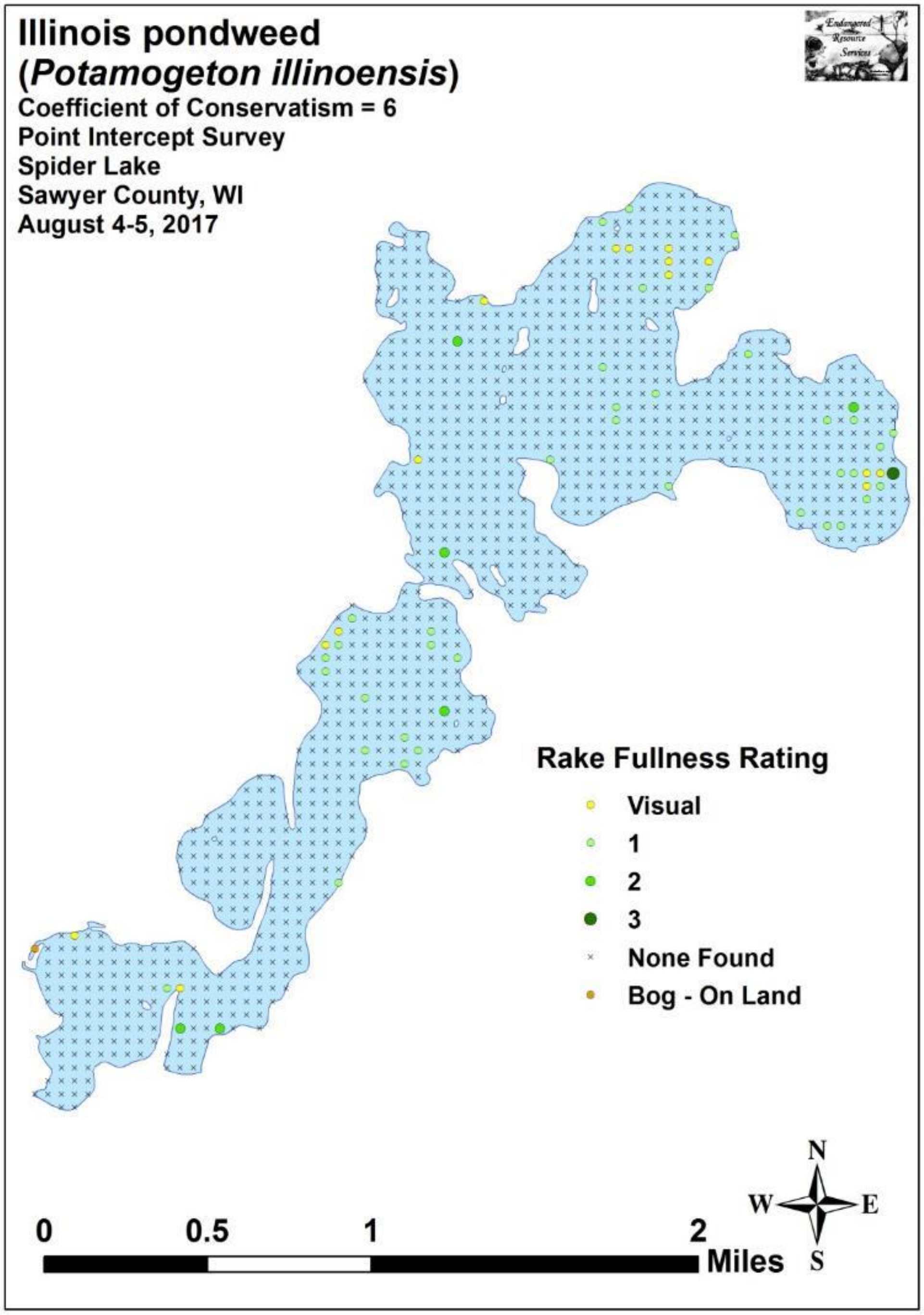


Ribbon-leaf pondweed
(*Potamogeton epihydrus*)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

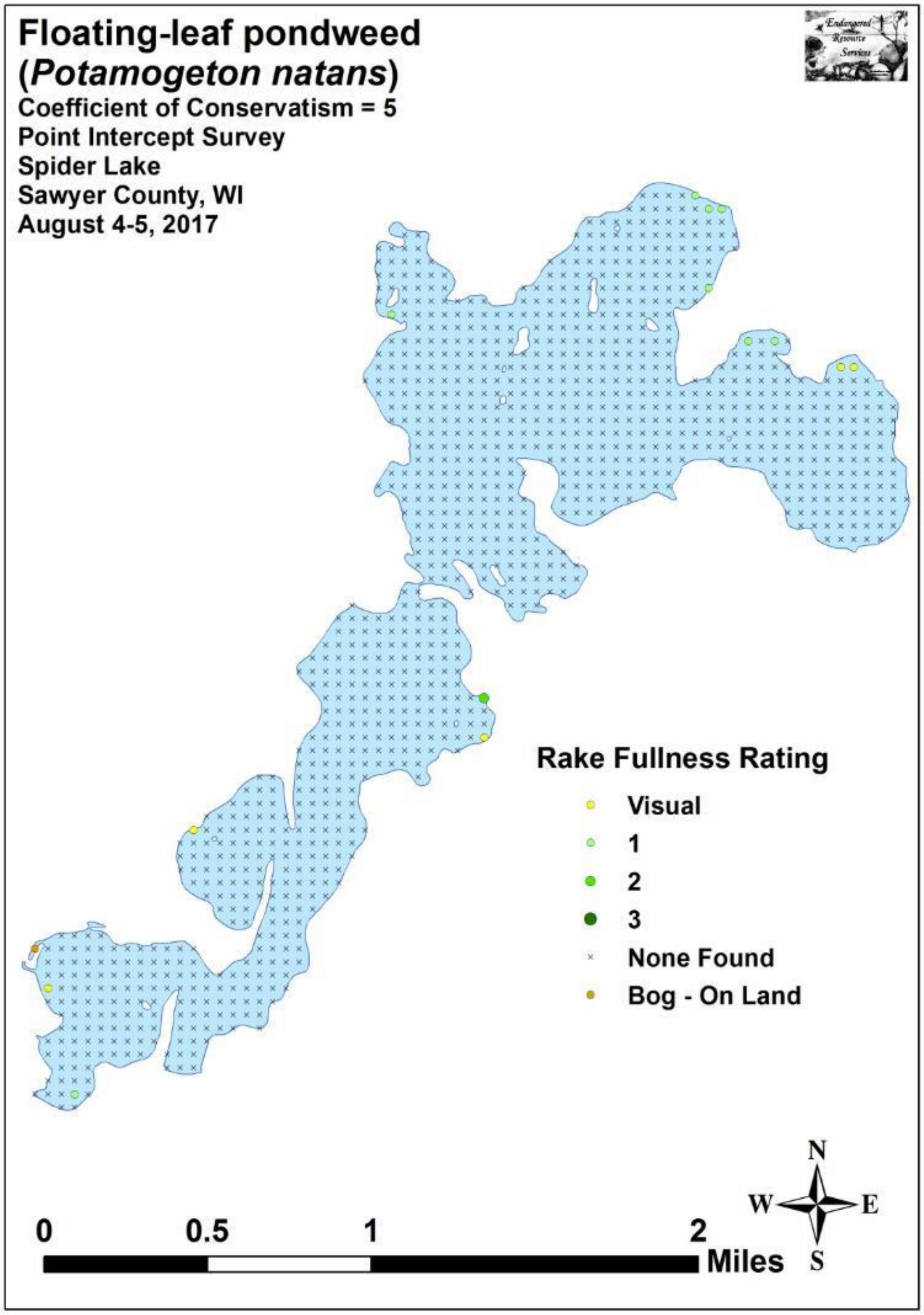

Leafy pondweed
(Potamogeton foliosus)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

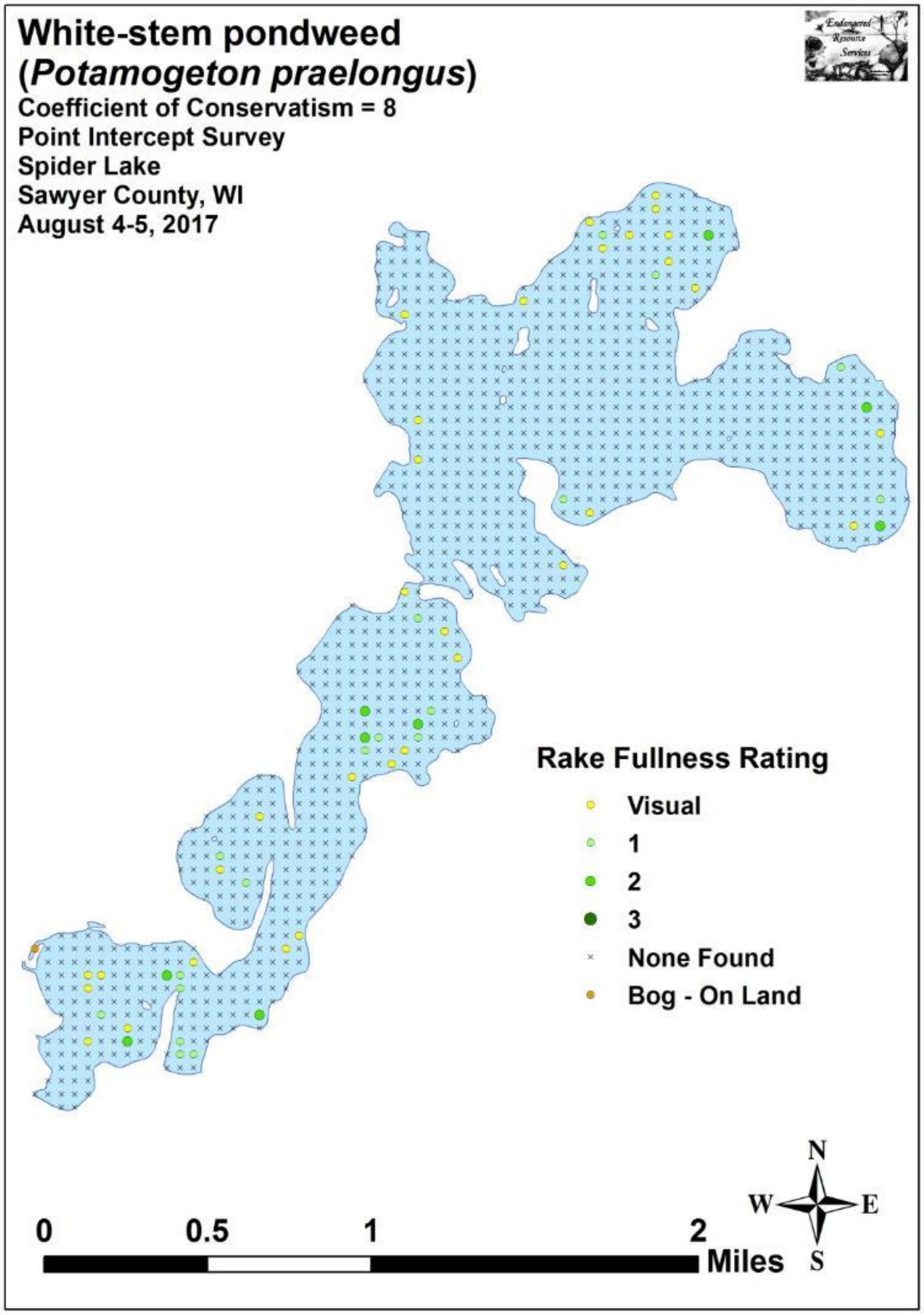

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

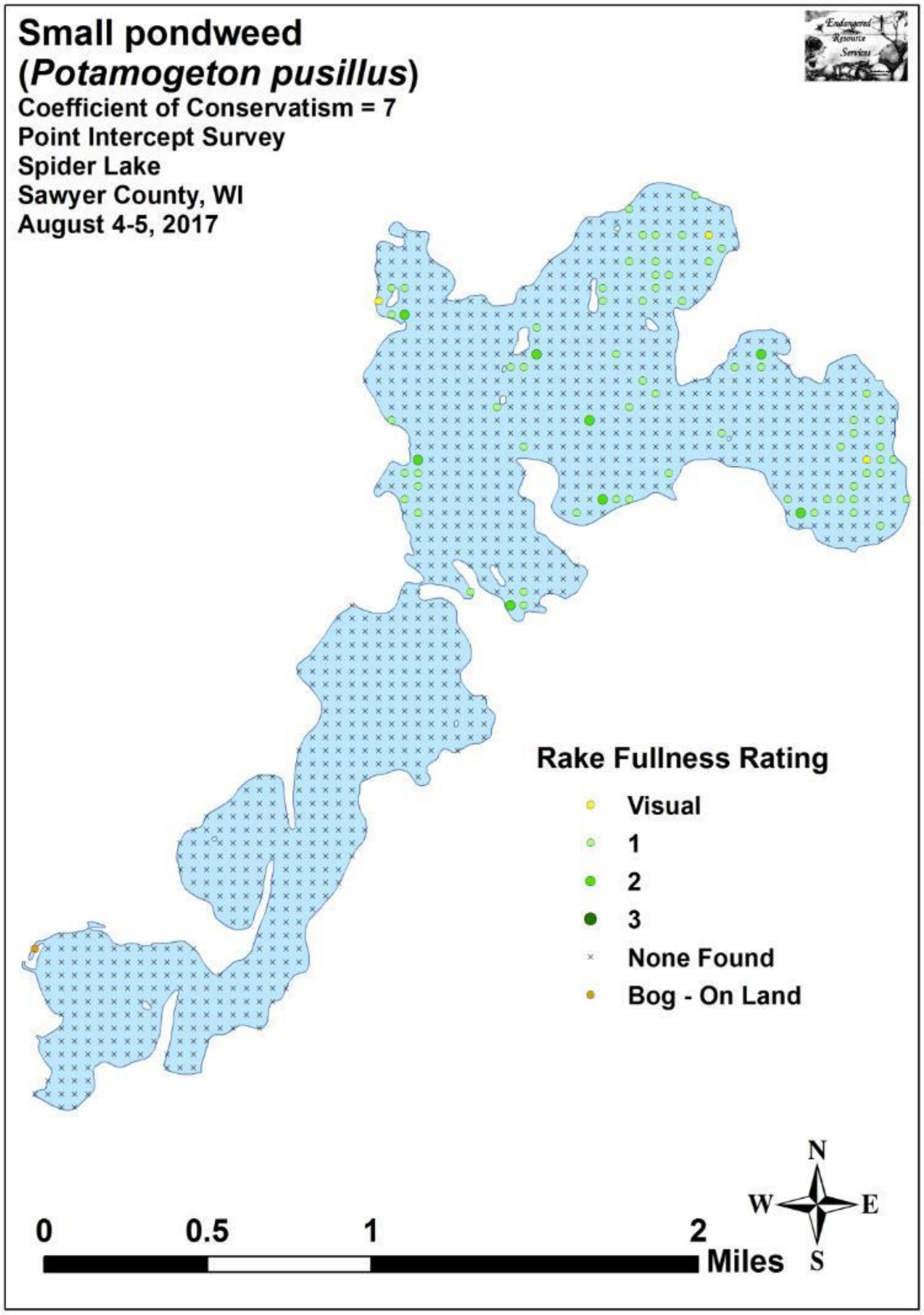

Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

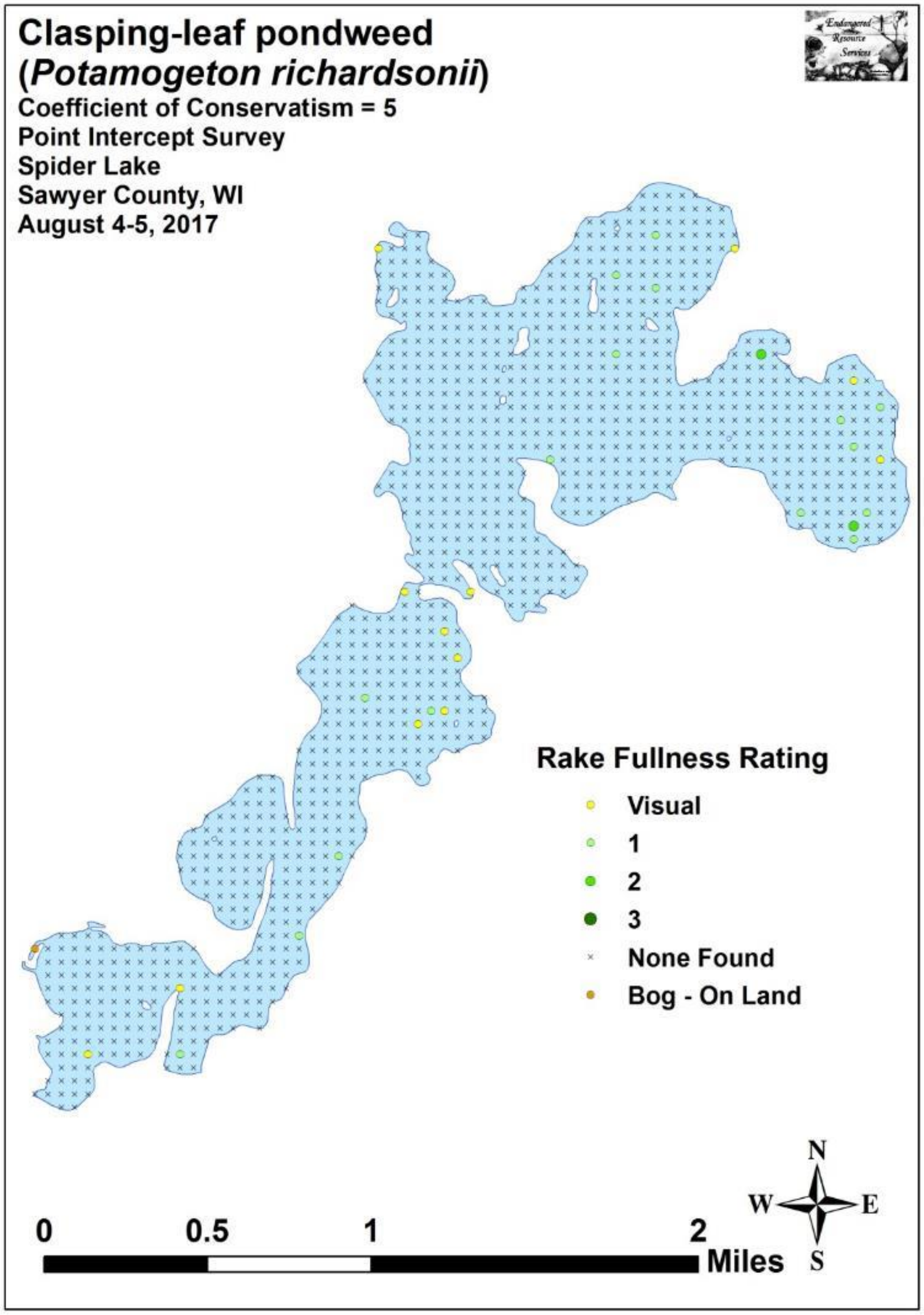


Illinois pondweed
(*Potamogeton illinoensis*)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

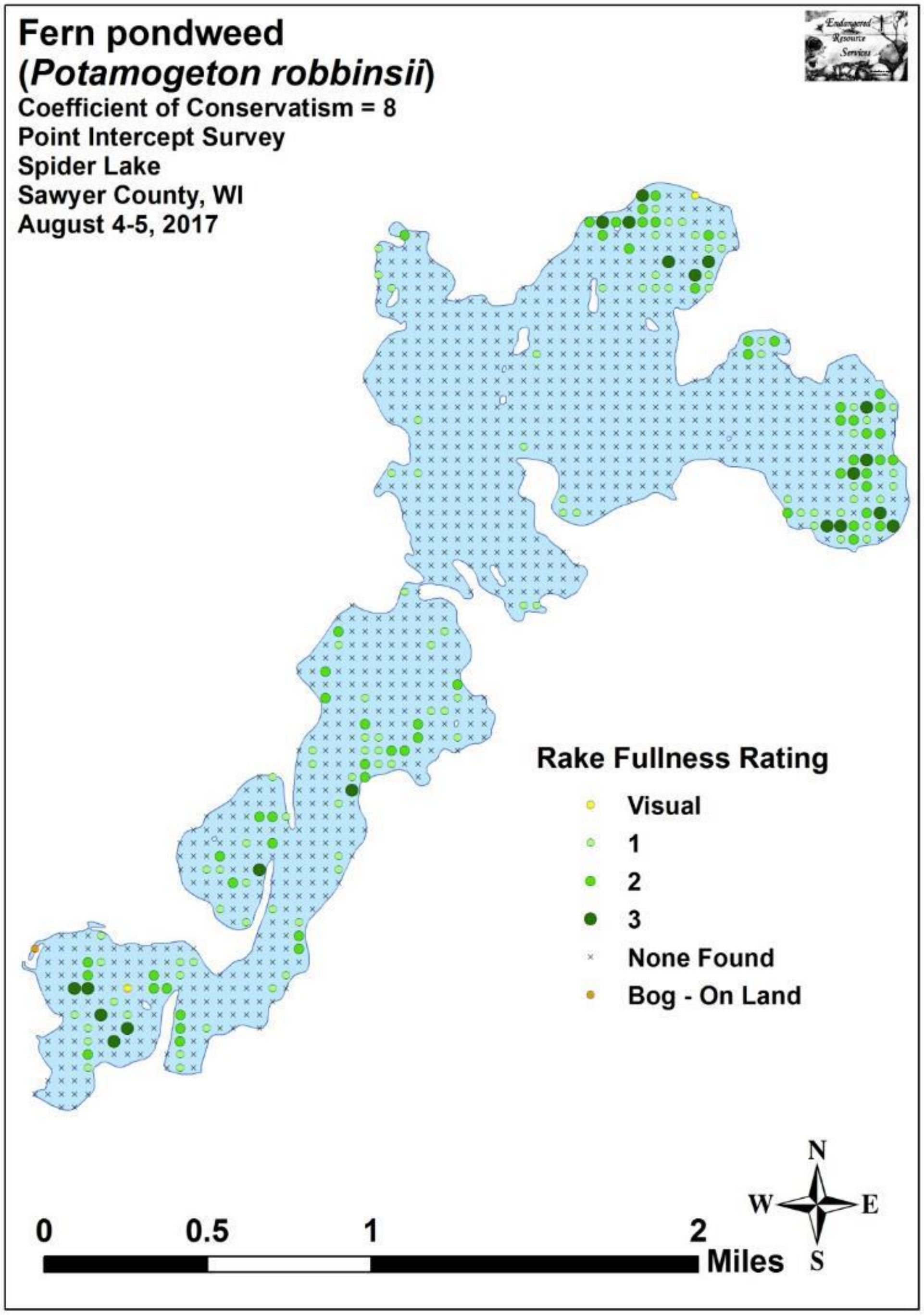

Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

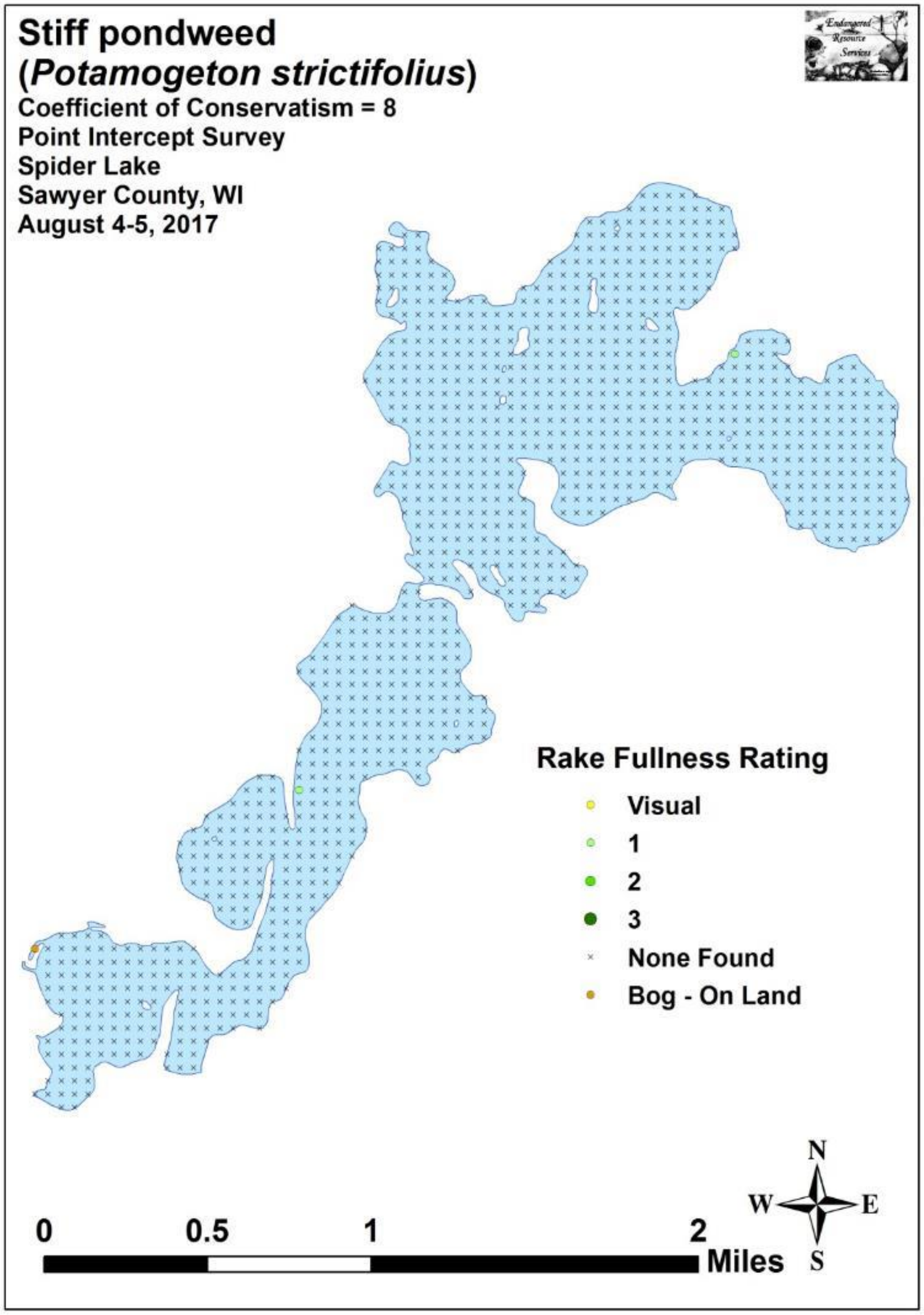

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

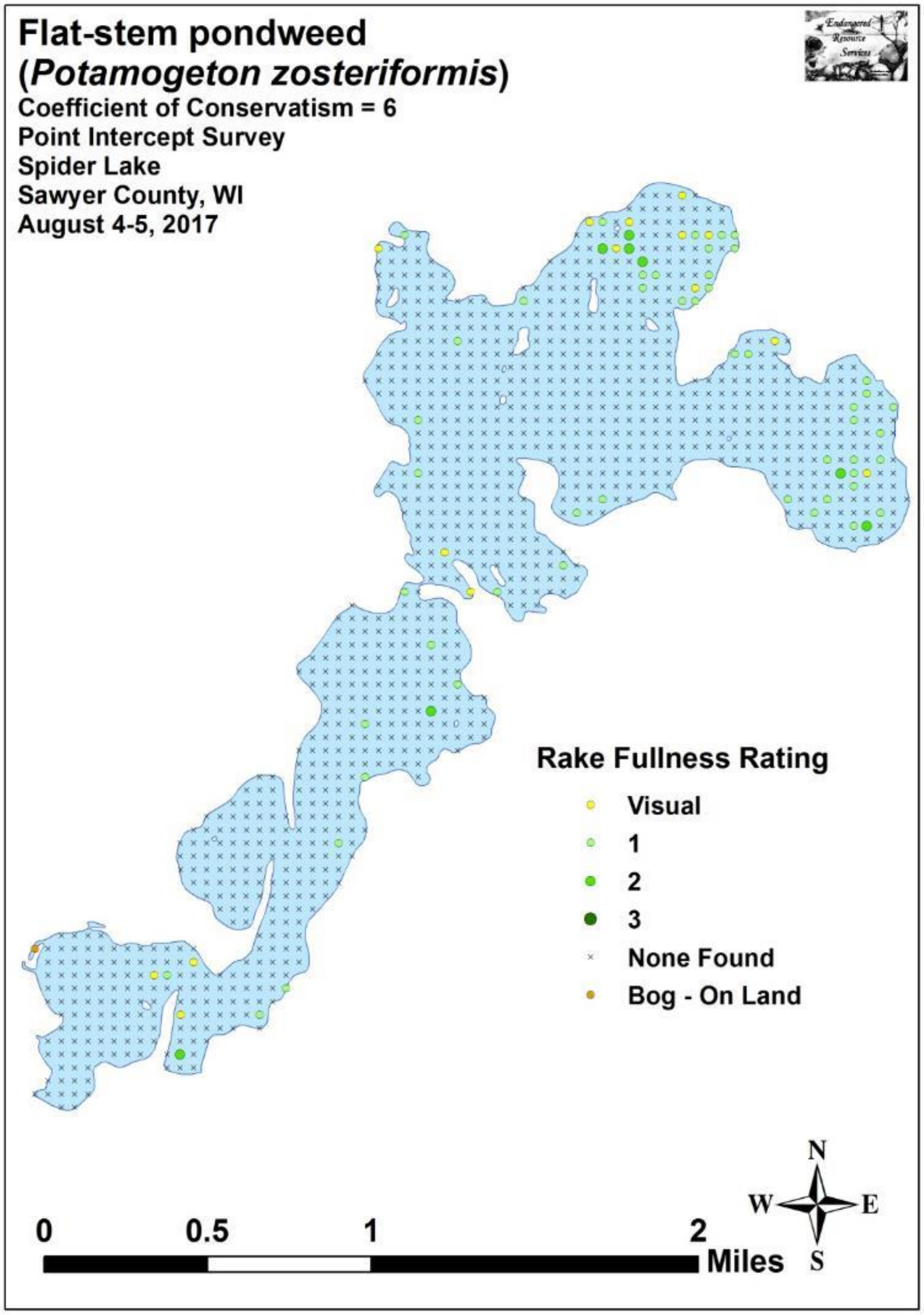

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

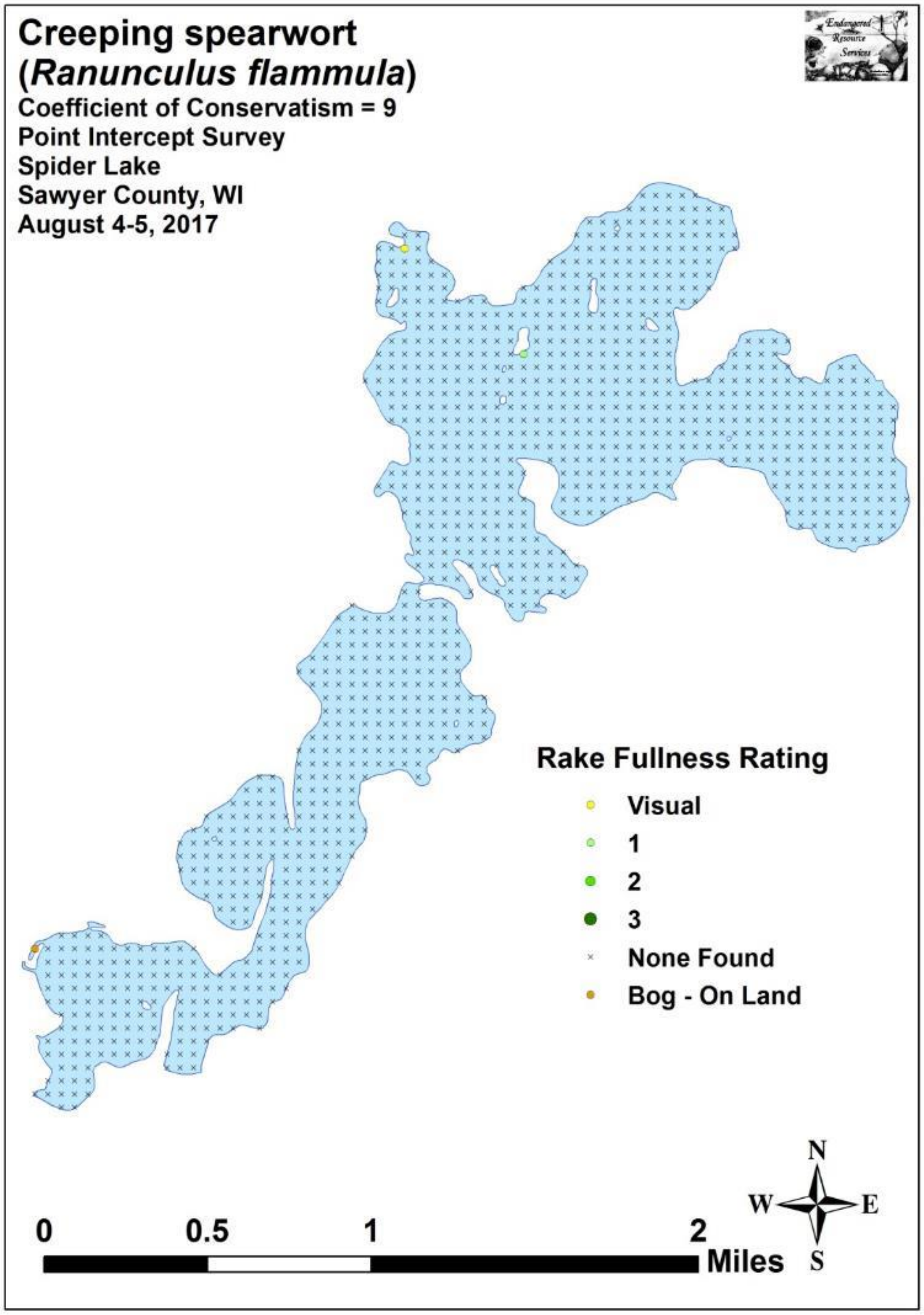


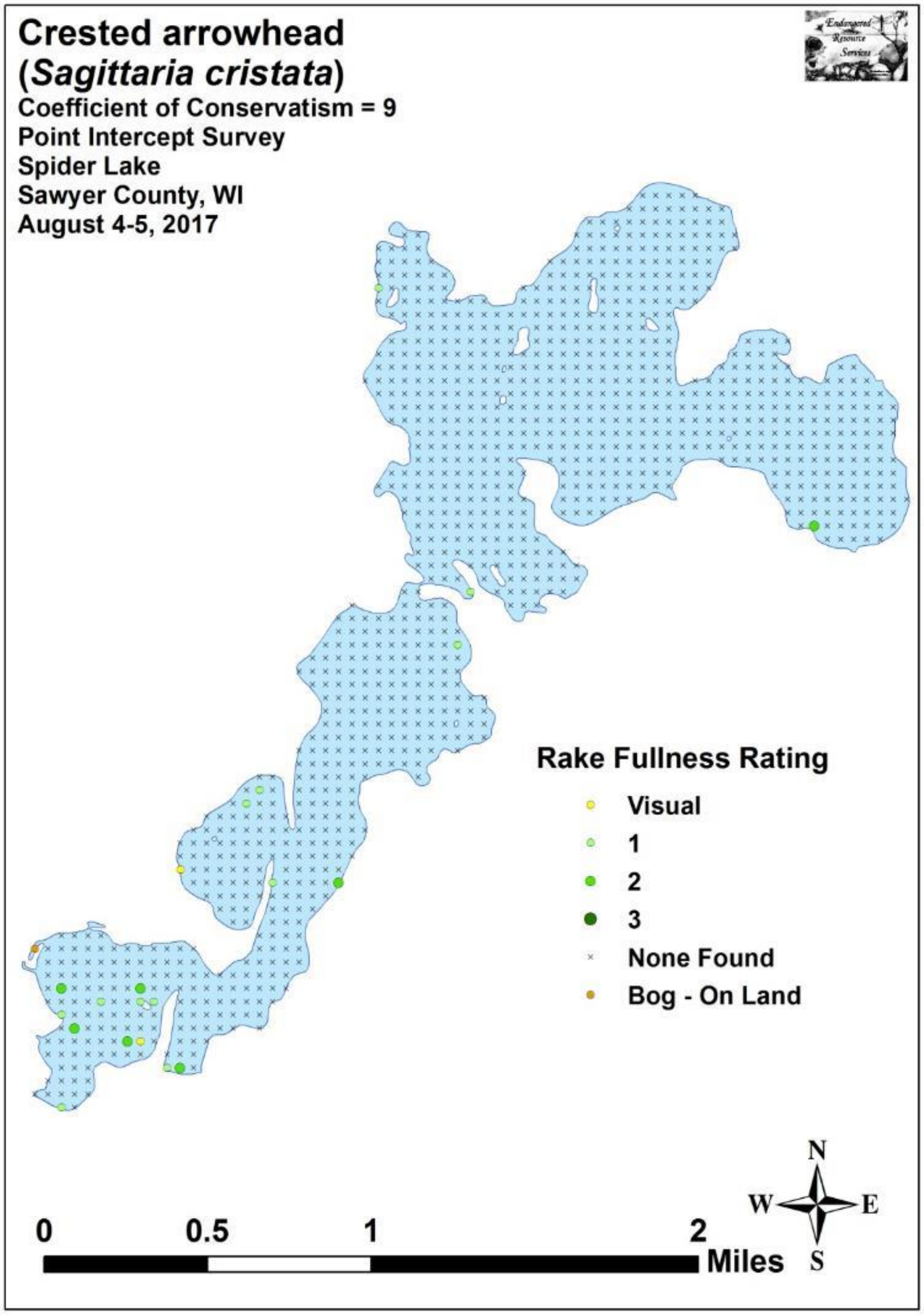
Clasping-leaf pondweed
(*Potamogeton richardsonii*)
Coefficient of Conservatism = 5
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S

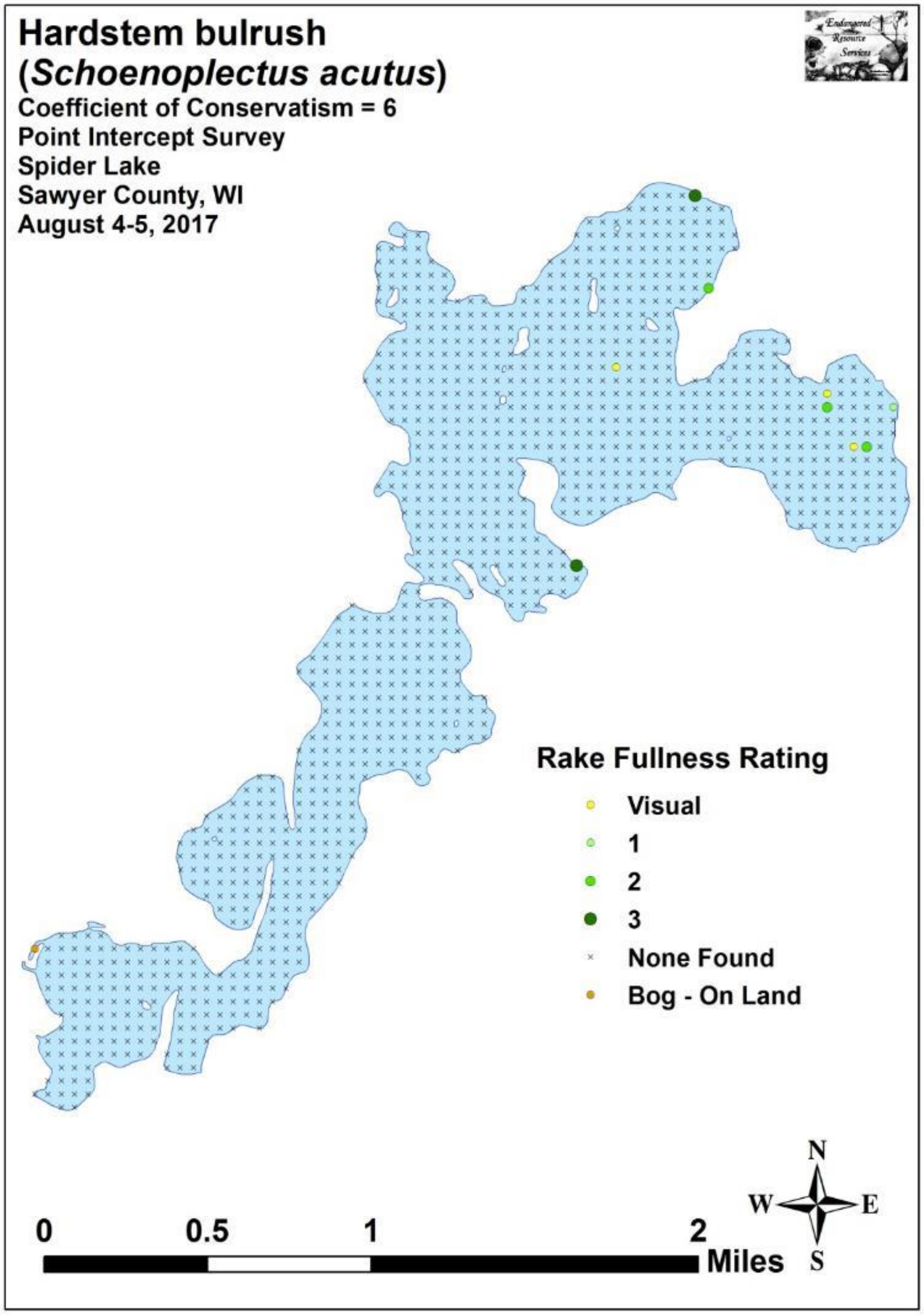

Stiff pondweed
(Potamogeton strictifolius)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

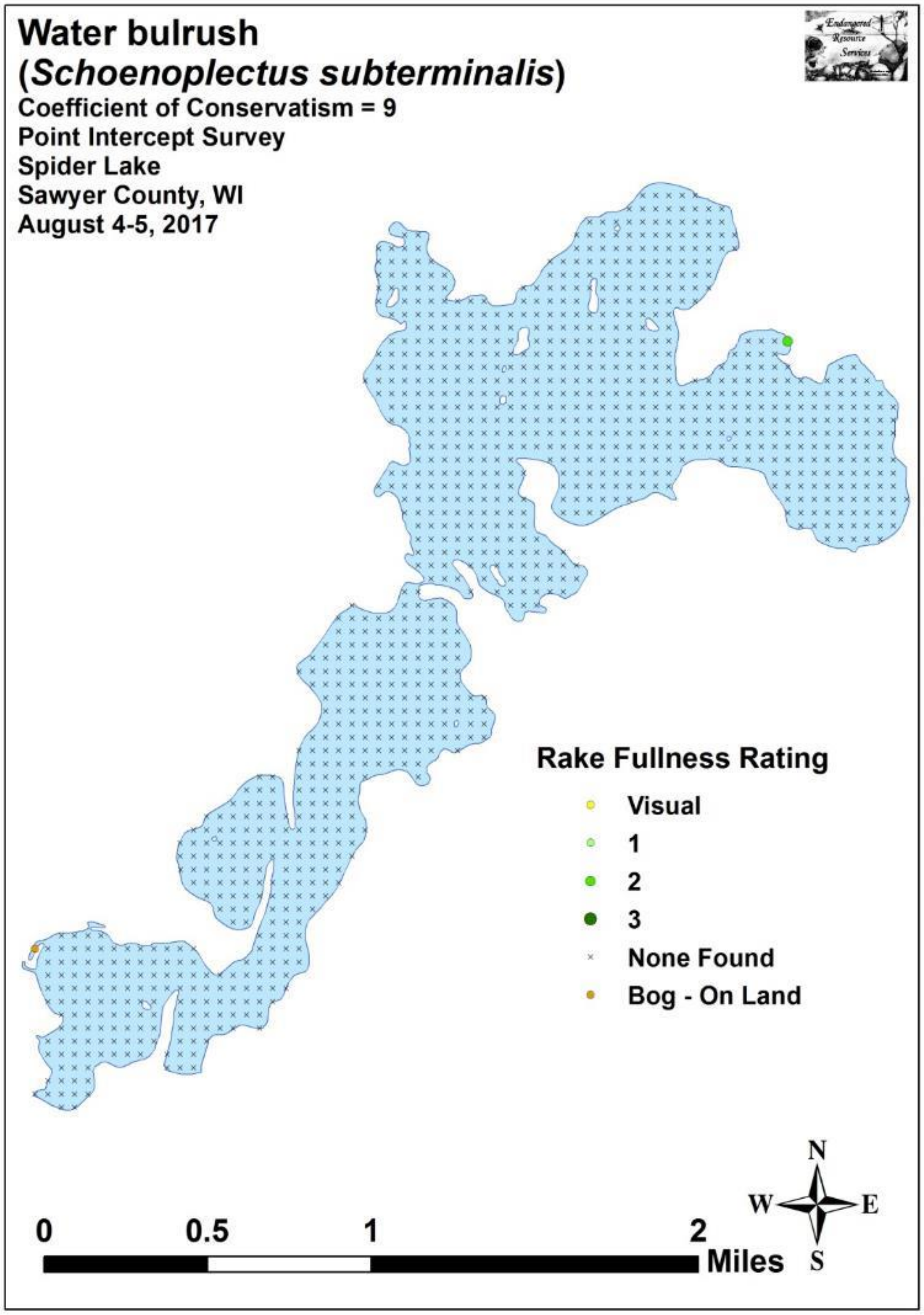

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

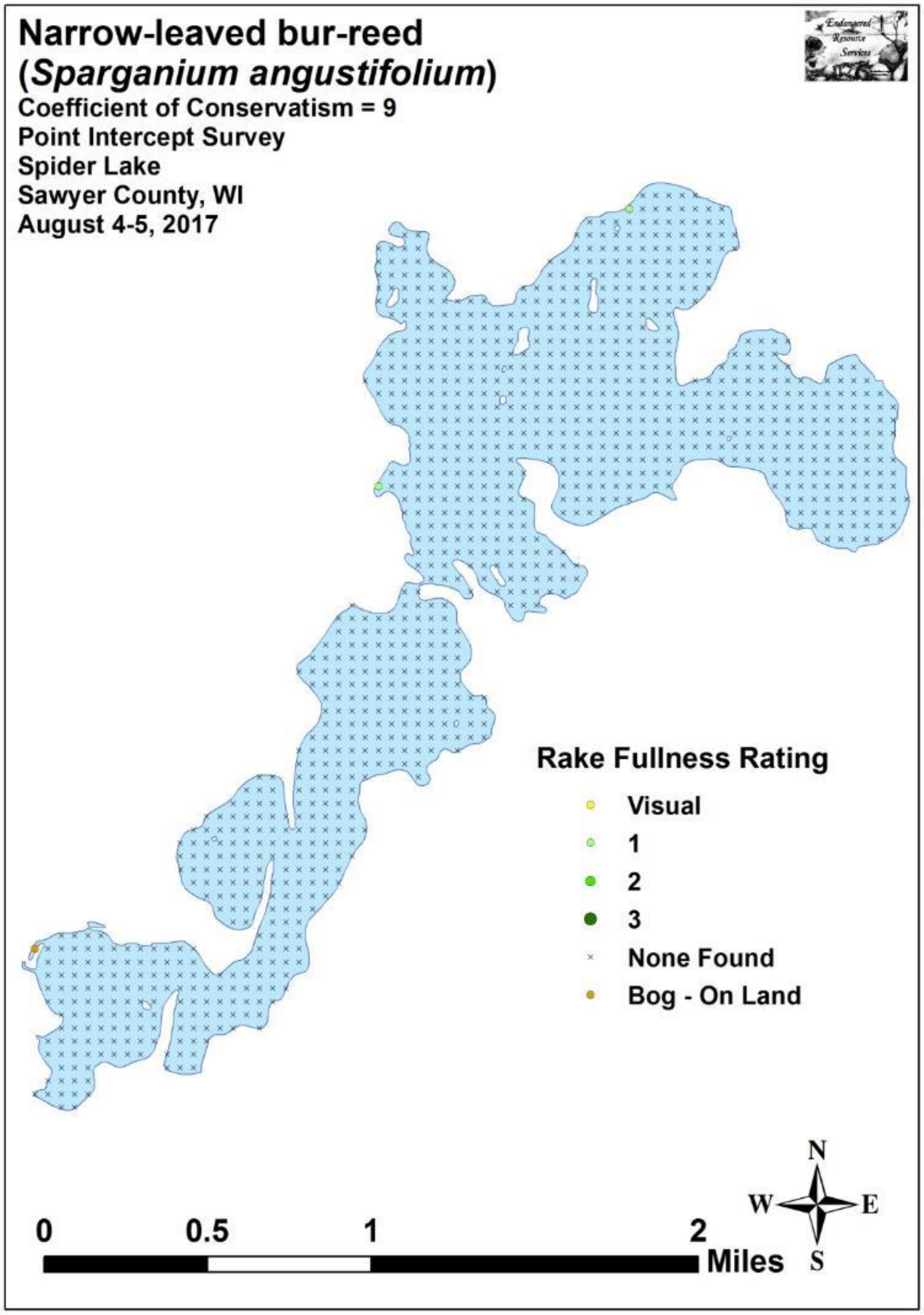

Creeping spearwort
(*Ranunculus flammula*)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

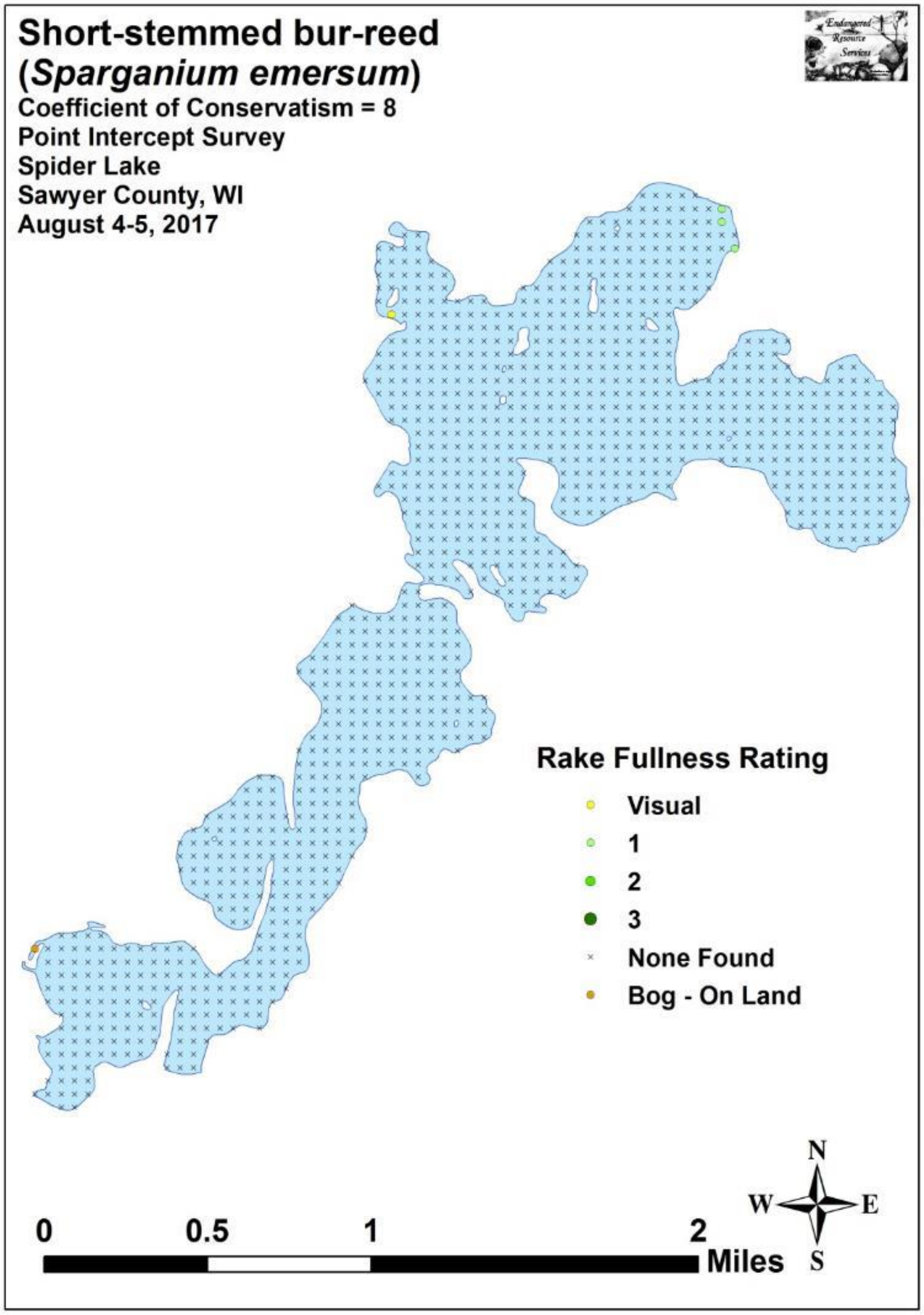


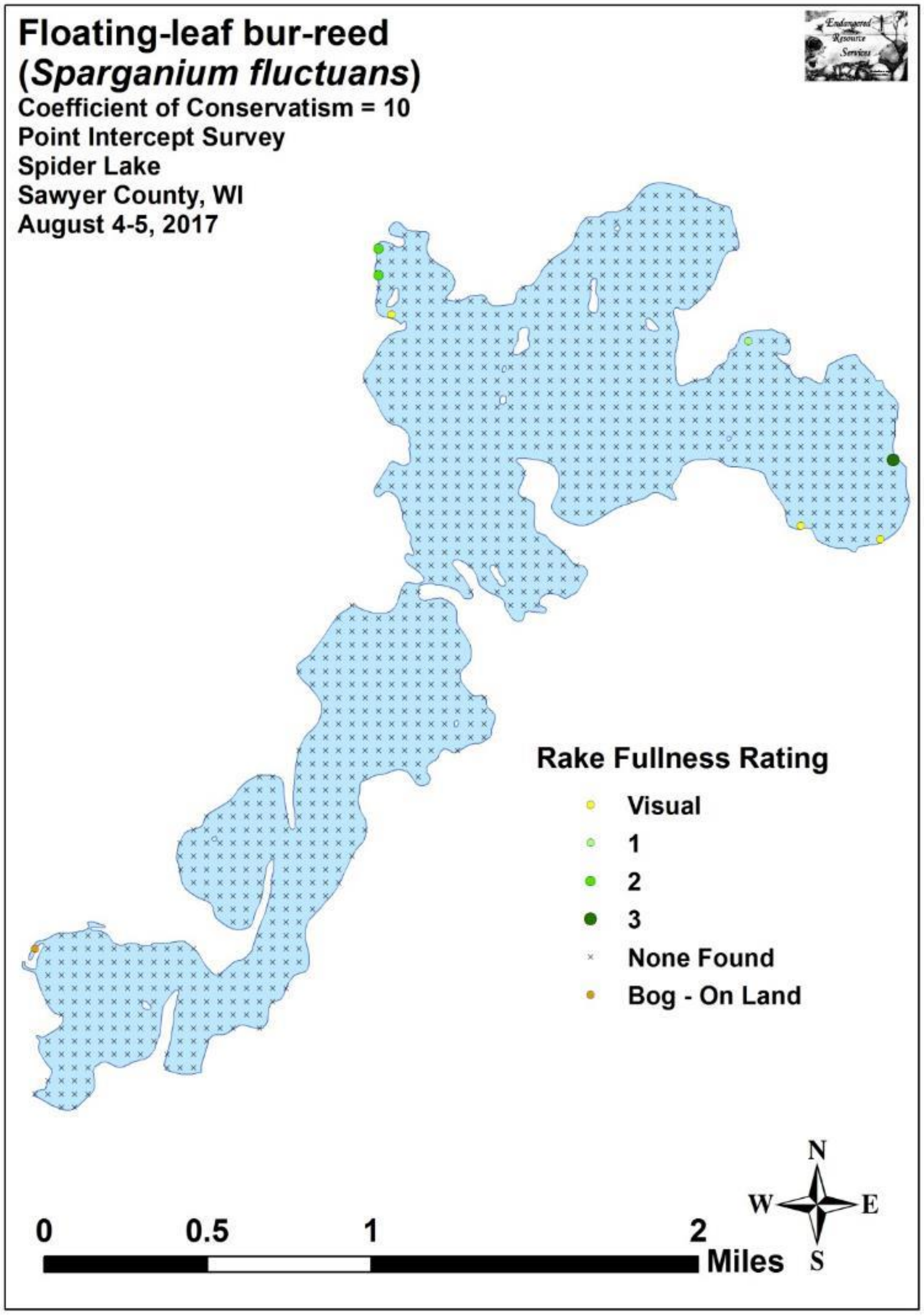
Crested arrowhead
(Sagittaria cristata)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

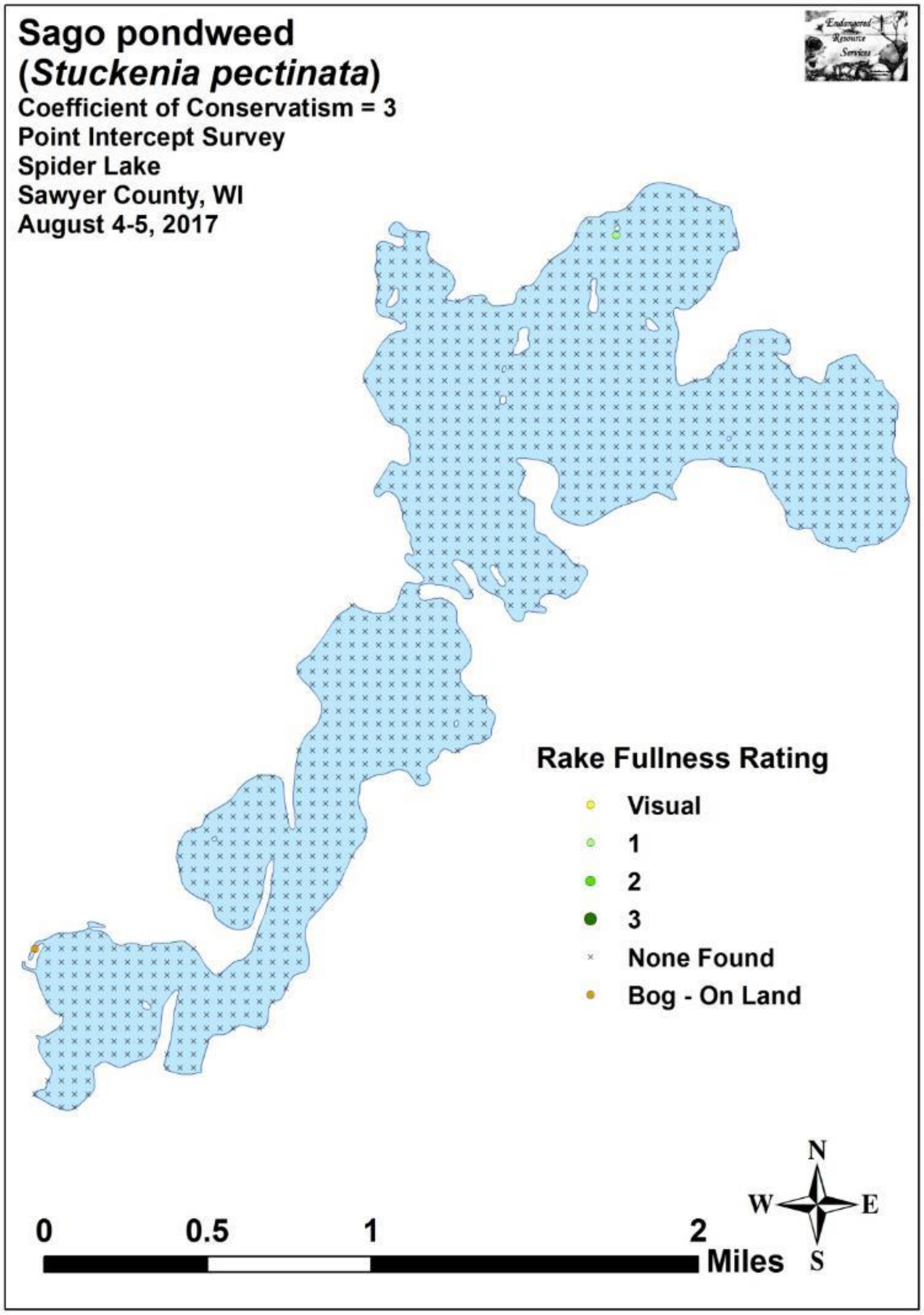

Hardstem bulrush
(Schoenoplectus acutus)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

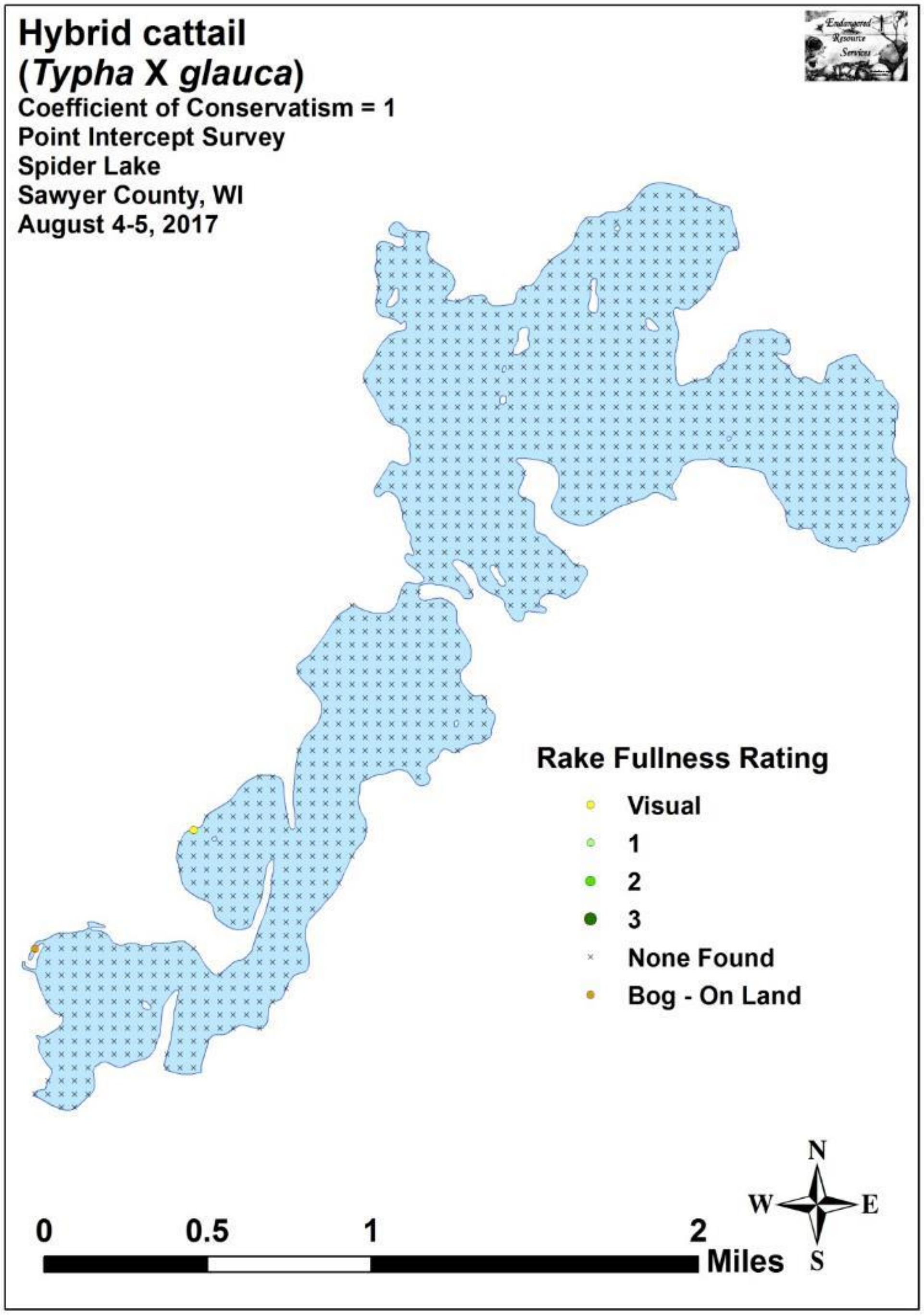

Water bulrush
(Schoenoplectus subterminalis)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

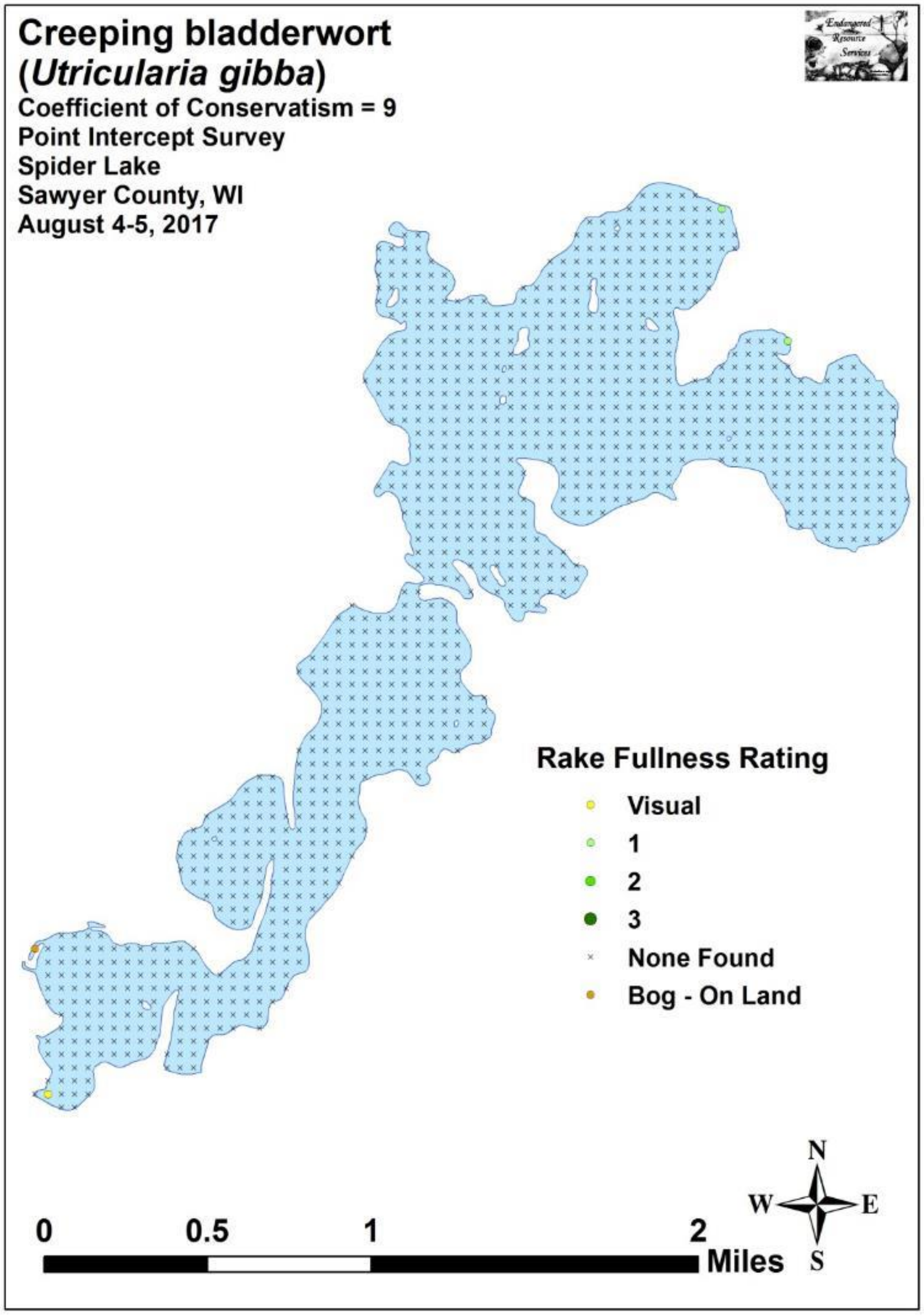

Narrow-leaved bur-reed
(Sparganium angustifolium)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

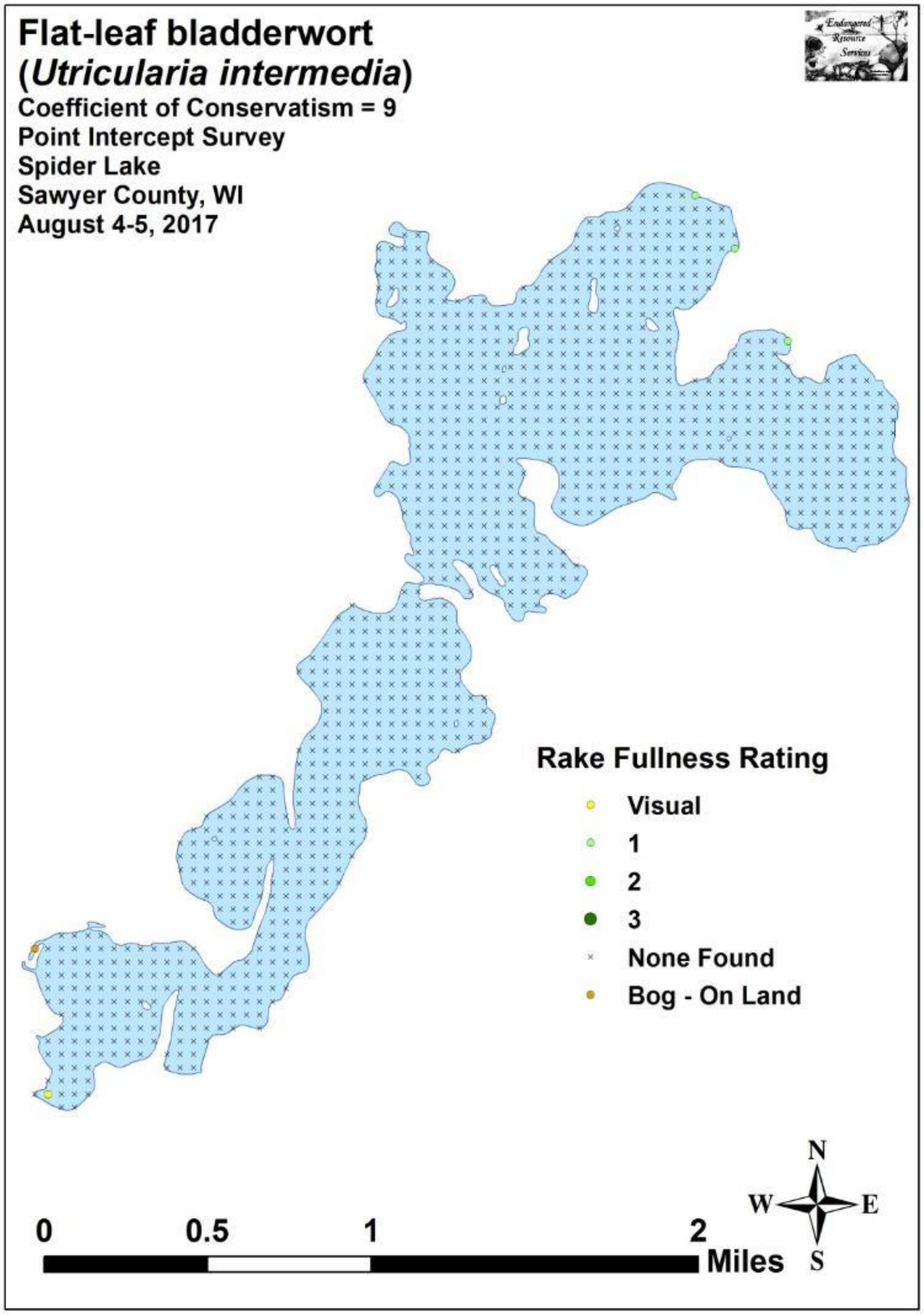

Short-stemmed bur-reed
(Sparganium emersum)
Coefficient of Conservatism = 8
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

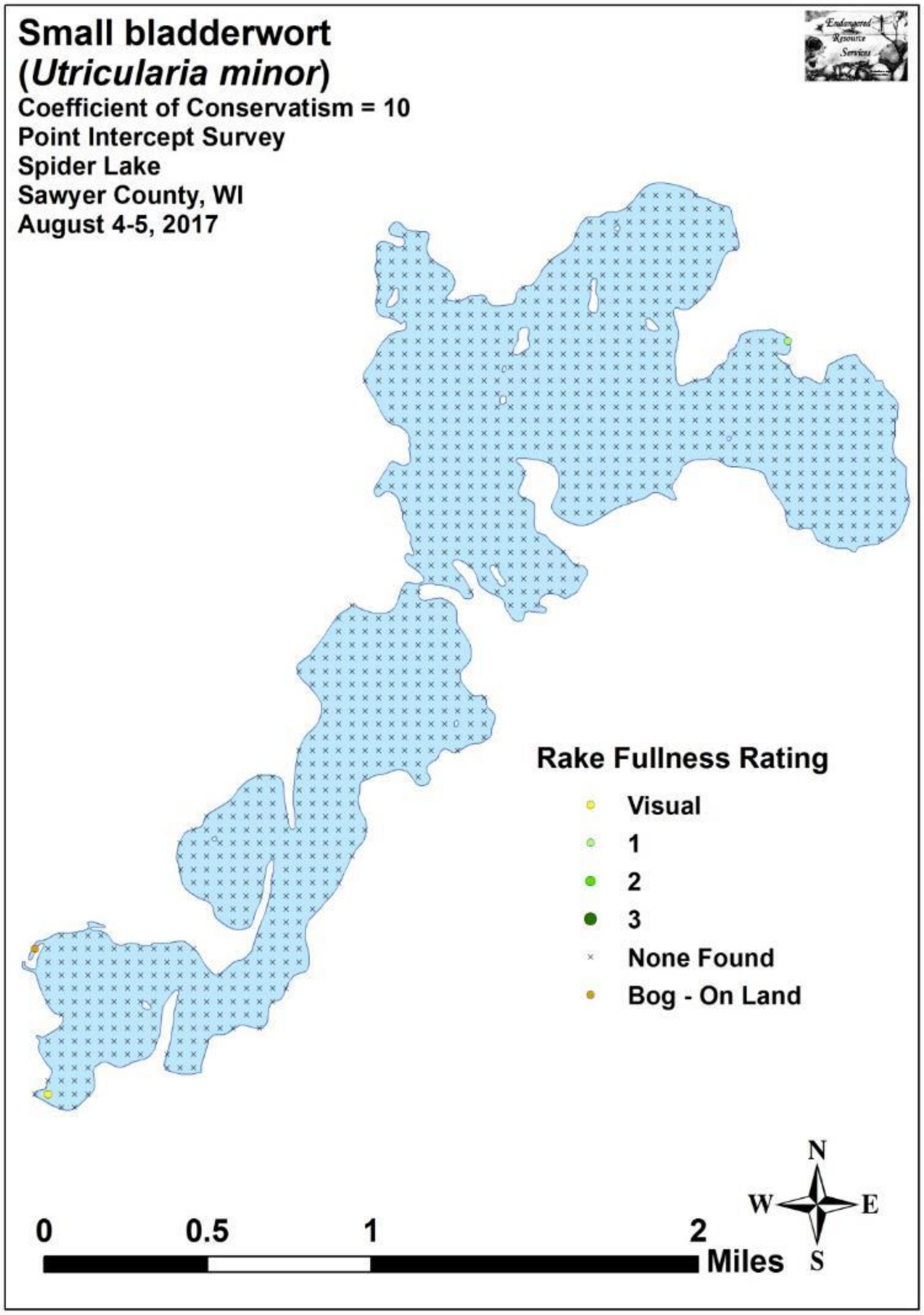

Floating-leaf bur-reed
(Sparganium fluctuans)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

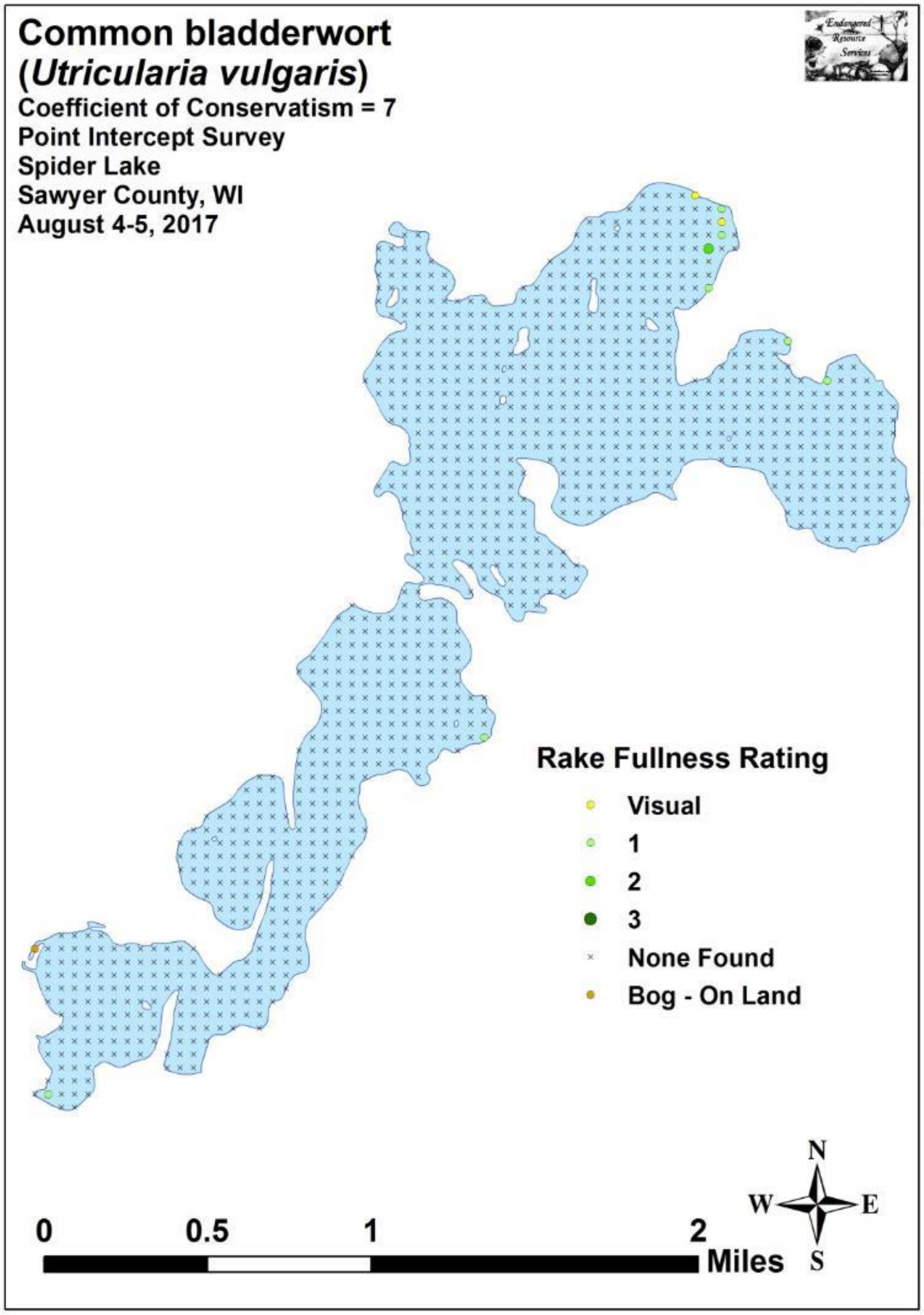

Sago pondweed
(*Stuckenia pectinata*)
Coefficient of Conservatism = 3
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles


Hybrid cattail
(Typha X glauca)
Coefficient of Conservatism = 1
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

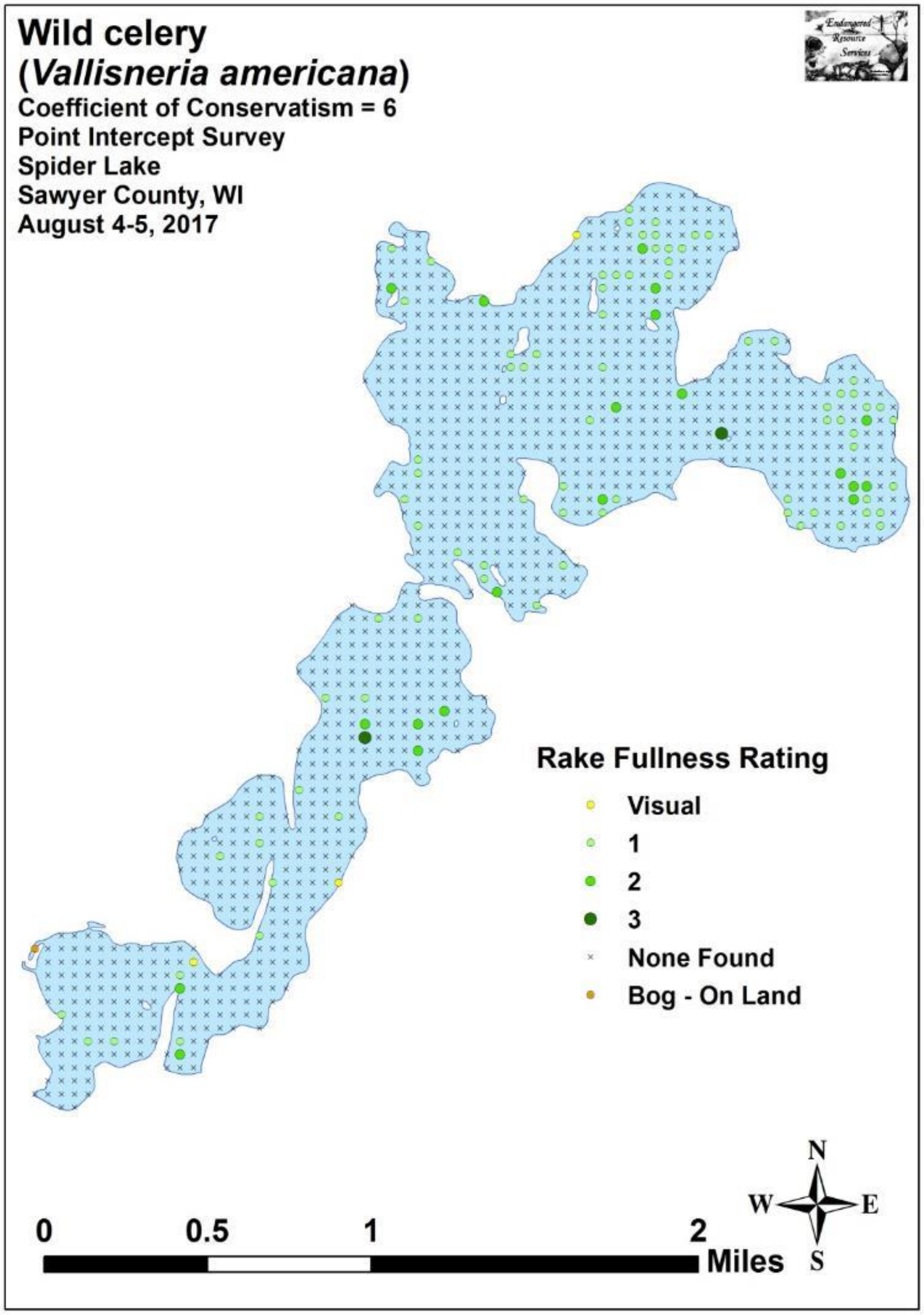

Creeping bladderwort
(Utricularia gibba)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Flat-leaf bladderwort
(Utricularia intermedia)
Coefficient of Conservatism = 9
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Small bladderwort
(Utricularia minor)
Coefficient of Conservatism = 10
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles



Common bladderwort
(*Utricularia vulgaris*)
Coefficient of Conservatism = 7
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
0
0.5
1
2
Miles
N
W
E
S


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point Intercept Survey
Spider Lake
Sawyer County, WI
August 4-5, 2017
Rake Fullness Rating
Visual
1
2
3
None Found
Bog - On Land
N
W
E
S
0
0.5
1
2
Miles

Appendix X: Aquatic Exotic Invasive Plant Species Information

Eurasian Water-milfoil

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

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

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

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

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

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

Curly-leaf pondweed

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

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

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

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

Reed canary grass

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

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

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

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

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

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

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

Purple loosestrife

(Photo Courtesy Brian M. Collins)

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

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

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

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

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

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

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

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

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

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

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

Aquatic:
: organisms that live in or frequent water.

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

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

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

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

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

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

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

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

Limnology:
: the study of inland lakes and waters.

Littoral:

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

Macrophytes:

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

Nutrients:

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

Organic Matter:

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

Photosynthesis:

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

Phytoplankton:

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

Plankton:

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

ppm:

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

Richness:

number of species in a particular community or habitat.

Rooted Aquatic Plants:

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

Runoff:

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

Secchi Disc:

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

Seepage lakes:

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

Turbidity:

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

Watershed:

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

Zooplankton:

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

Appendix XII: 2017 Raw Data Spreadsheets