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Little Traverse Lake
2021 Lake Biologist AIS
Final Report

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Aquatic Invasive Species

Task Description #1

Submergent Aquatic Vascular Plant Survey

All aquatic vascular plants and macrophytic algae will be identified and documented to genus along with their relative abundance at known plant beds along the drop-off zone. The rake toss method will be employed at up to 15 sites around the lake. Results will be compared to 2020 field work to monitor changes. Detection of highly invasive Eurasian Watermilfoil (*Myriophyllum spicatum*) and Starry Stonewort (*Nitellopsis obtuse*) will be a priority.

We conducted the rake-toss vascular aquatic plant survey on 29 June (please see the 2020 Final Report for methods). The same survey sampling protocol at the same locations was conducted in 2020 on 30 July, almost a month later. Although this year's date doesn't provide for an exact comparison, we wanted to see if there were any temporal differences in the vascular plant community on LTL. We did notice minor year-to-year variations at some locations. However, we believe those differences were due to sampling earlier in the growing season in 2021. The good news was that no invasive species were found using the rake-toss method.

Table 1: 2020/2021 Aquatic Vascular Plants and Macroscopic Algae Comparison

2020/2021 Plant Survey Comparison		**Site**														
Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Chara contraria	Common stonewort	4/4	4/4	2/3	4/4	3/1	4/4	3/4	4/4	3/4	2/4	4/4	3/4	4/3	3/4	4/4
Cladophora sp.				1/0		1/0										
Ludwigian polycarpa	False Loosestrife	1/0														
Myriophyllum sp.	Whorled/Northern watermilfoil		1/0	0/1				1/0			4/2				0/1	
Najas flexilis	Slender naiad	3/1	3/0					1/0							2/0	4/0
Nymphaea adorata	White Water Lily	1/1														
Potamogeton alpinus	Alpine Pondweed	1/0						1/0		2/0	1/0		2/0			4/1
Potamogeton foliosus	Leafy Pondweed	1/0													1/0	
Potamogeton gramineus	Variable Pondweed	1/1											2/1			0/1
Potamogeton natans	Floating Pondweed	2/1						0/1								
Potamogeton sp.	Pondweed												1/0			
Sagittaria cuneata	Arum-leaved Arrowhead							1/1								1/1
Stuckenia pectinata	Sago Pondweed	1/0					1/1	1/2		1/1			0/3		0/1	1/1
Vallisneria americana	Water Celery	1/0	1/0					1/1		4/4			4/1	0/1	3/0	4/3
	Unknown Woody															1/1

Table 2: 2020/2021 Rake Toss Collection Locations with Depth/GPS Coordinates

Site	Depth	Latitude	Longitude
1	3 ft	44.9242735	-85.8628616
2	10-12 ft	44.9240743	-85.8607099
3	15-17 ft	44.9241102	-85.8534748
4	7-10 ft	44.9251307	-85.8446591
5	9-10 ft	44.926034	-85.8389852
6	6-10 ft	44.9286036	-85.8282373
7	4-6 ft	44.9292984	-85.8274205
8	9-12 ft	44.9230602	-85.831246
9	10-12 ft	44.9212014	-85.8342907
10	7-8 ft	44.9207052	-85.83573
11	10-12 ft	44.9191158	-85.8423856
12	5 ft	44.91871	-85.8507742
13	16 ft	44.9209735	-85.8542208
14	5-6 ft	44.9236732	-85.8613981
15	3-4 ft	44.9188622	-85.832398

Diagram 1: 2020/2021 Rake Toss Collection Locations Google Earth

Task Description #2

Microscopic Algal Community Survey

Four (4) plankton tows will be conducted, 3 horizontal surface pulls and one vertical deep water pull. Common microscopic phytoplankton and zooplankton will be identified and

documented to genus along with their relative abundance. Results will be compared to 2020 field work to monitor changes.

As noted in 2020, microscopic organisms, including algae, rotifers and arthropods are important organisms in a lake ecosystem. Algae, along with submergent plants and photosynthetic bacteria, are the base of most aquatic food webs and their presence ultimately allows birds, fish and other animals to live in and around the lake. Zooplankton and phytoplankton were collected on 28 July at the same locations sampled in 2020 using the same protocol (please see the 2020 Final Report for methods). An additional tow was conducted in 2021 on 14 July.

We spent several hours on a day in July with Dr. Rex Lowe, noted freshwater phycology expert from Bowling Green, at the University of Michigan Biological Station examining our plankton collections from Little Traverse, Lime, and Glen Lakes. This time turned into a short "refresher course" for us and further validated our findings. In general, samples from Little Traverse Lake appeared more diverse than samples from either Lime Lake or Glen Lake. Organismal diversity is considered a good thing for most aquatic and terrestrial ecosystems.

As you can see from Table 3, we observed some similarities and differences from this two-year data set (numbers represent relative abundance from 1-5). It is much too early to draw conclusions about trends with such a short duration study, but this archived data can be used to observe trends in future years. For example, Peridinium sp. was the most abundant algae present in the plankton tow composite sample for the second year in a row. This algae is completely healthy and we will continue to monitor these algal trends. Please refer to the 2020 Final Report for pictures of common plankton observed.

Table 3: 2020/2021 Plankton Tow Comparison

Type	Classification	Tow Date				
		Vertical 7/30/20	Tows 7/30/20	Tow 7/14/21	Tows 7/28/21	Vertical 7/28/21
Aphanocapsa sp.	Algae - Blue Green			4	4	2
Merismopedia sp	Algae - Blue Green	2	3	2	1	2
Microcystis aeruginosa	Algae - Blue Green	4	3	4	3	2
Asterionella sp	Algae - Diatom	3				
Cyclotella sp	Algae - Diatom			1	1	
Cymbella sp	Algae - Diatom	1				
Fragularia sp.	Algae- Diatom	2	3	4		
Navicula sp	Algae - Diatom	1	1		1	
Pinnularia sp	Algae - Diatom				1	
Pleurosigma sp	Algae - Diatom	1				
Synedra nana	Algae - Diatom	3	2			
Synedra capitata	Algae - Diatom	2				
Tabellaria sp	Algae - Diatom	1				
Ceratium hirundinella	Algae - Dinoflagulate	3	4	2	2	1
Peridinium sp	Algae - Dinoflagulate	5	5	2	5	2
Chlorococcus sp	Algae - Green		3		1	1
Chroococcus sp	Algae - Green	3	2		3	
Cosmarium sp.	Algae - Green		1			
Euglena	Algae- Green			1		
Mougeotia sp	Algae - Green		1	1		
Pediastrum simplex	Algae - Green	2	3	1	2	1
Scenedesmus sp	Algae- Green	2		1	1	1
Spirogyra sp	Algae - Green		1	1		
Zygnema sp	Algae - Green			1		
Chrysosphaerella sp	Algae - Yellow Green			1		1
Dinobryon cylindricum	Algae - Yellow Green	2	3			1

Diagram 2: 2020/2021 Plankton Tow Locations

Task Description #3

Shoreline/Shallow Water Emergent Plant Survey

The entire shoreline will be assessed and the presence of all emergent and floating aquatic vascular plants will be identified and documented to genus along with their relative abundance. The presence of invasive Purple Loosestrife (*Lythrum salicaria*), Yellow Flag Iris (*Iris pseudacorus*) and other invasive species will be assessed.

We conducted four (4) shoreline/shallow water emergent plant surveys in 2021, the first two on 8 June and 15 June looking specifically for Yellow-flag Iris (YFI), one on 16 July surveying all plants, and the last on 15 August looking specifically for Purple Loosestrife (PL). The only two invasive species we found, other than Narrow Leaf Cattail, which is invasive but generally not considered a threat, were YFI and PL.

During our surveys we consistently noted Golden Algae communities, especially along the north shore, and increasing amounts of filamentous green algae concentrated especially along the SSW section of the lake. Recent literature indicates that filamentous algal blooms (FABs) are becoming more and more prevalent in oligotrophic lakes in northern Michigan where it has rarely been observed in the past (https://academic.oup.com/bioscience/advance-article/doi/10.1093/biosci/biab049/6307421). More research will be required to determine causes and possible control measures. For now, we simply note it for the record and will continue to monitor in future years.

Table 4 shows the GPS coordinates (from our boat directly offshore) of the YFI. We took photographs of each site from the boat for documentation purposes. Those pictures will be made available to the LTLA AIS task force chair upon request. Since we surveyed for this invasive after the flowering season in 2020, we are not certain whether this invasive plant is increasing its presence on LTL. Regardless, we recommend developing a plan for eradication.

Table 4: Yellow-flag Iris Colonies

LTL 6-15 Yellow-flag Iris Shoreline Survey Pics 2021		
Site #	**GPS Lat**	**GPS Lon**
1	44.924351	-85.863318
2	44.922869	-85.862255
3	44.918790	-85.852925
4	44.916726	-85.848708
5	44.916348	-85.845881
6	44.917622	-85.838742
7	44.921055	-85.828749
8	44.927796	-85.822095
9	44.928489	-85.831315
10	44.927546	-85.837091
11	44.925003	-85.853317
12	44.925034	-85.853577
13	44.924726	-85.856475

Table 5 shows the GPS coordinates (from our boat directly offshore) of the PL. We took photographs of each site from the boat for documentation purposes and are also available to the LTLA AIS task force chair upon request. We did observe a marked decrease in PL at the very western edge of LTL where there was an established population in 2020. Apparently, eradication efforts are underway and effective. We did, however, observe more sites with PL and one site in the SW section had grown noticeably larger.

Table 5: Purple Loosestrife Colonies

LTL PL Shoreline Survey 2021		
Site #	**GPS Lat**	**GPS Lon**
1	44.921655	-85.858339
2	44.921517	-85.857633
3	44.917857	-85.850750
4	44.917683	-85.850213
5	44.917331	-85.849307
6	44.917024	-85.848527
7	44.916844	-85.847899
8	44.916774	-85.847057
9	44.919793	-85.831205
10	44.924550	-85.856050
11	44.924464	-85.858371
12	44.923604	-85.862590

Task Description #4

Drone Shoreline Footage Analysis

The 2020 drone footage of the entire LTL shoreline conducted by Zero Gravity Aerial (Dennis Wiand) will be analyzed and cataloged for the following: beach sanding, detectable algal growth, drain pipes, erosions, greenbelts, inlets, lake water irrigations, natural shoreline, no greenbelt, riprap, seawalls, terrestrial invasive species. Screen shots of each will be cataloged and filed. A separate report will be generated early in the season to facilitate 2021 summer field work.

This work was completed in the spring and presented to the LTLA in May, 2021. Please see the submitted report entitled "*2020 Little Traverse Lake Drone Shoreline Survey Analysis Report*".

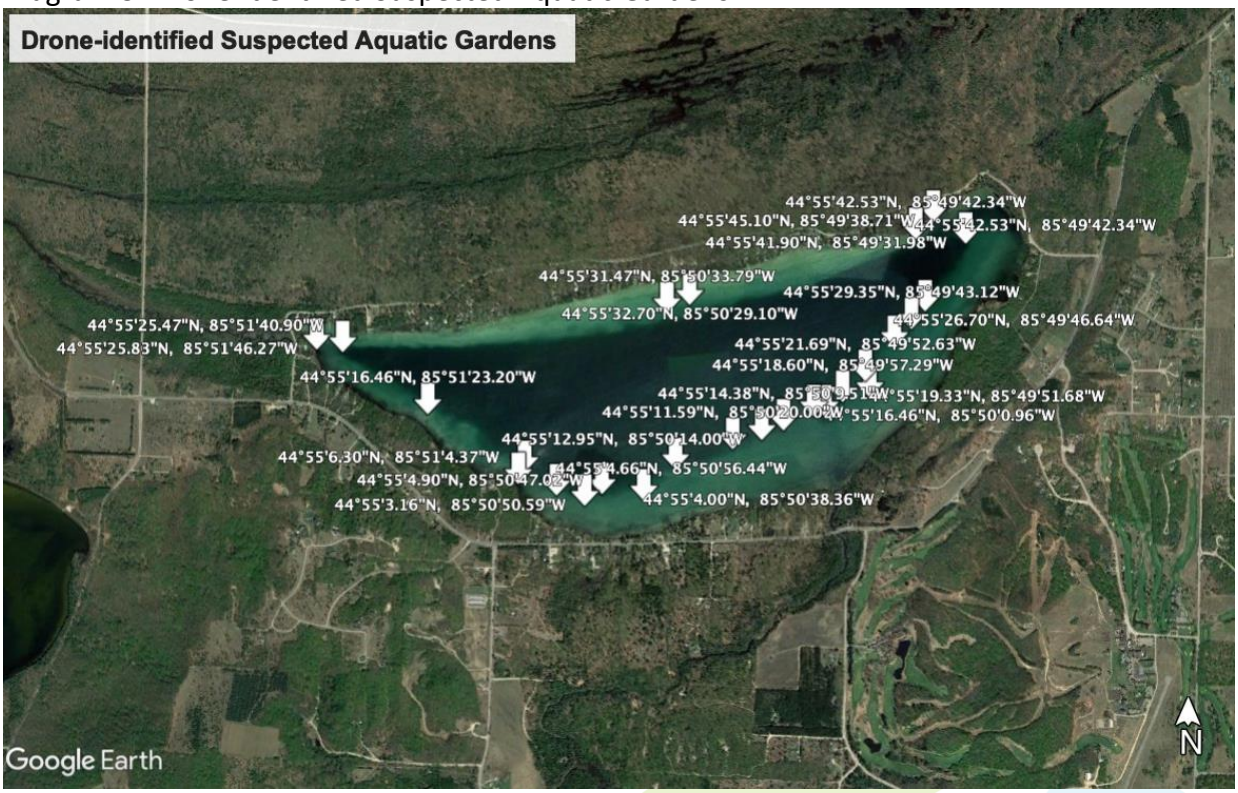
Task Description #5

Drone High Altitude AIS Footage & Analysis

FWS Biologists will work in collaboration with Zero Gravity Aerial to map and analyze all aquatic gardens ('weed beds") mid-summer. Ground-truthing of all major gardens will take place once drone footage has been obtained and analyzed.

Dennis Wiand of Zero Gravity Aerial conducted a high flyover of the entire shoal area on LTL on 26 July. For each suspected aquatic garden ("weed bed"), they recorded the GPS coordinates and took an aerial photograph. In all, 26 sites with suspected plant growth were discovered and recorded.

Diagram 3: Drone-identified Suspected Aquatic Gardens



Task Description #6

Ground truthing Aquatic Gardens via snorkel or SCUBA

FWS Biologists will either snorkel or dive on all major aquatic gardens as identified by the high-altitude drone survey or rake toss survey. All aquatic plants will be identified but not quantified, with special attention directed towards discovering AIS. Diving will be billed at $100/hour for up to 10 hours. Any work past 10 hours will be pre-approved by LTLA representatives.

We conducted the ground-truthing of all 26 sites on 29 July using full SCUBA diving gear. This technique, although labor intensive, provided unmatched surveillance and assessment of all likely locations ("weed beds") where Eurasian Watermilfoil (EWM) could become established. We are pleased to report we found no EWM at any location. Of the 26 suspected sites, 4 were either a log or dark substrate with no plants. Of the 22 other sites, plants that dominated the flora were Sago Pondweed, Water Celery, Northern & Whorled Milfoil, and Common Stonewort (Chara), with a few other plants in small numbers that we had identified with the rake-toss method. No new plants were discovered.

Task Description #7

Miscellaneous consulting

FWS/UA biologists will be available throughout the year for consulting on biological issues found on LTL or within the Good Harbor Bay Watershed.

We continue to work closely with LTLA board members to answer questions and give recommendations on all water-related issues. It continues to be a pleasure to work in collaboration with the Lime Lake Association and the National Park Service to protect and preserve the water quality within the Good Harbor Bay Watershed.

General 2022 Recommendations

1. Due to our significant involvement this year with the Lake Leelanau Lake Association and Grand Traverse Band of Ottawa and Chippewa Indians on their Eurasian Watermilfoil control efforts, we are even more keenly aware of the importance of constant and relentless surveillance of this highly invasive plant in our watershed. In near-future correspondence we will be recommending more regular surveillance in 2022, and the establishment of a EWM eradication protocol, complete with the required expertise, equipment and personnel in place if (when?) EWM is discovered.
2. It appears that Yellow-flag Iris may be on the increase on LTL so we recommend a task force be formed to begin eradication of all plants (with landowner permission, of course) in the spring of 2022.
3. Our surveys show your good work eradicating Purple Loosestrife from certain areas has been effective. However, it appears other colonies have formed so we recommend a task force be formed to begin eradication of all plants (with landowner permission, of course) in the late summer of 2022.
4. We recommend continuing the plant and algal surveys in future years to develop and document trends and to find invasive species (besides just EWM) in the earliest stages of infestation.