
BIG CARNELIAN, WASHINGTON COUNTY: 2019 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): July 30, 2019

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Report updated: July 2, 2020

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2019 Summary:

The most recent aquatic vegetation point-intercept survey of Big Carnelian Lake (DOW# 82004900) was completed on July 30, 2019. Plants were present throughout the lake to a maximum depth of approximately 5.8 meters (19 feet). Within the littoral zone [zone in lake from the 0-15 foot depth range (0-4.5 meters)], 100% of sample points contained native submersed taxa. The average number of native submersed taxa per sample point was 4.4. Twenty submersed plant species were documented during the 2019 survey. Historically, curly-leaf pondweed has been observed at low densities and to our knowledge no Eurasian watermilfoil is present in this lake. The long term monitoring conducted in Big Carnelian Lake serves as a non-managed reference lake and can be used for comparison to various invasive plant control projects.

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	Max Depth of Growth in feet [95%] [†]	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa	AVG Secchi Depth [m]
2014 AUG 15	23	97	3.9	19	5.8
2015 JUL 17	20	100	4.2	18	4.7
2016 JUL 8	19	70	2.6	16	4.8
2017 AUG 4	18	97	4.0	21	4.6
2018 JUL 27	17	91	3.3	18	4.8
2019 JUL 30	19	100	4.4	20	4.7

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	6.9	7.1	5.0	5.1	4.1	5.6
2015	4.4	5.2	4.9	5.6	4.8	5.0
2016	3.6	6.1	6.0	5.2	3.5	4.9
*2017	6.9	6.6	5.4	4.8	3.9	4.6
*2018	6.1	4.6	3.5	5.0	4.9	4.8
*2019	6.2	4.4	4.1	4.6	4.3	4.7

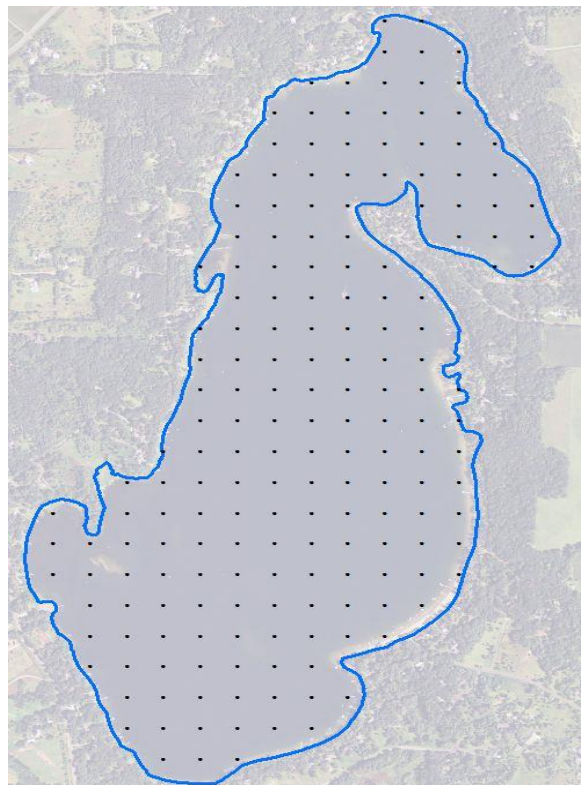
*Data collected by WCD

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 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 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 plants 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 has been conducting point intercept surveys in Big Carnelian Lake since 2014 as a non-treatment reference lake. In 2019, maximum depth of rooted vegetation was observed at 5.8 meters (19 feet) and 100% of points within the littoral zone contained native taxa (see **Table 2-Point Intercept Metrics** for historical point-intercept survey calculations and **Figure 2** for plant growth depth ranges). For the past 5 years, the most dominant submersed aquatic plant species in Big Carnelian include macroalgae, flat-stem pondweed and northern watermilfoil (> 30% frequency of occurrence). The majority of all native taxa observed has stayed fairly consistent across survey years (see **Table 3-Plant Frequency Occurrence** for plant frequency observations). Additionally, narrow-leaf water plantain (a species of Special Concern in Minnesota; see *photo below*) has been observed in Big Carnelian Lake, Washington County since the first point intercept survey in 2014. Curly-leaf pondweed was not found in the most recent survey given its early senescence and to date, Eurasian watermilfoil has not been observed in Big Carnelian Lake.

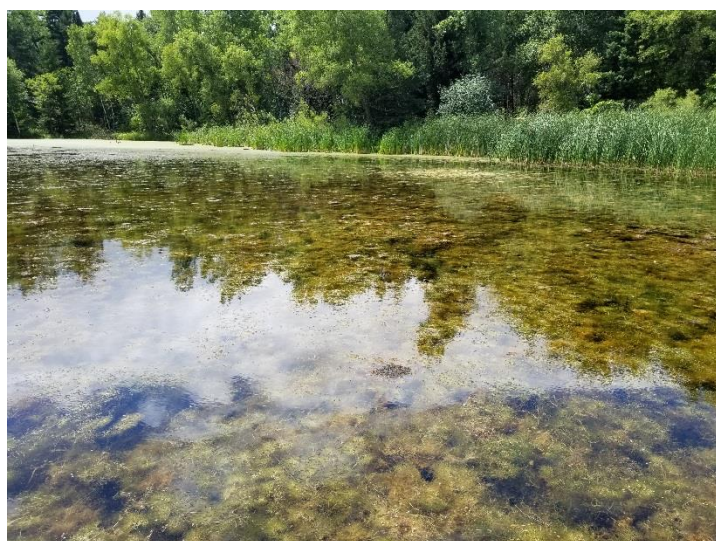
Table 2- Point Intercept Metrics. Summary of point intercepts metrics for Big Carnelian Lake, Washington County, Minnesota (DOW# 82004900). Shaded values were calculated from littoral depth range.

Survey Metrics	AUG 15 2014	JUL 17 2015	JUL 8 2016	AUG 4 2017	JUL 27 2018	JUL 30 2019
Treated (Y/N)	N	N	N	N	N	N
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR
Total # Points Sampled	185	186	183	184	182	182
Max Depth of Growth (95%) in feet	23	20	19	18	17	19
# Point in Max Depth Range	110	80	73	75	67	69
# Points in Littoral (0-15 feet)	119	54	56	60	58	54
% Points w/ Submersed Native Taxa	80	100	70	97	91	100
Mean Submersed Native Taxa/ Point	3.9	4.2	2.6	4	3.3	4.4
# Submersed Native Taxa	18	17	16	20	18	20
# Submersed Non-Native Taxa	1	1	0	1	0	0

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 15 2014	JUL 17 2015	JUL 8 2016	AUG 4 2017	JUL 27 2018	JUL 30 2019
SUBMERSED PLANTS							
<i>Potamogeton crispus</i> *	Curly-leaf pondweed*	1	6	0	5	0	0
<i>Ceratophyllum demersum</i>	Coontail	42	30	29	32	28	35
<i>Macroalgae</i>	Muskgrass and Stonewort	40	61	59	67	55	72
<i>Elodea canadensis</i>	Canadian waterweed	2	4	0	5	5	6
<i>Heteranthera dubia</i>	Water stargrass	4	7	5	8	7	9
<i>Megalodonta beckii</i>	Water marigold	7	11	7	2	3	15
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	30	56	46	45	31	43
<i>Najas spp.</i>	Naiad	10	11	20	18	12	17
<i>Potamogeton foliosus</i>	Leafy pondweed	0	22	9	22	5	7
<i>Potamogeton friesii</i>	Fries pondweed	0	22	9	25	26	17
<i>Potamogeton gramineus</i>	Variable-leaf pondweed	3	0	9	8	14	9
<i>Potamogeton illinoensis</i>	Illinois pondweed	19	37	29	32	28	37
<i>Potamogeton praelongus</i>	White-stem pondweed	13	26	13	17	12	13
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	8	20	20	18	16	26
<i>Potamogeton robbinsii</i>	Fern-leaf pondweed	0	2	0	5	9	2
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	35	59	52	48	43	57
<i>Ranunculus aquatilis</i>	White water crowfoot	1	7	2	3	2	9
<i>Stuckenia pectinata</i>	Sago pondweed	12	24	18	13	24	30
<i>Vallisneria americana</i>	Water celery	16	22	29	23	16	26
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>Schoenoplectus 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 and 2019, <i>Potamogeton robbinsii</i> (Fern pondweed) in 2015, <i>Eleocharis acicularis</i> (Needle spikerush) and <i>Utricularia macrorhiza</i> (Common bladderwort) in 2017, <i>Potamogeton pusillus</i> (Very small pondweed) in 2019							

* denotes invasive aquatic plant and ** denotes rare species



Photos of Narrow-leaved water plantain (*Alisma gramineum*) upper left; 2014), abundant northern watermilfoil (upper right; 2015), and a diverse native submersed assemblage including sago pondweed, water stargrass and naiad (lower left; 2018) observed in Big Carnelian Lake, Washington County (DOW# 82004900). *A. gramineum* is a Special Concern Species in Minnesota.

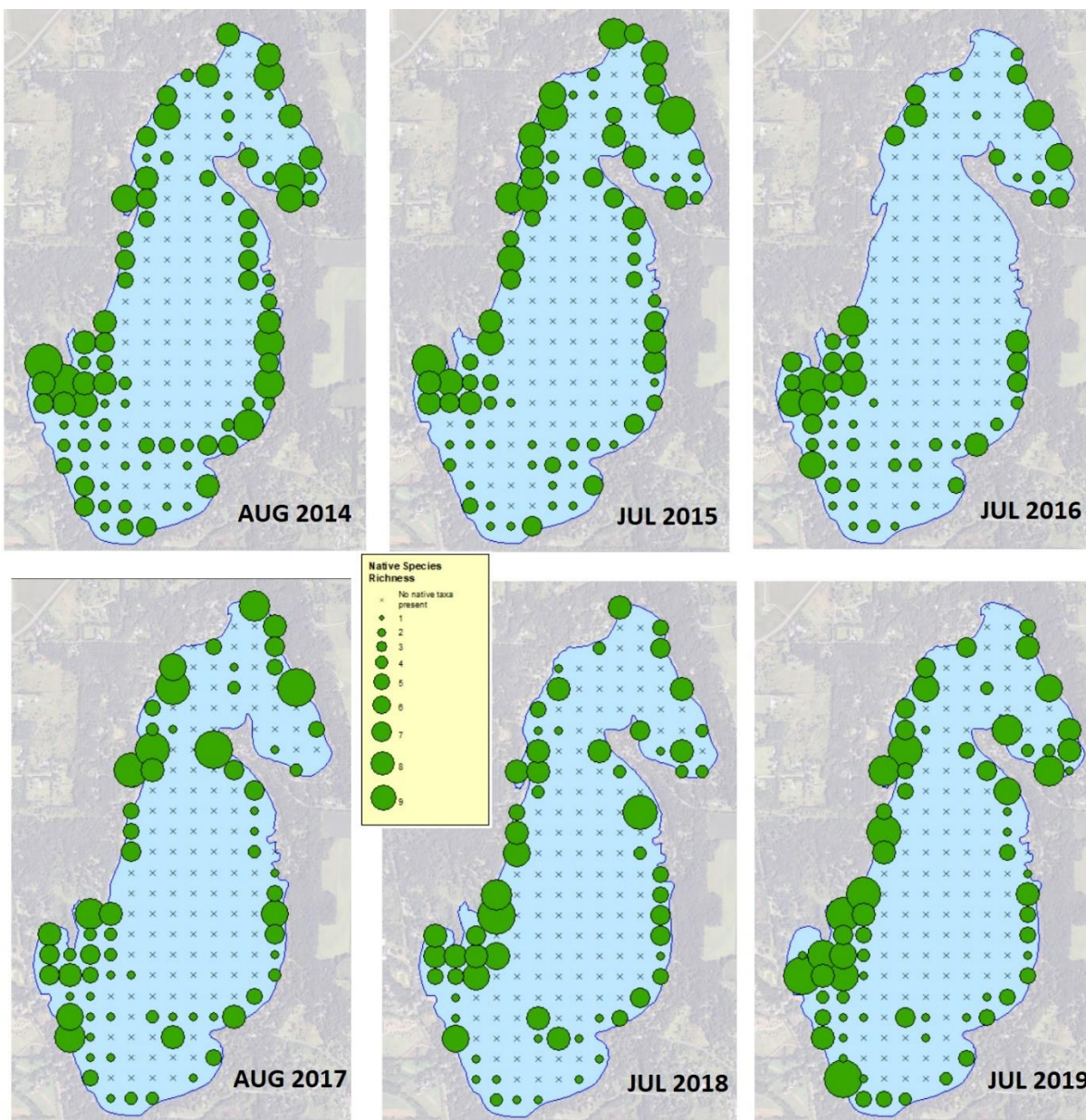


Figure 1. Spatial distribution and species richness (# of native species per sample point) of all native submersed plant species from 2014-2019 point intercept surveys. Big Carnelian, Washington County (DOW# 82004900).

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