Aquatic Macrophyte Surveys for
Little Dummy and Big Dummy Lakes
Barron County, Wisconsin
WBIC: 1861400 and 1835100

(Purple bladderwort blooming among Watershield)

Project Sponsored by:
Wisconsin Department of Natural Resources and the
Dummy Lakes Management District

(Robbins spikerush bed in northeast corner of Little Dummy)

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ABSTRACT

Little Dummy Lake (WBIC 1861400) and Big Dummy Lake (WBIC 1835100) combine to form a 142 acre seepage lake system in north-west Barron County. The lakes are mesotrophic in nature with maximum Secchi readings ranging from 7-10ft, and a littoral zone that reaches 20.0ft in Little Dummy and 15.5ft in Big Dummy. In 2008, a need to update the lakes' Aquatic Plant Management Plan prompted the Dummy Lakes Management District and the WDNR to commission a systematic point intercept macrophyte survey of Little Dummy Lake to compliment the WDNR survey on Big Dummy in 2006. The surveys found macrophytes at 74 of the 119 survey points on Little Dummy (62%), and 227 of 311 survey points on Big Dummy (73%). We identified a total of 27 species on Little Dummy, and WDNR researchers identified 33 species on Big Dummy for a combined total of 40 species in and immediately adjacent to the lakes. They produced above average mean Coefficients of Conservatism of 7.2 and 7.2, and above average Floristic Quality Indexes of 36.0 and 39.4 on Little Dummy and Big Dummy respectively. Large purple bladderwort (*Utricularia purpurea*) and Watershield (*Brasenia schreberi*) were the most common species on both lakes being found at 85.14% and 43.24% of points with vegetation on Little Dummy and 55.95% and 50.22% of points with vegetation on Big Dummy. Six species of Special Concern including Spiny hornwort (*Ceratophyllum echinatum*), Robbins spikerush (*Eleocharis robbinsii*), Farwell's water milfoil (*Myriophyllum farwellii*), Water-thread pondweed (*Potamogeton bicupulatus*), Vasey's pondweed (*Potamogeton vaseyi*), and Large purple bladderwort (*Utricularia purpurea*) were also identified. Future management goals should include preserving the lakes' healthy, diverse and rare native plant community, minimizing the impact of any plant control on these sensitive native plants, working to improve the lakes' clarity and quality by reducing the nutrient load coming into the system, improving the signage and/or developing a "Clean Boats/Clean Water" program at the boat landing, and consideration to monitor for Eurasian water milfoil (*Myriophyllum spicatum*) in transects parallel to the shore at the Big Dummy Lake boat landing at least once a month during the summer.

ACKNOWLEDMENTS

We wish to thank the Wisconsin Department of Natural Resources and the Dummy Lakes Management District for funding this project; Jennifer Hauxwell for technical assistance; Lee Peterson for helping coordinate the project; and Vanessa Kleiss, Nicole Davis, and Mitchel and Noah Berg for assistance in conducting this survey.

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INTRODUCTION:

Little Dummy Lake (WBIC 1861400) and Big Dummy Lake (WBIC 1835100) combine to form a 142 acre seepage lake system (Little Dummy 31 acres and Big Dummy 111 acres) in north-west Barron County, Wisconsin in the Town of Lakeland (T36N R13W S28 NW NW/ NE SW). Little Dummy Lake achieves a maximum depth of 44ft in the north-central basin while Big Dummy Lake reaches its maximum depth of 54 feet in the east-central basin. Both lakes have an average depth between 12 and 13ft, and are mesotrophic in nature with summer Secchi readings averaging 7-10ft (WDNR 2008). Little Dummy's littoral zone reached 20ft in 2008 while Big Dummy's extended to 15.5ft in 2006. The bottom substrate of both lakes is predominately organic muck with thin areas of sand along the west and north shores of each.

Figure 1: Little and Big Dummy Lakes Aerial Photo

A need to update the lakes' Aquatic Plant Management Plan (APMP), concern over the introduction of Eurasian water milfoil (*Myriophyllum spicatum*) in nearby Duck, Beaver Dam and Lower Vermillion Lakes, and a desire to establish baseline data should an exotic invasive species enter the lakes prompted members of the Dummy Lakes Management District to authorize a Curly-leaf pondweed (*Potamogeton crispus*), and full point/intercept survey of the lakes' aquatic macrophytes in the summer of 2008. A request to the WDNR for survey points revealed that Big Dummy Lake had been surveyed by WDNR personnel in 2006. Because of this, only Little Dummy Lake was surveyed in 2008. This report represents the summary analysis of the data collected during the 2008 Little Dummy Lake surveys and supplemental analysis of the WDNR's survey of Big Dummy Lake in 2006. The immediate goals of the project were to

determine if Eurasian water milfoil or Curly-leaf pondweed had invaded the lakes, and to establish baseline data on the diversity, abundance and distribution of native aquatic plant populations. These data will be used to provide a baseline for long-term monitoring of the lakes' macrophyte community and to develop an APMP moving forward.

PLANT SURVEY METHODS:

June Cold Water Curly-leaf pondweed Survey:

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth and total lake acreage, Jennifer Hauxwell (WDNR) generated a sampling grid for Big and Little Dummy Lakes (Appendix I). On June 2nd, we conducted a Curly-leaf pondweed survey to look for the presence of this invasive species. Normally this survey randomly selects approximately 20% of all points, but, due to Little Dummy's small size, we sampled all 122 points. This survey should result in detection, rake density and approximate mapping of any infestation.

July Warm Water Full Point/Intercept Survey:

On July 19th, prior to beginning the point intercept survey, we conducted a general boat survey of Little Dummy Lake to gain familiarity with the species present (Appendix II). All plants found were identified (Voss 1996; Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006), and two vouchers were pressed and retained for herbarium specimens – one to be retained by the Dummy Lakes Management District, and one to be sent to the state for identification confirmation. During the point intercept survey, we located each survey point using a handheld mapping GPS unit (Garmin 76Cx). At each point, we recorded a depth reading with a Polar Vision hand held sonar unit. Following the establishment of the littoral zone at 20ft., we sampled for plants within the depth range of plant growth. At each of these points, we used a rake on a pole to sample an approximately 2.5ft section of the bottom. All plants on the rake, as well as any that were dislodged by the rake were identified and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of plants within six feet of the sample point. Substrate (lake bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake.

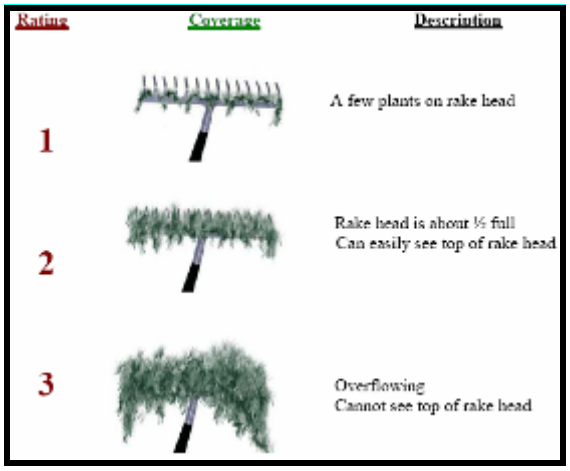


Figure 2: Rake Fullness Ratings (UWEX, 2008)

DATA ANALYSIS:

We entered all data collected into the standard APM spreadsheet (Appendix III) (UWEX, 2008). From this, we calculated the following:

Total number of points sampled: This included the total number of points on the lake coverage (Appendix I). Although depth measurements are taken at all points, only those points that were within the littoral zone (0-maximum depth where plants are found) were sampled for plants. Once we established this maximum depth, most points beyond this depth were not rake sampled.

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 lake's littoral zone has plants.

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

Frequency of occurrence example:

Plant A is sampled at 70 out of 700 total points = 70/700 = .10 = 10%
This means that Plant A's frequency of occurrence = 10% considering the entire lake sample.

Plant A is sampled at 70 out of 350 total points in the littoral zone = 70/350 = .20 = 20%
This means that Plant A's frequency of occurrence = 20% when only considering the littoral zone.

From these frequencies, we can estimate how common each species was throughout the lake, and how common the species was at depths where plants were able to grow. Note the second value will be greater as not all the points (in this example, only ½) occur at depths shallow enough for plant growth.

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 individuals (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be **more resistant** to invasion by exotic species.

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

Number of sites sampled using rope/pole rake: This indicates which rake type was used to take a sample. Protocol suggests a 15ft pole rake, and a 25ft rope rake for sampling (Wagoner personal communication).

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** indicates 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 during the point intercept survey and the initial boat survey.

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.

Relative frequency: This value shows a species' frequency relative to all other species. It is expressed as a percentage, and the total of all species' relative frequency will add up to 100%. Organizing species from highest to lowest relative frequency value (Tables 3 and 4) gives us an idea of which species are most important within the macrophyte community.

Relative frequency example:

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

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

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

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

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

Floristic Quality Index (FQI): This index measures the impact of human development on a lake's aquatic plants. 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 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 species found in the lake during the point intercept and boat surveys and multiplying it by the square root of the total number of plant species (N) in the lake ($FQI = \Sigma(c1+c2+c3+\ldots cn)/\sqrt{N}$). Statistically speaking, the higher the index value, the healthier the lake's macrophyte community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. The Dummy Lakes are in the Northern Central Hardwood Forests Ecoregion.

RESULTS:

June Cold Water Curly-leaf pondweed Survey:

We did not locate any Curly-leaf pondweed or Eurasian water milfoil during either the June cold water survey or the July full point/intercept survey (Figure 3) (Appendix IV). The only non-native species we did locate was Reed canary grass (*Phalaris arundinacea*) which grows in a few small patches at scattered shoreline locations around the lakes.

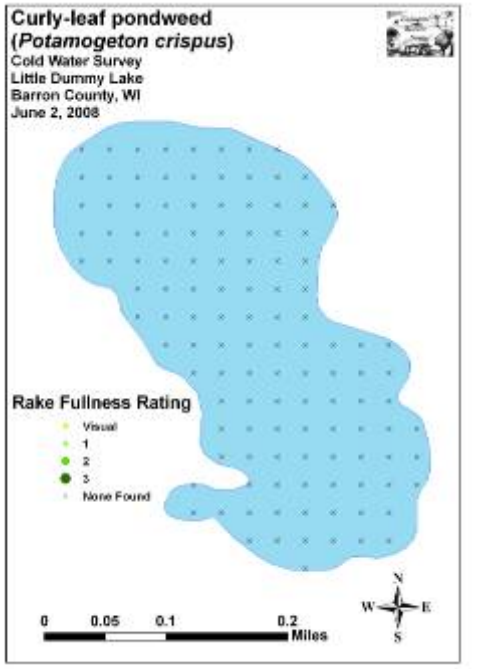


Figure 3: June Cold Water Curly-leaf pondweed Survey

Although we did not locate any Purple loosestrife (*Lythrum salicaria*) on or directly adjacent to the lakes, it is present in the greater Cumberland area making it another exotic species that should be watched for. Because it prefers organic muck soil similar to where cattail marshes establish, these areas should be checked annually in August when the plants are in bloom and are the easiest to spot. For more information on exotic species, see Appendix IX.

July Warm Water Full Point/Intercept Survey:

We surveyed all 122 points (Figure 4) for depth (Figure 5) on Little Dummy while the WDNR sampled 255 of 332 for depth on Big Dummy. Little Dummy has an expansive shallow flat (<8ft) on the southeast end of the lake, and a deep, slightly elongated bowl (17-44ft) with steep drop offs in the central and north part of the lake. Big Dummy also has a shallow flat (<7ft) that dominates the west half of the lake. The eastern side forms a deep bowl (7-54ft) with steep sides.

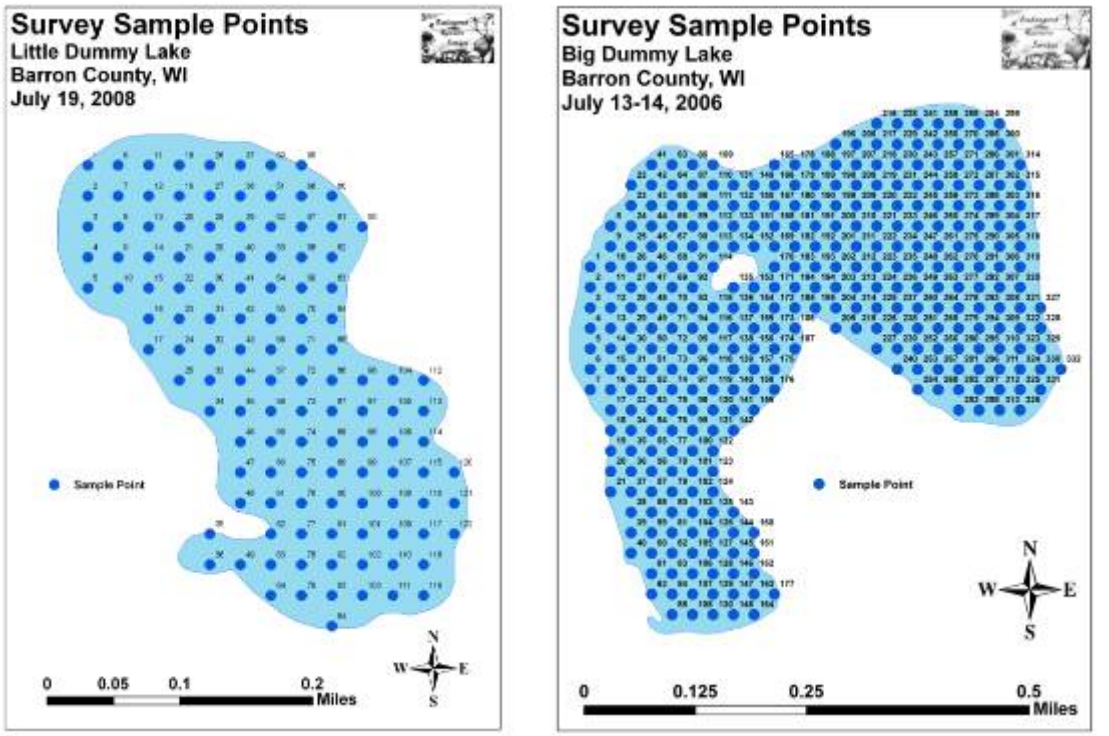


Figure 4: Survey Sample Points

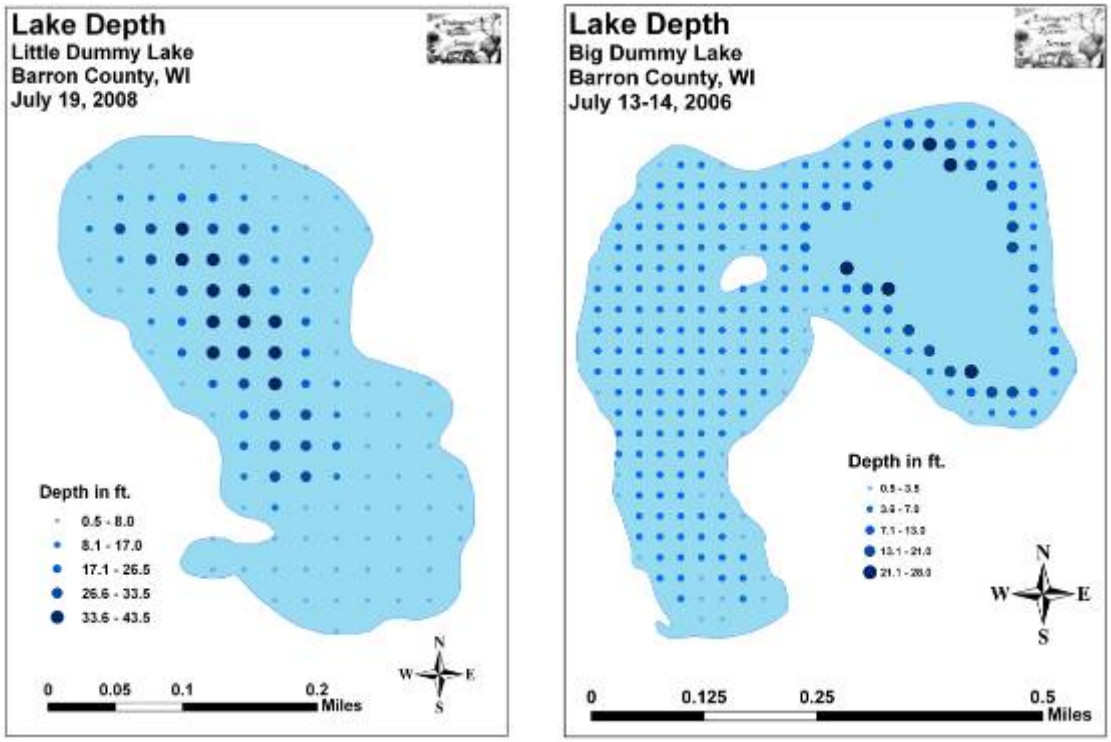


Figure 5: Lake Depth

Although we found some sandy bottom shoreline areas on the north and northeast sides of Little Dummy, all of the 87 survey points that fell in the littoral zone were over organic muck (Figure 6 and 7) (Appendix V). Of the 240 points in Big Dummy's littoral zone, 5% were sand with the rest being organic muck. These shallow, muck bottom flats had the highest density and diversity of plants on both lakes.

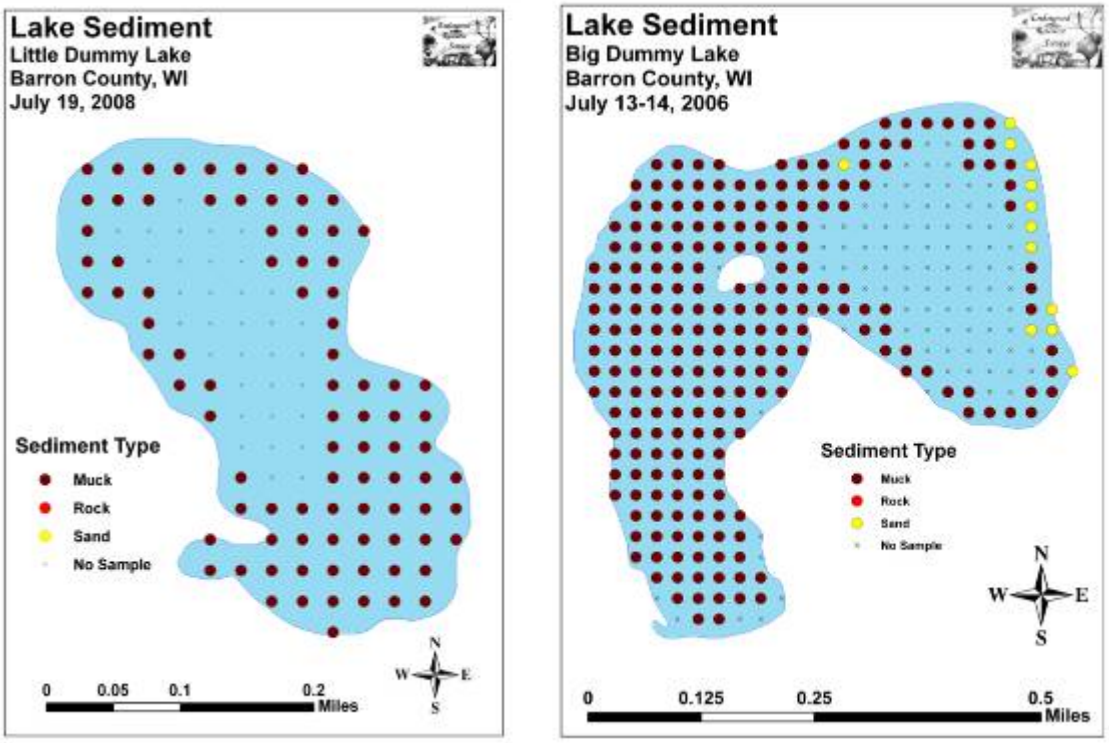


Figure 6: Lake Bottom Sediment Type

On Little Dummy Lake, we found plants growing on approximately 62.2% (74 of 119) of the entire lake bottom, and in 85.1% of the littoral zone (Table 1). Diversity was relatively high with a Simpson Diversity Index value of 0.84. Species richness was also high for such a small lake with 27 species found growing in and immediately adjacent to the lake (Appendix VI and VII). The majority of aquatic macrophytes were found growing in relatively shallow water with a mean depth of 5.1ft, and a median depth 4.0ft. The presence of aquatic moss at the lower edge of the littoral zone beyond all other species was at least partially responsible for the observed skewing of data.

On Big Dummy Lake, WDNR surveyors found plants growing on approximately 73.0% of accessible sites (227 of 311), and 93.8% of the accessible littoral zone (Table 2). Big Dummy's Simpson Diversity Index was slightly higher than Little Dummy's at 0.89. They also located slightly more species with a total of 33 found in and adjacent to the lake. Mean depth of plants was similar to Little Dummy at 4.9ft, and the median was 5.1ft. They also noted that if aquatic moss was excluded, the littoral zone shrunk to 10.5ft.

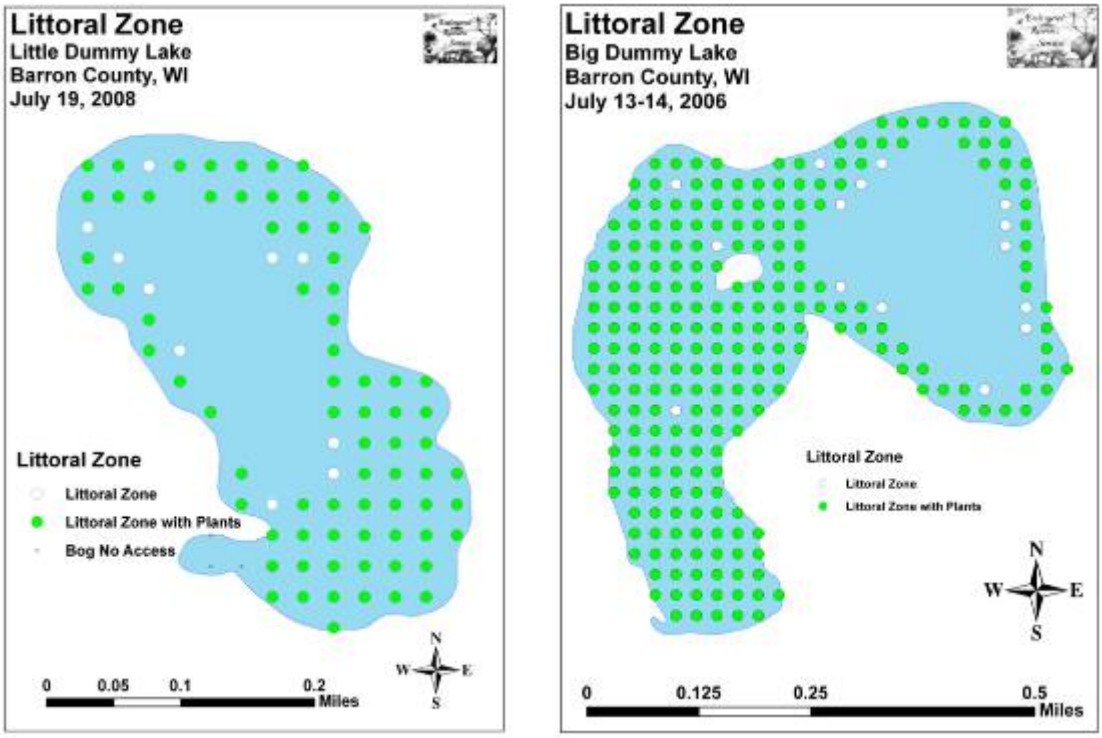


Figure 7: Littoral Zone

Table 1: Aquatic Macrophytes Survey Summary Statistics
Little Dummy Lake, Barron County
July 2008

Summary Statistics:

Total number of points sampled	122
Total number of sites with vegetation	74
Total number of sites shallower than the maximum depth of plants	87
Frequency of occurrence at sites shallower than maximum depth of plants	85.1
Simpson Diversity Index	0.84
Maximum depth of plants (ft)	20.0
Number of sites sampled using rope rake (R)	10
Number of sites sampled using pole rake (P)	75
Average number of all species per site (shallower than max depth)	2.22
Average number of all species per site (veg. sites only)	2.61
Average number of native species per site (shallower than max depth)	2.22
Average number of native species per site (veg. sites only)	2.61
Species Richness	17
Species Richness (including visuals)	17
Species Richness (including visuals and boat survey)	27
Mean depth of plants (ft)	5.10
Median depth of plants (ft)	4.00

Table 2: Aquatic Macrophytes Survey Summary Statistics
Big Dummy Lake, Barron County
July 2006

Summary Statistics:

Total number of points sampled	255
Total number of sites with vegetation	227
Total number of sites shallower than the maximum depth of plants	242
Frequency of occurrence at sites shallower than maximum depth of plants	93.8
Simpson Diversity Index	0.89
Maximum depth of plants (ft)	15.5
Number of sites sampled using rope rake (R)	2
Number of sites sampled using pole rake (P)	239
Average number of all species per site (shallower than max depth)	2.67
Average number of all species per site (veg. sites only)	2.84
Average number of native species per site (shallower than max depth)	2.60
Average number of native species per site (veg. sites only)	2.84
Species Richness	26
Species Richness (including visuals)	26
Species Richness (including visuals and boat survey)	33
Mean depth of plants (ft)	4.91
Median depth of plants (ft)	5.00

Large purple bladderwort (*Utricularia purpurea*) and Watershield (*Brasenia schreberi*) were the most common species on Little Dummy (Figure 8) being found at 85.14% and 43.24% of points with vegetation (Table 3). WDNR researchers also found them to be the most common on Big Dummy (Figure 9) where they grew at 55.95% and 50.22% of points with vegetation (Table 4).

In Little Dummy, Large purple bladderwort was widespread throughout the littoral zone, but Watershield was more restricted being found in water generally <4ft deep. It formed dense canopies along with White water lily (*Nymphaea odorata*) and Spatterdock (*Nuphar variegata*). Beyond these "lilypad" beds, Large-leaf pondweed (*Potamogeton amplifolius*), Robbins (Fern) pondweed (*Potamogeton robbinsii*) and Farwell's water milfoil (*Myriophyllum farwellii*) formed scattered beds of vegetation. In the shallow areas of the lake, Robbins spikerush (*Eleocharis robbinsii*), Water bulrush (*Schoenoplectus subterminalis*), and Pickerelweed (*Pontederia cordata*) formed dense emergent beds. Sandy shoreline areas were dominated by Ribbon-leaf pondweed (*Potamogeton epihydrus*), Filament-leaf pondweed (*Potamogeton bicupulatus*), Spiny-spored quillwort (*Isoetes echinospora*), Needle spikerush (*Eleocharis acicularis*), and Pipewort (*Eriocaulon aquaticum*).

All total, six "Special Concern"** species including Spiny hornwort (*Ceratophyllum echinatum*), Robbins spikerush, Farwell's water milfoil, Filament-leaf pondweed, Vasey's pondweed (*Potamogeton vaseyi*), and Large purple bladderwort were found on Little and Big Dummy Lakes. The presence of these species along with others such as Dwarf water milfoil (*Myriophyllum tenellum*), Water bulrush, and Flat-leaf bladderwort (*Utricularia intermedia*) that are highly sensitive to pollution and human disturbance is a testament to a history of good water quality and human stewardship that the Dummy Lakes have apparently enjoyed.

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

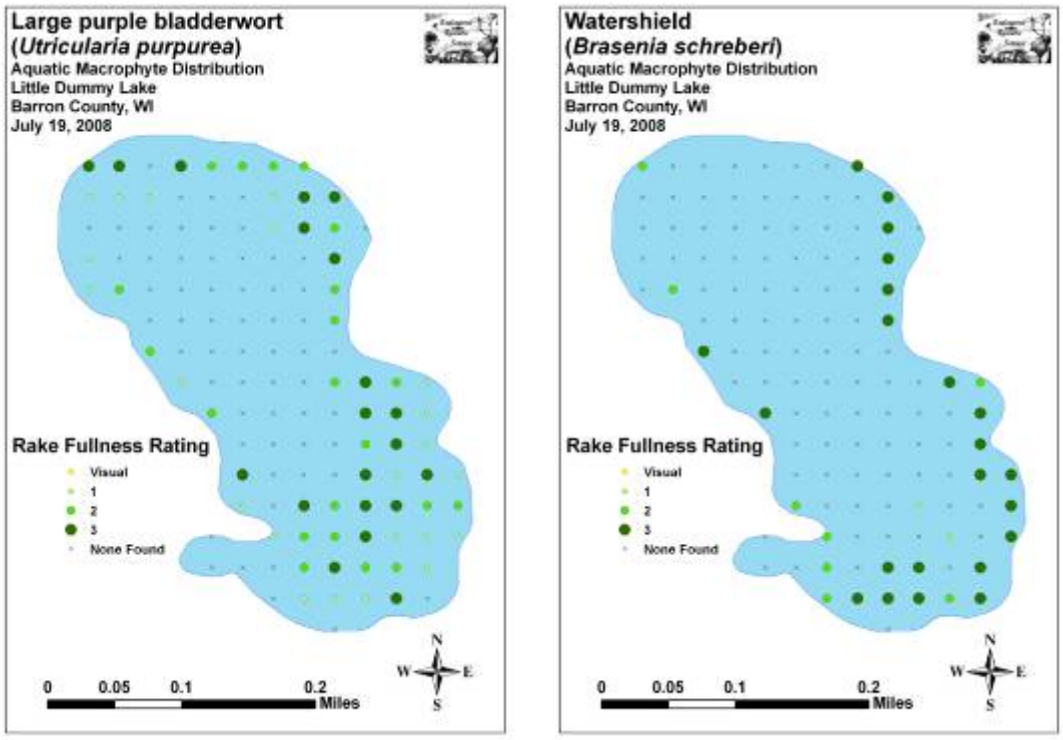


Figure 8: Little Dummy Lakes Dominant Species

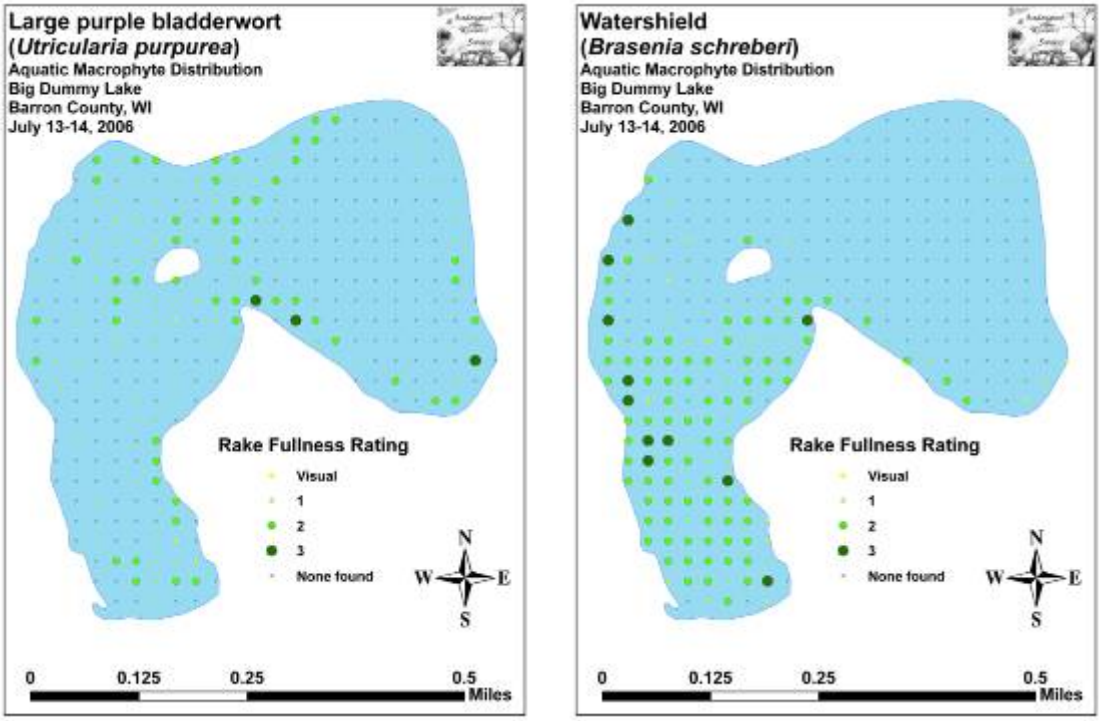


Figure 9: Big Dummy Lake Dominant Species

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Little Dummy Lake, Barron County
July 2008

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
Utricularia purpurea	Large purple bladderwort	63	32.64	85.14	72.41	1.97
Brasenia schreberi	Watershield	32	16.58	43.24	36.78	2.63
Nymphaea odorata	White water lily	20	10.36	27.03	22.99	1.45
Schoenoplectus subterminalis	Water bulrush	15	7.77	20.27	17.24	1.73
Nuphar variegata	Spatterdock	12	6.22	16.22	13.79	1.33
Eleocharis robbinsii	Robbins spikerush	11	5.70	14.86	12.64	1.18
	Aquatic moss	6	3.11	8.11	6.90	1.17
Pontederia cordata	Pickerelweed	6	3.11	8.11	6.90	1.50
Potamogeton amplifolius	Large-leaf pondweed	6	3.11	8.11	6.90	1.17
Utricularia vulgaris	Common bladderwort	6	3.11	8.11	6.90	1.00
Potamogeton robbinsii	Robbins (fern) pondweed	5	2.59	6.76	5.75	1.60
Utricularia gibba	Creeping bladderwort	4	2.07	5.41	4.60	1.00
Myriophyllum farwellii	Farwell's water milfoil	2	1.04	2.70	2.30	1.50
Utricularia intermedia	Flat-leaf bladderwort	2	1.04	2.70	2.30	1.00
Dulichium arundinaceum	Three-way sedge	1	0.52	1.35	1.15	1.00
Potamogeton bicupulatus	Filament-leaf pondweed	1	0.52	1.35	1.15	1.00
Sagittaria latifolia	Common arrowhead	1	0.52	1.35	1.15	1.00
Eleocharis acicularis	Needle spikerush	***	***	***	***	***
Eleocharis erythropoda	Red-footed spikerush	***	***	***	***	***
Eriocaulon aquaticum	Pipewort	***	***	***	***	***
Isoetes echinospora	Spiny-spored quillwort	***	***	***	***	***
Juncus pelocarpus f. submersus	Brown-fruited rush	***	***	***	***	***

Table 3 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes
Little Dummy Lake, Barron County
July 2008

Phalaris arundinacea	Reed canary grass	***	***	***	***	***
Potamogeton epihydrus	Ribbon-leaf pondweed	***	***	***	***	***
Potamogeton gramineus	Variable pondweed	***	***	***	***	***
Schoenoplectus acutus	Hardstem bulrush	***	***	***	***	***
Typha latifolia	Broad-leaved cattail	***	***	***	***	***
*** Boat Survey Only						

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes Big Dummy Lake, Barron County, July 2006

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
Utricularia purpurea	Large purple bladderwort	127	19.69	55.95	52.48	1.46
Brasenia schreberi	Watershield	114	17.67	50.22	47.11	1.91
Utricularia vulgaris	Common bladderwort	70	10.85	30.84	28.93	1.47
Schoenoplectus subterminalis	Water bulrush	67	10.39	29.52	27.69	1.36
Potamogeton robbinsii	Robbins (fern) pondweed	47	7.29	20.70	19.42	1.60
Nymphaea odorata	White water lily	35	5.43	15.42	14.46	1.57
Utricularia gibba	Creeping bladderwort	31	4.81	13.66	12.81	1.03
	Aquatic moss	29	4.50	12.78	11.98	1.14
Potamogeton amplifolius	Large-leaf pondweed	23	3.57	10.13	9.50	1.35
Nuphar variegata	Spatterdock	22	3.41	9.69	9.09	1.55
Utricularia intermedia	Flat-leaf bladderwort	19	2.95	8.37	7.85	1.21
	Filamentous algae	17	2.64	7.49	7.02	1.12
Potamogeton vaseyi	Vasey's pondweed	11	1.71	4.85	4.55	1.09
Ceratophyllum demersum	Coontail	5	0.78	2.20	2.07	1.00
Ceratophyllum echinatum	Spiny hornwort	5	0.78	2.20	2.07	1.20
Myriophyllum tenellum	Dwarf water milfoil	4	0.62	1.76	1.65	1.00
Nitella sp.	Nitella	4	0.62	1.76	1.65	1.00
Scirpus sp.	Bulrush sp.	3	0.47	1.32	1.24	1.33
Eleocharis acicularis	Needle spikerush	2	0.31	0.88	0.83	1.00
Heteranthera dubia	Water star-grass	2	0.31	0.88	0.83	1.00
Myriophyllum verticillatum	Whorled water milfoil	2	0.31	0.88	0.83	1.00
Sagittaria latifolia	Common arrowhead (assumed)	2	0.31	0.88	0.83	1.00
Najas flexilis	Bushy pondweed	1	0.16	0.44	0.41	1.00
Pontederia cordata	Pickerelweed	1	0.16	0.44	0.41	2.00
Potamogeton pusillus	Small pondweed	1	0.16	0.44	0.41	1.00

Table 4 (cont'): Frequencies and Mean Rake Sample of Aquatic Macrophytes Big Dummy Lake, Barron County, July 2006

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
Vallisneria americana	Wild celery	1	0.11	0.31	0.26	1.00
Dulichium arundinaceum	Three-way sedge	**	**	**	**	**
Elatine minima	Waterwort	***	***	***	***	***
Isoetes echinospora	Spiny-spored quillwort	***	***	***	***	***
Juncus pelocarpus f. submersus	Brown-fruited rush	***	***	***	***	***
Polygonum amphibium	Water smartweed	***	***	***	***	***
Potamogeton bicupulatus	Filament-leaf pondweed	***	***	***	***	***
Typha latifolia	Broad-leaved cattail (assumed)	***	***	***	***	***

** Visual Only

*** Boat Survey Only

Table 5: Floristic Quality Index of Aquatic Macrophytes
Little Dummy Lake, Barron County
July 2008

Species	Common Name	C
Brasenia schreberi	Watershield	7
Dulichium arundinaceum	Three-way sedge	9
Eleocharis acicularis	Needle spikerush	5
Eleocharis erythropoda	Red-footed spikerush	3
Eleocharis robbinsii	Robbins spikerush	10
Eriocaulon aquaticum	Pipewort	9
Isoetes echinospora	Spiny-spored quillwort	8
Juncus pelocarpus f. submersus	Brown-fruited rush	8
Myriophyllum farwellii	Farwell's water-milfoil	9
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	9
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Filament-leaf pondweed	9
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton robbinsii	Robbins (fern) pondweed	8
Sagittaria latifolia	Common arrowhead	3
Schoenoplectus acutus	Hardstem bulrush	5
Schoenoplectus subterminalis	Water bulrush	9
Typha latifolia	Broad-leaved cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
N		25
mean C		7.2
FQI		36.0

We identified a total of 25 native plants to species (Aquatic moss and Reed canary grass were excluded) in and immediately adjacent to Little Dummy Lake (Table 5). This produced a mean Coefficient of Conservation 7.2 and a Floristic Index of 36.0. Nichols (1999) reported Average Mean C for the Northern Central Hardwood Forests Region of 5.6 putting Little Dummy Lake well above average for this part of the state. The FQI was also much higher than the mean FQI of 20.9 for the Northern Central Hardwood Forests Region (Nichols 1999). These above average values are a result of the high species richness and high sensitivity of plants found on the lake.

Table 6: Floristic Quality Index of Aquatic Macrophytes
Big Dummy Lake, Barron County
July 2006

Species	Common Name	C
Brasenia schreberi	Watershield	7
Ceratophyllum demersum	Coontail	3
Ceratophyllum echinatum	Spiny hornwort	10
Dulichium arundinaceum	Three-way sedge	9
Elatine minima	Waterwort	9
Eleocharis acicularis	Needle spikerush	5
Heteranthera dubia	Water star-grass	6
Isoetes echinospora	Spiny-spored quillwort	8
Juncus pelocarpus f. submersus	Brown-fruited rush	8
Myriophyllum tenellum	Dwarf water-milfoil	10
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Bushy pondweed	6
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Pontederia cordata	Pickerelweed	9
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Filament-leaf pondweed	9
Potamogeton pusillus	Small pondweed	7
Potamogeton robbinsii	Robbins (fern) pondweed	8
Potamogeton vaseyi	Vasey's pondweed	10
Sagittaria latifolia	Common arrowhead (assumed)	3
Schoenoplectus subterminalis	Water bulrush	9
Typha latifolia	Broad-leaved cattail (assumed)	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		30
mean C		7.2
FQI		39.4

WDNR researchers identified a total of 30 plants to species (Filamentous algae, Aquatic moss, and Scirpus sp. were excluded) in and immediately adjacent to Big Dummy Lake (Table 6). This was also well above average for both mean C and FQI for this part of the state. All combined, the two lakes provided habitat for an impressive 40 species of aquatic plants.

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

The Dummy Lakes have a healthy, abundant, diverse and rare plant community that contains an unusually high number of state species of special concern. This is likely due to a combination of factors including the lakes varied habitats, natural water chemistry, and good water quality. The lakes are essentially both bog lakes, and have high levels of tannic acid in their water. This brown chemical, a natural byproduct from the breakdown of plant leaves and roots, provides ideal conditions for many of these rare plants to the point that they are filling in the lakes and making it difficult for some property owners to access the water. Although bog formation (floating mats of plants) is a natural process, as this growth continues to expand and fill in, owners will have to balance preservation of this unique ecosystem with individual property rights. The development of an Aquatic Plant Management Plan with WDNR, consultant and lake owner input will help the Management District facilitate this balance of preservation and human usage moving forward.

If chemical control and/or manual removal are part of the APMP, the District should be mindful that these plants are the base of the aquatic food pyramid, provide habitat for other aquatic organisms, are an important food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve water clarity by absorbing excess nutrients from the water. The reed/rush beds are especially important as they provide "nursery" habitat for baitfish and juvenile gamefish. In essence, a lake's plants are as critical to the aquatic environment as trees are to a forest, and any control should be the minimum required to meet management goals.

Improving water clarity and quality should also be continuing goals for the Management District to consider. Secchi readings over the past 15 years appear to indicate steadily improving clarity in Big Dummy, and stable clarity in Little Dummy. Filamentous algae, a threat to many lakes' water clarity/quality, are normally associated with an abundance of nutrients in the water from lawn and field fertilizer runoff. It was absent in Little Dummy and had a low relative frequency of 2.64 in Big Dummy Lake. Although there were few places in Big Dummy that exhibited excessive algal growth, these levels could be lowered even further by reducing or eliminating fertilizer applications near the lake, and developing native vegetation buffer strips to restore shorelines and limit nutrient runoff.

Finally, aquatic invasive species (AIS) such as Eurasian water milfoil are an increasing problem in the lakes of northern Wisconsin in general, and Barron County in particular. Preventing their introduction into the Dummy Lakes with proactive measures is strongly encouraged. Especially around the boat landing, lakeshore owners should refrain from removing native plants from the lake unless absolutely necessary as these patches of barren substrate can provide an easy place for invasive plants to take root and become established. The Management District's lack of a visible "Clean Boats/Clean Water" program and noticeable signage at the boat landing are also improvements to consider. Both would offer a layer of protection against AIS by providing education, reeducation, and continual reminders of the dangers/impacts of aquatic invasive species to lake owners and visitors alike. In addition to improving signage at the boat landing, conducting monthly or bimonthly survey transects parallel to the shore near the boat launch on Big Dummy Lake could result in immediate detection if AIS are introduced to the lakes. The sooner an infestation is detected, the greater the chances it can be controlled or even eliminated.

Management Recommendations Summary:

- Preserve the Dummy Lakes' healthy, diverse and rare native plant community.
- If plant control is required, it should be the minimal required to meet management goals.
- Preserve the lakes' many rush/reed beds which serve as fish nurseries.
- Reduce and, wherever possible, eliminate fertilizer and pesticide applications near the lakeshore.
- Establish native vegetation buffer strips along the lakeshore.
- Encourage shoreline restoration.
- Encourage owners to refrain from removing native plants from the lake – especially near the boat landing.
- Initiate a Clean Boats/Clean Water campaign.
- Improve signage at the Big Dummy Lake boat landing.
- Consider transect monitoring for invasive species at the lakes' boat landing.

LITERATURE CITED

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

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

Crow, G. E., C. B. Hellquist. 2006. Aquatic and Wetland Plants of Northeastern North America, Volume I + II: A Revised and Enlarged Edition of Norman C. Fassett's A Manual of Aquatic Plants. University of Wisconsin Press; 1st editon.

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

UWEX Lakes Program. [online]. 2008. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp (2008, September).

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

WDNR. [online]. 2008. Big and Little Dummy Lake Secchi Reports.
http://dnr.wi.gov/lakes/clmn/reportsanddata/station.asp?folder=CLMN&stationid=033171
http://dnr.wi.gov/lakes/clmn/reportsanddata/station.asp?folder=CLMN&stationid=033184

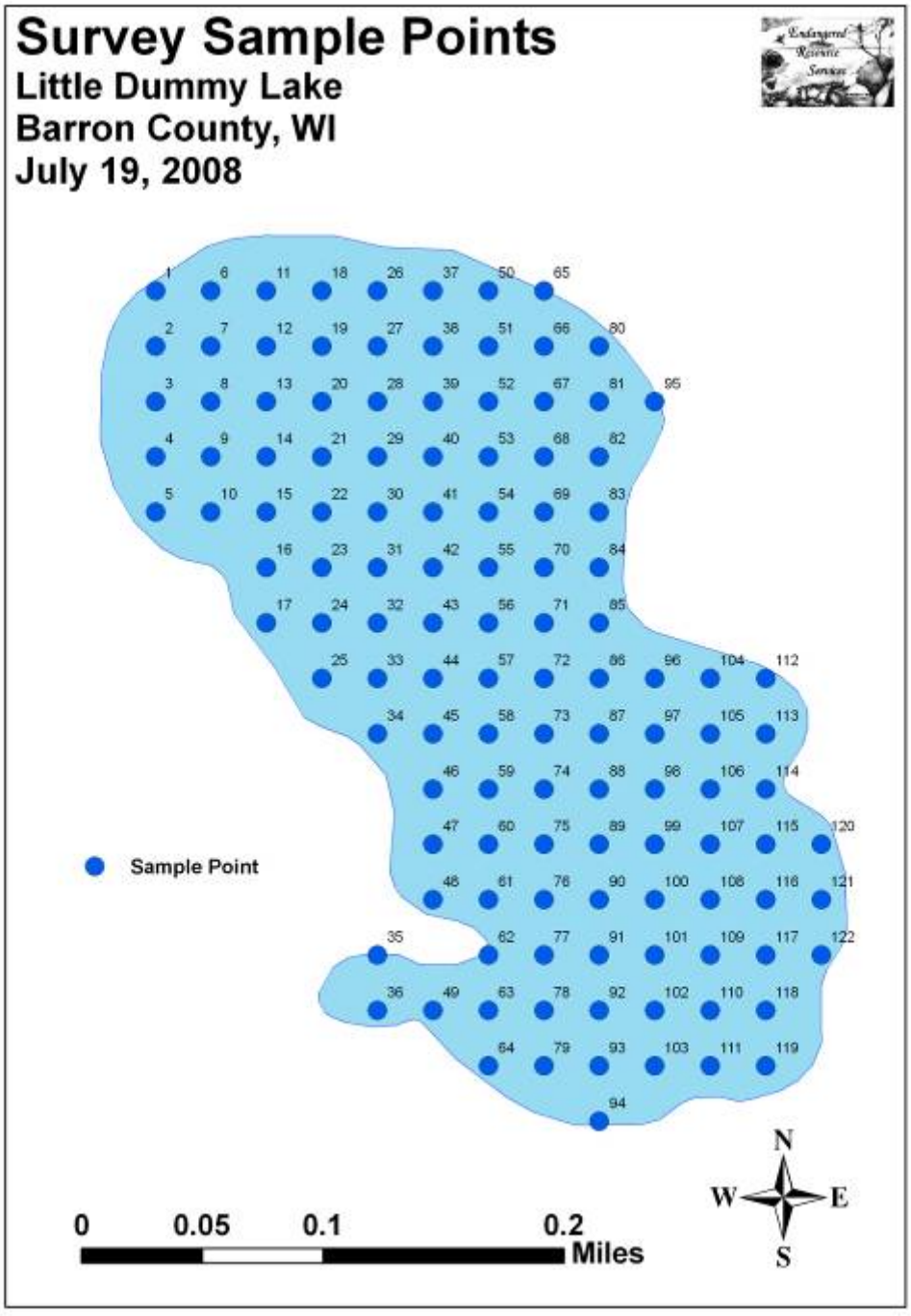
WDNR. [online]. 2008. Curly-leaf pondweed fact sheet.
http://www.dnr.state.wi.us/invasives/fact/curlyleaf_pondweed.htm (2008, September).

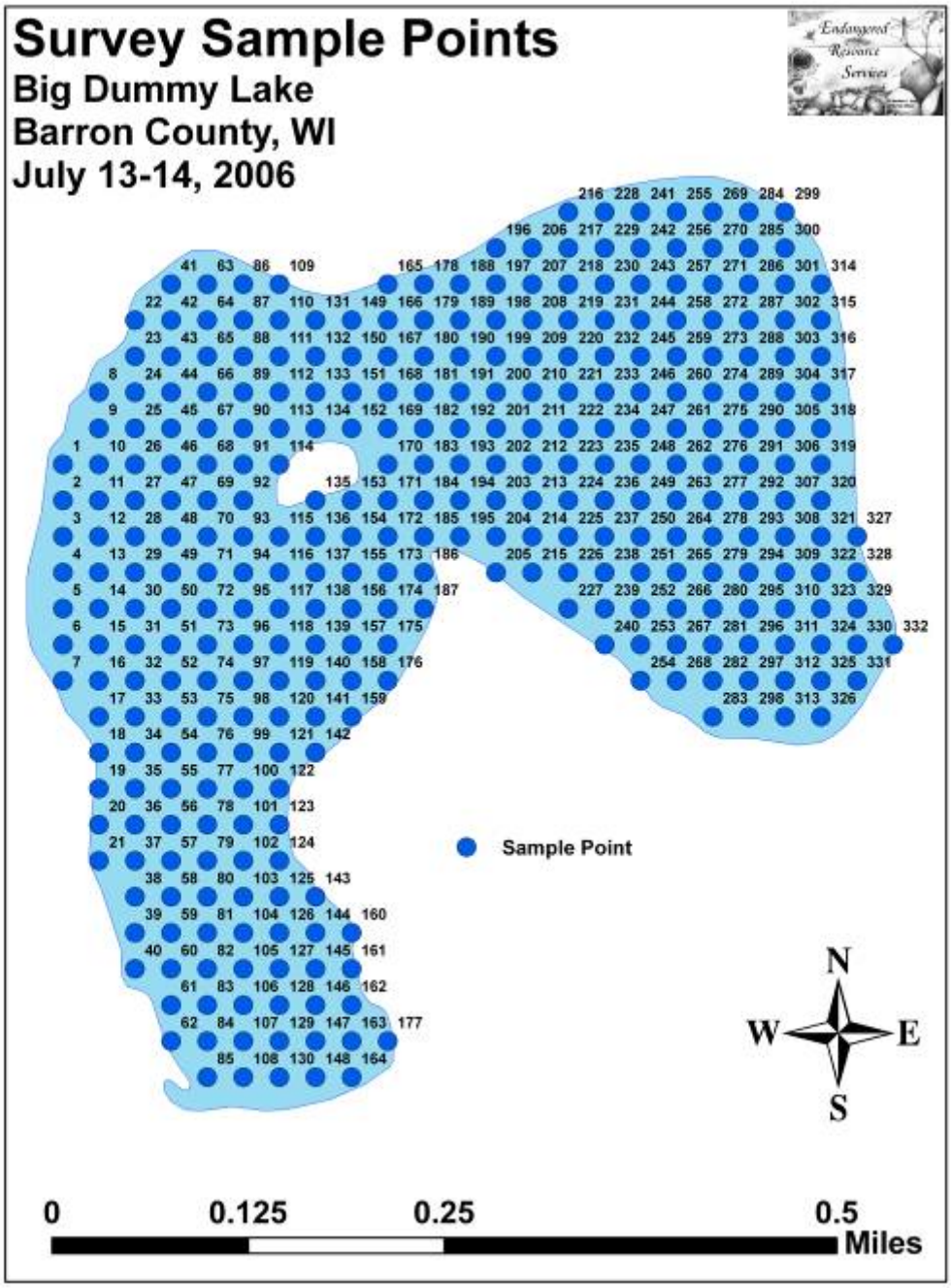
WDNR. [online]. 2008. Eurasian water milfoil fact sheet.
http://www.dnr.state.wi.us/invasives/fact/milfoil.htm (2008, September).

WDNR. [online]. 2008. Purple loosestrife fact sheet.
http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm (2008, September).

WDNR. [online]. 2008. Reed canary grass.
http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm (2008, September).

Appendix I: Little and Big Dummy Lake Maps with Survey Sample Points


Survey Sample Points
Little Dummy Lake
Barron County, WI
July 19, 2008
Sample Point
0
0.05
0.1
0.2
Miles
N
W
E
S


Survey Sample Points
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Sample Point
N
W
E
S
0
0.125
0.25
0.5
Miles

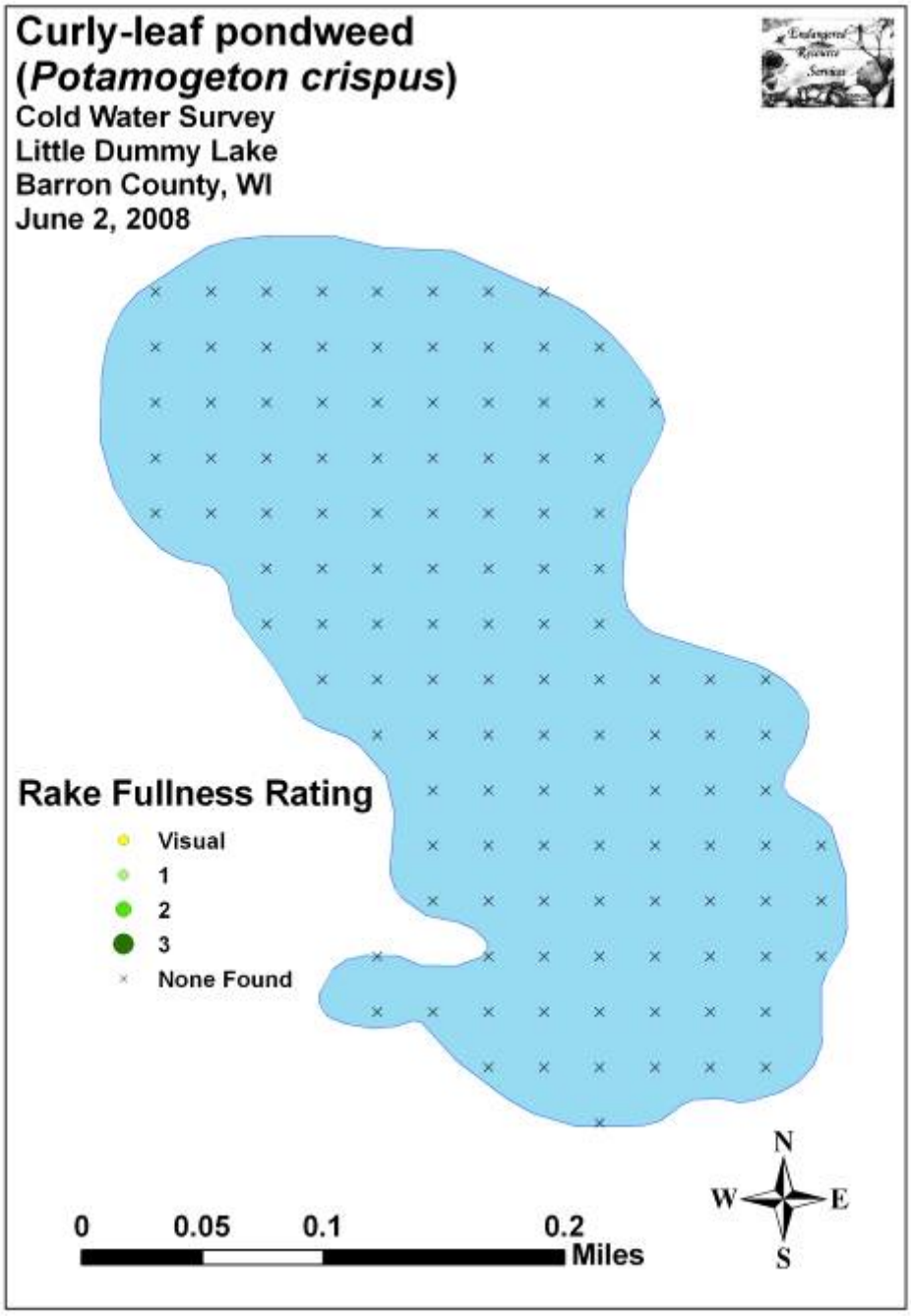
Appendix II: Boat Survey Data Sheet

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

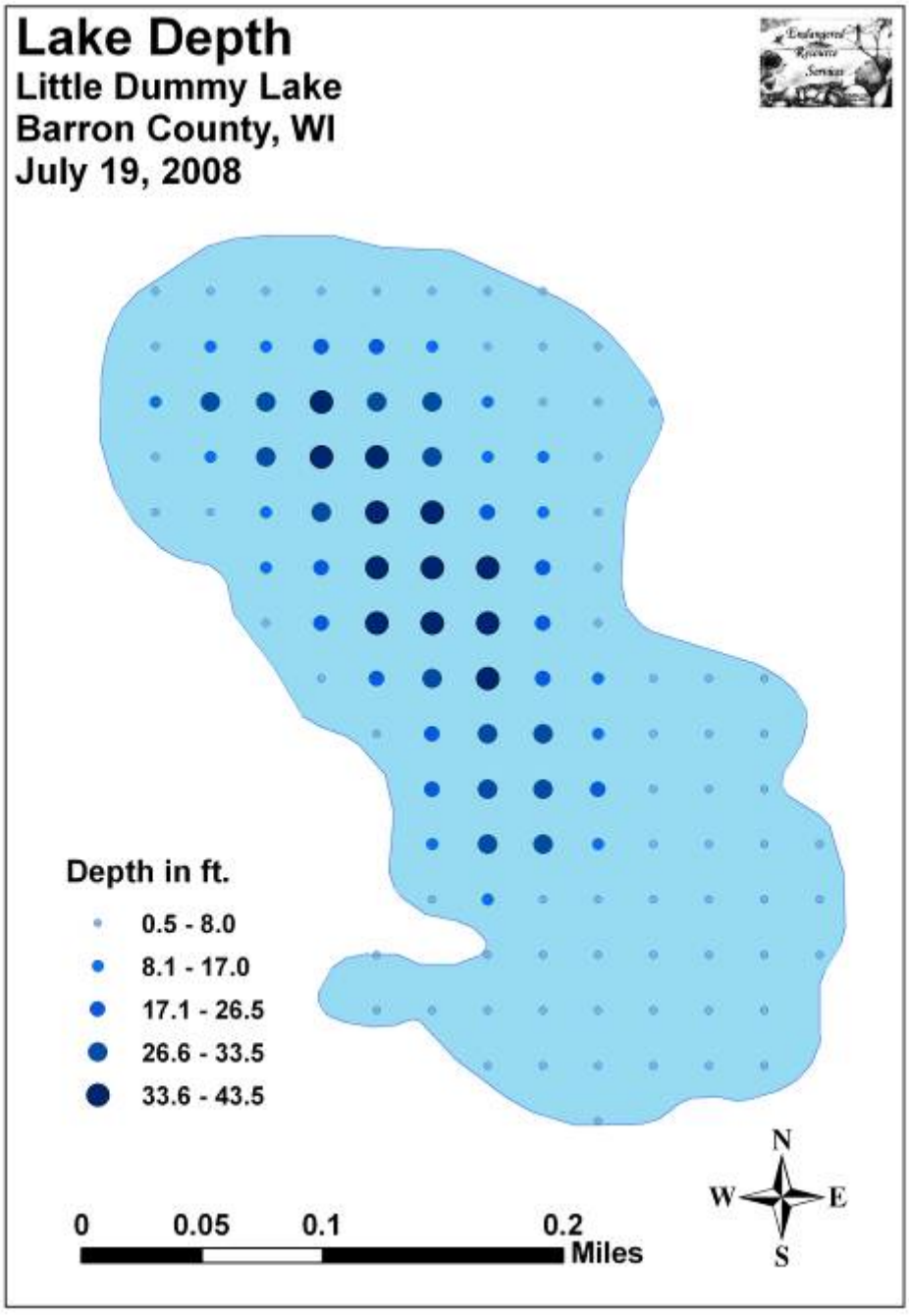
Appendix III: Vegetative Survey Data Sheet

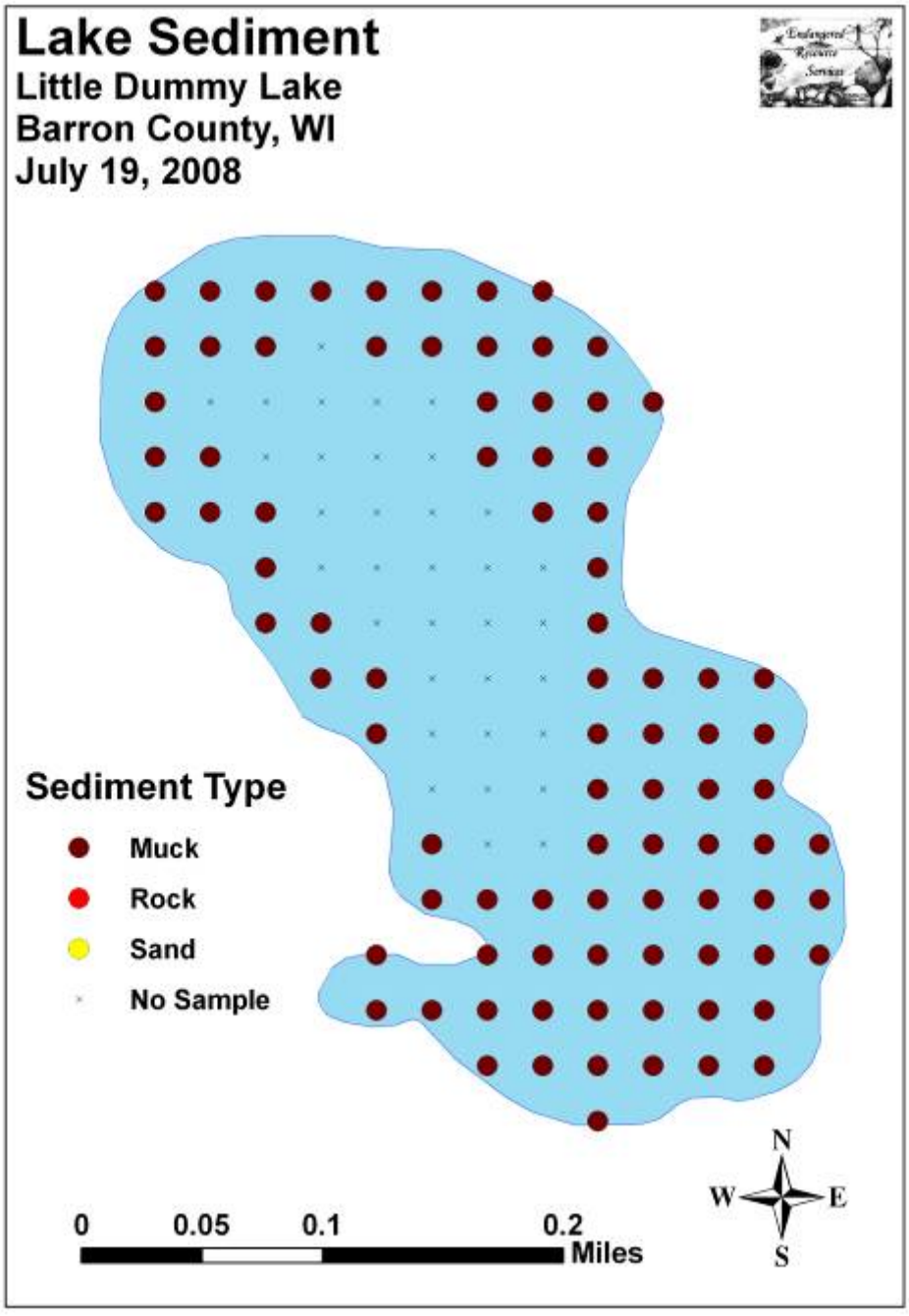
Observers for this lake: names and hours worked by each:																										
Lake:									WBIC									County						Date:	
Site #	Depth (ft)	Muck (M), Sand (S), Rock (R)	Rake pole (P) or rake rope (R)	EWM	CLP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																									
2						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

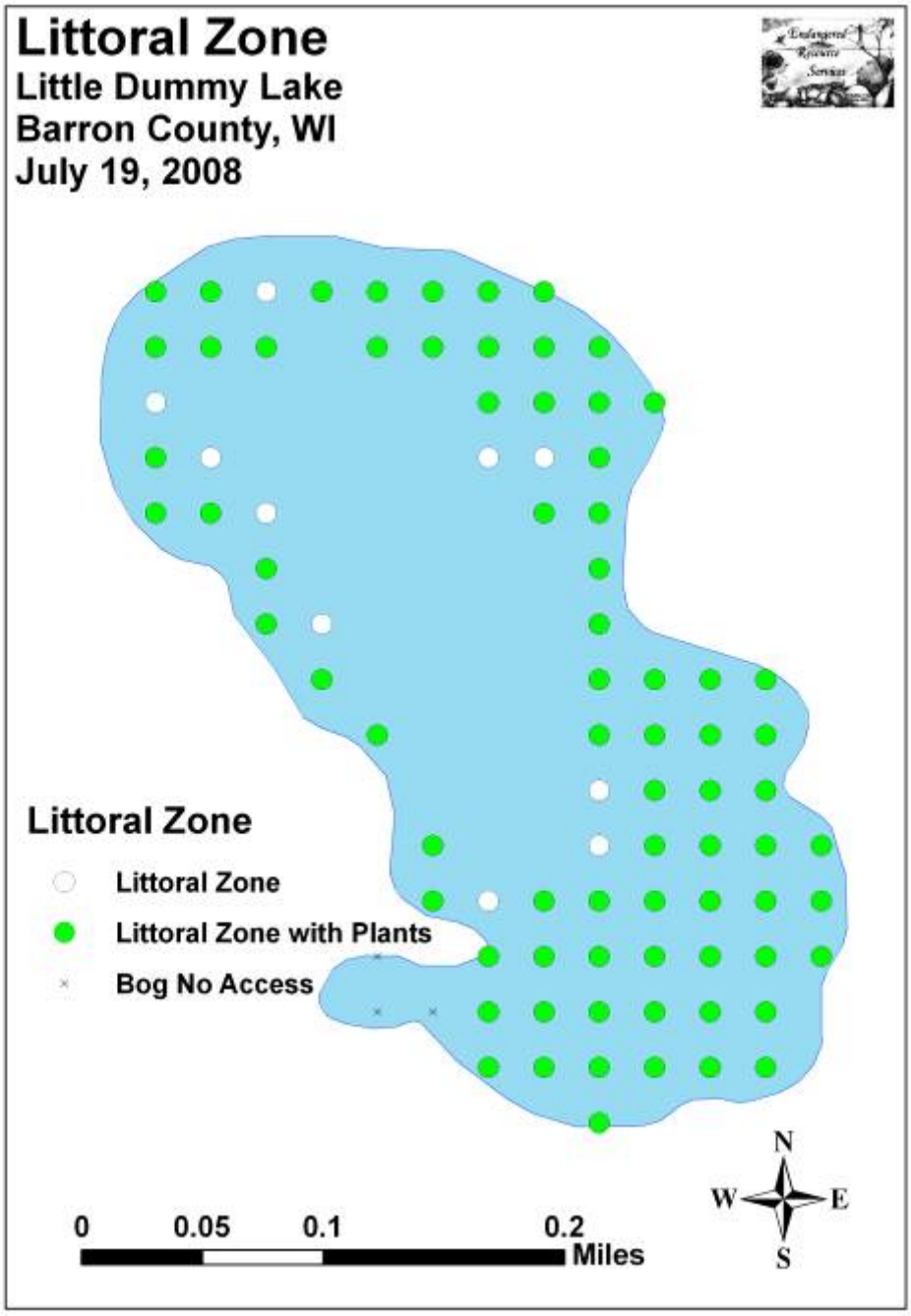
Appendix IV: Little Dummy Cold Water Curly-leaf pondweed Survey

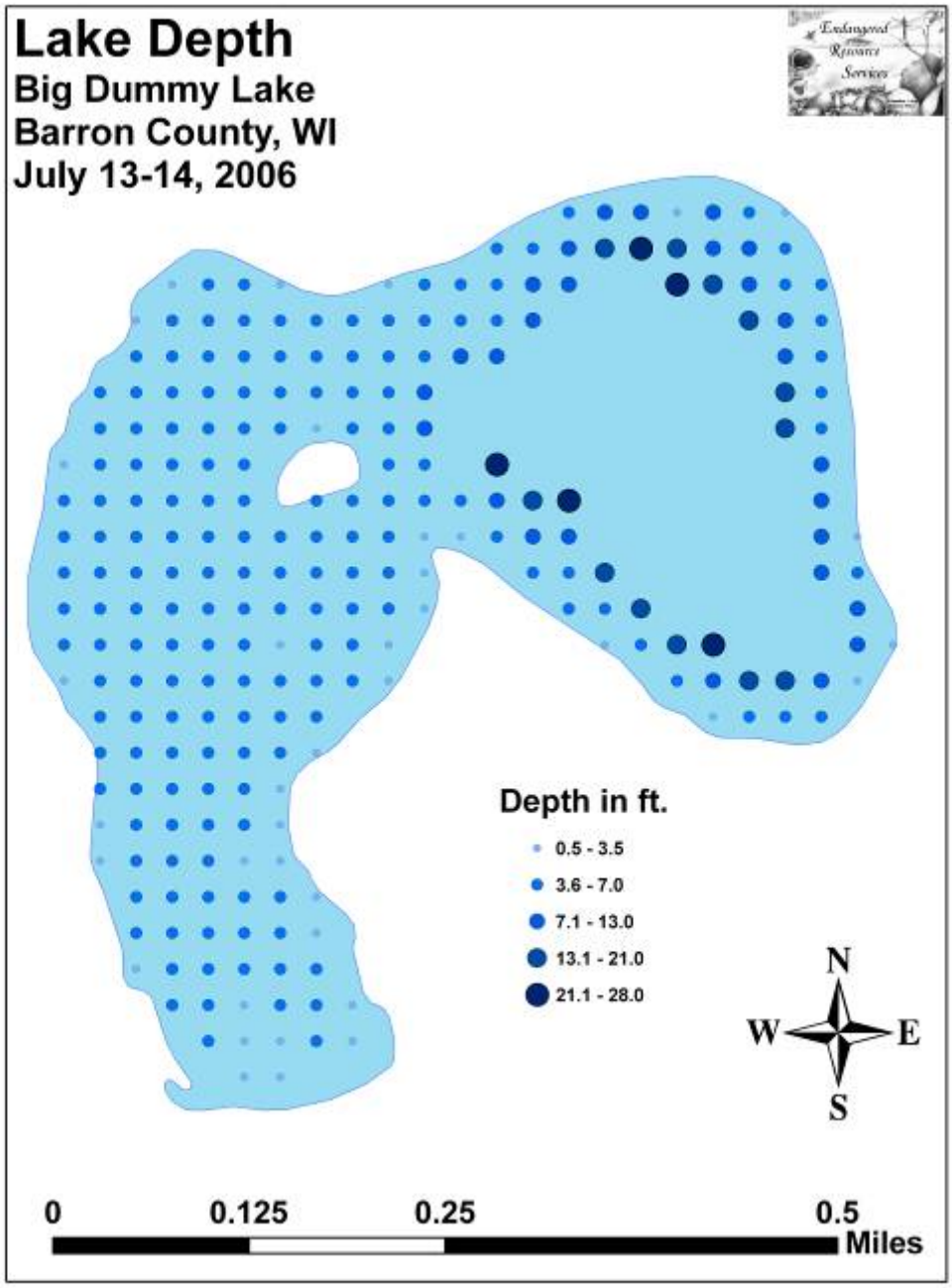

Curly-leaf pondweed
(Potamogeton crispus)
Cold Water Survey
Little Dummy Lake
Barron County, WI
June 2, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles

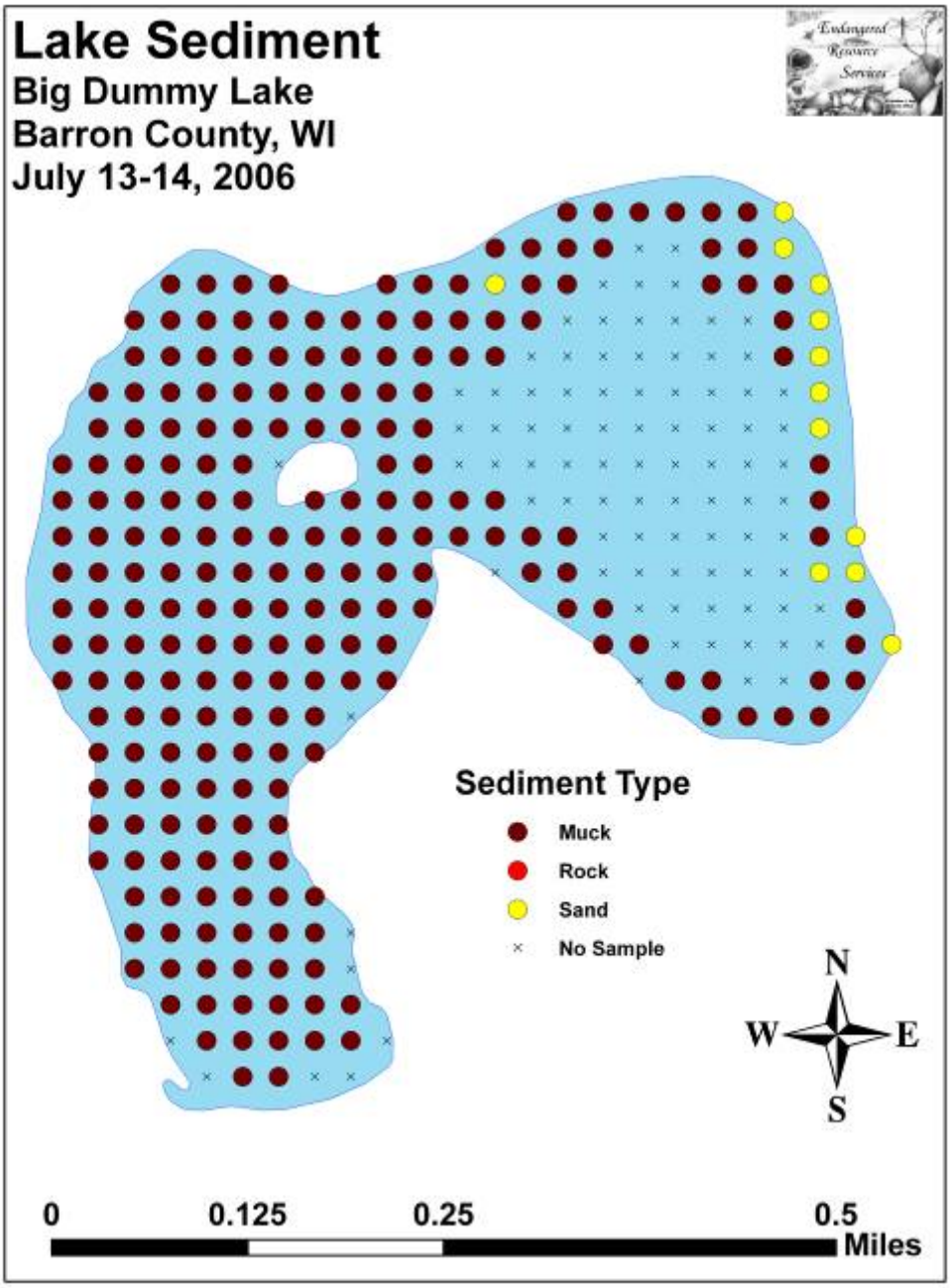
Appendix V: Little and Big Dummy Lake Habitat Variable Maps

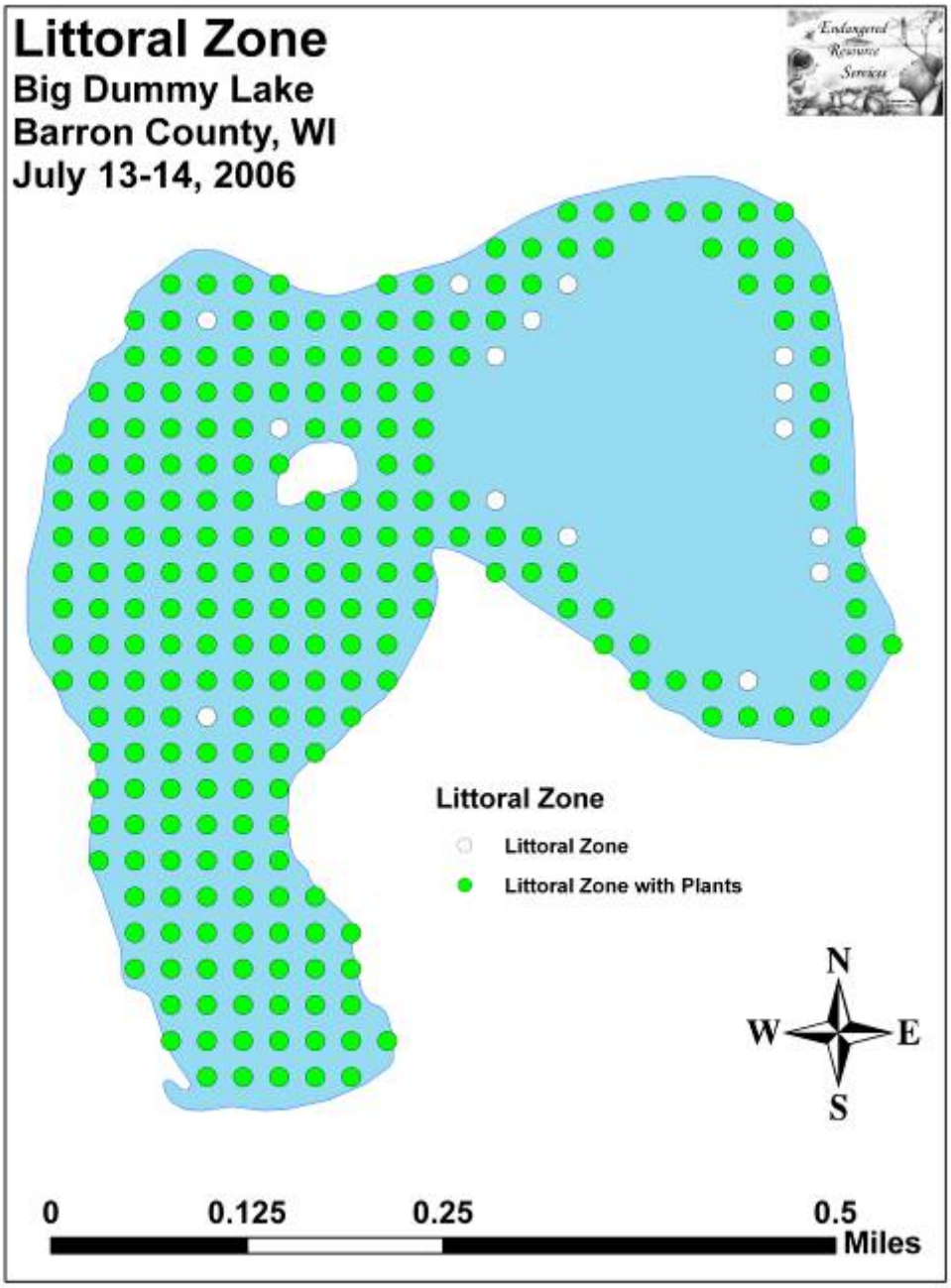

Lake Depth
Little Dummy Lake
Barron County, WI
July 19, 2008
Depth in ft.
0.5 - 8.0
8.1 - 17.0
17.1 - 26.5
26.6 - 33.5
33.6 - 43.5
0
0.05
0.1
0.2
Miles
N
W
E
S


Lake Sediment
Little Dummy Lake
Barron County, WI
July 19, 2008
Sediment Type
Muck
Rock
Sand
No Sample
0
0.05
0.1
0.2
Miles
N
W
E
S


Littoral Zone
Little Dummy Lake
Barron County, WI
July 19, 2008
Littoral Zone
Littoral Zone
Littoral Zone with Plants
Bog No Access
N
W
E
S
0
0.05
0.1
0.2
Miles


Lake Depth
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Depth in ft.
0.5 - 3.5
3.6 - 7.0
7.1 - 13.0
13.1 - 21.0
21.1 - 28.0
N
W
E
S
0
0.125
0.25
0.5
Miles


Lake Sediment
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Sediment Type
Muck
Rock
Sand
No Sample
N
W
E
S
0
0.125
0.25
0.5
Miles


Littoral Zone
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Littoral Zone
Littoral Zone
Littoral Zone with Plants
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix VI: Little Dummy Voucher Label and Plant Species Accounts

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: Aquatic moss
Specimen Location: Little Dummy Lake; N45.57804°, W91.98724°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-027
Habitat/Distribution: Mucky bottoms in deep water (4-5.5 meters). It was common in this depth range in the north half of the lake.
Common Associates: (*Utricularia purpurea*) Large purple bladderwort was the only other species found at this depth.

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Brasenia schreberi*) **Watershield**
Specimen Location: Little Dummy Lake; N45.57604°, W91.98812°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-028
Habitat/Distribution: Muck and mucky sand bottom in 1-1.5 meters. Common to abundant; especially in the south and southeast bays where it forms a closed canopy with other floating leaf species.
Common Associates: (*Eleocharis robbinsii*) Robbins spikerush, (*Nuphar variegata)* Spatterdock, (*Nymphaea odorata*) White water lily, (*Pontedera cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Dulichium arundinaceum*) **Three-way sedge**
Specimen Location: Little Dummy Lake; N45.58005°, W91.98684°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-029
Habitat/Distribution: Located at the edge of the water in mucky soil. Scattered locations on the east shoreline and near the channel entrance from Big Dummy; especially common in the northeast bay.
Common Associates: (*Potamogeton bicupulatus*) Filament-leaf pondweed, (*Eleocharis robbinsii*) Robbins spikerush, (*Pontedera cordata*) Pickerelweed

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Eleocharis acicularis*.) **Needle spikerush**
Specimen Location: Little Dummy Lake; N45.57879°, W91.98699°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-030
Habitat/Distribution: Sand/silt bottom areas in water <1 meter deep. Relatively common near the shoreline in the sandiest areas on the east and north sides.
Common Associates: (*Potamogeton bicupulatus*) Filament-leaf pondweed, (*Juncus pelocarpus*) Brown-fruited rush, (*Dulichium arundinaceum*) Three-way sedge, (*Isoetes echinospora*) Spiny-spored quillwort, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Eriocaulon aquaticum*) Pipewort

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Eleocharis erythropoda*) **Red-footed spikerush**
Specimen Location: Little Dummy Lake; N45.57571°, W91.98706°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-031
Habitat/Distribution: Mucky to firm bottoms in 0-0.5 meters of water. Scattered individuals found growing among cattails and arrowheads along shore.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Dulichium arundinaceum*) Three-way sedge, (*Sagittaria latifolia*) Common arrowhead

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Eleocharis robbinsii*) **Robbins spikerush**
Specimen Location: Little Dummy Lake; N45.58005°, W91.98684°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-032
Habitat/Distribution: Mucky to firm bottoms in 0-1 meter of water. Common to abundant; especially on the east shoreline where it forms dense reed beds in late summer.
Common Associates: (*Nuphar variegata)* Spatterdock, (*Nymphaea odorata*) White water lily, (*Pontedera cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Eriocaulon aquaticum*) **Pipewort**
Specimen Location: Little Dummy Lake; N45.57879°, W91.98699°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-033
Habitat/Distribution: Sand/silt bottom areas in water <1 meter deep. Restricted to a sandy point mid-lake on the east side.
Common Associates: (*Potamogeton bicupulatus*) Filament-leaf pondweed, (*Eleocharis robbinsii*) Robbins spikerush, (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Isoetes echinospora*) Spiny-spored quillwort, (*Potamogeton epihydrus*) Ribbon-leaf pondweed

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Isoetes echinospora*) **Spiny-spored quillwort**
Specimen Location: Little Dummy Lake; N45.58100°, W91.98963°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-034
Habitat/Distribution: Sand/silt bottom areas in water <1 meter deep. Relatively common near the shoreline in the sandiest areas on the east and north sides.
Common Associates: (*Potamogeton bicupulatus*) Filament-leaf pondweed, (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Eriocaulon aquaticum*) Pipewort

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Juncus pelocarpus*) **Brown-fruited rush**
Specimen Location: Little Dummy Lake; N45.57571°, W91.98706°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-035
Habitat/Distribution: Muck to sandy bottoms in <1m of water. Specimen was growing out of water at shoreline near the channel from Big Dummy. A few sterile submersed plants were also located on the north and east sides.
Common Associates: (*Potamogeton bicupulatus*) Filament-leaf pondweed, (*Eleocharis acicularis*) Needle spikerush, (*Dulichium arundinaceum*) Three-way sedge, (*Isoetes echinospora*) Spiny-spored quillwort, (*Potamogeton epihydrus*) Ribbon-leaf pondweed

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Myriophyllum farwellii*) **Farwell's water milfoil**
Specimen Location: Little Dummy Lake; N45.57806°, W91.98677°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-036
Habitat/Distribution: Muck bottom in a narrow range of depth around 1.5 meters. Uncommon and local in only a few well defined beds in the southeast bay.
Common Associates: (*Potamogeton amplifolius*) Large-leaf pondweed, (*Utricularia purpurea*) Large purple bladderwort, (*Potamogeton robbinsii*) Robbins (fern) pondweed

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Nuphar variegata)* **Spatterdock**
Specimen Location: Little Dummy Lake; N45.57604°, W91.98812°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-037
Habitat/Distribution: Muck bottom in 0-1.5 meters of water where it often forms dense canopies. Relatively common in the south and southeast bays. It prefers a firmer bottom than *Nymphaea odorata*.
Common Associates: (*Eleocharis robbinsii*) Robbins spikerush, (*Nymphaea odorata*) White water lily, (*Pontedera cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Nymphaea odorata*) **White water lily**
Specimen Location: Little Dummy Lake; N45.57604°, W91.98812°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-038
Habitat/Distribution: Muck bottom in 0-1.5 meters where it forms dense canopies with other floating leaf species. Common to abundant on the east and south shorelines.
Common Associates: (*Eleocharis robbinsii*) Robbins spikerush, (*Nuphar variegata)* Spatterdock, (*Pontedera cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Phalaris arundinacea*) **Reed canary grass**
Specimen Location: Little Dummy Lake; N45.58094°, W91.99066°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-039
Habitat/Distribution: Common but not abundant; especially in the northwest corner. Prefers thick muck soil in and out of water <0.5 meters. Primarily found on shore in undeveloped low areas.
Common Associates: Reed canary grass generally excludes all other species.

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Pontederia cordata*) **Pickerelweed**
Specimen Location: Little Dummy Lake; N45.58005°, W91.98684°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-040
Habitat/Distribution: Silt to muck bottom over firm substrate in 0-1.5 meters of water. Common in emergent beds throughout; especially in the south and east bays.
Common Associates: (*Eleocharis robbinsii*) Robbins spikerush, (*Nuphar variegata)* Spatterdock, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Potamogeton amplifolius*) **Large-leaf pondweed**
Specimen Location: Little Dummy Lake; N45.57806°, W91.98677°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-041
Habitat/Distribution: Found in most mucky bottom areas in water from 1-2m deep. Widely distributed but seldom abundant in the southeast bay.
Common Associates: (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield, (*Myriophyllum farwellii*) Farwell's water milfoil

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Potamogeton bicupulatus*) **Filament-leaf pondweed**
Specimen Location: Little Dummy Lake; N45.58005°, W91.98684°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-042
Habitat/Distribution: Found in sand to mucky bottom areas in shallow water usually <1m deep. Common and widely distributed on the north and east shoreline in shallow sandy areas.
Common Associates: (*Eleocharis robbinsii*) Robbins spikerush, (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Isoetes echinospora*) Spiny-spored quillwort, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Eriocaulon aquaticum*) Pipewort

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Potamogeton epihydrus*) **Ribbon-leaf pondweed**
Specimen Location: Little Dummy Lake; N45.58100°, W91.98963°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-043
Habitat/Distribution: Found in sandy to mucky bottom conditions in shallow water generally <1m deep. Scattered locations along shore throughout.
Common Associates: (*Potamogeton bicupulatus*) Filament-leaf pondweed, (*Eleocharis robbinsii*) Robbins spikerush, (*Eleocharis acicularis*) Needle spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Dulichium arundinaceum*) Three-way sedge, (*Isoetes echinospora*) Spiny-spored quillwort

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Potamogeton gramineus*) **Variable pondweed**
Specimen Location: Little Dummy Lake; N45.57604°, W91.98812°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-044
Habitat/Distribution: Uncommon in sandy/muck bottom conditions in shallow water 0.5-1m deep. A few individuals were scattered among the lilypads and Watershield leaves in the south and southwest bays.
Common Associates: (*Nuphar variegata)* Spatterdock, (*Nymphaea odorata*) White water lily, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Potamogeton robbinsii*) **Robbins (fern) pondweed**
Specimen Location: Little Dummy Lake; N45.57838°, W91.98725°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-045
Habitat/Distribution: Prefers organic muck in 2.5-4 meters of water. Common at this depth around the drop off into the north basin, and at scattered locations throughout the southeast bay.
Common Associates: (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia purpurea*) Large purple bladderwort, (*Myriophyllum farwellii*) Farwell's water milfoil

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Sagittaria latifolia*) **Common arrowhead**
Specimen Location: Little Dummy Lake; N45.57917°, W91.99114°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-046
Habitat/Distribution: Uncommon in scattered mucky shoreline locations throughout. In addition to shoreline emergent plants, a single submergent rosette was found in the northwest bay.
Common Associates: (*Typha latifolia*) Broad-leaved cattail, (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis erythropoda*) Red-footed spikerush

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Schoenoplectus acutus*) **Hardstem bulrush**
Specimen Location: Little Dummy Lake; N45.57679°, W91.98815°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-047
Habitat/Distribution: Firm muck bottoms in 0-1 meter of water. A single small bed was growing on the point of land jutting out of the southwest bog/bay.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Potamogeton gramineus*) Variable pondweed, (*Pontedera cordata*) Pickerelweed

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Schoenoplectus subterminalis*) **Water bulrush**
Specimen Location: Little Dummy Lake; N45.57672°, W91.98720°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-048
Habitat/Distribution: Firm muck bottom areas in water .5-2.5 meters deep. Common with scattered individuals found among beds of Robbins spikerush in shallow water, and dense beds of sterile plants in water >1.5m deep.
Common Associates: (*Eleocharis robbinsii*) Robbins spikerush, (*Nuphar variegata)* Spatterdock, (*Nymphaea odorata*) White water lily, (*Pontedera cordata*) Pickerelweed, (*Utricularia purpurea*) Large purple bladderwort, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Typha latifolia*) **Broad-leaved cattail**
Specimen Location: Little Dummy Lake; N45.57571°, W91.98706°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-049
Habitat/Distribution: Thick muck soil in and out of water <0.5 meters. Found in undeveloped shoreline areas throughout; especially on the south shore and bordering the bog in the southwest bay.
Common Associates: (*Dulichium arundinaceum*) Three-way sedge, (*Eleocharis erythropoda*) Red-footed spikerush, (*Sagittaria latifolia*) Common arrowhead

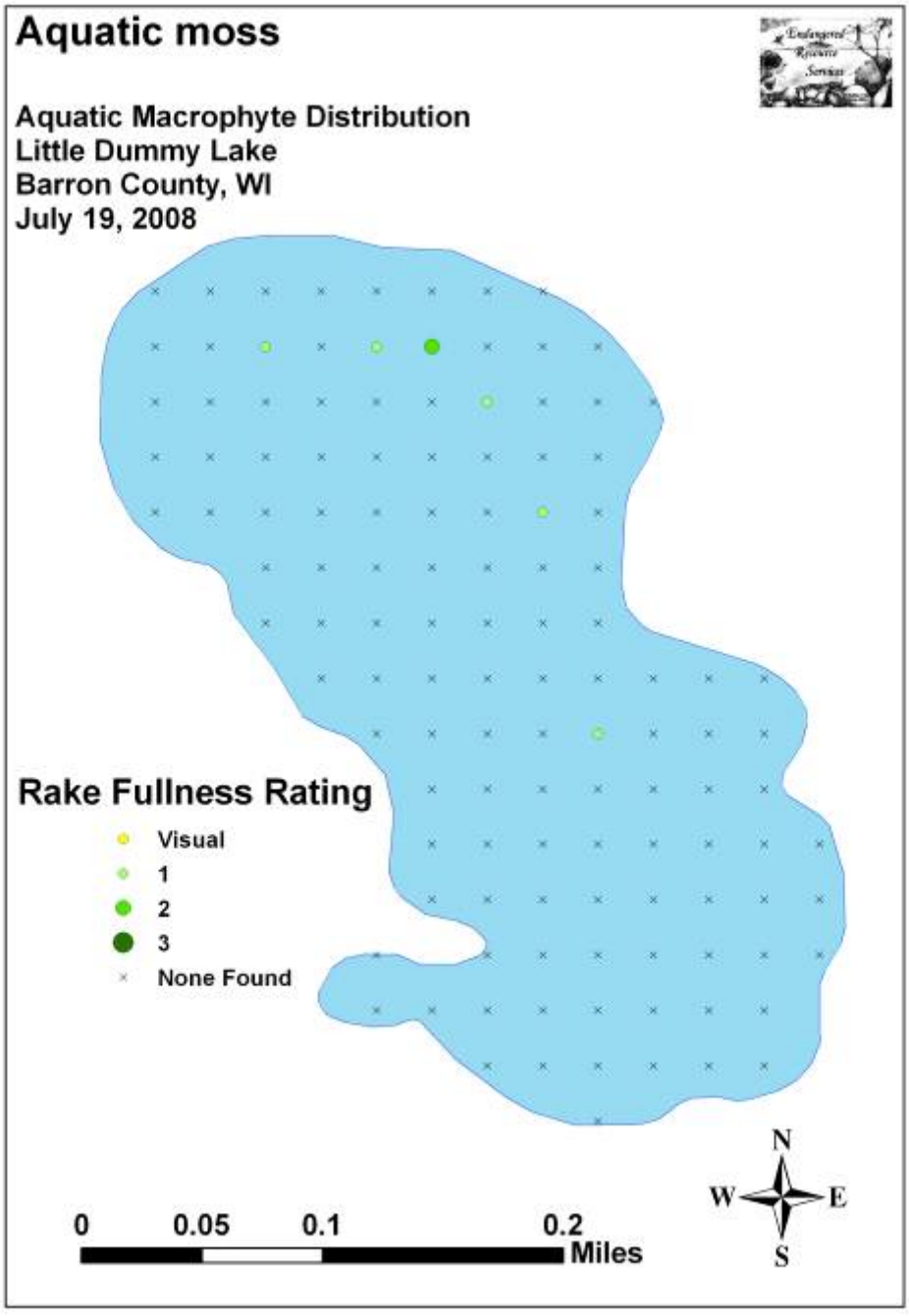
County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Utricularia gibba*) **Creeping bladderwort**
Specimen Location: Little Dummy Lake; N45.58005°, W91.98684°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-050
Habitat/Distribution: Muck bottom in shallow water 0-1.5 meters deep. Widespread and relatively common throughout; especially in the southeast bay where it was found floating among floating leaf species.
Common Associates: (*Utricularia vulgaris*) Common bladderwort, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia intermedia*) Flat-leaf bladderwort, (*Nuphar variegata*) Spatterdock

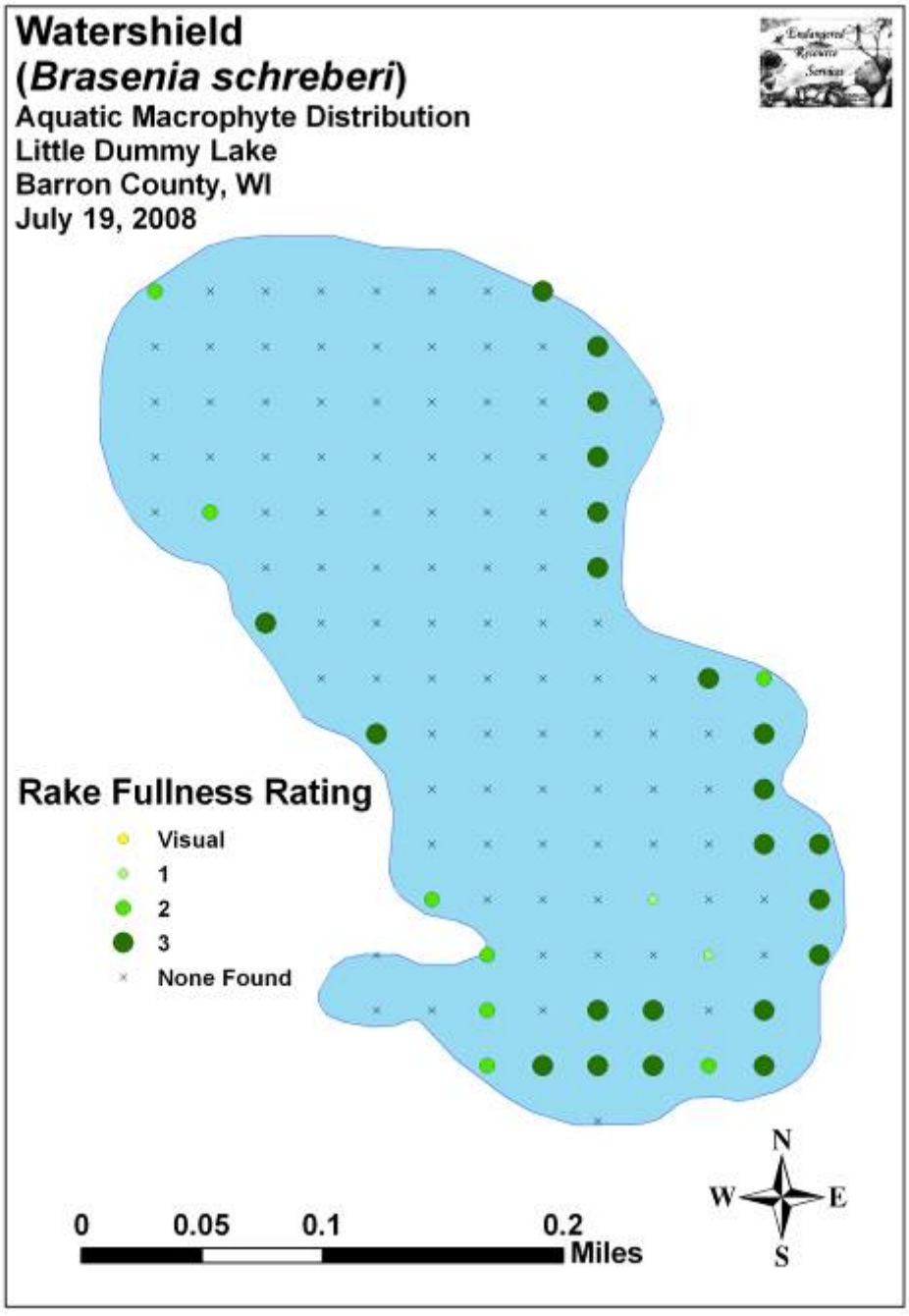
County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Utricularia intermedia*) **Flat-leaf bladderwort**
Specimen Location: Little Dummy Lake; N45.58005°, W91.98684°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-051
Habitat/Distribution: Floating over thick muck bottom in water .5-1.5m deep. Uncommon being found in widely scattered locations in the southeast bay.
Common Associates: Large purple bladderwort, (*Eleocharis robbinsii*) Robbins spikerush, (*Utricularia vulgaris*) Common bladderwort, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia gibba*) Creeping bladderwort, (*Nuphar variegata*) Spatterdock

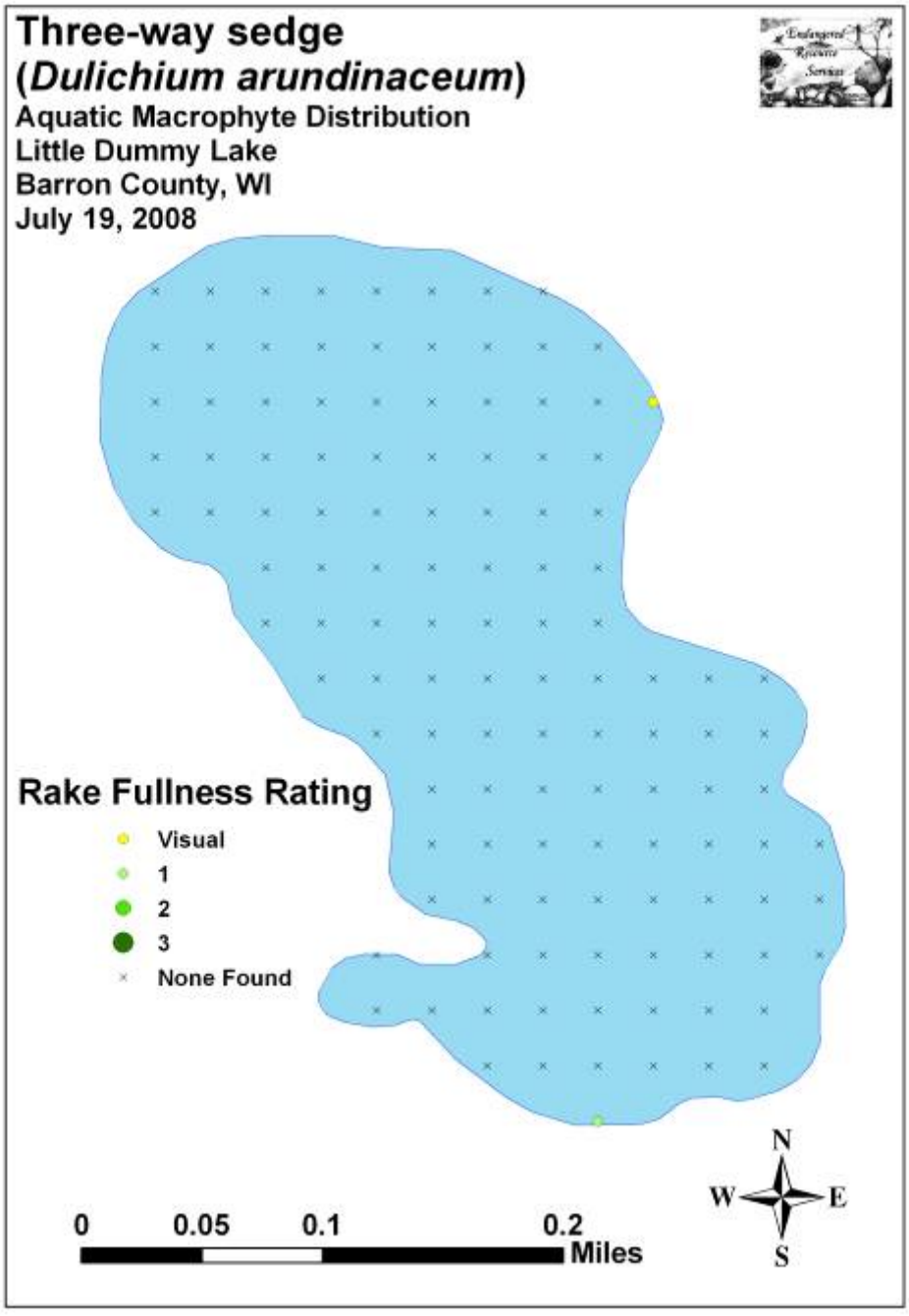
County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Utricularia purpurea*) **Large purple bladderwort**
Specimen Location: Little Dummy Lake; N45.57638°, W91.98766°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-052
Habitat/Distribution: Thick muck bottom in shallow water 0-4.0 meters deep. Abundant throughout the lake to the point of choking out other species and restricting boat travel.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Schoenoplectus subterminalis*) Water bulrush, (*Eleocharis robbinsii*) Robbins spikerush, Aquatic moss

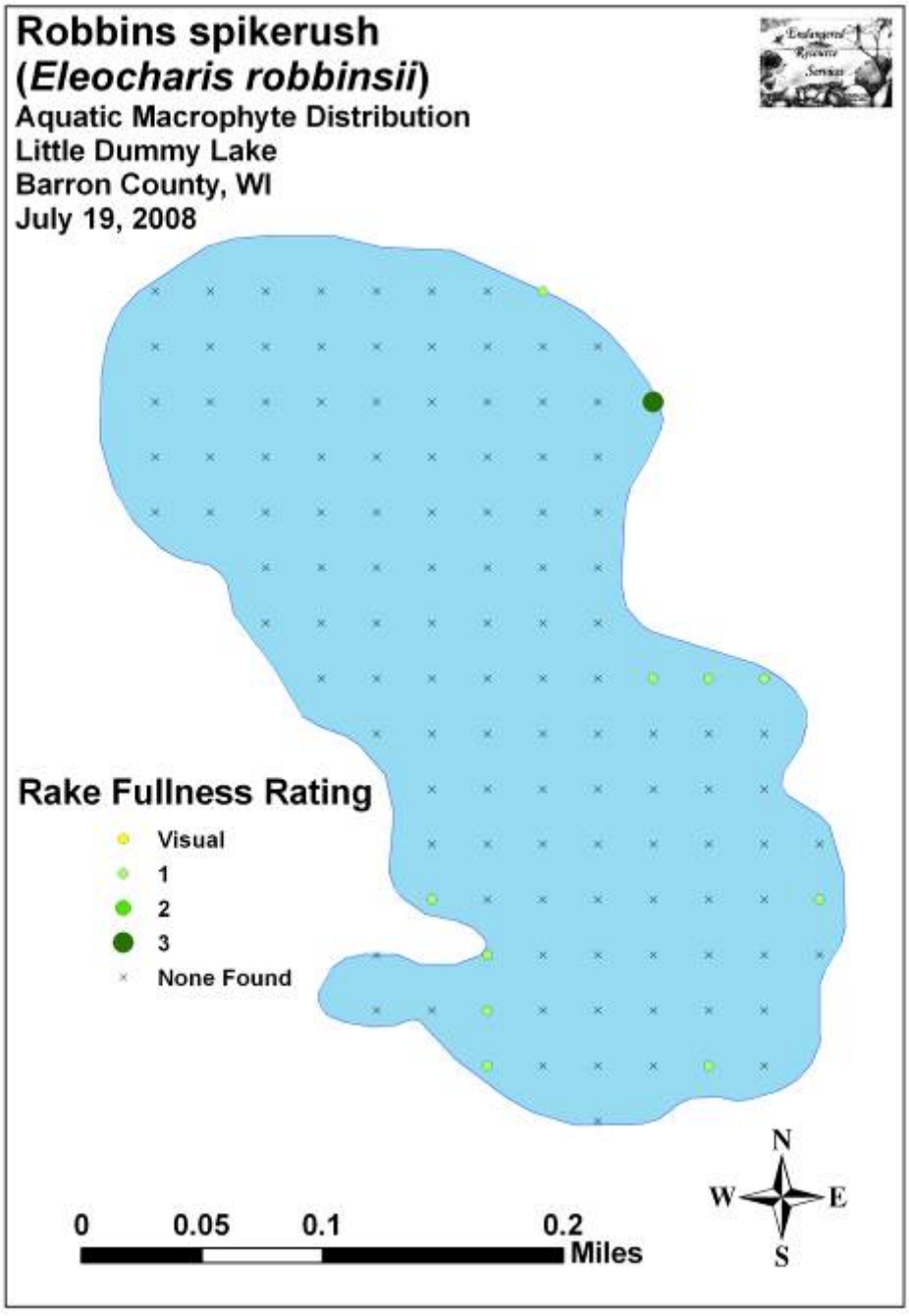
County/State: Barron County, Wisconsin **Date:** 7/19/08
Species: (*Utricularia vulgaris*) **Common bladderwort**
Specimen Location: Little Dummy Lake; N45.57638°, W91.98766°
Collected/Identified by: Matthew S. Berg Col. #: MSB-2008-053
Habitat/Distribution: Floating over thick muck bottom in shallow water 0-1.5 meters deep. Scattered locations throughout the lake.
Common Associates: (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Utricularia purpurea*) Large purple bladderwort, (*Eleocharis robbinsii*) Robbins spikerush

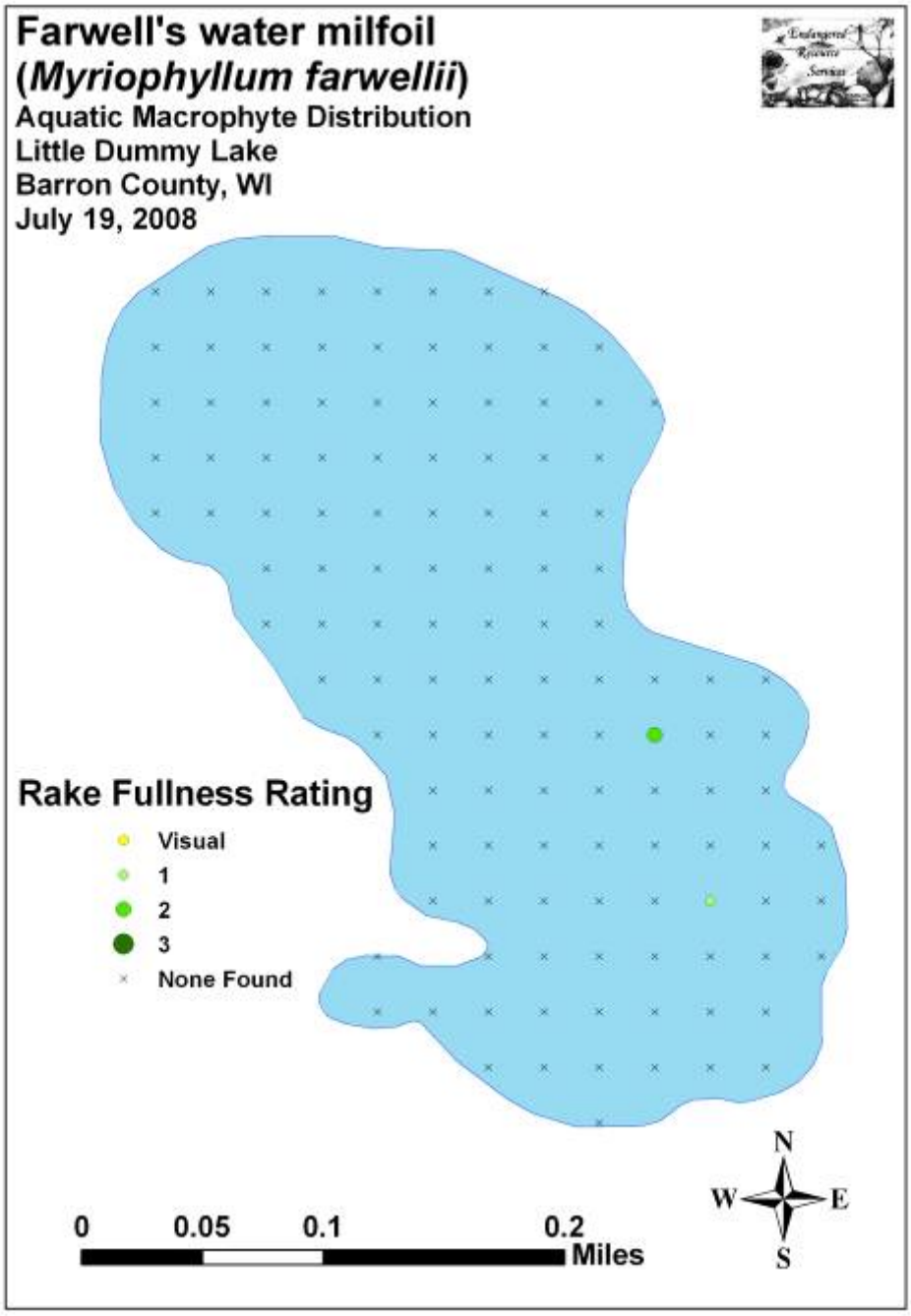
Appendix VII: Little and Big Dummy Lake Plant Species Distribution Maps


Aquatic moss
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles


Watershield
(Brasenia schreberi)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles


Three-way sedge
(Dulichium arundinaceum)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles


Robbins spikerush
(Eleocharis robbinsii)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
N
W
E
S


Farwell's water milfoil
(Myriophyllum farwellii)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
N
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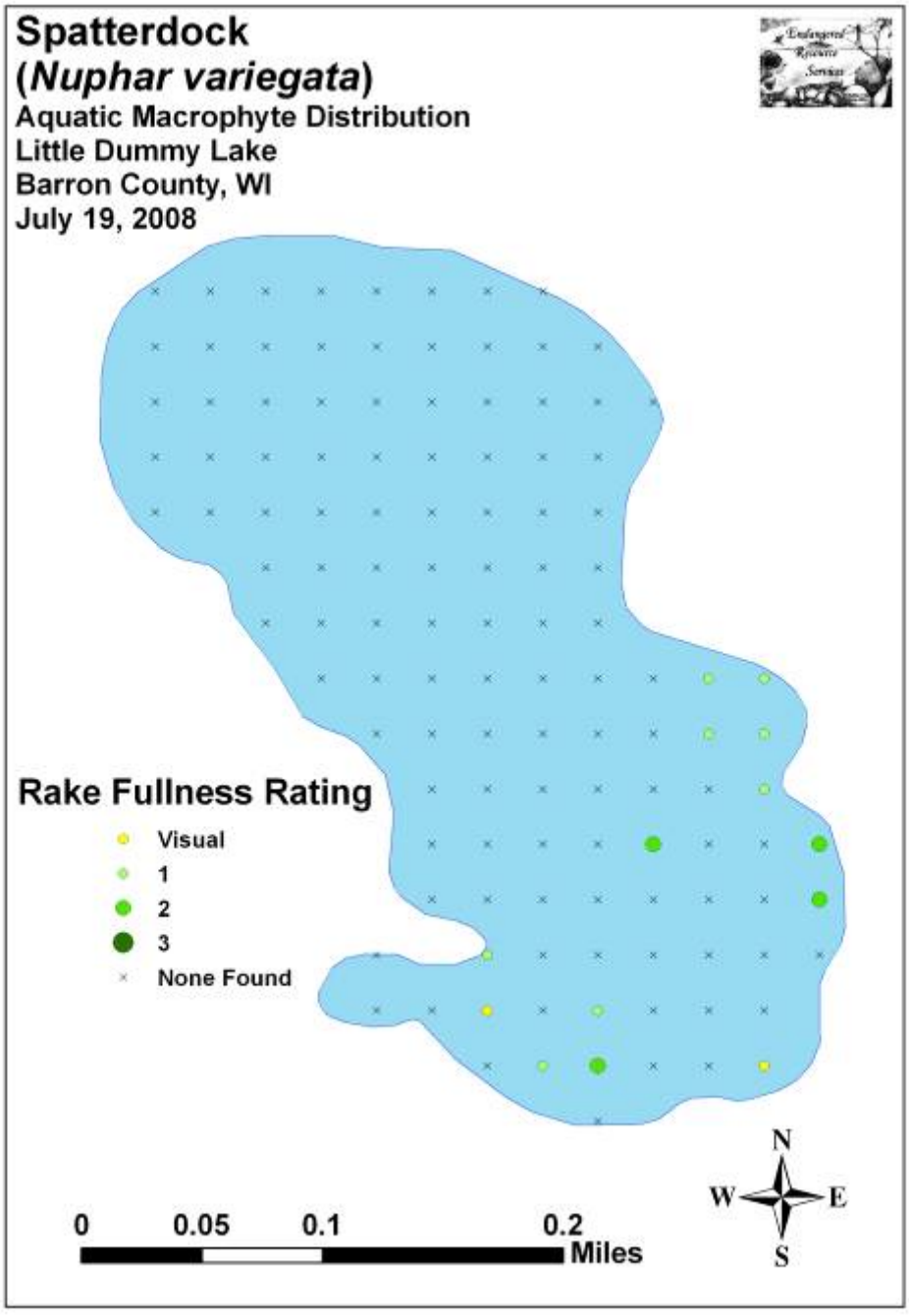
E
S


Spatterdock
(Nuphar variegata)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
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W
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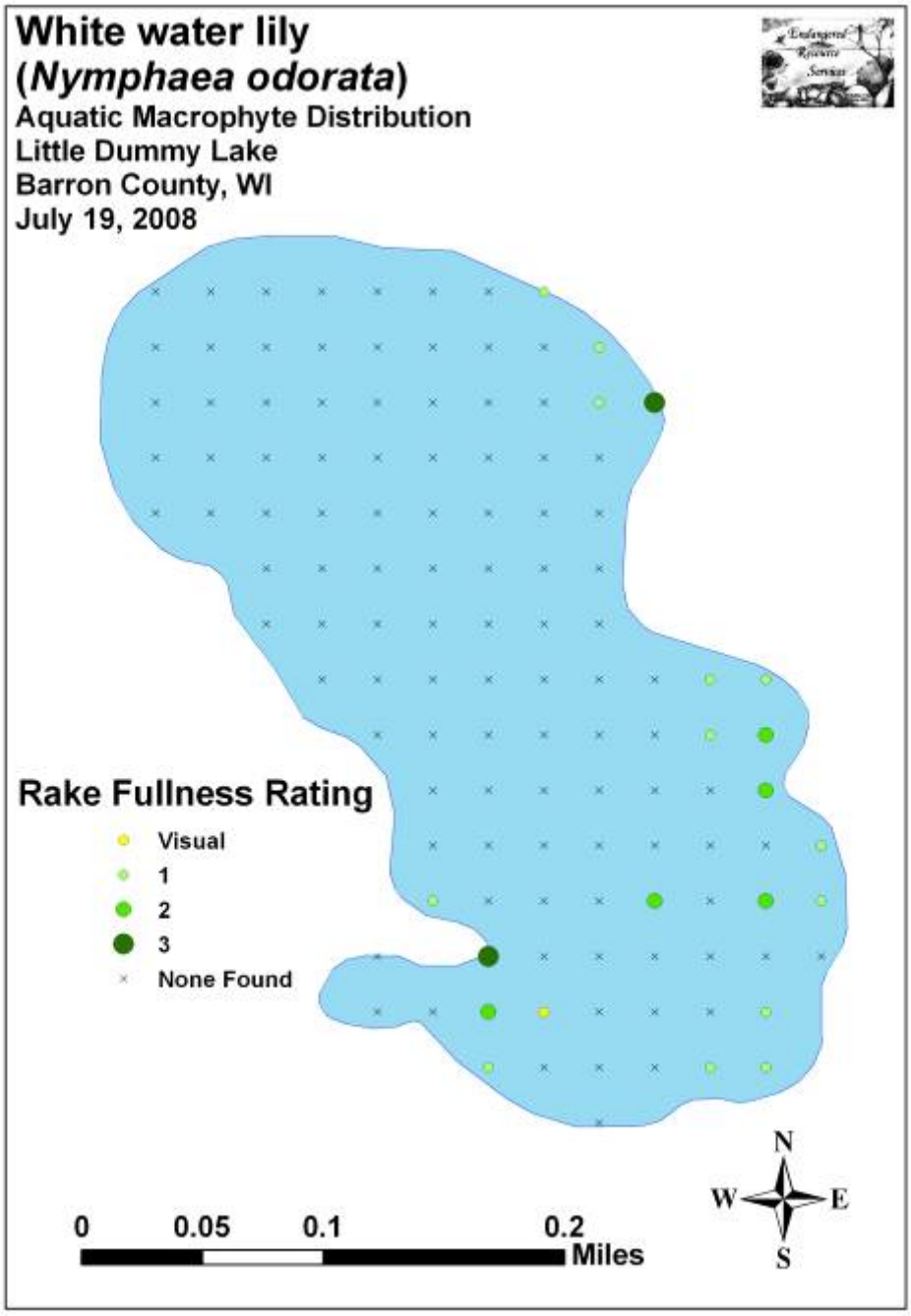
S
0
0.05
0.1
0.2
Miles


White water lily
(Nymphaea odorata)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
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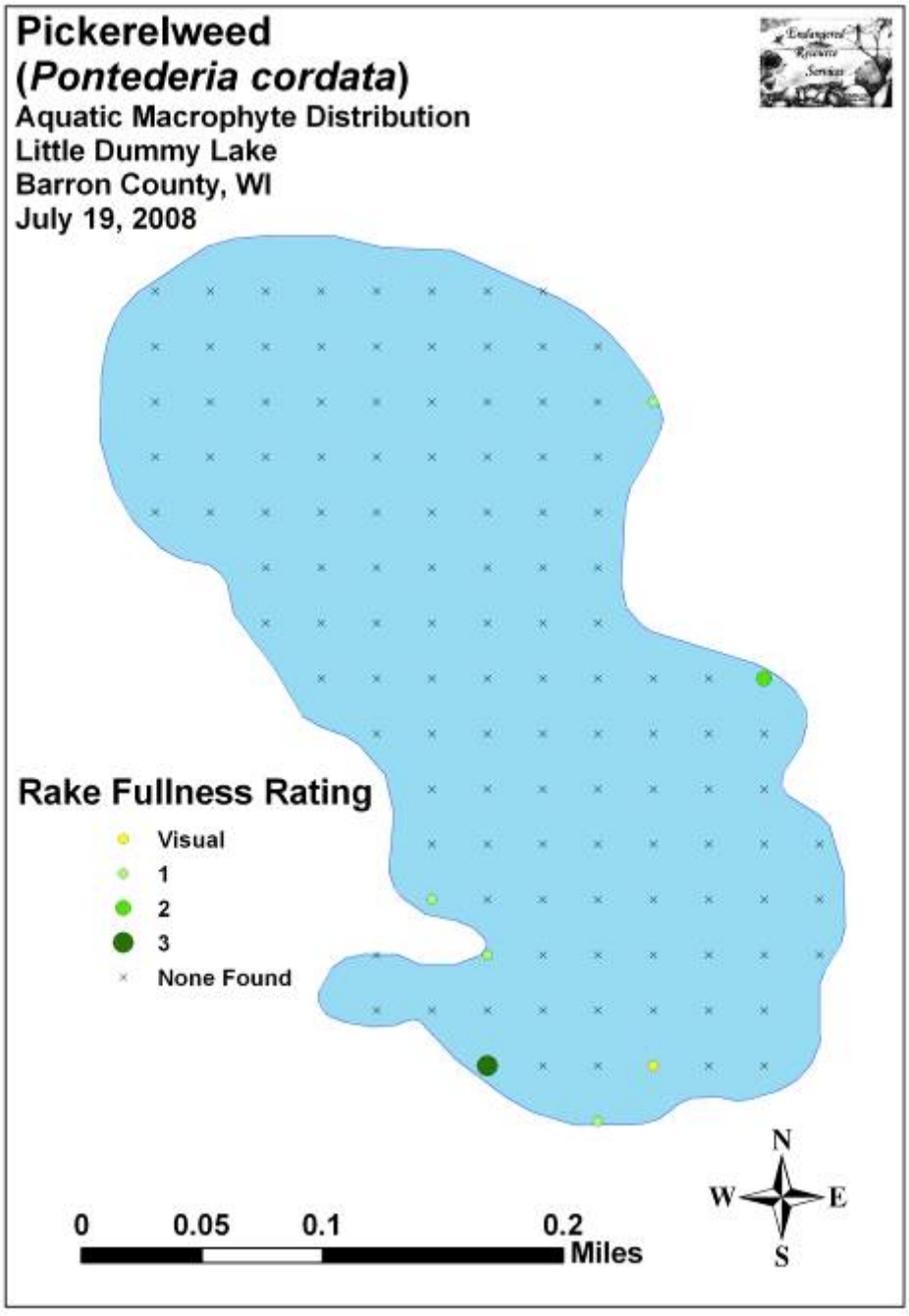
W
E
S
0
0.05
0.1
0.2
Miles


Pickerelweed
(Pontederia cordata)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
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W
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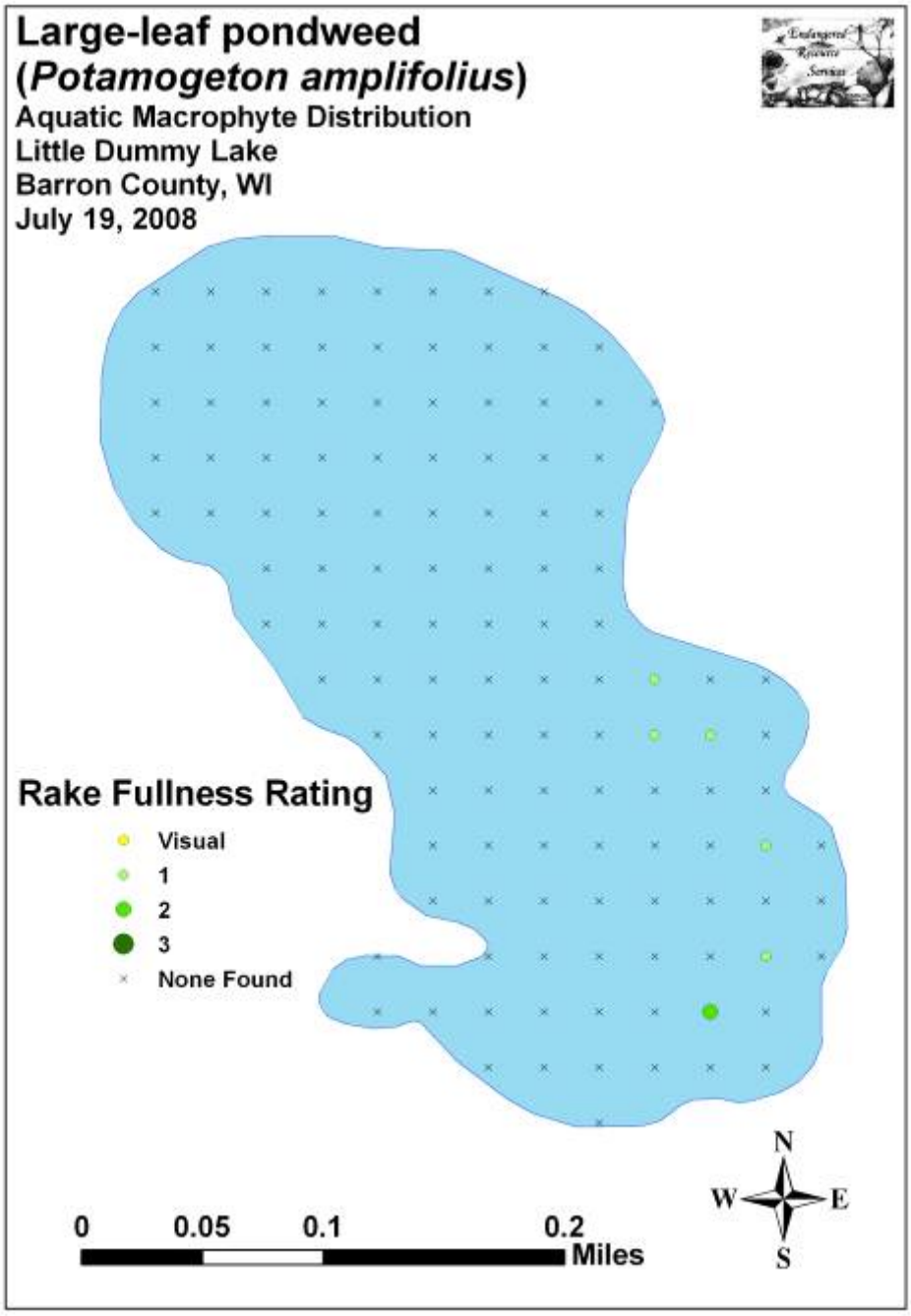
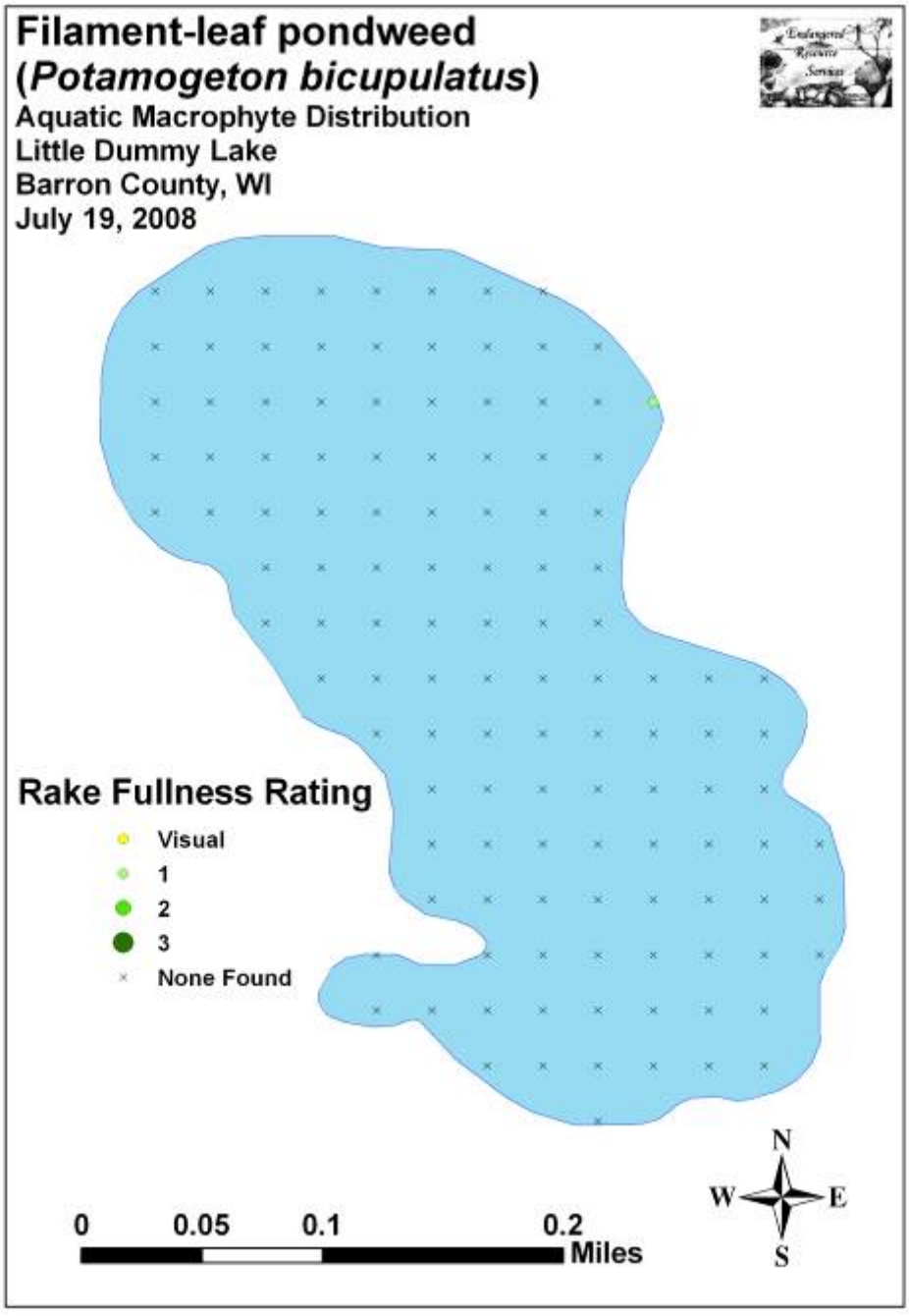
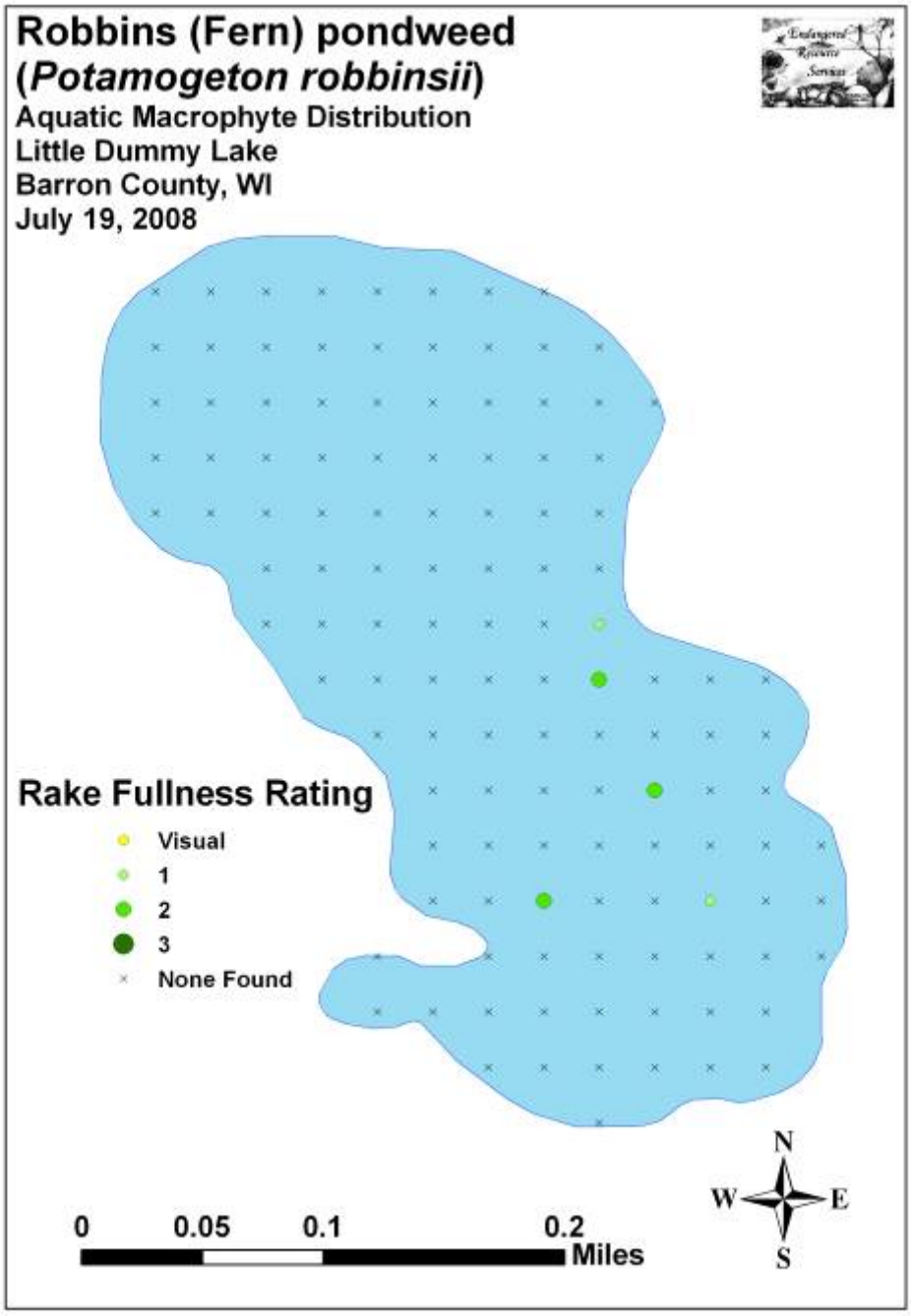
S


Large-leaf pondweed
(Potamogeton amplifolius)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles


Filament-leaf pondweed
(Potamogeton bicupulatus)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
N
W
E
S


Robbins (Fern) pondweed
(Potamogeton robbinsii)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
N
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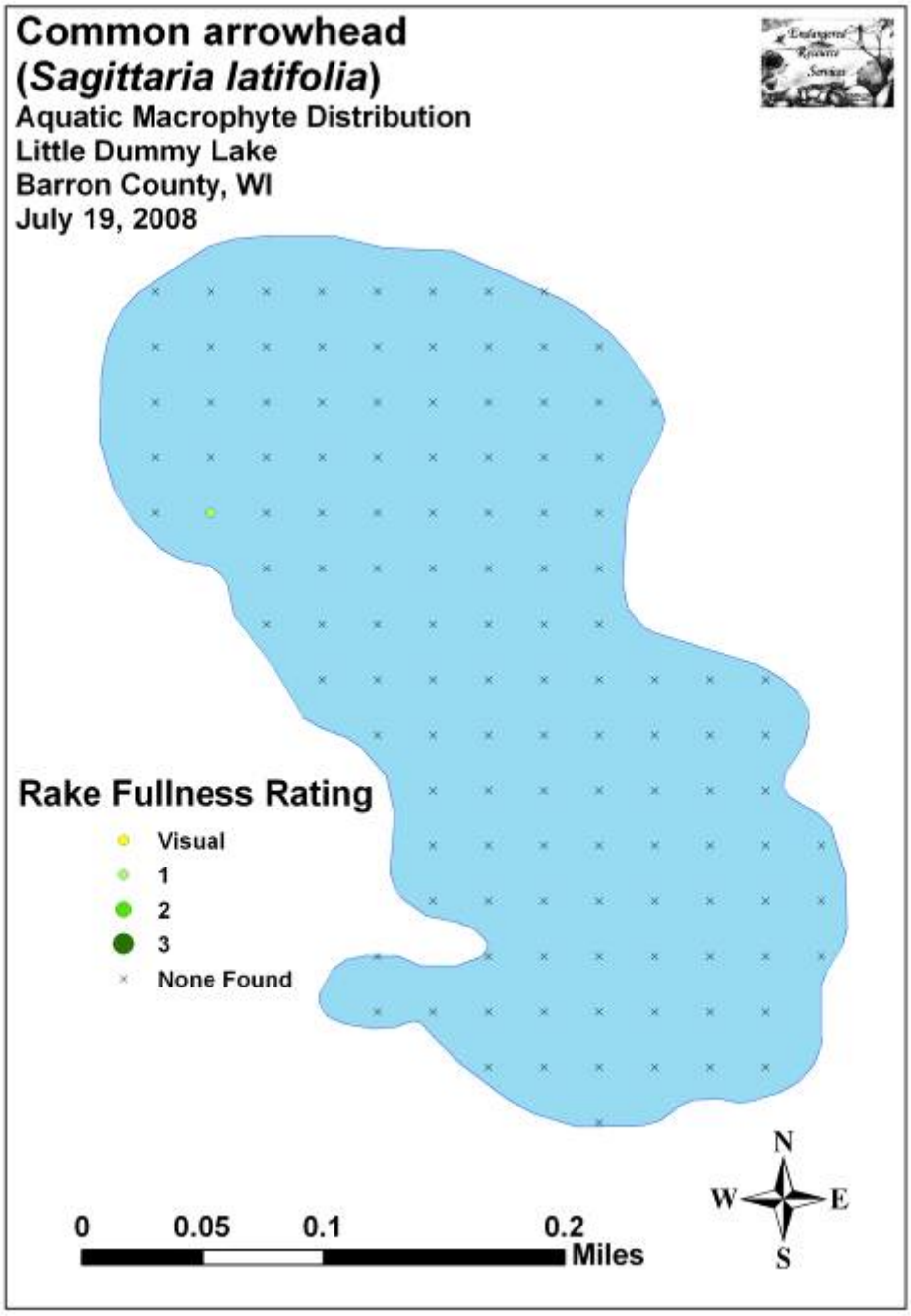
Common arrowhead
(Sagittaria latifolia)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
N
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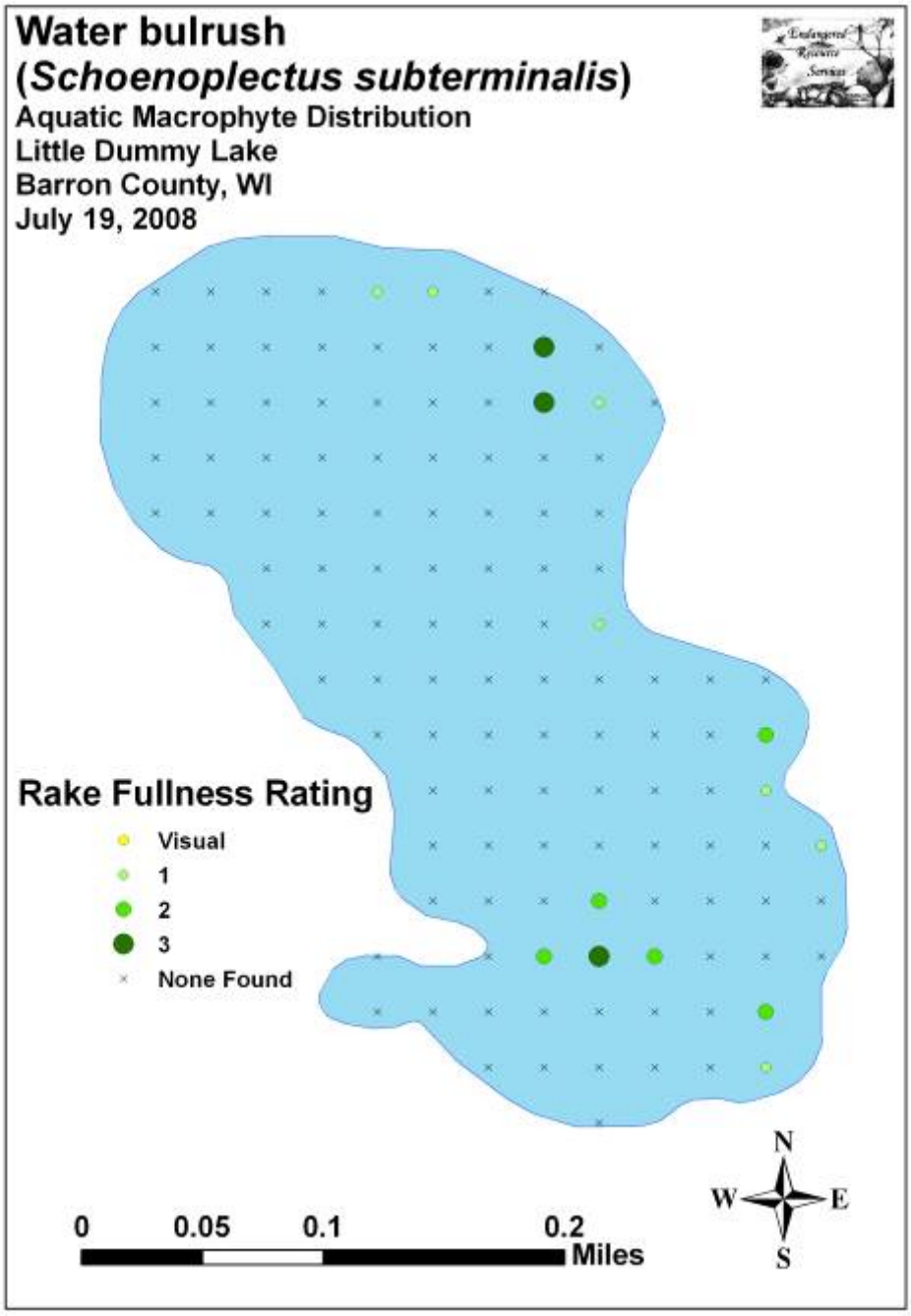
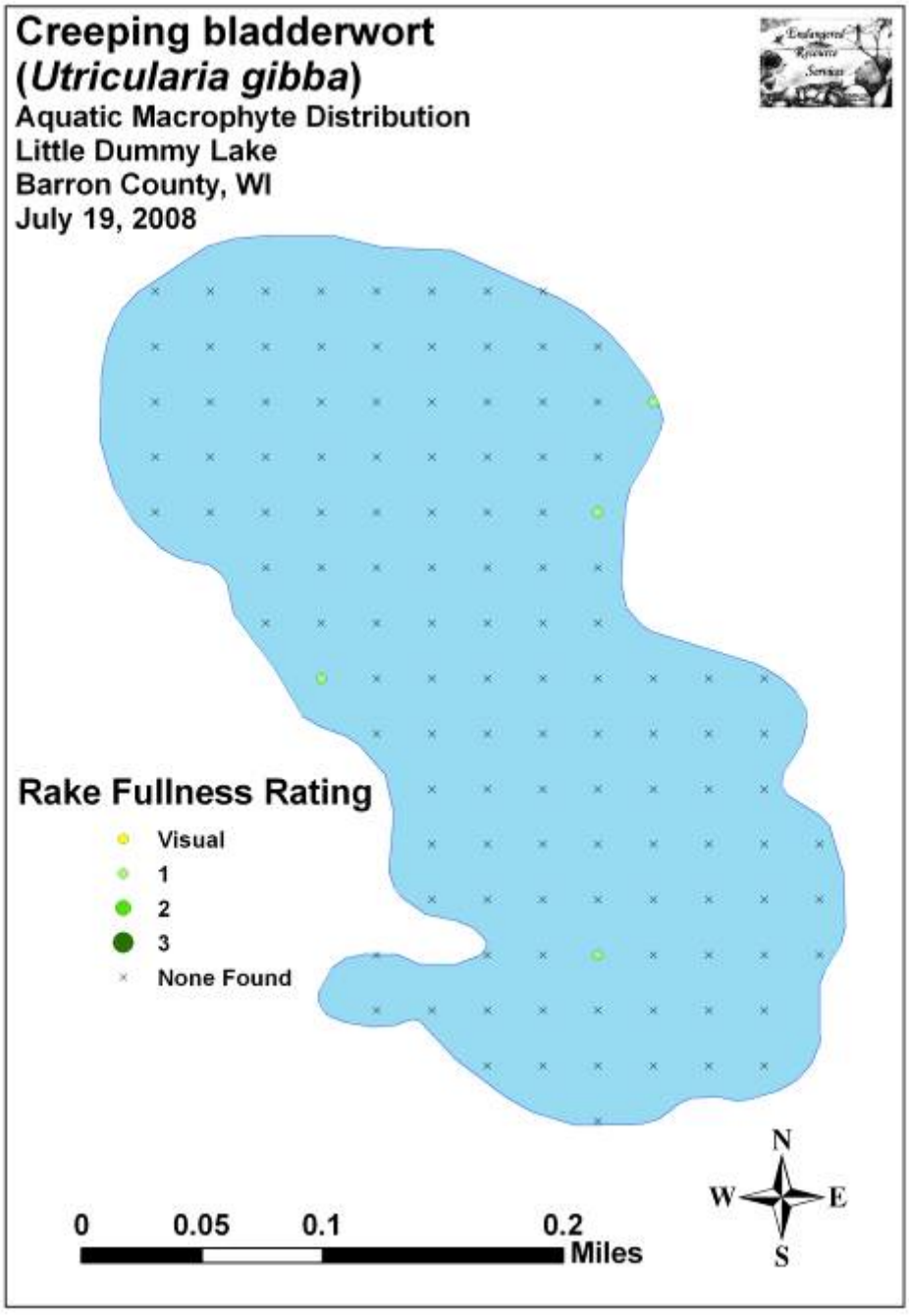
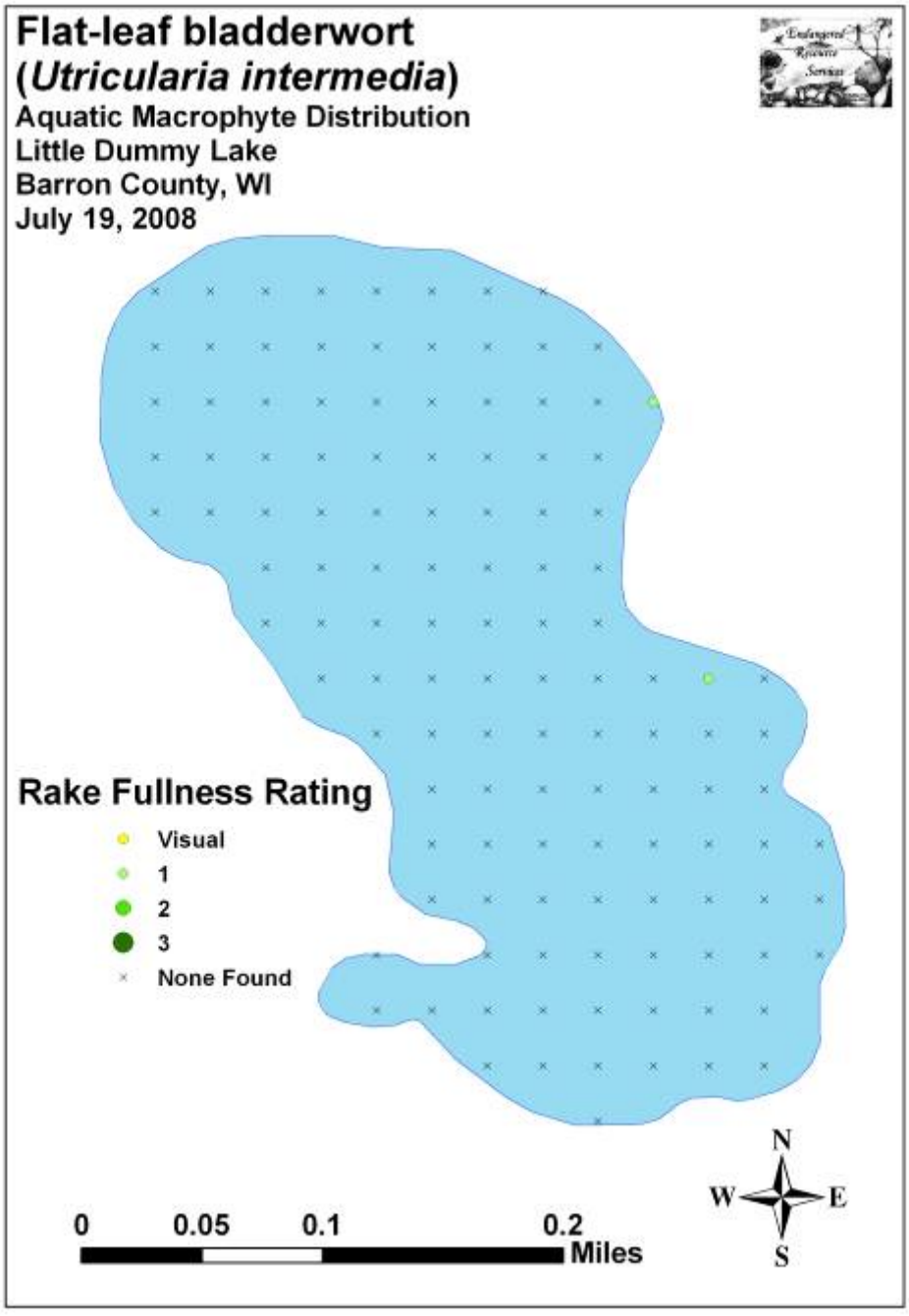
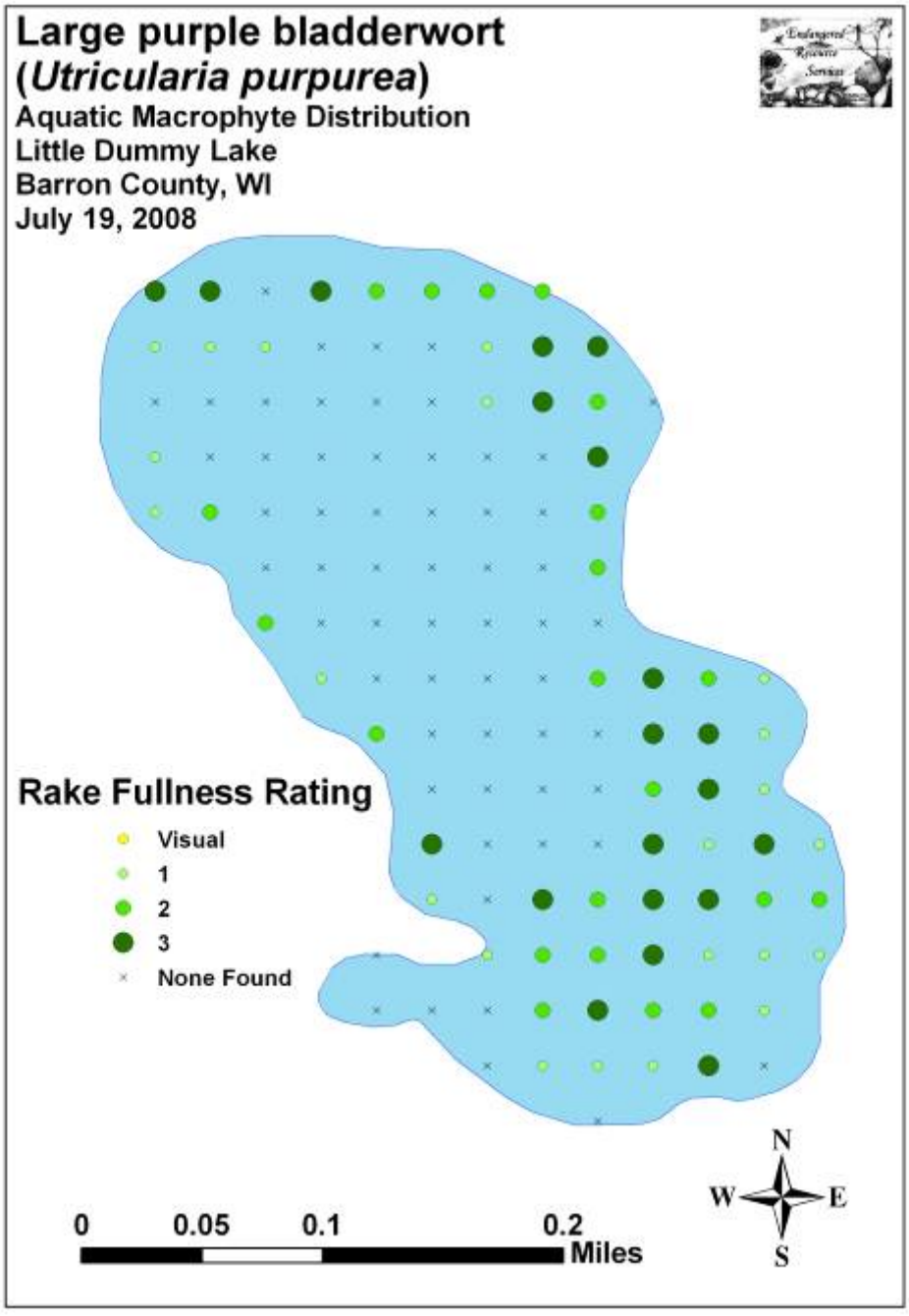
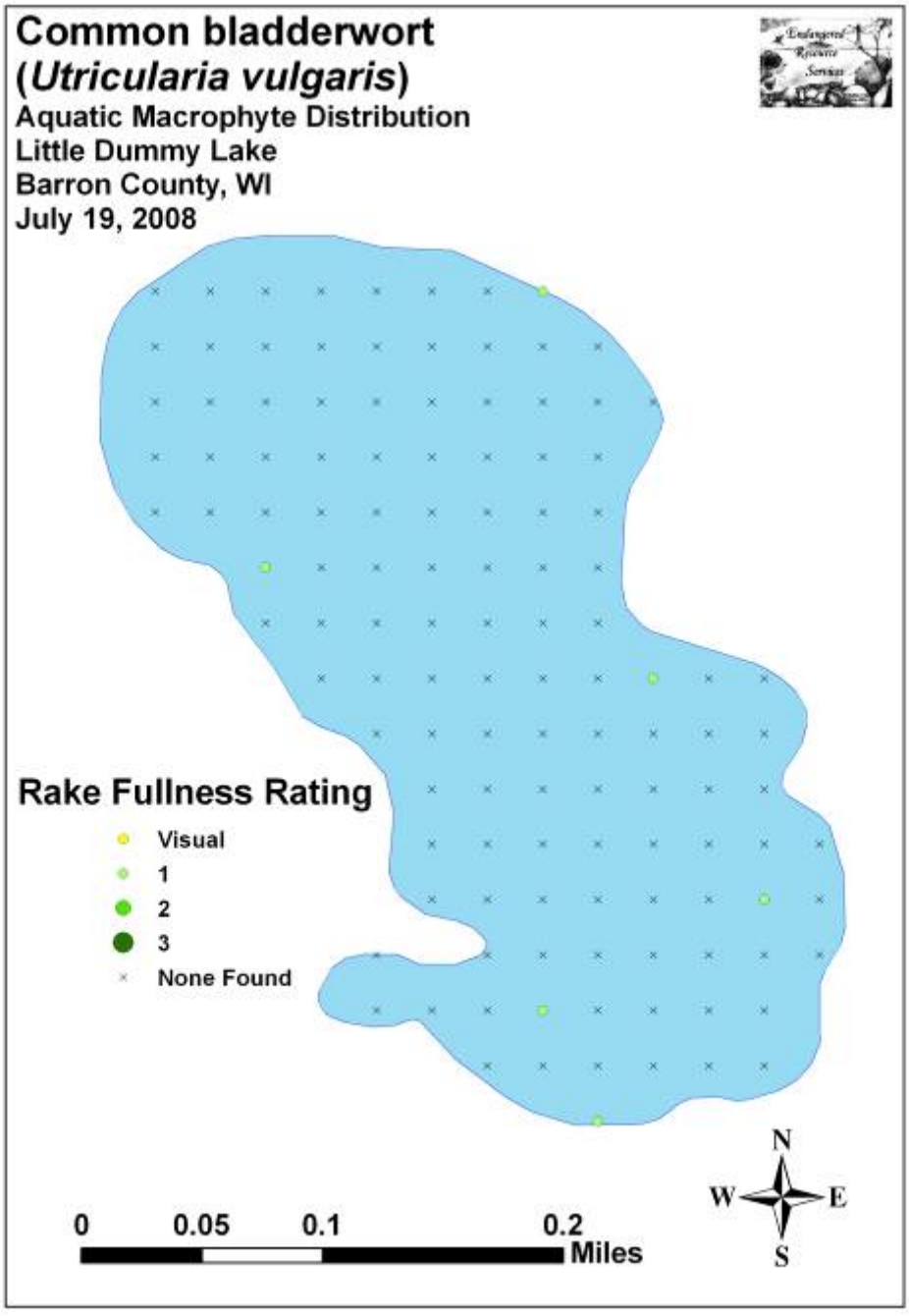
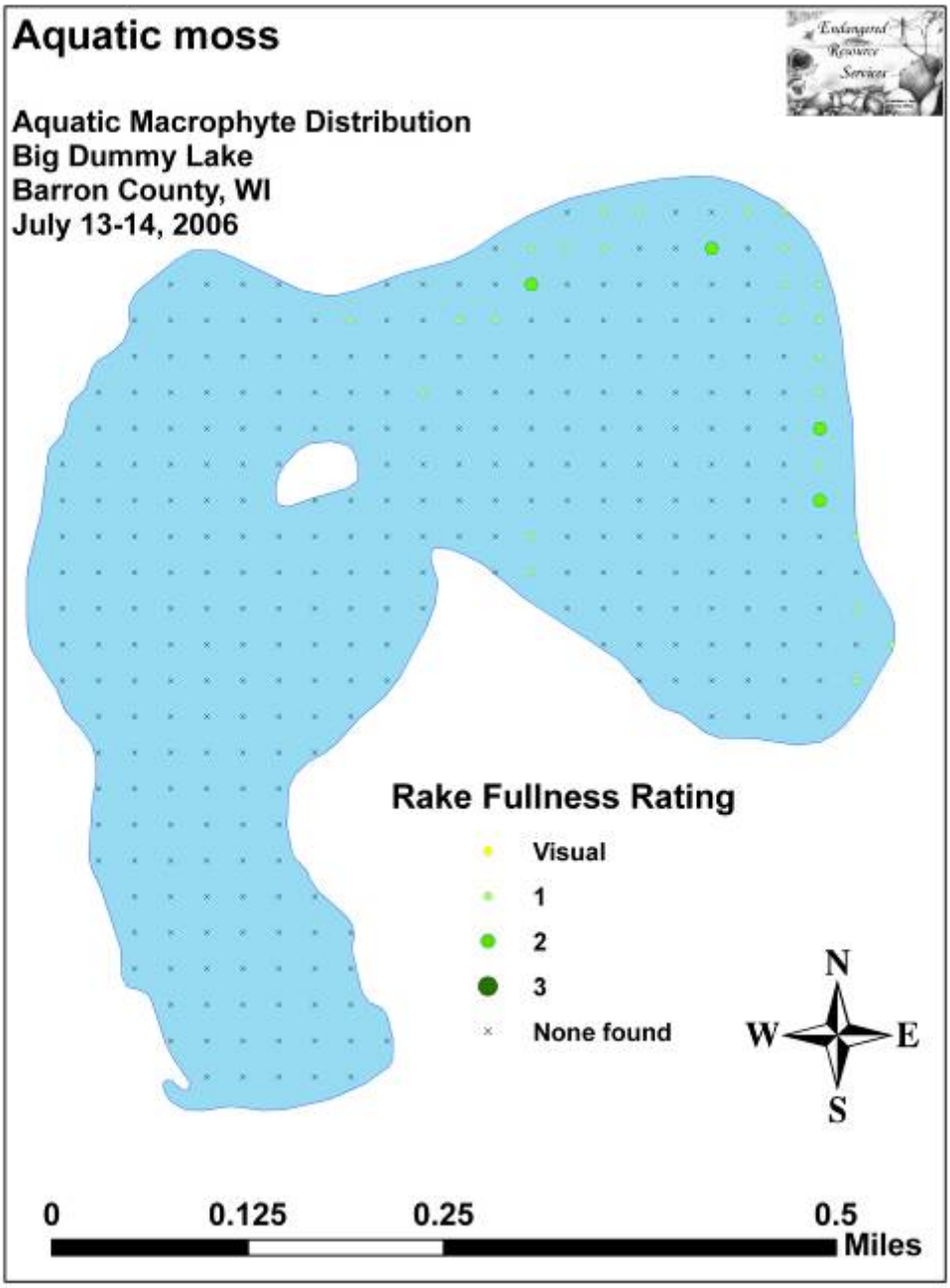

Water bulrush
(Schoenoplectus subterminalis)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles

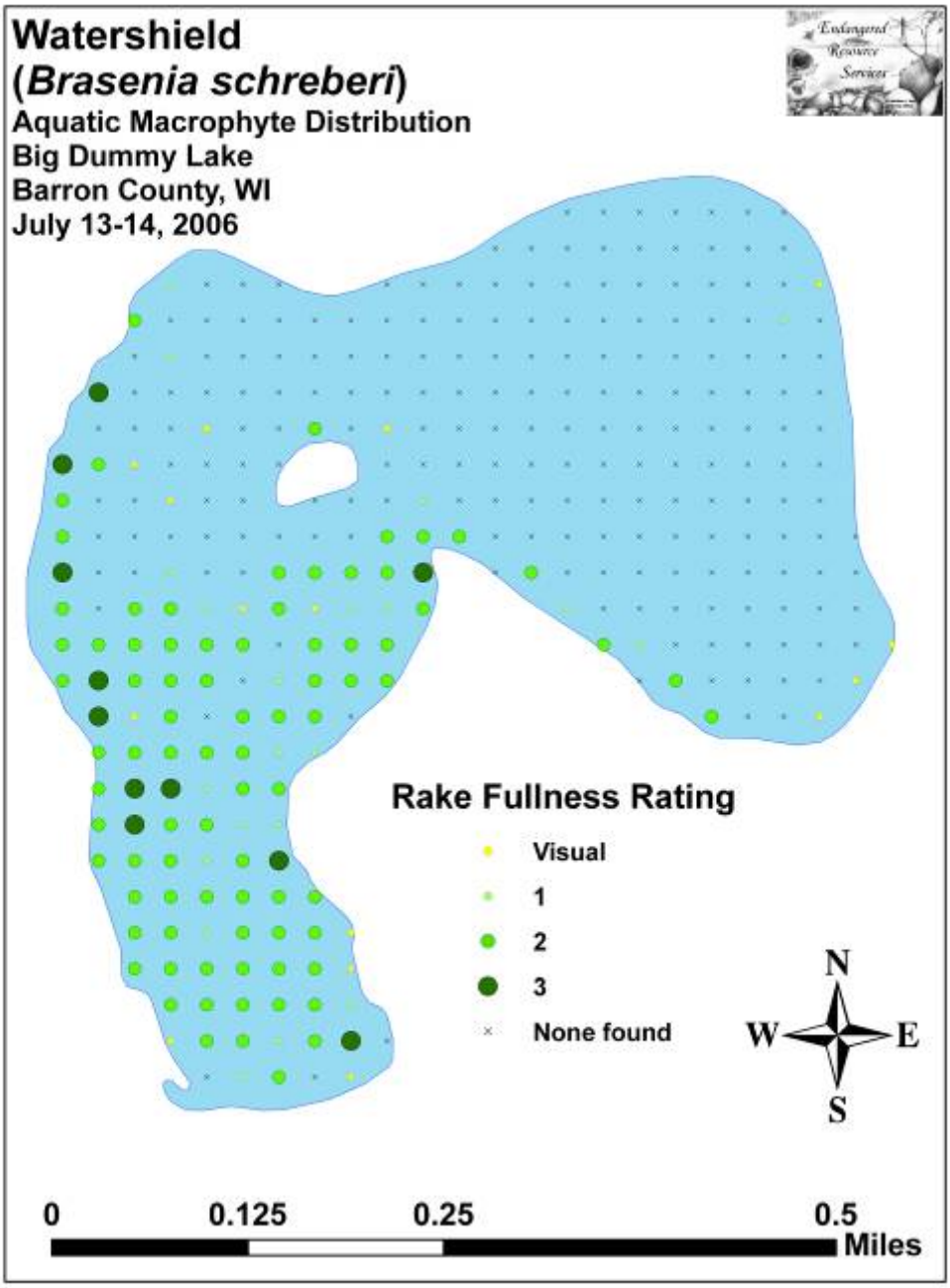

Creeping bladderwort
(Utricularia gibba)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
0
0.05
0.1
0.2
Miles
N
W
E
S

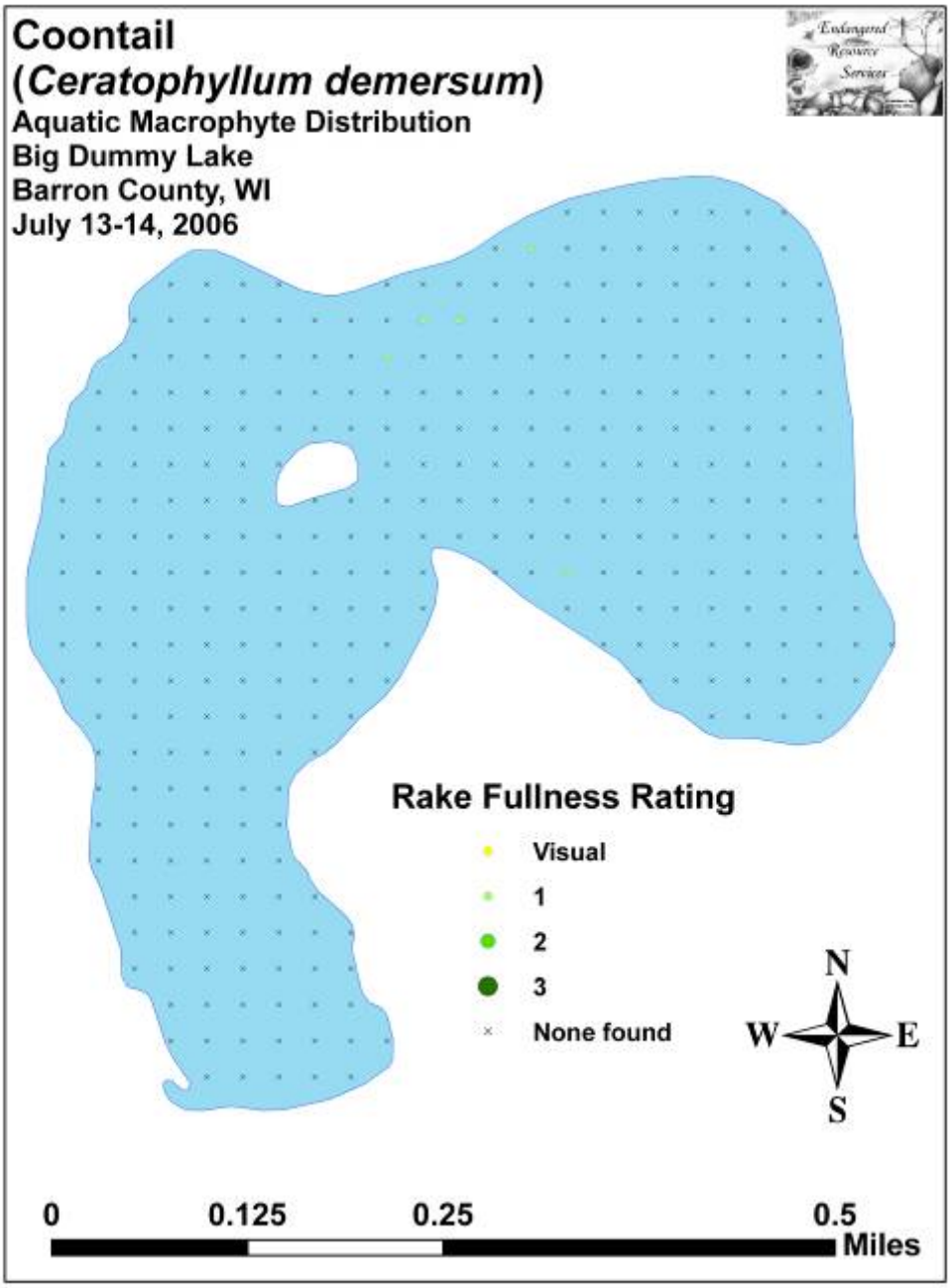

Flat-leaf bladderwort
(Utricularia intermedia)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles

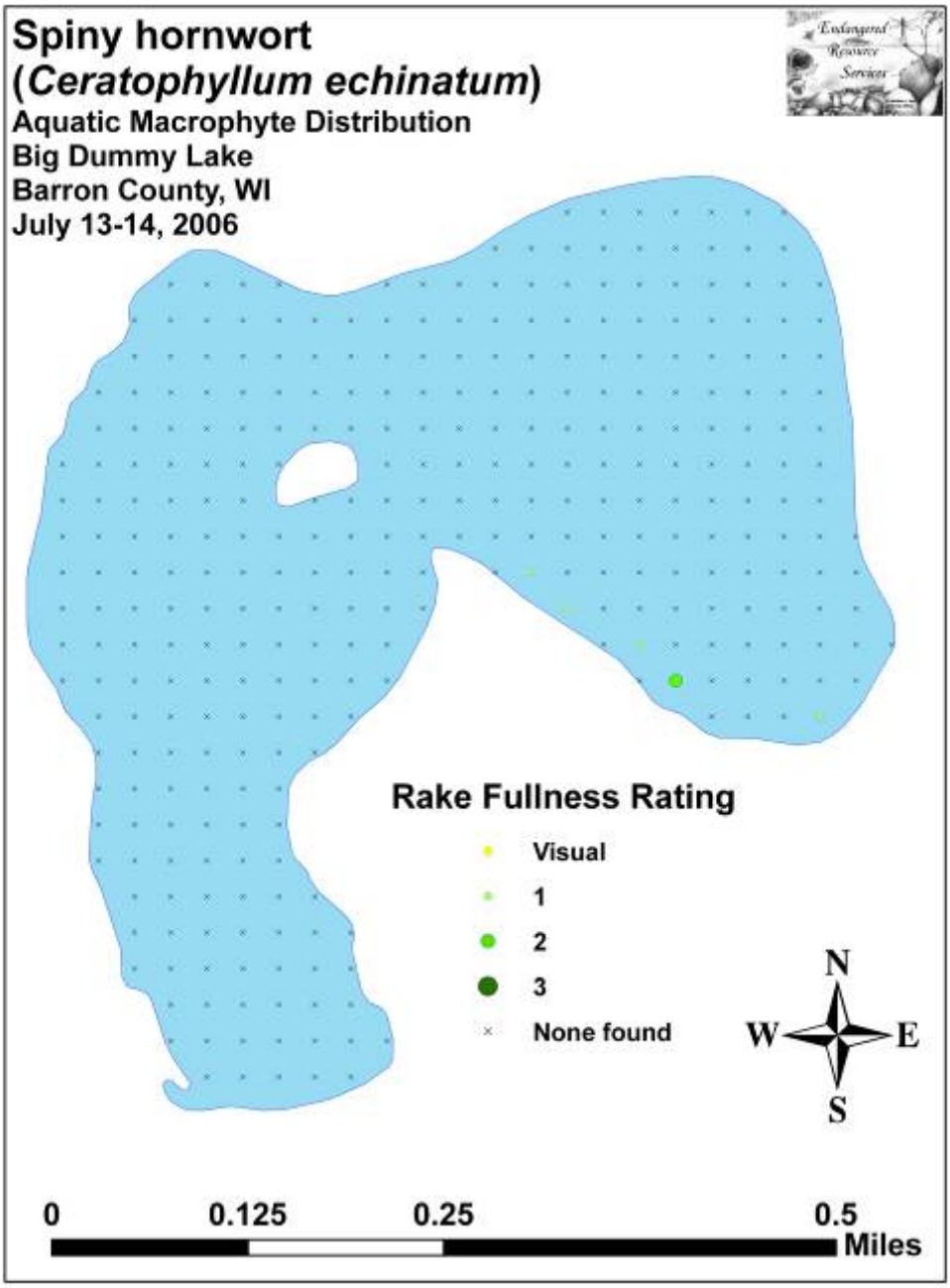

Large purple bladderwort
(Utricularia purpurea)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles

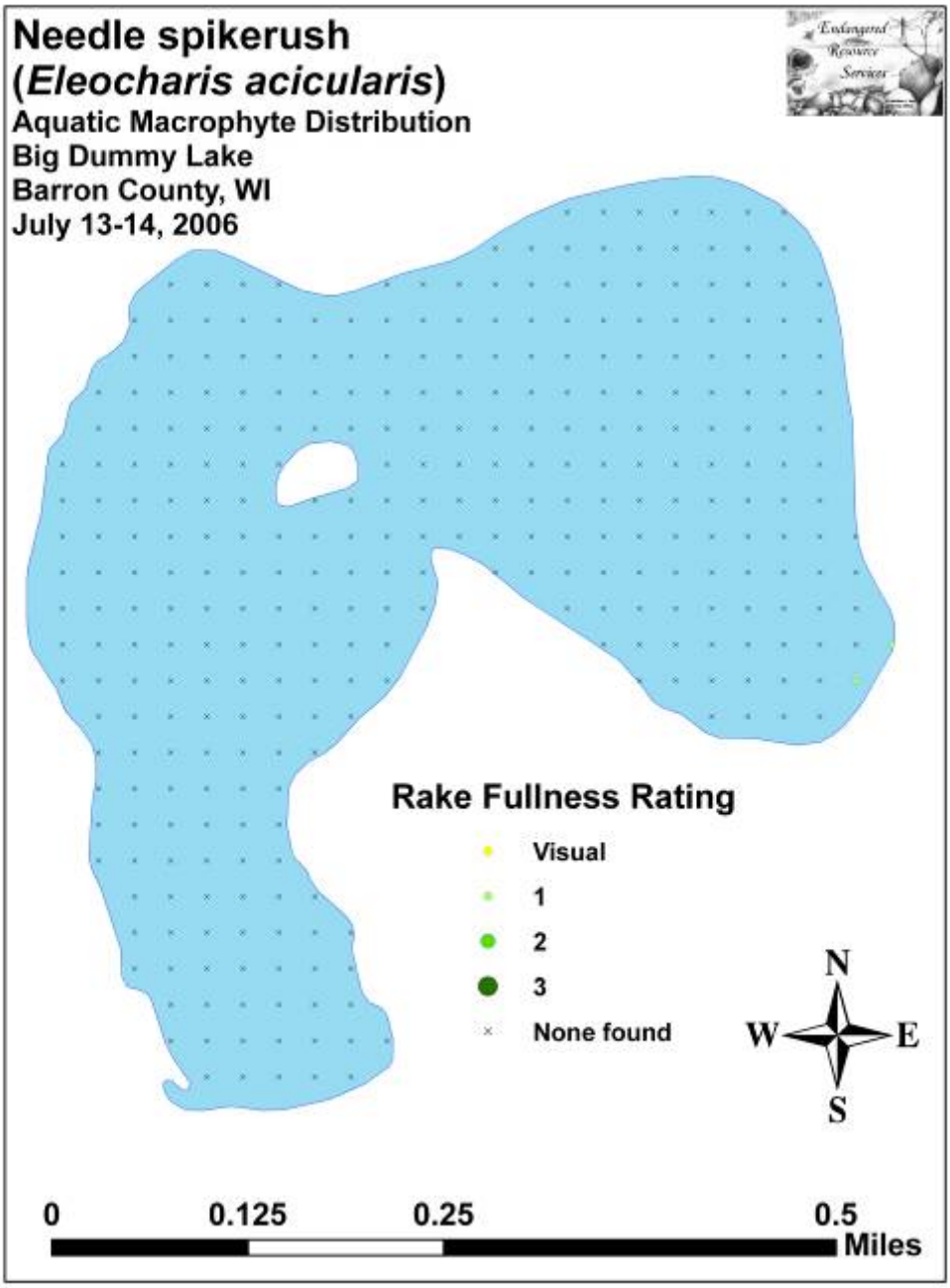

Common bladderwort
(Utricularia vulgaris)
Aquatic Macrophyte Distribution
Little Dummy Lake
Barron County, WI
July 19, 2008
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.05
0.1
0.2
Miles

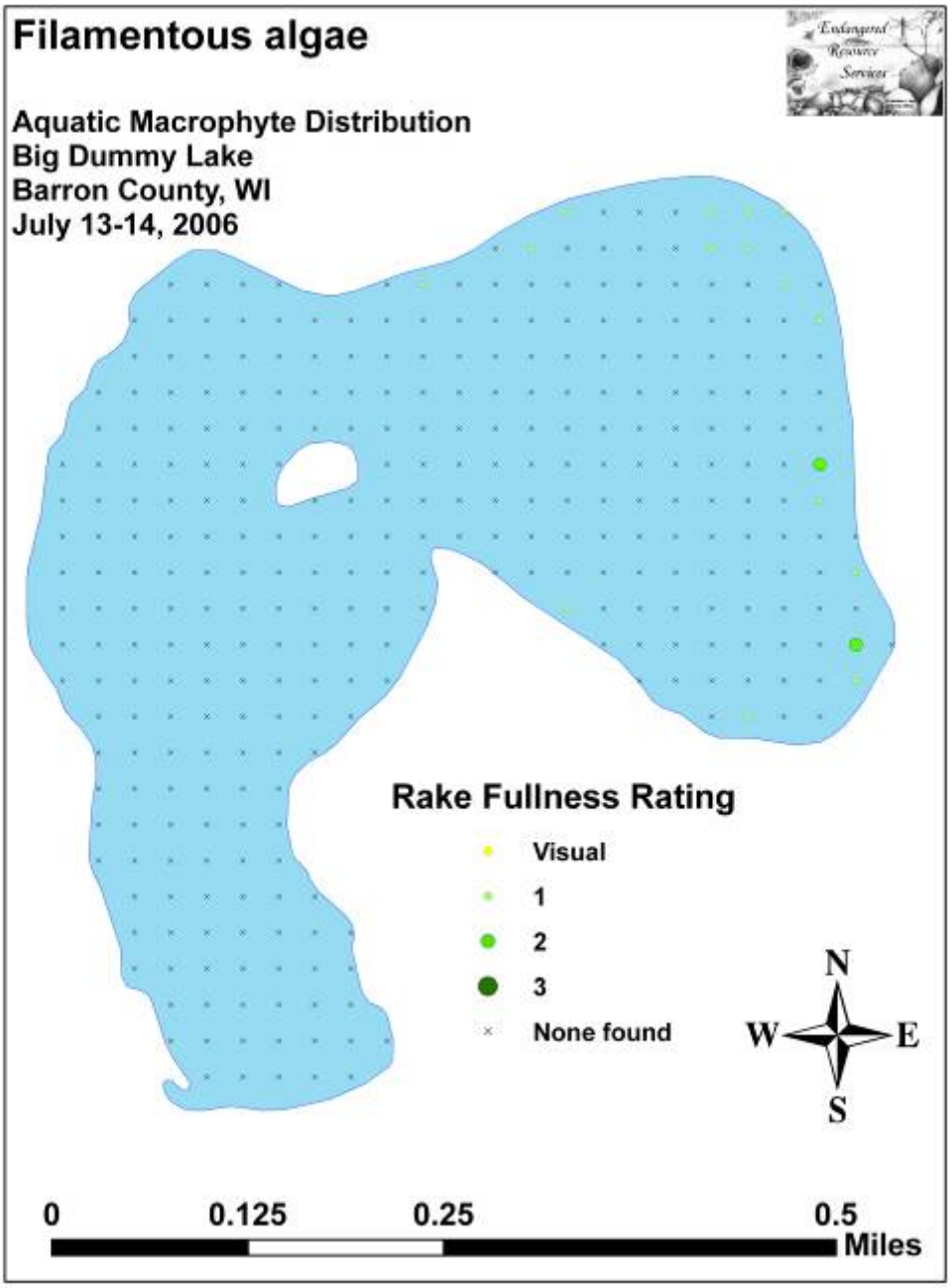

Aquatic moss
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Watershield
(Brasenia schreberi)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Coontail
(Ceratophyllum demersum)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Spiny hornwort
(Ceratophyllum echinatum)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Needle spikerush
(Eleocharis acicularis)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Filamentous algae
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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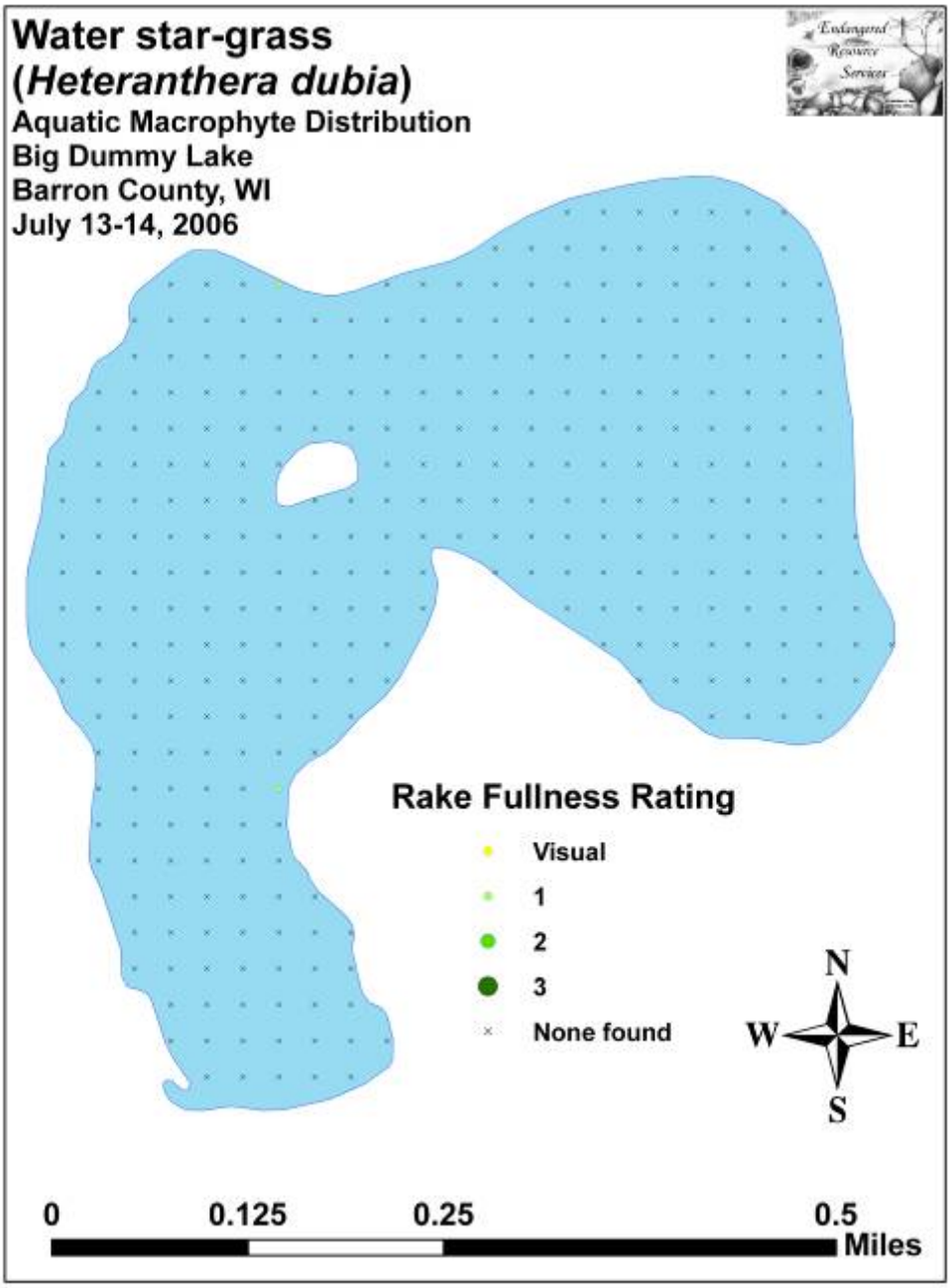
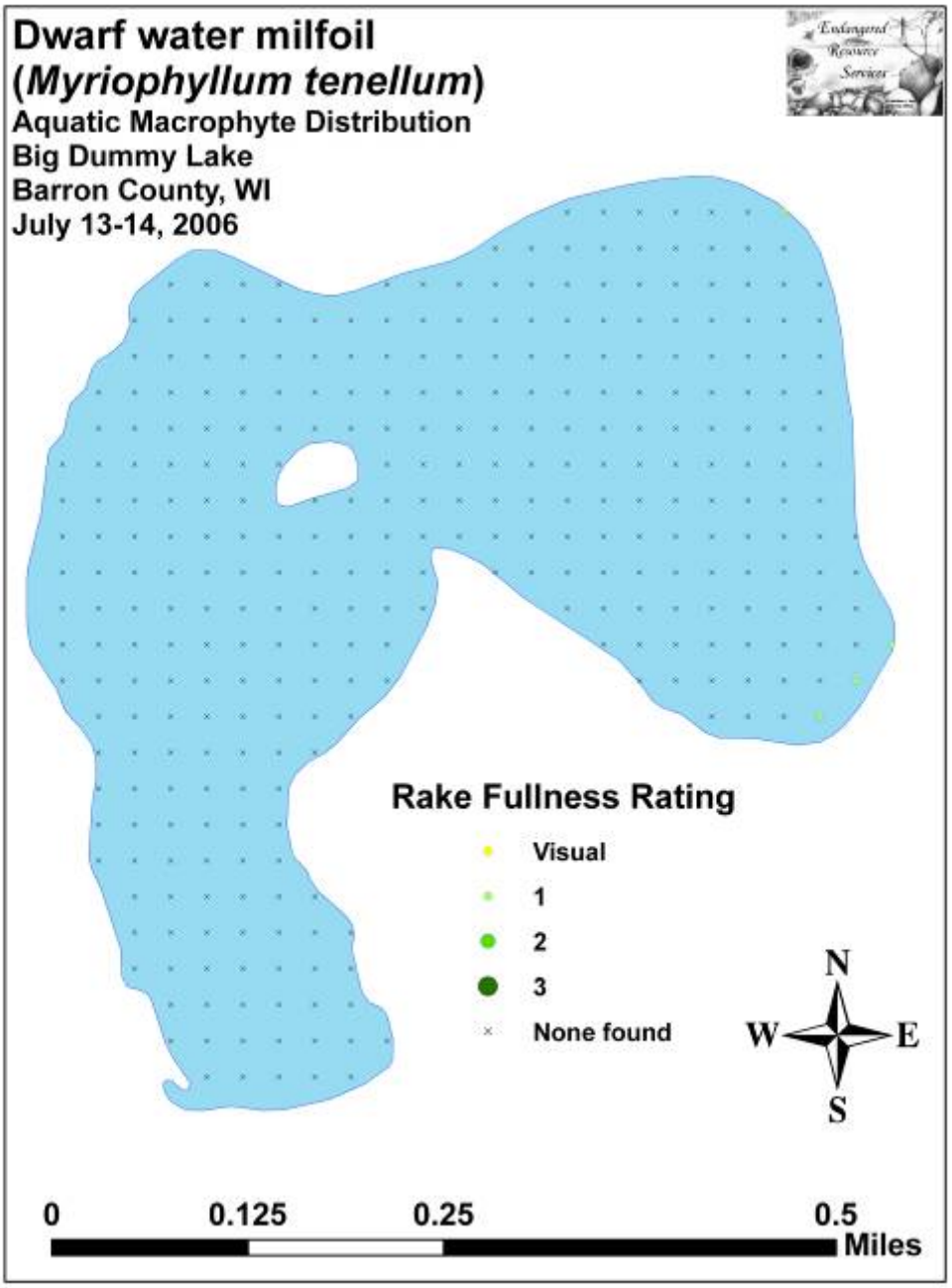
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Water star-grass
(Heteranthera dubia)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
2
3
None found
N
W
E
S
0
0.125
0.25
0.5
Miles


Dwarf water milfoil
(Myriophyllum tenellum)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
N
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0.125
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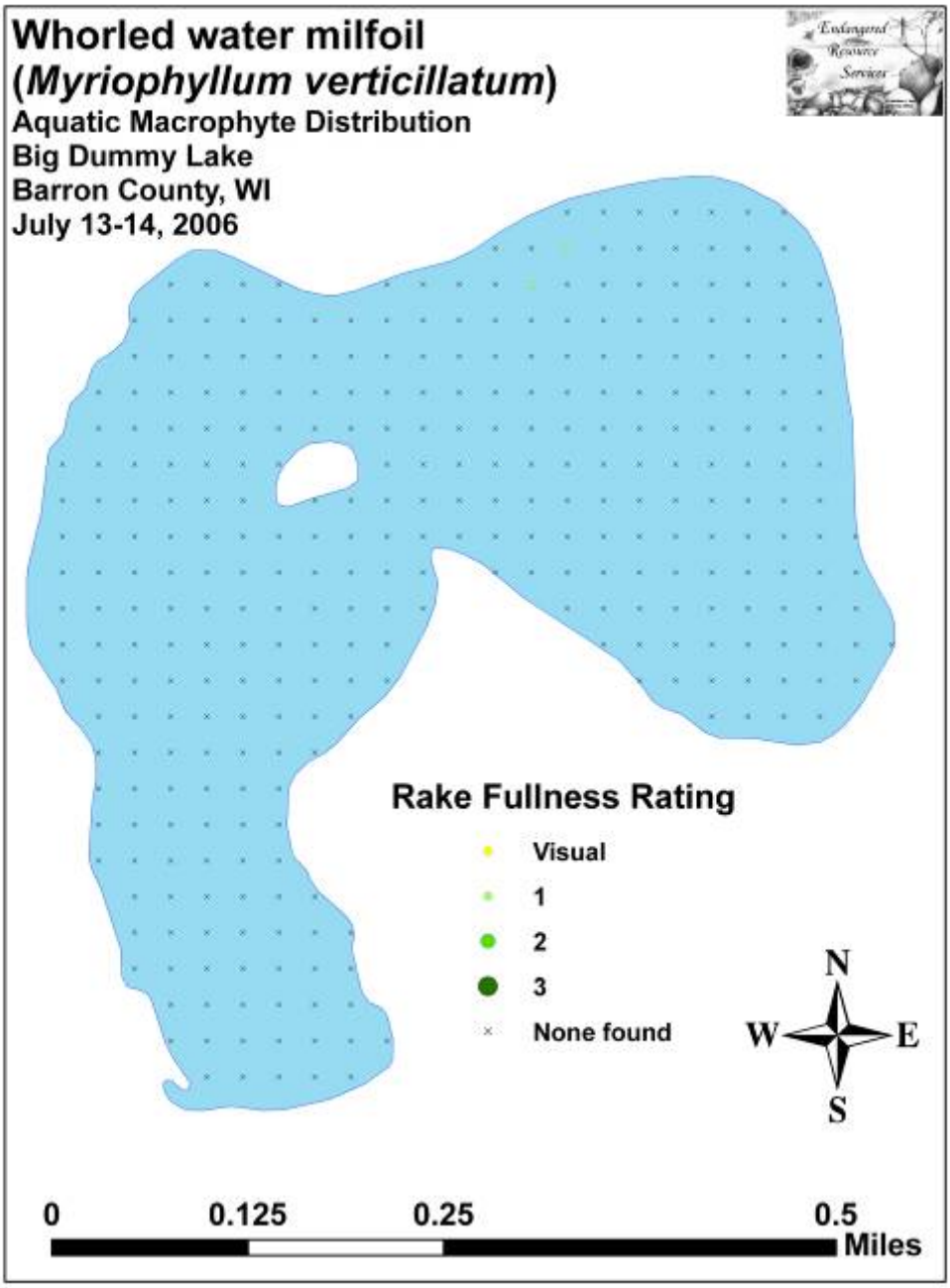
0.5
Miles


Whorled water milfoil
(Myriophyllum verticillatum)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
N
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0.125
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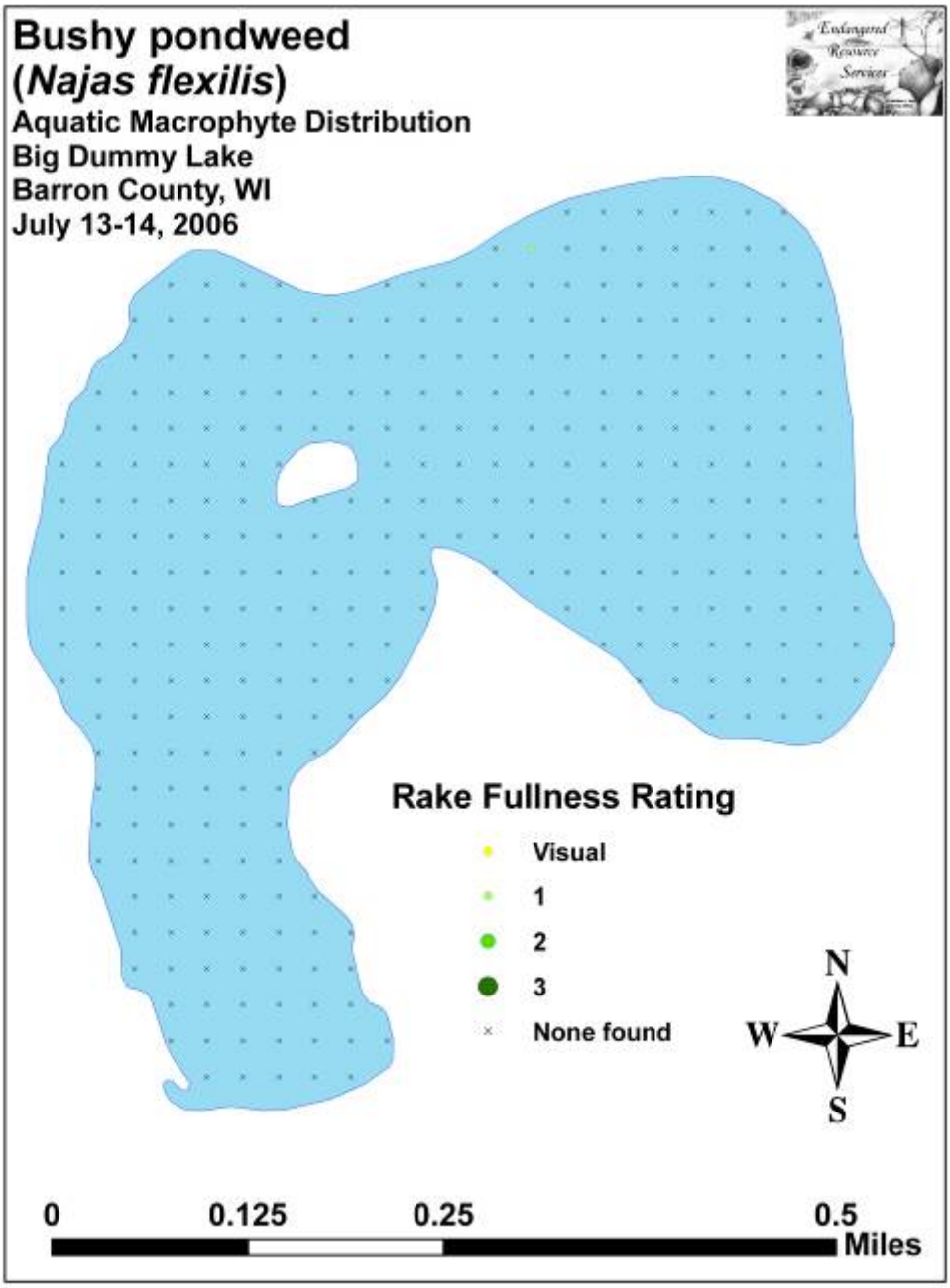
Miles


Bushy pondweed
(Najas flexilis)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
N
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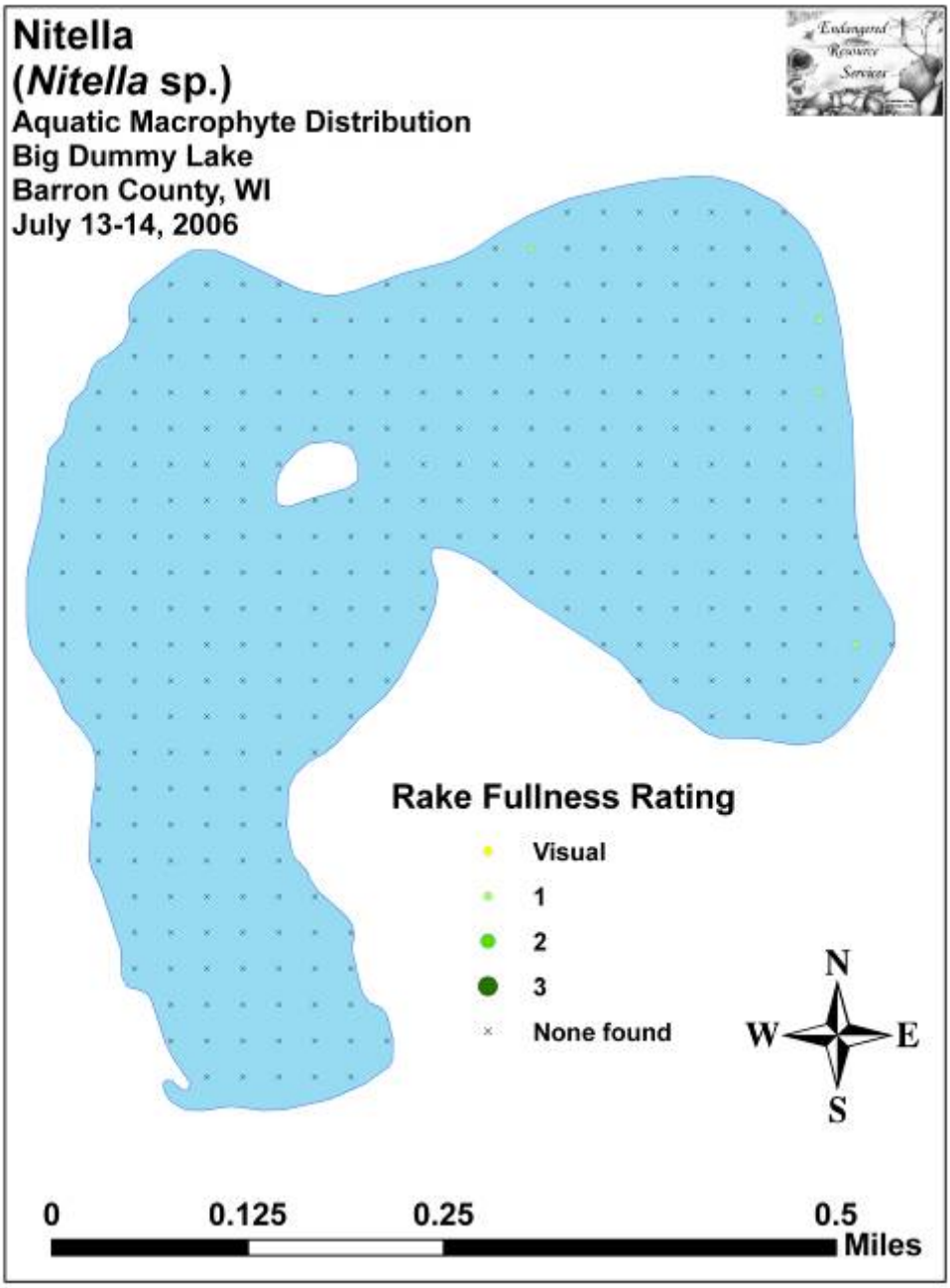
Miles


Nitella
(Nitella sp.)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
N
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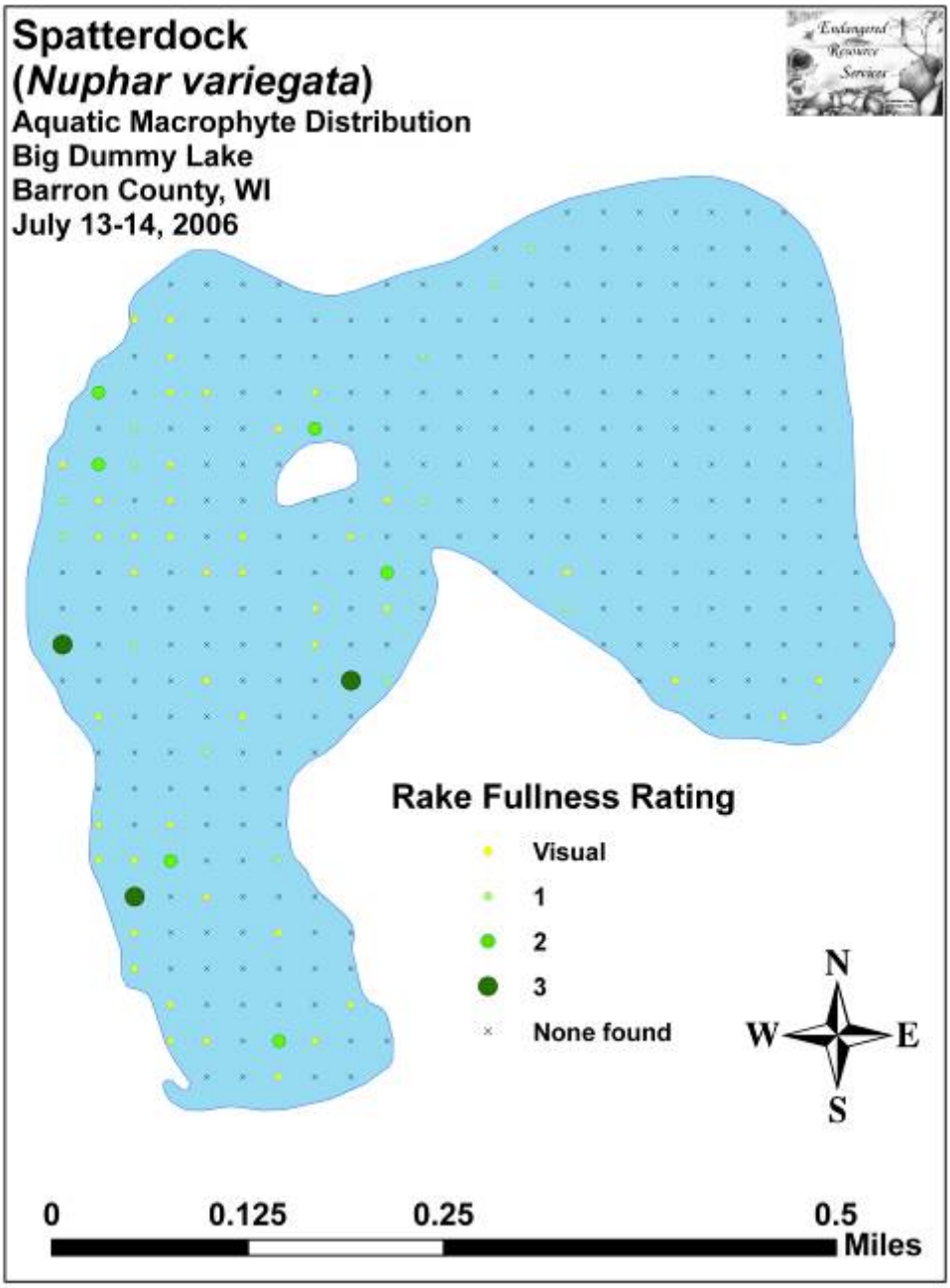
Miles


Spatterdock
(Nuphar variegata)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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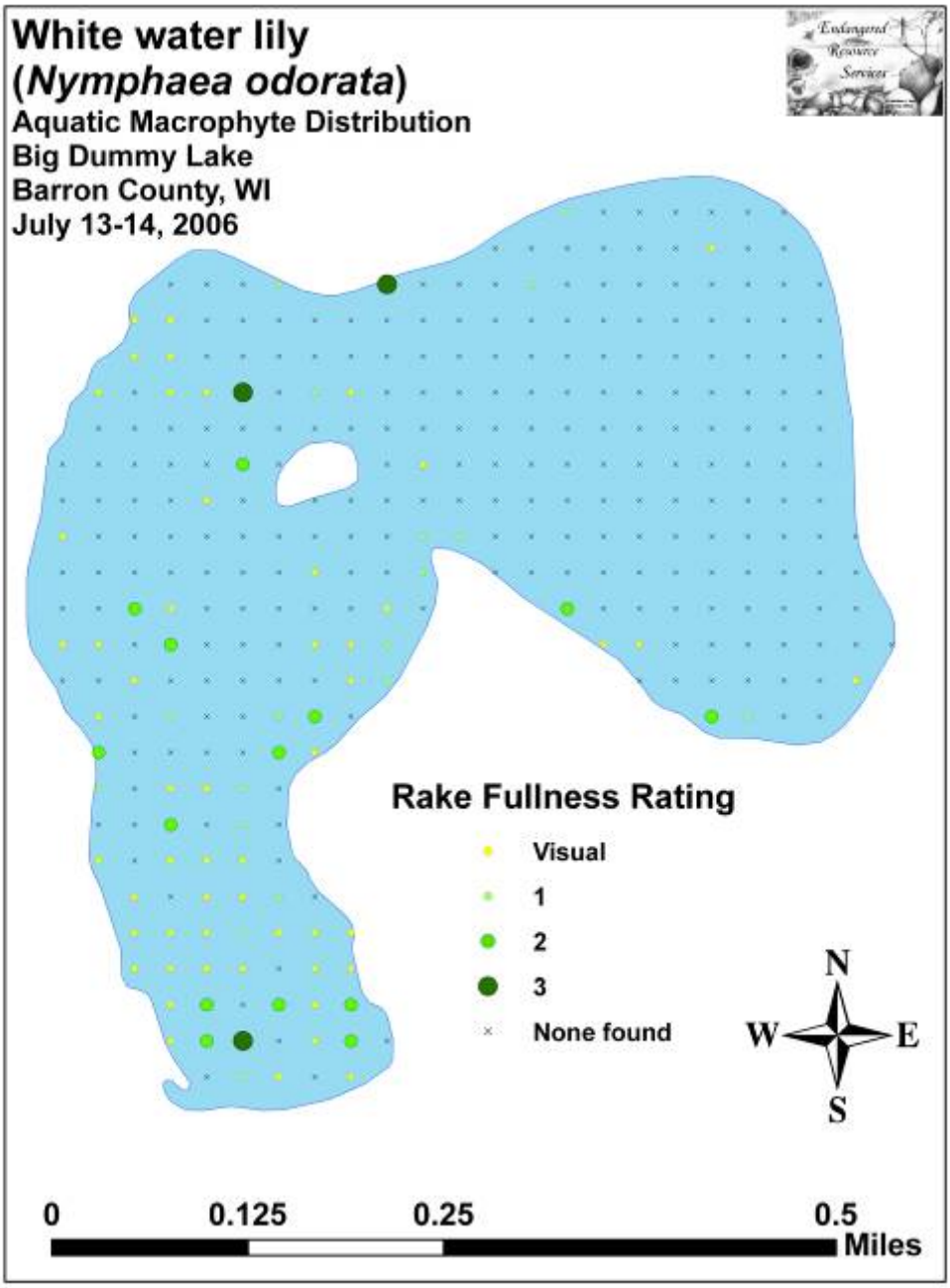
Miles


White water lily
(Nymphaea odorata)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
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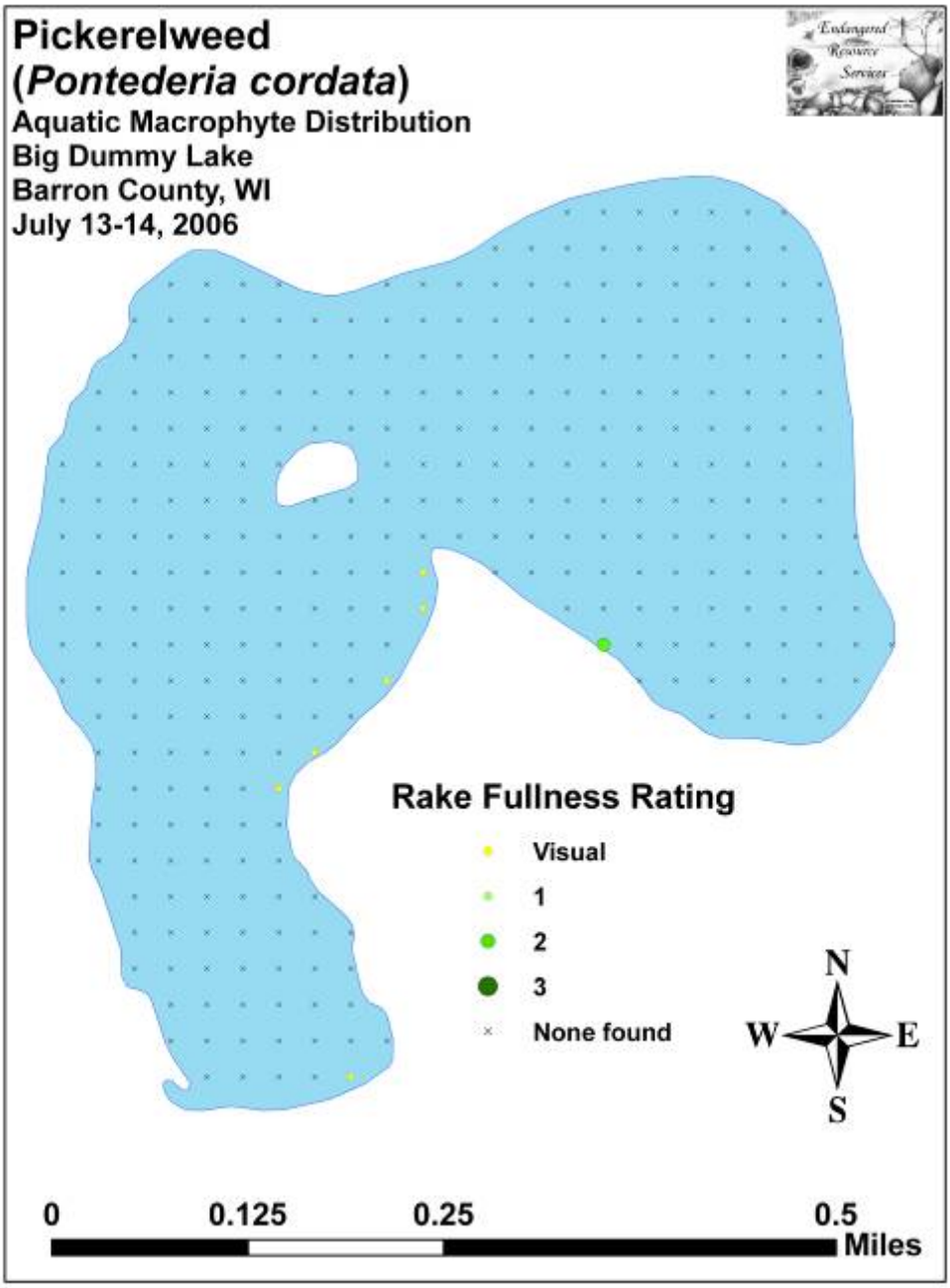
Miles


Pickerelweed
(Pontederia cordata)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
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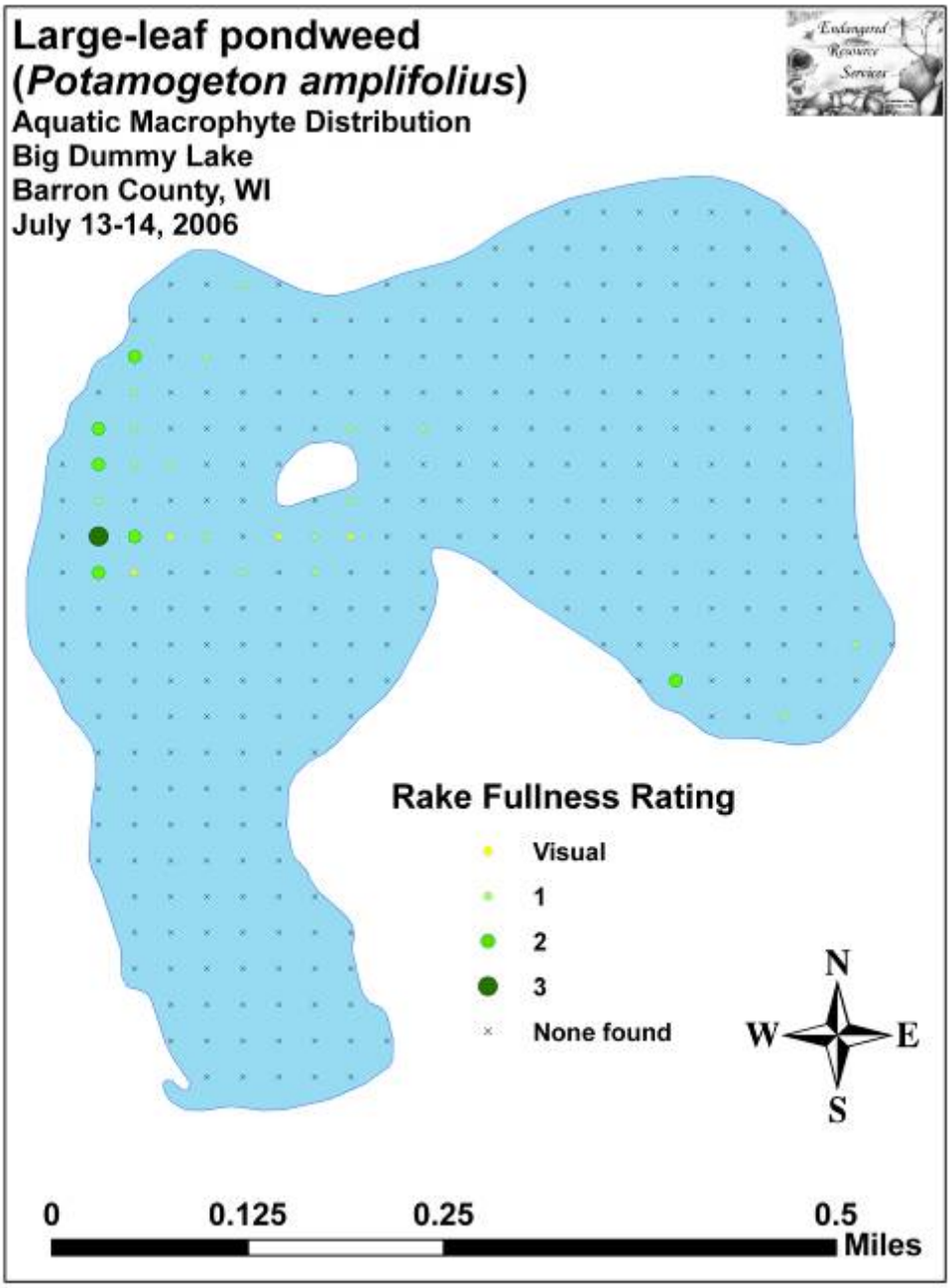
Miles


Large-leaf pondweed
(Potamogeton amplifolius)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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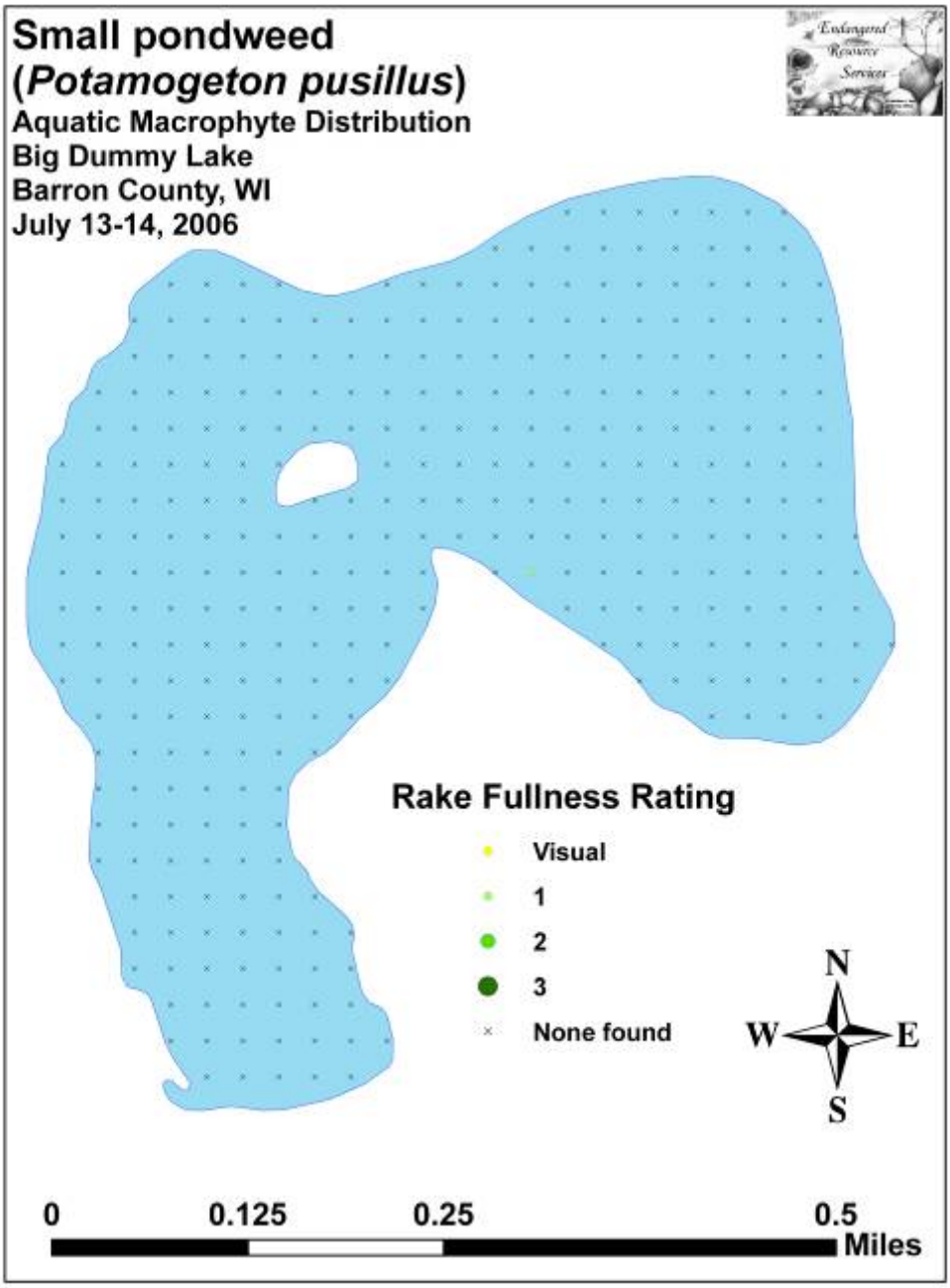
Miles


Small pondweed
(Potamogeton pusillus)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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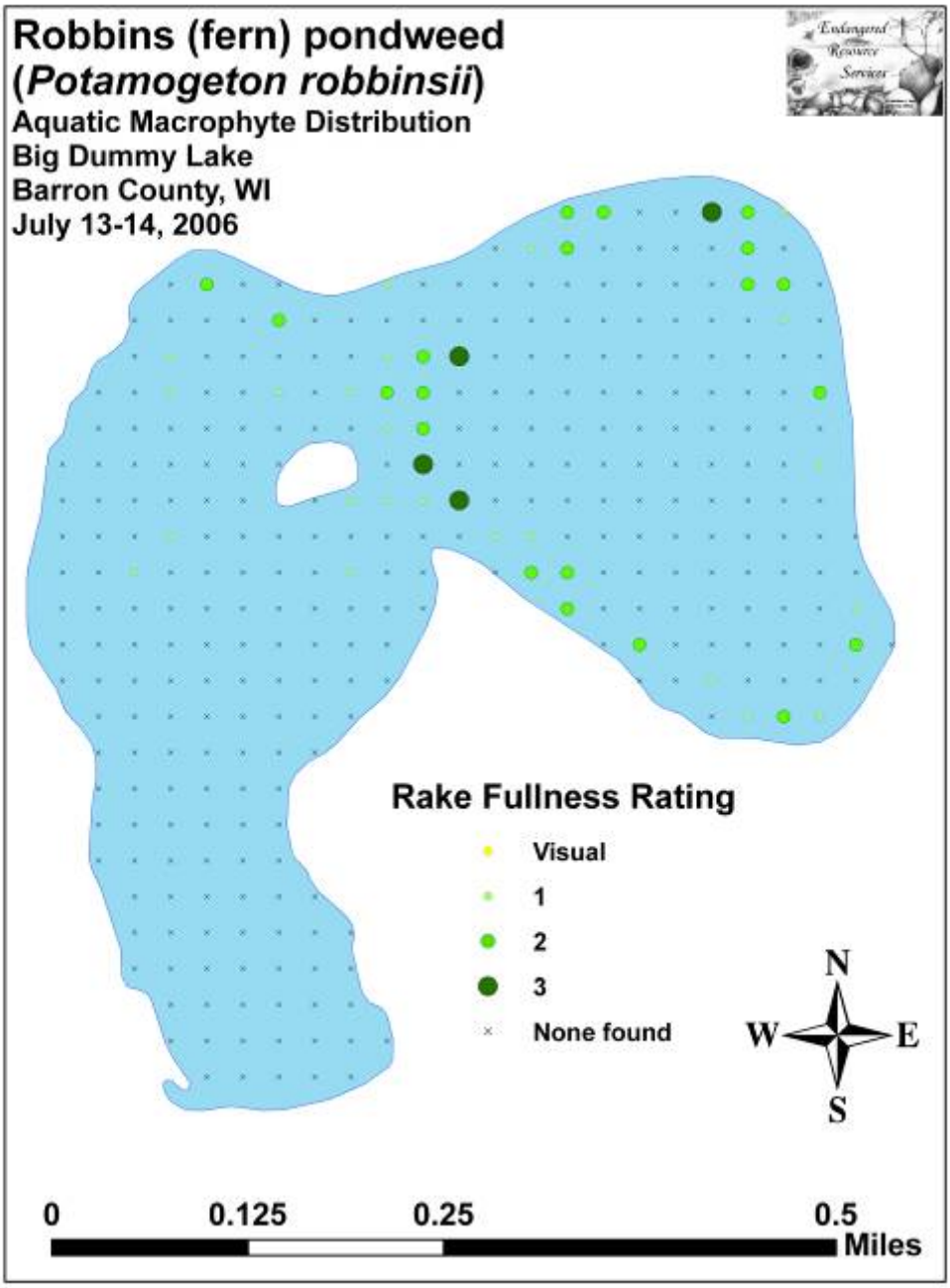
Miles


Robbins (fern) pondweed
(Potamogeton robbinsii)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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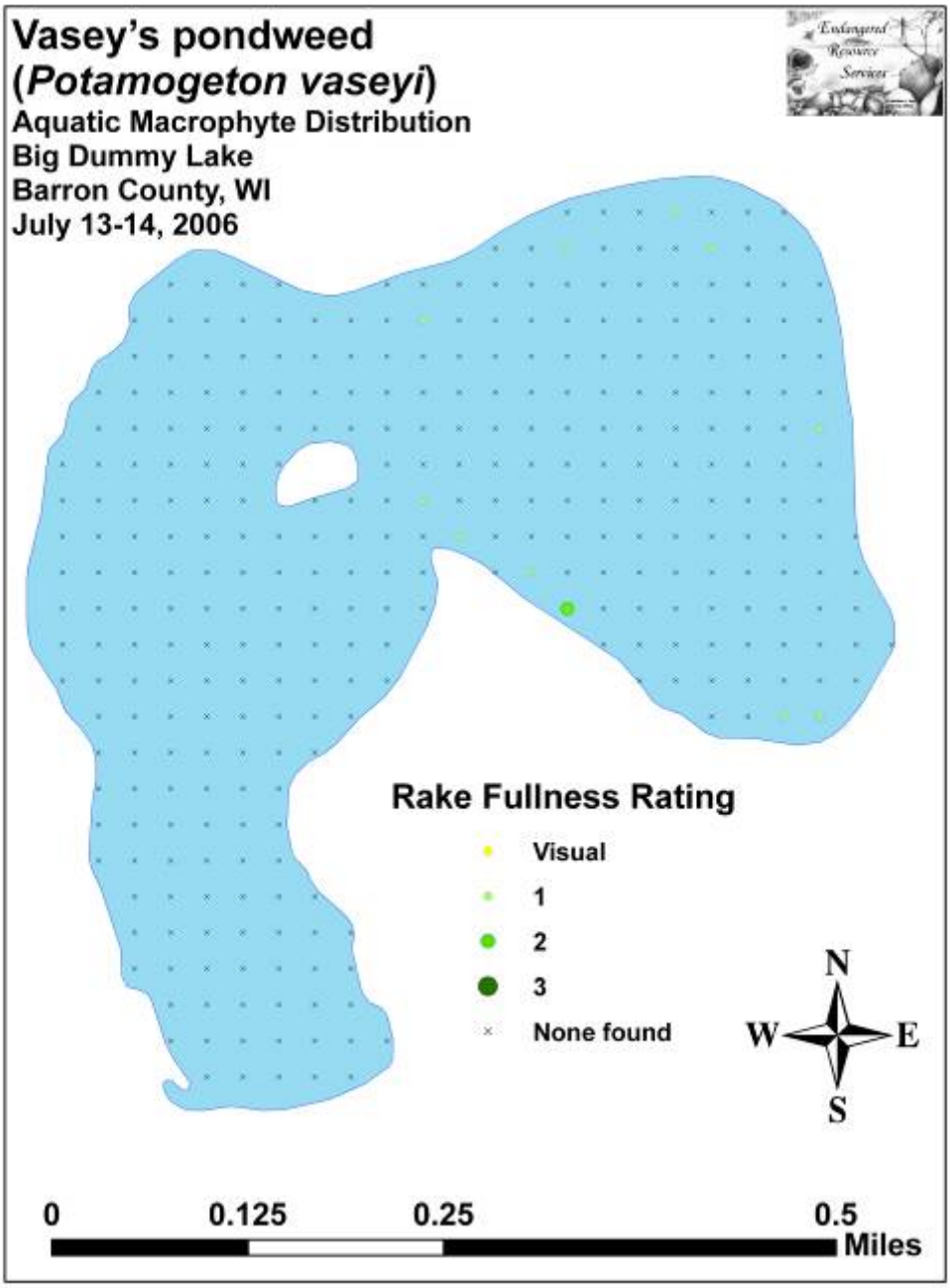
Miles


Vasey's pondweed
(Potamogeton vaseyi)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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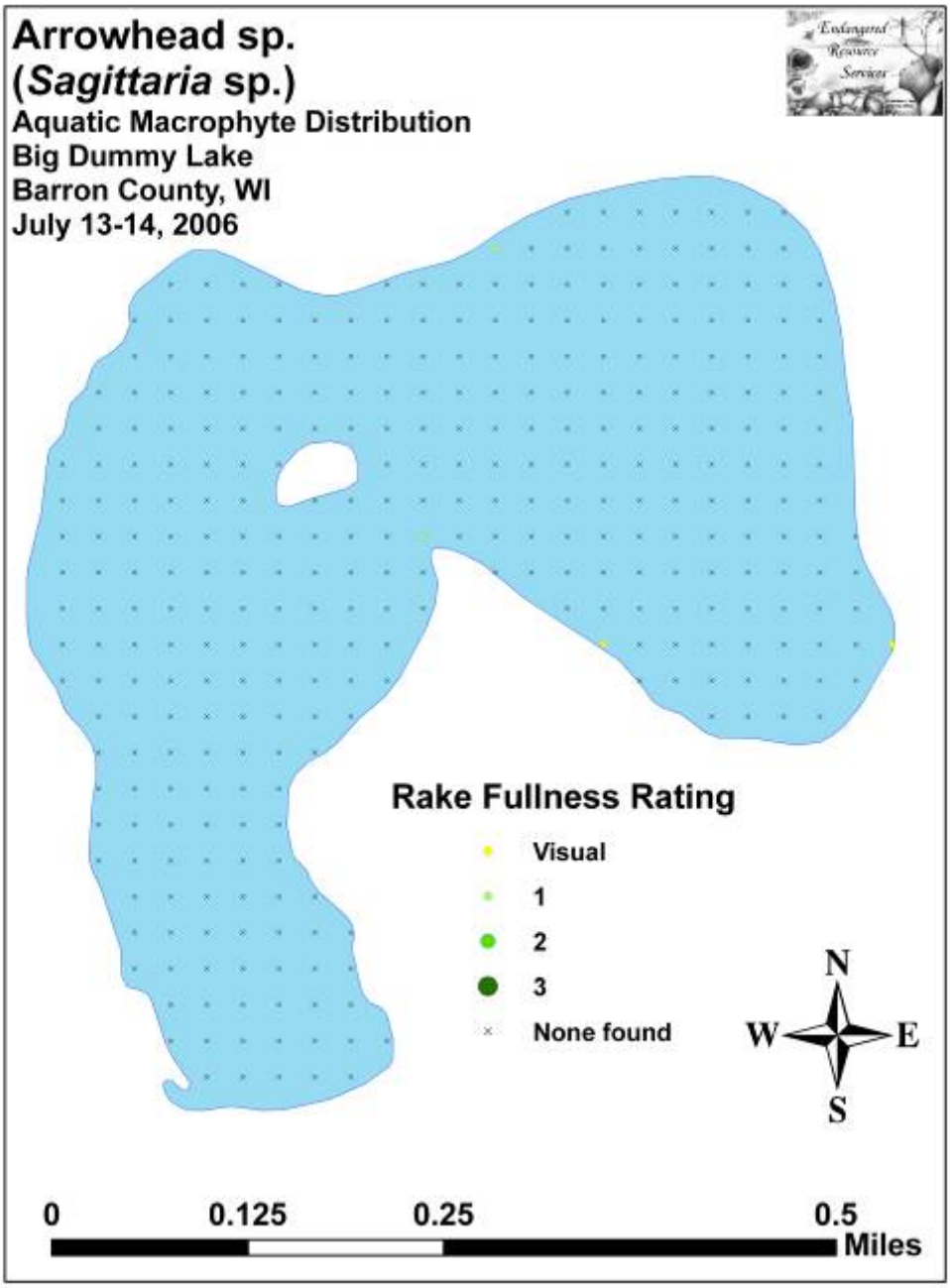
Arrowhead sp.
(Sagittaria sp.)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
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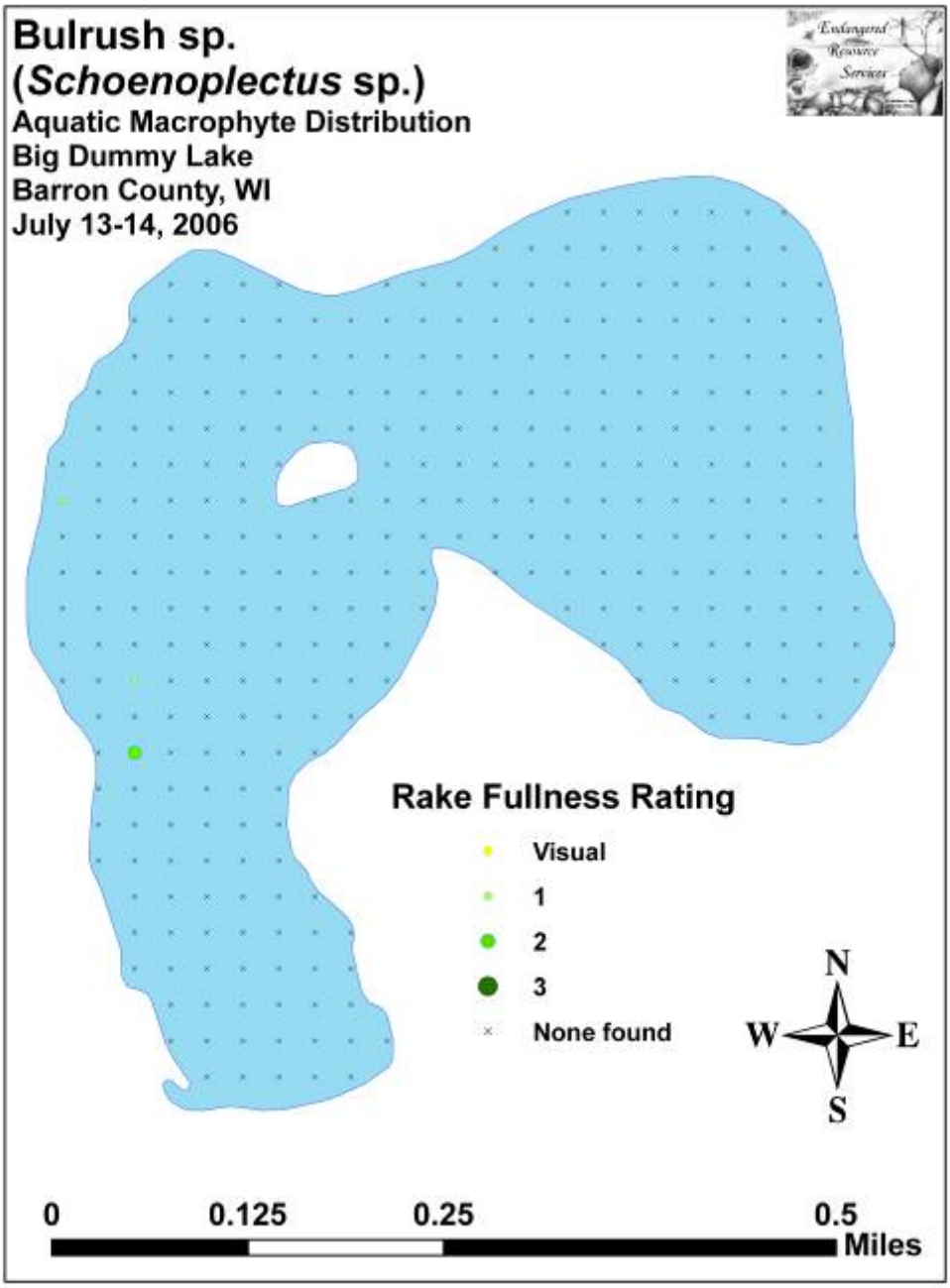
Miles


Bulrush sp.
(Schoenoplectus sp.)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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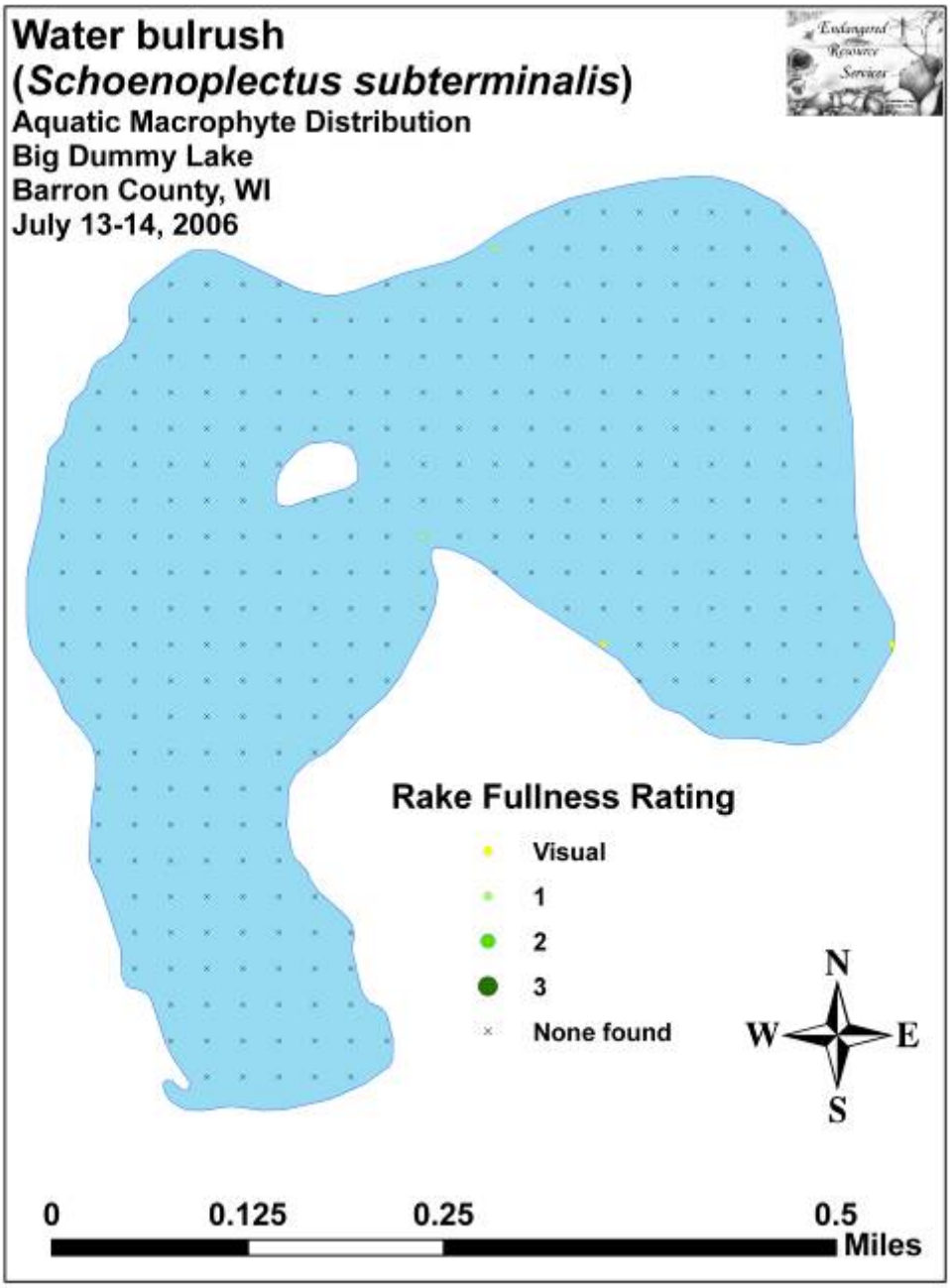
Miles


Water bulrush
(Schoenoplectus subterminalis)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
N
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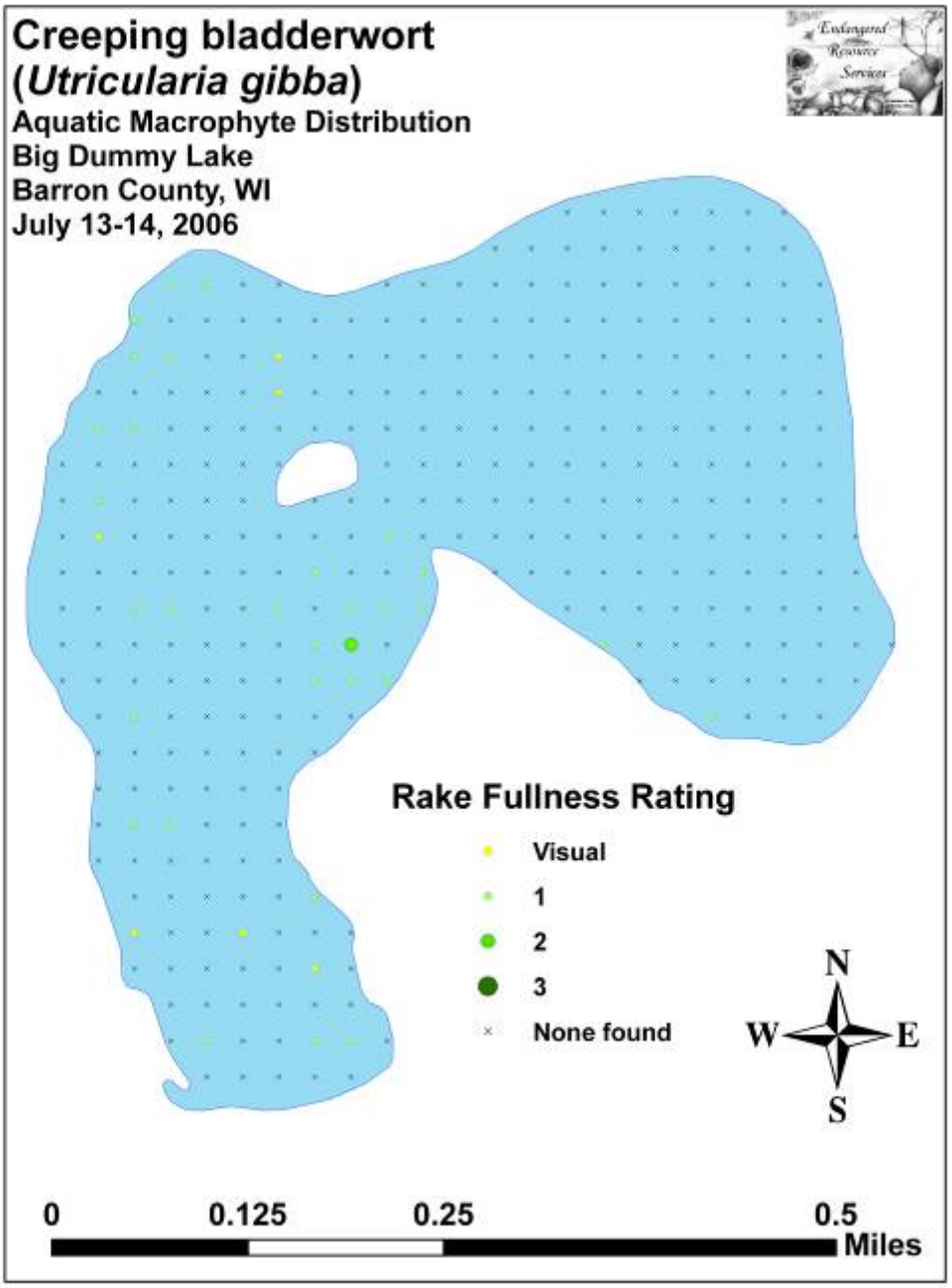
Miles


Creeping bladderwort
(Utricularia gibba)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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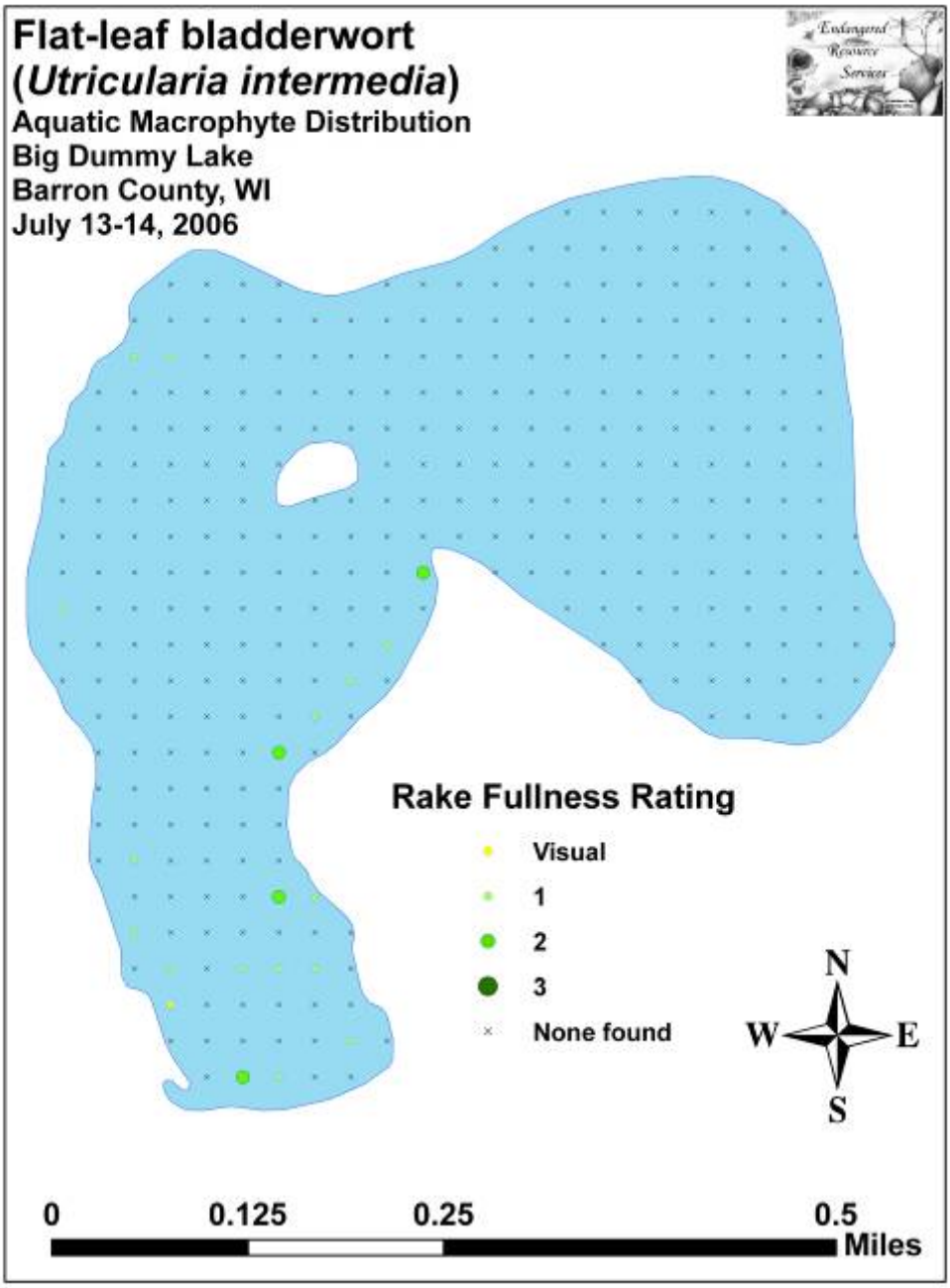
Miles


Flat-leaf bladderwort
(Utricularia intermedia)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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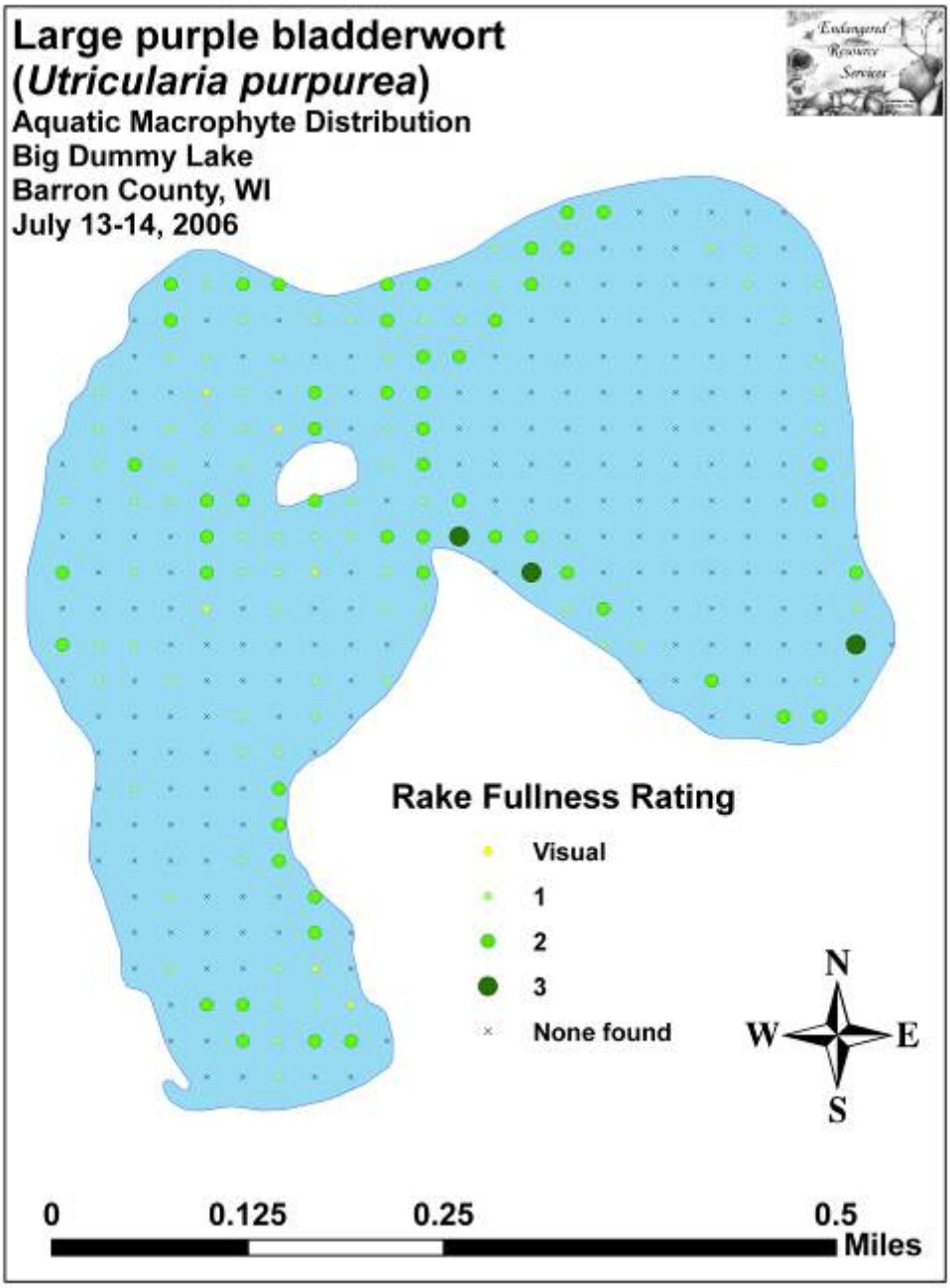
Miles


Large purple bladderwort
(Utricularia purpurea)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
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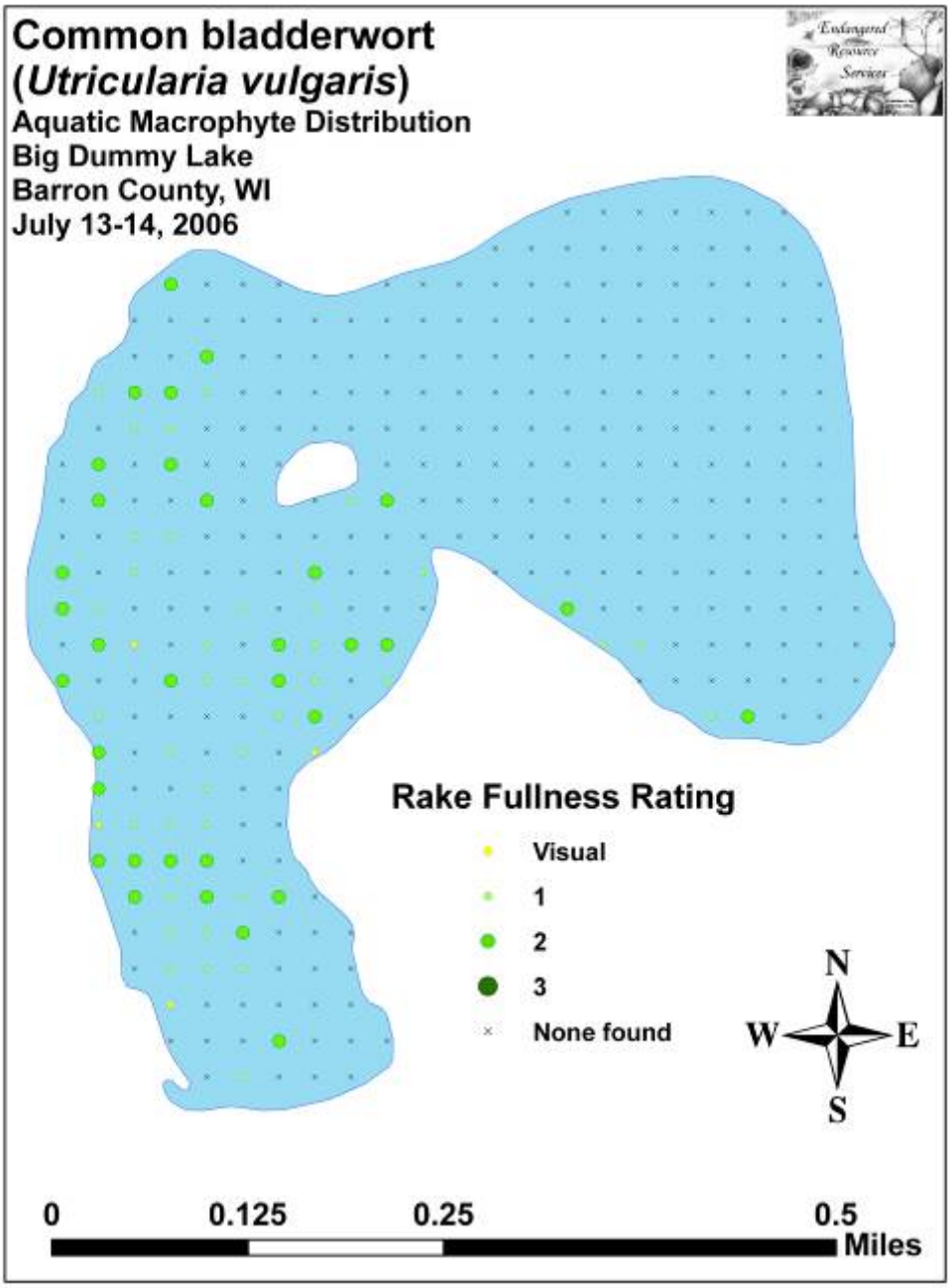
Miles


Common bladderwort
(Utricularia vulgaris)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
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None found
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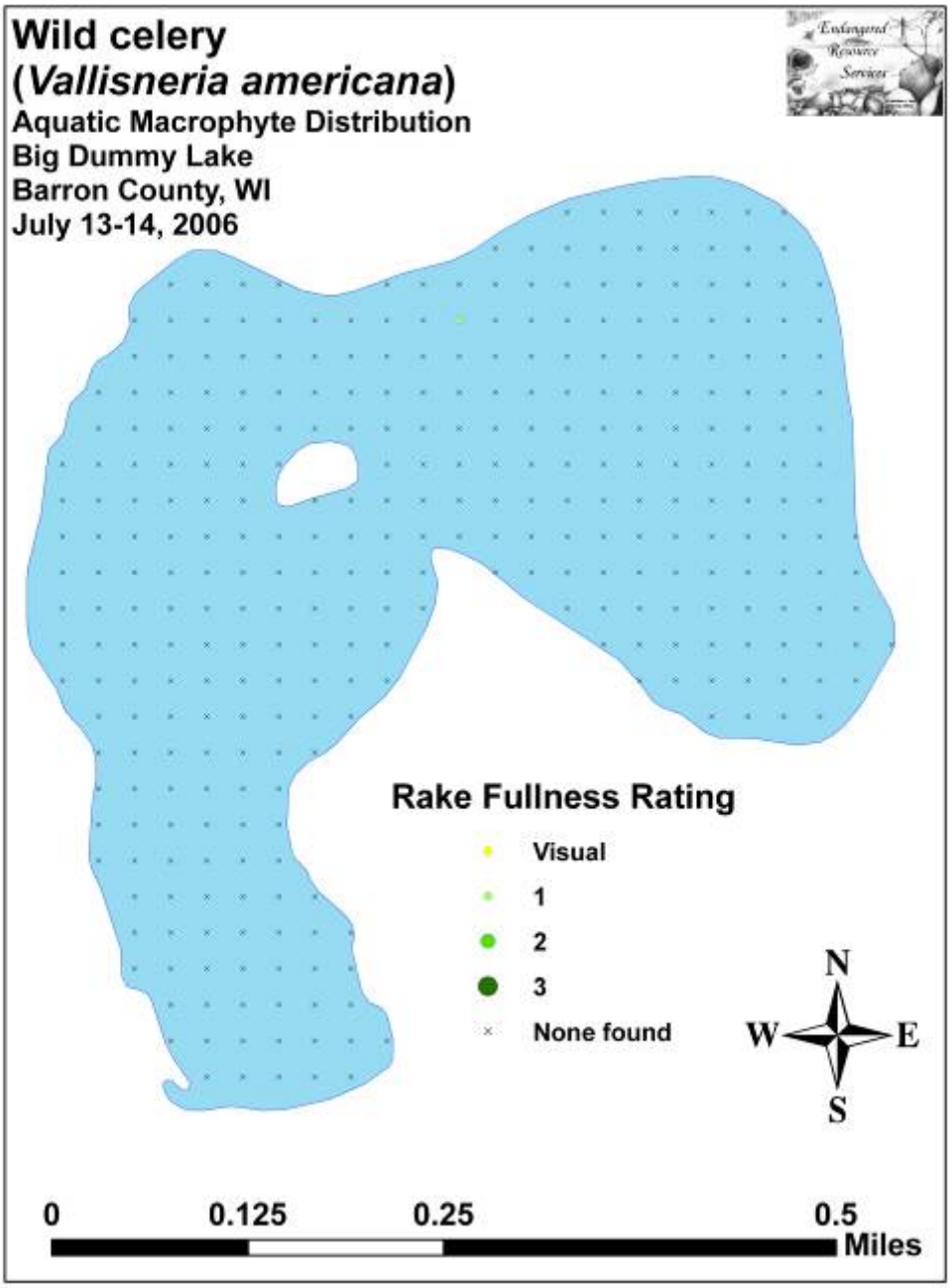
Miles


Wild celery
(Vallisneria americana)
Aquatic Macrophyte Distribution
Big Dummy Lake
Barron County, WI
July 13-14, 2006
Rake Fullness Rating
Visual
1
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None found
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Miles

VIII: Glossary of Biological Terms (Adapted from UWEX 2008)

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 IX: Aquatic Exotic Invasive Species Information

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, 2008 http://www.dnr.state.wi.us/invasives/fact/curlyleaf_pondweed.htm)

Eurasian water milfoil

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

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

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

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

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

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms of infested lakes. (Taken in its entirety from WDNR, 2008 http://www.dnr.state.wi.us/invasives/fact/milfoil.htm)

Reed canary grass

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

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

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

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

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

LIFE HISTORY AND EFFECTS OF INVASION: Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-July. 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, 2008 http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm)

Purple loosestrife

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 July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

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

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

Distribution and Habitat: Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to

reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

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

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

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

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

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

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2008 http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm)

Appendix X: Little Dummy Lake Raw Data Spreadsheets