BIG MARINE LAKE, WASHINGTON COUNTY: 2017 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 22, 2017

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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%]†	% 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

*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

2017 Summary:

The most recent aquatic vegetation point-intercept survey of Big Marine Lake (DOW# 82005200) was completed on August 22, 2017. Submersed plants were identified out to a maximum depth of 5.18 meters (17.0 feet). Within the littoral zone (zone in lake from the 0-15 foot depth range [0-4.5 meters]), 97% of sampled points contained native submersed taxa. The average number of native submersed taxa per sample point was 3.8. Twenty-nine submersed plant species were documented during the 2017 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.

Management History:

The most recent invasive plant management herbicide treatment of 11.65 acres was organized by the Big Marine Lake Association (BMLA) in 2017 and targeted EWM. In 2016, BMLA evaluated the effectiveness of various herbicides and exposures on spot treatment 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 2017). See ***Table 1-Invasive Plant Management Summary*** below for more information on historical invasive plant management activities.

Table 1-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.

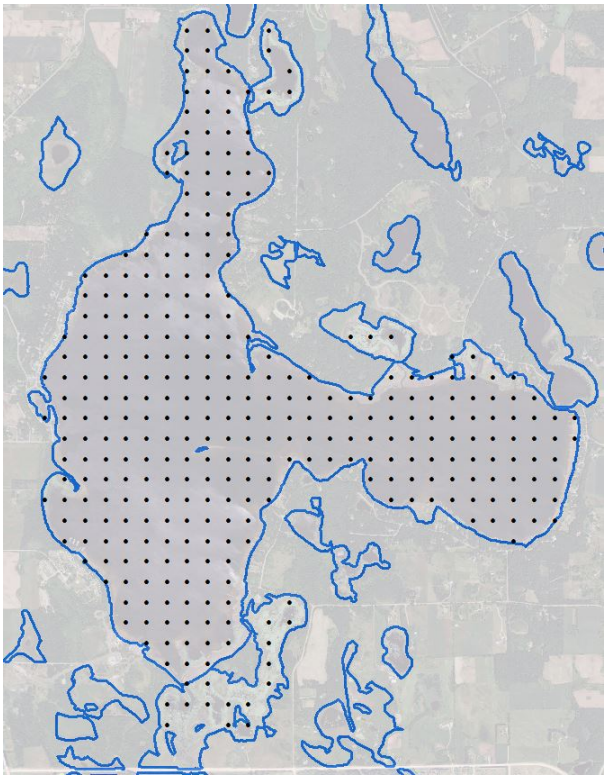
Date	Treatment [W,P,N]	Target Species	Total Acres Treated	Herbicide	Licensed Commercial Applicator
JUN 2011	P	EWM	14.5	Triclopyr	Lake Management
JUN 2012	P	EWM	11	2,4-D	Lake Management
JUL 2012	P	EWM	27	2,4-D	Lake Management
JUN 2013	P	EWM	27	2,4-D	Lake Management
AUG 2013	P	EWM	30	2,4-D	Lake Management
JUL 2014	P	EWM	39	2,4-D	PLM Lake & Land Management Corp
JUN 2015	P	EWM	19	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	11.65	Triclopyr	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 meters apart using a Geographic Information System (GIS). This spacing allowed for placement of 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 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:

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

(341 sampling point survey). In 2017, maximum depth of rooted vegetation was at 4.26 meters and 97% of points within the littoral zone contained native taxa (see ***Table 2-Point Intercept Metrics*** for historical point-intercept survey calculations and ***Figure 3*** for plant growth depth ranges). There was an average of 3.8 native taxa per point and a total of 28 submersed native taxa observed as well as one invasive species. Densities for EWM remain relatively low with the exception of a few reoccurring areas where EWM surface mats (see ***Figure 2*** below). Eurasian watermilfoil was found at a 28% frequency of occurrence (FOQ) while Curly-leaf-pondweed was not observed this year. The most common native taxa included Coontail, Canadian waterweed, Naiad, and Flat-stem pondweed (see ***Table 3-Plant Frequency Occurrence*** for historical plant frequency observations). Spiny hornwort was observed and noted for the first time in 2017. Other macrophytes were observed at lower frequencies including; Creeping bladderwort, Fries' pondweed, Ribbon-leaf pondweed, Watershield, Dwarf watermilfoil and Water stargrass. Additionally, Narrowleaf water plantain (*Alisma gramineum*), a rare aquatic plant, was first observed in the 2016.

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

Table 3- 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
SUBMERSED PLANTS					
*Myriophyllum spicatum**	Eurasian watermilfoil*	12	15	17	28
Ceratophyllum demersum	Coontail	53	59	51	47
Macroalgae	Muskgrass and Stonewort	21	24	23	25
Elodea canadensis	Canadian waterweed	43	32	31	34
Megalodonta beckii	Water marigold	6	7	6	10
Myriophyllum sibiricum	Northern watermilfoil	34	28	28	19
Najas spp.	Naiad	45	48	26	35
Potamogeton amplifolious	Large-leaf pondweed	7	3	3	8
Potamogeton foliosus	Leafy pondweed	0	12	0	0
Potamogeton gramineus	Variable-leaf pondweed	16	22	25	17
Potamogeton illinoensis	Illinois pondweed	17	15	12	11
Potamogeton praelongus	White-stem pondweed	14	34	32	27
Potamogeton pusillus	Small pondweed	0	1	0	14
Potamogeton richardsonii	Clasping-leaf pondweed	6	0	13	8
Potamogeton robbinsii	Fern pondweed	30	26	28	29
Potamogeton strictifolius	Narrowleaf pondweed	0	0	11	2
Potamogeton zosteriformis	Flat-stem pondweed	40	51	52	42
Ranunculus aquatilis	Common bladderwort	3	3	6	9
Stuckenia pectinata	Sago pondweed	11	2	2	0
Vallisneria americana	Water celery	17	12	15	15

Floating, Free-floating & Emergent plants observed: *Brasenia schreberi* (Watershield), *Nuphar variegata* (Bullhead pondlily), *Nymphaea odorata* (White waterlily); *Lemna trisulca* (Forked duckweed); *Alisma gramineum* (Narrowleaf water-plantain)*, *Juncus pelocarpus* (Brown-fruited rush), *Lythrum salicaria* (Purple loosestrife), *Persicaria amphibia (*Water smartweed), *Pontederia cordata*(Pickerelweed), *Sagittaria spp*. (Arrowhead), *Sparganium spp.* (Bur-reed), *Schoenoplectus americanus* (Three-square bulrush), *Schoenoplectus acutus* (Hardstem bulrush).

Less common (< 5% frequency) submersed vegetation observed: *Heteranthera dubia* (Water stargrass) 2010, 2015 -2017*, Myriophyllum tenellum* (Dwarf watermilfoil) and *Utricularia macrorhiza* (Common bladderwort) in 2015 & 2017*, Eleocharis acicularis* (Needle spikerush), *Myriophyllum verticillatum* (Whorl-leaf watermilfoil), *Potamogeton natans* (Floating pondweed) and *Utricularia minor* (Lesser bladderwort) in 2015-2017, *Potamogeton crispus* (Curly-leaf pondweed)* *Isoetes tenella* (Spiny-spored quillwort), *Juncus pelocarpus* (brown-fruited rush), *Potamogeton epihydrus* (Ribbon-leaf pondweed) in 2016, *Potamogeton friesii* (Fries' pondweed), *Potamogeton nodosus* (Long-leaf pondweed),*Utricularia gibba* (Floating bladderwort) in 2016 & 2017, *Ceratophyllum echinatum* (Spiny hornwort) in 2017.

* denotes invasive aquatic plant

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).

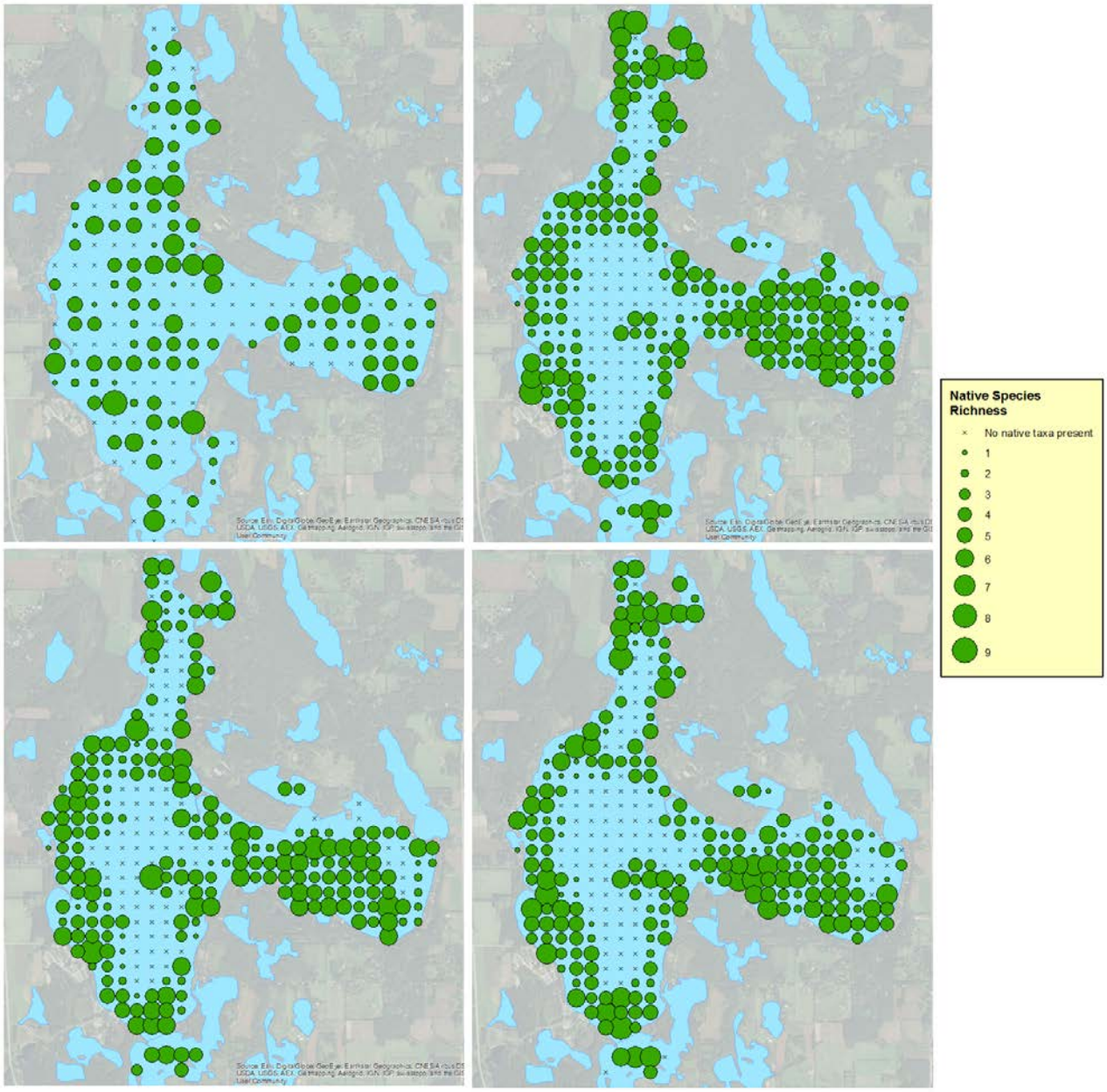


Figure 1. Spatial distribution and species richness (# of native species per sample point) of all native submersed plant species from 2010 and 2015-2017 surveys. Big Marine Lake, Washington County (DOW# 82005200).

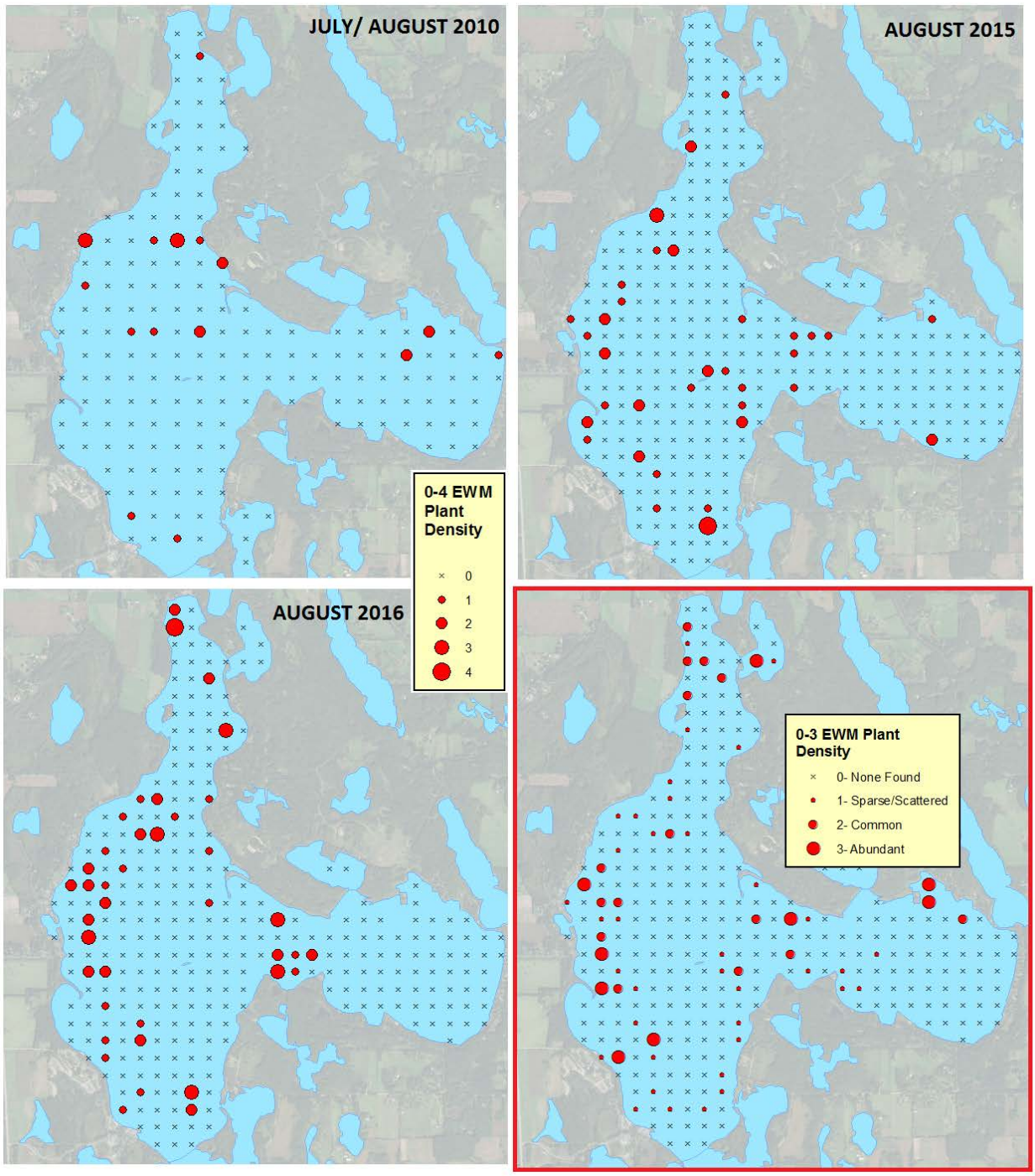


Figure 2. Spatial distribution and rake density rating of Eurasian watermilfoil. Big Marine Lake, Washington County (DOW# 82005200). Densities were based on a 0-4 scale in 2010-2016 and a 0-3 scale in 2017.

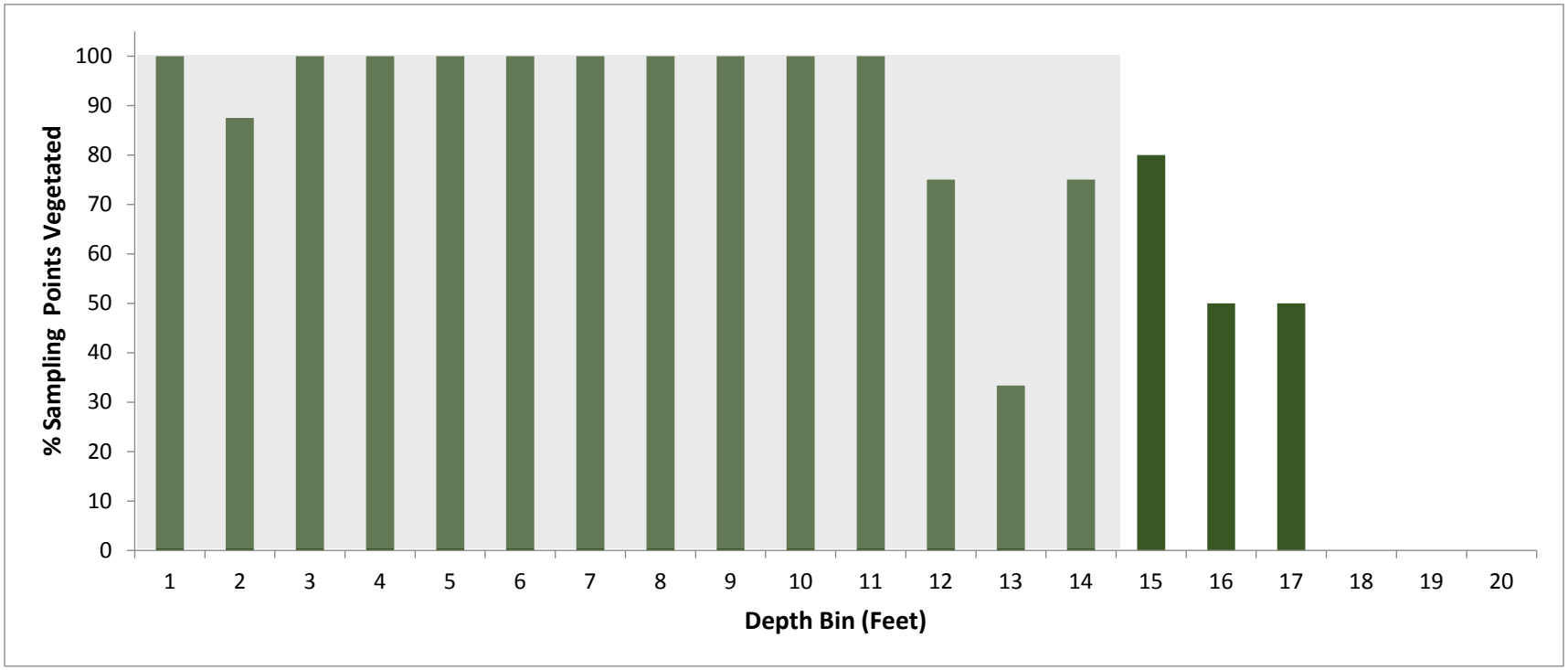


Figure 3. Maximum depth of plant colonization in feet during 2017 point intercept survey. Depths were binned in feet. Percent sampling points vegetated is defined as the number of sampling points with submersed vegetation divided by the total number of sampling points for each depth. Shaded area represents depth range of the 95th percentile of all submersed plants observed.