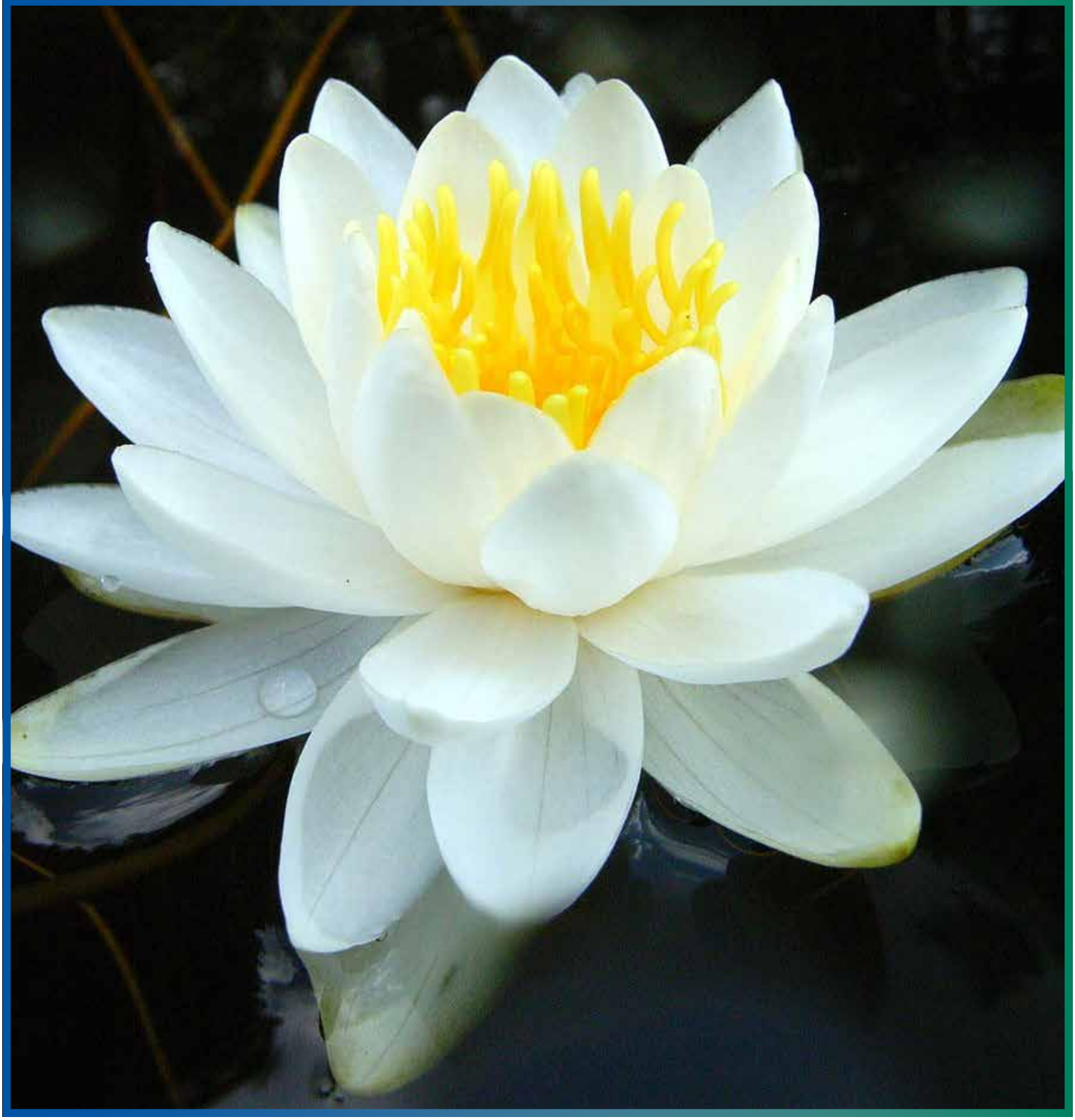
the WATER COLUMN

The Newsletter of Lake Stewards of Maine - Volunteer Lake Monitoring Program

Vol. 25, No. 1 Celebrating the Work of Maine's Citizen Lake Stewards Winter 2020-21



What's Inside:

Layout & Design by Jonnie Maloney, LSM Program Coordinator

Cover Photo: *Nymphaea odorata*, taken by Dennis Roberge. Please enjoy this photo as much as we do—it's lovely, mesmerizing, peaceful, and tranquil—a little something we could all use right now, and a true work of art, courtesy of Mother Nature...

Lake Stewards of Maine
Volunteer Lake Monitoring Program
Keeping a watchful eye on the health of Maine lakes since 1971

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President's Message

Barb Welch
President, LSM Board of Directors

This has been a different kind of year for all of us, and a very difficult year for many. I hope you are doing okay and you and your families are well.

Despite, as well as considering the COVID-19 situation this year, I am so proud of what the LSM staff and hundreds of volunteer monitors accomplished this sampling season.

Come April, in the face of COVID-19, LSM's usual protocols for gearing up for trainings, developing schedules, checking equipment, sampling, attending lake association and professional meetings were obsolete. So, at first, we thought it would be a quiet summer, since not much could be accomplished because in-person training, meetings, even traveling together were no longer advisable.

Staff soon figured out, however, they could still train and support volunteers using technology. They learned how to do remote training, host seminars, do quality control, identify specimens… over Zoom. Thank goodness for Zoom. They hosted weekly seminars for 9 weeks with an average attendance of 50 people, twice-weekly workshops for Invasive Plant Patrollers, a weekly support session for water quality monitors, weekly conferences with EPA, DEP and other New England collaborators on blooming lakes, as well as meeting with monitors from individual lakes that were experiencing problems.

They answered more email and telephone questions than ever before. In addition, staff continued to apply for grants, looked for new ways to connect with donors, and tried some innovative fundraising to keep programs running.

And staff were all in their separate homes; no heads together over the conference table. They were still a team, though, and each used their skills, experience, and ingenuity to put together programs that gathered water quality data as accurately as before, supported Invasive Plant Patrollers from afar, and kept LSM running and afloat.

The volunteers were intrepid. They collected data on hundreds of lakes. If someone out-of-state couldn't make it back to Maine, they found substitutes. Some of the Invasive Plant Patrollers (IPPers), we call them Uber IPPers, took it upon themselves to organize local teams to survey new lakes. Some found some new infestations (ugh). Maine's citizen lake scientists continued to monitor our lakes efficiently, effectively, and safely.

My thanks, respect and admiration to all who helped make this summer's monitoring season so successful.

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If you would like to go green and receive *the Water Column* in electronic format, please contact LSM at (207) 783-7733 or stewards@lakestewardsme.org.

Lakeside Notes

by Scott Williams
LSM Executive Director

Navigating Turbulent Waters

Autum leaves have fallen, and on recent brisk November mornings we have been clearly reminded of what is soon to come. During the past several weeks, data from LSM citizen lake monitors have been arriving in droves. And while all of this sounds "normal", given the time of year, six months ago we were uncertain about the extent to which LSM volunteers would be able to undertake their valuable work during the upcoming summer season. We should have known better than to doubt a group of extraordinary people who have time and again demonstrated their determined commitment to "getting the job done".

Even so, the last several months have been anything but normal. When LSM staff and board of directors were confronted with the circumstances of an impending pandemic in April, planning for the busy summer season was already well underway. For several days, everything came to an abrupt halt while we attempted to become informed about the implications of the COVID-19 virus, so that we might formulate a safe, effective and efficient work plan for ourselves and all of you.

During normal times, the summer months are filled with daily personal interactions through training workshops, personal meetings, the nearly-continuous flow of constituents and the general public coming to our work place in Auburn, the annual lake monitoring conference, meetings with our partners, and much more. We are genuinely energized and inspired by our many personal connections with all of you!

Our obvious highest priority was to ensure the safety of both staff and volunteers. With that in mind, we made the difficult decision to not conduct in-person workshops, meetings or conferences last summer. Fortunately technology would allow us to continue to communicate regularly with all existing volunteers, whether by phone, email or videoconference. New volunteers were also able to participate in online training workshops, but the important on-the-water component was necessarily delayed until such time when it will be safe to work with people in person.

We all anticipated a somewhat less-hectic summer than normal, but quickly learned that reinventing the wheel is both time-consuming and a bit stressful! Between restructuring, replying to thousands (really) of phone and email inquiries, planning and conducting online workshops and webinars, and dealing with lower profile, but nonetheless essential organizational and administrative issues, summer went by very quickly!

We have been deeply heartened by the continuous encouragement and support offered by many partner organizations, lake communities and others. Supporting charitable foundations showed empathy and compassion, offering to do what they could to reduce the stresses of uncertainty. Most of our wonderful volunteers were able to get out on the water and do what they have been doing for decades – helping to protect the health of Maine's lakes by monitoring water quality, screening for invasive aquatic species, identifying and helping to resolve problems in their watersheds, and spreading their wise stewardship throughout their lake communities.

On behalf of all LSM staff and members of the board of directors, we wish all of you and your families good health, and hope that the New Year will bring better times.

2021 LSM Annual Conference

LSM plans to hold an annual conference in July, 2021. Details will be made available at a later date.

Littorally Speaking

An Invasive Plant Patroller's Musings on the Wonders of *Connection*

by Roberta Hill
LSM Invasive Species Program Director

I have found one thing that all dedicated Invasive Plant Patrollers (IPPers) seem to have in common. We are, by nature and inclination, careful observers of the natural world. Perhaps it is this that gives us an advantage when it comes to appreciating the connectivity of things, the intricacy and vital interdependency of things in nature.

Bringing this inclination to our work as IPPers, we soon discover the myriad of ways that aquatic plants are interwoven into the fabric of the watery places they inhabit: how aquatic plants change with the seasons and with water level fluctuations; how plant assemblages vary in response to wind and wave exposure, to substrate composition, to depth, water chemistry, and more. Our watchful eyes are attuned to detail, which means we notice signs of connection that others, perhaps—in their hurry to get from here to there—might miss: the delicately-perforated trails left behind by foraging herbivores; the vacant exuvia left behind on emergent stems by metamorphosed insects; the silent schools of tiny fish that flash suddenly from the safety of the leafy shadows into golden shafts of sunlight. Our ears alert to the piercing, mechanical chatter of kingfishers as they hunt the shallows, but also to the low thrum of an unseen pollinator barely amplified (but just enough) by the waxy interior of a *Nuphar* blossom.

Kezar reflection – At the most basic level of connection, lakes are directly connected to the sky (through the water cycle) and land (through the watershed). Photo credit: Roberta Hill.

As patrollers we are directly emersed in a world of connection. Following well-worn channels through the dense vegetation, and eyeing the stumps of young trees lined up along the shore like sharpened pikes, and know we have passed into beaver territory long before the lodge comes into view. Rounding a point and setting a flock of ducks suddenly skyward, we methodically pick our way through the remains—the tattered bur-reed spikes and the uprooted spatterdock rhizomes—and smile to know that the vital carbohydrates needed to sustain the flock's southward migration are being harvested.

Perhaps IPPers have a natural advantage when it comes to appreciating the connectivity of things. Here, yellow perch swim among the purple bladderwort and waterlily stems. Photo credit: Dennis Roberge.

The connections we see in a single foray into the littoral zone are too numerous to count. The connections we don't *see (as well as those that we may never see, nor ever come to know) are far more numerous yet.*

As an ecologist, I must admit, my mind is pretty much always on connection of one sort or another, so thinking along such lines is nothing new. But—and here is the thing—2020 has brought me to see, moreover *to feel,* the connectivity of the world and the critical interdependency of all things, more keenly than ever before. In a year when we have all had to banish ourselves from so many of the connections—the physical gatherings and community events—that we have come to most cherish, that give us strength and replenish our sprits, somehow, in this time of *distancing,* the thing that I learned most was just how *very* dear, how *very* wondrous, and how downright necessary, natural, vital and meaningful, *all* of these connections are.

It was connection that weighed most heavily upon our minds back in April of this year, when Maine and much of the country were under strict stay-at-home orders due to the COVID pandemic, and we all suddenly understood that LSM would not be able to conduct any in-person workshops, meetings, events or expeditions for forseeable future. *Staying connected became our number one challenge*. How will we maintain connection with hundreds of existing lake stewards, and with all those who would be reaching out to LSM for the first time for training and support, with questions or concerns? How will we continue to work closely, and safely, with all of our statewide and regional partners? What would happen to our annual conference? How would we, as staff, continue to work collectively, as a tightly-knit team, to manage all of this change? It soon became clear that pretty much every aspect of every program we had put in place over the past few decades through which we have carried out our mission—each piece relying to varying degrees upon at least some level of physical connection and interaction—would have to be re-envisioned, re-designed, adapted and transitioned to something entirely new. We would need to do our very best *to stay connected* in a new way, and that new way was *virtually*.

The process of making this transition to *virtual connection* has not been without

its challenges, and frankly we cannot wait for the time when there will be no barriers to being back within physical proximity of all of you. But the good news is, *we did it!* With your help, support, engagement and patience, *we stayed connected!* And while virtual connection will never be a substitute for physical connection, there is no question that technology has provided us with many new opportunities for making meaningful new connections and enhancing those we already enjoy.

The littoral zone provides essential habitat (food, shelter, and living space) for a vast and complex array of species. Here, two mallards stock up on carbs in preparation for migration. Photo credit: Billy Helprin.

In the process of reimagining what we do and how we do it, and then setting about to make that happen, Lake Stewards of Maine has gained many useful new capabilities and a more inclusive, resilient and adaptable way of carrying out our mission. All of this will have lasting impact on how LSM carries out its work from now on. (For more on what *Virtual* IPP training and technical support looked like in 2020 please see *How Maine's Invasive Plant Patrol Went Virtual* below).

In this issue of *the Water Column* you will find many more stories by IPPers that build further on this theme of connection. In her inspiring article on page 10, Debbie Broderick describes the many interlocking puzzle pieces that all came together this past summer to ensure the detection and swift removal of a new invader in Lake Arrowhead. Dale Schultz's article, on page 11, provides practical guidance for conducting snorkel surveys, while connecting to your lake in a whole new way. In her story on page 14, Lucy Leaf describes how a solo IPPer

Farrington Pond – IPPer Keith Williams, happily emersed in a world of connection. Photo credit: Roberta Hill.

can help keep a critically-important team effort going in a time of need. On page 30 you will learn how one IPPer's milfoil find in Androscoggin Lake, followed by a timely collaborative response are providing hope for a threatened lake.

So, what has this challenging year of pandemic taught us? Clearly a great deal, but this for certain . . . Even when we are all physically distant from one another, we are all working *together* to keep Maine's lakes clear, clean and healthy. And that is one powerful connection!

How Maine's Invasive Plant Patrol Went Virtual

Though we greatly look forward to the day when we will be able to provide face-to-face classroom and on-lake workshops, to lead survey expeditions to more remote parts of the state once again, and to welcome you and your coolers full of plants back to our office, we are nonetheless pleased with how well our transition to doing things virtually turned out in the end. Here are some highlights from *the year IPP went virtual*.

The **Invasive Plant Patrol 101** (certification) workshop is now, and will contine to be, offered as a three-part online course:

- Part 1 provides a general introduction to the threat of aquatic invaders;
- Part 2 provides guidance for conducting an invasive plant screening survey, including discussion of tools and techniques;
- Part 3 takes a deep dive into Aquatic Plant ID with a focus on the eleven invasive aquatic plants considered to be most imminent threats to our state, and their native look-a-likes.

Participants who wish to become LSM Certified Invasive Plant Patrollers must pass a short online quiz at the conclusion of each course section. The quiz is optional for all others. Through this course, we have been able to train and certify many new IPPers this year, and we believe the online option will enable us to engage people who may not have engaged otherwise. More trained eyes on the water. *All good!*

We also created and offered three new **Advanced Plant Identification** webinars, each covering a different plant group: milfoils, bladderworts, and common pondweeds. Recordings of these sessions have been archived on the LSM website for viewing at any time. We look forward to adding to new plant groups to the online collection in the months to come.

As LSM's COVID-19 plan called for all staff to work remotely most of the time, leaving the office only staffed periodically, we realized that receiving packages full of live plant specimens was not going to be possible. So we needed to come up with a better way to assist IPPers and members of the public with their species identifications. Receiving photos via email had already proven to be unweildy and inefficient, so we created a spiffy new online **Suspicious Aquatic Organism Reporting Form** that not only provides guidance to users on how to take a good quality (readable) photograph, but also allows users to upload multiple images for review by LSM staff.

Most fun of all have been the **Tuesday Technical Assistance** sessions! These weekly sessions, which ran throughout the summer, provided a wonderful gathering place for IPPers of all ages and abilities to share experiences, ask questions, discuss challenges, organize actions, and celebrate our love of lakes and the stewardship work that joins us. The first session, the **IPPer Zoom Room** which started at 2PM focused quite generally on any issues that pertain to Invasive Plant Patrol that attendees wished to discuss. Following at 3PM, was **What's This Aquatic Plant?** a super fun (and often illuminating) aquatic botany fest.

More online gathering opportunities are planned through the winter and early spring, so please stay tuned!

Thank You! To Cabela's Outdoor Fund and Bass Pro Shops for supporting our Invasive Plant Patrol trainings.

Connecting the Drops . . .

Funding Our Way During the Pandemic

by Alison Cooney
LSM Development Coordinator

Fortunately, our staff have been able to work full time keeping programs running during the pandemic. This was possible because much of LSM's 2020 budget had been secured through state agencies, private foundations and other sources prior to the onset of the pandemic. Individual supporters and lake communities have continued to support our work through generous donations, enabling us to achieve funding goals for both the Spring and Lake & Regional Watershed Association appeals.

Looking ahead to next year, there are many uncertainties that could significantly impact our budget. State and Federal funds represent almost 50% of LSM's annual operating budget. We are uncertain whether costs associated with the pandemic could change future State and Federal funding for our programs. Meanwhile, LSM continues to research and seek grants through charitable foundations, and we are fortunate to already have multi-year grant commitments from some interested and supportive foundations. In addition, we are seeking major donors to support specific budget items or programs.

One way volunteer lake stewards can help us with program development is through our new JustGiving online fundraising platform. Online fundraisers have made raising funds easy and FUN! If you spend any amount of time on social media, you have probably viewed or contributed to a fundraiser posted by a family member or friend who is raising money for a special cause. The ideas are endless, but here are a few to consider:

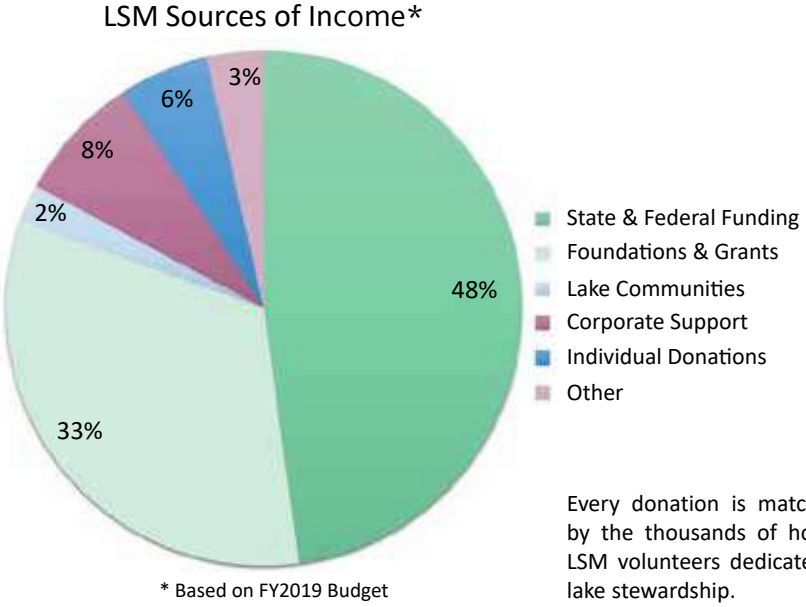
Ask your family and friends to celebrate your birthday with a donation to LSM.

Organize an independent or group event or challenge like kayaking, paddle boarding, swimming, walking/running, etc. Funds raised would benefit LSM and support volunteer citizen lake science in your lake community.

Set an invasive aquatic plant survey goal! For example, *I have set a goal to screen one mile of shoreline for invasive aquatic plants this summer. Please support my efforts through a contribution to Lake Stewards of Maine.*

LSM values and appreciates all our lake stewards who are already volunteering many hours of their time. Our intent is not to ask more of you, but to offer simple opportunities for those of you who would like to help us fundraise. If this interests you, please contact alison@lakestewardsME.org who can guide you through the process of creating your on-line fundraiser as you organize the event, activity, or challenge to support LSM's citizen lake science programs.

Please begin by visiting www.lakestewardsofmaine.org and click on the *Donate* button. You will be re-directed to LSM's charity fundraising page where you will find a *Fundraise for Us* button. Follow the steps to set up your special LSM fundraiser. *Fundraise your way!* Be creative! Have fun! Friends and family, especially those who spend time on a lake, will want to support your fundraiser because they know how much you care about your lake. Thank you in advance for any help! ◔



* Based on FY2019 Budget

Every donation is matched by the thousands of hours LSM volunteers dedicate to lake stewardship.

A Legacy for Lake Stewardship

Give long-term sustainability for LSM's mission through a Legacy gift*. We would be deeply honored by and grateful for inclusion in your Will.

Lake Stewards of Maine-
Volunteer Lake Monitoring Program

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***Notifying us of your intentions is not necessary, but helpful.**

Quality Counts!

Quality Assurance & Quality Control - Do You Know the Difference?

by Linda Bacon
LSM Quality Assurance Officer; Aquatic Biologist, Maine Department of Environmental Protection

QA/QC, Quality Assurance and Quality Control are phrases that you've heard frequently as a citizen scientist, but do you know the difference? Explanations abound - some clear, some obscure. This COVID-19 pandemic provides an opportunity to look at QA/QC from another perspective.

Maine's Dr. Shah and Governor Mills have established fundamental Quality Assurance guidelines like wearing a face covering indoors and outdoors, and, maintaining social distancing. In addition, they have established limits on the number of people at indoor and outdoor gatherings. These are Quality Assurance measures that are proactive and preventative. When one enters a store and a kind attendant hands them a mask, this is a reactive or corrective Quality Control action. If an establishment exceeds the limit on indoor gatherings, the Health Inspection Program reacts by implementing progressive discipline to correct the situation; another Quality Control example.

In the LSM water quality realm, the proactive initial trainings our citizen scientists receive are Quality Assurance actions designed to assure consistency in how monitoring is conducted and prevent errors from creeping in. Even the field sheet you complete is a Quality Assurance tool to make sure you are recording the correct information. And examples of Quality Control include Re-certification workshops, the Secchi Simulator, and duplicate readings you take when collecting data.

When you send in your dissolved oxygen meter to be checked in the Spring, that is a Quality Assurance step you take. Checking the surface dissolved oxygen concentration against the table of expected readings for various temperatures is a Quality Control action; if the meter was giving readings more than 1.5 ppm off from expected, corrective action would be needed unless bloom conditions were causing the deviation.

And winterization of your meter is another Quality Assurance step that will prolong the life of your meter. It is particularly important to remove the batteries from your meter to prevent battery leakage from ruining the electronics. We suggest putting the used batteries in flashlights or other household items and purchasing fresh batteries for the 2021 season. If you have a galvanic probe, be sure to remove the membrane or membrane cap, rinse the probe with distilled or deionized water and blot it dry to prevent oxidation of the anode (silver-coated portion) of the probe. If you have an optical probe, make sure the sponge is wet and establish a plan to check the sponge once a month. If the optical probe caps dry out, they may not function properly next year. Refer to your owner's manual for specifics.

Both Quality Control and Quality Assurance activities at LSM have been difficult to implement in 2020 due to COVID-19. On one hand, the lockdown provided time to implement Zoom approaches for meeting with citizen scientists for classroom-based learning and question-and-answer sessions. And the shift to mail-in meter checks was a huge success, with more meters checked in 2020 than in previous years. We already have meters being sent in for winterization and storage until next year's meter checks.

But not being able to safely meet on the boat in groups of 10 was an issue in 2020. It is difficult to know if 2021 will be any different. If you have any ideas on how we could accomplish this, please share your thoughts with us. We very much appreciate your patience and dedication to keeping a watchful eye on our lakes during these challenging times.

Plants with Pluck

Contributed by Debbie Broderick, IPPer on Lake Arrowhead

Common Bladderwort *(Utricularia vulgaris)*

This carnivorous beauty supplements its nutritional needs by trapping living organisms. The little black "bladders" (they're bright green when young) ingest tiny critters with a suction motion when triggered. I love seeing them in the lake. Their iridescent green leaves, like delicate threads, glow in the underwater light. They remind me of a fine filigreed piece of jewelry.

Georges Pond Alum Treatment: Monitoring Application & Response

by Tristan Taber; *LSM Training & Technical Outreach Coordinator*

Georges Pond (MIDAS# 4406) is a 358-acre (1.45 km^2) freshwater great pond located in Franklin, Hancock county, Maine. In the summer of 2018, the lake experienced a major bloom of cyanobacteria (aka: blue-green algae), turning the pond a murky pea-green color, diminishing the average water transparency to 1.7 meters, and ruining a summer of fun for its residents and visitors. The Georges Pond Association (GPA) and the Maine Department of Environmental Protection (ME DEP) responded immediately to this threat by conducting a robust sampling routine and working with consultants Ken Wagner and the firm Ecological Insights to determine the cause, and to propose measures for helping the lake. It was determined that internal phosphorus loading from the lake sediments was a major contributor to the sudden decline of the pond's health.

Georges Pond is largely littoral with a mean depth of 4.9 meters (16 ft) and a maximum depth of 13.7 meters (45 ft). The residence time— the average estimate of how long it takes for a water molecule to leave a waterbody after entering it— is around two years. The watershed area is approximately 636 acres and is fairly heavily developed. The shoreline has over 125 buildings on its 4.4 mi (7.1 km) perimeter, two quarry pits in the vicinity, and in early 2018 a thorough watershed survey identified 53 major erosion sites that were contributing significantly to the destabilization of the pond. The GPA has worked diligently to clean up stormwater contributions. Unfortunately, in the summer of 2018, the previous years of watershed erosion, and resulting algae growth from this phosphorus, caused dissolved oxygen levels in the lake to become critically low. Under this circumstance, phosphorus that had accumulated in the bottom sediments, and which normally bonds with iron in a stable insoluble compound, was released into the overlying water column. The recycled phosphorus from the sediments stimulated algae growth, resulting in the cyanobacteria bloom.

The HAB barge administering alum is pictured in the foreground, Taber in the monitoring craft is seen towards the left-middle of the picture in Georges Pond; Tunk, Catherine, Caribou, and Black Mountains are pictured in background from left to right. Photo credit: Dean Tyler Photography.

Recent research suggests four advantages cyanobacteria have compared to other organisms in this suddenly nutrient rich system. Many cyanobacteria:

1. are small in size. The large ratio of their surface area to volume allows for efficient uptake of phosphorus;
2. have a short reproduction time. This allows them to double their population rapidly and "bloom";
3. contain heterocysts. These are cells of a different type and some of these heterocysts can "fix" nitrogen, meaning the cyanobacteria are not nitrogen limited;
4. grow or overwinter in the benthic (lake bottom) environment, then rise to the surface in the spring and summer, when sunlight and warmer water may stimulate a bloom. This allows them to take advantage of the phosphorus-rich waters near the bottom and act as an annual inoculum.

It is well known that aluminum and some other elements bind strongly to phosphorus, preventing its remobilization. Several decades ago, lake researchers determined that the application of aluminum compounds to lakes that were experiencing algal blooms as a result of the internal release of phosphorus could effectively immobilize and chemically bind the phosphorus for periods of time, thus reducing the availability of this limiting nutrient to algae/cyanobacteria.

Alum treatments were first conducted in Maine during the 1970's. Since that time, nine lakes have been treated, with varying degrees of success. In some cases, the positive effect has lasted for up to two decades. However, alum treatments are very costly, and they will likely not be successful over time unless external (watershed) sources of phosphorus have been identified and addressed. As I, and others have written about in previous newsletters, the application of alum should be treated as a last resort effort to stabilize or restore an imperiled lake.

White alum flocculant (crystals) settling down through the water column and coating the lake bottom of Georges Pond. Photo taken of the image as it appeared on the display of an underwater camera. Photo credit: Tristan Taber.

GPA began fundraising for the alum treatment in the first months of 2020. The treatment plan, which must be authorized through a permitting process by the Maine DEP, requires applicants to closely monitor the effects of the application of aluminum sulfate and sodium aluminate to the lake, a process that may take several days. The GPA contacted Lake Stewards of

Georges Pond Treatment . . . **continued on page 27**

Meet Maine's Lake Stewards!

Perhaps more than any other year in the history of our organization, 2020 tested Maine's capacity for widespread lake stewardship. Some volunteer lake monitors never made it back to their summer homes on the lakes of Maine. Jobs and lives were disrupted for many, and the day-to-day challenges associated with the pandemic weighed heavily upon most. All of these added a new layer of complication for volunteers. Nonetheless, as the year comes to an end, one thing is very clear: lake stewardship continued, even thrived here in Maine, despite it all. Even as we kept our physical distance from one another, we continued to work as a team: organizing and conducting watershed surveys; taking our semi-monthly Secchi disk readings; searching the shallows for signs of invasive intruders; inventing and sharing new and improved monitoring gear and protocols. How was this possible? Perhaps there is no one answer to that question. But the pieces below, all contributed by LSM volunteer stewards, especially when taken together, provide some important clues. Enjoy!

Our Life on Abrams Pond

Contributed by Bill & Kathleen Cotter, LSM Certified 13 Years; Abrams Pond, Eastbrook

The decision came in autumn 2001, finding a property in Downeast Maine after spending several vacations on Mt. Dessert Island. Not only was it a property of mature evergreen forest and a forest floor of wildflowers and ground covers, it was situated on a long sand beach on a shallow cove with colorless water and a swimming rock. Abrams Pond in Hancock County, what a dream come true!

Of course, it was only the beginning. Before signing the sales agreement, we found out there was an algae bloom in 1999. That was its first ever and things seemed okay since. With the property ours, we visited it for several summers, a day at a time, until 2005 when we decided to build the camp of our dreams.

During the time before building, we rented a camp on the pond, met the Abrams Pond Association president and attended APA's annual meeting. We were hooked! So hooked that we agreed to head the pond's first watershed survey. It was a great success! In mid-May of 2004, at the town hall we had a good crop of volunteers to walk the mostly waterfront properties of the small watershed along with APA and the DEP. Not surprisingly, we found camp roads and properties that were adding nutrients to the pond. But somehow the next step of applying for a grant to correct these man-made findings did not evolve. It took some time for camp owners to digest and understand the science of it all.

Once we were in our new camp home, 2006, we were able to become more engaged. In 2007, we became officers in the APA. Enthusiasm exploding, we began attending VLMP annual meetings. We met Scott Williams who introduced us to the Secchi disk. We took the certification class. We had to admit and still do: the Secchi monitoring makes us get out on the water; it makes us explore and enjoy the lake; it makes us get to know our pond-owning neighbors from their docks. We recall our own conversations, "This is great!"

Kathleen and Bill Cotter on Lake Louise, 2016.

From there it was being certified with a class on dissolved oxygen, then one on invasive plants, and from there Kathleen ascended to the presidency of APA. We were evolving into people of lake knowledge. We began educating our watershed with the development of a newsletter. The annual meetings of then VLMP, now Lake Stewards of Maine, and also Congress of Lakes, now Maine Lakes, were leading us to additional knowledge and connecting and getting to know on a first-name basis the experts in the State of Maine. At every meeting we were meeting lake-front owners from lakes all over the state and gained much in our discussions at break times. This was for us a total enrichment that has become our avocation in our early-age retirement.

But the story evolves. Abrams Pond had a second bloom in 2012. It lasted from June to August. It was a summer of finding another lake to take a swim. The bloom had a positive effect: people were upset and realized maybe there is something to the idea that human activity could impact the water of Abrams Pond. At the encouragement of Scott Williams at LSM and Hancock County Soil and Water, we lead another watershed survey. This time we advanced to an application for a 319 Grant to address the problems identified in the survey. That grant was awarded in winter of 2018. All of the work from that grant has now been completed. We applied for a second grant, and it was awarded to us this summer. It takes effect January 2021. Pond-front owners are seeing the results of the first grant. The work for the second grant is lining up.

How did we get to where we are? We believe it began with getting to know our pond neighbors; education with a newsletter full of awareness of the character of the pond with "how to" articles including diagrams; and updates of our progress in stopping nutrients from entering the water. We did not do this alone. We must thank Alan Hershey, a pond-front owner who has been instrumental in leading the mitigation projects of the past and upcoming grants. We also must thank all those around the pond for their willingness to invest their parts in the undertaking. Through stopping nutrients from entering this colorless-water, sandy-bottom pond, there is hope that algae blooms will not occur as time goes on.

Maine's Lake Community Comes Together to Address New Invader in Lake Arrowhead

Contributed by Debbie Broderick, LSM Certified IPPer; Lake Arrowhead, Waterboro

My husband, Dale, and I live on Lake Arrowhead's lakefront in York County. Our lake is infested with Variable water-milfoil, and our Conservation Council uses a diver assisted suction harvester (DASH) to keep it from choking up our boating areas. At the beginning of July, we participated in the free online Aquatic Species Plant identification course run by Lake Stewards of Maine. It was a perfect thing to do during our COVID-19 shelter-in-place measures. Up until then, we classified aquatic plants into Variable water-milfoil and NOT Variable water-milfoil. Part of the LSM coursework was to collect and identify a few plants, using the online key and distinguishing characteristics that Roberta had taught us, and share our findings on Zoom. We passed our tests, and became certified Plant Patrollers.

After the course, I continued looking carefully at the plants and fragments being washed up in my cove because I'd discovered a new-found interest. I was fascinated, and keen to practice my new skills. It was like a new puzzle or sleuthing project, and the detective in me kept trying to figure out what I was seeing. On Aug 21, I became aware of a plant fragment that looked unfamiliar, and very different from the usual varieties that washed up on my shore. I became suspicious. It was crispy to the touch, and had very distinctive teeth along each curved leaf. It's quite possible it had showed up previously, but I had not yet reached the level of discernment I needed to acknowledge its distinctness.

I felt alarms going off in my head when I saw it, and went to the online identification key. It looked like one of the 11 invasives listed, and I felt a horrible sense of dread. Dale looked at it, and came to the same conclusion. I immediately texted some pics through to Roberta, explaining that I suspected I'd found the invasive European Naiad *(Najas minor)*. Her response was swift, and concurred with my initial identification, but in order to be 100% sure, she needed to examine a sample, which I mailed to her. After confirmation from fellow taxonomists, she gently let me know that I was, unfortunately, correct. I was devastated- I had correctly identified the plant, which made me feel good about my identification skills, but upset that I had confirmed another invasive for our lake. It was a terrible blow. Now I needed to find where the fragments were coming from. I scoured the cove in front of our property and found 8 skinny plants growing right under my nose! I felt awful, as if I were harbouring a fugitive. But these few plants couldn't account for the fragments washing in from the open boating area. Dale and I started kayak-surveying along the shoreline, on both sides of the dam, and came up with nothing.

Najas minor from the kayak. Photo Credit: Dale Schultz.

The DEP responded rapidly after the confirmation ID. I got a call on Monday morning from Laurie Callahan of the York County Invasive Aquatic Species Project (YCIASP), saying she was at the boat launch with a team of volunteers and would be in my cove in 20 minutes! The response that the DEP had set in motion was amazing! I'm so impressed at how quickly they took action. The Lake Arrowhead Conservation Council's DASH team participated too, and located a flourishing mat of the invasive in an area estimated to be about 50 feet across, just outside our cove. I felt sick to my stomach, as up until now, we'd only seen individuals scattered here and there in our cove. More importantly though, the site of the large infestation was where our Public Works crew would be installing a water pipeline in the upcoming weeks. It was imperative that we remove that infestation before the scheduled disturbance began. Four days later, Milfoil New England came in to remove the large mat of plants, and any others we'd marked during the subsequent organized surveys by YCIASP's enthusiastic volunteers. The Lake Arrowhead Conservation Council and DASH team used this as a learning experience to find out how to adapt our suction harvesters so that they could tackle this plant next year.

Dale and I continued surveying whenever we could, especially when the light was good, using the skills we had learned from Laurie's trained volunteers. We located another large infestation in better lighting conditions in an area previously surveyed. That is the beauty of having a team on site and available when conditions are perfect. Dale donned his wetsuit and began snorkeling in earnest to help get a broader view of plants, without the nuisance of surface winds and ripples. This enabled the discovery of numerous additional plants. With the permission of John McPhedran of the DEP, he was able to dive and harvest individual plants with a deep landing net, which he handed to me in my kayak to empty into plastic bags. I floated above the site and scooped up any surface fragments with my hand net. Though very few escaped his net, I nevertheless made sure to "scoop first, ask questions later." That way, I didn't miss anything. We have since removed over 50 individual plants in this manner. With very little time left in the season for removal, we recently constructed an enormous hoop with mosquito-netting mesh to remove a large stand that won't be able to be tackled by a suction team this year.

Were it not for COVID-19 restrictions, I'd likely not have spent time on an online plant ID course. Everything just seemed to fall into place to discover that suspicious plant when I did. If I'd seen it without benefit of the course, I'd have overlooked it completely, which is a very scary thought, because before this July, I had NO idea what this plant looked like. Additionally, Dale and I are thrilled to have found a community of like-minded people who care about Maine's lakes as we do.

Kayak-Assisted Snorkel Survey

A system for searching for, and marking, suspicious aquatic plants using a combination of snorkeling and kayaking

Contributed by Dale Schultz, LSM Certified IPPer; Lake Arrowhead, Waterboro

Snorkeling presents the opportunity for much clearer observation of items below the surface of a lake than attempts to observe things from above, even with scopes. It avoids all surface reflection and disturbance due to water ripples. It also allows things to be seen to a greater depth, even when swimming at the surface. Snorkeling is nowhere near as complex as SCUBA diving, and has minimal equipment requirements. All you really need is a mask and snorkel. If you plan on covering quite a bit of territory, you will want some fins as well, but be mindful never let your fins dangle down where they might disturb the bottom sediments or plants.

While snorkeling is a great way to conduct invasive plant patrol surveys, doing surveys this way also poses some safety and logistical challenges. Here are some of the tips Debbie Broderick and I have come up with for conducting snorkel surveys in a safe and efficient manner.

The system requires two people, one in a kayak and the other in the water. In addition to the basics—kayak, paddles, PFD, and snorkeling gear—you will need:

- Kayaker
- GPS
- Marker buoys
- Drinking water for both people
- Hat
- *Optional:* Dry clothing & towel for snorkeler
- *Optional:* Tow rope to tow snorkeler's kayak
- Snorkeler
- Small temporary marker (clipped onto outside of wetsuit, or tucked into pocket or belt, see below)
- *Recommended:* Dive flag on snorkel
- *Optional:* Wetsuit
- *Recommended:* Diving knife

Staying Safe

If you are the snorkeler, remember that it is very easy to get disoriented underwater. Get in the habit of raising your head out of the water every few minutes to look about to get yourself oriented, and to make sure that your support person in the kayak is still nearby. And of course, when you hear a boat motor, pop your head up immediately to see where the boat is and where it is heading. Remember to look all around, there may be more than one boat. Should the need arise, the person in the kayak also needs a way to get the attention of the snorkeler. Banging a weight against the bottom of the kayak works. Experiment with this in advance to make sure your communication system works under a variety of conditions. Though the kayak provides a visible presence on the surface, (as well as an additional spotter for boats) it is also a good idea to attach a dive flag to your snorkel.

Dale conducting a survey on Lake Arrowhead. Note the dive flag on snorkel, temporary marker in foreground, proper marker in background. Photo credit: Debbie Broderick.

Never try to swim under fallen tree logs or branches. It is very easy for a small branch to catch on your clothing, wet suit, belt, etc. There is often fishing line tangled up on branches in the water that can prevent you getting back to the surface if you become entangled in it. Always swim around fallen trees and branches. The same goes for docks and any other things in the water, too. Stop immediately, if you get tired or cold.

Working Efficiently

If the area to be surveyed is some distance from where you put in, we suggest that the snorkeler uses a second kayak to reach the survey area. Once at the survey area, the second kayak can be towed behind the first.

One of the challenges of doing this work while in the water is what to do if/when you spot a suspicious plant. Obviously you are not going to snorkel about with a bag full of heavy marker buoys in hand. This is where the two person team really comes in handy. The snorkeler carries a slimmed-down temporary marker on them at all times. The person in the kayak always has a heavier, more-permanent marker ready to go. When you find a suspicious plant, the most important thing is not to lose sight of it! It is very easy to lose the plant by drifting and or turning in the water. Remaining at the surface so as not to disturb silt or cause fragmentation, and keeping your eye on the plant, place the small, temporary marker by carefully lowering the weight down near the plant. (Be careful not to stir up silt with the weight or clobber the plant, creating fragments.) Obtain a proper marker from the kayaker and place it, and then retrieve the temporary marker. Watch that you do not get the two markers tangled up. Take your time. Once a plant has been properly marked the kayaker can record the position using the GPS, while the snorkeler goes in search of the next suspicious plant.

The kayaker should always try to keep the kayak positioned between snorkeler and other boat traffic, and if possible, try avoiding shading the area of the snorkeler.

More on the Temporary Marker

You will need a small, smooth weight attached to a small float with a lightweight string (nylon works well). The string should be able to be wrapped around the weight and/or float so that the marker can be easily carried in a pocket, or clipped onto a belt. My first marker was a small brass pipe attached to a 1 cm slice of a foam swimming noodle. The string wrapped easily around the pipe and the end of the pipe to be pushed into the foam to hold the string in position. When that one came unclipped from my belt and was lost, I made a second one using two threaded ⅜" rod connectors instead of the brass pipe. (I am pretty sure you have something in your garage that will do the job nicely.) Having learned a lesson with the clip system, I now keep the temporary marker in a small pouch with a Velcro™ closure that is on a belt. I can easily get the marker in and out of the flap by feel alone, allowing me to keep my eyes on the plant to be marked. An old cell phone belt pocket with a Velcro closure may also work well.

Dale's temporary marker. Photo credit: Dale Schultz.

If you have never tried to conduct an invasive aquatic plant screening survey while in the water before, I hope you will try it! In addition to optimizing direct observation of your survey area, you will also see and experience your lake in a whole new way. Get ready to see lots of wildlife too!

Restoring Clary Lake: A Success Story!

Contributed by George Fergusson, LSM Certified 13 Years; Clary Lake, Jefferson

Clary Lake, formerly Pleasant Pond, is one of the longest continually monitored lakes in Maine. According to DEP's Linda Bacon, my father Stuart Fergusson was the first person to start collecting Secchi disk readings on the lake back in 1975. His friend and neighbor David Hodsdon started at the same time and soon took over when my father's health and eyesight precluded him from continuing. In 2001 another monitor, Jack Holland joined David on his bi-monthly monitoring trips. I became certified and started helping out in 2013 and for a few years all 3 of us would head out on the lake. We could have used a bigger boat! Then in 2018 Kelsie French joined our monitoring team. Having plenty of help monitoring Clary Lake has been a blessing. Today Clary Lake is a relatively healthy "productive" lake but

(L-R) David Hodsdon, Kelsie French, and George Fergusson in 2019.

it hasn't always been that way. Always plagued over the years to some extent by occasional water level issues, in 2006 the dam that impounds Clary Lake had fallen into disrepair and was sold to a company who had other plans than repairing it and maintaining a historical lake level. By the Fall of 2011 the Clary Lake Association's negotiations with the dam owner had failed to resolve the issues so the Clary Lake shore owners filed a water level petition with DEP. The dam owner fought the petition but ultimately lost, and two years later in late January 2014, a Water Level Order was issued. The dam owner promptly appealed the Order in Lincoln County Superior Court which thwarted DEP's attempts at enforcement of the WLO. Four years later, in early 2018 the Court finally upheld the WLO. That should have been the end of the story, but it wasn't. The dam owner then filed for bankruptcy, providing the Clary Lake Association with the break we'd been waiting for and in October 2018 we were able to purchase the dam from the dam owner's bankruptcy estate. The dam was quickly repaired and the water level restored.

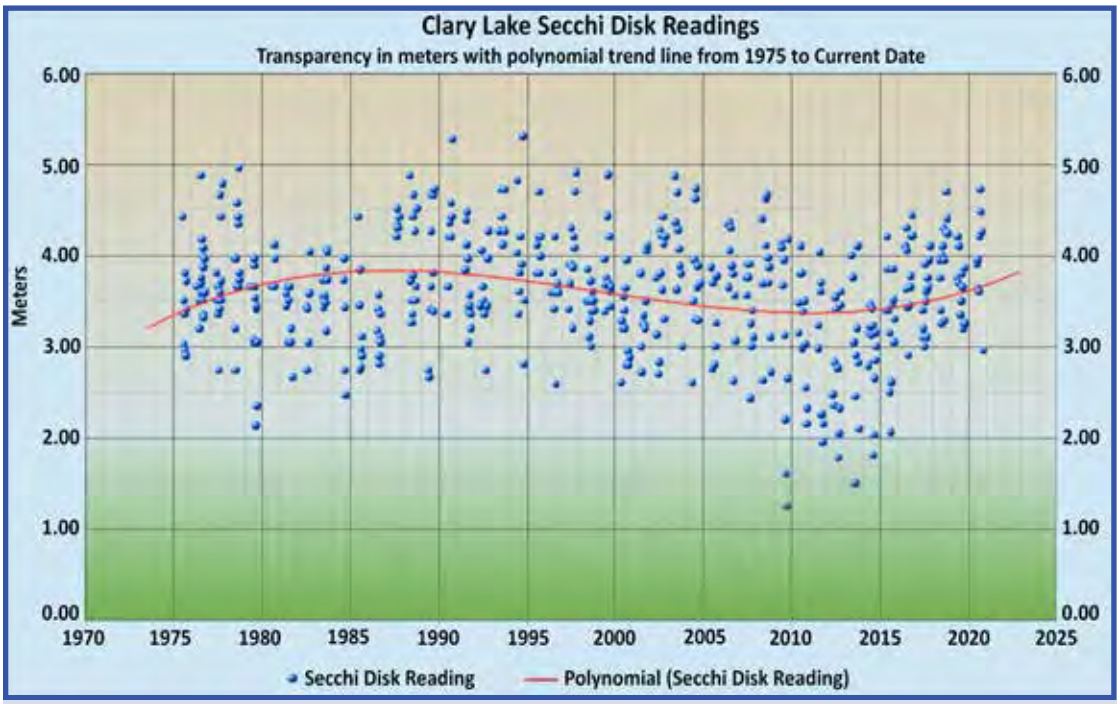
State boat launch, 2015.

The Clary Lake dam, built around 1900, raised the level of Clary Lake approximately 5 feet. For eight long years starting in 2011 and continuing until the CLA bought the dam in the fall of 2018, the then dam owner kept the gate wide open so as to keep the lake level as low as possible. The result was wildly fluctuating and generally lower water levels, and the effect was devastating. The picture above shows the State boat launch on September 26, 2015 when the lake level was close to five feet below the top of the dam. Needless to say, the boat launch didn't get much use when it looked like this. These extreme low water conditions recurred every summer from 2011 through the end of 2018. Over 300 acres of sensitive wetlands with an average depth of only 2-4 feet were completely drained, reducing the overall size of Clary Lake by as much as 42% and the lake volume by over 40%. Every spring, rain and snow melt would raise the lake level up typically to within a foot or so of the normal high water mark, but it didn't last long; by early summer the level would have again fallen four to five feet below the top of the dam. The entire littoral zone around the lake was drained, exposing dozens and in some cases hundreds of feet of sensitive lake bottom, destroying valuable fish habitat and depriving lake shore owners of a usable waterfront.

The water level crisis had a profound and deleterious impact on lake water quality as evidenced by Secchi disk readings. Between 2009 when the water level crisis began through the end of 2018 when we were finally able to take control of and repair the dam, we experienced severe algal blooms (defined as transparency below 2m) five of those years and several minor blooms (defined as transparency between 2m and 2.5m). The reason was obvious: with lake volume cut almost in half but with normal amounts of rainfall and runoff, the nutrient load was significantly higher than had the lake been full of water. Ironically, starting about 2017 and in spite of the ongoing water level crisis, transparency and water quality was much improved due in large part to summer drought conditions which limits runoff, to the benefit of many Maine lakes, including Clary. *The chart on the following page shows 45 years worth of Secchi disk readings.* It is easy to see the impact of reduced water levels on transparency from 2009 through 2015. The 2nd-order polynomial trendline shows the likelihood of improving transparency in the future, though we are not about to become complacent since excessive nutrient load in many Maine lakes is a perennial problem.

Algae bloom, 2013.

The picture above shows the end result of a particularly bad algal bloom that occurred in 2013. At the height of this bloom, our Secchi disk reading was only 1.5 meters. The green scum is dead blue-green algae that floated to the surface. Not conducive to wanting to go swimming! This bloom was pretty much lake-wide.



Trend line (red) shows reduced transparency during period of dam mismanagement.

Now, 2 years after historical water levels were restored, Clary Lake is well on it's way to a full recovery, but its going to take a while longer before the effects of 8 years of subpar water levels is fully reversed. This year the average transparency was about 4 meters and the once-devastated wetlands and littoral zone are rapidly returning to their former states. In a few more years the travails of the past will be but a distant memory.

Years of low water levels transformed this once-sand beach.

The picture above shows the long-term impact of reduced water levels on a small section of shoreline on the north side of the lake where the water is rather shallow to begin with. Taken in June 2017, the water level was only down about 2.5 feet at the time but it had already receded fully 75 feet from the normal high water mark. Five years of reduced water levels had turned what was a sandy beach area into this uninviting weedy shorefront. As the water level fell, people would move their docks and moorings further out into the lake. A month after this picture was taken the lake had fallen another 2 feet and the water had receded an additional 75 feet. Periodically the lake shore owners would descend on what used to be beach with lawnmowers and weed whackers in an attempt to preserve their access to the water. Everyone on Clary Lake was affected by the water level crisis to some extent, some more than others. For the 7 years of our water level crisis, the people who had camps on this shoreline in particular didn't have much summer fun at the lake.

Perhaps the most devastating impact of our multiyear water level crisis was the complete dewatering of 300 acres of emergent wetlands at the northwest end of Clary Lake. The picture below, taken in early April of 2013 shows a small section of this wetland area and only hints at the devastation. With luck this wetland area might have had water over it for about a month in late winter or early spring when runoff and snow melt brought the lake level up. The rest of the year it was completely dewatered. After a few years this sensitive wetland area had become a meadow with exclusively terrestrial vegetation growing on it. Rather than ducks, turtles, and lily pads it was home to coyotes and growing maple trees and goldenrod. I am happy to report that in the two years since historical water levels were restored, this important wetland is recovering nicely.

De-watered wetland.

In closing, I'd like to take this opportunity to thank David Hodsdon (pictured below, using our YSI Pro20 DO meter) for his exemplary service as Clary Lake's principal Water Quality Monitor. This year David decided to give up the job he's held for 45 years and let me and Kelsie French take the reins. I only hope we can bring the same degree of dedication, quality control, and perseverance to the job that David did. We owe him that much, and more!

David Hodsdon - 45 years of lake monitoring!

David has been a mentor to me over the years, and a true friend. David and I still consult on water quality issues and get together every few weeks for a cup of hot black coffee and a good discussion on all things Clary Lake. Plans are underway for a more fitting tribute to David next year when hopefully this pandemic craziness will be behind us.

George Fergusson is the current Secretary of the Clary Lake Association and can be reached at gsfergusson@clarylake.org

Keeping the Team Effort Going on Big Lake

Contributed by Lucy Leaf; LSM Invasive Plant Patroller on Toddy Pond in Surry

COVID-19 has catapulted us into a reality that most of us never anticipated. It's bad enough that a large milfoil infestation was discovered in a remote region of Maine. Adding to the challenge was that one of the best volunteer response teams in the nation was not able to bring full forces to bear on Big Lake this year due to the pandemic.

Of course, this parallels many other situations where families, schools, business owners, service and health care workers have simply had to carry on the best they can. Life has plenty of twists. Here is mine.

Invasive Plant Patrol (IPP) took on a new dimension for me when I began surveying other lakes besides my own. With every new lake I visited, I learned at least one new native plant. As yet, we have not found any invasives growing in Hancock County, where I live, though I myself found Eurasian milfoil on a boat trailer while doing Courtesy Boat Inspections.

I actually fantasized about having a whole summer free to do nothing but IPP. Well, be careful what you wish for. COVID-19 eliminated my usual summer job. But simultaneously, a $1200 check arrived. For eight years I have been doing extensive IPP, but never owned my own boat. That was about to change.

Another bit of fortune was the advice from our regional IPP coordinator, Catherine Fox, who convinced me to choose performance efficiency versus the roominess of a large cockpit in selecting the right kayak. Not only could I paddle twice as far in my new boat with much greater ease, I enjoyed being in it.

From my participation in several Zoom sessions organized by LSM, I decided there was a question that needed an answer. How far had the invasive milfoil at Big Lake spread? Big Lake is part of an enormous watershed with a large littoral zone. Anything I could survey would be a drop in the bucket. But I knew that even one plant found further afield would provide a great deal of information.

Uber-IPPer, Lucy Leaf, in her element.

Since I'm used to primitive camping and my boat could also carry essential gear, I figured I could go to this more remote region without having contact with anyone, the primary stumbling block preventing the massive coordinated response that had been intended before the pandemic struck. Leaving Big Lake itself to the experts, I decided I would best do my surveying upstream and downstream, as the water flows, for it might be awhile before much attention could be given to these areas.

On my second trip to the region, I did find variable milfoil in two smaller downstream lakes, (Long Lake and Lewey Lake). They were very small colonies in highly productive areas, embedded with look-alike natives. It seemed like pure luck that I spotted them through the trunk scope. Roberta's immediate responses to photos sent was extremely helpful, for I have never seen variable milfoil in its own habitat. Of course, finding plants in three sites that were later confirmed by DNA analysis spurred me to continue looking for more. All together, in five different trips, I was able to do forty hours of on-water surveying in the region. And—I enjoyed every minute of it.

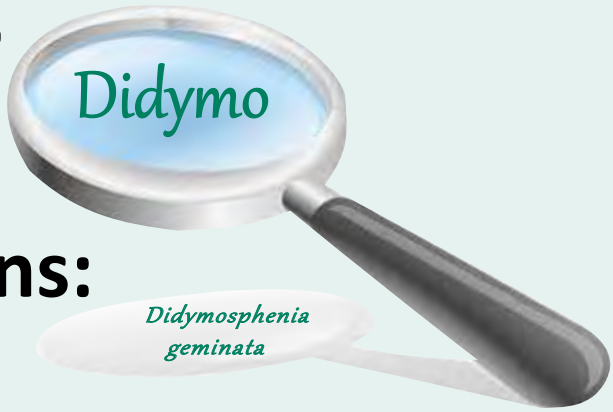
Later in the summer DEP staff traveled to the region with a diver and equipment to remove the small colonies I found, and further explore the extent of the infestation on Big Lake itself. Additional volunteers, both local and downstate, also braved the flukey fall weather to add to the bank of knowledge. With all this vital information, locals rallied to begin the work of mitigation, which has already started with a commercial team.

I offer this to show that every little bit counts, even one person in one kayak on an enormous watershed. But overall, it is One Big Team Effort!

Inspired to share a story of your own?
We can't wait to see it- please contact us today!!

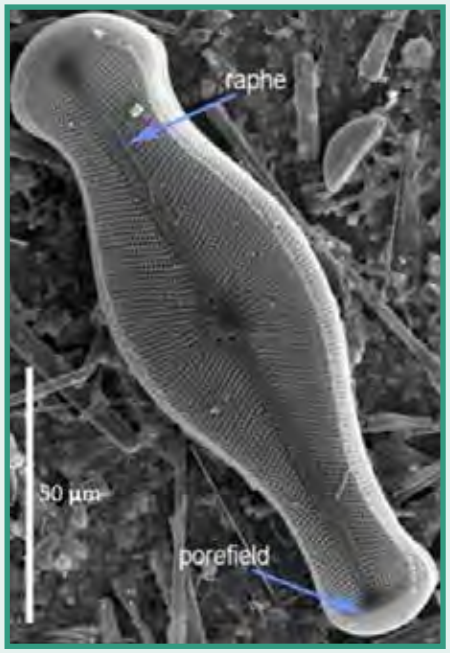
Stewards@LakeStewardsME.org or (207) 783-7733

Under the Hand Lens:



During the late 1800s, amateur naturalists would pack up their precious microscopes and travel hundreds of miles at great expense to waters of the northern US and Canada in pursuit of the rare glassy diatoms known as *Didmosphenia geminata.* According to Sharon Moen, University of Minnesota Sea Grant Program, in her 2009 article *How Didymo Became Rock Snot*, the tiny silica-shelled organisms were, at that time "as rare as diamonds. Diatom collectors who owned a didymo slide owned a trophy."

A little over a hundred years later, Didymo—now widely reviled as "rock snot"—becomes so abundant at times in these same waters (and others) that it restricts water flows; smothers stream beds killing off native benthic dwellers such as mussels and macroinvertebrates (interrupting critical food webs); depletes dissolved oxygen levels (as the algal mats decompose); and destroys habitat for cold water fish species such as brook trout. The mechanism by which this organism made the transition from the algal equivalent of Dr. Jekell to the snot-evoking Mr. Hyde is not well understood, but paleolimnological research conducted in 2014[1] suggests that climate change may be playing a significant role. "The climate link is a hypothesis, and much more research is needed to determine a cause, but the effects of warming seem to favor the species," writes Michelle Lavery, lead author of the study.



Scanning electron micrograph of *Didymo geminata*. The cell secretes a mucousy substance through the raphe in order to move across surfaces, and then attaches itself by secreting a fibrous polysaccharide stalk though the porefield at the base of the cell. Image by Sarah Spaulding, US Geological Survey.

Didymo mats look and feel like wet cotton or thick wet felt. Photo courtesy of Missouri Conservation Department.

The alarming transition was first documented in 2006, as didymo began to take on the characteristics of an invasive species in its original range, and also began expanding its range to warmer, more nutrient rich waters. In the past several years, didymo has expanded its range in the Western United States and has infested rivers and streams in several southeastern states, including Virginia, West Virginia, Tennessee and North Carolina. In 2007, didymo was found in the northern reaches of the Connecticut River in Vermont, marking the first official report of *Didymosphenia geminata* in the Northeastern United States. Blooms have since been detected in New York and New Hampshire. To date, there have been no sightings in Maine.

Didymo is a single-cell freshwater diatom that produces a fibrous stalk on which it attaches itself to rocks and vegetation, typically in clear, cool streams and rivers, especially those with moderate, year-round flows and good light. (Though more rare, this species may also occur along the rocky shores of lakes and ponds.) Didymo may exist for a time as small, relatively benign, bubbly colonies on submerged rocks, boulders and gravel, and then suddenly "bloom" into a thick yellowy-brown layer, capable of covering wide expanses. Unlike other algal species that attach to rocks, didymo mats are neither green nor slimy. They look and feel more like wet cotton or thick wet felt, and in a more advanced "rogue" stages, the didymo-stalk streamers—which may alarmingly grow up to a meter long—resemble streaming clumps of soggy toilet paper, with fragments breaking away and floating downstream.

The microscopic, virtually invisible, algal cells cling to fishing gear, waders, boots and boats, and may remain viable for several weeks. Photo courtesy of Ziga, Wikimedia Commons.

There are currently no known methods for controlling or eradicating didymo once it infests a water body. Preventing

***Hand Lens* . . . continued on page 31**

Influences of Extreme Weather on Maine Lakes in 2020

by Scott Williams; LSM
Executive Director; Limnologist

Climatologists are largely in agreement that one effect of a rapidly warming planet will continue to be an increase in the frequency and intensity of "extreme weather events". High-profile storms like hurricanes, which include strong winds, torrential downpours, flooding and tornadoes, get a lot of coverage by the media. Video coverage of recent historic wildland fires on the west coast and in the mid-west have also been featured in the news. Fortunately, Maine has been spared from extreme weather events in 2020. Or has it?

In fact, Maine experienced at least two lower-profile, but relatively speaking "extreme" forms of weather last summer. *National Weather Service (NWS) summary data for Portland, Maine indicate this past summer was the "warmest summer on record", based on data extending from the late 1800's to present.* The average temperature for the area last summer was 70.5 degrees F, which is 3.6 degrees above normal for the period. The warmest month of July on record resulted, in part because evening temperatures remained well above normal for most of the month (note that 2019 had the second-warmest July on record). June and August were the 3rd warmest on record for each month, and this past September was the 7th warmest since 1871. Also note that 2018 and 2016 previously held the record for the warmest Maine summers. Despite the large geographic area covered by Maine, weather data obtained from Portland last summer is reasonably representative of conditions that occurred throughout much of the state, with some variation in temperature from north to south, and along the coast.

Unusually Warm Lake Water!

Historically, even in mid-summer, Maine lake water temps have been characterized as cool and refreshing. But anyone who spent much time on (and in) Maine lakes last summer knows that the water was unusually warm. *By late July, lake surface temperatures for many lakes in the lower half of the state were in the low to mid-eighties (F)!* Temperatures in the mid-seventies were more typical in Maine lakes only a decade ago. In late July, Lake Stewards of Maine (LSM) staff were contacted by volunteers on Saturday Pond in Otisfield, who reported that many small Yellow Perch had died and were washing up along the shoreline. Fish "die-offs" were also reported in four northern Maine lakes last summer (Cross, Square, Long and Madawaska), according to biologists and pathologists from the Maine Department of Inland Fisheries & Wildlife, who indicated that the mortality was likely indirectly due to the unusually warm water temperatures which promoted parasite infestations.

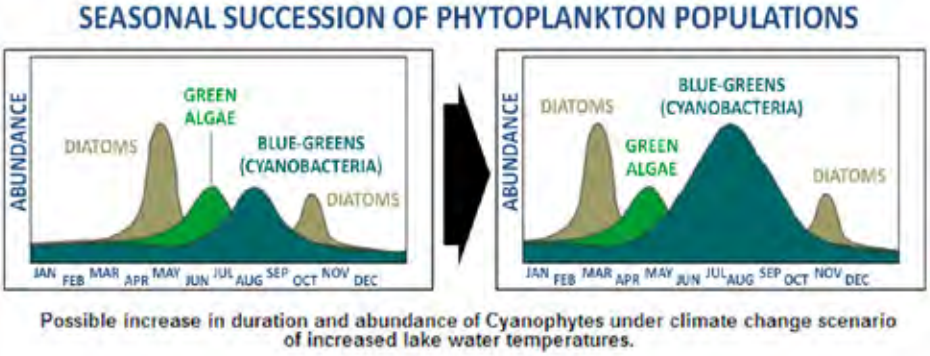


FIGURE 1: As lakes warm over time, a shift toward greater cyanobacteria (bluegreen algae) is likely to occur.

Some likely effects of unusually warm weather on Maine's lakes include:

- An increase in surface water loss due to evaporation.
- An alteration or acceleration of biological processes in lakes, the most significant of which is likely be an increase in planktonic algae growth, resulting in reduced water clarity.
- An increase in the number of lakes that experience summer thermal stratification, and, an overall lengthening of the period during which lakes are stratified (from earlier in the spring to later in the fall). This often results in greater dissolved oxygen loss in those lakes, reducing coldwater fishery habitat. In some lakes, an increase in phosphorus release from lake sediments can also occur, which can dramatically stimulate the growth of planktonic algae.
- Shifts in phytoplankton (algae) assemblage dominance, which most notably favor the metabolism and growth of cyanobacteria, a.k.a. bluegreen algae (see **Figure 1** above). Cyanobacteria are well adapted to rapid growth as water temperatures increase. It has been said that "Cyanobacteria like it hot", compared to true algae, which grow better at lower temperatures. This increases the potential for "Harmful Algal Blooms" (HAB's) and associated "cyanotoxin" production to occur.
- Alterations to lake food webs can result in "trophic cascades" that could favor increased algae growth.
- A shortening of the duration of winter ice cover (forming later in the fall and melting earlier in the spring) will result in profound changes to lake ecosystems, including those listed above and more.
- *Gloeotrichia,* a cyanobacteria that has occurred historically at very low densities in some of Maine's clearest lakes, was reported to be "more prevalent" by citizen scientists on some lakes last summer (limited data available at the time this article was written). Ongoing research suggests that multiple factors may be responsible for its increasing abundance and changing phenology. The fact that "Gloeo" has recently been documented at very high densities in "reference lakes", situated in remote areas away from any human influence, suggests that some aspect of climate warming could be a factor.

Another Severe Drought!

In addition to Maine lakes being unusually warm last summer, another significant form of extreme weather occurred

throughout the State, and continues as of this writing (November, 2020). *According to the National Weather Service, the period from mid-May through June was "the driest stretch of weather ever recorded" at the Portland monitoring station!* August was the 4th consecutive month of below-average precipitation, and by the end of September, all of the state of Maine was experiencing historic drought conditions that ranged from *moderate* to *extreme,* as the map in **Figure 2** (at right) illustrates.

In late October, the Commissioner of the Maine Department of Agriculture declared a "State of Emergency" for Piscataquis, Sagadahoc and Somerset Counties, due to the extreme, prolonged drought.

By late summer, LSM staff had been contacted by dozens of lake stewards, who reported extremely low water levels on the lakes that they monitor. Unusually warm water temperatures, resulting in increased evaporation, a severely depressed water table, and tributaries from lake watersheds with very little to no flow due to the extended drought, were the primary factors driving this phenomenon.

Overall, prolonged periods of drought do not benefit the health of our lakes. Low water levels de-water attached wetlands and littoral areas which exposes and kills beneficial rooted lake plants and impairs or eliminates invertebrate and fishery habitat. Some species of invasive aquatic plants, such as Variable Milfoil are actually well adapted to drying conditions, which may give them a competitive edge over native plants.

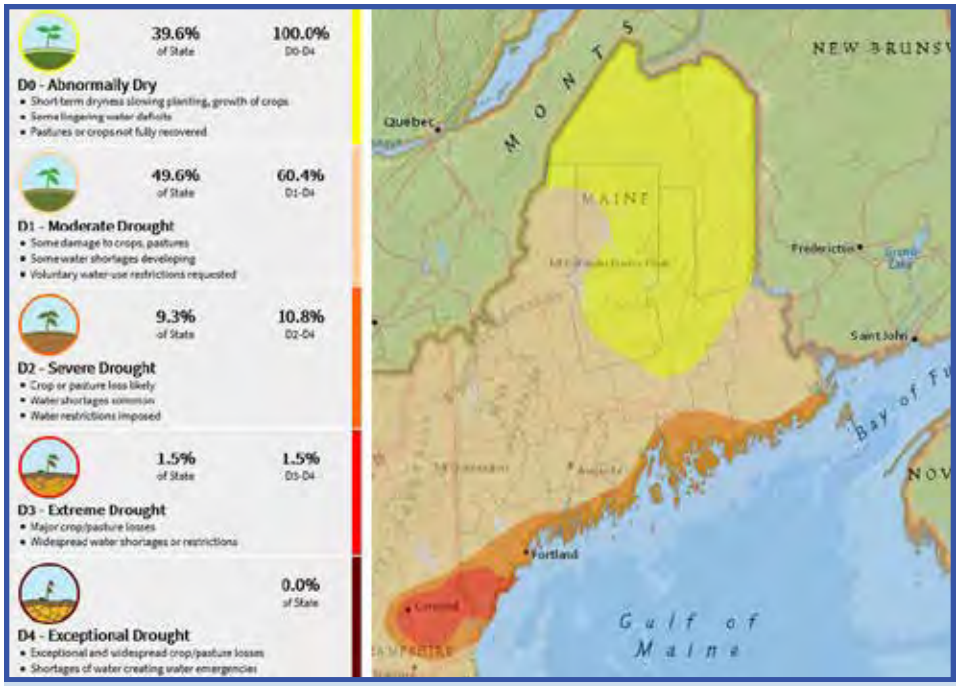


FIGURE 2: Maine Drought Severity Map

Ironically (but somewhat predictably) periods of drought dramatically reduce stormwater runoff from developed areas in lake watersheds, and because runoff is the transportation vector for the nutrient phosphorus, sediment particles from soil erosion, and other pollutants to lakes from their watersheds, historical Secchi data from hundreds of LSM certified lake monitors has shown us that many Maine lakes tend to be clearer than their historical average during drought years (see **Figure 3** below). As you might expect, the few Maine lakes that already have high phosphorus concentrations often experience greatly reduced transparencies because there is no rainfall to flush out nutrients.

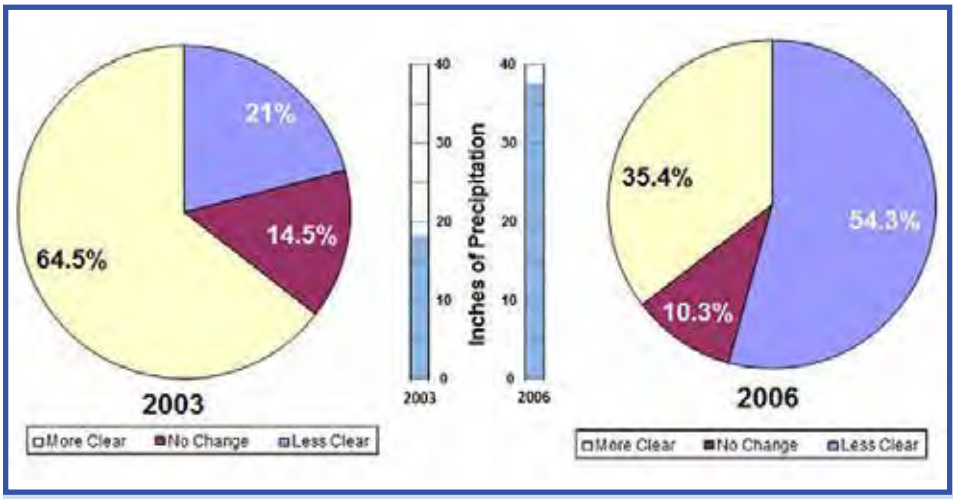


FIGURE 3. The two pie charts illustrate the percentage of Maine lakes that were clearer than, less clear, or unchanged from their historical averages for the years indicated. Note the bar charts in between that show annual precipitation (January-July) for the same years.

The combined effect of extreme drought and heat last summer could have caused Maine's lakes to have been more productive (greater algae growth, and less clear) due to warmer water temperatures. But many might have been overall clearer, because of lower nutrient inputs due to the drought. As always, the ways in which individual lakes respond to external and internal influences depends very much on the many ways that Maine lakes differ from each other. The natural physical characteristics of a lake, including variability in depth, the area of the surface, relative to the lake volume, flushing rate, the shape of the lake basin, prevailing winds, the geochemistry of the watershed soils and lake sediments, fisheries and biota, and of course watershed development, are just some of the factors that determine how individual lakes respond.

Preliminary 2020 Lake Observations…

By mid-August, a number of LSM water quality monitors had commented about experiencing unusually clear and deep Secchi readings in their lakes. Certified Lake Monitor, Woody Trask, who has monitored Taylor Pond in Auburn since 2010, reported that Secchi readings taken in both May (7.0 meters) and September (6.55 meters) broke the all-time high reading in four decades!

Extreme Weather . . . **continued on page 21**

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

In Kind

And for those of you who have donated your time, expertise, and dedication to the work of the LSM in the past year– many thanks!

Lake & Regional Watershed Associations

THANK YOU to all the Lake and Regional Watershed Associations who supported LSM's annual association appeal. We anticipate reaching our appeal goal of $20,000 by year's end! Contributions from Lake and Regional Watershed Associations help to cover expenses associated with training and ongoing support to volunteers in their lake communities, printing and mailing of data forms, ensuring the accuracy and quality of lake data through re-certification of current volunteers, and detailed quality assurance review of more than 2000 volunteer data forms and surveys.

Data gathered by LSM citizen lake scientists helps to identify trends, threats and lake phenomena throughout Maine. We share this information with lake communities and the general public to help educate and inform people, and ultimately, to increase efforts to protect our lakes. LSM's staff and more than 1,000 lake stewards throughout Maine deeply appreciate the strong support from Maine's lake communities.

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Extreme Weather ... continued from page 17

On July 22, staff from the Auburn Water District documented a 12.1 meter Secchi disk reading in Lake Auburn, an exceptionally high reading for any lake!

Wynn and Sandra Muller on Wilson Pond in Wilton also commented on unusually clear conditions in their lake last summer. Drought conditions very likely contributed to this phenomenon. Stewards from other lakes have made similar comments.

However, some lakes throughout the state did not fare as well, including the following, which experienced unusual planktonic algal blooms last summer, some of which were characterized as severe (Secchi transparency readings of less than 2.0 meters depth):

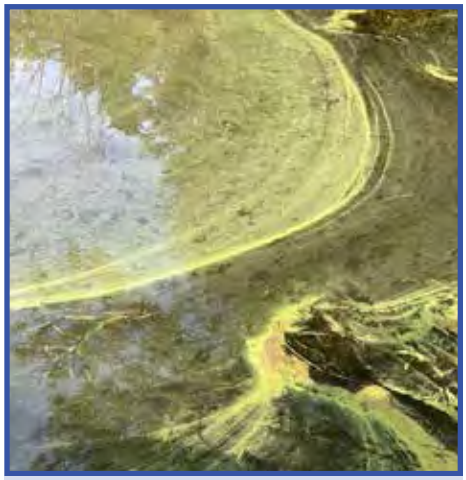
- Damariscotta Lake in Jefferson, Newcastle and Nobleboro, which has historically experienced overall stable water quality, but is vulnerable due in part to low levels of dissolved oxygen during the summer, experienced unusual "stringy aggregations" of cyanobacteria (*Oscillatoria* or *Planktothrix*, and *Dolichospermum* (formerly *Anabaena*) growth in the lower "South Arm" of the lake in July. By August, a severe bloom had occurred in the area near the lake outlet. Neurotoxins associated with the cyanobacteria *Planktothrix* and *Dolichospermum* bloom were documented. Fortunately, toxin levels remained well below the threat to public health.

Blob from algae bloom in North Pond, Smithfield. Photo credit: Linda Bacon.

- North Pond in Smithfield experienced the worst algal bloom on record for the lake, developing large clumps of gelatinous blobs, which formed from the decay of the bluegreen algae *Dolichospermum*.
- Sabattus Pond in Sabattus, a lake that has experienced algae blooms of varying intensity and duration for the past few decades, experienced a severe bloom of somewhat less severity in 2020.
- Chickawaukie Lake in Rockport, which underwent an "Alum" treatment more than 25 years ago to control algal blooms, experienced Secchi readings of less than 1.0 meter during the summer for the first time in nearly three decades.
- LSM lake monitors, Bill and Kathleen Cotter, documented a severe late summer bloom in Abrams Pond in Eastbrook. The bloom persisted into the month of October.

Algae bloom in Long Pond, Parsonsfield. Photo credit: Linda Bacon.

- Long Pond in Parsonsfield, a clear lake with a history of Secchi readings averaging more than 6 meters, experienced a severe bloom for the fourth consecutive year.
- Pattee Pond in Winslow and Crowell Pond in Chesterville and New Sharon also bloomed this year. Both lakes are productive systems, but do not typically reach bloom conditions. Unusually high temperatures likely played a role in both cases.
- Long-time LSM lake monitor, Peter Devine reported a severe bloom in Garland Pond on July 18th.
- Webber Pond in Vassalboro, a lake with a history of annual algal blooms mixed with average Secchi readings experienced bloom conditions last summer worse than in recent years.



Algae bloom in Sabattus Pond, Sabattus. Photo credit: Linda Bacon.

It should be noted that variability in lake Secchi data is not just about extreme changes! Many additional Maine lakes are likely to have trended significantly above or below their historical averages in 2020, without necessarily reaching the point of an official algae bloom, or "exceptionally clear" conditions. For example, a lake with historical Secchi averages of 7.5 meters, which experienced readings in the 4-5 meter range, or in the 8-9 meter range last summer, would have had an unusual year - one that would have a bearing on the long-term average for that lake and perhaps a foreshadowing of future conditions.

We will not likely have the complete picture of how the extreme weather of 2020 influenced Maine's lakes for several months to come. Fortunately, data continue to arrive daily from hundreds of LSM certified water quality monitors. That extensive information for several hundred lakes throughout Maine, will further our understanding of the ways in which a changing climate will influence our lakes. ◔

Algae bloom in Pattee Pond, Winslow. Photo credit: Linda Bacon.

Changes to Communication & Technology in the Past Few Years and the Spurs of CoViD-19

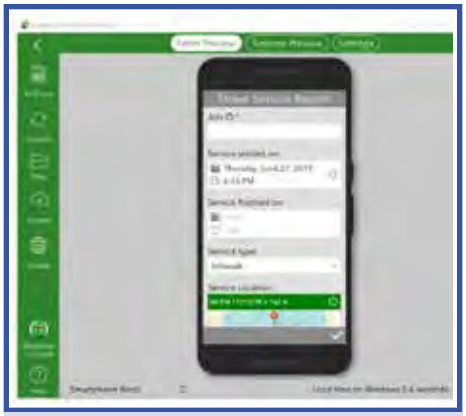
by Tristan Taber

Technology at Large

Communication technologies and means of monitoring have been changed drastically by the development of personal electronic devices and the home computer. According to Graham Kendal, PhD., cellular (smart) phones have, on average, 4 gigabytes of random access memory (34,359,738,368 bits). The Apollo 11 guidance computer had 32,768; that is over six orders of magnitude less than the phone many people have in their pocket. With this illustration, it should be easy to see that technology is leaps and bounds more powerful, portable, and dynamic than it was decades ago. It was just a matter of time before these small portable computers would be employed for scientific collection of data.

At the same time, because of this new computing power, science reached a point where scientists who (obviously) cannot be everywhere at once, suddenly had the power to analyze far more data than could be gathered in a single lifetime. The compilation of citizen science data and generation of big datasets allowed for scientists to discover trends that had been previously obscured. Downloadable cell phone programs (applications) like eBird, iNaturalist, and **EPA's BloomWatch (a cyanobacterial bloom documentation and reporting software)** leverage a range of average citizens to experts in their field to observe, document, chronicle, discuss, and curate the wonders of the world around them.

Using unmanned aerial vehicles (UAVs), digital cameras, and photostations, people are able to capture everything from phenology (changes to seasonal cycles) to the three-dimensional environment which they develop using technologies like photogrammetry and lidar point clouds—think radar with lasers. Mobile phone applications like Global Mapper Mobile™ allow for the recording of and modification to these geospatial databases and can incorporate base maps to allow for visual interfaces that reflect satellite imagery, aerial photographs, or other forms of remote sensing.



Area of study in the northeastern United States. Sediment cores were collected from the lakes outlined and labeled. Watershed area of each lake is highlighted in green.

LSM, in conjunction with the Maine DEP, ventured into this territory in 2020 with the mobile application, **Survey123™, for use in aquatic plant surveys**. *If you were part of a watershed survey in the past few years, you may have used Survey123 when working with the DEP.* This tabular form and documentation software uses the GPS system in a phone or tablet to register **geospatial coordinates**, and by following a series of prompting questions notate the occurrence of specific aquatic species in a lake (or stream). This, however, **still requires training in the ability to identify** at least certain aquatic specimens. *LSM is seeking two major levels of use with this application: those persons who are able to identify the eleven aquatic invasive plants that threaten Maine lakes; and those persons who have a more robust knowledge of the native, as well as the invasive, aquatic species for native plant habitat, location, and identification mapping.* Both are important components of monitoring the health of Maine lakes.

In addition to Survey123 for the Aquatic Plant Mapping, we are planning on rolling out a version of **Survey123** that could be used **for tracking metaphyton in spring of 2021** We understand there are cyclical concerns raised about metaphyton, however until we have a better understanding of seasonal, yearly, and spatial variability of metaphyton, it is difficult to elucidate more about it. This new package for the tracking of it will provide us with much of that critical information.

How CoViD-19 Has Changed LSM on the Technology Front

CoViD-19 changed a lot about our world. In the past year, we had to change a great deal of the way our program functioned. Fortunately, we have had a very supportive group of volunteers, donors, and we were lucky to be positioned in such a way that we could make use of the communication technologies available. One such technology is Zoom™. Zoom has been giving many people, our stakeholders included, a crash course in distance learning and video communication platforms. According to Zoom Video Communications, Inc., documents:

- In June 2014 there were approximately 10 million participants each day;
- In December 2019 there were approximately 10 million participants each day;
- In March 2020 there were over 200 million participants each day; and,
- In April 2020 there were over 300 million participants each day.

Zoom is not alone, however. Google has updated their Hangouts platform with the launch of Google™ Meet. YouTube, a subsidiary of Google, has expanded their YouTube™ Live program. GoToMeeting™ and Microsoft™ Teams™ are both popular offerings as well. There are a number of others, including the Discord™, which launched a video component to their VOIP (voice over internet

Communication . . . **continued on page 31**

In lieu of our Annual Lake Monitoring Conference, *Lake Stewards of Maine* hosted a series of weekly informational webinars from June through August, on a wide range of topics pertaining to Maine Lakes. They ran approximately one hour in length, and included an opportunity for Q&A for those who attended. All sessions were recorded, and are available for viewing on the Lake Stewards of Maine website (LakeStewardsOfMaine.org). The complete season of topics and speakers is shown below.

The Crown Jewel Lakes of Central Maine, and the Threats that They Face

Presented by Matt Scott, Aquatic Biologist, Emeritus; Maine DEP, Past President of the North American Lake Management Society and Lloyd Irland, PhD; Research Scientist, Author & Consultant

The Influence of A Warming Climate on Aquatic Invaders in Maine Lakes

Presented by Roberta Hill; LSM Invasive Aquatic Species Director & Aquatic Ecologist

Metaphyton in Maine Lakes: What Is It? Should We Be Concerned?

Presented by Scott Williams; LSM Executive Director & Limnologist

Citizen Stewards and Maine Lakes: Collaborative Approaches for Sustainable Systems

Presented by Firooza Pavri, PhD; Professor of Anthropology, University of Southern Maine

Northeast Climate Trends, Tracking Increasing Harmful Algal Blooms, and the Vital Role of Citizen Science in this Research

Presented by Hilary Snook; Senior Scientist, US EPA Regional Laboratory

An Overview of Citizen Lake Watershed Surveys

Presented by Amanda Pratt, Environmental Specialist, Maine DEP Watershed Management Unit

Lake Ice Regimes: Some Baffling Trends and Challenges for Citizen Science

Presented by Lloyd Irland, PhD; Research Scientist, Author & Consultant

What You Need to Know About Lake Algae

Presented by Alan Baker, PhD; Professor Emeritus of Botanical Sciences, University of New Hampshire

Healthy Vegetated Buffers – Healthy Lakes. Working with Mother Nature to Protect the Waters of Maine

Presented by Roberta Hill; LSM Invasive Aquatic Species Director & Aquatic Ecologist

A Guided Tour of LSM's *Lakes of Maine* Website

Presented by Peter Vaux, PhD; Developer and Manager of LSM's *Lakes of Maine* Website

All webinars are currently available for viewing at https://www.lakestewardsofmaine.org/2020-summer-webinar-series/

For a more in-depth overview of the research, please click
https://www.lakestewardsofmaine.org/wp-content/uploads/2021/01/tWC-2020-21-GloeoArticleTT.pdf

Gloeotrichia – In Time and Space

by Tristan Taber

In the new study, co-authored by LSM Scientific Advisory Board member, Dr. Holly Ewing, and titled *'New' cyanobacterial blooms are not new: two centuries of lake production are related to ice cover and land use*, Ewing and her colleagues discuss their investigation of *Gloeotrichia echinulata* in seven lakes with varying trophic states (levels of biological productivity) and morphometry (basin shape and surface area). The team attempts to answer questions about the ecology of the colonial cyanobacteria and possible historical drivers of trophic change in Maine lakes. The online version of this article includes additional figures and a more in-depth discussion of the paper.

Concentrated colonies of Gloeotrichia in Long Pond, Belgrade. Photo credit: Roberta Hill.

Ewing et al. examined lake-bottom sediments that have captured the last several hundred years of conditions in each lake and watershed. They compared the influences that watershed and lake characteristics, regional influences like climate, and anthropogenic (human-caused) factors had on lake productivity over time. By improving the understanding of lake sensitivity to trophic change and the drivers of that change, they hoped to provide better insights for managing these and possibly other New England lakes.

The team took sediment core samples from the bottom of each lake and sliced them into layers for analysis. They looked at nitrogen, carbon, algae pigments, and Gloeotrichia. Gloeotrichia was chosen because each lake currently supports populations, they are macroscopic, and persist in the sediments. By looking at the number in each sediment sample, they were able to determine the probable population in a lake over time.

Researchers estimated the age of the sediment subsamples and developed a timeline using radioactive dating techniques. Historical land use records were also used as a study factor. The study factors were compared in the timeline and to one another using statistics. When factors correlated, it could mean the shift was due to one or more of those environmental factors.

Based on their analysis, it can be said that Gloeotrichia has been present in New England lakes even before European settlement (c. 1750 CE). Gloeotrichia was found in the sediments of all but the most eutrophic lake in the study, Sabattus Pond, Sabattus, ME. The authors speculate that Gloeotrichia was not found in Sabattus because it needs light for germination and that a highly eutrophic lake with diminished transparency cannot provide this.

Gloeotrichia populations appeared to be largest in five out of the six lakes (not including Sabattus) when non-indigenous land clearing was the most pervasive (c. 1780–1860). As agriculture declined, especially animal husbandry, Gloeotrichia also declined. However, agriculture is not the only factor, given that other biologists have witnessed Gloeotrichia blooms in lakes with minimal human influence, such as Katahdin Lake in Baxter State Park.

Although some prior research has suggested that Gloeotrichia is able to change the lake

Area of study in the northeastern United States. Sediment cores were collected from the lakes outlined and labeled. Watershed area of each lake is highlighted in green.

LSM Advisory Board members Holly Ewing [L] and Steve Norton [2nd from R], and Linda Bacon [R] (MDEP and LSM Director) examine a sediment core from Lake Auburn.

community structure and drive trophic change, there was not strong evidence for this in all the study lakes, thus it may occur only in certain circumstances. In fact, they found that Gloeotrichia was not a good proxy for trophic changes. Algal pigments, which are associated with specific algae groups, found in the sediments correlated well with trophic shifts. In addition, these algal pigments correlated with ice-out records, a proxy for climate change, much better than Gloeotrichia did.

The study found evidence that relatively small watersheds were correlated to ice-out and pigment changes over the time; relatively large watersheds showed no correlation. Agriculture and the presence of Gloeotrichia also appeared to be more synchronized in lakes with smaller relative watersheds. While these relationships are likely influenced by factors that were not part of the study design, it still provides some evidence that relatively smaller watersheds are more sensitive to watershed changes and regional drivers, like climate change. The authors suggest that the effects of agricultural activity, especially livestock, relatively closer to the lakes may have distorted this relationship.

Trophic shifts were highly associated with land use change. Gloeotrichia appeared to be most strongly associated with changes in watershed land use. The team inferred that because the relationship between population and trophic indicator shifts in five out of the six lakes with development (Long Pond was excluded), shoreline related development may have been a significant driver of those trophic

changes. This is good evidence for lake communities that they need to pay attention to watershed and lake area development.

One of the difficulties with any ecology or complex system study, is that there may be significant variation between groups and among groups. Ewing et al. concluded that there was no 'smoking gun' causing trophic changes, however both the duration of ice cover and the extent of land use did appear to be key drivers. The complex interplay of morphometry, watershed land use, climate change, organic matter contributions, and many other unmeasured components of the lake environment meant that no single factor is a clear-cut cause. Even in the same lake, the timing and drivers of trophic change did not always correlate the same way over time.

Regardless, this study provides a wealth of information about the trophic history of these lakes, particularly about the incidence of Gloeotrichia and further evidence that watershed land use and ice cover play important roles in lake health.

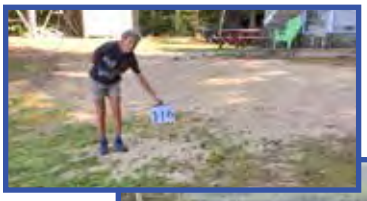
Maintaining high quality water requires a significant understanding of how these factors interact, however limiting stressors like phosphorus from the watershed will help mitigate the eutrophication of lakes in general.

Works Cited

Ewing, H. A., Weathers, K. C., Cottingham, K. L., Leavitt, P. R., Greer, M. L., Carey, C. C., ... & Sowles, J. P. (2020). "New" cyanobacterial blooms are not new: two centuries of lake production are related to ice cover and land use. Ecosphere, 11(6), e03170.

For a more detailed summary, please visit the LSM website:
www.LakeStewardsOfMaine.org

2020 Watershed Survey Grant Recipients



Bear Pond

Lovejoy Pond

Lake Stewards of Maine was pleased to be able to provide startup grants for four citizen lake watershed surveys in 2020: China Lake in China, Long Pond in Belgrade, Lovejoy Pond in Fayette/Readfield/Wayne and Bear Pond in Turner/Harford. These photos show the level of determination and commitment of volunteers who participated (safely!) in these successful projects. Lake Watershed surveys are an efficient and effective process for engaging lake communities in the identification and resolution of sources of pollution in lake watersheds. Many thanks to all who participated, and to the Ram Island Conservation Fund of the Maine Community Foundation for helping to facilitate these projects.

China Lake

Long Pond

Late Season Algae "Flash Blooms" in Lakes

by Scott Williams

Many Maine lakes periodically experience a fleeting burst of algae growth in the late summer or early fall when they de-stratify or mix (a.k.a. turning over). Mixing is a natural process that occurs when the water temperature and density is uniform from the surface to the bottom of the lake, at which time wind energy causes a lake to mix. Water clarity often declines slightly during this process, as particulate debris from the lake bottom is swept up through the water column.

Phosphorus that may have been released from bottom sediments, or which has been released from organic matter that has broken down near the lake bottom, is also brought closer to the surface during the turnover process. The amount of phosphorus varies from one lake to the next, depending on several factors. Typically, much of the phosphorus is not soluble (biologically available), and therefore has little visible effect on water quality. But a small percentage is soluble and reactive; because this form of phosphorus is readily available to algae, it can very quickly be assimilated, resulting in rapid, but usually very limited growth, as the phosphorus is rapidly depleted and other conditions promoting growth (water temperature and shorter days) are not ideal.

The spurt of algal growth typically dies off as quickly as it developed, usually in a matter of only a day or two, after which cells float to the surface sometimes causing a multi-colored sheen to form on the lake surface, or a ribbon along downwind shoreline areas. The sheens and narrow bands of concentrated algae may or may not be noticed because by early September and October, many lake residents have left for the year. In a short time, the algae dissipate from additional wind and wave action, often disappearing in several hours. The water surrounding the dense bands is often relatively clear, which indicates that aside from the area where the dying cells have concentrated, there is no "lake-wide" concern for an algal bloom.

Although the concentrated areas generally don't indicate a problem for the lake, people and pets should nonetheless avoid contact with them. Concentrated cyanobacteria (a.k.a. bluegreen algae) are often the dominant form of algae under these circumstances, and areas of dense cells could potentially be toxic for a brief period, especially if ingested.

Figure 1: Two photos of a recent October ephemeral algae bloom in Little Ossipee Lake in Waterboro.

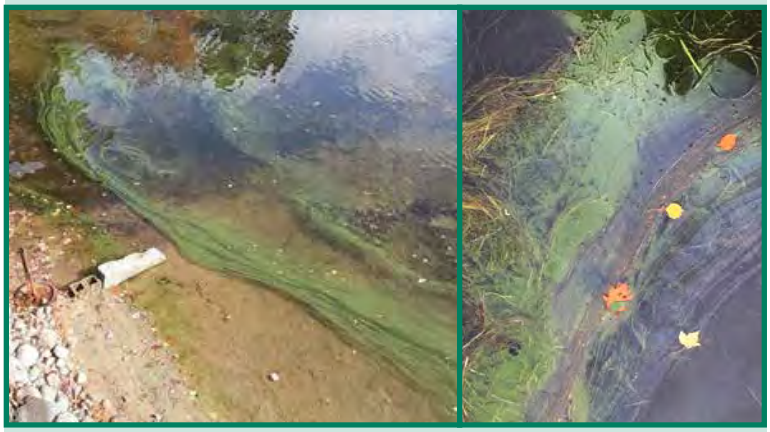


Photo taken by Bob Camden, Oct 22, 2020.

Photo taken by Lorraine Marcotte, Oct 23, 2020.

Ephemeral algae blooms (a.k.a. "flash blooms") as described above in **Figure 1**, recently occurred in late October in Little Ossipee Lake in Waterboro. The pictures were taken at two shoreline locations on the lake. Within a very short time (less than 48 hours), all evidence of the bloom had disappeared as the dying cells were dispersed to eventually sink to the lake bottom and decompose. The photos show both "bands" and "sheens" associated with the concentration of cells. Lake monitoring data gathered by LSM certified volunteers Robert and Sandra Labelle indicate that only a few days prior to observation of the bloom, lake water clarity readings were excellent (between 9.1 and 9.9 meters), indicating very low algal productivity in the lake water column. Temperature and dissolved oxygen data from the same period suggest that the lake was very close to the point of mixing, and that the low concentration of DO in the deepest readings could have resulted in some release of phosphorus from the lake sediments…classic conditions for the development of a brief algal bloom following mixing!

A similar bloom was reported by George Fergusson on October 3 on the south shore of Clary Lake in Jefferson (**Figure 2**). In October, 2013, Ross Swain captured a similar event in Ellis Pond with several excellent photos, including **Figure 3**, which illustrates a classic "cyano" surface sheen from that brief event.

Unusually warm summer weather in 2020 caused lakes to become warmer throughout much of Maine. As a result, the process of destratification and mixing likely occurred later in the fall, especially for large and deep lakes. Reports of turnover-related blooms were received as late as mid-November, when Sally Smith reported the classic conditions described above along the shoreline of Green Lake in Ellsworth. By the time we had spoken by phone 24 hours later, all evidence of this bloom had dissipated. It is likely that such conditions occurred in many other lakes this year, but due to the timing, were not observed or documented.

Figure 2: Flash algae bloom on Clary Lake on October 3. Photo credit: George Fergusson.

If you observe conditions similar to those in the accompanying photos, please document the information with a few photos, and the date, time and location, and share the information with LSM. Similar events involving short or longer-term algae growth can be documented using the smartphone app "BloomWatch", a product of a group of agencies and organizations in New England and the USEPA. If you choose to use this app, your photos and information will reach the Maine DEP and LSM. An indication of a more significant algae bloom would typically

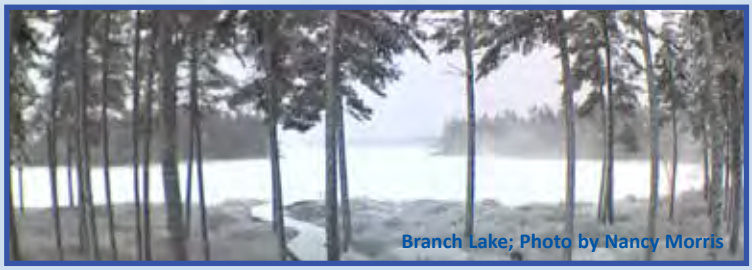
Figure 3: A classic October (2013) short-lived bloom on Ellis Pond was captured by Ross Swain. Note the cyano coloring of the surface sheen.

be preceded by declining Secchi disk readings, in which case you should alert LSM and/or Maine DEP staff well in advance of readings declining to the 2.0 meter threshold.

Late season "turnover blooms", while generally not an indication of a serious problem, could be harbingers of earlier, more significant blooms in the future, especially as Maine lakes become warmer over time from climate change. LSM trained citizen scientists play critically important roles in documenting changes in the lakes that they monitor. Thanks to all of you who continue to provide such valuable information concerning the health of Maine's lakes!

Please Remember to Document and Report Your Lake's Ice Cover!

Once winter begins to set in, please remember to document your lake's ice cover. LSM acts as a state repository for **ice-in** and **ice-out** records, some stretching as far back as the mid-1800's. Lake ice cover data, when paired with water quality data, may improve our understanding of the relationship between the duration of ice cover and water quality. For more information on determining ice-in/out, please visit our website at **https://www.lakestewardsofmaine.org/programs/other-programs/ice-in-ice-out/**. You may report ice-in/out dates to LSM using our online form at **https://www.lakestewardsofmaine.org/submit-ice-data/**, or by phone at 207-783-7733. We actively update the map of reported ice-in/out dates on our website at **https://www.lakestewardsofmaine.org/near-real-time-lake-data/** as part of the Near Real-Time Lake Data initiative. All ice-in/out submissions should include your name, the lake's name and related town, and the date of ice-in/out, in order to be added to the statewide map on the LSM website.



Branch Lake; Photo by Nancy Morris

Georges Pond Treatment... continued from page 8

Maine to request assistance with this undertaking.

On a cool and windy day, in May, 2020, I arrived on the shores of Georges Pond. I met with the president, board member, and vice president of the GPA, John and Ginger Eliasberg, and Brian Friedmann (while still physically distancing) to discuss the logistics of the monitoring process. Two treatments, the first costing over $140,000 would begin the following day. HAB Aquatic Solutions, LLC. administered approximately 35,250 gallons of alum and I performed more than 35 localized water quality tests over the span of the next 4 days. The Eliasbergs, Friedmann, and myself all monitored the pond and shorelines for impacted wildlife. Due to the nature of alum (both aluminum's inherent toxicity to aquatic organisms and waterfowl, and the potential to alter pH) precise application and careful monitoring is necessary. Fortunately, no impacts to biota were observed, and other than some normal weather related delays, the application completed without issue.

Tristan Taber is pictured in the monitoring craft on the choppy waters of Georges Pond. Photo credit: John Eliasberg.

One month after the treatment, LSM was contacted by John and Ginger Eliasberg. They had just measured 6.4 and 6.3 meters for Secchi disc transparencies, respectively. The deepest transparency LSM has on record for Georges Pond is 6.2 meters. GPA hopes to begin part two of the application in the spring of 2021. They have continued to work towards limiting external phosphorus in their watershed. We wish them luck as they continue the good work they are doing to limit erosion and fertilizers, and we are happy we were able to help in beginning to correct the lake's health.

Big Lake Infestation Update

Big Lake is in the very heart of the Passamaquoddy Tribe's ancestral homeland. Located in and around the town of Grand Lake Stream, near the border with New Brunswick, the lake is part of a sprawling and much larger -roughly 17,000 acre- system known for its remote, wilderness beauty and extraordinary fishing.

In October of 2019, an urgent message from Joe Musante (a biologist with the Passamaquoddy Environmental Department) arrived at Lake Stewards of Maine (LSM) headquarters. The invasive aquatic plant, variable-leaf milfoil *(Myriophyllum heterophyllum)* had recently been found (and was soon confirmed by genetic analysis), for the first time in Big Lake. A survey of the immediate area determined that the infestation was well established and widespread throughout much of Clifford Bay, at the southeast corner of the lake. Plans were soon underway for an LSM-led volunteer team to conduct a complete level-3 survey of Big Lake during the summer of 2020.

Though the COVID-19 pandemic brought the planned team-mobilization to a halt, we are pleased to report that the response to the Big Lake infestation has continued in earnest. Here is an overview of progress made during the 2020 field season.

- Warning buoys were placed in Clifford Bay to help boaters steer clear of known infested areas.
- On June 16, Downeast Lakes Land Trust (DLLT) hosted a Facebook Live event at which Maine Department of Environmental Protection (DEP) and LSM staff were invited to inform the Big Lake community about the new threat to local lakes, and to encourage participation in the response effort.
- DLLT implemented a Courtesy Boat Inspection (CBI) program at Big Lake's primary public boat landing at Greenlaw Chopping. In addition to inspecting boats launching into and leaving the lake, DLLT CBIs are helping to educate boaters to the threat of aquatic invaders and what boaters can do to help prevent their spread. (Please contact DLLT if you would like to learn how you can help with this important program next year.)
- In August, experienced solo adventurer and certified LSM Invasive Plant Patroller, Lucy Leaf, struck off for the Downeast Lakes Region to conduct screening surveys on some of the nearby waters connected to Big Lake. Through her determination and careful vigilance, several small patches of variable-leaf milfoil were found and confirmed in downstream Lewey Lake and Long Lake. The confirmation that invasive milfoil had spread to downstream waters was bad news, indeed, but by finding these (possible) pioneer colonies early, Lucy provided the opportunity for swift removal and containment.
- A group of concerned shorefront property owners has formed in response to the infestation, and, working in partnership with DLLT, the Passamaquoddy Tribe and others, the group is helping to facilitate outreach and response efforts on the lake, and taking part in the search for milfoil around the lake.
- Hosted by a founding member of the property owners' group, DEP staff was able to spend a week in the region during the month of September, conducting surveys on Big Lake and downstream waters, and carefully removing the small invasive milfoil patches found earlier by Lucy. Though they were not able to survey Big Lake in its entirety, the finding of two live (but not yet rooted) variable milfoil fragments in Cass Cove, at the north end of the lake, suggests that invasive milfoil is moving about at large in Big Lake. This find is especially concerning, as variable milfoil spreads readily through fragmentation and vegetative propagation. The plant stems, which become more brittle as the season progresses, easily break apart, creating numerous viable fragments. Once a fragment, a clone of the parent plant, is set adrift in the waterbody, it is free to move about on currents or to catch a ride on moving objects such as a boats or wildlife. The fragments quickly sprout roots, and if they land well, they will anchor into the sediments and establish a new colony.

New England Milfoil's Diver Assisted Suction Harvester (DASH). Photo courtesy of New England Milfoil.

Variable milfoil is well established in Clifford Bay. Photo credit: Brad Richard.

- On September 24, LSM and DEP teamed up once again to offer a second webinar for the Big Lake community. The session provided an update on the infestation, as well as more information on how to get involved in the search for the invader. Participants learned the key features by which variable milfoil may be positively identified, tips for conducting an effective and efficient survey, what to do if a suspicious plant is found, etc. Here is a link to a recording of the session - **https://vimeo.com/462669105/e345cd4e1f**
- With funding from Maine DEP's Lake and River Protection fund and housing generously provided by local landowners, professional divers with Maine-based New England Milfoil and their DASH (Diver Assisted Suction Harvester) were engaged for five days to remove milfoil from Clifford Bay. The DASH employs a venturi system

Big Lake Infestation... **continued on page 31**

(originally developed for gold mining operations) to facilitate the process of getting the plants that have been carefully weeded from the lake bed, up to the surface by way of a vacuum hose. The plant material is collected in totes on deck, for later disposal on dry land. NEM divers concentrated their efforts on a dense colongy of variable milfoil to the east of Brittany Island where the plants were growing offshore in water that ranged from 3 to 10 feet deep. The harvest operation was a great success with the crew filling forty-four 20-gallon totes to capacity. We can all rest a bit easier knowing that 880 gallons of varible milfoil are no longer free to grow and spread in Big Lake.

- In early October, Uber-IPPers Ross and Bunny Wescott traveled to the Big Lake region to meet with some of the local shorefront property owners with whom they had established a connection, and to survey portions of Big Lake and two nearby waterbodies: Pocumcus Lake and Pocomoonshine Lake. No invasive plants were found in Pocumus or Pocomoonshine, but in Big Lake, Bunny and Ross discovered a swath of suspected variable milfoil growing along the westerly shore in the vicintity of Hanneman Island. The plants were growing in discrete clumps and patches along a contiguous line about 40-feet long and 10 to 12 feet wide. Their find (which was mapped, and later confirmed by DNA to be variable milfoil) provides yet more evidence that the invasive milfoil has been spreading freely in Big Lake for some time.

Uber-IPPers Lucy Leaf (L) and Bunny Wescott (R) kept the survey moving forward in the region despite the pandemic. Photo credits: (L) Steve Underwood; (R) Roberta Hill.

Maine Warden and longtime Big Lake resident Brad Richard, the person who first noted something suspicious growing in Clifford Bay and sounded the alarm, was recently interviewed by a local reporter for an article focused on Big Lake's plight. In that article, Brad sums things up very well: "I hope the Downeast boating community hears the message and heeds the call to protect Washington County waterways. Learn how to clean your boat; learn how to spot invasive milfoil. For mitigation efforts to succeed, early action is key. It literally takes only a one-inch piece of this plant to re-generate itself, and if you look at our area on a map, you'll see blue water everywhere. If this invasive plant is here on Big Lake, there's a really good chance that it is somewhere else in the region as well."

Planning for next season's continued response is already underway. If you would like to learn more about how you can get involved, please contact Roberta at ***roberta@lakestewardsme.org.***

Botanical Haikus

Contributed by Debbie Broderick, IPPer on Lake Arrowhead

Floating bladderwort
With its radial platform
Supports its small blooms.

White water lilies
Overwhelm with sweet fragrance
Their cup-shaped beauty.

Pipewort multitudes,
White buttons on erect stalks ~
Aquatic hatpins.

Coiling eelgrass stalks,
Spiral up to the surface,
Showing their flowers.

Variable Water-Milfoil Confirmed in Androscoggin Lake

By Lidie Robbins, 30 Mile River Watershed Association and Roberta Hill, Lake Stewards of Maine

Signs point to possible early detection. More surveying needed . . .

In early September, Katherine Mahoney, a member of Androscoggin Lake's "Eyes on the Water" IPP team, noticed a bright green bottle-brush-like stem amidst a particularly thick patch of darker-colored plants in her survey sector. The suspicious plant was found in Inner Cove at the northern end of the lake, about 400 yards northwest of the state boat launch. Katherine noted the location, bagged the plant, notified Androscoggin Lake's IPP team leader, Buddy Cummings, and IPP Regional Coordinator for that region, Lidie Robbins, Executive Director of 30 Mile River Watershed Association. Photos of the plant were sent to LSM, and though the images clearly confirmed that the plant was a milfoil, the distinctive features (including the emergent flower) needed to confirm the identification were not present. The only way to know whether or not Katherine had found an invasive milfoil was to send it out for DNA testing. Within a day, Katherine delivered the live specimen to LSM, and from there it was taken to the Dr. Lucas Bernacki's DNA lab at Saint Joseph's College for analysis. Within a couple of weeks, the results came back: much to everyone's distress, Katherine's find was indeed invasive variable water-milfoil, *Myriophyllum heterophyllum*.

This is the first time an invasive aquatic plant has been found anywhere in the 30 Mile River watershed, and it poses a serious threat not only to Androscoggin Lake, but to all other lakes and ponds in the watershed, and beyond. Because invasive milfoil grows and spreads rapidly, identifying infested areas early and implementing aggressive, immediate control efforts are critical and provide the best hope of containment. Upon learning the DNA results, a coalition of local, regional and statewide partners leapt into action. With days, representatives of Androscoggin Lake Improvement Corporation, 30 Mile River Watershed Association, Maine Department of Environmental Protection, and Lake Stewards of Maine were on Zoom, planning a rapid response strategy for Maine's most recently confirmed infestation.

Searching through a colony of dense native plants for any sign of the invader. Photo credit: Steve Underwood.

The discovery of a well-established 12-foot diameter patch of variable milfoil suggests the invader has been present in this part of the lake for at least two seasons. Is this the pioneer colony? The only way to answer this important question is to complete the lakewide survey. Photo credit: Roberta Hill.

Once an aquatic invader has been found to be present in a waterbody, one of the first steps in response is to determine the full extent of the infestation. This information is needed to guide management efforts that will follow. Ideally the whole waterbody is screened during such a baseline infestation survey. However, due to the late season and the fact that many patrollers had already buttoned up their camps and had left the lake, efforts this season, would of necessity, be more limited.

By October 3rd, an IPP rapid response team led by Lidie and LSM's Roberta Hill, comprised of fifteen volunteer IPPers, had gathered on the shore of Androscoggin Lake. The focus of the survey would be Inner Cove and the adjacent Androscoggin Yacht Club basin. Though many of the volunteers were members of Androscoggin Lake's plant patrol team, others were IPPs from neighboring lakes in the 30 Mile watershed, and one, IPP Uber-IPPer Lucy Leaf, traveled 2-hours in each direction from Toddy Pond in Surry, to participate in the survey. By the end of the day, several more variable milfoil plants and one well-established, 12-foot diameter patch had been found, all very near to where the original plant had been spotted. The larger patch, especially, seems to indicate that variable milfoil has been present in the lake for at least two growing seasons.

The hunt to determine if there is more variable milfoil in Inner Cove begins. Photo credit: Roberta Hill.

Two days later, Lidie returned to the cove with DEP staff, and DEP diver Denise Blanchette carefully removed by hand all of the invasive milfoil that had been marked in that area.

A second survey was organized for October 15th; this time Lidie, Roberta, and Lucy were joined by two additional Uber-IPPers from 'away,' Bunny Wescott (Panther Pond, Raymond) and Keith Williams (Highland Lake, Windham). Two divers, one from the DEP and one from Little Sebago's milfoil-removal

team, surveyed deeper waters of the cove. Four additional plant clusters were found this time, again, all in the same general area. These plants too, were removed within a few days.

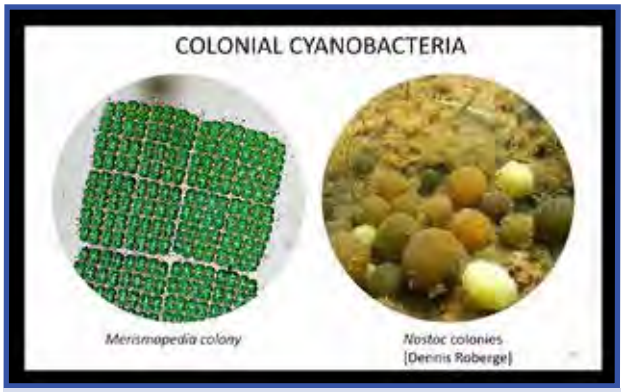
Though the baseline survey is far from complete, the fact that, so far, the variable milfoil seems to be confined to the wetland at the northwestern corner of Inner Cove, provides a glimmer of hope that the infestation very well may have been caught early on. This would be great news indeed, as early detection provides the best chance for successful control. The only way to confirm this of course, is to complete a comprehensive (Level-3) survey of the entire littoral zone of the lake. And thankfully, much due to the efforts and dedication of the various partners and IPP volunteers, plans are already underway to ensure such a survey will be completed next summer. Whatever the result of that survey, one thing is eminently clear. IPPers and their local, regional and statewide allies, by working together, are helping to make sure that Androscoggin Lake has a fighting chance to prevail against this newest threat. *Please contact Roberta at roberta@lakestewardsme.org to learn how you can get involved.*

Communication **... continued from page 22**

protocol) in the spring, and Mozilla™ the nonprofit that makes the Firefox™ web browser, has been developing a 3-D virtual environment people can use called Hubs™ (more information can be found at hubs.mozilla.com).

Because of the need to transition to distance engagement with our stakeholders, **LSM put together a series of webinars in lieu of a traditional annual meeting**. If you did not see these presentations, we have **recordings available on the LSM website and our Vimeo™ website**. Please see page 23 for information on the *Fridays at 4 for Lakes* webinar series.

We also held a number of virtual sessions including trainings, social events, roundtable discussions, and weekly tech support sessions for both water quality and invasive aquatic species lake monitors this past summer and fall—**because of the excellent response these weekly sessions are continuing throughout the year**. Perhaps our greatest takeaway from this was the added value these sessions can provide. Folks not usually able to journey to Auburn for in-person meetings were able to be heard from, and people who had conflicts in their schedules were still able to watch the recordings.



A screenshot of Dr. Alan Baker's webinar on algae, from LSM's summer webinar series *Fridays at 4 for Lakes*. For a complete list of webinars, please see page 23.

With more people at computers and online our websites have seen an increase in traffic. Our dataportal website, **LakesOfMaine.org, passed the 1,000,000 page view count** in mid-September, and it has seen increasing numbers each year. In order to cultivate a cleaner look and to make our websites more user-friendly, we have been making small changes to both the LSM and the LakesOfMaine websites. **We are currently working with a user interface, user experience (UI/UX) designer**. UI/UX, much like proper ergonomics, helps the user of a website better navigate, read, interpret, and remember information and messages on a website.

This is what we are striving for at LSM, to illustrate the importance of this work in a clear and concise way. We develop and enact easy-to-understand and highly-replicable training sessions, administer the compilation and curation of high quality lake data for Maine's lakes, and engage and inspire our stakeholders and volunteer network with presentations and resources.

Resources:

https://cyanos.org/bloomwatch/

https://vimeo.com/lakestewardsofmaine

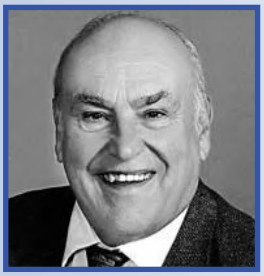
https://www.youtube.com/channel/UCHvwmCgjVAfvIdeOL2HBzBw

Hand Lens**... continued from page 15**

its spread is seen as the best (and currently only) defense against the harmful effects of this species. Anglers, kayakers and canoeists, boaters and jet skiers can all unknowingly spread didymo. The microscopic (and virtually invisible) algal cells cling to fishing gear, waders, boots and boats, and remain viable for several weeks under even slightly moist conditions. Decontamination requires soaking clothing and equipment in hot water containing a liberal amount of detergent. Thoroughly drying clothing and equipment for a minimum of 48-hours can also be effective, but only if completely dry conditions are maintained.

[1] Authors: J.M. Lavery, J. Kurek, K.M. Rühland, C.A. Gillis, M.F.J. Pisaric, and J.P. Smol, **Exploring the environmental context of recent Didymosphenia geminata proliferation in Gaspésie, Quebec, using paleolimnology**, Canadian Journal of Fisheries and Aquatic Sciences, 26 February https://cdnsciencepub.com/doi/full/10.1139/cjfas-2013-0442#.UxtL1IVm6So

Passings



Stu Belden

Stuart L. "Stu" Belden, a lifelong resident of Arlington, Mass. and summer resident of Sabbathday Lake, passed away peacefully on October 5, 2020 at age 77. Beloved husband of Charlene (Carroll) Belden. Stu was an active member of the Sabbathday Lake Association and participated in many activities. He was active in our last Watershed Survey and most recently he was a valued member of the Invasive Plant Patrol surveying sections on the East side of the lake. He loved the lake and was most happy while entertaining his family and especially being active in the lives of his grandchildren. Stu was always happy to do his part in any way to help protect the lake for future generations. Stu will be missed by all that knew him!

David Brown *(picture not available)* was a Panther Pond IPPer (PPIPPer) for over a decade. He snorkeled many sectors along the north shore of Panther. Fellow PPIPPers remember David as a quiet, diligent observer of the lake, and a valuable member of the team. His wife is now being mentored to take over David's sectors. When not at Panther, he and his wife wintered in Ponte Vedra, FL.

We regret that additional information was not available at the time of this printing.

Brian Steinwand

"And into the woods I go, to lose my mind and find my soul."
~ John Muir

Brian Steinwand was born in 1950, in Queens, New York.

He married Robin Waite in 1983 and they shared over 40 years together across the Caribbean, Africa, Maryland, and finally Maine. Brian loved the outdoors and sharing it with those close to him. He spent his life devoted to these things, from his years at the University of Montana doing backcountry research projects, to working in the Peace Corps to provide African communities with sustainable fishing methods, to regulating pesticide use while at the EPA, to helping Lake Stewards of Maine monitor water quality in Saint Albans on both Big and Little Indian ponds.

In his later years, he enjoyed being a part of the Saint Albans community. He served on the town's planning board, the Big Indian Pond Lake Committee, and worked on the town's comprehensive plan.

Ed Knapp

John Edward "Ed" Knapp was a LSM certified lake monitor on McCurdy Pond in Bremen. For many years, Ed was also LSM (VLMP) Regional Volunteer Coordinator for Knox and Lincoln Counties. He will long be remembered by those who attended his well-organized re-certification workshops as collegial, supportive and interested in hearing about the work and interests of all present.

Ed also volunteered his time for the Midcoast Conservancy, the Damariscotta Lake Watershed Association and the Maine Department of Marine Resources Phytoplankton Research Program. He was a professional mechanical engineer. Described as a "life-long learner", Ed had many personal interests and pursuits ranging from classical music, ham radio, beekeeping, bread making, fly-fishing, skiing and jumping horses, to researching genealogy.

Dick Thibodeau

Recently, we learned of the passing of **Dick Thibodeau**, following a lengthy illness. Dick's history with LSM and Maine lakes is long and rich. He monitored Little Wilson Pond in Turner for 20 Years, and served on the LSM/VLMP board of directors, during which time he provided wise and steady guidance. A professional Master Electrician, he volunteered many hours of his time to update the antiquated wiring of LSM's Auburn headquarters.

Dick also served on the Turner Conservation Commission for many years, during which time he steadfastly advocated for the protection of several lakes in his community. He was a longtime member of the Lake Auburn Watershed Protection Commission. He served as an Associate Supervisor for the Androscoggin Valley Soil and Water Conservation District, where he played a valuable role in lake watershed surveys, and assisted with many technical visits.

The list of organizations and local initiatives that benefited from Dick's participation is lengthy. He was a highly respected, kind, knowledgeable, and much-loved member of his community, where he could always be counted on to lend a helping hand to those in need.

In addition to time spent on Little Wilson Pond in Turner, Dick enjoyed fishing, camping and being with friends and family on Mooselookmeguntic Lake in the Rangeley area. His passion for Maine's environment was strong and clear for all who were fortunate to have known him.

Passings

Don Richardson was a certified volunteer lake monitor on Crystal Lake in Gray, Maine. He also served on LSM's Development Committee, along with his lifelong friend, and fellow ham radio operator, Lew Wetzel. Don made many improvements to the plumbing, electrical system and infrastructure of LSM's facilities in Auburn. His generosity of spirit, and friendly support were seemingly unlimited. We always looked forward to his visits.

Don Richardson

Don's wide range of skills came from professional backgrounds in electrical engineering, community leadership, flight instruction, and a lengthy list of organizations that he volunteered with in addition to LSM. He was a pilot for the Life Flight program, and a firewatcher for the Maine Forest Service. He is credited with the invention of a portable movie camera first introduced at the 1964 Winter Olympics in Innsbruck, Austria, and the leadership of Sylvania's educational electronics division.

Lifelong Lake Love *Contributed by Debra Smith, Sandra, Laura & Don Richardson, Jr.*

When we were growing up, our family moved a lot because of our father's job. The one constant was our family camp on Crystal Lake in Gray. This special spot continues to be an anchor for us, our children and grandchildren.

Our father, Don Richardson, spent summers on Crystal Lake growing up. It wasn't until he retired that he was able to once again spend the entire summer at camp. It was at this time that Don's friend Lew Wetzel introduced him to water quality monitoring and to the Lake Stewards of Maine (then, the Maine Volunteer Lake Monitoring Program). As the child in closest proximity, Deb became his apprentice, learning to read a Sechhi disk and collect oxygen samples, and following Don's exacting directions on filling in the data sheets for submission. Don liked to get out on the lake to collect data when there was a satellite flyover, even if it meant going alone. In his last years, it was difficult for him to climb in and out of the boat. But he never lost his love and commitment to protecting his lake, and other Maine lakes through his volunteer work with LSM.

Lew Wetzel and Don Richardson invested many hours of their time helping maintain LSM's facilities in Auburn, Maine.

Lew Wetzel

LSM staff, Directors and many of Maine's lake monitoring community were saddened to learn of the recent passing of **Lew Wetzel**. His past contributions to this organization, to the Pleasant Lake & Parker Pond association, and to his lake community go far beyond what can be said in this column.

Lew introduced himself to us one summer afternoon nearly 20 years ago, when he appeared at our Auburn office with a box of underwater photography components, many photos, and a mind full of ideas about how to survey and document lakes for the presence of aquatic invaders. We thanked him for his thoughtful and creative contributions, never imagining how energetic and committed to the cause Lew would turn out to be.

Lew quickly became a certified lake monitor, and as his knowledge of lakes increased, he became a mentor to many in his lake community. He joined the LSM board of Directors, and served as Treasurer of the organization for many years.

Lew helped facilitate the restructuring of the VLMP (now LSM) when, for many years he volunteered to spend dozens of hours of his time annually assisting staff with the entry of volunteer data into a database. Not being satisfied with the extent of his efforts, he offered his capable services in the maintenance of both our office building in Auburn, and the surrounding grounds. Although his professional background was in the field of electronic engineering, he was a competent plumber, carpenter and grounds keeper. Late into his 80's Lew would appear nearly every week for several summers with his truck, trailer and mower in tow, undertaking all aspects of keeping the grounds looking well cared for. In 2010 Lew and Don Richardson completely rebuilt a utility building at LSM facilities, painted the trim on second floor dormers, and undertook aerial feats that none of the staff were willing to do.

Following his retirement from the board a few years ago, Lew became LSM's first "Director Emeritus".

He was an accomplished aircraft pilot and amateur radio operator, and a great story teller, of which there were many. For all of Lew's generosity of energy, ideas and skills, his greatest gift to LSM staff and board was the inspiration that he instilled in us to believe in the good work of the organization.

We care deeply about Maine's volunteer lake monitors. If you would like to share news of a monitor's passing, please contact us.

Welcome, New LSM Board Members!

Sue Motley

Sue Motley has been a water quality monitor on Quimby Pond in Rangeley for almost twenty years. She serves as a plant patroller and a regional coordinator for water quality monitors in Franklin and Somerset counties. She has been a team leader for watershed surveys and a LakeSmart evaluator/coordinator. She formed a lake association, The Friends of Quimby Pond, and headed up the organization for 11 years. She compiled and wrote a handbook titled Caring for Quimby Pond.

Prior to her retirement several years ago, she spent nearly forty years working as an Emergency Medicine Physician Assistant. She has worked in various hospitals in the state including MaineGeneral Medical Center in Waterville/Augusta, Maine Medical Center in Portland, and Eastern Maine Medical Center in Bangor. She has a bachelor's degree in biology from St. Andrews University in North Carolina and a Physician Assistant certification from Wake Forest University in North Carolina. Whether it's Quimby Pond, the Kennebec River, the Kenduskeag Stream, Casco Bay, or the Rappahannock River, she has never lived far from the water.

In her free time, she enjoys the outdoors, including bicycling, photography, and travel.

Joe Musante

Joe Musante is the water resources biologist for the Passamaquoddy Tribe at Indian Township, having worked in their environmental department since 2004. Previously, he graduated with a BoA and a BoS from the University of Maine at Machias in 2002, all while working with his mentor, Norman Famous. The pair conducted all manner of environmental field work around Maine, but predominantly in Washington County.

Joe now spends most of his summer field seasons tracking the water quality of the lakes on the West Branch of the St. Croix River Watershed, as well as surveying for invasive aquatic plants. In his spare time Joe thoroughly enjoys gardening, foraging for wild mushrooms, fishing, and spending time outdoors where he lives in Machiasport.

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Would you like to contribute to the growth and sustainability of LSM?

Consider Becoming an LSM Board Member

Are you enthusiastic about the work of LSM? Looking to support a good cause, for a way to give back to your community, or to help the lakes of Maine? The LSM Board of Directors welcomes you to apply for a position on our board, or one of our subcommittees.

The Board develops policy, oversees fiduciary matters, and works with an enthusiastic staff. We help with the annual conference, fundraising, and outreach to the public, and some of us even volunteer in the field, working alongside LSM staff. We are particularly interested in bringing on new board members who have knowledge and experience in the areas of marketing, fundraising and program development. Some of our Directors are monitors who bring that background, as well as various experience and skills to the job; others are in the field of lake science or environmental conservation.

The Board of Directors meets 4-6 times annually at the LSM Center for Citizen Lake Science, in Auburn, Maine, and also through videoconferencing. Meetings typically take place on weekday mornings, and may last until early afternoon.

Please contact LSM Executive Director, Scott Williams, if you are interested in a position on the LSM Board, joining a subcommittee, or if you have questions. Following an initial discussion, candidates will be interviewed by a subcommittee of the Board, and the Board will act upon all applications. These are volunteer positions.