Curly-leaf pondweed (*Potamogeton crispus*) Point-intercept and Bed Mapping Surveys, and Warm-water Point-intercept Macrophyte Survey Cranberry Lake - WBIC: 2741700 Bayfield County, Wisconsin

Cranberry Lake aerial photo showing encroaching bogs on south shore (2015)

Typical low-density rake of Slender naiad over marl – 8/1/23

Project Initiated by:

The Town of Barnes – Aquatic Invasive Species Committee,
Lake Education and Planning Services, LLC, and the
Wisconsin Department of Natural Resources (Grant AEPP66422)

Mink frog match pattern camouflage on Watershield and White water lily – 6/29/23

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June 29 and August 1, 2022

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ABSTRACT

Cranberry Lake (WBIC 2741700) is a 131-acre drainage lake in southwest Bayfield County, WI. The lake is mesotrophic in nature with Secchi readings averaging 9.3ft from 2001-2021. A desire to determine if exotic species such as Curly-leaf pondweed (*Potamogeton crispus*) (CLP) or Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) had invaded the lake; and to establish baseline data on the richness, diversity, abundance, and distribution of other native aquatic plant populations prompted members of the Town of Barnes Aquatic Invasive Species Committee (TOB) to apply for a Wisconsin Department of Natural Resources (WDNR) lake planning grant to fund three plant surveys on the lake in 2022: early-season CLP point-intercept and bed mapping surveys on June 29, and a warm-water point-intercept survey of all aquatic plants on August 1, 2022. The June survey found no evidence of CLP or EWM in the lake. In August, we found the entire lake fell within the littoral zone, and macrophytes were growing at 254 of 284 survey points or approximately 89.4% of the total lake bottom. Overall diversity was moderately high with a Simpson Index value of 0.84. Richness was also moderately high with 42 species found in the rake. This total increased to 60 species when including visuals and plants found during the boat survey. Localized richness was low/moderate as we calculated a mean native species at sites with native vegetation of 2.20 species/site. We found that biomass at sites with vegetation was a moderate mean total rake fullness of 1.78. Slender naiad (*Najas flexilis*), Watershield (*Brasenia schreberi*), White water lily (*Nymphaea odorata*), and Large-leaf pondweed (*Potamogeton amplifolius*) were the most widely-distributed macrophyte species. They were present at 80.71%, 18.90%, 17.32%, and 12.60% of survey points with vegetation; and, collectively, they accounted for 58.75% of the total relative frequency. The 40 native index species found in the rake during the point-intercept survey produced a mean Coefficient of Conservatism of 6.5 and a Floristic Quality Index of 41.3. When compared to other lakes in the Northern Lakes and Forest Ecoregion, Cranberry Lake was below the average mean C of 6.7, but much above the median FQI of 24.3. Northern wild rice (*Zizania palustris*), a plant of significant wildlife and cultural value, was present at a single point with a rake fullness of 2. We also recorded it as a visual at two points. In total, we estimated there were perhaps a few hundred plants in the lake's southeast bay. By August, most were goose-cropped, and it was questionable if any would set significant grain. Because of this and the overall low density, there were no areas on the lake that were fit for human harvest. Filamentous algae were not found at any point. A large bed of Common forget-me-not (*Myosotis scorpioides*) in a cold-water seep on the lake's southeast shoreline was the only exotic plant species found in or adjacent to the lake. Future management considerations include preserving the lake's high quality native plant communities; and working to maintain water clarity and limit nutrient inputs along the lakeshore by such things as establishing buffer strips of native vegetation, eliminating fertilizer applications, bagging grass clippings, removing pet waste, disposing of fire pit ash away from the lake, maintaining septic systems, and avoiding motor startups in shallow water.

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INTRODUCTION:

Cranberry Lake (WBIC 2741700) is a 131-acre drainage lake in southwest Bayfield County, Wisconsin in the Towns of Barnes (T44N R9W S30). It reaches a maximum depth of 12ft in the narrow trench in the center of the lake and has an average depth of approximately 3ft. The lake is mesotrophic in nature with summer Secchi readings averaging 9.3ft from 2001-2021 (the most recent year data was available) (WDNR 2022). This good clarity produced a littoral zone that included the entire lake in 2022. The bottom is dominated by sandy muck with a ring of sand and gravel along most of the immediate shoreline (Holt et al. 1970) (Figure 1).

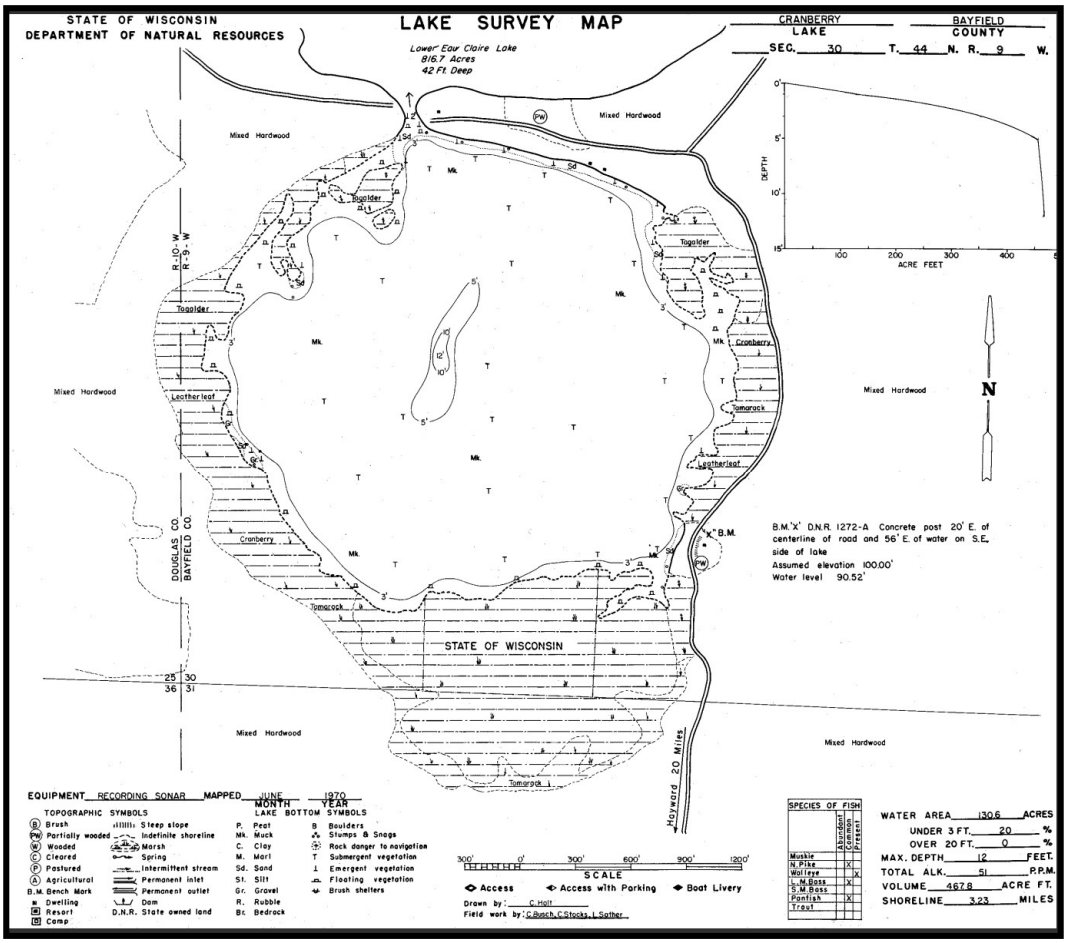


Figure 1: Cranberry Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

In 2005, concern over the spread of Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) into nearby Tomahawk and Sand Bar Lakes prompted members of the Town of Barnes Aquatic Invasive Species Committee (then the Eurasian water-milfoil Committee) and the Eau Claire Lakes Area Property Owners Association (ECLAPOA) to authorize an initial point-intercept survey to look for exotic plant species in Lower Eau Claire Lake which is connected to Cranberry Lake by a narrow channel. This survey did **not** find EWM, Curly-leaf pondweed (*Potamogeton crispus*) (CLP), or any other exotic species in Lower Eau Claire Lake (Kudlas et al. – pers. comm.).

In an effort to determine if both Lower Eau Claire and Cranberry Lake remained free of these harmful exotic species, the TOB applied for and received a Wisconsin Department of Natural Resources (WDNR) lake planning grant that authorized three plant surveys on each lake in 2022: June Curly-leaf pondweed point-intercept and bed mapping surveys and an August warm-water point-intercept survey of all macrophyte species. The goals of these studies were to look for and, if found, quantify the density and distribution of any exotic species; and to gather baseline data on the richness, diversity, abundance, distribution, and density of the lake's native vegetation. This report is the summary analysis of the surveys conducted on Cranberry Lake on June 29 and August 1, 2022.

METHODS:

Curly-leaf Pondweed Point-intercept Survey:

Using a standard formula that takes into account the shoreline shape and distance, water clarity, depth, and total acreage, Michelle Nault (WDNR) generated a 284-point sampling grid for Cranberry Lake (Appendix I). Using this grid, we completed a density survey where we sampled for Curly-leaf pondweed at each point in and adjacent to the lake's littoral zone. We located each survey point using a handheld mapping GPS unit (Garmin 76CSx) and used a rake to sample an approximately 2.5ft section of the bottom. When found, CLP was assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also noted visual sightings of CLP within six feet of the sample point.

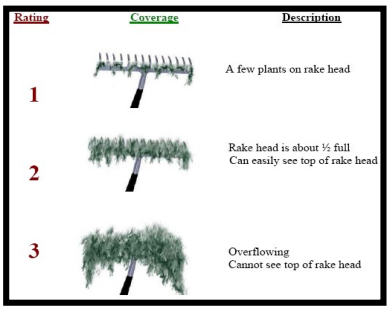


Figure 2: Rake Fullness Ratings (UWEX 2010)

Curly-leaf Pondweed Bed Mapping Survey:

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 Curly-leaf pondweed 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 depth range and mean 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.

Warm-water Full Point-intercept Macrophyte Survey:

Prior to beginning the August point-intercept survey, we conducted a general boat survey to gain familiarity with the lake's macrophytes. All plants found were identified (Voss 1996, Boreman et al. 1997; Chadde 2012; Crow and Hellquist 2005; Skawinski 2019), a datasheet was built from the species present, and two vouchers were collected to be pressed and mounted for herbarium specimens – one to be retained by the lake association, and one to be sent to the state herbarium the University of Wisconsin - Stevens Point for identification confirmation (Appendix II).

During the survey, we again located each survey point with a GPS, recorded a depth reading using a metered pole, 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 WDNR aquatic plant management 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 or kayak.

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. Although 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 WDNR 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 1).

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 (Table 2).

Relative frequency example:

Suppose that we sample 100 points and found four 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 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. Cranberry Lake is in the Northern Lakes and Forests Ecoregion (Table 3).

**** 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.**

RESULTS:

Curly-leaf Pondweed Point-intercept Survey:

On June 29h, we surveyed transects covering 13.4km (8.3 miles) throughout the lake, and took a rake sample at all 284 points (Figure 3) (Appendix III). We saw no evidence of Curly-leaf pondweed, Eurasian water-milfoil, or Yellow iris (*Iris pseudacorus*).

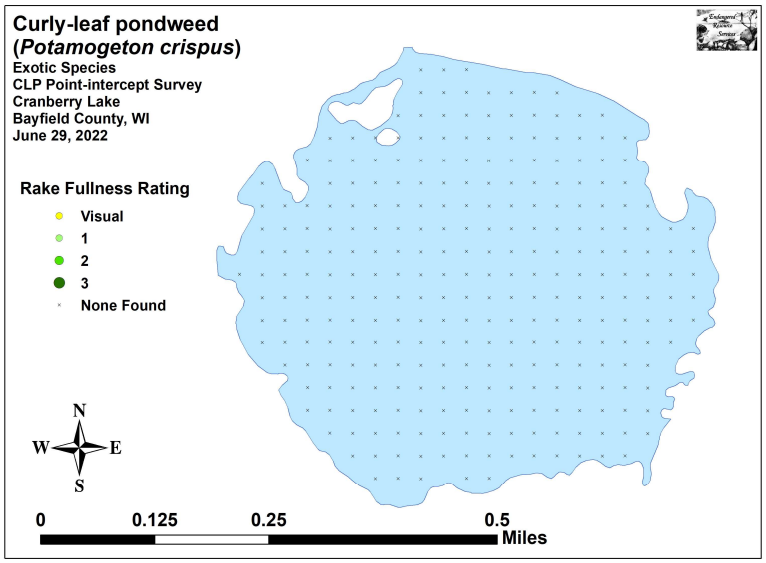


Figure 3: June Curly-leaf Pondweed Density and Distribution

Warm-water Full Point-intercept Macrophyte Survey:

Depth readings taken at Cranberry Lake's 284 survey points (Appendix I) revealed the majority of the lake was a 2-4ft flat (Figure 4). The only exception to this was a narrow north/south 10ft+ trench in the middle of the lake that appeared to be centered around at least one spring hole (Appendix IV).

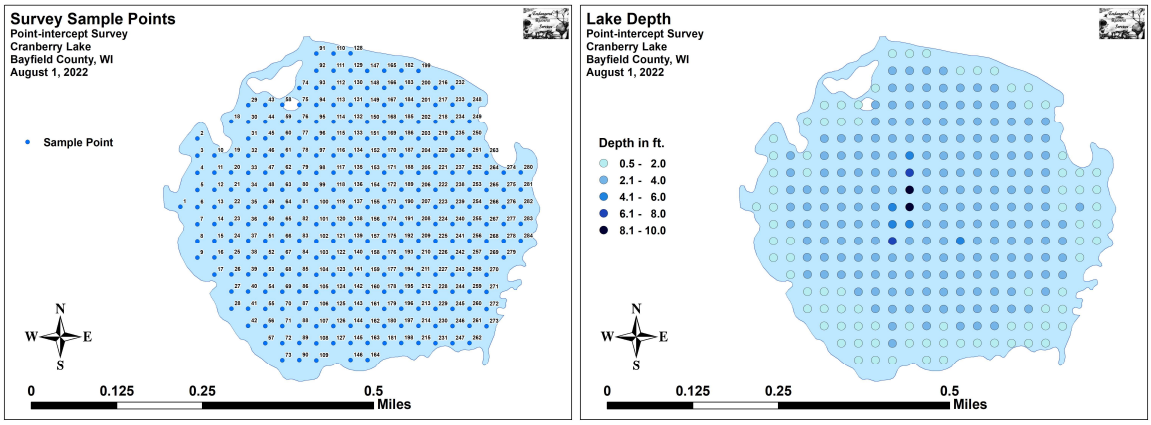


Figure 4: Survey Sample Points and Lake Depth

We categorized the bottom substrate as 89.1% as sandy, marly, and organic muck (253 points) and 10.9% pure sand (31 points) (Figure 5) (Appendix IV). The majority of areas along the immediate shoreline were pure sand, although there were a few gravel patches on the western shoreline. With increasing depth, most areas transition to sandy or marly muck. Almost all nutrient-rich organic muck occurred on the lake's south shoreline where muck bogs were breaking free from the bottom.

The entire lake fell within the littoral zone, and we found plants growing at 254 points (Table 1) or approximately 89.4% of the total lake bottom (Figure 5) (Appendix V). Overall plant colonization was slightly skewed to shallow water as the mean depth of 2.6ft was less than the median depth of 3.0ft (Figure 6).

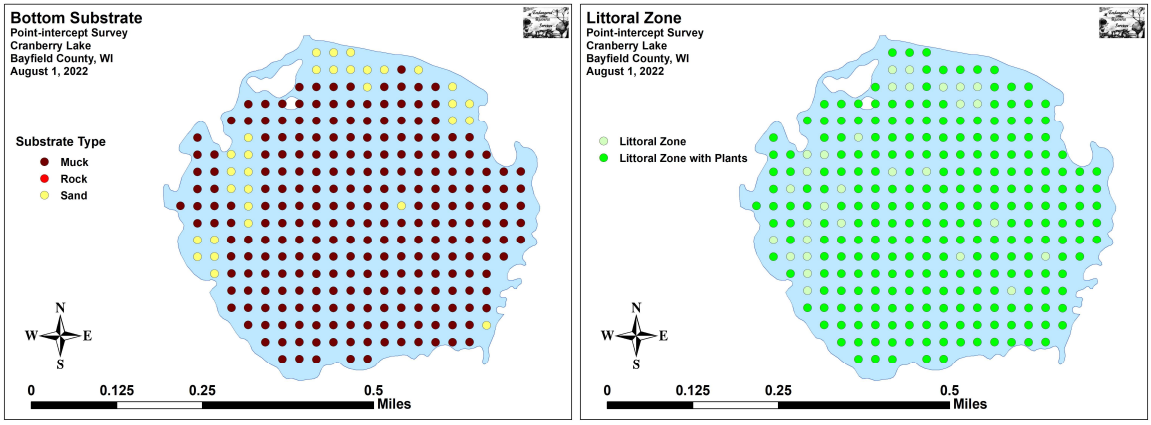


Figure 5: Bottom Substrate and Littoral Zone

Table 1: Aquatic Macrophyte P/I Survey Summary Statistics
Cranberry Lake – Bayfield, Wisconsin
August 1, 2022

Summary Statistics:

Total number of points sampled	284
Total number of sites with vegetation	254
Total number of sites shallower than the maximum depth of plants	284
Frequency of occurrence at sites shallower than maximum depth of plants	89.4
Simpson Diversity Index	0.84
Number of sites sampled using rake on Rope (R)	0
Number of sites sampled using rake on Pole (P)	284
Maximum depth of plants (ft)	10.0
Mean depth of plants (ft)	2.6
Median depth of plants (ft)	3.0
Average number of all species per site (shallower than max depth)	1.97
Average number of all species per site (veg. sites only)	2.20
Average number of native species per site (shallower than max depth)	1.97
Average number of native species per site (sites with native veg. only)	2.20
Species richness	42
Species richness (including visuals)	51
Species richness (including visuals and boat survey)	60
Mean total rake fullness (veg. sites only)	1.78

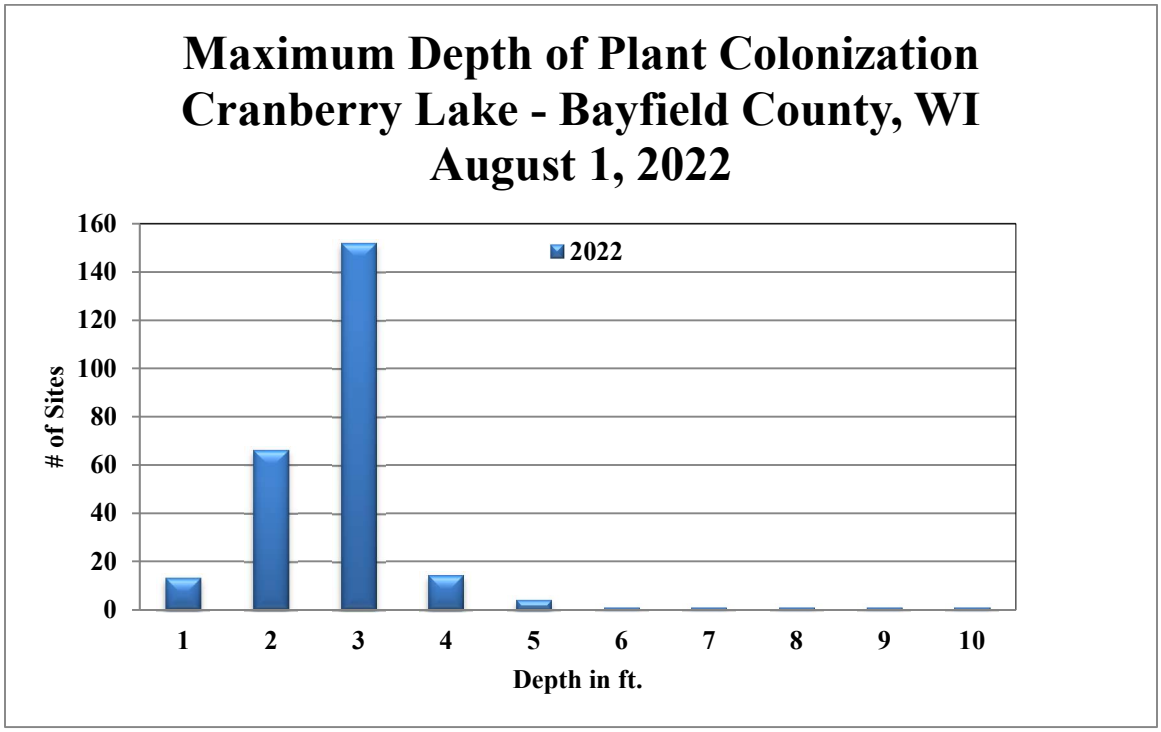


Figure 6: Plant Colonization Depth Chart

Plant diversity was moderately high with a Simpson Index value of 0.84. Richness was also moderately high with 42 species found in the rake. This total increased to 60 species when including visuals and plants seen during the boat survey. Localized richness was low/moderate as we calculated a mean native species at sites with native vegetation of 2.20 species/site. We noted that most high richness areas were nearshore on and between the muck bogs that dominated the lake's southern shoreline. On the marly muck flats that covered the majority of the rest of the lake, we found few sites had more than two species present (Figure 7) (Appendix V).

We found that biomass at sites with vegetation was a moderate mean total rake fullness of 1.78. Similar to localized richness, visual analysis of the map showed most nearshore areas over organic muck had dense plant growth, while most areas over marly muck had low to moderate plant densities (Figure 7) (Appendix V).

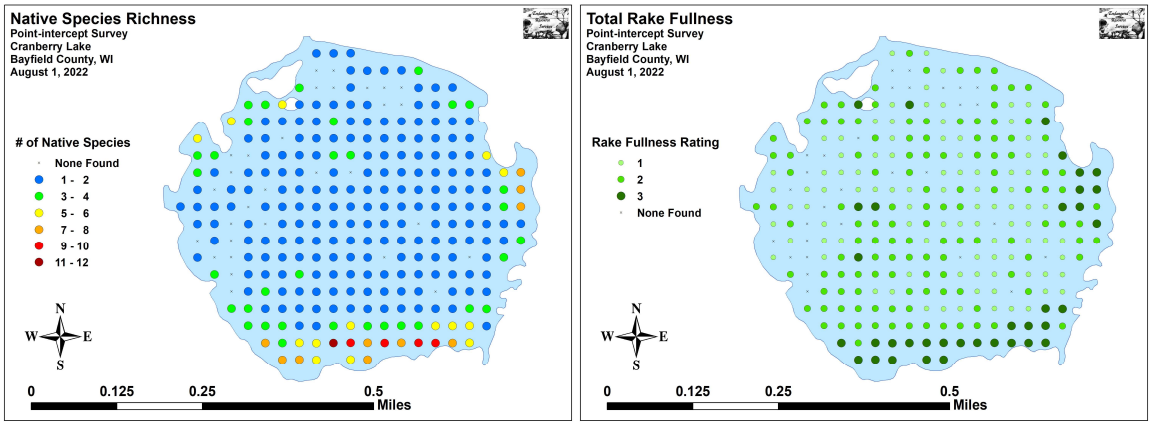


Figure 7: Native Species Richness and Total Rake Fullness

Cranberry Lake Plant Community:

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

In shallow areas, beds of emergent plants prevent erosion by stabilizing the shoreline, 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.

At the immediate shoreline, Bluejoint (*Calamagrostis canadensis*) and Sweet gale (*Myrica gale*) were common at the waterline on undeveloped sandy lakeshores. On boggy margins where the soil was a more nutrient-rich organic muck, we also found Narrow-leaved woolly sedge (*Carex lasiocarpa*), Bald spikerush (*Eleocharis erythropoda*), Northern blue flag (*Iris versicolor*), Canada rush (*Juncus canadensis*), Common arrowhead (*Sagittaria latifolia*), and Broad-leaved cattail (*Typha latifolia*).

Bluejoint (Routledge 2013)

Sweet gale (Devlin 2016)

Narrow-leaved wooly sedge (Navratil 2016)

Bald spikerush (Schipper 2019)

Northern blue flag (Tracey 2007)

Canada rush (Eggers 2007)

Common arrowhead (Young 2010)

Broad-leaved cattail (Raymond 2011)

Over shallow gravel and sand flats, the emergent community was dominated by Creeping spikerush (*Eleocharis palustris*) and Hardstem bulrush (*Schoenoplectus acutus*). Scattered among them, we also found small beds of Common yellow lake sedge (*Carex utriculata*), Smooth saw-grass (*Cladium mariscoides*), Common reed (*Phragmites australis americanus*), and Torrey's three-square bulrush (*Schoenoplectus torreyi*).

Creeping spikerush (Legler 2016)

Hardstem bulrush (Elliot 2007)

Common yellow lake sedge (Lavin 2011)

Smooth saw-grass (Perlman 2011)

American common reed (Chayka 2016)

Torrey's three-square bulrush (Rothrock 2018)

As the substrate transitioned to sandy muck, these species were joined by Three-way sedge (*Dulichium arundinaceum*) and Water horsetail (*Equisetum fluviatile*). Growing in the soft muck and silt next to cold-water seeps, we found beds of Common forget-me-not (*Myosotis scorpioides*); and, scattered on and around the muck bogs in the south bay, we found scattered patches of Water bulrush (*Schoenoplectus subterminalis*), Softstem bulrush (*Schoenoplectus tabernaemontani*), and Northern wild rice (*Zizania palustris*).

Three-way sedge (GMNRI 2016)

Water horsetail (Dziak 2005)

Common forget-me-not (Raymond 2011)

Water bulrush (Dziuk 2016)

Softstem bulrush (Schwarz 2011)

Northern wild rice flower (Haines 2018)

Just beyond the emergents, pure sand and marly muck areas seldom provided enough nutrients for floating-leaf species. In this environment, we found Variable pondweed (*Potamogeton gramineus*) occasionally produced floating leaves. We also found a few scattered beds of Northern manna grass (*Glyceria borealis*), Narrow-leaved bur-reed (*Sparganium angustifolium*), and Floating-leaf bur-reed (*Sparganium fluctuans*) with their long ribbon-like leaves growing in these areas.

Variable pondweed – with and without floating leaves (Koshere 2002)

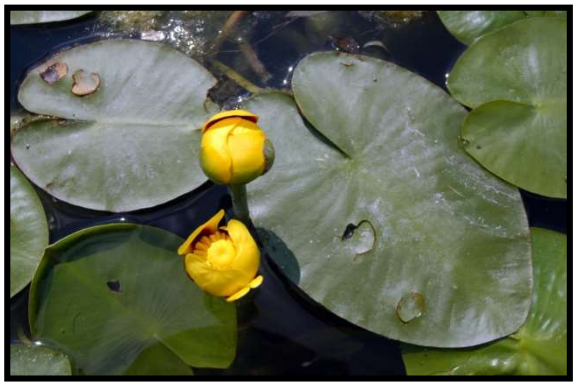
Northern manna-grass (Fewless 2010)

Narrow-leaved bur-reed (Schouh 2006)

Floating-leaf bur-reed (Sullman 2009)

When these shallow areas had at least a thin layer of sandy or organic muck, they were often dominated by the floating-leaf species Watershield (*Brasenia schreberi*), Spatterdock (*Nuphar variegata*), White-water lily (*Nymphaea odorata*), and Water smartweed (*Polygonum amphibium*).

Watershield (WED 2019)



Spatterdock (CBG 2014)

White water lily (Falkner 2009)

Water smartweed (Someya 2009)

In and around the muck bogs in the southern bays, we also found lesser amounts of Alpine pondweed (*Potamogeton alpinus*), Large-leaf pondweed (*Potamogeton amplifolius*), Ribbon-leaf pondweed (*Potamogeton epihydrus*), Floating-leaf pondweed (*Potamogeton natans*), Short-stemmed bur-reed (*Sparganium emersum*), and Small bur-reed (*Sparganium natans*). The protective canopy cover all these species provide is often utilized by panfish and bass.

Alpine pondweed (Holm 2016)

Large-leaf pondweed (Dziuk 2018)

Ribbon-leaf pondweed (Petroglyph 2007)

Floating-leaf pondweed (Petroglyph 2007)

Short-stemmed bur-reed (Cameron 2016)

Small bur-reed (Taylor 2004)

Primarily in the far corners of the southern bay, we documented a few scattered Small duckweed (*Lemna minor*) and Large duckweed (*Spirodela polyrhiza*) drifting between these larger floating-leaf species. More typical of nutrient-rich systems, the "duckweeds" were predictably rare in Cranberry Lake.

Small duckweed (Kramer 2013)

Large duckweed (Thomas 2014)

This environment also supported the submergent species Whorled water-milfoil (*Myriophyllum verticillatum*) and Leafy pondweed (*Potamogeton foliosus*) as well as a variety of carnivorous plants including Creeping bladderwort (*Utricularia gibba*), Flat-leaf bladderwort (*Utricularia intermedia*), Small bladderwort (*Utricularia minor*), and Common bladderwort (*Utricularia vulgaris*). 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.

Whorled water-milfoil (Cameron 2018)

Leafy pondweed (Kleinman 2009)

Creeping bladderwort showing bladders for catching prey (Eyewed 2010)

Flat-leaf bladderwort (Woods 2012)

Small bladderwort (Cameron 2019)

Common bladderwort flowers among lilypads (Hunt 2010)

Just beyond the emergents, in water up to 5ft deep, shallow sugar sand and gravel areas tended to have low total biomass as these nutrient-poor substrates provide habitat most suited to fine-leaved "isoetid" turf-forming species. In this environment, we documented Muskgrass (*Chara* sp.), Needle spikerush (*Eleocharis acicularis*), Variable pondweed, and Crested arrowhead (*Sagittaria cristata*). All of these "turf" species, along with the emergents, stabilize the bottom and prevent wave action erosion.

Muskgrass (Gibbons 2012)

Needle spikerush (Fewless 2005)

Variable pondweed – submergent leaves (Cameron 2018)

Crested arrowhead (Fewless 2004)

In shallow marly muck, Slender naiad (*Najas flexilis*) dominated the plant community with only scattered Large-leaf pondweed and Stiff pondweed (*Potamogeton strictifolius*) mixed in. Areas with sandy muck tended to support slightly broader-leaved species like Water star-grass (*Heteranthera dubia*), Northern water-milfoil (*Myriophyllum sibiricum*), Fries' pondweed (*Potamogeton friesii*), Clasping-leaf pondweed (*Potamogeton richardsonii*), Sago pondweed (*Stuckenia pectinata*), and Wild celery (*Vallisneria americana*). The roots, shoots, and seeds of these species are heavily utilized by both resident and migratory waterfowl for food. They also provide important habitat for the lake's fish throughout their lifecycles, as well as a myriad of invertebrates like scuds, dragonfly and mayfly nymphs, and snails.

Slender naiad (Apipp 2009)

Stiff pondweed (Andrews 2012)

Water star-grass (Mueller 2010)

Northern water-milfoil (Berg 2007)

Fries' pondweed (End 2012)

Clasping-leaf pondweed (Cameron 2014)

Sago pondweed (Hilty 2012)

Wild celery (Dalvi 2009)

In water up to 10ft deep over organic muck, the plant community was dominated by Water marigold (*Bidens beckii*), Coontail (*Ceratophyllum demersum*), Common waterweed (*Elodea canadensis*), Large-leaf pondweed, White-stem pondweed (*Potamogeton praelongus*), Small pondweed (*Potamogeton pusillus*), Fern pondweed (*Potamogeton robbinsii*), and Flat-stem pondweed (*Potamogeton zosteriformis*). Predatory fish like the lake's Musky (*Esox masquinongy*) and Northern pike (*Esox lucius*) are often found along the edges of these rich underwater forests waiting in ambush.

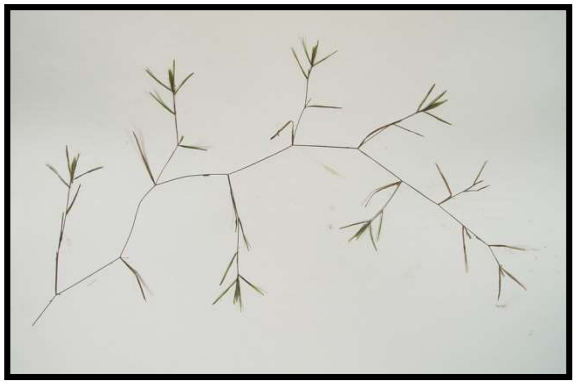
Water marigold (Dziuk 2012)

Coontail (Hassler 2011)

Common waterweed (Fischer 2005)

Large-leaf pondweed (Cameron 2022)

White-stem pondweed (Fewless 2005)



Small pondweed (Cameron 2021)

Fern pondweed (Apipp 2011)

Flat-stem pondweed (Dziuk 2019)

Plant Community Dominance:

When considering the lake as a whole, Slender naiad, Watershield, White water lily, and Large-leaf pondweed were the most widely-distributed macrophyte species (Figure 8). They were present at 80.71%, 18.90%, 17.32%, and 12.60% of survey points with vegetation respectively; and, collectively, they accounted for 58.75% of the total relative frequency (Table 2). Common bladderwort (4.11%) was the only other species with a relative frequency over 4.00% (Maps and species accounts for all plants are located in Appendixes VI and VII).

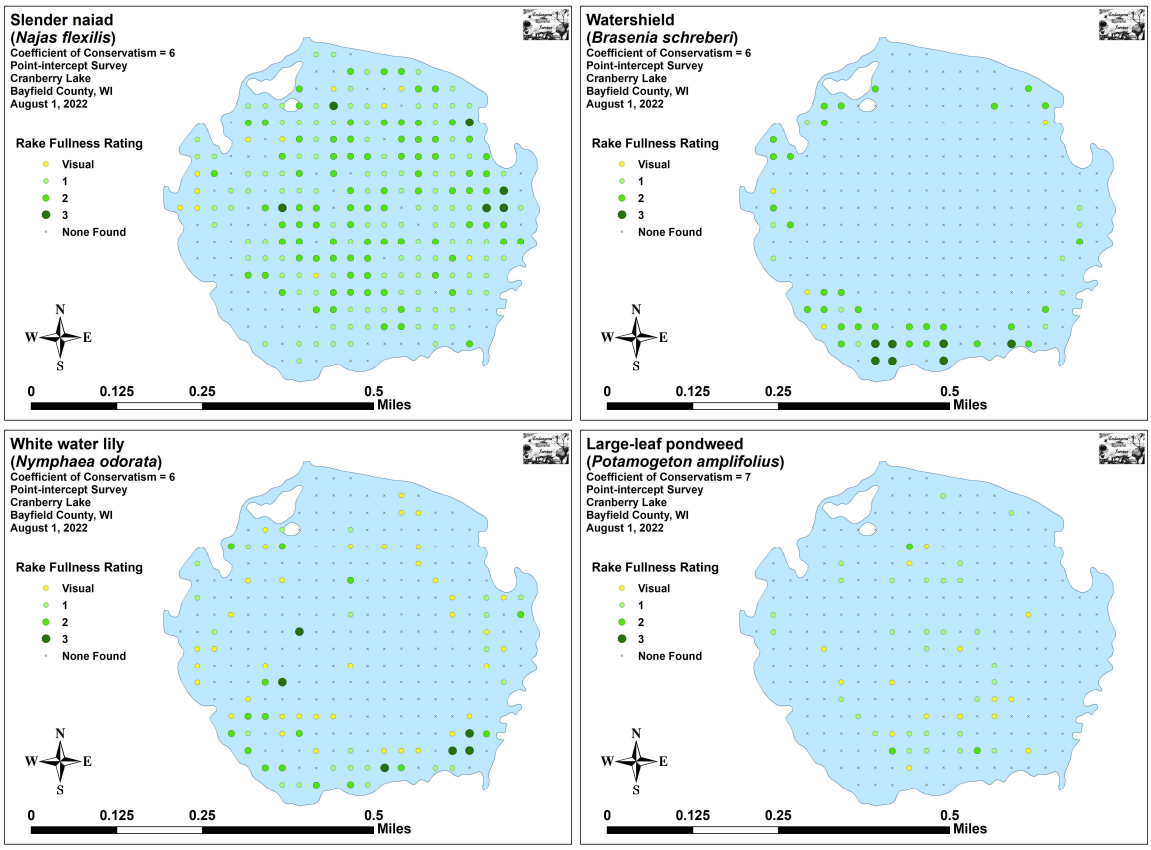


Figure 8: Cranberry Lake's Most Common Species

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Cranberry Lake – Bayfield County, Wisconsin
August 1, 2022

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Najas flexilis	Slender naiad	205	36.61	80.71	72.18	1.48	11
Brasenia schreberi	Watershield	48	8.57	18.90	16.90	1.94	4
Nymphaea odorata	White water lily	44	7.86	17.32	15.49	1.64	38
Potamogeton amplifolius	Large-leaf pondweed	32	5.71	12.60	11.27	1.09	15
Utricularia vulgaris	Common bladderwort	23	4.11	9.06	8.10	1.30	3
Chara sp.	Muskgrass	21	3.75	8.27	7.39	1.52	1
Schoenoplectus subterminalis	Water bulrush	21	3.75	8.27	7.39	1.48	2
Potamogeton robbinsii	Fern pondweed	20	3.57	7.87	7.04	1.40	3
Utricularia intermedia	Flat-leaf bladderwort	19	3.39	7.48	6.69	1.47	3
Utricularia minor	Small bladderwort	12	2.14	4.72	4.23	1.50	1
Utricularia gibba	Creeping bladderwort	10	1.79	3.94	3.52	1.10	0
Elodea canadensis	Common waterweed	9	1.61	3.54	3.17	1.22	1
Potamogeton natans	Floating-leaf pondweed	9	1.61	3.54	3.17	1.00	5
Vallisneria americana	Wild celery	8	1.43	3.15	2.82	1.25	1
	Freshwater sponge	8	*	3.15	2.82	1.00	0
Nuphar variegata	Spatterdock	7	1.25	2.76	2.46	1.57	4
Potamogeton pusillus	Small pondweed	7	1.25	2.76	2.46	1.00	1
Potamogeton zosteriformis	Flat-stem pondweed	7	1.25	2.76	2.46	1.00	0
Myriophyllum verticillatum	Whorled water-milfoil	6	1.07	2.36	2.11	1.33	1
Potamogeton gramineus	Variable pondweed	5	0.89	1.97	1.76	1.00	4
Sagittaria cristata	Crested arrowhead	5	0.89	1.97	1.76	1.40	2
Potamogeton alpinus	Alpine pondweed	4	0.71	1.57	1.41	1.50	0
Potamogeton foliosus	Leafy pondweed	4	0.71	1.57	1.41	1.75	0

*Excluded from relative frequency analysis

Table 2 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Cranberry Lake – Bayfield County, Wisconsin
August 1, 2022

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Bidens beckii	Water marigold	3	0.54	1.18	1.06	1.00	4
Eleocharis palustris	Creeping spikerush	3	0.54	1.18	1.06	1.67	1
Potamogeton friesii	Fries' pondweed	3	0.54	1.18	1.06	1.00	1
Schoenoplectus acutus	Hardstem bulrush	3	0.54	1.18	1.06	1.33	4
Sparganium natans	Small bur-reed	3	0.54	1.18	1.06	1.00	3
Eleocharis acicularis	Needle spikerush	2	0.36	0.79	0.70	1.50	0
Eleocharis erythropoda	Bald spikerush	2	0.36	0.79	0.70	1.50	0
Heteranthera dubia	Water star-grass	2	0.36	0.79	0.70	1.50	1
Potamogeton strictifolius	Stiff pondweed	2	0.36	0.79	0.70	1.00	1
Carex lasiocarpa	Narrow-leaved wooly sedge	1	0.18	0.39	0.35	2.00	0
Ceratophyllum demersum	Coontail	1	0.18	0.39	0.35	1.00	0
Myrica gale	Sweet gale	1	0.18	0.39	0.35	1.00	0
Myriophyllum sibiricum	Northern water-milfoil	1	0.18	0.39	0.35	1.00	2
Potamogeton praelongus	White-stem pondweed	1	0.18	0.39	0.35	1.00	1
Potamogeton richardsonii	Clasping-leaf pondweed	1	0.18	0.39	0.35	2.00	1
Sagittaria latifolia	Common arrowhead	1	0.18	0.39	0.35	1.00	2
Schoenoplectus tabernaemontani	Softstem bulrush	1	0.18	0.39	0.35	1.00	1
Sparganium emersum	Short-stemmed bur-reed	1	0.18	0.39	0.35	2.00	1
Typha latifolia	Broad-leaved cattail	1	0.18	0.39	0.35	1.00	1
Zizania palustris	Northern wild rice	1	0.18	0.39	0.35	2.00	2
	Aquatic moss	1	*	0.39	0.35	1.00	0

*Excluded from relative frequency analysis

Table 2 (continued): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Cranberry Lake – Bayfield County, Wisconsin
August 1, 2022

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Calamagrostis canadensis	Bluejoint	**	**	**	**	**	1
Carex utriculata	Common yellow lake sedge	**	**	**	**	**	1
Dulichium arundinaceum	Three-way sedge	**	**	**	**	**	2
Equisetum fluviatile	Water horsetail	**	**	**	**	**	1
Glyceria borealis	Northern manna grass	**	**	**	**	**	1
Phragmites australis americanus	Common reed	**	**	**	**	**	1
Potamogeton epihydrus	Ribbon-leaf pondweed	**	**	**	**	**	1
Sparganium angustifolium	Narrow-leaved bur-reed	**	**	**	**	**	1
Sparganium fluctuans	Floating-leaf bur-reed	**	**	**	**	**	1
Cladium mariscoides	Smooth sawgrass	***	***	***	***	***	***
Iris versicolor	Northern blue flag	***	***	***	***	***	***
Juncus canadensis	Canada rush	***	***	***	***	***	***
Lemna minor	Small duckweed	***	***	***	***	***	***
Myosotis scorpioides	**Common forget-me-not**	***	***	***	***	***	***
Polygonum amphibium	Water smartweed	***	***	***	***	***	***
Schoenoplectus torreyi	Torrey's three-square bulrush	***	***	***	***	***	***
Spirodela polyrhiza	Large duckweed	***	***	***	***	***	***
Stuckenia pectinata	Sago pondweed	***	***	***	***	***	***

Visual only * Boat survey only **Exotic species in bold**

Floristic Quality Index:

We identified a total of 40 **native index plants** in the rake during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.5 and a Floristic Quality Index of 41.3 (Table 3). Nichols (1999) reported an average mean C for the Northern Lakes and Forest Region of 6.7 putting Cranberry Lake slightly below average for this part of the state. The FQI was, however, much above the region's median FQI of 24.3 (Nichols 1999). Seven highly sensitive index plants of note included Alpine pondweed (C = 9), Crested arrowhead (C = 9), Water bulrush (C = 9), Small bur-reed (C = 9), Creeping bladderwort (C = 9), Flat-leaf bladderwort (C = 9), and Small bladderwort (C = 10). Six other high-value species found were either only recorded as visuals – Three-way sedge (C = 9), Narrow-leaved bur-reed (C = 9), and Floating-leaved bur-reed (C = 10) – or are not included in the index – Narrow-leaved wooly sedge (C = 9), Smooth sawgrass (C = 10), and ***Torrey's three-square bulrush (C = 9).

*** Torrey's three-square bulrush is a **Wisconsin State Species of Special Concern** - 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.

Table 3: Floristic Quality Index of Aquatic Macrophytes
Cranberry Lake – Bayfield County, Wisconsin
August 1, 2022

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 erythropoda	Bald spikerush	3
Eleocharis palustris	Creeping spikerush	6
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water star-grass	6
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Slender naiad	6
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Potamogeton alpinus	Alpine pondweed	9
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton foliosus	Leafy pondweed	6
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
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

Table 3 (continued): Floristic Quality Index of Aquatic Macrophytes
Cranberry Lake – Bayfield County, Wisconsin
August 1, 2022

Species	Common Name	C
Potamogeton zosteriformis	Flat-stem pondweed	6
Sagittaria cristata	Crested arrowhead	9
Sagittaria latifolia	Common arrowhead	3
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus subterminalis	Water bulrush	9
Schoenoplectus tabernaemontani	Softstem bulrush	4
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium natans	Small bur-reed	9
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
Zizania palustris	Northern wild rice	8
N		**40**
Mean C		**6.5**
FQI		**41.3**

Northern Wild Rice:

Northern wild rice, a plant of significant wildlife and cultural value, was present at a single point with a rake fullness of 2. We also recorded it as a visual at two points. In total, we estimated there were perhaps a few hundred plants in the lake's southeast bay. By August, most were goose-cropped, and it was questionable if any would set significant grain. Because of this and the overall low density, there were no areas on the lake that were fit for human harvest (Figure 9).

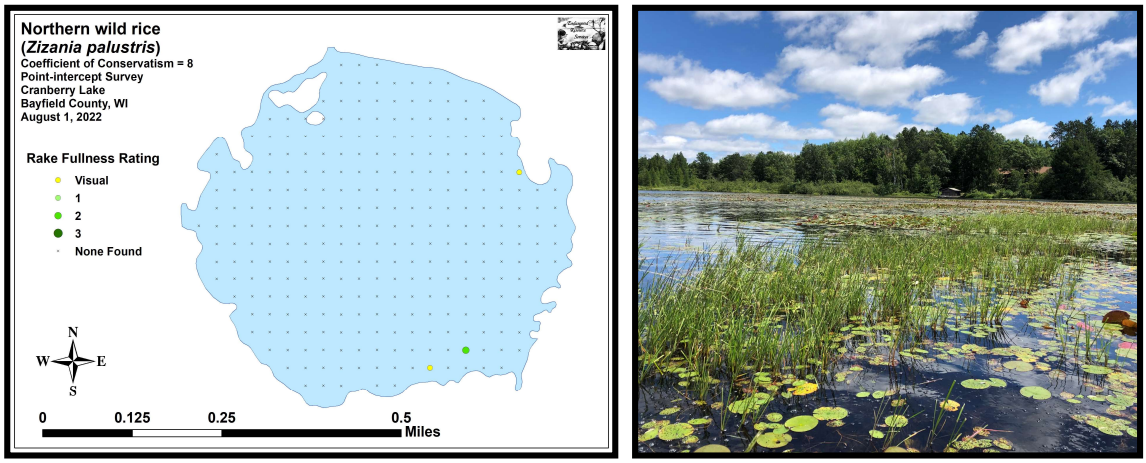


Figure 9: Northern Wild Rice Density and Distribution and Rice Bed West of the Creek Inlet on the Lake's Southeast Side

Filamentous Algae:

Filamentous algae are normally associated with excessive nutrients in the water column from such things as runoff, internal nutrient recycling, and failed septic systems. We saw no evidence of these algae anywhere in the lake (Figure 10).

Figure 10: Filamentous Algae Density and Distribution

Exotic Plant Species:

We did NOT find any evidence of Curly-leaf pondweed or Eurasian water-milfoil in Cranberry Lake during either of our surveys. However, we documented a large bed of Common forget-me-not in a shaded area where a cold-water spring was trickling in at the shoreline (Figure 11). As this type of preferred habitat appears to be rare on the lake, it is unlikely this species will ever be more common than it currently is or a cause for concern. By all other accounts, the lake's plant community appears to be pristine and intact (Exotic species maps and additional information on a sampling of aquatic exotic invasive plant species can be found in Appendix VIII).

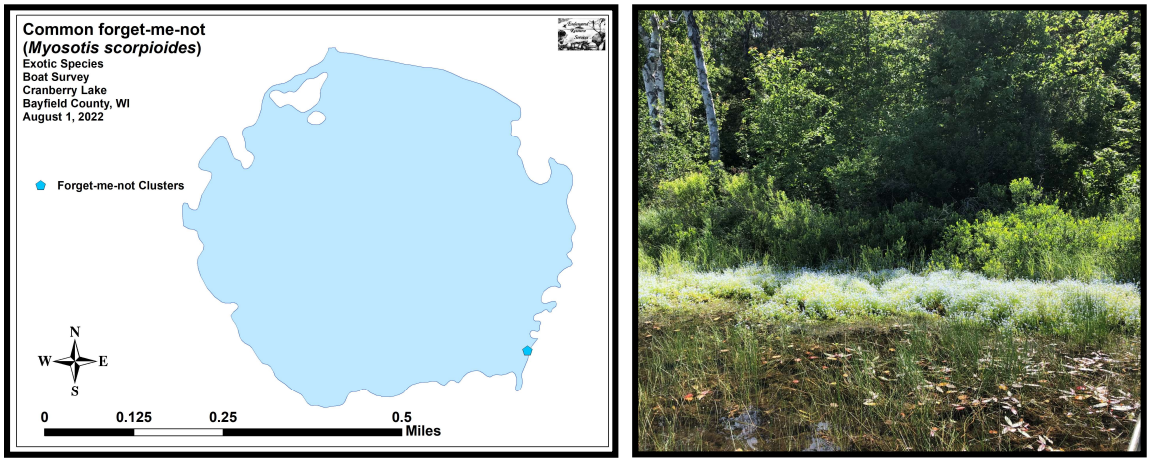


Figure 11: Common Forget-me-not Distribution and Shoreline Bed

The only other plant we found that was of potential concern was Common reed which occurred along the north shoreline of the lake (Figure 12). Although this species can be highly invasive in its exotic form, careful analysis of the plants present showed their leaf sheaths were detached, and the culms (stems) were red in color (Figure 13). These characteristics show it is the native subspecies *americanus* which is NOT generally invasive.

Figure 12: Common Reed Bed on the North Shoreline – 8/1/22

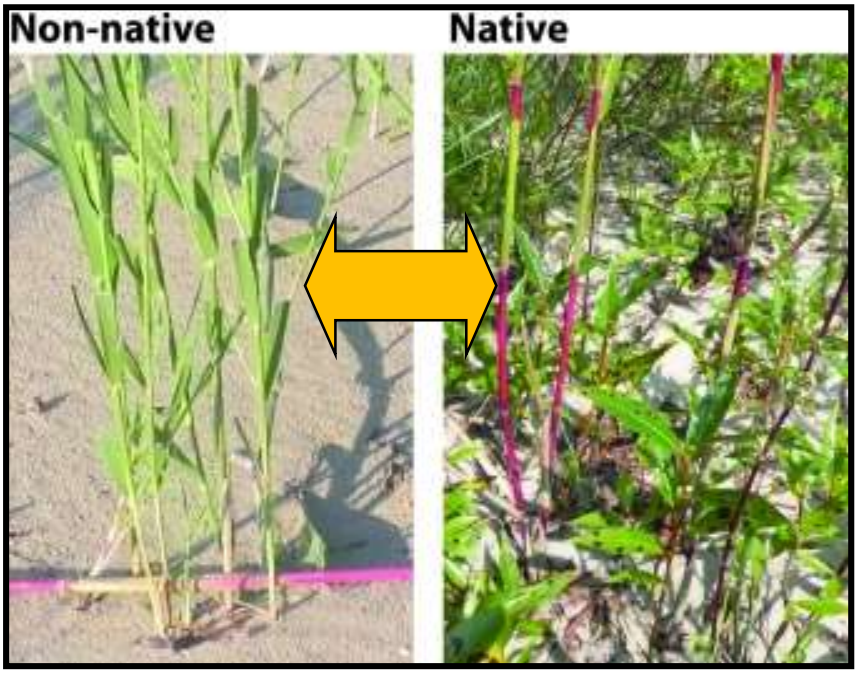


Figure 13: Stem Pattern on Exotic vs. Native Common Reed

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

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

Cranberry Lake is home to a healthy native plant community that is dominated by many high-value species that are sensitive to human disturbance. Like trees in a forest, these 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.

When phosphorus and nitrogen in a lake's water column increase to levels beyond what macrophytes can absorb, filamentous and floating algae tend to proliferate leading to declines in both water clarity and quality. Over the past 20+ years, water quality data collected by Cranberry Lake volunteers shows a history of improving clarity. This is probably not a coincidence. Rather, it is likely at least partially tied to the work done by conservation-minded people. Their native vegetation buffers along much of the lake's shoreline helps cut down on soil erosion and nutrient runoff into the lake which would otherwise promote algae growth and decrease clarity. Despite this positive news, the lake's relatively small size means even a slight increase in nutrient inputs could negatively impact clarity. Because of this, residents should continually evaluate how their shoreline practices may be impacting the lake. Simple things like establishing a buffer strip of native vegetation along the lakeshore if one isn't already present (Figure 14), bagging grass clippings, eliminating fertilizer near the lake, collecting pet waste, disposing of ash from fire pits away from the lakeshore, maintaining septic systems, and avoiding stirring up sediments with motor start-ups in shallow water can all significantly reduce the amount of nutrients entering the lake's water column. Hopefully, a greater understanding of how even individual property owners can have lake-wide impacts will result in even more people taking appropriate conservation actions and thus ensure continued water clarity and quality for all.

Figure 14: Model Natural Shoreline on a Nearby Northwest Wisconsin Lake

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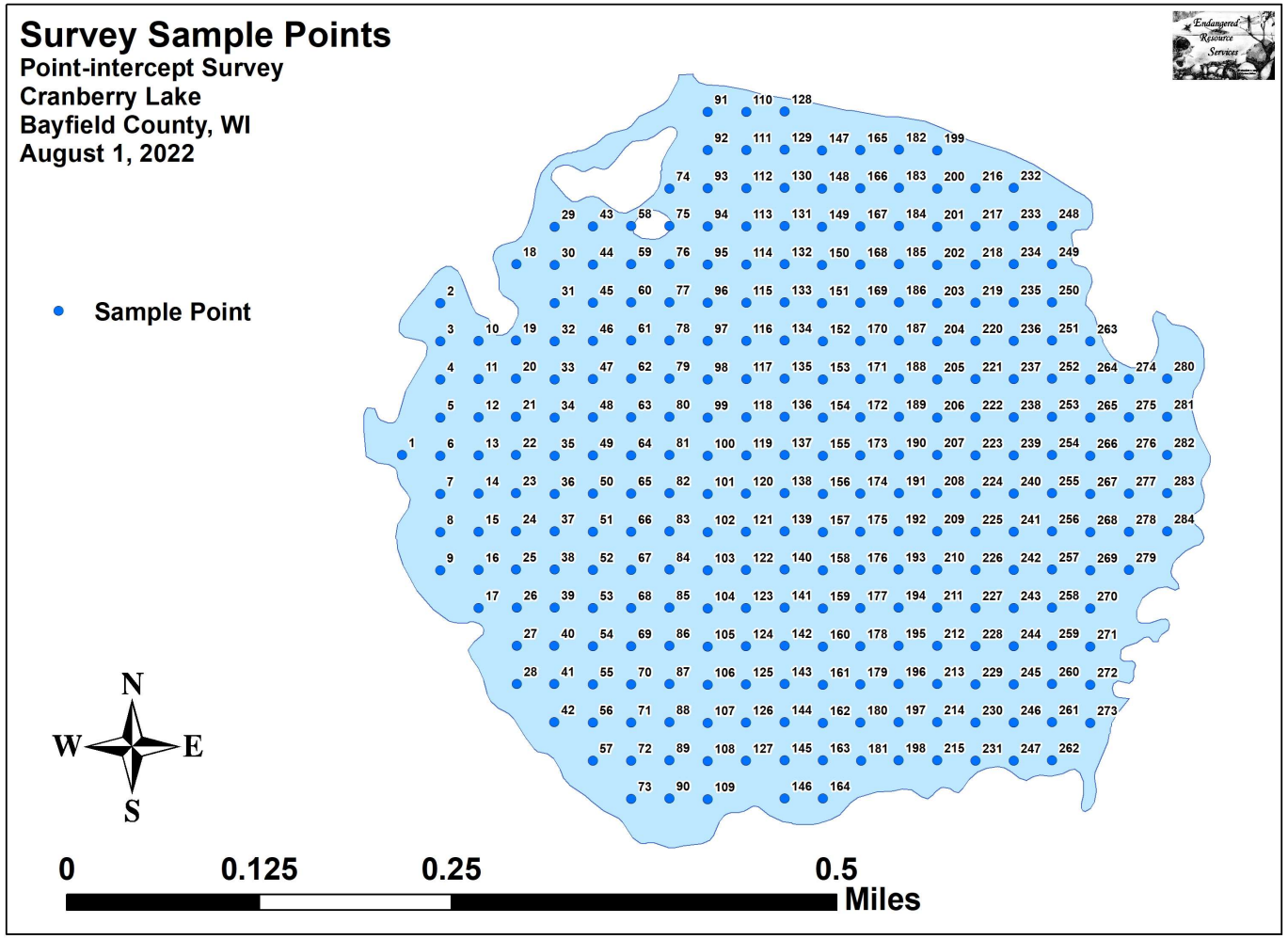
Appendix I: Point-intercept Survey Sample Points Map

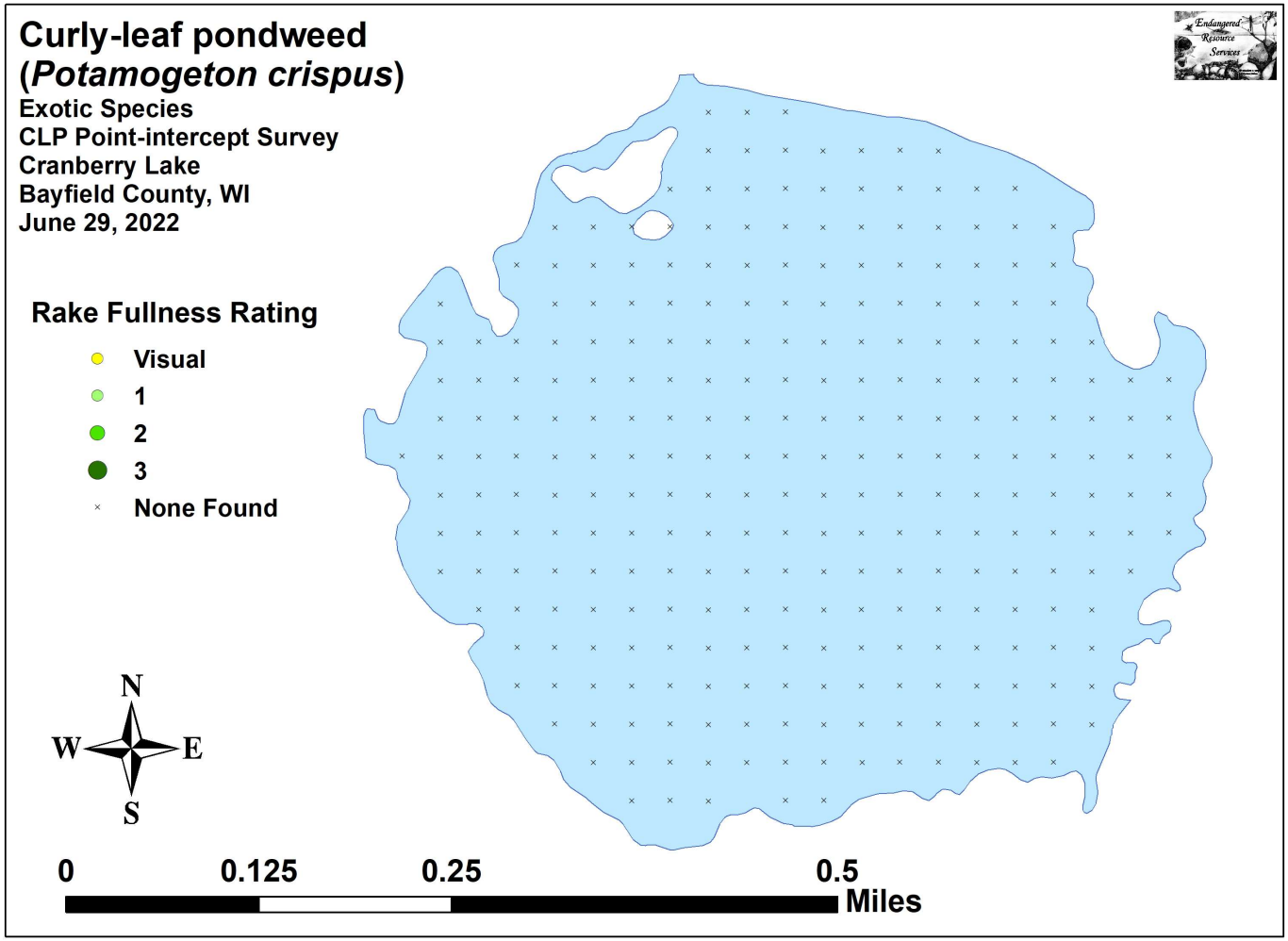

Survey Sample Points
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Sample Point
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix II: Boat and Vegetative Survey Datasheets

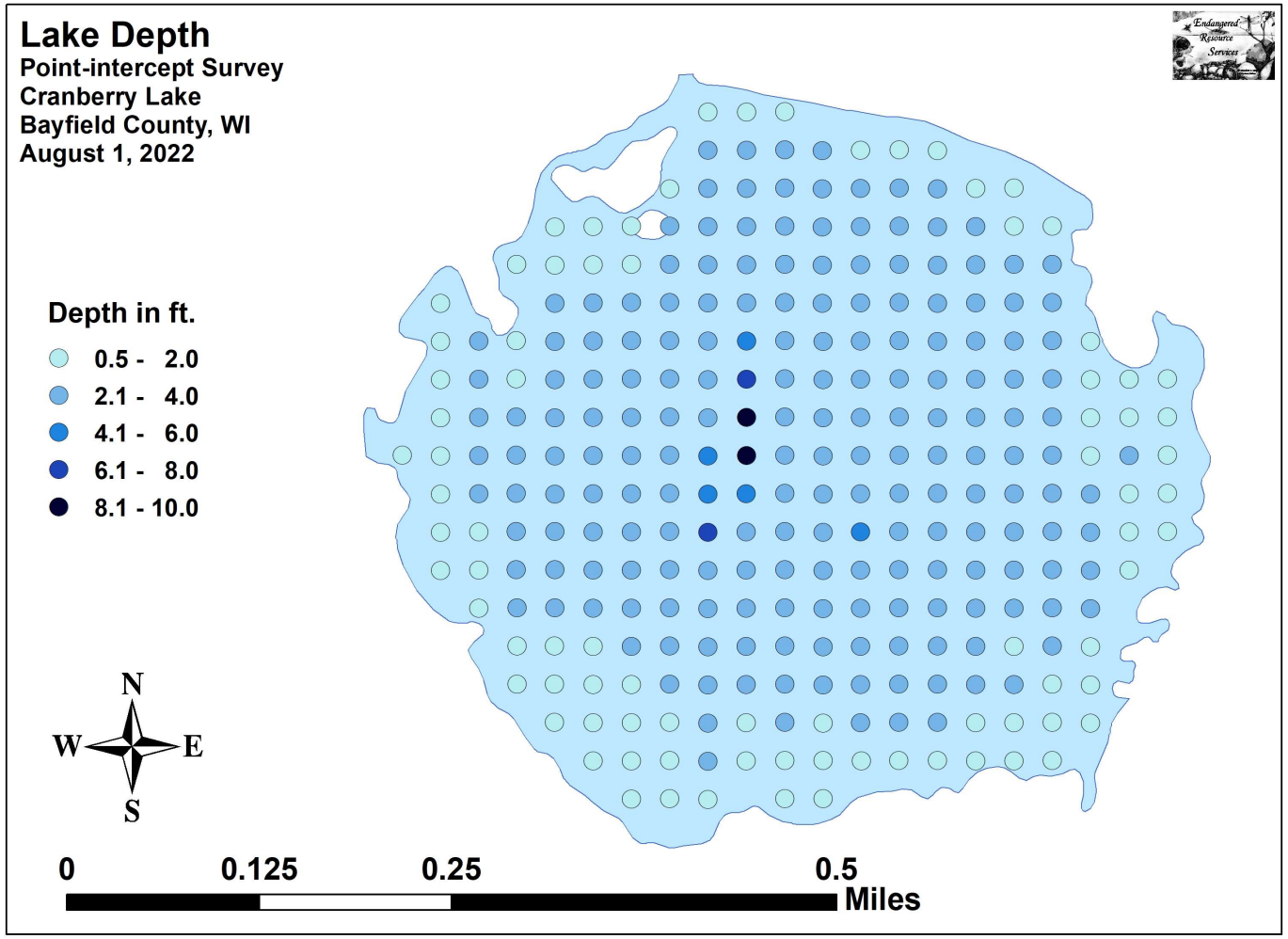
Boat Survey	
Lake Name	
Counties	
WBIC	
Date of Survey	
(mm/dd/yy)	
workers	
Nearest Point	**Species seen, habitat information**

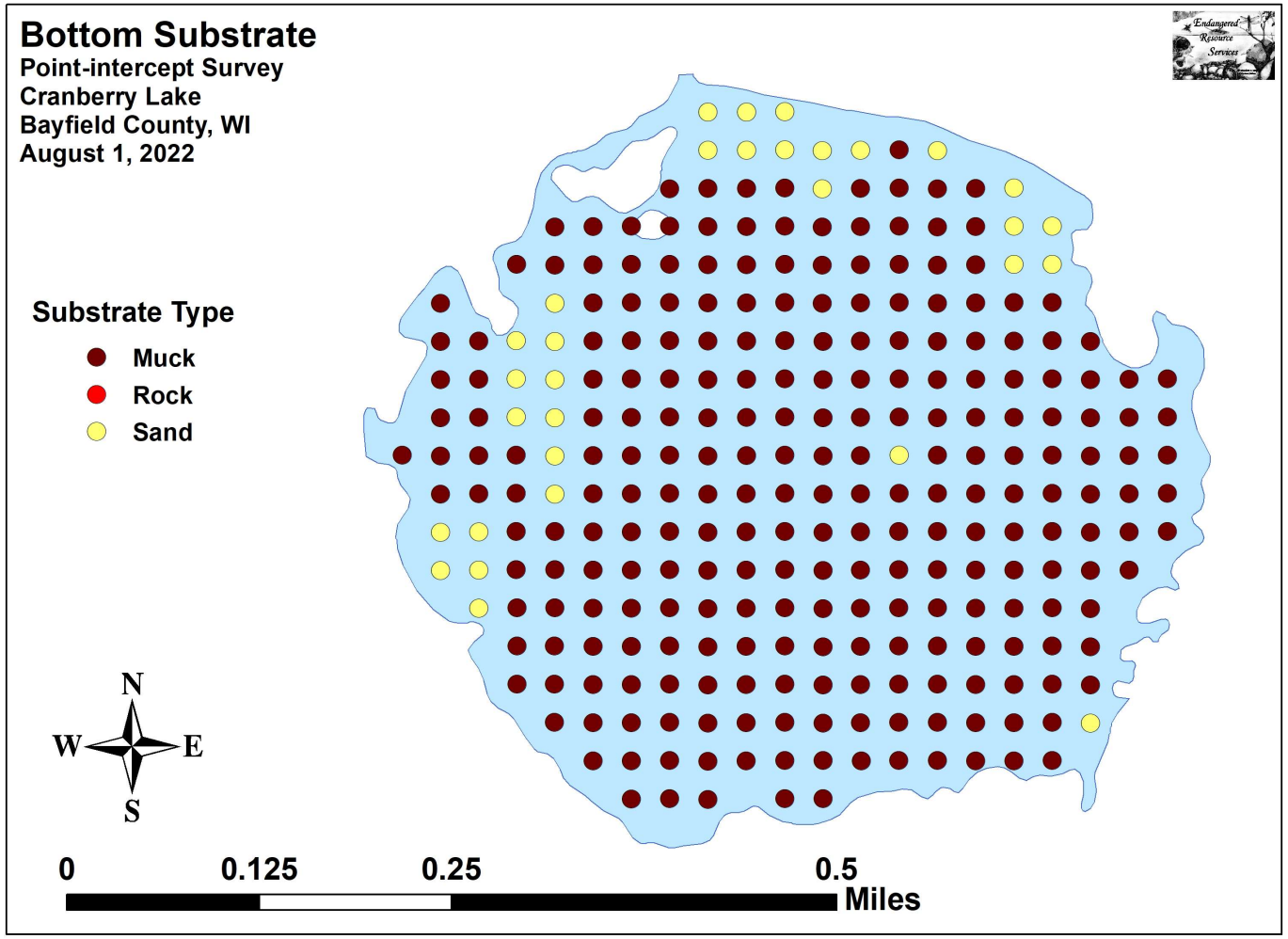
Observers for this lake: names and hours worked by each:																										
Lake:									**WBIC**									**Counties**						**Date:**		
Site #	**Depth (ft)**	**Muck (M), Sand (S), Rock (R)**	**Rake pole (P) or rake rope (R)**	**Total Rake Fullness**	**EWM**	**CLP**	**1**	**2**	**3**	**4**	**5**	**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: Early Season Curly-leaf Pondweed Density and Distribution Map

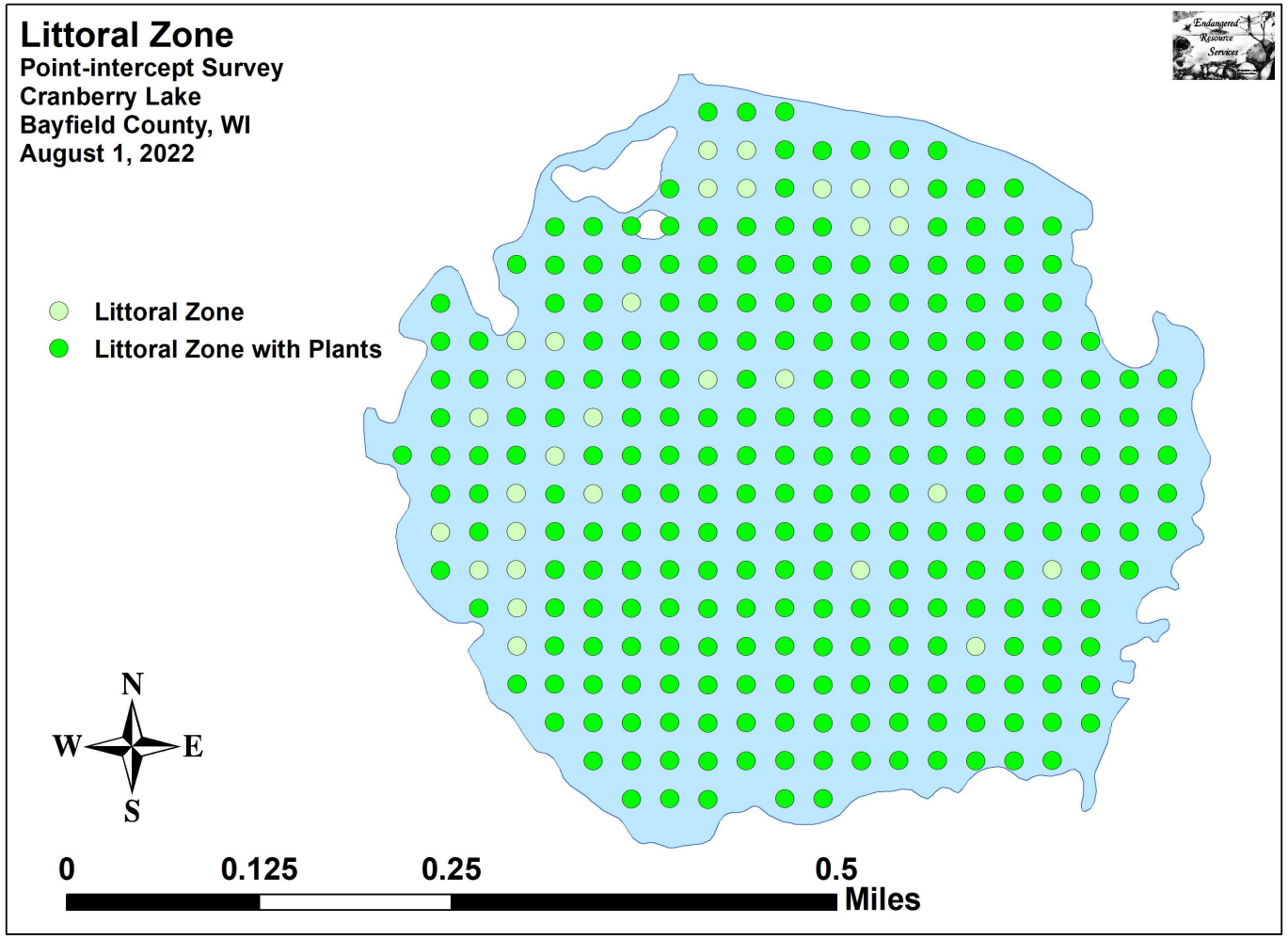

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Point-intercept Survey
Cranberry Lake
Bayfield County, WI
June 29, 2022
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

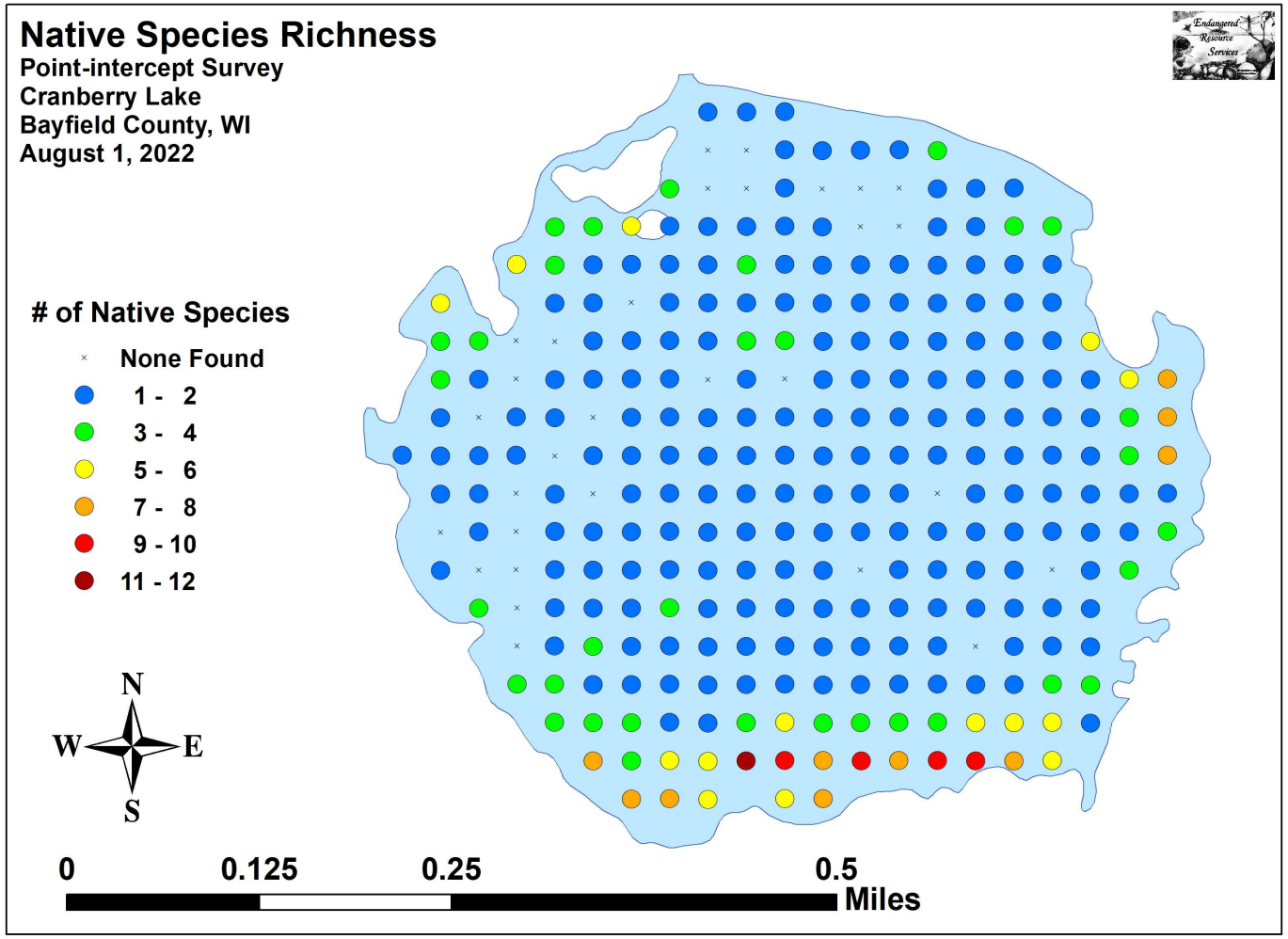
Appendix IV: Habitat Variable Maps

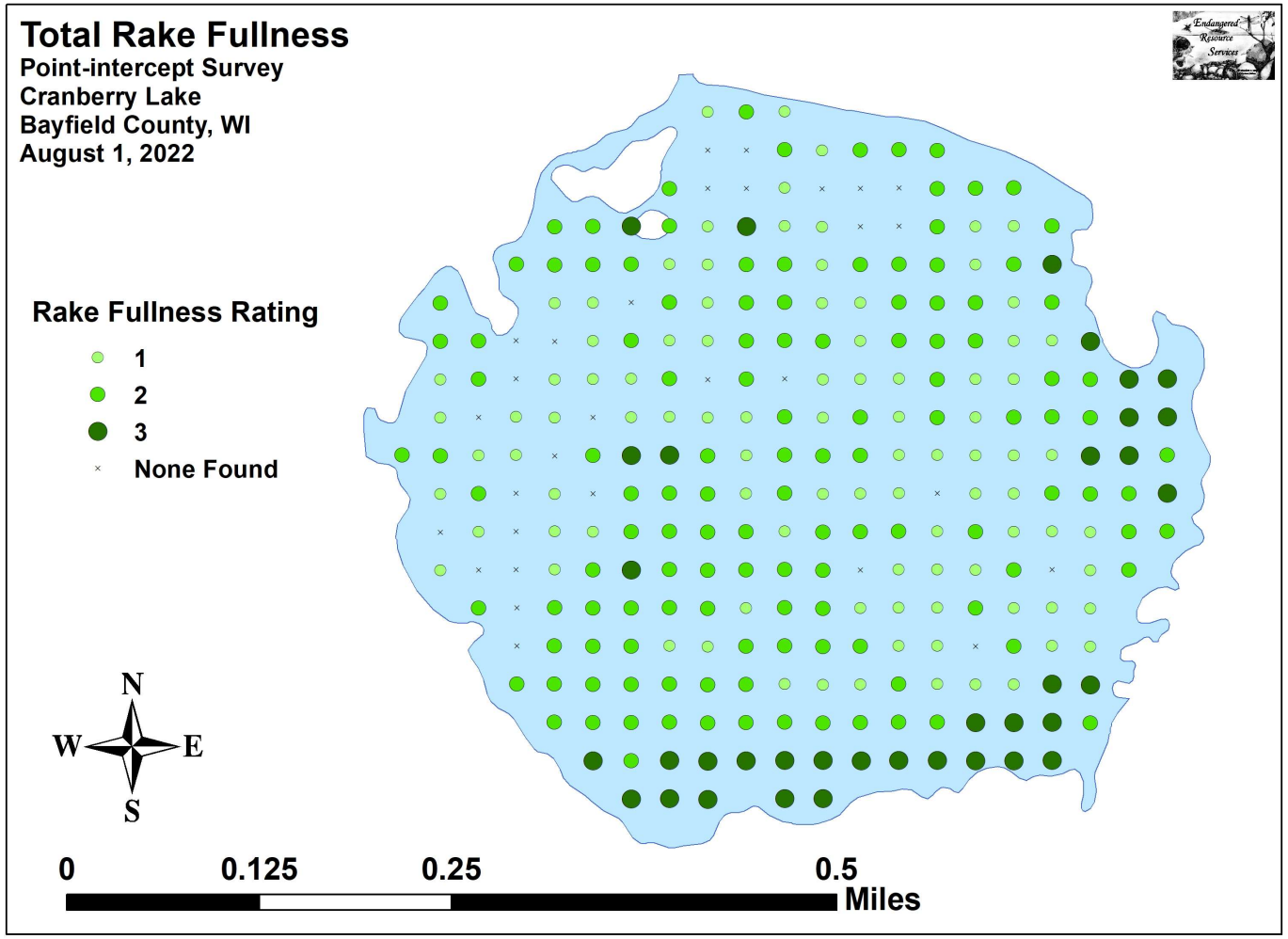

Lake Depth
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Depth in ft.
0.5 - 2.0
2.1 - 4.0
4.1 - 6.0
6.1 - 8.0
8.1 - 10.0
N
W
E
S
0
0.125
0.25
0.5
Miles


Bottom Substrate
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix V: Littoral Zone, Native Species Richness, and Total Rake Fullness Maps


Littoral Zone
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Littoral Zone
Littoral Zone with Plants
N
W
E
S
0
0.125
0.25
0.5
Miles


Native Species Richness
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11 - 12
N
W
E
S
0
0.125
0.25
0.5
Miles


Total Rake Fullness
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.125
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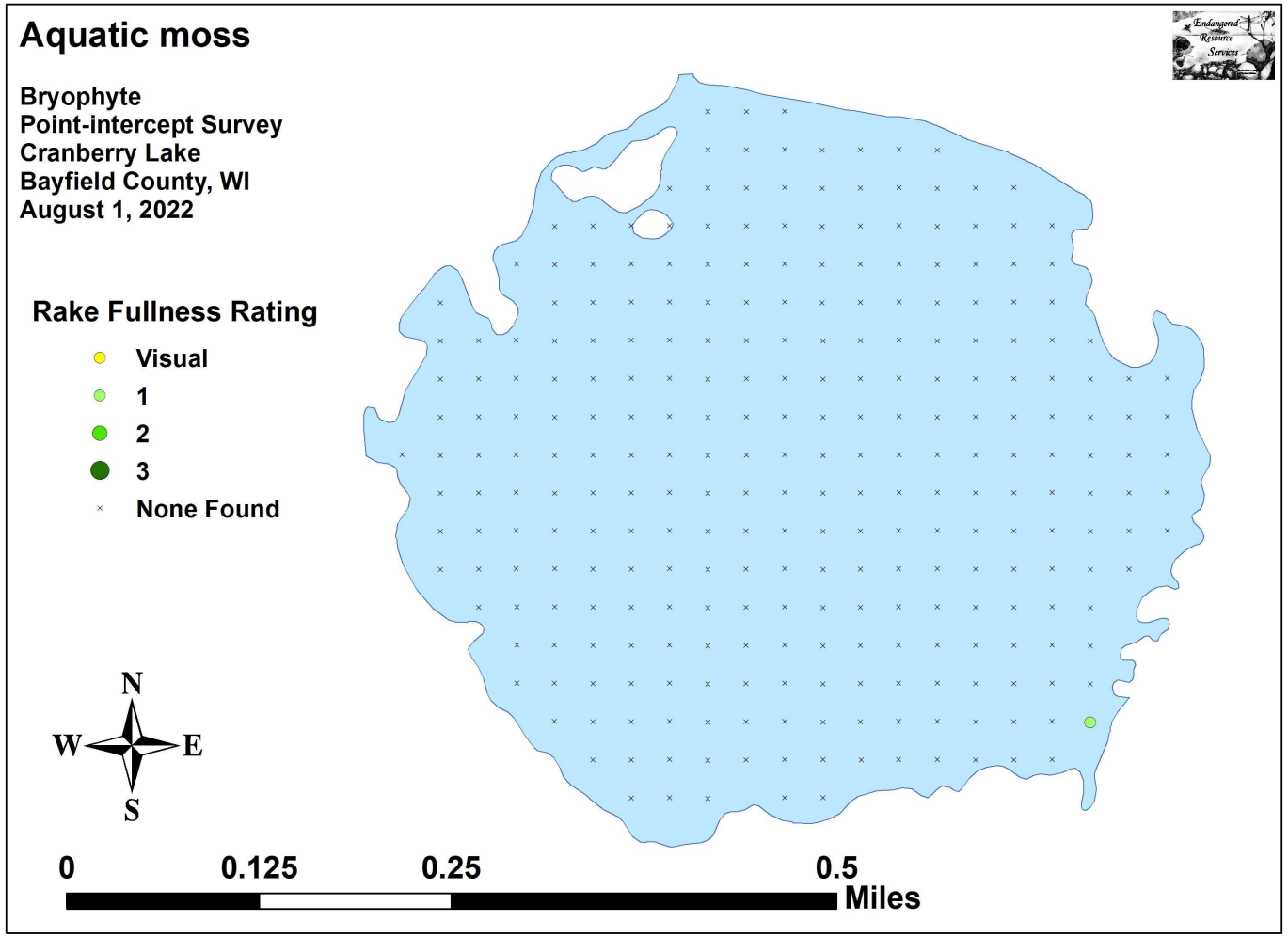
Miles

Appendix VI: Native Species Density and Distribution Maps


Aquatic moss
Bryophyte
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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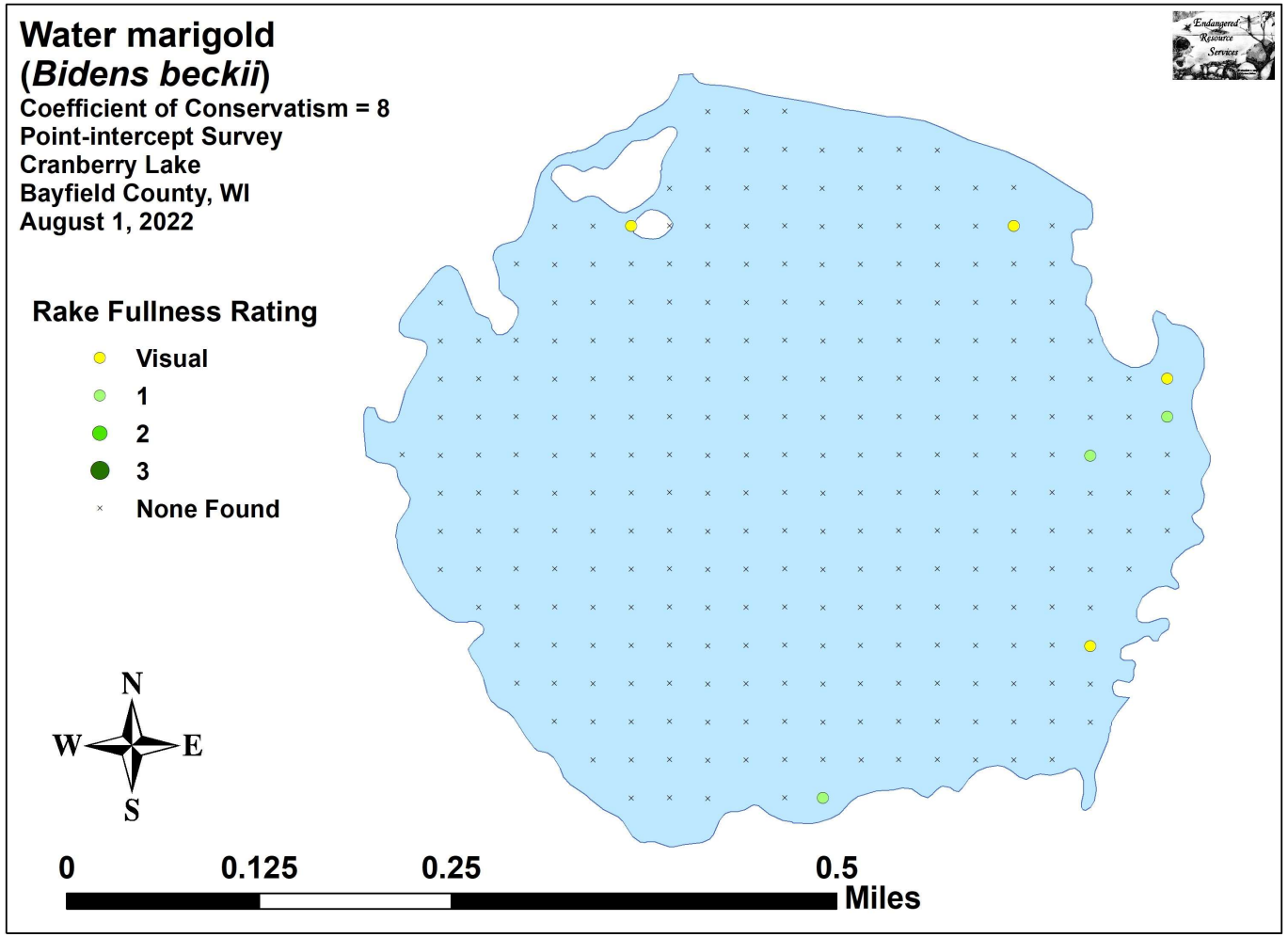
Miles


Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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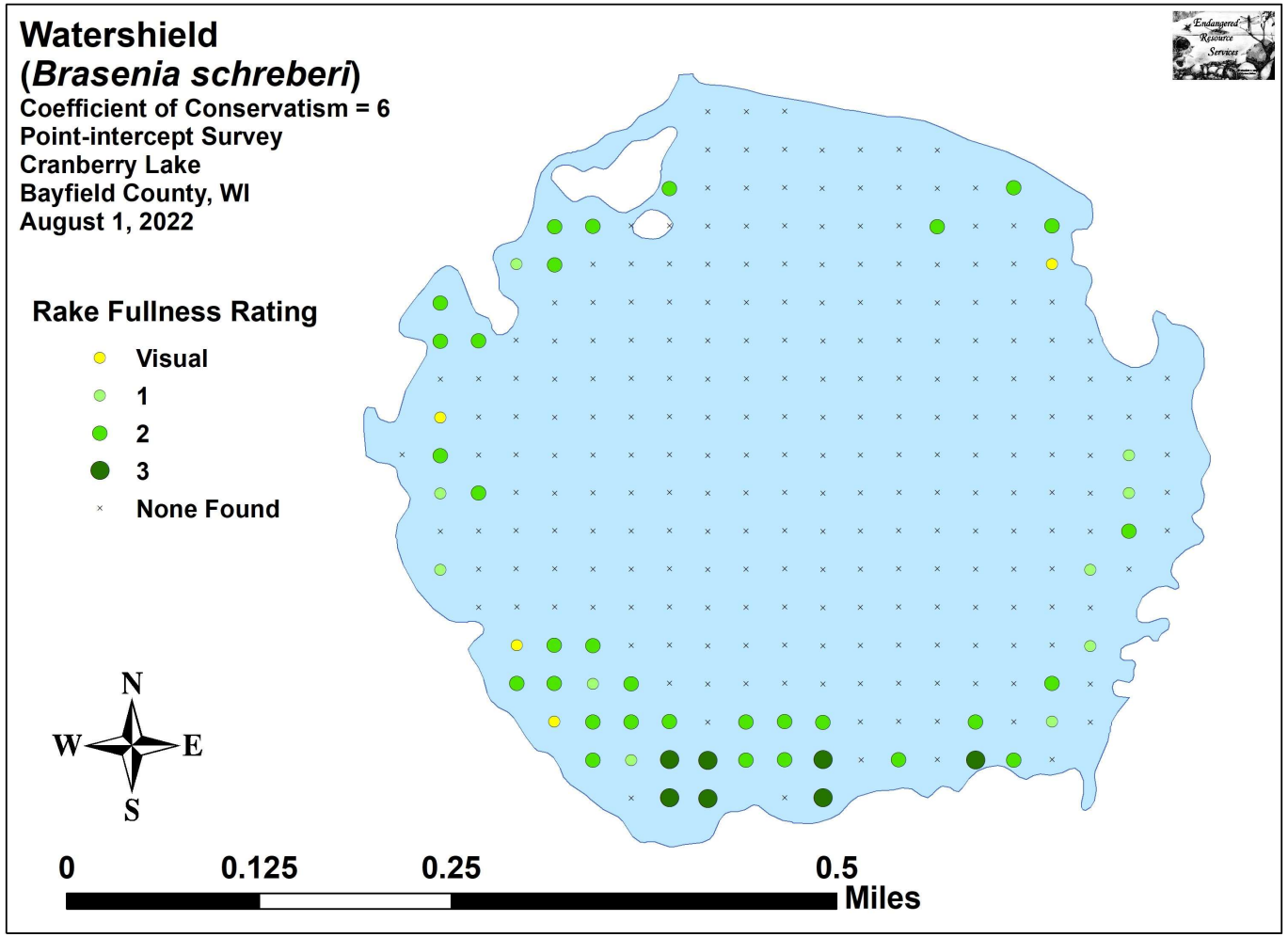
Miles


Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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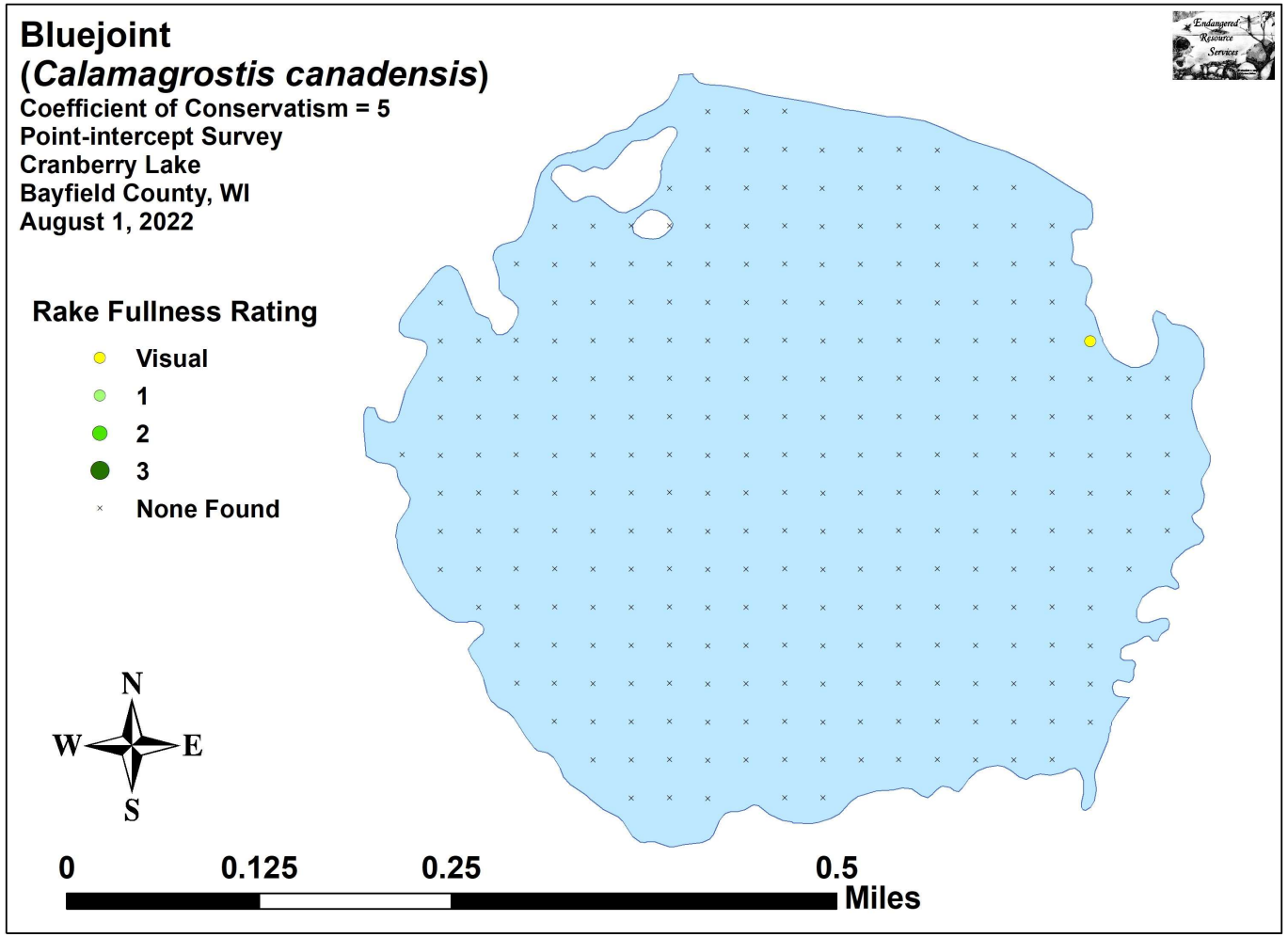
Miles


Bluejoint
(Calamagrostis canadensis)
Coefficient of Conservatism = 5
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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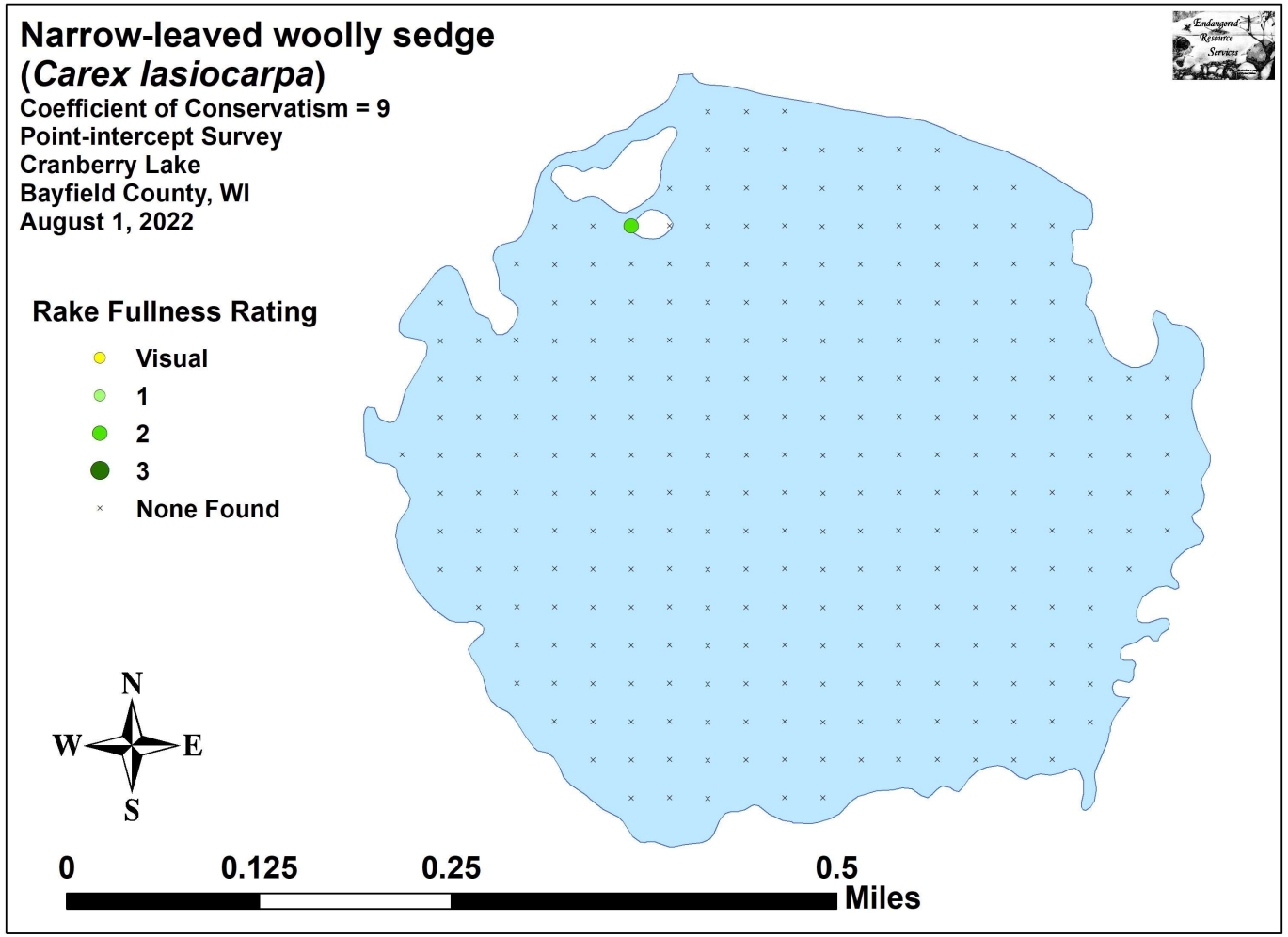
Miles


Narrow-leaved woolly sedge
(Carex lasiocarpa)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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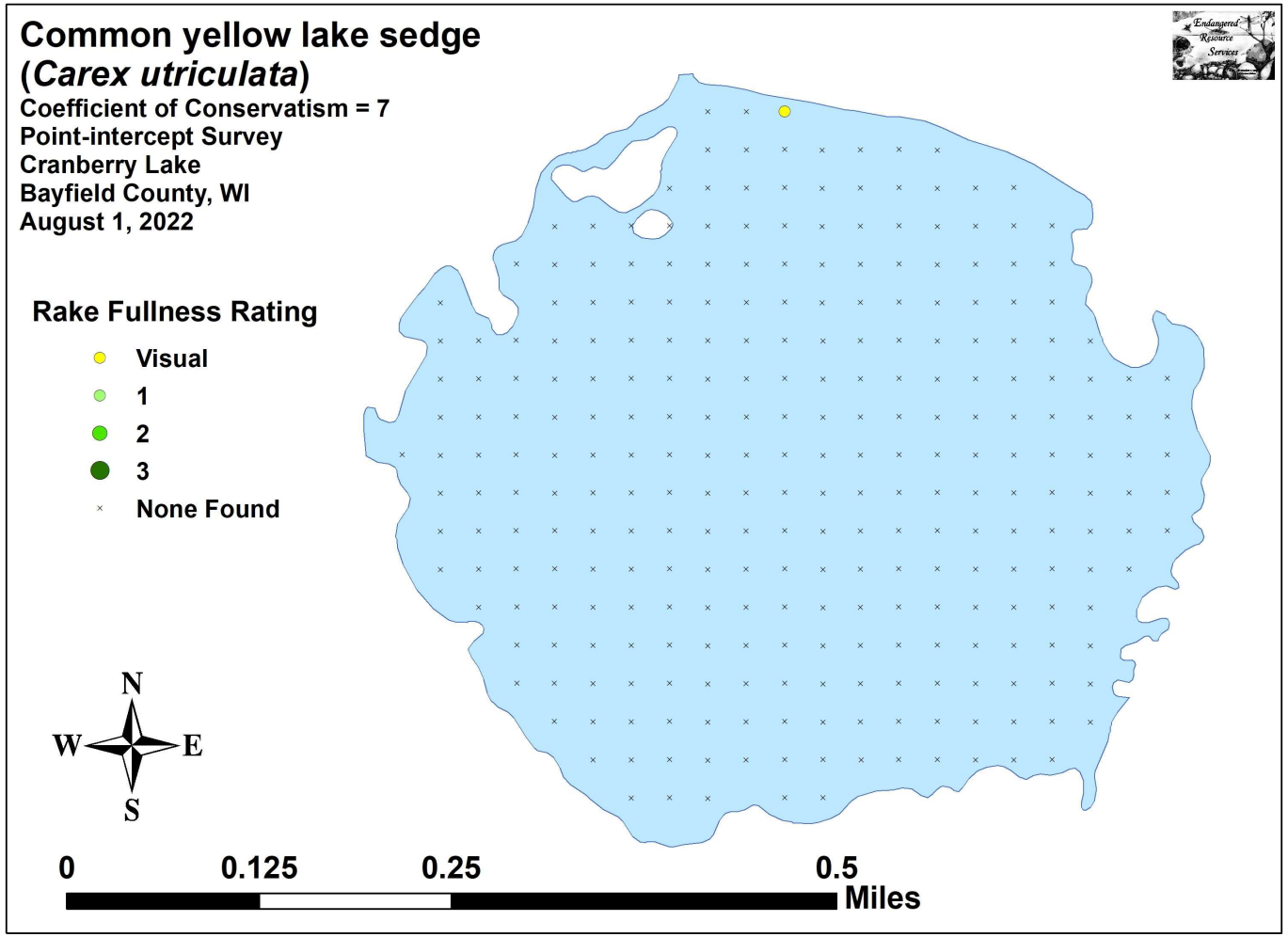
Miles


Common yellow lake sedge
(Carex utriculata)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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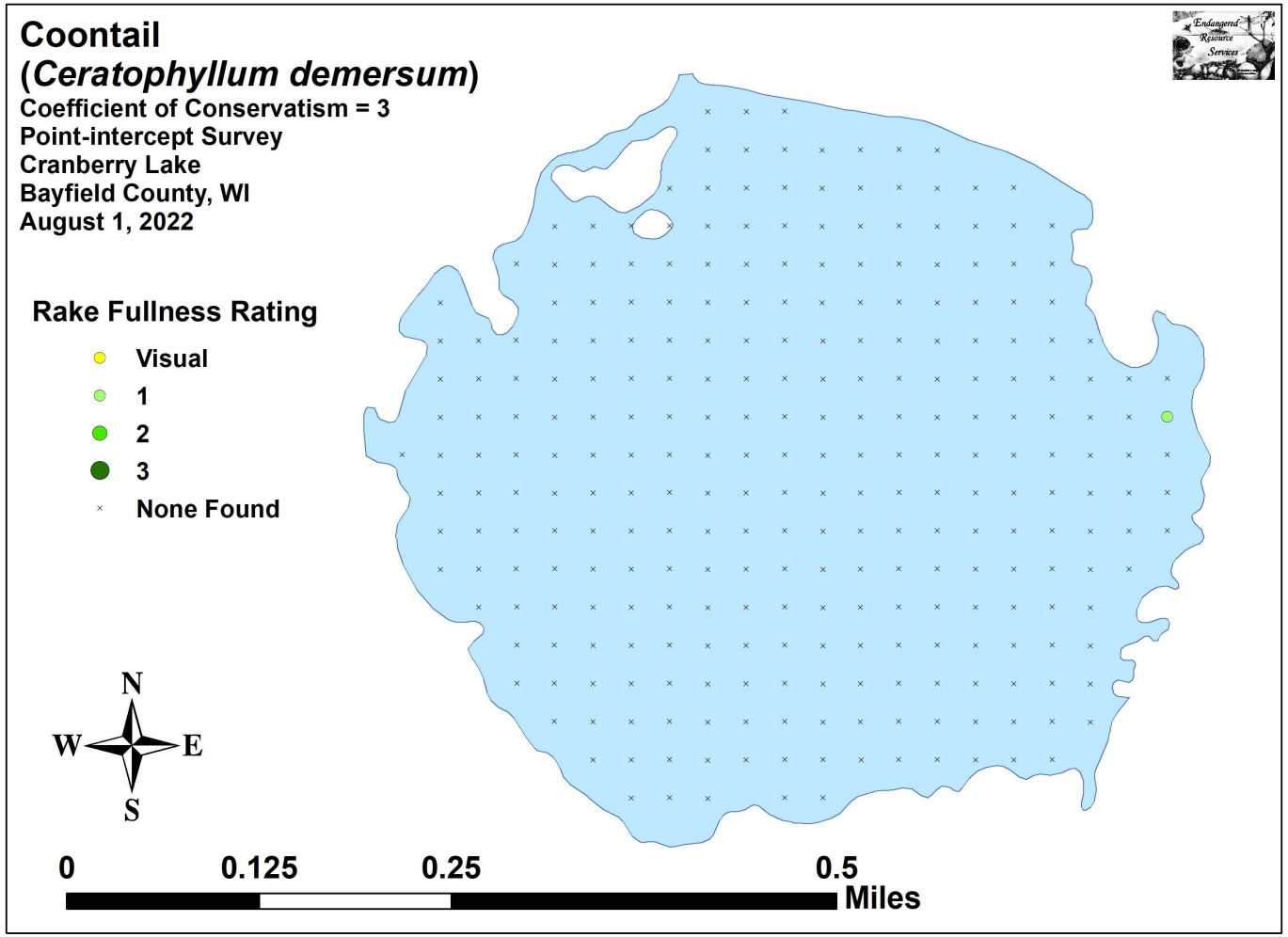
Miles


Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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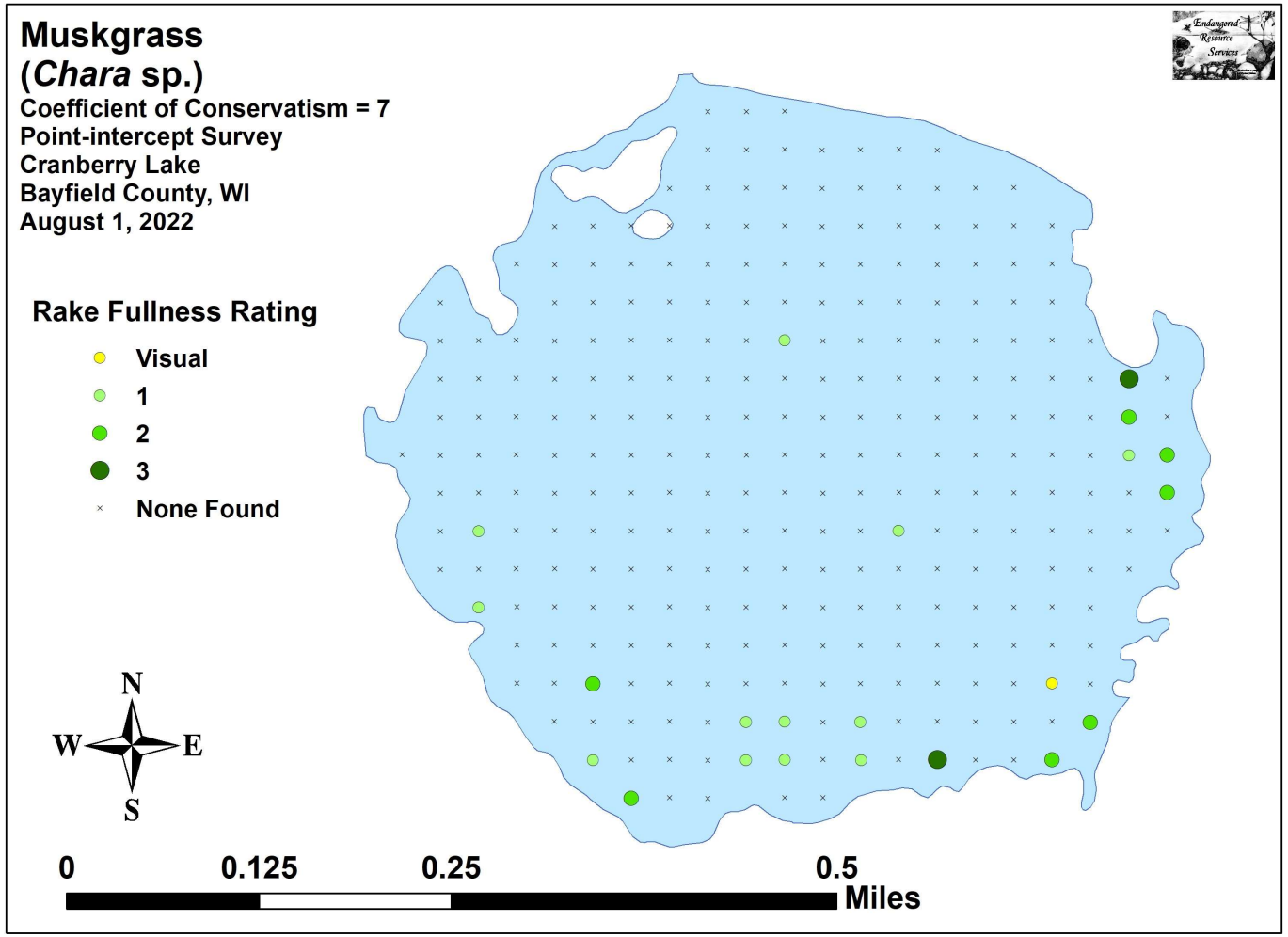
Miles


Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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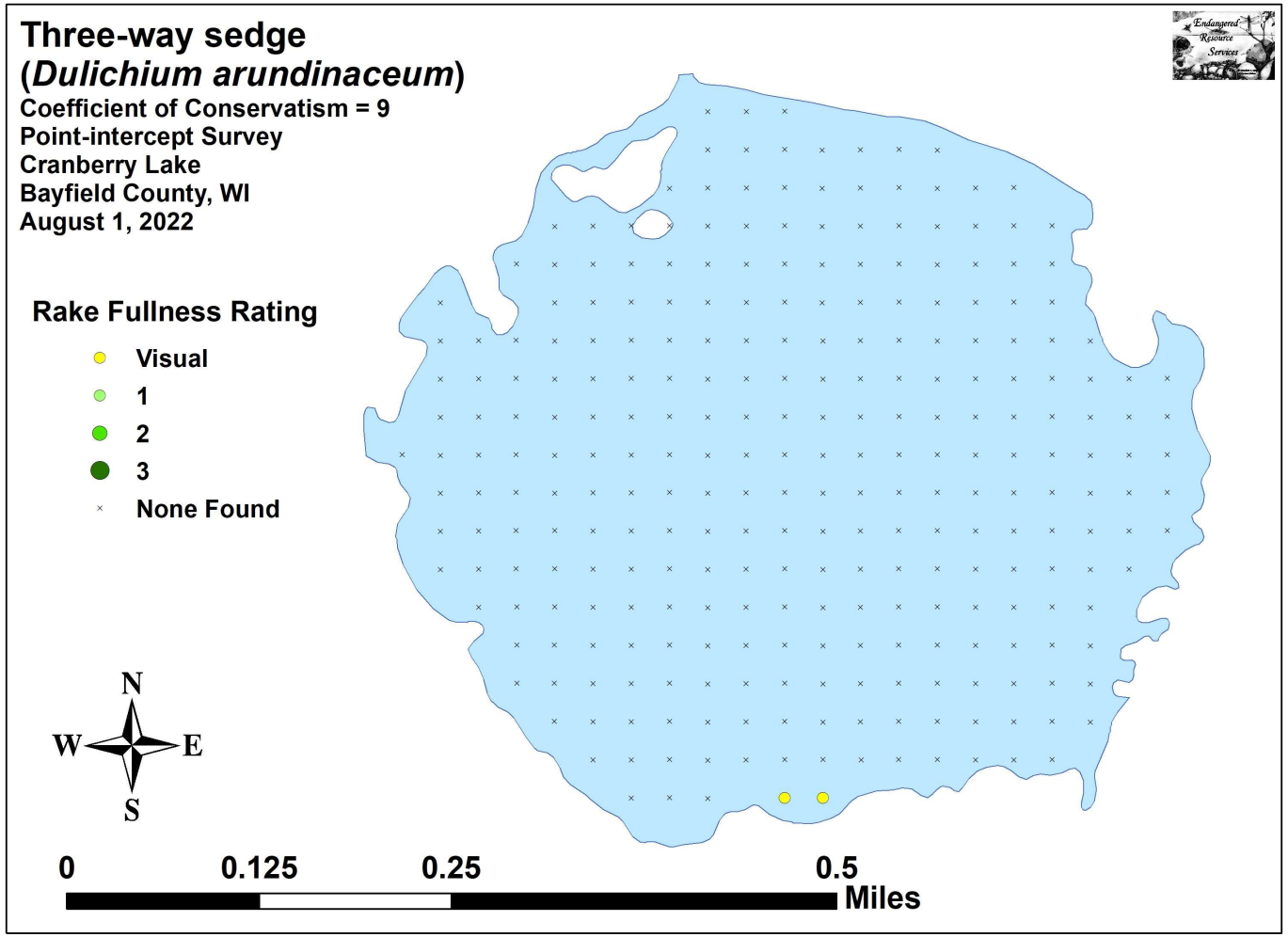
Miles


Three-way sedge
(Dulichium arundinaceum)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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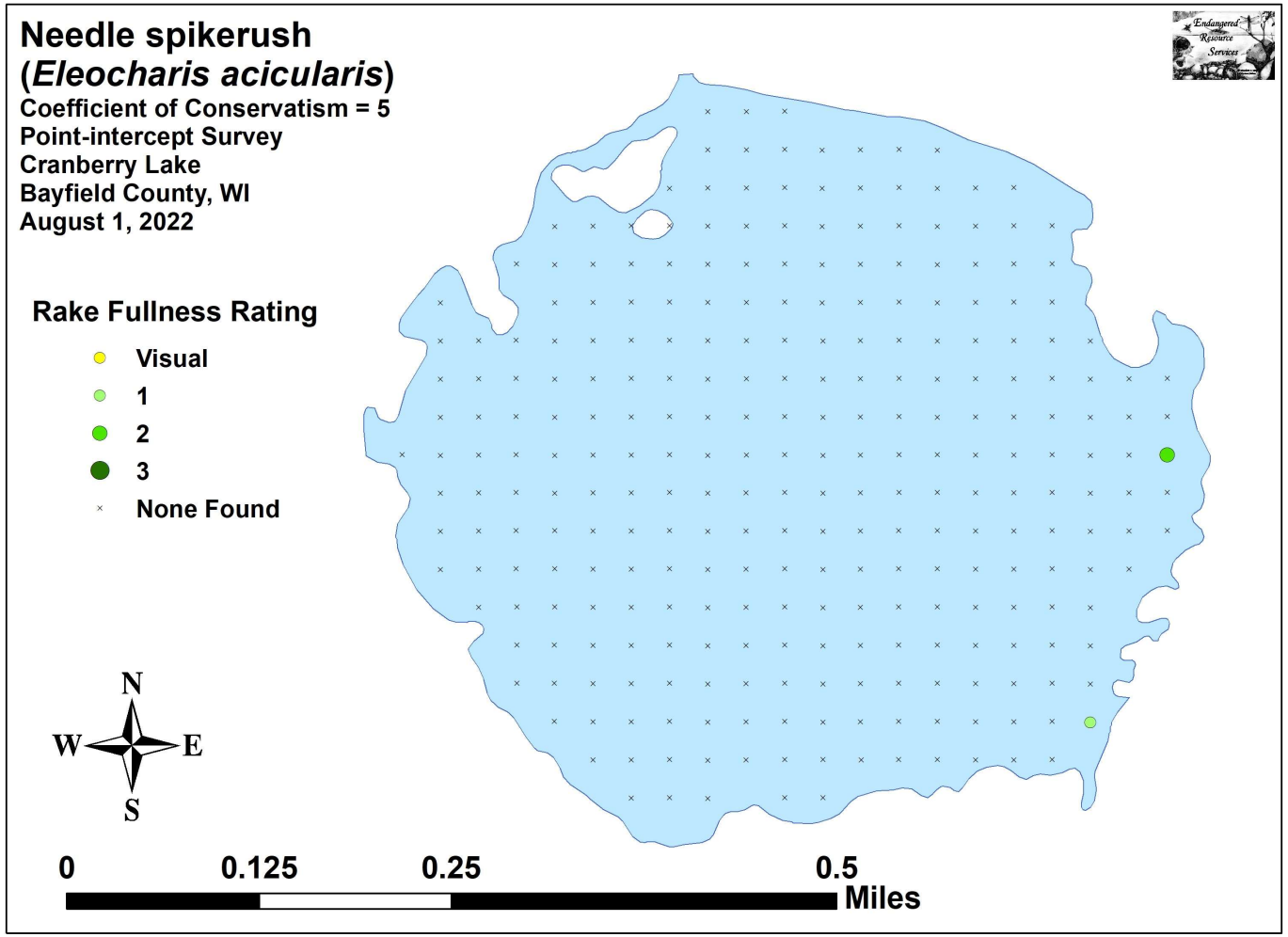
Miles


Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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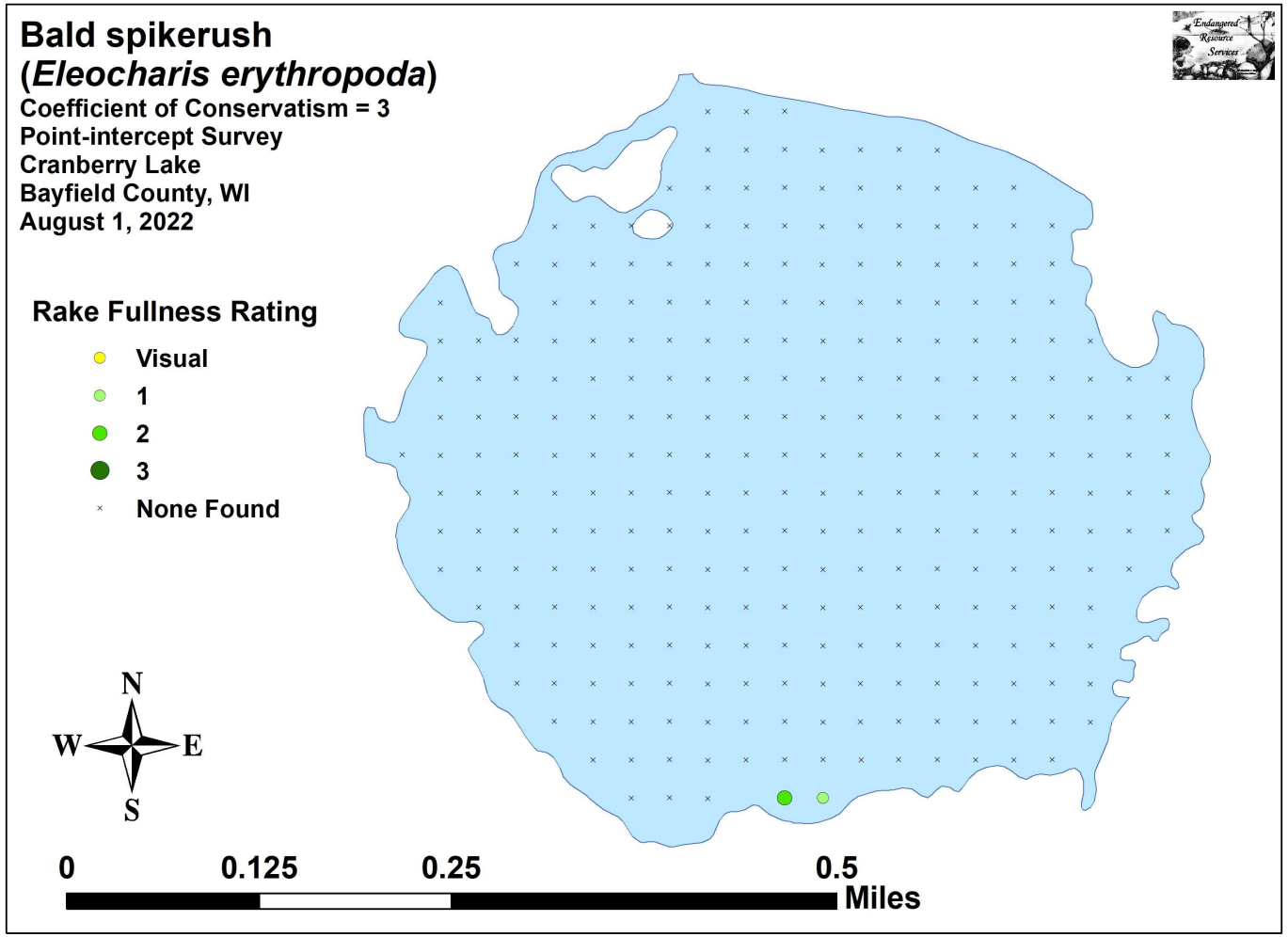
Miles


Bald spikerush
(Eleocharis erythropoda)
Coefficient of Conservatism = 3
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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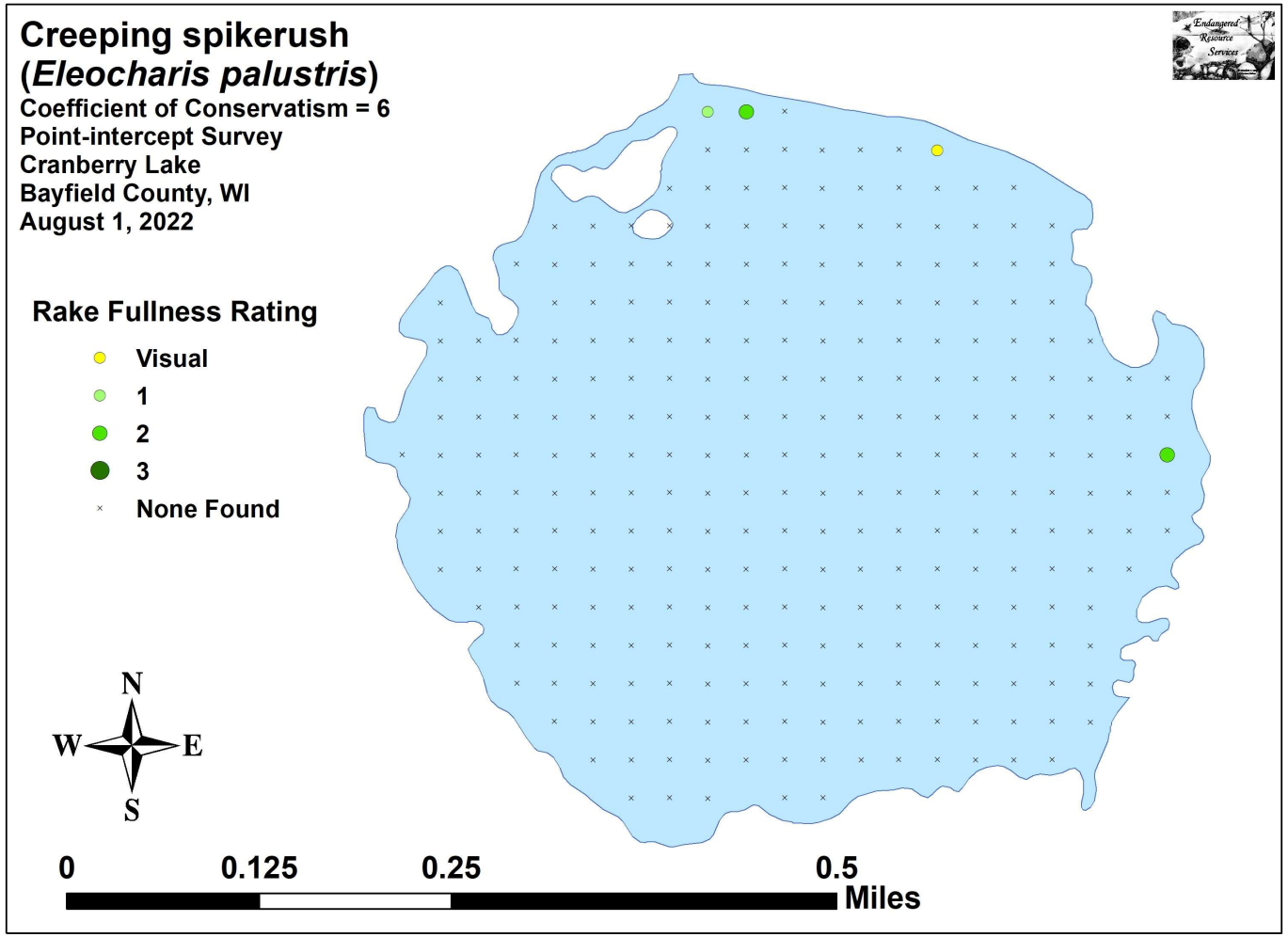
Miles


Creeping spikerush
(Eleocharis palustris)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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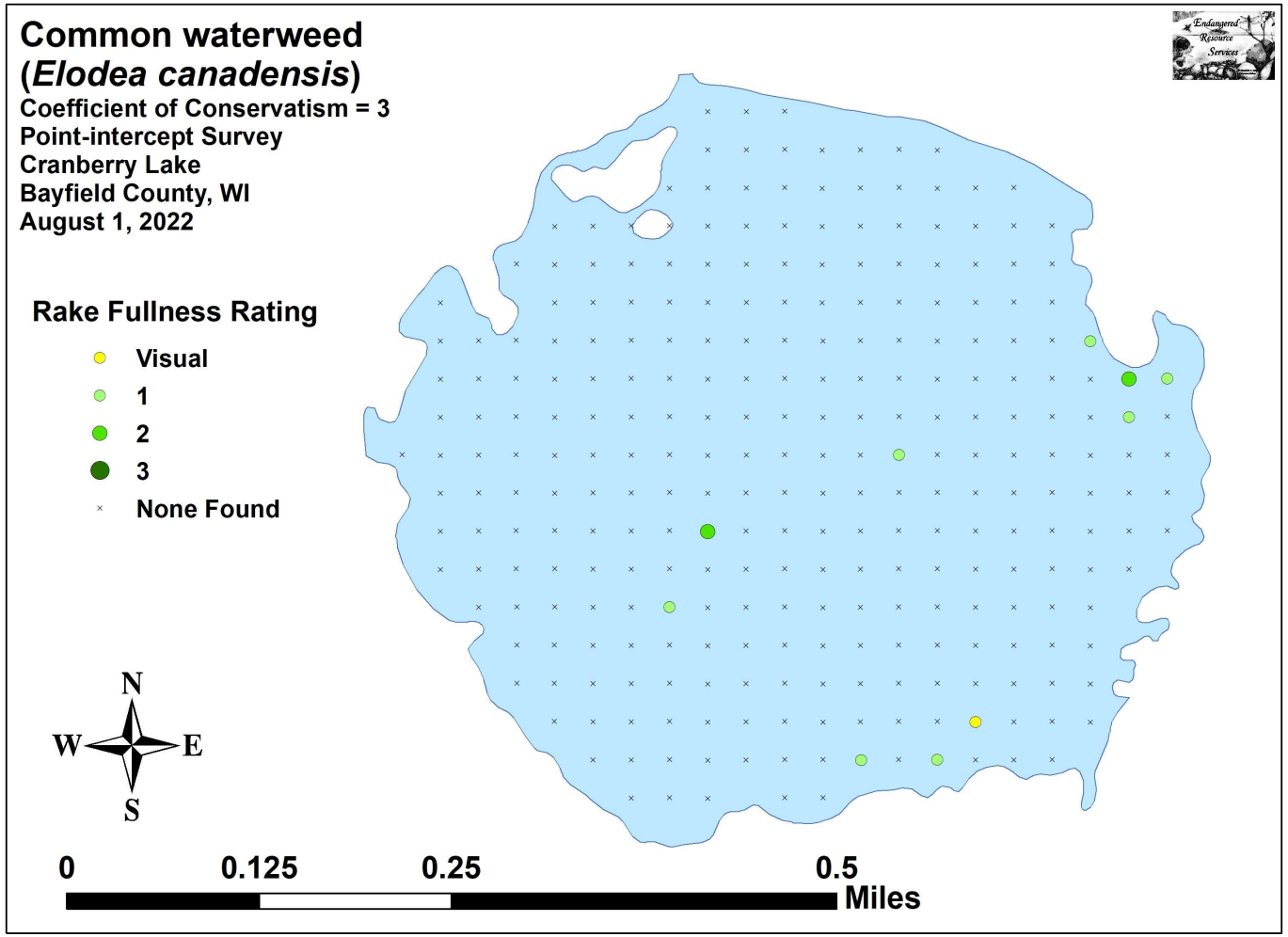
Miles


Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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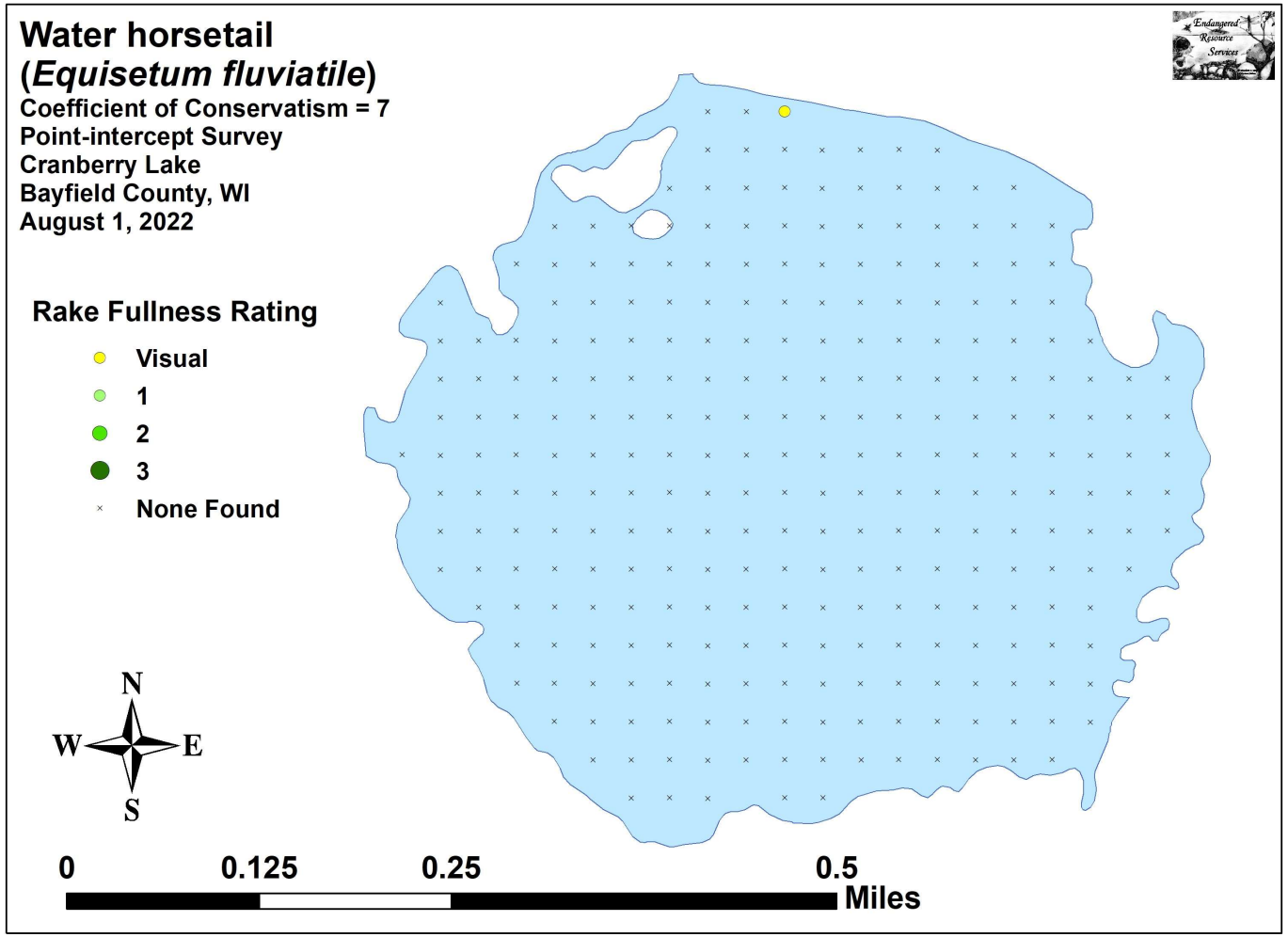
Miles


Water horsetail
(Equisetum fluviatile)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
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None Found
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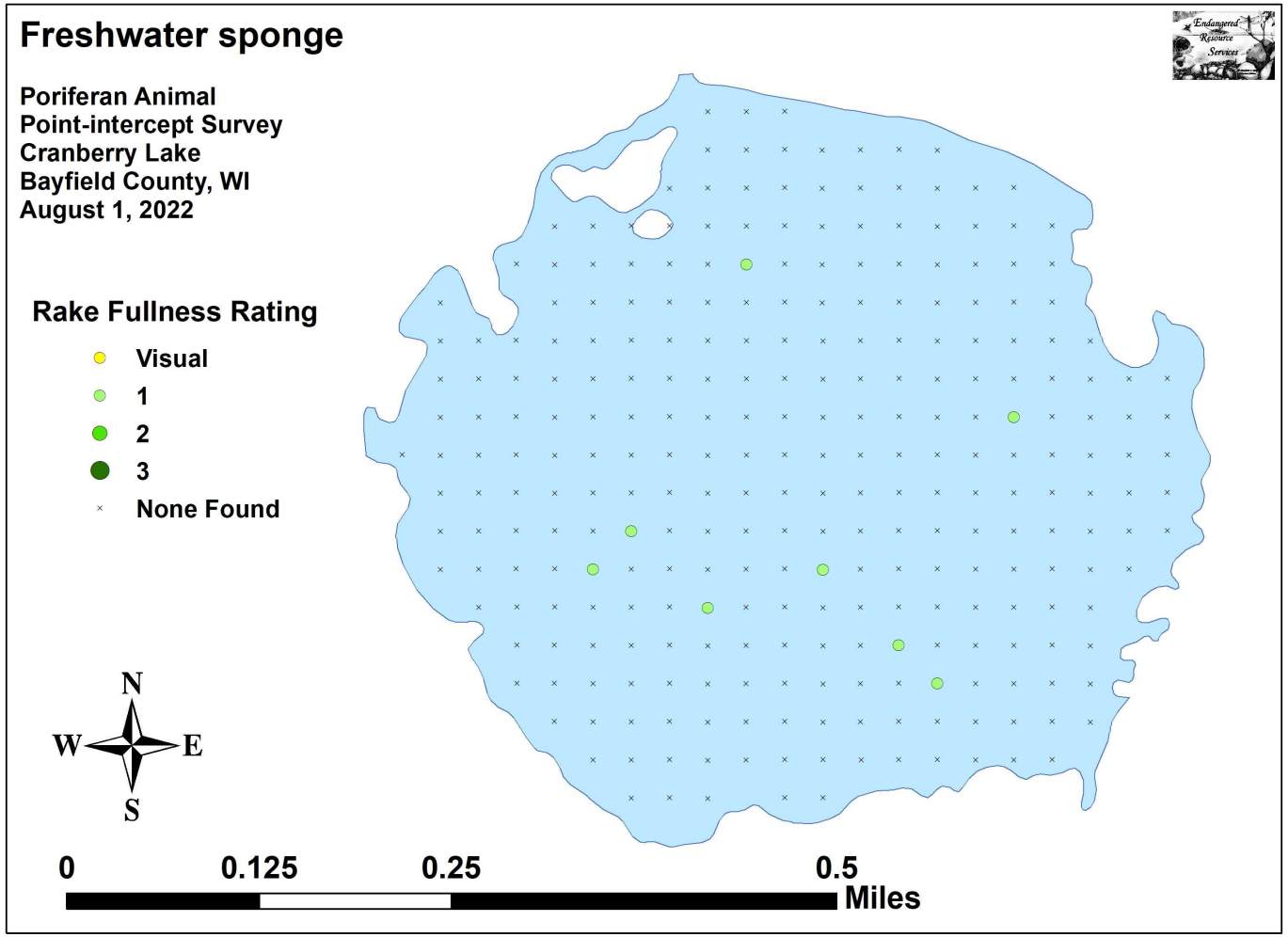
Freshwater sponge
Poriferan Animal
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
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None Found
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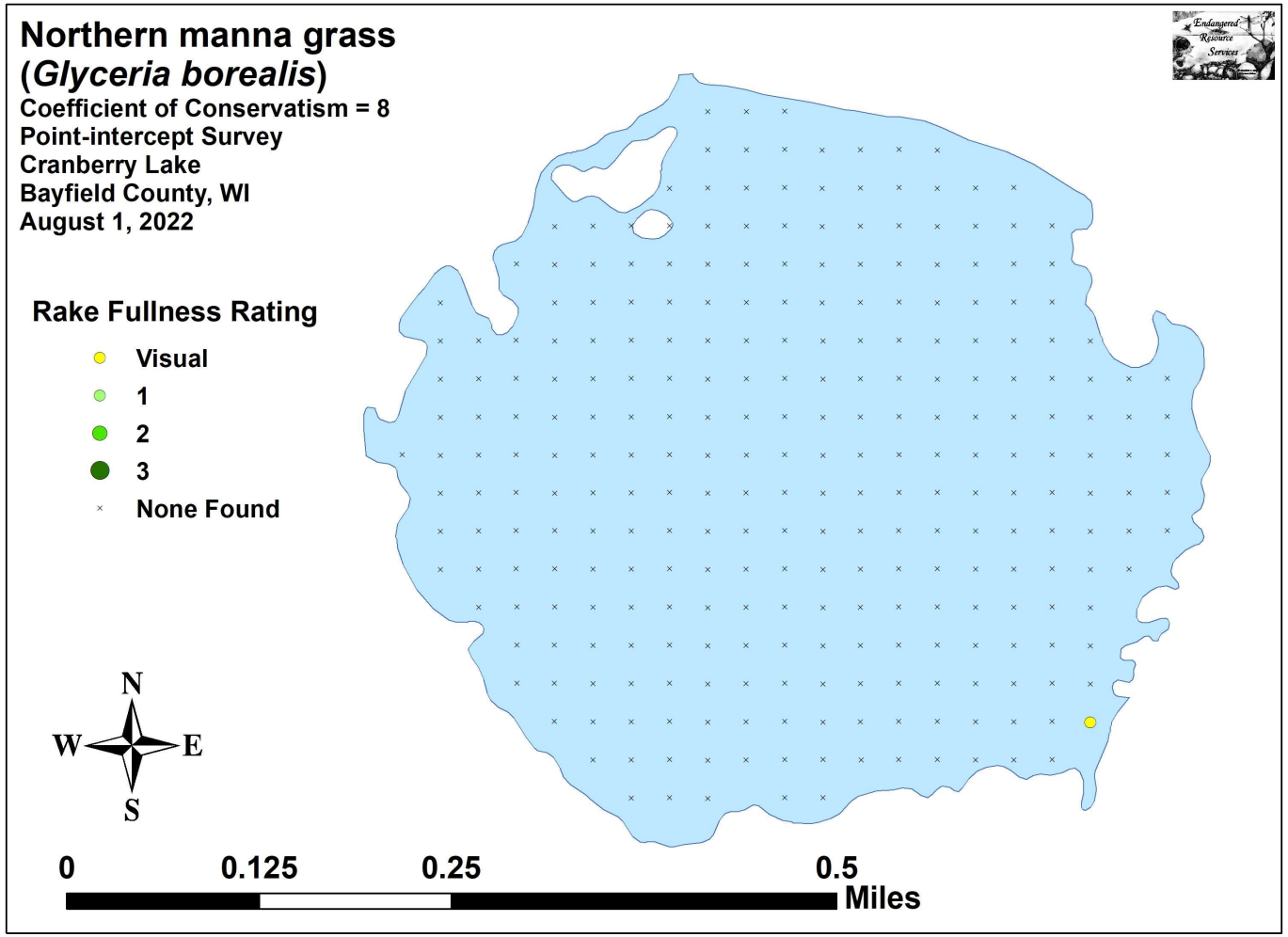
Northern manna grass
(Glyceria borealis)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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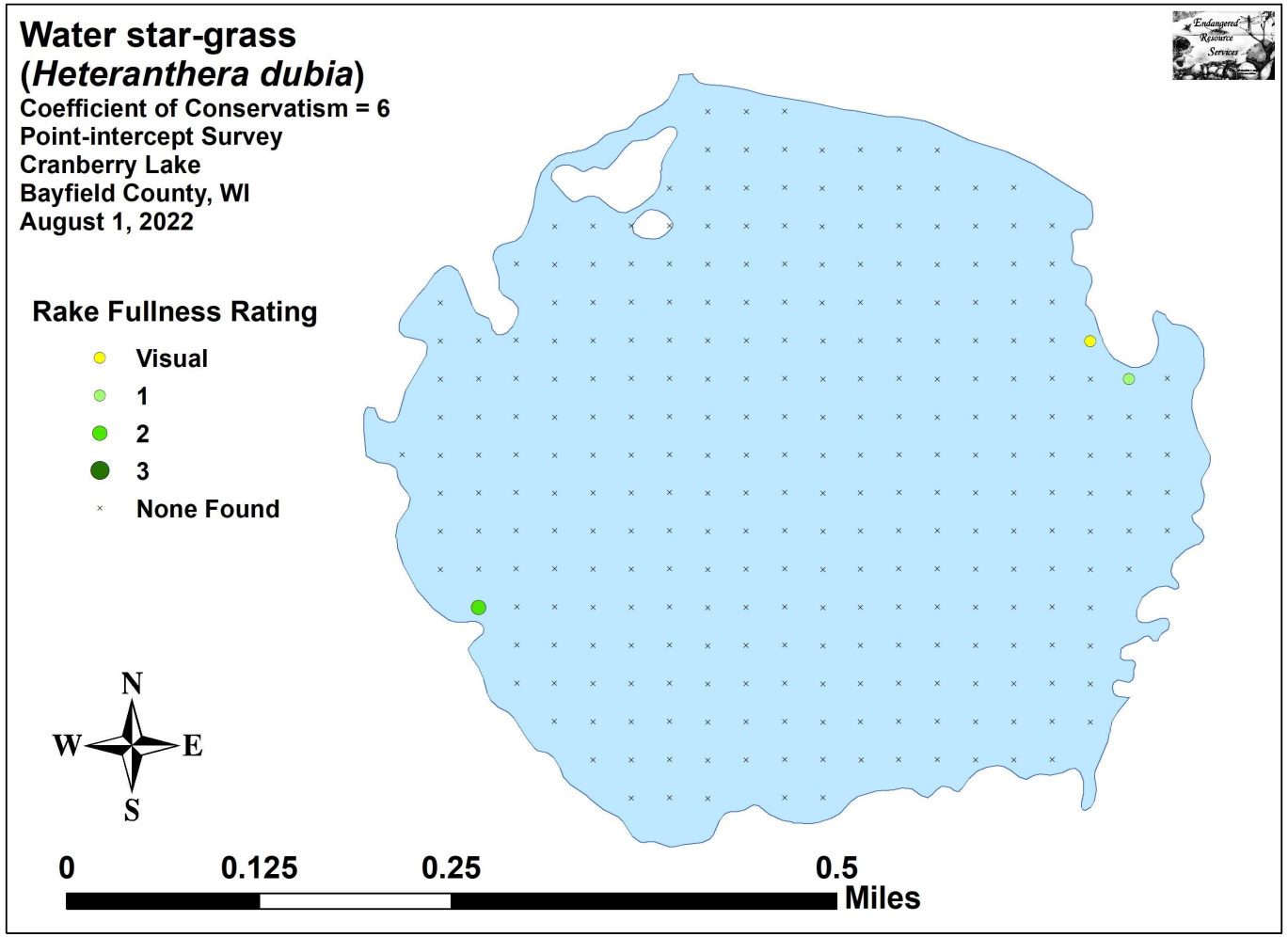
Miles


Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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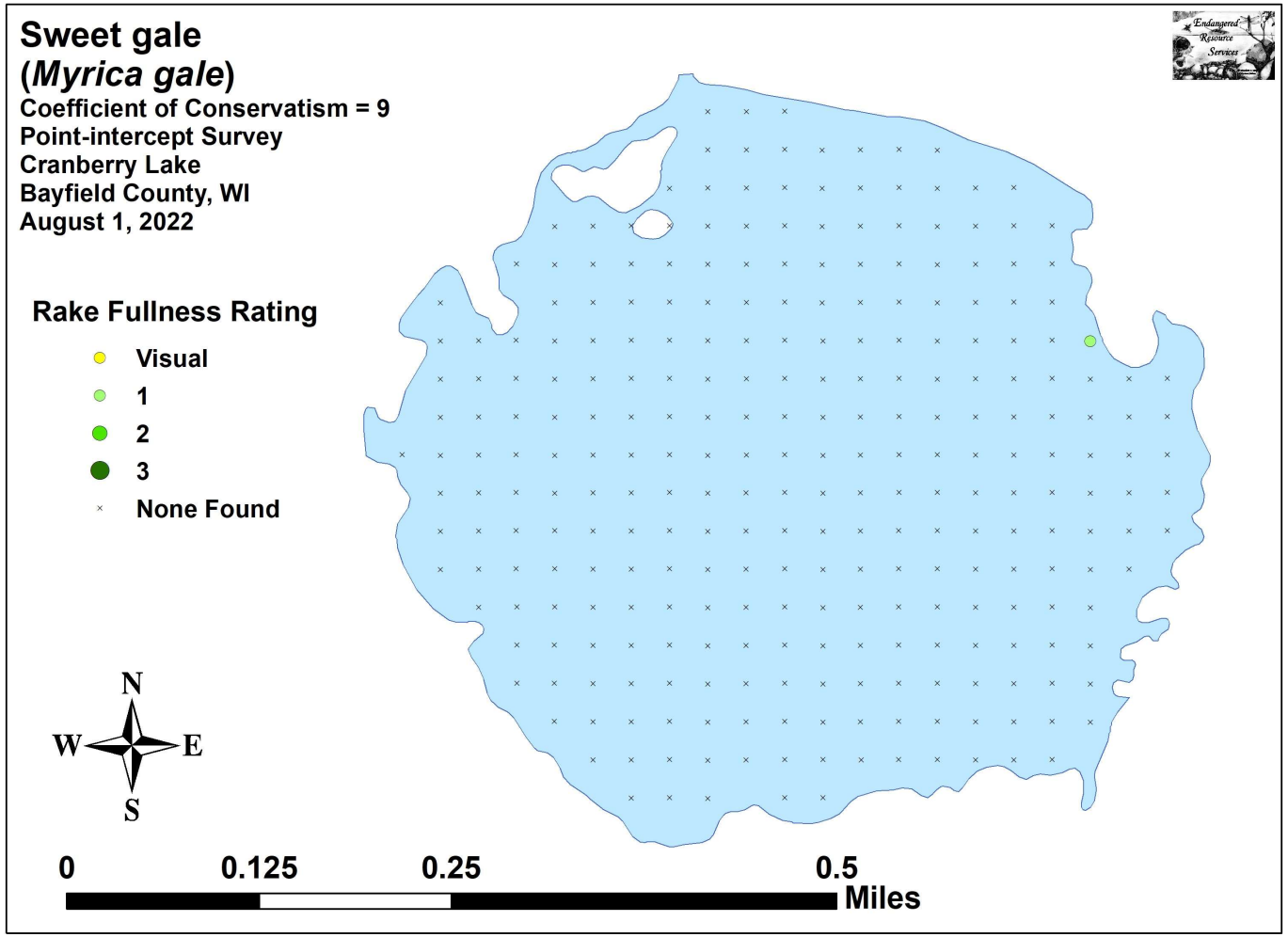
Sweet gale
(Myrica gale)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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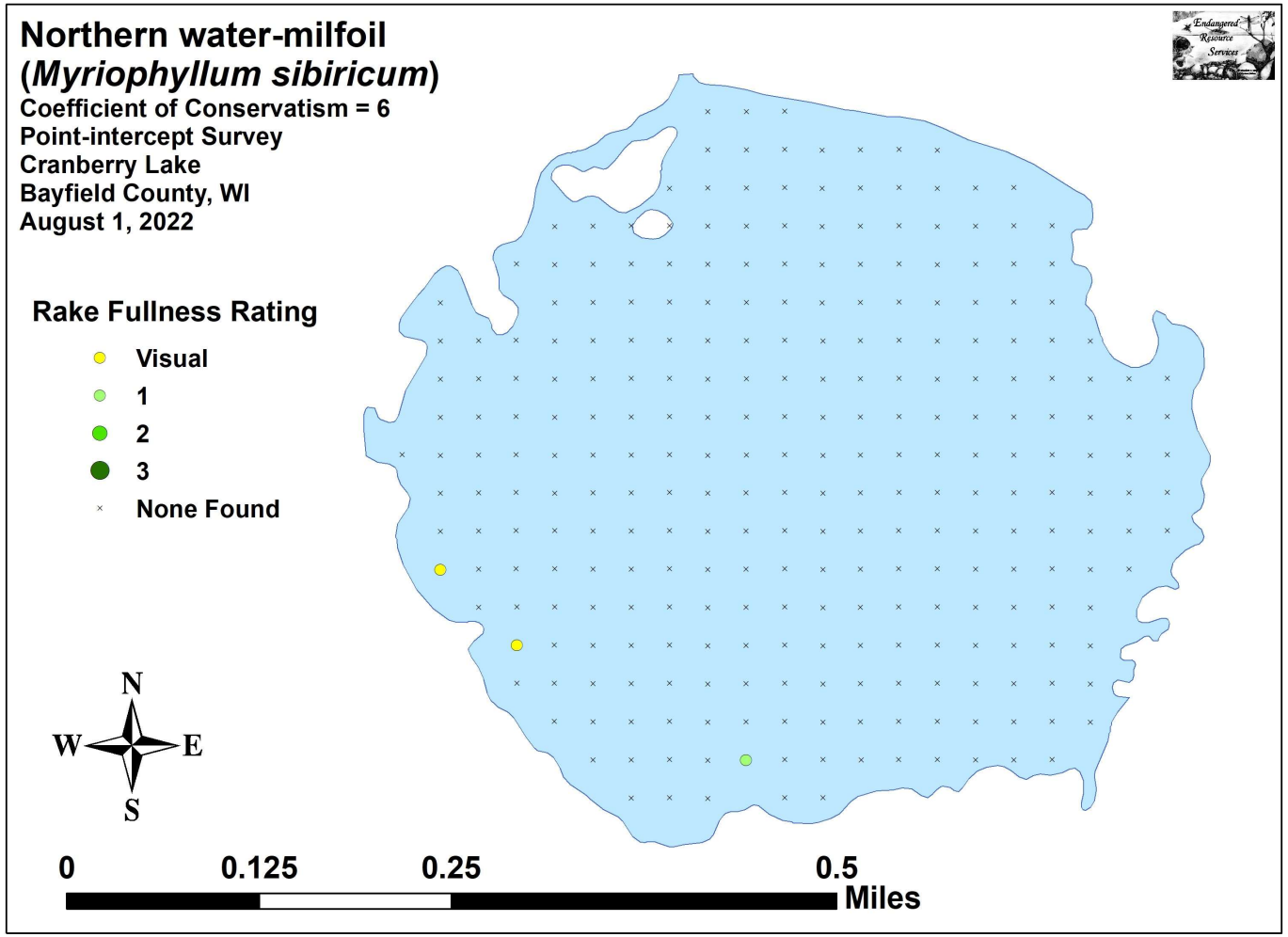
Miles


Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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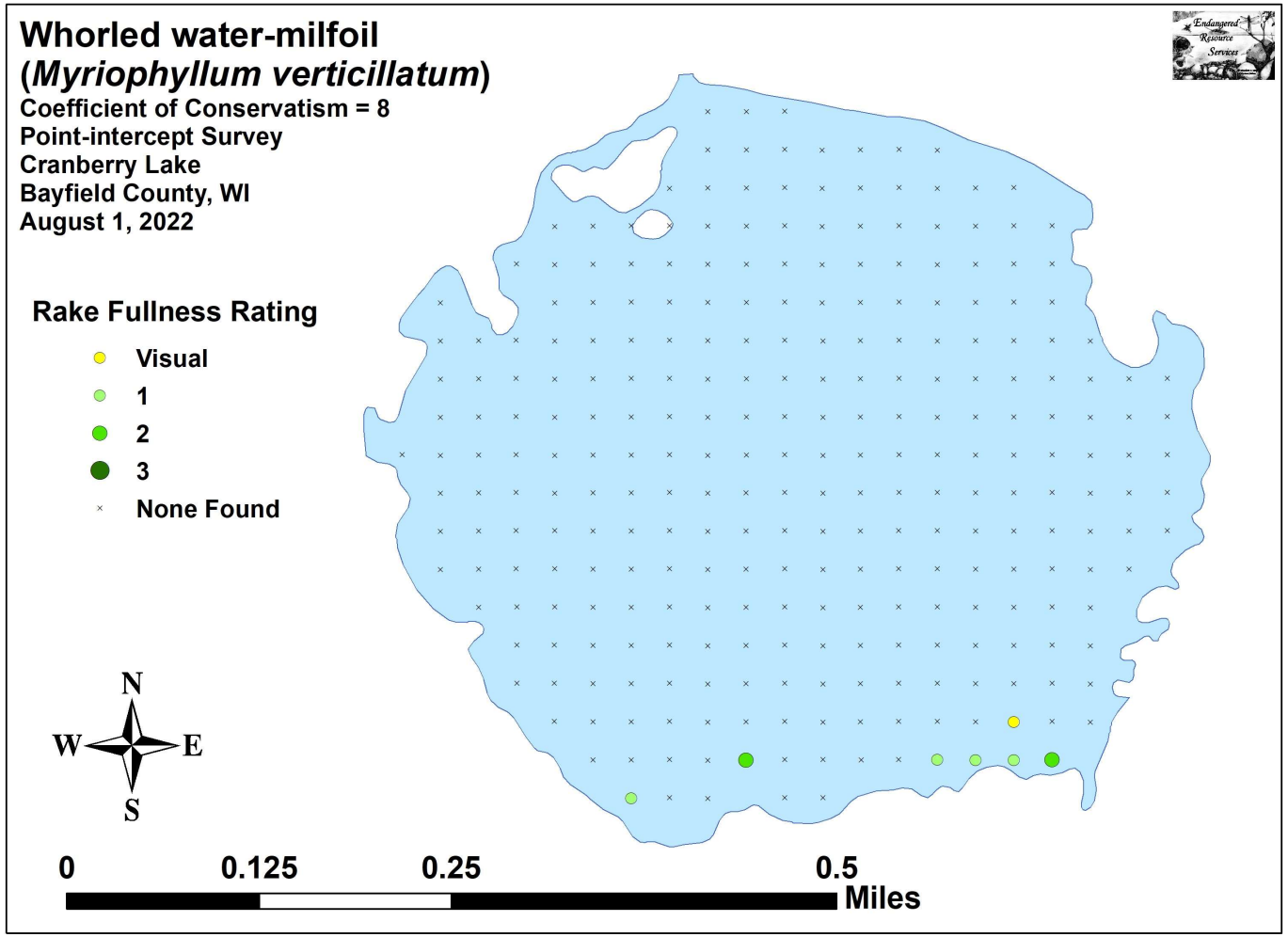
Miles


Whorled water-milfoil
(Myriophyllum verticillatum)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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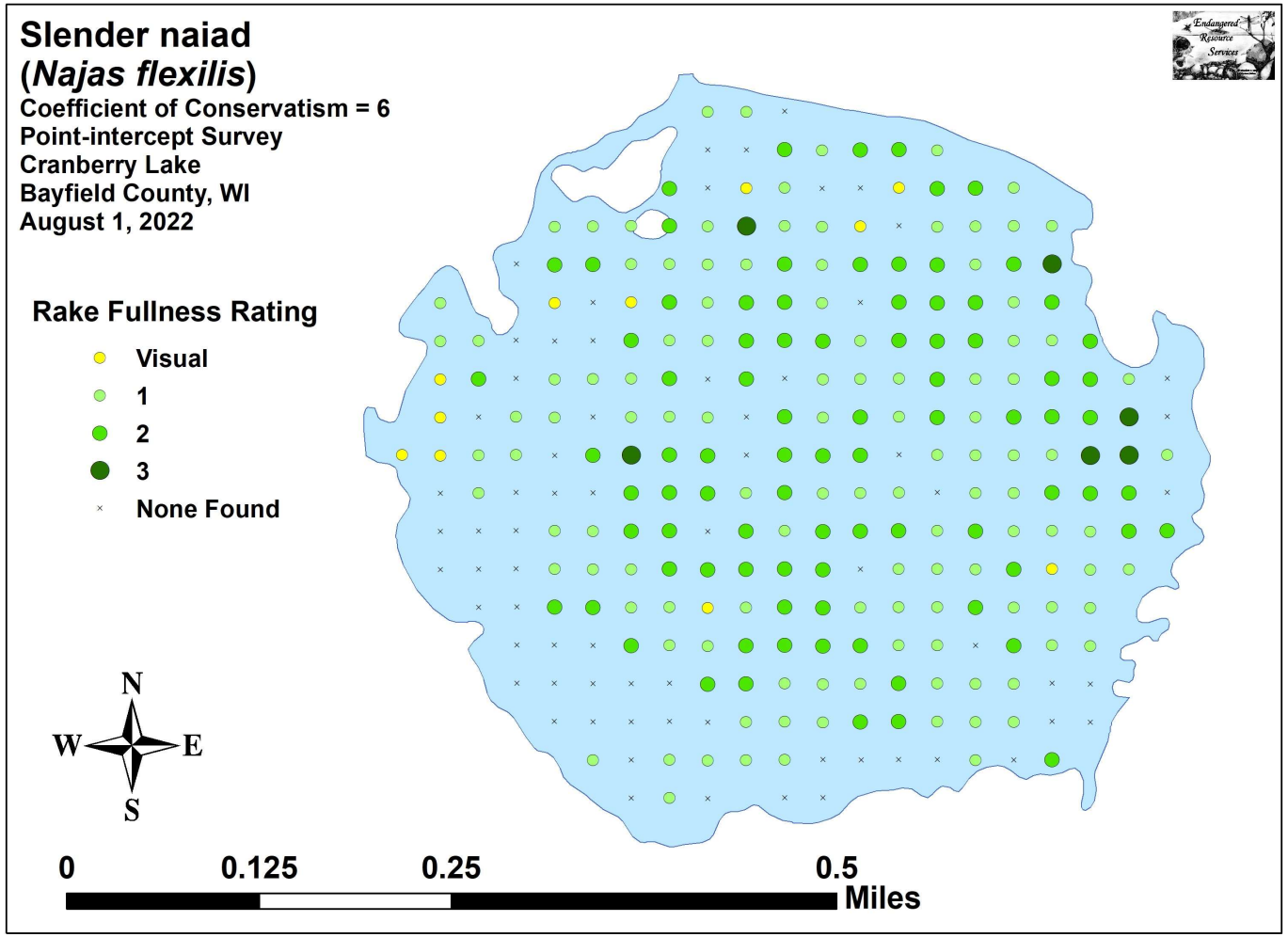
Miles


Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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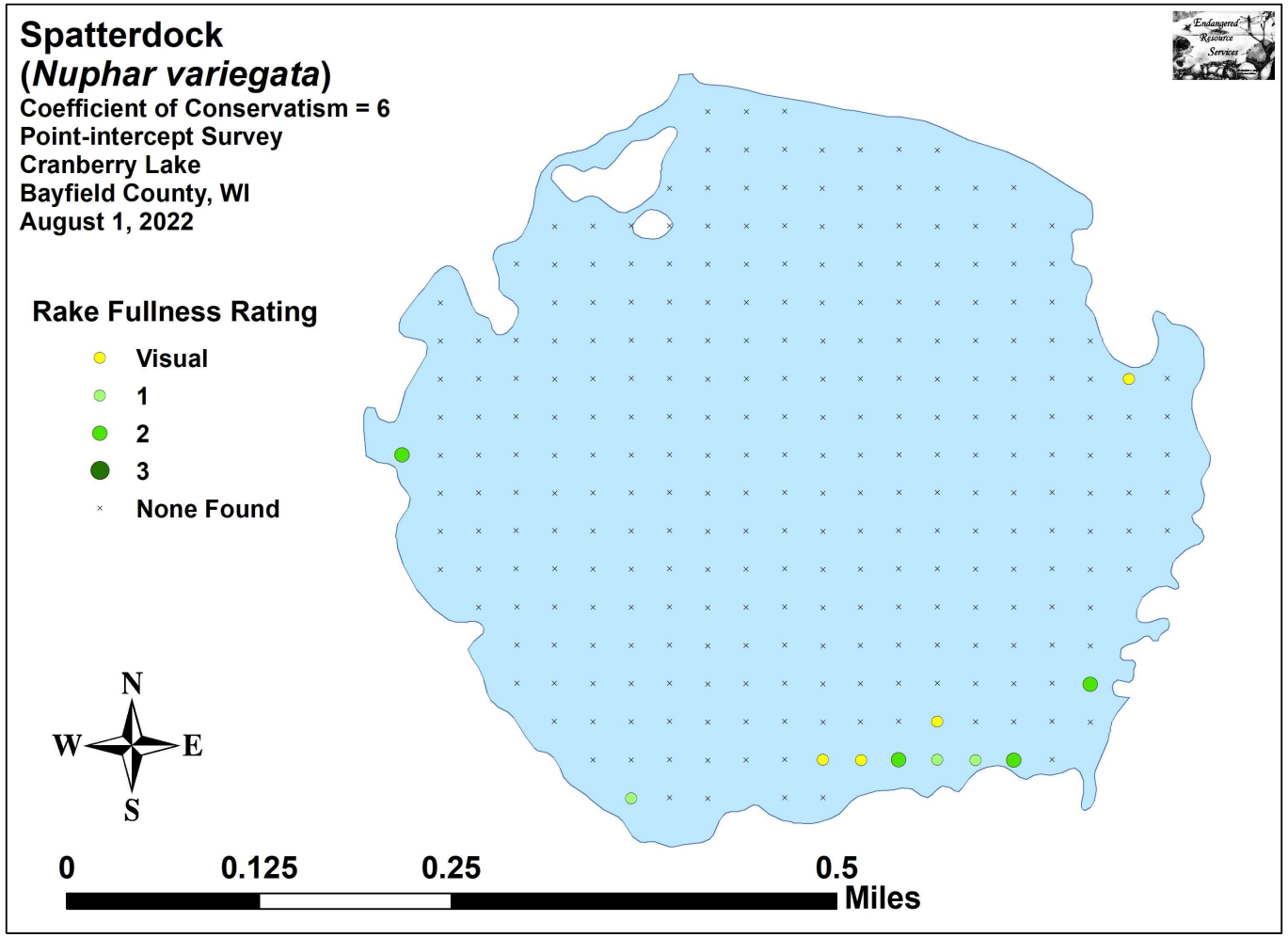
Miles


Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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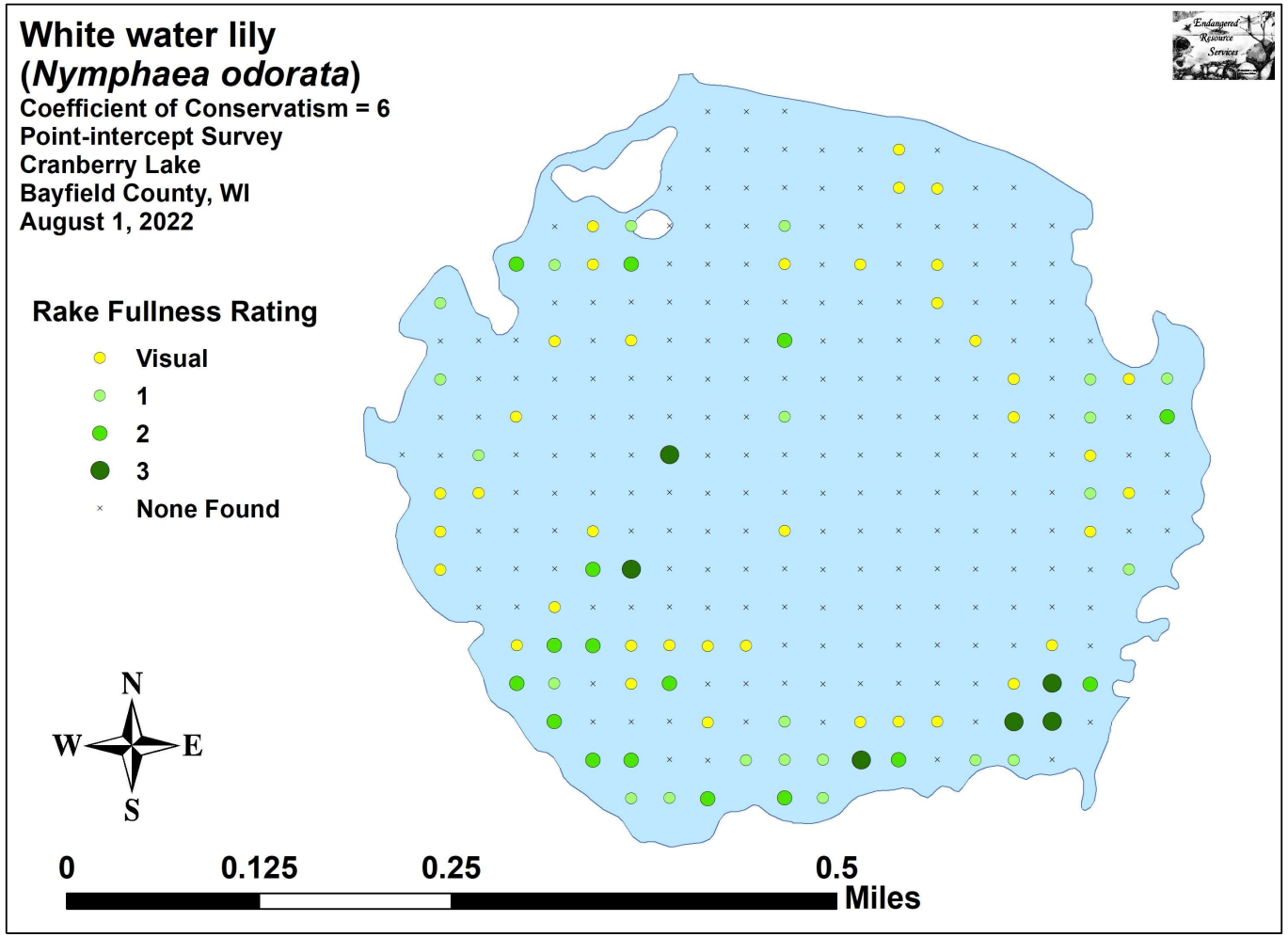
White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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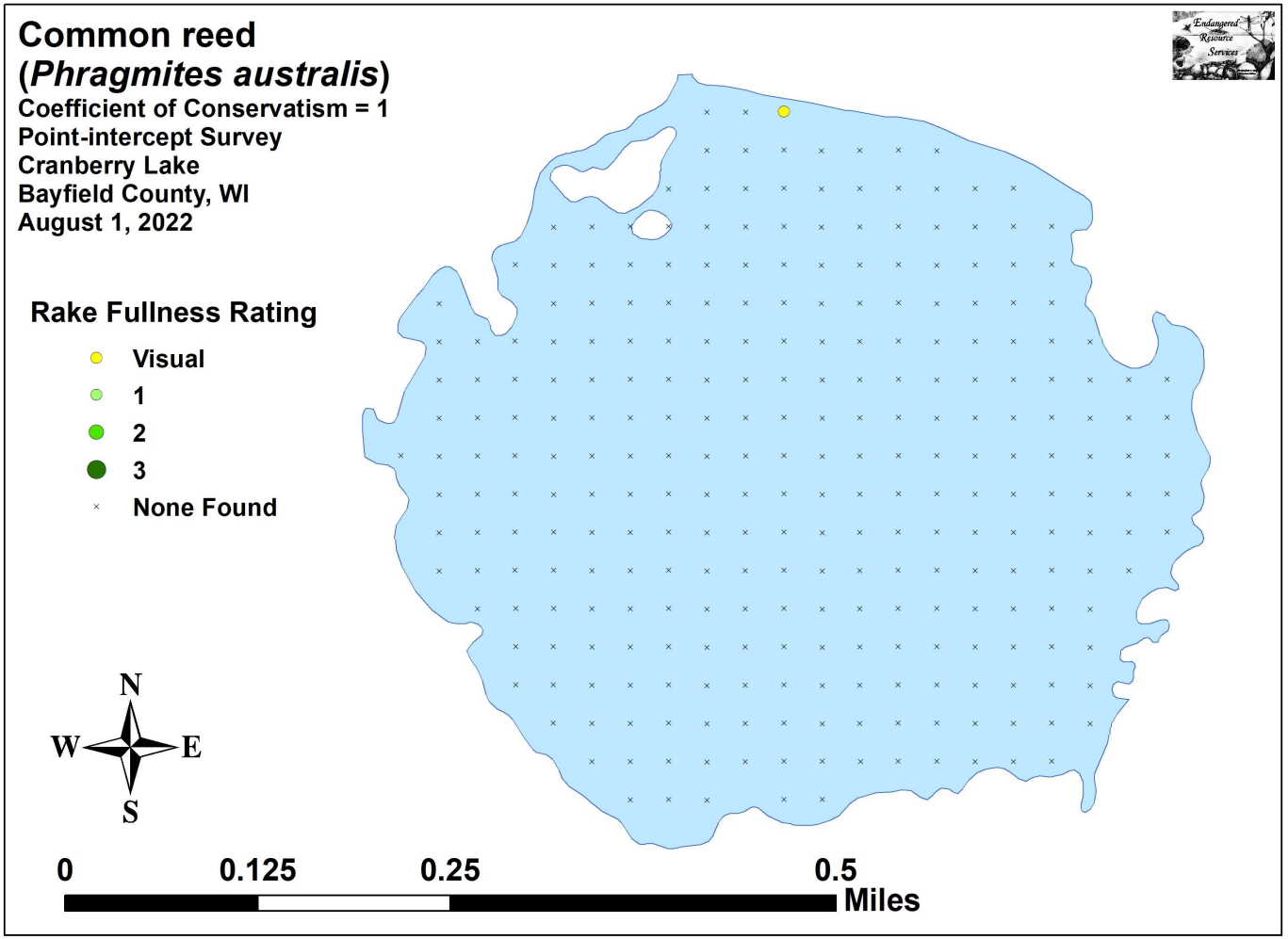
Miles


Common reed
(Phragmites australis)
Coefficient of Conservatism = 1
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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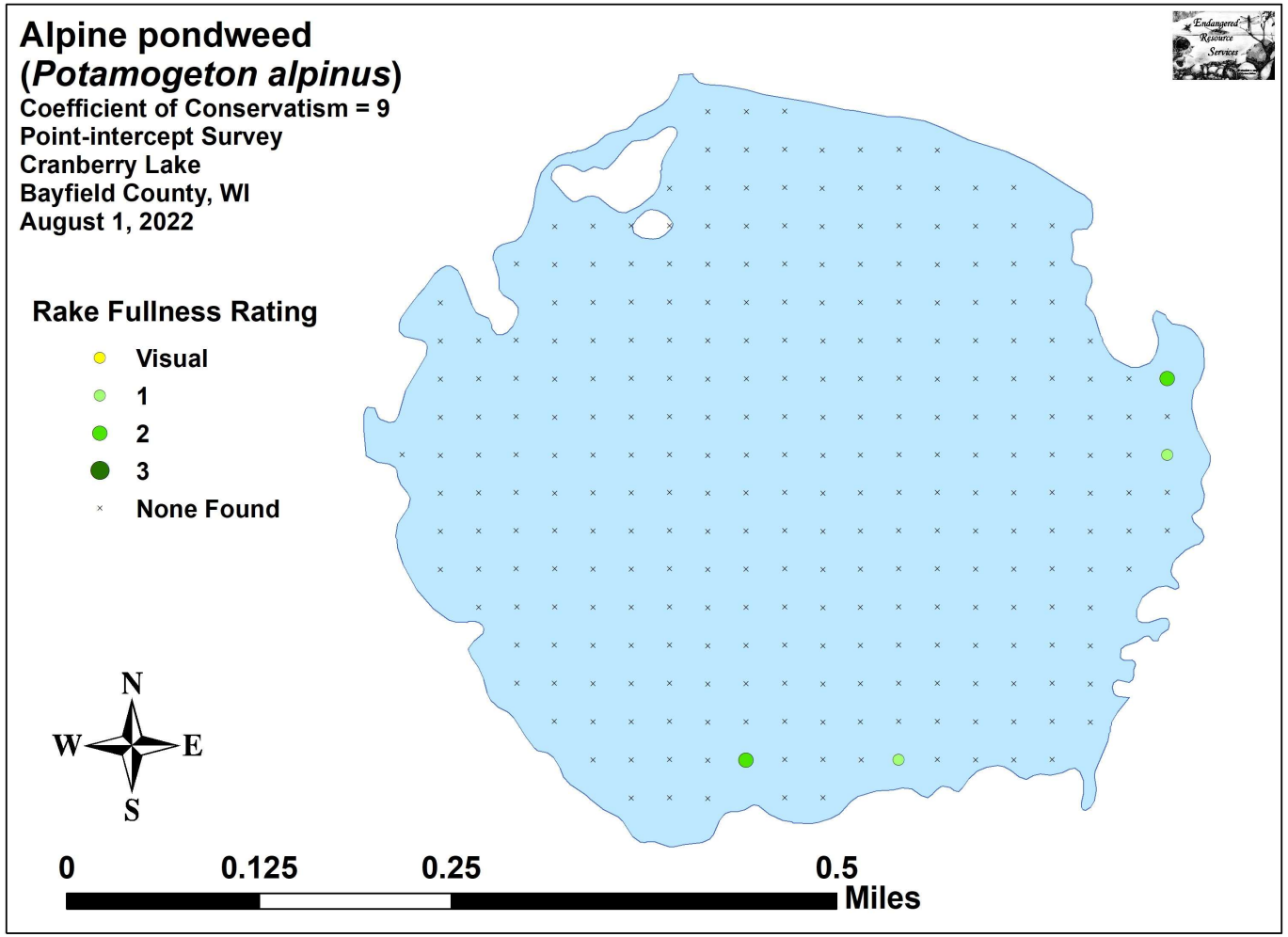
Miles


Alpine pondweed
(Potamogeton alpinus)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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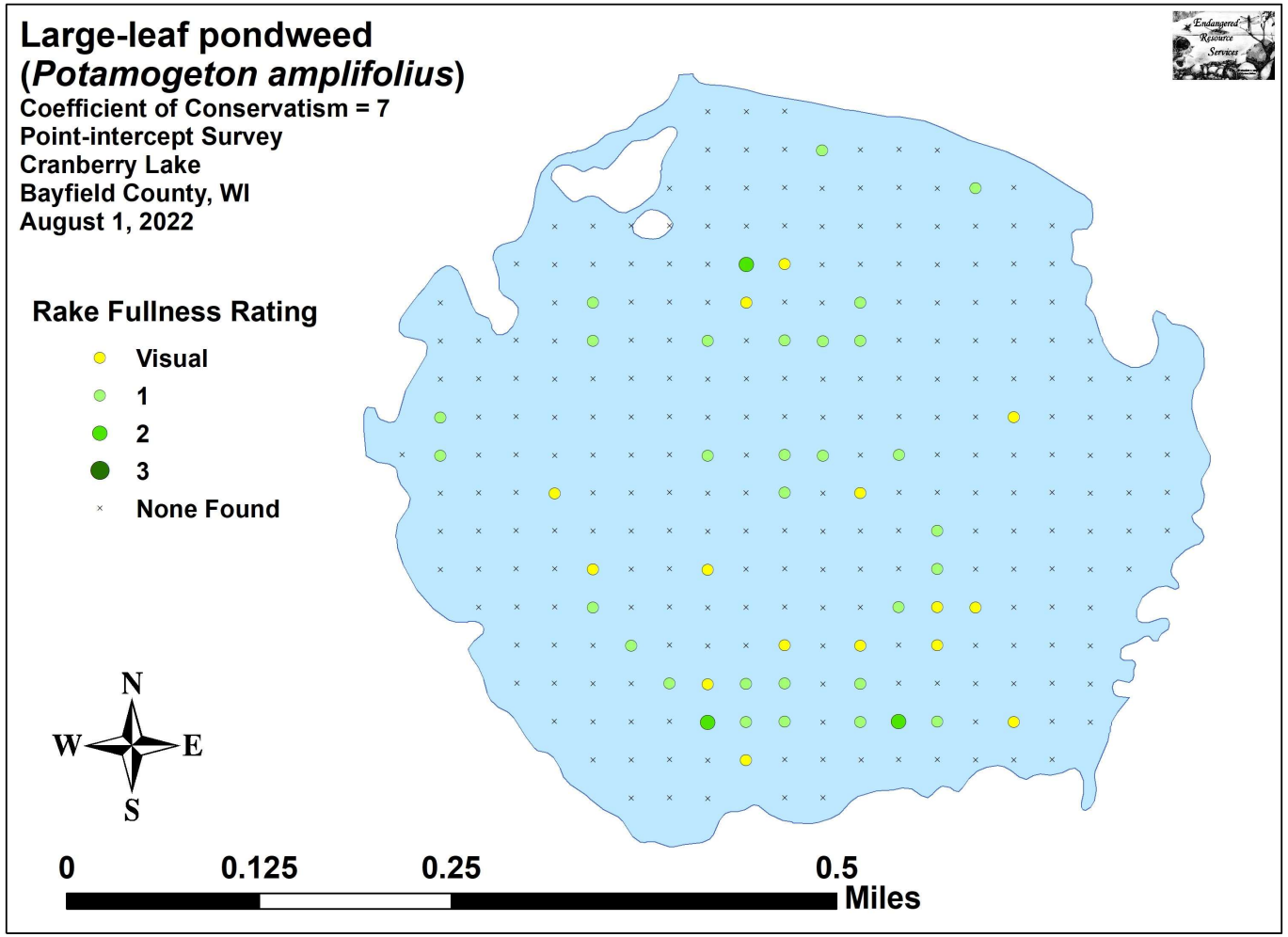
Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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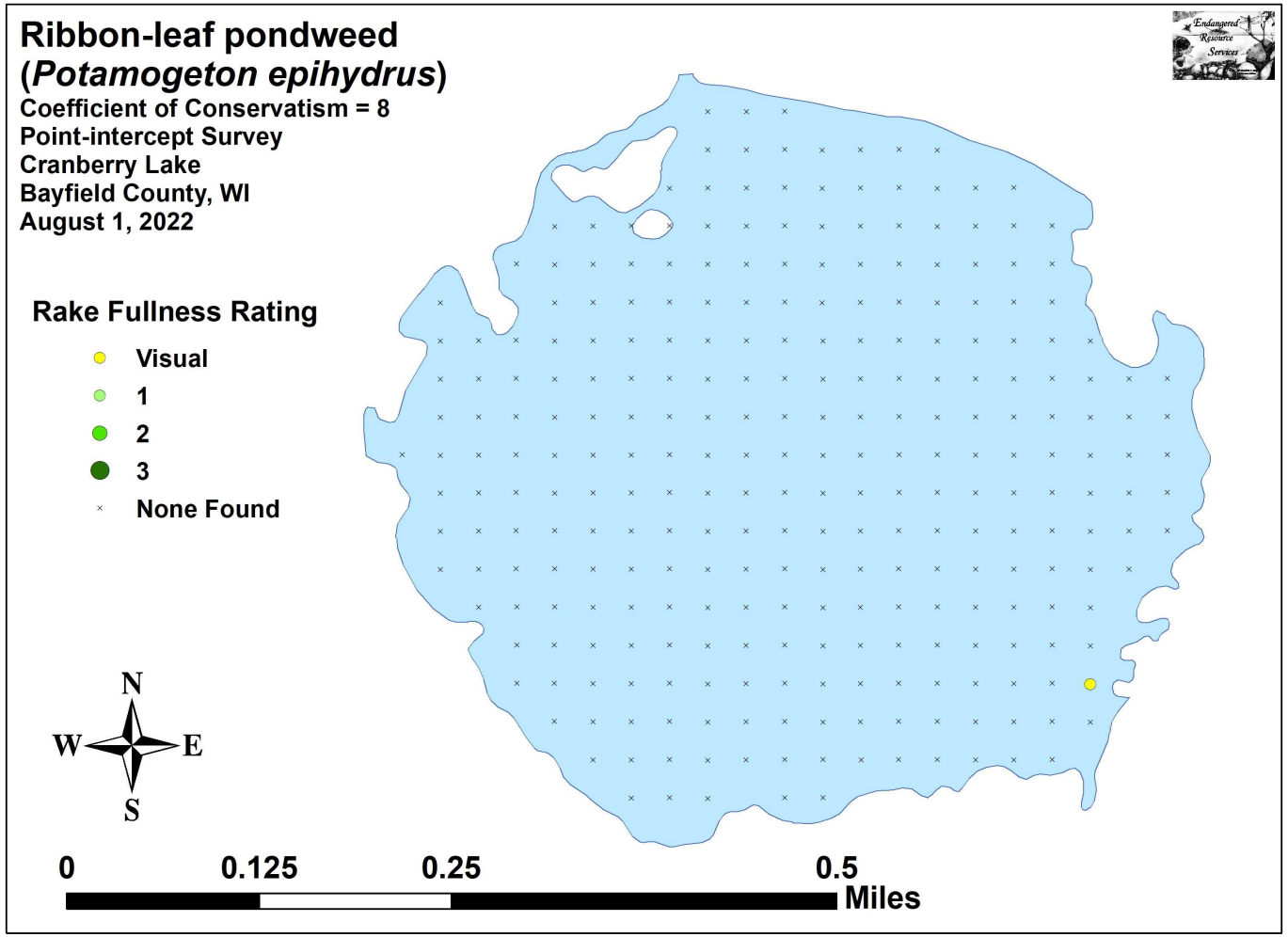
Ribbon-leaf pondweed
(Potamogeton epihydrus)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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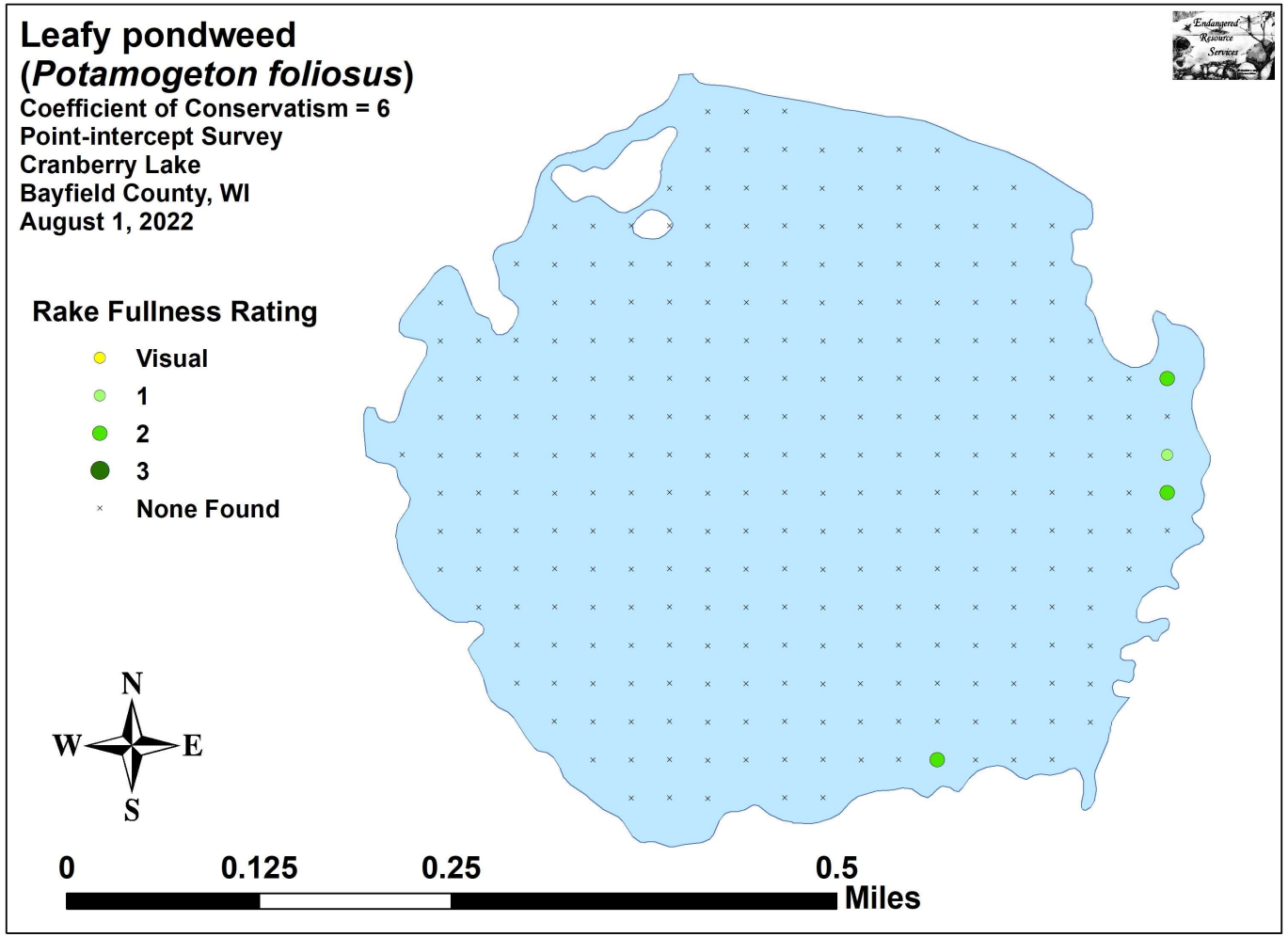
Leafy pondweed
(Potamogeton foliosus)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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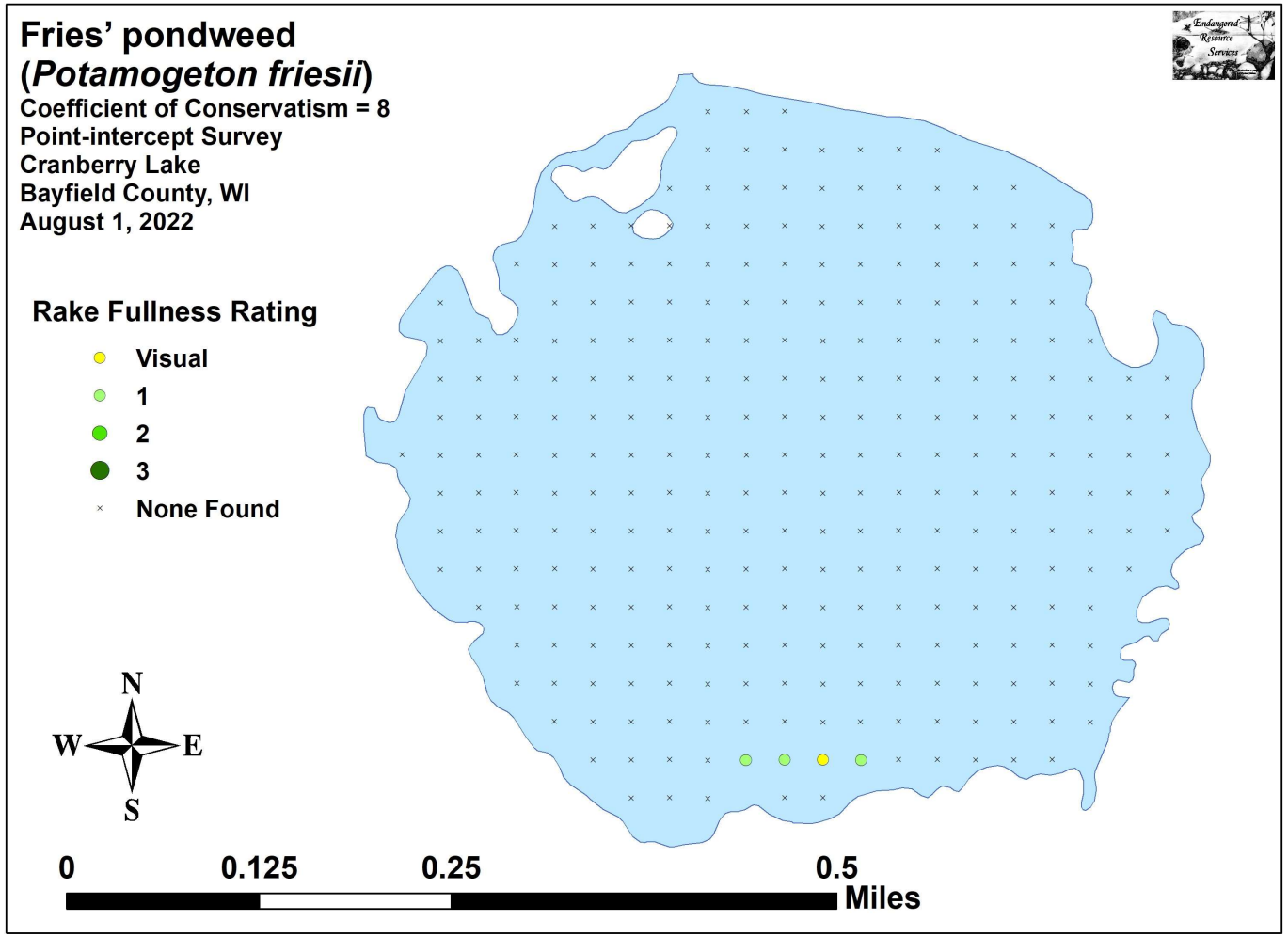
Miles


Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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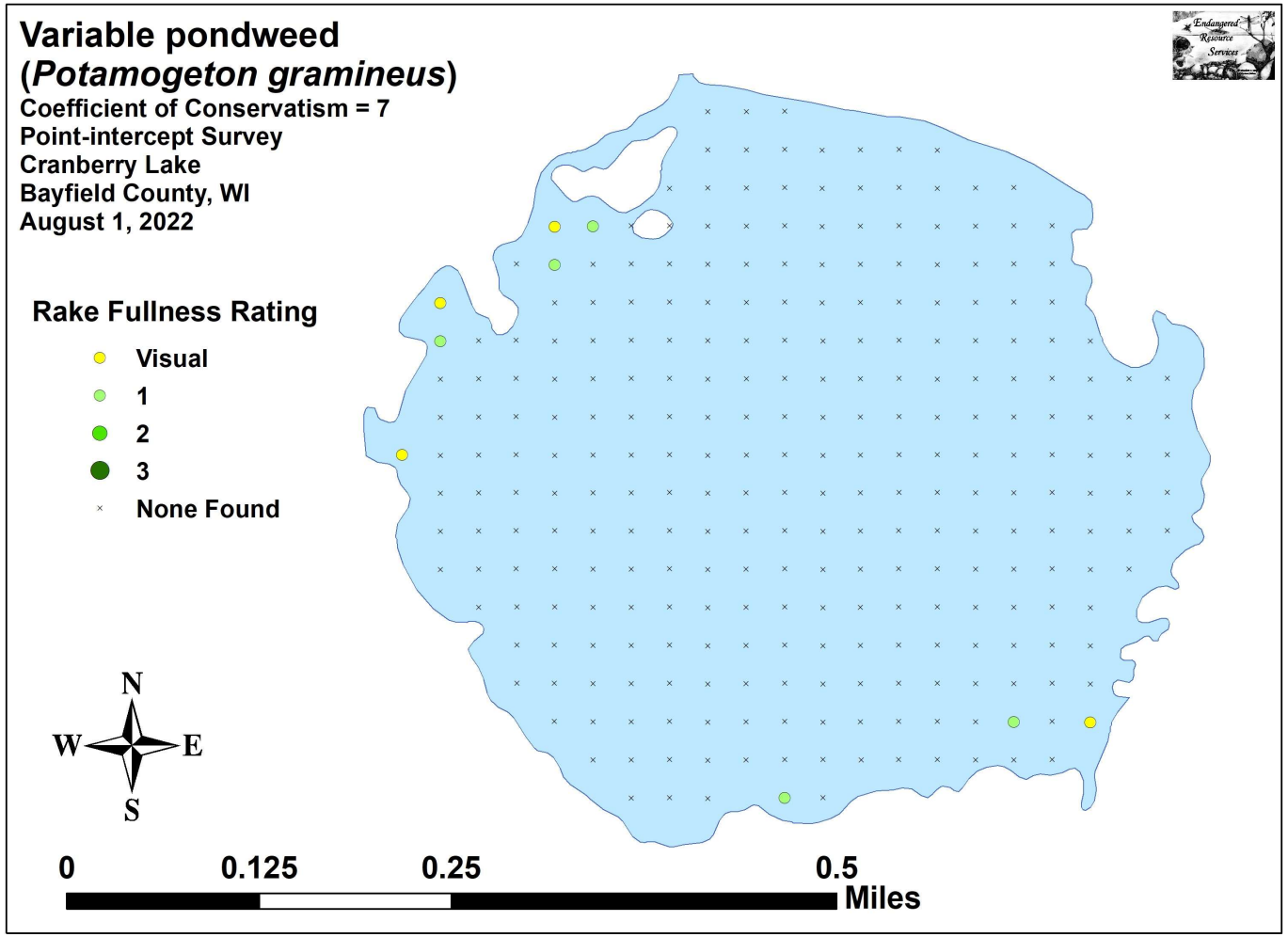
Miles


Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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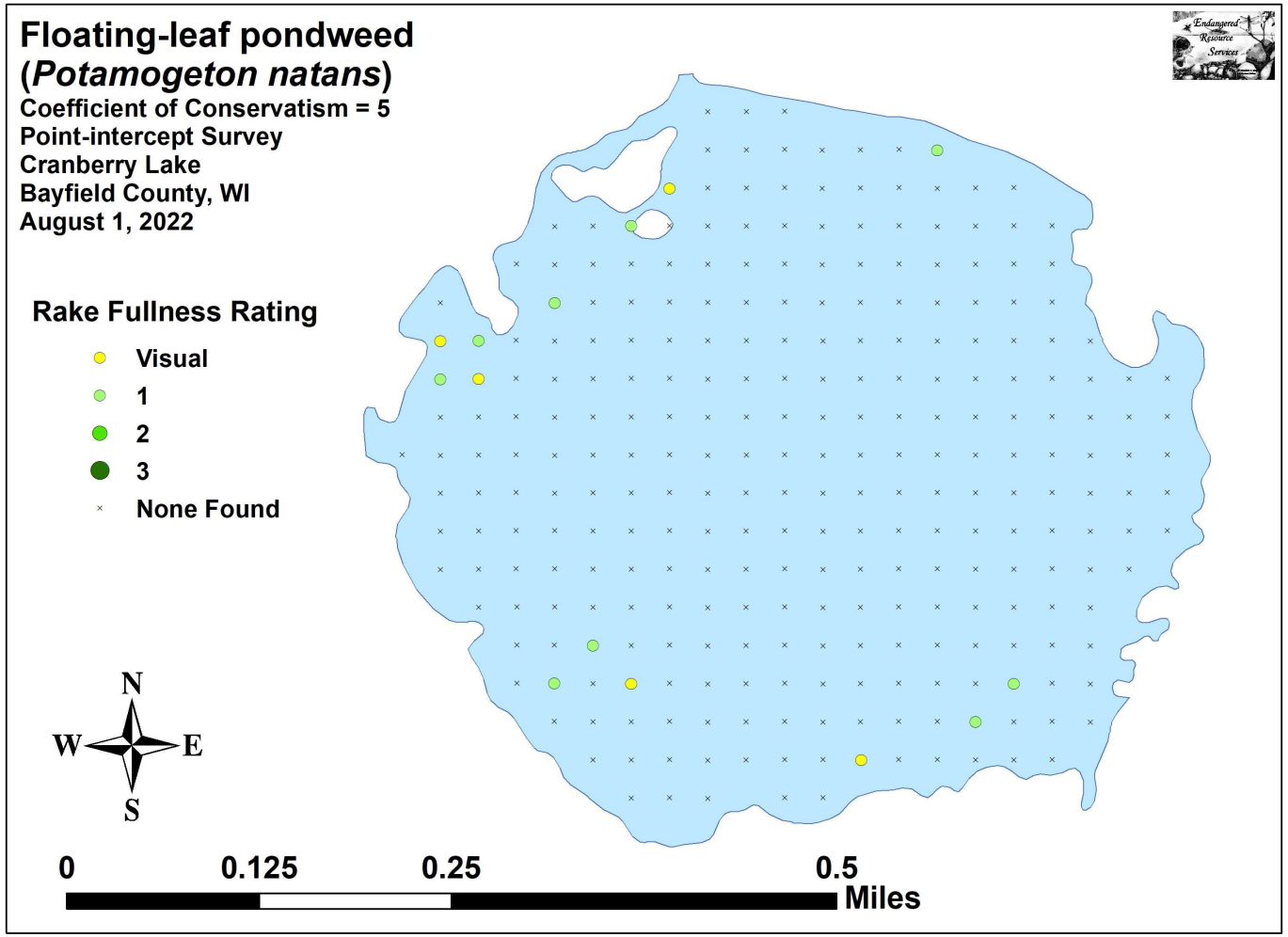
Miles


Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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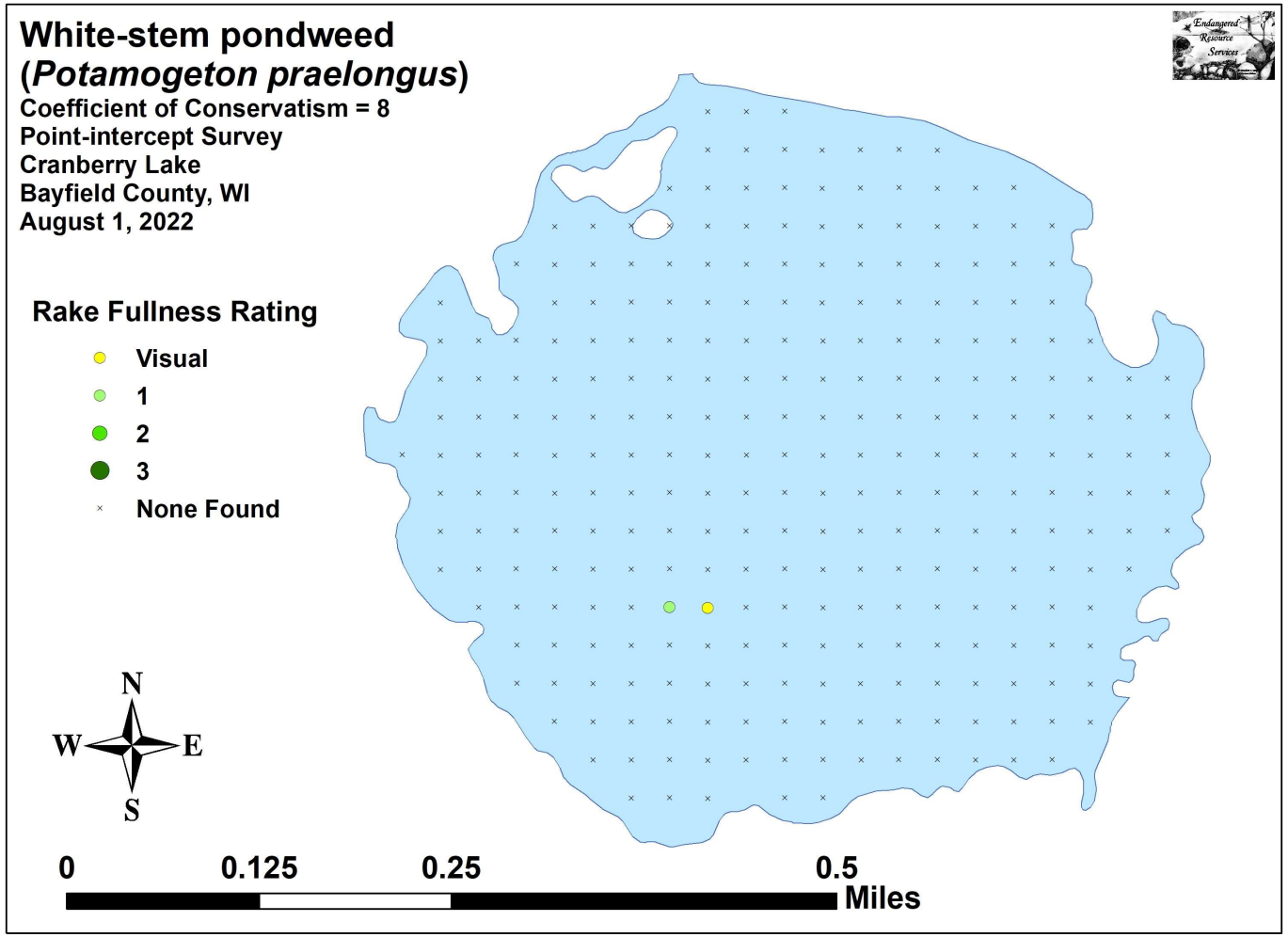
Miles


White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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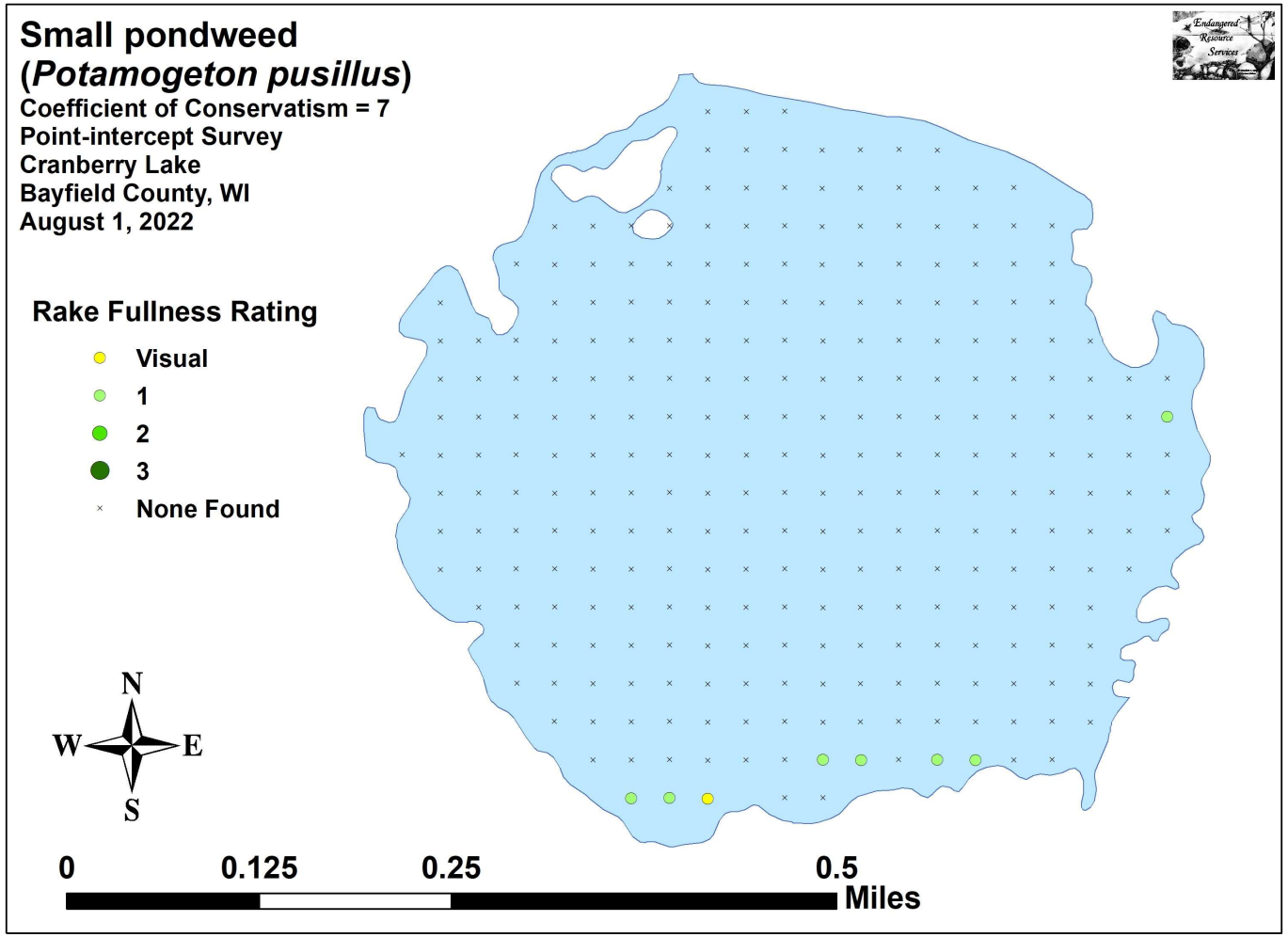
Miles


Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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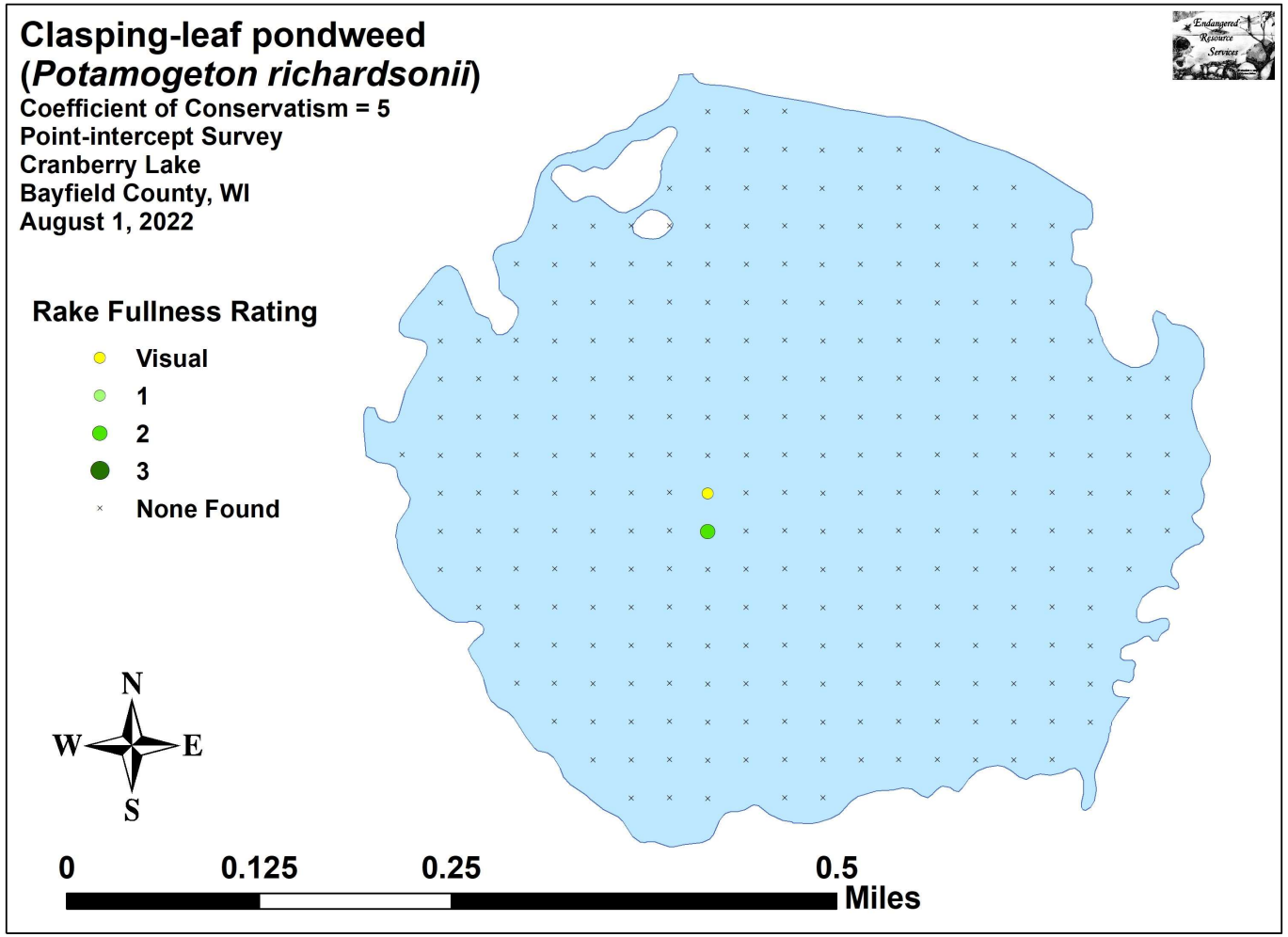
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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0.125
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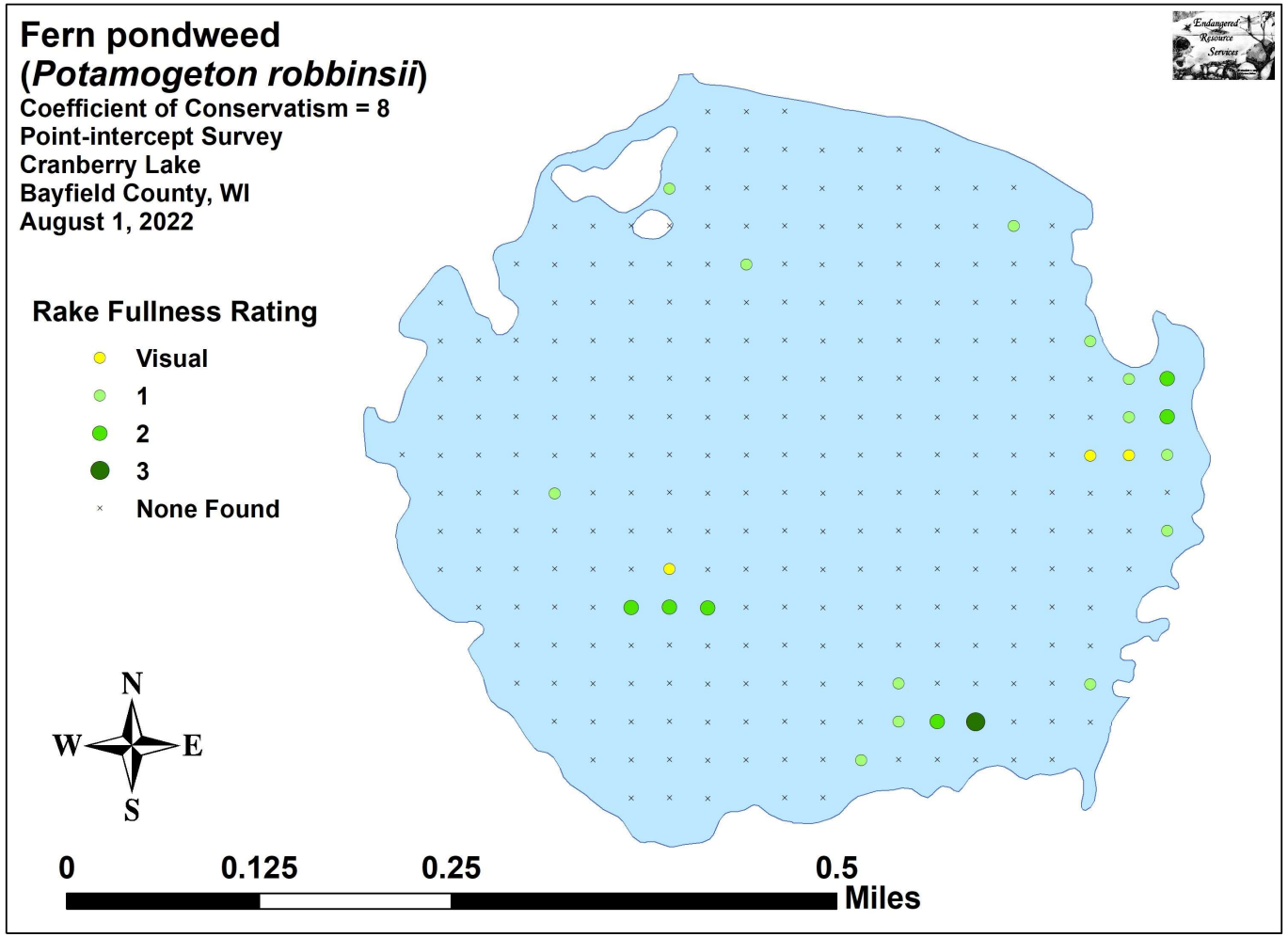
0.5
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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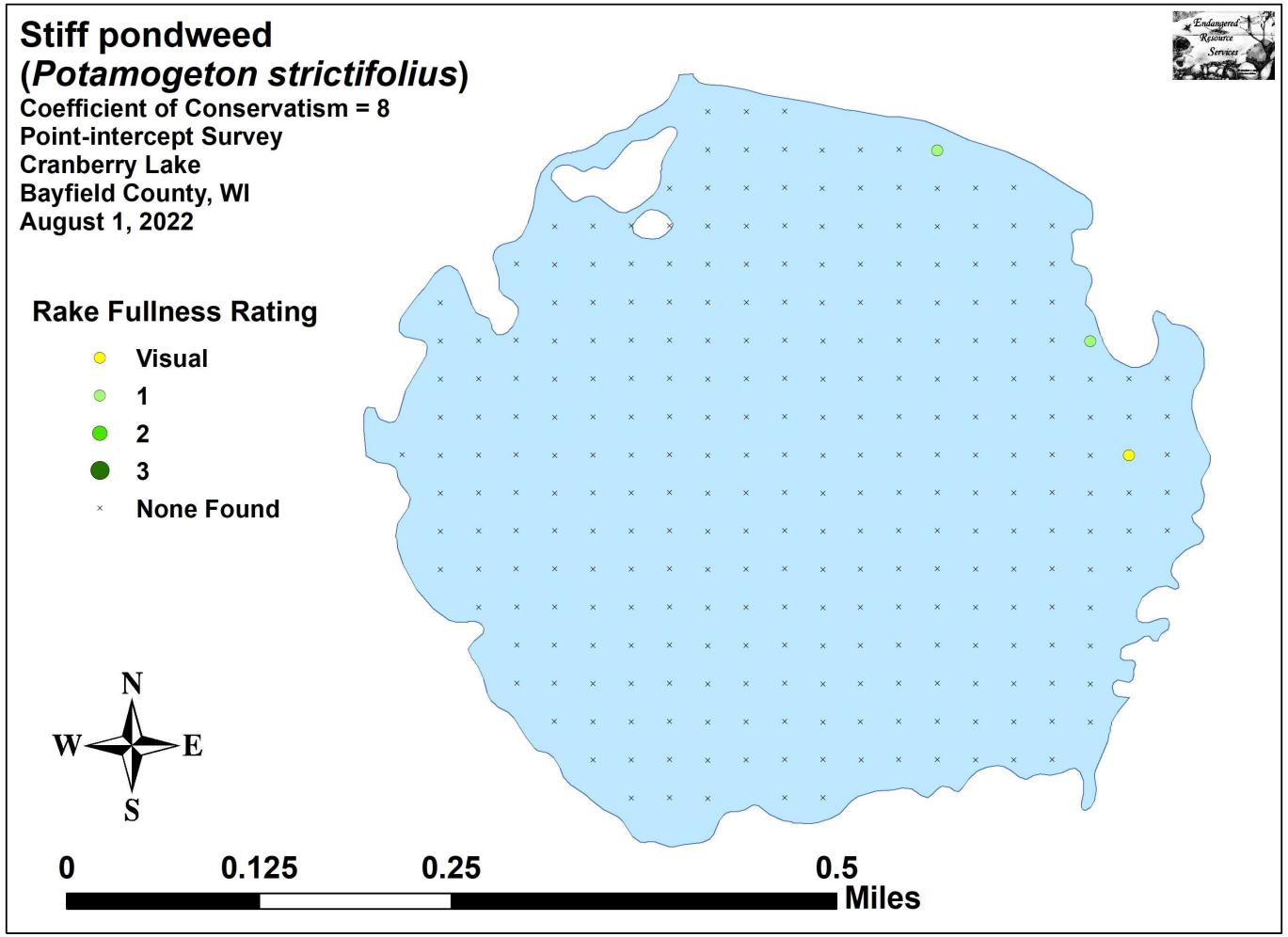
Miles


Stiff pondweed
(Potamogeton strictifolius)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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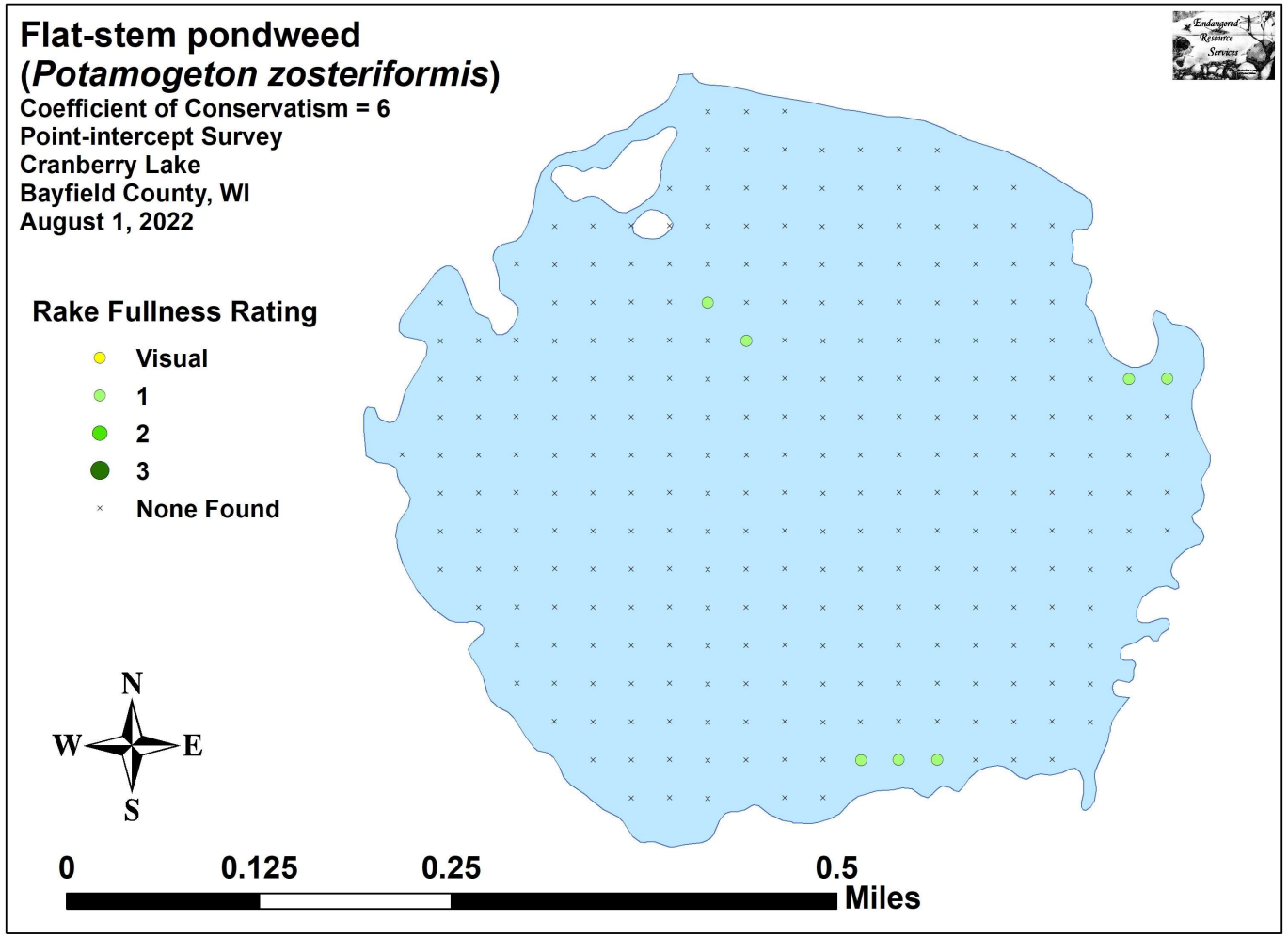
Miles


Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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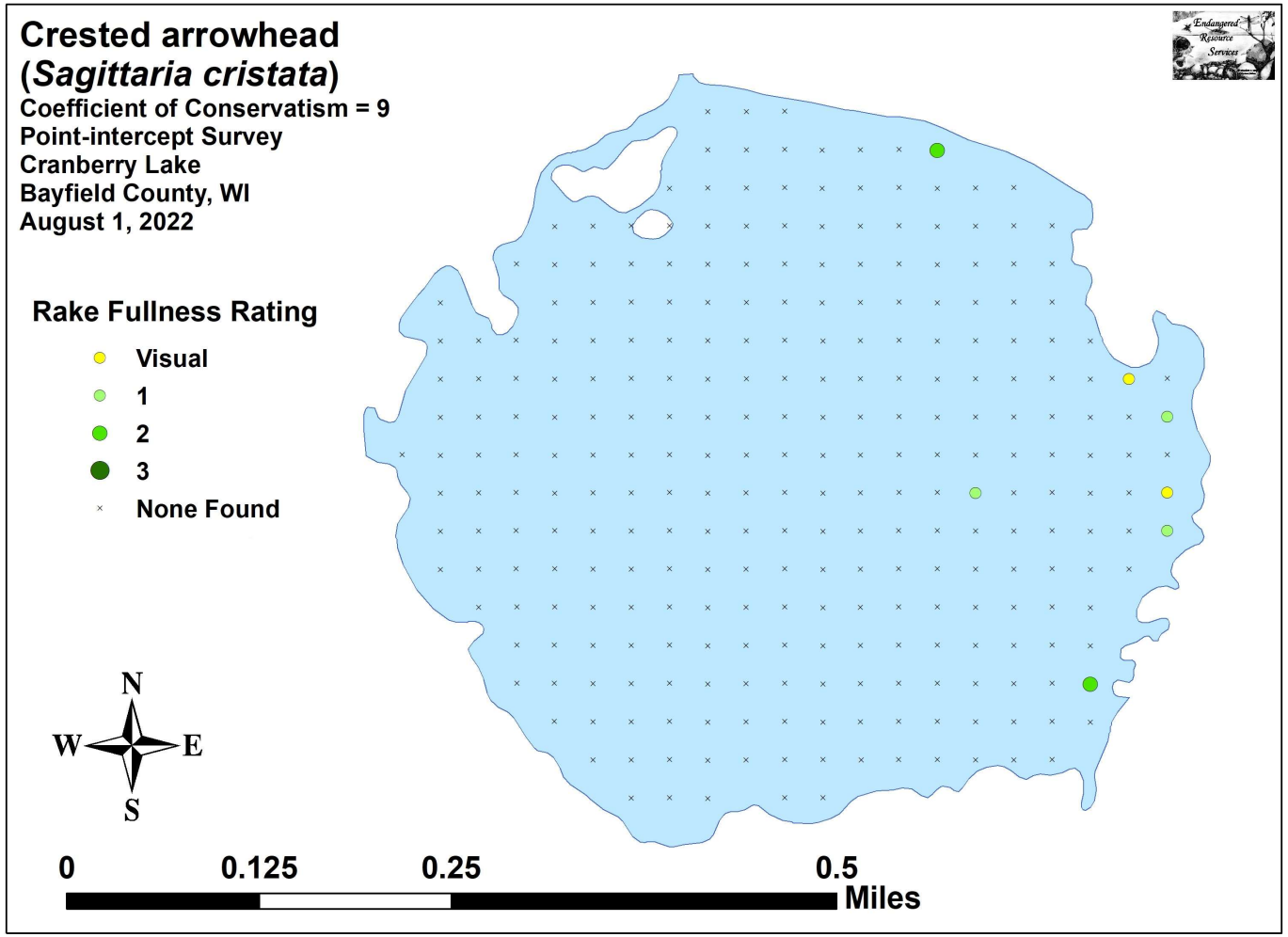
Miles


Crested arrowhead
(Sagittaria cristata)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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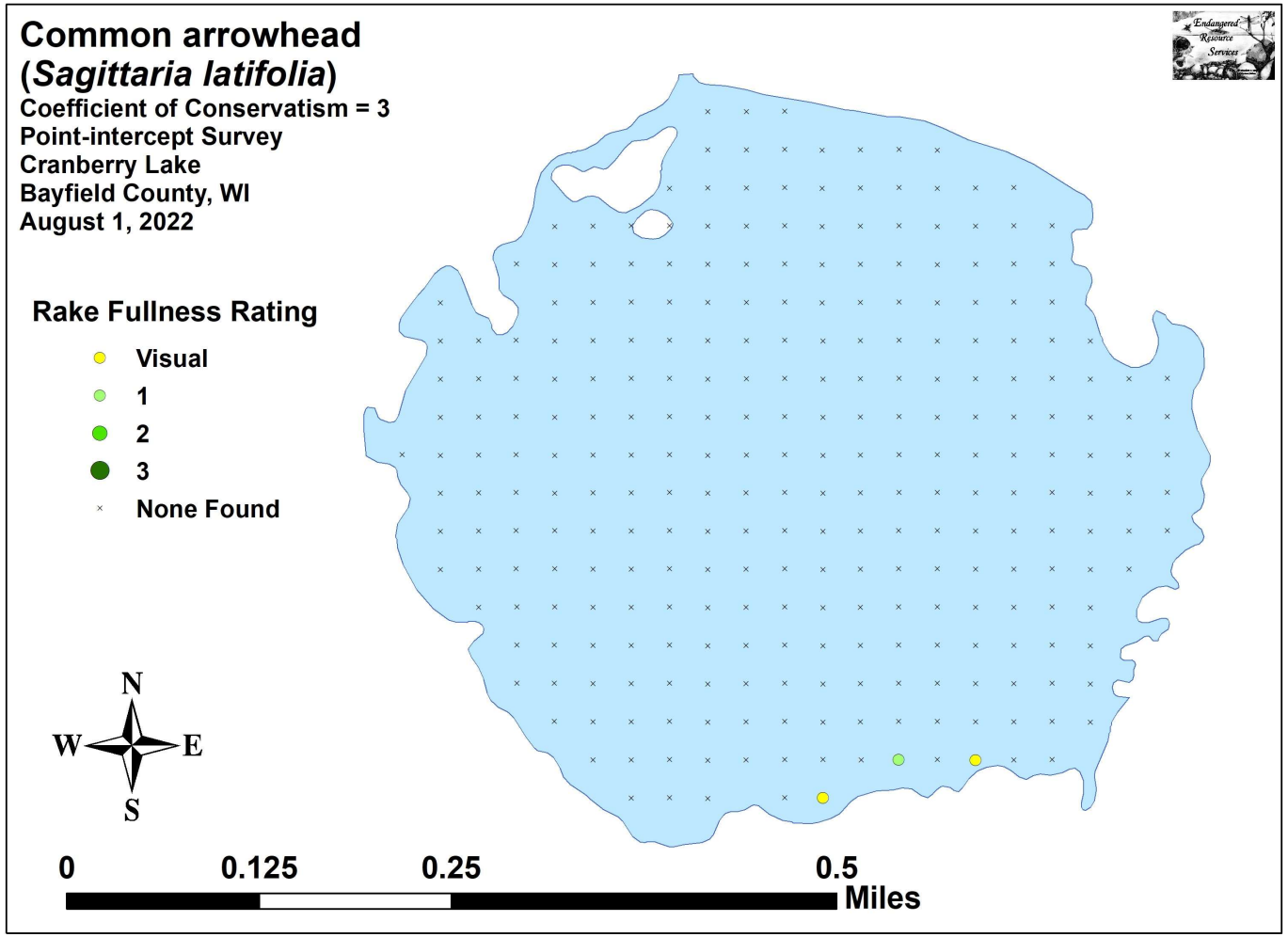
Miles


Common arrowhead
(Sagittaria latifolia)
Coefficient of Conservatism = 3
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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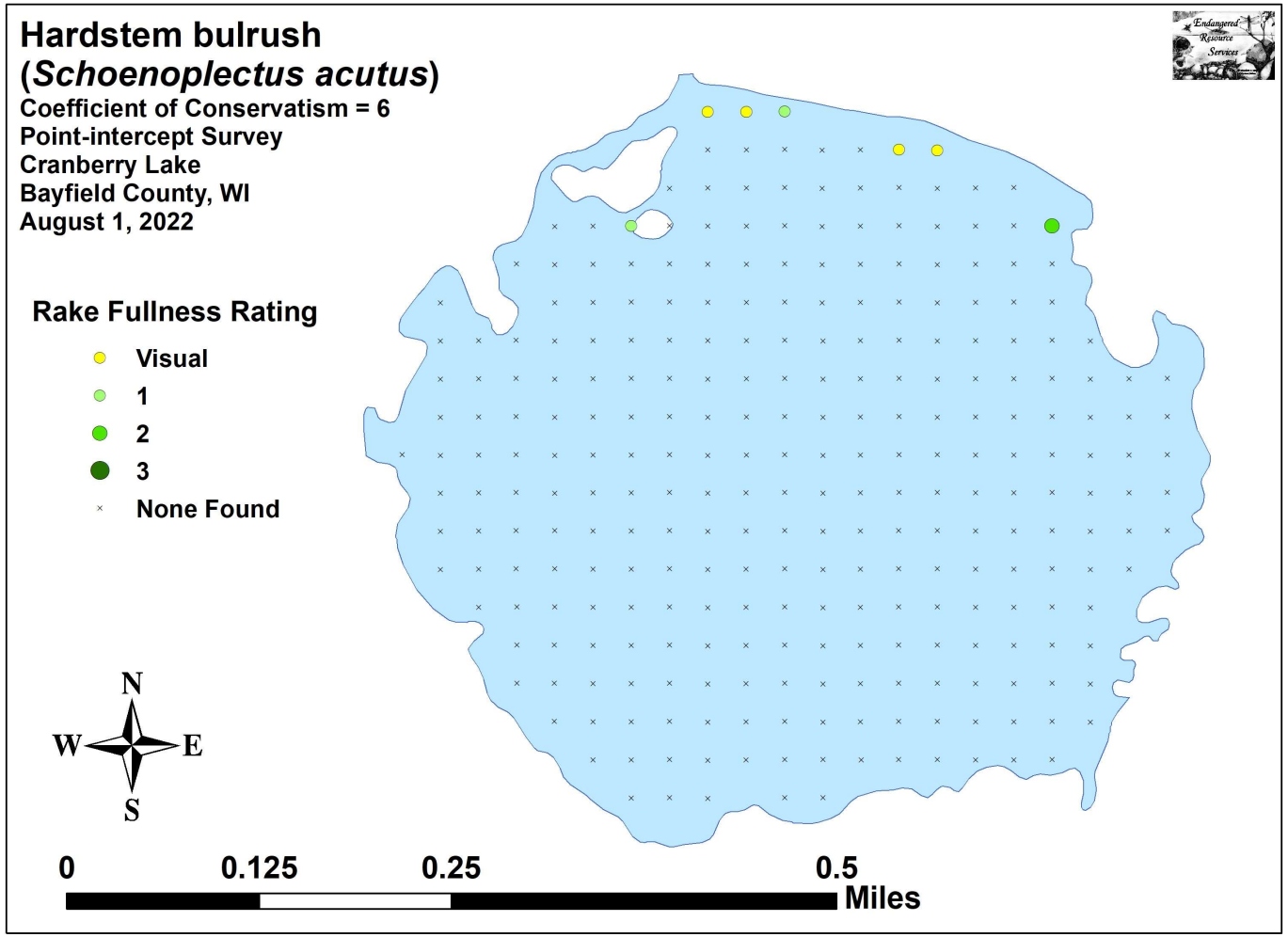
Miles


Hardstem bulrush
(Schoenoplectus acutus)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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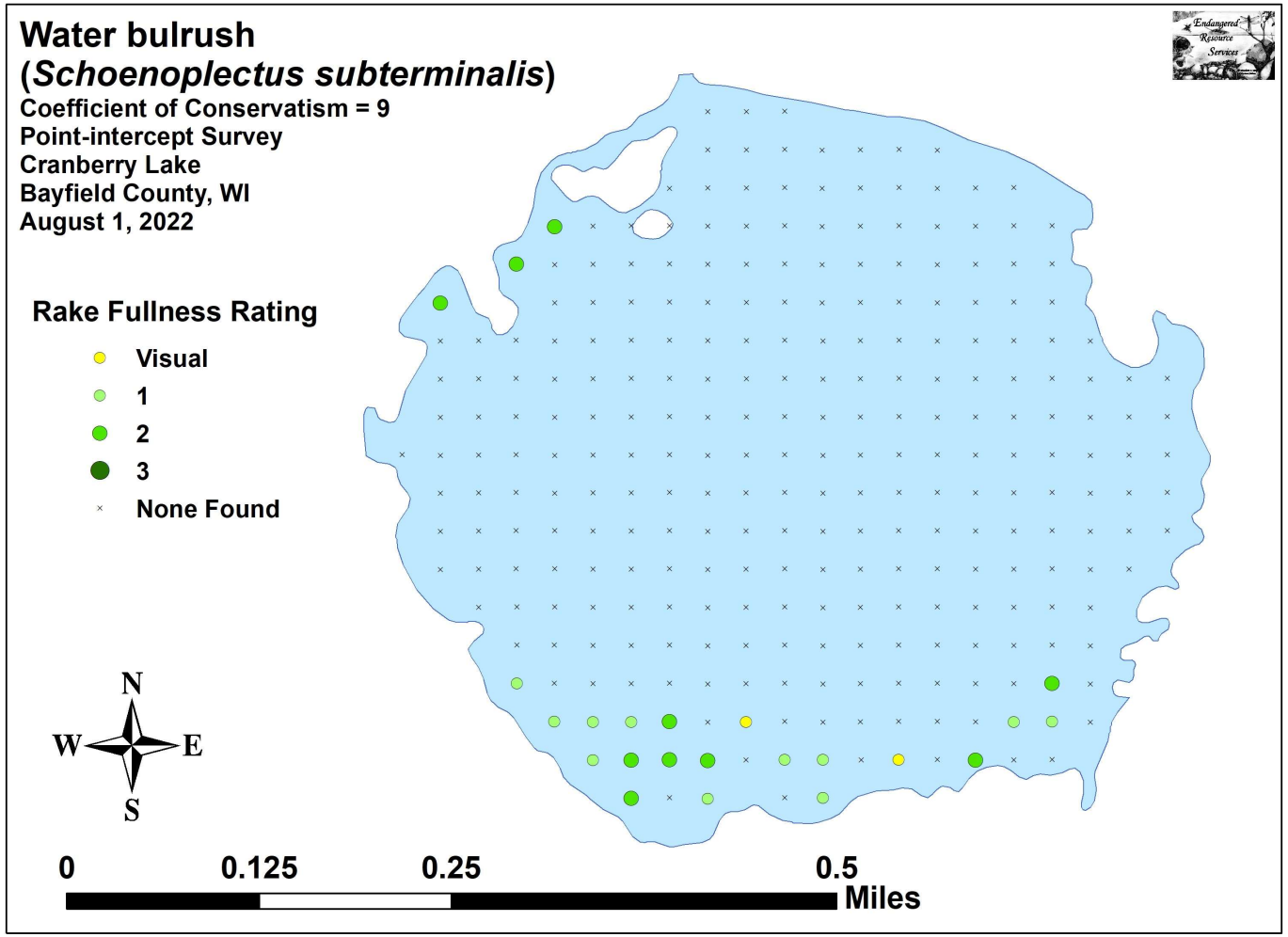
Miles


Water bulrush
(Schoenoplectus subterminalis)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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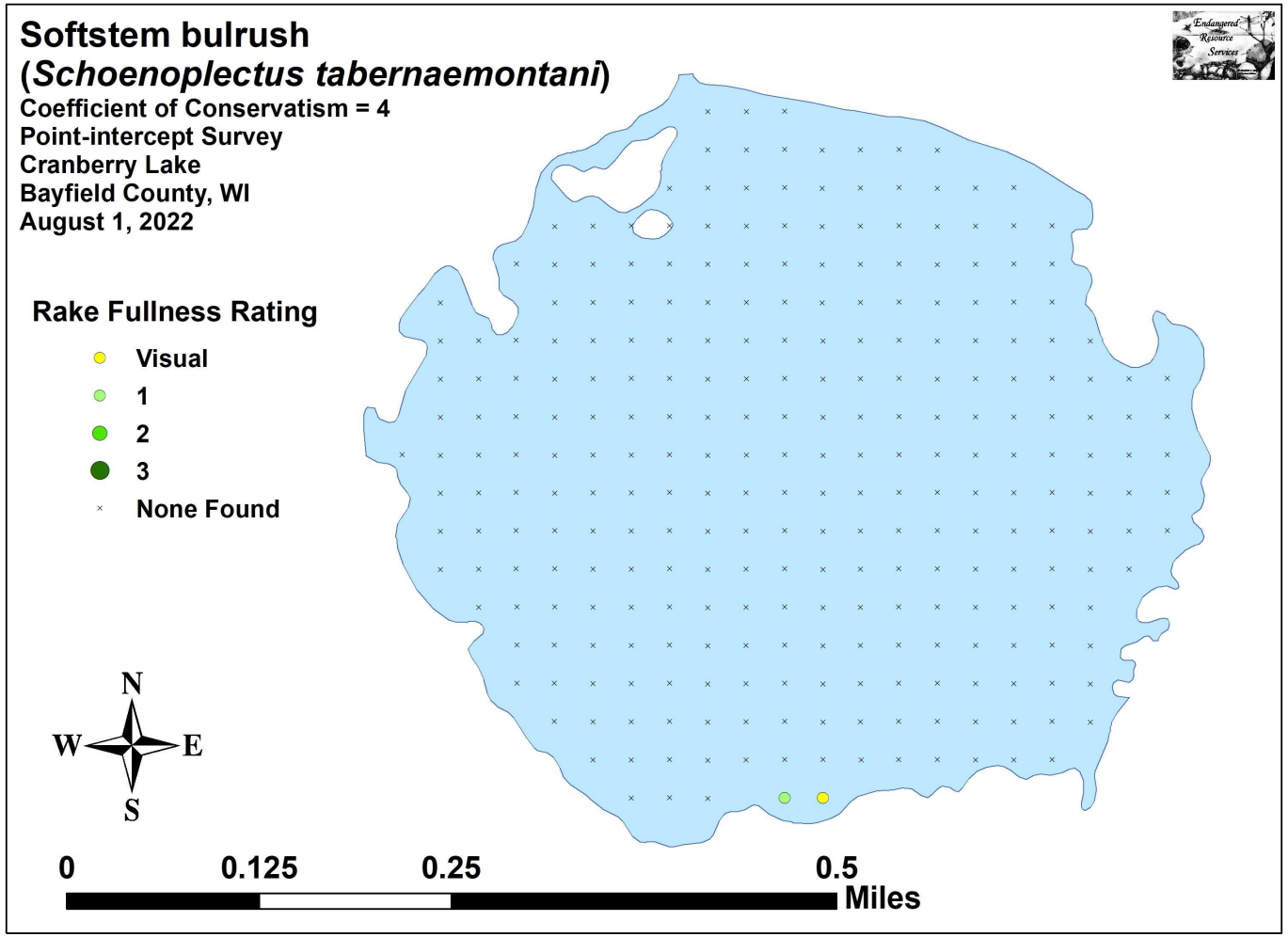
Miles


Softstem bulrush
(Schoenoplectus tabernaemontani)
Coefficient of Conservatism = 4
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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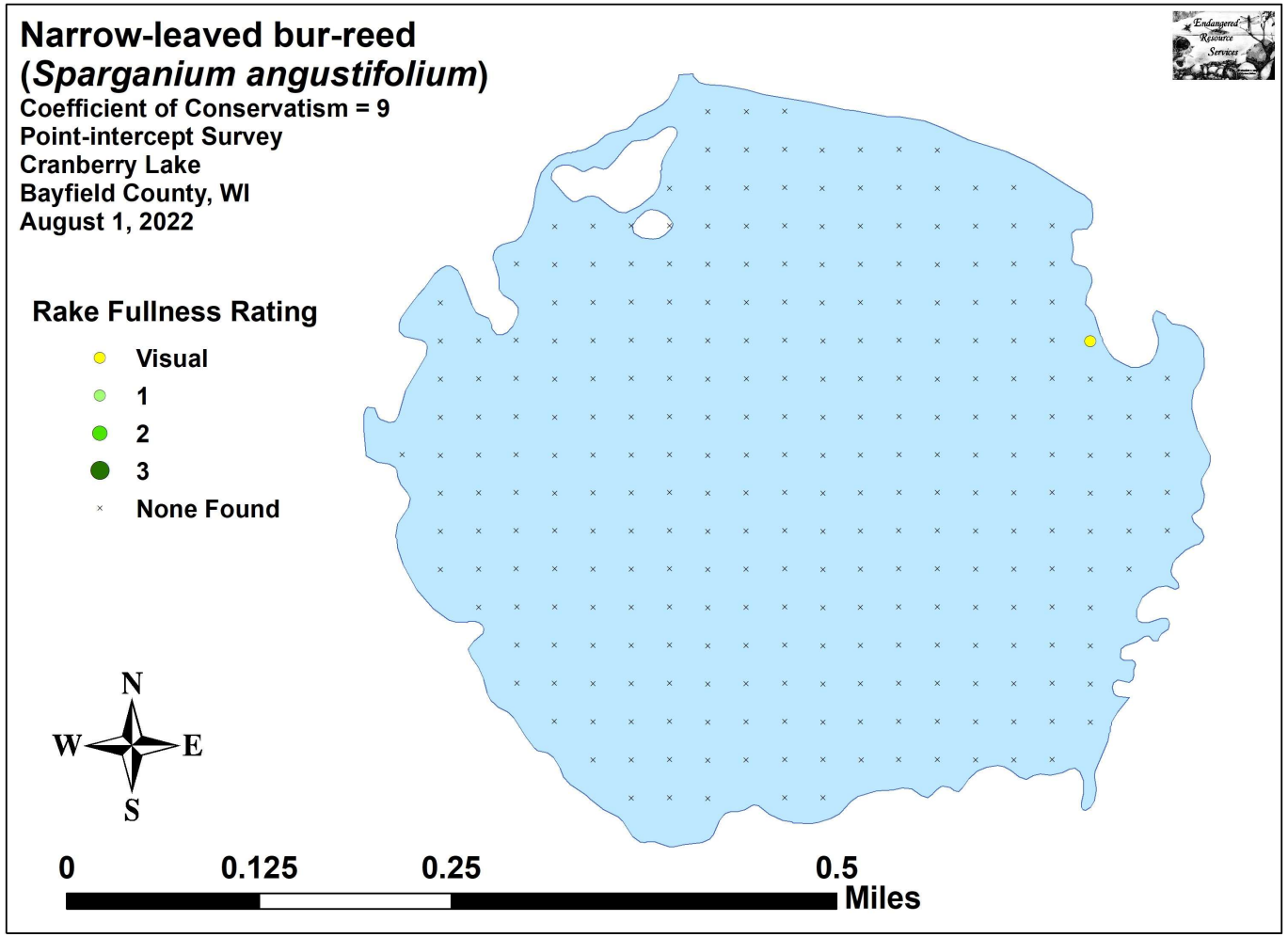
Miles


Narrow-leaved bur-reed
(Sparganium angustifolium)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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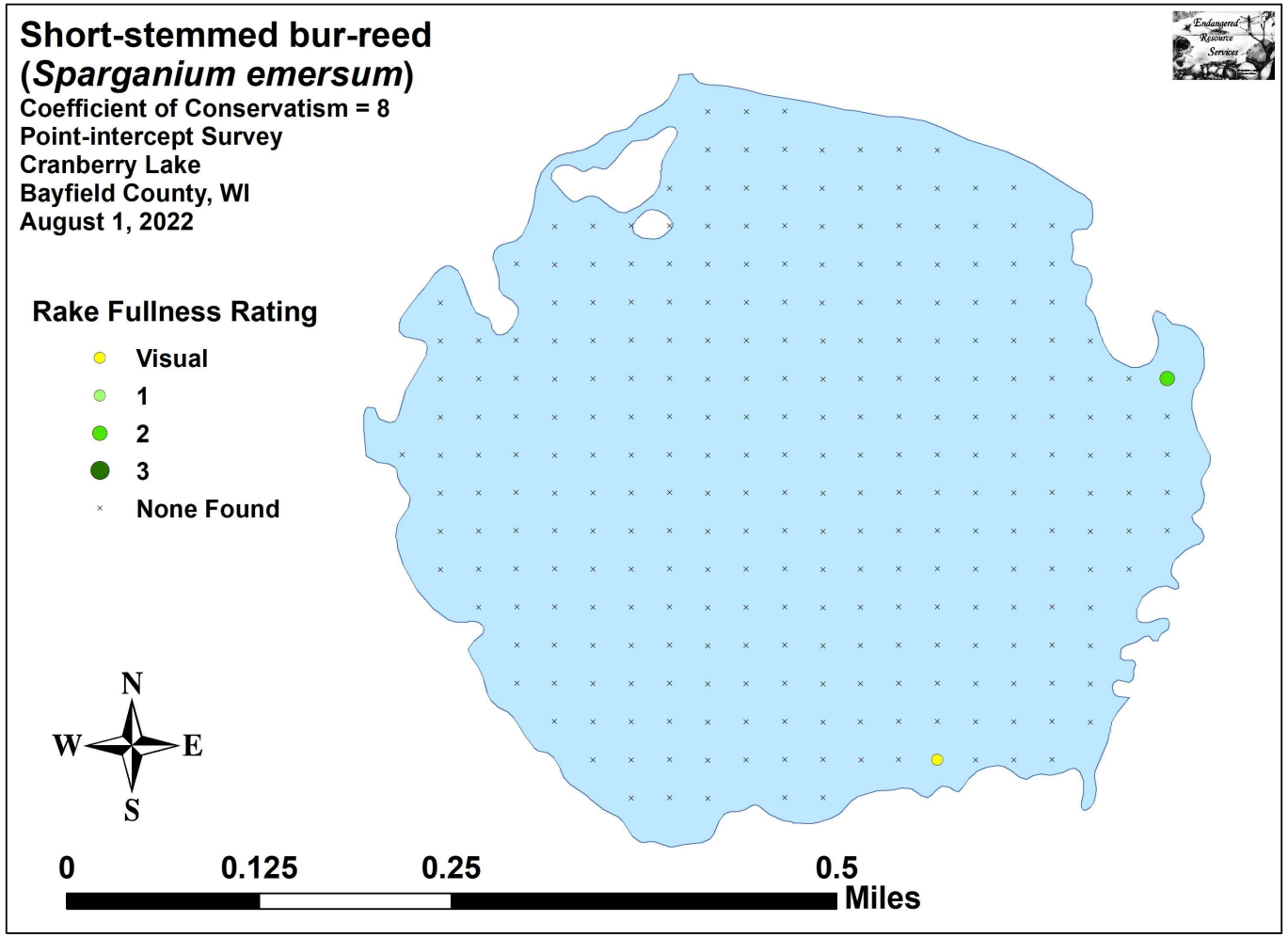
Miles


Short-stemmed bur-reed
(Sparganium emersum)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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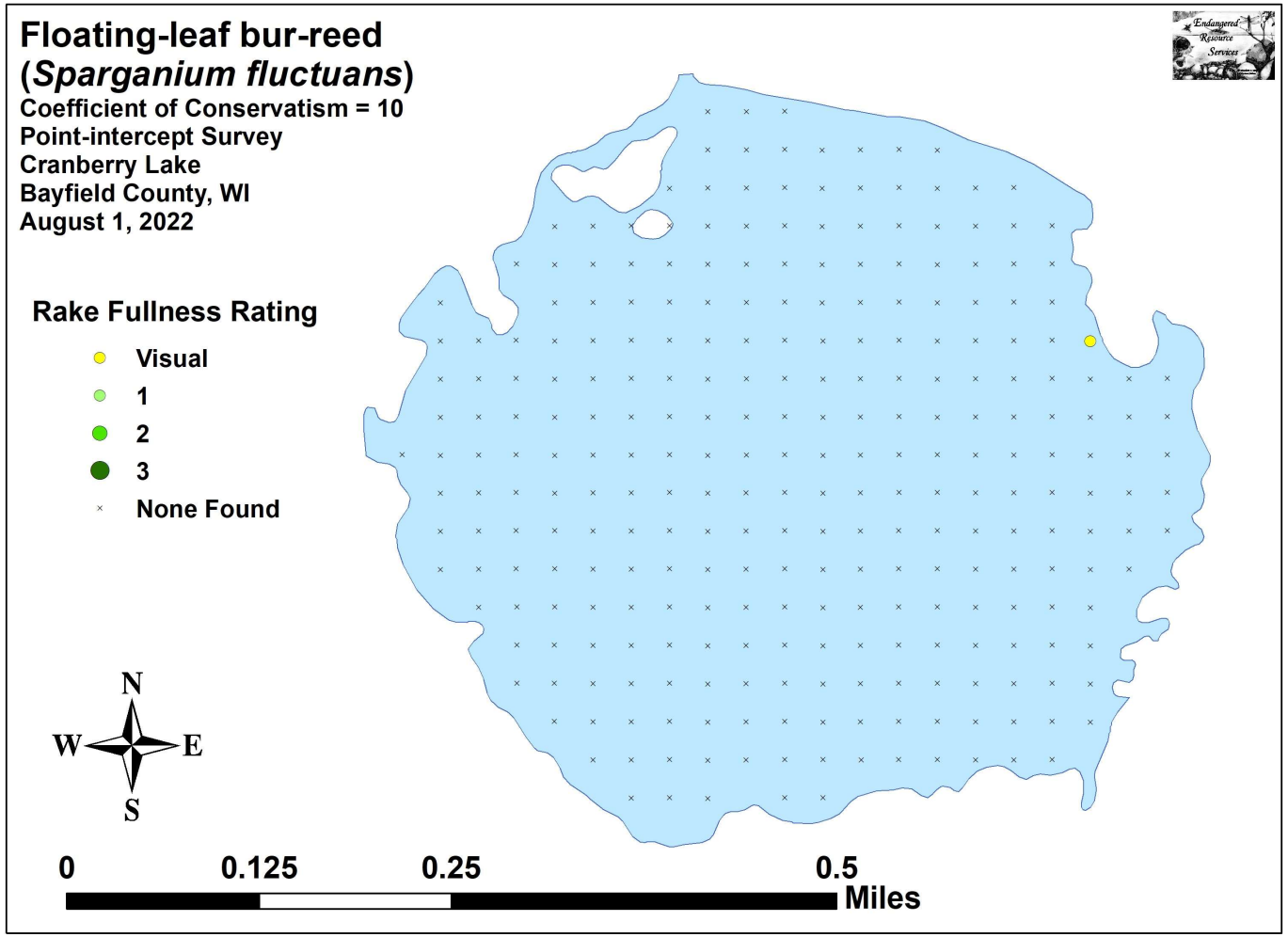
Miles


Floating-leaf bur-reed
(Sparganium fluctuans)
Coefficient of Conservatism = 10
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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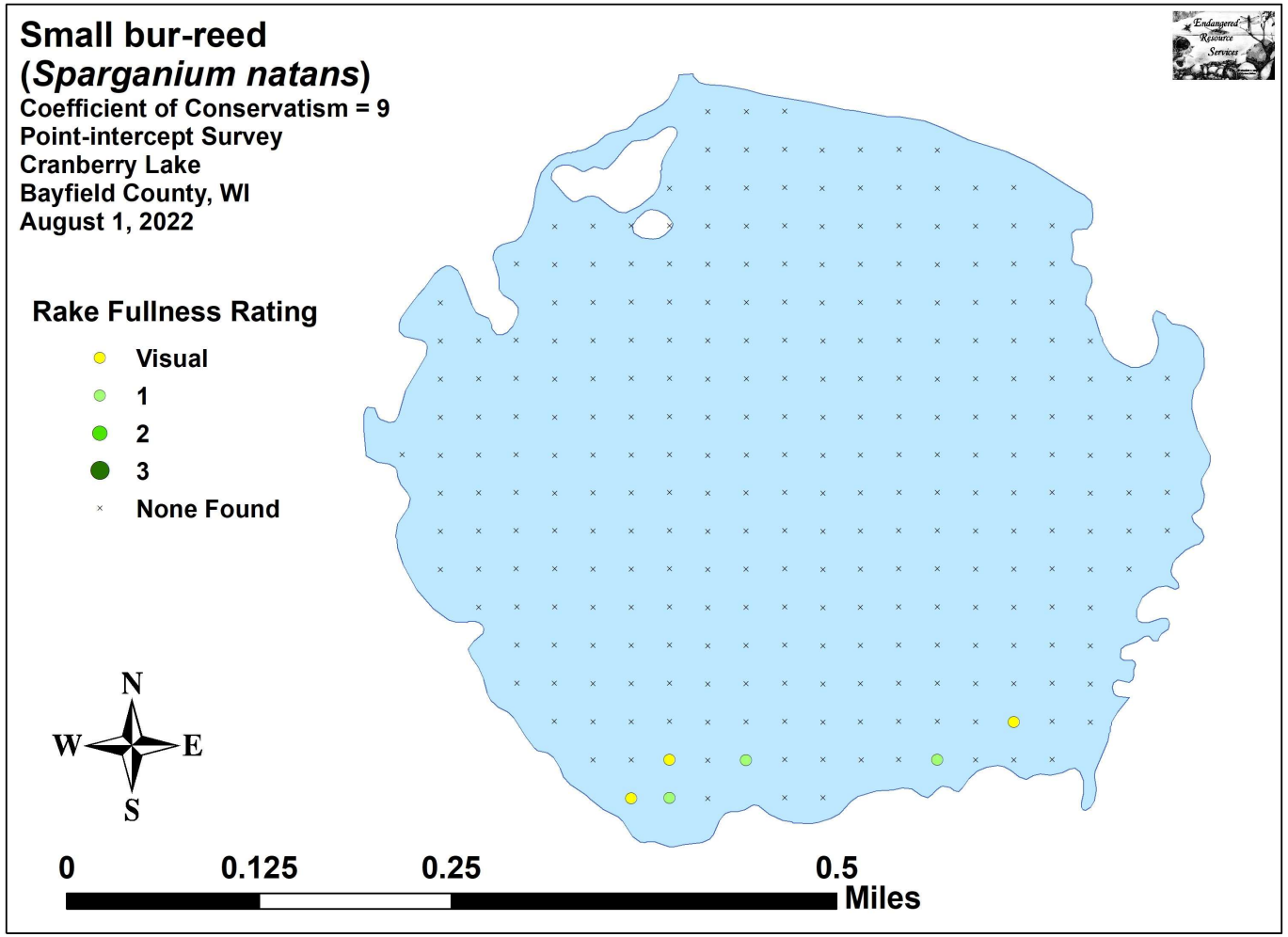
Miles


Small bur-reed
(Sparganium natans)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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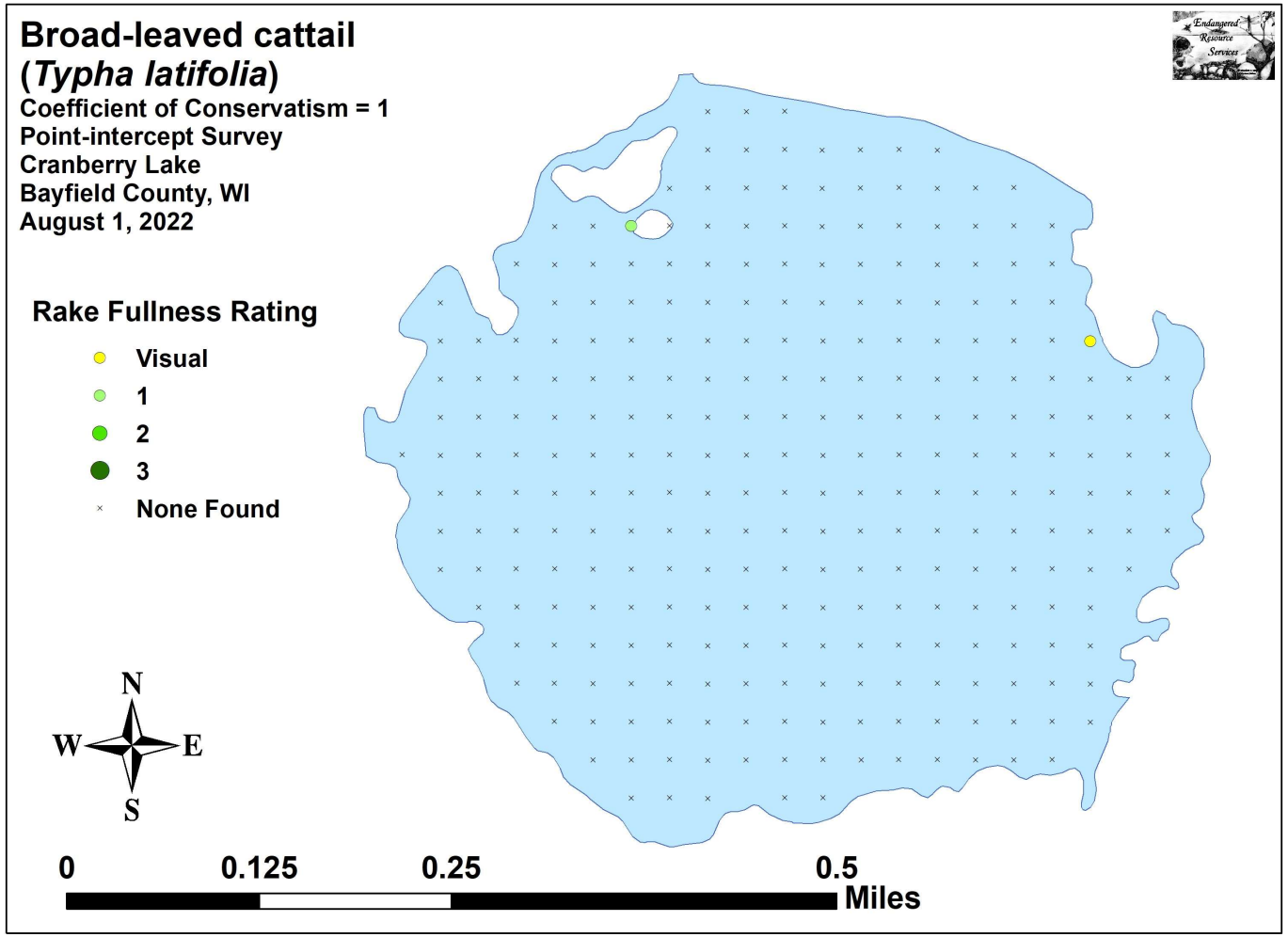
Miles


Broad-leaved cattail
(Typha latifolia)
Coefficient of Conservatism = 1
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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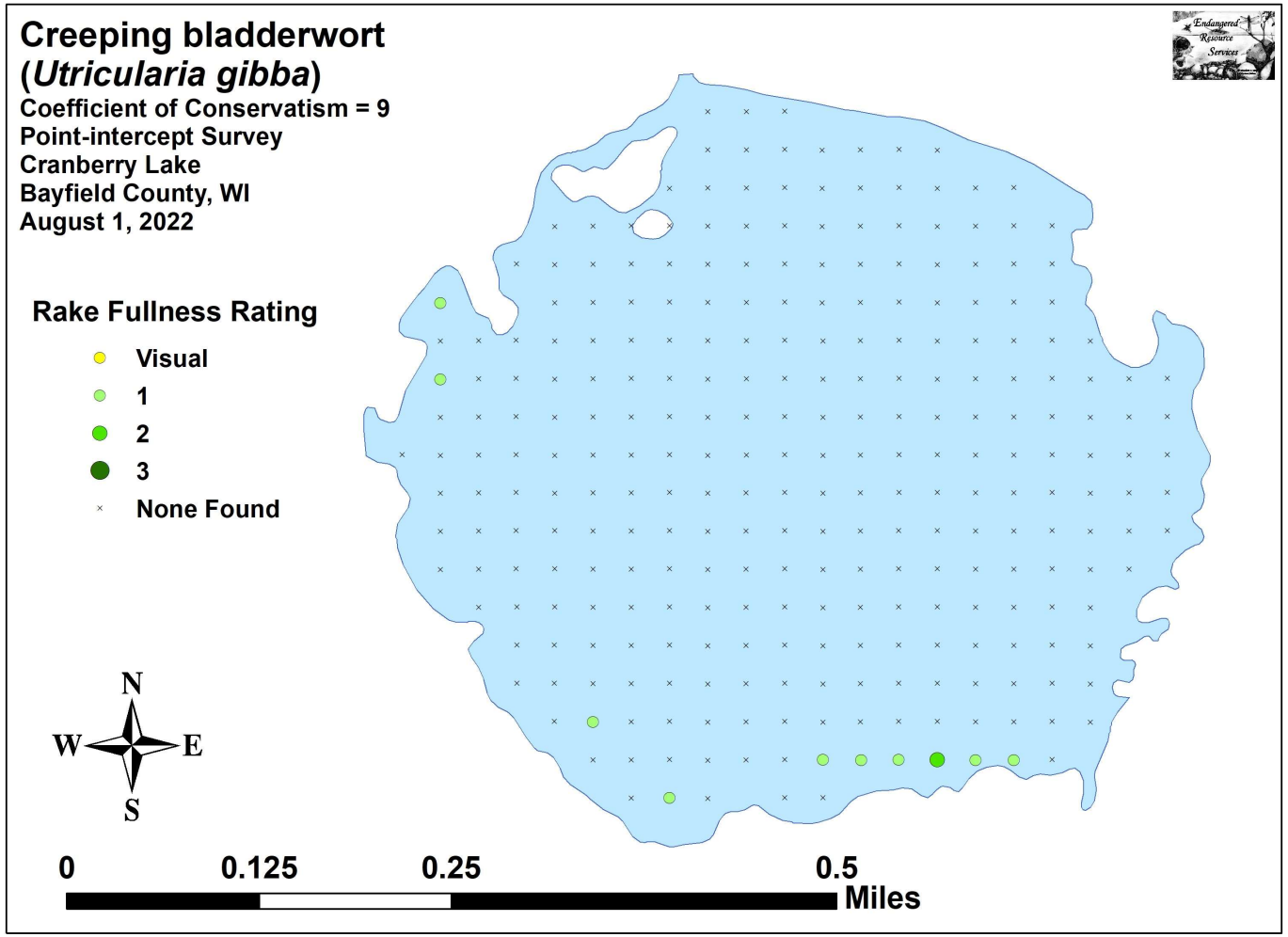
Miles


Creeping bladderwort
(Utricularia gibba)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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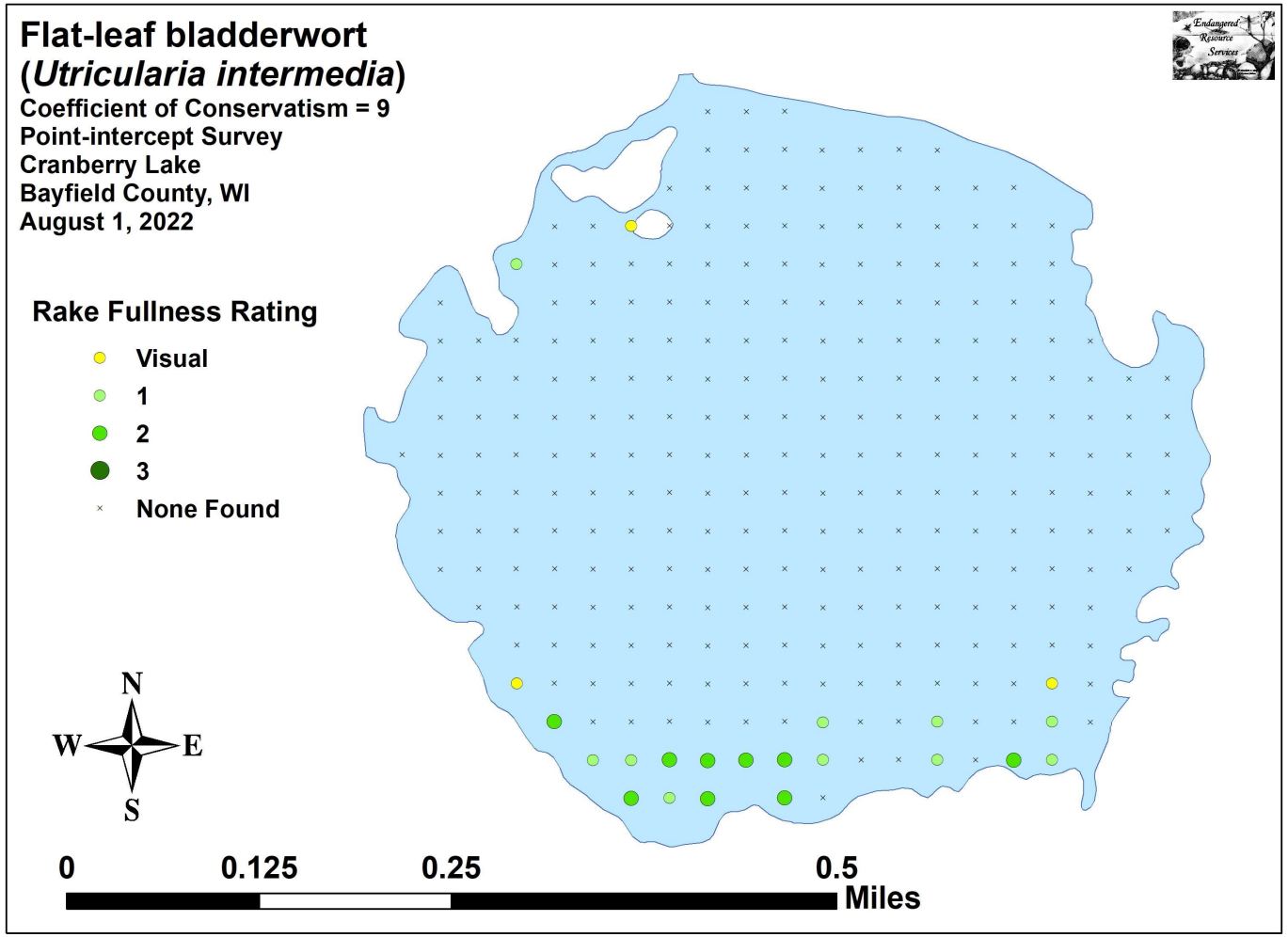
Miles


Flat-leaf bladderwort
(Utricularia intermedia)
Coefficient of Conservatism = 9
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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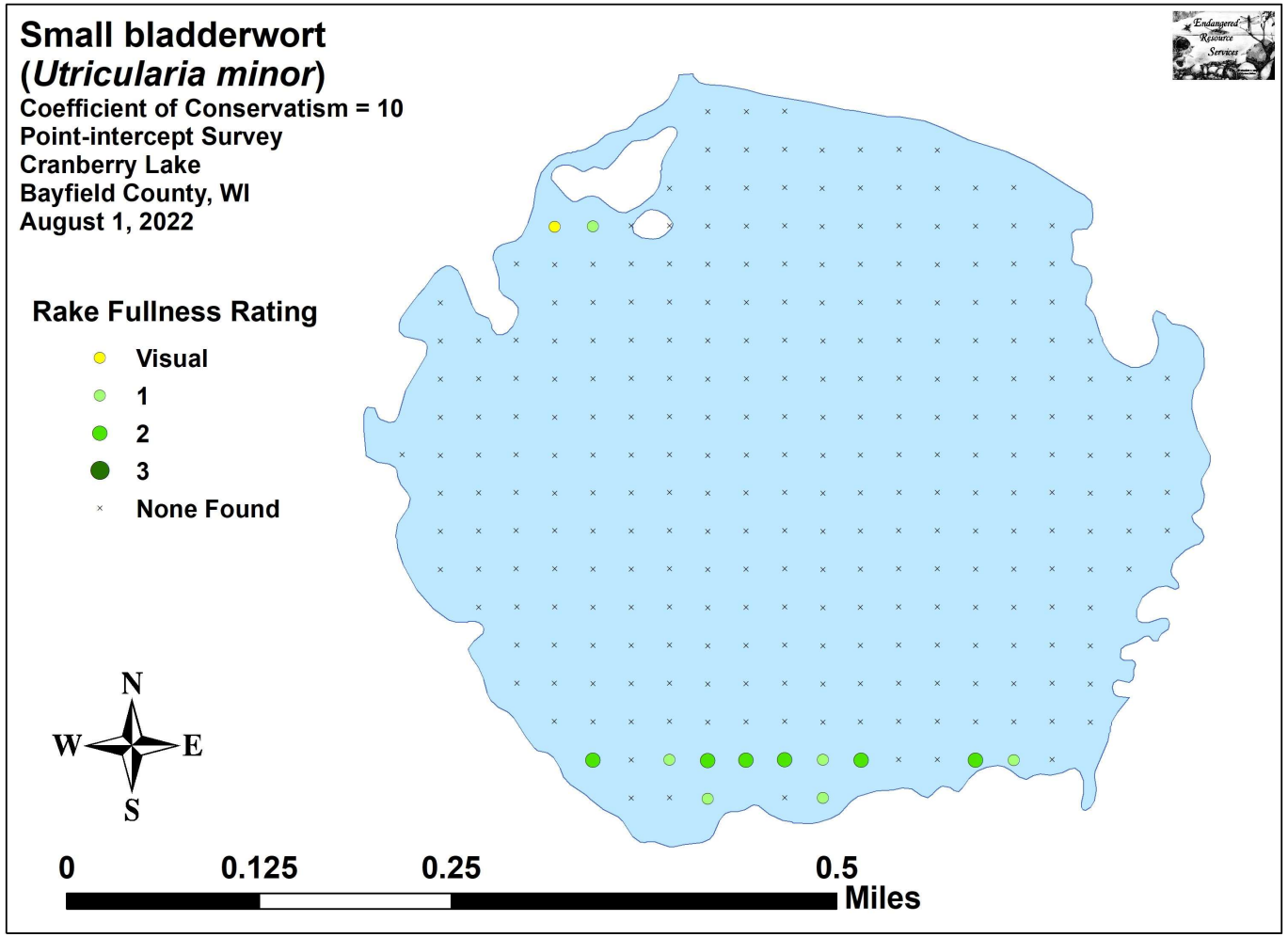
Miles


Small bladderwort
(Utricularia minor)
Coefficient of Conservatism = 10
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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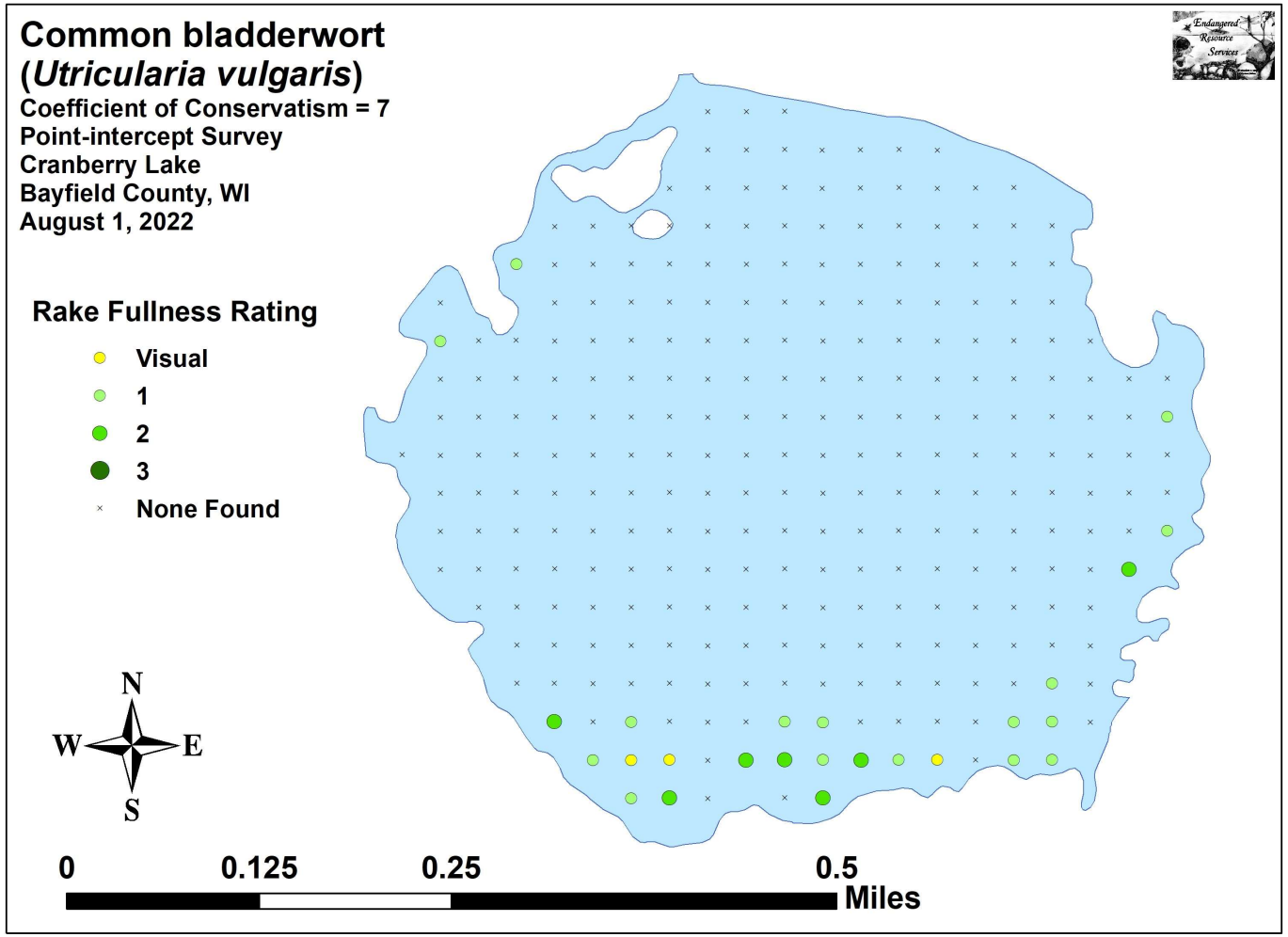
Miles


Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Rake Fullness Rating
Visual
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None Found
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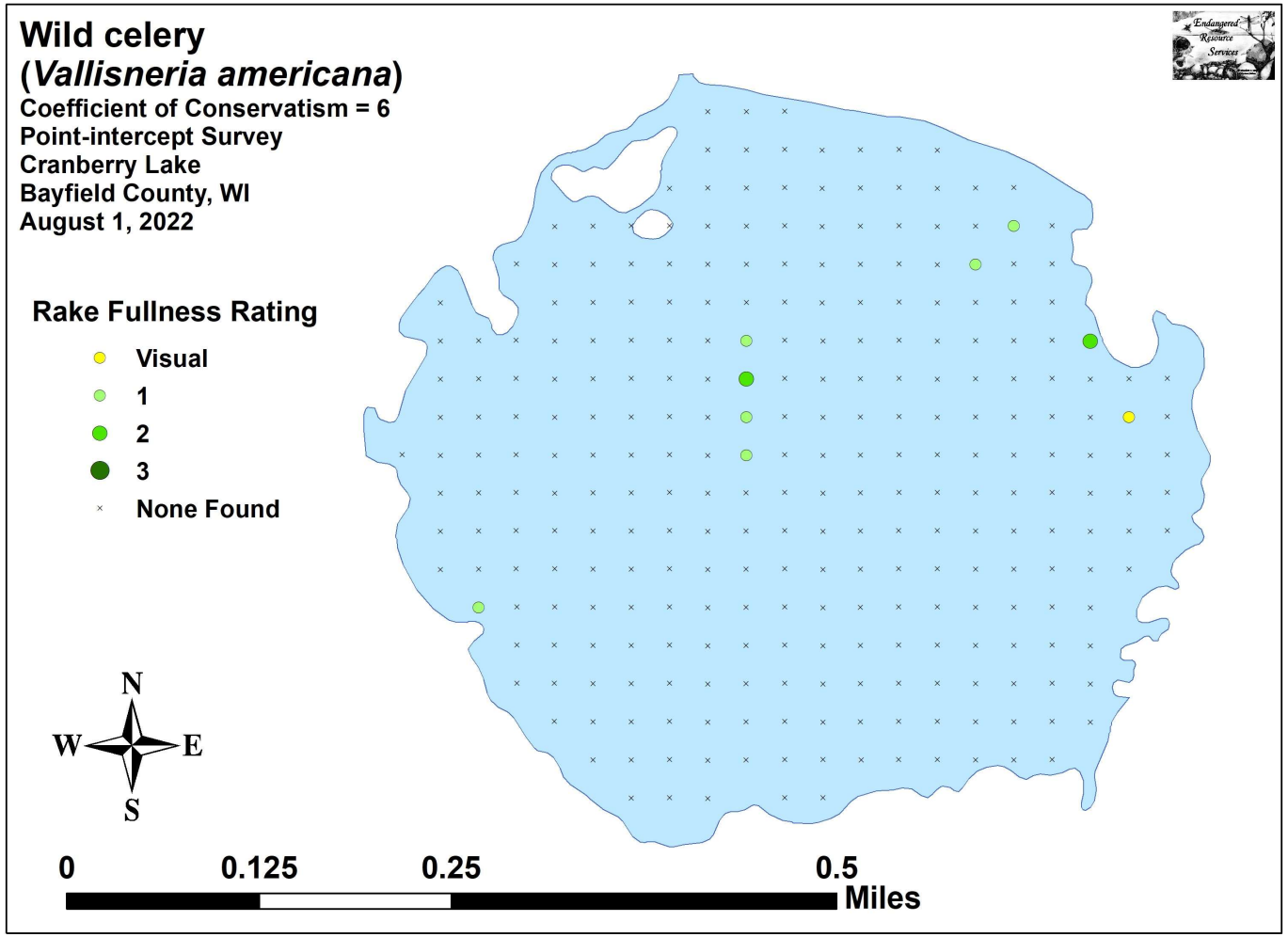
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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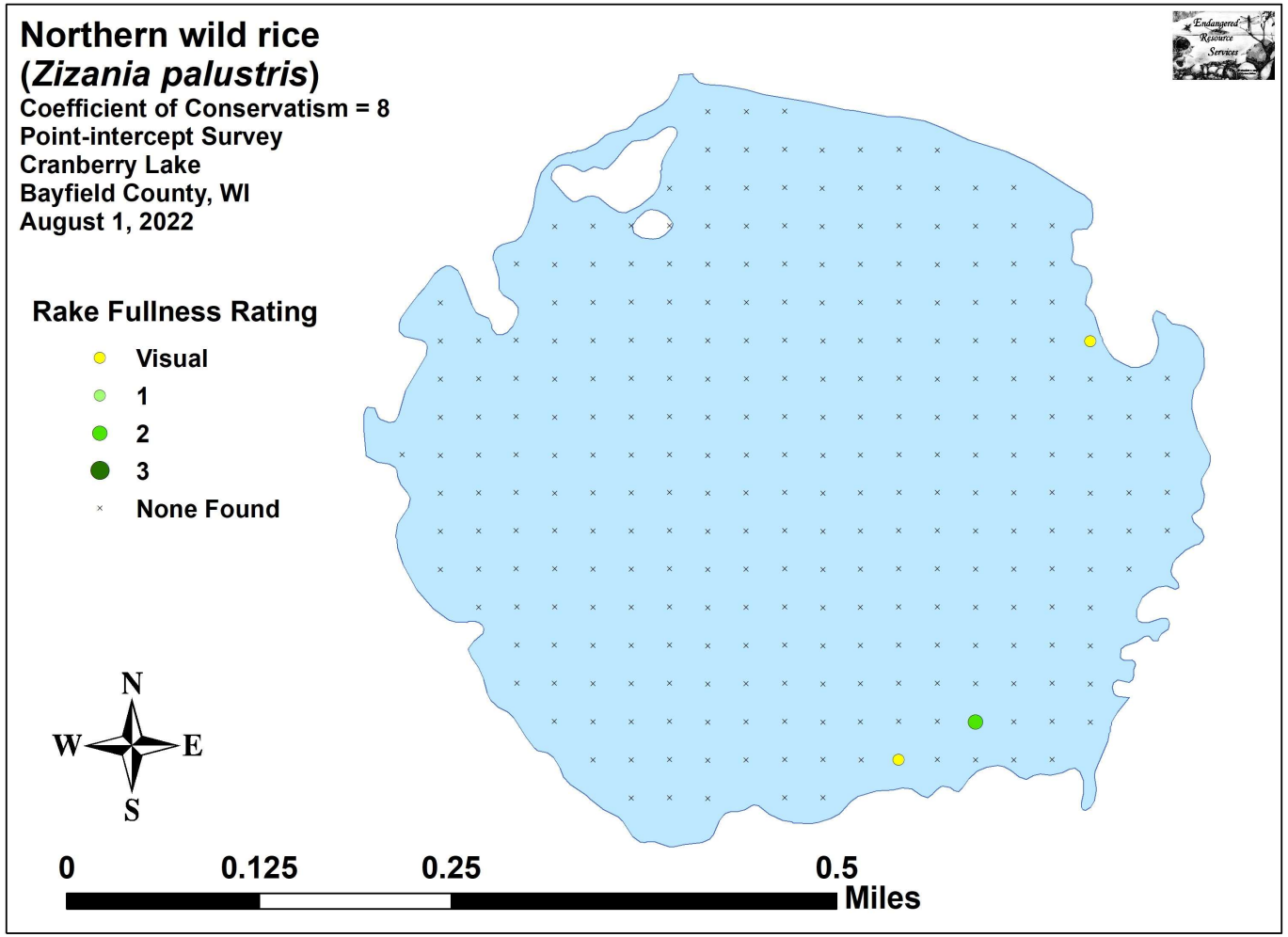
Miles


Northern wild rice
(Zizania palustris)
Coefficient of Conservatism = 8
Point-intercept Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Rake Fullness Rating
Visual
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None Found
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Miles

Appendix VII: Lower Eau Claire and Cranberry Lakes Plant Species Accounts

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: Aquatic moss
Specimen Location: Cranberry Lake; N46.26045°, W91.54440°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-102
Habitat/Distribution: Found in water 0.5-1.5 meters deep over organic and sandy muck. Rare; scattered locations among muck bogs.
Common Associates: (*Brasenia schreberi*) Watershield, (*Eleocharis acicularis*) Needle spikerush, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Bidens beckii)* **Water marigold**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-103
Habitat/Distribution: Found in water 0.5-3.5 meters deep over organic and sandy muck. Relatively common; scattered locations throughout both lakes.
Common Associates: (*Lemna trisulca*) Forked duckweed, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Brasenia schreberi*) **Watershield**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-104
Habitat/Distribution: Found in water <1.0 meter deep over sand and muck substrates. Common throughout Cranberry; largely restricted to the narrows and outlet bay in LEC.
Common Associates: (*Lemna trisulca*) Forked duckweed, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Sparganium emersum*) Short-stemmed bur-reed, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Calamagrostis canadensis*) **Bluejoint**
Specimen Location: Cranberry Lake; N46.26445°, W91.54088°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-105
Habitat/Distribution: Sand and sandy muck at the immediate shoreline of both lakes.
Common Associates: (*Myrica gale*) Sweet gale

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Calla palustris*) **Wild calla**
Specimen Location: Lower Eau Claire Lake; N46.25849°, W91.56545°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-106
Habitat/Distribution: Found at the shoreline in <0.25m of water over sandy and organic muck. Rare; a few clusters were seen on bog margins in the outlet bay.
Common Associates: (*Carex comosa*) Bottle brush sedge, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis erythropoda*) Bald spikerush, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Typha latifolia*) Broad-leaved cattail

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Carex comosa*) **Bottle brush sedge**
Specimen Location: Lower Eau Claire Lake; N46.25849°, W91.56545°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-107
Habitat/Distribution: Found at the shoreline in <0.25m of water over organic muck. Rare; a few clusters were seen on bog margins in the outlet bay.
Common Associates: (*Calla palustris*) Wild calla, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis erythropoda*) Bald spikerush, (*Nymphaea odorata*) White water lily, (*Typha latifolia*) Broad-leaved cattail

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Carex lacustris*) **Lake sedge**
Specimen Location: Lower Eau Claire Lake; N46.26900°, W91.56744°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-108
Habitat/Distribution: Found at the shoreline in <0.25m of water over sand and sandy muck. Only seen at the point.
Common Associates: (*Carex scoparia*) Broom sedge, (*Sparganium americanum*) American bur-reed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Carex lasiocarpa*) **Narrow-leaved woolly sedge**
Specimen Location: Cranberry Lake; N46.26545°, W91.54714°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-109
Habitat/Distribution: Found at the shoreline in <0.25m of water over sand and organic muck. Scattered in adjacent wetlands, on bogs, and in sheltered bays.
Common Associates: (*Bidens beckii)* Water marigold, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Schoenoplectus acutus*) Hardstem bulrush, (*Typha latifolia*) Broad-leaved cattail

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Carex scoparia*) **Broom sedge**
Specimen Location: Lower Eau Claire Lake; N46.26900°, W91.56744°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-110
Habitat/Distribution: Rare; only seen at the point. Clusters of plants were found at the shoreline over sand.
Common Associates: (*Carex lacustris*) Lake sedge, (*Sparganium americanum*) American bur-reed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Carex utriculata*) **Common yellow lake sedge**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-111
Habitat/Distribution: Found in <0.25m of water over sand and sandy muck. Scattered on sheltered sand flats and in adjacent wetlands.
Common Associates: (*Equisetum fluviatile*) Water horsetail, (*Phragmites australis americanus*) Common reed, (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Ceratophyllum demersum*) **Coontail**
Specimen Location: Cranberry Lake; N46.26009°, W91.54439°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-112
Habitat/Distribution: Found throughout the littoral zone over organic and sandy muck. Common throughout both lakes; especially over nutrient-rich muck.
Common Associates: (*Lemna trisulca*) Forked duckweed, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Chara* sp.) **Muskgrass**
Specimen Location: Cranberry Lake; N46.26112°, W91.54754°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-113
Habitat/Distribution: Multiple species found in a variety of habitats. Common and widespread throughout both lakes.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Najas flexilis*) Slender naiad, (*Nitella* sp.) Nitella, (*Tolypella intricata*) Bird's nest stonewort, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Cladium mariscoides*) **Smooth sawgrass**
Specimen Location: Cranberry Lake; N46.26654°, W91.54613°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-114
Habitat/Distribution: Found in water <0.5 meter deep over sand and sandy muck. Scattered among other emergents on both sides of the Cranberry Channel.
Common Associates: (*Carex utriculata*) Common yellow lake sedge, (*Phragmites australis americanus*) Common reed, (*Schoenoplectus acutus*) Hardstem bulrush, (*Schoenoplectus torreyi*) Torrey's three-square bulrush

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Dulichium arundinaceum*) **Three-way sedge**
Specimen Location: Cranberry Lake; N46.26009°, W91.54439°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-115
Habitat/Distribution: Found in water <0.25 meter deep over firm sand and muck. Uncommon; most beds were found near bogs.
Common Associates: (*Brasenia schreberi*) Watershield, (*Carex comosa*) Bottle brush sedge, (*Eleocharis erythropoda*) Bald spikerush, (*Nymphaea odorata*) White water lily, (*Typha latifolia*) Broad-leaved cattail

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Elatine minima*) **Waterwort**
Specimen Location: Lower Eau Claire Lake; N46.27253°, W91.56585°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-116
Habitat/Distribution: Found in water <0.5 meter deep over sand. Rare; a few patches were found on the lake's most pristine shorelines.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, *Isoetes echinospora*) Spiny spored quillwort, (*Najas flexilis*) Slender naiad, (*Ranunculus aquatilis*) White water crowfoot

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Eleocharis acicularis*) **Needle spikerush**
Specimen Location: Cranberry Lake; N46.26085°, W91.54078°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-117
Habitat/Distribution: Found in water <1.5 meters deep over sand. Also found growing as an emergent on muck bogs. Common and widespread.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis palustris*) Creeping spikerush, (*Najas flexilis*) Slender naiad

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Eleocharis erythropoda*) **Bald spikerush**
Specimen Location: Cranberry Lake; N46.26009°, W91.54439°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-118
Habitat/Distribution: Found at the shoreline in <0.25m of water over organic muck. Relatively common on bog margins of both lakes.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Eleocharis palustris*) **Creeping spikerush**
Specimen Location: Cranberry Lake; N46.26085°, W91.54078°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-119
Habitat/Distribution: Found in water <0.5 meter deep over firm sand and muck. Uncommon; primarily found on shallow sand flats on either side of the Cranberry Channel.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Equisetum fluviatile*) Water horsetail, (*Najas flexilis*) Slender naiad, (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Elodea canadensis*) **Common waterweed**
Specimen Location: Lower Eau Claire Lake; N46.26084°, W91.56467°
Also found in Cranberry Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-120
Habitat/Distribution: Found in water 1-6 meters deep over sand and muck. Scattered throughout – becoming common in the outlet bay of LEC.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Equisetum fluviatile*) **Water horsetail**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Also found in Lower Eau Claire Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-121
Habitat/Distribution: Found in water <0.5 meter deep over firm sand and muck. Uncommon; primarily found on shallow sand flats on either side of the Cranberry Channel.
Common Associates: (*Carex utriculata*) Common yellow lake sedge, (*Eleocharis palustris*) Creeping spikerush, (*Phragmites australis americanus*) Common reed, (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Glyceria borealis*) **Northern manna grass**
Specimen Location: Cranberry Lake; N46.26049°, W91.54129°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-122
Habitat/Distribution: Found in water <1.0 meter deep over sand. Rare; a few plants were found at the point along the creek inlet.
Common Associates: Aquatic moss, (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton gramineus*) Variable pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Heteranthera dubia*) **Water star-grass**
Specimen Location: Lower Eau Claire Lake; N46.26928°, W91.54635°
Also found on Cranberry Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-123
Habitat/Distribution: Found in water <4.5 meters deep over sand and muck. Uncommon, but widespread throughout both lakes.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Iris versicolor*) **Northern blue flag**
Specimen Location: Cranberry Lake; N46.26445°, W91.54088°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-124
Habitat/Distribution: Found on firm muck at the immediate shoreline. Scattered clusters occurred on bog edges.
Common Associates: (*Carex lasiocarpa*) Narrow-leaved woolly sedge, (*Carex utriculata*) Common yellow lake sedge

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Isoetes echinospora*) **Spiny-spored quillwort**
Specimen Location: Lower Eau Claire Lake; N46.26866°, W91.54887°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-125
Habitat/Distribution: Found in water <1.5 meters deep over sand and gravel. Uncommon on pristine shorelines.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Najas flexilis*) Slender naiad, (*Ranunculus aquatilis*) White water crowfoot, (*Vallisneria americana*) Wild celery

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Juncus brevicaudatus*) **Narrow-panicle rush**
Specimen Location: Lower Eau Claire Lake; N46.25849°, W91.56545°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-126
Habitat/Distribution: Rare; a few scattered individuals were found in water <0.25 meter deep over muck at the immediate shoreline and on floating bogs.
Common Associates: (*Brasenia schreberi*) Watershield, (*Calla palustris*) Wild calla, (*Eleocharis erythropoda*) Bald spikerush, (*Nymphaea odorata*) White water lily, (*Schoenoplectus tabernaemontani*) Softstem bulrush

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Juncus canadensis*) **Canada rush**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-127
Habitat/Distribution: Rare; a few scattered individuals were found over firm muck at the immediate shoreline on bog edges.
Common Associates: (*Carex lasiocarpa*) Narrow-leaved woolly sedge, (*Carex utriculata*) Common yellow lake sedge

County/State: Douglas County, Wisconsin **Date:** 8/2/22
Species: (*Juncus effusus*) **Common rush**
Specimen Location: Lower Eau Claire Lake; N46.25883°, W91.56948°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-128
Habitat/Distribution: Rare; a few scattered individuals were found along the north shoreline at the dam.
Common Associates: (*Lythrum salicaria*) Purple loosestrife, (*Phalaris arundinacea*) Reed canary grass

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Lemna minor*) **Small duckweed**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-129
Habitat/Distribution: Rare; scattered individuals were found among floating-leaf species in the far ends of bays with organic muck.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Spirodela polyrhiza*) Large duckweed

County/State: Douglas County, Wisconsin **Date:** 6/29/22
Species: (*Lemna trisulca*) **Forked duckweed**
Specimen Location: Lower Eau Claire Lake; N46.26553°, W91.56396°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-130
Habitat/Distribution: Found in water <5.0 meters deep over sand and muck. Scattered locations throughout – becoming common in the outlet bay.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Douglas County, Wisconsin **Date:** 8/2/22
Species: (*Lythrum salicaria*) **Purple loosestrife**
Specimen Location: Lower Eau Claire Lake; N46.25883°, W91.56948°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-131
Habitat/Distribution: Rare; a few scattered individuals were found along the north shoreline at the dam.
Common Associates: (*Juncus effusus*) Common rush, (*Phalaris arundinacea*) Reed canary grass

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Myosotis scorpioides*) **Common forget-me-not**
Specimen Location: Cranberry Lake; N46.26085°, W91.54078°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-132
Habitat/Distribution: Rare; a single large bed occurred in <0.25m of water over soft organic muck in a cold-water seep along a shaded shoreline.
Common Associates: (*Eleocharis erythropoda*) Bald spikerush, (*Potamogeton alpinus*) Alpine pondweed

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Myrica gale*) **Sweet gale**
Specimen Location: Cranberry Lake; N46.26545°, W91.54714°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-133
Habitat/Distribution: Scattered shoreline locations throughout the system over sand and sandy muck.
Common Associates: (*Calamagrostis canadensis*) Bluejoint

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Myriophyllum sibiricum*) **Northern water-milfoil**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-134
Habitat/Distribution: Found in water <6.0 meters deep over sand and muck. A dominant species throughout LEC, but only scattered on Cranberry.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Najas flexilis*) Slender naiad, (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Myriophyllum verticillatum*) **Whorled water-milfoil**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-135
Habitat/Distribution: Found in water <0.5 meter deep over muck. Uncommon; scattered along the south shoreline among floating bog mats.
Common Associates: (*Chara* sp.) Muskgrass, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Najas flexilis*) **Slender naiad**
Specimen Location: Cranberry Lake; N46.26547°, W91.54558°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-136
Habitat/Distribution: Found in water <2.5 meters deep over muck, marl, and sand. A dominant species throughout; especially on Cranberry.
Common Associates: (*Chara* sp.) Muskgrass, (*Nymphaea odorata*) White water lily, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton pusillus*) Small pondweed

County/State: Douglas County, Wisconsin **Date:** 6/29/22
Species: (*Nitella* sp.) **Nitella**
Specimen Location: Lower Eau Claire Lake; N46.27137°, W91.56497°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-137
Habitat/Distribution: Found in water 2.0-6.5 meters deep over sand. Common and widespread scattered among other Charophytes.
Common Associates: (*Chara* sp.) Muskgrass, (*Najas flexilis*) Slender naiad, (*Potamogeton pusillus*) Small pondweed, (*Tolypella intricata*) Bird's nest stonewort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Nuphar variegata*) **Spatterdock**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-138
Habitat/Distribution: Found in water <1.5 meters deep over muck and sand. Relatively common throughout Cranberry, but largely restricted to the narrows and outlet bay on LEC.
Common Associates: (*Brasenia schreberi*) Watershield, (*Lemna trisulca*) Forked duckweed, (*Nymphaea odorata*) White water lily, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Nymphaea odorata*) **White water lily**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-139
Habitat/Distribution: Found in water <1.5 meters deep over sandy and organic muck. Common throughout Cranberry, but largely restricted to the narrows and outlet bay on LEC.
Common Associates: (*Brasenia schreberi*) Watershield, (*Lemna trisulca*) Forked duckweed, (*Najas flexilis*) Slender naiad, (*Nuphar variegata*) Spatterdock, (*Utricularia vulgaris*) Common bladderwort

County/State: Douglas County, Wisconsin **Date:** 8/2/22
Species: (*Phalaris arundinacea*) **Reed canary grass**
Specimen Location: Lower Eau Claire Lake; N46.25883°, W91.56948°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-140
Habitat/Distribution: Rare; a few scattered individuals were found along the north shoreline at the dam.
Common Associates: (*Juncus effusus*) Common rush, (*Lythrum salicaria*) Purple loosestrife

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Phragmites australis americanus*) **Common reed**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-141
Habitat/Distribution: Found in water <0.5 meter deep over sand. A single large bed was located on the north shoreline. Culms were red and leaf sheaths were detached confirming subspecies.
Common Associates: (*Carex utriculata*) Common yellow lake sedge, (*Equisetum fluviatile*) Water horsetail, (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Polygonum amphibium*) **Water smartweed**
Specimen Location: Cranberry Lake; N46.26085°, W91.54078°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-142
Habitat/Distribution: Found in water <1.0 meter deep over firm sand and muck. Uncommon; a few beds were located in the west bay.
Common Associates: (*Brasenia schreberi*) Watershield, (*Dulichium arundinaceum*) Three-way sedge, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton alpinus*) **Alpine pondweed**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-143
Habitat/Distribution: Found in water <0.5 meter deep over soft organic muck. Uncommon; scattered plants located next to muck bogs and spring inlets.
Common Associates: (*Brasenia schreberi*) Watershield, (*Chara* sp.) Muskgrass, (*Nymphaea odorata*) White water lily, (*Potamogeton robbinsii*) Fern pondweed, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton amplifolius*) **Large-leaf pondweed**
Specimen Location: Cranberry Lake; N46.26045°, W91.54440°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-144
Habitat/Distribution: Found in water from 1-3.5 meters deep over organic and sandy muck. Relatively common throughout Cranberry, but largely restricted to the narrows and outlet bay on LEC.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Najas flexilis*) Slender naiad, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Douglas County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton crispus*) **Curly-leaf pondweed**
Specimen Location: Lower Eau Claire Lake; N46.26671°, W91.56315°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-145
Habitat/Distribution: Found in water 2-3 meters deep over muck. Restricted to the narrows and the outlet bay.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Potamogeton richardsonii*) Clasping-leaf pondweed, (*Potamogeton robbinsii*) Fern pondweed

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Potamogeton epihydrus*) **Ribbon-leaf pondweed**
Specimen Location: Cranberry Lake; N46.26761°, W91.54700°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-146
Habitat/Distribution: Found in water <1 meter deep over muck. Rare; scattered patches occurred among muck bogs on both lakes.
Common Associates: (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Potamogeton robbinsii*) Fern pondweed, (*Sagittaria cristata*) Crested arrowhead

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton foliosus*) **Leafy pondweed**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-147
Habitat/Distribution: Found in water <1 meter deep over muck. Rare; scattered clusters were found among floating muck bogs on both lakes.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Potamogeton friesii*) **Fries' pondweed**
Specimen Location: Lower Eau Claire Lake; N46.26024°, W91.56634°
Also found on Cranberry Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-148
Habitat/Distribution: Found in water from 2-6m deep over muck and sand. Common and widespread on LEC; especially around the main basin. Uncommon, but widely scattered on Cranberry.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton gramineus*) **Variable pondweed**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-149
Habitat/Distribution: Found in water <2.0 meters deep over firm substrates. Relatively common scattered throughout both lakes.
Common Associates: (*Chara* sp.) Muskgrass, (*Eleocharis acicularis*) Needle spikerush, (*Najas flexilis*) Slender naiad, (*Vallisneria americana*) Wild celery

County/State: Douglas County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton illinoensis*) **Illinois pondweed**
Specimen Location: Lower Eau Claire Lake; N46.26084°, W91.56467°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-150
Habitat/Distribution: Found in water from 2.0-2.5 meters deep over muck. Rare; only seen in the outlet bay.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton natans*) **Floating-leaf pondweed**
Specimen Location: Cranberry Lake; N46.26545°, W91.54714°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-151
Habitat/Distribution: Found in water <2.0 meters deep over organic and marly muck and sand. Largely restricted to bog margins.
Common Associates: (*Brasenia schreberi*) Watershield, (*Lemna trisulca*) Forked duckweed, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton praelongus*) **White-stem pondweed**
Specimen Location: Cranberry Lake; N46.26026°, W91.56466°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-152
Habitat/Distribution: Found in water from 1.5-3.5m over muck. Rare; restricted to the deepest parts of Cranberry and the narrows and outlet bay on Lower Eau Claire.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton pusillus*) **Small pondweed**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-153
Habitat/Distribution: Found in water from 1-6m deep over sand and muck. Common and widespread on both lakes.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Nymphaea odorata*) White water lily, (*Potamogeton friesii*) Fries' pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton richardsonii*) **Clasping-leaf pondweed**
Specimen Location: Cranberry Lake; N46.26335°, W91.54293°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-154
Habitat/Distribution: Found in water from 1-4m deep over muck and sand. Common and widespread on both lakes.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Elodea canadensis*) Common waterweed, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton robbinsii*) **Fern pondweed**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-155
Habitat/Distribution: Found in water <3.5 meters deep in muck and sand. A dominant species on Cranberry and abundant in the outlet bay on LEC.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Najas flexilis*) Slender naiad, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Potamogeton strictifolius*) **Stiff pondweed**
Specimen Location: Cranberry Lake; N46.26445°, W91.54088°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-156
Habitat/Distribution: Found in water from 1-2 meters deep over primarily marly muck and sand. Uncommon in both lakes.
Common Associates: (*Lemna trisulca*) Forked duckweed, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Najas flexilis*) Slender naiad, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Potamogeton zosteriformis*) **Flat-stem pondweed**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-157
Habitat/Distribution: Found in water from 0.5-5 meters deep over muck and sand. Scattered in Cranberry and abundant in the narrows and outlet bay of LEC.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Elodea canadensis*) Common waterweed, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Potamogeton pusillus*) Small pondweed

County/State: Douglas County, Wisconsin **Date:** 6/29/22
Species: (*Ranunculus aquatilis*) **White water crowfoot**
Specimen Location: Lower Eau Claire Lake; N46.26900°, W91.56744°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-158
Habitat/Distribution: Found in water from 0.5-2.5 meters deep over sand and sandy muck. Relatively common throughout.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Sagittaria cristata*) **Crested arrowhead**
Specimen Location: Cranberry Lake; N46.26546°, W91.54662°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-159
Habitat/Distribution: Found in water <1 meter deep over muck. Uncommon over sandy muck and around muck bogs.
Common Associates: (*Chara* sp.) Muskgrass, (*Lemna trisulca*) Forked duckweed, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Potamogeton robbinsii*) Fern pondweed

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Sagittaria graminea*) **Grass-leaved arrowhead**
Specimen Location: Lower Eau Claire Lake; N46.26923°, W91.55057°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-160
Habitat/Distribution: Found in water <2.0 meters deep over sand. Scattered locations; usually along pristine shorelines.
Common Associates: (*Elatine minima*) Waterwort, (*Eleocharis acicularis*) Needle spikerush, (*Najas flexilis*) Slender naiad, (*Stuckenia pectinata*) Sago pondweed, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Sagittaria latifolia*) **Common arrowhead**
Specimen Location: Cranberry Lake; N46.26009°, W91.54439°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-161
Habitat/Distribution: Found in water <0.25 meter deep over firm organic muck. Scattered locations on bog margins.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia minor*) Small bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Schoenoplectus acutus*) **Hardstem bulrush**
Specimen Location: Cranberry Lake; N46.26545°, W91.54714°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-162
Habitat/Distribution: Found in water <1 meter deep over firm sand and gravel. A dominant emergent along the margins of both lakes.
Common Associates: (*Carex utriculata*) Common yellow lake sedge, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis palustris*) Creeping spikerush, (*Equisetum fluviatile*) Water horsetail

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Schoenoplectus pungens*) **Three-square bulrush**
Specimen Location: Lower Eau Claire Lake; N46.26753°, W91.54631°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-163
Habitat/Distribution: Found in water <0.5 meter deep over sand and sandy muck. Rare; only plants seen were at the point.
Common Associates: (*Brasenia schreberi*) Watershield, (*Carex utriculata*) Common yellow lake sedge, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis palustris*) Creeping spikerush, (*Equisetum fluviatile*) Water horsetail, (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Schoenoplectus subterminalis*) **Water bulrush**
Specimen Location: Cranberry Lake; N46.26399°, W91.54866°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-164
Habitat/Distribution: Found in water <0.5 meter deep over muck. Common on and around muck bogs.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia minor*) Small bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Schoenoplectus tabernaemontani*) **Softstem bulrush**
Specimen Location: Cranberry Lake; N46.26047°, W91.54233°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-165
Habitat/Distribution: Found in water <0.5 meter deep over organic muck. Uncommon scattered on and around bogs margins.
Common Associates: (*Brasenia schreberi*) Watershield, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis erythropoda*) Bald spikerush, (*Nymphaea odorata*) White water lily

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Schoenoplectus torreyi*) **Torrey's three-square bulrush**
Specimen Location: Cranberry Lake; N46.26654°, W91.54613°
Also found in Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-166
Habitat/Distribution: Found in water <0.5 meter deep over sand and sandy muck. Scattered locations on either side of channel leading to/from Cranberry Lake.
Common Associates: (*Brasenia schreberi*) Watershield, (*Carex utriculata*) Common yellow lake sedge, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis palustris*) Creeping spikerush, (*Equisetum fluviatile*) Water horsetail, (*Schoenoplectus acutus*) Hardstem bulrush

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Sparganium americanum*) **American bur-reed**
Specimen Location: Lower Eau Claire Lake; N46.26900°, W91.56744°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-167
Habitat/Distribution: Rare; only seen at the point. Clusters of plants were found at the shoreline over sand.
Common Associates: (*Carex lacustris*) Lake sedge, (*Carex scoparia*) Broom sedge

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Sparganium angustifolium*) **Narrow-leaved bur-reed**
Specimen Location: Cranberry Lake; N46.26507°, W91.54869°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-168
Habitat/Distribution: Found in water <0.5 meter deep over muck. Rare; a few clusters were found over marly muck.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Najas flexilis*) Slender naiad, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Sparganium emersum*) **Short-stemmed bur-reed**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-169
Habitat/Distribution: Found in water <1 meter deep over muck. Uncommon; scattered among muck bogs in both lakes.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Potamogeton foliosus*) Leafy pondweed

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Sparganium fluctuans*) **Floating-leaf bur-reed**
Specimen Location: Cranberry Lake; N46.26445°, W91.54088°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-170
Habitat/Distribution: Found in water <1 meter deep over firm muck. Rare; a few plants were found at the point – not seen anywhere else.
Common Associates: (*Elodea canadensis*) Common waterweed, (*Najas flexilis*) Slender naiad, (*Vallisneria americana*) Wild celery

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Sparganium natans*) **Small bur-reed**
Specimen Location: Cranberry Lake; N46.26006°, W91.54647°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-171
Habitat/Distribution: Found in water <0.5 meter deep over muck. Plants were regularly encountered among floating muck bogs on both lakes.
Common Associates: (*Brasenia schreberi*) Watershield, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Spirodela polyrhiza*) **Large duckweed**
Specimen Location: Cranberry Lake; N46.26656°, W91.54509°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-172
Habitat/Distribution: Rare; a few individuals were found among floating-leaf species on the south shoreline around floating muck bogs.
Common Associates: (*Lemna minor*) Small duckweed, (*Nymphaea odorata*) White water lily, (*Potamogeton natans*) Floating-leaf pondweed

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Stuckenia pectinata*) **Sago pondweed**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-173
Habitat/Distribution: Scattered locations in water <2 meters deep over sand and sandy muck on LEC. Only seek in the creek inlet on Cranberry.
Common Associates: (*Eleocharis acicularis*) Needle spikerush, (*Najas flexilis*) Slender naiad, (*Sagittaria graminea*) Grass-leaved arrowhead

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Tolypella intricata*) **Birds nest stonewort**
Specimen Location: Lower Eau Claire Lake; N46.27440°, W91.55747°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-174
Habitat/Distribution: Found in 3-6 meters over sand. Relatively common scattered around the littoral edge adjacent to sharp drop-offs into deep water.
Common Associates: (*Chara* sp.) Muskgrass, (*Nitella* sp.) Nitella

County/State: Douglas County, Wisconsin **Date:** 6/29/22
Species: (*Typha angustifolia*) **Narrow-leaved cattail**
Specimen Location: Lower Eau Claire Lake; N46.25849°, W91.56545°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-175
Habitat/Distribution: Found in water <0.5 meter deep over firm muck. Several large beds were located on the south shoreline of the outlet bay.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia gibba*) Creeping bladderwort, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Typha latifolia*) **Broad-leaved cattail**
Specimen Location: Cranberry Lake; N46.26545°, W91.54714°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-176
Habitat/Distribution: Found in water <0.5 meter deep over nutrient-rich muck. Scattered on bogs.
Common Associates: (*Brasenia schreberi*) Watershield, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis erythropoda*) Bald spikerush, (*Nymphaea odorata*) White water lily

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Utricularia gibba*) **Creeping bladderwort**
Specimen Location: Cranberry Lake; N46.26043°, W91.54544°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-177
Habitat/Distribution: Found in water <1.0 meter deep over muck. Relatively common among muck bogs entangled in other vegetation.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia minor*) Small bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Utricularia intermedia*) **Flat-leaf bladderwort**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-178
Habitat/Distribution: Found in water <1.0 meter deep over muck.
Relatively common among muck bogs on both lakes.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia vulgaris*) Common bladderwort

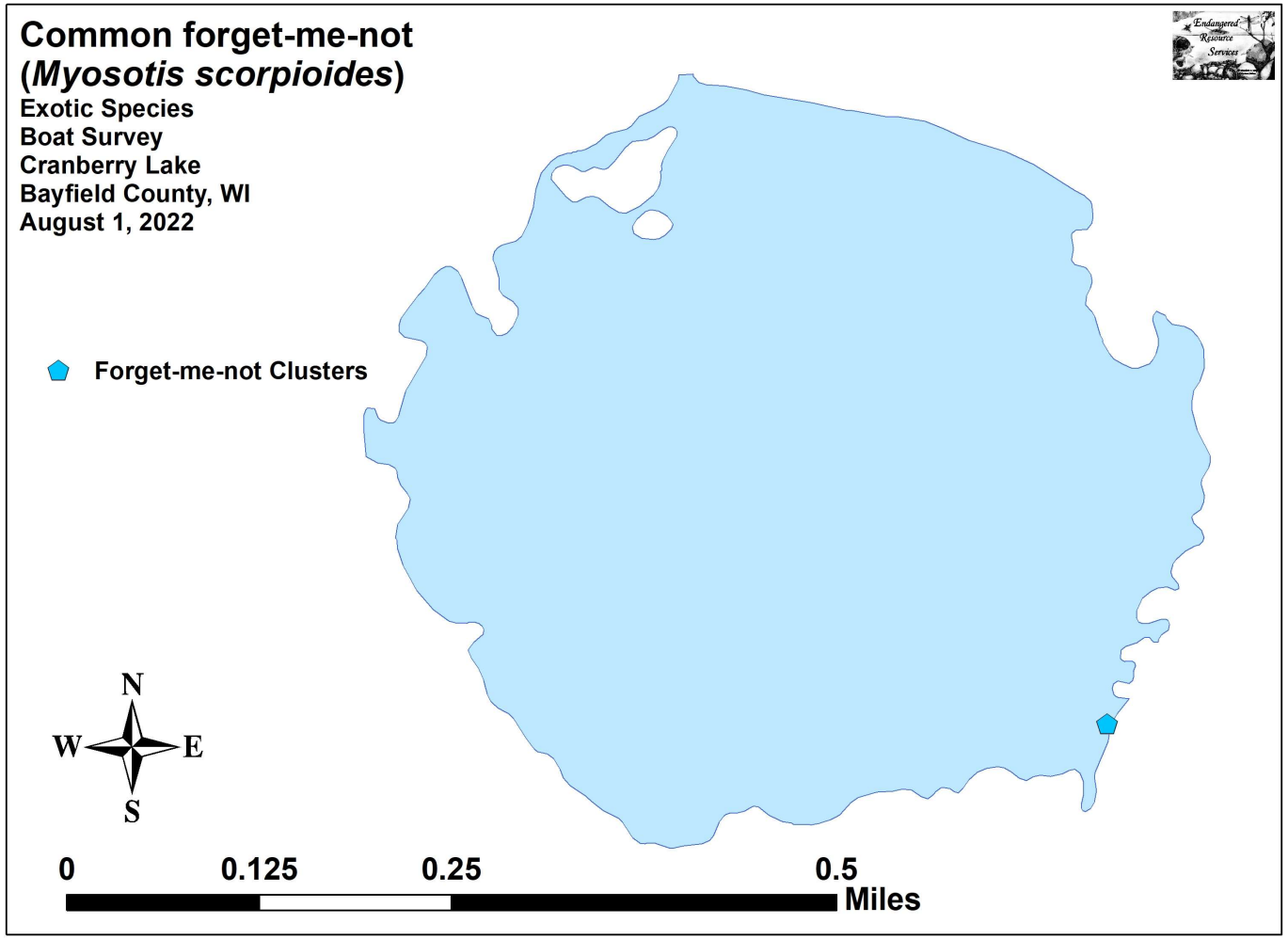
County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Utricularia minor*) **Small bladderwort**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-179
Habitat/Distribution: Found in water <1.0 meter deep over muck.
Relatively common among muck bogs on both lakes.
Common Associates: (*Brasenia schreberi*) Watershield, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia vulgaris*) Common bladderwort

County/State: Bayfield County, Wisconsin **Date:** 8/1/22
Species: (*Utricularia vulgaris*) **Common bladderwort**
Specimen Location: Cranberry Lake; N46.26006 °, W91.54595°
Also found on Lower Eau Claire Lake.
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-180
Habitat/Distribution: Found in water <1.0 meter deep over muck. Relatively common among muck bogs on both lakes.
Common Associates: (*Brasenia schreberi*) Watershield, (*Najas flexilis*) Slender naiad, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Utricularia minor*) Small bladderwort

County/State: Douglas County, Wisconsin **Date:** 8/1/22
Species: (*Vallisneria americana*) **Wild celery**
Specimen Location: Lower Eau Claire Lake; N46.26084°, W91.56467°
Also found on Cranberry Lake
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-181
Habitat/Distribution: Found in water <4.0 meters deep over sand and sandy muck. Common throughout both lakes.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Myriophyllum sibiricum*) Northern water-milfoil, (*Najas flexilis*) Slender naiad

County/State: Bayfield County, Wisconsin **Date:** 6/29/22
Species: (*Zizania palustris*) **Northern wild rice**
Specimen Location: Cranberry Lake; N46.26083°, W91.54234°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2022-182
Habitat/Distribution: Found in water <0.5 meter deep over muck. Uncommon; perhaps a few 100 plants scattered near the point just west of the creek inlet. Not seen anywhere else in the system.
Common Associates: (*Brasenia schreberi*) Watershield, (*Elodea canadensis*) Common waterweed, (*Najas flexilis*) Slender naiad, (*Potamogeton robbinsii*) Fern pondweed

Appendix VIII: Exotic Species Distribution Map and Aquatic Exotic Invasive Plant Species Information


Common forget-me-not
(Myosotis scorpioides)
Exotic Species
Boat Survey
Cranberry Lake
Bayfield County, WI
August 1, 2022
Endangered Resource Services
Forget-me-not Clusters
N
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0.25
0.5
Miles

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 water-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, blue-joint 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 berms 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

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 IX: 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 X: Raw Data Spreadsheets

CranberryLakeBayfieldCoWBIC2741700CLPPISurvey629,2022MBergERSLLC.xlsx

CranberryLakeBayfieldCoWBIC2741700PISurvey81,2022MBergERSLLC.xlsx