



Native Submerged Aquatic Plants in Lake John on October 1, 2019.

Starry Stonewort Search for Lake John, Wright County, Minnesota, October 1, 2019

Prepared for:
Lake John Association



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Summary of the 2019 search: One searcher from Blue Water Science, surveyed two boat access locations October 1, 2019 on Lake John looking for occurrences of an invasive plant species, starry stonewort (Table 1, Figure 1). The searchers spent a cumulative total of approximately 2.5 search hours. No starry stonewort was observed at either location. Underwater conditions for the North Access are shown in the YouTube video <https://www.youtube.com/watch?v=UjYRf66vnE&t=4s> and for the South Access are shown in the YouTube video <https://www.youtube.com/watch?v=umrtwoi2Su0&t=34s> Representative plant species are shown on the next page.

Table 1. Individual site data for the starry stonewort search on October 1, 2019.

	Representative Rake Sampling and other searches	SSW	Bottom Conditions
1. Public Access South Side	- 30 rake samples - Snorkeling within the public access area (40 minutes)	No SSW found	Organic sediments with some sand
2. Private Access Northeast Side	- 30 rake samples - Snorkeling within the public access area (30 minutes)	No SSW found	Mostly sand-gravel substrate

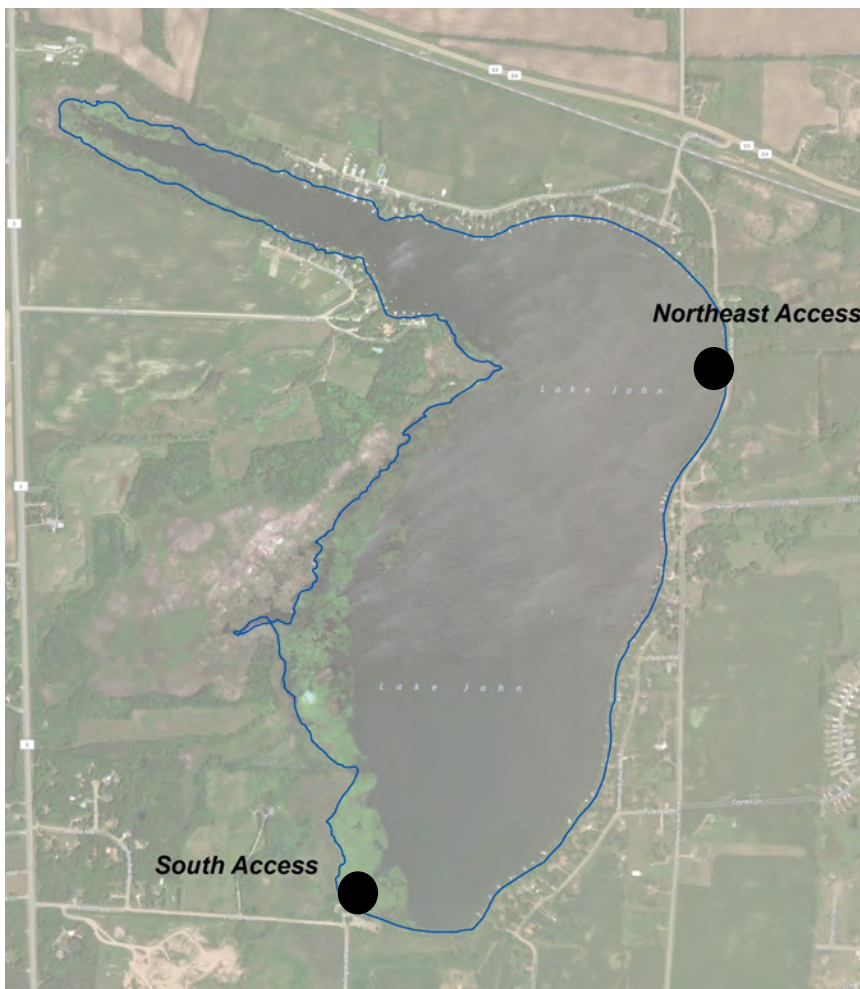


Figure 1. Location of the search sites.

Lake John Plant Conditions October 1, 2019



Figure 2. Plants were actively growing in Lake John on October 1, 2019.

Starry Stonewort Information Sheet

INVASIVE

Starry stonewort
Nitellopsis obtusa

KEYS TO ID

- Long, smooth branchlets are attached in whorls of 5 - 8
- Small, star-shaped bulbils form on clear threads at base of plant and may be found above or below the sediment surface
- Small, orange spheres called antheridia may be visible, these are male reproductive structures
- Typical branchlets are long; can be up to twelve inches
- Can form dense mats in water





LOOKS SIMILAR TO

- Native *Chara* (native)
- Native *Nitella* (native)
- Sago pondweed (native)
- Water stargrass (native)

WHERE TO LOOK

- In shallow, still water and near accesses

CURRENTLY FOUND

Actual size of bulbils
Below: orange antheridia



Figure 3a. [left] Starry stonewort identification page from the University of Minnesota Aquatic Invasive Species Research Center (MAISRC). [left] Chara from Lake John, collected on June 22, 2017. Chara looks somewhat like starry stonewort.

NATIVE

Muskgrasses
Chara spp.

KEYS TO ID

- Stems are typically rough and crunchy
- Thin branchlets form whorls around thin stems
- May produce bulbils, but not star-shaped
- May have musky odor




LOOKS SIMILAR TO

- Starry stonewort (invasive)
- Native *Nitella* (native)
- Sago pondweed (native)
- Water stargrass (native)
- Minnesota has nine *Chara* species

WHERE TO LOOK

- Fully submerged
- Along lake bottoms forming patches called meadows

CURRENTLY FOUND

Rough stems; whorled branchlets

Starry stonewort looks a lot like some growth forms of chara and nitella (Figure 3). Starry stonewort was not observed in Lake John on the October 1, 2019 search. The northeast private access of Lake John has sandy sediments compared to the south side public access where sediments are more organic and softer.

Figure 3b. Chara identification page from the MAISRC.

Typical Chara Characteristics in Lake John from 2018

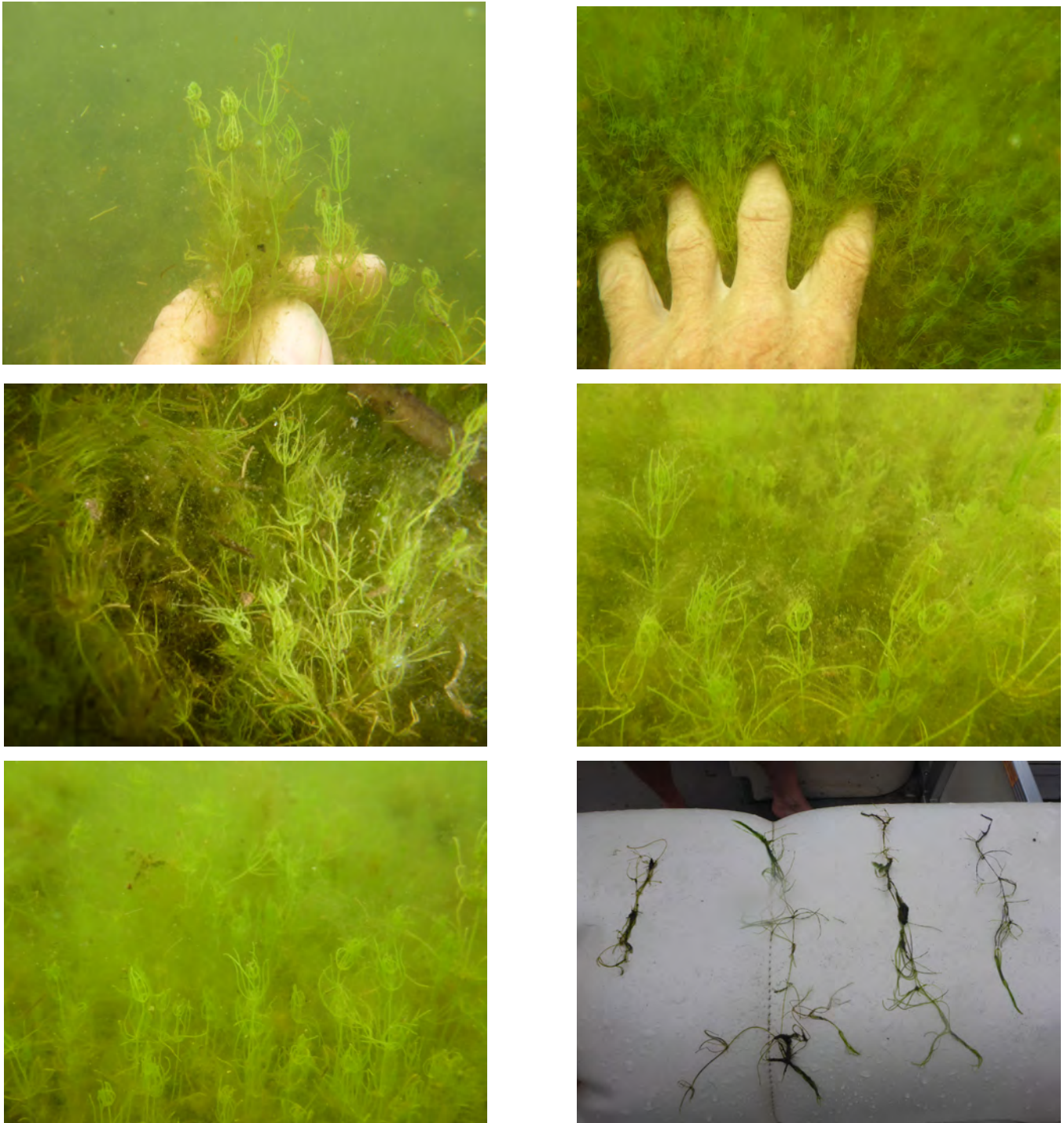


Figure 4. Chara, a macro-algae is present in many lakes throughout Minnesota. It is closely related to starry stonewort, another macro-algae. One distinguishing feature of chara is a distinctive musty odor. Another common name for chara is muskgrass.

Representative Aquatic Plants in Lake John



Cabbage



Chara



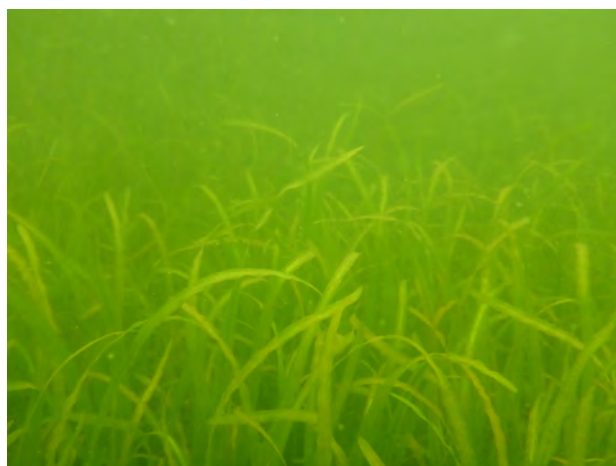
Curlyleaf pondweed



Elodea



Northern watermilfoil



Water celery

Figure 5. Typical lake conditions in Lake John.

Rapid Response Plan for Starry Stonewort

Starry stonewort has not been found in Lake John as of October 1, 2019. A rapid response plan, shown in Table 2, has a number of preventative steps as well as actions after a potential sighting..

Table 2. Tasks and assignments for an early detection and rapid response program for Lake John, Wright County, Minnesota.

	Lake John Lake Assoc.	Volunteers	Wright County	MnDNR	Others	Treatment Contractor	BWS
1. Early Detection							
1.1. Create website information.	X						
1.2. Designate contact person.	X						
1.3. Conduct training session for volunteer searchers.	Late summer	Late summer					Late summer
1.4. Conduct monthly targeted searches (late summer).	X						X
1.5. Press release if SSW is found.	X			X			
2. Rapid Response Assessment							
2.1. Conduct an initial exploratory search after the first report of a starry stonewort observation.				X			X
2.2. Organize and train lake resident searchers for a full search effort.	X						X
2.3. Conduct an expanded targeted search with diving (if needed).	X	X		X			X
3. Rapid Response Action							
3.1. Meet to determine treatment options.	X		X	X	X	X	X
3.2. Close public access, if necessary.	X		X	X	X		
3.3. Treat area with copper sulfate.						X	
3.4. Evaluate treatment.				X			X
3.5. Report all findings and results.	X			X			X



Figure 6. Rapid response assessment for zebra mussels in Christmas Lake in 2014. Some of the same approaches are used for starry stonewort.

APPENDIX

Locations of Zebra Mussels Found in Lake John in 2015

A zebra mussel search on September 26, 2015 by Lake John volunteers found zebra mussels at 6 locations (Figure A1). Multiple zebra mussels were found at Locations 4 and 5. Zebra mussels were found at three additional sites as docks and boatlifts were removed for the season (Sites 7, 8, and 9) (Figure A1). Over 70 zebra mussels were found from these locations. Zebra mussels sizes ranged from 4 to 23 mm in length.

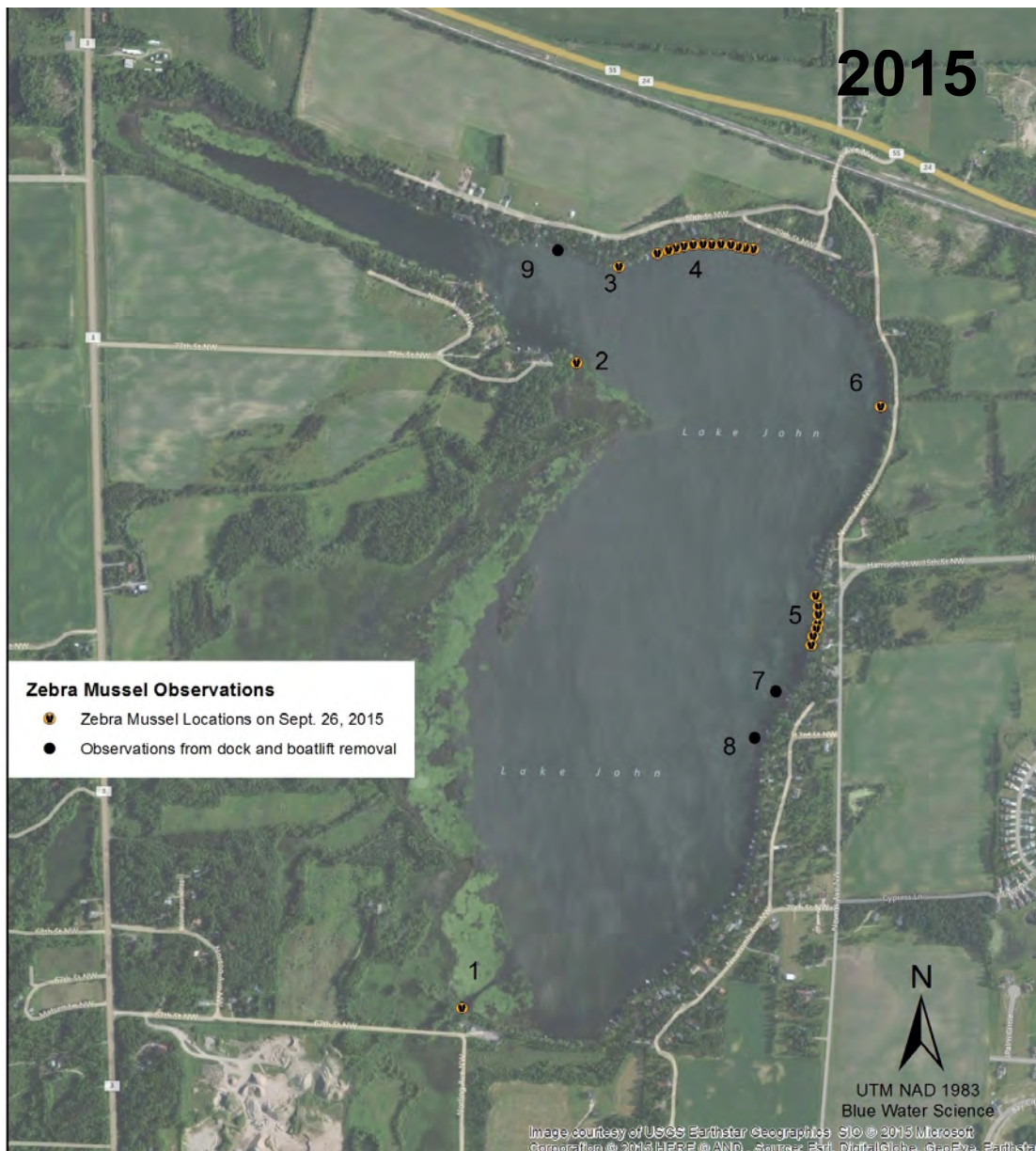


Figure A1. Zebra mussels were found at 6 locations on September 26, 2015 (orange and black dots) by Lake John volunteers and Blue Water Science. A few days later lake residents reported additional zebra mussel observations with boatlift and dock removal at sites 7 (no mussels), 8 (2 mussels), and 9.

Lake John Zebra Mussel in 2015

Both juvenile and adult zebra mussels were found during the Lake John zebra mussel search on September 26, 2015 (Figure A2). Sizes ranged from 4 mm to 23 mm.



Figure A2. Zebra mussel sizes in Lake John, collected on September 26, 2015.



Figure A3. Zebra mussel on a concrete block from the rocky point (Location 2).

Zebra Mussel Suitability Criteria for Lake John

Zebra mussels are present in Lake John. One of many questions is what kind of a population will they produce. Based on available data it appears conditions are favorable for moderate growth initially (Table A1). After a few years, algal concentrations could be reduced due to filter feeding of zebra mussels, and zebra mussel growth would likely be food limited and would then decrease in abundance.

Table A1. Zebra mussel suitability criteria for Lake John.

		Little Potential for Adult Survival	Little Potential for Larval Development	Moderate (survivable, but will not flourish)	High (favorable for optimal growth)
Shell Formation Factors					
Calcium (mg/l)	Lake John				42.3 (9.26.15)
	Mackie and Claudi 2010*	<8	8 - 15	15 - 30	>30
pH	Lake John				8.4 (9.26.15)
	Mackie and Claudi 2010	<7.0 or >9.5	7.0 - 7.8 or 9.0 - 9.5	7.8 - 8.2 or 8.8 - 9.0	8.2 - 8.8
Alkalinity (as mg CaCO ₃ /l)	Lake John				159 (9.26.15)
	Mackie and Claudi 2010	<30	30 - 55	55 - 100	100 - 280
Conductivity (umhos)	Lake John				360 (9.26.15)
	Mackie and Claudi 2010	<30	30 - 60	60 - 110	>110
Food Factors					
Chlorophyll a (ug/l) (May-Sept)	Lake John				6 (2012-2014 avg)
	Mackie and Claudi 2010	<2.5 or >25	2.0 - 2.5 or 20 - 25	8 - 20	2.5 - 8
Secchi depth (m) (May-Sept)	Lake John				2.1 (10-year avg)
	Mackie and Claudi 2010	<1 or >8	1 - 2 or 6 - 8	4 - 6	2 - 4
Total phosphorus (ug/l) (May-Sept)	Lake John			24 (2012-2014 avg)	
	Mackie and Claudi 2010	<5 or >50	5 - 10 or 35 - 50	10 - 25	25 - 35
Substrate Factors (Dissolved oxygen and sediment composition)					
Dissolved oxygen (mg/l)	Lake John (2014)	greater than 6 m	3 - 6 m	0 - 3 m	
	Mackie and Claudi 2010	<3 mg/l	3 - 7 mg/l	7 - 8 mg/l	>8 mg/l
Bottom substrate (in the ZM growing zone)	Lake John	24%		70%	6%
		soft muck with no hard objects		muck, silt, sand	rock or wood

*Mackie, G.L. and R. Claudi. 2010. Monitoring and control of macrofouling mollusks in fresh water systems. Second Edition. CRC Press, Boca Raton, FL.

Some of the Searchers and Some of the Items Investigated



Representative Zebra Mussel Conditions in Lake John in 2017

