

## Crooked Lake: 2016 Aquatic Plant Survey Anoka County, MN (#02-0084)

Surveyed August 5, 2016



**Surveying, Analysis, and Reporting by:**  
*James A. Johnson – Freshwater Scientific Services, LLC*



**Funded by:**  
*Crooked Lake Area Association*

## Survey & Analysis Methods

### Point-Intercept Aquatic Plant Survey

Freshwater Scientific Services conducted a lake-wide aquatic plant survey for Crooked Lake on August 5, 2016 using the point-intercept method described by Madsen (1999). This survey incorporated assessments at a total of 180 sample points arranged in a uniform grid (45-m spacing; Figs 1 and 2). We generated these sample points using desktop GIS software to project a grid of points over an aerial image of the lake. We then loaded the selected sample locations onto a handheld GPS unit (Garmin GPSMAP-78) for navigation to each point while in the field.

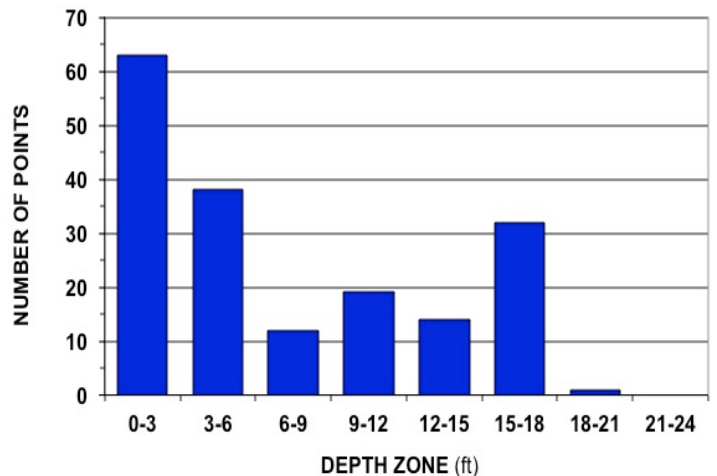
At each designated sample location, we collected plants using a double-headed, 14-tine rake on a on a rope. For each rake sample, we dragged the rake over the lake bottom for approximately 5 ft before retrieving. Retrieved plants were piled on top of the rake head and assigned density scores from 1 to 4 based upon rake head coverage (Table 3) for each individual species and for all plants collectively.

We calculated the littoral frequency ( $\leq 15$  ft, % occurrence) and littoral mean density score (plant abundance) for each encountered plant species (Table 1), as well as lake-wide and littoral plant community metrics (Table 2). We also used desktop GIS software to map the distribution and abundance of plants in the lake (pages 5–9). Additional species that were observed floating or growing in the vicinity of a sample point but not retrieved on the rake were given a rating of zero for that location. These “zero” species were noted as being present on the plant distribution maps (shown as an “X”), but “zero” ratings were excluded from calculations of plant community metrics and statistics (not treated as denoting presence). At each location, we also documented water depth and overall plant height.

**Figure 1.** Designated sample locations for the 2016 Crooked Lake plant survey. Darker shaded area  $>15$  ft (based upon MDNR bathymetric map).



**Figure 2.** Sampling effort (number of locations sampled) within successive 3-ft depth zones; Crooked Lake, Aug 5, 2016



## Results

### Statistical Summary of Findings

**Table 1.** Littoral frequency (% occurrence) and abundance (mean density score) of plant species found in Crooked Lake (Anoka Co., MN) during the Aug 5, 2016 survey. % Occurrence and Mean Density (0-4 scale) were calculated using all littoral points (water depth ≤15 ft). Plant taxa that were observed growing in the lake but not retrieved in any rake samples are noted as being present (P).

PLANT TAXA	COMMON NAME	% OCCURRENCE	MEAN DENSITY
<b>ALL TAXA</b> (combined)		<b>72</b>	<b>2.5</b>
<b>SUBMERSED TAXA</b>			
<i>Myriophyllum spicatum</i> *	Eurasian watermilfoil	60	0.9
<i>Ceratophyllum demersum</i>	Coontail	50	0.8
<i>Chara</i> sp.	Muskgrass	41	1.0
<i>Potamogeton illinoensis</i>	Illinois pondweed	29	0.3
<i>Stuckenia pectinata</i>	Sago pondweed	17	0.2
<i>Najas guadalupensis</i>	Southern naiad	6	0.1
<i>Eleocharis acicularis</i>	Needle spikerush	1	<0.1
<i>Potamogeton crispus</i> *	Curly-leaf pondweed	1	<0.1
<i>Potamogeton pusillus</i>	Small pondweed	1	<0.1
<i>Zosterella dubia</i>	Water stargrass	1	<0.1
<b>FLOATING TAXA</b>			
<i>Nymphaea odorata</i>	White waterlily	17	0.2
<i>Lemna minor</i>	Small duckweed	13	0.1
<i>Spirodela polyrhiza</i>	Large Duckweed	7	0.1
<i>Wolffia columbiana</i>	Common watermeal	4	<0.1
<i>Nuphar variegata</i>	Spatterdock	1	<0.1
<b>EMERGENT TAXA</b>			
<i>Typha</i> sp.	Cattail	2	<0.1
<i>Schoenoplectus acutus</i>	Hard-stem Bulrush	P	–

\* Invasive, non-native species





**Table 2.** Summary of Crooked Lake plant community metrics from the Aug 5, 2016 survey.

**CROOKED LAKE**

<b>WHOLE-LAKE METRICS</b>	<b>2016</b>
Lake Area	116 acres
Total Points Sampled	179
Vegetated Area	80 acres (69%)
Area with Veg. to Surface	36 acres
Max Depth of Growth (95%)	14.0 ft
Native Submersed Taxa	10
Native Floating/Emergent Taxa	7
Non-Native Submersed Taxa	2

<b>LITTORAL METRICS</b>	<b>2016</b>
Littoral Area (≤15 ft)	84 acres
Littoral Points Sampled	151
% Littoral Points Vegetated	95%
Mean Plant Height	2.7 ft
% of Max Littoral Biovolume	52%
Mean Native Taxa / Point	1.5
Simpson's Diversity	84.8
Floristic Quality (FQI)	17.9
AMCI Score (Nichols et al. 2000)	47

**Table 3.** Overview of rake density scores used to document plant abundance

Density Score	Rake Coverage	Description
1		Only a few plants retrieved
2		Full length of rake head covered, but tines only partially covered
3		Plants completely cover the rake head and tines
4		Enough plants to cover rake head and tines multiple times

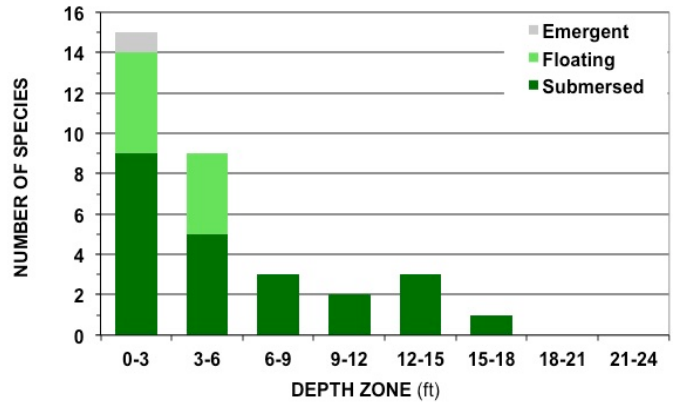
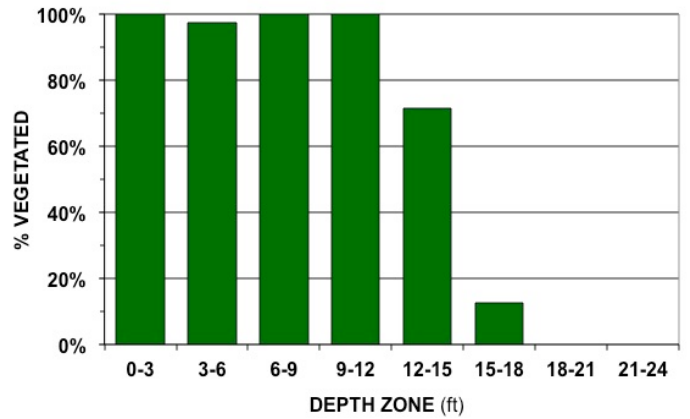
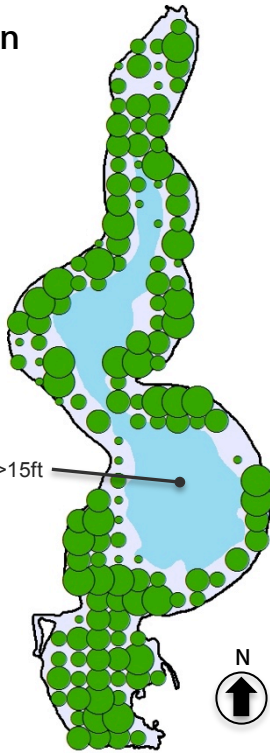
## Crooked Lake – Aquatic Plant Community

### All Vegetation

#### Density (1-4)

- × No plants
- 1
- 2
- 3
- 4

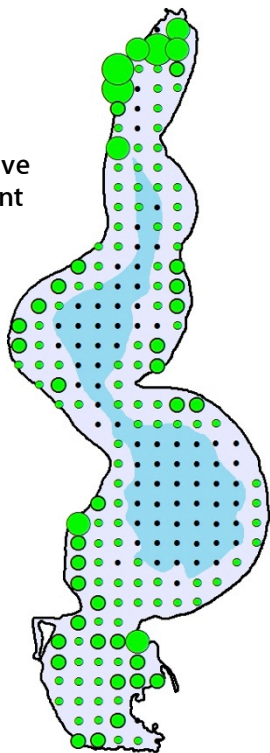
Darker shaded area >15ft



### Native Plant Diversity

#### Number of Native Species per point

- None
- 1-2
- 3-4
- 5-6
- 7-8



Surveyed: Aug 5, 2016  
 Surveyor: JA Johnson  
 Affiliation: Freshwater Scientific Services  
 Methods: Rake, Sonar, Depth Rod

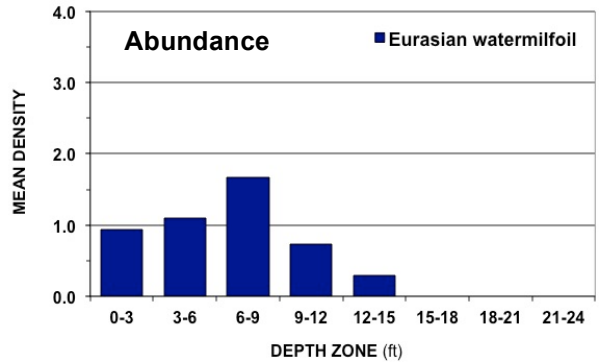
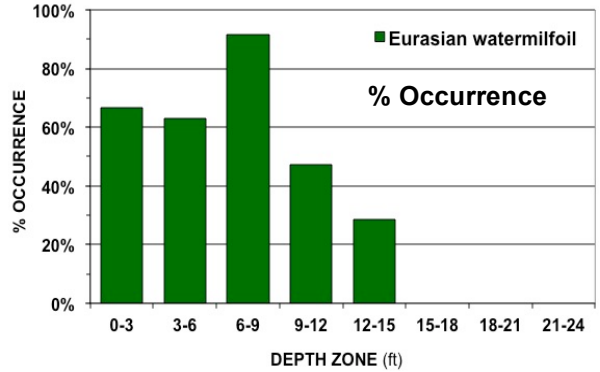
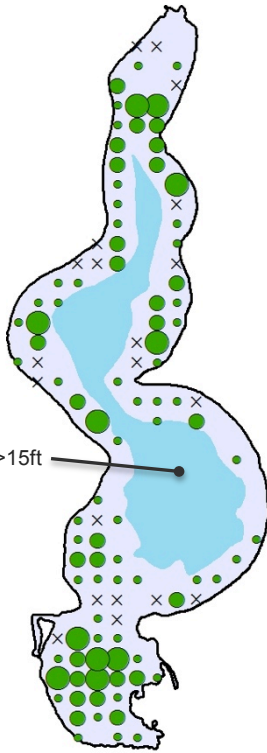
## Crooked Lake – Aquatic Plants

### Eurasian Watermilfoil

#### Density (1-4)

- x In vicinity
- 1
- 2
- 3
- 4

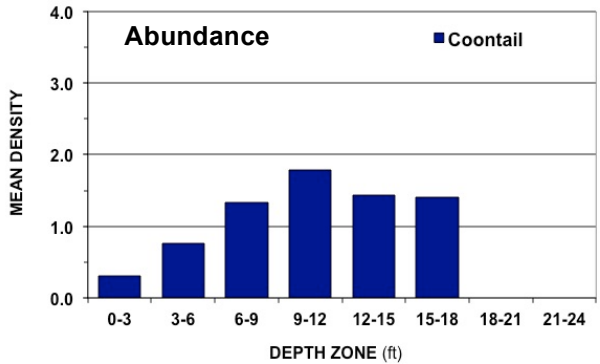
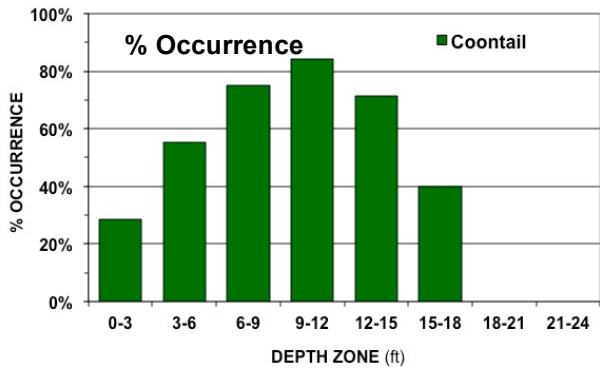
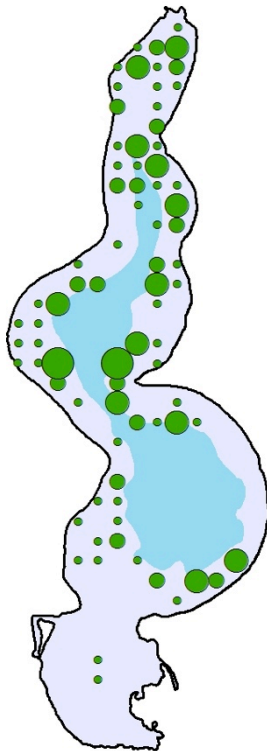
Darker shaded area >15ft



### Coontail

#### Density (1-4)

- x In vicinity
- 1
- 2
- 3
- 4





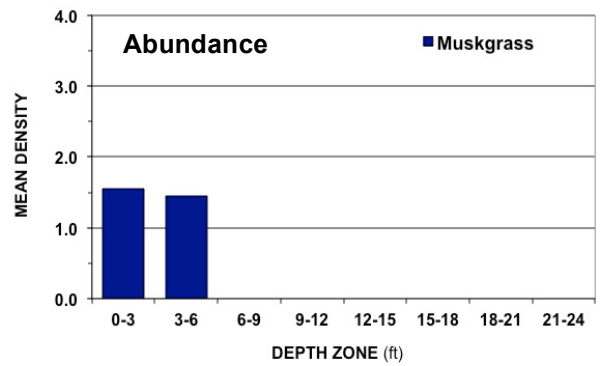
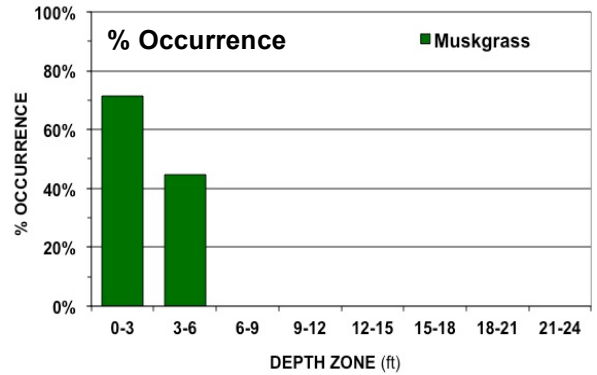
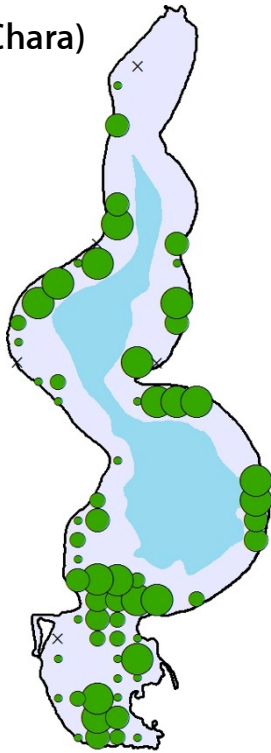
## Crooked Lake – Aquatic Plants

### Muskgrass (Chara)

**Density (1-4)**

× In vicinity

- 1
- 2
- 3
- 4

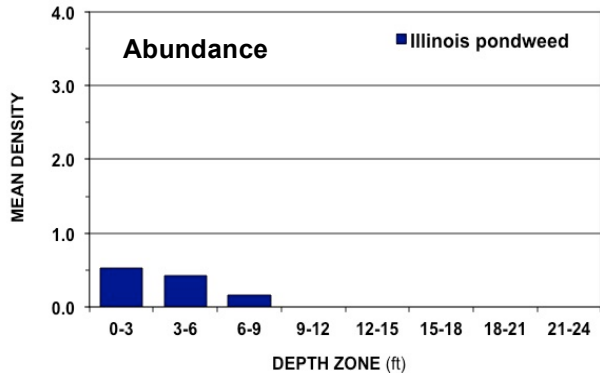
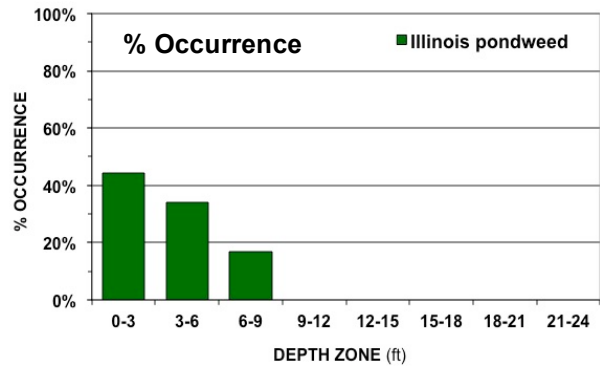
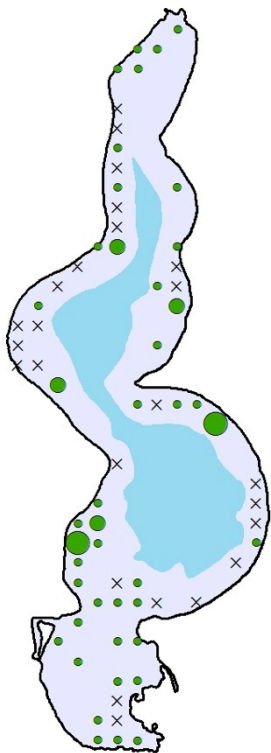


### Illinois Pondweed

**Density (1-4)**

× In vicinity

- 1
- 2
- 3
- 4

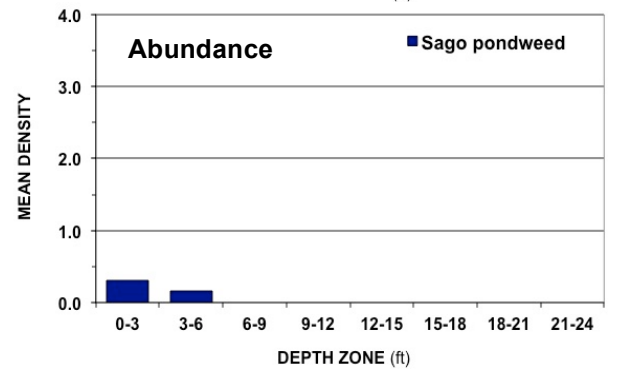
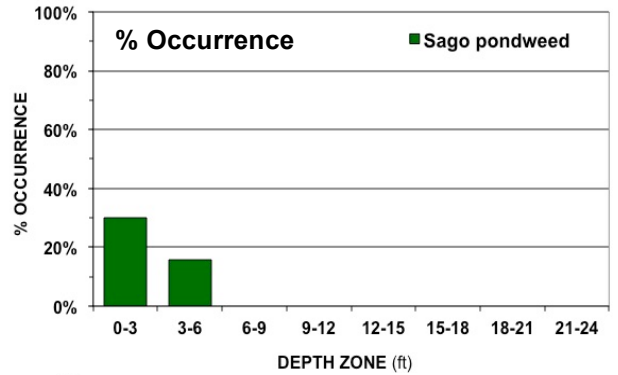
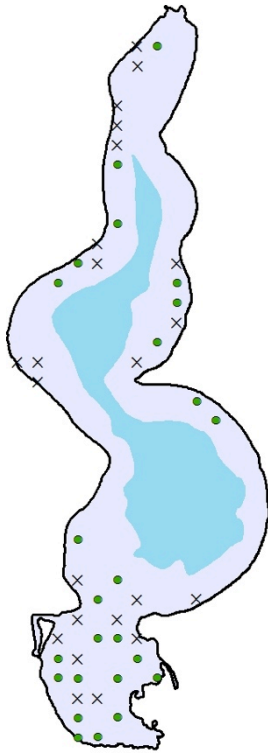


## Crooked Lake – Aquatic Plants

### Sago Pondweed

#### Density (1-4)

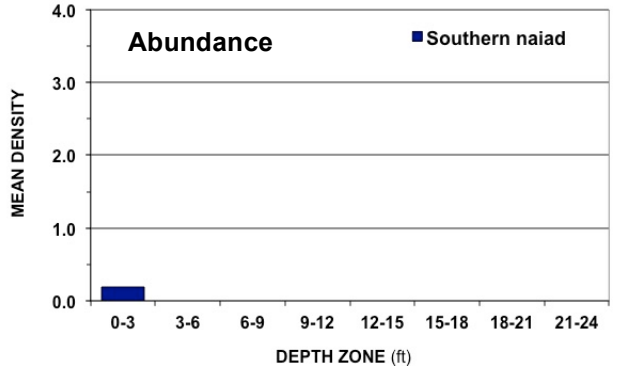
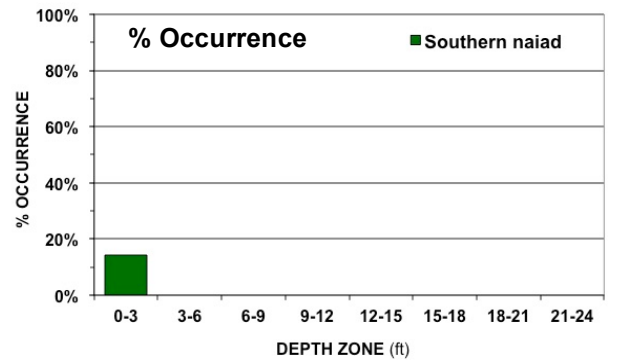
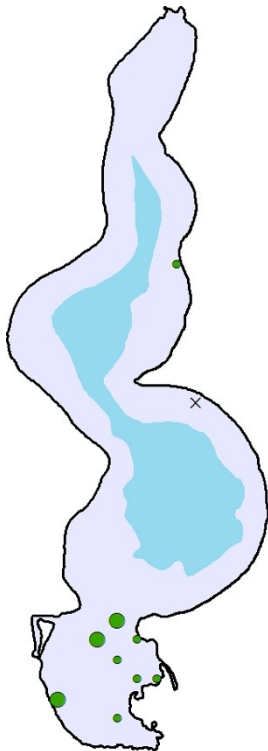
- x In vicinity
- 1
- 2
- 3
- 4



### Southern Naiad

#### Density (1-4)

- x In vicinity
- 1
- 2
- 3
- 4



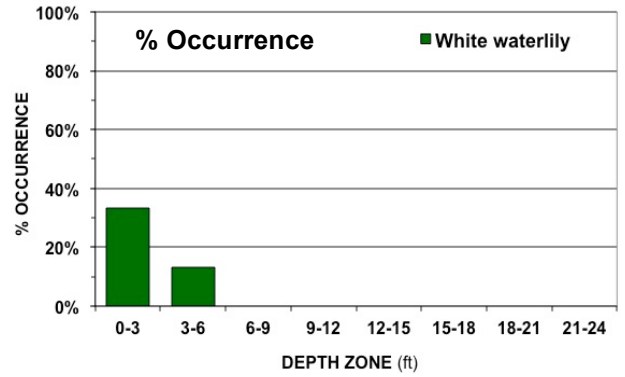
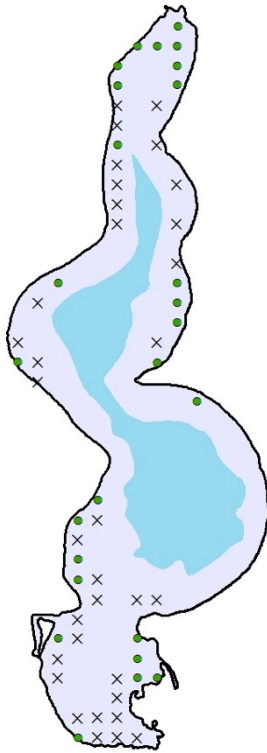


## Crooked Lake – Aquatic Plants

### White Waterlily

#### Density (1-4)

- x In vicinity
- 1
- 2
- 3
- 4



### Hard-stem Bulrush

#### Density (1-4)

- x In vicinity
- 1
- 2
- 3
- 4

