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# Grand Lake, Stearns County (2017-2020)

## 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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*Minnesota Department of Natural Resources*

*April 29, 2021*

## Lake Summary

**Lake:** Grand Lake

**County:** Stearns

**DOW Number:** 73005500

**Lake Area:** 650 acres

**Littoral Area:** 235 acres

## Project Details

**Project Year:** 4

**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- 2020 (see Table 1)

**Date(s) of Survey(s):** 2017-2020

**Date of Report:** April 29, 2021

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

## Report Details

Jurek C. and E. Hauck Jacobs. 2021. Monitoring report for starry stonewort in Grand Lake, Stearns County (2017- 2020). Minnesota Department of Natural Resources, Division of Ecological and Water Resources, Invasive Species Program, 1035 South Benton Drive, Sauk Rapids, MN 56379. 16 pp.

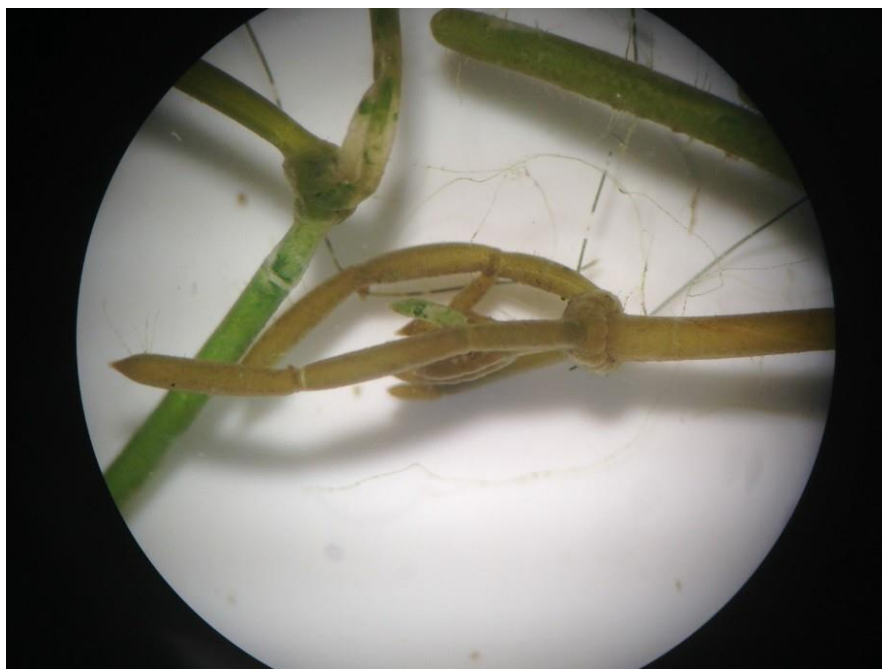
## Summary

This report summarizes starry stonewort monitoring data collected by MN DNR staff between 2017 and 2020. 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 was within 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 (*Schoenoplectus* 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 both resemble starry stonewort.

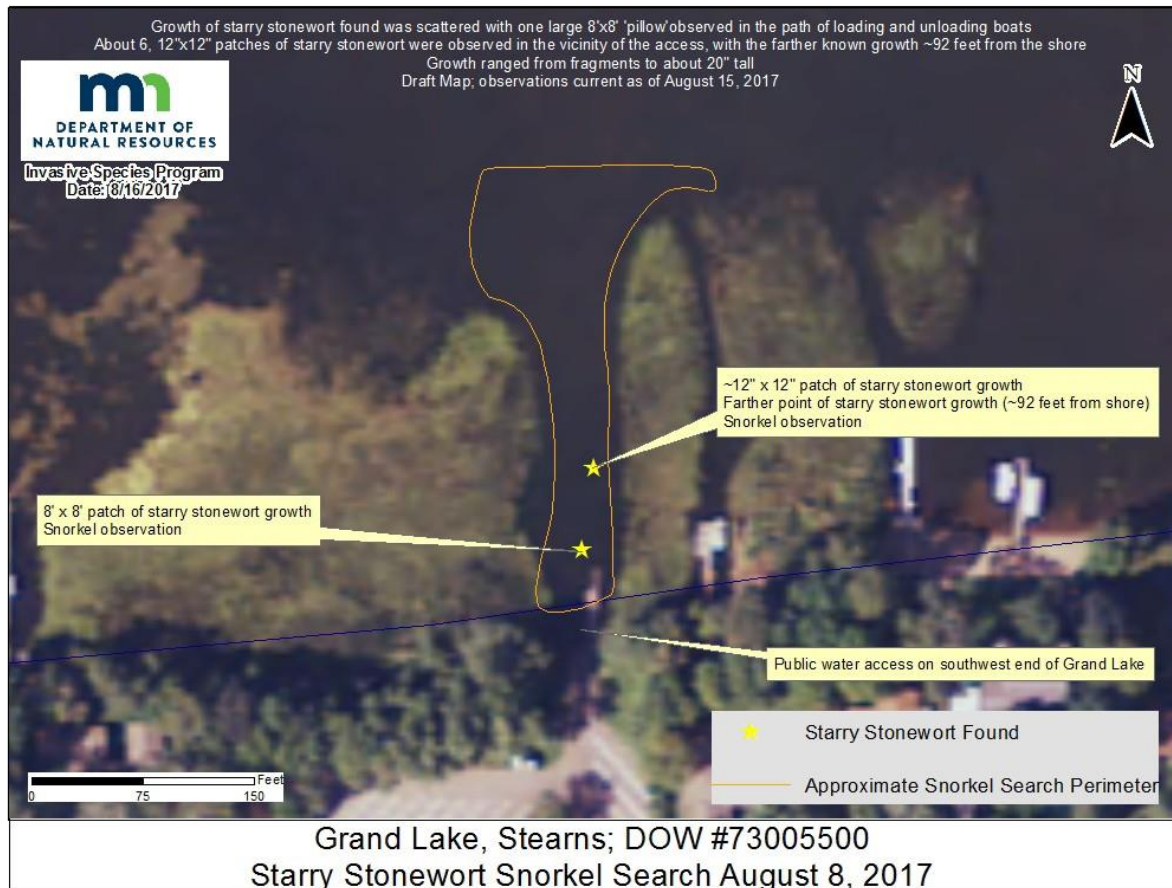


**Figure 1** – Starry stonewort (*Nitellopsis obtusa*) sample collected from Grand Lake, Stearns County (DOW# 73005500) by volunteers during the MAISRC Starry Trek event held on 5 August 2017. Photo taken on 7 August 2017.

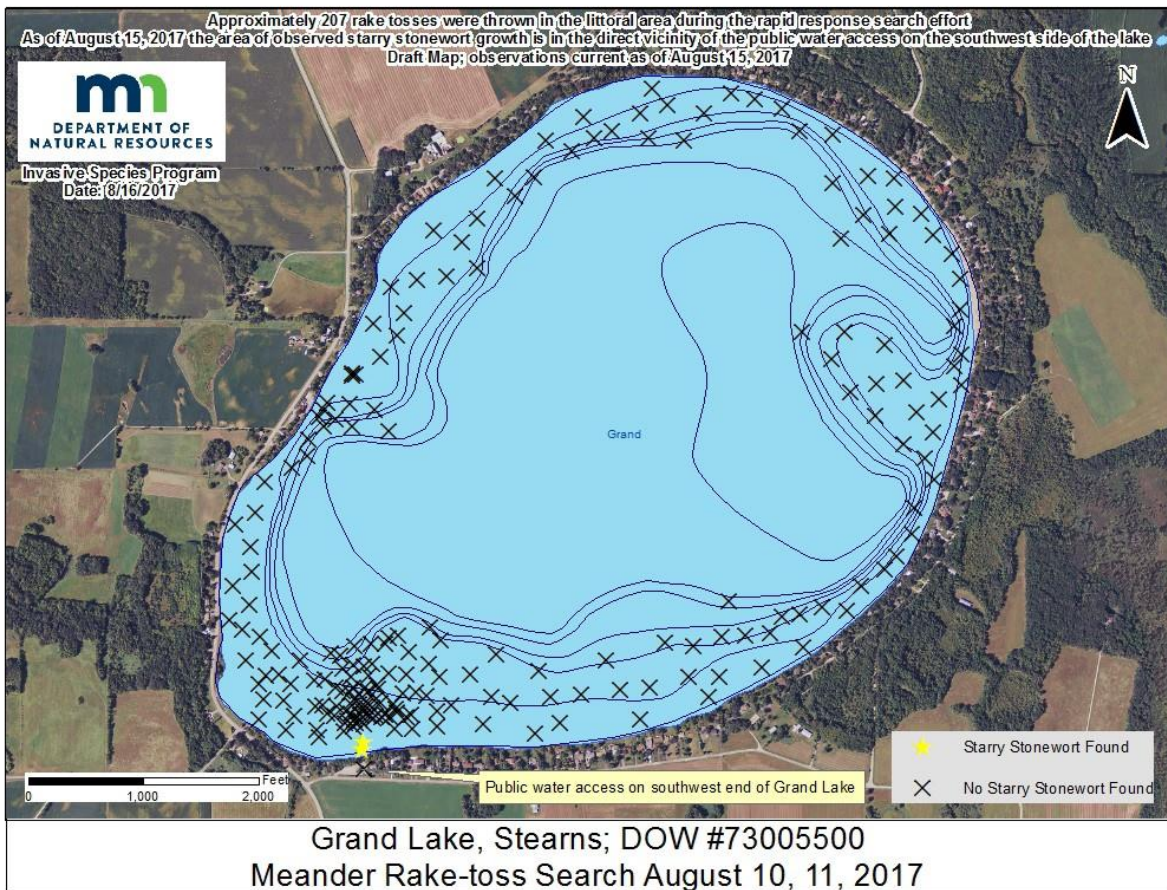


**Figure 2** - Starry stonewort (*Nitellopsis obtusa*) sample collected from Grand Lake, Stearns County (DOW# 73005500) by volunteers during the MAISRC Starry Trek event held on 5 August 2017. Photo taken with magnification from a dissecting scope on 7 August 2017.





**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

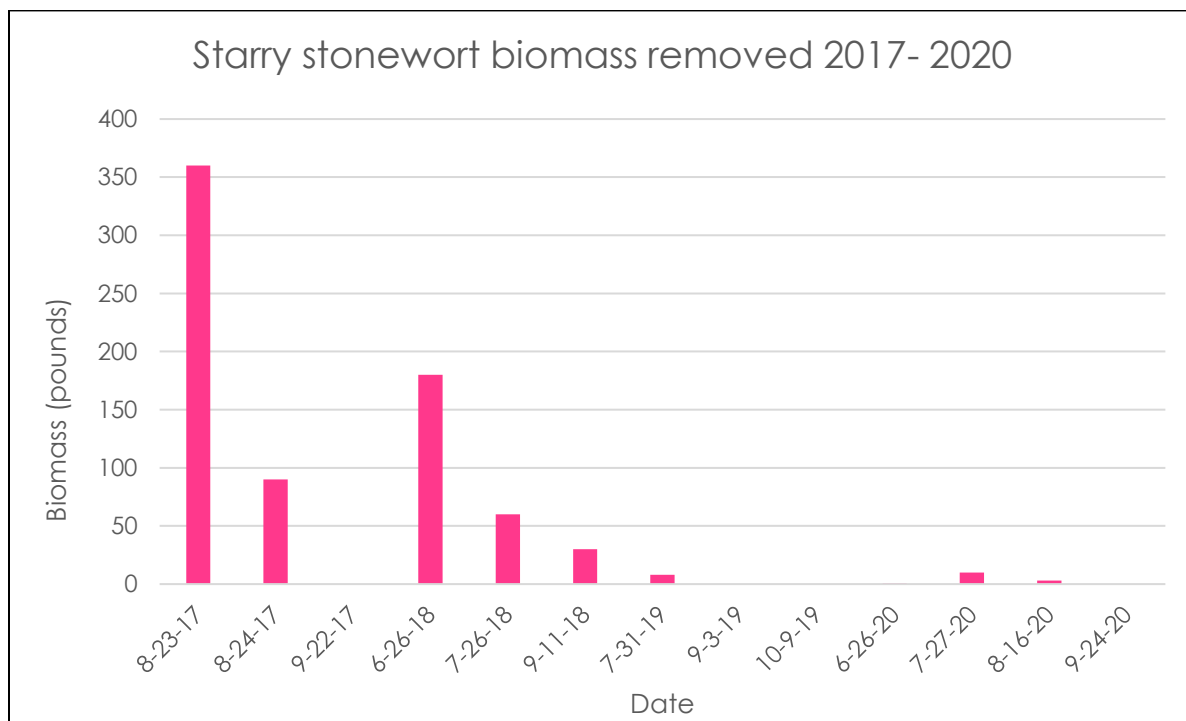
Since 2017, management of starry stonewort has been conducted annually (Table 1). Before the scuba divers physically removed the starry stonewort (Figure 5), we first conducted a monthly survey to determine the extent and locations of starry stonewort. Buoys were placed at starry stonewort locations to aid in the removal process. Significant decreases in biomass occurred over the past four years (Figure 6).

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

| Date    | Surveyor/ Management Conducted by: | Approx. Amount (lbs.) |
|---------|------------------------------------|-----------------------|
| 8-23-17 | MN DNR                             | 360                   |
| 8-24-17 | MN DNR                             | 90                    |
| 9-22-17 | MN DNR                             | <1                    |
| 6-26-18 | MN DNR                             | 180                   |
| 7-26-18 | MN DNR                             | 60                    |
| 9-11-18 | MN DNR                             | 30                    |
| 7-31-19 | Blue Water Science                 | 8                     |
| 9-3-19  | Blue Water Science                 | <1                    |
| 10-9-19 | Blue Water Science                 | <1                    |
| 6-26-20 | Blue Water Science                 | 0.5                   |
| 7-27-20 | Blue Water Science                 | 10                    |
| 8-16-20 | Blue Water Science                 | 3                     |
| 9-24-20 | Blue Water Science                 | <1                    |



**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.



**Figure 6**- Starry stonewort biomass removed between 2017- 2020 from Grand Lake, MN by MN DNR (2017- 2018) and Blue Water Science (2019-2020).



## Pre- and Post-Treatment Plant Surveys

### Methods

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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. Plant surveys were conducted during the growing season starting in September of 2018 and continued into 2020. No surveys occurred earlier than 2018 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 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; 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

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Reductions in the frequency and abundance of starry stonewort had been documented in Grand Lake; both over time and within a growing season. No point-intercept survey grids occurred in 2017, although visual snorkel surveys indicated a few fragments of starry stonewort during post-management in 2017. The frequency of starry stonewort had declined in all years managed (Table 2 and Table 3).

Based on its growing cycle, starry stonewort is most abundant during mid to late summer; therefore, hand-pulling efforts started in July. The first hand-pulling event among years had removed the majority of biomass (Table 1). Furthermore, 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 also limited its spread both in and outside of the lake. To date, starry stonewort has not spread within the lake.

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, with a slight uptick in native aquatic plant density in 2020 (Table 2, Figure 7). Because management efforts only targeted starry stonewort, the percent of points with native submersed aquatic plants did not decline (Figure 8). Instead, there has been an increase in native submersed plants by 18% over the past three years (Table 2). 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. To date, hand-pulling efforts have been successful at meeting the desired goals of reducing starry stonewort frequency and abundance at the public access and preventing the spread lakewide.

**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 Aug 2019<br>(Post-Mgmt.) | 16 Sept 2019<br>(Post-Mgmt.) | 24 June 2020<br>(Pre-Mgmt.) | 9 Sept 2020<br>(Post-Mgmt.) |
|---------------------------------------|-------------------------------|----------------------------|-----------------------------|-----------------------------|------------------------------|-----------------------------|-----------------------------|
| Surveyor                              | MNDNR                         | MNDNR                      | MNDNR                       | MNDNR                       | MNDNR                        | MNDNR                       | MNDNR                       |
| Total # Points Sampled                | 22                            | 32                         | 20                          | 22                          | 19                           | 35                          | 33                          |
| Max Depth of Growth (95%) in feet     | 4                             | 3.3                        | 4.7                         | 4.7                         | 4.8                          | 2.7                         | 3                           |
| # Point in Max Depth Range            | 21                            | 29                         | 18                          | 19                          | 17                           | 33                          | 33                          |
| Max Depth of *SSW in feet             | 0                             | 0                          | 3.8                         | 4.5                         | 0                            | 2.8                         | 2                           |
| # Points in Littoral (0-15 feet)      | 22                            | 32                         | 20                          | 22                          | 19                           | 35                          | 33                          |
| % Points w/ Submersed Native Taxa     | 64                            | 59                         | 95                          | 86                          | 95                           | 97                          | 82                          |
| Mean Submersed Native Taxa/ Point     | 1.7                           | 0.7                        | 1.9                         | 2.2                         | 1.7                          | 2.1                         | 1.6                         |
| Mean Density of Submersed Native Taxa | 1.3                           | 1.1                        | 1.3                         | 1.2                         | 1.1                          | 1.7                         | 1.6                         |
| # Submersed Native Taxa               | 7                             | 7                          | 10                          | 7                           | 7                            | 11                          | 8                           |
| % Points w/ Non-native Taxa           | 0                             | 13                         | 10                          | 9                           | 0                            | 31                          | 1                           |
| % Points w/ Starry Stonewort          | 0                             | 0                          | 10                          | 5                           | 0                            | 29                          | 6                           |
| Mean Density of Starry Stonewort      | 0.0                           | 0.0                        | 1.0                         | 1.0                         | 0.0                          | 0.3                         | 0.1                         |

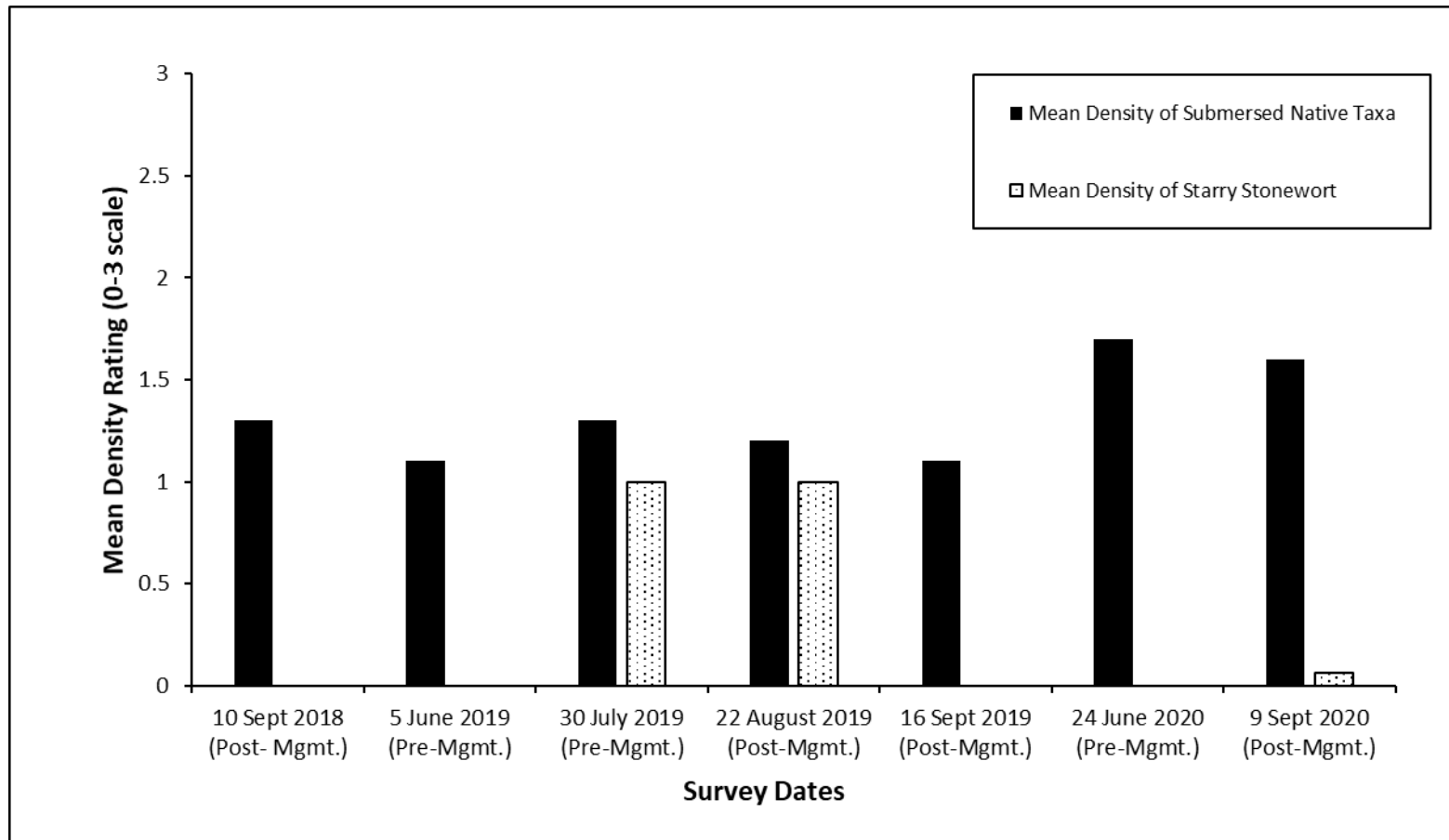
\*95th percentile calculated based on all vegetated sampling points

Taxa refers to groups of submersed aquatic plant species or genera

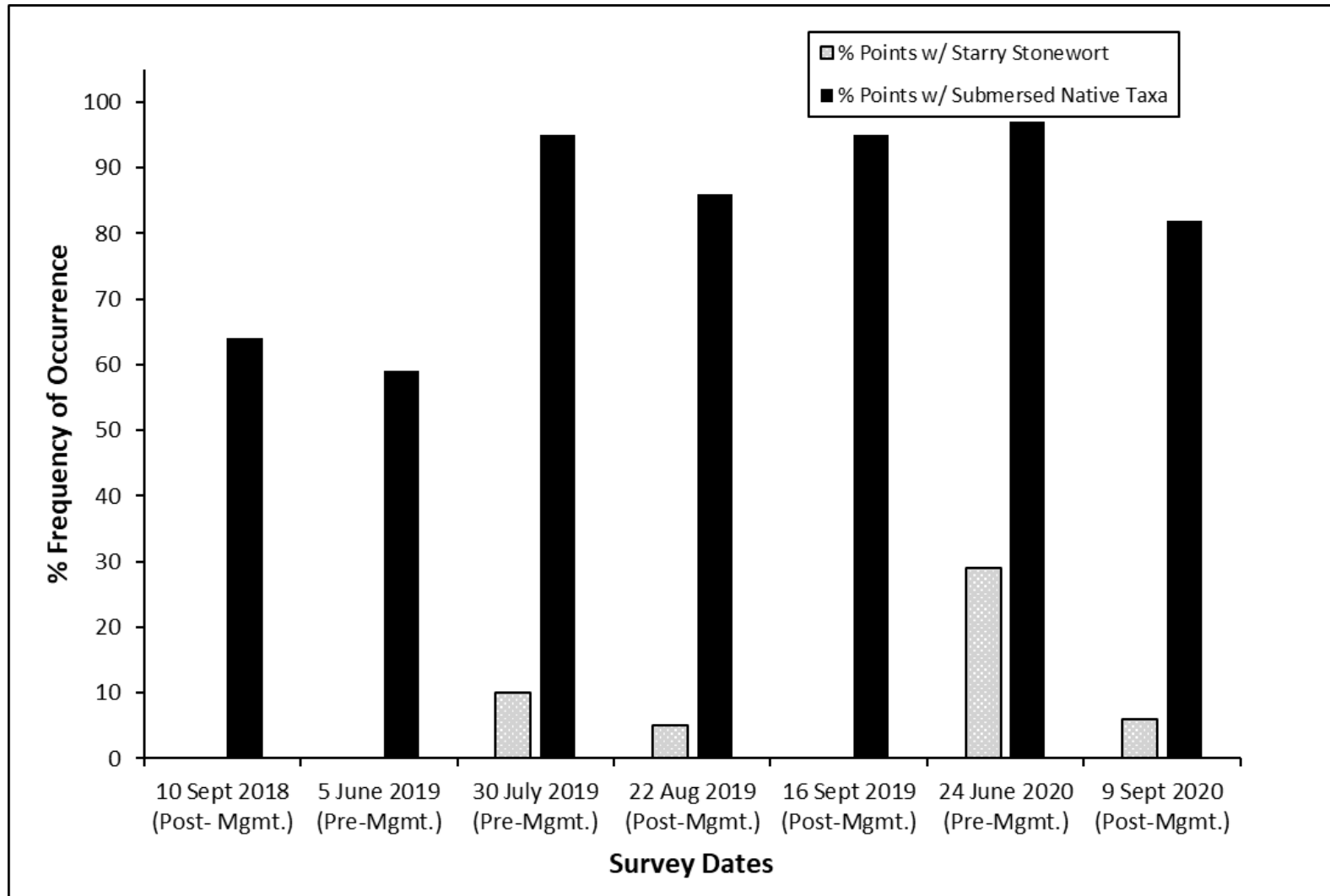
**Table 3 - Plant Frequency Occurrence inside Management Area 2017- 2020.** Percent frequency of occurrence for submersed taxa (most identified to species) in Grand Lake, Stearns County (DOW# 73005500). \*denotes invasive aquatic plant/algae

| 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.) | 24 June 2020<br>(Pre-Mgmt.) | 9 Sept 2020<br>(Post-Mgmt.) |
|----------------------------------|---------------------------|------------------------------|----------------------------|-----------------------------|--------------------------------|------------------------------|-----------------------------|-----------------------------|
| <b>SUBMERSED PLANTS</b>          |                           |                              |                            |                             |                                |                              |                             |                             |
| <i>Nitellopsis obtusa*</i>       | Starry stonewort*         | 0                            | 0                          | 10                          | 5                              | 0                            | 29                          | 6                           |
| <i>Ceratophyllum demersum</i>    | Coontail                  | 45                           | 31                         | 25                          | 64                             | 32                           | 46                          | 52                          |
| <i>Chara</i> sp.                 | Muskgrass                 | 5                            | 6                          | 15                          | 18                             | 0                            | 17                          | 0                           |
| <i>Elodea canadensis</i>         | Canadian waterweed        | 0                            | 0                          | 0                           | 0                              | 0                            | 0                           | 3                           |
| <i>Heteranthera dubia</i>        | Water stargrass           | 27                           | 0                          | 10                          | 23                             | 42                           | 9                           | 18                          |
| <i>Lemna trisulca</i>            | Star duckweed             | NA                           | 88                         | 65                          | 82                             | 37                           | 66                          | 48                          |
| <i>Myriophyllum sibiricum</i>    | Northern watermilfoil     | 0                            | 3                          | 5                           | 0                              | 5                            | 6                           | 9                           |
| <i>Najas</i> sp.                 | Naiad                     | 0                            | 0                          | 0                           | 0                              | 0                            | 0                           | 0                           |
| <i>Nitella</i> sp.               | Stonewort                 | 27                           | 13                         | 70                          | 50                             | 47                           | 66                          | 58                          |
| <i>Nuphar variegata</i>          | Yellow waterlily          | 9                            | 3                          | 20                          | 0                              | 16                           | 23                          | 18                          |
| <i>Potamogeton crispus</i>       | Curly-leaf pondweed       | 0                            | 13                         | 0                           | 5                              | 0                            | 6                           | 0                           |
| <i>Potamogeton illinoensis</i>   | Illinois pondweed         | 4                            | 0                          | 0                           | 0                              | 0                            | 0                           | 0                           |
| <i>Potamogeton gramineus</i>     | Variable- leaved pondweed | 0                            | 0                          | 5                           | 0                              | 0                            | 0                           | 0                           |
| <i>Potamogeton natans</i>        | Floating pondweed         | 0                            | 0                          | 5                           | 5                              | 5                            | 3                           | 3                           |
| <i>Potamogeton praelongus</i>    | White-stem pondweed       | 5                            | 0                          | 0                           | 0                              | 0                            | 6                           | 3                           |
| <i>Potamogeton richardsonii</i>  | Richardson's pondweed     | 0                            | 13                         | 15                          | 23                             | 21                           | 14                          | 3                           |
| <i>Potamogeton</i> sp.           | Narrow-leaved pondweed    | 0                            | 0                          | 5                           | 0                              | 0                            | 0                           | 0                           |
| <i>Potamogeton zosteriformis</i> | Flat-stem pondweed        | 0                            | 3                          | 0                           | 0                              | 0                            | 0                           | 0                           |
| <i>Ranunculus</i> sp.            | Buttercup                 | 0                            | 0                          | 10                          | 5                              | 11                           | 11                          | 0                           |
| <i>Schoenoplectus</i> sp.        | Bulrush                   | NA                           | 9                          | 5                           | 9                              | 21                           | 17                          | 12                          |
| <i>Stuckenia pectinata</i>       | Sago pondweed             | 0                            | 0                          | 0                           | 0                              | 0                            | 3                           | 0                           |
| <i>Typha</i> sp.                 | Cattail                   | 0                            | 0                          | 0                           | 0                              | 5                            | 0                           | 0                           |
| <i>Utricularia vulgaris</i>      | Common bladderwort        | 5                            | 3                          | 0                           | 0                              | 0                            | 23                          | 0                           |
| <i>Vallisneria americana</i>     | Water celery              | 9                            | 0                          | 25                          | 41                             | 16                           | 6                           | 12                          |
| <i>Zizania palustris</i>         | Wild rice                 | NA                           | 50                         | 20                          | 18                             | 16                           | 40                          | 27                          |





**Figure 7 - 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 8- 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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In 2017, 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 was small, it was practical to physically remove the starry stonewort. Hand removal via scuba diving was a good option since it had minimal, non-target effects on native macroalgae and native aquatic plants. Removing all bulbils during the hand-removal process, especially in the sediment, was challenging. Since it was not 100% achievable to remove all bulbils, re-growth occurred. Overall, physical removal has shown to be an effective option for small, isolated infestations. Between 2017 and 2020, the size of the infestation had decreased from one large patch (64 sq. ft.) and six smaller patches (<1 sq. ft.) to sparse fragments with limited distribution by the fall of 2020. 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

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.