LAKE COON, ANOKA COUNTY:
2019 AQUATIC VEGETATION REPORT

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

Lake: Coon (DOW# 2004200)

Lake Surface Area: 1,985 acres

Littoral Area: 1,332 acres

County: Anoka

Survey Type: Point-intercept

Date of Survey (most recent): July 17, 2019

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Report updated: December 13, 2019

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2019 Summary:

The 2019 aquatic vegetation point-intercept survey of Coon Lake (DOW #02004200) was completed in the West basin only on July 17, 2019. Plants were present to a maximum depth of 10 feet (3.0 meters) and 96% of 166 sampled points contained native submersed vegetation. The Coon Lake Improvement District (CLID) has been managing the invasive plants curly-leaf pondweed (CLP) and Eurasian watermilfoil (EWM) for the past 10+ years at below the 15% littoral limit in both the East and West basin. Due to an increase in nuisance Eurasian watermilfoil observed in the West basin, a variance was issued to allow basin wide use of fluridone in the spring of 2019. Low-dose fluridone treatments are effective at controlling Eurasian watermilfoil and provide 3+ years of control.

Summary Table A. Summary of aquatic submersed plants in Coon Lake **(East Basin),** Anoka County, Minnesota (DOW# 2004200) 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%]†	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa
AUG 2010	12	9	64	1.2	7
AUG 2011	16	13	68	1.5	10
AUG/SEPT 2012	14	12	76	1.8	10
SEPT 2013	6	10.5	69	1.7	15
SEPT 2014	16	10	70	1.8	16
AUG 2018	17	8	79	2.6	15

*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

Summary Table B. Summary of aquatic submersed plants in Coon Lake (**West Basin**), Anoka County, Minnesota (DOW# 2004200) 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%]†	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa
AUG 2010	22	10	98	3.6	18
SEPT 2012	3	15	100	2.4	13
SEPT 2014	3	8.5	80	2.7	13
AUG 2018	39	8	93	3.4	25
JUNE 2019	44	10	96	4.0	27

Lake Description:

Coon Lake is a 1,985-acre eutrophic (nutrient rich) lake located in East Bethel in Anoka County, Minnesota. The lake is composed of three basins, but for management purposes is grouped into Coon East and Coon West which represent the main recreational bodies for the lake (see maps in *Survey Methods* section).

Both basins of Coon Lake are infested with two invasive aquatic plants: Eurasian watermilfoil (*Myriophyllum spicatum*, abbreviated as EWM) and curly-leaf pondweed (*Potamogeton crispus*, abbreviated as CLP). The maximum depth of water is located in the east basin at 27 feet (8.2 meters). Approximately 67% of the lake is littoral (water depth zone from 0-15 feet where aquatic plants are likely to be found). Secchi has remained consistent for the last 5 years (see below ***Table 1-Secchi Averages***). Transparency data collected for the MPCA were from a variety of sample locations in both basins. These data were collected by Citizen Monitoring Groups. Data collected by Anoka Conservation District in 2018 was averaged between the East and West basin. For more information concerning Coon Lake water quality, see https://cf.pca.state.mn.us/water/watershedweb/wdip/waterunit.cfm?wid=02-0042-00.

Table 1-Secchi Averages. Secchi disk observations in meters for Coon Lake (DOW #02004200). Data gathered from the Minnesota Pollution Control Agency and Anoka Conservation District (ACD).

YEAR	MAY	JUNE	JULY	AUG	SEPT	Secchi Depth Average [May-Sept]
2010	3.1	2.0	1.5	1.2	1.4	1.8
2011	2.3	1.7	1.5	1.3	1.4	1.6
2012	2.6	1.7	1.6	1.2	1.3	1.7
2013	2.5	2.4	1.5	1.6	1.2	1.8
2014	2.5	2.8	2.1	1.8	2.0	2.2
2015	2.1	1.8	1.4	1.4	1.6	1.7
2016	2.5	2.2	1.6	1.3	1.7	1.9
2017	1.9	1.8	1.8	1.5	1.6	1.7
*** 2018**	2.8	3.2	2.1	1.8	2.1	2.4

* data collected by Anoka Conservation District

Management History:

The most recent herbicide treatments (28.6 acres in the East and 960 acres in the West) were organized by the Coon Lake Improvement District (CLID) on May 22 & 28, 2019, respectively (***see below Table 2- Invasive Plant Management Summary for a recent history of herbicide treatments***).The spot treatment in the East basin targeted curly-leaf pondweed while the basin-wide treatment in the West basin targeted both invasive plants species (CLP & EWM). A variance was issued to allow for the use of fluridone in the West basin. Fluridone is a selective herbicide that is applied at a low dose (2-4 parts per billion) throughout the growing season (>60 days of exposure). Due to this mechanism, a slow knock down of Eurasian watermilfoil is often times observed with the plant collapsing in August.

Historically, Coon Lake has managed both invasive plant species under the 15% littoral limit with separate herbicide applications as spot treatments to control nuisance areas (endothall for CLP and 2,4-D for EWM).

Table 2-Invasive Plant Management Summary. Characteristics and history of herbicide treatment for Coon Lake (East and West, DOW# 02004200, Total acres: 1,984.7, Littoral acres: 1,331.9, 15% Littoral acres: 199.8). Acres treated includes both basins for each year unless otherwise noted.

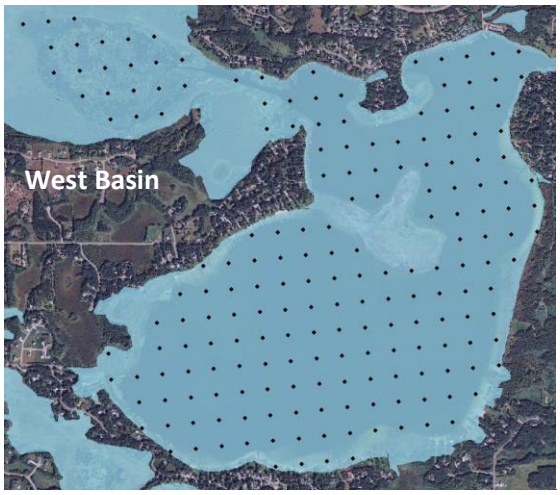
Date	Treatment by Basin [W,P,N]	Target Species	Total Acres Treated	Herbicide	Applicator
APR 2010*	P	CLP	78.5	Aquathol K	Lake Restoration Inc.
2010*	P	EWM	53	2,4-D	PLM Lake and Land Management Corp.
MAY 2011*	P	CLP	53	Aquathol K	Lake Restoration Inc.
2011*	P	EWM	42	2,4-D	PLM Lake and Land Management Corp.
MAY 2012*	P	CLP	136	Aquathol K	Lake Restoration Inc.
JUN 2012*	P	EWM	116	2,4-D	PLM Lake and Land Management Corp.
MAY 2013*	P	CLP	35	Aquathol K	Lake Restoration Inc.
JUL 2013*	P	EWM	16	2, 4-D	PLM Lake and Land Management Corp.
MAY 2014*	N	CLP	-	-	-
JUN 25 2014*	P	EWM	10	2, 4-D	PLM Lake and Land Management Corp.
APR 29 2015	P	CLP	43	Aquathol K	PLM Lake and Land Management Corp.
JUL 1 2015	P	EWM	26	2, 4-D	PLM Lake and Land Management Corp.
MAY 6 2016	P	CLP	25	Aquathol K	PLM Lake and Land Management Corp.
JUN 9 2016	P	EWM	111	2, 4-D	PLM Lake and Land Management Corp.
APR 28 2017	P	CLP	42	Aquathol K	PLM Lake and Land Management Corp.
JUN 27 2017	P	EWM	30	2, 4-D	PLM Lake and Land Management Corp.
MAY 30 2018	P	CLP	19.5	Diquat (Tribune)	PLM Lake and Land Management Corp.
JUL 18 2018	P	EWM	13	Diquat (Tribune)	PLM Lake and Land Management Corp.
May 28 2019	P^{E}	CLP	28.6	Diquat (Tribune)	PLM Lake and Land Management Corp.
May 22 2019*	W^{W}	EWM/CLP	960	Fluridone (Sonar A.S)	PLM Lake and Land Management Corp.

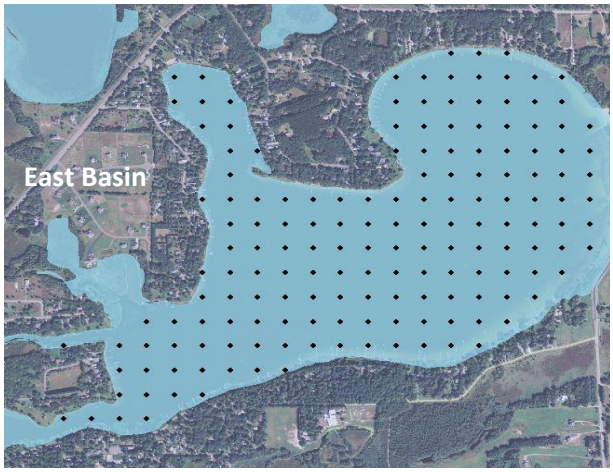
Treatment: W (whole lake), P (partial lake), N (no treatment)
CLP is an abbreviation for curly-leaf pondweed. EWM is an abbreviation for Eurasian watermilfoil
* LVMP year
^{E} East Basin only, ^{W} West Basin only, No superscript indicates both basins

Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Coon 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 100 meters (East basin) and 150 meters (West basin) apart using a Geographic Information System (GIS). Note: surveys from 2010 were 175 meters apart, respectively. This spacing allowed for placement of 162-170 points, depending on basin and year. 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 2012-2014 and a zero to 3 scale in 2018 and 2019). 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:

Both Coon East and Coon West were surveyed in 2018 for the first time since 2014. See ***Table 3-Point Intercept Metrics*** for historical point-intercept survey calculations and ***Table 4-Plant Frequency of Occurrence*** for historic plant frequency observations. See ***Figure 3*** for plant growth depth ranges from the 2018 survey. Additionally, as part of a University of Minnesota/MAISRC study, hybrid milfoil (*Myriophyllum spicatum* [EWM] x *Myriophyllum sibiricum* [Northern watermilfoil]) was confirmed in Coon Lake in 2018. No significant observations of CLP were found in these surveys, as would be expected for this late timing. CLP senesces and dies back generally around early July of each year.

Coon East

No point intercept survey was conducted in 2019. The most recent point intercept survey was completed on August 16, 2018. 2018 survey data showed a maximum depth of rooted vegetation was observed at 8 feet, but historically has been observed growing up to 15 feet in depth (***Table 3a; Figure 3a***). Native plant distribution and abundance has been fairly consistent in the last 6 years with an increase observed in mean native submersed taxa per point in 2019 (***Figure 1a***) . A total of fourteen native plant species were found within the littoral area which included coontail, naiad, water celery, and flat-stem pondweed as the most predominant species in the basin. Eurasian watermilfoil has remained at or under 17% frequency of occurrence in Coon East. The majority of EWM has been observed on the northeast side near the public water access and on the southwest side near the channel connecting the two basins.

Table 3a- Point Intercept Metrics. Summary of point intercepts metrics for Coon Lake (**East Basin**), Anoka County (DOW# 02004200). Values shaded in blue were calculated from littoral depth range.

Survey Metrics	AUG 2010	AUG 2011	AUG/SEPT 2012	SEPT 2013	SEPT 2014	AUG 2018
Treated (Y/N)	Y	Y	Y	Y	Y	Y
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MNDNR
Total # Points Sampled	33	163	164	164	162	162
Max Depth of Growth (95%) in feet	9	11	9	8	10	8
# Point in Max Depth Range	22	78	78	88	82	82
# Points in Littoral (0-15 feet)	33	100	98	119	105	107
% Points w/ Native Taxa	52	69	77	68	76	79
Mean Native Taxa/ Point	1.1	1.5	1.8	1.7	1.8	2.6
# Native Taxa	6	9	9	13	15	14
# Non-Native Taxa	1	1	1	2	1	1

Table 4a- Plant Frequency Occurrence. Percent frequency of occurrence for submersed vegetation within the littoral zone (0-15 feet) in Coon Lake (**East Basin**), Anoka County (DOW# 02004200).

Taxonomic Name SUBMERSED PLANTS	**Common Name**	**AUG 2010**	**AUG 2011**	**AUG/SEPT 2012**	**SEPT 2013**	**SEPT 2014**	**AUG 2018**
*Myriophyllum spicatum**	Eurasian watermilfoil*	12	16	14	6	17	17
*Potamogeton crispus**	Curlyleaf pondweed*	0	0	0	1	0	0
Ceratophyllum demersum	Coontail	21	13	21	34	32	50
Macroalgae	Muskgrass and Stonewort	24	24	20	7	10	21
Elodea canadensis	Canadian waterweed	15	26	27	11	7	12
Heteranthera dubia	Water stargrass	0	0	0	4	7	5
Myriophyllum sibiricum	Northern watermilfoil	0	2	0	0	3	0
Najas sp	Naiad	33	51	59	54	58	50
Potamogeton amplifolius	Large-leaf pondweed	0	2	0	3	0	6
Potamogeton gramineus	Variable-leaf pondweed	0	0	3	2	4	14
Potamogeton illinoensis	Illinois pondweed	3	2	9	15	14	13
Potamogeton praelongus	White-stem pondweed	0	0	0	6	0	1
Potamogeton richardsonii	Clasping-leaf pondweed	0	0	1	0	6	12
Potamogeton zosteriformis	Flat-stem pondweed	0	0	0	1	1	32
Stuckenia pectinata	Sago pondweed	0	2	3	5	2	0
Vallisneria americana	Water celery	9	24	32	27	36	42

Floating and emergent plants observed: *Lemna spp.* (Duckweeds), *Nuphar advena* (Yellow pond lily), *Nuphar variegata* (Bullhead pond lily), *Nymphaea odorata* (White water lily, *Sagittaria spp.* (Arrowheads), *Schoenoplectus acutus* (Hardstem bulrush), *Schoenoplectus americanus* (Olney's three-square bulrush), *Typha spp.* (Cattail).
Less common (<5% frequency) submersed vegetation observed: *Eleocharis acicularis* (Needle spikerush) in 2013, *Myriophyllum tenellum* (Slender watermilfoil), *Ranunculus aquatilis* (White water crowfoot), and *Utricularia macrorhiza* (Common bladderwort) in 2014.

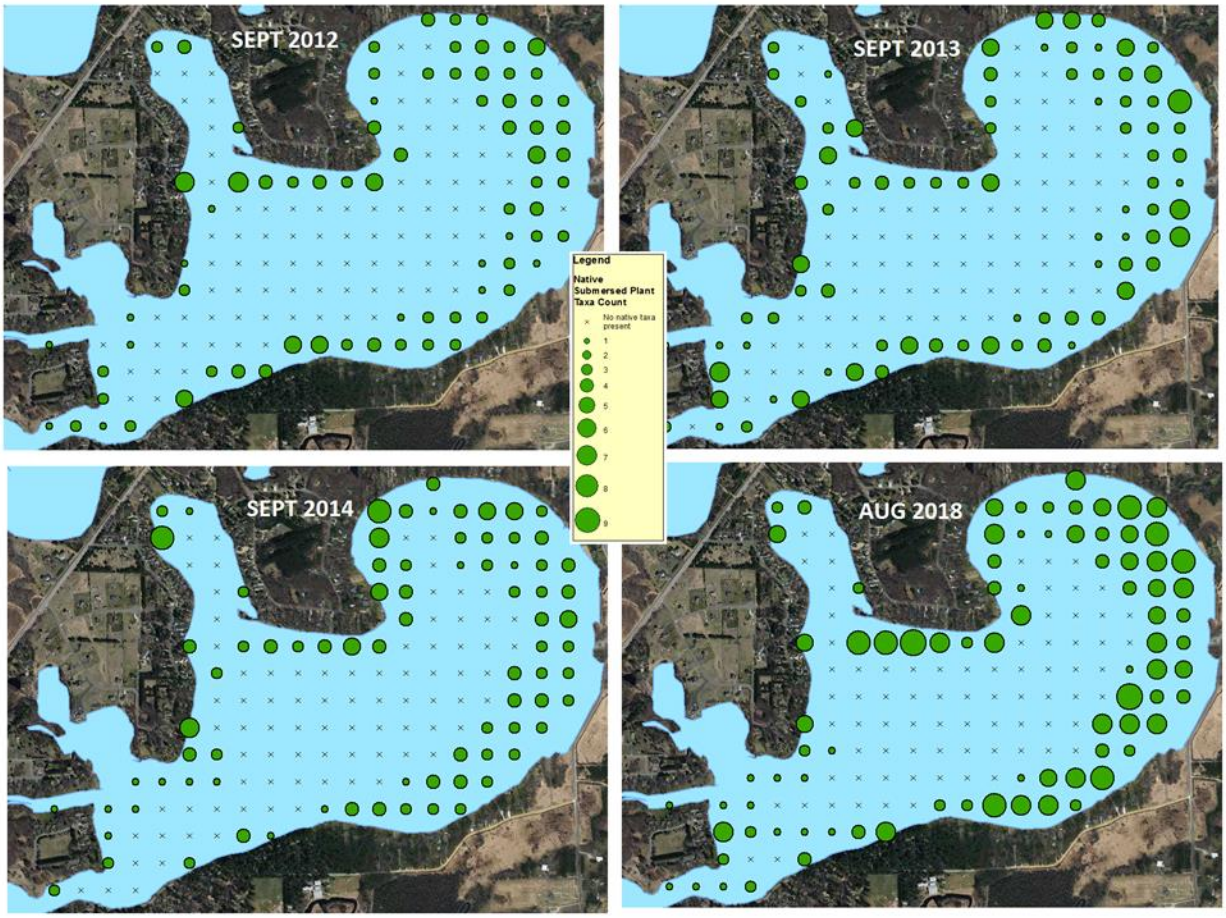


Figure 1a. Spatial distribution and species richness (# of native submersed taxa per sample point) in the **East Basin**. Dates correspond to month of point intercept survey. Coon Lake, Anoka County (DOW # 02004200).

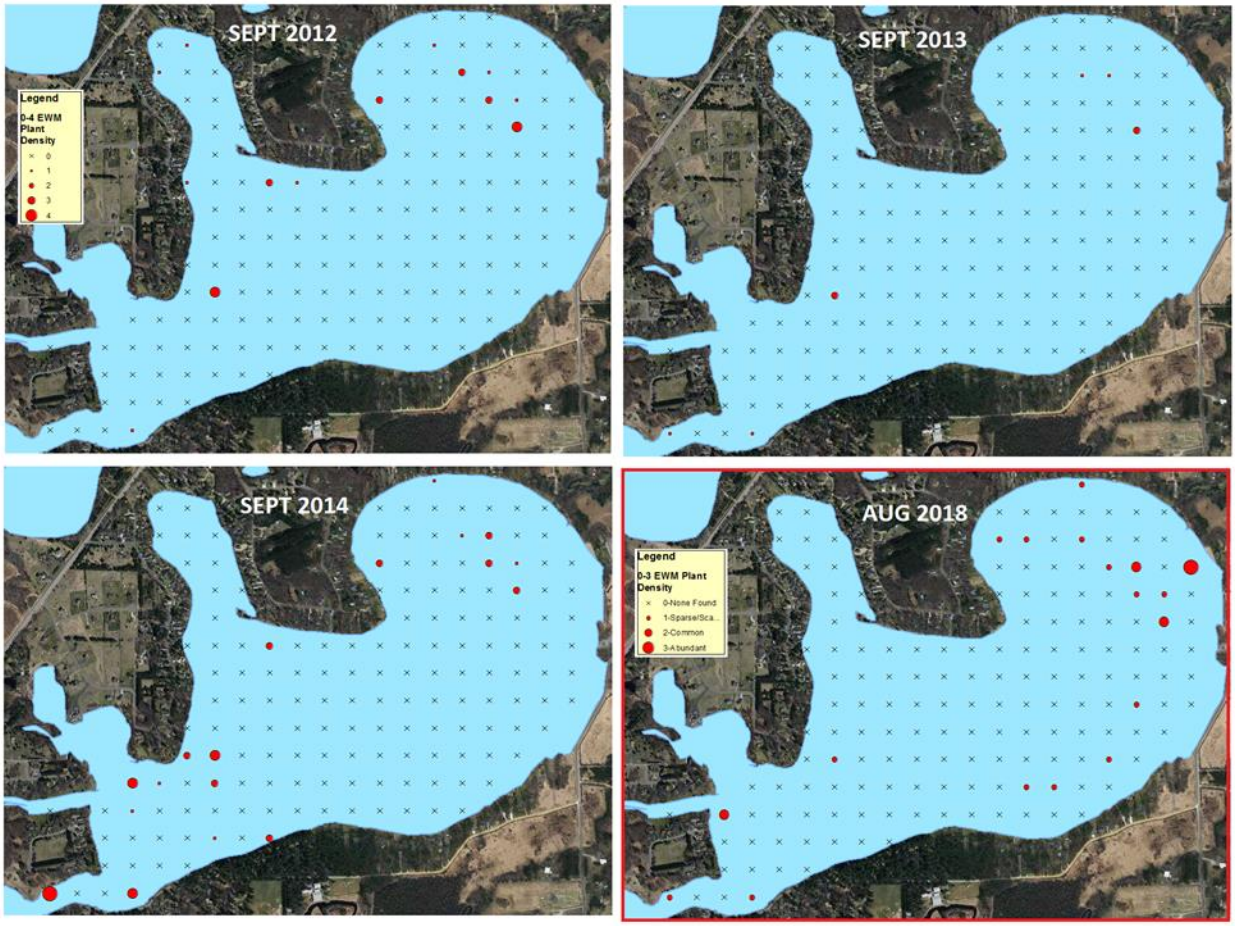


Figure 2a. Spatial distribution and species richness (Density of Eurasian watermilfoil per sample point) for 2012-2014 and 2019 in the **East Basin**. Dates correspond to month of point intercept survey. Years 2012-2014 were surveyed on a 1-4 density rake rating scale while 2018 was rated on a 1-3 density rake rating. Coon Lake, Anoka County (DOW # 02004200).

Coon West

The most recent point intercept survey in Coon West was completed on July 17, 2019. The West basin is shallow, allowing for 100% of the littoral points to be sampled. Maximum depth during the 2019 survey was 10 feet although rooted plants were observed in 15 feet of water in previous years (***Table 3b***). Native plants have remained stable while EWM has expanded (from 3% FOO in 2014 to 39% FOO in 2018) within the last six years (***Figures 1b&2b***).

No significant changes were observed to native plant communities from 2018 to 2019 although northern watermilfoil was not found in the most recent survey. Frequency of occurrences increased for several pondweeds such as flat-stem pondweed, large-leaf pondweed and clasping-leaf pondweed as well as for macroalgae and Canadian waterweed (***Table 4b***). Stiff pondweed and small pondweed were identified for the first time in 2019. Eurasian watermilfoil was noted as present if it was found on the rake, regardless of its status. Although EWM was found at 44% FOO, the majority of the plants observed showed signs of degradation and discoloration, collapsing in the water and have been impacted by the herbicide treatment (***Photos 2&3***). The efficacy of fluridone to control Eurasian watermilfoil will be better reflected in the 2020 survey.

The West basin of Coon Lake continues to be slightly more diverse in its plant community compared to the East basin with a total of 25 native submersed plant species observed in 2019 (compared to 14 species in the East).

Table 3b- Point Intercept Metrics. Summary of point intercepts metrics for Coon Lake (**West Basin**), Anoka County (DOW# 02004200). Values shaded in blue were calculated from littoral depth range.

Survey Metrics	**AUG 2010**	**SEPT 2012**	**SEPT 2014**	**AUG 2018**	**JUL 2019**
Treated (Y/N)	Y	Y	Y	Y	Y
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR
Total # Points Sampled	122	170	166	166	166
Max Depth of Growth (95%) in feet	10	11	9	8	10
# Point in Max Depth Range	116	150	136	151	149
# Points in Littoral (0-15 feet)	120	162	164	166	165
% Points w/ Native Taxa	100	92	84	93	96
Mean Native Taxa/ Point	3.6	2.4	2.7	3.4	4.0
# Native Taxa	18	12	18	23	25
# Non-Native Taxa	1	1	1	2	2

Table 4b- Plant Frequency Occurrence. Percent frequency of occurrence for submersed vegetation within the littoral zone (0-15 feet) in Coon Lake (**West Basin**), Anoka County (DOW# 02004200).

Taxonomic Name SUBMERSED PLANTS	Common Name	AUG 2010	SEPT 2012	SEPT 2014	AUG 2018	JUL 2019
*Myriophyllum spicatum**	Eurasian watermilfoil	22	4	3	39	44
Ceratophyllum demersum	Coontail	55	42	45	54	61
Macroalgae	Muskgrass and Stonewort	9	10	9	14	37
Elodea canadensis	Canadian waterweed	60	60	35	30	51
Megalodonta beckii	Water marigold	6	0	5	1	1
Myriophyllum sibiricum	Northern watermilfoil	1	0	0	8	0
Najas sp	Naiad	39	33	45	72	51
Potamogeton amplifolius	Large-leaf pondweed	16	10	5	8	12
Potamogeton foliosus	Leafy pondweed	0	0	0	8	8
Potamogeton gramineus	Variable-leaf pondweed	2	2	5	8	8
Potamogeton illnoensis	Illinois pondweed	17	19	23	12	12
Potamogeton praelongus	White-stem pondweed	1	3	4	3	5
Potamogeton richardsonii	Clasping-leaf pondweed	4	2	5	9	15
Potamogeton robbinsii	Fern pondweed	59	28	20	28	31
Potamogeton zosteriformis	Flat-stem pondweed	57	4	29	31	66
Utricularia gibba	Creeping bladderwort	0	0	5	9	4
Vallisneria americana	Water celery	20	24	27	30	28

Floating and emergent plants observed: *Brasenia schreberi* (Watershield), Lemna minor (Small duckweed), *Lemna trisulca* (Star duckweed), *Nuphar advena (Yellow pond lily), Nuphar variegata (Bullhead pond lily), Nymphaea ordata (White water lily), Sagittaria spp.* (Arrowheads), *Scirpus acutus* (Hardstem bulrush), *Scirpus americanas* (Olney's three-square bulrush), *Schoenoplectus subterminalis* (Water bulrush), *Scirpus tabernaemontani* (Softstem bulrush), *Typha spp.* (Cattails).

Less common (<5% frequency) submersed vegetation observed: *Potamogeton crispus** (Curly-leaf pondwed) in 2018 and 2019, *Utricularia macrohiza* (Common bladderwort) in 2010, 2014 and 2019, *Ranunculus aquatilis* (White water crowfoot) in 2010, 2014 and 2018 *Heteranthera dubia* (Water stargrass), and *Stuckenia pectinata* (Sago pondweed) in 2010, 2014, 2018 and 2019, *Elocharis acicularis* (Needle spikerush) in 2014, 2018 and 2019, *Potamogeton friesii* (Fries' pondweed) and *Lychnothamnus barbatus* (Bearded stonewort) in 2018, *Potamogeton pusillus*(Small pondweed) and *Potamogeton strictifolius* (Stiff pondweed) in 2019.

Photo 1. Rake throw showing EMW growing in high densities in 2018.

Photo 2. EWM starting to senesce in June from fluridone treatment in Coon West.

Photo 3. Defoliation observed during 2019 summer survey, Coon Lake, West Basin, Anoka County.

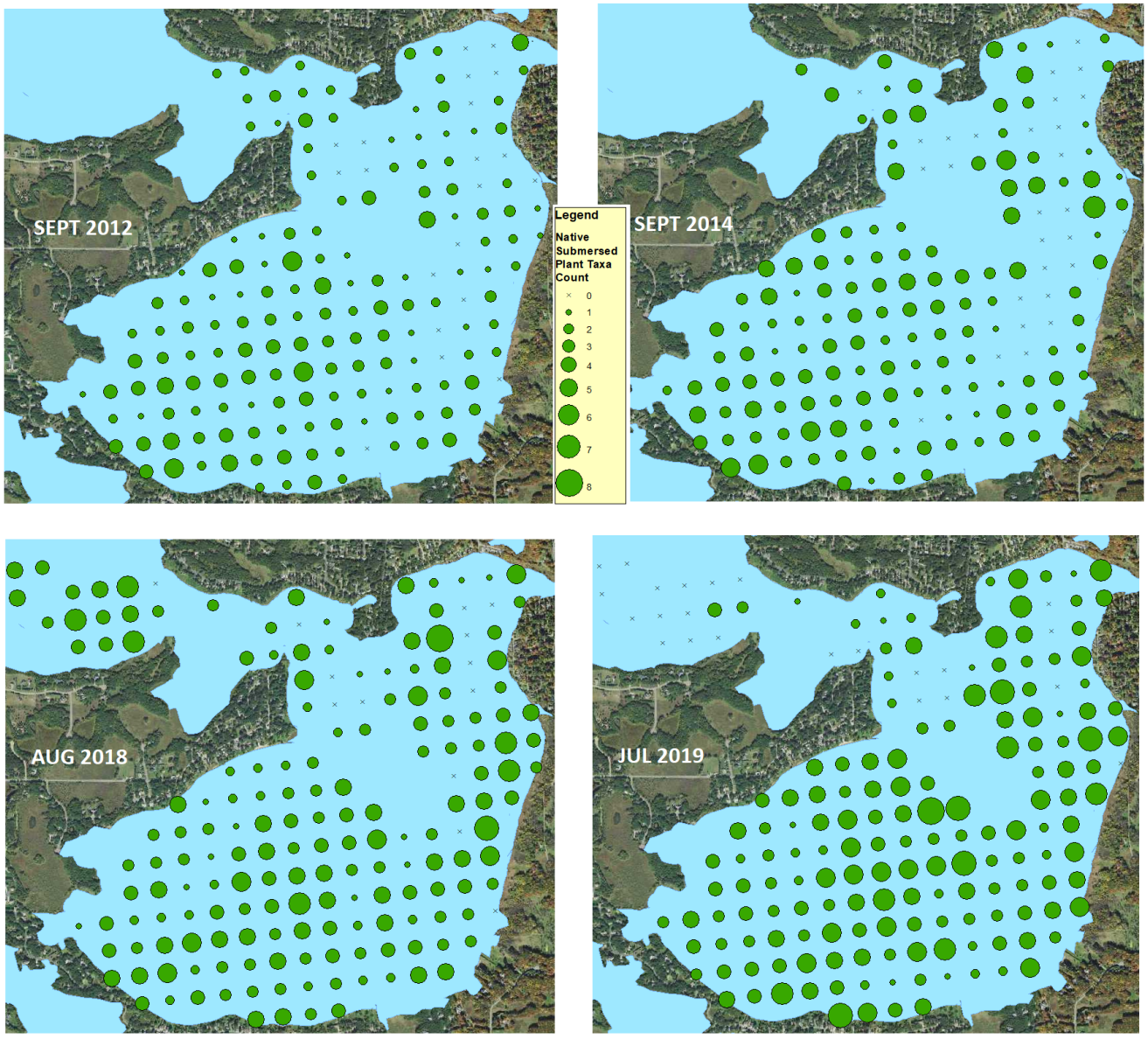


Figure 1b. Spatial distribution and species richness (# of native submersed taxa per sample point) in the West Basin. Dates correspond to month of point intercept survey. Coon Lake, Anoka County (DOW # 02004200).

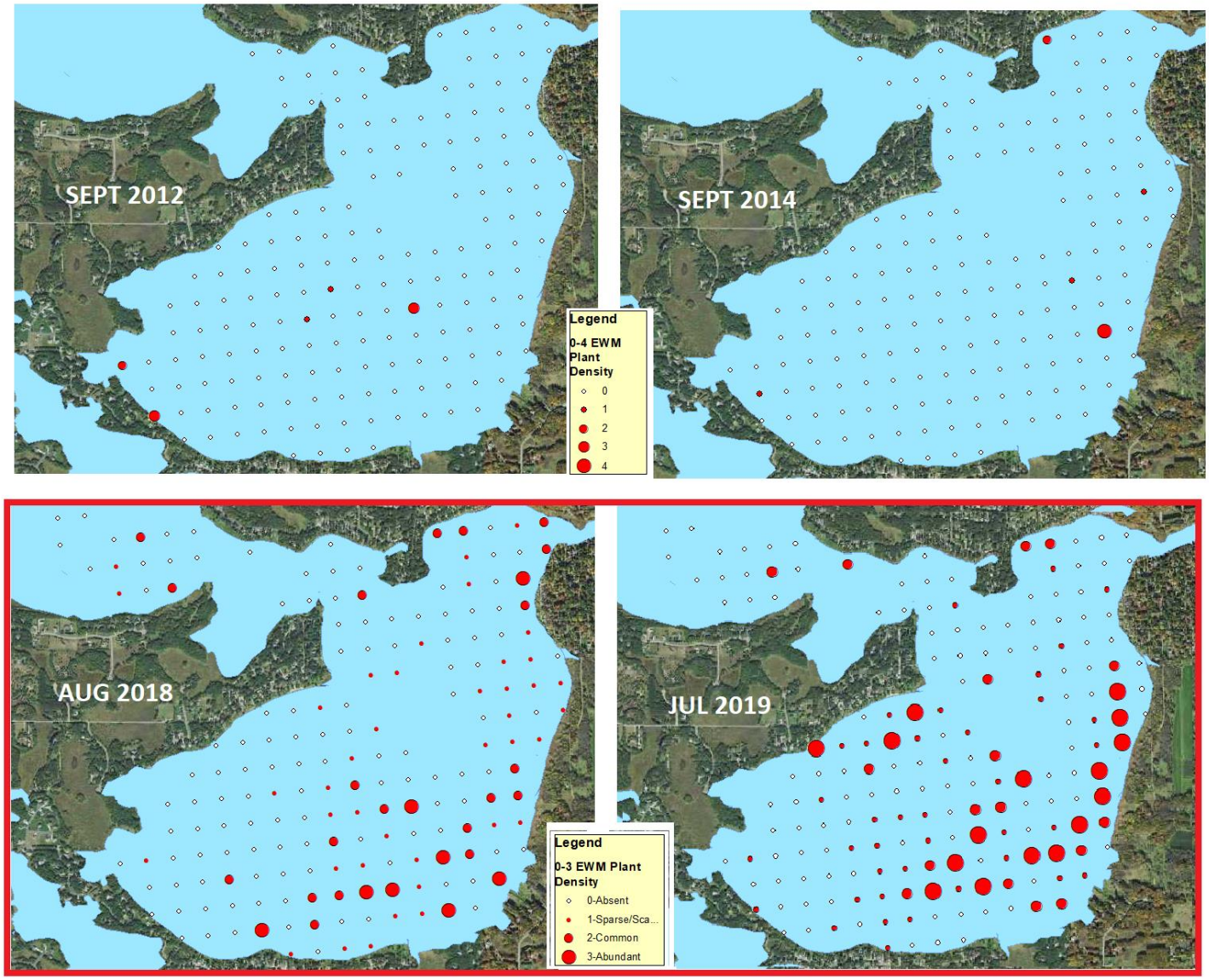


Figure 2b. Spatial distribution and species richness (Density of Eurasian watermilfoil per sample point) for 2012-2014 and 2019 in the **West Basin**. Dates correspond to month of point intercept survey. Years 2012-2014 were surveyed on a 1-4 density rake rating scale while 2018-2019 was rated on a 1-3 density rake rating. Coon Lake, Anoka County (DOW # 02004200).

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