HAM LAKE, ANOKA COUNTY:
2022 AQUATIC VEGETATION REPORT

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

Lake: Ham (DOW# 02005300)

Lake Surface Area: 203 acres

Littoral Area: 190.5 acres

County: Anoka

Survey Type: Point-intercept

Date of Survey (most recent): July 11th, 2022

Observer[s]: April Londo (MN DNR)
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2022 Summary:

The most recent aquatic vegetation point-intercept survey of Ham Lake (DOW# 02005300) was completed on July 11, 2022. Plants were present throughout the lake to a maximum depth of 3.0 meters (10 feet). Within the littoral zone (area in the lake from the 0 – 15-foot depth range [0 – 4.5 meters]), 64% of sampled points contained native submersed taxa. The average number of native submersed taxa per sample point was 1.5. Fourteen submersed plant species were documented while no invasive plant species were observed during the 2022 survey. Management efforts to control the invasive plant hybrid watermilfoil on Ham Lake began in 2014, one year after the initial discovery. Various herbicide formulations have been used to target invasive milfoils including: DMA-4 (2,4-D), Renovate OTF (granular triclopyr), Tribune (diquat), ProcellaCOR (Florpyrauxifen-benzyl) and fluridone.

Summary Table. Summary of aquatic submersed plants in Ham Lake, Anoka County, Minnesota (DOW# 02005300) as indicated by the results of point-intercept surveys. Values were calculated from the littoral depth range (0 – 15 feet).

PI Survey Date	% Frequency of HWM*	Max Depth of Growth in feet [95%]†	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa	AVG Secchi Depth [m]
2014 JUL	22	13	87	2.7	17	2.9
2015 SEPT	7	13	94	2.8	19	2.8
2016 JUL	14	11	72	1.4	13	2.1
2017 JUL	10	8	59	1.1	13	2.3
2018 AUG	36	11	77	1.8	15	NA
2019 JUL	6	13	87	1.7	17	2.7
2020 JUL	16	10	63	2.0	22	2.6
2021 JUL	0	10	64	1.5	14	NA
2022 JUL	0	10	64	1.5	15	2.5

*HWM is short for hybrid 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:

Ham Lake is a 203-acre lake located in the city of Ham Lake, Minnesota. It has two invasive aquatic plant species: Hybrid watermilfoil (*Myriophyllum spicatum x Myriophyllum sibiricum*, abbreviated as HWM) and curly-leaf pondweed (*Potamogeton crispus*, abbreviated as CLP). The maximum depth of water is 6.7 meters (22 feet). Approximately 94% of the lake is littoral (water depth zone from 0 – 15 feet where aquatic plants are likely to be found). Ham Lake contains a moderate level of nutrients and is considered a mesotrophic lake. Overall seasonal water clarity has remained constant in recent years (see **Table 1-Secchi Averages** below for historic Secchi disk observations). For more information concerning Ham Lake water quality see:

https://webapp.pca.state.mn.us/surface-water/station/02-0053-00-451

Table 1 – Secchi Averages. Average Secchi disk observations in meters for Ham Lake, Anoka County, Minnesota (DOW #02005300). Data was gathered from the Minnesota Pollution Control Agency and Anoka Soil and Water Conservation District (ASWCD). The ASWCD conducts Secchi surveys on a two out of every three-year cadence and Ham Lake was not surveyed in 2018 and 2021.

YEAR	MAY	JUNE	JULY	AUG	SEPT	Secchi Depth Average [May – Sept]
2011	3.2	3.0	2.5	1.8	1.5	2.4
2012	3.8	3.0	2.7	2.5	2.7	2.9
2013	3.9	3.6	3.3	3	2.2	3.2
2014	3.4	3.1	3.1	2.9	2.3	3.0
2015	3.7	2.1	2.9	2.5	2.9	2.8
2016	2.3	2.1	2.4	1.7	1.8	2.1
2017	3.5	2.3	2	2.1	2.3	2.3
2018	NA	NA	NA	NA	NA	NA
2019	4.0	2.6	2.7	2.4	1.8	2.7
2020	NA	NA	2.6	3.1	2.3	2.6
2021	NA	NA	NA	NA	NA	NA
2022*	3.0	3.3	2.5	1.9	1.7	2.5

*Denotes data gathered from the Minnesota Pollution Control Agency

Management History:

Historically, efforts to manage invasive hybrid watermilfoil (HWM) have included: the use of auxin-mimic herbicide (2,4-D) in 2014 which was reported to be largely ineffective according to the herbicide applicator, granular triclopyr in 2015 which showed significant lake-wide reductions, and finally, targeting small patches of HWM using diquat in the fall of 2016. Impacts to floating leaf species such as white waterlily and yellow pond lily were observed following the larger scale granular triclopyr treatment (2015), however according to more recent point intercept surveys, floating leaf species have returned to pre-treatment levels. No treatment of HWM occurred in 2017, as HWM nuisance areas were small and did not create surface mats. ProcellaCOR, a newly registered herbicide by the EPA, was

applied in July of 2018 and later again in September of 2018. The first treatment's dosing was inadequate, so re-application was required later in the season by the pesticide applicator.

Herbicides have historically been used to treat HWM spatially at a level below the 15% littoral limit (28.58 acres). However, a variance to treat more than the 15% littoral limit was granted in 2020 to allow for a whole-lake control of HWM using the selective herbicide fluridone. In 2020, low-dose fluridone was applied in October before ice cover and re-applied in the spring of 2021 following ice-off. Fluridone for HWM control is generally applied in early spring but a novel approach was used in Ham Lake. An evaluation of this fall/winter treatment method will be needed to determine the efficacy on HWM and impact to native plants. Herbicides were not needed in 2022 as HWM was not detected in the spring delineation.

Table 2 – Invasive Plant Management Summary. Characteristics and history of herbicide treatments for Ham Lake, Anoka County, Minnesota (DOW# 02005300, total acres: 203, littoral acres: 190.5, 15% littoral acres: 28.58).

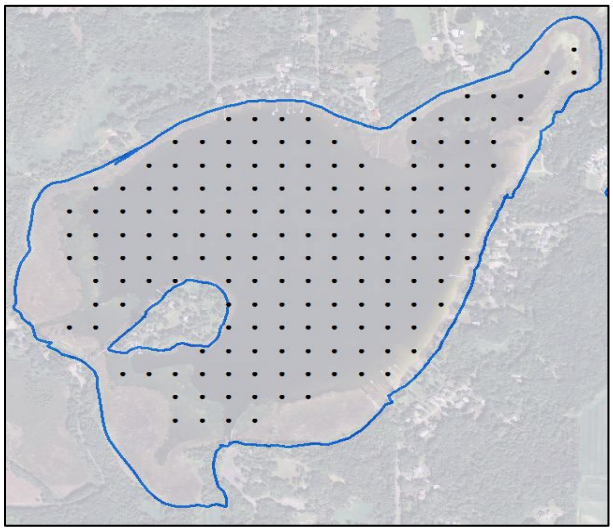
Year	Month	Treatment [W, P, N]	Target Species	Total Acres Treated	Herbicide	Licensed Commercial Applicator
2014	**JUL**	P	HWM	6.1	2,4-D	PLM Lake and Land Management Corp.
2015	**JUN**	P	HWM	19.4	Tricolpyr (granular)	PLM Lake and Land Management Corp.
2016	**APRIL**	P	CLP	13.5	Endothall	PLM Lake and Land Management Corp.
2016	**OCT**	P	HWM	11.3	Diquat	PLM Lake and Land Management Corp.
2017	**MAY**	P	CLP	13.5	Endothall	PLM Lake and Land Management Corp.
2018	**JUL**	P	HWM	5.5	ProcellaCOR	PLM Lake and Land Management Corp.
2018	**SEPT**	P		13.3	ProcellaCOR & diquat	PLM Lake and Land Management Corp.
2020	**OCT**	W	HWM	119	Fluridone	PLM Lake and Land Management Corp.
2021	**APRIL**	W	HWM	119	Fluridone	PLM Lake and Land Management Corp.
2022	**-**	N	HWM	-	-	-

Treatment: W (whole lake), P (partial lake), N (no treatment)
HWM is an abbreviation for hybrid watermilfoil
CLP is an abbreviation for curly-leaf pondweed

Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Ham 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 placed 60 meters apart using a Geographic Information System (GIS), allowing for the placement of 166 points. Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point for approximately 3 meters. 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 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 that is less than 15 feet in depth).

Survey Observations:

During the most recent point intercept survey in 2022, 64% of points contained native taxa and we recorded eight fewer species than in 2020. Although the mean native submersed taxa decreased, diversity is comparable to 2016 – 2018 surveys (See **Table 3 – Point Intercept Metrics**). Macroalgae and coontail continue to be the most dominant species in Ham Lake and have been since 2014, although flat-stem pondweed has also become more abundant within the last year. Additional native species sampled during the survey include sago pondweed, three different types of bladderworts, flat-stem pondweed, and wild celery. Overall, native submersed plant abundance and species richness have remained constant (see **Table 4 – Plant Frequency of Occurrence; Figure 1**).

Lakewide hybrid watermilfoil was observed at its highest frequency (36% frequency of occurrence; **Figure 2**) in 2018. Following the initial 2018 ProcellaCOR treatment, the application appeared to be ineffective, possibly due to low application rates. A second application that included a larger treatment area and greater application rate was conducted in the fall of 2018. Signs of epinasty to both hybrid milfoil and native coontail were observed post-treatment (see **Photos 1 & 2**). Pre- and post-ProcellaCOR treatment point intercept data are available upon request. In fall 2020, fluridone was applied lake wide to target hybrid watermilfoil; coordinated by the Ham Lake Association. In the most recent survey conducted in 2022, hybrid watermilfoil was not observed in Ham Lake. Follow-up surveys in 2023 are needed to evaluate the lasting effectiveness of fluridone on hybrid watermilfoil in Ham Lake.

Photos 1 & 2. Elongated stems and sparse leaves were observed on hybrid watermilfoil (**left; Photo 1**) and coontail (**right; Photo 2**); a change in plant growth often seen following ProcellaCOR treatments. Photos were taken on August 29, 2021, in Ham Lake, Anoka County, Minnesota (DOW # 02005300).

Table 3 – Point Intercept Metrics. Summary of point intercept metrics for Ham Lake, Anoka County, Minnesota (DOW# 02005300). Shaded values were calculated from the littoral depth range (0 – 15 feet).

Survey Metrics	JUL 24 2014	SEPT 14 2015	JUL 20 2016	JUL 19 2017	AUG 8 2018	JUL 10 2019	JUL 23 2020	JUL 22 2021	JUL 11 2022
Treated (Y/N)	Y	Y	Y	Y	Y	N	Y	N	N
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	U of M	MN DNR	MN DNR	MN DNR
Total # Points Sampled	153	159	148	158	162	161	148	137	136
Max Depth of Growth (95%) in feet	13	13	11	8	11	13	10	10	10
# Point in Max Depth Range	107	114	92	83	107	114	88	83	83
# Points in Littoral (0-15 feet)	129	124	128	143	142	129	142	133	131
% Points w/ Submersed Native Taxa	87	94	72	59	77	87	63	64	64
Mean Submersed Native Taxa/ Point	2.7	2.8	1.4	1.1	1.8	1.7	2	1.5	1.5
# Submersed Native Taxa	15	17	11	11	15	15	20	14	14
# Submersed Non-Native Taxa	2	2	2	2	2	2	2	0	1

Table 4 – Plant Frequency of Occurrence. Historic percent frequency of occurrence for submersed vegetation within the littoral zone (0 – 15 feet) in Ham Lake, Anoka County, Minnesota (DOW# 02005300).

Taxonomic Name	Common Name	JUL 24 2014	SEPT 14 2015	JUL 20 2016	JUL 19 2017	AUG 8 2018	JUL 10 2019	JUL 23 2020	JUL 22 2021	JUL 11 2022
Myriophyllum spicatum x M.	Hybrid watermilfoil*	22	7	14	10	36	6	16	-	-
*Potamogeton crispus**	Curly-leaf pondweed*	2	2	2	3	6	34	7	-	19
Ceratophyllum demersum	Coontail	67	79	58	43	63	69	46	47	46
Macroalgae	Muskgrass and Stonewort	17	21	23	15	28	38	29	34	27
Eleocharis acicularis	Needle spikerush	13	-	1	-	-	-	-	-	-
Elodea canadensis	Canadian waterweed	0	29	27	11	10	32	18	-	-
Myriophyllum sibiricum	Northern watermilfoil	22	6	-	2	-	6	-	-	-
Najas spp.	Naiad	8	4	2	1	2	-	3	-	3
Potamogeton amplifolius	Large-leaf pondweed	9	16	-	-	2	5	2	10	6
Potamogeton foliosus	Leafy pondweed	-	-	-	-	-	-	8	-	2
Potamogeton friesii	Fries' pondweed	-	-	-	-	1	-	11	-	-
Potamogeton illinoensis	Illinois pondweed	-	6	2	-	3	-	6	2	-
Potamogeton praelongus	White-stem pondweed	12	3	-	1	-	-	1	-	-
Potamogeton pusillus	Small pondweed	18	-	-	-	-	-	2	2	1
Potamogeton robbinsii	Fern pondweed	3	10	1	-	-	-	-	-	-
Potamogeton zosteriformis	Flat-stem pondweed	60	49	2	4	4	1	15	24	37
Ranunculus aquatilis	White water crowfoot	2	-	9	-	-	-	-	-	-
Stuckenia pectinata	Sago pondweed	2	6	-	4	10	6	10	9	5
Utricularia gibba	Creeping bladderwort	-	-	-	-	26	-	4	4	-
Utricularia macrorhiza	Common bladderwort	32	26	9	16	24	42	19	6	5
Utricularia minor	Small bladderwort	-	8	1	-	-	-	4	-	-
Vallisneria americana	Water celery	-	9	5	4	5	7	15	12	7

*Denotes an invasive aquatic plant

- Denotes no detection during the survey

***Floating, free-floating & emergent plants observed**: Nuphar advena (yellow pond lily), Nuphar variegata (bullhead pond lily), Nymphaea odorata (white water lily), Lemna trisulca (star duckweed), Potamogeton natans (floating pondweed), Typha sp. (cattail), Schoenoplectus subterminalis (water bulrush).*

***Less common (< 5% frequency) submersed vegetation observed:** Potamogeton gramineus (variable-leaf pondweed) in 2014-2015, 2018- 2021, Potamogeton richardsonii (clasping-leaf pondweed) in 2015-2016, 2019 and 2020, Heteranthera dubia (water stargrass) in 2015-2018 and 2020-2022, Utricularia intermedia (flat-leaf bladderwort) in 2018, Ceratophyllum echinatum (spiny hornwort) in 2021, and Potamogeton strictifolius (straight-leaved pondweed) in 2022.*

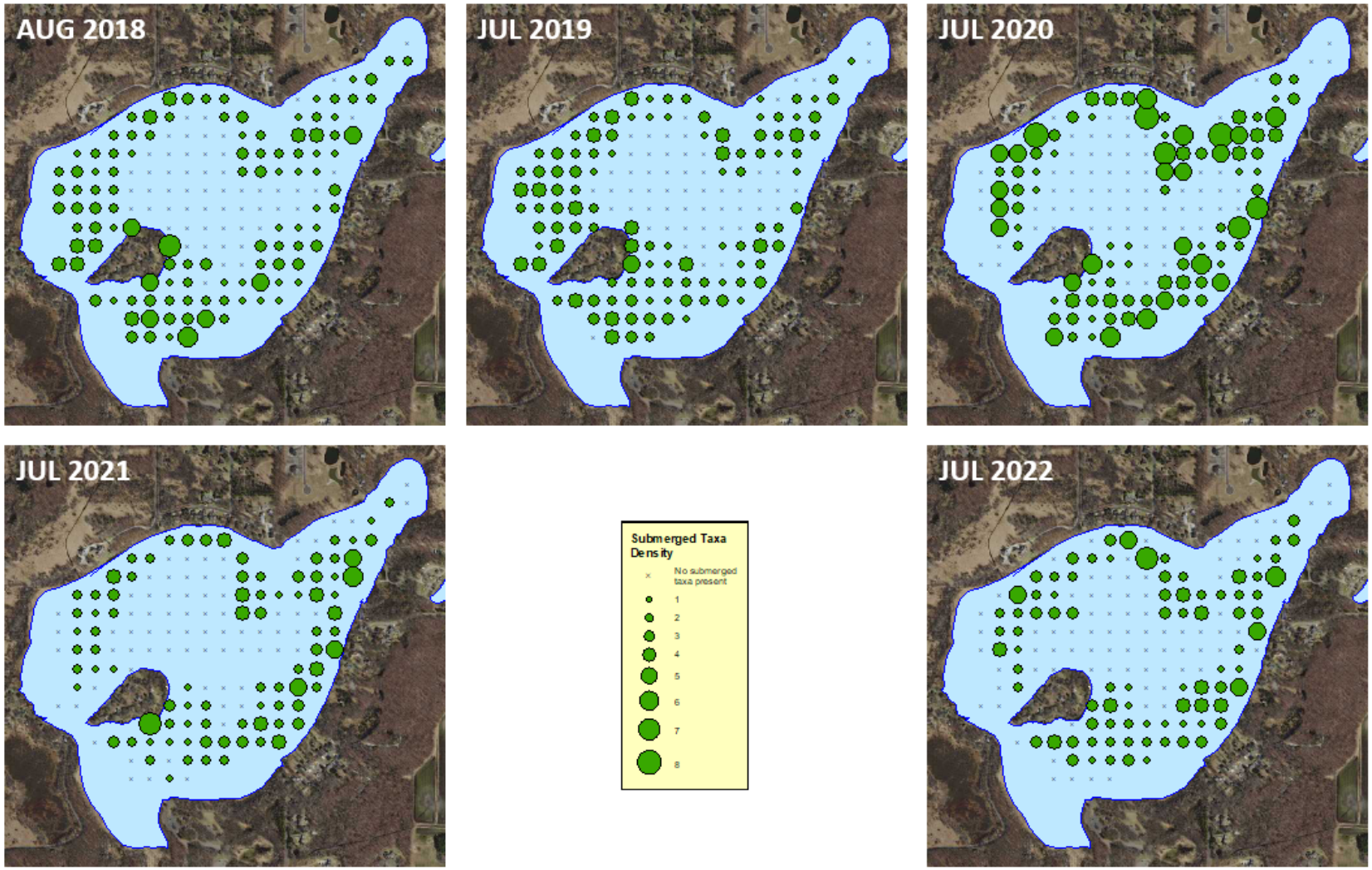


Figure 1 – Native Species Taxa Density. Spatial distribution and species richness (# of native species per sample point) of all submersed plant species from Minnesota Department of Natural Resources point intercept surveys (2018-2022). Ham Lake, Anoka County, Minnesota (DOW# 02005300).

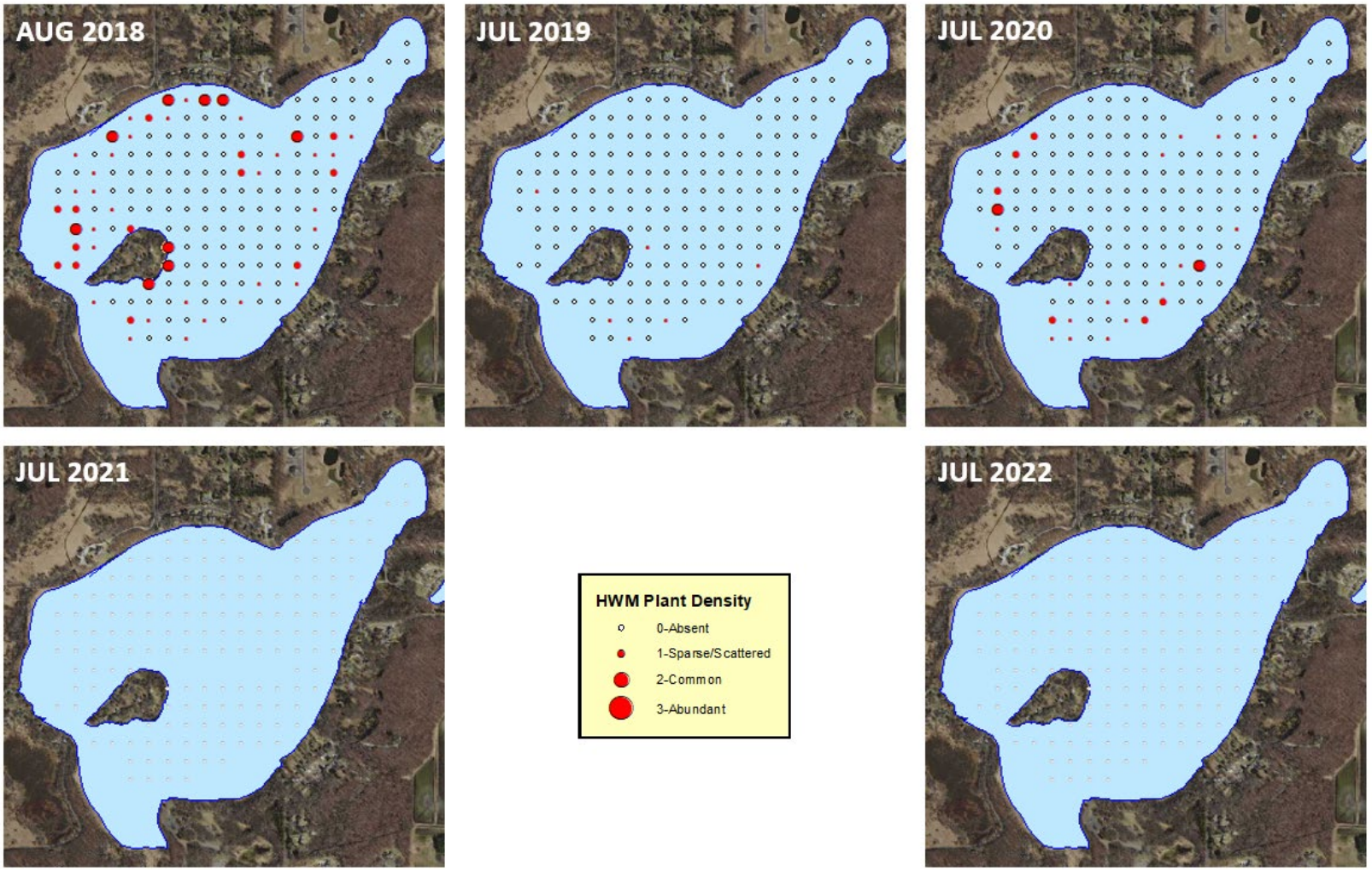


Figure 2 – Hybrid Watermilfoil Density. Spatial distribution and rake density per sample point of hybrid watermilfoil from Minnesota Department of Natural Resources point intercept surveys (2018-2022). Ham Lake, Anoka County, Minnesota (DOW # 02005300). In years 2021 and 2022, no HWM was observed.

This information can be made available in alternative formats such as large print, braille, or audiotape by emailing info.dnr@state.mn.us or by calling 651-259-5016.