
LAKE GEORGE, ANOKA COUNTY: 2018 AQUATIC VEGETATION REPORT

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

Lake: George (DOW# 2009100)

Lake Surface Area: 517 acres

Littoral Area: 383 acres

County: Anoka

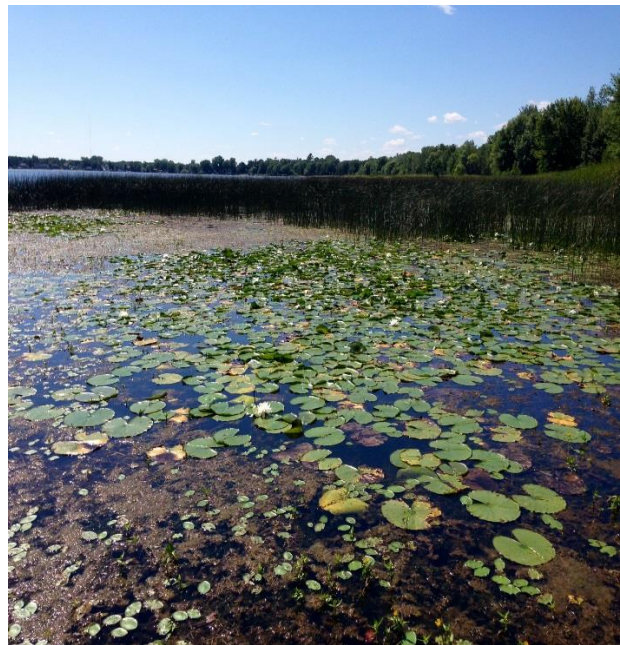
Survey Type: Point-intercept

Date of Survey (most recent): September 5, 2018

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Report updated: March 11th, 2019

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2018 Summary:

The most recent aquatic vegetation point-intercept survey of Lake George (DOW #2009100) was completed on September 5, 2018. Submersed plants were identified out to a maximum depth of 3.35 meters (11 feet). Within the littoral zone [zone in lake from the 0-15 foot depth range (0-4.5 meters)], 81% of sampled points contained native submersed taxa. The average number of native submersed taxa per sample point was 2.3. Seventeen submersed plant species were observed during the 2018 survey. Offshore herbicide treatments targeting curly-leaf pondweed and Eurasian watermilfoil (invasive aquatic plants) have been historically organized by the Lake George Improvement District.

Summary Table. Summary of aquatic submersed plants in Lake George, Anoka County, Minnesota (DOW# 2009100) 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	AVG Secchi Depth [m]
JUL 2010	23	14	98	2.9	16	2.1
SEPT 2011	20	15	79	1.9	17	1.9
AUG 2012	3	13	84	2.8	19	1.9
SEPT 2013	13	8	73	1.9	16	2.2
AUG 2014	30	11	85	2.7	19	2.2
AUG 2015	27	9	86	2.7	18	2.2
SEPT 2016	4	8	79	1.7	18	2.2
AUG 2017	15	10	82	2.0	16	2.3
AUG 2018	4	8	81	2.3	15	3.4

*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:

Lake George is a 517-acre lake located near St. Francis, Minnesota. 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 9.72 meters (32 feet).

Approximately 74% of the lake is littoral. For more information on Lake George water quality see

<http://cf.pca.state.mn.us/water/watershedweb/wdip/waterunit.cfm?wid=02-0091-00>.

Table 1-Secchi Averages. Average Secchi disk observations in meters for Lake George (DOW #2009100). 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	3.0	1.9	1.3	1.4	2.1
2011	3.3	2.2	1.6	1.0	1.6	1.9
2012	2.8	2.2	1.2	1.7	1.5	1.9
2013	3.8	2.7	1.4	1.5	1.5	2.2
2014	3.8	3.1	1.1	1.6	1.3	2.2
2015	3.6	2.8	1.8	1.5	1.5	2.2
2016	3.7	2.6	2.1	1.4	1.5	2.2
2017	3.2	3.0	1.9	2.0	1.6	2.3*
2018	4.0	5.2	3.3	2.3	2.1	3.4*

* data collected by Anoka Conservation District

Management History:

The most recent Eurasian watermilfoil herbicide treatment (56.7 acres; 2,4-D) was implemented in June of 2018. Similar areas historically treated for EWM control were targeted this year. Declines were observed in native plant species following the 2016 dual treatment utilizing endothall and 2,4-D targeting both EWM and CLP. As a result, invasive species herbicide management was minimized in 2018 to allow recovery of native plant populations. Invasive plant treatments have been organized by the Lake George Improvement District (see below **Table 2-Invasive Plant Management Summary** for a recent history of herbicide treatments). Herbicide concentration monitoring and post-treatment delineations for CLP and EWM were completed in Lake George in 2016 to evaluate effectiveness of the dual treatments. Data is available upon request.

Table 2-Invasive Plant Management Summary. Characteristics and history of herbicide treatment for Lake George (DOW# 2009100, Total acres: 517, Littoral acres: 383, 15% Littoral acres: 57.49).

Date	Treatment [W,P,N]	Target Species	Total Acres Treated	Herbicide	Licensed Commercial Applicator
JUL 2010	P	EWM	29.5	2,4-D	Lake Restoration Inc.
MAY 2012	N	-	-	-	-
JUN 2012	P	EWM	32.5	2,4-D	Lake Restoration Inc.
JUN 2013	P	CLP	43	Endothall	PLM Lake and Land Mgmt Corp
JUL 2013	P	EWM	4.1	2,4-D	Lake Restoration Inc.
MAY 2014	P	CLP	16	Endothall	Lake Restoration Inc.
JUL 2014	P	EWM	34	2,4-D	Lake Restoration Inc.
MAY 2015	P	CLP	5.7	Endothall	Lake Restoration Inc.
JUN 2015	P	EWM	50	2,4-D	Lake Restoration Inc.
JUN 2016	P	EWM & CLP	58.6	2,4-D & Endothall	Lake Management
MAY 2017	P	CLP	29	Endothall	Lake Restoration Inc.
JUN 2017	P	EWM	40.1	2,4-D	Lake Restoration Inc.
JUN 2018	P	EWM	56.7	2,4-D	Lake Restoration Inc.

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

Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Lake George. 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 100-125 meters apart using a Geographic Information System (GIS). This spacing allowed for placement of 124-215 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 density (scale of zero [no plants] to 3 [abundant or matted on the surface]). 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:

Maximum depth of rooted vegetation ranged between 2.4 and 4.6 meters (8-15 feet) from 2010 to 2018 (see **Table 3-Point Intercept Metrics** for historical point-intercept survey calculations and Figure 3 for plant growth depth ranges). Native plant diversity and frequency has remained fairly constant over the last 6 years, with some declines to both metrics observed within the last 3 survey years.

In 2018, 17 species of submersed aquatic plants were observed. The native plant community has been historically dominated by coontail, macroalgae and in more recent year, Canadian waterweed (see **Table 4-Plant Frequency Occurrence** for historical plant frequency observations). Recent declines in some natives such as variable-leaf pondweed and white-stem pondweed showed some recovery in 2018, while a number of pondweeds have been greatly reduced from the lake (i.e. large-leaf pondweed, Illinois pondweed, fern-leaf pondweed, flat-stem pondweed). Freshwater sponges were observed on the eastern part of Lake George for the first time in 2018. Watershield, a floating-leaf plant species, has been observed historically in Lake George and typically indicates higher species richness and/or limited shoreline development in metro area lakes.



Photo of rake sample showing area where EMW were growing in high densities in 2014, Lake George, Anoka County.



Photo of a freshwater sponge observed during the 2018 point intercept survey. Lake George, Anoka County.

Table 3- Point Intercept Metrics. Summary of point intercepts metrics for Lake George, Anoka County (DOW # 2009100). Shaded values were calculated from littoral depth range.

Survey Metrics	JUL 19 2010	2011	AUG 14 2012	SEPT 11 2013	AUG 12 2014	AUG 31 2015	SEPT 1 2016	AUG 21 2017	SEPT 5 2018
Treated (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR
Total # Points Sampled	108	169	127	126	125	125	124	124	194
Max Depth of Growth (95%)	14	15	13	8	11	9	8	10	8
# Point in Max Depth Range	87	145	83	76	79	69	69	79	120
# Points in Littoral (0-15 feet)	87	149	90	96	92	84	92	95	145
% Points w/ Submersed Native Taxa	98	79	84	73	85	86	79	82	81
Mean Submersed Native Taxa/ Point	2.9	1.9	2.8	1.9	2.7	2.7	1.7	2.0	2.3
# Submersed Native Taxa	15	15	17	14	17	16	16	14	15
# Submersed Non-Native Taxa	1	2	2	2	2	2	2	2	2

Table 4- Plant Frequency Occurrence. Historic percent frequency of occurrence for submersed vegetation within the littoral zone (0-15 feet) in Lake George, Anoka County (DOW # 2009100).

Taxonomic Name	Common Name	JUL 2010	SEPT 2011	AUG 2012	SEPT 2013	AUG 2014	AUG 2015	SEPT 2016	AUG 2017	AUG 2018
SUBMERSED PLANTS										
<i>Myriophyllum spicatum</i> *	Eurasian watermilfoil*	22	20	3	13	30	27	4	15	4
<i>Potamogeton crispus</i> *	Curly-leaf pondweed*	0	2	14	13	1	7	3	1	4
<i>Ceratophyllum demersum</i>	Coontail	40	26	28	30	37	43	21	43	40
<i>Macroalgae</i>	Muskgrass and Stonewort	39	22	33	30	38	55	48	46	53
<i>Elodea canadensis</i>	Canadian waterweed	1	1	7	14	37	42	30	53	37
<i>Megalodonta beckii</i>	Water marigold	9	3	9	11	10	7	2	2	4
<i>Myriophyllum tenellum</i>	Dwarf watermilfoil	8	0	2	0	0	5	3	5	6
<i>Najas spp.</i>	Naiad	23	13	24	31	54	25	21	12	20
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	6	6	7	0	0	0	0	0	0
<i>Potamogeton gramineus</i>	Variable-leaf pondweed	1	0	13	5	13	14	7	9	14
<i>Potamogeton illinoensis</i>	Illinois pondweed	40	0	18	5	0	4	1	1	1
<i>Potamogeton praelongus</i>	White-stem pondweed	0	13	38	17	24	29	8	9	19
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	5	13	9	0	1	8	0	1	6
<i>Potamogeton robbinsii</i>	Fern-leaf pondweed	38	3	11	14	5	0	2	0	0
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	43	49	57	0	1	1	1	0	0
<i>Utricularia macrorhiza</i>	Common bladderwort	0	5	0	0	0	1	0	0	0
<i>Vallisneria americana</i>	Water celery	14	17	28	24	30	29	22	19	19
Floating, Free-floating & Emergent plants observed: <i>Brasenia schreberi</i> (Watershield), <i>Lemna minor</i> (Small duckweed), <i>Lemna trisulca</i> (Forked duckweed), <i>Nymphaea odorata</i> (White water lily), <i>Persicaria amphibia</i> (Water smartweed), <i>Sagittaria spp.</i> (Arrowhead), <i>Scirpus acutus</i> (Hardstem bulrush), <i>Scirpus tabernaemontani</i> (Softstem bulrush), <i>Typha spp.</i> (Cattail)., <i>Schoenoplectus spp.</i>										
Less common (< 5% frequency) submersed vegetation observed: <i>Potamogeton epihydrus</i> (Ribbon-leaf pondweed) and <i>Potamogeton pusillus</i> (Small pondweed) in 2010, <i>Stuckenia pectinata</i> (Sago pondweed) in 2010-2017 and <i>Potamogeton strictifolius</i> (Stiff pondweed) in 2010-2016, <i>Myriophyllum sibiricum</i> (Northern watermilfoil) in 2011, 2012 and 2016, <i>Heteranthera dubia</i> (Water stargrass) 2011, 2014-2018, <i>Potamogeton foliosus</i> (Leafy pondweed) in 2012 and 2015, <i>Eleocharis acicularis</i> (Needle spikerush) in 2013, 2014, 2017 and 2018.										

* denotes invasive aquatic plant



Photo of floating watershield near emerging bulrush in 2014 survey. Lake George, Anoka County.

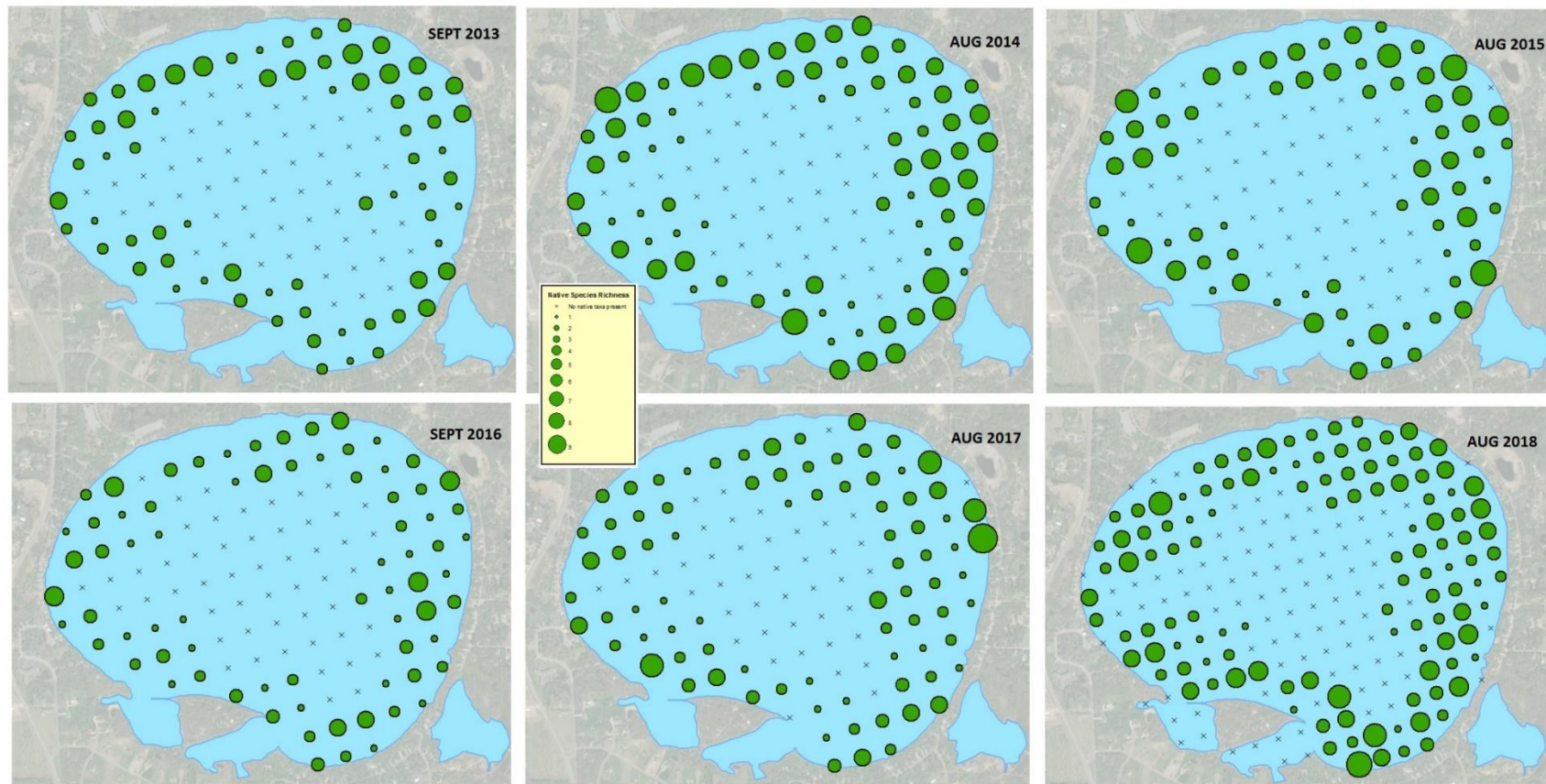


Figure 1. Spatial distribution and species richness (# of native submersed taxa per sample point). Dates correspond to month of point intercept survey. Lake George, Anoka County (DOW # 02009100).

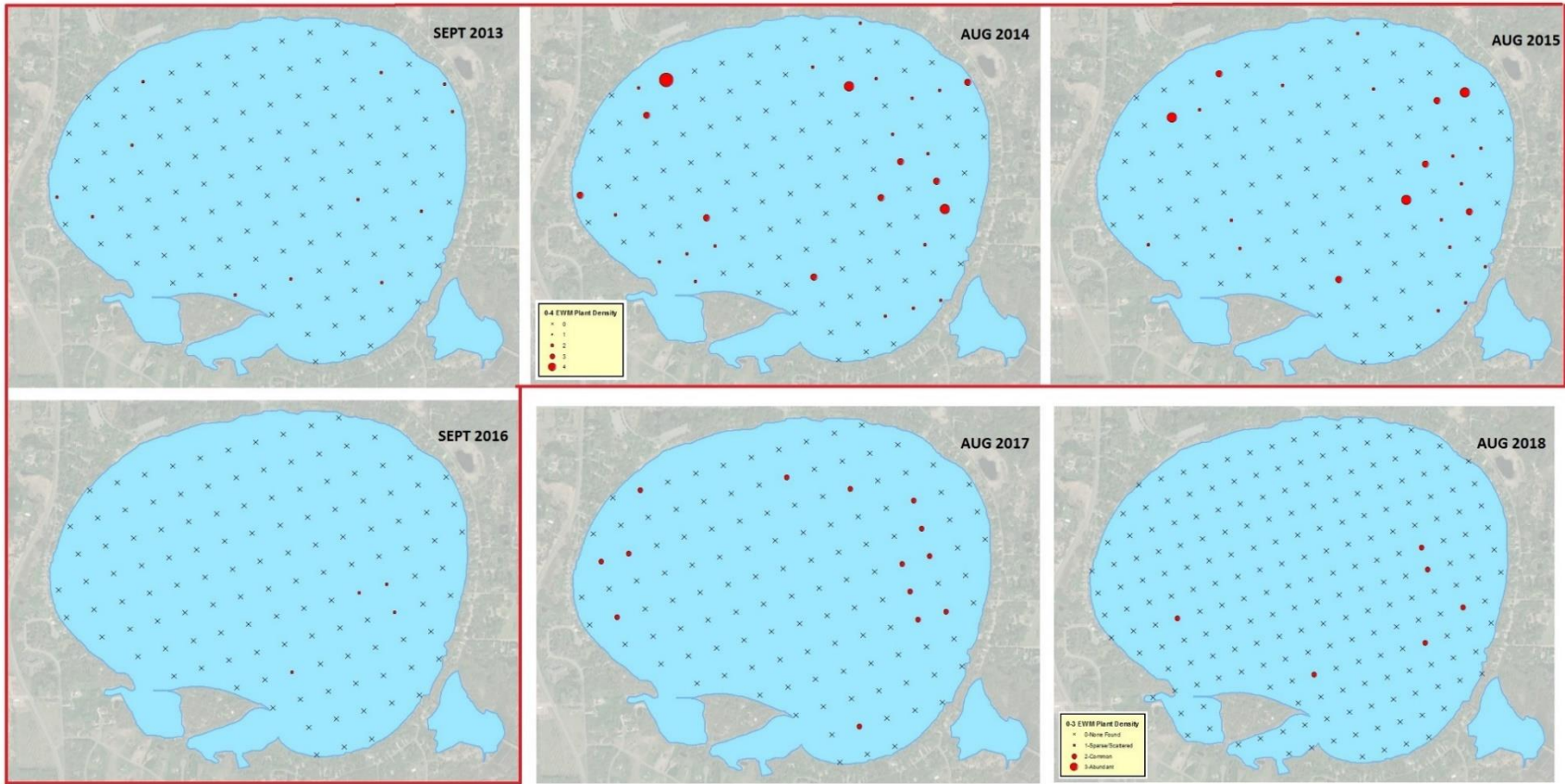


Figure 2. Spatial distribution and species richness (Density of Eurasian watermilfoil per sample point) for 2013-2018. Dates correspond to month of point intercept survey. Years 2013-2016 were surveyed on a 1-4 density rake rating scale while 2017-2018 were rated on a 1-3 density rake rating. Lake George, Anoka County (DOW # 02009100)

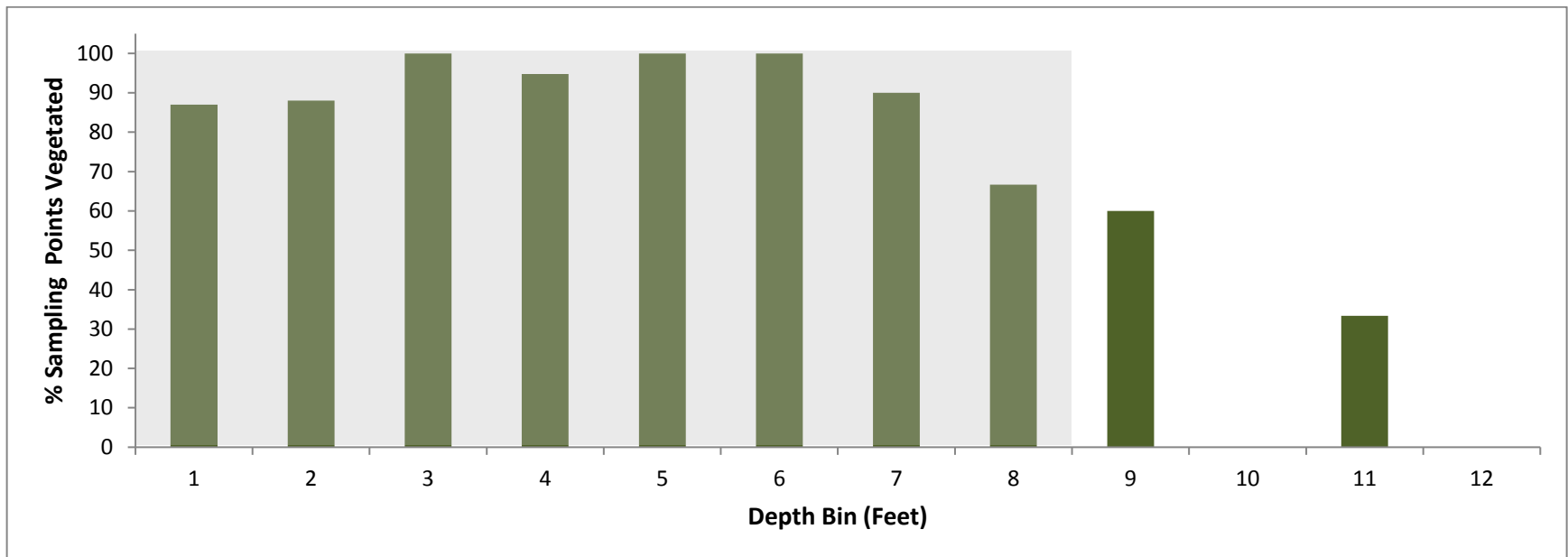


Figure 3. Maximum depth of plant colonization in feet during 2018 point intercept survey. Depths were binned in feet. Percent sampling points vegetated is defined as the number of sampling points with submersed vegetation divided by the total number of sampling points for each depth. Shaded area represents depth range of the 95th percentile of all submersed plants observed.

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