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# Grand Lake, Stearns County (2017-2019)

## Monitoring Report for Starry Stonewort Management

Report by the Invasive Species Program - Division of Ecological and Water Resources  
Minnesota Department of Natural Resources

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Prepared by:

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## Lake Summary

**Lake:** Grand Lake

**County:** Stearns

**DOW Number:** 73005500

**Lake Area:** 650 acres

**Littoral Area:** 235 acres

## Project Details

**Project Year:** 3

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

**Surveyors:** Chris Jurek, Courtney Millaway, Ty Riihiluoma, Emelia Hauck Jacobs, Tim Plude and seasonal interns (MN DNR)

**Date(s) of Management:** 2017- 2019 (see Table 1)

**Date(s) of Survey(s):** 2017-2019

**Survey Methods:** Aquatic Plants: Point-intercept survey; snorkel surveys

## Report Details

Jurek C. and E. Hauck Jacobs. 2019. Monitoring Report for Starry Stonewort in Grand Lake, Stearns County (2017- 2019). Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Invasive Species Program, 1035 South Benton Drive, Sauk Rapids, MN 56379. 15pp.

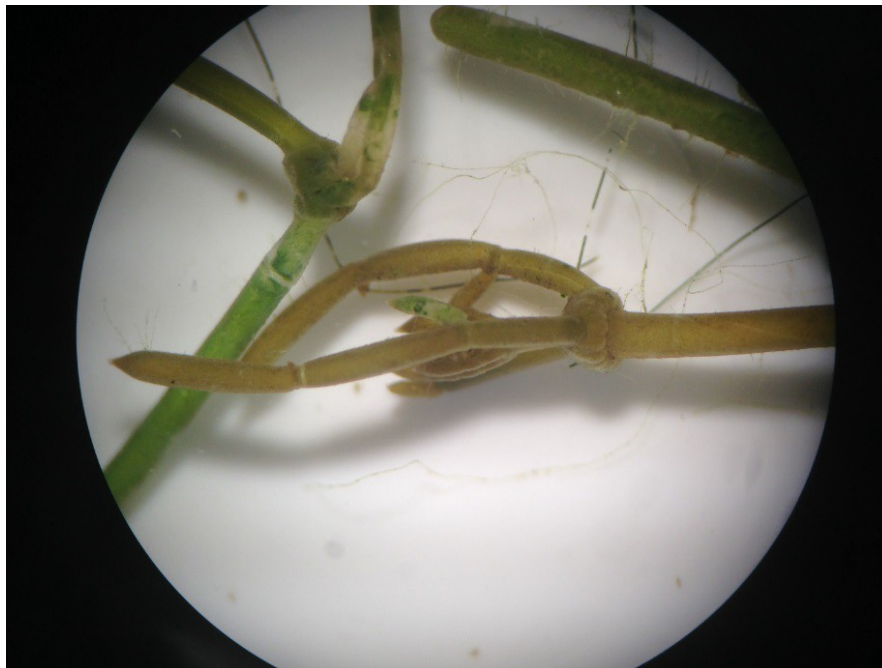
## Summary

This report summarizes starry stonewort monitoring data collected by MN DNR staff between 2017 and 2019. In addition, this document summarizes the management efforts via hand pulling by MN DNR, Grand Lake Improvement District, and Steve McComas with Blue Water Science.

Starry stonewort (*Nitellopsis obtusa*) was found in Grand Lake during the Minnesota Aquatic Invasive Species Research Center (MAISRC) Starry Trek event on 5 August 2017 (Figure 1 and Figure 2). On 8 August 2017, DNR staff conducted an initial field inspection by snorkeling and rake sampling to determine the extent of the infestation. The snorkel area was about 20,000 square feet in front of the public access (Figure 3). During the snorkel search, observers found one large patch of starry stonewort growth (approximately 64 sq. ft.) within 38 feet from shore and six smaller patches (approximately 1 sq. ft.) within the area surveyed. Starry stonewort growth extended up to 92 feet from shore. The maximum height of the growth was approximately 20 inches. The following aquatic plants were observed during the initial survey: coontail (*Ceratophyllum demersum*), water star-grass (*Heteranthera dubia*), native stonewort (*Nitella* sp.), bladderwort (*Utricularia* sp.), Canada waterweed (*Elodea canadensis*), northern watermilfoil (*Myriophyllum sibiricum*), muskgrass (*Chara* sp.), bushy pondweed (*Najas* sp.), curly-leaf pondweed (*Potamogeton crispus*), sago pondweed (*Stuckenia pectinata*). The edge of the public access comprised of wild rice (*Zizania palustris*), bulrushes (*Scirpus* sp.), yellow waterlilies (*Nuphar variegata*), and arrowhead (*Sagittaria* sp.). A lake-wide meandering survey conducted on 10 and 11 August 2017 further determined its spread was limited to the access (Figure 4). In addition, observations from both the lake-wide meander survey and snorkel search indicated that Grand Lake had extensive beds of muskgrass (*Chara* sp.) and native stonewort (*Nitella* sp.) which are both starry stonewort look-alikes.

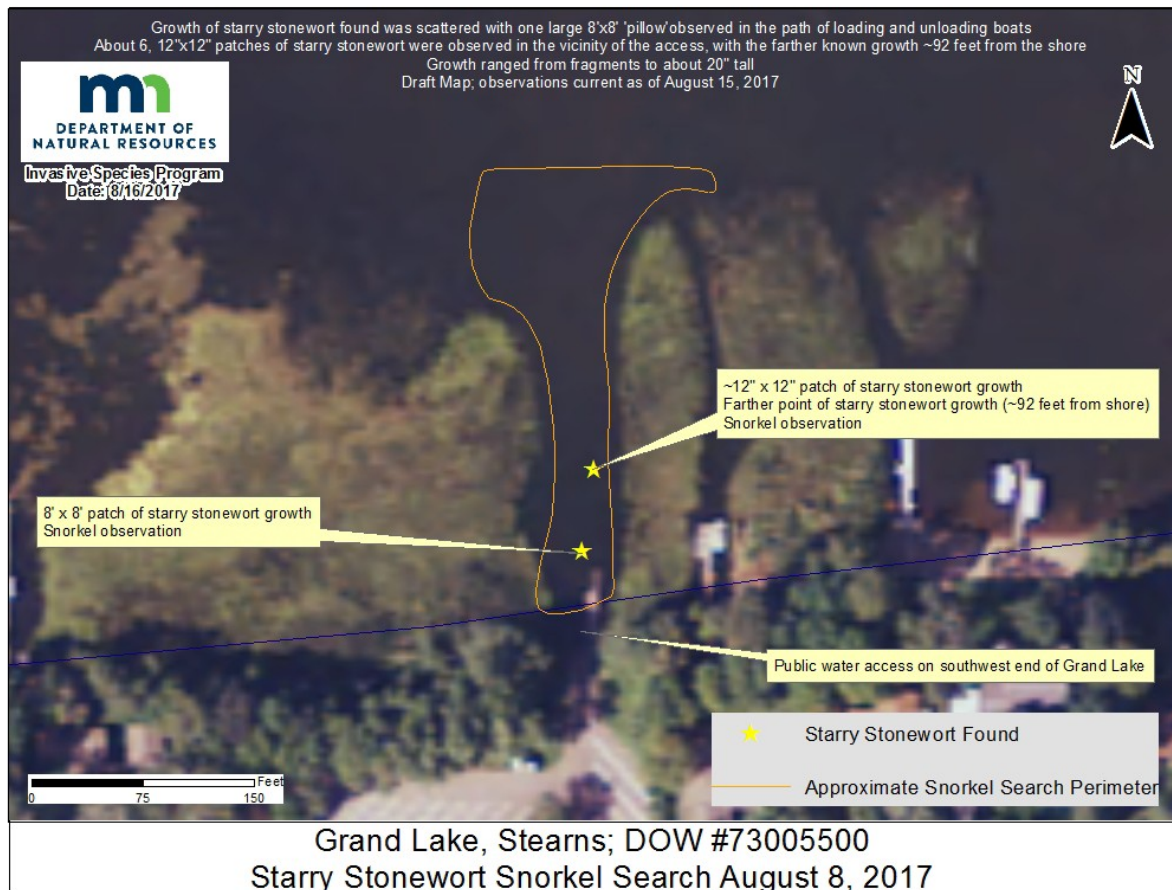


**Figure 1** – Starry stonewort (*Nitellopsis obtusa*) sample collected from Grand Lake, Stearns County (DOW# 73005500) by volunteers during the MAISRC Starry Trek event held on 5 August 2017. Photo taken on 7 August 2017.

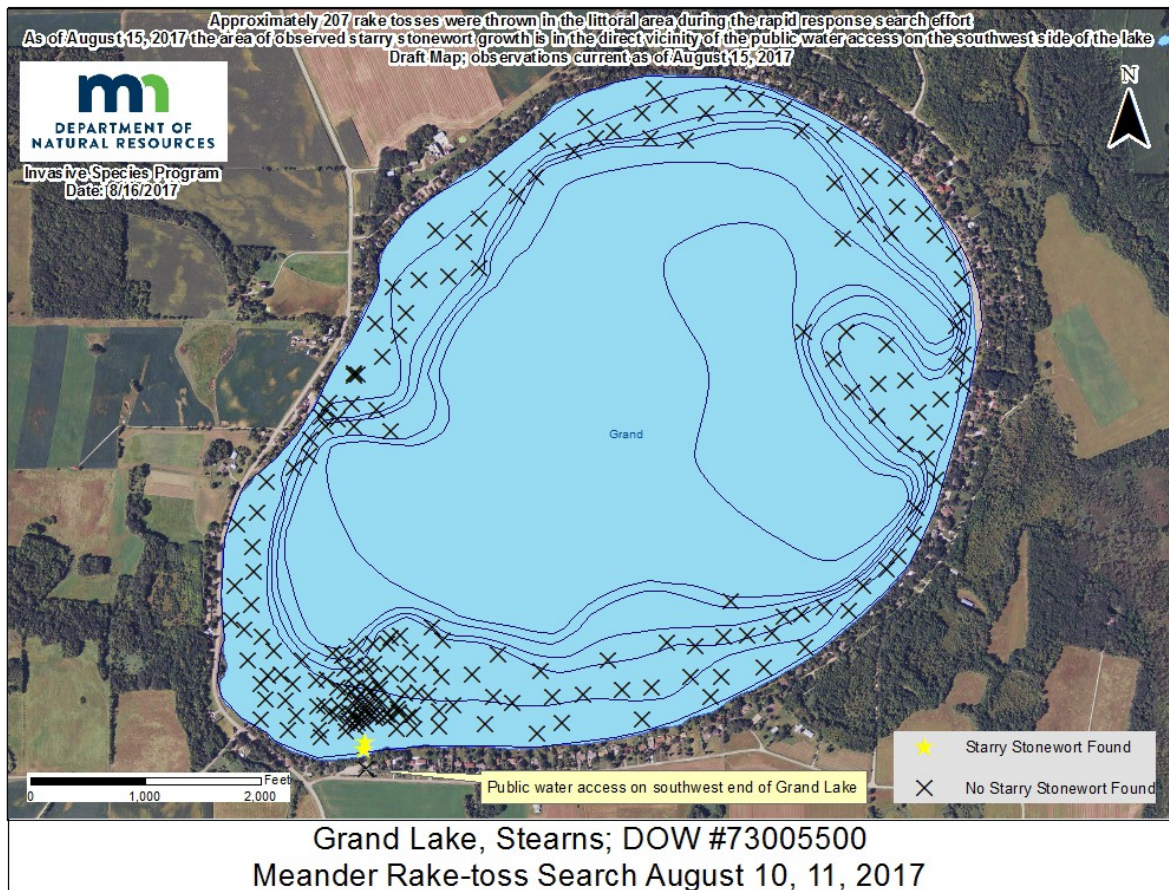


**Figure 2** - Starry stonewort (*Nitellopsis obtusa*) sample collected from Grand Lake, Stearns County (DOW# 73005500) by volunteers during the MAISRC Starry Trek event held on 5 August 2017. Photo taken with magnification from a dissecting scope on 7 August 2017.





**Figure 3** - Initial starry stonewort search summary; Approximate perimeter of the area snorkeled in search of starry stonewort, location of the large 8'x8' growth of starry stonewort, and the location of the farther known point of starry stonewort growth as of 8 August 2017 in Grand Lake, Stearns County (DOW #73005500).



**Figure 4** - Lake-wide meander survey illustrating locations of the rake toss waypoints within the littoral area (<15 feet) in Grand lake, Stearns County (DOW#73005500). Approximately 159 rake toss samples were thrown during the lake-wide meander survey. Combined rake tosses from the initial search and the meander search effort totaled 207 locations.

## Management

Since 2017, management of starry stonewort has been conducted annually (Table 1). Scuba divers had physically removed the starry stonewort by first conducting monthly surveys to determine the extent and locations of starry stonewort and then placing buoys to mark the locations. Three hand-pulling events occurred in both 2017 and 2018 by MN DNR (Figure 5). These efforts reduced the abundance and distribution of starry stonewort. In 2019, only one hand-pull was implemented because of the reduced abundance and distribution found at the management area. In 2019, Steve McComas with Blue Water Science conducted the third year of management via hand pulling. The first hand-pull was on 31 July 2019 and yielded 3,810 grams (8.4 pounds) of starry stonewort (Table 1). Two additional hand-pulls occurred on 9 September 2019 and 9 October 2019, yielding less than one gram of starry stonewort. Possible other factors of declines in abundance may include annual variation, water clarity and other environmental variables.



**Figure 5** - Underwater view of a patch of starry stonewort that MNDNR divers hand removed from the public water access on Grand Lake, Stearns County (DOW #73005500). Photo taken on 23 August 2017.



**Table 1 - Starry Stonewort Management Summary.** History of management activities (physical removal) for Grand Lake, Stearns County (DOW# 76005500, Total acres: 650, Littoral acres: 235). Weight rounded to the nearest whole number.

| Date    | Surveyor/ Management Conducted by: | Method        | Approx. Amount      | Approx. Max Weight in Pounds |
|---------|------------------------------------|---------------|---------------------|------------------------------|
| 8-23-17 | MN DNR                             | scuba/snorkel | 10 to 12 seed bags  | 360                          |
| 8-24-17 | MN DNR                             | snorkel       | 2 to 3 seed bags    | 90                           |
| 9-22-17 | MN DNR                             | snorkel       | 3 plants/ fragments | <1                           |
| 6-26-18 | MN DNR                             | scuba         | 4 to 6 seed bags    | 180                          |
| 7-26-18 | MN DNR                             | scuba/snorkel | 2 seed bags         | 60                           |
| 9-11-18 | MN DNR                             | snorkel       | <1 seed bag         | 30                           |
| 7-31-19 | MN DNR<br>Blue Water Science       | scuba/snorkel | NA                  | 8                            |
| 9-3-19  | MN DNR<br>Blue Water Science       | scuba/snorkel | NA                  | <1                           |
| 10-9-19 | MN DNR<br>Blue Water Science       | scuba/snorkel | NA                  | <1                           |



## Pre- and Post-Treatment Plant Surveys

### Methods

In 2017, as part of the rapid response plan, the population of starry stonewort was delineated and mapped (Figure 3). Based on the initial delineation of less than 0.5 acres, a grid of 22 sampling points was set-up to start monitoring the management during late 2018. These surveys were conducted by MN DNR to evaluate the effects of hand pulling on both starry stonewort and the native plant communities. These surveys documented the distribution and abundance of all taxa, including starry stonewort. It is important to note that distributions of aquatic plants may vary from year to year due to variables such as differences in weather as well as the effects from the proposed management.

MN DNR surveyors used a point-intercept survey method developed by John Madsen in “Aquatic Plant Control Technical Note MI-02, 1999” to develop a grid within the management area. Monthly plant surveys were conducted during the growing season between September 2018 and 2019. No surveys occurred earlier due to staffing limitations. Survey points were placed 32 feet (9.8 meters) apart using a Geographic Information System (GIS). A minimum of 22 points were sampled in depths up to 5 feet of water.

At each sample point, a double-sided garden rake was thrown and dragged along the lake bottom of the lake. All plant taxa (submerged, floating-leaf, emergent and free floating) were recorded during the survey. 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 (how often a plant species appeared on a rake) were calculated based on the littoral zone (area of the lake where plants can grow; typical estimation is up to 15 feet).

To better illustrate the reduction of biomass removed annually, biomass approximations were tabulated (Table 1). Biomass removal estimates were based on volume in seed bags collected in 2017 and 2018, although in 2019 measurements were collected using wet weight measurements developed by Bickel and Perrett in “[Precise determination of aquatic plant wet mass using a salad spinner](#)”. Plant fragments were rinsed before each spinning process. After plant material was spun 20 times in a commercial salad spinner, 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.

### Results

Reductions in the frequency and abundance of starry stonewort had been documented in Grand Lake; both over time and within a growing season. Point-intercept surveys conducted within the management area indicated no starry stonewort after management in 2018 and 2019 (Table 2 and Table 3). No point-intercept surveys occurred in 2017, although visual snorkel surveys indicated a few fragments of starry stonewort during post-management in 2017.

Based on its growing cycle, starry stonewort is most abundant during mid to late summer; therefore, hand-pulling efforts in 2019 began in July. The first hand-pull removed the majority of biomass (Table 1) and consecutive hand-pulls during the rest of the growing season removed any new growth caused

by the remaining bulbils in the sediment. This approach limited the starry stonewort biomass during its peak growth season and its spread both in and outside of the lake. To date, no known spread has occurred within the lake or surrounding lakes.

Grand Lake has up to 15 submerged native aquatic plants within the management area. Overall, there has been no negative impact to native aquatic plant communities. The mean density of submersed native taxa has remained constant among years (Figure 6). Because management efforts only targeted starry stonewort, the percent of points with native submersed aquatic plants also has not declined; instead, there has been an increase between 2018 and 2019 by 31% (Table 2; Figure 7). Changes in plant communities between years could be due to a variety of factors such as differing phenology, seasonal variation or environmental variables. Continued monitoring and management of this site will be helpful to determine if this management technique will continue to be effective at reducing and preventing the spread of starry stonewort within the lake, as well as improving the native aquatic plant community at the infestation site.

**Table 2 - Plant Survey Metrics inside Management Area.** Summary of metrics for Grand Lake PWA Starry Stonewort Management in Grand Lake, Stearns County (DOW# 73005500). Shaded values were calculated from littoral depth range.

| Survey Metrics                        | 10 Sept 2018<br>(Post- Mgmt.) | 5 June 2019<br>(Pre-Mgmt.) | 30 July 2019<br>(Pre-Mgmt.) | 22 August 2019<br>(Post-Mgmt.) | 16 Sept 2019<br>(Post-Mgmt.) |
|---------------------------------------|-------------------------------|----------------------------|-----------------------------|--------------------------------|------------------------------|
| Surveyor                              | MNDNR                         | MNDNR                      | MNDNR                       | MNDNR                          | MNDNR                        |
| Total # Points Sampled                | 22                            | 32                         | 20                          | 22                             | 19                           |
| Max Depth of Growth (95%) in feet     | 4                             | 3.3                        | 4.7                         | 4.7                            | 4.8                          |
| # Point in Max Depth Range            | 21                            | 29                         | 18                          | 19                             | 17                           |
| Max Depth of Starry Stonewort (feet)  | 0                             | 0                          | 3.8                         | 4.5                            | 0                            |
| # Points in Littoral (0-15 feet)      | 22                            | 32                         | 20                          | 22                             | 19                           |
| % Points w/ Submersed Native Taxa     | 64                            | 59                         | 95                          | 86                             | 95                           |
| Mean Submersed Native Taxa/ Point     | 1.7                           | 0.7                        | 1.9                         | 2.2                            | 1.7                          |
| Mean Density of Submersed Native Taxa | 1.3                           | 1.1                        | 1.3                         | 1.2                            | 1.1                          |
| # Submersed Native Taxa               | 7                             | 7                          | 10                          | 7                              | 7                            |
| % Points w/ Non-native Taxa           | 0                             | 13                         | 10                          | 9                              | 0                            |
| % Points w/ Starry Stonewort          | 0                             | 0                          | 10                          | 5                              | 0                            |
| Mean Density of Starry Stonewort      | 0.0                           | 0.0                        | 1.0                         | 1.0                            | 0.0                          |

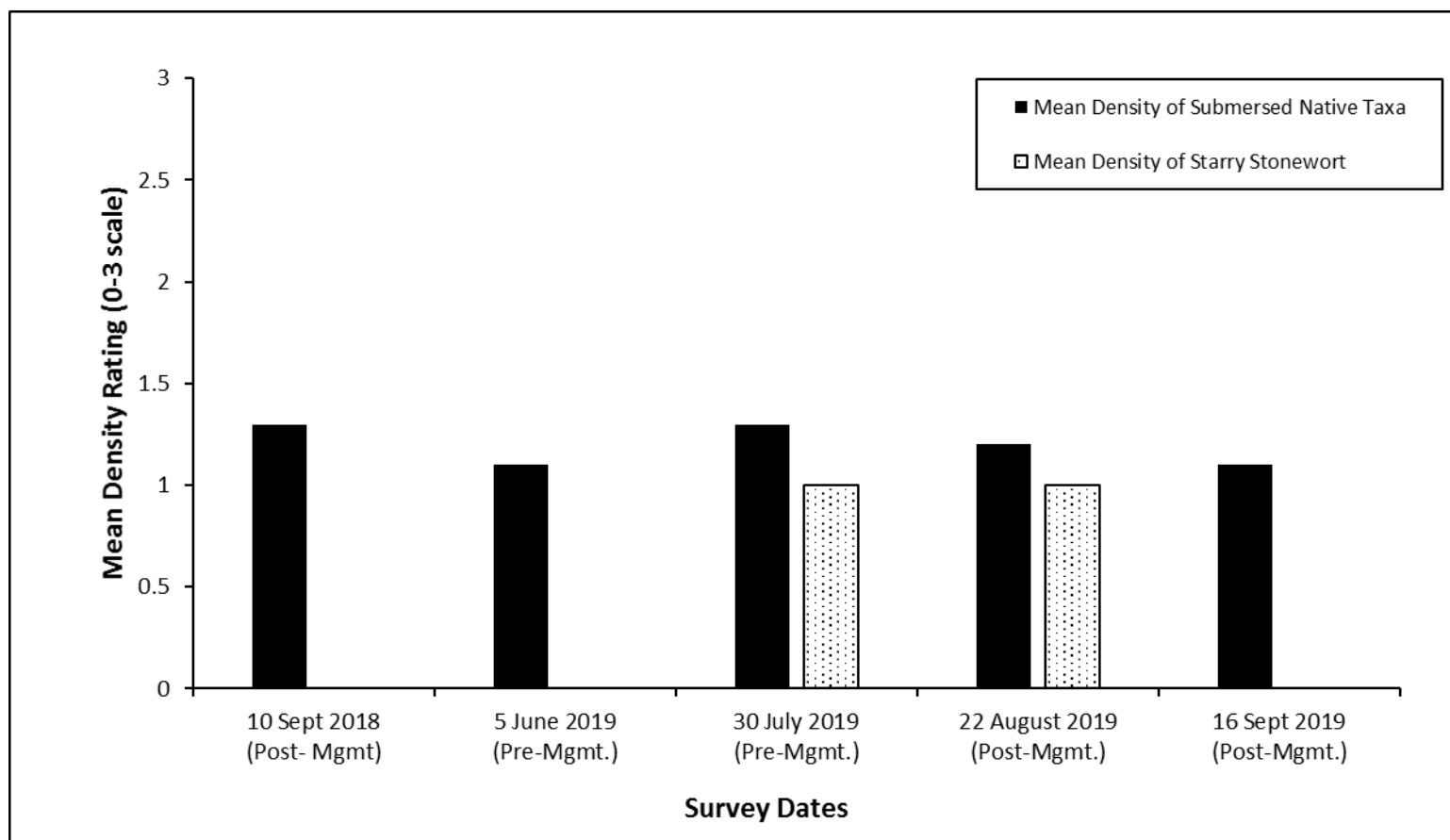
\*95th percentile calculated based on all vegetated sampling points

Taxa refers to groups of submersed aquatic plant species or genera

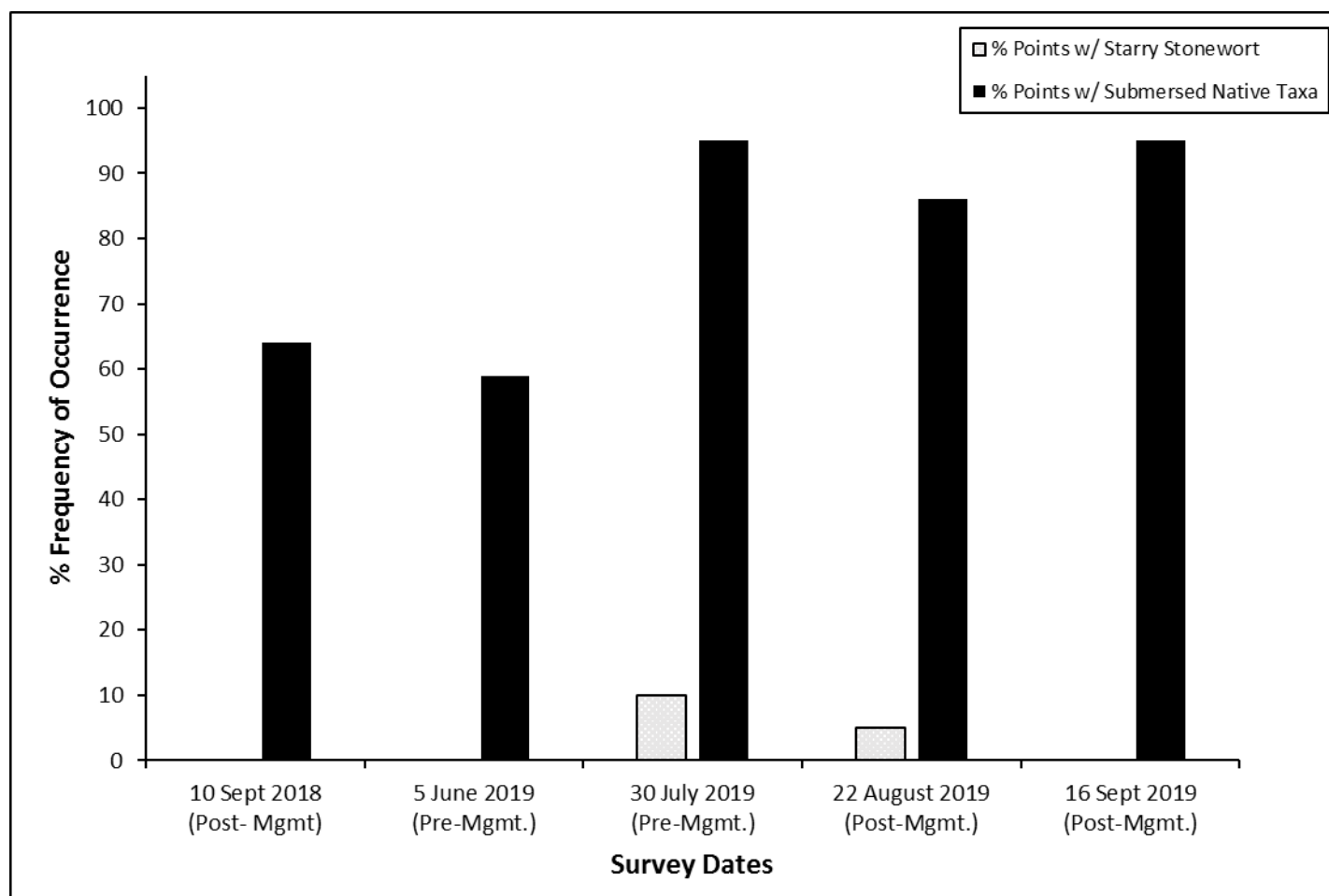
**Table 3 - Plant Frequency Occurrence inside Management Area.** Percent frequency of occurrence for submersed taxa (most identified to species) in Grand Lake, Stearns County (DOW# 73005500). \*denotes invasive aquatic plant/algae

| Taxonomic Name                   | Common Name              | 10 Sept 2018<br>(Post- Mgmt.) | 5 June 2019<br>(Pre-Mgmt.) | 30 July 2019<br>(Pre-Mgmt.) | 22 August 2019<br>(Post-Mgmt.) | 16 Sept 2019<br>(Post-Mgmt.) |
|----------------------------------|--------------------------|-------------------------------|----------------------------|-----------------------------|--------------------------------|------------------------------|
| <i>Nitellopsis obtusa</i> *      | starry stonewort*        | 0                             | 0                          | 10                          | 5                              | 0                            |
| <i>Ceratophyllum demersum</i>    | coontail                 | 45                            | 31                         | 25                          | 64                             | 32                           |
| <i>Chara</i> sp.                 | muskgrass                | 5                             | 6                          | 15                          | 18                             | 0                            |
| <i>Heteranthera dubia</i>        | water star-grass         | 27                            | 0                          | 10                          | 23                             | 42                           |
| <i>Lemna trisulca</i>            | star duckweed            | 0                             | 88                         | 65                          | 82                             | 37                           |
| <i>Myriophyllum sibiricum</i>    | northern watermilfoil    | 0                             | 3                          | 5                           | 0                              | 5                            |
| <i>Najas</i> sp.                 | naiad species            | 0                             | 0                          | 0                           | 0                              | 0                            |
| <i>Nitella</i> sp.               | native stonewort species | 27                            | 13                         | 70                          | 50                             | 47                           |
| <i>Nuphar variegata</i>          | yellow waterlily         | 9                             | 3                          | 20                          | 0                              | 16                           |
| <i>Potamogeton crispus</i> *     | curly-leaf pondweed      | 0                             | 13                         | 0                           | 5                              | 0                            |
| <i>Potamogeton illinoensis</i>   | Illinois pondweed        | 4                             | 0                          | 0                           | 0                              | 0                            |
| <i>Potamogeton gramineus</i>     | variable pondweed        | 0                             | 0                          | 5                           | 0                              | 0                            |
| <i>Potamogeton natans</i>        | floating-leaved pondweed | 0                             | 0                          | 5                           | 5                              | 5                            |
| <i>Potamogeton praelongus</i>    | white-stem pondweed      | 5                             | 0                          | 0                           | 0                              | 0                            |
| <i>Potamogeton richardsonii</i>  | clasping-leaved pondweed | 0                             | 13                         | 15                          | 23                             | 21                           |
| <i>Potamogeton</i> spp.          | narrow-leaf pondweed     | 0                             | 0                          | 5                           | 0                              | 0                            |
| <i>Potamogeton zosteriformis</i> | flat-stemmed pondweed    | 0                             | 3                          | 0                           | 0                              | 0                            |
| <i>Ranunculus</i> sp.            | water crowfoot species   | 0                             | 0                          | 10                          | 5                              | 11                           |
| <i>Schoenoplectus</i> sp.        | bulrush species          | 0                             | 9                          | 5                           | 9                              | 21                           |
| <i>Typha</i> sp.                 | cattail species          | 0                             | 0                          | 0                           | 0                              | 5                            |
| <i>Utricularia</i> sp.           | bladderwort species      | 5                             | 3                          | 0                           | 0                              | 0                            |
| <i>Vallisneria americana</i>     | water celery             | 9                             | 0                          | 25                          | 41                             | 16                           |
| <i>Zizania palustris</i>         | wild rice                | 0                             | 50                         | 20                          | 18                             | 16                           |





**Figure 6 - 2016 Mean Density of Plants inside Management Area.** Mean density rating (0-3 scale) of for submersed native taxa and starry stonewort across treatment dates in Grand Lake, Stearns County (DOW# 73005500).



**Figure 7 - 2016 Plant Frequency of Occurrence Inside Management Area.** Percent frequency of occurrence for submersed native taxa and starry stonewort across survey dates in Grand Lake, Stearns County (DOW# 73005500).

## Conclusion

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Grand Lake was the first lake in Minnesota to hand remove starry stonewort via scuba diving. These recent management efforts have shown to be effective at decreasing the frequency of occurrence and abundance, in addition, to limiting the spread within the lake. Because the extent of the infestation, it was practical to physically remove the starry stonewort. Hand removal via scuba diving is a good option 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. Between 2017 and 2019, the size of the infestation had decreased from one large patch of 64 square feet and six smaller patches less than 1 square foot each to undetectable during the fall of 2019. In addition, no starry stonewort was found outside the access. Re-growth is likely to occur during the following year because of the bulbils in the sediment; therefore continued monitoring and management is recommended.

## Literature Cited

Aquatic Plant Control Technical Note MI-02, 1999

Bickel, T.O and C. Perrett. (2015). *Precise determination of aquatic plant wet mass using a salad spinner*. Can. J. Fish. Aquat. Sci., 73 (2015), 1-4pp.

Crow, G.E. and C.B. Hellquist. (2000). *Aquatic and wetland plants of Northeastern North America*. (Vols. 1 & 2). Madison, WI: The University of Wisconsin Press.

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Madsen, J. (1999). *Point-intercept and line intercept methods for aquatic macrophytes management*. APCRP Technical Notes Collection (TN APCRP-M1-02). Vicksburg, MS: U.S. Army Engineer Research and Development Center.