
BIG CARNELIAN 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 Carnelian (DOW# 82004900)

Lake Surface Area: 460 acres

Littoral Area: 137.5 acres

County: Washington

Survey Type: Point-intercept

Date of Survey (most recent): August 4, 2017

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Summary Table. Summary of aquatic submersed plants in Big Carnelian Lake, Washington County, Minnesota (DOW# 82004900) as indicated by results of Point-Intercept surveys. Values were calculated from littoral depth range (0-15 feet).

PI Survey Date	% Frequency of CLP*	Max Depth of Growth in feet [95%] [†]	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa	AVG Secchi Depth [m]
AUG 2014	1	23	97	3.9	19	5.8
JUL 2015	6	20	100	4.2	18	4.7
JUL 2016	0	19	70	2.6	16	4.8
AUG 2017	5	18	97	4.0	21	4.6

*CLP is short for Curly-leaf pondweed

[†]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 Carnelian Lake (DOW# 82004900) was completed on August 4, 2017. Plants were present throughout the lake to a maximum depth of 6.5 meters (21.4 feet). Within the littoral zone [zone in lake from the 0-15 foot depth range (0-4.5 meters)], 97% of sample points contained native submersed taxa. The average number of native submersed taxa per sample point was 4.0. Twenty one submersed plant species were documented during the 2017 survey and include one invasive plant species, curly-leaf pondweed. To date, there has been no management of the invasive submersed plant species in Big Carnelian Lake as it is not a nuisance.

Lake Description:

Big Carnelian Lake is a 460-acre lake located near Stillwater, Minnesota. It has one invasive aquatic plant species: curly-leaf pondweed (*Potamogeton crispus*, abbreviated as CLP). The maximum depth of water is 20.1 meters (66 feet). Approximately 30% of the lake is littoral. It contains a moderate level of nutrients and is considered a mesotrophic lake. Big Carnelian Lake has high water clarity (see **Table 1-Secchi Averages** below for historic Secchi disk observations) with transparency increasing in the last decade (data not shown). For more information concerning Big Carnelian Lake water quality see here: <http://cf.pca.state.mn.us/water/watershedweb/wdip/waterunit.cfm?wid=82-0049-00>.

Table 1-Secchi Averages. Average Secchi disk observations in meters for Big Carnelian Lake, Washington County, Minnesota (DOW# 82004900). Data gathered from the Minnesota Pollution Control Agency and Washington Conservation District (WCD).

YEAR	MAY	JUNE	JULY	AUG	SEPT	Secchi Depth Average [May-Sept]
2014	7.0	7.5	4.6	5.4	4.3	5.8
2015	4.5	5.2	4.6	-	4.4	4.7
2016	3.3	6.7	5.8	4.8	3.2	4.8
2017	5.7	5.3	4.0	4.6	4.6	*4.6

* data collected by WCD

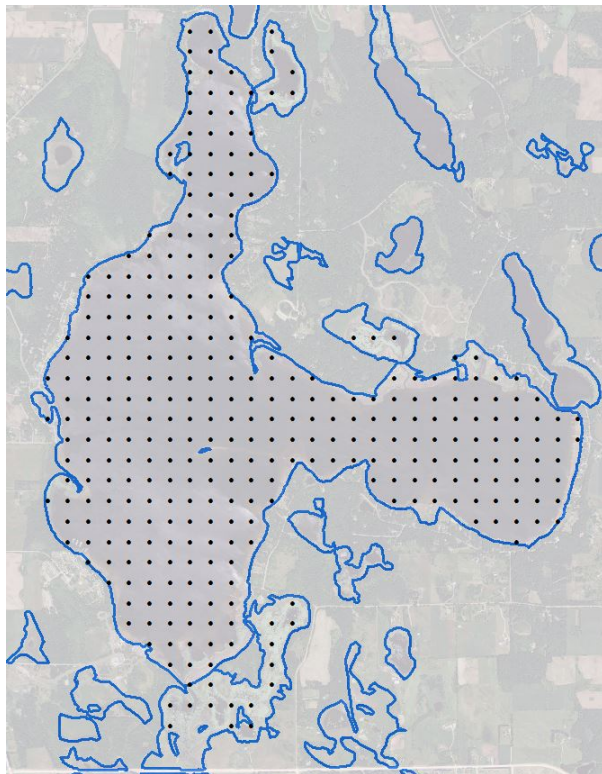
Management History:

There is no invasive plant management history for Big Carnelian Lake.

Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Big Carnelian 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 apart using a Geographic Information System (GIS). This spacing allowed for placement of 183 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 invasive species program has been conducting point intercept surveys of Big Carnelian Lake since 2014 as a reference lake. In 2017, maximum depth of rooted vegetation was observed at 6.5 meters (21.4 feet) and 97% of points within the littoral zone contained native taxa, which is a 27% increase from 2016 (see **Table 2-Point Intercept Metrics** for historical point-intercept survey calculations and **Figure 2** for plant growth depth ranges). There was an average of 4.0 native taxa per point and a total of 20 native taxa observed. Similar to past years the most common native taxa included Macroalgae, Northern watermilfoil, Coontail, Illinois pondweed, and Flat-stem pondweed (see **Table 3-Plant Frequency Occurrence** for plant frequency observations). Historically, 10 native pondweed species have been observed with an addition of one in 2017. Additionally, Narrow-leaf water plantain (a species of Special Concern in Minnesota) has been observed in Big Carnelian Lake, Washington County since the first point intercept survey in 2014. To date, Eurasian watermilfoil has not been observed in Big Carnelian Lake.

Table 2- Point Intercept Metrics. Summary of point intercepts metrics for Big Carnelian Lake, Washington County, Minnesota (DOW# 82004900). Shaded values were calculated from littoral depth range.

Survey Metrics	AUG 2014	JUL 2015	JUL 2016	AUG 2017
Treated (Y/N)	N	N	N	N
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR
Total # Points Sampled	185	186	183	184
Max Depth of Growth (95%) in feet	23	20	19	18
# Point in Max Depth Range	110	80	73	75
# Points in Littoral (0-15 feet)	119	54	56	60
% Points w/ Submersed Native Taxa	80	100	70	97
Mean Submersed Native Taxa/ Point	3.9	4.2	2.6	4
# Submersed Native Taxa	18	17	16	20
# Submersed Non-Native Taxa	1	1	0	1

Table 3- Plant Frequency Occurrence. Historic percent frequency of occurrence for submersed vegetation within the littoral zone (0-15 feet) in Big Carnelian Lake, Washington County, Minnesota (DOW# 82004900).

Taxonomic Name	Common Name	AUG 2014	JUL 2015	JUL 2016	AUG 2017
SUBMERSED PLANTS					
<i>Potamogeton crispus</i> *	Curly-leaf pondweed*	1	6	0	5
<i>Ceratophyllum demersum</i>	Coontail	42	30	29	32
<i>Macroalgae</i>	Muskgrass and Stonewort	40	61	59	67
<i>Elodea canadensis</i>	Canadian waterweed	2	4	0	5
<i>Heteranthera dubia</i>	Water stargrass	4	7	5	8
<i>Megalodonta beckii</i>	Water marigold	7	11	7	2
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	30	56	46	45
<i>Najas spp.</i>	Naiad	10	11	20	18
<i>Potamogeton foliosus</i>	Leafy pondweed	0	22	9	0
<i>Potamogeton friesii</i>	Fries pondweed	0	22	9	25
<i>Potamogeton gramineus</i>	Variable-leaf pondweed	3	0	9	8
<i>Potamogeton illinoensis</i>	Illinois pondweed	19	37	29	32
<i>Potamogeton praelongus</i>	White-stem pondweed	13	26	13	17
<i>Potamogeton pusillus</i>	Small pondweed	0	0	0	22
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	8	20	20	18
<i>Potamogeton robinsii</i>	Fern-leaf pondweed	0	2	0	5
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	35	59	52	48
<i>Ranunculus aquatilis</i>	White water crowfoot	1	7	2	3
<i>Stuckenia pectinata</i>	Sago pondweed	12	24	18	13
<i>Vallisneria americana</i>	Water celery	16	22	29	23
Floating, Free-floating & Emergent plants observed: <i>Lemna trisulca</i> (Forked duckweed), <i>Sagittaria sp.</i> (Arrowhead species), <i>Spirodela polyrhiza</i> (Greater duckweed), <i>Schoenoplectus americanus</i> (Three-square bulrush), <i>Scripus acutus</i> (Hardstem bulrush), <i>Typha angustifolia</i> (Narrow-leaf cattail)					
Less common (< 5% frequency) submersed vegetation observed: ** <i>Alisma gramineum</i> (Narrow-leaf water plantain) in 2014-2016, <i>Potamogeton strcitifolius</i> (Stiff pondweed) in 2014, <i>Potamogeton robbinsii</i> (Fern pondweed) in 2015, <i>Eleocahris acicularis</i> (Needle spikerush) and <i>Utricularia macrorhiza</i> (Common bladderwort) in 2017					

* denotes invasive aquatic plant

** denotes rare species



Photos of abundant native plant species (left photo), northern watermilfoil (middle photo), and Narrow-leaved water plantain (*Alisma gramineum*) observed in Big Carnelian Lake, Washington County (DOW# 82004900). *A. gramineum* is a Special Concern Species in Minnesota.

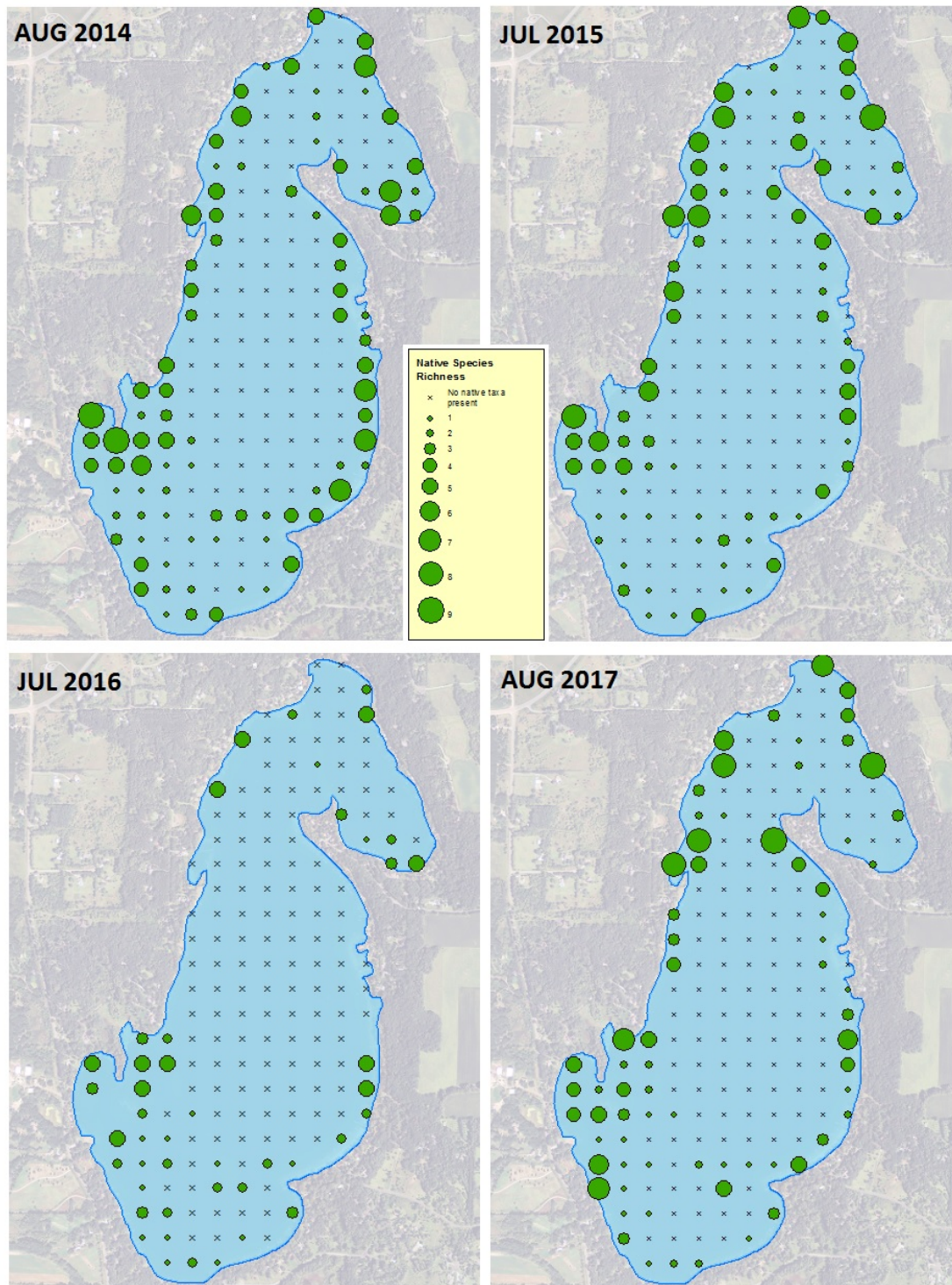


Figure 1. Spatial distribution and species richness (# of native species per sample point) of all native submersed plant species from 2014-2017 point intercept surveys. Big Carnelian, Washington County (DOW# 82004900).

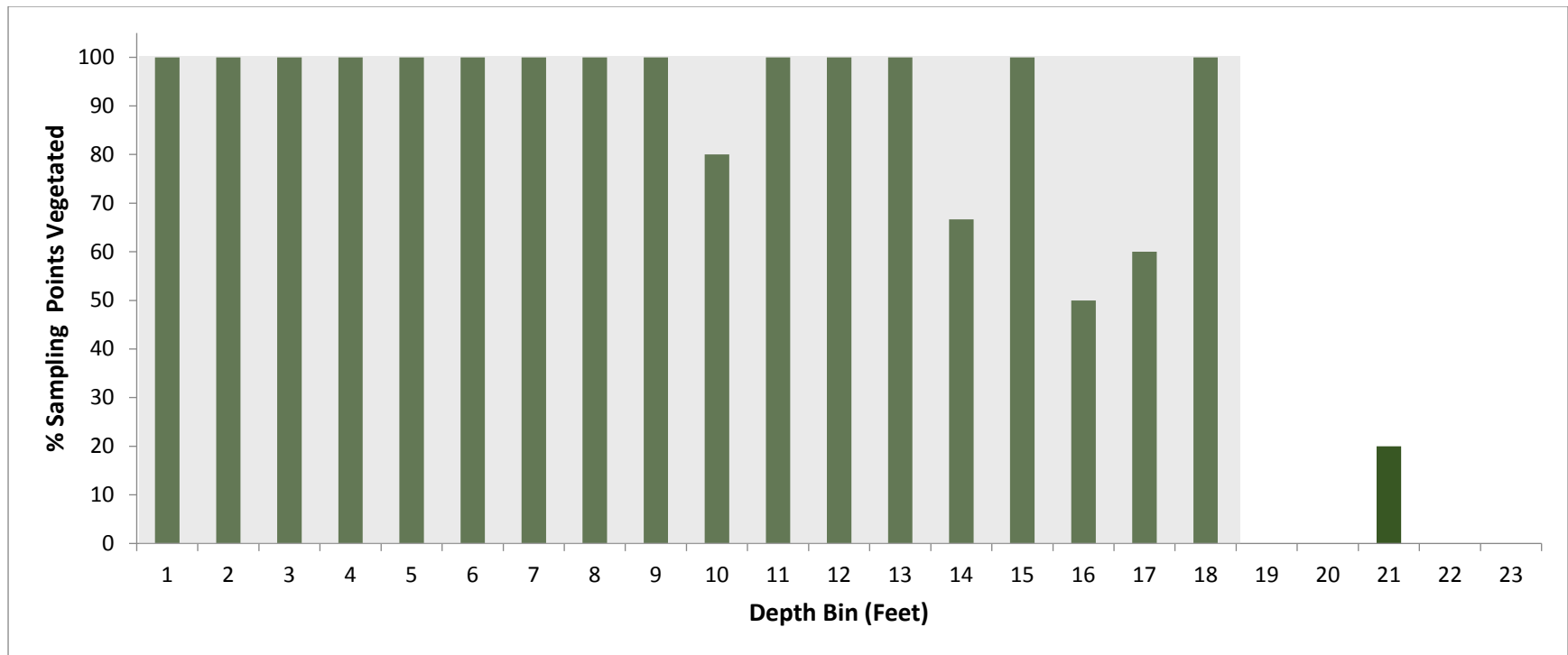


Figure 2. Maximum depth of plant colonization in feet during 2017 point intercept survey. Depths were binned in feet. Percent sampling points vegetated is defined as the number of sampling points with submersed vegetation divided by the total number of sampling points for each depth. Shaded area represents depth range of the 95th percentile of all submersed plants observed.

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