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SAND LAKE, BARRON COUNTY

2019 AQUATIC PLANT MANAGEMENT SUMMARY REPORT
WDNR WBIC: 2661100

Prepared by: Heather Wood, Lake Management Assistant & Dave Blumer, Lake Educator

May 18, 2019

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2018 AQUATIC PLANT MANAGEMENT SUMMARY REPORT-SAND LAKE

PREPARED FOR THE SAND LAKE MANAGEMENT DISTRICT

INTRODUCTION

This report discusses aquatic plant management activities completed by the Sand Lake Management District (SLMD) and Lake Education and Planning Services (LEAPS) during the 2019 season and provides details of the preliminary 2020 Eurasian watermilfoil (EWM) control plan. The following list of education and management actions were completed in 2019.

- 2019 preliminary EWM treatment proposal
- EWM readiness survey, treatment, and changes in EWM over 3 years
- Post-treatment summer littoral zone point-intercept survey results
- Clean Boats Clean Waters
- AIS monitoring
- 2020 preliminary EWM management planning
- Citizen Lake Monitoring Network water quality testing
- Grant funded project and grant applications
- Picnic and Annual Meeting

Each of these actions will be summarized in the following sections of this report.

Based on 2018 summer littoral point-intercept survey data (Berg, 2018), an initial proposal for treating 5 areas totaling 2.65 acres, down from 14.65 acres in 2018, was made by LEAPS in April 2019. All of the areas proposed to be treated in 2019 were in the same area as 5 of the 8, 2018 treatment areas, but all were notably smaller than their 2018 counterparts. After a treatment readiness survey was completed by LEAPS, the initial treatment proposal was modified. Four of the areas remained unchanged, and one of the proposed areas was reduced from 0.26 acres to 0.15 acres while the initial the final treatment. The final proposal covered 2.54 acres of the lake. All of the areas proposed were to be treated with Sculpin G (granular 2,4-D) with all of these areas being treated at the maximum label rate of 4.0 ppm (Table 1).

Table 1: 2019 Final EWM treatment proposal

2019 Sand Lake Final Spring EWM Treatment Proposal (5/30/2019)							
New Name	**Acres**	**Mean Depth (feet)**	**Acre-feet**	**Target 2,4-D (granular) (ppm a.e.)**	**Application rate (lbs/acre-feet)**	**Granular (lbs)**	**2018 Treatment Notes**
BtLdBay1-19	1.22	10.50	12.81	4.00	65.40	837.77	Excellent control except on the deep water edge
BtLdBay2-18	0.25	10.50	2.63	4.00	65.40	171.68	Excellent control except on the deep water edge
StmpBay-19	0.32	7.50	2.40	4.00	65.40	156.96	2018 treatment of a larger area was very successful
SiloBay-19	0.60	9.50	5.70	4.00	65.40	372.78	Nearly all EWM in the flat was gone with the 2018 treatment. 2019 is on the south edge of the 2018 treated area
WstShr-19	0.15	7.50	1.13	4.00	65.40	73.58	
Total	**2.54**		**24.66**			**1612.76**	

EWM READINESS SURVEY, TREATMENT, AND CHANGES IN EWM OVER 4-YEARS: 2016, 2017, 2018 AND 2019

EWM READINESS SURVEY

With the implementation of a new Aquatic Plant Management Plan (APMP) for Sand Lake in 2017, pre and post-treatment surveys were no longer being done. Instead, as EWM readiness survey was completed in May of 2019 by LEAPS. A EWM readiness survey involves visually inspecting proposed treatment areas and rake throws to determine if EWM in the proposed treatment areas is ready to treat. At the same time, the rest of the lakes' littoral zone is searched for EWM beds that may have been missed in the previous year. Based on this visual inspection and several rake samples, treatment areas are modified, as needed. Based on EWM readiness survey results, the preliminary chemical treatment plan was not modified.

2019 EWM SPRING TREATMENT

Northern Aquatic Services (NAS) completed the 2019 early season EWM treatment on Sand Lake on June 6th. NAS treated a total five beds ranging in size from 0.15 acres up to 1.22 acres totaling to 2.54 acres. Water temperature was 65°F, air temperature was 70°F. There was no wind to speak of. All of the treated areas were treated with Sculpin G (granular 2,4-D). During the treatment, coontail, large-leaf pondweed, clasping-leaf pondweed, northern watermilfoil, white waterlily, and white-stem pondweed were present in the treatment areas.

EWM SPOT TREATMENTS

In most previous years of EWM management, spring treatments have been followed up with chemical treatments of individual EWM plants or small clumps of plants later in the season. With the approval of the new APM Plan in 2016, spot treatments were discontinued in 2017.

CHANGES IN EWM: 2016, 2017, 2018, AND 2019

The 2016 survey found Eurasian water-milfoil at 15 points (3.19% of points with vegetation) which resulted in a relative frequency of 0.87. Of these, three had a rake fullness of 3, five were a 2, and the remaining seven were a 1 for a mean rake fullness of 1.73. EWM was also reported as a visual at eight additional survey points.

During the 2017 survey, EWM was found at 20 points (4.22% of points with vegetation) and it accounted for 1.05 of the total relative frequency. Six points had a rake fullness of 3, three were a 2, and 11 were a 1 for a mean rake of 1.75. EWM was recorded as a visual at five additional points. Although both the distribution and density increased in 2017, none of these values represented a significant change over the 2016 survey. Likewise, none of the changes in rake fullness were significant.

In 2018, EWM was present at 11 points (2.32% of points with vegetation) and totaled just 0.59 of the total relative frequency. Five points rated a rake fullness of 3, two points a 2, and four points a 1 for a mean rake of 2.09. EWM was again recorded as a visual at five additional points. Similar to the changes noted in 2017, neither the increase in density nor the decline in distribution was significant.

In 2019, EWM was found in the rake at 17 sites (3.60% of points with vegetation), and it contributed 0.90% of the total relative frequency. Two points were rated a rake fullness of 3, five points a 2, and ten points a 1 for a mean rake of 1.53. EWM was also recorded as a visual at four points. Just as in each year since 2016, none of the changes in rake fullness were significant. Similarly, the overall decrease in mean density, and the increase in distribution were not significant (Figure 1)

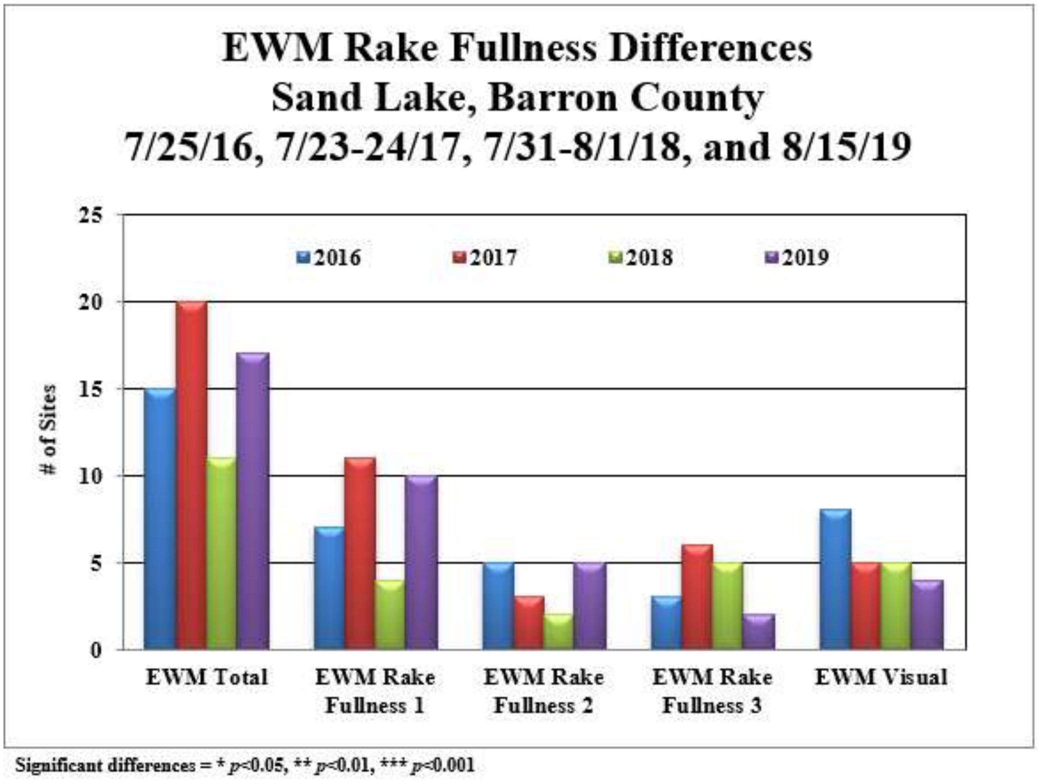


Figure 1: Comparison of EWM Density and significant changes from 2016, 2017, 2018, and 2019 (Berg, 2019)

The July 2016 survey identified six significant beds of Eurasian water-milfoil (Figure 2). In July 2017, only two significant beds were documented – both of which were located along the western shoreline in the southern third of the lake. This total jumped back up to five beds in 2018. Each of these areas represent continued "trouble spots" where herbicide control has been difficult because the EWM is located in 8-12ft of water on the outer edge of the littoral zone adjacent to sharp drop-offs into deep water.

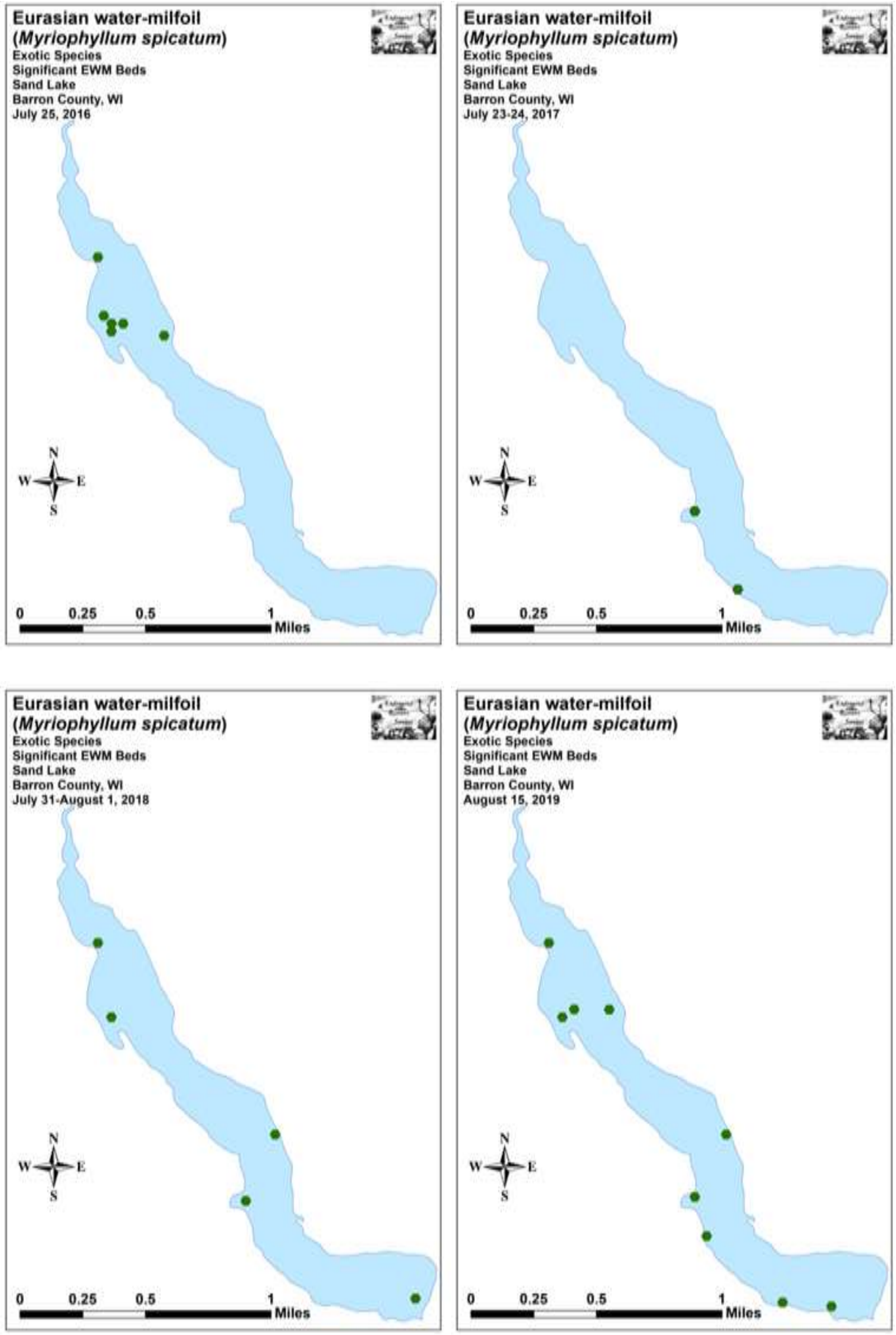


Figure 2: 2016, 2017, 2018 and 2019 Significant EWM beds (Berg, 2019)

It appears that three years of spring chemical management of EWM has been effective at reducing the level of EWM in the lake, at least on a seasonal basis. Fall bedmapping results in 2017 and 2018 show a distinct change in the amount of EWM identified (Figure 3). This is also evident in the fact that the preliminary 2019 EWM spring chemical treatment proposal includes less than 3.0 acres of the treatment as opposed to 12 or more acres in both 2017 and 2018.

That said, EWM continues to be difficult to manage along the deep water edges of the littoral zone. It is these areas that are basically being treated every year (Figure 3).

Figure 3: 2016, 2017, 2018, and 2019 chemical treatment areas

POST-TREATMENT SUMMER LITTORAL ZONE POINT-INTERCEPT SURVEY OF ALL AQUATIC PLANTS

A change that was made in the 2016 revision of the APMP was replacing the post-treatment plant survey in just the treated areas with a larger point-intercept survey that covers the entire littoral zone. All EWM and native plants are documented during this survey. Annual results can more accurately compare the results and impacts of each year's treatment.

2019 SUMMER POINT-INTERCEPT SURVEY RESULTS

From July 23-24, 2019 ERS conducted a summer warm water full point-intercept survey based on a survey grid established in 2016 that included 518 points within the 20-ft contour of the lake at a distance apart of 25 meters, more than double the number of points in the littoral zone included in the original WDNR survey grid (Figure 4). Using this grid, each point was located with a handheld mapping GPS unit, a depth reading (Figure 5) was recorded with a metered pole rake or hand held sonar, and a rake was used to sample an approximately 2.5ft section of the bottom. Substrate (bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake. The depth of points sampled ranged from 0.5 to 24.5 ft.

Organic and sandy muck in the lake's sheltered bays and flats accounted for 41.5% (215 points) of the substrate within the littoral zone. Pure sand shorelines that ringed the majority of the central basins composed 52.9% (274 points) of the bottom, and scattered gravel and cobble areas, especially on the south shoreline adjacent to the lake's deepest point, made up the remaining 5.6 % (29 points) (Figure 5). All plants on the rake, as well as any that were dislodged by the rake, were identified and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 6). Visual sightings of all plants within six feet of the sample point but not found in the rake were also recorded. In addition to a rake rating for each species, a total rake fullness rating was also noted.

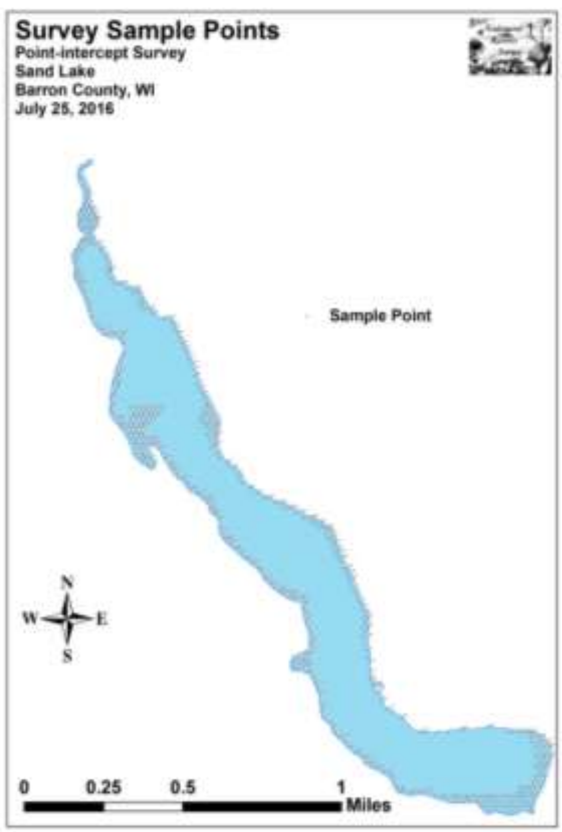


Figure 4: Summer PI survey points (Berg, 2016)

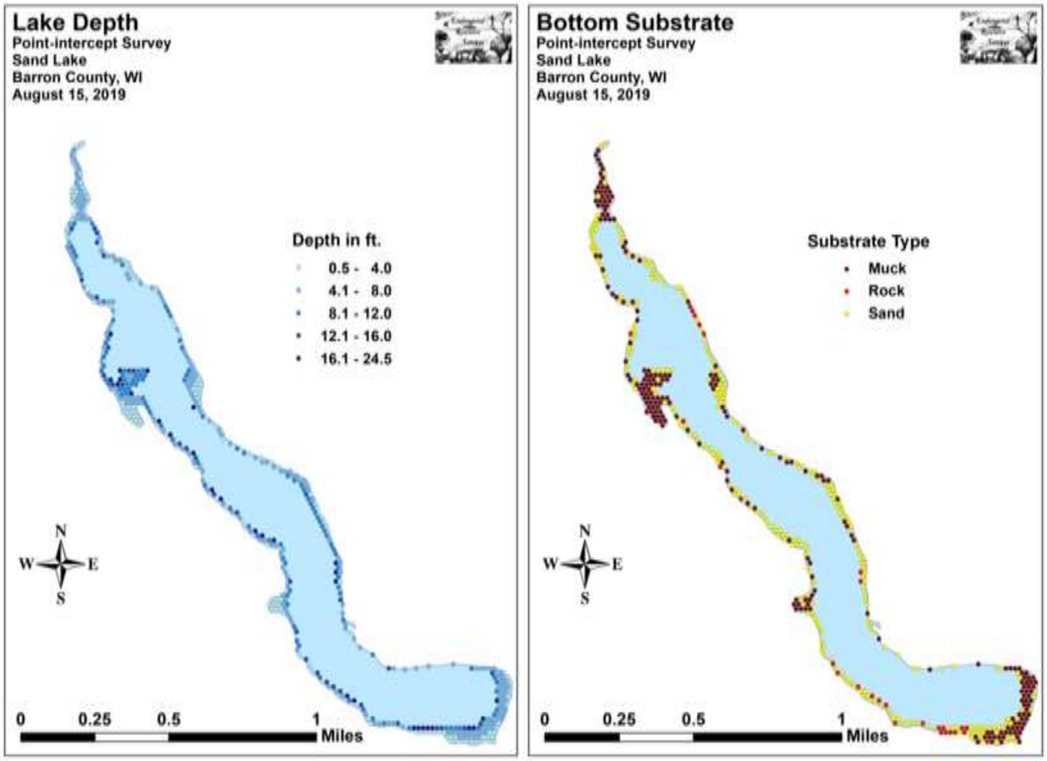


Figure 5: Lake depth and bottom substrate (Berg, 2019)

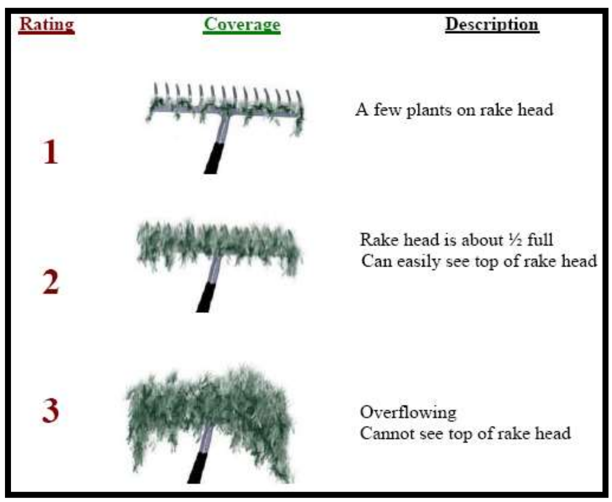


Figure 6: Rake-fullness ratings

Plants were found growing at 472 sites or on approximately 95% of the 17.0ft littoral zone (Figure 7). This was very close to 2017 and 2018 when plants were found at at 474 points (91.9% of the then 19.0ft littoral zone in 2017 and and 96.3% of the 16.0ft littoral zone in 2018) and to 2016 when plants were located at 470 points (90.9% of the 18.5ft littoral zone). The mean and median depths of plants were almost unchanged from 2016-2019 (6.3ft/6.0ft in 2016 – 6.6ft/6.0ft in 2017 – 6.2ft/6.0ft in 2018, and 6.5ft/6.5ft in 2019) (Table 2).

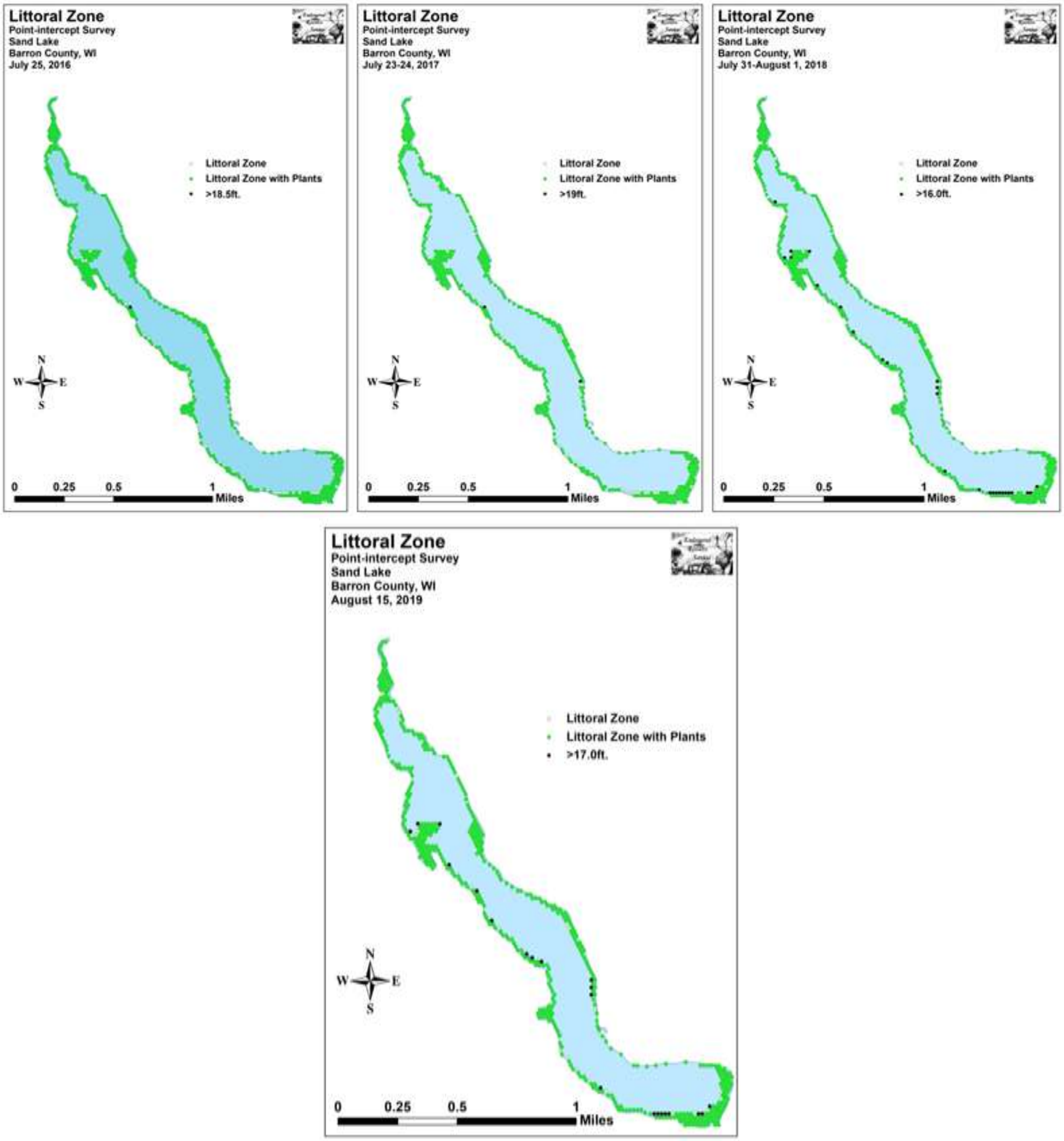


Figure 7: 2016, 2017, 2018, & 2019 littoral (plant growing) zone

The intent of the summer survey was to compare the aquatic plant community within the lake over three years (2016, 17, & 18) of active EWM management. Table 2 shows the statistical comparison of the 2016, 2017, 2018 and 2019 surveys.

Table 2: 2016, 2017, 2018, 2019 Survey Statistic Comparison (Berg, 2019)

Summary Statistics:	2016	2017	2018	2019
Total number of points sampled	518	518	518	518
Total number of sites with vegetation	470	474	474	472
Total number of sites shallower than the max. depth of plants	517	516	492	497
Freq. of occurrence at sites shallower than max. depth of plants	90.9	91.9	96.3	95.0
Simpson Diversity Index	0.94	0.94	0.93	0.94
Maximum depth of plants (ft)	18.5	19.0	16.0	17.0
Mean depth of plants (ft)	6.3	6.6	6.2	6.5
Median depth of plants (ft)	6.0	6.0	6.0	6.5
Ave. number of all species per site (shallower than max depth)	3.32	3.71	3.80	3.80
Ave. number of all species per site (veg. sites only)	3.65	4.03	3.95	4.00
Ave. number of native species per site (shallower than max depth)	3.29	3.67	3.78	3.77
Ave. number of native species per site (veg. sites only)	3.62	4.01	3.93	3.99
Species richness	43	44	43	45
Species richness (including visuals)	47	49	46	45
Species richness (including visuals and boat survey)	51	52	48	49
Mean rake fullness (veg. sites only)	2.16	2.19	2.18	2.37

NATIVE AQUATIC PLANTS

Plant diversity in 2019 was exceptionally high with a Simpson Diversity Index value of 0.94 (identical to 2016 and 2017, and up from 0.93 in 2018). Total richness was also moderately high as surveyors found 45 species in the rake (similar to the 43 species in 2016, 44 in 2017, and 43 in 2018). This number jumped to 49 when including visuals and species seen during the boat survey (also similar to 51 in 2016, 52 in 2017, and 48 in 2018).

In 2016, the mean native species richness at sites with native vegetation was a moderate 3.62 species/site. Following a highly significant increase ($p<0.001$) to a high 4.01 species/site in 2017, the 2018 average underwent a non-significant decline ($p=0.27$) to 3.93 species/site. In 2019, mean richness experienced a non-significant increase ($p=0.32$) back to a high 3.99 native species/site (Figure 8)

From 2016 to 2017, mean total rake fullness experienced a non-significant increase ($p=0.24$) from a moderately dense 2.16 to 2.19 (Figure 9). In 2018, this value was nearly unchanged at 2.18 before experiencing a highly significant increase ($p<0.001$) to a moderately high density of 2.37 in 2019

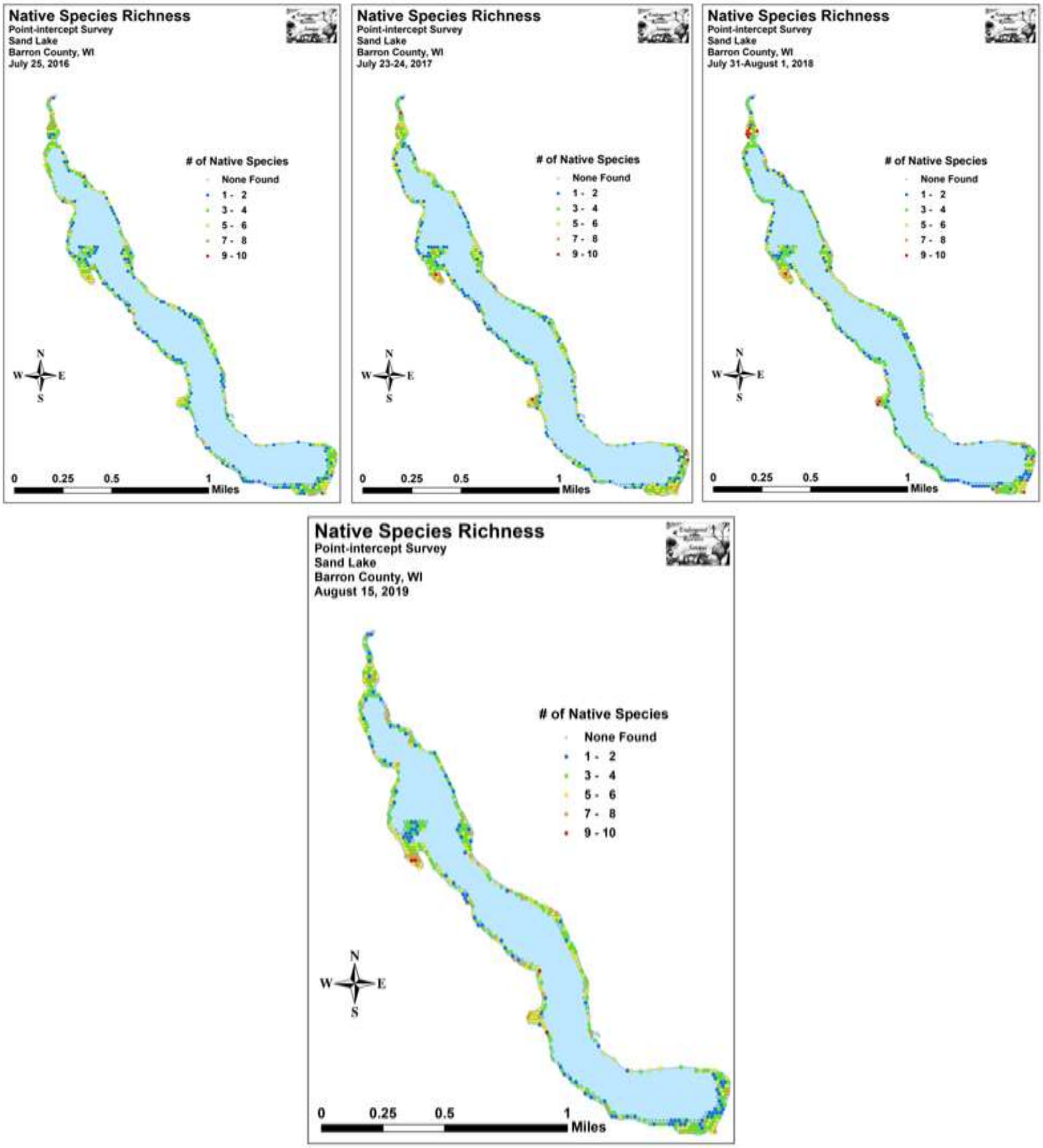


Figure 8: 2016, 2017, 2018, and 2019 native species richness (Berg, 2019)

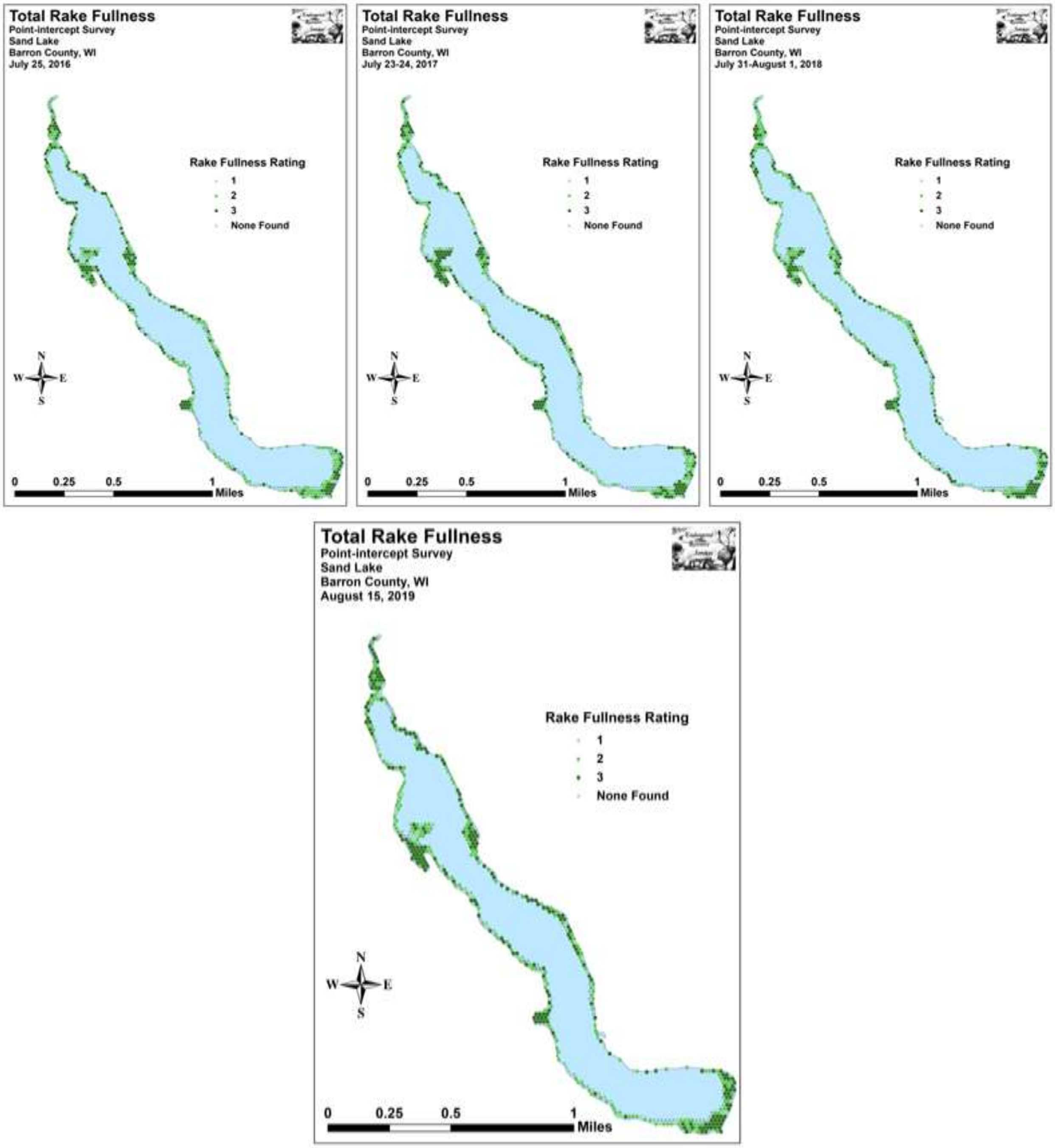


Figure 9: 2016, 2017, 2018, and 2019 total rake fullness (Berg, 2019)

COMPARISON OF NATIVE AQUATIC PLANT SPECIES IN 2016, 2017, 2018

In 2016, Coontail, Flat-stem pondweed, Small pondweed, and Northern water-milfoil were the most common species. Found at 49.79%, 41.06%, 30.21%, and 28.51% of survey points with vegetation respectively, they accounted for 40.94% of the total relative frequency. Muskgrass (5.94), Illinois pondweed (4.66), Clasping-leaf pondweed (4.60), Forked duckweed (4.37), Common waterweed (4.19), and Slender naiad (4.14) were the only other species with relative frequencies over 4.00.

During the 2017 survey, these four species were again the most common with Coontail present at 52.95% of sites with vegetation, Flat-stem pondweed at 39.66%, Small pondweed at 35.02%, and Northern water-milfoil at 26.16%. Collectively, they accounted for 38.13% of the total relative frequency. Common waterweed (5.81), Muskgrass (5.07), Clasping-leaf pondweed (4.65), Variable pondweed (4.60), Forked duckweed (4.34), and Fries' pondweed (4.18) also had relative frequency values over 4.00.

In 2018, Coontail, Small pondweed, Flat-stem pondweed, and Muskgrass were the most common species. Found at 47.26%, 45.78%, 43.25%, and 28.27% of survey points with vegetation respectively, they accounted for 41.67% of the total relative frequency. Forked duckweed (6.30), Slender naiad (6.09), and Common waterweed (4.59) also had relative frequency values over 4.00. Northern water-milfoil, which had been one of the four most abundant plants in 2016 and 2017, was found at only 10.76% of the sites with vegetation in 2018, taking it out of the top four species and dropping it to only the 14th most common species. It had a relative frequency of 2.62 in 2018 compared to 6.49 in 2017, and 7.80 in 2016. This decline is potentially at least partially due to the chemical treatments over the three years, although this species is known to go through natural boom/bust population cycles.

The 2019 survey identified Coontail, Small pondweed, Flat-stem pondweed, and Forked duckweed as the most common species. Found at 51.69%, 41.53%, 40.47%, and 27.33% of survey points with vegetation respectively, they accounted for 40.23% of the total relative frequency. Other species with relative frequency values over 4.00% included Northern water-milfoil (6.19%), Clasping-leaf pondweed (5.98%), Wild celery (4.98%), Fern pondweed (Potamogeton robbinsii) (4.66%), and Muskgrass (4.18%).

When considering only distribution, nine species experienced significant changes from 2016 to 2017, ERS documented a highly significant decline in Illinois pondweed; and a significant decline in Slender naiad. Conversely, they found highly significant increases in Common waterweed and filamentous algae; moderately significant increases in Fries' pondweed, Fern pondweed, Small duckweed, and Nitella; and a significant increase in Large duckweed (Figure 10).

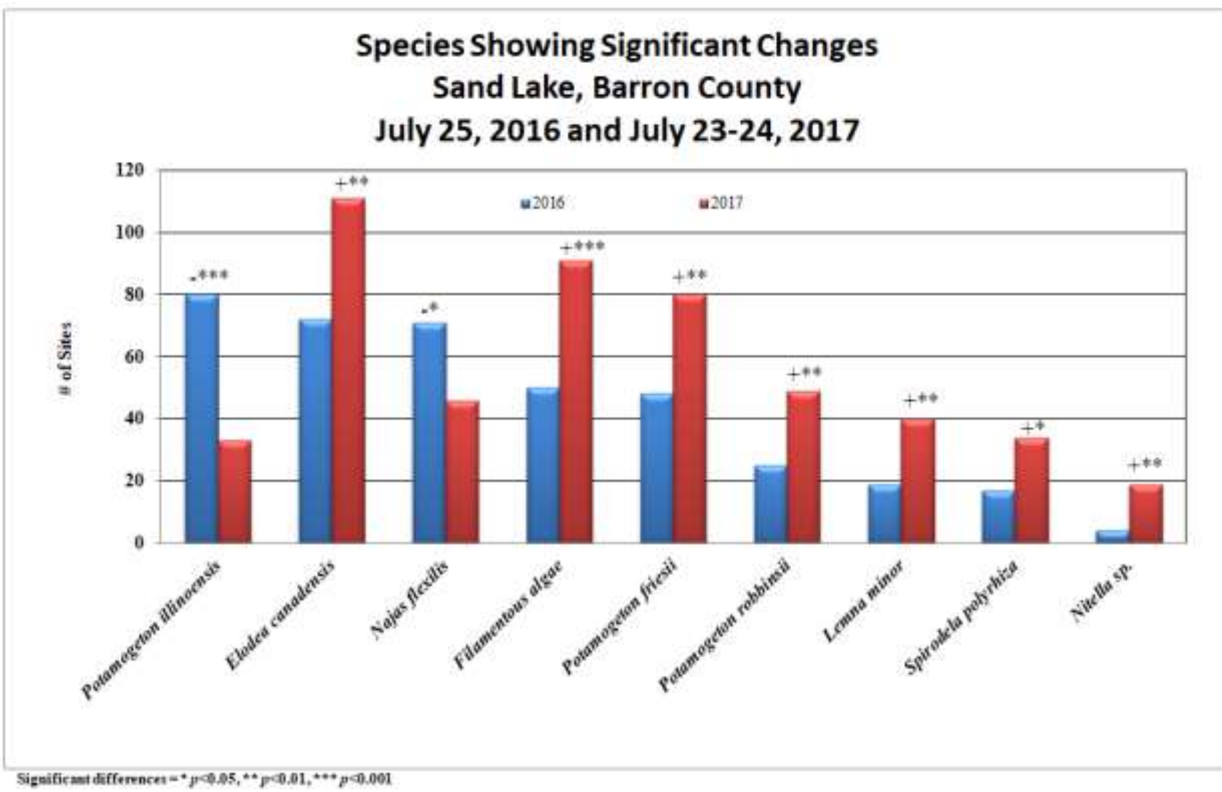


Figure 10: Species with a significant change from 2016 to 2017 (Berg, 2017)

From 2017 to 2018, 12 species experienced significant changes in distribution. Northern water-milfoil, Variable pondweed, White water crowfoot, and Nitella suffered highly significant declines; Large-leaf pondweed demonstrated a moderately significant decline; and Common waterweed and Water star-grass saw significant declines. Despite these losses, highly significant increases were found in Small pondweed and Slender naiad; and moderately significant increases were found in Muskgrass, Forked duckweed, and Common watermeal (Figure 11).

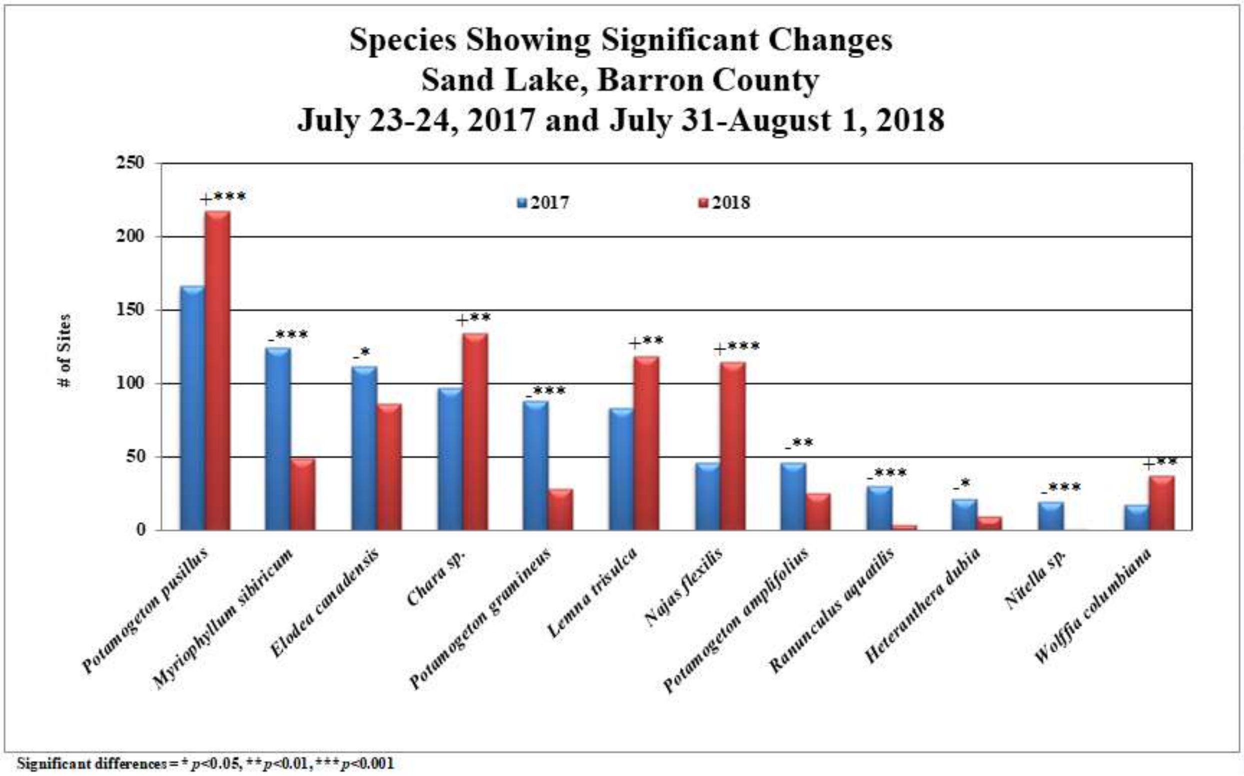
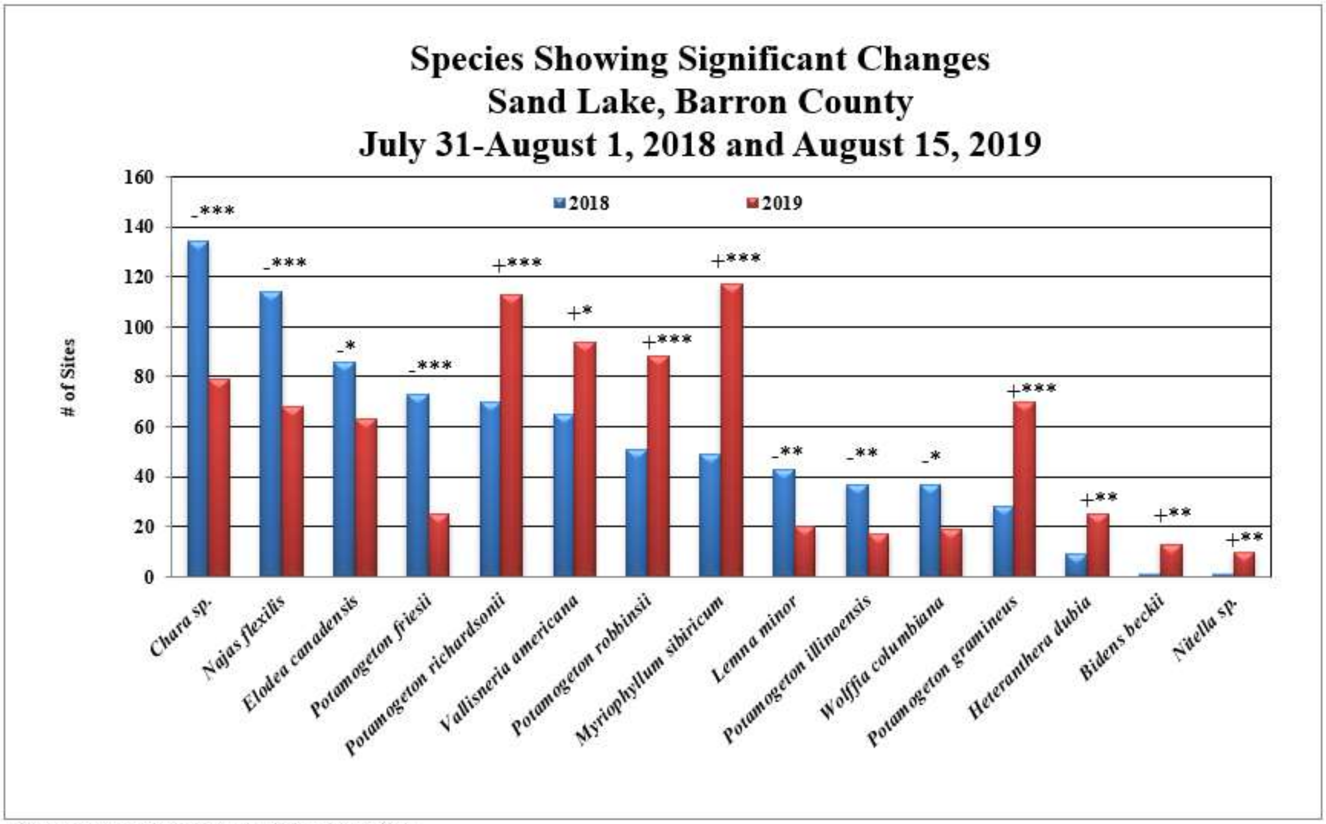


Figure 11: Species with a significant change from 2017 to 2018 (Berg, 2018)

From 2018 to 2019, 15 species experienced significant changes in distribution. Highly significant declines were found in Muskgrass, Slender naiad, and Fries' pondweed; moderately significant declines in Small duckweed and Illinois pondweed; and Common waterweed and Common watermeal had significant declines. Alternatively, Clasping-leaf pondweed, Fern pondweed, Northern water-milfoil, and Variable pondweed all demonstrated highly significant expansions; Water star-grass and Water marigold both showed moderately significant increases; and Wild celery had a significant increase (Figure 12).



Significant differences = * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure 12: Species with a significant change from 2018 to 2019 (Berg, 2019)

The significant reduction of the native species Northern water-milfoil (NWM) in 2018 after a large-scale treatmenr was potentially concerning. Fortunately, with a smaller treatment in 2019, NWM made a highly significant recovery. Active management of EWM will be important to prevent it from overtaking NWM populations, but it will be important to balance the control of EWM with the potential collateral damage of future treatments.

COMPARISONS OF FLORISTIC QUALITY INDEXES IN 2016, 2017, 2018, AND 2019

In 2016, a total of 41 native index plants in the rake were identified during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.0 and a Floristic Quality Index of 38.3. In 2017, a total of 43 native index plants were found in the rake during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.1 and a Floristic Quality Index of 39.8. During the 2018 survey, a total of 42 native index plants were identified on the rake during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.0 and a Floristic Quality Index of 38.7. In 2019, a total of 43 native index plants in the rake. They produced a mean Coefficient of Conservatism of 5.9 and a Floristic Quality Index of 38.6. Nichols (1999) reported an average mean C for the Northern Central Hardwood Forests Region of 5.6 putting Sand Lake above average for this part of the state. The FQI was also nearly double the median FQI of 20.9 for the Northern Central Hardwood Forests Region. Three exceptionally high value index plants found in each of the three years including Wild calla (C = 9), Crested arrowhead (C = 9), and Creeping bladderwort (C = 9).

SUMMER PI SURVEYS VERSES PRE-POST TREATMENT SURVEYS AND FALL EWM BEDMAPPING

One of the big questions going into this three year (2017-2019) EWM management project was whether or not doing a summer PI survey of the entire littoral zone each year provided any benefit over the normal plant survey process of completing a pre-treatment survey, post-treatment survey, and the a fall EWM bedmapping survey. Over the last four seasons the main plant survey event on Sand Lake was the summer PI of 518 survey points within the littoral zone around Sand Lake. In 2016, a <20ft bathymetric contour shapefile provided by LEAPS was used to create a 518 regular offset point survey grid at 25m resolution – double the approximately 250 littoral points in the original WDNR 932 point grid at 37m resolution. The increased concentration of points in the littoral zone was set up with several goals in mind: to quantify the effectiveness of the current management programs on EWM; to better assess any potential impacts on native plants; and to locate deep water EWM beds that were not visible from the surface.

Matt Berg of Endangered Resource Services who completed all of the summer PI surveys made the following comments about the results. "On the positive side and as intended, the surveys are detecting EWM in deep water at a higher rate than traditional fall bed monitoring. They are also providing annual lakewide data on native plants which would ultimately allow long term trends to be established. On the negative side, the survey is labor intensive, and, consequently, costly."

From the perspective of the manager working with the data, the summer PI surveys by themselves did not provide enough data to do management planning. A pattern has been developed over the last three years of EWM management, starting with the fall of 2016. Fall EWM meandering bedmapping data is combined with summer PI data and both used to set up preliminary treatment plans for the following spring. Then in the spring of the following year, a readiness survey is completed, sometimes multiple times to determine when EWM is ready to treat and if any modifications need to be made to the preliminary treatment plan. The treatment is then completed. Sometime in late July or early August the summer PI survey is done. Then in early October a fall meandering EWM bedmapping survey in completed. The PI survey data helps identify deep water EWM that can easily be missed during a meandering survey. But both the summer and PI data and the fall bedmapping data is necessary to put treatment plans together. Figures 13-15 show how this pattern developed over the three years of this project (2017-2019) using GIS spatial data in one area of Sand Lake adjacent to the boat landing that was treated in all three years.

As was mentioned in the comments from Matt Berg, the summer PI surveys have made it easier to locate the deep water beds of EWM. However, the points with EWM identified in the summer surveys bear only a slight resemblance to what is found in the fall survey. The fall survey usually identifies additional individual plants and additional beds of EWM, and it often fails to identify individual plants mapped during the summer PI survey.

Some discussion has been had about trying to use a statistical analysis of the individual points with EWM from the summer survey in the year before and the year after a chemical treatment to help determine efficiency and efficacy of the treatments. However, the limited numbers of points (15 in 2016, 20 in 2017, 11 in 2018, and 17 in 2019) make any statistical analysis difficult, particularly since not all of the points identified with EWM in the summer PI surveys are actually in a treatment area.

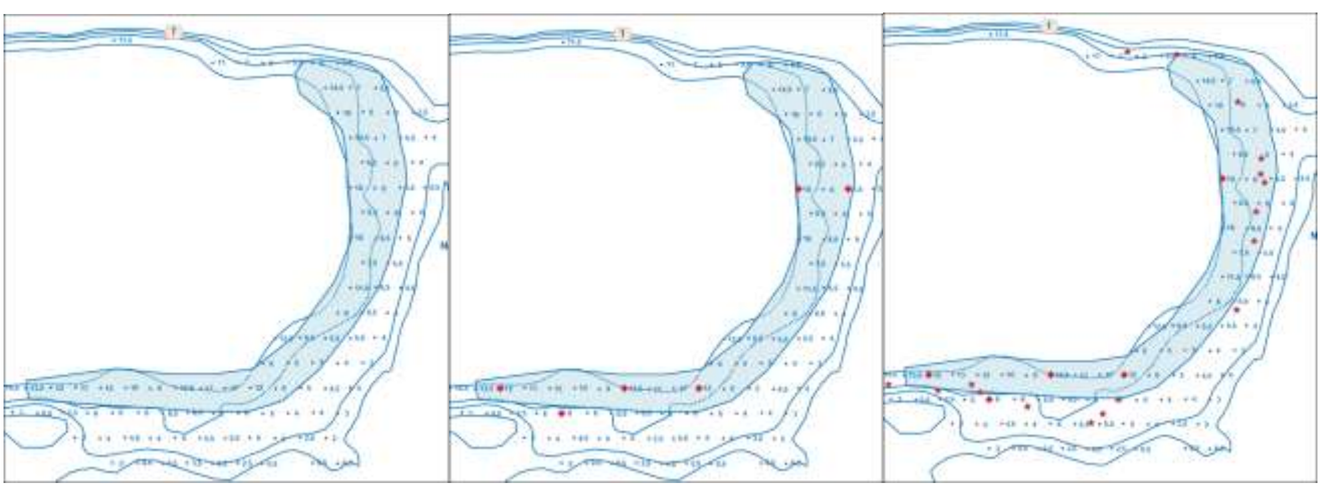


Figure 13: 2017 Spring EWM treatment areas (left); 2017 Summer PI points with EWM (center); 2017 Fall EWM bedmapping points (right)

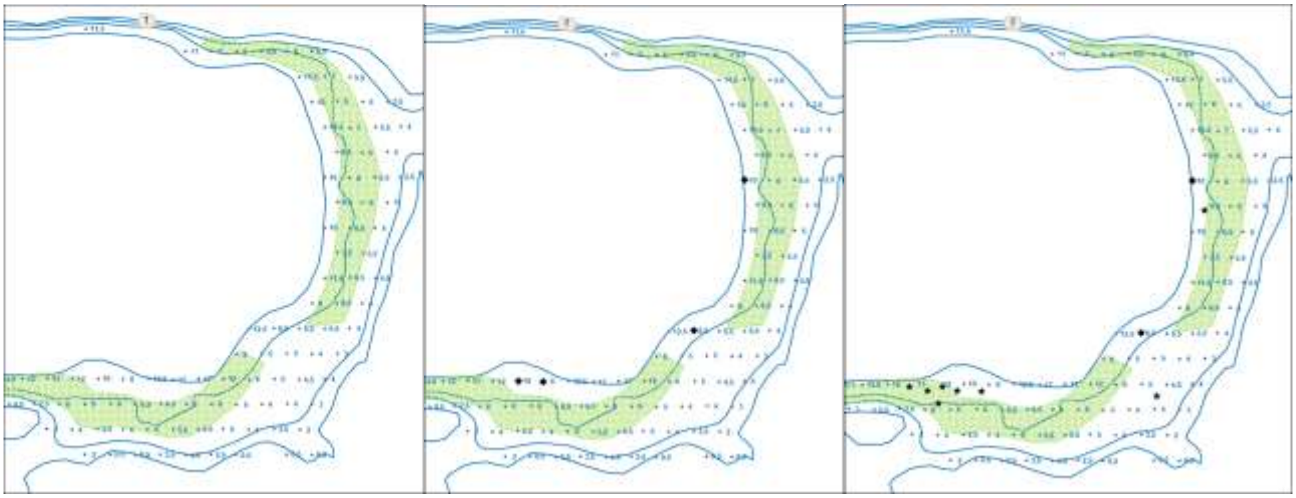


Figure 14: 2018 Spring EWM treatment areas (left); 2018 Summer PI points with EWM (center); 2018 Fall EWM bedmapping points (right)

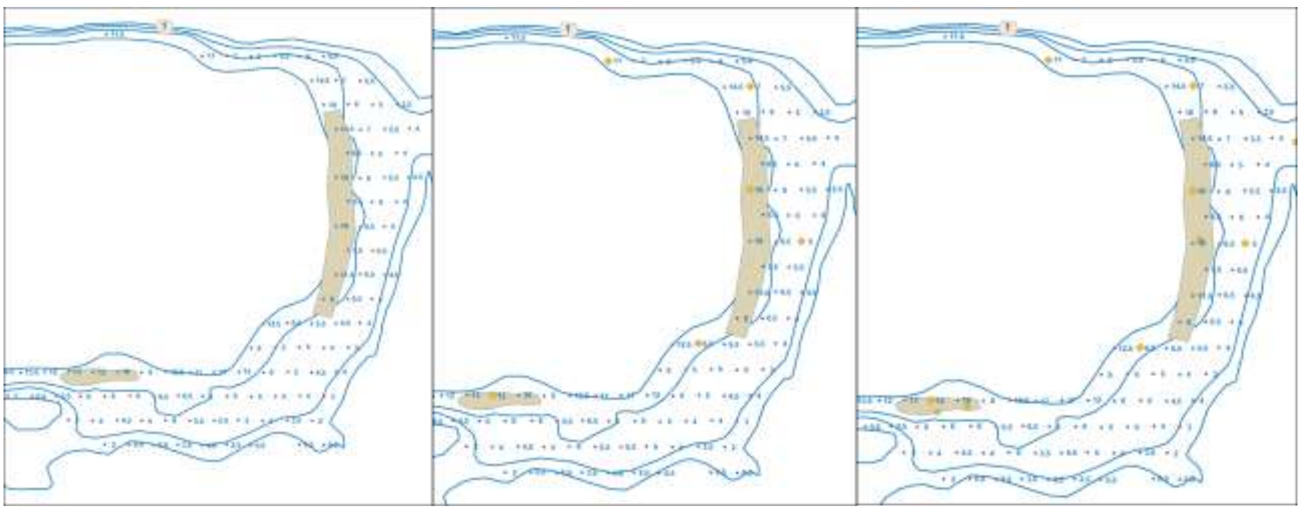


Figure 15: 2019 Spring EWM treatment areas (left); 2019 Summer PI points with EWM (center); 2019 Fall EWM bedmapping points (right)

For the purposes of determining impacts to native aquatic plant species due to EWM management, the annual summer PI surveys provided a lot of detail. For instance, the 2018 chemical treatment of EWM was the largest of the three years, and was extremely effective at taking out EWM. Unfortunately, it also took out most of the northern watermilfoil (NWM) at the same time. Prior to the 2018 treatment, this had not happened. The reasons it happened in 2018 are unclear, but none-the-less it happened and there was some concern over what the loss of all that NWM would do to the lake. As it happened, the NWM recovered very quickly the following year showing little difference in the amount of NWM from 2016 to 2019.

It is that fact that questions the benefit of the annual summer PI surveys. While quite a few changes were documented on an annual basis, by the time it was all said and done, three to four years later, the differences from start to finish were minimal. This suggests that a summer PI done every five years might have been just as good for determining changes over the long run, as doing the annual surveys was.

Without the annual summer PI survey, the traditional aquatic plant monitoring regime generally consists of a pre-treatment survey of pre-determined points in a proposed treatment area, followed by a post-treatment survey of the same points, followed by a fall meandering EWM bedmapping survey. A whole-lake PI survey would be completed every five or so years to determine overall changes in native aquatic plants. While this approach certainly is common place, this consultant questions the validity of doing the post-treatment survey, unless it is combined with a fall meandering survey.

It is expected that in the short-term, ie the one to two months between the pre-treatment and post treatment surveys, that the target plant will be negatively impacted. The bigger question is will the target plant remain "gone" through at least the fall of the same year, and more preferably through the next season. Chemical treatments in Sand Lake have mostly had the impact of controlling the EWM from pre to post. However, in certain areas, primarily along the deep water edges of the treatment areas, even keeping it down into the fall is difficult. This has been the issue with treatment in Sand Lake since it started. One way to address this would be to set up points only in the areas of the lake that are consistently problematic. We know where these are now. These points would not be tied to any treatment plan. They would however, be surveyed every year preferably in the fall to watch for long-term, statistically valid changes. At the same time, the fall EWM bedmapping survey would be completed providing the data needed to set up the following year treatment plan. Other than a spring treatment readiness survey, no other survey would be done on an annual basis.

PURPLE LOOSESTRIFE

Purple loosestrife is present at several locations around the lake. Gallerucella beetles have been release on the lake for many years, but if a self-replicating population exists, it is small. No purple loosestrife was identified in the 2016 summer survey, but 2017, 2018, and 2019 surveys found several locations scattered along the shoreline of the lake. From 2018 to 2019, the purple loosestrife was not found in any new locations along the lake shore (Figure 13). None of these areas were more than just a few plants, and in most cases, when found, the plants were cut or dug out. Despite this, purple loosestrife is still present suggesting that the lake has a seed bank already established and continual monitoring and removal is needed annually.

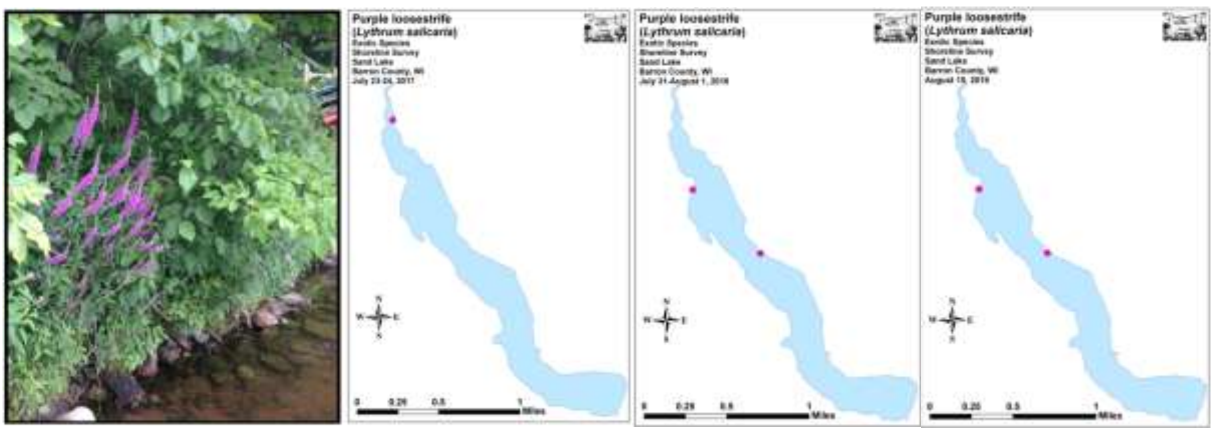


Figure 16: Purple loosestrife flowers and 2017, 2018, and 2019 locations (Berg, 2019)

CLEAN BOATS, CLEAN WATERS

Over the course of four years – 2016-2019, the Sand Lake Management District as put in more than 500 hours of CBCW inspection time at the WDNR landing on the lake. There were 208 hours of watercraft inspection time recorded at the Sand Lake public boat landing in 2019. Time recorded was put in by both paid and volunteer watercraft inspectors. At least 175 boats were contacted during this time. Approximately 309 people were contacted. Data recorded during watercraft inspection showed boats coming from 19 different lakes in the area in 2019 – 2 of these lakes have EWM in them (Beaver Dam & Rice).

AIS MONITORING

AIS monitoring was completed each year out of three (2016-19) with no new AIS being discovered in Sand Lake. Volunteers and resource personnel identified purple loosestrife and EWM during the surveys. Japanese knotweed had been present on the shore of the lake, but this was removed prior to 2016 and has not been seen since. There is no curly-leaf pondweed in Sand Lake. What could be Chinese Mystery Snails have been seen, but are few and far between. No rusty crayfish, zebra mussels, or spiny waterflea have been discovered.

In the fall of 2019, LEAPS completed an informal meandering visual survey of EWM in Sand Lake. EWM was found at only a few locations and then only as individual plants or small concentrations of plants (Figure 14). This is very similar to 2018 when EWM was found in problem areas, but very minimally outside of these usual suspect areas like Silo Bay or near the boat landing.

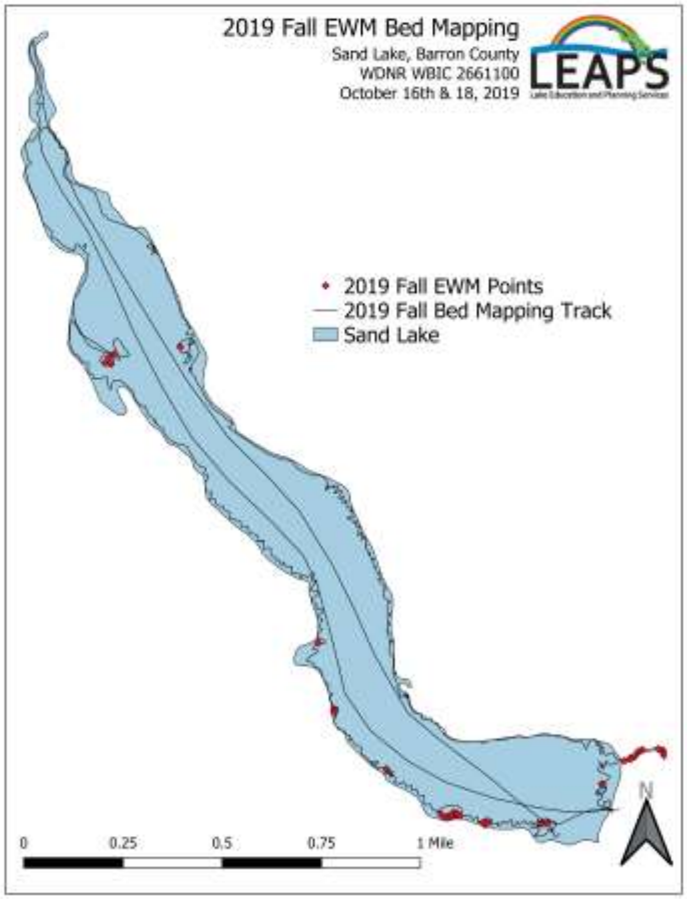


Figure 17: 2019 fall EWM meandering survey results

Based on results from the 2019 summer point-intercept survey of the littoral zone and the 2019 fall meandering survey, a preliminary treatment proposal was created in March 2020 that included 8 treatment areas ranging in size from 0.14 acres to 0.54 acres totaling 2.34 acres (Table 3). A treatment readiness survey will be completed prior to the application of any herbicides. Since the areas in the final treatment will likely be either small or in deep water, based on historic trends, granular 2,4-D (Sculpin G) will likely be used at the maximum label rate of 4.0ppm.

Table 3: 2020 Sand Lake Preliminary Spring EWM Treatment Proposal

2020 Sand Lake Prelimnary Spring EWM Treatment Proposal (3/18/2020)							
New Name	**Acres**	**Mean Depth (feet)**	**Acre-feet**	**Target 2,4-D (granular) (ppm a.e.)**	**Application rate (lbs/acre-feet)**	**Granular (lbs)**	**2019 Treatment Notes**
East Shr Boat Landing	0.15	12.00	1.80	4.00	65.40	117.72	Excellent control except on the deep water edge
South Shore Stump Bay	0.21	12.00	2.52	4.00	65.40	164.81	Excellent control except on the deep water edge
South Shore Tribal	0.32	9.50	3.04	3.50	57.23	173.98	new site in 2020
West Shore Elbow	0.14	8.00	1.12	4.00	65.40	73.25	Excellent control except on the deep water edge
Bikini Bay	0.18	8.00	1.44	4.00	65.40	94.18	Excellent control except on the deep water edge
Silo Bay Flat	0.54	12.00	6.48	3.50	57.23	370.85	Excellent control except on the deep water edge
East Shore Bay	0.29	12.00	3.48	4.00	65.40	227.59	new site in 2020
East Back Bay	0.51	5.00	2.55	3.00	49.05	125.08	new site in 2020
Total	**2.34**		**22.43**			**1347.45**	

There are three water quality monitoring sites in Sand Lake that are a part of the CLMN monitoring program. However, only the main site "Near Deepest Pt" in the southern-most basin had more than one set of data collected from it in 2019. In 2019, water clarity readings were collected at the deep hole on thirteen different dates. Chlorophyll data was collected on three dates, and TP date was collected on four dates. Figure 16 shows the average summer (July-August) Secchi disk readings since CLMN began. The 2019 average summer (July-Aug) Secchi disk reading for Sand Lake - Near Deepest Pt (Barron County, WBIC: 2661100) was 13.92 feet, somewhat higher than 2018. The average for the Northwest Georegion was 8.6 feet. Summer (July-Aug) water was reported as CLEAR and GREEN suggesting that the Secchi depth may be mostly impacted by algae. Algal blooms are generally considered to decrease the aesthetic appeal of a lake because people prefer clearer water to swim in and look at. Algae are always present in a balanced lake ecosystem. They are the photosynthetic basis of the food web. Algae are eaten by zooplankton, which are in turn eaten by fish.

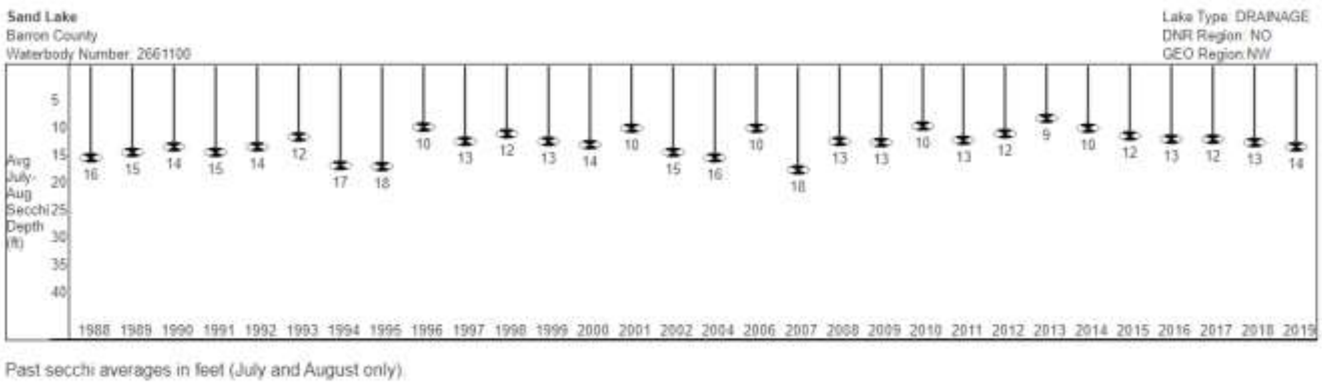


Figure 18: Average summer (July-August) Secchi disk readings at the Near Deepest Pt

Chemistry data was collected on Sand Lake - Near Deepest Pt. The average summer Chlorophyll was 4.9µg/l, an increase of 0.4µg/l from 2018 and 1.9µg/l from 2017. The Northwest Georegion summer average was 13.2µg/l. The summer total phosphorus average was 14.4µg/l. This a decrease of 2.3 µg/l from the values seen in 2018, and 5.6µg/L less than the vales seen in 2017. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticeable algae blooms.

Figure 17 shows the average summer Trophic State Index (TSI) value for total phosphorus, chlorophyll, and Secchi disk readings. The overall Trophic State Index (based on chlorophyll) for Sand Lake - Near Deepest Pt was 47. This TSI suggests that Sand Lake - Near Deepest Pt was mesotrophic. Mesotrophic lakes are characterized by moderately clear water, but have an increasing chance of low dissolved oxygen in deep water during the summer. These conditions accurately describe Sand Lake in 2019.

Trophic State Index Graph: Sand Lake - Near Deepest Pt - Barron County

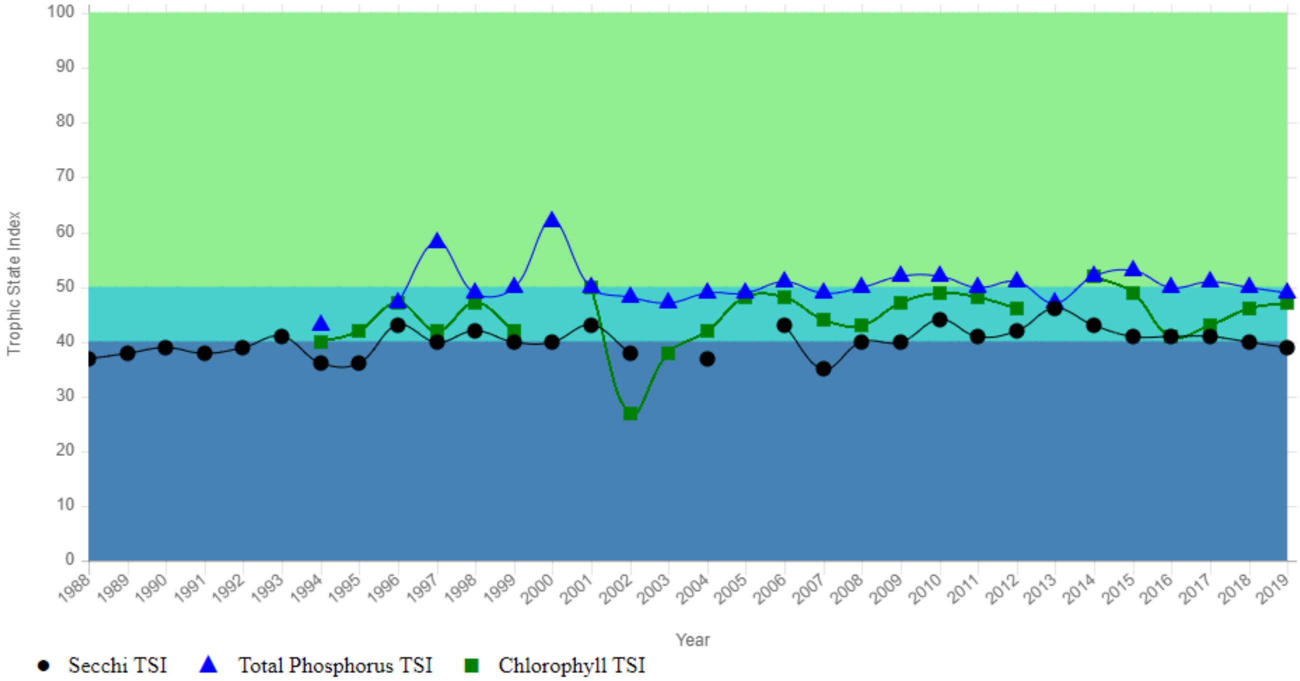


Figure 19: 1988-2019 Summer (July and August) TSI values for total phosphorus and chlorophyll-a at the Near Deepest Pt on Sand Lake

GRANT FUNDED PROJECTS AND GRANT APPLICATIONS

2019 is the third year included in the ACEI grant awarded in 2017. There will be one more summer PI survey and then comparisons can be made across a four year period of management. At that point it will be determined if the summer PI approach to EWM mapping is any better or worse at guiding management and if it does a better job of tracking changes in the native aquatic plant community.

The Lake Protection Grant to cover the repair of the NW Wash was again extended through the end of 2019 to accommodate additional runoff monitoring in it. Monitoring results from 2018 and 2019 will be used to determine if a repair or improvement project is necessary in the NE Wash. Water was moving through the NE wash from April through the middle of June in 2019 so several samples, flow measurements, and cross-sections were recorded.

LAKE FAIR AND ANNUAL MEETING

Every year the SLMD holds a picnic/lake fair event to focus on AIS and other actions being completed by the Lake District. In 2019, the picnic was cancelled, but SLMD did hold a lake fair in conjunction with its annual membership meeting. This event was held on August 24, 2019 at 10:00am in the Maple Plain Town Hall. Approximately 25 people were in attendance at the meeting.

Respectfully Submitted by LEAPS on June 25, 2019

REFERENCES

Berg, M. (2019). *Warm-water Point-intercept Macrophyte Survey – Sand Lake WBIC: 2661100 Barron County, WI*. St. Croix Falls, Wisconsin: Endangered Resource Services, LLC.