RMB Environmental Laboratories, Inc.

West Battle Lake 56-0239-00 OTTERTAIL COUNTY

Aquatic Vegetation Meandering Delineation Survey

Survey Date	6/18/25
Observers	Jeff Kasowki, Zack O' Neal
Date of Report	11/10/25
Report Author	Jeff Kasowski

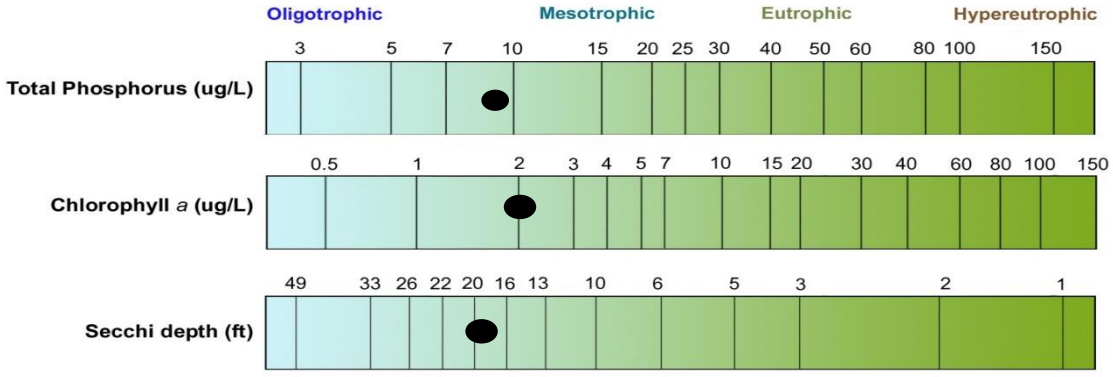
Lake Summary

West Battle Lake (DOW 56-0239-00) is a large-sized 5615-acre lake located east of the city of Battle Lake, MN in Ottertail County. West Battle Lake has a maximum depth of 108ft. Approximately 2496 acres, or 44.5% of West Battle Lake is considered littoral zone, area less than 15-20 feet which permits light penetration and allows plant growth.

West Battle Lake is classified as a mesotrophic lake as measured from 2015-2024 by a mean TSI score of 36. West Battle Lake has a historical Secchi depth mean of approximately 19 feet. Total phosphorous and chlorophyll-a (values that provide a measure of nutrients in lake and the amount of algae in the water) have mean values of 9 and 2 µg/L, respectively. Continual annual monitoring can help track trends in water quality in the lake.

WATER QUALITY STATISTICS
Over the past 10 years

MPCA primary site	Years with Data	Mean Secchi depth (feet)	Mean Phosphorous (µg/L)	Mean Chlorophyll-a (µg/L)	Mean TSI	Trophic State
202	2015-2024	19	9	2	36	Mesotrophic



Objectives of the Survey

This survey describes the aquatic plant community of West Battle Lake including:

1. Plant taxa observed and the estimated abundance of each taxon
2. Identification of taxa to the level of species when possible
3. Frequency of occurrence of each taxon found, stating the number of points used as the denominator for the calculations
4. Frequency of all aquatic plants found
5. Estimation of abundance of species sampled using MN DNR ranking system
6. Distribution map for common species
7. Determination of any invasive aquatic plants

Methods

The aquatic plant survey followed our RMBEL Standard Operating Procedure, and the methodology described by Madsen (1999). A meandering delineation was done on West Battle Lake placing survey points every 50 meters, resulting in a total of 991 potential survey points. In the field, all points were sampled, and vegetation was not found beyond 18 feet in depth. A Global Positioning System (GPS) unit was used to navigate the boat and record each sample point. Water depths at each site were recorded in 1-foot increments using an electronic depth finder.

A double-headed, weighted garden rake attached to a rope (Figure 2 and 3) was used to survey vegetation. Vegetation that was found under the surface by use of the double-headed garden rake was assigned a number between 0 and 3; 0 being absent, 1 being rare (≤ 1/3 of the rake head covered), 2 being scattered (>1/3 but ≤ 2/3 of the rake head covered), 3 being Abundant (>2/3 of the rake head covered), Plant identification followed Blickenderfer (2007).

Double-headed, weighted garden rake, attached to a rope used to survey aquatic vegetation.

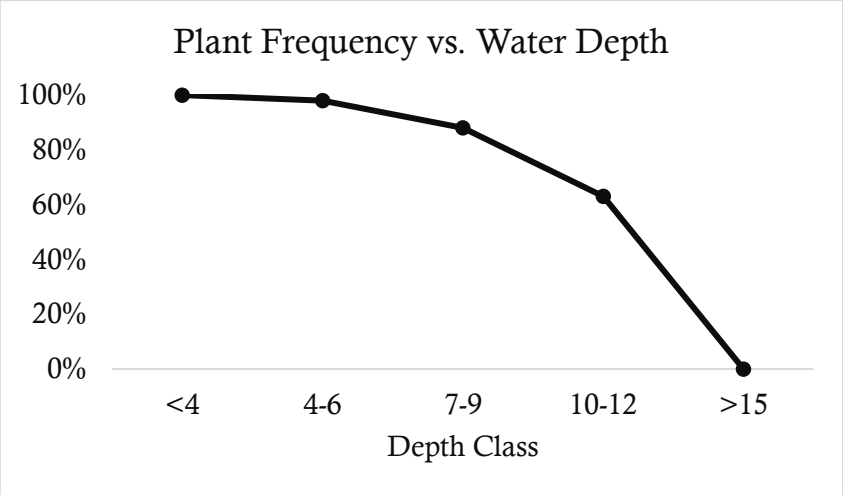
Frequency of occurrence was calculated for each species as the number of sites in which a species occurred divided by the total number of sample sites. The average number of plants per rake sample was calculated as the total number of plants sampled divided by the number of sample locations.

Sampling points were also grouped by water depth and separated into 5 depth zones for analysis. Depth zones included less than 4 feet, 4-6 feet, 7-9 feet, 10-15 feet, over 15 feet.

Survey Results

On 18th of June 2025, 991 points were observed and sampled for aquatic vegetation. The weather was conducive for the survey with sunny skies, temperatures reaching 85 degrees and little wind. Water temperatures were well in the 70s.

Sampling occurred to a maximum depth of 28 feet; however, no plants were found to be growing beyond 18 feet of water. Plant abundance was greatest between two and eleven feet of water. As depths increased beyond that range, the presence of vegetation decreased and became less dense.



Plant frequency for each depth zone in West Battle Lake.

The maximum number of species found at a site was five. Nineteen different types of native plants were found across the sampling area while no invasive species were present at the sampled locations.

Of the 991 sampled locations in West Battle Lake, 422 sites had no vegetation present. The most abundant native plant species were chara (*Chara sp.*), bladderwort (*Utricularia*), Whitestem pondweed (*Potamogeton praelongus*), and northern milfoil (Myriophyllum sibiricum).

The average number of plants per rake sample on West Battle Lake was 0.82 for all sampled depths.

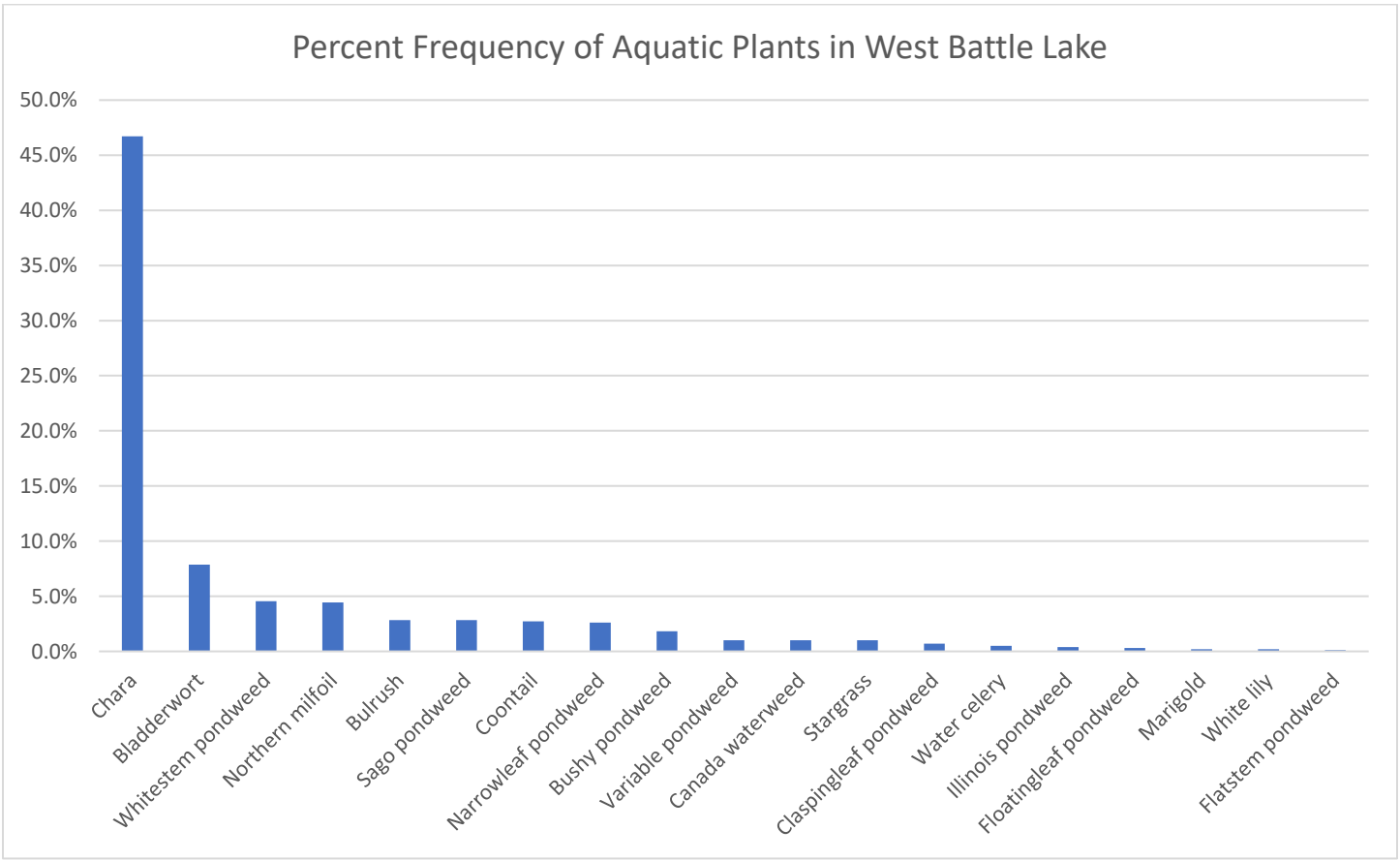
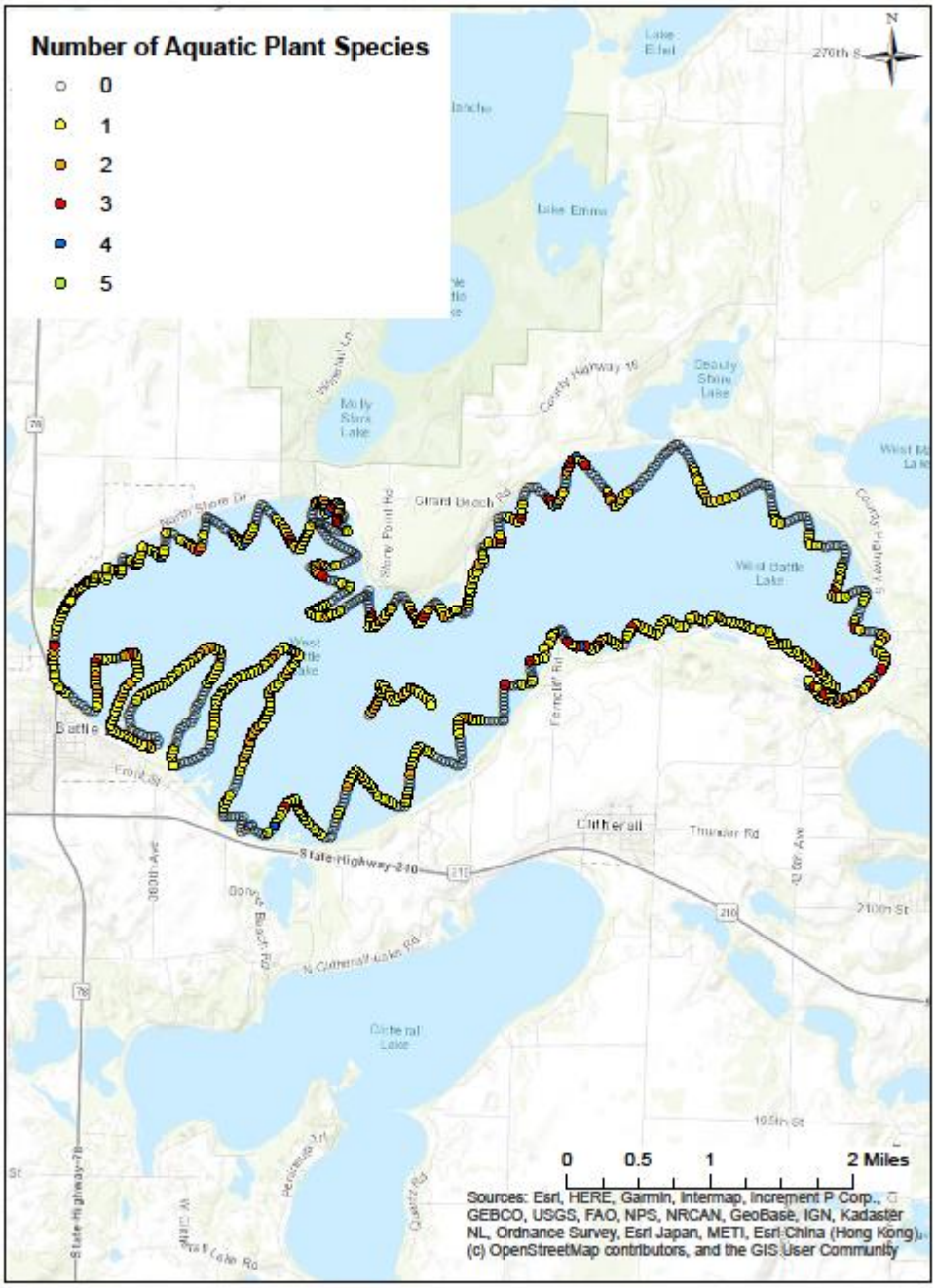
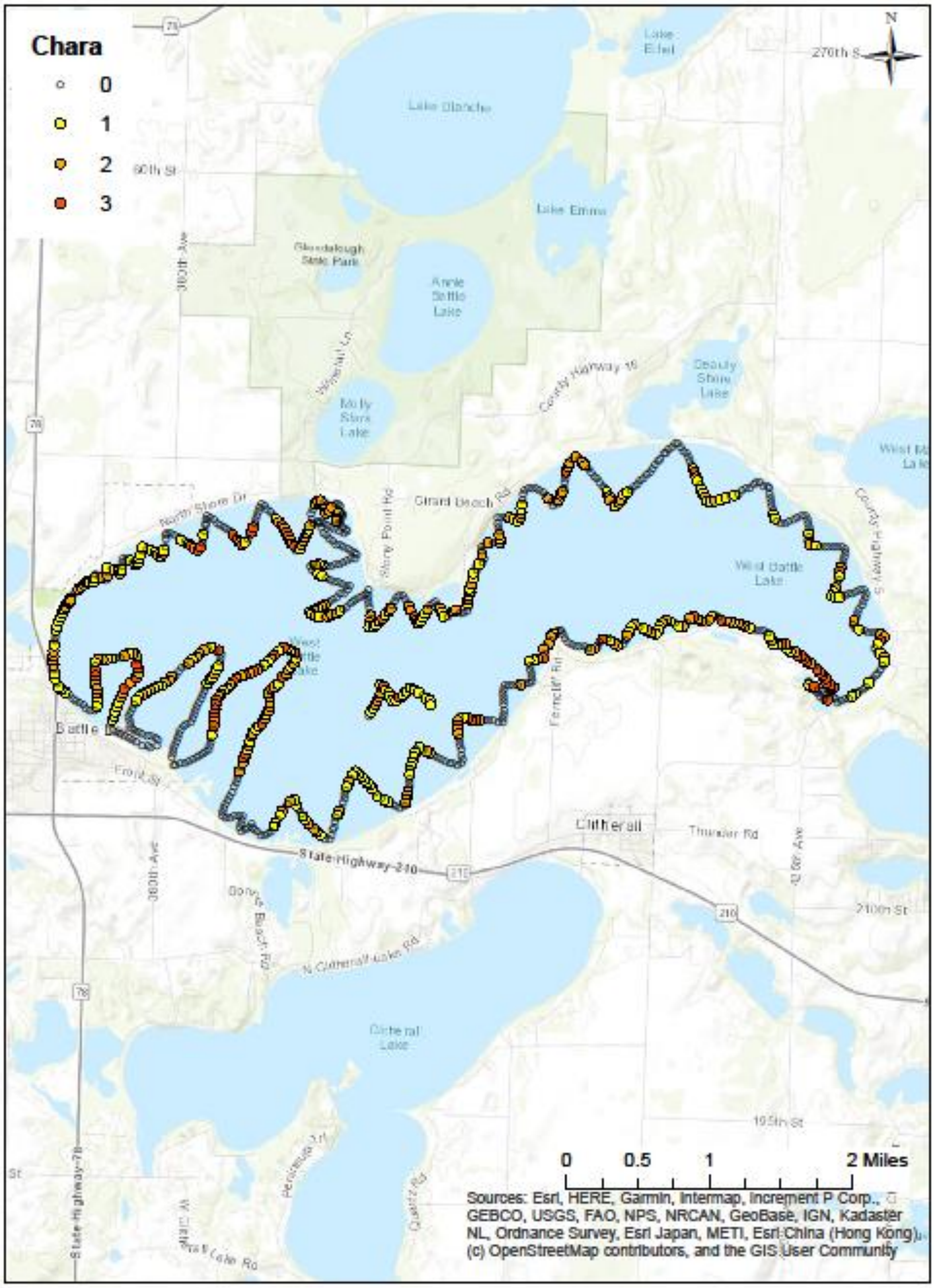
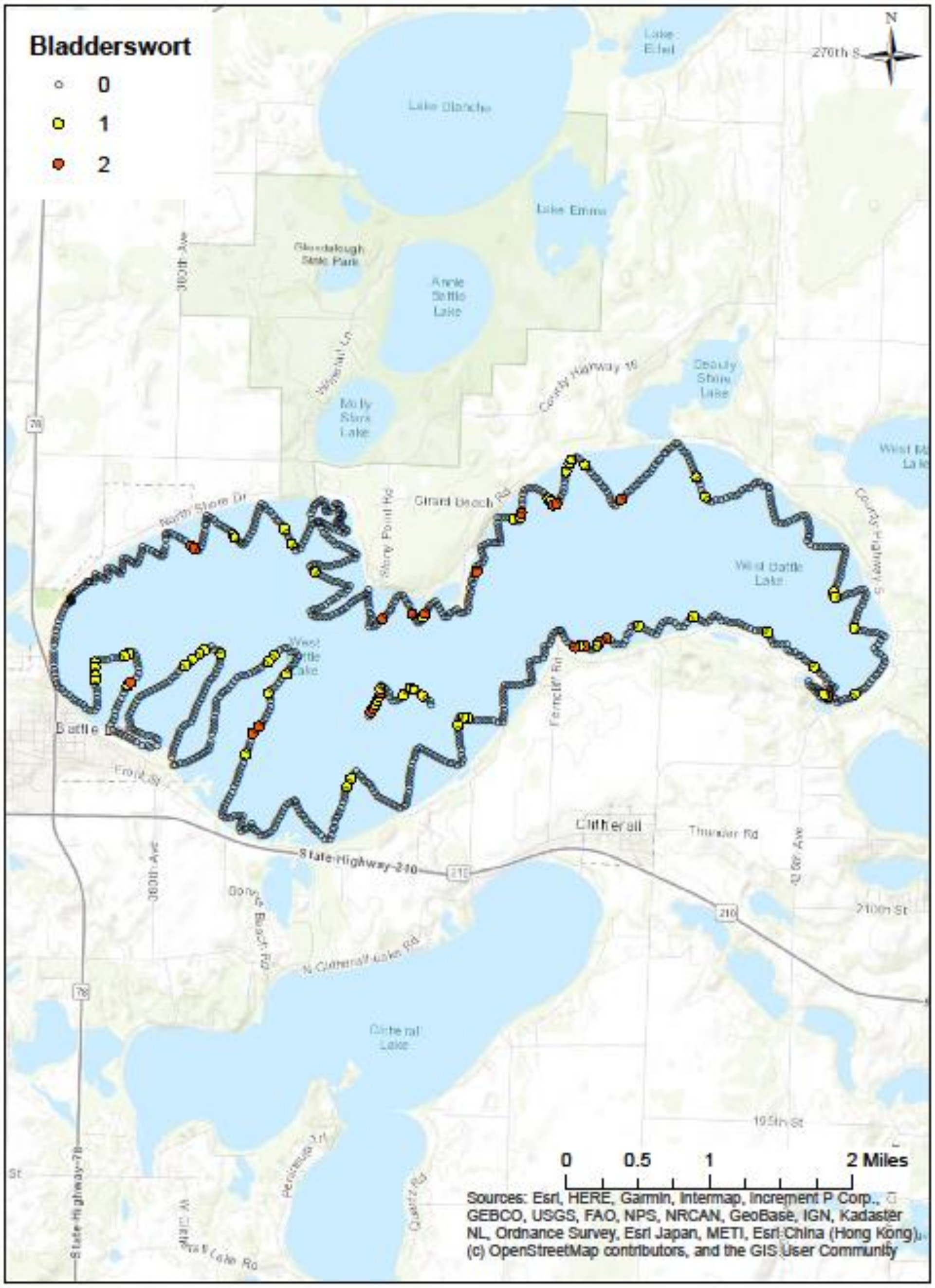


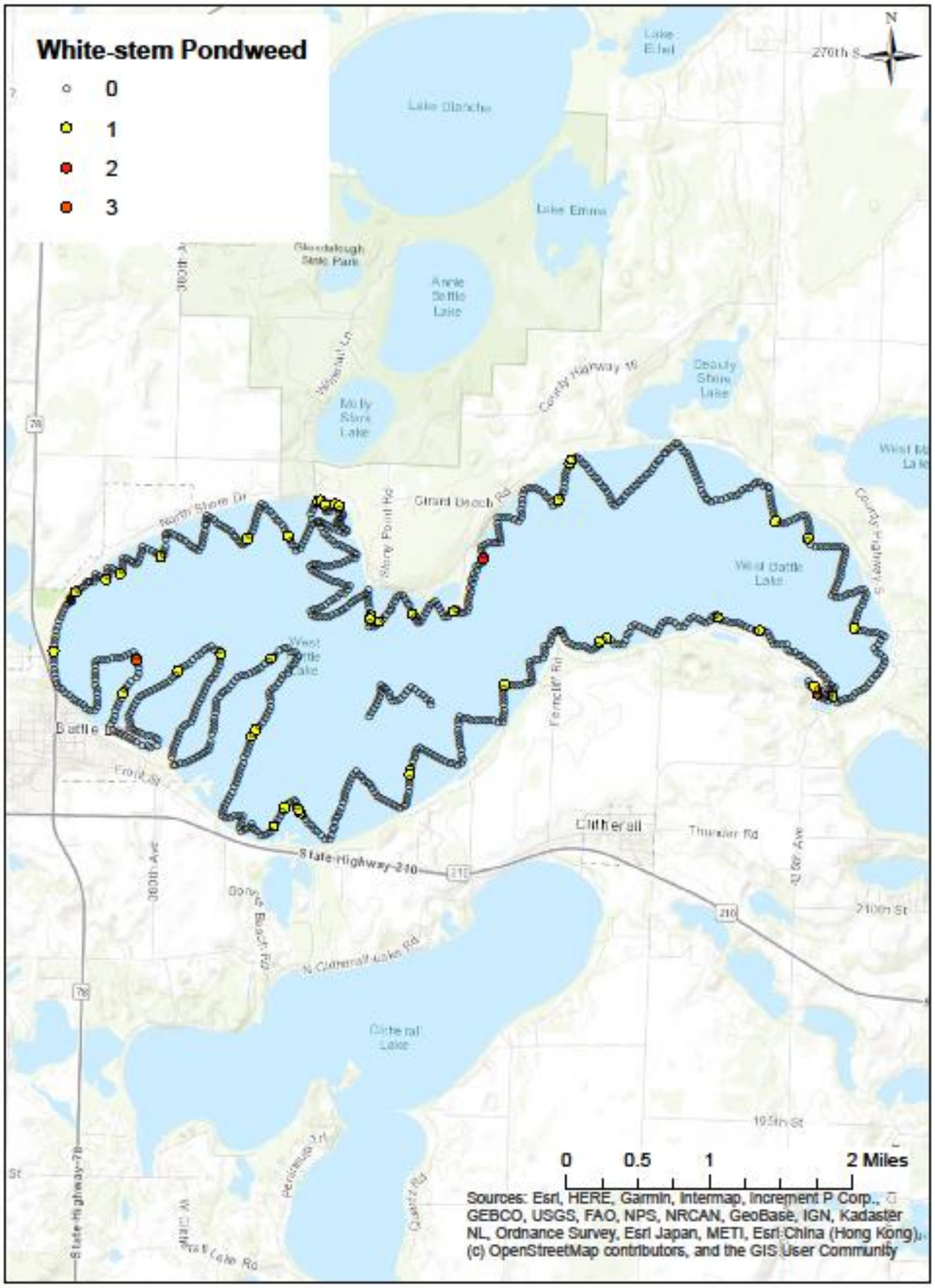
Table 2. Aquatic plants surveyed from West Battle Lake, Ottertail County, MN.

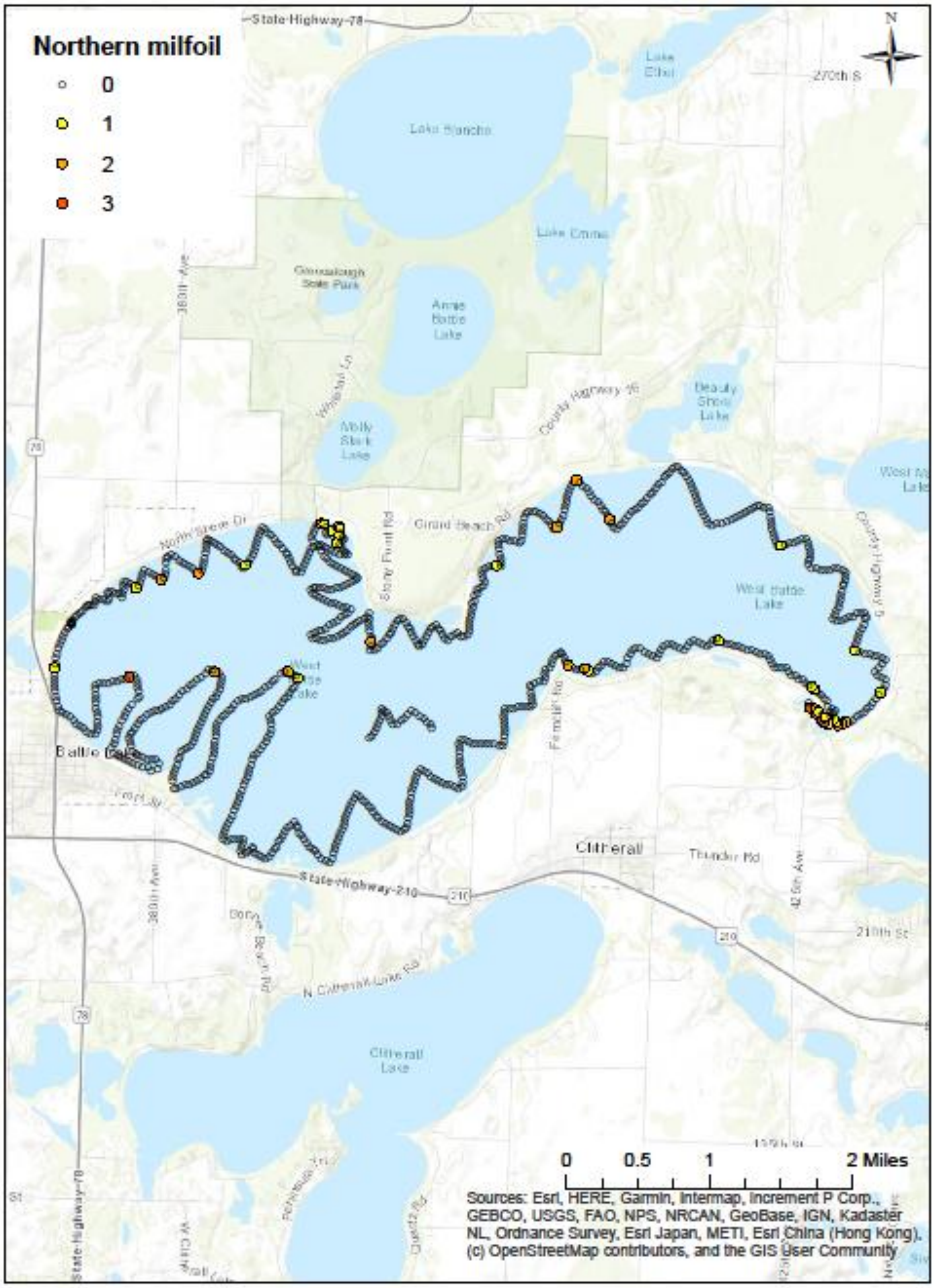
West Battle Lake				All sampled sites Frequency (%)	
Life Form	**Common Name**	**Scientific Name**	**Count**		
SUBMERGED – ANCHORED – These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants are often rooted or anchored to the lake bottom.	Chara	*Chara sp.*	463	46.7%	
	Badderswort	*Utricularia*	78	7.9%	
	White-stem pondweed	*Potamogeton praelongus*	45	4.5%	
	Northern watermilfoil	*Myriophyllum sibiricum*	44	4.4%	
	Sago pondweed	*Stucke Nia pectina*	28	2.8%	
	Coontail	*Ceratophyllum demersum*	27	2.7%	
	Narrowleaf Pondweed	*Potamogeton zosteriformes*	26	2.6%	
	Bushy pondweed	*Najas guadalupensis*	18	1.8%	
	Variable pondweed	*Potamogeton gramineus*	10	1.0%	
	Canada waterweed	*Elodea canadensis*	10	1.0%	
	Stargrass	*Hypoxis hirsuta*	10	1.0%	
	Claspingleaf pondweed	*Potamogeton perfoliatus*	7	0.7%	
	Water celery	*Vallisneria mericana*	5	0.5%	
	Illinois pondweed	*Potamogeton illinoensis*	4	0.4%	
	Marigold	*Bidens backii*	2	0.2%	
	Flat-stem pondweed	*Potamogeton zosteriformis*	1	0.1%	
FLOATING – LEAF – These plant leaves float on water and are anchored to the bottom of the lake.	Floatingleaf pondweed	*Potamogeton natans*	3	0.3%	
	White waterlily	*Nymphaea odorata*	2	0.2%	
EMERGENT – These plants extend above the water surface and are found in shallow water.	Bulrush	*Typha lati folia*	28	2.8%	
Total number of plants (species diversity for the lake)			19		
Total number of plant occurrences			811		
Total number of sites			991		


Number of Aquatic Plant Species
0
1
2
3
4
5
N
270th St
Lake Ethel
Lake Emma
Molly Stark Lake
Beauty Shore Lake
Girard Beach Rd
Stony Point Rd
Wild Battle Lake
Battle
Clitherall
State Highway 210
Thrasher Rd
210th St
Clitherall Lake
195th St
0 0.5 1 2 Miles
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Chara
0
1
2
3
N
Lake Emma
West Battle Lake
North Shore Dr
Clitherall
State Highway 210
0
0.5
1
2 Miles
Sources: Esri, HERE, Garmin, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Bladderswort
0
1
2
N
2 Miles
0
0.5
1
Sources: Esri, HERE, Garmin, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
State Highway 210
Clitherall


White-stem Pondweed
0
1
2
3
0 0.5 1 2 Miles
Sources: Esri, HERE, Garmin, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Northern milfoil
0
1
2
3
0 0.5 1 2 Miles
Sources: Esri, HERE, Garmin, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
West Battle Lake
Clitherall Lake
Clitherall
State Highway 210
State Highway 78

Discussion

West Battle Lake is a moderately deep lake for central Minnesota. The presence of plants and the depth at which one finds them is related to the water clarity. In areas where the sunlight does not reach the lake's bottom, there won't be plants present. West Battle Lake has an average clarity of 19 feet, and plant abundance was greatest between two and eleven feet of water. After eleven feet, plant abundance dropped off quickly.

The Minnesota DNR lists the littoral area of West Battle Lake to be approximately 44.5% of the total surface area, and the findings of this plant survey support these findings. In general, the littoral area is approximated as the area of the lake that is 15-20 feet deep or less; in this plant survey, no plants were found deeper than 18 feet.

Aquatic plant communities are important to a body of water because of their ability to maintain water clarity and good fish habitat. Plants in all lakes lock up nutrients in their tissues which limit algae growth, keeping lakes clear and healthy. Aquatic plants produce oxygen throughout the water column as a byproduct of photosynthesis, which oxygenates the water column. Plants also help to keep the sediments stable at the bottom of the lake and prevent it from mixing into the water column. Tiny invertebrates called zooplankton eat algae and use plants as a hiding place from predators such as perch, sunfish, and crappies.

Unfortunately, a lake isn't taken care of, the water can become green and murky (switch to the turbid state). If large areas of plants are removed, the sediments can get churned up and nutrients are released. If there are fewer plants to use the nutrients, the algae will use the nutrients and multiply. Once the water is "green" with dense algae, these lakes have mostly muck on the bottom instead of plants because the sunlight can't get through the dense algae to the bottom of the lake. Algae-dominated shallow lakes are also not as high of quality habitat for fish and wildlife. If the plants are gone there is no place for aquatic animals to hide. The natural state of the littoral area in lakes is to have abundant aquatic vegetation and clear water.

Lake Learning

Aquatic Plants – Good or Bad?

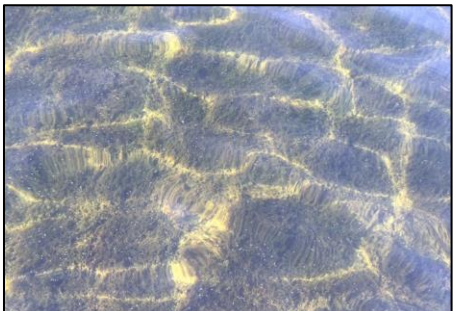
Native beneficial aquatic plants.

If you've spent any length of time at your favorite Minnesota lake, chances are you're no stranger to aquatic plants. Maybe you've cast into lily pads looking for bass, watched minnows dart to safety in plant beds, pulled in an anchor covered with green vegetation, or waded through a few plants while swimming.

Unfortunately, most people see aquatic plants as problems. They perceive lakes or lakeshores with lots of so-called "weeds" as messy and in need of cleaning. But what a cabin owner sees as a weedy mess is an essential part of a lake's or river's ecosystem (MN DNR).

Aquatic plant communities are important to a body of water because of their ability to maintain water clarity and good fish habitat. Plants in all lakes lock up nutrients in their tissues which limit algae growth keeping lakes clear and healthy. Aquatic plants produce oxygen throughout the water column as a byproduct of photosynthesis, which oxygenates the water column. Plants also help to keep the sediments stable at the bottom of the lake and prevent it from mixing into the water column. Tiny invertebrates (zooplankton and aquatic insects) eat algae and use plants as a hiding place from predators such as perch, sunfish and crappies.

The presence of plants and the depth at which one finds them is related to the water clarity. In areas where the sunlight does not reach the lake's bottom (usually deep areas), there won't be plants present.



A Muskgrass (Chara) meadow in clear water.

Minnesota is home to about 150 species of aquatic plants, most of which are native species. Certain native plants can be water quality indicators. Muskgrass (*Chara*) is found more often in lakes with good water clarity. Though it gives off a 'musky' odor when brought to the surface, it is a great bottom stabilizer and slows the suspension of sediments; therefore, large communities of it can greatly benefit water quality and clarity. This plant is also wonderful habitat for fish and is a favorite food for waterfowl.

Bladderwort is a very interesting native aquatic plant. It is carnivorous and captures small invertebrates with its bladder-like traps. Despite their small size, the traps are extremely sophisticated. The prey brush against trigger hairs connected to the trapdoor. The bladder, when "set", is under negative pressure in relation to its environment so that when the trapdoor is mechanically triggered, the prey, along with the water surrounding it, is sucked into the bladder. Once the bladder is full of water, the door closes again, the whole process taking only ten to fifteen milliseconds

Bulrush is very important to a lake for many reasons. It provides spawning habitat for crappies, filters the water, and helps to prevent shoreline erosion by acting as a wave break. It is imperative to protect bulrush beds in lakes for these reasons. Larger leave plants, such as the pondweeds, are important spawning and hiding areas for panfish.

Bladderwort, a carnivorous aquatic plant that is common in Minnesota lakes.

Homeowners should be careful not to cut or remove large areas of native plants in the lake. When aquatic plants are uprooted, the lake bottom is disturbed, and the phosphorus in the water column gets used by algae instead of plants. This contributes to "greener" water and more algae blooms. Protecting native aquatic plant beds will ensure a healthy lake and healthy fishery. If a swimming area is necessary in front of people's docks, clear only a small area of plants. Clearing a whole 100 foot frontage is not necessary and can contribute to additional algae blooms. The natural, healthy state of shallow lakes and bays is to have clear water and abundant native plant growth.

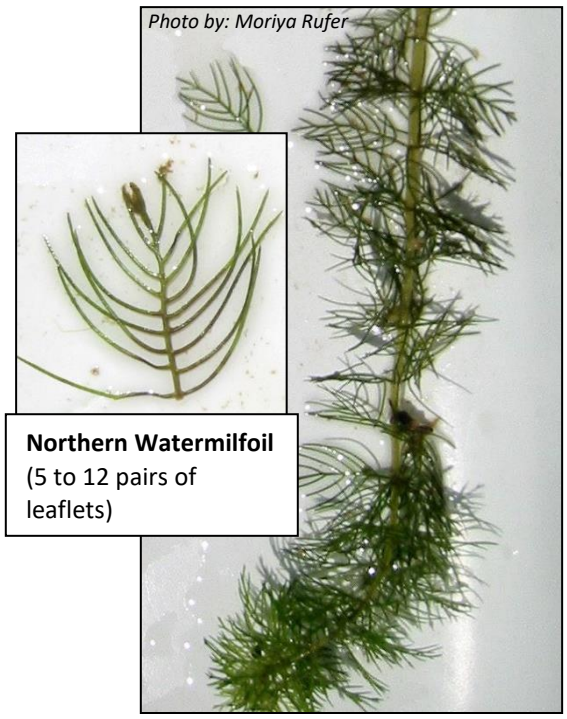
Some aquatic plants in Minnesota are not native and they may cause problems. Control of these species may be done to reduce interference with boating or swimming, to reduce the risk of spread of invasive species to un-infested water-bodies, or in some situations to attempt to produce ecological benefits such as increases in native plant communities. A DNR permit is needed for removal of aquatic plants including aquatic invasive species, and for plant control devices such as weed rollers.

Resources
DNR Guide to Aquatic Plants: https://www.dnr.state.mn.us/shorelandmgmt/apg/index.html
Permits to control aquatic plants: https://www.dnr.state.mn.us/shorelandmgmt/apg/permits.html
DNR AIS Specialists: https://www.dnr.state.mn.us/invasives/ais/contacts.html
AIS permits: https://www.dnr.state.mn.us/invasives/training_permits.html

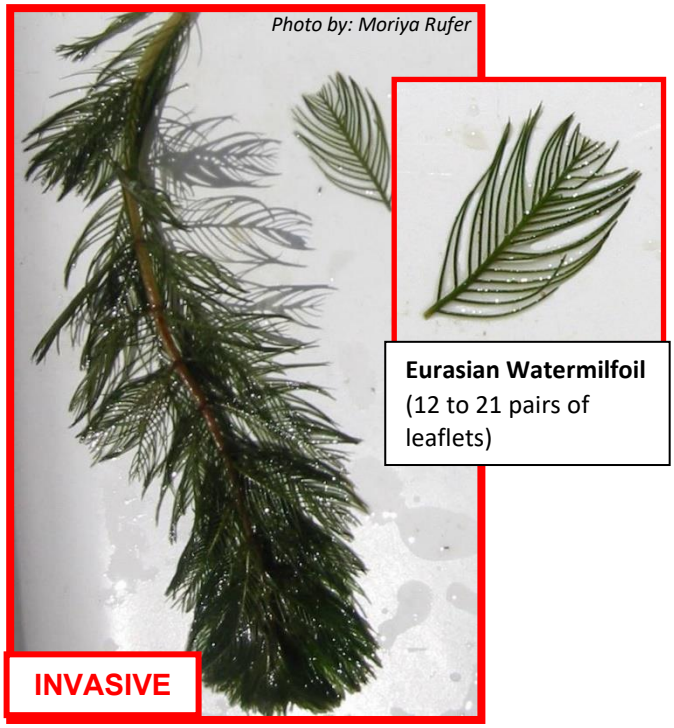
Enjoy the lakes! This article was written and shared by Moriya Rufer at RMB Environmental Laboratories as part of continuing education for their Lakes Monitoring Program (218-846-1465, lakes@rmbel.info). To learn more, visit www.rmbel.info.

Aquatic Plants In Minnesota Lakes

Compiled by Emelia Hauck Jacobs and Moriya Rufer, RMB Environmental Laboratories, Inc, 218-846-1465, rmbel.info

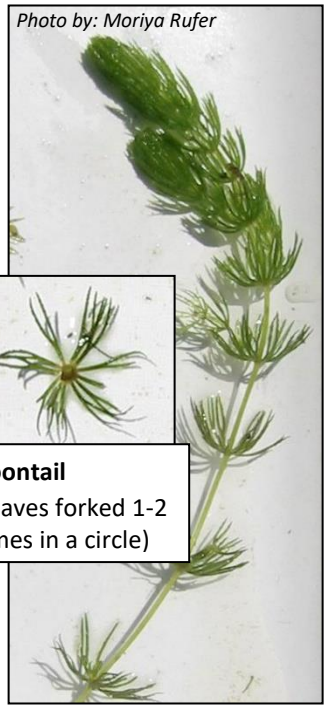


Northern Watermilfoil
(*Myriophyllum sibiricum)*

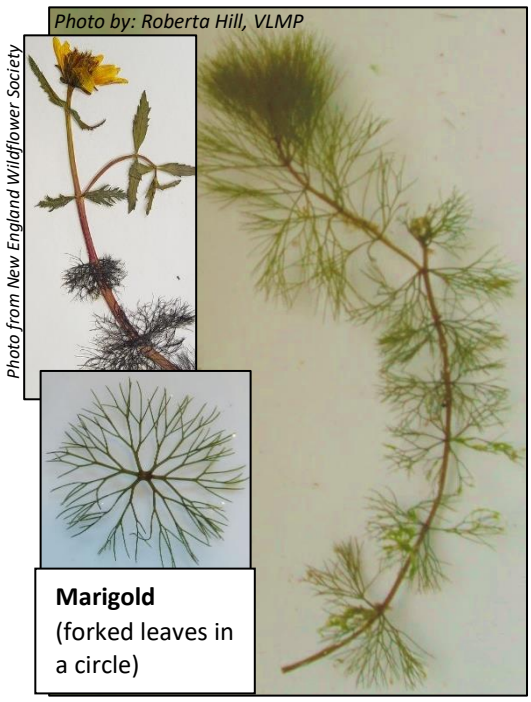


Eurasian Watermilfoil
(*Myriophyllum spicatum)*

Bladderwort
(*Utricularia vulgaris*)



Coontail
(Ceratophyllum demersum)



Water Marigold
(Bidens beckii)

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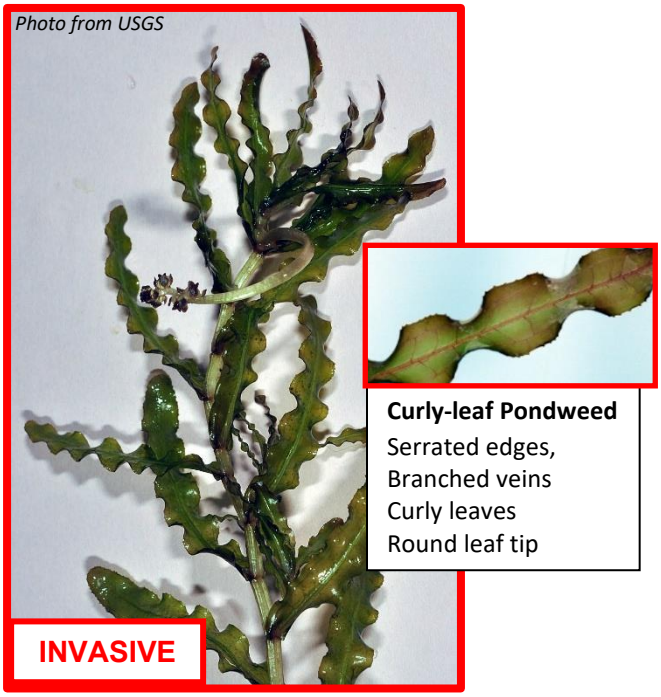
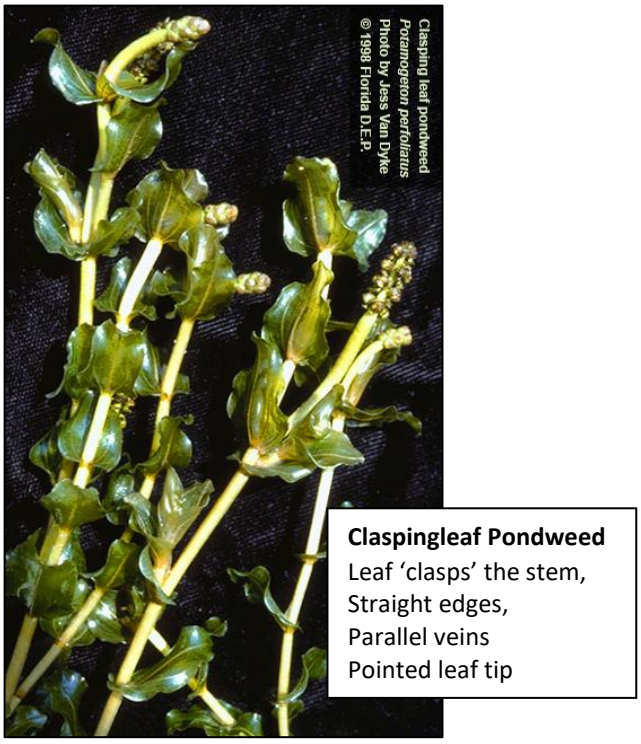


Curly-leaf Pondweed
(*Potamogeton crispus*)

Whitestem Pondweed
(*Potamogeton praelongus*)



Claspingleaf Pondweed
(*Potamogeton richardsonii*)

Robbin's Pondweed
(*Potamogeton robinsii)*

Aquatic Plants In Minnesota Lakes

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Chara
(*Chara spp.*)

Starry Stonewort
(*Nitellopsis obtuse)*

Sago Pondweed
(*Potamogeton pectinatus)*

Brittle Naiad
(*Najas minor)*

Aquatic Plants In Minnesota Lakes

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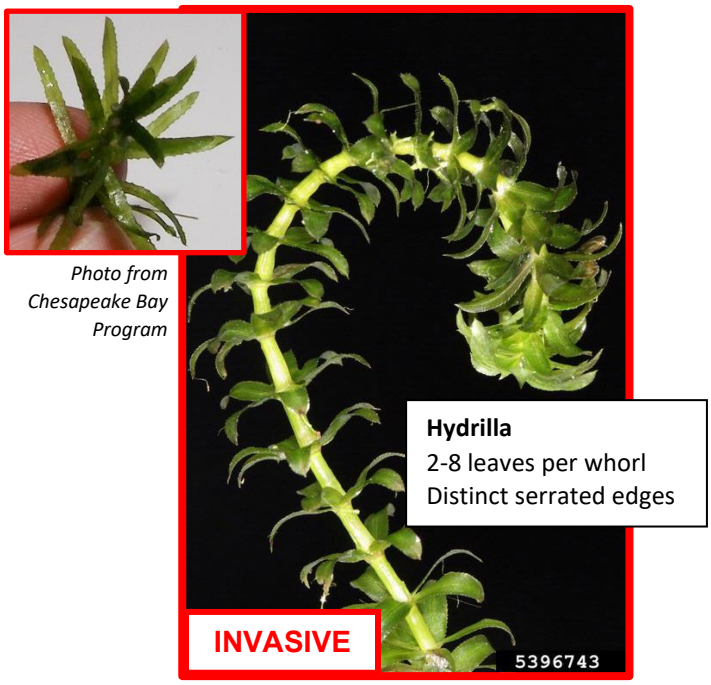
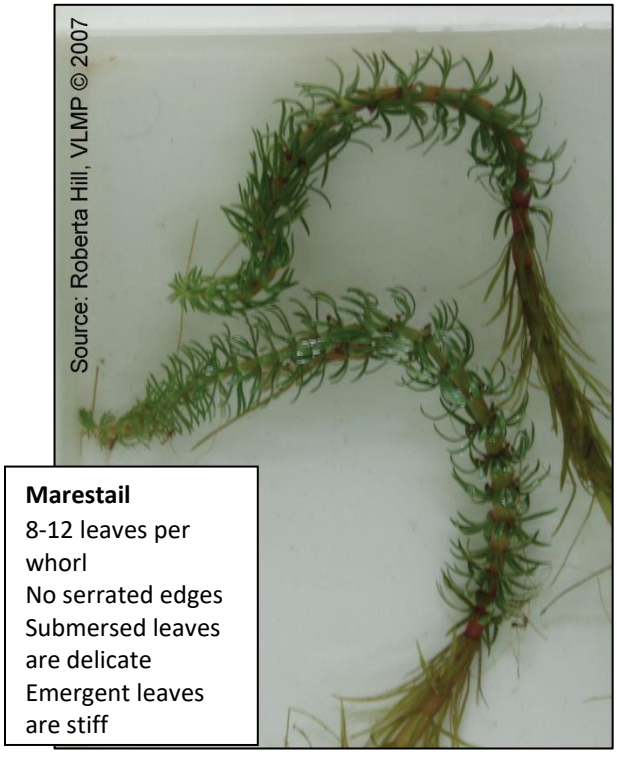
Brazilian Elodea
(Egeria densa)



Hydrilla
(*Hydrilla verticillata*)

Canada Waterweed
(Elodea canadensis)



Marestail
(*Hippuris vulgaris)*

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Madsen, J. D. 1999. Point intercept and line intercept methods for aquatic plant management. *APCRP Technical Notes Collection* (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/aqua