
TURTLE LAKE, RAMSEY COUNTY: 2023 AQUATIC VEGETATION REPORT

Report by the Invasive Species Program – Division of Ecological and Water Resources
Minnesota Department of Natural Resources

Lake: Turtle (DOW# 62006100)

Lake Surface Area: 454 acres

Littoral Area: 284 acres

County: Ramsey

Survey Type: Point-intercept

Date of Survey (most recent): July 19, 2023

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2023 Summary:

The most recent aquatic vegetation point-intercept survey of Turtle Lake (DOW# 62006100) was completed on July 19, 2023. Submersed plants were identified out to a maximum depth of 3.96 meters (13 feet). Within the littoral zone (area in the lake from the 0 – 15-foot depth range [0 – 4.5 meters]), 57% of sampled points contained native submersed taxa. The average number of native submersed taxa per sample point was 1.73. Fourteen submersed plant species were documented during the 2023 survey including one invasive plant species, Eurasian watermilfoil. Offshore herbicide treatments targeting Eurasian watermilfoil have been organized since 2002 by the Turtle Lake Homeowners Association.

Summary Table. Summary of aquatic submersed plants in Turtle Lake, Ramsey County, Minnesota (DOW# 62006100) as indicated by the results of point-intercept surveys. Values were calculated from littoral depth range (0 – 15 feet).

PI Survey Date	% Frequency of EWM*	Max Depth of Growth in feet [95%] [†]	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa	AVG Secchi Depth [m]
JUN 2 2010	5	-	-	-	14	3.6
JUN 4 2014	3	-	-	-	17	3.1
JUL 12 2016	5	12	54	1.2	19	2.4
JUL 13 2017	5	11	70	1.6	15	2.9
JUL 23 2018	3	11	72	1.9	14	3.3
JUL 21 2022	-	8	49	1.3	13	2.2
JUL 19 2023	16	10	57	1.7	14	2.7

*EWM is short for Eurasian watermilfoil

[†]95th percentile calculated based on all vegetated sampling points

Taxa refers to groups of submersed aquatic plant species or genera

AVG – average Secchi depth (water clarity measurement) from May - September

Lake Description:

Turtle Lake is a 454-acre lake located in Shoreview, Minnesota and contains one public access. It has two invasive aquatic plant species: Eurasian watermilfoil (*Myriophyllum spicatum*, abbreviated as EWM) and curly-leaf pondweed (*Potamogeton crispus*, abbreviated as CLP). The maximum depth of water is 8.5 meters (28 feet). Approximately 63% of the lake is littoral (water depth zone from 0 – 15 feet where aquatic plants are likely to be found). Turtle Lake is mesotrophic and contains a moderate level of nutrients. For more information on Turtle Lake water quality: <https://webapp.pca.state.mn.us/surface-water/station/62-0061-00-100> and <https://arcgis.dnr.state.mn.us/ewr/whaflakes/>.

Table 1-Secchi Averages. Average Secchi disk observations in meters for Turtle Lake, Ramsey County, Minnesota (DOW# 62006100). Data gathered from the Minnesota Pollution Control Agency (station #208) unless otherwise noted. No data was collected in 2015.

YEAR	MAY	JUNE	JULY	AUG	SEPT	Secchi Depth Average [May-Sept]
2010	5.6	5.5	2.8	2.5	1.8	3.6
2011	3.3	2.3	2.9	2.3	1.1	2.4
2012	3.5	2.3	3.0	2.1	2.4	2.7
2013	6.1	3.7	3.4	3.6	2.8	3.9
2014	3.6	4.1	2.4	2.8	2.5	3.1
2015	-	-	-	-	-	-
2016	3.0	2.3	2.6	2.3	2.0	2.4
2017*	3.8	2.3	3.4	2.7	2.5	2.9
2018	4.6	2.7	3.0	2.7	3.4	3.3
2019	4.5	4.0	3.5	2.7	2.6	3.5
2020	3.3	2.1	3.0	2.4	2.7	2.7
2021	3.3	3.7	3.4	2.4	2.0	3.0
2022	2.8	2.5	2.0	2.1	1.7	2.2
2023	4.0	2.8	2.2	2.4	2.1	2.7

*Data gathered by the Minnesota Department of Natural Resources

Management History:

Pre-treatment delineation surveys and organization has been conducted by Freshwater Scientific Services and the Turtle Lake Homeowners Association, respectively. In 2023, with an increased abundance in EWM a whole-lake treatment was implemented with the use of Fluridone. Treatment size has ranged from 5 to 42 acres in the past nine years using five different herbicides. 2,4-D has been historically used to target EWM in Turtle Lake (2012 – 2018), while a combination treatment using Diquat and ProcellaCOR has been used in the three following seasons. See **Table 2-Invasive Plant Management Summary** below for more information on invasive plant management activities. Non-native Phragmites (an invasive emergent reed) has been historically managed by mechanical and herbicide means, treating <1 acre from 2014-2016. Additional information available upon request.

Table 2-Invasive Plant Management Summary. Characteristics and history of herbicide treatment for Turtle Lake, Ramsey County, Minnesota (DOW# 62006100, total acres: 454.0, littoral acres: 284.2, 15% littoral acres: 42.6).

Date	Treatment [W, P, N]	Target Species	Total Acres Treated	Herbicide	Licensed Commercial Applicator
2012	P	EWM	20	2,4-D	Midwest Aquacare
2013	P	EWM	25	2,4-D	Midwest Aquacare
2014	P	EWM	5	2,4-D	Midwest Aquacare
2015	P	EWM	25	2,4-D	Midwest Aquacare
2016	P	EWM	8.9	2,4-D	Midwest Aquacare
2017	P	EWM	9.7	2,4-D	Lake Management
2018	P	EWM	21.8	2,4-D	PLM Lake & Land Mgmnt
	P	EWM	7.9	Triclopyr	PLM Lake & Land Mgmnt
2019	P	EWM	8.3	Diquat	PLM Lake & Land Mgmnt
2022	P	EWM	16.6	ProcellaCOR, Diquat	PLM Lake & Land Mgmnt
2021	P	EWM	31.4	ProcellaCOR, Diquat	PLM Lake & Land Mgmnt
2022	P	EWM	42.6	ProcellaCOR, Diquat	PLM Lake & Land Mgmnt
2023	W	EWM	454	Fluridone	PLM Lake & Land Mgmnt

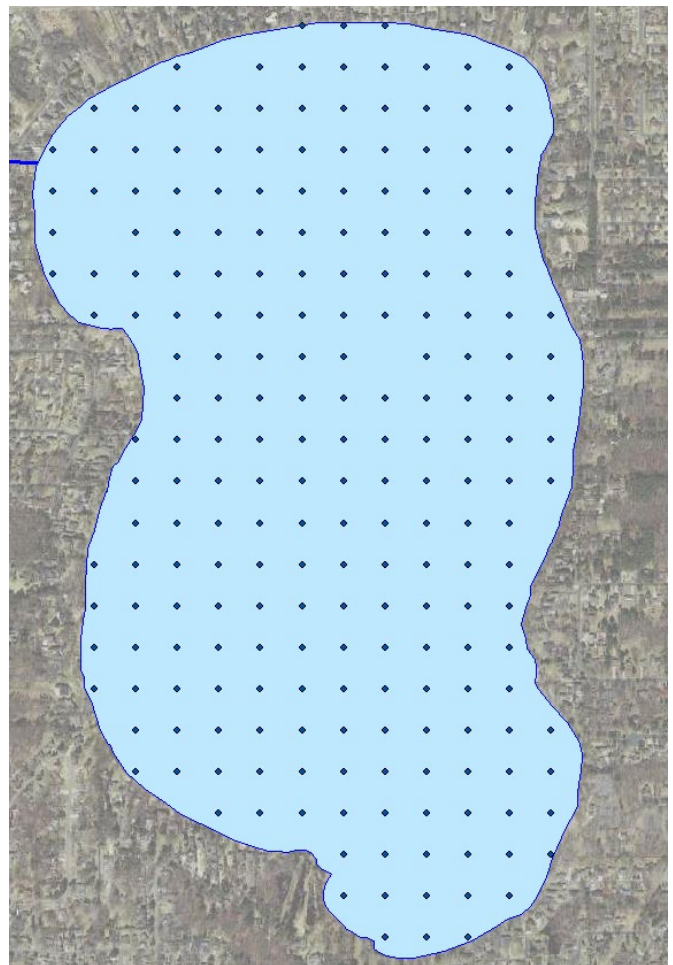
Treatment: W (whole lake), P (partial lake), N (no treatment)
EWM is an abbreviation for Eurasian watermilfoil

Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Turtle Lake. The primary purpose for this type of survey is to 1) develop baseline knowledge of the current plant community in a lake, and over time, 2) compare year to year plant variation (in plant presence and spatial location). Moreover, this survey will help the Minnesota Department of Natural Resources and our partners monitor native plant communities and evaluate possible responses to invasive aquatic plant management efforts. It is important to note that distributions of aquatic plants may vary from year to year due to effects such as differences in weather, as well as the effects from plant and water quality management.

Survey Methods:

We used a point intercept survey method developed by John Madsen in [“Aquatic Plant Control Technical Note MI-02, 1999”](#). Survey points were historically placed 70 meters apart using a Geographic Information System (GIS). This spacing allowed for placement of 335 points in years prior to 2022. In 2022, and subsequent years, a new grid was created where survey points were placed 90 meters apart allowing for placement of 225 points. Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point. Plant samples were assessed on the boat to determine species and rake fullness as a surrogate for abundance (scale of zero [no plants] to 4 [dense plants, matted on the surface] was used in 2012 – 2017, and a zero to 3 scale in 2018 and all years thereafter). Frequencies of occurrence percentages (i.e., how often a plant species was found in the lake) were calculated based on the littoral zone (the portion of the lake is less than 15 feet in depth).



Survey Observations:

The Minnesota Department of Natural Resources (MN DNR) Invasive Species Program has conducted point intercept surveys on Turtle Lake in 2016, 2017, 2018, 2022, and 2023. Maximum depth of rooted vegetation remains relatively consistent (between 2.4 – 3.6 meters [8 – 12 feet]; see **Table 3 – Point Intercept Metrics** for historical point-intercept survey calculations). In 2023, thirteen native submersed aquatic plants species were observed. In addition, plant diversity has remained constant with six out of the seven surveys ranging from 12 to 15 species.

The most common native taxa included macroalgae, clasping-leaf pondweed, flat-stem pondweed, naiad, and water celery (see **Table 4 – Plant Frequency Occurrence** for historical plant frequency observations). Native plant frequency has stayed consistent from 2010 to 2022 with macroalgae and naiads peak frequencies occurring in 2010 and 2014, while water celery has increased from 2018 to 2023.

Eurasian watermilfoil was detected in the most recent survey with a frequency of 16%. Northern watermilfoil was found with a frequency of 1%. Identification of northern watermilfoil was based on leaflet count. Both pure genetic Eurasian watermilfoil and northern watermilfoil strains have been recorded in Turtle Lake.

The Ramsey Conservation District (RCD) & Ramsey County Public Works Environmental Resources (RCPW) have aquatic plant data from surveys conducted in June of 2010 and 2014. Most native submersed plant taxa have remained the same across all surveys, except for variable-leaf pondweed and water stargrass (found by Minnesota Department of Natural Resources only), whitewater crowfoot (found by RCD & RCPW only). Additionally, curly-leaf pondweed has only been documented in the 2010 and 2014 surveys, likely due to time of year. More information on either survey can be provided upon request.

Table 3 – Point Intercept Metrics. Summary of point intercepts metrics for Turtle Lake, Ramsey County, Minnesota (DOW # 62006100). Shaded values were calculated from littoral depth range (0 – 15ft).

Survey Metrics	JUN 2 2010	JUN 4 2014	JUL 12 2016	JUL 13 2017	JUL 23 2018	JUL 21 2022	JUL 19 2023
Treated (Y/N)	-	Y	Y	Y	Y	Y	Y
Surveyor	RCD	RCD	MN DNR	MN DNR	MN DNR	MNDNR	MNDNR
Total # Points Sampled	110	336	332	335	300	170	112
Max Depth of Growth (95%) in feet	-	-	12	11	11	8	10
# Point in Max Depth Range	-	-	156	164	168	100	99
# Points in Littoral (0-15 feet)	-	-	182	191	189	136	112
% Points w/ Submersed Native Taxa	-	-	54	70	72	49	57
Mean Submersed Native Taxa/ Point	-	-	1.2	1.6	1.9	1.3	1.8
# Submersed Native Taxa	12	15	18	14	13	13	13
# Submersed Non-Native Taxa	2	2	1	1	1	-	1

Table 4 – Plant Frequency Occurrence. Historic percent frequency of occurrence for submersed vegetation within the littoral zone (0 – 15 feet) in Turtle Lake, Ramsey County, Minnesota (DOW # 62006100). 2010 and 2014 surveys were conducted by the Ramsey Conservation District & Ramsey County Public Works Environmental Resources. Surveys in 2016-2018, 2022, and 2023 were conducted by Minnesota Department of Natural Resources.

Taxonomic Name	Common Name	JUN 2	JUN 4	JUL 12	JUL 13	JUL 23	JUL 21	JUL 19
SUBMERSED PLANTS		2010	2014	2016	2017	2018	2022	2023
<i>Myriophyllum spicatum</i> *	Eurasian watermilfoil*	5	3	5	5	3	-	16
<i>Ceratophyllum demersum</i>	Coontail	2	3	2	2	7	3	7
<i>Elodea canadensis</i>	Canada waterweed	9	2	1	2	4	2	4
<i>Heteranthera dubia</i>	Water stargrass	-	-	-	-	-	1	5
<i>Macroalgae</i>	Muskgrass and Stonewort	59	70	27	36	39	29	50
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	8	8	2	2	1	7	1
<i>Najas spp.</i>	Naiad	54	51	13	11	33	17	17
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	18	5	1	-	-	3	5
<i>Potamogeton gramineus</i>	Variable-leaf pondweed	-	-	7	4	14	2	11
<i>Potamogeton illinoensis</i>	Illinois pondweed	1	11	7	5	6	11	9
<i>Potamogeton praelongus</i>	White-stem pondweed	-	32	4	9	6	1	2
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	15	5	5	12	15	14	30
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	-	2	2	3	4	7	20
<i>Stuckenia pectinata</i>	Sago pondweed	-	7	1	1	2	-	-
<i>Vallisneria americana</i>	Water celery	4	3	3	3	2	10	13

*Denotes invasive aquatic plant

Floating, free-floating & emergent plants observed: *Phragmites australis subsp. Australis* (non-native common reed) and *Phragmites australis subsp. Americanus* (native common reed), *Nymphaea odorata* (white waterlily), *Sagittaria spp.* (arrowhead)

Less common (< 5% frequency) submersed vegetation observed: *Potamogeton crispus* (curly-leaf pondweed) in 2010 and 2014, *Eleocharis acicularis* (needle spikerush) in 2017 and 2018, *Heteranthera dubia* (water stargrass) in 2022, *Myriophyllum tenellum* (dwarf watermilfoil) in 2017, *Potamogeton foliosus* (leafy pondweed) in 2016, *Potamogeton pusillus* (small pondweed) in 2016, *Potamogeton robbinsii* (fern-leaf pondweed) in 2016, *Potamogeton strictifolius* (narrowleaf pondweed) in 2017, *Ranunculus aquatilis* (white water crowfoot) in 2010, and *Utricularia macrorhiza* (common bladderwort) in 2016.



Photos 1 & 2. Left (1): Collection of decaying Eurasian watermilfoil after the 2023 Fluridone treatment. Right (2): Rake of aquatic vegetation from point intercept survey conducted in July 2023. Turtle Lake, Ramsey County, Minnesota (DOW # 62006100).

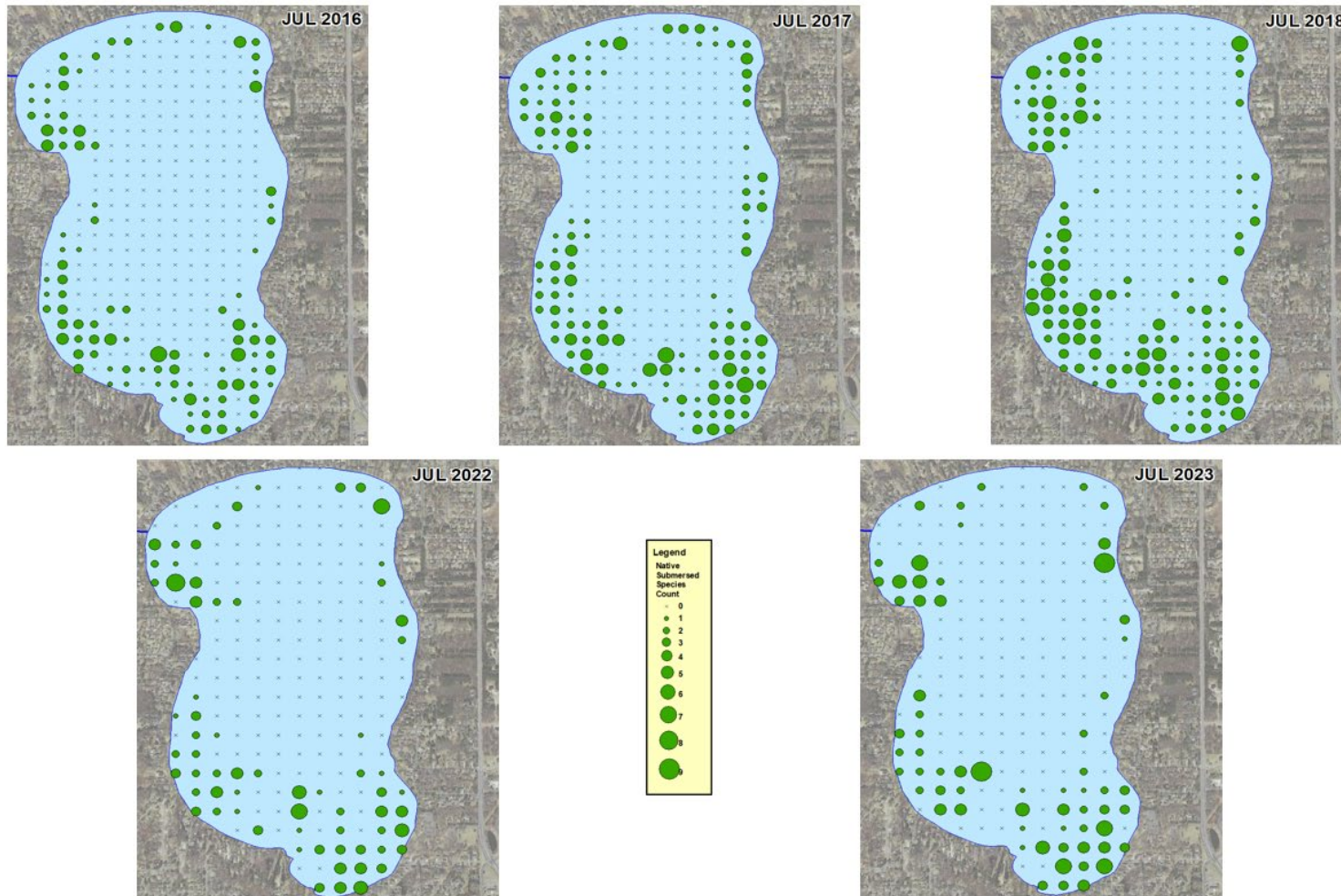


Figure 1 – Native Species Taxa Density. Spatial distribution and species richness (# of native species per sample point) of all submersed plant species from 2016-2018, 2022, and 2023 surveys in Turtle Lake, Ramsey County, Minnesota (DOW#62006100). Surveys conducted in 2016 – 2018 used 300 to 335 sampling points, 170 points were sampled in 2022, and 112 points were sampled in 2023.

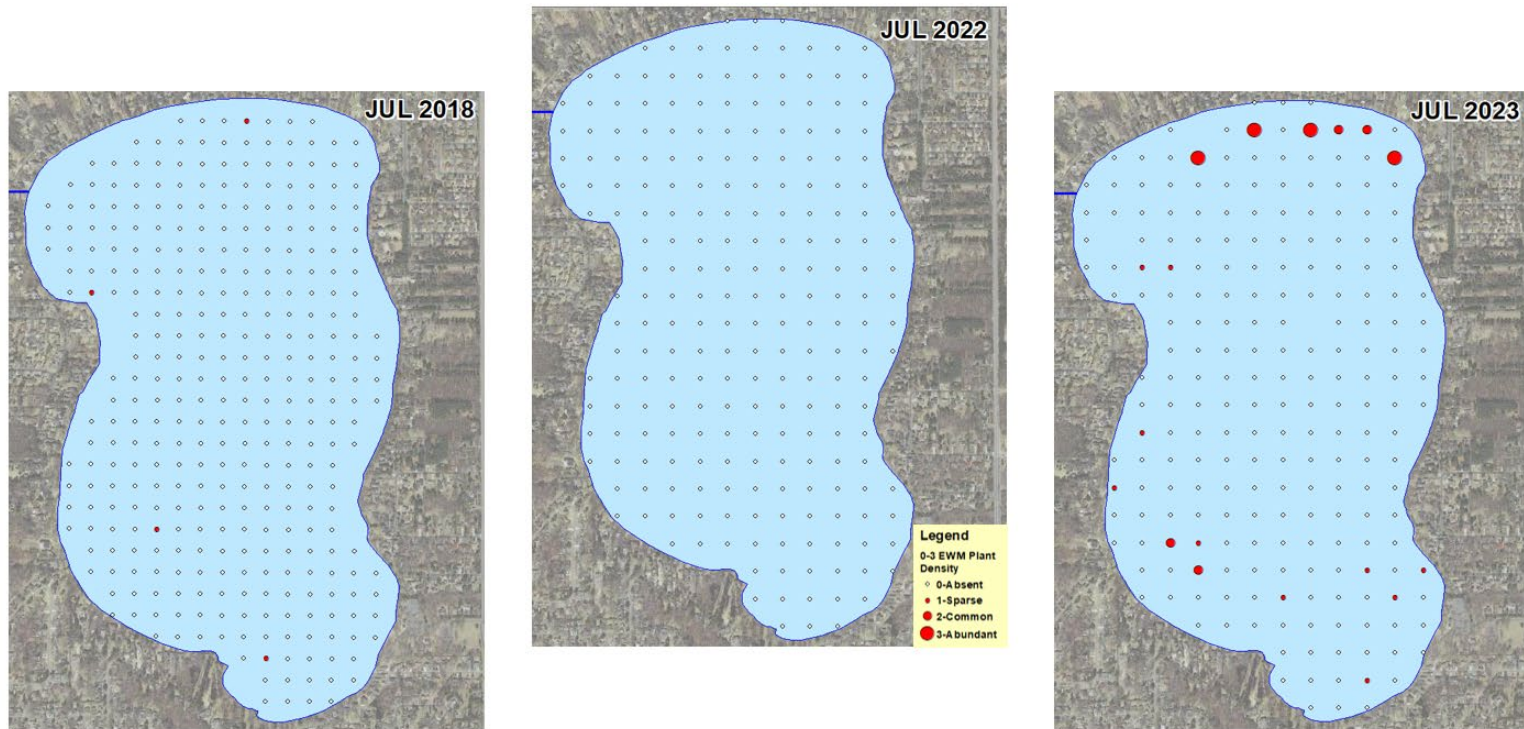


Figure 2 – Eurasian Watermilfoil Density Spatial distribution and rake density rating per sample point of Eurasian watermilfoil. The July 2018 map displays point intercept survey data following a spring Triclopyr treatment. The July 2022 map displays point intercept survey data following a spring ProcellaCOR and Diquat combination treatment; no Eurasian watermilfoil was observed. The August 2023 map displays point intercept survey data following a spring fluridone treatment. Dot sizes are based on a 1-3 density rake rating. Turtle Lake, Ramsey County, Minnesota (DOW# 62006100).

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