

2019 Annual Monitoring Report for Starry Stonewort Management in Pleasant Lake, Wright County



Prepared by:

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Division of Ecological and Water Resources

Minnesota Department of Natural Resources

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Project Summary

Lake: Pleasant

Lake Acres: 597

County: Wright

Littoral Acres: 260

DOW Number: 86025100

Project Details

Project Years: 2018- 2019

Primary Contact: Christine Jurek, Invasive species specialist, Minnesota Department of Natural Resources, Christine.jurek@state.mn.us, 320-223-7847.

Surveyors: Steve McComas (Blue Water Science), Chris Jurek and Emelia Hauck Jacobs (MN DNR)

Date(s) of Treatment(s): Physical removal of starry stonewort via scuba diving and copper treatments occurred between 31 August 2018 and 27 September 2019 (see Table 1)

Date(s) of Survey(s): 2018- 2019

Survey Methods: Snorkel, Point Intercept, Copper monitoring, Wet weight biomass sampling

Report Details

Jurek C. and E. Hauck Jacobs. 2019. 2019 Annual Monitoring Report for Starry Stonewort in Pleasant Lake, Wright County. Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Invasive Species Program, 1035 South Benton Drive, Sauk Rapids, MN 56379. 17 pp.

Summary

In this report, we summarized the starry stonewort monitoring data collected in 2018 and 2019 at Pleasant Lake, Wright County. Monitoring includes underwater snorkel surveys, point-intercept grid surveys, biomass measurements of removed starry stonewort and copper concentration monitoring.

Background

MN DNR discovered the initial infestation of starry stonewort via snorkeling at the north public access on 8 Aug 2018. The MN DNR later conducted a lake wide search on 15 August 2018 to determine the extent of infestation. Based on the survey, the starry stonewort was limited to the public water access. Two, small dense patches and eight locations were identified within the access area. The macroalgae were approximately 12 to 15 inches tall and at depths of 5-10 feet deep. MN DNR contracted with Steve McComas with Blue Water Science to conduct additional monitoring in 2018, including a snorkel survey, point intercept survey grid at the access, meandering lake-wide survey and the physical removal of starry stonewort. The MN DNR also contracted with Professional Lake Management to perform a copper treatment on 4 October 2018. The objective of the copper treatment was to target starry stonewort that remained after the physical removal efforts. Pre and post treatment monitoring was also conducted at the public water access on 31 August and 1 November 2018 to assess the management efforts. The combination of both pesticide and physical removal was employed to remove the invasive algae and to prevent the spread within the lake (Figure 1). In 2018, the MN DNR covered monitoring and treatment costs. Continuous management occurred in 2019 including the physical removal (4x) of starry stonewort, followed by copper treatments. Management efforts to date have shown success. Within one- year, the perimeter of the infestation had decreased from approximately 25 square feet to 1 square foot. In addition, no starry stonewort was surveyed outside the access.

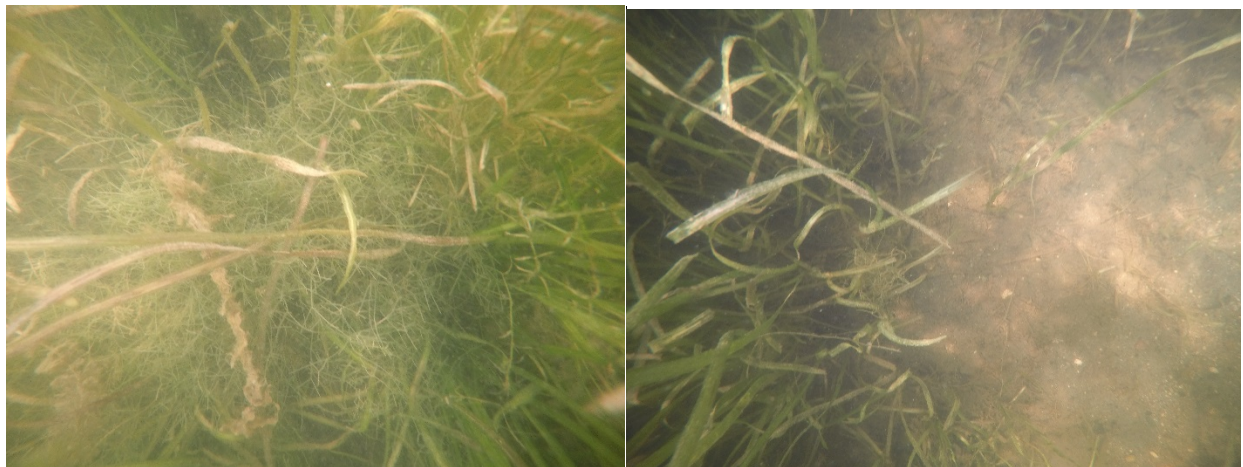


Figure 1- Pre and post management photos of starry stonewort taken by Chris Jurek (MN DNR) using a GoPro underwater camera. Steve McComas with Blue Water Science conducted hand removal via scuba diving on 31 Aug 2018 in Pleasant Lake, Wright County (86025100).

Management

The implementation of both physical and pesticide removal of starry stonewort at the north access in Pleasant Lake (Table 1 and Figure 2), reduced the occurrence and spread of starry stonewort.



Figure 2- Management location of starry stonewort at Pleasant Lake, Wright County (86025100).

Table 1-Starry Stonewort Management Summary. Characteristics and history of pesticide treatments and management activities for Pleasant Lake, Wright County (DOW# 86025100), Total acres: 597, Littoral acres: 260, 15% Littoral acres: 39).

Date	Control Method	Total Acres	Pesticide	Dose Rate	Licensed Commercial Applicator
31 Aug 2018	Manual	<0.5			Steve McComas, Blue Water Science
4 Oct 2018	Pesticide	0.5	Cutrine Plus (liquid)	3.0 gallons/acre ft	Professional Lake Management
1 July 2019	Manual	<0.5			Steve McComas, Blue Water Science
2 July 2019	Pesticide	0.5	Cutrine Plus (liquid)	3.0 gallons/acre ft	Lake Restoration
24 July 2019	Manual	<0.5			Steve McComas, Blue Water Science
31 July 2019	Pesticide	0.5	Cutrine Plus (liquid)	3.0 gallons/acre ft	Lake Restoration
19 Aug 2019	Manual	<0.5			Steve McComas, Blue Water Science
28 Aug 2019	Pesticide	0.5	Cutrine Plus (liquid)	3.0 gallons/acre ft	Lake Restoration
26 Sep 2019	Manual	<0.5			Steve McComas, Blue Water Science
27 Sep 2019	Pesticide	0.5	Cutrine Plus (liquid)	3.0 gallons/acre ft	Lake Restoration

Pre- and Post-Treatment Plant Surveys

Methods

In 2018, the population of starry stonewort was delineated and mapped (as part of the rapid response effort). Based on the initial delineation of 0.5 acres, a grid of 23 sampling points was set-up to monitor the treatments both pre and post- management. The survey evaluated the impacts of copper and physical removal on both starry stonewort and the native plant communities, while documenting the distribution and abundance of all taxa. The survey expanded in 2019 to include a reference area (19 points) adjacent to the treatment area. The establishment of a reference area would able us to evaluate impacts to native aquatic plants in the treatment area over time. It is important to note that distributions of aquatic plants can vary from year to year due to effects such as differences in weather, as well as the effects from the proposed management.

Surveyors used a point intercept survey method developed by John Madsen in “Aquatic Plant Control Technical Note MI-02, 1999” and MN DNR protocols to develop the survey. Survey points were placed 32 feet (9.7 meters) apart using a Geographic Information System (GIS). Sampling points include 23 points in the treatment area. Plant surveys were conducted using a PI grid within the treatment and reference area both pre and post-management (Figure 3). Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point recording all plant taxa (submerged, floating-leaf, emergent and free floating). Plant samples were assessed on the boat to determine species and abundance (1: sparse, 2: common/frequent/occasional, 3: abundant/matted) and data was recorded using an electronic device. 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).

In addition, after each hand-pull in 2019, biomass measurements were collected (Table 2). Wet weight measurements developed by Bickel and Perrett in “Precise determination of aquatic plant wet mass using a salad spinner” were implemented. Plant fragments were rinsed before each spinning process. After plant material was spun 20 times in a commercial salad spinner (Figure 4), the plant material was then weighed using a digital scale. Any fragments of starry stonewort that were not detectable on the scale were recorded as <1 gram.



Pleasant Lake, Wright County (DOW # 86025100)
Point-intercept Monitoring Grid

Figure 3- Point-intercept sampling grid at Pleasant Lake, Wright County (86025100).

Pre- and Post-Treatment Plant Surveys

Results

During both years, following the management of starry stonewort (both physical removal and pesticide), the starry stonewort percent frequency reduced from 4% to 0% (Table 3a, Figure 5). The physical removal efforts removed the majority of the starry stonewort, although the addition of using a copper pesticide likely removed any remaining starry stonewort plants. Physical removal methods are labor-intensive, although are very effective at removing the biomass. Results show mean densities of starry stonewort reductions after the first hand pull for each year (Table 3a, Figure 6). Any continued hand pulling during the growing season showed minimal reductions (only a few fragments remained after management). Re-growth of additional starry stonewort likely occurred because of any

existing bulbils in the sediment. Furthermore, following the physical removal, an application of Cutrine Plus[®] (liquid chelated copper) likely controlled any remaining starry stonewort by causing injury to the algal cells.

Pleasant Lake has a diverse native aquatic plant community with 16 native submerged native taxa (Table 3a and 3b). The most dominant aquatic plants include marigold, coontail, muskgrass, northern watermilfoil, naiad, pondweeds and wild celery (Table 4a and 4b). Copper treatments may have affected some native aquatic plant species, such as muskgrass, although long-term monitoring is necessary to detect significant changes. Overall, any changes in plant communities are influenced by a variety of other factors including phenology, seasonal variation or possible impacts from the copper treatment. Continued monitoring and management of this site will be helpful to determine if this management technique is effective at reducing and preventing the spread of starry stonewort within the lake.

Table 2- Starry stonewort Biomass Summary. Summary of wet weight biomass sampling during hand-removal of starry stonewort at the north access in Pleasant Lake, Wright County (DOW# 86025100).

Biomass Summary	31 Aug 2018	1 July 2019	24 July 2019	19 Aug 2019	26 Sept 2019	8 October 2019
Total Biomass Wet Weight (gram)	NA	4,990	<1	<1	<1	<1



Figure 4- Commercial salad spinner used to spin starry stonewort before its wet weight measurement.

Table 3a- Plant Survey Metrics inside Treatment Area. Summary of metrics for the north public access in Pleasant Lake, Wright (DOW# 86025100). Shaded values are calculated from the littoral depth range.

Survey Metrics	8/31/18 (Pre- Treatment)	11/1/18 (Post- Treatment)	6/28/19 (Pre- Treatment)	7/30/2019 (Post- Treatment)	9/16/19 (Post- Treatment)
Surveyor	Blue Water Science	Blue Water Science	MNDNR	MNDNR	MNDNR
Total # Points Sampled	23	23	23	21	22
Max Depth of Growth (95%) in feet	7	7	6.5	6.6	7
# Point in Max Depth Range	23	23	21	18	18
Max Depth of Starry Stonewort (feet)	6	0	5.3	0	0
# Points in Littoral (0-15 feet)	23	23	23	21	22
% Points w/ Submersed Native Taxa	91	91	100	95	91
Mean Submersed Native Taxa/ Point	3.7	3.5	3.9	3.7	3.1
Mean Density of Submersed Native Taxa	1.1	1.1	1.2	1.1	1
# Submersed Native Taxa	13	11	16	13	13
% Points with Starry Stonewort	4	0	4	0	0
Mean Density of Starry Stonewort	1	0	1	0	0

*95th percentile calculated based on all vegetated sampling points
Taxa refers to groups of submersed aquatic plant species or genera

Table 3b- Plant Survey Metrics inside Reference Area. Summary of metrics for the north public access in Pleasant Lake, Wright (DOW# 86025100). Shaded values based littoral depth range.

Survey Metrics	6/28/19 (Pre-Treatment)	7/30/2019 (Post-Treatment)	9/16/19 (Post-Treatment)
Surveyor	MN DNR	MN DNR	MN DNR
Total # Points Sampled	18	19	19
Max Depth of Growth (95%) in feet	5.6	4.3	5.2
# Point in Max Depth Range	16	17	17
Max Depth of Starry Stonewort (feet)	0	0	0
# Points in Littoral (0-15 feet)	18	19	18
% Points w/ Submersed Native Taxa	100	100	100
Mean Submersed Native Taxa/ Point	3.4	5.2	3.7
Mean Density of Submersed Native Taxa	1.1	1.2	1.3
# Submersed Native Taxa	14	16	12
% Points with Starry stonewort	0	0	0
Mean Density of Starry Stonewort	0	0	0

*95th percentile calculated based on all vegetated sampling points

Taxa refers to groups of submersed aquatic plant species or genera

Table 4a- Plant Frequency Occurrence inside Treatment Area. Percent frequency of occurrence for submersed taxa (most identified to species) in Pleasant Lake, Wright County (DOW# 86025100). *denotes invasive aquatic plant/algae

Taxonomic Name	Common Name	31 Aug 2018 (Pre- management)	1 Nov 2018 (Post- management)	28 June 2019 (Pre- management)	30 July 2019 (Post- management)	19 Sep 2019 (Post- management)
SUBMERSED PLANTS						
<i>Nitellopsis obtusa</i> *	Starry stonewort*	4	0	4	0	0
<i>Potamogeton crispus</i> *	Curly leaf pondweed*	4	0	39	5	5
<i>Ceratophyllum demersum</i>	Coontail	22	52	39	52	27
<i>Bidens beckii</i>	Marigold	17	52	48	33	45
<i>Chara spp.</i>	Muskgrass	39	35	26	5	5
<i>Elodea canadensis</i>	Canada waterweed	0	0	4	0	0
<i>Heteranthera dubia</i>	Water stargrass	9	17	17	14	23
<i>Lemna triscula</i>	Forked Duckweed	1	1	22	14	23
<i>Myriophyllum sibiricum</i>	Northern milfoil	48	48	57	24	9
<i>Najas spp.</i>	Naiad species	74	13	13	5	0
<i>Nitella sp.</i>	Nitella species	0	0	0	0	5
<i>Potamogeton freisii</i>	Fries' pondweed	0	0	13	0	0
<i>Potamogeton richardsonii</i>	Claspingleaf pondweed	22	26	30	43	68
<i>Potamogeton spp.</i>	Narrowleaf pondweed	4	0	52	5	0
<i>Potamogeton zosteriformis</i>	Flatstem pondweed	17	4	35	38	23
<i>Ranunculus sp.</i>	Buttercup	9	0	17	5	5
<i>Stuckenia pectinata</i>	Sago pondweed	22	22	9	24	14
<i>Utricularia spp.</i>	Bladderwort species	4	9	4	29	9
<i>Vallisneria americana</i>	Water celery	78	70	22	95	77

Table 4b- Plant Frequency Occurrence in Reference Area. Percent frequency of occurrence for submersed taxa (most identified to species) in Pleasant Lake, Wright County (DOW# 86025100). *denotes invasive aquatic plant/algae

Taxonomic Name	Common Name	28 June 2019	30 July 2019	19 Sept 2019
SUBMERSED PLANTS				
<i>Nitellopsis obtusa</i> *	Starry stonewort*	0	0	0
<i>Potamogeton crispus</i> *	Curly leaf pondweed*	11	0	6
<i>Bidens beckii</i>	Marigold	28	47	33
<i>Ceratophyllum demersum</i>	Coontail	33	53	50
<i>Chara spp.</i>	Muskgrass	61	58	22
<i>Elodea canadensis</i>	Canada waterweed	0	5	0
<i>Heteranthera dubia</i>	Water stargrass	11	11	28
<i>Lemna triscula</i>	Forked Duckweed	0	0	11
<i>Myriophyllum sibiricum</i>	Northern milfoil	50	42	28
<i>Najas spp.</i>	Naiad species	17	42	0
<i>Nitella sp.</i>	Nitella species	0	0	22
<i>Potamogeton Illinoisensis</i>	Illinois pondweed	0	16	0
<i>Potamogeton freisii</i>	Freis pondweed	11	26	0
<i>Potamogeton spp.</i>	Narrowleaf pondweed	50	11	0
<i>Potamogeton zosteriformis</i>	Flatstem pondweed	28	58	50
<i>Ranunculus sp.</i>	Buttercup	6	5	0
<i>Stuckenia pectinata</i>	Sago pondweed	11	0	11
<i>Utricularia spp.</i>	Bladderwort species	6	5	6
<i>Vallisneria americana</i>	Water celery	11	84	94

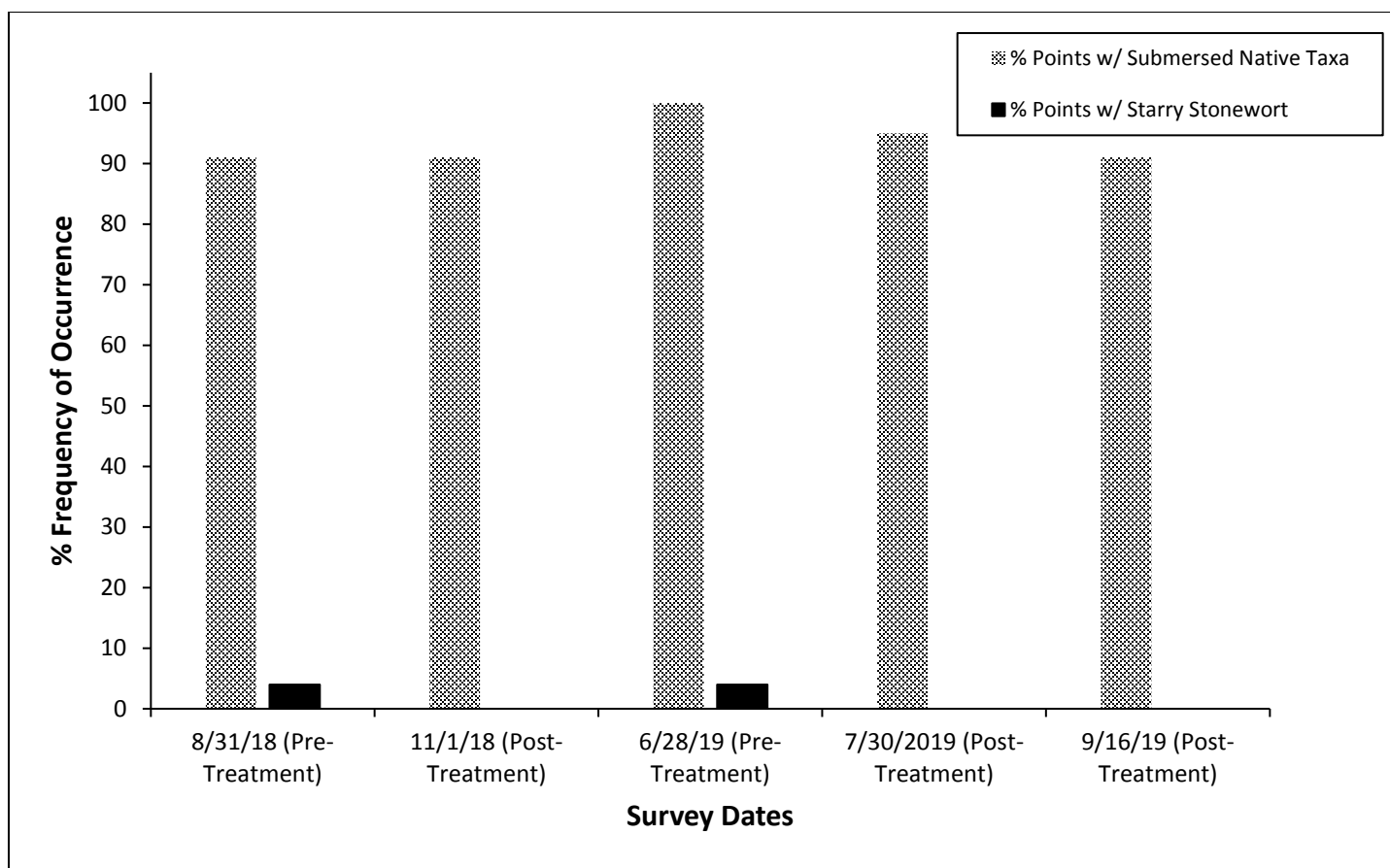


Figure 5- Plant Frequency of Occurrence inside Treatment Area. Percent frequency of occurrence for submersed native taxa and starry stonewort across treatment dates in Pleasant Lake, Wright (DOW# 86025100).

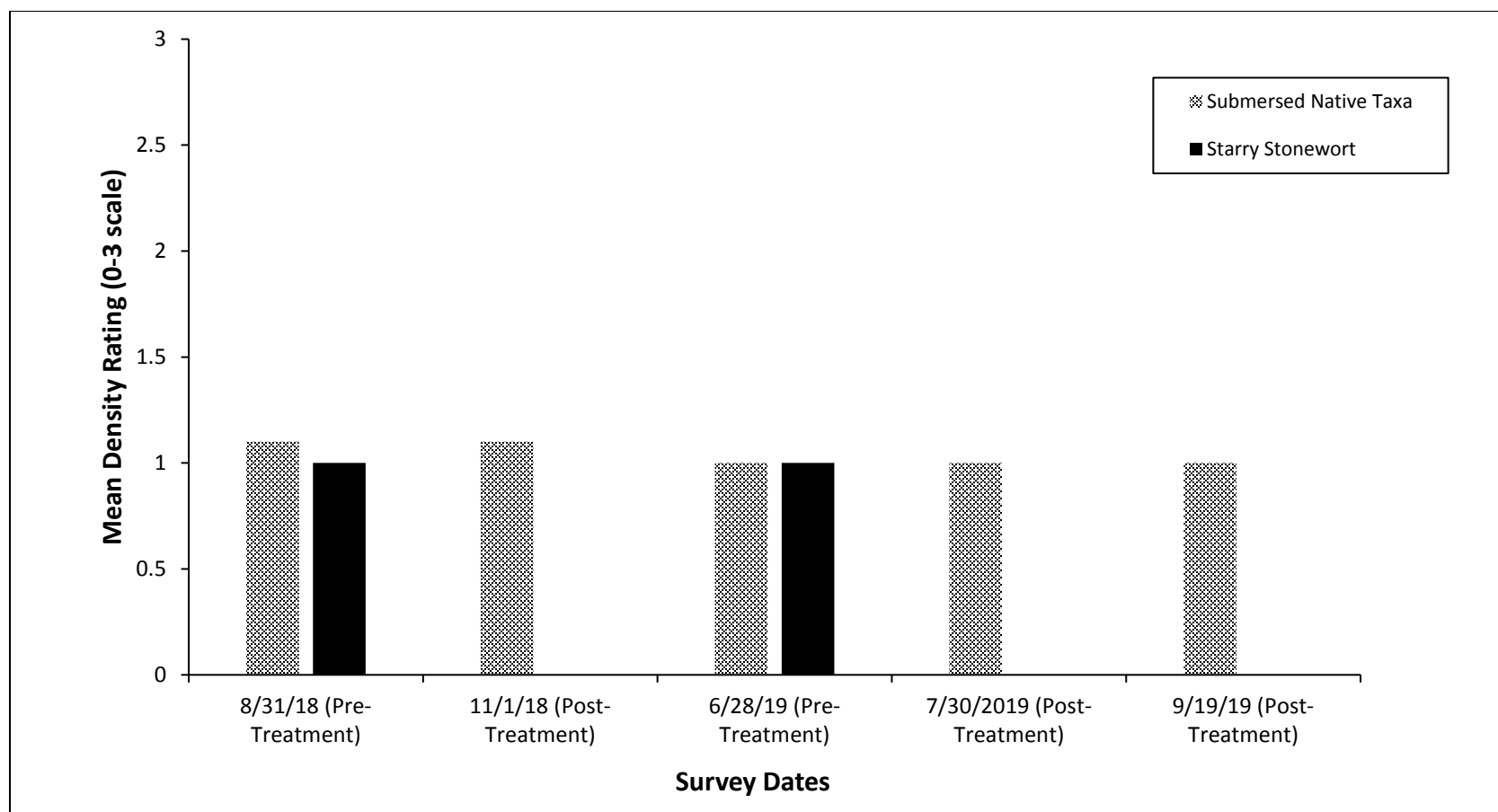


Figure 6- Mean Density of Plants inside Treatment Area. Mean density rating (0-3 scale) of for submersed native taxa and starry stonewort across treatment dates in Pleasant Lake, Wright (DOW# 86025100).

Pesticide Concentrations

Copper monitoring was conducted to determine the fate of copper in water from 0 to 5 HAT (Hours after treatment). The pesticide treatment occurred on 4 October 2018 with a target dose rate of 1 mg/L. Per the label, concentrations must be maintained for a minimum of three hours for effective control of starry stonewort. The samples were obtained by MN DNR at the access on 4 October 2018 and were analyzed using a YSI 9500. Figure 7 displays the copper concentrations (in mg/L) taken at two feet below the surface at one location (average depth of treatment: 5 ft).

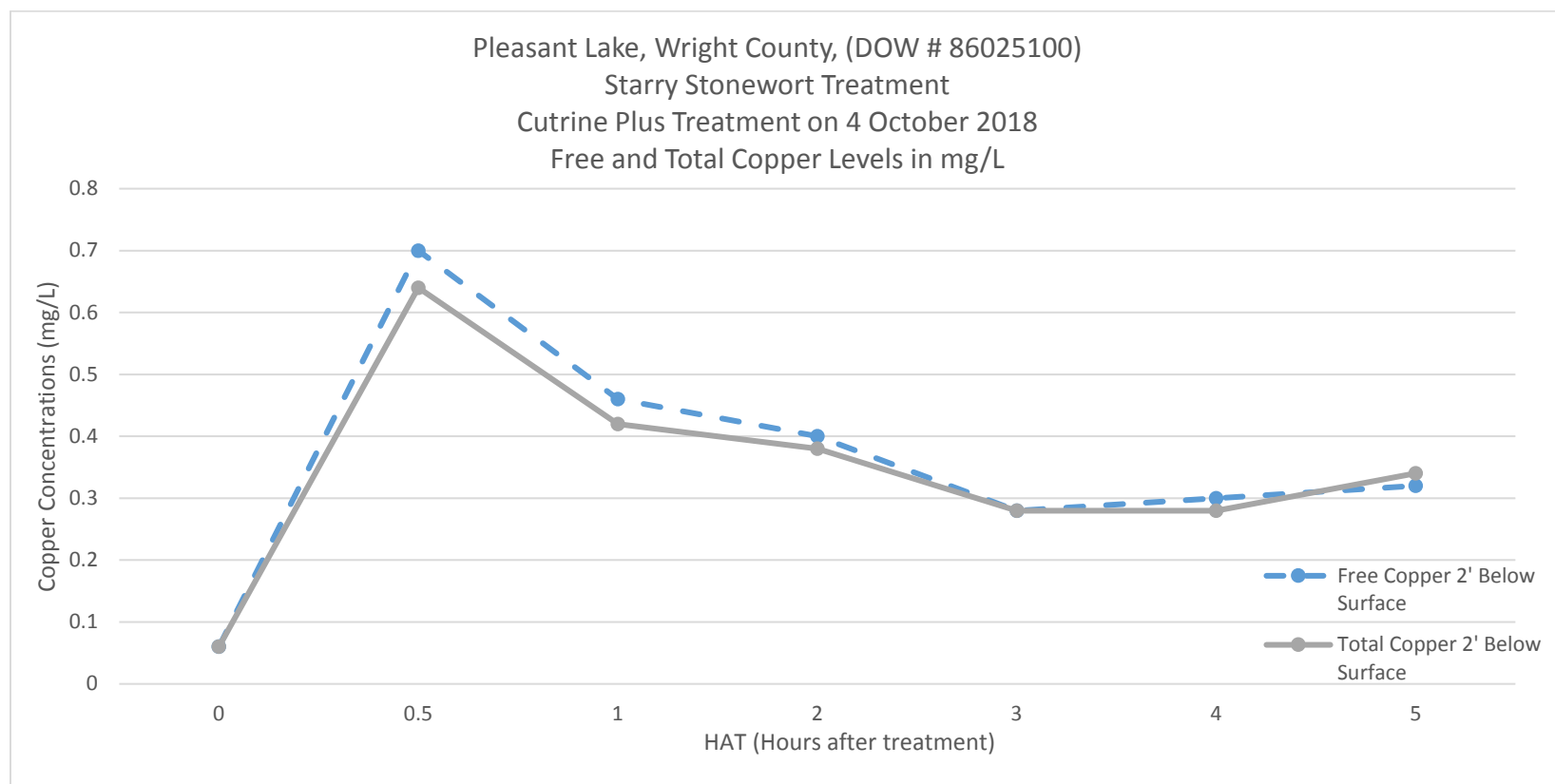


Figure 7- Post-Treatment copper concentrations (ppm) for control of starry stonewort on 4 October 2018 in Pleasant Lake, Wright County (DOW# 86025100).

Treatment Area and Survey Activity Maps

Management was conducted at the public water access on Pleasant Lake in Wright County. The following maps (Figure 8-9) display the frequency starry stonewort both pre and post- management.

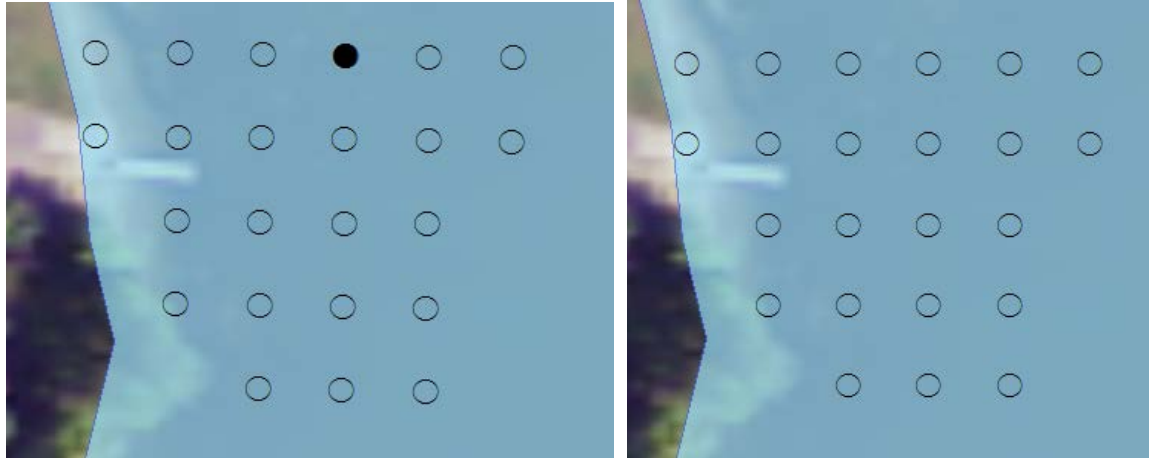


Figure 8- Map of starry stonewort abundance on 31 August 2018 (pre-management) and 1 November 2018 (post- management) at the sampling locations in Pleasant Lake, Wright County (DOW# 86025100).

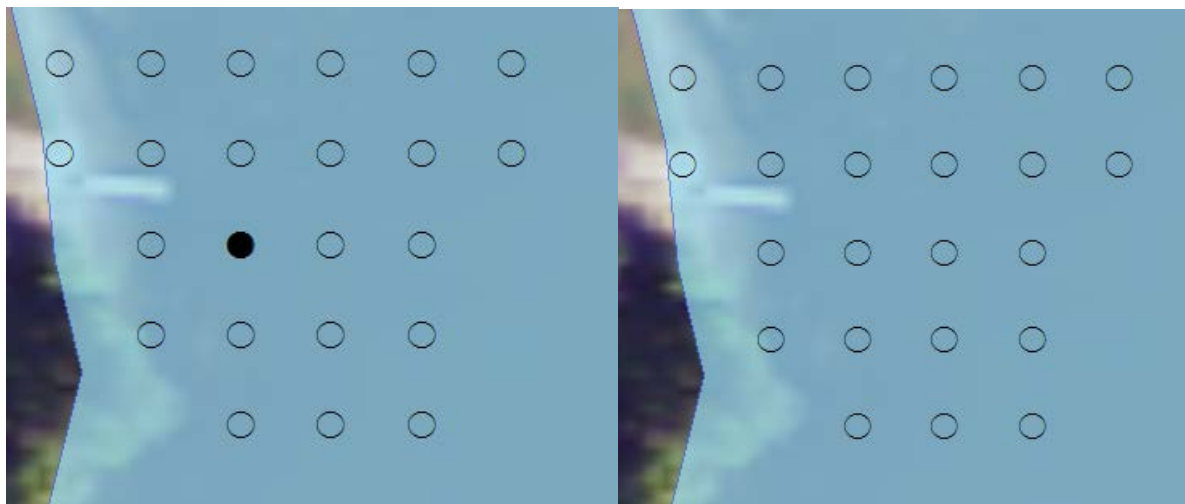


Figure 9- Map of starry stonewort abundance on 28 June 2019 (pre-management) and 19 September 2019 (post-management) at the sampling locations in Pleasant Lake, Wright County (DOW# 86025100).

Conclusion Summary

Pleasant Lake was the first lake in Minnesota to use both copper treatment and hand removal via scuba diving to remove starry stonewort. These recent management efforts have shown to be effective at decreasing frequency of occurrence and abundance, in addition to, limiting the spread within the lake. Because the size of the infestation at Pleasant Lake, it was practical to physically remove the starry stonewort. Hand removal via scuba diving is a good option for removing starry stonewort since it has minimal, non-target effects to native macroalgae and native aquatic plants. This method removes the macroalgae as well as the attached bulbils. Removing all bulbils during hand-removal however, especially in the sediment, is challenging and not likely achievable, therefore re-growth is likely. Overall, physical removal has shown to be an effective option for small, isolated infestations. Within the first full year (2018 to 2019), the perimeter of the infestation had decreased from approximately 25 square feet to 1 square foot. In addition, no starry stonewort was found outside the access. Continued monitoring is necessary to determine if the starry stonewort can be effectively managed in Pleasant Lake using this management technique.