Aquatic Vegetation Survey 2020
Larks Lake

by

Tip of the Mitt Watershed Council

Survey performed and report written by Tip of the Mitt Watershed Council

Funded by the Petoskey-Harbor Springs Area Community Foundation

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Introduction

Aquatic plant communities are an important aspect of lake ecosystems. Submerged macrophytes provide food and shelter for other organisms within the ecosystem, such as fish and invertebrate communities. Like almost all plants, macrophytes supply oxygen to the system via photosynthesis. Macrophyte photosynthesis can also potentially reduce eutrophication in lakes by utilizing large amounts of nutrients, which decreases nutrient availability to phytoplankton (Canfield *et al*. 1984). By reducing the amount of nutrients in the water column, aquatic plants decrease the likelihood of algal blooms. Macrophytes also reduce effects of water turbulence (Canfield *et al*. 1984), which means that shoreline and nearshore vegetation can help prevent erosion.

Lake ecosystems that have do not have healthy and abundant macrophyte communities are less biologically diverse due to the lack of habitats and food resources on which organisms rely. Typically, fewer macrophyte communities also corresponds with greater nuisance algae populations and increased erosion of the shoreline. Reduced native plant communities also allow invasive species, such as Eurasian watermilfoil (*Myriophyllum spicatum)*, to dominate the ecosystem, which could further change the community structure.
Despite all the benefits of aquatic plant communities, an overabundance of species, especially invasive species, can be detrimental to lake ecosystems. Excessive plant growth can disrupt recreational uses of the lake, such as boating, fishing, and swimming, as well as ecosystem functions. Lakes that contain excessive nuisance plant growth can require management programs to control the effects of the plant community on the ecosystem.

Management of aquatic plant communities is important to maintain a stable lake ecosystem. Aquatic plants surveys are a way to understanding the macrophyte community by recording plant species, abundance, density, and the presence of invasive species.

In 2019, Tip of the Mitt Watershed Council received a grant from the Petoskey-Harbor Springs Area Community Foundation to conduct a comprehensive survey of aquatic plant species on Larks Lake and map vegetation communities using a drone. A “spot-check” of vegetation on

Pickerel and Crooked Lakes was also part of the project. This report covers work conducted on Larks Lake. One previous aquatic plant survey was conducted on Larks Lake in 2009.

Study Area

Larks Lake is located in the center of Emmet County, Michigan, in Center Township. The lake covers 600 acres and has a small watershed of just over eight square miles. The lake's 4 miles of shoreline are characterized by long stretches of natural vegetation, small cabins, a few road ends, and a township park called Pioneer Park. Most of the lake is about 4 feet deep, however the deepest spot is 9 feet in the southwestern part of the lake. There is one outlet, Brush Creek, also on the southwestern part of the lake. Brush Creek connects Lark Lake to the West Branch of the Maple River and the greater Burt Lake Watershed.

Methods

The survey was conducted over 6 days between July 8, 2020 and August 4, 2020. Plant samples were collected using grappling rakes (made by attaching the head of a double-sided bow rake to a rope). Visual assessments from boats and drones aided in mapping and identifying plant communities. Individual data points were captured on iPads using Survey123 for ArcGIS. Survey123 collects quantitative, qualitative, and spatial information that makes creating, sharing, and analyzing surveys easy. Specimens were collected, identified, photographed, and recorded into Survey123 forms. Outlines of plant communities or areas without vegetation were mapped using ArcCollector.

A total of 112 sites were sampled through all vegetated lake areas (Figure 1). Sample sites were chosen as close to the middle of plant communities as possible. Where communities were larger than what could be sampled at a single sample point, multiple samples were collected in the interior and edges of plant communities. At each sample site, the boat was anchored, most of the time with two anchors. A new Survey123 form was opened after anchoring at the site on an iPad, which used cellular signal from cell phone hot spots to acquire GPS coordinates automatically. Survey123 geopoints have a precision range of one square meter. Grappling hooks were used as sampling devices and thrown in four directions from the boat to obtain a sufficient sample. When possible, a visual assessment of the site was used to ensure that all plant species were

accounted for. Specimens sighted in the water that were not represented in the grappled samples were noted in observations and included in density estimations.

Most vascular plant specimens were identified to the species level except for some certain species of bulrush, naiad, chara, and burr-reed. All species present were recorded and estimated to one of seven possible density categories using the following subjective scale: 1- Very Light; 2- Light; 3- Light/Moderate; 4- Moderate; 5- Moderate/Heavy; 6- Heavy; 7- Very Heavy. The same scale was used to determine the overall density for a site using Very Light to indicate only a few stems and Very Heavy to indicate plants reaching the water's surface. If multiple throws at a site with visible plants resulted in no specimens, that site was documented as having little to no vegetation and assigned a scale value of 0. No vegetation rake was thrown in areas where there was no visible vegetation. All specimens were identified in the field.

Survey123 automatically created a Graphic Information System (GIS) shapefile with all information from the survey forms. The sample point layer was overlaid with an aerial map of Larks Lake and the surrounding area to display survey results. Density data for each sample point were displayed on the map to assess patterns and trends.

Line and point features, as well as photographs and field notes, were used to create polygons representing distinct plant communities. Plant community polygons were determined based on like characteristics in a lake area's plant assemblage and density. Attributes for plant community polygons included density, dominant community, other species present, and community description.

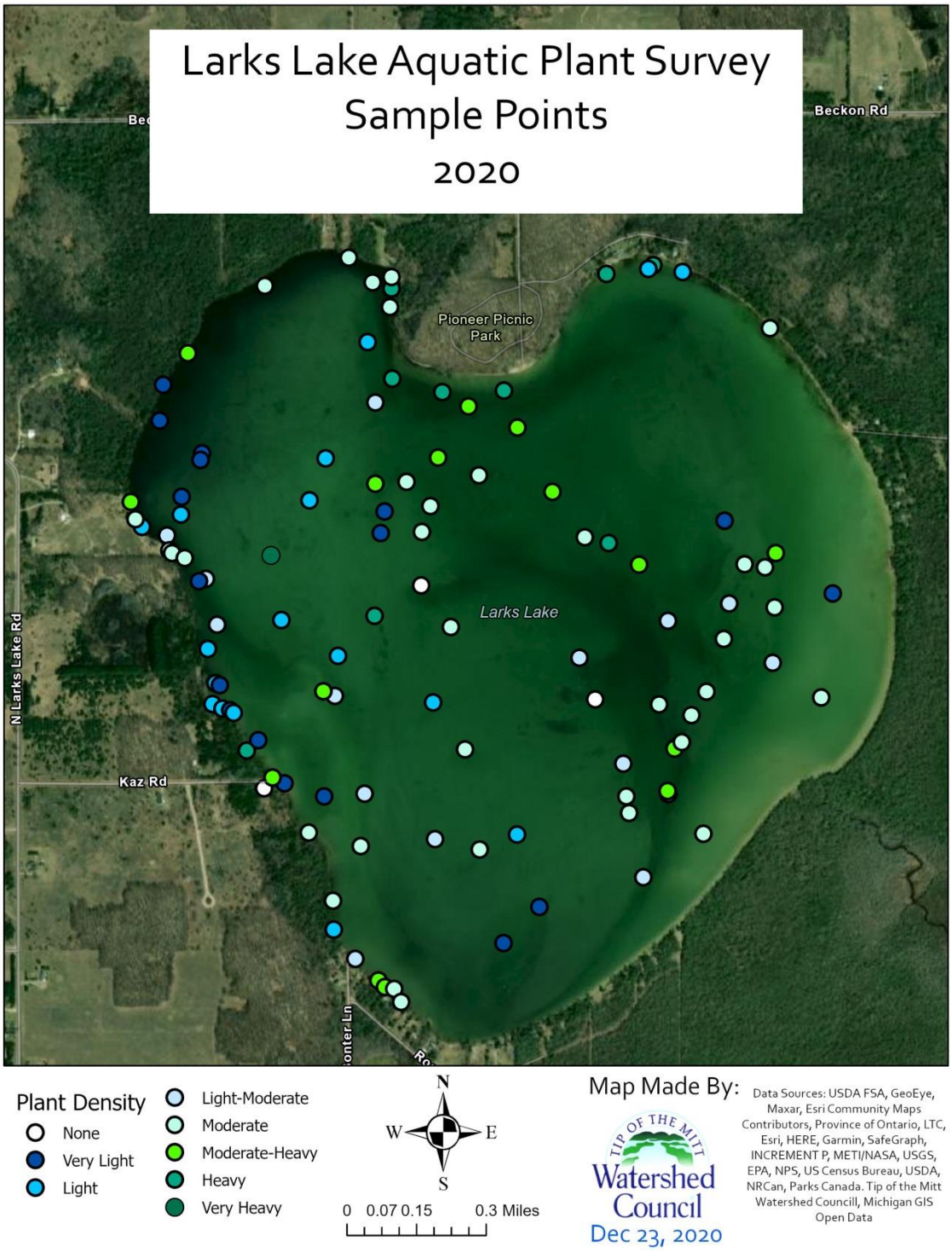

Figure 1. Locations of sample points and community density at each point.

Results

Larks Lake was comprehensively surveyed to document current aquatic plant species and communities, with a particular emphasis on documenting the presence of Eurasian watermilfoil, Phragmites, or other invasive aquatic plant species.

Sample Sites: Species and Density

24 different plant taxa were found in Larks Lake. The most commonly found plant was naiad (*Najas spp.),*found at nearly 40% of sites (Table 1). Muskgrass and variable-leaf pondweed were also commonly found at 25% and 23% of sites respectively. Wild rice (*Zizania palustris* or manoomin in the Odawa language Anishinaabemowin) is a culturally significant food for the Little Traverse Bay Bands of Odawa Indians (LTBB). It was found at 20 sites in Larks Lake. Previous surveys by the Watershed Council did not mention wild rice and there could be multiple reasons. Wild rice may have been scarce in Larks Lake prior to LTBB planting efforts throughout the 2000s. Surveyors may not have been familiar with the species also.

No invasive plants were found besides invasive cattail and invasive *Phragmites*. Invasive cattail is fairly common in Northern Michigan and hard to eradicate. Once invasive *Phragmites* was found, efforts were made by Larks Lake Association and the Watershed Council to treat with herbicides. Herbicides were applied by Wildlife and Wetland Solutions in 2020 and will likely have to be applied in future years. Purple loosestrife was not documented in the survey, however it's presence along the eastern shore is well known and currently being mechanically removed and treated with the biological control *Galerucella* beetles. Low water levels prevented watercraft from reaching known purple loosestrife areas.

Table 1. Plant taxa freqency found in Larks Lake 2020

Latin Name	Common Name	Sites Found	Percent of Sites Found
Najas spp.	Naiad	43	38.39
Chara spp.	Muskgrass	28	25.00
Potamogeton gramineus	Variable-leaf pondweed	26	23.21
Zizania palustris	Wild rice	20	17.86
Schoenoplectus spp.	Soft/hardstem bulrush	13	11.61
Myriophyllum sibiricum	Common watermilfoil	11	9.82
Stuckenia pectinata	Sago pondweed	9	8.04
Potamogeton amplifolius	Large-leaved pondweed	8	7.14
Potamogeton illinoensis	Illinois pondweed	8	7.14
Typha latifolia	Invasive cattail	6	5.36
Schoenoplectus pungens	Common threesquare	6	5.36
Phragmites australis ssp. americanus	Native *Phragmites*	4	3.57
Juncus balticus	Baltic rush	4	3.57
Valisneria america	Eel grass	3	2.68
Equisetum fluviatile	Horsetail	3	2.68
Typha angustifolia	Native cattail	2	1.79
Asclepias incarnata	Swamp milkweed	2	1.79
Nuphar variegata	Yellow pond lily	2	1.79
Lycopus americanus	Bugleweed	2	1.79
Phragmites australis ssp. Australis	Invasive *Phragmites*	1	0.89
Saggitaria latifolia	Arrowhead	1	0.89
Sparganium spp.	Burr-reed	1	0.89
Myrica gale	Sweetgale	1	0.89
	Total		112

The majority of sites had moderate plant density (Table 2). Few sites had very heavy or heavy density.

Table 2. Plant density at sample sites in Larks Lake 2020

None	3
Very Light	17
Light to Moderate	14
Moderate	35
Moderate to Heavy	15
Heavy	10
Very Heavy	1
Total	112

Plant Communities and Density

Plants covered 36% of the lake in this survey, which is an increase from 34% in 2009 (

Table 3). Naiad was the most dominant plant community. It accounted for 120.11 acres in areas where it was the sole dominant species. An additional 9 acres of the lake was covered by naiad mixed with other plant species. Naiad accounts for 60% of the lake's vegetated areas, which is a decrease from 70% in 2009. The next most dominant plant species were muskgrass and pondweed. Of the lake area with vegetation, 36% was covered in very heavy to heavy vegetation, the same amounts as 2009 (

Table 4). The densest vegetation was concentrated to the southeast of Pioneer Park and mostly consisted of large populations of naiad (Figure 2Figure 3).

Table 3. Plant taxa distribution in Larks Lake 2020.

Common Name	Acres	Percentage of Total Plant Acreage	Percentage of Total Lake Area
Naiad	120.11	54.92	20.02
Muskgrass	57.64	26.35	9.61
Naiad and Pondweed	11.31	5.17	1.89
Pondweed	11.44	5.23	1.91
Common threesquare	6.26	2.86	1.04
Bulrush Mix	4.98	2.28	0.83
Muskgrass and Pondweed	2.29	1.05	0.38
Wild rice and naiad	1.03	0.47	0.17
Bulrush and muskgrass	0.96	0.44	0.16
Muskgrass and Bulrush	0.78	0.36	0.13
Bulrush and naiad	0.51	0.23	0.08
Milfoil and Pondweed	0.22	0.10	0.04
Muskgrass and Bladderwort	0.22	0.10	0.04
Wild rice	0.21	0.09	0.03
Yellow Pond Lily and Pondweed	0.18	0.08	0.03
Bulrush Mix and Pondweed	0.14	0.06	0.02
Invasive Cattail	0.13	0.06	0.02
Native Cattail	0.11	0.05	0.02
Native *Phragmites*	0.07	0.03	0.01
Horsetail	0.04	0.02	0.01
Wild rice and pondweed	0.03	0.01	0.00
Invasive *Phragmites*	0.02	0.01	0.00
Swamp Milkweed	0.02	0.01	0.00
Arrowhead	0.01	0.00	0.00
Yellow Pond Lily	0.01	0.00	0.00
Total	218.7	0.00	36.45

Table 4. Density of plant communities in Larks Lake 2020.

Density Category	Acres	Percentage of Total
Very Light	57.44323	26.26466
Light	22.06848	10.09033
Light to Moderate	30.44574	13.92065
Moderate	27.68685	12.6592
Moderate to Heavy	38.05783	17.40111
Heavy	32.83133	15.0114
Very Heavy	10.17578	4.652653
Total	218.7093	100

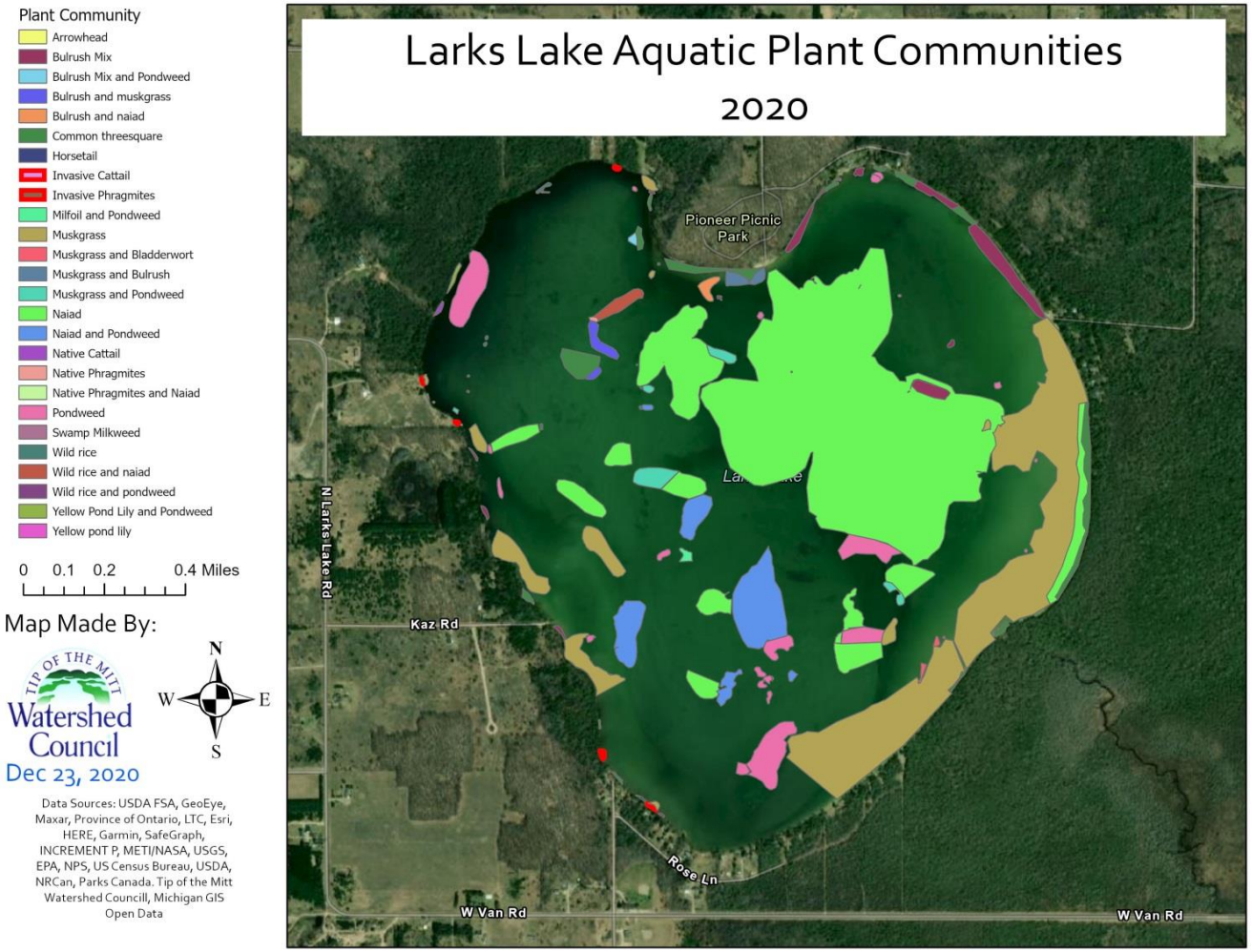

Figure 2. Plant community distribution in Larks Lake 2020.

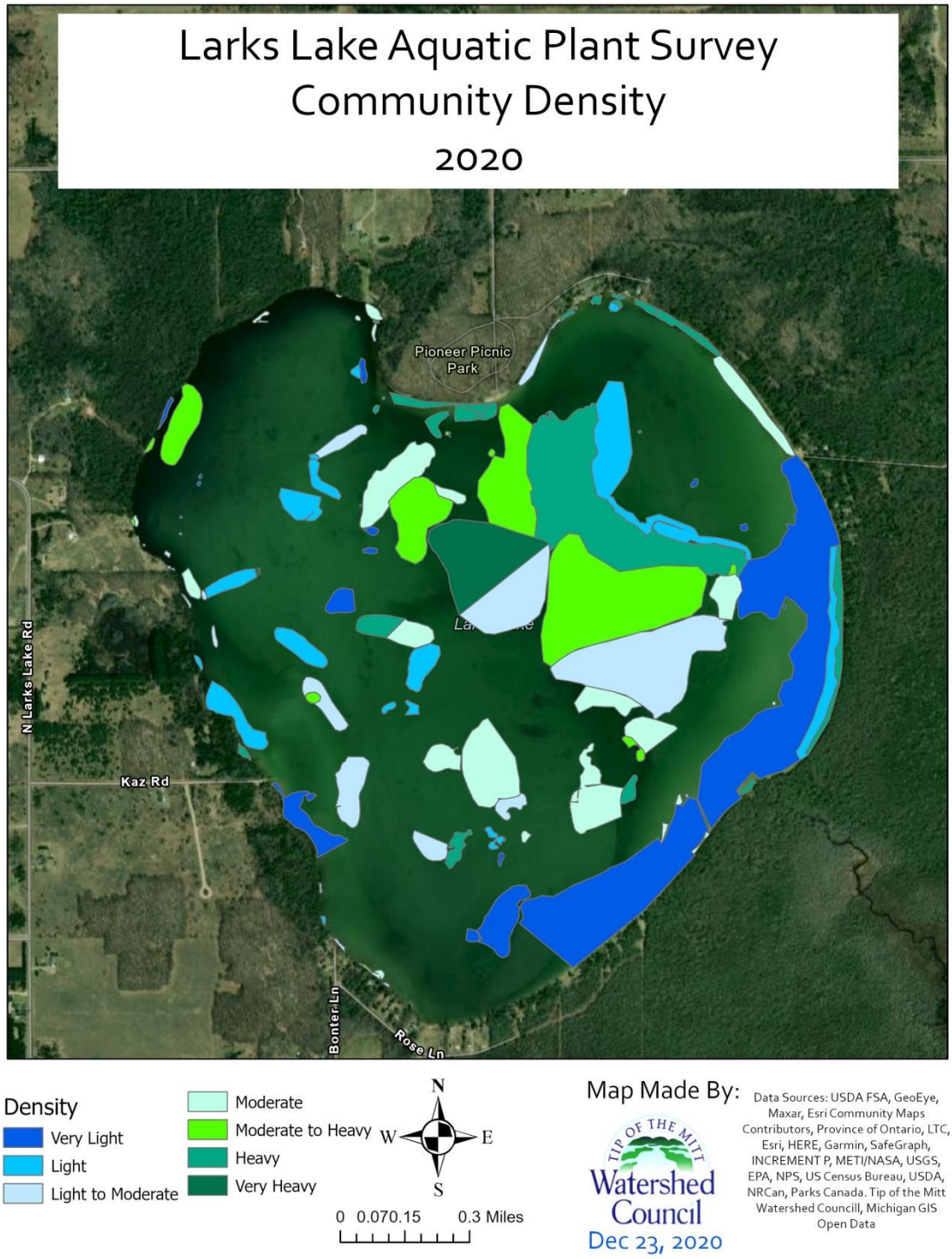

Figure 3. Plant community density in Larks Lake 2020.

Comparison to Other Lakes

Tip of the Mitt Watershed Council has performed plant surveys on 17 other lakes in Northern Michigan since 2005. Larks Lake was below average in all categories of comparison. It has fewer total taxa in the lake, fewer total taxa per sampling site, a smaller vegetated area, and fewer densely vegetated sites. Larks Lake is a marl lake, which means its substrate is mainly clay mixed with calcium carbonate. This is typical of lakes with limestone bedrock and it also caused by decomposing algae. The abundance of muskgrass (an alga) and the lake's geology are likely causes of its substrates. Lakes with marl substrates lack organic matter and thus nutrients to support plant life. While the lake's substrate causes a lack of vegetation and less habitat for fish and other aquatic life, it is not abnormal or concerning. In fact, the lake's lack of vegetation could be pleasing to swimmers and riparian landowners. The absence of excess nutrients could prevent invasive species from quickly multiplying if established.

Table 5. Comparison of vegetation surveys conducted in Northern Michigan.

Lake Name	Survey Year	Lake Size (acres)	Max Depth (ft)	Total Taxa In Lake	Taxa Average Per Site	Vegetated Lake Area	Densely Vegetated Sites[†]
Adams	2010	43	18	27	4.9	99%	66%
Bellaire	2013	1810	95	27	2.9	18%	8%
Black	2014	10,133	50	38	3.9	18%	15%
Clam	2013	446	27	28	4.1	69%	43%
Crooked	2008	2,351	50	28	2.8	56%	13%
Hanley	2014	89	27	29	6.3	94%	34%
Intermediate	2014	1,570	70	30	2.7	23%	1%
Larks	2020	600	9	24	1.8	36%	10%
Long	2013	398	61	30	3.9	29%	11%
Douglas	2019	3,780	80	22	5.7	22%	33%
Millecoquins	2005	1,116	12	20	6.0	95%	61%
Mullett	2007	17,205	144	42	3.1	19%	13%
Paradise	2008	1,947	17	24	5.0	58%	28%
Pickerel	2008	1,083	70	20	1.5	24%	5%
Skegemog	2014	2,766	29	30	2.2	67%	0%
Walloon	2013	4,620	100	32	1.8	22%	3%
Wycamp	2006	689	7	35	4.9	83%	24%
AVERAGE	NA	NA	NA	29	3.9	50%	22%

**All surveys performed at least in part by TOMWC.*
[†]Includes sites with plant density classified as heavy or very heavy.

Drone Imagery

In addition to a traditional boat/kayak vegetation survey, drone aerials were also captured to aid in determining the extent of vegetation. When this project was first conceived, it did not factor in the requirements of capturing aerial imagery to compose a comprehensive map. Throughout this project, Watershed Council staff discovered the need for images to have a certain amount of overlap and angle, which can only be collected properly through use of a mapping program installed on the drone's controller (e.g. are Pix4d, DroneDeploy, Ground Station Pro, etc.). Beyond capturing the images, a second piece of computer software is needed to analyze the images, stich them together,

and create a map (e.g. Pix4d, Terra, MapsMadeEasy). The Watershed Council had neither the controller that could perform mapping operations nor the computer software that could process images at the time of the aerial survey. It is very difficult for computers to process maps of water because of the constantly changing surface and the inability for the computer to detect patterns. In addition to these challenges, weather was also an obstacle. A drone can normally operate in wind 7 mph or less. Any ripple on the water reduces visibility and ideally wind of less than 3 mph is desirable. The time of day is also an important factor. Capturing aerial imagery when the sun is directly overhead reduces shadows.

With the weather and software limitations, staff chose to fly on a sunny day in October with low winds around 300-400 feet high. 99 images were taken around Larks Lake. Captured drone imagery was processed by MapsMadeEasy. Only four were able to be stitched together by mapping software. The plants on the aerial are likely naiad and many individual images showed prop scars along the lake's surface.

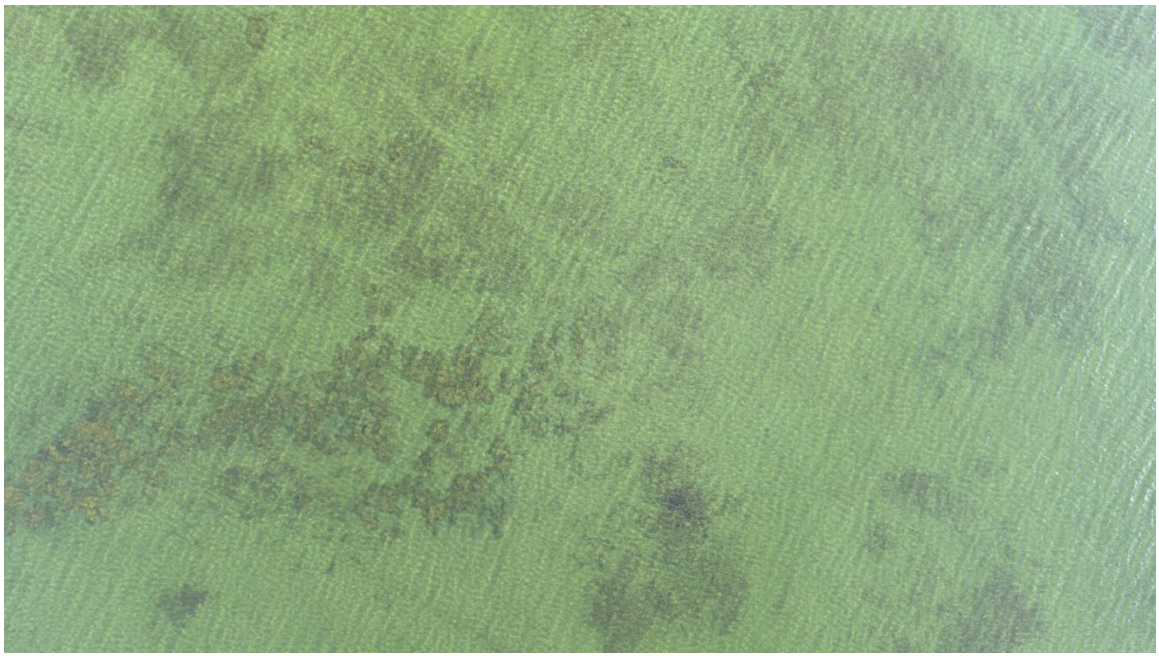

Figure 4. A community of large-leaved pondweed (*P. amplifolius*) seen from above.

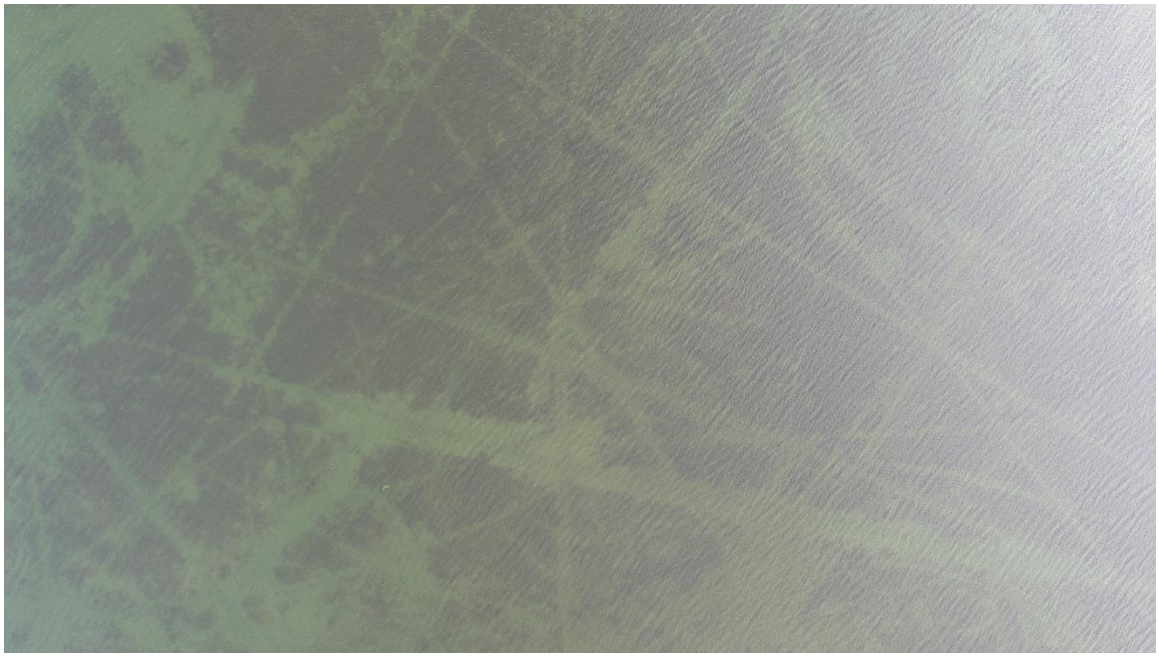

Figure 5. A community of naiad (*Najas spp.*). Notice the lighter-colored linear patches, likely scars from boat props.

Figure 6. Drone images collected on Larks Lake (October 30, 2020).

Recommendations

1. Share the results of the survey with the Charlevoix, Antrim, Kalkaska, Emmet (CAKE) Cooperative Invasive Species Management Area (CISMA), Larks Lake Association, Burt Lake Watershed Advisory Committee, and Little Traverse Bay Bands of Odawa Indians.

2. Provide information to riparian land owners from local and state-wide invasive species and landscape practices resources, for instance, the MI Shoreland Stewards program.

3. Encourage Larks Lake Association board members and riparian land owners to attend educational programs about invasive species and lake health.

4. Larks Lake Association should become a partner in the CAKE CISMA.

5. Maintain invasive species signage and handouts at boat launches.

6. Continue working with mobile boat wash station groups such as Tip of the Mitt Watershed Council and Clean Boats, Clean Waters to offer boat wash station and education opportunities.

7. Use the Midwest Invasive Species Information Network app to report sightings on invasive species.

8. Maintain a crew of volunteers that can respond to invasive species concerns around the lake and particularly monitor the boat launch.

9. Continue efforts to treat small patches of invasives such as purple loosestrife and *Phragmites*. Invasive species in Larks Lake are concentrated around the shoreline, likely as a result of landscaping practices or accidental transportation by landowners.