Michigan's Citizen Volunteer Partnership for Lakes

2018 Report on the Oakland County Healthy Lakes Initiative

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In partnership with
Michigan Department of Environmental Quality
Michigan Lake Stewardship Associations, Inc.
Michigan State University Department of Fisheries and Wildlife
Great Lakes Commission

With funding provided by:
Oakland County Board of Commissioners

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I. Introduction

In 2018, Oakland County Board of Commissioners (BOC) partnered with the Cooperative Lakes Monitoring Program (CLMP) to bring volunteer lake water quality monitoring to the County. The Huron River Watershed Council (HRWC), a key leader in the statewide CLMP, managed the project.

The goals of the CLMP are to:

- Provide baseline information and document trends in water quality for individual lakes
- Educate lake residents, users, and interested citizens in the collection of water quality data, lake ecology, and lake management practices
- Build a constituency of citizens to practice sound lake management at the local level and to build public support for lake quality protection
- Provide a cost-effective process for the Michigan Department of Environmental Quality to increase baseline data for lakes state-wide

The 2018 CLMP monitoring in Oakland County was dubbed "The Oakland County Healthy Lakes Initiative." Funding from the Oakland County BOC provided the following benefits to Oakland County volunteers:

- Expanded marketing and outreach to find and interest potential volunteers
- Free registration and equipment in the program (Cost normally ranges $100-$250 per lake)
- An in-person group training specifically for Oakland Co. residents.
- More convenient sample drop-off locations
- A summer intern that whose primary job would be to visit and train residents on their own lakes

To learn more about the CLMP program, there are many other resources available:

1. The Michigan Clean Water Corps website includes a variety of resources including the online database which contains all CLMP data. https://data.micorps.net/view/lake/

2. The CLMP Manual contains an overview of the program and the volunteer monitoring

procedures: https://micorps.net/wp-content/uploads/sites/63/2019/03/CLMP-Manual-2019update.pdf

3. Starting in 2014, each lake enrolling in the program received an individual report summarizing their data. https://micorps.net/lake-monitoring/individual-lake-reports/

4. The CLMP Quality Assurance Project Plan (QAPP) is a detailed report on how the CLMP collects and maintains high quality scientific data: https://cdn.cloud1.cemah.net/wp-content/uploads/sites/63/2018/06/QAPP_CLMP_2018.pdf

II. Project Timeline

July 2017: Commissioner Marcia Gershenson pulled together a meeting of large group of environmental organizations so that she could better understand what programs and tools were available for Oakland County to participate in. Paul Steen presented the CLMP and how lake residents would be able to join it to learn water quality monitoring techniques and collect water quality data.

September 2017: Commissioners Marcia Gershenson and Dave Woodward worked with the BOC to allot $50,000 towards a partnership between the CLMP, HRWC, and the BOC.

December 2017: HRWC worked with BOC staff in promoting the newly named "Oakland County Healthy Lakes Initiative" (OCHLI) to its residents. This was accomplished through 2 presentations to groups (Trails Alliance, CISMA), social media, emails, phone calls, and direct mail. In addition, HRWC was interviewed by several journalists who promoted the program through news outlets.

February 2018: HRWC led two information meetings with County residents to answer questions regarding OCHLI.

February-May 2018: HRWC oversaw the lake registration process and continued to reach out to residents to get them involved. In total, 77 lakes in Oakland County signed up for the program.

May 5, 2018: HRWC and partner Michigan State University led a lake monitoring training for all of the Oakland resident participants. Eighty-three participants attended along with BOC Commissioners and staff! Refreshments and lunch were provided.

May-September 2018: Oakland County residents conduct water quality monitoring across the state. HRWC Intern Nik Krantz visits and teaches lake residents on their lakes in order to improve volunteer experience, knowledge, and data quality.

October 2018-March 2019: The field season ends, and all samples go to the Michigan DEQ water quality laboratory. As results come in, HRWC creates a report for each lake that

participated. These are distributed in March 2019. Reports can be found here: https://micorps.net/lake-monitoring/individual-lake-reports/

November 2018: As the original $50,000 was not fully spent, BOC chief-of-staff Chris Ward renewed the BOC contract with HRWC, causing the program to stretch into the summer of 2019 and allowing Oakland residents to participate for another summer at no or very low cost. Each participating lake is granted $120 to register, which covers the full cost for most lakes. Nik Krantz is rehired for another field season (May-August 2019).

April 2019: HRWC wrote and distributed this report.

III. Summary Statistics and Maps of Monitored Parameters

Water Quality Parameters: Secchi Disk Transparency, Total Phosphorus, and Chlorophyll

1. Secchi Disk Transparency

CLMP volunteers measure water transparency using a Secchi disk from late spring to the end of the summer. Ideally, 18 weekly measurements are made from mid-May through mid-September. Minimum participation requires submitting 1 measurement; full participation is submitting at least 8 measurements.

2018 Secchi Disk Transparency		
	Oakland Co	All Michigan
No. of lakes enrolled	77	311
No. of lakes meeting minimum participation	55 (71%)	260 (83%)
No. of lakes meeting full participation	49 (64%)	230 (74%)
Total no. of measurements reported	678	3251
Lake with lowest average transparency (ft)	3.2 (West Bloomfield)	1.0 (Cedar, Alcona County)
Lake with high average transparency (ft)	21.8 (Angelus)	33.9 (Torch Lake, Antrim County)
Mean (average) measurement of all lakes	11.3’	12.1’

2. Total Phosphorus

CLMP volunteers collect water samples for total phosphorus during spring overturn, when the lake is generally well mixed from top to bottom, and during late summer, when the lake is at maximum temperature stratification from the surface to the bottom.

2018 Total Phosphorus Monitoring		
	Oakland Co	All Michigan
Spring Overturn Sampling		
No. of sites enrolled	59	233
No. of sites submitting valid samples	35 (59%)	189 (81%)
Minimum reported value	< 3 µg/L (Tan Lake)	< 3 µg/L (multiple lakes)
Maximum reported value	66 µg/L (Pleasant Lake)	110 µg/L (Crockery Lake, Shiawassee Co)
Mean (average) value	14.8 µg/L	12.7 µg/L
Summer Stratification Sampling		
No. of sites enrolled	77	289
No. of sites submitting valid samples	53 (69%)	243 (84%)
Minimum reported value	5 µg/L (Huff)	< 3 µg/L (multiple lakes)
Maximum reported value	53 µg/L (Rainbow)	100 µg/L (Van Etten Lake, Iosco Co)
Mean (average) value	19.8 µg/L	14.3 µg/L
Mean (average) TSI	45.9	39.7

3. Chlorophyll-a

Volunteers collect water samples for chlorophyll-a, an estimator of the amount of algae in the water column, once per month from May through September. Minimum participation requires at least one valid sample be submitted; at least four valid samples must be submitted to be considered full participation in this parameter.

Important note: Chlorophyll is an advanced parameter and only for experienced volunteers. First time volunteers did not register for Chlorophyll, hence the low participation numbers below.

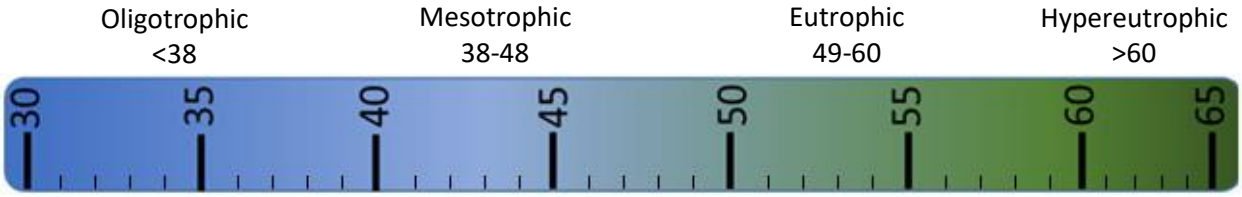
2018 Chlorophyll-a Monitoring		
	Oakland Co	All Michigan
No. of lakes enrolled	9	141
No. of lakes meeting minimum participation	8 (89%)	128 (91%)
No. of sites meeting full participation	8 (89%)	114 (81%)
Total no. of valid samples	39	578
Minimum median Lake measurement	< 1 µg/L (multiple lakes)	< 1 µg/L (multiple lakes)
Maximum median Lake	4.1 µg/L (Oxbow)	18 µg/L (Viking Lake,

measurement **Median Lake measurement**	0.5 µg/L	Otsego Co.) 2.1 µg/L

Water Quality Classification and Map

A note on trophic status:

The CLMP uses a system called the Trophic Status Index (TSI) to classify lakes into categories. Results from secchi disk, phosphorus, and chlorophyll together give a final TSI score, which is then converted to trophic category and mapped on the next page.



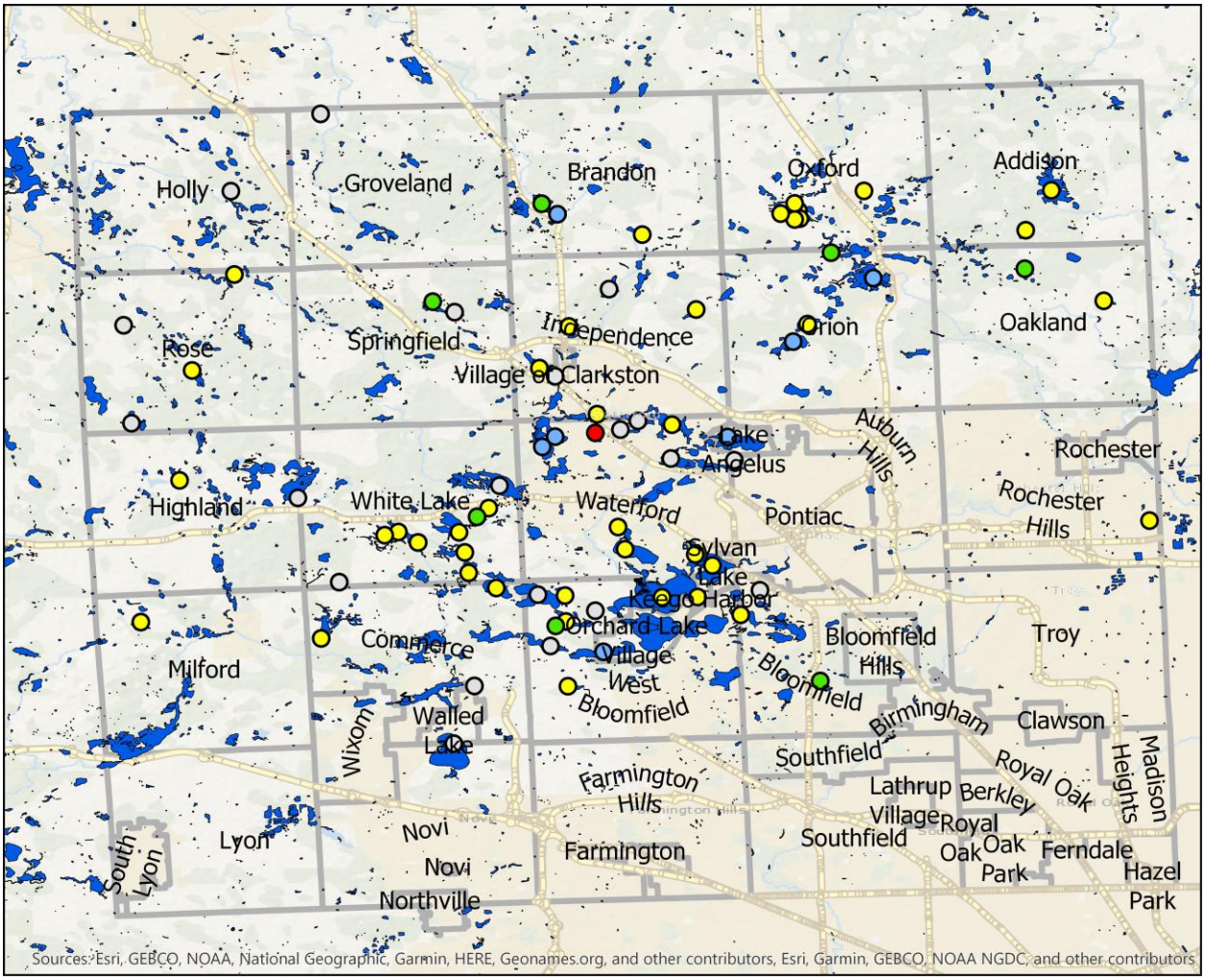
Oligotrophic: Generally deep and clear lakes with little aquatic plant or algae growth. These lakes maintain sufficient dissolved oxygen in the cool, deep-bottom waters during late summer to support cold water fish, such as trout and whitefish.

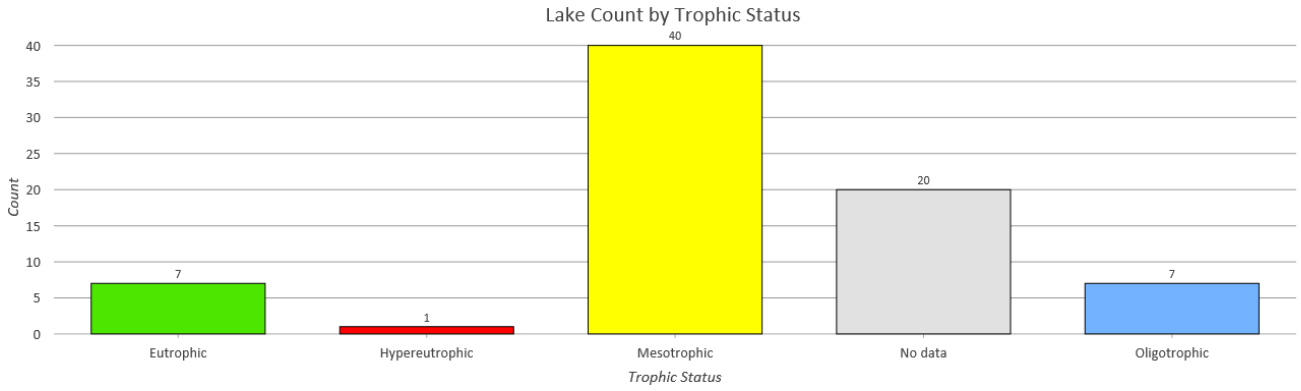
Mesotrophic: Lakes that fall between oligotrophic and eutrophic. Mid-ranged amounts of nutrients.

Eutrophic: Highly productive eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish, such as bass and pike.

Hypereutrophic: A specialized category of eutrophic lakes. These lakes exhibit extremely high productivity, such as nuisance algae and weed growth.

Oakland Lake Trophic Status (based on Secchi, Phosphorus, Chlorophyll)





Exotic Invasive Plant Monitoring

Invasive species are plants and animals that originally come from another area of the world and can easily become established in our ecosystems. Infamous aquatic invasive species include zebra mussels, starry stonewort, New Zealand mudsnails, sea lampreys, round gobies, eurasian water milfoil, and the Asian carp.

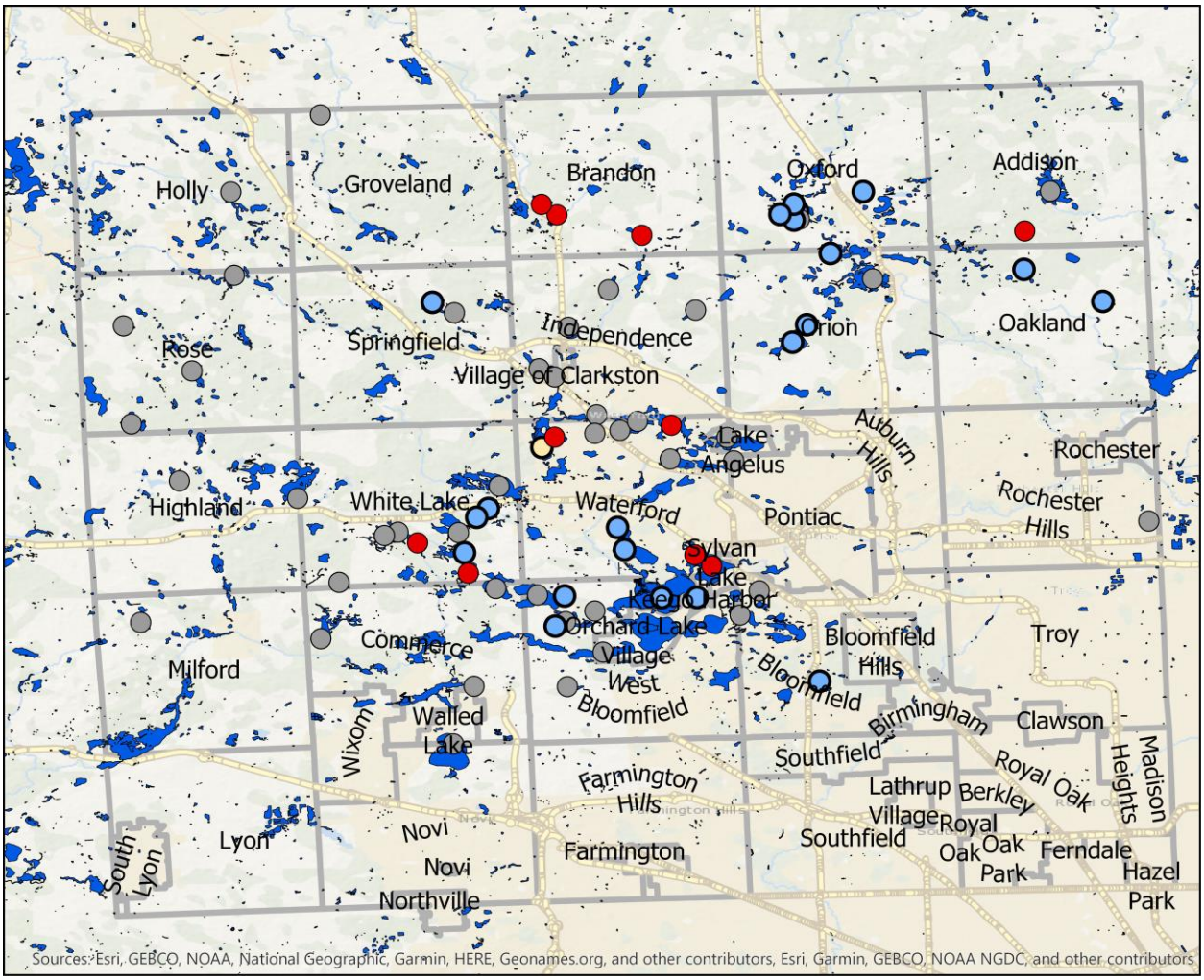
All invasive species share some similar properties- they grow fast and dense, they crowd out native species and lower their diversity and abundance, and very often they can damage human economy and health.

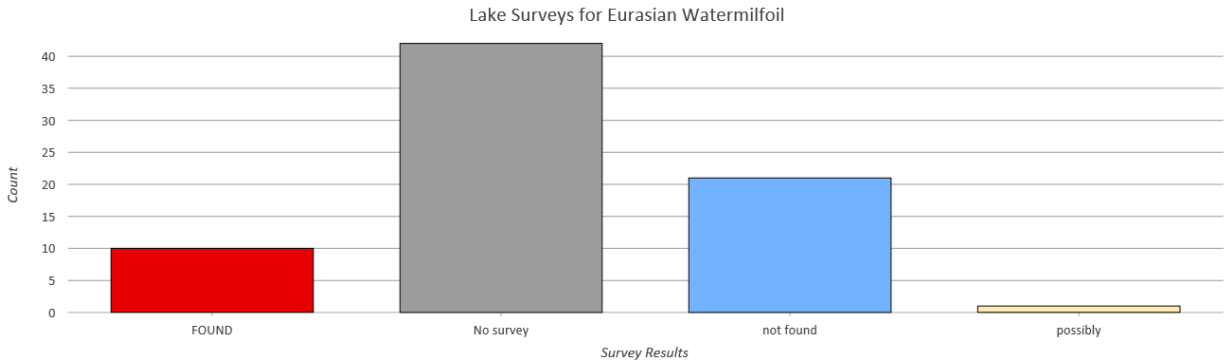
Eurasian water milfoil and other invasive aquatic plants like Starry Stonewort can grow so dense and thick that they can twist in the motors of boats and stop people from boating and recreating. It is nearly impossible to eradicate such plants once they take hold in a system and controlling them to manageable levels often requires chemicals which are distasteful to many and can have their own side effects on a lake system.

The best solution to stop invasive species is prevent them from entering in the first place. CLMP's Exotic Aquatic Plant Watch helps volunteers find the plants before they become too abundant to stop. Volunteers survey their lakes by conducting a series of straight line transects, sampling in all directions along that line with a dual-headed steel rake. Plants are pulled up and identified.

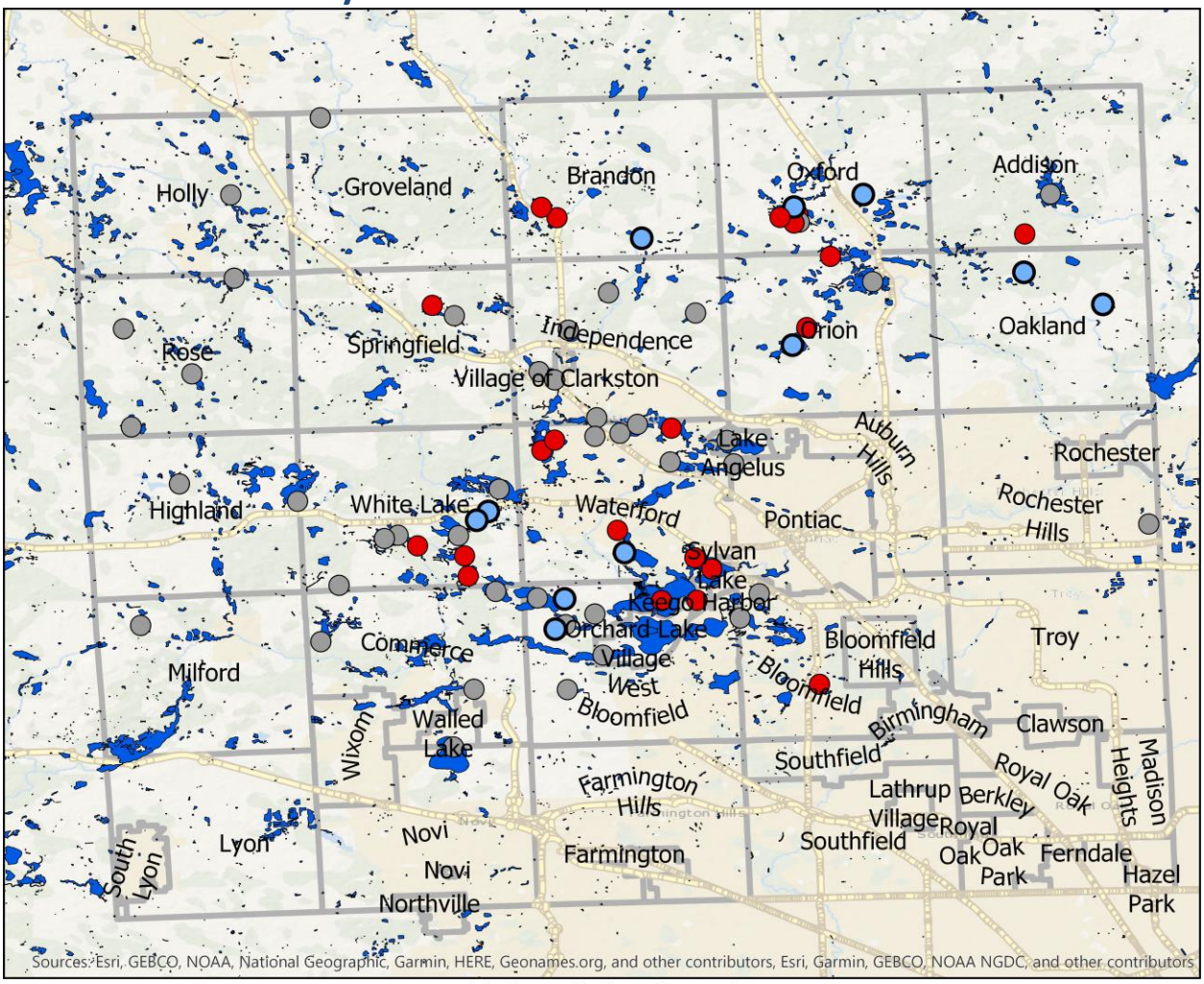
2018 Exotic Aquatic Plant Watch		
	Oakland Co	All Michigan
No. of lakes enrolled	65	94
No. of lakes submitting report	32 (49%)	60 (64%)
No. of lakes reporting Eurasian water milfoil:	10 (31%)	26 (43%)
No. of lakes reporting curly-leaf pondweed:	8 (25%)	18 (30%)
No. of lakes reporting Hydrilla:	0 (0%)	0 (0%)
No. of lakes reporting starry stonewort:	21 (66%)	23 (38%)
No. of lakes reporting European frog-bit:	0 (%)	0 (0%%)

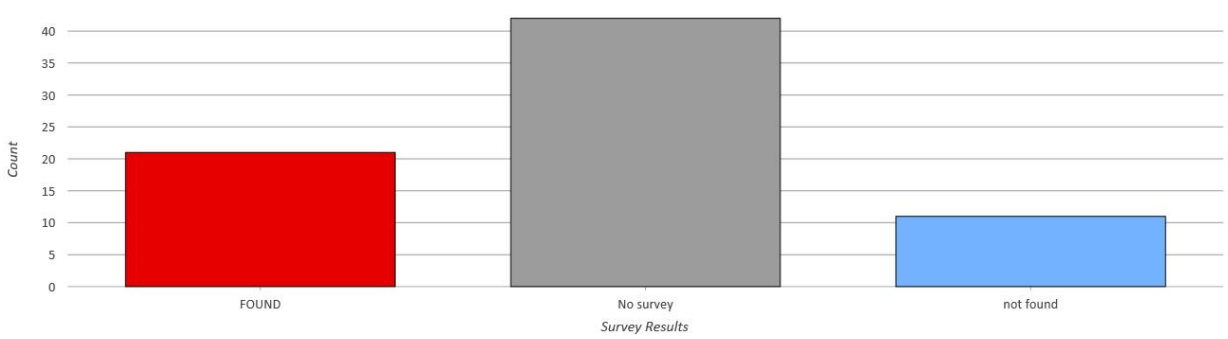
Oakland Lakes Eurasian Watermilfoil





Oakland Lakes Starry Stonewort

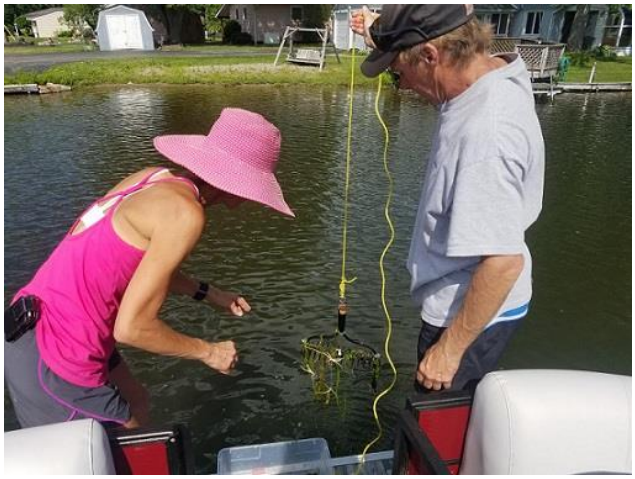




IV. Side by Sides and Volunteer Survey

Side by Sides

HRWC hired a senior Niklas Krantz from Wayne State University to serve as a lake monitoring technician for the summer. Krantz's primary job responsibility was to answer plant and limnology questions from the volunteers and provide whatever hands on assistance he could. The Exotic Plant Watch is a difficult task for people who have no experience sampling and identifying aquatic plants. Krantz went out on 32 lakes visits over the course of the summer (June through August) to work directly with volunteers on their lakes and their boats. Through those visits, he trained volunteers from a total of 48 lakes (sometimes training several volunteers at the same time as many lakes were close in proximity). The following table breaks down his summer activities.



Technician Activities	**Number**
Visited lake for Exotic Aquatic Plant Watch	32
Did not visit lake, but trained the volunteer during another lake visit	16
Could Not Make Contact with volunteer to schedule visit (Emails and phone calls went unanswered)	11
Volunteer withdrew from program due to personal issues	3
Volunteer Didn't Need Help (Often the case for volunteer already experienced in the CLMP)	15
Total	77 lakes

Volunteer Feedback

Krantz's enthusiasm and knowledge were well appreciated by the volunteers

Below is a small sample of the compliments that Nik received.

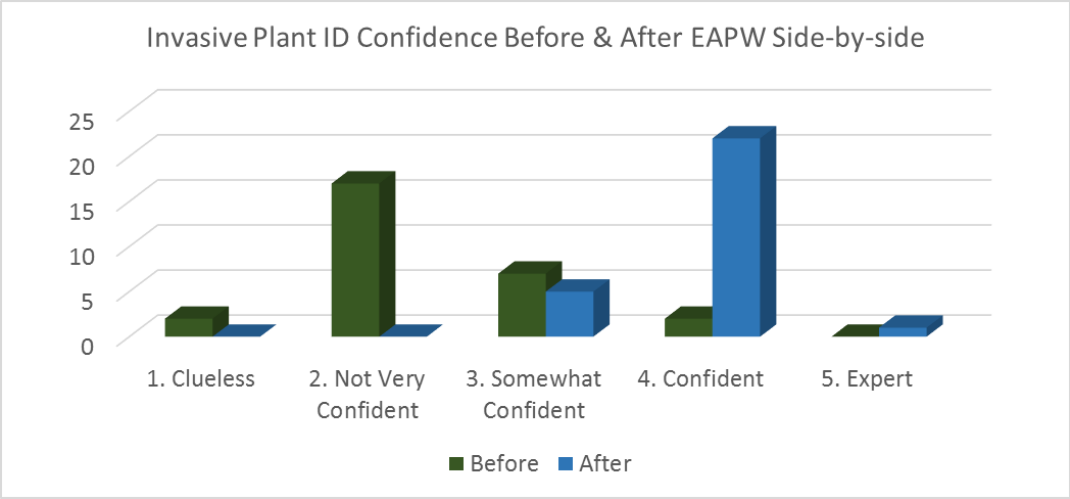
I wanted to take a moment to recognize Niklas Krantz. We completed our visit on Sylvan/Otter Lake today. His enthusiasm is contagious and his personality delightful. His teaching and communication process is inviting and pleasantly instructive. This process in preparing the CLMP volunteers takes the worry and fear out of doing a job that is carried out by non-experts. We learned so much and with experience will become more knowledgeable. Thanks for the opportunity to work with him.

Respectfully, Debi Emmer

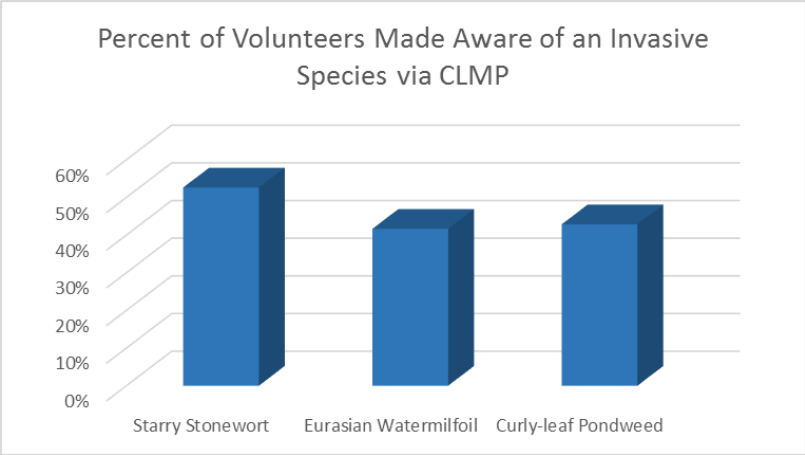
Lakes Huff, Louise and Theresa hosted our CLMP training yesterday afternoon. Niklas Krantz did a great job providing us the training and as important as sharing his expertise was his attitude and passion for his craft. It was incredibly refreshing to interact with someone with that level of passion, positive energy and excitement to share and teach his pupils about ecology. The field has hope with people like Niklas. He did a great job and was a pleasure to work with.
Regards,
Dwight Woodbridge

All the best to you in the future Niklas! It was a pleasure to learn from you when you came out to our lakes for education and "weed identification hand holding sessions". Thank you for your patience and expertise. Hope to work together again in future years as you further your education and help us keep our lakes healthy.
Sincerely,
Denise Kramer
Lakes Tan, Cedar and Long

Volunteer Survey
At the end of Nik's lake visits, he sent a survey to the volunteers to gauge their satisfaction with the program and their knowledge growth. Volunteers' confidence in plant identification grew from majority "Not very confident" to a clear majority in "Confident".



Nearly half of the survey respondents did not know that their lake held an invasive species! This is a very important result. **Nearly half of the volunteers first became aware of the invasive species because of this program!** Now that they know it is there, they can start pursuing management before it gets out of control. This is one of the CLMP's primary goals and it is terrific to see it being realized.



V. Analysis and Conclusions

Trophic Status
Most of the lakes that volunteers monitored in Oakland County are mesotrophic. These lakes are in a middle category for lake nutrients and transparency and this is a generally a safe level

for lakes to be in. Moderate nutrient levels mean the lakes will not regularly experience harmful algae blooms, oxygen depletion, or fish kills. In fact, many lakes in Southeast Michigan are naturally mesotrophic because of natural geologic positioning and would be mesotrophic whether humans were building on their shores or not.

However, it is true that some lakes, perhaps due to very high development in the watershed and lake edge, or those that are more shallow, or those that a man-made, are more susceptible to nutrient enrichment and there is a danger of eutrophication and poor water quality.

Therefore, the wisest course of action is for:

1) Lake residents to act as if their lake is susceptible to nutrient enrichment, because once too much phosphorus enters a lake, it is impossible to turn back. There are a number of very practical things that all residents can do to minimize risk: https://www.hrwc.org/wp-content/uploads/HRWC-Waterfront-Wisdom-Web.pdf
2) Lake residents to continue monitoring long term, and if their water monitoring begins to pick up changes in transparency or phosphorus levels, they know that changes are occurring and can take further management action.

In summary then, overall nutrient conditions in Oakland County are not a problem. They can certainly be a problem for individual lakes, but these lakes are in the minority.

Plants

On the other hand, invasive plants are a major problem in Oakland County, and this problem will likely only grow in the future. Eurasian watermilfoil is a problem for many lakes, and curly leafed pondweed is a problem for just a few. Treatment is expensive and almost always contentious, but at least there a management strategies known to work.

The same can't be said for starry stonewort. There is no current effective treatment for starry stonewort, and it is spreading very fast.

We are seeing more new invasions of starry stonewort in Oakland County than anywhere in the state. In fact, of the 60 2018 plant surveys across Michigan in the CLMP, 23 surveys found starry stonewort, and 21 one these were in Oakland County. There are a couple of reasons for this:

1) Oakland Lakes are generally naturally mesotrophic with about 10-15 feet of transparency, which is right in the sweet spot for starry stonewort. Oakland County basically is starry stonewort's heaven in term of habitat.
2) There are so many lakes in Oakland County that are connected to each other or in close proximity to each other, and boaters are visiting multiple lakes on their trips, spreading the plant from one lake to another.

Many residents realized that they have starry stonewort as a result of this 2018 program. Unfortunately, in Oakland County as throughout the state, the burden of the management ultimately rests on the landowners. If found early though, perhaps it can still be eradicated. As

mentioned, eradication of the algae once it becomes established and widespread is currently impossible with our current technology and management options.

Volunteer Participation and Future Efforts

There were 20 lakes that signed up in the program, had volunteers who were trained and in some cases were even visited by the field trainer we hired, and who still ultimately did not participate in the monitoring or in data submission. This is not unusual, as people get busy, or they ultimately decide that they aren't interested, and in the statewide program it is normal to lose 10-15% of volunteers as the summer progresses. The number is usually larger for the plant surveys, as these are harder and require more effort than transparency or phosphorus.

In Oakland County, the percent of volunteer attrition was about double that of the statewide levels, and this is probably due to the volunteers not having any of their own money invested into the program. They had very little "skin in the game", in other words. A small amount of personal investment in the program results in much better participation rates. On the other hand, at least we got a chance to reach people with the initial training who otherwise wouldn't have signed up at all.

In future years, we recommend that volunteers should pay some out of pocket expenses while Oakland County also subsidizes their efforts. This would help volunteers have greater ownership of what they are doing, and while it may reduce initial registration, it would probably result in greater participation at the end.

VI. Thank you, Volunteers!

95 Oakland County residents signed up to monitor 77 lakes in 2018. Thank you all so much! (Volunteer names are pulled from volunteer waiver forms).

Lake Name	Volunteers
Angelus	Linda Daniels, B.L. Embrey Jr., Steve Presby
Avon	Gary Beach
Bloomfield (West)	Jill Forbis
Brendel	William Dow, Corey O'Higgins
Buckhorn	Gisela Lendle King
Buhl	Alexander Kriebel
Cass	Leslie Clark
Cedar	Denise Kramer
Cedar Island	Jane Moore
Cemetery (aka Middle)	Dennis Lietz

Clear	Sheryl Hugger, Yvonne Dudley
Cranberry	Ronald Heady
Crescent	Shari Sakall
Crooked	Alexander Kriebel
Cross	Debbie Marshall
Crystal	Kathalee James
Darby	Rylee Robinson
Deer	Ken Gill, Fred Daris, Rob Namowlcz
Dixie	Tracy Stolzenfeld, Mike Mulligan, Ginny Fischbach, Dan Tunnecliffe
Dollar	Leslie Clark
Eagle	David Hattie
Elizabeth	Eric Akkashian, John Green
Fish	Kevin Walters
Gilbert	Jim Parker
Green	George Molnar
Hawk	Gordon Buchanan
Huff	Richard Hanes
Indianwood	Todd Rachel
Lake 16	William Maass
Lakeville	Jeffrey Banaszynski
Long	Laurence Gavin, Collin O'Dea
Long	Denise Kramer
Long (Upper)	Ron Cousineau
Loon	Robert Locher
Lost	Benjamin VanderWeide
Lotus	Marilyn Meritt
Louise	Dwight Woodbridge
Maceday	Marilyn Merit
Marl	Sherri Ruth
Middle Straits	Alan Proulx
Mud	William Dow
Neva	Corey O'Higgins
Oakland	Richard Sabina
Ona	Michael Jensen
Orion	Michael Kellar
Otter	Deborah Emmer, Kim Yelp
Oxbow	Richard Walklet
Pleasant	Tanya Sharon
Pontiac	Bodo Lux
Rainbow	Colleen Davison
Round	Paulette Wcisel, Brian Norloch
Round	Colleen Schmidt, Sue Whalen, Steve Flora
Sears	Stephen McKenzie, Michael LaLonde

Seymour	David Wilson, Robert Devore
Sherwood	T.J. Gurski
Square	Margaret Remer
Squaw	Cindy Wright, Glenn McTaggert, Thomasina Kay Collins
Straits (Upper)	Doug Cooper, Jim Cherfoli, Bob Haase
Susin	Steven Vaughn, John Opie, Keith Jones
Susin	Lawrence Ziehr
Sylvan	Deborah Emmer
Tan	Denise Kramer
Taylor	Charles Pilar
Theresa	Alicia DiGirolamo
Townsend	Mark Pelkey, Jill Nagi
Tull # 1	Joe and Char Jereckos
Tull # 2	Gerald Bronersky
Twin	Benjamin VanderWeide, Tom Korb, Alex Korb
Union	Lea Ann Coldren
Vorheis	William Maass
Walled	Blair Still
Walnut	Katie Parker
Walter's	Don Mattise
White	Frank Dyson
Willow	Laurie Orlando
Woodhull	Jeff Quinn
Woodruff	Scott Weickel, Dan Boyd

Appendices.

Lake Name	Lat	Long	Avg Trophic Status Index Score	Trophic Classification	Average Secchi Depth (feet)	April Total Phosphorus (ppb)	September Total Phosphorus (ppb)	Median of Chlorophyll Measurements (ppb)	Eurasian Watermilfoil	Starry Stonewort	Curly-leaf pondweed	Hydrilla	European Frogbit
Angelus	42.6939	-83.3297	34.9	Oligotrophic	21.8	4	13	0.5	Not surveyed for plants				
Avon	42.6481	-83.0981	43.8	Mesotrophic	11.0	10	17		Not surveyed for plants				
Brendal	42.6419	-83.5104	42.2	Mesotrophic	12.1		15		Not surveyed for plants				
Buckhorn	42.7305	-83.6236	40.0	Mesotrophic			12		Not surveyed for plants				
Buhl	42.8073	-83.1662	48.3	Mesotrophic	9.8	23	28		Found	Found	Not Found	Not Found	Not Found
Cass	42.6060	-83.3657	41.7	Mesotrophic	10.4		12		Not Found	Found	Not Found	Not Found	Not Found
Cedar	42.8180	-83.2908	39.4	Mesotrophic	13.0		11		Not Found	Found	Not Found	Not Found	Not Found
Cedar Island	42.6306	-83.4739	44.3	Mesotrophic	9.0	14	15		Not Found	Found	Not Found	Not Found	Not Found
Clear	42.8133	-83.2929	43.3	Mesotrophic	11.0	18	16		Not Found	Found	Not Found	Not Found	Not Found
Cranberry	42.7545	-83.4169	47.0	Mesotrophic	9.5	22	23		Not surveyed for plants				
Crescent	42.6446	-83.3899	43.5	Mesotrophic	10.3	14			Not Found	Found	Not Found	Not Found	Not Found
Cross	42.6070	-83.4190	41.2	Mesotrophic	14.9		16		Not Found	Not Found	Found	Not Found	Not Found
Deer	42.7317	-83.4330	38.7	Mesotrophic	10.2	4	12	1.2	Not surveyed for plants				
Dixie	42.7681	-83.4916	49.2	Eutrophic	8.5		28		Not Found	Found	Found	Not Found	Not Found
Dollar	42.6062	-83.3462	48.1	Mesotrophic	9.3		26		Not Found	Found	Not Found	Not Found	Not Found
Elizabeth	42.6324	-83.3860	40.9	Mesotrophic	14.4	5	15		Not Found	Not Found	Not Found	Not Found	Not Found
Gilbert	42.5601	-83.2789	49.3	Eutrophic	7.8	14	26		Not Found	Found	Not Found	Not Found	Not Found
Green	42.5928	-83.4184	39.5	Mesotrophic	14.0		12		Not surveyed for plants				

Lake Name	Lat	Long	Avg Trophic Status Index Score	Trophic Classification	Average Secchi Depth (feet)	April Total Phosphorus (ppb)	September Total Phosphorus (ppb)	Median of Chlorophyll Measurements (ppb)	Eurasian Watermilfoil	Starry Stonewort	Curly-leaf pondweed	Hydrilla	European Frogbit
Huff	42.8162	-83.4231	34.9	Oligotrophic	11.2	22	5		Found	Found	Found	Not Found	Not Found
Indianwood	42.7950	-83.2729	51.3	Eutrophic	8.7		38		Not Found	Found	Not Found	Not Found	Not Found
Lake 16	42.7559	-83.2859	43.6	Mesotrophic	11.3	15	17		Not Found	Found	Not Found	Not Found	Not Found
Lakeville	42.8292	-83.1521	38.8	Mesotrophic	13.1	9	15	1.3	Not surveyed for plants				
Long	42.6111	-83.4567	40.5	Mesotrophic	14.3	9	14		Not surveyed for plants				
Long	42.8138	-83.2900	41.5	Mesotrophic	12.5		14		Not surveyed for plants				
Long (Upper)	42.5965	-83.3225	47.8	Mesotrophic	9.7	15	26		Not surveyed for plants				
Lost	42.7863	-83.1666	55.5	Eutrophic	5.2	25	41		Not Found	Not Found	Not Found	Not Found	Not Found
Lotus	42.6941	-83.4244	37.7	Oligotrophic	12.3	6	13	0.5	Found	Found	Not Found	Not Found	Not Found
Louise	42.8219	-83.4317	51.9	Eutrophic	7.1	14	34		Found	Found	Found	Not Found	Not Found
Maceday	42.6885	-83.4314	36.5	Oligotrophic	16.9	5	14	0.5	possibly	Found	Not Found	Not Found	Not Found
Mud	42.6361	-83.4997	44.4	Mesotrophic	10.8	9	18		Found	Found	Not Found	Not Found	Not Found
Neva	42.6401	-83.5179	46.3	Mesotrophic	8.5				Not surveyed for plants				
Oakland	42.7007	-83.3603	45.6	Mesotrophic	10.5	9	21		Found	Found	Found	Not Found	Not Found
Orion	42.7811	-83.2497	37.6	Oligotrophic	15.3	8	16	0.5	Not surveyed for plants				
Otter	42.6295	-83.3474	42.5	Mesotrophic	12.4		16		Found	Found	Not Found	Not Found	Not Found
Oxbow	42.6417	-83.4772	40.6	Mesotrophic	14.4	14	11	4.1	Not surveyed for plants				
Pleasant	42.5572	-83.4174	47.9	Mesotrophic	10.2	66	28		Not surveyed for plants				

Lake Name	Lat	Long	Avg Trophic Status Index Score	Trophic Classification	Average Secchi Depth (feet)	April Total Phosphorus (ppb)	September Total Phosphorus (ppb)	Median of Chlorophyll Measurements (ppb)	Eurasian Watermilfoil	Starry Stonewort	Curly-leaf pondweed	Hydrilla	European Frogbit
Rainbow	42.6962	-83.4023	61.4	Hypereutrophic			53		Not surveyed for plants				
Round	42.7830	-83.6004	41.2	Mesotrophic		15	13		Not surveyed for plants				
Round	42.6195	-83.4719	44.9	Mesotrophic	10.0		18		Found	Found	Not Found	Not Found	Not Found
Sears	42.5924	-83.6518	48.1	Mesotrophic		13	21		Not surveyed for plants				
Seymour	42.8050	-83.3765	45.1	Mesotrophic	10.2		19		Found	Not Found	Found	Not Found	Not Found
Sherwood	42.5835	-83.5528	42.5	Mesotrophic		18	20		Not surveyed for plants				
Squaw	42.8164	-83.3006	40.6	Mesotrophic	11.1	22	11		Not Found	Found	Not Found	Not Found	Not Found
Sylvan	42.6234	-83.3381	39.5	Mesotrophic	15.1		13		Found	Found	Not Found	Not Found	Not Found
Tan	42.8221	-83.2930	46.6	Mesotrophic		3	19		Not Found	Not Found	Not Found	Not Found	Not Found
Townsend	42.7064	-83.4013	46.6	Mesotrophic		15	19		Not surveyed for plants				
Tull #1	42.6549	-83.4609	46.1	Mesotrophic	7.6	6	16		Not Found	Not Found	Not Found	Not Found	Not Found
Tull #2	42.6502	-83.4673	54.5	Eutrophic	4.4		30		Not Found	Not Found	Not Found	Not Found	Not Found
Twin	42.7687	-83.1233	46.6	Mesotrophic			19		Not Found	Not Found	Found	Not Found	Not Found
Upper Straits	42.5761	-83.3978	36.8	Oligotrophic	17.2		15	0.5	Not surveyed for plants				
Voorheis	42.7462	-83.2937	37.5	Oligotrophic	21.6	12	14		Not Found	Not Found	Not Found	Not Found	Not Found
Walter's	42.7639	-83.3470	46.6	Mesotrophic	10.6		24		Not surveyed for plants				
West Bloomfield	42.5903	-83.4241	59.2	Eutrophic	3.2	46	42		Not Found	Not Found	Found	Not Found	Not Found
Willow	42.8289	-83.2549	45.7	Mesotrophic	10.5	7	21		Not Found	Not Found	Not Found	Not Found	Not Found

Lake Name	Lat	Long	Avg Trophic Status Index Score	Trophic Classification	Average Secchi Depth (feet)	April Total Phosphorus (ppb)	September Total Phosphorus (ppb)	Median of Chlorophyll Measurements (ppb)	Eurasian Watermilfoil	Starry Stonewort	Curly-leaf pondweed	Hydrilla	European Frogbit
Woodhull	42.6701	-83.6305	43.5	Mesotrophic	10.8	7	16		Not surveyed for plants				

Registered in program but did not submit any data

Cemetery	42.7272	-83.4244	Taylor	42.7552	-83.6612
Crooked	42.7750	-83.3948	Theresa	42.8711	-83.5531
Crystal	42.6811	-83.3260	Union	42.6075	-83.4338
Darby	42.5987	-83.4023	Walled	42.5257	-83.4800
Eagle	42.6979	-83.3885	White	42.6606	-83.5656
Fish	42.7014	-83.6569	Woodruff	42.7028	-83.3789
Hawk	42.5574	-83.4687			
Loon	42.6821	-83.3609			
Marl	42.8287	-83.6023			
Middle Straits	42.5793	-83.4270			
Ona	42.6144	-83.5428			
Pontiac	42.6672	-83.4549			
Square	42.6098	-83.3120			
Susin	42.7624	-83.4795			

VIII. Appendix B. Healthy Lakes Initiative Recruitment News Coverage

April 12, 2018
C&G Newspapers
New initiative bolsters lake monitoring program
https://www.candgnews.com/news/new-initiative-bolsters-lake-monitoring-program-107526

February 15, 2018
The Citizen
Clean Water Corps wanted
http://thecitizenonline.com/clean-water-corps-wanted/

The Clarkston News
Clean Water Corps needs volunteers
http://clarkstonnews.com/guest-viewpoint-clean-water-corps-needs-volunteers/

February 1, 2018
Lakefront Lifestyles Magazine
Board of Commissioners launching healthy lakes initiative in 2018
https://www.oakgov.com/boc/Documents/NEWS%20ARTICLES/2018%20News%20Articles/2018-0201%20Board%20of%20Commissioners%20launching%20healthy lakes initiative in 2018.pdf

January 22, 2018
C&G Newspapers
Volunteers needed for lake health monitoring
https://www.candgnews.com/news/volunteers-needed-for-lake-health-monitoring-106250

January 4, 2018
Detroit Metro Times
Oakland County lakes to get environmental and invasive monitoring in 2018
https://www.metrotimes.com/the-scene/archives/2018/01/04/oakland-county-lakes-to-get-environmental-and-invasive-monitoring-in-2018

January 3, 2018
WDET 101.9 FM Radio
Oakland County seeks volunteers to test water quality in lakes
https://wdet.org/posts/2018/01/03/86224-oakland-county-seeks-volunteers-to-test-water-quality-in-lakes/

December 29, 2017
U.S. News
Program teaches residents how to monitor lake water quality

https://www.usnews.com/news/best-states/michigan/articles/2017-12-29/program-teaches-residents-how-to-monitor-lake-water-quality

December 28, 2017
The Oakland Press
Oakland County partners with MiCorps to provide residents with free water quality training and equipment
https://www.theoaklandpress.com/news/nation-world-news/oakland-county-partners-with-michigan-clean-water-corps-to-provide/article_91b0fd16-765f-511b-89f2-f6a3b6732644.html

INVASIVE SPECIES FIELD REPORT

Starry Stonewort:
A Serious Threat to Michigan's Lakes

Huron River Watershed Council

Starry stonewort. If you are a lakefront property owner somewhere downstream of the St. Lawrence Seaway, you may have heard the name at some point in the past decade. Having spent the summer on lakes across Oakland County MI with MiCorps volunteers for the Cooperative Lakes Monitoring Program's Exotic Aquatic Plant Watch, I have been struck by the damage caused by this invasive large algae from Eurasia. Starry stonewort is arguably among the most disruptive invasive species to find its way into the Great Lakes region since the introduction of zebra mussels. In fact, it likely was introduced the same way, carried in the ballast water from ships engaging in transatlantic trade. So what is it, why is it so problematic, and how do we deal with it?

What is starry stonewort?

In order to answer the latter two questions, we must first understand what starry stonewort is. Nitellopsis obtusa, also known as starry stonewort, is a member of the Characeae family of algae. The charoids are an interesting family, considered a missing link between microscopic algae and more advanced forms of plant life. In Michigan, the charoid you are probably most familiar with is called Chara, or muskgrass. This is the crunchy, garlic-scented mat commonly found near docks and mingling with other lake weeds. Although it is neither crunchy nor smelly, starry stonewort is a cousin of muskgrass and the two algae share many similarities.

The lack of crunchiness and smell are two ways we can distinguish starry stonewort from muskgrass, but in order to definitively identify it we have to look for the tiny white star-shaped structures called bulbils *(pictured right)* for which it is named after. The star-shape is unique to starry stonewort, and the bulbils can usually be found close to the sediment attached to fishing line-like threads called rhizoids. The bulbils are a part of starry stonewort's reproductive strategy. They are essentially hardy spores, designed to get buried in the sediment and sprout new starry stonewort several years later.

Look familiar? This is a typical clump of starry stonewort collected during the Exotic Aquatic Plant Watch on Woodruff Lake in Oakland County.

Starry stonewort reproduces aggressively. Tiny fragments of the algae can generate entirely new mats of starry stonewort, and the fragments can be easily spread, whether stuck to an unwashed boat or on the underside of a duck's feather. Lastly, starry stonewort can be found at greater depths than most native aquatic plants. It has been recorded growing three meters high in nine meters of water, whereas most plants are limited to a depth of less than five meters.

A pair of star-shaped bulbils used to identify starry stonewort. Image: New York State Dept of Environmental Conservation.

What impact does it have on lakes?

Starry stonewort fulfills a similar role in the ecosystem as its native cousin muskgrass but it is how they differ which accounts for the damaging impacts of starry stonewort. They both prefer the alkaline lakes common to Michigan and cover lakebeds in dense mats, sometimes even coexisting with one another in the same mat. Muskgrass beds are great shelter for tiny fish, making it prime spawning grounds for many fish and great habitat for smaller species. On the other hand, native fishes actively avoid starry stonewort. Therefore, as starry stonewort spreads, available fish habitat shrinks.

Both muskgrass and starry stonewort filter out nutrients from the water column and stabilize the sediment. However, because it grows at greater depths than muskgrass, starry stonewort can cover more area and fill more volume in the lake, potentially filtering out too many nutrients and choking the sediment.

This can deprive native flora and fauna of nutrients and trap toxic substances in the sediment.

Starry stonewort is an aggressive competitor for space, and while muskgrass can coexist with it, other native aquatic plants such as eelgrass, pondweeds, and watermilfoils are pushed out of its territory. Even other aggressive invasive species such as Eurasian watermilfoil and curly-leaf pondweed are unable to compete. Only unrooted floating plants, namely coon tail and bladderwort, appear to coexist peacefully with starry stonewort.

The aggressive and damaging characteristics of starry stonewort are not just problematic for the lake ecosystem, but also for the lives of lakefront property owners. When left unmanaged, starry stonewort can reach the water's surface, becoming a significant obstacle for motorized boats and paddlers alike. Even in deeper water, detached chunks of starry stonewort can float along the surface, posing further danger to propellers as well as a trip-hazard to waterskiiers. Recreational fishers are likely to notice the impact of starry stonewort on fish populations, although the exact consequences have yet to be determined.

These recreational obstacles in combination with the ecological damage being caused may lead to further indirect consequences, including economic impacts such as reduced lakefront property values and costs associated with boat repair and environmental restoration.

As Huron River Watershed Council's Lake Monitoring Intern, I have had the opportunity to visit over thirty lakes across Oakland County this summer, and have personally witnessed the extent and severity of the starry stonewort invasion in southeastern Michigan. Starry stonewort has been found in the wide majority of these lakes in all stages of invasion. Lake Sixteen in Orion Oaks County Park appeared nearly pristine, until sharp-eyed volunteer William Maass pointed out a patch of starry stonewort below the dock as we disembarked for the day. Mr. Maass reached out to the county and with any luck that patch can be eliminated before it can spread throughout the lake. On the other side of the coin, starry stonewort had come to dominate virtually the whole volume of Eagle Lake in Waterford Township, making the shallow lake nearly unnavigable.

On my lake visits, it was common to have to tear thick chunks of starry stonewort from propellers and carefully steer around pillows of starry stonewort in what should have been open water., However, not all volunteers knew which plant had been giving them so many headaches. We surveyed volunteers and found that 50% of volunteers who identified starry stonewort during the Exotic Aquatic Plant Watch had not previously been aware of its presence. This is startling since starry stonewort is the most commonly found invasive aquatic plant in Oakland County, according to the same survey. That our proactive and scientifically-engaged volunteers are only learning about it now is an ominous indication of the awareness gap amongst Michigan's lakeside communities.

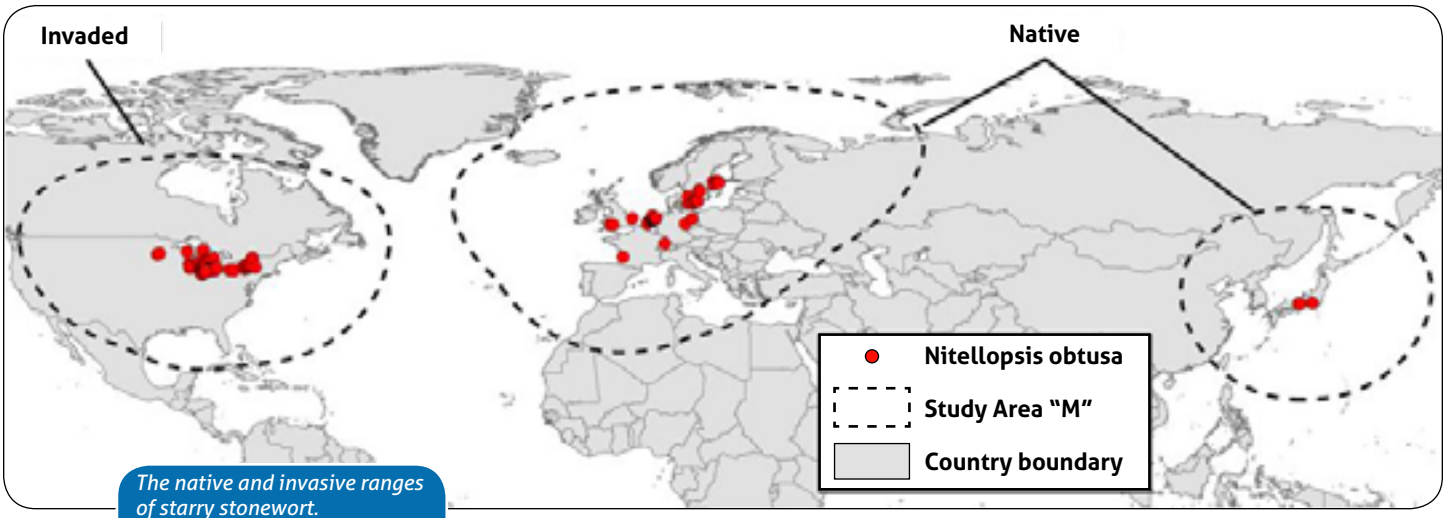
CLMP volunteers Alicia and Dwight inspect a plant sampling rake for starry stonewort on Lake Louise in Oakland County.

How do we deal with it?

Armed with understanding of what starry stonewort is and why it's dangerous, we can now take a critical look at the options we have for combating the invasion. First, foremost, and always, the best management is prevention and early detection. Thorough boat washing practices when taking a boat from lake to lake can lower the chances that starry stonewort fragments will be carried from an infested lake to a pristine lake. Consistent monitoring for starry stonewort around docks and inlets may give you the opportunity to eradicate a lone patch of starry stonewort before it can establish itself.

Once established, the prospects of managing starry stonewort become somewhat grimmer. There are three primary methods of management that are used in treating invasive and nuisance weeds: physical, chemical and biological. Biological control is when another organism, say a stonewort eating beetle, is introduced to destroy the invasive plant. Unfortunately, no biological controls for starry stonewort are known.

Physical management is removal by hand or by harvester. Physical methods are controversial because



The native and invasive ranges of starry stonewort. Image: www.nature.com

the resulting fragments of starry stonewort can be carried by wave or current, potentially spreading starry stonewort even further across a lake basin or into an outflowing stream. Hand harvesting is impractical for anything but the smallest dockside patch of starry stonewort, but the decision to use a harvesting machine to manage starry stonewort is difficult. The machines are rather expensive and the sheer biomass of starry stonewort means harvesters are filled to capacity quickly, making for an arduous process.

Chemical treatments are also complicated. As an algae, common copper and endothall based algaecides are effective against starry stonewort but can only penetrate the upper layers of well-established mats. This combined with the persistence of the bulbils in sediment even after treating starry stonewort means that known chemical treatments cannot eradicate it. Instead, algaecides are used to "haircut" starry stonewort, keeping it low in the water column and out of the way of recreational lake users. Chemical treatments are always used with caution, because the chemicals run the risk of damaging beneficial and native organisms in the lake as well.

So our management options are clearly not perfect. That doesn't mean that we are doomed to accept the starry stonewort invasion.

Although it has been identified in Michigan since the 80s, it has only been recognized as a worrisome invasive within the past decade. Scientists are beginning to pay attention as the starry stonewort invasion spreads. The more we learn about how starry stonewort behaves and what makes it tic, the better shot we have at effective management. Further research may help to track its spread and improving our ability to prevent it, as well as discover which combination of management options can be used to effectively eradicate it or at least minimize its damaging impacts.

If you are a Michigan lakefront property owner and you discover starry stonewort below your dock, don't worry, you're in the majority. Instead of pouting, take action and study it! Find out where on your lake it is growing, and where it isn't. Perhaps take the extra step and alert the riparians downstream of you in your chain of lakes, who are at great risk. Consider joining MiCorps' Cooperative Lakes Monitoring Program. Volunteers who enroll in the program are given the tools and training necessary to better understand the ecology of their lake and which invasive species may be lurking within.

Lastly, before you grab a torch and pitchfork and demand starry stonewort be wiped off the face off the Earth for its vile assault on our lake sovereignty, let me offer a bit of perspective. Starry stonewort is ironically scarce in its native ranges in Europe and Asia. It is officially listed as endangered in the United Kingdom and recognized as becoming increasingly rare in Germany and Japan, where it is known as an indicator of high water quality. In its native range it coexists peacefully with the other plants and animals which it has evolved alongside for millennia. It is only because of human intervention that starry stonewort is so damaging. We accidentally introduced the algae to a foreign environment where it does not exist in a natural balance. So the next time your heart sinks at the sight of an ugly pillow of starry stonewort, remember, we're responsible for bringing it here, and so we're also responsible for getting rid of it.

—Nik Krantz
HRWC's Lake Monitoring Intern

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