

## BIG MARINE LAKE, WASHINGTON COUNTY: 2020 AQUATIC VEGETATION REPORT

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

**Lake:** Big Marine (DOW# 82005200)

**Lake Surface Area:** 1799 acres

**Littoral Area:** 1278 acres

**County:** Washington

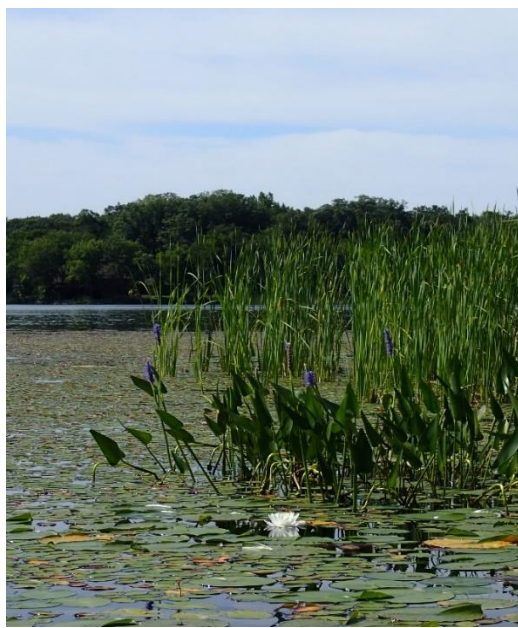
**Survey Type:** Point-intercept

**Date of Survey (most recent):** August 6, 2020

**Observer[s]:** Keegan Lund (MnDNR),  
Kylie Cattoor (MnDNR)

**Report updated:** May 24, 2021

**Author[s]:** Keegan Lund  
Email: Keegan.Lund@state.mn.us  
Phone: 651.259.5828



**Summary Table.** Summary of aquatic submersed plants in Big Marine, Minnesota (DOW# 82005200) as indicated by 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%] <sup>†</sup>	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa
AUG 2010	12	12	100	3.8	19
AUG 2015	15	16	99	3.9	26
AUG 2016	17	16	99	4	35
AUG 2017	28	14	97	3.8	29
AUG 2020	19	12	95	4	29

\*EWM is short for Eurasian watermilfoil

<sup>†</sup>95<sup>th</sup> percentile calculated based on all vegetated sampling points

Taxa refers to groups of submersed aquatic plant species or genera

## 2020 Summary:

The most recent aquatic vegetation point-intercept survey of Big Marine Lake (DOW# 82005200) was completed on August 6, 2020. Submersed plants were identified out to a maximum depth of 3.7 meters (12.0 feet). Within the littoral zone (zone in lake from the 0-15 foot depth range [0-4.5 meters]), 95% of sampled points contained native submersed taxa. The average number of native submersed taxa per sample point was 34.0. Twenty-nine submersed plant species were documented during the 2020 survey including one invasive submersed plant species, Eurasian watermilfoil. Historically, curly-leaf pondweed has also been observed. Offshore herbicide treatments targeting Eurasian watermilfoil have been organized since 2009 by the Big Marine Lake Association. Native abundance and species richness have remained high during this timeframe.

## Lake Description:

Big Marine Lake is a 1799-acre lake located near Forest Lake, Minnesota. It has two invasive aquatic plant species: Eurasian watermilfoil (*Myriophyllum spicatum*, abbreviated as EWM) and curly-leaf pondweed (*Potamogeton crispus*). The maximum depth of water is 15.24 meters (50 feet).

Approximately 71% of the lake is littoral. Big Marine Lake is mesotrophic and contains a moderate level of nutrients. For more information on Big Marine Lake water quality, see

<http://cf.pca.state.mn.us/water/watershedweb/wdip/waterunit.cfm?wid=82-0052-00>.

**Table 1-Secchi Averages.** Average Secchi disk observations in meters for Big Marine Lake, Washington County, Minnesota (DOW# 82005200). Data gathered from the Minnesota Pollution Control Agency.

YEAR	MAY	JUNE	JULY	AUG	SEPT	Secchi Depth Average [May-Sept]
2014	4.4	4.5	3.4	4.1	2.6	3.8
2015	4.5	4.6	3.7	3.4	2.8	3.8
2016	5.64	4.57	3.81	3.05	3.51	4.1
2017	4.06	4.19	3.5	3.66	2.9	3.7
2018	3.96	5.8	4.0	3.96	3.66	4.3
2019	6.1	5.95	4.5	4.45	4.75	5.2
2020	5.2	3.5	4.2	3.75	3.67	4.1

## Management History:

In recent years, 2019 and 2020, a combined treatment using ProcellaCOR and Diquat was used to target EWM and was organized by the Big Marine Lake Association (BMLA). Eight to 16 acres were treated with triclopyr from 2016 to 2018 while prior to this 2,4-D was utilized. In 2016, BMLA evaluated the effectiveness of various herbicides and exposures on spot treatments of EWM through herbicide concentration monitoring and pre/post treatment invasive plant delineations using a third party consultant. The BMLA have observed a reduction in areas treated for EWM (19 acres in 2015, 11.65 acres in 2020). See **Table 1-Invasive Plant Management Summary** below for more information on historical invasive plant management activities.

**Table 2-Invasive Plant Management Summary.** Characteristics and history of herbicide treatment for Big Marine Lake (DOW# 82005200), Total acres: 1799, Littoral acres: 1278, 15% Littoral acres: 191.7.

Date	Treatment [W,P,N]	Target Species	Total Acres Treated	Herbicide	Licensed Commercial Applicator
JUL 2009	P	EWM	9.5	2,4-D	Lake Management
JUN 2010	P	EWM	19	2,4-D	Lake Management
JUN 2011	P	EWM	16	2,4-D	Lake Management
JUN 2012	P	EWM	27	2,4-D	Lake Management
JUN 2013	P	EWM	30	2,4-D	Lake Management
JUL 2014	P	EWM	40	2,4-D	PLM Lake & Land Management Corp
JUN 2015	P	EWM	35	2,4-D (liquid & granular)	PLM Lake & Land Management Corp
JUN 2016	P	EWM	16	Triclopyr	PLM Lake & Land Management Corp
JUN 2017	P	EWM	11.6	Triclopyr	PLM Lake & Land Management Corp
JUN 2018	P	EWM	8	Triclopyr	PLM Lake & Land Management Corp
JUN 2019	P	EWM	8.7	ProcellaCOR/ Diquat	PLM Lake & Land Management Corp
JUL 2020	P	EWM	0.6	ProcellaCOR/ Diquat	PLM Lake & Land Management Corp

Treatment: W (whole lake ), P (partial lake), N (no treatment)

EWM is an abbreviation for Eurasian watermilfoil

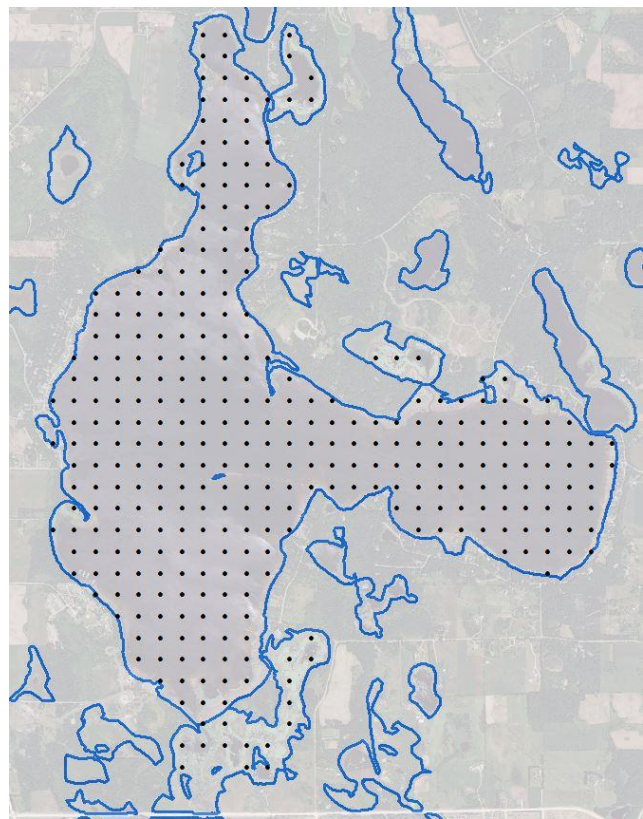
## Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Big Marine 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 DNR 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 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 placed 150-200 meters apart using a Geographic Information System (GIS). This spacing allowed for placement of 174-341 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 density (scale of zero [no plants] to 4 [dense, matted on the surface] was used in 2012-2017 and a zero to 3 scale in 2018 and subsequent years).

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 that is less than 15 feet in depth).



## Survey Observations:

The MN DNR Invasive Species Program conducted a preliminary point intercept survey of Big Marine Lake in 2010 (187 sampling point survey). Since 2015, a more extensive point intercept survey has been conducted (174-341 sampling point survey). In 2020, maximum depth of rooted vegetation was at 3.7 meters and 95% of points within the littoral zone contained native taxa (see **Table 2-Point Intercept Metrics** for historical point-intercept survey calculations). There was an average of 4.0 native taxa per point and a total of 28 submersed native taxa observed as well as one invasive species, which is consistent with the past four historical surveys. Eurasian watermilfoil was found at a 19% frequency of occurrence (FOO) while curly-leaf-pondweed has only been found in 2016. The most common native taxa included coontail, naiad, variable-leaf pondweed, fern-leaf pondweed and flat-stem pondweed (see **Table 3-Plant Frequency Occurrence** for historical plant frequency observations). Ten pondweed species were observed in the most recent survey offering a high level of diversity for a metro lake. Throughout the past ten years, frequencies of native submersed plants have increased or remained largely the same. Other macrophytes were observed in 2020 at lower frequencies including: three bladderwort species (common bladderwort, lesser bladderwort, floating bladderwort), water stargrass, and spiny hornwort. Additionally, Narrowleaf water plantain (*Alisma gramineum*), a rare aquatic plant, was first observed in the 2016.

**Table 3- Point Intercept Metrics.** Summary of point intercepts metrics for Big Marine Lake, Washington County (DOW# 82005200). Shaded values were calculated from littoral depth range.

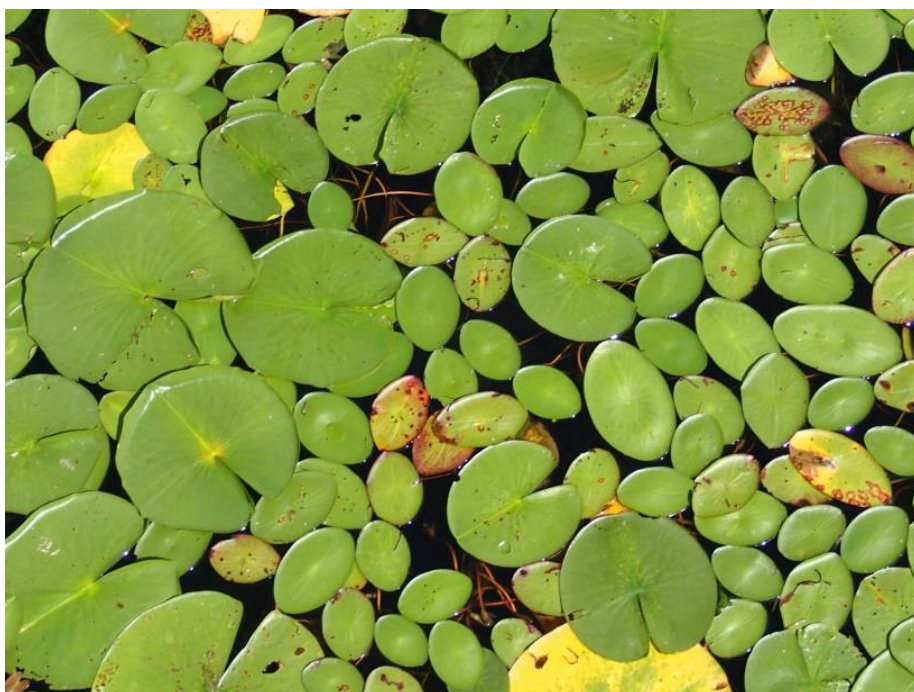
Survey Metrics	AUG 2010	AUG 2015	AUG 2016	AUG 2017	AUG 2020
Treated (Y/N)	Y	Y	Y	Y	Y
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR
Total # Points Sampled	122	341	313	314	174
Max Depth of Growth (95%)	12	16	16	14	12
# Point in Max Depth Range	115	228	219	217	118
# Points in Littoral (0-15 feet)	121	221	213	223	128
% Points w/ Submersed Native Taxa	100	99	99	97	95
Mean Submersed Native Taxa/ Point	3.8	3.9	4.0	3.8	4.0
# Submersed Native Taxa	18	25	33	28	28
# Submersed Non-Native Taxa	1	1	2	1	1

**Table 4- Plant Frequency Occurrence.** Historic percent frequency of occurrence for submersed vegetation within the littoral zone (0-15 feet) in Big Marine Lake, Washington County (DOW# 82005200).

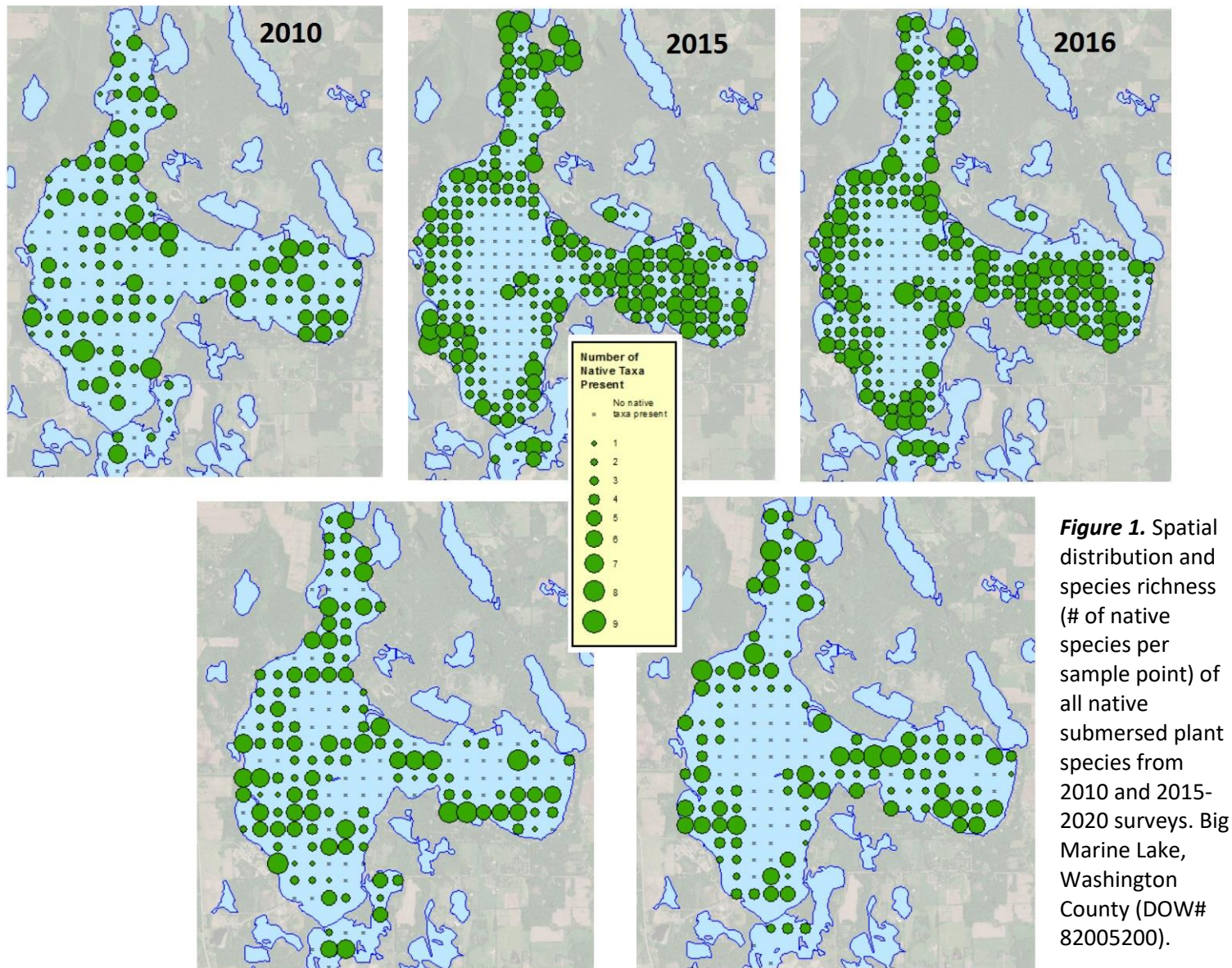
Taxonomic Name	Common Name	AUG 2010	AUG 2015	AUG 2016	AUG 2017	AUG 2020
<b>SUBMERSED PLANTS</b>						
<i>Myriophyllum spicatum</i> *	Eurasian watermilfoil*	12	15	17	28	19
<i>Ceratophyllum demersum</i>	Coontail	53	59	51	47	41
<i>Macroalgae</i>	Muskgrass and Stonewort	21	24	23	25	22
<i>Eleocharis acicularis</i>	Needle spikerush	0	1	1	3	7
<i>Elodea canadensis</i>	Canadian waterweed	43	32	31	34	27
<i>Megalodonta beckii</i>	Water marigold	6	7	6	10	9
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	34	28	28	19	10
<i>Najas spp.</i>	Naiad	45	48	26	35	43
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	7	3	3	8	10
<i>Potamogeton foliosus</i>	Leafy pondweed	0	12	0	0	20
<i>Potamogeton gramineus</i>	Variable-leaf pondweed	16	22	25	17	35
<i>Potamogeton illinoensis</i>	Illinois pondweed	17	15	12	11	9
<i>Potamogeton praelongus</i>	White-stem pondweed	14	34	32	27	27
<i>Potamogeton pusillus</i>	Small pondweed	0	1	0	14	5
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	6	0	13	8	5
<i>Potamogeton robbinsii</i>	Fern pondweed	30	26	28	29	31
<i>Potamogeton strictifolius</i>	Narrowleaf pondweed	0	0	11	2	0
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	40	51	52	42	52
<i>Ranunculus aquatilis</i>	White-water crowfoot	3	3	6	9	3
<i>Stuckenia pectinata</i>	Sago pondweed	11	2	2	0	1
<i>Vallisneria americana</i>	Water celery	17	12	15	15	23
<p>Floating, Free-floating &amp; Emergent plants observed: <i>Brasenia schreberi</i> (Watershield), <i>Nuphar variegata</i> (Bullhead pondlily), <i>Nymphaea odorata</i> (White waterlily); <i>Lemna trisulca</i> (Forked duckweed); <i>Alisma gramineum</i> (Narrowleaf water-plantain)*, <i>Juncus pelocarpus</i> (Brown-fruited rush), <i>Lythrum salicaria</i> (Purple loosestrife), <i>Persicaria amphibia</i> (Water smartweed), <i>Pontederia cordata</i> (Pickerelweed), <i>Sagittaria</i> spp. (Arrowhead ), <i>Sparganium</i> spp. (Bur-reed ), <i>Schoenoplectus americanus</i> (Three-square bulrush), <i>Schoenoplectus acutus</i> (Hardstem bulrush) and <i>Veronica spicata</i> (Speedwell).</p> <p>Less common (&lt; 5% frequency) submersed vegetation observed: <i>Heteranthera dubia</i> (Water stargrass) 2010, 2015 -2017 &amp; 2020, <i>Utricularia macrohiza</i> (Common bladderwort) in 2015, 2017 &amp; 2020, <i>Myriophyllum tenellum</i> (Dwarf watermilfoil), <i>Myriophyllum verticillatum</i> (Whorl-leaf watermilfoil) 2015 &amp; 2020, <i>Potamogeton natans</i> (Floating pondweed) and <i>Utricularia minor</i> (Lesser bladderwort) in 2015-2017 &amp; 2020 <i>Potamogeton crispus</i> (Curly-leaf pondweed)* <i>Isoetes tenella</i> (Spiny-spored quillwort), <i>Potamogeton epihydrus</i> (Ribbon-leaf pondweed) in 2016, <i>Potamogeton friesii</i> (Fries' pondweed) in 2016 &amp; 2017, <i>Potamogeton nodosus</i> (Long-leaf pondweed), <i>Utricularia gibba</i> (Floating bladderwort) in 2016, 2017 &amp; 2020, <i>Ceratophyllum echinatum</i> (Spiny hornwort) in 2017 &amp; 2020.</p>						

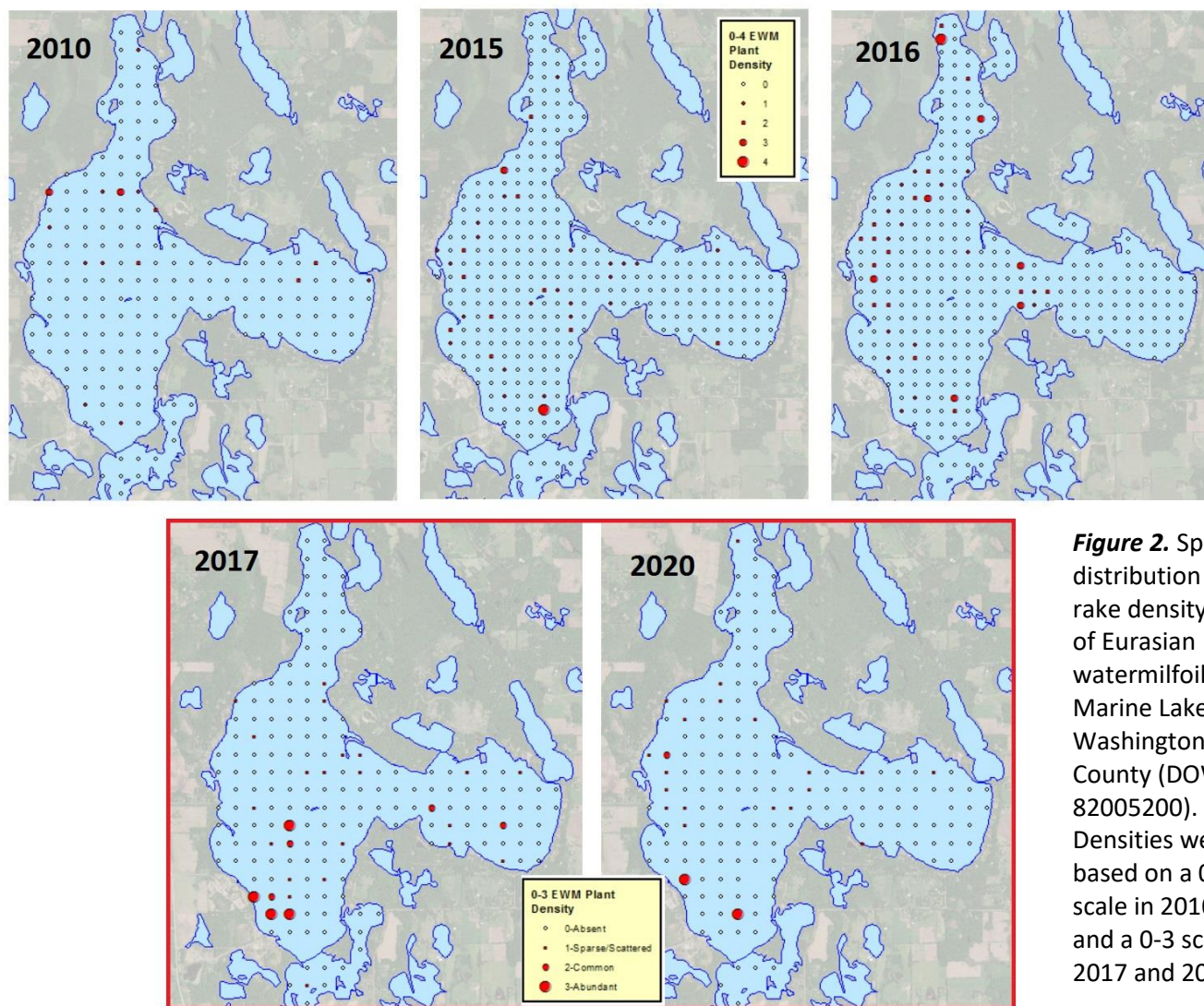
\* denotes invasive aquatic plant

\*\* denotes rare species



Photos of floating native plant species Watershield and White waterlily in 2015 (left photo) and quillwort found in the 2016 survey (right photo). Big Marine Lake, Washington County (DOW# 82005200).





**Figure 2.** Spatial distribution and rake density rating of Eurasian watermilfoil. Big Marine Lake, Washington County (DOW# 82005200). Densities were based on a 0-4 scale in 2010-2016 and a 0-3 scale in 2017 and 2020.

This information can be made available in alternative formats such as large print, braille or audio tape by emailing [info.dnr@state.mn.us](mailto:info.dnr@state.mn.us) or by calling 651-259-5016.