the Water Column

Annual Newsletter 2022–2023

Lake Stewards of Maine

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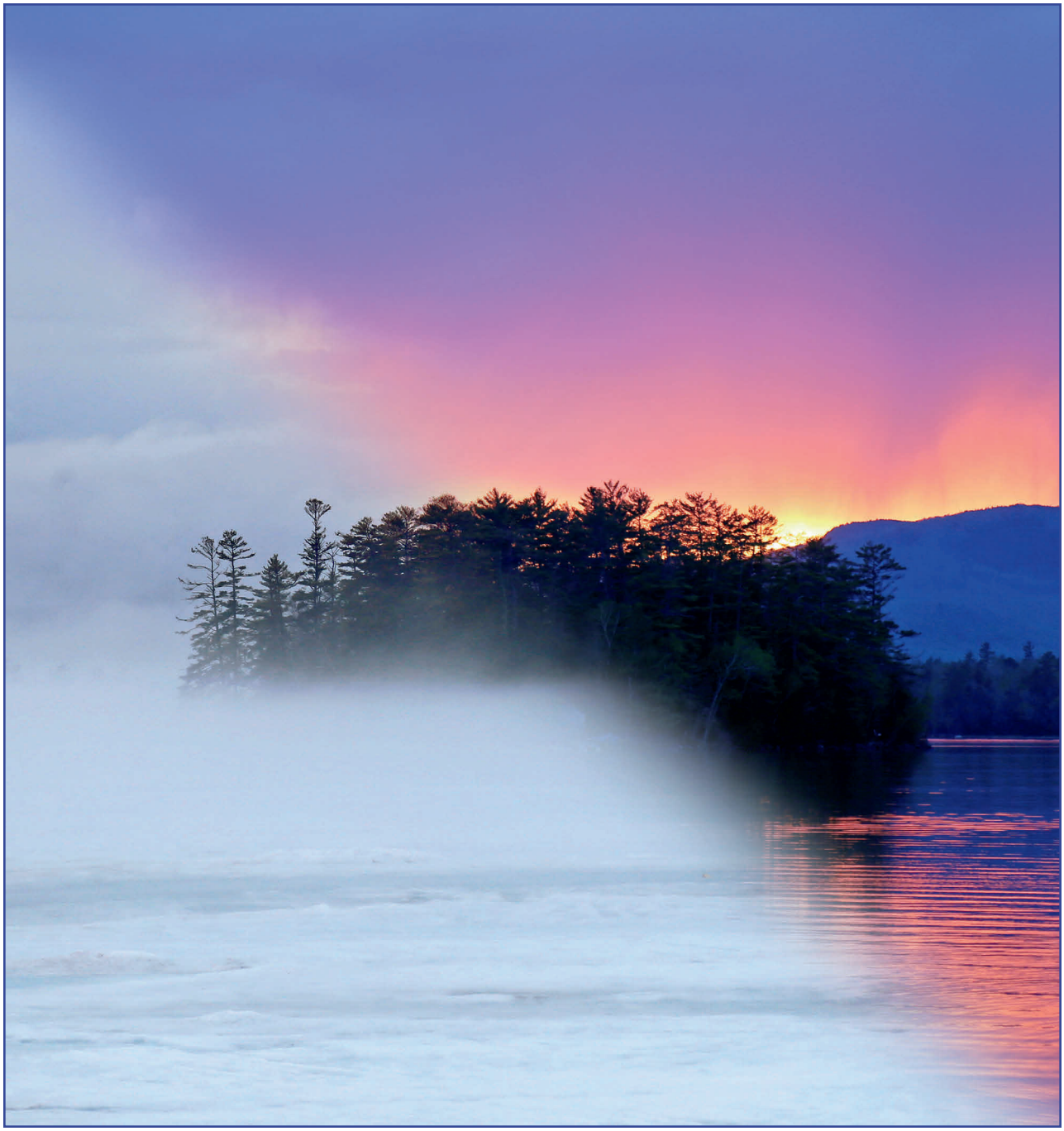
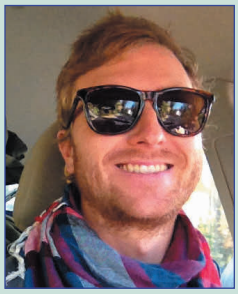


What's Inside

Meet our Staff

Alison Cooney
Interim Executive Director, Deputy Director



Tristan Taber
Water Quality Director, Aquatic Scientist

Christine Guerette
Interim Aquatic Invasive Species Director, Programs Manager

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President's Message—Gratitude!

by Barb Welch, President, LSM Board of Directors

Dear Friends,

It is an honor to write in this space as Board President of Lake Stewards of Maine (LSM). I am proud of this organization; we have hundreds and hundreds of volunteer stewards throughout the state dedicated to protecting their lake's health for future generations and a highly adept staff committed to supporting them.

Our volunteers are the largest and most significant portion of the LSM organization! They are trained, and certified citizen scientists keeping watch over Maine's lakes. They spend thousands of hours monitoring, surveying, and reporting lake conditions, forming an early warning system for their lake as well as lakes statewide. Many volunteers have been part of LSM for 10, 20, 30 years or more.

LSM has only a handful of staff serving the 1200+ certified LSM citizen scientists and the hundreds more lake stewards who have been trained but not certified. Needless to say, LSM Staff need to be talented, hardworking and enthusiastic to keep up with all the volunteers, as well as responding to requests from municipalities, lake associations, researchers and the general public.

The past year has been a transitional year for LSM as two longtime senior staff departed the organization. Scott Williams, LSM's Executive Director for 26 years retired, and Roberta Hill, LSM's AIS Director for 22 years, resigned to pursue her passion to build community resilience as threats to the environment increase due to climate change. Scott and Roberta grew LSM from a small organization of a few hundred volunteers doing Secchi disk transparency to the LSM of today. Scott developed the water quality program and Roberta the Aquatic Invasive Species Program, and with staff, raised funds to train and support thousands of stewards. Adam Zemans, who was hired to succeed Scott as executive director, resigned in February to focus on completing his PhD and work towards climate change group adaptation responses in order to meet increasing environmentally-induced challenges. Adam was extremely helpful in improving operational procedures, supporting staff, and securing additional grant funding to assist with expenses anticipated in 2023, including new staff training, development support, and major LSM building repairs.

As we welcome a new year, we will also welcome two new staff. The Aquatic Invasive Species Director position will be filled by March and the Executive Director position will be filled before the summer field season. Our new additions will be joining a great team of hardworking talented people:

- Alison Cooney, Deputy Director, and Interim Executive Director
- Tristan Taber, Water Quality Program Director, Technical Director and Aquatic Scientist
- Christine Guerette, acting Aquatic Invasive Species Program Director and Programs Manager

LSM is very fortunate to have partners who believe in our organization's vital role in lake protection and the value of citizen scientists. Annually, hundreds of individuals donate to help safeguard Maine's lakes. A number of foundations support our lake protection programs. The Legislature grants us funds each year to support data collection and dissemination as LSM supplies roughly 90% of the state's lake data. The Department of Environmental Protection contracts with LSM to help support our volunteer water quality monitoring and invasive plant programs, and our staff work closely with the biologists from the Environmental Assessment Division.

My gratitude to the lake stewards, staff, and all our funders and supporters.

Sincerely,

Barbara Welch

50k Matching Grant Challenge—*Coming Together for Lakes of Maine*

We met the challenge again! The $50,000 LSM raised in 2022 will be matched 100% by the Ram Island Conservation Fund. Thank you to everyone who supported this campaign and *THANK YOU* to the trustees of the Ram Island Conservation Fund!

Farewell, Forward and Carpe Diem

Dear LSM Community:

I am proud of the many accomplishments that LSM has achieved over the course of my tenure and deeply grateful for all the amazing volunteers and funders who contributed to our successes. From late 2021 through 2022, we were able to revamp the accounting system; recruit phenomenal new staff, a rock-solid new accounting firm, and talented independent contractors for bookkeeping and marketing and communications; and preserve a solid working relationship with Maine DEP's Office of Environmental Assessment.

Most importantly, I retained and provided strength-based leadership for existing staff. LSM has *become a strong team* that maintained volunteer training numbers and the quality of the volunteer training programs. Staff improved the reporting process to the LSM board regarding finances and human resources; launched a new comprehensive website of over 130 pages; built a virtual office platform; selected and began donor database replacement; and produced a 50th-anniversary newsletter of 40-plus pages.

We recruited two new board candidates, expanded the summer internship program from 2 to 5 interns; and preserved working relationships with two pre-existing internet contractors and an incredible videographer, who has been extremely generous with his time.

There is so much more to be done, and I am quite confident that under the leadership of Alison Cooney, our Interim Executive Director as of my resignation on February 2, 2023, our *staff and board team* will do an outstanding job of moving our mission, strategic priorities, goals and objectives forward.

Again, I am deeply grateful for the opportunity to serve LSM and the state of Maine. I know that any small contributions that I have made pale in comparison to those of many volunteers and board members over years if not decades!

Reflecting back on my choice, at the request of Scott Williams and Roberta Hill, to help transition the organization past the incredible legacy of LSM's founding directors was a fantastic decision that I would make again, both in order to safeguard LSM's crucial mission and for the immense learning and professional development. Among other things, central to what I learned is that:

"Mainers face increasing impacts and unprecedented threats to our lakes and watersheds."

I have a PhD thesis to complete on this theme, a gargantuan task that is not compatible with being an Executive Director of a statewide organization trusted to protect and steward the lakes of Maine. I look forward to collaborating with the LSM community as a volunteer, donor, researcher and colleague.

Godspeed in all your vitally important monitoring and invasives work, and I hope to see you at annual and public meetings, conferences and while I am out on the water monitoring, searching for invasives or driving boats for Uber IPPers like my friend, Dr. Keith Williams. Forward! Time is of the essence, and please enjoy every day as much as you possibly can on your lakes, with those whom you hold dearest. Carpe diem. (Seize the day).

With gratitude,

Adam R. Zemans

Adam Zemans taking water samples during a training on Lake Auburn, in the summer of 2022.

Lakeside Notes

By Tristan Taber

What a pleasure it was to see so many people this year. In my first year as the LSM water quality program director, I performed 30 training and/or recertification sessions for volunteers this summer—catching up on the backlog of interested volunteers from 2020 and 2021. I had a lot on my plate, but it was such a wonderful change of pace to see people in person again. Working together with the Maine DEP, we offered training sessions in 13 of the 16 counties of Maine and, in the process, certified more than 60 **new** water quality volunteers! This is the first year in a while that LSM staff traveled around the state to perform water quality certifications. The coordination of providing training outside of our Auburn office required many hours of logistical planning. I corresponded with a number of volunteers, who graciously hosted the training sessions and helped with accommodations and boat usage, sending over 900 emails in the process of field season certifications.

While this was time intensive, I plan to continue to travel throughout the state to offer water quality training sessions going forward. Not only does it aid the local volunteers, saving them a sometimes very long trip to Auburn for training, it also provides LSM staff the opportunity to visit and meet many of the wonderful lake communities who are actively involved in preserving and protecting their lake. I would be remiss in not thanking the local boat hosts who took time out of their schedules to take myself and multiple groups of volunteers out for training. *Thank you!* If you are interested in acting as a local boat host, be sure to contact our office and let me know. Thank you for your assistance!

In other news for 2022, we launched the new digital water quality (WQ) data collection form (not to mention the new LSM website, **www.lakestewardsofmaine.org**). The WQ data form is available to all certified volunteers and can be installed on a mobile device such as a tablet or smartphone, or it can be accessed on a computer. It uses the Survey123 digital platform and populates a near-real time database that can be seen on our website. Paper data forms must still be submitted, but the website database provides access for the general public to view current water quality data collected for a lake.

Tristan Taber (standing right) speaking to volunteers during a training on Lake Auburn (MIDAS 3748) in Androscoggin Co. Photo by LSM Staff.

In 2022, many lakes saw high levels of clarity during the height of summer, most likely influenced by the lower than average levels of rain we received. In autumn, a number of lakes that had not experienced algae blooms previously began blooming. The work of both monitoring and erosion mitigation activities in a watershed are critical to preserving the health of Maine's lakes. It is unlikely that human-driven climate change will alleviate in the short-term, thus its continued impacts to Maine's lakes must be considered.

Unfortunately, we will need to act more conservatively to help preserve Maine's lakes. To best do this lake communities should follow best management practices regarding erosion, champion native vegetative species buffers along the shoreline of their lake, and actively work towards preserving undeveloped areas in their watershed—what happens in the watershed is going to impact your lake. LSM will strive to train 60+ new water quality volunteers each year in an effort to expand lake data collection to include many of the far flung and data poor lakes, and to spread the essential lake stewardship mindset that is exemplified by our volunteers.

Thank you LSM volunteers for all your service!

Criteria for boat hosts

1. Access to a boat that can safely carry at least seven people and their equipment;
2. A deep hole (or other measurement station) that is at least 10 meters (33 feet) in depth;
3. Up to one full day of host availability to take volunteers out over the summer;
4. Some flexibility for schedule changes due to weather; and,
5. Restroom facilities, either in a house or at the boat launch where volunteers attending can park.

Program Time

A Fork in the Road

By Joe Musante, Water Resources Biologist, Indian Township Environmental Department

Time. In a world full of finite resources, time can often be overlooked as one of them. When it comes to doing field work in Maine, time is never on your side. Even when sunrise peaks over the horizon at 4:30 AM and doesn't fall below the western treetops until 8:30 PM, it's not on your side. For those of us that have the good fortune to work or play on Maine's lakes and ponds, our season is short. Ice out typically isn't until early April here in northeast Washington County: the big lakes wait the longest, the small ones go the quickest. Once the ice starts breaking up, you get outside more and more to enjoy those warm Spring days before the bugs and flies hatch. You wait for the mud to dry up, the water to warm a bit, and that rough April weather to pass by. Finally, you've made it to May, field season! The boat motor's oil is changed, the battery is charged, and the trailer lights fixed (again). The race begins -the blur that is May through September in Maine.

The Passamaquoddy Tribe at Indian Township has had some form of a federally funded water resources program since 1993. The waters of the St. Croix River Watershed are very important to the Tribe. This water has been their life for thousands of years. Monitoring and preserving it for present and future generations is essential. Since 1993, water chemistry data has been gathered: Secchi disks lowered, water temperatures taken, oxygen levels measured, and chemistry tested. For the past 15 years we have gathered even more data—visiting lakes and ponds than our department previously monitored. In 2019 we saw a fork in the road begin to appear, a new concern, away from primarily gathering water quality data: Variable-leaf milfoil (VLM). This highly invasive aquatic plant was found in our backyard: Clifford Bay in Big Lake.

Huh. Where'd that come from? How did it get here? How long has it been there? All these questions immediately come to mind, and most are still unanswered other than the last: quite a few years at least, long enough to grow into patches measured in acres, not just square feet.

VLM made us reconsider things, specifically our limited resources. When you're working on the water, every good weather day in the forecast is too important to not maximize. For us? Sunny and calm? Time to survey milfoil. Cloudy and calm? How about some water sampling? Maybe some removal work? Juggling these tasks even within a single day is important. Milfoil surveys in the calm, clear morning followed by removal after lunch once the breeze and clouds start to roll in. One quickly learns to keep your eyes on that forecast, plan accordingly, and be flexible. Watch out for those afternoon thunder clouds!

We finally hit that fork in the summer of 2022. After a season and a half of juggling water quality sampling and intensive VLM surveys, the Environmental Department came to the consensus: we don't have enough time. Staff time is too limited, the season is too short, and this opportunity too precious; we can't do what needs to be done to fight the growing milfoil infestation on a part-time basis. We've got to go all in, redirecting our resources towards the most pressing need at the expense of something else. We all do this without thinking about our daily lives; a triage of duties and responsibilities where something usually just won't get done, put off until more time allows. Right now, for us, that means scaling back our water quality sampling program, back to what it was twenty or so years ago. It's hard to stomach, but we believe it'll be worth it. Invasive aquatic plants won't stop growing and spreading just because we don't have time. Find the time, take the time, before it's too late.

Joe Musante taking water quality readings on Long Lake (MIDAS 1286) in Indian Twp. Res. in Washington Co. Photo by Tristan Taber.

Littorally Speaking

By Christine Guerette

After two decades of dedication to the prevention of aquatic plant infestations in Maine lakes here at LSM, Roberta Hill, LSM's Aquatic Invasive Species (AIS) Program founder, moved on to new adventures. During that time Roberta trained thousands of volunteers and, along with LSM staff, supported hundreds of certified invasive plant patrollers. We are grateful for all of the knowledge and expertise that Roberta shared which has allowed us to continue to support you, our volunteers, as seamlessly as possible.

Often, this space serves to inform you of what our AIS program has done in the past year, but instead I'd like to share what is on the horizon. While the staff changes that LSM is experiencing present challenges, they also present us with opportunities. During this period of transition, we will review our program and request input from you to learn more about how we can help serve you better. Please keep an eye on your email inbox, as we will be reaching out to you with chances to get involved.

We are also well on the path to engaging a new Aquatic Invasive Species Director, and anticipate the person will be joining us at the beginning of March. We are excited to have a new staff join our team who will bring fresh eyes to the program. I know you will join me in giving them a warm welcome, and helping them get their feet under them for the upcoming survey season. I'm sure that they will learn so much about dedication, determination, and discipline from your example, just as I have in the time I have worked with you.

This summer we plan to offer a full schedule of trainings all across the state, continue to support those lakes where early detection teams are already active, aid those of you battling an invader already, build capacity on lakes with a small number of volunteers, and bring your expertise to bear on new lakes in remote and underserved areas. For those who are able and willing to travel, there will be a great opportunity to do so!

I said we would look forward, but I would be remiss not to say one last thing. The volunteers are the people that make this organization, but the Invasive Plant Patrol program, and LSM itself, would not be what it is today without Roberta Hill's enduring influence. I would like to share with you a poem by Debbie Broderick, a certified LSM Invasive Aquatic Plant Patroller, dedicated to Roberta and the love for lakes she has helped inspire in us all.

A Special Kind of Soul

Roberta patrols
Littoral communities,
Viewing aquatics.

She pulls up samples,
And floats them in a frisbee,
Takes out her hand lens:

Leaflets, stems and fruits
Might need magnification
Are they forked or branched?

Is the leaf buoyant?
Are the blades triangular?
What is its ranking?

Check for serrations,
& the shape of winter buds,
Or ridges on seeds.

She recommends scopes
And bringing along baggies
Or picking up frags.

She doesn't mind muck,
And will sniff at her fingers
To see if it's skunky.

She'll encourage you
To touch mucilaginous
Slime under the leaf

She talks of gestalt:
& describes "taco shell" leaves.
Or feather dusters,

Some plants are "cheerful"
Some are lasagne noodles,
Others, a birdcage.

She respects al life,
& rescues bugs from drowning
In her floating trays.

Inspiring IPPER -
Enthusing about bladders-
And spiny horn-worts!

Gites teacher,
Sharing her passion on land,
On water and Zoom,

Amazing human,
Kind and generous mentor,
Busy, activist.

A leaf from her book
We must take, to continue
Clonal expansion,

WE are HER fragments,
Floating, rooting, & spreading
To preserve Maine's lakes.

—Debbie Broderick

Quality Counts!

By Linda Bacon, Lake Assessment Section Leader, Maine DEP

Early 2023

First, *Thank You*, *Thank You*, *Thank You* for your patience! Be assured, neither LSM nor the Maine Department for Environmental Protection (DEP) has lost your data since COVID-19 hit. No one ever expects for a perfect storm to hit, otherwise the expression 'perfect storm' would never have come into being. In hindsight, 'perfect storm' is probably the best way to describe what has happened over the last few years. As our partners, you deserve an explanation as to why the delay has occurred. Kudos to all of you who continued to monitor through the pandemic!

Early 2020, when COVID-19 hit, DEP was close to finishing up with the proofing and quality assurance checks on the 2019 data. The 'Lakes' section at DEP only has 4 full-time positions. One, vacant for six months, was filled the day before the first COVID-19 case hit Maine. Then in July, we had another vacancy – for 16 months! COVID-19 also shifted us to working out of our homes which slowed data processing down. Late December of 2021, DEP had to move from one building to another, which brought its own set of challenges. Likewise, 2021 brought many changes at LSM. In Spring, Jonnie Maloney, who had been primarily responsible for water quality data entry, left LSM for another position. LSM's former Executive Director, Scott Williams, went into semi-retirement in early October that year. LSM does not have a huge number of staff and data processing and quality assurance duties were completed as soon as they could, which was Spring 2022, as field season began. The DEP now has all of the 2019 through 2022 data files. As a result, January and February of2023 will be a HUGE data processing period for DEP staff! We are hoping that all goes smoothly so that the DEP Water Quality reports can be posted, including all the data through 2022! If you have any datasheets that have not been submitted, please let LSM staff know!.

Again, thank you to all of you who continued to monitor through the pandemic. The Maine Lakes dataset is one of the most valuable lake datasets in the country. Very few states have data spanning a period up to 51 years. Data continuity is so very important when statistical analyses are done on lake data. When too many years are missing for one lake, its data is excluded from analyses. Your data provided the foundation for four publications that have come out of DEP over the past few years, which have afforded a great amount of insight into how Maine lakes and ponds function. At a local level, without your data, DEP would have a difficult time determining which lakes are impaired and need attention – which is often a combination of efforts: local officials and volunteers, DEP staff and consultants. **We are all in this together!**

On another note, DEP has begun conversations with the Maine Center for Disease Control (CDC) regarding an advisory approach for cyanotoxins and will hopefully have something in place before bloom season hits in 2023. Please visit the DEP website and links for general information regarding cyanobacteria blooms: ***https://www.maine.gov/dep/water/lakes/algalbloom.html***

Also worth mentioning is that there is a move afoot to approach the legislature for more lakes funding. The Lake Restoration and Protection Fund has not been funded since the late 1980s. It is imperative that this fund have dedicated resources to help support the numerous protection and restoration activities needed across the state, including partial support for alum treatments. The threats to our lakes are not going to disappear any time soon. Watershed development and seasonal camp conversions are at an all-time high increasing the amount of nutrient-laden runoff to our lakes. Our lake ecosystems are changing. Additional nutrients, invasive species and non-native fish are slowly spreading across the state. And the highly variable weather we experience due to climate shifts does not help; lakes on the edge are particularly at risk. Keep an eye out for this legislative effort!

I would be remiss if I didn't remind LSM Water Quality volunteers and cooperators to carefully check over equipment, change batteries and perform probe maintenance to prepare for field season. DEP plans to conduct lab QA checks on meters that come in, in early spring as we have over the past few years. Until then, enjoy the opportunities that winter provides in the great state of Maine and be safe!

Cyanobacteria bloom on Clary Lake (5382) in Lincoln County. The extensive bloom began in September and continued into October of 2022. Multiple lakes in the state experienced a similar late season bloom event. Photo by George Fergusson.

Tech Session Reflection

By Tristan Taber

Lake Stewards of Maine (LSM) has been through a number of changes in the past few years. We have had changes to our staff roles and leadership, we have had to adapt to the issues caused by the COVID-19 global pandemic, and have been forced to reevaluate our role in a changing society and ecosystem as global warming continues to impact Maine lakes and people. Through it all, we have embraced new technologies and expanded our outreach to communities in which we've had little representation. We have acted in an integral capacity on four alum applications, and collaborated with many other non-profits, municipalities, and lake associations. COVID-19 required a rapid pivot to our work, as it did for many. One such program that spun out of this pivot was technical support sessions for the water quality program (WQ tech sessions).

We are now in our 3rd year of WQ tech sessions. These have provided a fantastic opportunity to speak with many of our constituents—many of *you*. I am elated to have the opportunity to speak with volunteers, seeing faces that I would otherwise only see once or twice in a year, at most. Since these sessions generally take place on weekday mornings and not everybody can attend, I think it is worthwhile to share with the reader an often remarked upon topic, both as a learning opportunity and as my reflection of the value of our volunteers.

A major conversation topic at WQ tech sessions are the observations by volunteers or lake association members of their particular lake. As more participants discuss their observations, we see a thread of similarity, with striking differences punctuating the conversation. Most of the lake stewards have a similar observation, for instance, their lake is extremely warm, it hasn't rained in 5 weeks, and it is crystal clear. A few share that their lake is extremely warm, it hasn't rained in 5 weeks, and their lake has become stagnant and rife with algae. Those few are understandably unhappy about this. We discuss the differing factors that are playing roles in their watershed, including: water cycling and flushing rates, weather, and impacts from climate change.

These are incredibly complex interactions that we discuss as we parse out some of the contributing factors. Most Maine lakes have **better** transparency when it is **dry** (Bacon and Williams, Lake Stewards of Maine 2007 Annual Lake Report). Some lakes become stagnant from the severe drought and a lack of source water flowing through them. Some lakes are deep and have strong thermoclines that are keeping the cold water at depth separate from the warm surface water. Some lakes are shallow and the wind stirs up their waters, warming them throughout, but also reoxygenating them.

To understand lakes, we need to consider them both as singular entities and as members of groups. There are a variety of lakes and they have similarities and differences. It comes back to "What should they look like? The answer to [that] varies..." (7:43) (Deeds, 2021). In a WQ tech session we discuss our observations, our volunteers have a chance to understand what their lake *is* looking like, and we look at the historical data to better understand, *Is this what it should be like? Is it comparable to historical data?* Climate change, human development pressures within a watershed, and variation in weather will cause lakes to respond differently, but this all makes a strong case for the work of our LSM volunteers. The lake data they collect, and the observations they provide throughout a lake's daily, seasonal, and multi-year cycles, provides critical information that helps to answer some of the questions discussed in our tech sessions. Living close to a lake, enjoying it, caring for it—this is a privilege and a joy. At LSM, we aim to foster community stewardship and in return we become richer with the knowledge and experience of many lake stewards who are protecting and caring for Maine's lakes.

If you are interested in becoming a Water Quality Monitor and joining our WQ Tech Sessions, please visit our website, **www.lakestewardsofmaine.org** for more information.

LSM has water quality data on approximately 845,500 acres of Maine lakes. That is ~85% of all Maine lake area!

Thank you to all who contribute to LSM to support our volunteers and programs. With much appreciation and gratitude, LSM Staff & Board *All Lists are current as of 12-23-2022*

Major Funding

Major funding for LSM is made possible through grants from the Maine Department of Environmental Protection, and the US Environmental Protection Agency.

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In Kind

Many thanks to those of you who have donated your time, shared your expertise, and have been dedicated to supporting LSM's Mission!

In Honor/In Memory

In Honor of

Acton Wakefield Watershed Association & Wilson Lake
~ Jeanne Achille

Denise Blanchette
~ Green Lake Association

Roberta Hill
~ Janet & Robert Bissell
~ Unn Boucher
~ Diane Clay
~ Buffy & Don DeMatteis
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~ Robert & Patricia Severance

Maggie Shannon
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Michael Taflas
~ Lindsay Taflas & Will Banister

Scott Williams
~ Friends of Walker Pond
~ Carl & Sookie Weymouth

In Memory of

Joseph Andrychowski
~ Robert Kramer & Mary Lyons

Peter K. Barber
~ Marygrace Barber

J.B. & Lil Beach
~ Justine & Edward Beach

Louis & Claire Boeri
~ Charles & Linda Whitten

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~ Crystal Lake Association

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~ Jill & Aaron Smart

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~ Pamela Albertsen

Dick Thibodeau
~ Little Wilson Pond Improvement Association

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~ Jaqueline Warren

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~ Lorraine White

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~ Peter Montano

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Amanda Christian
Diane Clay
David B. Clement & Sharon D. Barstow
Louis & Dorli Cloutier
Di & Jack Clymer
Denis M. Coffey
Jerry & Jennifer Cohen
Robert & Jeri Cohn
Marie Connolly
Pamela & David Constantine
Linda Corapi
Thomas & Sara Costello
Carmen L. Coulombe
Dave Courtemanch
Richard & Catherine Cranston
Albert P. Croston
John E. Crouch & Poppy Connor-Crouch
Broce/Cullinane Family
Jim Cummings & Family
John Cummings
Karen & Paul Cummings
Farahad Dastoor
Charles & Joan Dattelbaum
Mary Davis
Mark Deegan
Buffy & Don DeMatteis
Barry DeNofrio
Lisa Deschenes & Michael Welsher
Brenda & Ray Dickey
Deidre & Michael Donovan
Brent Douglass
Norman A. Dudziak, Jr. & Damaris J. Rohsenow
Sandra & Donald Dumont
David W. Edsall
Martha Ehrenfeld & Carla G. McKay
Susan Eland
John & Ginger Eliasberg
Ron & Eileen Epstein
Charles Evans
William & Lori Evans
Holly Ewing
Josephine Ewing
Laurence & Bonnie Faiman
Eileen Fair
Bruce & Susan Fenn
Chris & Deby Ferguson
Michael Fisher & Merry Post
Scott Flagg
Maureen Flanagan
Katherine Flood
Emily Fontaine
Eugenie Francine
Ellen Frankel & Herbert Levine
Douglas Frantzen
Marlee Franzen
Robert & Sibyl French
Kevin & Susan Frewert
Brian Friedmann
Rocco Fucetola
David & Carol Fuller
John & Carol Gabranski
Claire Gargalli
Doug & Andrea Gathany
Carla & Richard Gauthier
Suzanne W. Gerry
Virginia Geyer
George P. & Lorraine Gilbert
Paul & Carol Gillis
Goody & Rosalind Gilman
Sal & Lynn Girifalco
Sue Glann
John & Janene Gorham
Katie & John Greenman
Dan & Lori Guerette
Bart & Mary Ann Hague
John & Diane Hale
Thomas R. Hamilton
Jane Hanauer
Bruce Hanke
Julie Hanlon
Phoebe & Vaughn Hardesty
Jo Harmon & Greg Guerrette
William & Virginia Hart
Hartford-Wright Family
Elin Haugen
Marilyn Heineman
Billy Helprin
Charlotte P. Henderson
Thomas D. Herman
Jeffrey Heyer
Rebekah Higgins
Mark Hillman
Leonard Hirsh
David Hoaglin
David & Janette Hodsdon
Roberta Hodson & Herbert Korn
Holly Hoglund
Jack & Ann Holland
Doug Hollett
Colin & Brie Holme
Karen E. Holmes
Albert Holzwarth
Ellie Hopkins
Richard A. & Jill E. Horr
William B. Inglee
Nancy Innes
Lloyd & Connie Irland
Richard & Elizabeth Jagger
Jarashow Randall Charitable Fund
Neil & Peggy Jensen
Jennifer Jespersen
Kay & Ralph Johnson
Rick & Louise Johnson
Tom & Mary Beth Johnson
Larry Johnston
Bambi Jones
Steve Kahl & Mary Ann McGarry
Peter & Linda Kallin

Individuals, continued

Charlotte Kerrigan
David & Diane Kew
Harry Kimball
John & Joanne Kimball
Brigitte & Harold Kingsbury
Carol Knapp
Fred Knight
Ken Knight
Justine Knizeski
Robert Kramer & Mary Lyons
Barry & Roslyn Kutzen
Colton Laferriere
Norton Lamb
David Landry
Mary R. Lane
Mary LaPointe
John E. Laskey
Sydney Lea
Peter Leitner
Victor & Joanna Lerish
Beverly Lessard
Ilene & Eli Leveston
Robert & Gloria Limoges
David Lind
Eric & Sandra Lind
Robert & Martha Lively
Joseph L. Longtin
Patti & Toby Lott
Scott A. Lowell
Maggie & John Lowry
Heidi Lukas
Mike & Judy Madden
Mike Maguire
Bill & Michelle Mann
Donald & Pamela Mantovani
Amy March
Norman & Barbara Marcotte
Steve & Jeri Markarian
Randall & Betsy Mason
Mary Maxwell & Roy Lambert
Judith F. McGeorge
Patricia McGillivary
Carol & Bill McGuckin
Diana McLaughlin
Ellen McLaughlin
Daniel & Karen McLean
Paulette & Harry McNally
Paul & Nancy McNulty Giving Fund
Ronald D. & Edith L. McPherson
Bret & Sandy Meck
Jeff Melanson & Suzanne Uhl-Melanson
The Adam & Nathan Mendelson Fund
Tom & Marie Michaud
Bill Monagle
Peter Montano
Audrey Moody
Harry & Ellen Moore
Jennifer Morrill
Scott Morrill
Nancy & Steve Morris
Earl & Joanne Morse
Richard & Viola Morse
Susan Motley
Wynn & Sandra Muller
Michael Munzer & Karin Otto
Michael Murray & Rosanne Ducey
Sue Neal
Gerry & Pam Nelson
Mark & Lindsay Nelsen
Muriel Maxwell Nelson
Melanie & Steve Ness
Thomas & Marcia Nigro
Karyn Oakes Keeper
James V. O'Brien & Patricia M. Dugan
Steve & Karen O'Bryan
Patricia Onion
Whitney Wing Oppersdorff
Thomas & Jody O'Rourke
Elizabeth & Victor Otley Charitable Gift Fund
Gloria & Rich Pasquini
Rodger & Patricia Patterson
Ben Peierls
Elizabeth Folsom Peltier
Wallace & Barbara Penrod
Terrie Perrine
Sherry Pettyjohn
Julianna Pfeiffer
Robert & Cynthia Phillips
Nancy Pierce
Shirley Pierce
Tracy Porell
Andree & Jeffrey Pride
James & Joan Proctor
Louise Proulx
Lea & José Ramirez
Jeanne E. Raymond
Frank Read
Wayne & Sharyn Reetz
William F. Reid, Jr.
Irene Reilly
Ron Reinhart
Susan Marie Reinke
Karen Rhinehart
Chris & Julie Ann Ricardi
Linda Rice
Deanne Ricker
Peter & Louise Riley
Dennis Roberge
Lynn Roberge Ligay
John & Adrienne Rollo
Donna & William Rosenkrans
Mary Ross
Margaret Teele Rothberg
Carol & Stanley Rothenberg
Matthew & Layne Rowe
Craig & JuleAnn Rule
Elizabeth Ryder
Robert Sampson
Sara & Eric Sandberg
Caroline & Hugh Savage
Shelley Sazer
Tony & Lori Scarlatos
Nancy Winetrout Schenck
Rich & Lonny Schneider
Claudia & John Scholz
John Schooley
Todd Schwendeman
Christine Scott-Deutsch & Henry Deutsch
Guy Seeley
Robert & Patricia Severance
Ann Sharp
Keith & Ellen Shaughnessy
Tim & Danny Sholtis
Paul & Susan Shook
Anne Shure
Lynn & Alan Sidman
Drs. David & Ann Simmons
Edward & Priscilla Simmons
Lee Sligh & Tom Prescott
Sandra Small-Hughes
Jill & Aaron Smart
Brenda Smith
Debra & Douglas Smith
Dennis & Ellen Smith
Heather & Jane Smith
James Smith
Jeanne & Michael Smith
Nancy Smith
Ronald & Sara-Jane Snyder
Susan Sokol & Ted Webersinn
Ken Sparkes
Deborah Q. Spurlock
Cheryl & Kirk St. Peter
Sherry St. Pierre
Don & Ingrid Stanley
Rebecca Stanley & Charles Jacobs
Loren Starcher
Jeff Stern
Carl & Sally Stillwell
William & Sara Stockwell
Iva & Ted Sussman
Ozro & Donna Swett
Lindsay Taflas & Will Banister
Donna & Yasuyuki Tamaki
Brenda Taylor
Barbara & Patrick Tedesco
Edward & Patricia Thomas
Hall & Debbie Thompson Family Fund
Nathaniel P. Thompson
Stephanie Thornton
Catherine D. Thorpe
James & Janet Timmins
Joyce Toman & Scott Lessard
Robert & June Tracy

Individuals, continued

Woody & Susan Trask
Steve Triggs
Mark & Kathy Tripp
Rob & Tricia True
Truscott Family Camps
Stephen Underwood
Herman & Nancy Voigt
Dennis Volpe & Leslie Muir-Volpe
Sidney Wade
Pete Walton
Jaqueline Warren
Virginia & Paul Warren
John Wasileski
Beatty Watts
Barb Welch
John & Cheryl Welch
Ross & Bunny Wescott
John Westerman & Patty Frackleton
Karen H. & Gary S. Westerman
Cynthia Westlund
Carl & Sookie Weymouth
Dian White
Kim & Ray White
Lorraine White
Charles & Linda Whitten
Susie Wilding-Hartford
Peter Willcox
Keith Williams
Robert C. & Ann K. Williams
Warren & Holly Williams
Bruce & Sylvia Wilson
Richard & Patricia Windecker
Mary & Len Winsky
Bob & Ursula Withrow
Stanley Wood
Joani & Glenn Yankee
Bill Young
Robin Yurkevicz
Stephan Zeeman
Adam Zemans
Grete Zemans
Jon Zemans
Nancy Zimny

Lake Associations

Alamoosook Lake Association
Alford Lake/Lermond Pond Association
Allen Pond Improvement Association
Androscoggin Lake Improvement Corporation
Annabessacook Lake Improvement Association
Basin, David, Tilton Ponds Association
Bauneg Beg Lake Association
Bear Pond Improvement Association
Berry Dexter Wilson Ponds Watershed Association
Branch Lake Association
Cathance Lake Association
China Lake Association
Citizens Association of Liberty Lakes
Clary Lake Association
Clearwater Lake Improvement Association
Clemons Pond Association
Cold Stream Camp Owners' Association
Community Lakes Association
Craig Pond Association
Crawford Lake Association
Crystal Lake Association
Dexter Lake Association
East Pond Association
Echo Lake Association
Embden Pond Association
Five Kezars Watershed Improvement Association
Forest Lake Association
Friends of Cobbossee Watershed
Friends of Cross Lake
Friends of Lake Winnecook
Friends of Monson Pond
Friends of Quimby Pond
Friends of Walker Pond
Friends of Wilson Lake
Georges Pond Association
Great East Lake Improvement Association
Greater Pushaw Lake Association
Green Lake Association
Green & Mirror Ponds Association
Gull Pond Association
Highland Lake Association
Hosmer Pond Association
Howard Pond Preservation Association
Island Falls Lakes Association
Kennebunk Pond Association
Keoka Lake Association
Kezar Lake Watershed Association
Lake Anasagunticook Association
Lake Wesserunsett Association
Lakeville Camp Owners Association
Little Ossipee Lake Association
Little Sebago Lake Association
Little Wilson Pond Improvement Association
Long Pond Association
Loon Pond Betterment Association
Lovejoy Pond Improvement Association
Meddybemps Lake Association
Mirror Lake Association
Muscongus Pond Association
No Name Pond Watershed Management Association
North Pond Association
Pequawket Lake Preservation Association
Piper Pond Association
Pitcher Pond Improvement Association
Pleasant Lake & Parker Pond Association
Pleasant Pond Protective Association
Pleasant River Lake Association
Portage Lake Association
Porter Lake Association
Property Owners of Lovewell Pond
Raymond Waterways Protective Association
Rock Haven Lake Association
Sabbathday Lake Association
Sand Pond & Locke Pond Association
Saturday Pond Watershed Association
Sheepscot Lake Association
Sokokis Lake Association
Summer Haven Lakes Association
Swan Lake Association
Tacoma Lakes Association
Taylor Pond Association
Thompson Lake Environmental Association
Toddy Pond Association
Toothaker Pond Association
Torsey Pond Association
Tripp Lake Improvement Association
Webb Lake Association
West Harbor Pond Watershed Association
Woods Pond Water Quality Association
Worthley Pond Association

A Summer in The 100-Mile Wilderness

Surveying Remote Lakes

By Karina Ricker and Sarah Nelson, PhD, Appalachian Mountain Club

The Appalachian Mountain Club's Maine Woods Initiative (MWI) seeks to permanently protect land in Maine's famed 100-Mile Wilderness through an innovative approach to conservation which combines outdoor recreation, resource protection, responsible forestry, education, and community partnerships. Within the 100,000-acres managed by the organization, there are 52 remote lakes and ponds that vary in size, depth, elevation, and wetland influence. Prior to 2021, the majority of these freshwaters had not been monitored or surveyed. In fact, according to LakesofMaine.org, only four lakes on the Appalachian Mountain Club's (AMC's) land were ever sampled for water quality and these only had minimal measurements of Secchi disk transparency and total phosphorus.

Through our 2021 pilot project, supported by the Maine Outdoor Heritage Fund, we measured water clarity and total phosphorus in 10 lakes and ponds. We also surveyed two additional ponds that were deemed too shallow for repeated sampling. In 2022, our goal was to build on this progress and assess at least 10 more ponds. Thanks to the backcountry navigation skills and persistence of AMC's MWI Lakes Intern Karina Ricker, we exceeded that goal by visiting 16 more lakes.

Ricker spent the summer characterizing and sampling these new bodies of water to gather baseline data on water quality in addition to re-sampling the initial set of lakes we monitored last year. Karina's work brings the total of lakes surveyed to 28! After Lake Stewards of Maine (LSM) certification early in the 2022 field season and with ongoing support from LSM and Maine DEP (Department of Environmental Protection), Ricker traversed many miles with Secchi disk and scope in hand (or backpack). She really enjoyed learning more about lake ecology and loved feeling part of the larger project and community helping to monitor and protect Maine lakes! Ricker attends University of King's College and Dalhousie University.

We have now characterized 28 of the 52 ponds in MWI, contributed over 120 Secchi readings to LSM, and determined late-summer total phosphorus concentrations for a majority of the 28 lakes and ponds. In the future, our goal is to assess this valuable baseline data as a first step to establish a long-term monitoring program that will help identify potential threats to remote, 'reference' lakes—and to continue surveying candidate lakes and ponds across this wild landscape.

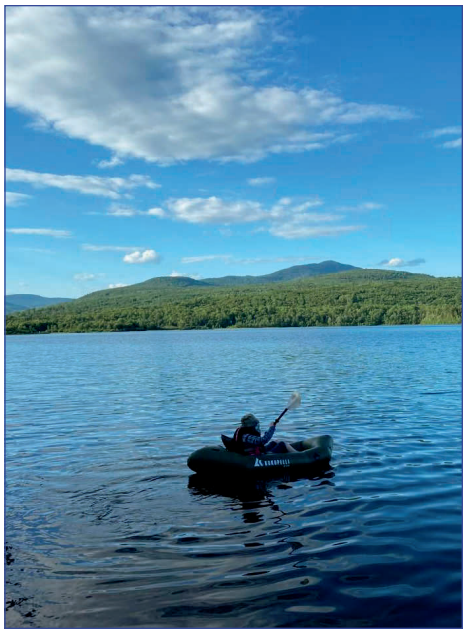


Photo by Karina Ricker.

The Appalachian Mountain Club

The Appalachian Mountain Club (AMC) has been a close partner with LSM. Their work has provided valuable insights into some of the remote lakes in New England, both helping improve the science of limnology in the northeast and creating contrastable data from that which many of our volunteers provide.

If you are interested in reading more about this project and similar work AMC is doing, you can visit their website and read about Michael Macalus', AMC's 2021 intern, experience here: **https://www.outdoors.org/resources/amc-outdoors/conservation-and-climate/the-only-human-for-miles-deep-in-the-maine-woods-with-an-amc-aquatic-researcher/**

On the Front Lines

We're "Infested"! Now What?

by Katie Greenman, former President of the Alamooosook Lake Association and Coordinator for AACT (Alamoosook All Clear Team)

The call from Roberta Hill came in February 2022 with the news that the sample we submitted in September of 2021 had a positive DNA identification for *Myriophyllum heterophyllum* (variable water milfoil), a first for Hancock County. Hearing these words was not a cause for PANIC but a call for a PLAN. And that's exactly what we got through the formation of the Alamoosook Invasive Milfoil Response Team, thanks to Roberta Hill's leadership. The Response Team met virtually twice a month starting in March to coordinate a robust plan of action.

Members of the core Response Team included LSM represented by Roberta Hill and Drew Perlmutter; Maine DEP Aquatic Invasive Species Team John McPhedran, Denise Blanchette and Chris Reily; representatives of Alamoosook's AACT (Katie Greenman and Charleyne Gilbert) and CBI program (Charlie Dodge and Chip Stubbs); Hancock County Soil and Water Conservation District and Hancock County Lakes Association represented by Mark Whiting and Catherine Fox; Lucy Leaf, "Uber IPPer" and representative of neighboring Toddy Pond Association; and Billy Helprin of the Somes-Meynell Wildlife Sanctuary on MDI. Other members of AACT and "Uber IPPers" joined the meetings as needed. A Google Drive folder archived our living agendas, maps, photos, communication, and a record of lab results. This folder has been essential to managing our meetings and storage of documents related to the response.

Because of the positive invasive ID, Alamoosook was listed on the Maine DEP's "Infested Lakes" List for 2022. To alert boaters, signage was required not only at the Craig Brook National Fish Hatchery Boat Launch, but at other area boat launches (all requiring permission to post). LSM provided the poster design expertise. Smaller versions were posted at town offices and businesses. We had no idea of the extent of the infestation based on one sample from one colony; a Level 3 survey focusing on milfoils became the goal for Summer 2022. AACT needed new and improved sector maps. Using Google Earth and IF&W maps, Uber IPPer Ross Wescott of Panther Pond, with his extensive expertise in this area, created an expanded number of sector maps with increased detail of littoral zones. With the focus on milfoils, we needed in-depth training in native and invasive milfoil identification. In May, Roberta and Drew organized an online Zoom webinar open to all stakeholders.

While we did not achieve a complete Level 3 Survey, we covered a majority of sectors and mapped colonies of native milfoils. No colony of *M. heterophyllum* (VWM) was identified as being the same one found by team member Charleyne Gilbert in 2021. After sending multiple samples for DNA analysis during the summer, the mystery remains. All of the samples that were clearly identified as native by the experts were eventually confirmed as alternate-flowered (*M. alterniflorum*). This native species has been found in numerous other sectors along with other native milfoil species (*M. humile* and *M. farwelli*).

Key Elements of the Plan:

- Form a Team with varied expertise.
- Set up a Google Drive (or other) online accessible document storage system.
- Outreach in the form of press release for media, towns and lake associations and presentations to associations, environmental groups and town select boards/councils.
- Signage—design, printing, laminating, posting.
- Protocol for reporting and submitting suspicious plants.
- Create and/or revise sector maps.
- Schedule training: online webinars and on-site Plant Paddles/Plant ID workshops.
- Assemble additional equipment such as marker buoys, grab tools, scopes etc.
- Organize a Level 3 Survey orientation for an Invasive Plant Patrol team; welcome "uber IPPers"(trained LSM volunteers willing to support lake lake communities with invasive aquatic plant surveys) to join the effort.
- Seek grant funding. DEP automatically provides funding to assist CBI efforts on newly infested lakes.
- Work with DEP to create an Invasive Aquatic Plant Management Plan.

Aquatic vegetation on Alamoosook Lake (MIDAS 4336) in Hancock Co. Photo by LSM.

Unfortunately, no emergent flower spikes were observed to help confirm the identification. Although two samples, one *M. alterniflorum*-appearing sample from Birdsacre and a similarly-appearing sample from another lake tested positive for the invasive VWM, they were retested in late November using DNA sequencing and found to be *M. alterniflorum*. Conflicting DNA results over the summer called for sending samples from one additional plant to two labs using different techniques for comparison. By late November we had the results from both labs: NATIVE ALTERNATE-FLOWERED MILFOIL! This was reassuring news, but it does not exactly solve the mystery of the original 2021 *M. heterophyllum* find, nor give us a green light to relax our survey efforts. Since hybridization of species may still be a possibility, Alamoosook will remain on the "Infested Lakes" list for another season.

Thanks to grant funding from Ram Island Conservation Fund through the Maine Community Foundation, we have funds for outreach, equipment, consultants, and sample shipping for 2023.

What more could we have done? Perhaps a full team in-person orientation to review the 2022 plan because email notifications seemed inadequate. Coordinating more group survey sessions involving more "Uber IPPers" were challenging due to juggling ideal weather conditions and individual availability. It was noted by one AACT member that there's more to life than milfoil. While organizing AACT efforts and assisting with Team Response meetings and actions, I often ran out of steam. Sharing the load will be important in 2023.

I am grateful for all AACT members who contributed to the survey work this summer, especially our superbly dedicated Charleyne Gilbert and "UberIPPers" Lucy Leaf and Bunny Wescott whose expertise was critical. We would have been lost without Chip Stubbs who motored surveyors, aided the DEP dive team and knows the lake like the back of his hand. Finding key people like these who are ready to go above and beyond is essential.

Finally, without Roberta Hill's guidance, supported by Drew Perlmutter none of this orchestrated response would have been possible. Roberta gave us the confidence we needed to take on the challenge and her encouraging words kept us going. With the changing climate, more extreme weather events, frequent droughts and the warming of our shallow lake's water, the risk for invasive plants increases every year. Our vigilance is required going forward. We now know how to design a plan of action. More than anything this effort confirmed that Nature holds many mysteries including the intricate genetics of aquatic plants that we may never fully understand.

Invasive Aquatic Plant Removal on Lake Arrowhead

By Debbie Broderick LSM Invasive Plant Patroller, Lake Arrowhead

Lake Arrowhead, in York county Maine, has been fighting *Myriophyllum heterophyllum* (variable watermilfoil, VWM) for 20 years. We use Diver Assisted Suction Harvesters (DASH), which operate for 10-12 weeks each season, to remove dense infestations. With the discovery of *Najas minor* late in 2020, our invasive removal program had to change gears in a number of ways.

Our divers and crew had to learn the characteristics and habits of the new invasive. It required training and hands-on experience in order for them to distinguish this plant from the native naiads; in the early part of the season the differences are less obvious to the untrained eye. Only when *N. minor* sets seed does the characteristic leaf arch and coarse serrations become blatantly clear and easy to see. Our two LSM-trained volunteers surveyed and marked plants for the DASH crew until they were able to identify the plant's signature look with absolute confidence. With the call for additional resident volunteers proving fruitless, it was a daunting task to survey the almost 1,000 acres, so we had to prioritize the 'most likely infested' areas. It has been an extremely challenging and overwhelming task; *N. minor* has been found in every location the monitoring has focused on, and repeat visits to the same area turn up more each time, even after removal operations.

Removing *Najas minor* is timing-critical—there is a relatively narrow window in which to detect mature plants and remove them before they begin disintegrating and dispersing their seeds, but VWM can be harvested at any time throughout the growing season. Naiad harvesting had to take precedence, so VWM removal during that period had to be put on the back burner. This was a drain on the VWM

Dale Schultz prepares for removal work. Photo by Debbie Broderick.

efforts in a year when growth and flowering were prolific. Naiads are difficult to spot in deep water; they are not as robust in their presentation so light conditions, water color and turbidity, as well as surface wind, complicate its detection. A very fine mesh was used initially in our collection baskets but it proved too difficult to work with during a harvesting operation.

We also discovered that DASH operations to remove *N.minor* greatly impacted the site within a few minutes. The pump action of the boat, the trailing hose, and a diver's flippers caused a lot of turbulence and disturbance. The area became stirred up with sediment in minutes, making selective harvesting impossible (VWM suctioning relied on densely packed, monoculture situations). The water currents generated, and contact from hoses and flippers, also facilitated fragmentation and hence, seed dispersal. An infested area had to be abandoned after only a short time, and multiple return sessions were needed over the next couple of days in order to get a patch cleared. Getting divers in and out of the water to work on a small patch for a short time was demanding and costly.

Since the suction harvester cannot operate in very shallow areas, our kayak surveyors volunteered to remove the invasives in shallow water using snorkels. They could remain suspended above the substrate and use handnets to slowly cover and remove each plant. There was less site disturbance using this technique, but it was a drain on the volunteers without other help forthcoming. We are left with many unremoved plants at the end of the season and we have also not been successful in halting the spread of *N. minor* using the techniques described here. The plant has spread to broader sections of our waterbody since we began this effort.

We have learned a lot as we tried to adapt to harvesting both an annual and a perennial invasive on our lake. An annual (*N. minor*) that spreads by seed dispersal through water means that it needs to be located afresh each season. There is no knowing where the floating seeds will be deposited, so continual, seasonal surveying is needed in order to find where it is established each season. This makes it very volunteer dependent. There is also no guarantee of finding all the areas in which it has taken hold. Control of *N. minor* is rather hit-or-miss using targeted, manual removal, while mechanical extraction of a robust perennial like VWM, is more cost-effective.

The nugget of wisdom emerging from our experience is that different characteristics and habits of plants require different methods of treatment and removal. A perennial versus an annual makes a huge difference in the approach needed. Mechanical removal of an annual, prolific seed spreader is not an effective means of control. This is not the only factor to bear in mind when aiming to control invasives, for instance a floating, unrooted perennial presents a whole new set of difficulties. There is no one size fits all solution.

2022 Watershed Survey Grant Awardees

Androscoggin Lake, Leeds

Beech Hill Pond, Otis

Wilson Lake, Acton

LSM awarded three pass through grants to lake communities conducting watershed surveys. These grants were made possible by the Ram Island Conservation Fund.

Please visit *www.lakestewardsofmaine.org* for more information on watershed surveys.

NU Brewery Social & Lake Lovers Pale Ale

Jodie Mosher-Towle from North Pond and her friend are enjoying Lake Lovers Pale Ale at NU Brewery. Jodie along with Susan Beem (not pictured) suggested the name Lake Lovers for our NU Brewery beer.

Russell Voss (NU Brewery owner) serves up Lake Lovers Pale Ale to Jodie Mosher-Towle and her friend.

LSM eased back into in-person events with an informal social at NU Brewery to kick off the 2022 volunteer workshop, water quality monitoring and invasive plant surveying season. A beautiful evening on the first day of summer brought many smiles and engaging conversation as LSM volunteers, staff and board were finally able to gather together.

NU Brewery not only provided the venue for LSM to host the social event, they also crafted a special beer in honor of Lake Stewards of Maine, Lake Lovers Pale Ale. Proceeds from Lake Lovers beer sales resulted in a $750.50 donation to LSM from NU Brewery! If you missed out on trying Lake Lovers, there is still time! The brewery plans to continue offering Lake Lovers Pale Ale next year! A huge shout out and thank you to NU Brewery for being a Partner in Lake Stewardship!

Bob & Sibyl French receiving a LSM longevity award from Drew Perlmutter for their commitment of 15 years of invasive plant patrolling.

LSM volunteers meeting other lake stewards while enjoying a delicious spread of food.

Botanically Yours

By Christine Guerette

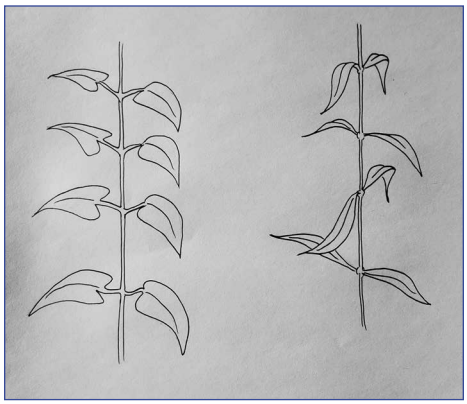
You've heard about invasive aquatic plants, you've decided to join the early detection effort, and you're about to use a guide to identify your first plant. But wait! What do all these terms mean?

The botanical terms we use to describe various parts and aspects of plants can seem like unnecessary jargon, but learning these terms will help you use identification keys and examine new plants like an expert. Identification will become easier, and soon others will be coming to you for help learning botanical terms!

Many of you who are Invasive Plant Patrollers are aware of the three major leaf arrangements seen on aquatic plants in Maine; Alternate, Opposite, and Whorled. An alternate leaf arrangement occurs when one leaf emerges from each node (bonus term: a node is where a leaf emerges from the stem), sometimes resulting in a stem that zigzags back and forth. Whorls happen when three or more leaves emerge from the same node, and oppositely arranged leaves occur in pairs.

But for an opposite leaf arrangement, there's another component to consider: how are the leaves arranged from node to node? There are two possibilities, which brings us to the two botanical terms we are exploring today. First, the leaves could be **superposed.** Superposed opposite leaves always come out in the same direction. Imagine a compass as you look down at the stem from above. In a plant with superposition, the leaves would emerge along a single plane all the way up the stem, always pointing east and west. Burning bush (*Euonymus alatus*), an invasive terrestrial plant in Maine, has an opposite superposed leaf arrangement.

The other type of opposite leaf arrangement is seen in our native water-starworts (*Callitriche*), but also the invasive fanwort (*Cabomba caroliniana*). This type of arrangement is called **decussate**. The word decussate means, according to the Merriam-Webster Dictionary, "arranged in pairs, each at right angles to the next pair above or below." If you were looking down at a plant with an opposite decussate leaf arrangement, the leaves would emerge along two planes. One pair would point east and west, while the next would point north and south, switching orientation at each node.



Superposed (left) and decussate leaf arrangements. Credit: Matthew Vachon.

Leaf arrangement is one of the first considerations when trying to identify an aquatic plant. I hope this article has given you a deeper understanding of the intricacies that are a part of our natural world. As always, if you have a plant that needs identifying, we're happy to help!

Notes From the Shallows: Littorally Protecting Maine Lakes

By Jeremy Deeds, PhD, Aquatic Ecologist, Maine DEP

Imagine yourself paddling along the shore of your favorite lake. The water is flat and calm as you glide past sections of shore guarded by shrubs, saplings, and large trees, some of which have long branches reaching out over the water. The lake surface is so still that you can peer over the side of your boat and see all the way to the bottom. What do you see there? Maybe you see logs and branches laying on a blanket of fallen leaves. Perhaps there are large boulders stacked up on top of each other, or a bed of aquatic plants. These natural features offer feeding and hiding places, or *habitat*, for fish, turtles, dragonflies, and all of their aquatic neighbors.

As you continue along the lakeshore, what do you see when you pass by a section of shore where the shrubs and trees have been removed? In this setting, there is no supply of logs, branches, or leaves from the nearshore area, and the root systems that hold back soil and nutrients from getting into the water are gone. Sediments from the shoreland zone may now reach the water, bringing nutrients to the lake and filling in little spaces between rocks that were once used as critical habitat areas. Since the long tree branches that reach out over the water are absent, there is no shade; this allows the water to warm and stimulates nuisance algae growth with an amplified supply of nutrients. Additionally, the aquatic plant beds may be missing from this shallow-water area (or "littoral zone") because of wading and boating activity, or they might have been removed to make the area more desirable for human lake-users. This habitat has become

A natural shoreline and littoral zone on Pleasant Lake (MIDAS 1100) in Washington County.

unnatural, and these areas with unnatural habitat are unable to support the plants and animals that depend on naturally functioning littoral zones.

The state of Maine greatly values its lakes and has passed legislation to preserve their quality. The law that protects and guides the assessment of Maine lakes includes a provision that lake habitat must be characterized as natural (**M.R.S. 38§465-A**). Scientific studies have established strong linkages between lakeshore human development (the conversion of natural vegetation to buildings, lawns, roads, etc.), to a decline in the quality of littoral habitat[1]. EPA's 2007 National Lake Assessment determined that lakes with poor lakeshore habitat were three times more likely to be in poor biological health.[2] Biologists in the DEP's Lake Assessment Section have been working to determine the degree of association between lakeshore development and the condition of the littoral habitat in Maine lakes. This includes developing a reliable method to measure the quality of littoral habitat, so that future littoral habitat observations may be compared to well-defined "natural" conditions.

To measure the condition of littoral habitat in a lake, 10 randomly-selected sites are surveyed around the shoreline. At each of these sites, the abundances of various littoral habitat components are estimated, such as tree trunks and branches, gravel and boulders, and aquatic plants. The shoreland area is evaluated for the presence and extent of various types of riparian vegetation, as well as evidence of human development. The shoreland observations help to determine if the habitat observed in the water is in a natural condition or is possibly being affected by human activities on shore.

When it's time to analyze the data, the habitat condition at sites with minimal human influence is used to establish a definition of "natural" littoral habitat. That definition, which is a numerical score based on the various types and amounts of habitat features observed at the natural sites, is a benchmark value that is used to compare the condition of littoral habitat across all lakes. With this information, lakes can be put into one of three categories: *natural*, if the littoral habitat meets the definition of natural; *intermediate*, if the habitat is slightly different from the natural condition; or *diminished*, if the littoral habitat is exceptionally different than found in natural settings. Lakes that have *diminished* littoral habitat may be prioritized for shoreland restoration activities, such as reinforcing vegetated buffers between homes and the shoreline. Restoration activities that help to improve littoral habitat will also likely support the protection of water quality by preventing erosion and promoting nutrient absorption by shoreland vegetation.

So far, DEP has performed these habitat surveys on over 100 Maine lakes. The Lake Assessment Section is moving towards using these surveys as a complement to current lake assessment methods, so that a more holistic picture of lake health may be included

A rocky littoral zone is Lower South Branch Pond (MIDAS 4222) in Baxter State Park in Piscataquis County. The small spaces between rocks are an important habitat feature for lake life, especially aquatic insects (like mayflies and dragonflies) and incubating eggs.

1. For example: https://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/lp_littorally.pdf, https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp_mainezoning.pdf
2. https://www.epa.gov/sites/default/files/2013-11/documents/nla_newlowres_fullrpt.pdf

in determinations of lake condition. Eventually, volunteers or regional lake organizations will be able to assess the health of lake littoral zones using the methods developed through this research.

After this winter's snow and ice has retreated, and you are once again out paddling along the shore of your favorite lake, take a closer look in the shallow water area. See if you can detect any differences in habitat between sections of shore that are undisturbed and those that have been developed. Maybe you'll start to see your nearshore areas differently; boulders and submerged tree branches that some may see as a tripping hazard or boating obstruction offer perfect little places for young fish to hide from larger predators. Fallen trees provide sunny spots for turtles to warm up on a cool morning. Aquatic plants reaching above the water's surface offer dragonflies ideal perching sites as they work on suppressing your local mosquito population. It's always a good idea to take a closer look—you might just be amazed at what you can see in the shallows.

What Role Do Soil and Sediment Play in Damping or Enhancing Eutrophication?

Stephen A. Norton; Professor Emeritus, School of Earth and Climate Sciences, University of Maine and Tristan G.S. Taber; Water Quality Program Director, Lake Stewards of Maine

Over the years, we have given talks to LSM (and its predecessor), lake associations, the Lakes Division of the Department of Environmental Protection, and professional meetings. Some questions consistently are asked or implied by interactions with the audience: Why do we care about erosion in the watershed of a lake? Why do some lakes deteriorate in water quality, while others are quite resilient? Why must some lakes get treated with "alum" when they experience increasingly problematic algal blooms? What in the world is "alum"? What role do soil and sediment play in the answers to these questions?

The answers are not easy. To understand the mechanisms of how soil, sediment, aluminum (Al), iron (Fe), and phosphorus (P) influence eutrophication (or prevent it), we need to dig deeper. What goes on among solid inorganic matter (minerals and non-minerals), organic matter, and water in the soil, streams, lakes, and lake sediment? We use abbreviations for elements (there are more than 100). A surprising concept for some of you is that the element oxygen (O) is 93.7% by volume of Earth's crust! We can walk on, tunnel through, drill, quarry, and move the Earth's crust with explosions. And yet we breathe the gaseous form of oxygen, O_2 (two joined atoms), which only comprises 20% of our atmosphere! Dissolved O_2 in surface water may range from about 16 mg/L, depending on the temperature, to virtually 0 mg/L in sediment. Every element occurs in water; most occur as more than one chemical species (e.g., four for Al in Table 1). Some elements occur in different states of oxidation: Iron (Fe) occurs as ferrous [II] and ferric [III]), having different charges because of the different number of electrons in the atom; higher charge for the atom dissolved in water (Fe^{+3}) is more oxidized. The oxidation state of Fe is designated by [brackets]. Superscript numbers are the charge of the various species dissolved in water. Subscript numbers represent the number of atoms or atom pairs in species. If we add dissolved organic carbon (DOC), the dissolved organic matter that colors lake and stream water various shades of yellow to deep brown, fluorine (F), and carbon (C), the table expands dramatically in the number of species. Elements in solutions like to associate with elements with the opposite charge! Let's examine the behavior of Al, Fe, and P.

Aluminum (Al) is the most abundant metal in Earth's crust (8.1% by weight). Most Al is in relatively insoluble silicate minerals, e.g., $KAlSi_3O_8$ feldspar (potassium aluminum silicate) is common in granite. When Al dissolves from minerals, it occurs

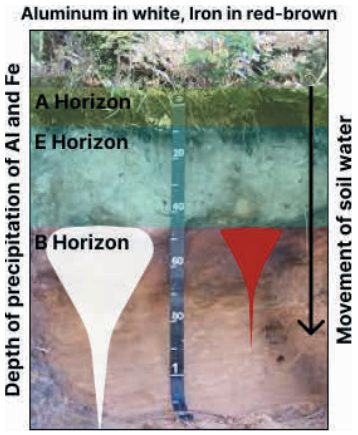


Figure 1: *"A" horizon soil is a low pH layer with abundant organic matter producing abundant DOC, which slowly dissolves Al and Fe from any admixed mineral matter, transporting the Al and Fe downward in the soil profile. Al and Fe are more abundant in the less weathered B horizon. Downward weathering of the "B" soil and consumption of DOC consume oxygen and raise the pH. Fe is preferentially precipitated as $Fe(OH)_3$ in the upper B while Al is precipitated as $Al(OH)_3$ throughout "B" and into "C". The area of white and red-brown is representative of the amount of precipitated Al and Fe. Image provided by Randy Schaetzl has been modified.*

Element symbols	Majors species in water	Charge on the species
Al = aluminum	Al^{+3}, $Al(OH)^{+2}$, $Al(OH)_2^{+1}$ $Al(OH)_4^{-1}$	+3, +2, +1,and -1, respectively
O = oxygen	O_2, mostly H_2O, $(OH)^{-1}$	O_2 is 0 in the atmosphere.
H = hydrogen	H^{+1}, mostly H_2O, $(OH)^{-1}$ Low pH corresponds to high H^{+1} mostly	H is +1 in H_2O, O is -2; therefore, H_2O has no overall charge.
Fe = iron	Fe[II]$^{+2}$, very little Fe[III]$^{+3}$	+2 (ferrous [II] and +3 (ferric [III], respectively
P = phosphorus	mostly $H_2PO_4^{-1}$ and HPO_4^{-2}	The charge of P in the species is +5.
K = potassium	K^{+1}	+1

Table 1: *Some chemical symbols and species used in the text. Everything is soluble, to some extent, in water and most elements in water occur as several species.*

as one or more of the species in Table 1. The pH of the water determines which specie(s) will be present and dominant, and how much Al could dissolve. The solubility of $Al(OH)_3$ is lowest at about pH = 6-6.5 (a few µg/L), increasing dramatically below pH = 5, and less dramatically above pH = 6.5. Just below the forest floor organic-rich layer, the pH of soil water is commonly between 4 and 5, promoting the dissolving of Al. Abundant DOC produced in this layer also increases the solubility of Al-bearing minerals, by combining with the Al as the uncharged molecule Al-DOC. As soil water moves downward, pH rises slowly from weathering (leaching), and as acidic DOC is consumed by microbes; consequently, Al is precipitated as $Al(OH)_3$ (Figure 1). That $Al(OH)_3$ adsorbs PO_4. The negative surface on the soil particle attracts Al^{+3} and H^{+1}, which then attract negative species from the soil water, thereby retaining PO_4. Al-DOC drains to streams and then to lakes. The Al-DOC remaining in surface water becomes photo-oxidized by sunlight, releasing the Al from DOC. Because the pH of many streams and most lakes in Maine is between 6 and 8, precipitation of small amounts of $Al(OH)_3$ and adsorption of P occurs, producing sediment.

Iron (Fe) is more complicated. In nature, Fe commonly occurs as either ferrous [II] iron or ferric Fe[III], depending on the availability of oxygen when the minerals formed within Earth's crust. In normal aerated water, Fe^{+3} is virtually zero and all Fe^{+2} becomes oxidized and precipitated as light to dark brown $Fe_{[III]}(OH)_3$. Iron-bearing minerals literally rust in place! If P species are present in the solution, they will be adsorbed on the $Fe(OH)_3$, as for $Al(OH)_3$. Forest soils retain their P for recycling in these two secondary products, and in organic matter. DOC also enhances the solubility of Fe-bearing minerals, forming the neutral molecule Fe-DOC. Unlike the Al story, as soon as the water reaches the water table in forest soils it typically has been depleted of O_2 because of use of O_2 by microorganisms for respiration. Dissolved O_2 in soil water starts out at 10 to 16 mg/L and ends up at close to 0 mg/L. Consequently, any remaining Fe^{+2} and Fe-DOC will continue moving with the groundwater; thereafter, more Fe^{+2} may be leached from the soil and bedrock. As groundwater emerges in a spring into a stream or lake, any Fe^{+2} will oxidize and precipitate. Most Fe-DOC becomes photo-oxidized by sunlight. Freshly precipitated $Fe(OH)_3$ adsorbs small amounts of P from the water column, and the sediment gains more P-laden precipitate. If dissolved O_2 in the lower hypolimnion during thermal stratification drops below about 2-3 mg/L (especially in the sediment), the sediment $Fe(OH)_3$ dissolves, releasing its Fe as Fe^{+2} ***and*** the adsorbed PO_4. This recycling of P is called "the ferrous wheel". Recycling of P is most common in shallow mesotrophic or eutrophic lakes. (This discussion explains the occurrence of the ring-around-the-collar and ring-around-the-bowl phenomenon in homes with drilled wells in Maine. Fe and manganese behave similarly so your rings can range from orange-brown to black). Dissolved Al enters a lake aided by low pH runoff (the acid rain days) and high DOC from wetlands. The Al is retained in the lake because of photo-oxidation of Al-DOC and higher pH which causes $Al(OH)_3$ precipitation in the water column, PO_4 adsorption from the water column, and accumulation as sediment. Most dissolved Fe in surface water reaches the lake in the form of Fe-DOC molecules (and some in groundwater), that are photo-oxidized to Fe^{+2}, which promptly precipitates as $Fe(OH)_3$, adsorbs minor PO_4 from the water column, and becomes sediment. Retention of dissolved Al and Fe in streams entering Maine lakes typically exceeds 90% in the lake. *Erosion of soil transports solid $Al(OH)_3$ and $Fe(OH)_3$, with substantial adsorbed PO_4, from the acidic soil environment to the higher pH environment of the lake. P is desorbed to the lake water in this transition (Figure 2).* ***That is why preventing erosion is important to lakes.***

The stage is set. Lakes get out of whack because of too much P. The cause can be lake susceptibility, climate change, or human activity of many kinds. The excess P causing algal blooms is from the atmosphere (which you can do almost nothing about), the watershed (which you can do something about), and from recycling from the sediment (which you can reduce with alum treatment). Years of declining Secchi disk transparency during summer stratification, and declining pleasure and real estate values get people's attention. People prefer to swim in clear water, rather than looking at swirly pea soup. So, landowners and associations call DEP and are told that alum treatment may help. Here is what alum does in the lake.

Alum is solid crystals of $KAl(SO_4)_2$ (potassium aluminum sulfate), but you may read that it is also $KAl(SO_4)_2 \cdot 12H_2O$. It is expensive and the cost of application is even more expensive. Alum is very soluble so

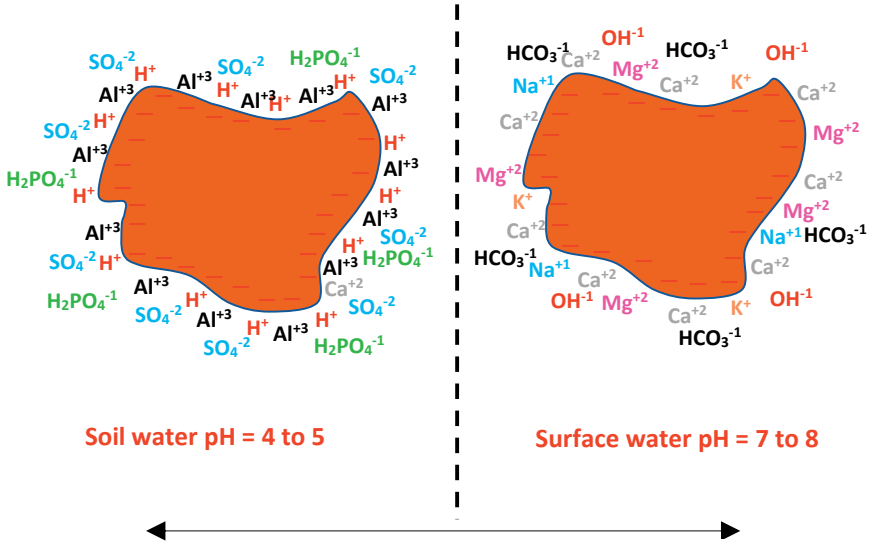


Figure 2: *Schematic of the ions adsorbed on a negatively charged soil particle at low soil pH (4-5, left) versus the same particle at higher surface water pH (7-8, right). A soil particle going from low pH to higher pH, either in soil water or open water will desorb P (**$H_2PO_4^{-1}$** = all species of ionic P), **SO_4^{-2}**, **Al^{+3}**, and **H^{+1}**, and adsorb **Ca^{+2}**, **Mg^{+2}**, **Na^{+1}**, **K^{+1}**, **$(OH)^{-1}$**, and **HCO_3^{-1}**. This process is called ion exchange.*

there is little difficulty getting it to dissolve as shown in Equation (1). The presence of water is implied by the charges of the ionic species.

$KAl(SO_4)_2 \rightarrow K^{+1} + Al^{+3} + 2SO_4^{-2}$ (1)

$Al(OH)_3$ starts to precipitate rapidly (Equation 2) because the pH of a typical lake in Maine (6.5 to 7.5) is near the minimum solubility of $Al(OH)_3$.

$Al^{+3} + 3H_2O \rightarrow Al(OH)_3 + 3H^{+1}$ (2)

One solid is yielding dissolved Al while the other is precipitating Al! Reaction (2) produces acid (H^{+1}), lowering the pH. The release of H^{+1} may be compensated for by adding an acid neutralizing agent which must be carefully combined with the alum. You may have seen photos or videos of an alum treatment, such as the one on Lake Auburn in Auburn, or Long Pond in Parsonsfield, ME (Figure 3). The white plume behind the boat is precipitating $Al(OH)_3$ in very tiny fluffy particles. The small particles have a high surface area to volume relationship. $Al(OH)_3$ surface area ***increases*** as the diameter of the particle ***decreases*** due to this size change for the same mass. Thus, adsorption of PO_4 increases as particle size decreases. The $Al(OH)_3$ slowly sinks down through the water because it is denser than water and eventually becomes sediment. On the way to the bottom, it adsorbs substantial amounts of PO_4 from the water column via adsorption. $Al(OH)_3$'s solubility is not affected by oxidation (high dissolved O_2) or reduction (low dissolved O_2). So, if the upper sediment or bottom water goes anoxic (less than about 2 mg O_2/L), only the $Fe(OH)_3$ will dissolve and yield its adsorbed PO_4. But the sediment is now "chemically capped" with a very thin layer of $Al(OH)_3$ that will adsorb any released PO_4 from the dissolving $Fe(OH)_3$. The million dollar question is how much alum should we add so that the sediment has a barrier to releasing PO_4 during anoxic periods. We need to know two things.

1. What are the unmodified proportions of $Al(OH)_3$, $Fe(OH)_3$, and P in the top 3-5 cm of sediment?

2. How much $Al(OH)_3$ must be added to the sediment to prevent recycling of P during anoxic (0 to 2 mg O_2/L) conditions.

The top 5+ cm (2+ inches) of sediment are most interactive with the lake water. Professor Jiří Kopáček (from the Czech Republic) answered the questions, in part with samples from Maine lakes. In their laboratory, uppermost sediment from cores (0-1 or 0-5 cm) was subjected to five successive increasingly rigorous chemical extractions and the resulting solutions (sol.) were analyzed for Al, Fe, P, and Ca: (sol. 1) distilled water to remove loosely bound ions; (sol. 2) a strong reducing agent (which mimics 0 mg dissolved O_2/L) that dissolves most $Fe(OH)_3$ and any PO_4 adsorbed to it;

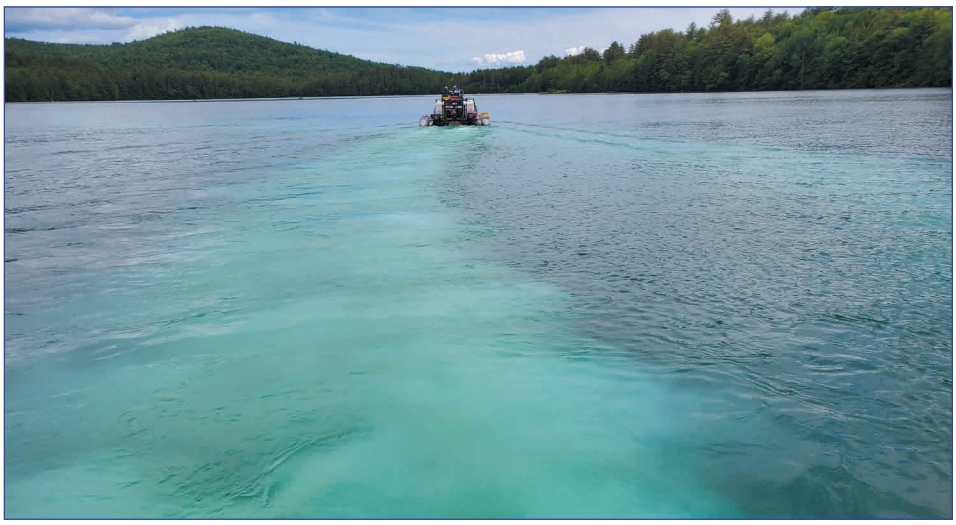


Figure 3: *Alum treatment on Long Pond (MIDAS 9701) in York Co. White aluminum hydroxide ($Al(OH)_3$) flocculant can be seen beneath the surface as alum is applied by the barge positioned towards the top of the image.*

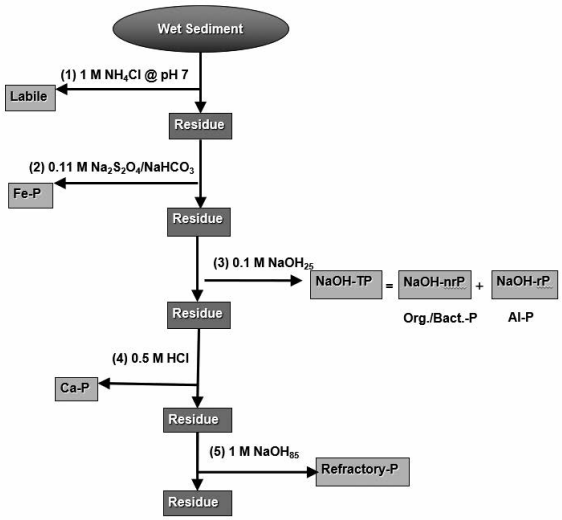


Figure 4: *Wet sediment from the top of a lake sediment core is subjected to five successive extractions with the same sediment sample, using dissolved chemical reagents labeled (1)...(5). After each reagent is added to 0.500-1.000 g of sediment, with specified contact time between sediment and reagent, the solution-sample is centrifuged, solution decanted with a pipette, sample washed with the same reagent, thoroughly mixed, centrifuged, decanted, filtered, combined with the first filtered supernatant, and chemically analyzed for Al, Fe, P, and Ca. The procedure is from Psenner et al. (1988), modified by using Tessier et al. (1979) for extraction (1) and Hieltjes and Lijklema (1980) for extraction (3). Most data from Maine lakes have been obtained using this procedure.*

(sol. 3) a strong basic solution (NaOH) that dissolves most $Al(OH)_3$ and PO_4 adsorbed to it; and sol. 4 and 5 which are irrelevant to the question (Figure 4). The conclusion of these experiment was: "*negligible amounts of PO_4 (are) released from lake sediments during hypolimnetic anoxia if either the molar ratio Al(sol. 3):Fe(sol. 2) is > 3, or the molar ratio Al(sol. 3):P(sol.1+sol.2) is >25" (Kopáček et al., 2005*). These analyses have been conducted on over 150 Maine lake cores; the rules are almost universally correct! These measurements enable us to calculate how much $Al(OH)_3$ from alum must reach the sediment to prevent release of P during anoxic periods for a calculated rate of Fe dissolution. Even as $Fe(OH)_3$ dissolves and releases its adsorbed PO_4, the $Al(OH)_3$ from alum treatment can adsorb it "immediately". Many processes control the length of the effectiveness of the treatment, including rate of sediment accumulation and flux of P from the watershed and atmospheric inputs, but the sediments are no longer a significant source of recycled P. A treatment may last about 8-10 years or more. Shallow lakes with developed shorelines (agriculture and housing) in certain geologic settings are most vulnerable to eutrophication. Deep lakes are generally less vulnerable (Amirbahman et al., 2022; Deeds et al., 2020, 2021).

Acknowledgments

We are very grateful to our colleagues: LSM staff, LSM's former Executive Director Scott Williams and the 1,000+ LSM volunteers, DEP Lakes Division leader Linda Bacon who helps train the volunteers and assures reliable data is made available to the scientific community, Aria Amirbahman at Santa Clara University, CA, Jeremy Deeds of DEP, Colin Holme, Director of LEA, and Jiří Kopáček. They have been generous with assistance, data, and wisdom for 40 years.

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Passings

Linda Breslin
1942–2022

LSM Invasive Plant Patroller on Liberty Lakes for 16 years.

Linda served as the Citizens' Association of Liberty Lakes (CALL) board president for over 20 years. She was the moving force behind numerous lake/town projects, notably a watershed survey in 2003 that identified major threats to water quality, the recent repair of dams for both Lake Saint George and Stevens Pond and the establishment of a no-cost summer experience—Lake Keepers Camp—teaching area youth about the preserving water quality in our lakes and ponds. Her energy and enthusiasm was contagious. She will be greatly missed by the CALL lake community. (notice on CALL Facebook page)

Elise "Lisa" Hall
1950–2022

LSM Invasive Plant Patroller on Crescent Lake for 10 years.

Elise "Lisa" Hall, a sparkling, enthusiastic and devoted steward of her favorite place: Crescent Lake in Raymond and Casco, stepped up to the plate just over a decade ago to organize that lake's invasive plant patrol. She recruited volunteers to adopt sectors to monitor Crescent each year, taking on several sectors herself, and sometimes with her devoted husband Ron, who predeceased her by 19 months.

After having seen the horror of milfoil in Lake Winnipesaukee, she went on a plant paddle offered by LSM, was trained and certified, and then sought mentorship by Panther Pond's team captains, attended the PPipper Kick-Offs annually, then set up her own for her CLIPPERS. Lisa was curious and enjoyed learning all about what is in Maine's lakes and how to take care of them. A can-do participatory spirit had she: filling in with many an 8 hr. shift when CBI coverage was lacking; carrying tarps and pegs to DASH crews; fabricating hundreds of said T-pegs; building and salvaging tarps; tirelessly hauling sacks of milfoil through the muck and up embankments in the Jordan River.

Lisa volunteered with the Crescent Lake Watershed Assn. by serving on its advisory board and went beyond her own lake to being on the board of the Raymond Waterways Protective Assn. (RWPA) in the capacity of Secretary; Christmas of 2021 she and President of RWPA, Peggy Jensen gathered items and assembled a holiday (lakes themed) tree for the RWPA to donate to the Raymond Village Library raffle fundraiser. This lake lover and contributing gem passed away far too soon, on Sept. 12, 2022 at the age of 72. (contributed by Bunny Wescott)

Laughlin H. Macdonald
1949–2022

"Locke" joined the Crescent Lake Watershed Association board in 2016 and soon thereafter he took the dual role of Vice President / Treasurer of the Association. His good humor and willingness to jump in were greatly appreciated by all the members of the board.

When Raymond Waterways Protective Association solicited volunteers to join their board, Locke once again stepped forward, and as Director of Raymond Waterways Protective Association, ran the Courtesy Boat Inspection program in Raymond, helping to prevent the introduction of invasive species into our waters. Locke was greatly appreciated by all the inspectors he hired. Locke will be missed for his generosity, humor, and fun-loving nature. (contributed by Russ Hutchinson & Peggy Jensen)

Joseph P. McMenimen
1944–2020

LSM Water Quality Monitor on Lower Kimball Pond for 11 years.

After retiring, Joe and his wife, Karen, moved to Maine where they enjoyed their best years. Joe spent the summers kayaking on Kimball Lake, and the winters navigating the ski slopes. He had a big smile, hearty laugh, quick wit and cared deeply for others. (**www.woodfuneralhome.org**)

Brainard Irwin Tripp
1937–2021

LSM Invasive Plant Patroller on Embden Pond for 12 years.

Brainard was a member of the Embden Pond Association. He was an avid outdoors man who enjoyed hunting, fishing, boating, gun collecting and observing wildlife. He was interested in Maine history and geography, and truly delighted in exploring in Maine's back country roads. (**www.centralmaine.com**)

Nancy Willard
1936–2021

LSM Water Quality monitor on Bryant Pond for 19 years.

Nancy was dedicated to family, church and friends, she was self-assured, independent, "feisty", a great sense of humor and passionate in regards to her town of Bryant Pond, Lake Christopher and helping others (handicapped skiing, outdoor activities, love of animals and a well respected College Educator and coach). (Sun Journal, Aug 2021)

Philip Ouellette
1938–2018

LSM Water Quality and Invasive Plant Patroller on Portage Lake for 7 years.

Philip enjoyed spending summers with his family at his beloved "Picklehead Point," their camp on Portage Lake. Philip and his wife, Crystal, raised their family in a sometimes chaotic, but always loving home, filled with laughter during the recounting of any number of adventures Phil would tell of life in The County, sometimes even at his own expense. (**www.legacy.com**)

Martin Velishka
1941–2022

LSM Invasive Plant Patroller on several lakes in the Rangeley Lakes Region for 7 years.

Martin lived on Lake Mooselookmeguntic. He enjoyed spending time with his family playing sports, hiking and boating. Martin volunteered with various groups and helped with fundraising activities. Along with other community members, he created a "Gnome Home Roam" trail in Rangeley for the Rangeley Lakes Trails Center and volunteered at the Maine Forestry Museum. His passion was building, and he developed a favorite project, Blueberry Fields in Haverhill, MA. (**www.berubecomeau.com**)

Dennis "Denny" Phillips
1946–2022

LSM Water Quality monitor and Invasive Plant Patroller on Watson Pond for 11 years.

Denny cared deeply about protecting the environment and this was apparent through his many dedicated years of community involvement. He was on the town of Rome's planning board for over 20 years. Denny was one of the founders of Belgrade Regional Conservation Alliance (now 7 Lakes Alliance) which started with conserving French Mountain on Watson Pond. He helped raise over a million dollars to protect the Kennebec Highlands, 6,400 acres of conserved land in central Maine. Denny loved working on the family farm with his wife, Sandy. He was an avid mountain biker, and thoroughly enjoyed kayaking and camping on Watson Pond where he could view all of the land that he helped to protect.

Ted Van Leer
1929–2022

Sue Van Leer
1930–2021

LSM Water Quality monitor on Alamoosook Lake for 7 years.

Ted and Sue enjoyed spending their summers with family and friends on Alamoosook Lake. In the early 1990s, the couple became alarmed at the large-scale clear-cut logging of an entire valley and mountain near them and the local lake community. Ted and Sue collaborated with other concerned locals to form a trust to solicit funding and donations to purchase and protect 4,500 acres in perpetuity from development. Nearly 30 years later, the Great Pond Mountain Trust has grown to become one of the largest private land trusts in the state. (The News-Gazette Corp., June 2022)

We care deeply about Maine's lake volunteer monitors. LSM does not always hear of passings right away, which is why a few volunteers who passed in recent years are included. If you would like to share news of a monitor's passing, please contact us stewards@lakestewardsme.org

In Memory of Pixie Williams

1924–2022

Lake Stewards of Maine will be forever grateful for Pixie's dedication and commitment to lake conservation. She was a member of LSM's Board of Advisors and an invasive plant patroller for 17 years! She was one of the major contributors to LSM's aquatic plant herbarium collection, which is named in Pixie's honor. Pixie was a fascinating woman with a sharp mind and an interesting outlook on life. All who knew her will miss her greatly.

Born Gertrude Ellen Mary Barton, Pixie was nicknamed by her father as an infant. She outlived all in her generation of the family and passed away in Maine at the venerable age of 97, while listening to Bach after suffering a stroke.

Pixie was an unconventional force of nature, driven by an incredible inner strength, and sometimes by sheer cussedness.

She attended Bryn Mawr College and subsequently earned a Bachelor of Science degree from the University College of Cape Breton (UCCB), and a master's degree in Plant Systematics from the University of New Hampshire. Her first career was full-time mother, managing the household and raising her four children. As Pixie's children grew up and needed less of her time, Pixie taught at St. George's School in Poughkeepsie, and next at the Dutchess School in Millbrook, New York.

Around 1970, her true professional calling kicked off when she volunteered at the Carey Arboretum in Millbrook (a division of the New York Botanical Gardens) and got hooked on botanical taxonomy.

In the mid-1980's Pixie and her husband, Rhys, moved to Homeville, Cape Breton, Nova Scotia—to the saltwater farm she and Rhys had purchased. Here, Pixie jumped into her botanical career with both feet, teaching part-time at UCCB, and collaborating with the Nova Scotia Museum and Nova Scotia Department of Natural Resources.

She established UCCB's plant herbarium collection and contributed to the provincial herbarium. She did her master's thesis identifying and documenting the flora on the miles of federal land at Fortress Louisbourg National Historic Site—across coastal, forest, and bog habitats. She was especially proud to have worked with members of the Mi'kmaq First Nation at Eskasoni, helping them identify the scientific names of their traditional medicinal plants, for which work she was made an honorary Elder.

Pixie joined Lake Stewards of Maine in 2004 where she refocused her botanical lens on invasive aquatic species. Pixie continued collecting aquatic plant specimens in her kayak into her early 90's. In 2015, Pixie moved in with her daughter Margaret in Topsham, and yes, she finally started slowing down, but she continued to work with the Lake Stewards of Maine. A Celebration of Life event is planned for July 8, 2023. For more information, please email Margaret (mewilliams443@gmail.com).

Paddle on, Pixie!

The Pixie Willams Herbarium, located at LSM's Center for Citizen Science, is a state-of-the-art herbarium devoted specifically to vascular plants that grow in and around the lakes of Maine. The herbarium storage cabinets, the knowledge of proper herbarium storage and classification, and much of the classification labor were provided by Pixie during the last few years of her life.

Intern Experience

Trey Cormier

My name is Trey Cormier, I'm a rising senior at Dartmouth College majoring in environmental studies and minoring in philosophy, and I spent the summer working as a water quality intern for Lake Stewards of Maine (LSM). My initial impression of LSM was that it was a fantastic example of citizen science, something that I had been interested in through my studies. Citizen science essentially bridges the gap between citizens and professional scientists, giving local communities the tools and opportunities to protect their home and scientists more resources and data to further their understanding of the environment. I knew that I wanted to be able to work with people who believed in this idea and care about the environment. Here are three lessons I have learned through my experience at LSM and from the people I met along the way.

Consistency is key! The data being taken and collected every year is obviously important, but meaningless when taken out of context of the historical data set. This is why LSM celebrates the volunteers and employees who have stuck around for years and even decades. Their commitment to LSM's mission is remarkable and makes monitoring Maine lake health possible. I have learned that this lesson is also true outside of taking lake data. The ability to stick to a task, however simple it may seem, is crucial to improving your craft, whatever it may be.

Community fosters the care necessary for the environments that we love. During LSM's social at NU Brewery early in the summer, most people I met monitor with other people, making the process more of a social event. I believe that it is important to find other people who care about your lake's health and involve them. Creating and engaging in a

community that cares for your lake just as you do makes the process more fulfilling and enjoyable. The larger and more involved the community is, the easier it is to combat whatever may degrade your lake's health. Taking water quality data does not actually prevent the degradation of a lake's health, but the data collected can provide an early warning system, a connection to the ecosystem, and, perhaps most importantly, fosters a community ready to take action against whatever issue the lake faces. The connections within a community and between that community and ecosystem are at the heart of community resilience. Community resilience motivates people to build and develop tools and networks that can be employed quickly if something bad does occur. LSM's invasive plant patrol program is a fantastic example of this resilience and community effort. When an invasive species is found in just one sector, the entire lake must be checked. This would be impossible without an entire community willing to comb over every part of their lake, ensuring that it is entirely eradicated. Watershed survey assessments are often led by an individual or small group, but without the participation of the community—and even upstream communities—the work of watershed surveys will not have as beneficial an impact on the lake's water quality.

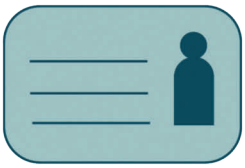
Giving back and having a sense of purpose creates a unique sense of fulfillment. This is no secret, but there is no better way to feel fulfilled than to give back to the places and communities that you care about. It is important to remember that when you volunteer your time or give money to LSM, you are not only helping the lake you are monitoring, but also indirectly benefiting yourself, your community, and future generations who will continue to use and care for the lake.

As my internship ends, I can confidently say that my initial impressions were absolutely correct. Everyone I worked with and met throughout the summer demonstrated such infectious passion for protecting lake health. As a lifetime New Englander, it was fulfilling to work towards building community resilience in the places that I care about and take pride in. I believe that everyone should aim to be the best possible steward they can through educating themselves and taking careful and intentional actions to sustainably manage the places that they love. I aim to remember the idea of stewardship as I connect with new places and communities throughout my life. I would like to thank everyone at LSM for giving me insight into how a small team interacts and manages such a large network of stewards throughout the state of Maine, and I am excited to watch LSM continue on their mission to promote lake stewardship throughout the years to come!

Shelby Deegan

Hi there! My name is Shelby Deegan and I served as a part-time Development, Marketing, and Communications intern for LSM last summer. My position was generously funded by John Wasileski and coordinated through McGill University. I am a third-year student at McGill pursuing a Joint Honours degree in Environment and International Development, as well as a minor in GIS and remote sensing. I am originally from the DC area and currently living in Montreal to attend university. Despite having never lived in Maine, I feel a close connection to its land and community as I spent several months after high school backpacking and canoeing throughout Maine. This life-changing experience is what led me to major in environment in college. Thus, I am very passionate about conserving the lakes of Maine so that others can be as inspired by them as I was. My work during the summer for LSM was mostly focused on fundraising through campaigns and events. I truly hope this work was impactful and will help LSM to continue their incredible work.

Over 120 Lake stewards joined in a Plant Paddle



Over 300 monitors were recertified via the online Secchi Simulator

2022 Webinar Series

Highland Lake—plankton community; comparison of eDNA findings and analysis of plankton tow samples

Sharon Mann, University of Maine

Overview of Climate Change in Maine

Ivan Fernandez, PhD, University of Maine

Panel: Experience of Alum Treatment as Lake Association

Wendy Dennis, Cobbossee Watershed District; John Eliasberg & Brian Friedmann, Georges Pond Association

Lake Auburn Water Quality and Watershed Protection

Erica Kidd, Lake Auburn Watershed Protection Commission

Heavy Metals, PFAS, Cyanotoxins in Maine Lakes—Risk Assessment Approaches to Toxic Substances

Breana Bennett, Maine Center for Disease Control and Prevention

Panel Discussion Volunteer Experiences

Debbie Broderick and Dale Schultz, Lake Arrowhead; Katie and John Greenman, Lake Alamoosook; and, Mike Cloutier, Sabbathday Lake

Application Design to Support Community-Based Water Monitoring

Srishti Gupta, Penn State University

Sedges, Rushes, and Grasses of Maine Lakes

Lisa Standley, PhD, New England Botanical Society

Recordings available on our website.

2023 Annual Conference

Save the Date June 17, 2023

We are extremely excited to announce that not only will Lake Stewards of Maine return to a conference format similar to pre-covid conferences, but we will also co-host the event with our colleagues at Maine Lakes! The joint conference will be held on **Saturday, June 17th at the China Lake Conference Center in China, Maine**.

Guest speakers will present on lake science issues and other topics that directly affect all those who live, work or play on Maine's lakes. The conference will also include activities, opportunities to network and socialize, and awards and recognitions.

Over 30 invasive plant patrollers joined IPP Zoom Tech and Aquatic Plant Botanizers Circle sessions

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Over 120 unique attendees participated in one or more Water Quality technical sessions

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