Full Summer Point-Intercept Aquatic Macrophyte Survey
Bass Lake (WBIC: 1833100)
Barron County, Wisconsin

Watershield and Purple bladderwort (Berg 2012)

Project Initiated by: Red Cedar Lakes Association, Wisconsin Department of Natural Resources, and Lake Education and Planning Services, LLC.

White water lily (Berg 2012)

Surveys Conducted by and Report Prepared by:
[1]Dave Blumer, [1]Megan Mader, [1]Savannah Yunkers, [2]Tom Goodwin, [3]Matthew Berg
[1]Lake Education and Planning Services, LLC
[2]Red Cedar Lakes Association
[3]Endangered Resource Services, LLC: Credit for template of this report
August 25, 2020

TABLE OF CONTENTS

ABSTRACT

Bass Lake (WBIC: 1833100) is a 20-acre mesotrophic seepage lake in northeast Barron County, Wisconsin. The lake's average depth is 13ft, and the bottom substrate is predominantly organic muck. The lake's water is fairly clear with Secchi values averaging 11.5 ft in 2019, and a littoral zone that extended to 25.0 ft in 2020. The Red Cedar Lakes Association, Lake Education and Planning Services, LLC, and the Wisconsin Department of Natural Resources authorized a warm water, full point intercept macrophyte survey in 2020. The August survey found no evidence of Curly Leaf Pondweed (CLP; *Potomogeton crispus*) or Eurasian Watermilfoil (EWM; *Myriophyllum spicatum*) – two common invasive macrophyte species – in the lake. The survey found 19 species of macrophytes in and around the lake at 88 of the 138 total survey points and produced a Simpson Diversity Index Value of 0.88. Plant growth was high with an average total rake fullness of 2.47. Slender waterweed (*Elodea nuttallii*), Coontail (*Ceratophyllum demersum*), Watershield (*Brasenia schreberi*), and Small Pondweed (*Potamogeton pusillus*) were the most common species, and they were found at 60.23%, 59.09%, 48.86%, and 42.05% of survey points with vegetation, respectively. Collectively, they accounted for 59.40% of the total relative frequency. A total of 14 native index species produced a mean Coefficient of Conservatism of 5.9 and a Floristic Quality Index of 22.2. Reed canary grass (*Phalaris arundinacea*) was the only exotic species found, and it was visually observed at one site. Future management considerations should include preserving and protecting Bass Lake's plant community and relatively low nutrient levels.

LIST OF FIGURES

LIST OF TABLES

Page #

INTRODUCTION:

Bass Lake (WBIC: 1833100) is a 20 acre seepage lake in northeastern Barron County, Wisconsin in the Town of Cedar Lake (T36N R10W S2). It reaches a maximum depth of 39ft in the approximate middle of the lake and has an average depth of 13ft (WDNR 2012). The lake is mesotrophic with Secchi readings from summer 2019 averaging 11.5ft (WDNR 2012). Bass Lake's tannic, stained water produced a littoral zone that extended to 25.0ft during the August 2020 survey. The bottom substrate is predominately muck (Figure 1).

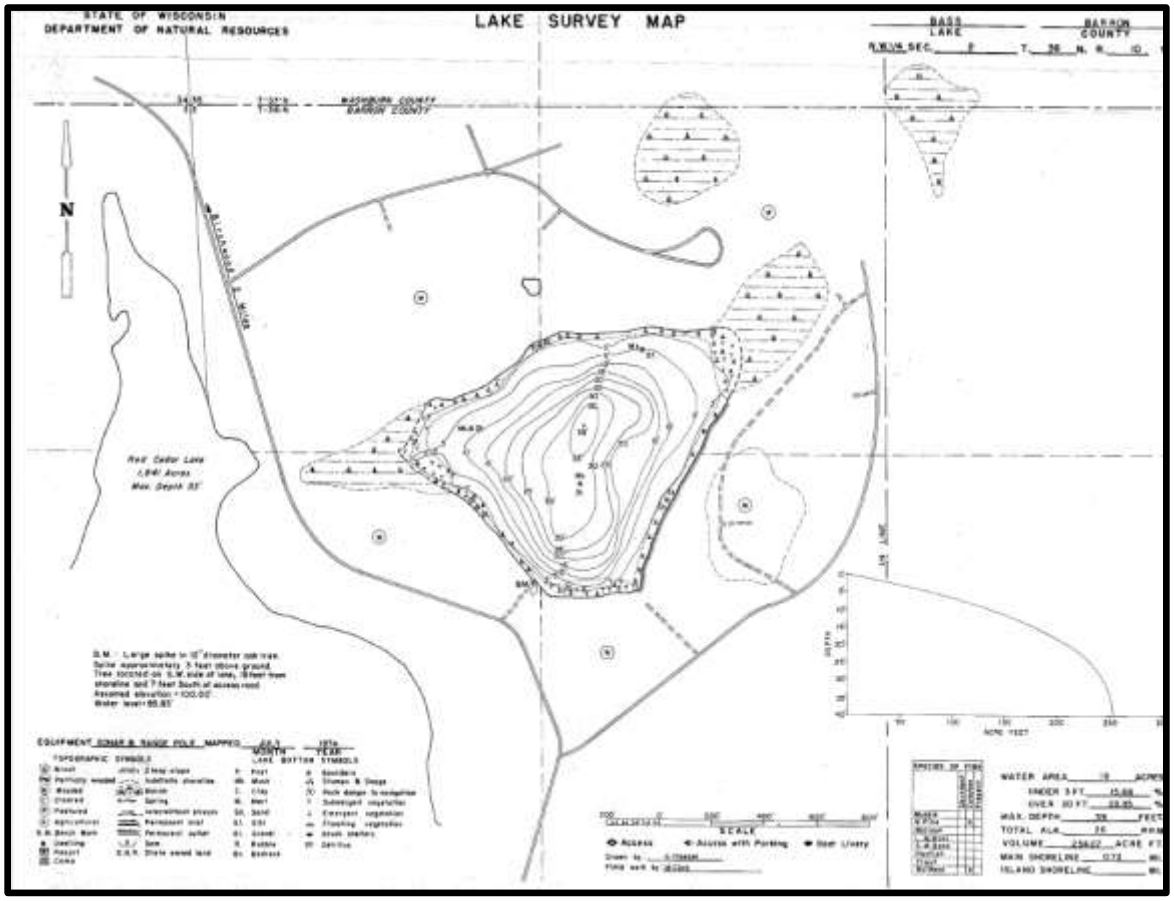


Figure 1: Bass Lake Bathymetric Map

The Red Cedar Lakes Association (RDLA), Lake Education and Planning Services, LLC (LEAPS), and the Wisconsin Department of Natural Resources (WDNR) authorized a full lake plant survey on Bass Lake. On August 25th, we completed a warm water survey of all aquatic macrophytes. This survey used the WDNR's statewide guidelines for conducting systematic point-intercept macrophyte sampling. These methods ensure that all surveys in the state will be conducted in the same manner, thus allowing data to be compared across time and space. The immediate goals of the survey were to document the plant community and establish data on the richness, diversity, abundance, and distribution of the lake's native aquatic plant populations. These data provide a baseline for future long-term monitoring of the lake's macrophyte community, as well to measure any impacts on the lake's plants if active management were to occur.

METHODS:

Warm Water Full Point-Intercept Macrophyte Survey:

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth and total acreage, Jennifer Hauxwell (WDNR) generated a 139 point sampling grid for Bass Lake (Appendix I). Using this grid, we completed a survey where we sampled macrophytes at each point on the grid. We located each survey point using a handheld mapping GPS unit (Garmin 78CSx) and used a rake to sample an approximate 2.5ft section of the bottom. All plants on the rake, as well as any that were dislodged by the rake, were identified and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of all plants within six feet of the sample point not found in the rake. In addition to a rake rating for each species, a total rake fullness rating was also noted. Substrate (lake bottom) type was assigned at each site where the bottom was visible or could be reliably determined using the rake.

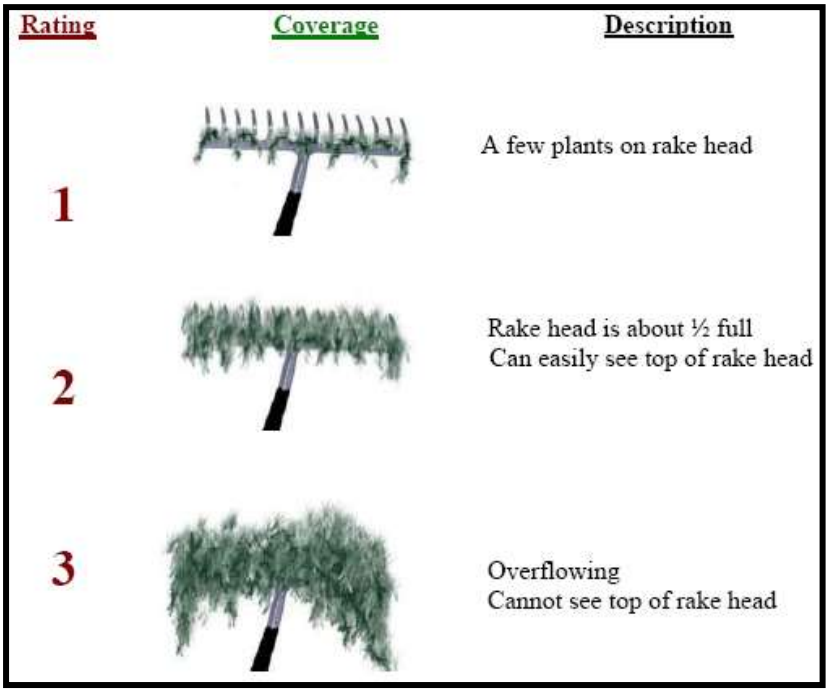


Figure 2: Rake Fullness Ratings (UWEX, 2010)

All plants found were identified to species (Voss 1996, Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006; Skawinski 2011), and one voucher sample was pressed and mounted to be sent to the state herbarium in Stevens Point for identification confirmation.

DATA ANALYSIS:

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

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

Total number of sites with vegetation: These included all sites where vegetation was found 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, this value is used 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 occurrences within the littoral zone. It can also be reported as a percentage of occurrences at sample points with vegetation.

Frequency of occurrence example:

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

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

From these frequencies, we can estimate how common each species was at depths where plants were able to grow, and at points where plants actually were growing. Note the second value will be greater as not all the points (in this example, only ½) had plants growing at them.

Simpson's Diversity Index: A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's Diversity Index, the index value represents the probability that two 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.

Average number of species per site: This value is reported using four different considerations. 1) **shallower than the maximum depth of plants** indicates the average number of plant species at all sites in the littoral zone. 2) **vegetative sites only** indicate the average number of plants at all sites where plants were found. 3) **native species shallower than the 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 additional species seen at a point but not found in the rake, and additional species that were only found during the initial boat survey or between survey points.

Note: Per WDNR protocol, filamentous algae, freshwater sponges, aquatic moss and the aquatic liverworts *Riccia fluitans* and *Ricciocarpus natans* are excluded from these totals.

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 (Table 1).

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

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 an area's aquatic plants. The 124 species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the point intercept survey, and multiplying it by the square root of the total number of plant species (N) in the lake ($FQI=(\Sigma(c1+c2+c3+\ldots cn)/N)*\sqrt{N}$). Statistically speaking, the higher the index value, the healthier the lake's macrophyte community is assumed to be. Nichols (1999) identified four ecoregions 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. Bass Lake is in the Northern Central Harwood Forests Ecoregion (Table 3).

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

RESULTS:

Warm Water Full Point-Intercept Macrophyte Survey:

Depth soundings taken at Bass Lake's 139 survey points revealed a bowl-shaped basin with shallow shorelines and steadily increasing depth until reaching the middle of the lake. The bays on the east and west end of the lake were not sampleable because they were very shallow and/or not inundated. The central basin reached a maximum depth of 40 feet (Figure 3).

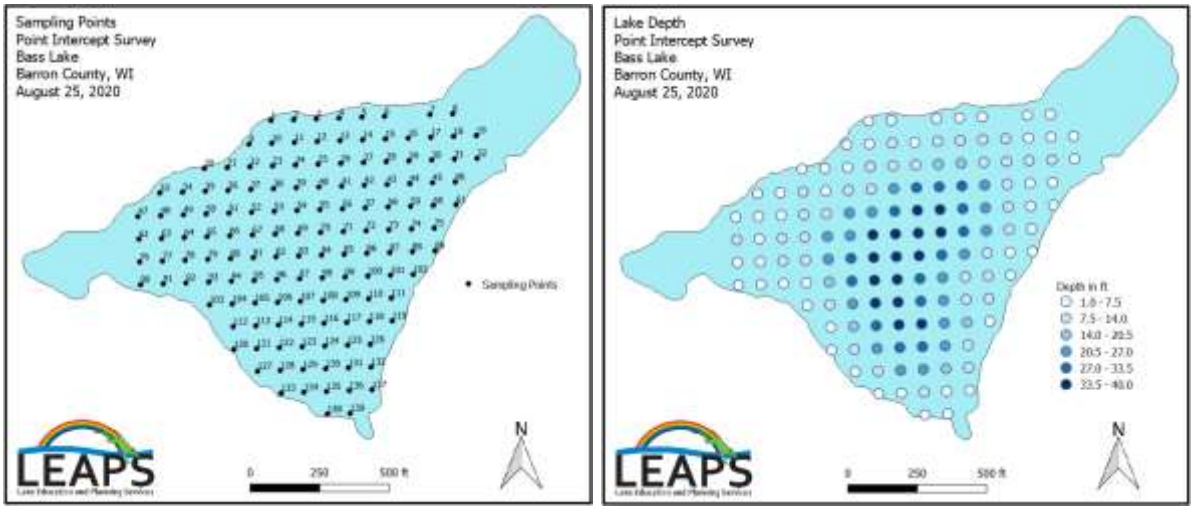


Figure 3: Survey Points and Lake Depth

Every point in the survey was identified as having muck substrate, and no other substrate textures were recorded (Figure 4).

At the time of the survey, Secchi disc readings were in the 11.5ft range. The high water clarity produced a littoral zone that extended to 25.0ft, but the majority of plants were found in water <12ft deep (Figure 4). The mean depth of sites with plants was 7.8ft, and the median depths of plants was 7.0 (Table 1). Plants were fairly uniform in distribution as 63.8% of the total lake bottom and 86.7% of the littoral zone were colonized. Total diversity was high with a Simpson Index Value of 0.88. Species richness was typical for a small lake with only 15 species observed on the rake, and including visual surveys, the total richness was 19.

Lake wide, 42 of the 91 sites with vegetation had four or more native species present in the rake – 2.17 on average. Overall, plant density was high with a mean rake fullness of 2.47 at sites with vegetation (Figure 5) (Appendix VI).

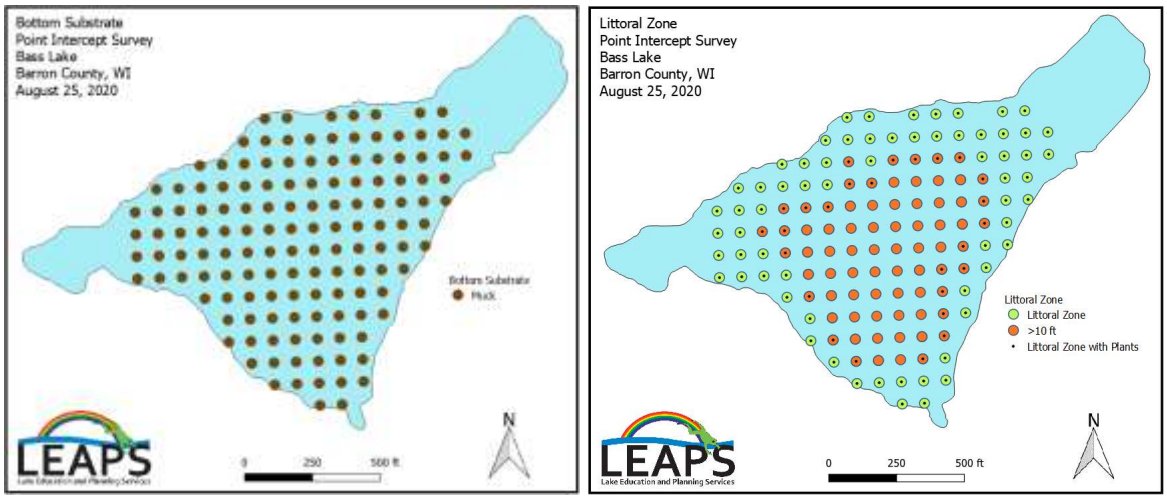


Figure 4: Lake Substrate and Littoral Zone

Table 1: Aquatic Macrophyte PI Survey Summary Statistics
Bass Lake, Barron County
August 25, 2020

Summary Statistics:

Total number of points sampled	138
Total number of sites with vegetation	88
Total number of sites shallower than the maximum depth of plants	105
Frequency of occurrence at sites shallower than maximum depth of plants	83.81
Simpson Diversity Index	0.88
Maximum depth of plants (ft)	25.0
Mean depth of plants (ft)	7.8
Median depth of plants (ft)	7.0
Average number of all species per site (shallower than max depth)	2.97
Average number of all species per site (veg. sites only)	3.55
Average number of native species per site (shallower than max depth)	2.97
Average number of native species per site (veg. sites only)	3.55
Species richness	15
Species richness (including visuals)	19
Mean total rake fullness (veg. sites only)	2.47

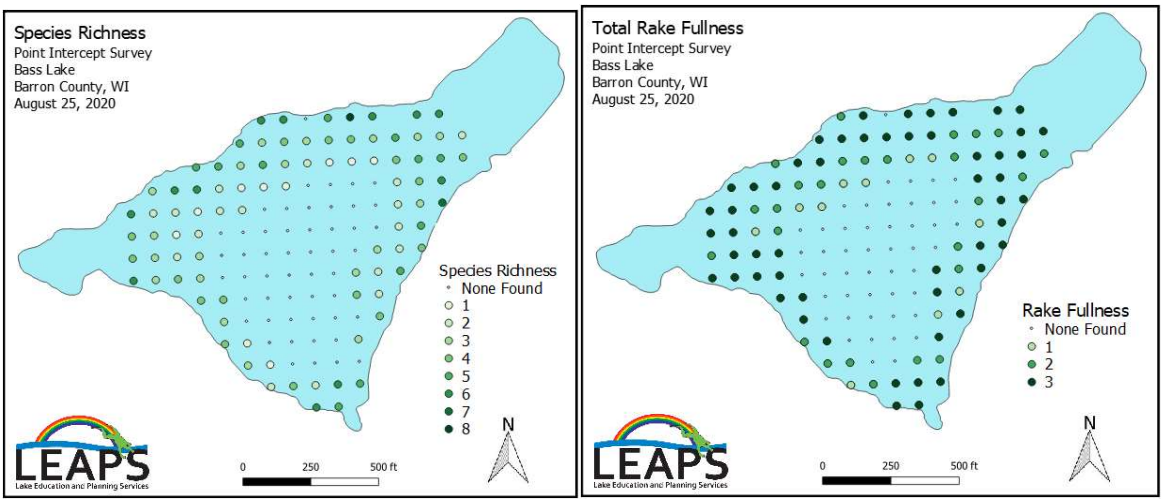


Figure 5: Native Species Richness and Total Rake Fullness Rating

Bass Lake is home to an abundant plant community that is characterized by species typical of soft water lakes with mucky substrate. This community can be subdivided into four distinct zones (emergent, shallow submergent, floating-leaf, and deep submergent), with each zone having its own characteristic functions in the lake ecosystem. Depending on the local bottom type (sand, rock, sandy muck, or nutrient rich organic muck), these zones often had somewhat different species present.

In shallow areas, beds of emergent plants prevent erosion by stabilizing the lakeshore, break up wave action, provide a nursery for baitfish and juvenile gamefish, offer shelter for amphibians, and give waterfowl and predatory wading birds like herons a place to hunt. These areas also provide important habitat for insects like dragonflies and mayflies. The emergent plant community was mainly comprised of Bottle brush sedge (*Carex comosa*) and Three-way sedge (*Dulichium arundinaceum*), but Arrowhead (*Sagittaria* sp.), Common Bur-reed (*Sparganium eurycarpum*), Cattail (*Typha* sp.) were observed as well.

In less than 5 feet of water, floating leaf species like Watershield (*Brasenia schreberi*), White-water lily (*Nymphaea odorata*), Spatterdock (*Nuphar variegata*), and Floating-leaf pondweed (*Potamogeton natans*) were commonly found in mucky, shallow regions of the lake. These plants provide habitat for the lake's fish community and help stabilize the substrate. Among these species, we found Common bladderwort (*Utricularia vulgaris*) which captures prey for nutrients rather than drawing them through its roots like other plants.

Floating-leaf and shallow submergent species generally disappeared on Bass Lake in water over 5ft deep. Beyond this, Small pondweed, Large-leaf pondweed, and Water celery were generally the only rooted plants found. Large-leaf pondweed (*Potamogeton amplifolius*), Coontail (*Ceratophyllum demersum*), Muskgrass (*Chara* sp.), Slender waterweed (*Elodea nutallii*), Northern naiad (*Najas gracillima*), Large-leaf pondweed (*Potamogeton amplifolius*), Small pondweed (*Potamogeton pusillus*), and Water celery (*Valisneria americana*) made up the submergent zone.

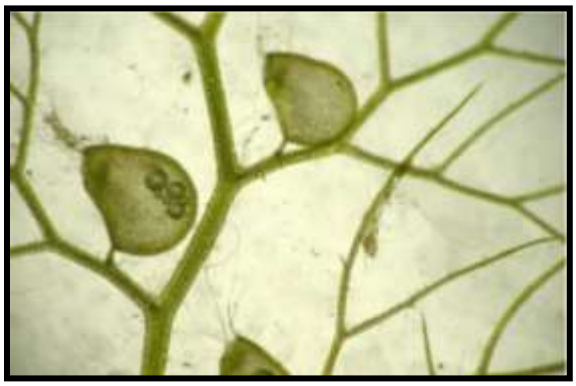
Watershield with gelatinous anti-insect coating (Berg 2012)

Spatterdock and White water lily (Falkner 2009)

Small pondweed (Villa 2011)

Slender waterweed (Fischer 2011)

Common bladderwort flowers among lilypads (Hunt 2010)



Bladders for catching plankton and insect larvae (Wontolla 2007)

When considering the lake as a whole, Slender waterweed, Coontail, Watershield, and Small Pondweed were the most common vascular species, and they were found at 60.23%, 59.09%, 48.86%, and 42.05% of survey points with vegetation respectively (Table 2). Collectively, they accounted for 59.29% of the total relative frequency (Figure 6). (Species accounts and distribution maps for all plants found are located in Appendixes VI and VII).

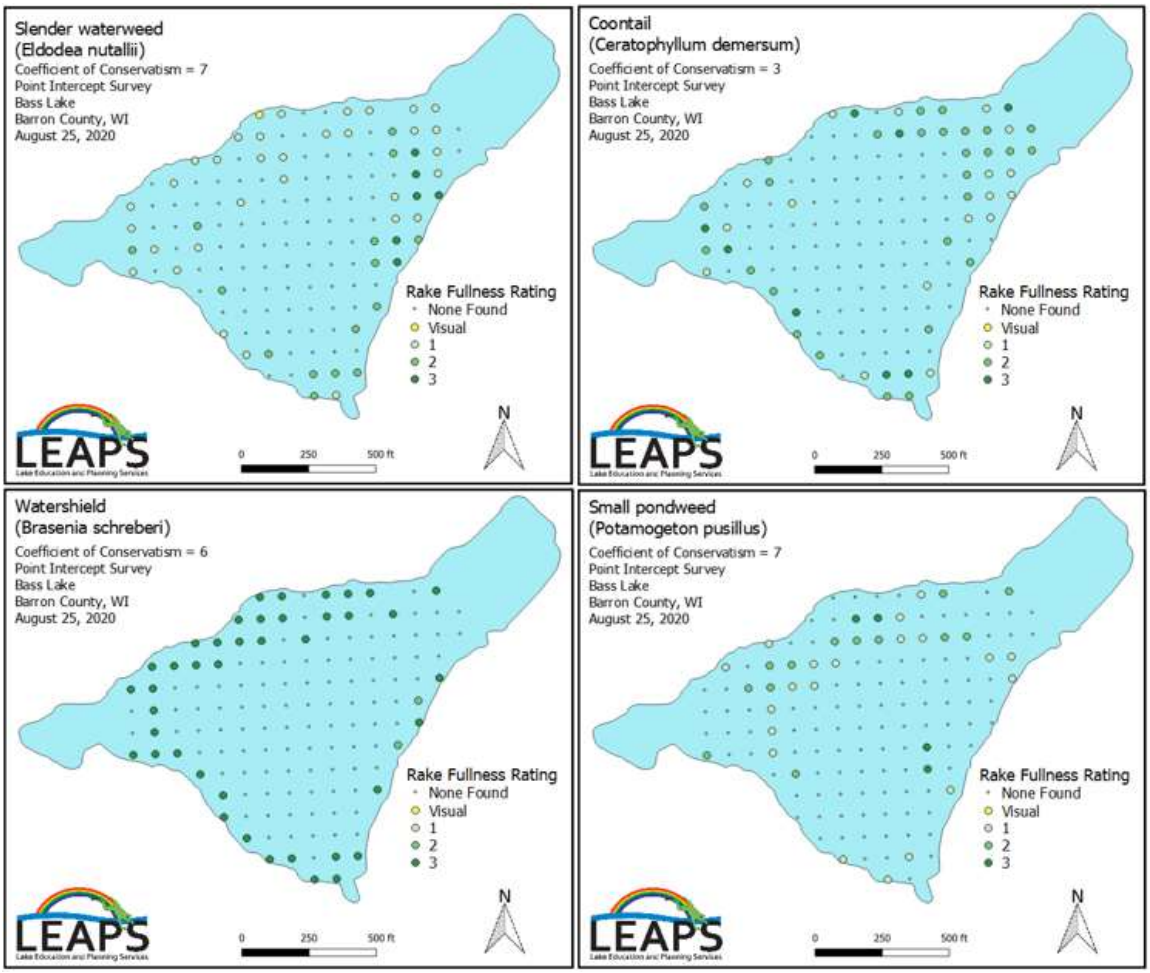


Figure 6: Bass Lake's Most Common Vascular Species in August, 2020

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Bass Lake, Barron County
August 25, 2020

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Elodea nuttallii	Slender waterweed	53	16.98	60.23	50.48	1.51	1
Ceratophyllum demersum	Coontail	52	16.67	59.09	49.52	1.83	0
Brasenia schreberi	Watershield	43	13.78	48.86	40.95	2.95	0
Potamogeton pusillus	Small pondweed	37	11.86	42.05	35.24	1.57	0
Nymphaea odorata	White water lily	32	10.25	36.36	30.48	2.91	0
Potamogeton amplifolius	Large-leaf pondweed	25	8.01	28.41	23.81	1.56	5
Nuphar variegata	Spatterdock	21	6.73	23.86	20	1.57	0
Chara sp.	Muskgrasses	17	5.45	19.31	16.19	1.59	0
Sagittaria sp.	Arrowhead	14	4.49	15.91	13.33	1.5	0
Vallisneria americana	Wild celery	7	2.2	7.95	6.67	1.14	0
Najas gracillima	Northern naiad	6	1.92	6.82	5.71	1.33	0
Utricularia vulgaris	Common bladderwort	2	0.64	2.27	1.9	1	0
Filamentous algae	Filamentous algae	2	*	2.27	1.9	1.5	44
Carex comosa	Bottle brush sedge	1	0.32	1.14	0.95	1	6
Lemna minor	Small duckweed	1	0.32	1.14	0.95	1	0
Potamogeton natans	Floating-leaf pondweed	1	0.32	1.14	0.95	1	2
Freshwater sponge	Freshwater sponge	1	*	1.13	0.95	1	0
**Dulichium arundinaceum*	Three-way sedge	**	**	**	**	**	2
**Phalaris arundinacea*	Reed canary grass	**	**	**	**	**	1
**Sparganium eurycarpum*	Common bur-reed	**	**	**	**	**	1
**Typha sp.*	Cattail	**	**	**	**	**	1

* not included in relative frequency calculations

** visual sightings only

Table 3: Floristic Quality Index of Aquatic Macrophytes
Bass Lake, Barron County
August 25, 2020

Species	Common Name	C
Brasenia schreberi	Watershield	6
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrasses	7
Elodea nuttallii	Slender waterweed	7
Lemna minor	Small duckweed	4
Najas gracillima	Northern naiad	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton pusillus	Small pondweed	7
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
	N	14
	Mean C	5.93
	FQI	22.18

We identified a total of 14 **native index species** in the rake during the point intercept survey. They produced a mean Coefficient of Conservatism of 5.93 and a Floristic Quality Index of 22.18 (Table 3). Nichols (1999) reported an average Mean C for the Northern Central Hardwood Forests Region of 5.6 putting Bass Lake just above average for this part of the state. The FQI was also approximately the median FQI of 20.9 for the Northern Central Hardwood Forests Region (Nichols 1999).

Exotic Species:

We did NOT find any evidence of Eurasian water milfoil or Curly-leaf pondweed in Bass Lake during our survey. However, Reed canary grass (*Phalaris arundinacea*), another exotic invasive species was visually observed (Figure 7). (For more information on aquatic exotic invasive plant species, see Appendix VIII).

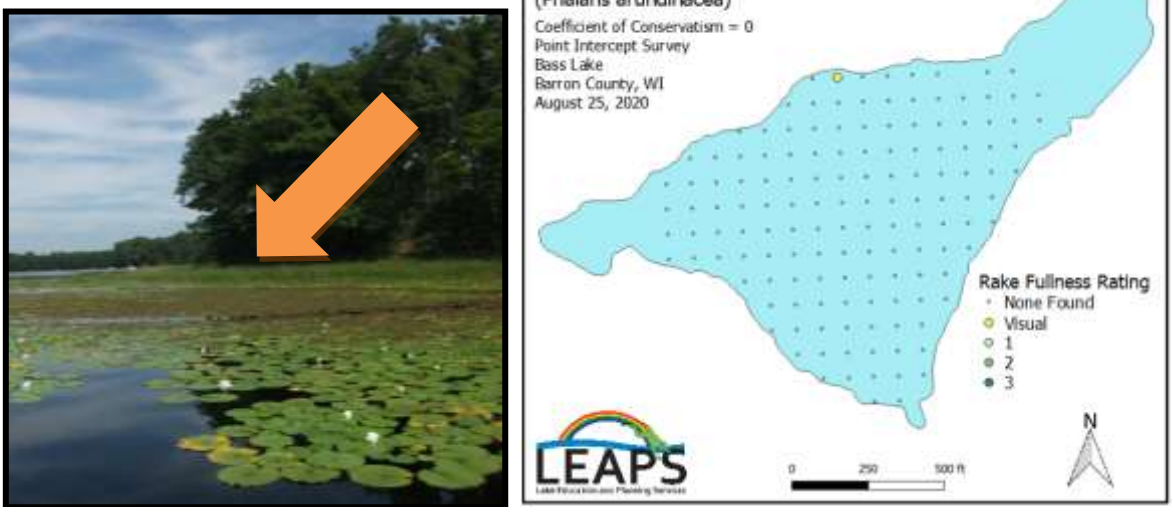


Figure 7: Reed Canary Grass and Distribution in Bass Lake August, 2020

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Uniqueness of the Lake's Native Plant Community:

Aquatic plants are the basis of a lake's ecosystem and are as important to the aquatic environment as trees are to a forest. They provide habitat for fish and other aquatic organisms, serve as food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve clarity by absorbing excess nutrients from the water. For these reasons, maintaining this community is critical to maintaining a healthy lake. Bass Lake's plant community was common of those found in mucky lakes with soft water, and there was only one visual identification of an invasive species. Because of this, the major recommendation for Bass Lake is to continue monitoring into the future to allow for better management and higher chance of success at removing aquatic invasive species should they arrive in Bass Lake. Continued monitoring will also provide important information on the state of the lake should future management plans be implemented.

Aquatic Invasive Species Prevention:

Aquatic Invasive Species (AIS) such as Eurasian water milfoil are an increasing problem in the lakes of northern Wisconsin in general, and several nearby lakes in the near vicinity have it. Preventing their introduction into Bass Lake with proactive measures is strongly encouraged. Improving the current signage at the boat landing to something that is brighter and less easily ignored is also encouraged. High quality signage that is engaging and attention provides education, reeducation, and continual reminders of the dangers/impacts of aquatic invasive species to lake owners and visitors alike.

Management Considerations Summary:

- Preserve Bass Lake's plant communities as they serve as the basis of the entire aquatic ecosystem.
- Encourage all property owners to help limit plant growth and maintain or improve water clarity and quality by identifying and then reducing potential sources of nutrient input near the lakeshore.
- Specifically, avoid mowing down to the lake shore, bag grass clippings, dispose of pet waste and fire pit ashes away from the lake, and avoid fertilizing near the lake.
- Reduce erosion by restoring shorelines, building rain gardens and maintaining native vegetation buffer strips along the lakeshore.
- Avoid beaching watercraft and shallow water motor start-ups as these practices release nutrients into the water column and promote algal blooms.
- Consider transect monitoring for invasive species at the lake's boat landing at least once a month and a meandering shoreline survey of the entire lake at least once during the summer growing season.
- Include a planned response to new AIS in the updated Aquatic Plant Management Plan that would outline a course of action if EWM or some other invasive species is introduced into the lake.

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.

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.

Skawinski, Paul. 2011. Aquatic Plants of the Upper Midwest: A photographic field guide to our underwater forests. Wausau, WI.

UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-C.xls (2021, April).

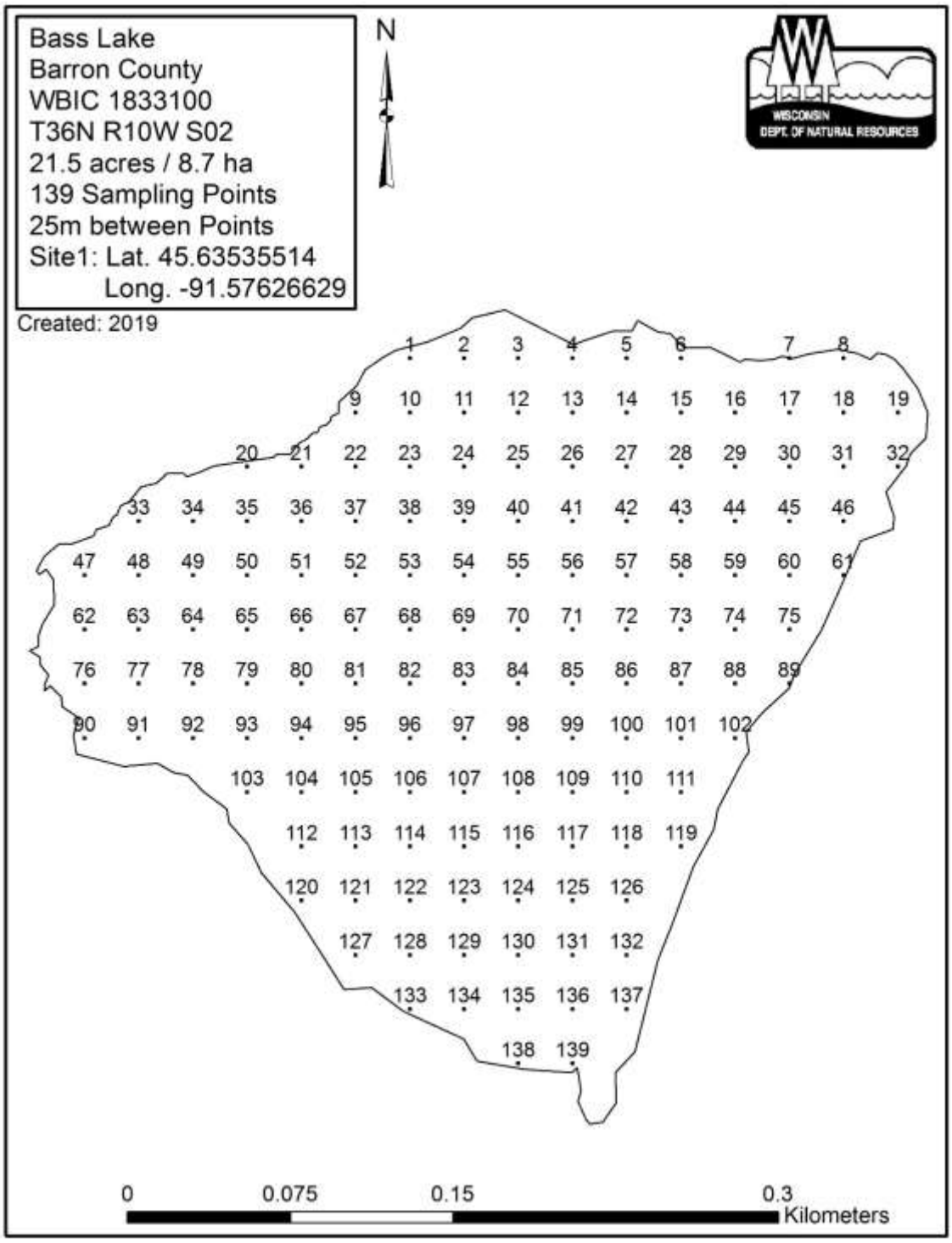
Voss, Edward G. 1996. Michigan Flora Vol I-III. Cranbrook Institute of Science and University of Michigan Herbarium.

WDNR. [online]. 1974. Bass Lake Bathymetric Map 608-266-2621. https://dnr.wi.gov/lakes/maps/DNR/1833100a.pdf (2021, April).

WDNR. [online]. 2012. Reed canary grass fact sheet. http://dnr.wi.gov/invasives/fact/reed_canary.htm (2012, April).

WDNR. [online]. 2019. Wisconsin Lake Citizen Monitoring Data for Bass Lake Barron County. Available from https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=1833100&page=waterquality (2021, April).

Appendix I: Bass Lake Survey Sample Points

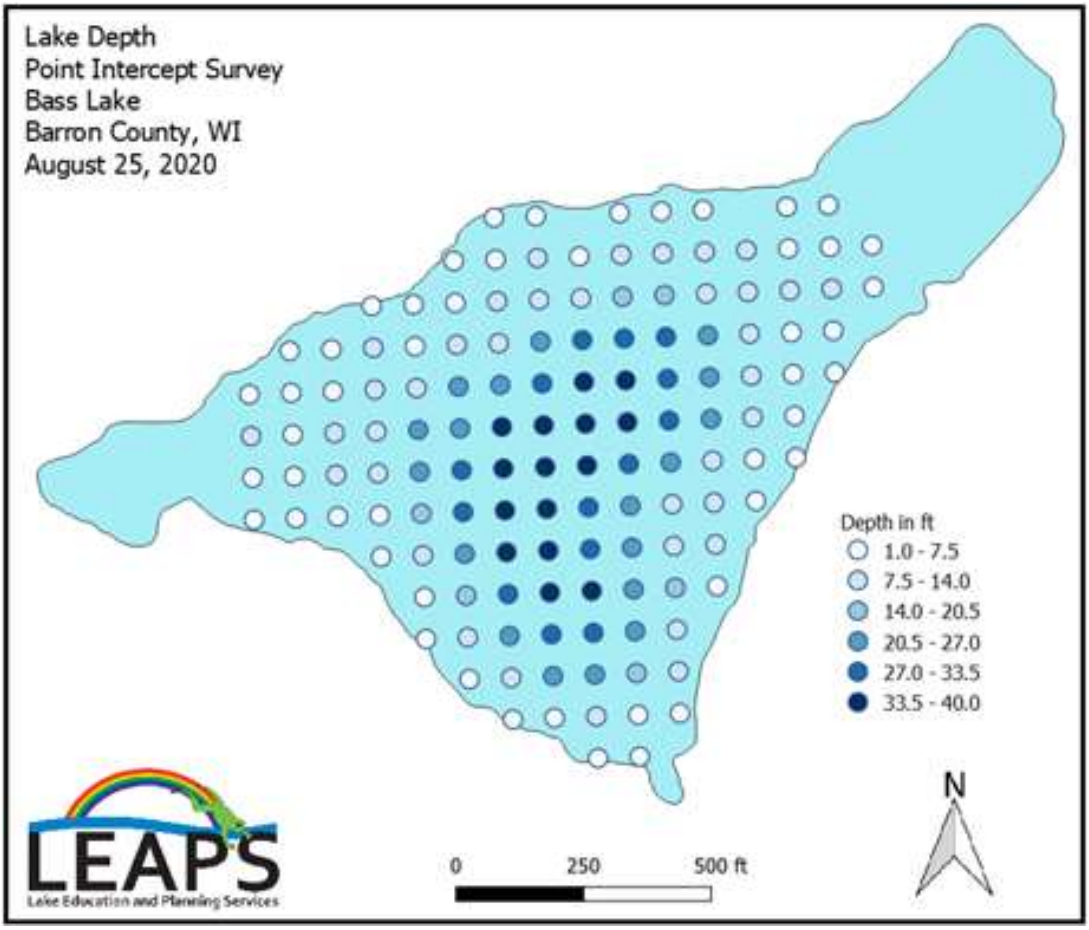

Bass Lake
Barron County
WBIC 1833100
T36N R10W S02
21.5 acres / 8.7 ha
139 Sampling Points
25m between Points
Site1: Lat. 45.63535514
Long. -91.57626629
Created: 2019
N
WISCONSIN
DEPT. OF NATURAL RESOURCES
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46
47 48 49 50 51 52 53 54 55 56 57 58 59 60 61
62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102
103 104 105 106 107 108 109 110 111
112 113 114 115 116 117 118 119
120 121 122 123 124 125 126
127 128 129 130 131 132
133 134 135 136 137
138 139
0 0.075 0.15 0.3
Kilometers

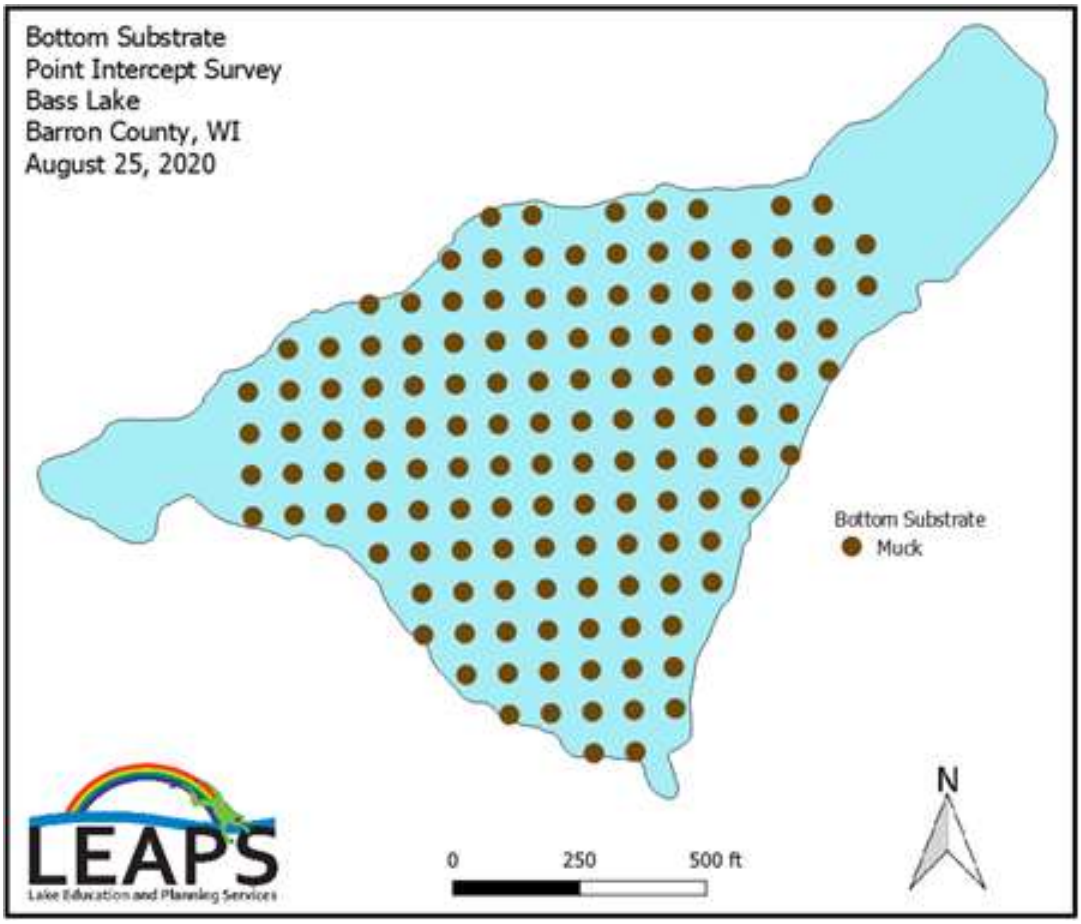
Appendix II: Boat and Vegetative Survey Data Sheets

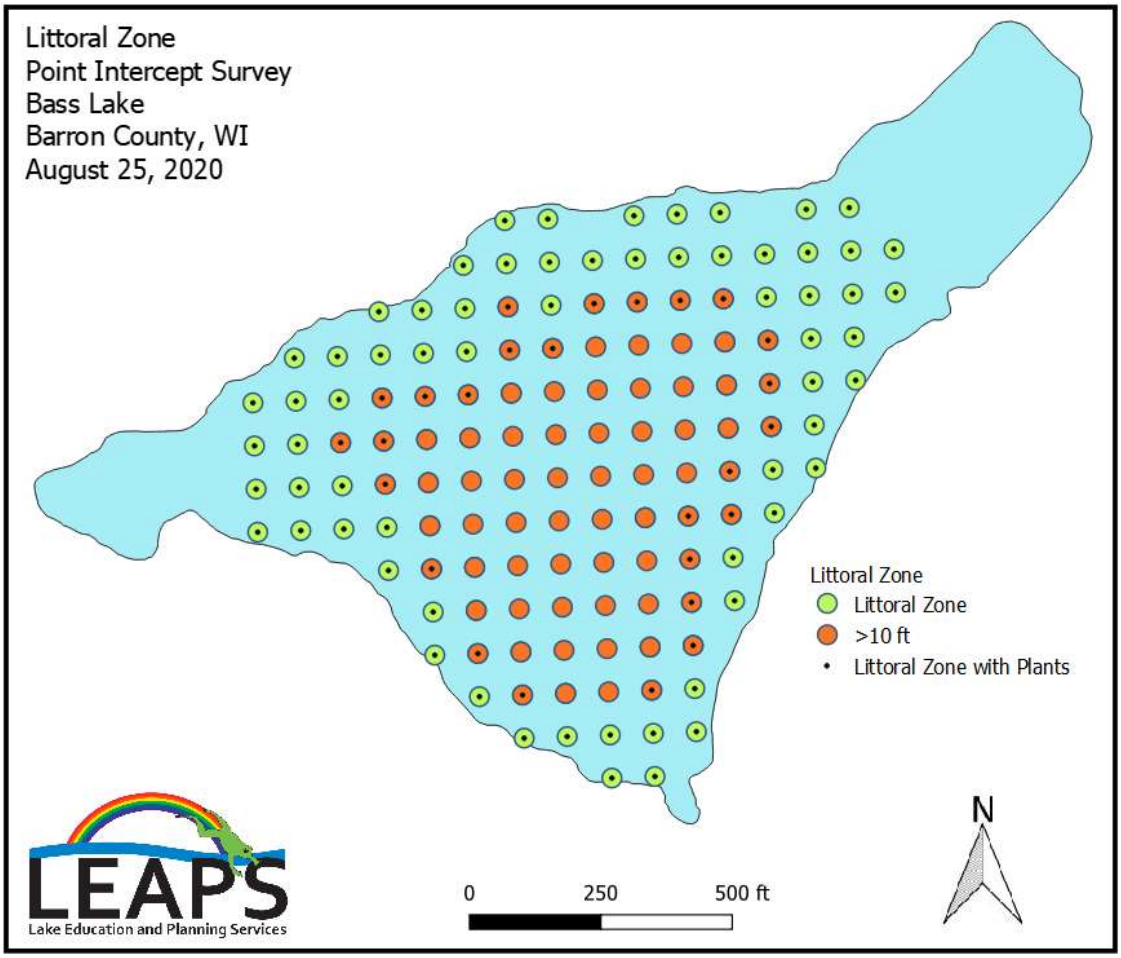
Boat Survey	
Lake Name	
County	
WBIC	
Date of Survey	
(mm/dd/yy)	
workers	
Nearest Point	**Species seen, habitat information**

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

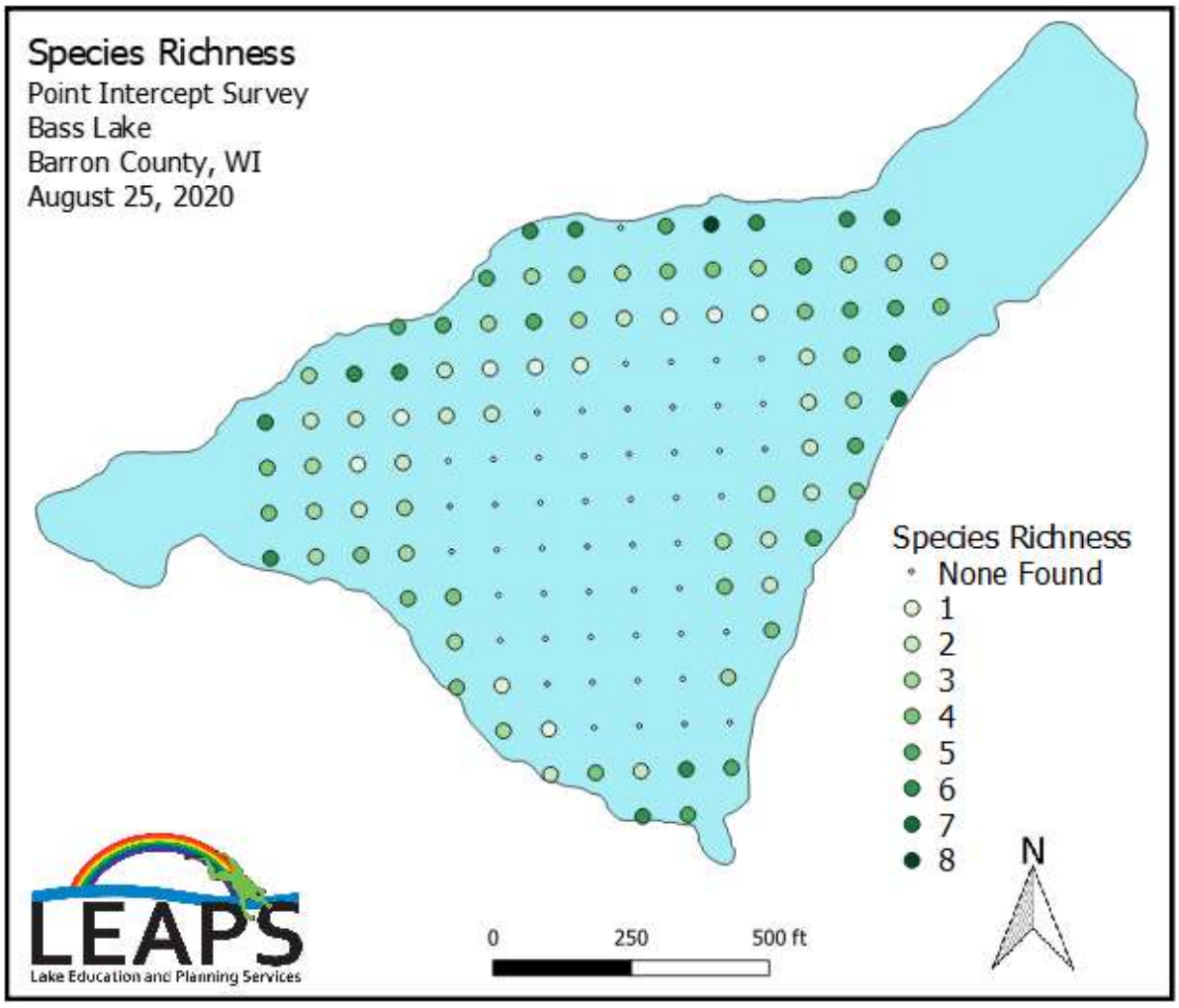
Appendix III: Habitat Variable Maps

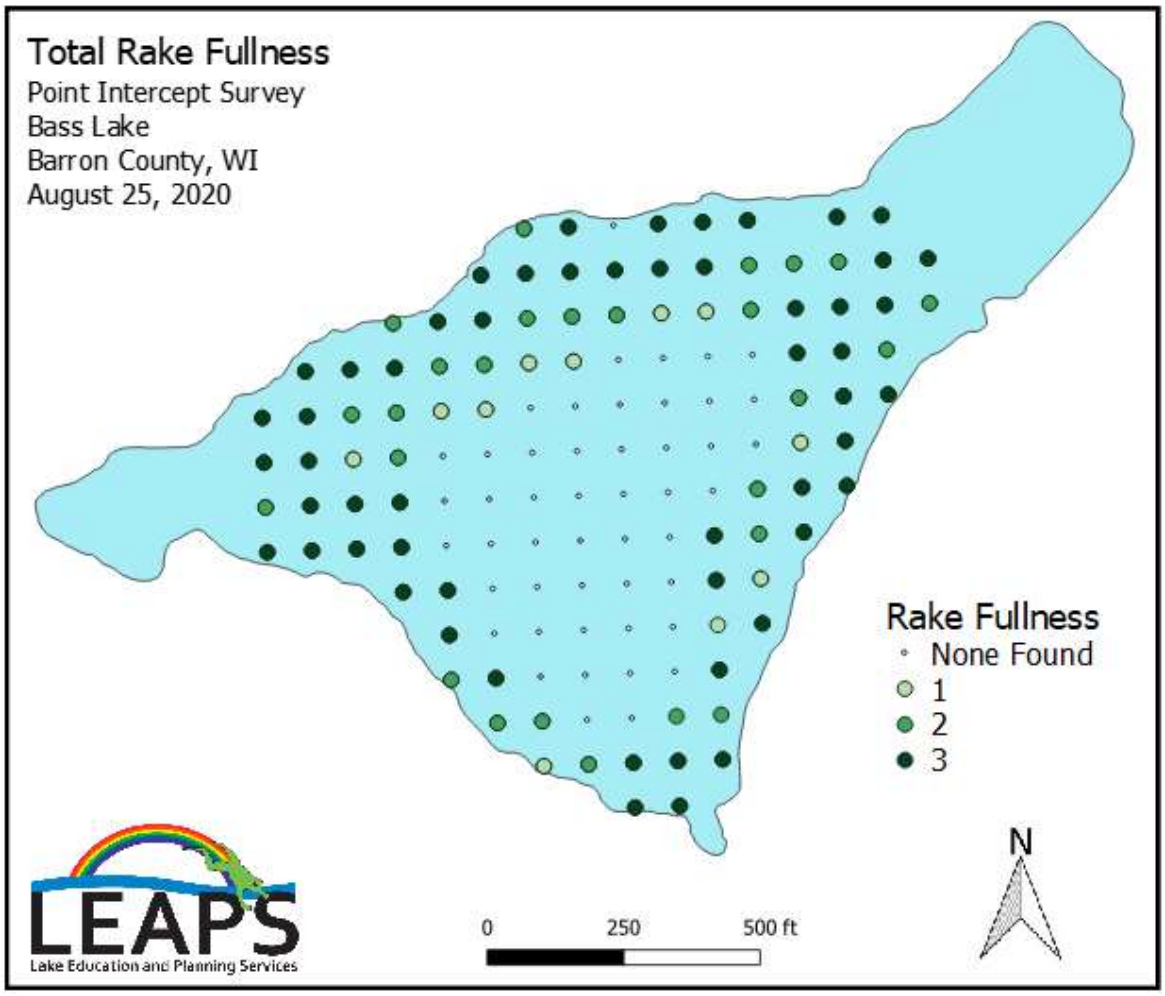

Lake Depth
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Depth in ft
1.0 - 7.5
7.5 - 14.0
14.0 - 20.5
20.5 - 27.0
27.0 - 33.5
33.5 - 40.0
N
0
250
500 ft
LEAPS
Lake Education and Planning Services


Bottom Substrate
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Bottom Substrate
Muck
LEAPS
Lake Education and Planning Services
0
250
500 ft
N


Littoral Zone
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Littoral Zone
Littoral Zone
>10 ft
Littoral Zone with Plants
LEAPS
Lake Education and Planning Services
0
250
500 ft
N

Appendix IV: Native Species Richness and Total Rake Fullness Maps


Species Richness
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Species Richness
None Found
1
2
3
4
5
6
7
8
N
LEAPS
Lake Education and Planning Services
0
250
500 ft


Total Rake Fullness
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness
None Found
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

Appendix V: Bass Lake Plant Species Accounts

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Brasenia schreberi*) **Watershield**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Muck and mucky sand bottom in 0.5-1.5 meters.
Common Associates: (*Ceratophyllum demersum*), (*Elodea nutallii*) Slender waterweed, (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Potamogeton pusillus*)

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Carex comosa*) **Bottle brush sedge**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Muck bottom in 0.5-3 meters.
Common Associates: (*Dulichium arundinaceum*) Three-way sedge

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Ceratophyllum demersum*) **Coontail**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Muck bottom up to 10.5 feet of water.
Common Associates: (*Elodea nutallii*) Slender waterweed, (*Nymphaea odorata*) White water lily

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Chara* sp.) **Muskgrass**
Specimen Location: Bass Lake; 45.63536841, -91.57530436
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Mucky bottom, 3-14 feet of water
Common Associates: (*Ceratophyllum demersum*) Coontail

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Dulichium arundinaceum*) **Three-way sedge**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Located at the edge of the water in mucky and sandy soil. Only observed with visuals.
Common Associates: (*Carex comosa*) Bottle brush sedge, (*Sagittaria* sp.) Arrowhead

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Elodea nutallii*) **Slender waterweed**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Located in 1-12.5 feet of water with mucky bottom
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Nymphaea odorata*) White water lily

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Lemna minor*) **Small duckweed**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer

Habitat/Distribution: Rare; located in 1 foot of water near shore at one sampling point.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Dulichium arundinaceum*) Three-way sedge, (*Nymphaea odorata*) White water lily, (*Sagittaria* sp.) Arrowhead

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Najas gracillima*) **Northern naiad**
Specimen Location: Bass Lake; 45.63379827, -91.57493961
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Found in deeper water, 4-14 feet with mucky bottom.
Common Associates: (*Chara* sp.) Muskgrass, (*Elodea nutallii*) Slender waterweed

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Nuphar variegata*) **Spatterdock**
Specimen Location: Bass Lake; 45.63536841, -91.57530436
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Firm muck bottoms in 1-9 feet of water. Less common than Nymphaea in the lake.
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Nymphaea odorata*) **White water lily**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Muck bottom in 1-9 feet. Plants were abundant in the near shore.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Brasenia schreberi*) Watershield, (*Nuphar variegata*) Spatterdock

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Phalaris arundinacea*) **Reed canary grass**
Specimen Location: Bass Lake; 45.63535956, -91.57594565
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Only observed in one visual.
Common Associates: (*Sagittaria* sp.) Arrowhead, (*Dulichium arundinaceum*) Three-way sedge, (*Sparganium androcladum*), (*Carex comosa*) Bottle brush sedge

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Potamogeton amplifolius*) **Large-leaf pondweed**
Specimen Location: Bass Lake; 45.63538609, -91.5740218
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Mucky bottom areas in water from 1-10 feet deep. Widely distributed.
Common Associates: (*Brasenia schreberi*) Watershield, (*Ceratophyllum demersum*) Coontail, (*Chara* sp.) Muskgrass, (*Elodea nutallii*) Slender waterweed

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Potamogeton natans*) **Floating-leaf pondweed**
Specimen Location: Bass Lake; 45.63449076, -91.57367597
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Only a few plants growing in 3-7 feet of water with mucky bottom.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed, (*Potamogeton amplifolius*) Large-leaf pondweed

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Potamogeton pusillus*) **Small pondweed**
Specimen Location: Bass Lake; 45.63537283 -91.57498372
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Most plants were growing over muck in 3.5-12 feet of water. Widely distributed, this species was found in medium densities in most submergent beds.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed, (*Potamogeton amplifolius*) Large-leaf pondweed

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Sagittaria* sp.) **Arrowhead**
Specimen Location: Bass Lake; 45.63535514, -91.57626629
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Relatively common around the shoreline in 1-2 feet if water.
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Nuphar variegata*) Spatterdock

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Sparganium eurycarpum*) **Common bur-reed**
Specimen Location: Bass Lake; 45.63489198, -91.57721558
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Rare in this survey. Only visually observed at one location in less than 3 feet of water.
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Nuphar variegata*) Spatterdock, (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Typha* sp.) **Cattail**
Specimen Location: Bass Lake; 45.63538609, -91.5740218
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Only one visual identified near shore in the survey. Not common in this lake.
Common Associates: (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed, (*Nymphaea odorata*) White water lily

County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Utricularia vulgaris*) **Common bladderwort**
Specimen Location: Bass Lake; 45.63538609, -91.5740218
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Thick organic muck bottom in shallow water <3 feet deep. Plants were not common in this survey.
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed

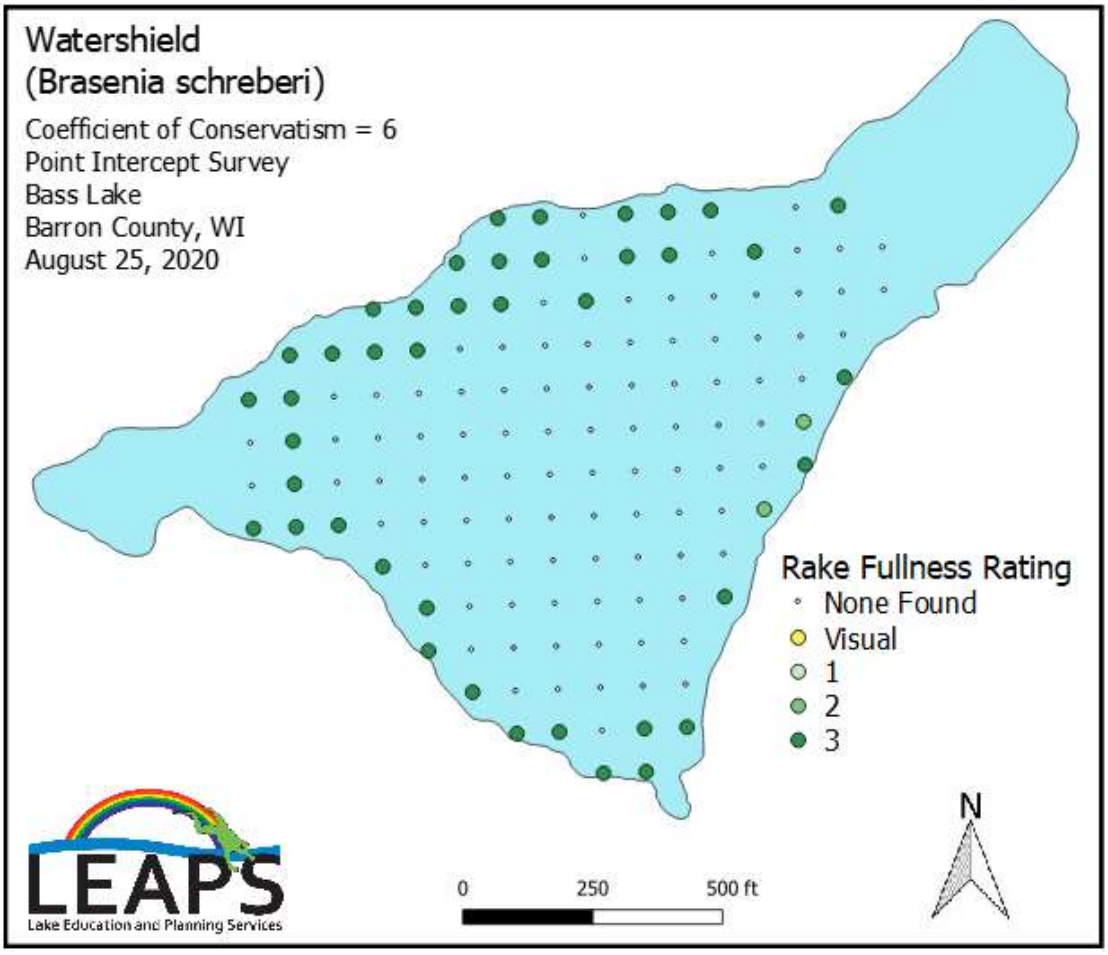
County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: (*Vallisneria americana*) **Wild celery**
Specimen Location: Bass Lake; 45.63535956, -91.57594565
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Thick organic muck bottom in shallow water <5 feet deep. Plants were not common in this survey and found only on the north side of the lake.

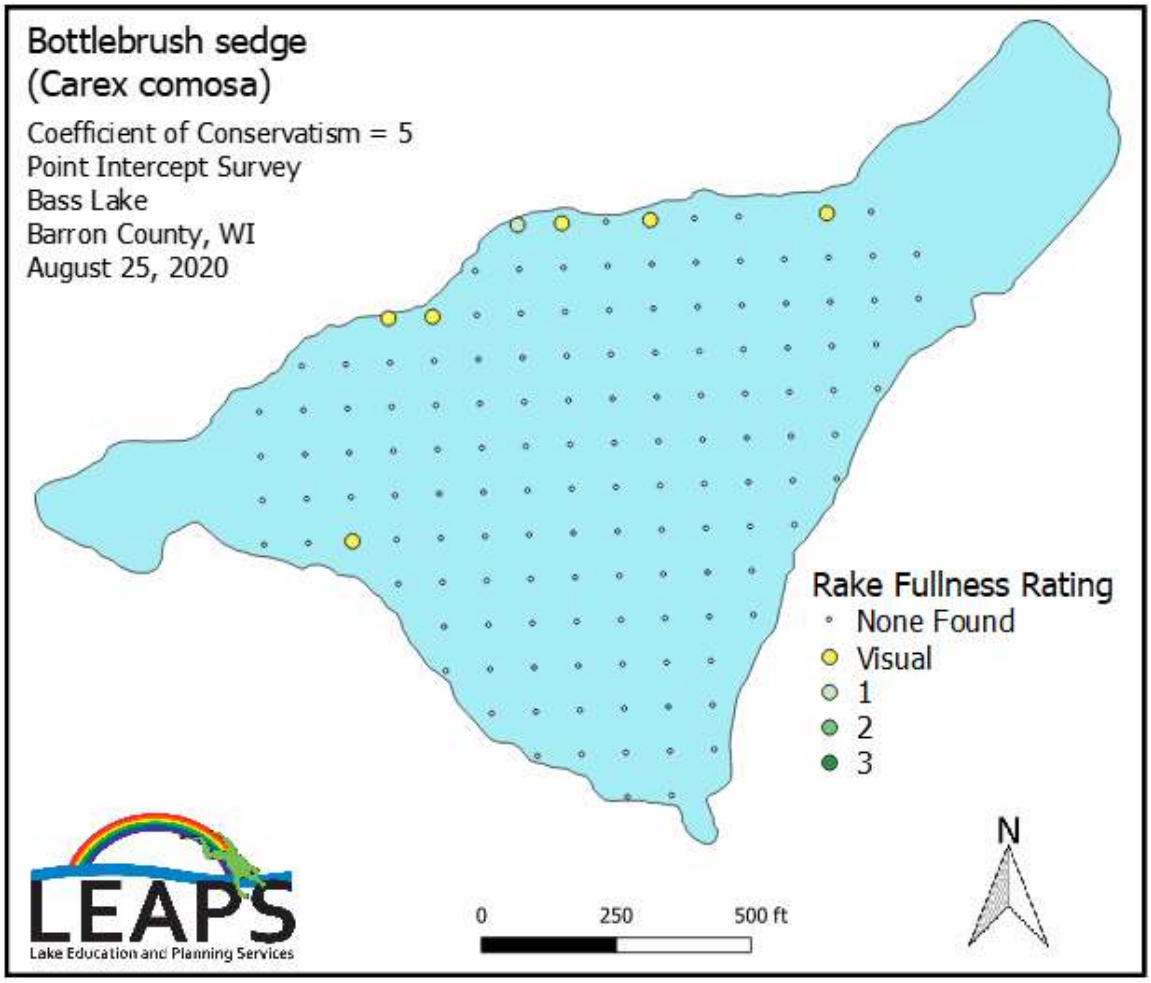
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed

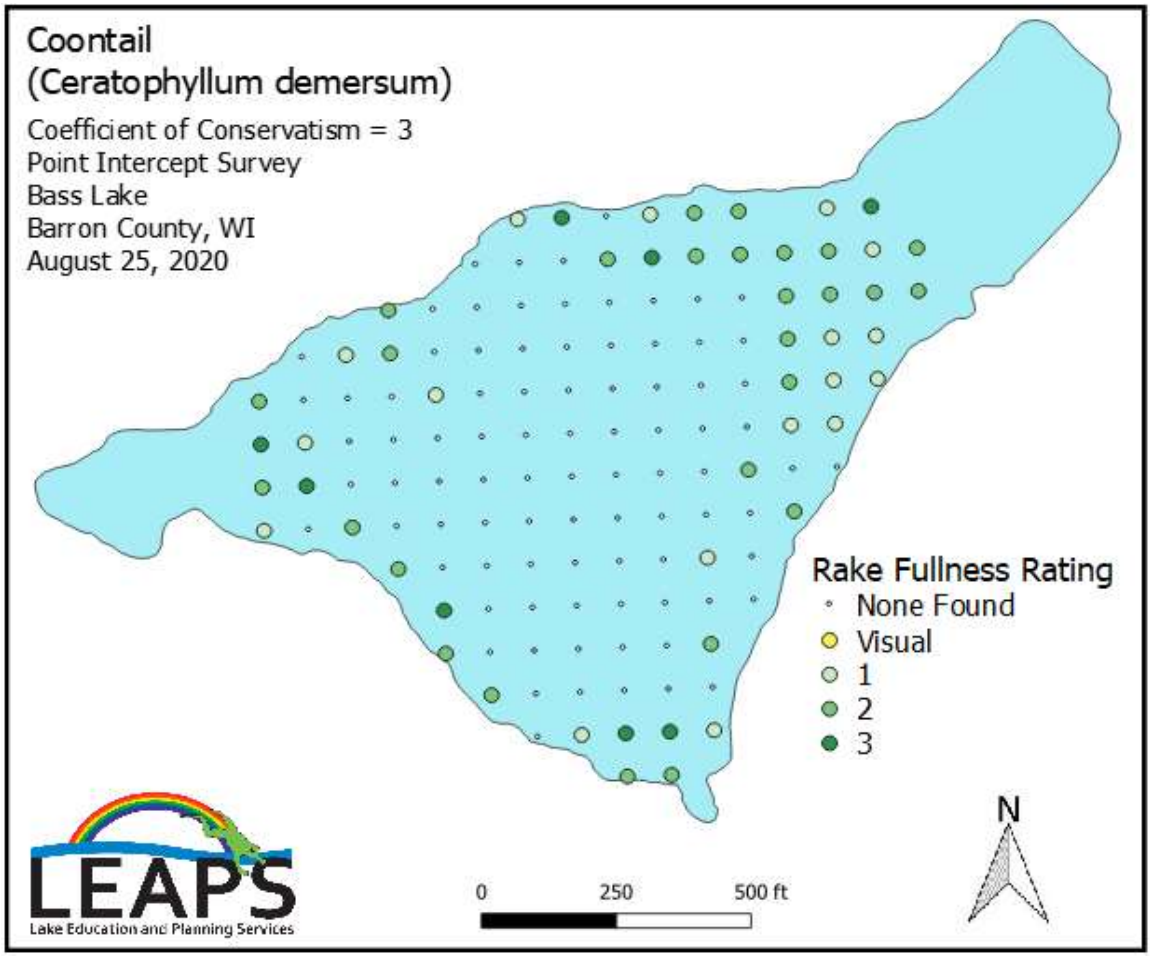
County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: Freshwater sponge
Specimen Location: Bass Lake; 45.63536841, -91.57530436
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Only one specimen observed in this study. Mucky bottom, <3 feet of water. Not common.
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed

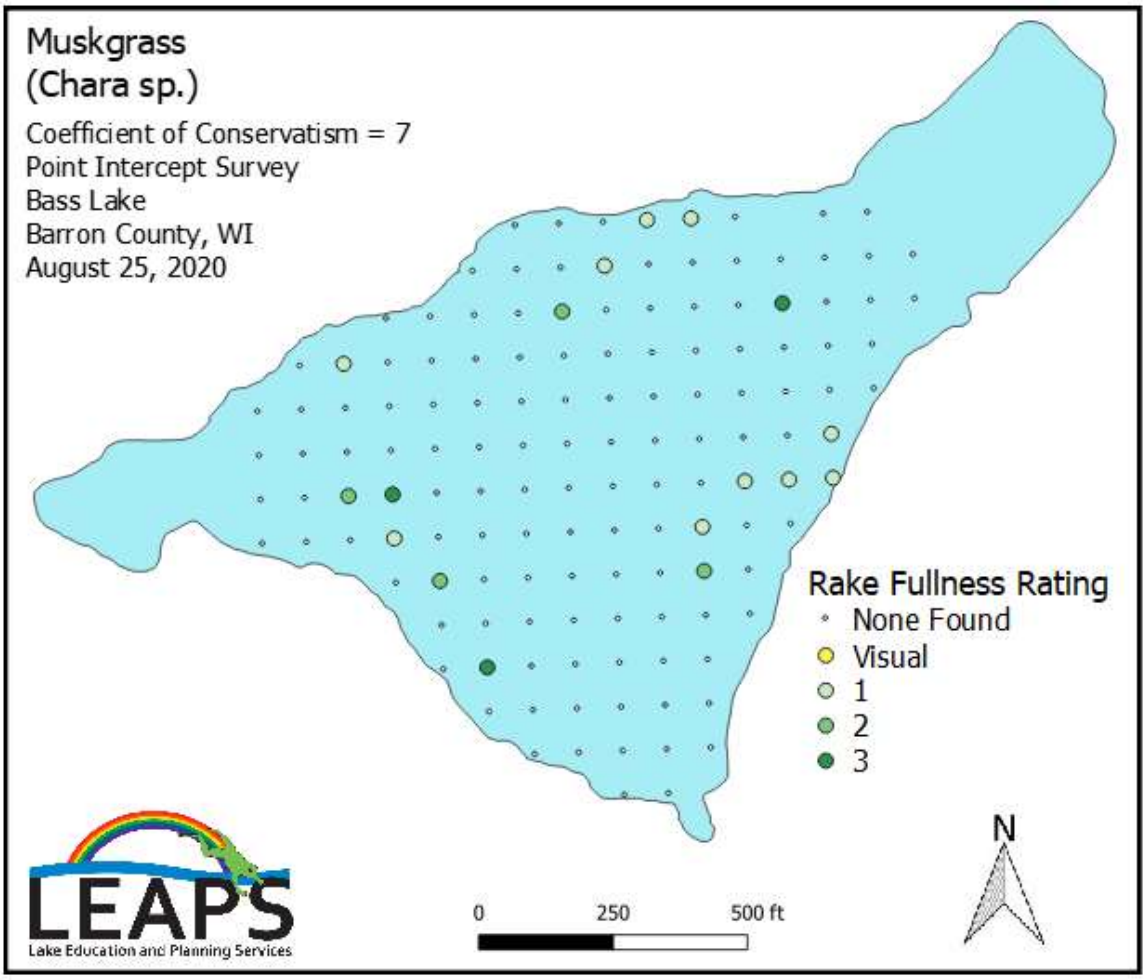
County/State: Barron County, Wisconsin **Date: 8/25/20**
Species: Filamentous algae
Specimen Location: Bass Lake; 45.63536841, -91.57530436
Collected/Identified by: Savannah Yunkers; Dave Blumer
Habitat/Distribution: Very common in this survey. Visually observed almost everywhere there were plants in 3-12 feet of water.
Common Associates: (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Ceratophyllum demersum*) Coontail, (*Elodea nutallii*) Slender waterweed

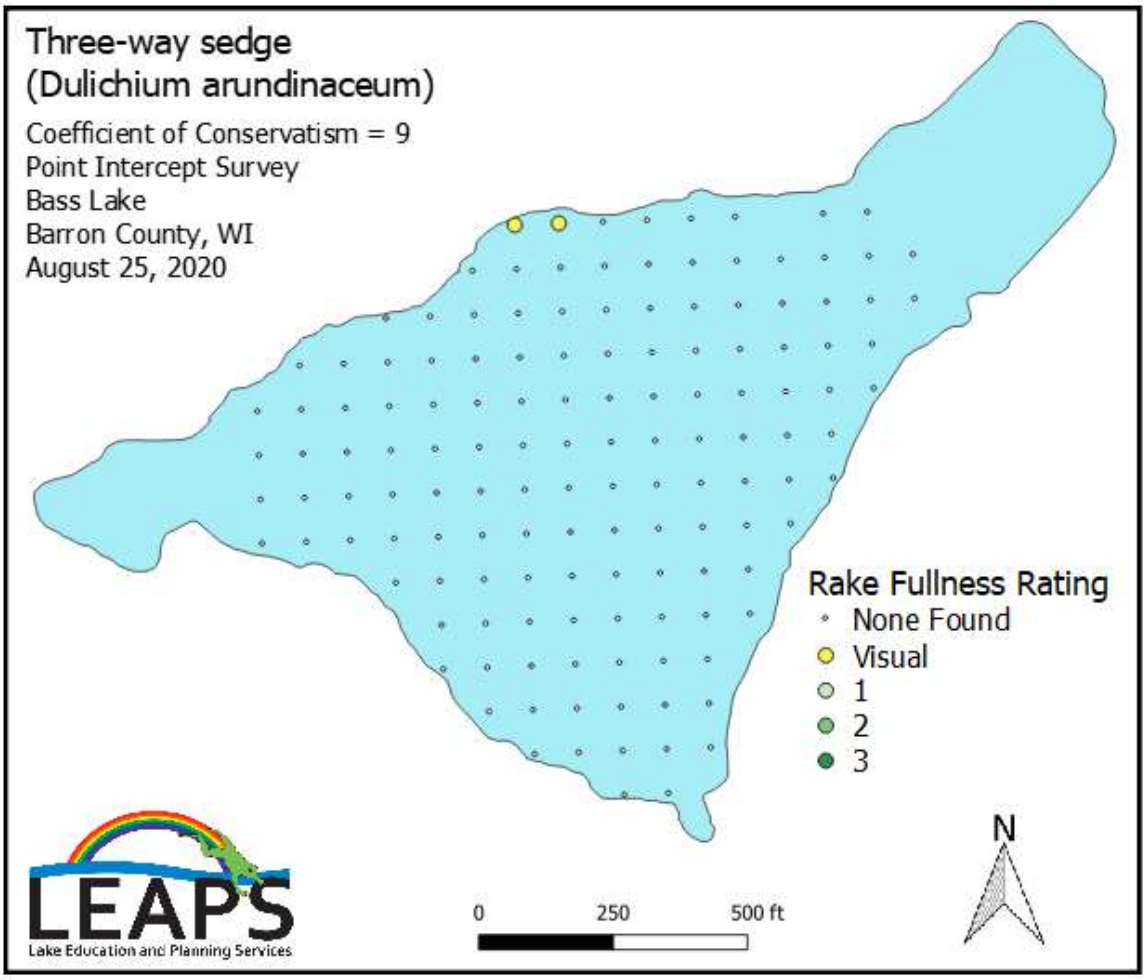
Appendix VI: 2020 Plant Species Density and Distribution Maps

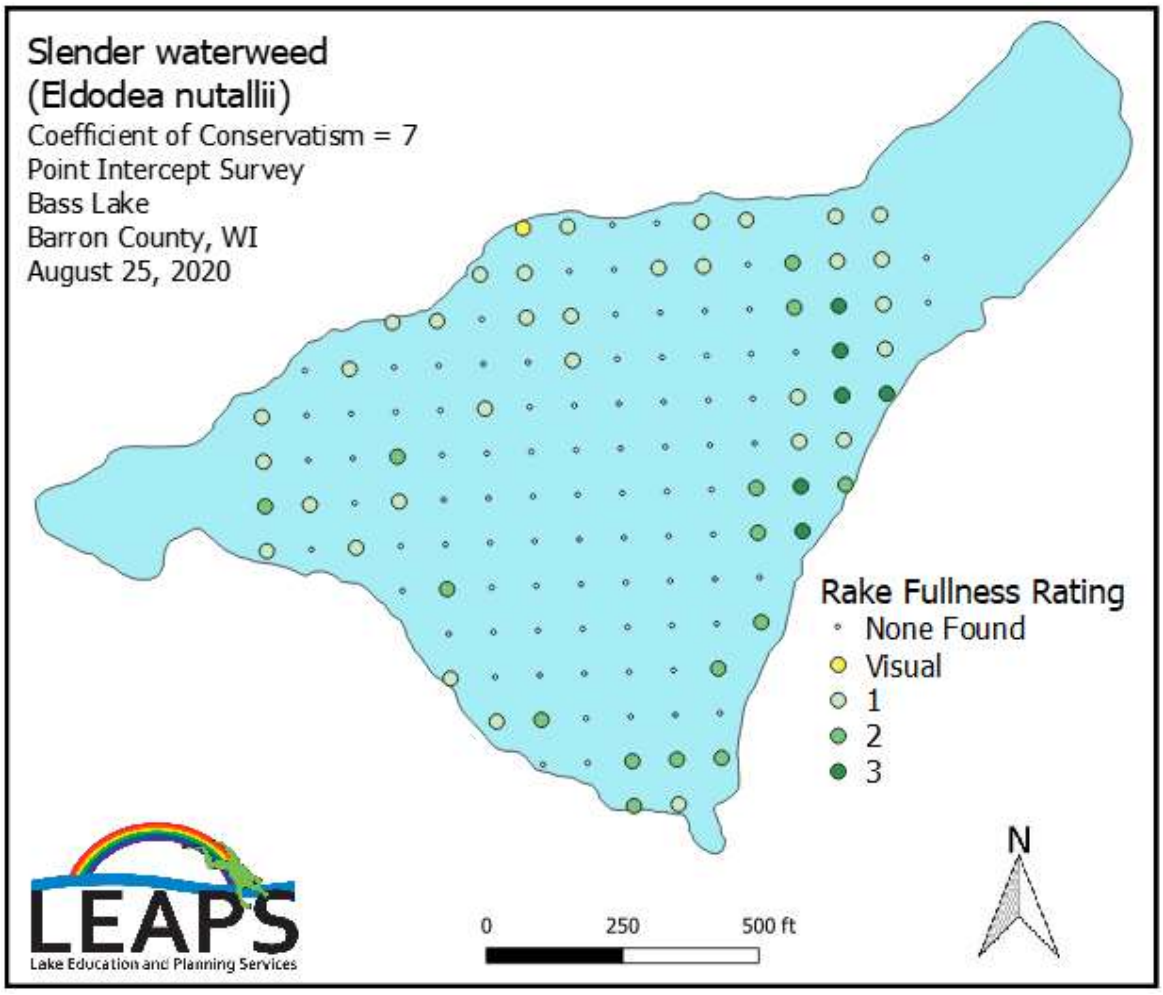

Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

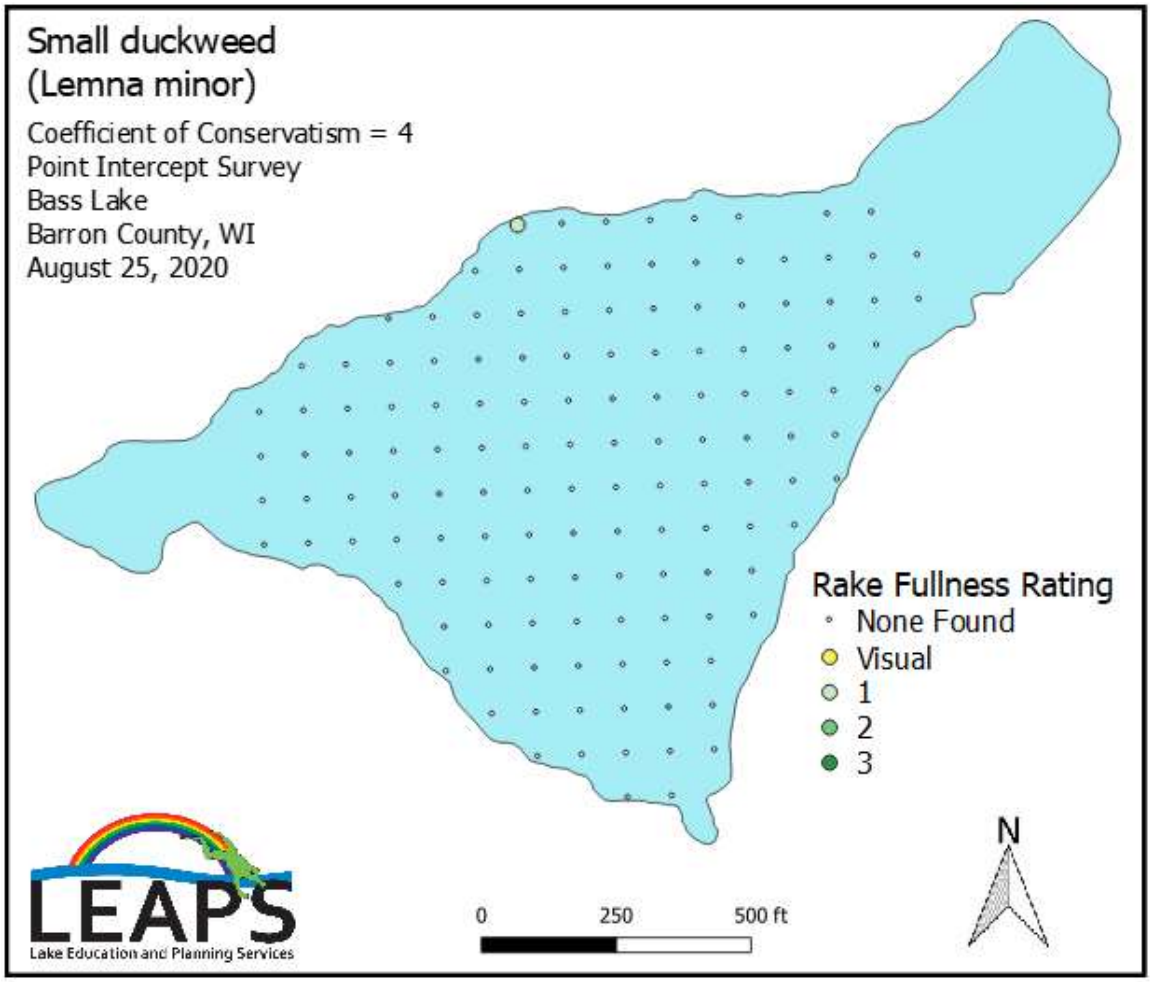

Bottlebrush sedge
(Carex comosa)
Coefficient of Conservatism = 5
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

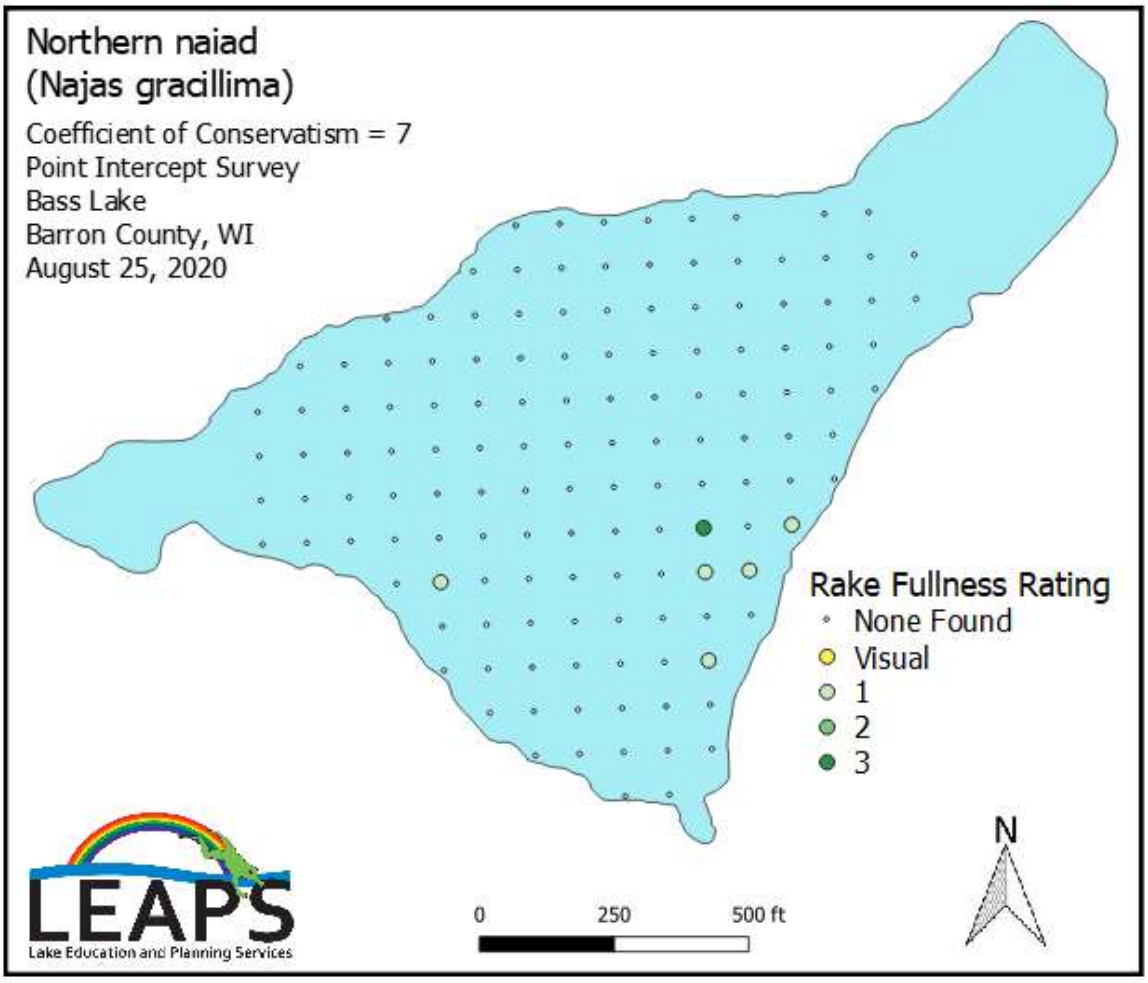

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

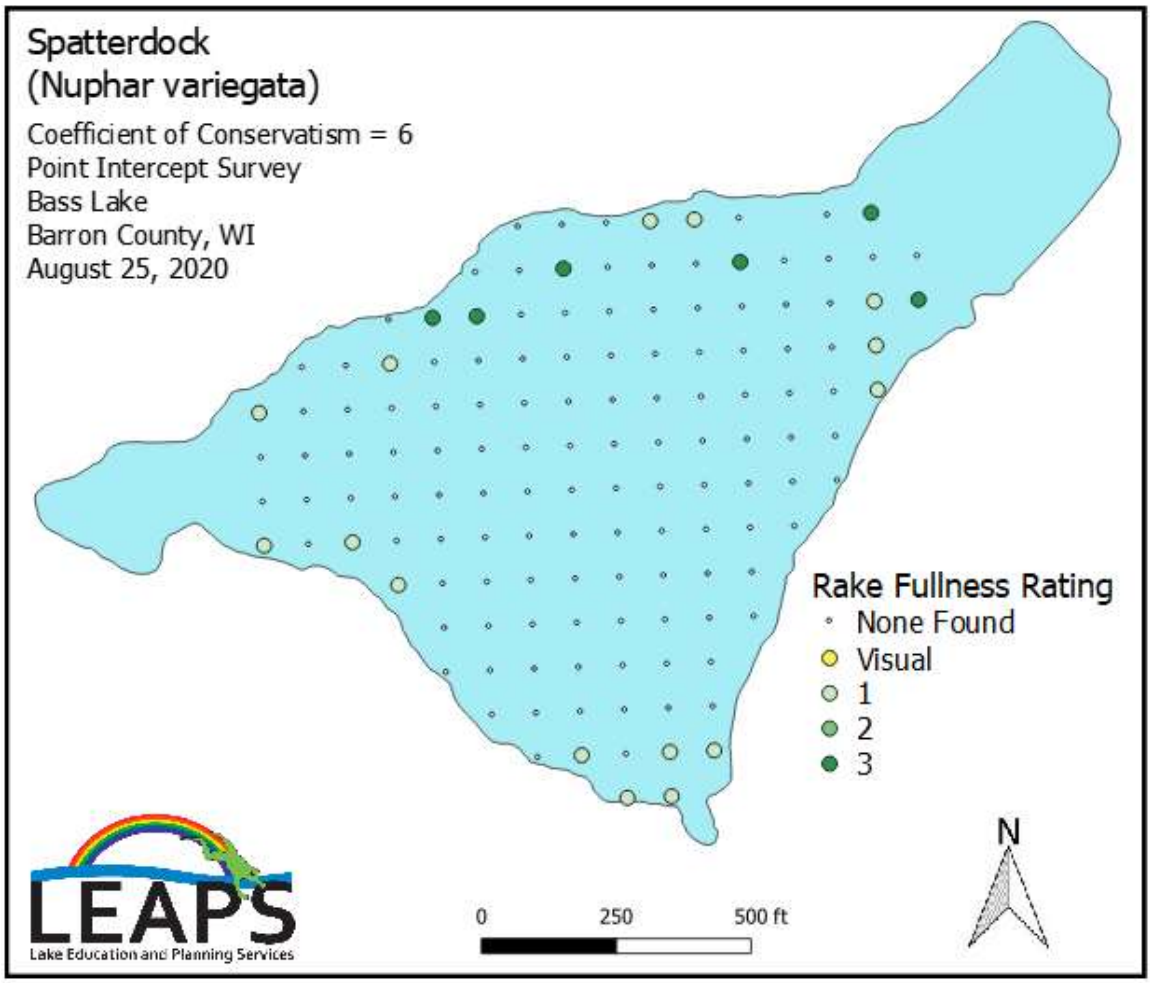

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

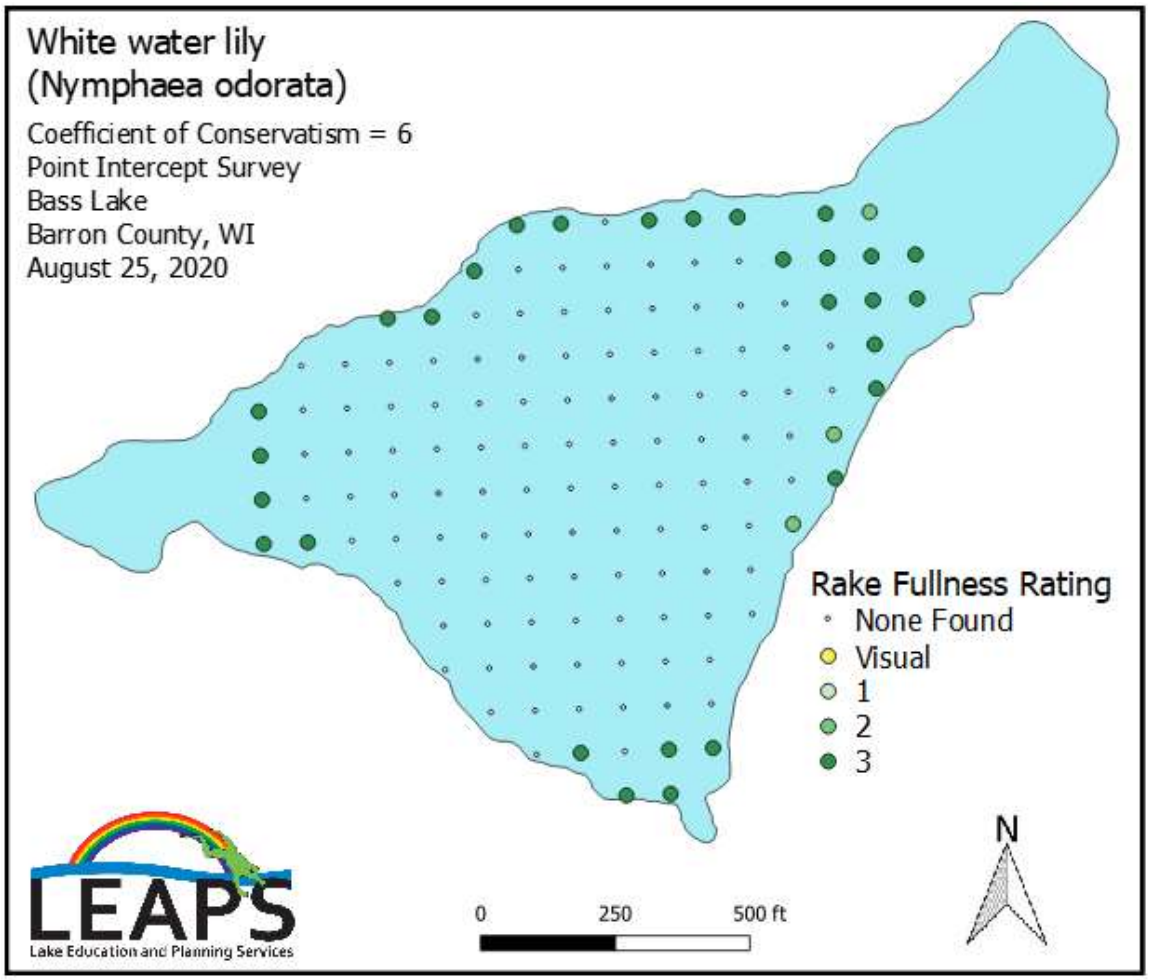

Three-way sedge
(Dulichium arundinaceum)
Coefficient of Conservatism = 9
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

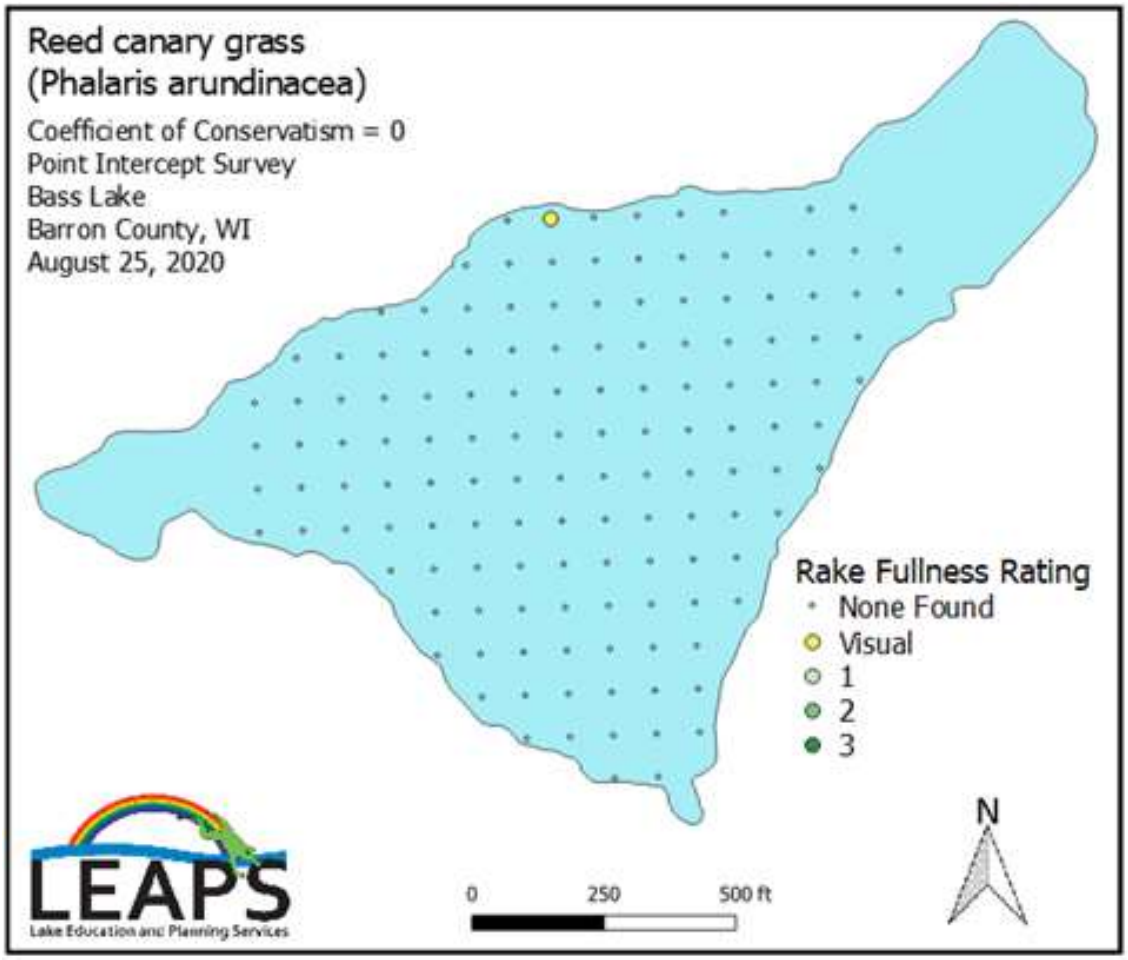

Slender waterweed
(Eldodea nutallii)
Coefficient of Conservatism = 7
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

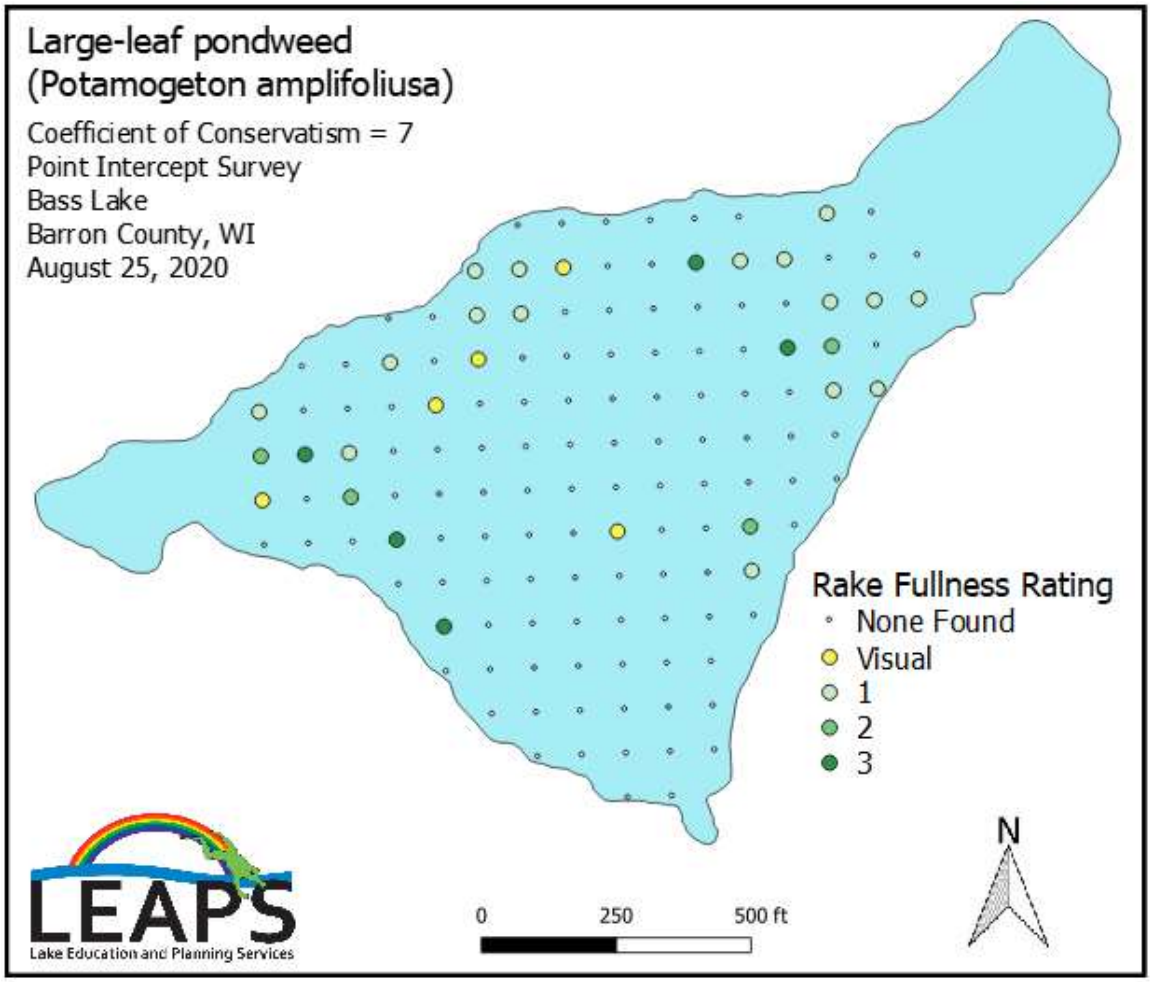

Small duckweed
(Lemna minor)
Coefficient of Conservatism = 4
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

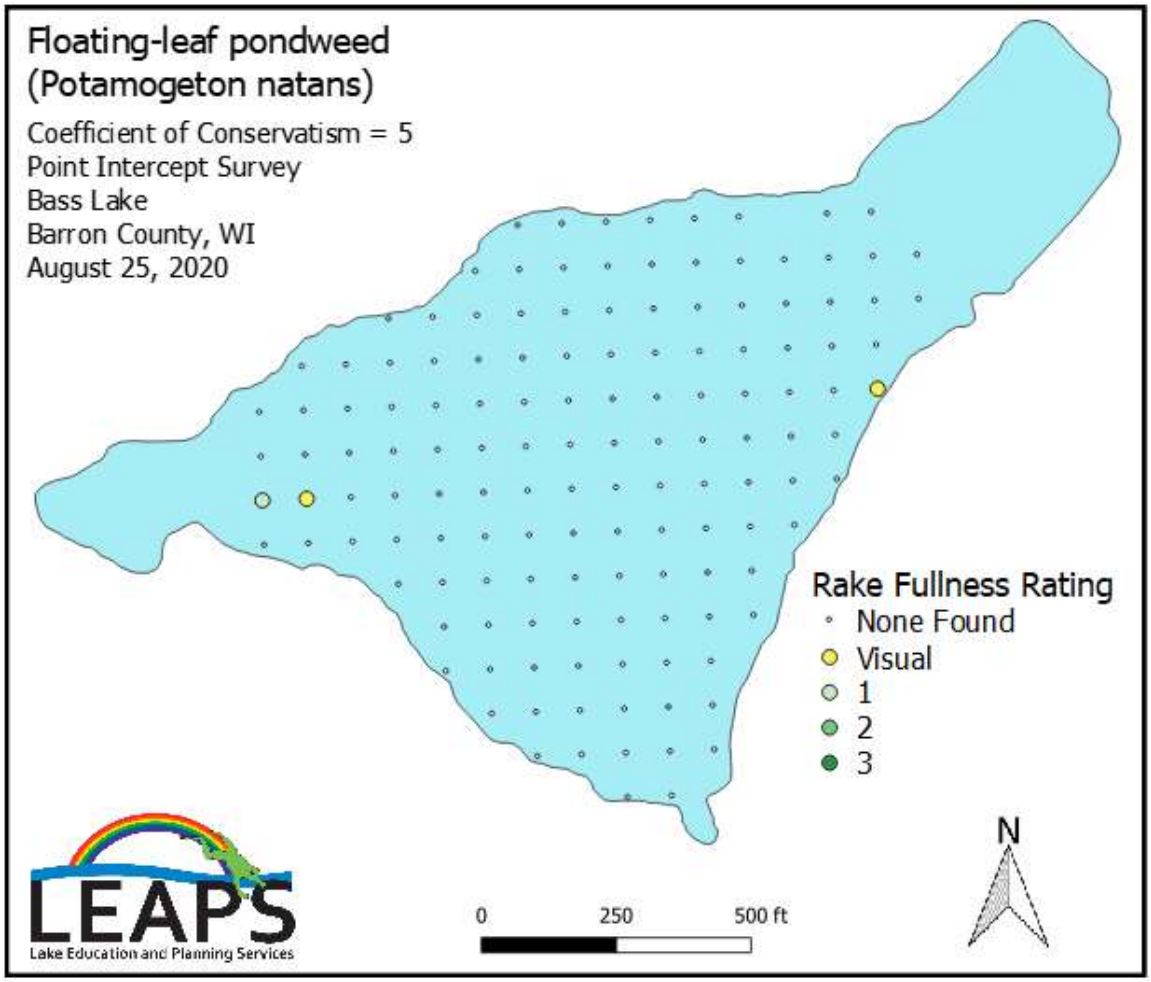

Northern naiad
(Najas gracillima)
Coefficient of Conservatism = 7
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

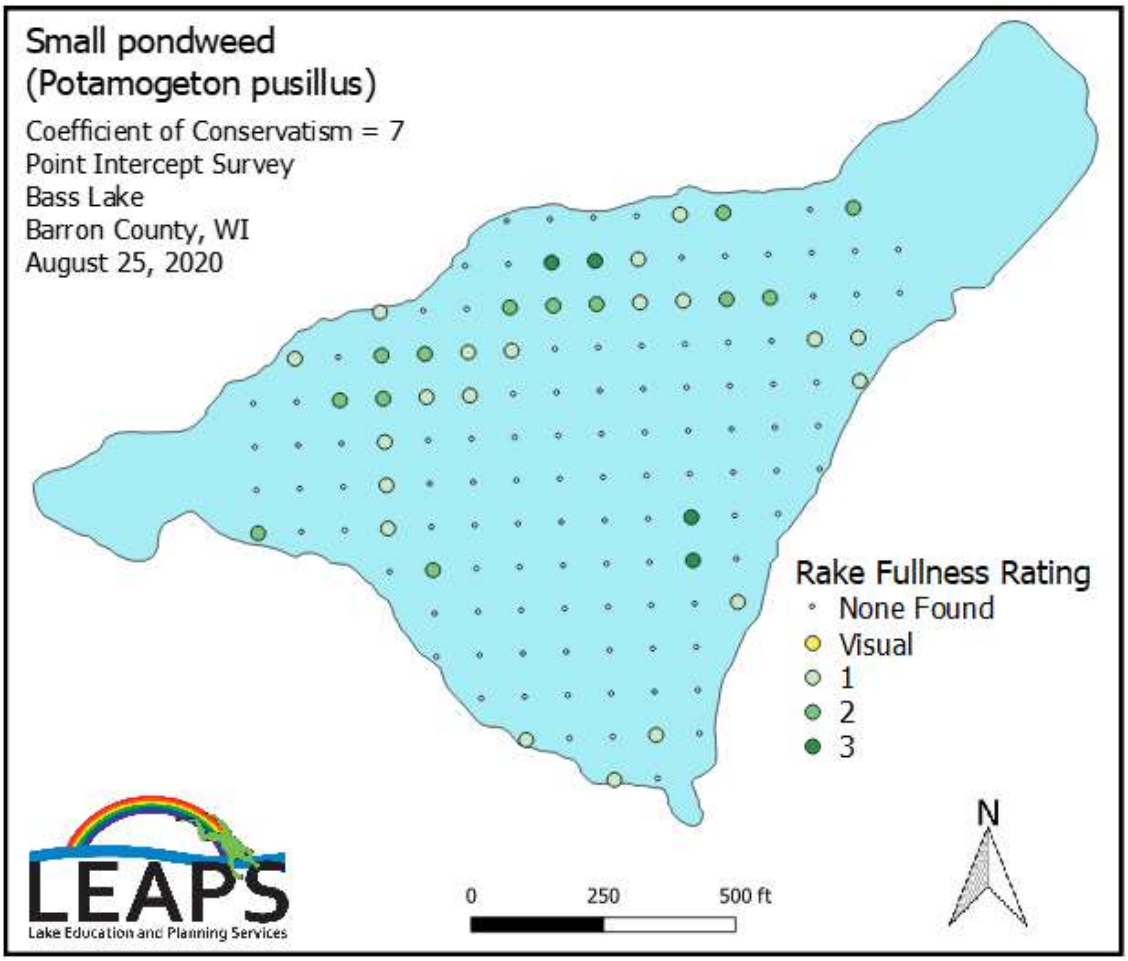

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

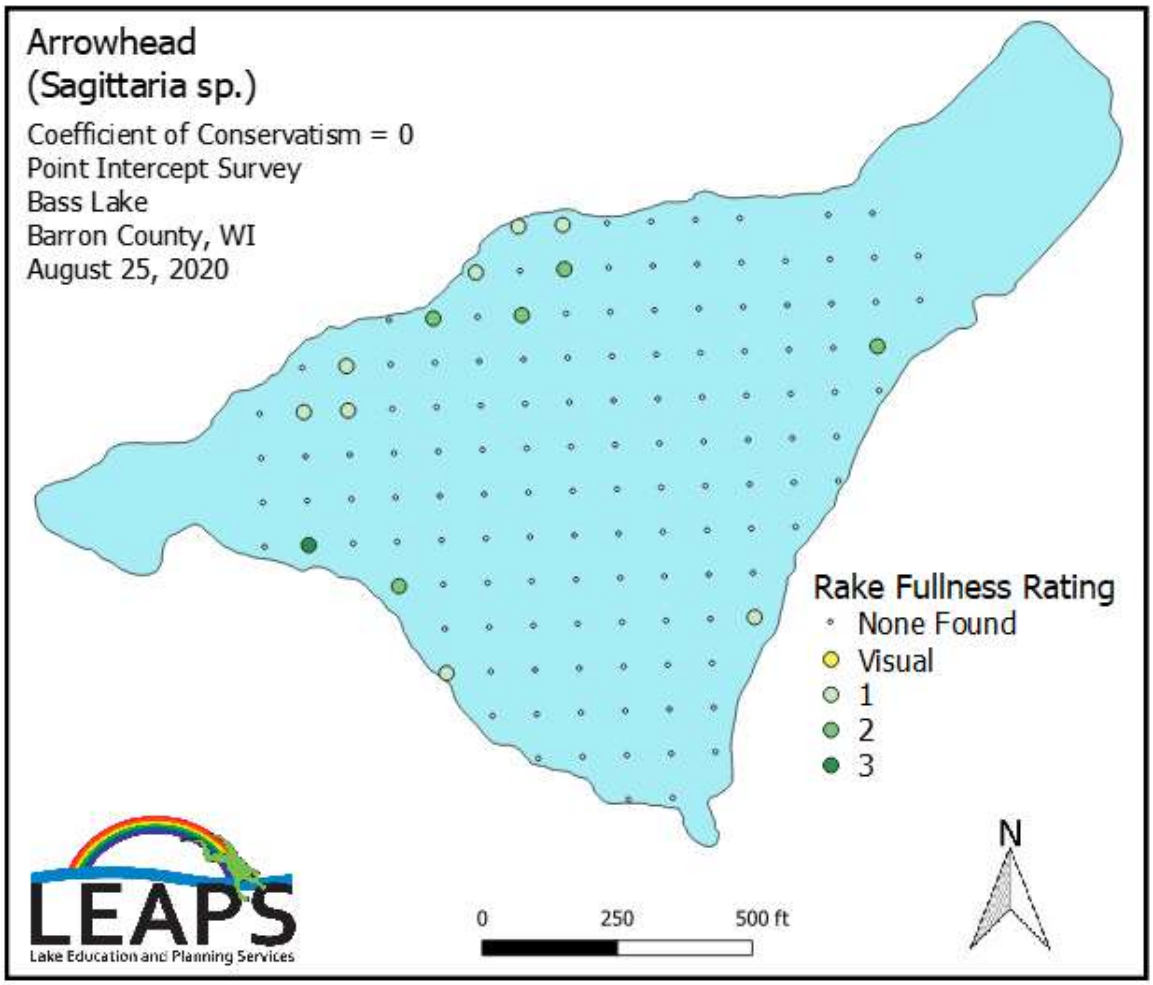

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

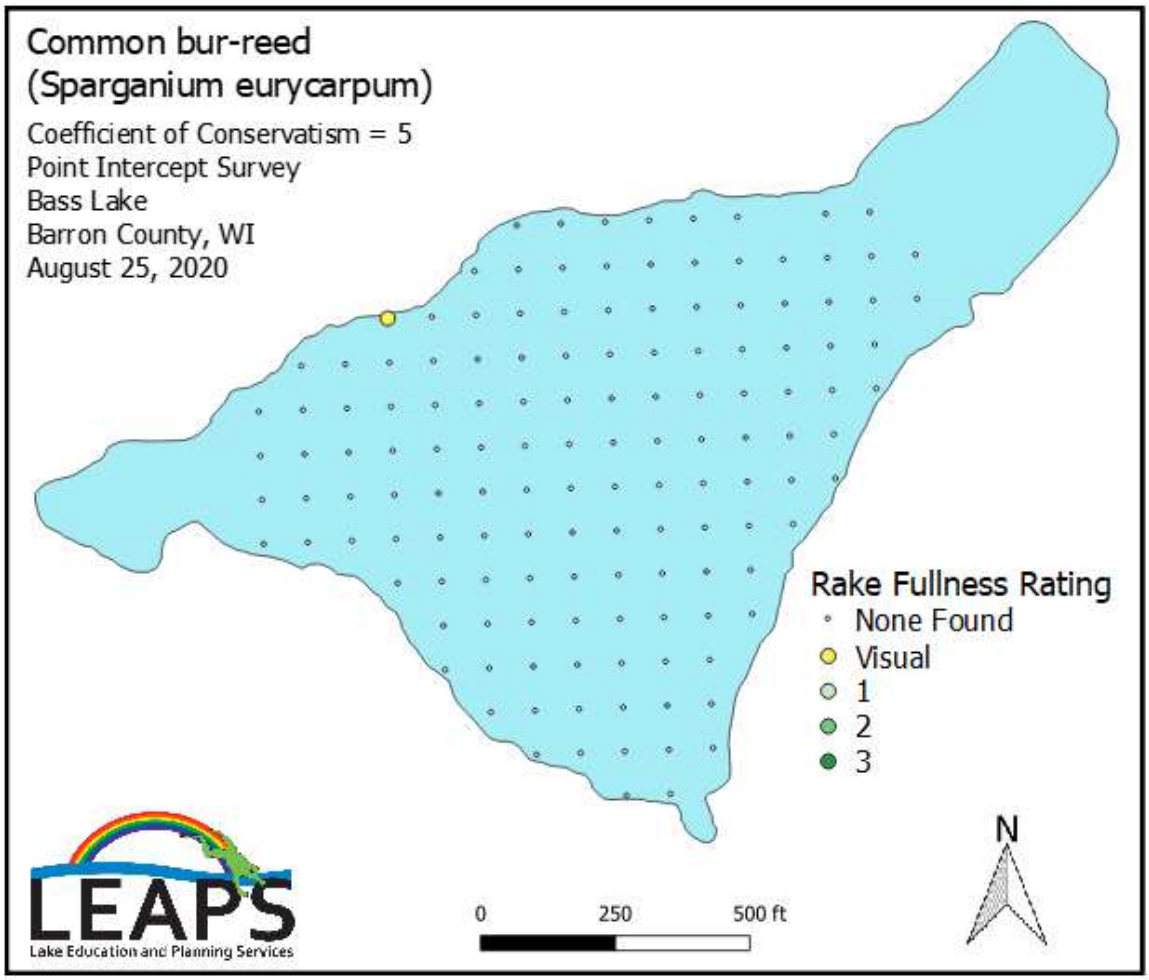

Reed canary grass
(Phalaris arundinacea)
Coefficient of Conservatism = 0
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

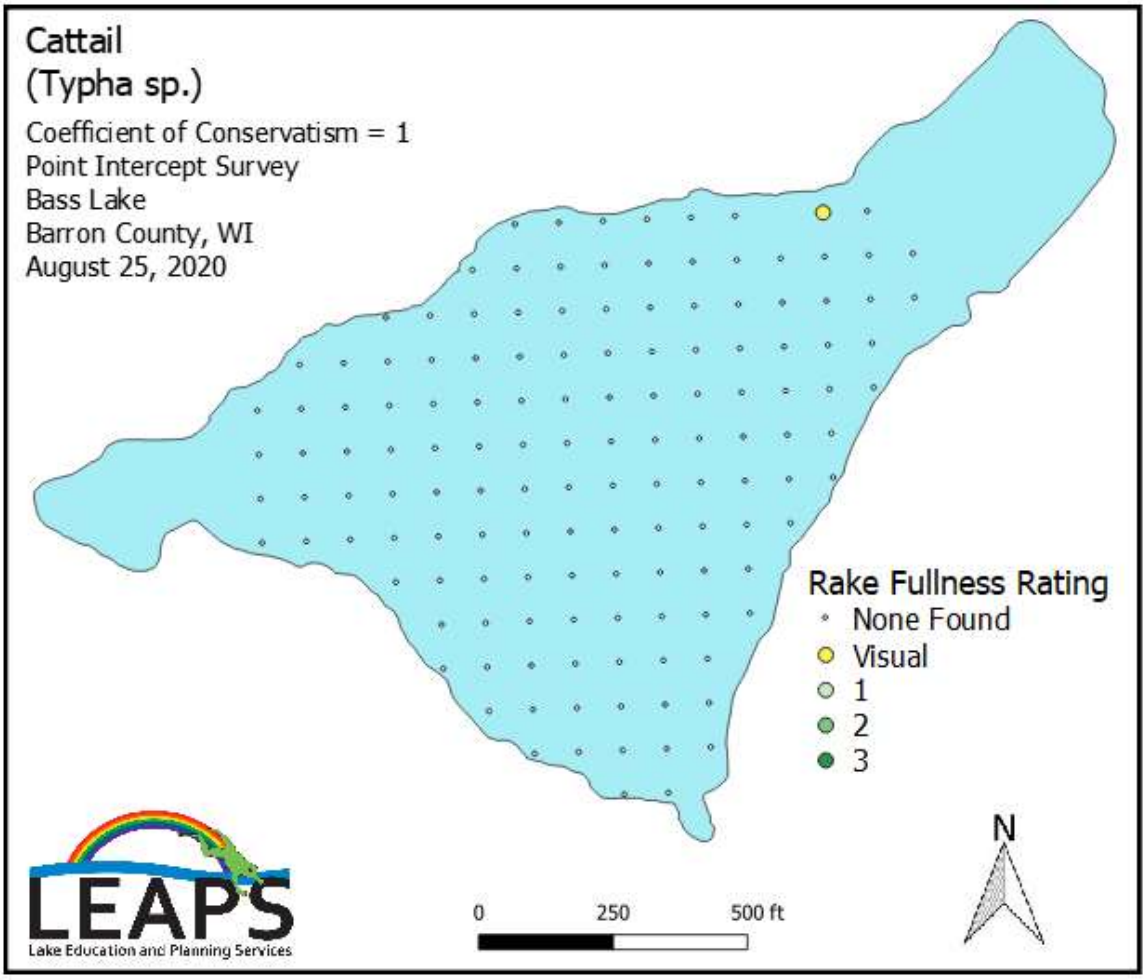

Large-leaf pondweed
(Potamogeton amplifoliusa)
Coefficient of Conservatism = 7
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

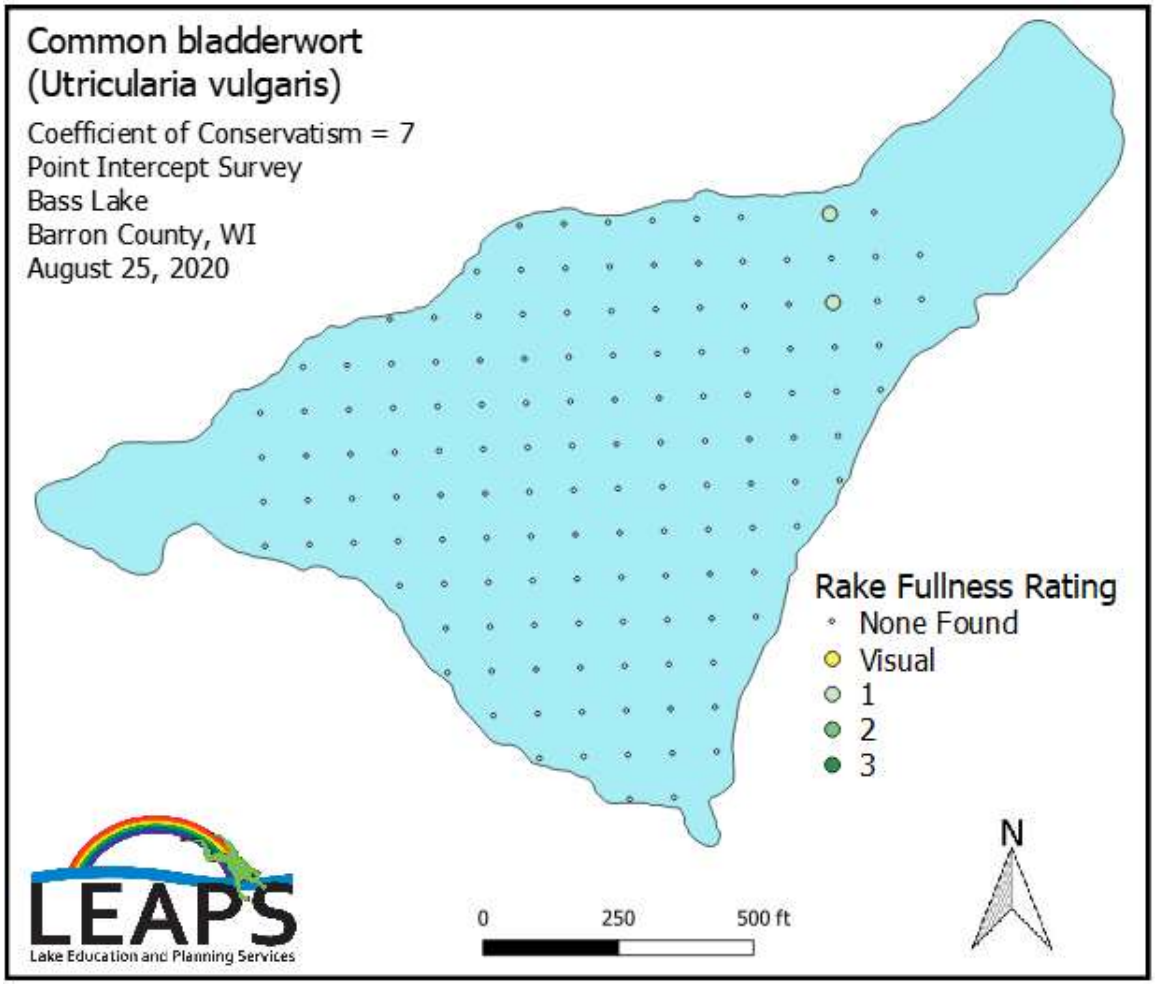

Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

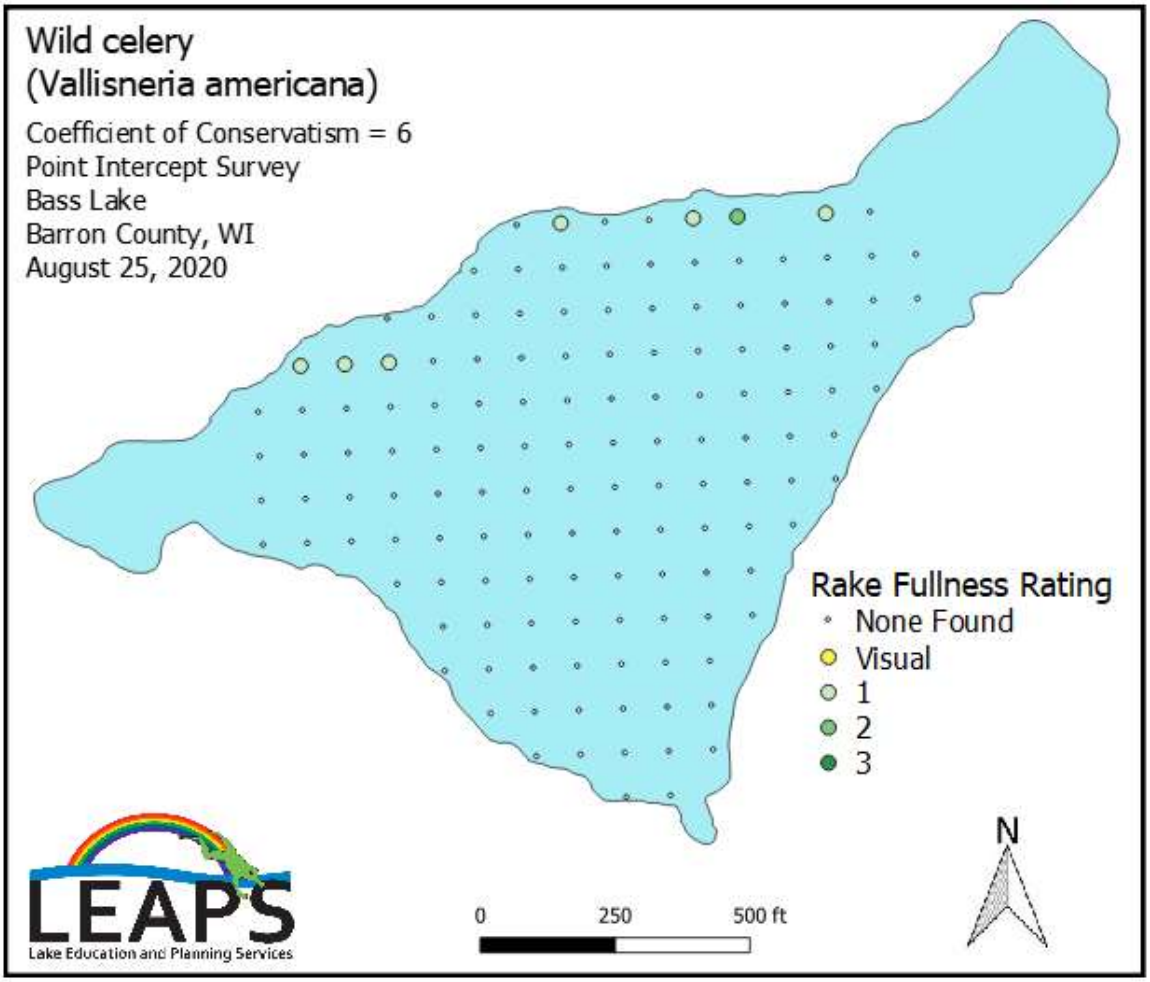

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

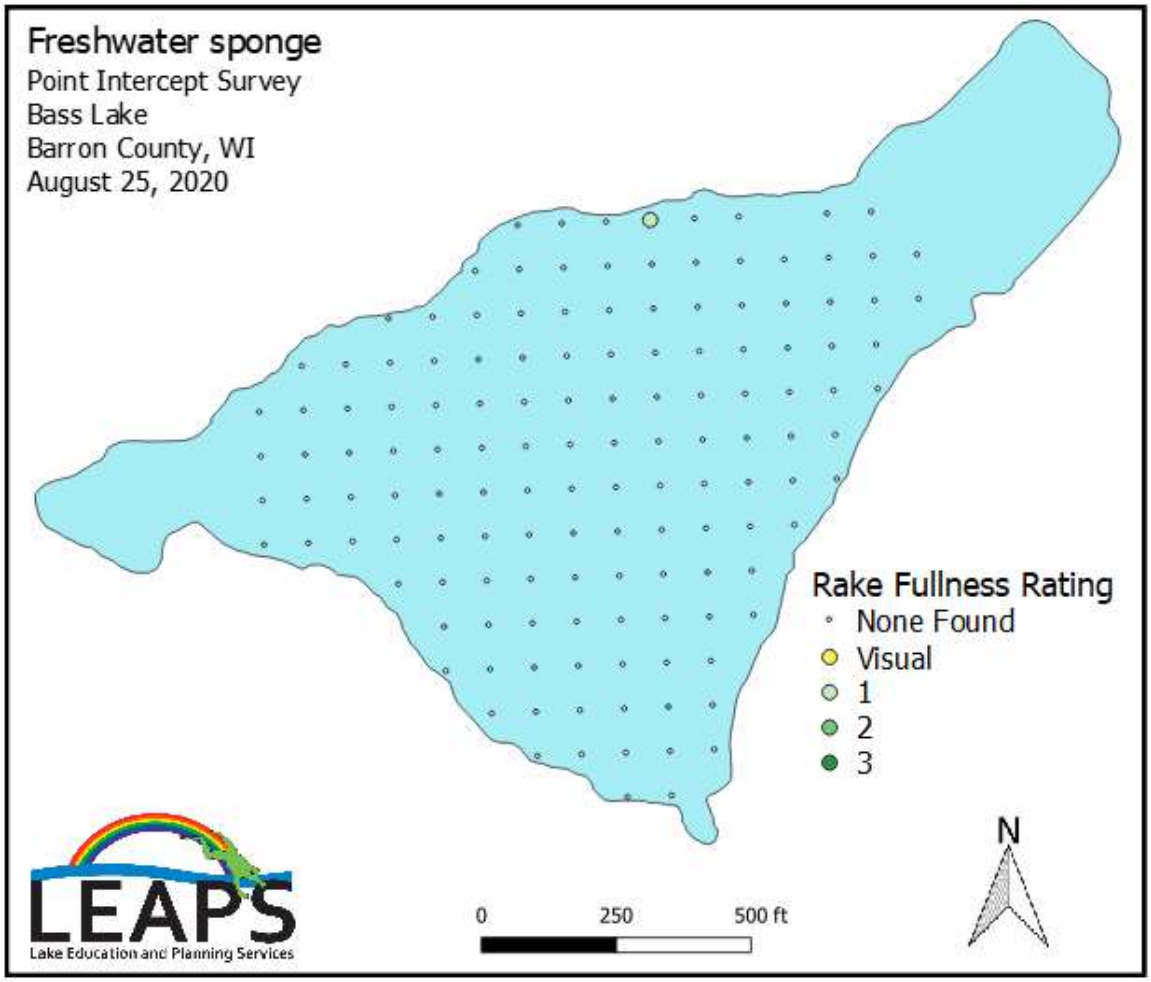

Arrowhead
(Sagittaria sp.)
Coefficient of Conservatism = 0
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

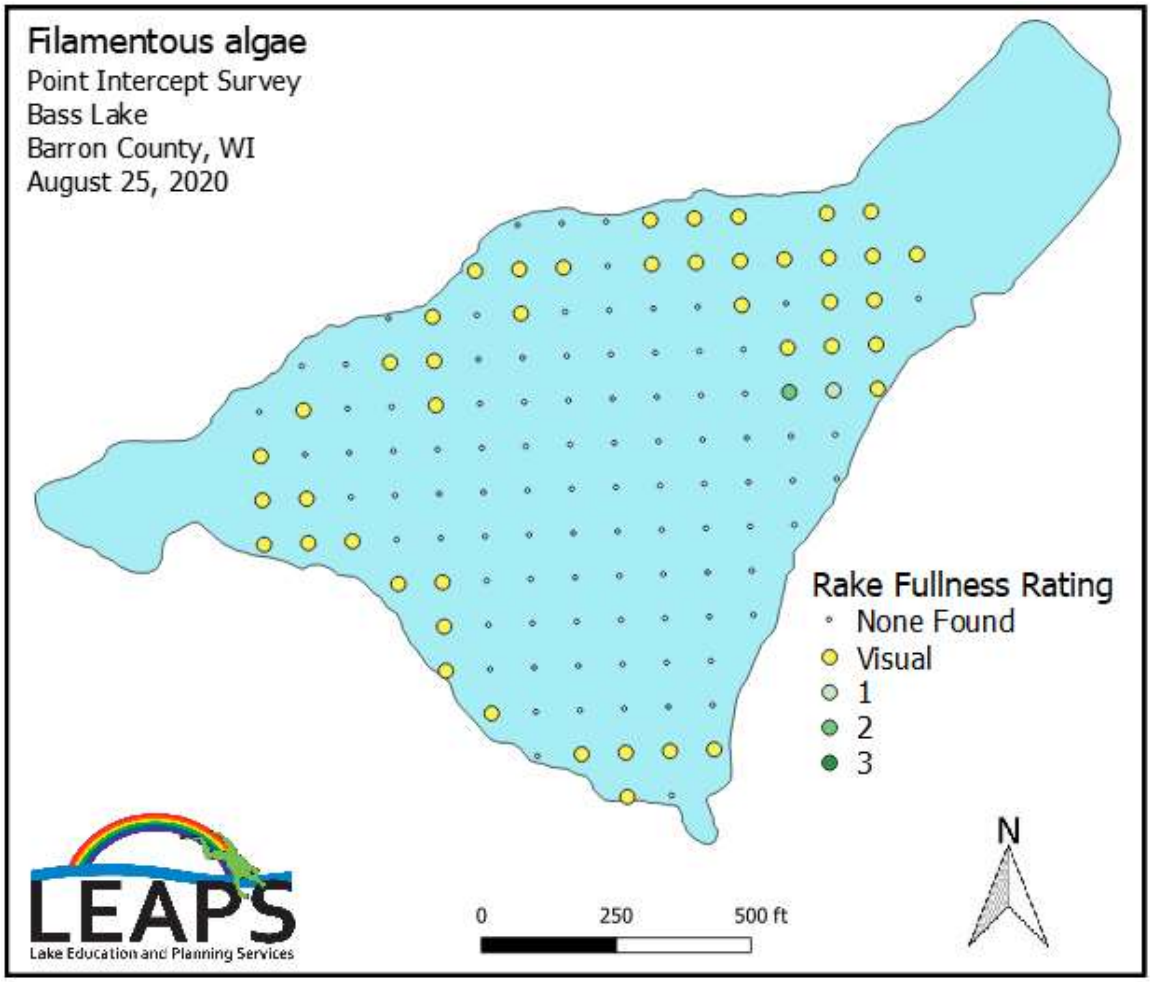

Common bur-reed
(Sparganium eurycarpum)
Coefficient of Conservatism = 5
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services


Cattail
(Typha sp.)
Coefficient of Conservatism = 1
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services


Common bladderwort
(Utricularia vulgaris)
Coefficient of Conservatism = 7
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services


Freshwater sponge
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services


Filamentous algae
Point Intercept Survey
Bass Lake
Barron County, WI
August 25, 2020
Rake Fullness Rating
None Found
Visual
1
2
3
N
0
250
500 ft
LEAPS
Lake Education and Planning Services

Appendix VII: Aquatic Exotic Invasive Plant Species Information

Reed canary grass

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

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

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

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

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

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

This species prefers disturbed areas but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. (Taken in its entirety from WDNR, 2012 http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm)

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

Aquatic:

organisms that live in or frequent water.

Cultural Eutrophication:

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

Dissolved Oxygen (DO):

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

Diversity:

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

Drainage lakes:

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

Ecosystem:

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

Eutrophication:

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

Exotic:

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

Habitat:

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

Limnology:

the study of inland lakes and waters.

Littoral:

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

Macrophytes:

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

Nutrients:

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

Organic Matter:

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

Photosynthesis:

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

Phytoplankton:

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

Plankton:

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

ppm:

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

Richness:

number of species in a particular community or habitat.

Rooted Aquatic Plants:

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

Runoff:

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

Secchi Disc:

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

Seepage lakes:

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

Turbidity:

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

Watershed:

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

Zooplankton:

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

Appendix IX: Raw Data Spreadsheets