the Water Column

A Publication of Maine Volunteer Lake Monitoring Program

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VLMP's New Maine Field Guide to Invasive Aquatic Plants

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What's Inside

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President's Message

Water: There is No Substitute!

Bill Monagle
VLMP President

With nearly three-fourths of its surface covered by water, the Earth has earned the reputation throughout the galaxy as the "Water Planet". Most of this water (ninety-seven percent), however, is contained in the oceans with only three percent existing as fresh water. And only a small portion, less than one percent, of the fresh water is readily accessible as surface water. The remainder of the freshwater is tied up in glaciers and polar ice caps—although this figure is declining due to climate change—or exists as groundwater. Therefore, on a relative basis, accessible sources of freshwater would seem a rare commodity, indeed.

It goes without saying that without water, there would be no lakes or ponds. There would also be no life on earth as most major biological processes, such as photosynthesis and animal metabolism, rely on the availability of water. Water, as an essential element of life, flows through our own lives, connects us as critical players within our watersheds, and places us squarely within the global hydrologic cycle. I'm confident most of us greatly appreciate water in our daily lives for a variety of reasons, but there are a few properties of water that may often go overlooked by the common observer that are extremely beneficial and provide comfort to all organisms that rely on it, including humans. As a substance, I don't believe it could have been better designed, and I'd like to share with you just a few of its many properties that I view as truly amazing.

Let's consider a few of the thermal properties of water for instance. Pure water has both very high melting and boiling points, which allows it to remain in a liquid phase under the wide range of temperature regimes encountered on the planet. In fact, there are only a very few inorganic compounds that exist as a liquid in as wide a range of temperatures as does water. Two that come to mind are liquid mercury and liquid carbon dioxide, the latter occasionally found inside young quartz crystals. How does Mercury Pond, Maine sound for a vacation destination? A Secchi disk reading of zero meters, I'm sure.

Water also possesses a very high specific heat index, which means a good amount of heat is required to raise or lower the temperature of a given volume of water, providing a buffer against temperature extremes. Many animals that inhabit our lakes and ponds, particularly those commonly referred to in early texts as "cold-blooded", such as fish, amphibians, and reptiles, lack either the proper mechanisms to regulate body temperature or the ability to adjust their position within their environment in response to rapid and extreme temperature swings, and therefore greatly

benefit from water's high specific heat index. If on the other hand, water had a low specific heat, most of these organisms would suffer severe, and likely lethal, "thermal shock" due to the rapidly fluctuating water temperatures that would occur.

And finally, during this time of the year, in the dead of a Maine winter, when driving past ice and snow covered lakes, I am reminded of one of water's characteristics that I find most intriguing. Water, which is really a liquid crystal (not the LCD type), has a non-linear temperature and density relationship and differs from practically all other substances in being less dense, or lighter, in a solid phase than in liquid phase. As warm lake water cools, it becomes denser and sinks until its temperature reaches about 39° F., at which point it then becomes increasingly less dense and floats until at 32° F. it becomes a solid crystal in the form of ice. The ice that forms on the surface of lakes and ponds serves to insulate the warmer (or less cold) underlying water from the atmosphere, thereby maintaining a stable environment for aquatic life. Just imagine if as ice was forming it sank to the bottom of a lake or pond rather than float and continued forming over the course of a winter until the lake was literally solid ice. My guess is that the lake or pond would never fully thaw out, especially during our brief Maine summers, not to mention that all aquatic organisms victimized by this bad joke would be arrested in suspended animation. Brrrr! You get the picture. There are many other remarkable properties that make water special, of course, but I thought sharing a few of my favorites with you might enhance your appreciation for this marvelous resource.

My closing message is a brief one regarding our continued need to monitor and protect our water resources. Maine's people have long understood the importance and value of water, but have not always understood or appreciated its vulnerability. And, the full value of Maine's inland waters, that is our lakes, ponds, and streams, include intangible qualities that are difficult to measure, but that are surely immense. It is both timely and fortunate that over the past few decades there has been a heightened awareness and understanding of the threats to Maine's waters and a recognized urgency to protect them. That is good, because the experience shared by many within the lake management community is that an ounce of prevention is really worth a pound of cure when it comes to lake restoration. It is also good because when it comes to water there is no substitute!

Lakeside Notes

Putting Threats to Maine Lakes in Perspective

Scott Williams
VLMP Executive Director

Water is the most critical resource issue of our lifetime and our children's lifetime. The health of our waters is the principal measure of how we live on the land.

- Luna B. Leopold

Over the past few decades, Maine lakes have been confronted with a number of human-induced threats, including watershed development, invasive aquatic species, acid rain, recreational use conflicts, and more. All present complex problems, with equally complex, costly, and often controversial solutions. From time to time, volunteers ask me which of these threats is most serious. It's a great question that I try to answer by putting things in perspective.

For nearly four decades, volunteer lake monitors have been taking Secchi disk transparency readings on Maine lakes. As we all know, this simple, low cost device provides quick, valuable information about lake water quality, and readings can be compared reliably from one volunteer to another. We have learned a great deal about Maine's lakes and ponds from volunteers and their humble Secchi disks.

It was not by chance that the VLMP (or VMP, as it was called for many years) started by training volunteers to collect information about lake water clarity. The formation of the organization in the early 70's was in response to growing awareness and concern that Maine lakes were threatened, and that some were beginning

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to exhibit visible signs of stress, like reduced water clarity and, in some cases, nuisance algal blooms. A few well-known examples of Maine's early problem lakes include Annabessacook, Haley, Sebasticook and Webber.

The formative years for the nation's environmental movement began in the late 60's. Maine's Department of Environmental Protection evolved from the Environmental Improvement Commission in the early 70's. Following the passage of the federal Clean Water Act in 1972, "point source" discharges (aka: pollution from a pipe, or discreet source) to public lakes were eliminated. But people were starting to recognize that rapidly increasing shoreline development was a threat to water quality, even when pollutants weren't finding their way into lakes from clearly visible sources. And, although most people were not yet thinking about protecting lakes and ponds from a watershed perspective, there *was* growing awareness that land uses other than shoreline development also had the potential to have a negative impact on lake water quality.

By the early 70's, much was already known about the effect of "phosphorus pollution" on lakes. Ongoing international research on the question of the key factors that influence lake ecosystem dynamics consistently pointed to this critical nutrient. One of the important early messages to the public was that the cumulative impact from small amounts of phosphorus in stormwater runoff could, over time, seriously degrade lake water quality. The term "cultural eutrophication" was coined to describe this phenomenon, caused by watershed development. This process, in which nutrients, sediment and other pollutants from the watershed find their way to a lake in stormwater runoff, (aka: nonpoint source pollution) results in an increase in the growth of algae and rooted plants, reduced water clarity, the loss of dissolved oxygen, impacts to aquatic habitat, and other significant changes to the ecosystem. Cultural eutrophication is sometimes described as a dramatic acceleration of the aging process of lakes, resulting from human activity.

Measuring water quality with a Secchi disk helps us to understand the influence of development on our lakes.

As the State's population grew, and shoreline development exploded on hundreds of Maine lakes, cultural eutrophication was perceived to be the most significant and widespread threat to water quality, and to all of the benefits that clean lakes provide. But at that time, relatively little was known about the extent to which the phenomenon influenced our lakes and ponds. Limnologists knew that by measuring the clarity of lake water, as an indirect indicator of biological productivity, it should be possible over time to monitor the effects of cultural eutrophication on Maine lakes. Enter Maine's volunteer lake monitors with their Secchi disks. This approach to the rapid gathering of data for a large number of Maine lakes was viewed as the quickest, least expensive and most reliable means for obtaining the information needed to begin to answer questions about the influence of development upon individual lakes, as well as for Maine lakes as a whole.

A lake's watershed encompasses all the surrounding land that drains into it. Human activities on the land within the watershed can affect water quality as pollutants such as soil and fertilizers are carried into the lake by stormwater runoff.

Hundreds of Maine lakes have been impacted by polluted runoff (a.k.a. non-point source pollution) including 250 that are listed as "Most At Risk" in the Maine Stormwater Management Law.

To some, the continued emphasis on gathering lake data related to watershed development may seem unbalanced, especially in light of what has been learned about the potentially catastrophic consequences to lakes that become infested by aquatic invaders like Eurasian water-milfoil and Hydrilla. Invasive species do pose a very real threat to Maine lakes and ponds, and we must use whatever resources are available to prevent the introduction and spread of these invaders. In response, hundreds of volunteers have stepped forward to become trained Invasive Plant Patrollers. These motivated individuals have made significant contributions to our knowledge and understanding of the effect of this threat to Maine lakes. Maine is very fortunate to have only 28 waterbodies that are known to be infested by aquatic invaders at this time.

However, in comparison, the Maine Stormwater Management Law lists nearly 250 lakes as "Most at Risk from New Development", which means that they are projected to experience a decline in water quality as a result of polluted runoff from new watershed development. Most of these lakes are *already* degraded to some degree from existing watershed development, and are likely to experience an additional decline if significant action is not taken to protect them in the future. In addition, data gathered by the Maine DEP and VLMP volunteers have identified 78 Maine lakes that have been known to experience nuisance algal blooms since the 1970's, and 32 that are "impaired" due to polluted runoff.

Polluted runoff from watershed development degrades hundreds of additional lakes. It takes only a single road in a lake watershed to contaminate runoff to the lake with phosphorus and sediment. Except for extremely remote and relatively inaccessible bodies of water, development has found its way to a high percentage of lakes throughout Maine. "Development" may be in the form of residential, commercial or agricultural activity in the watershed, and, in most cases, watershed disturbances from development are far more extensive than a single road. Even "moderate" shoreline development on a small lake can mean hundreds of buildings, driveways, septic systems, lawns, and dozens of eroding camp roads. And, this does not include forms of development throughout the upland watershed, even if it is limited to a relatively small network of public roads. Another factor to consider in the effects of watershed development and cultural eutrophication is that the entire lake ecosystem (encompassing not only the lake basin, but streams and land areas of the watershed, as well) becomes polluted. The insidious cumulative effects of watershed development on lake water quality take place slowly, and often go unnoticed by the public until things reach a critical state. Perhaps the best known example of this in Maine is China Lake.

Stormwater runoff from developed areas contains an ever-increasing array of pollutants, ranging from nutrients (phosphorus and nitrogen), sediment from soil erosion, pesticides used for virtually all land uses, biological contaminants from human and agricultural waste, traces of medications and drugs, oil and gas residues from roads, and much more. Recent studies have documented the complex cocktail of pollutants found in residential, commercial and agricultural stormwater runoff. And while the negative effects of phosphorus and sediment pollution to lakes are well known, the consequences of all the rest, while of considerable concern, are poorly understood, at best.

New threats to Maine's lakes have emerged over the years, but cultural eutrophication from stormwater runoff remains at the top of the list of concerns, because it is *by far* the most pervasive problem. The role of the VLMP in protecting the quality of Maine lakes has always been to gather credible and pertinent data, and to use the information to inform and educate the public. From day one, the Secchi disk has been a useful and effective tool for gathering lake water quality data related to the effects of shoreline and watershed development. In that respect, nothing has changed, except that, amidst other growing threats to our lakes and ponds, the need for, and the value of, Secchi data continues to grow.

Ice-out Observations

Last fall we made a request by e-mail for volunteers to share their observations on the duration of ice cover on their lakes. We received so many historical records that we are still entering the data!

Many of those participating inquired about the definitions for ice-in and ice-out. In order to develop a definition for those terms we are asking volunteers to share their methodology of determining ice-in and ice-out with us. However, the most important consideration for determining ice cover dates is to be *consistent with the methods used historically on your particular lake*.

Please share the 2008 ice-out date for your lake or pond with the VLMP. Historical observations are also welcome. Starting this spring, as we receive ice-out dates they will be posted on the VLMP website.

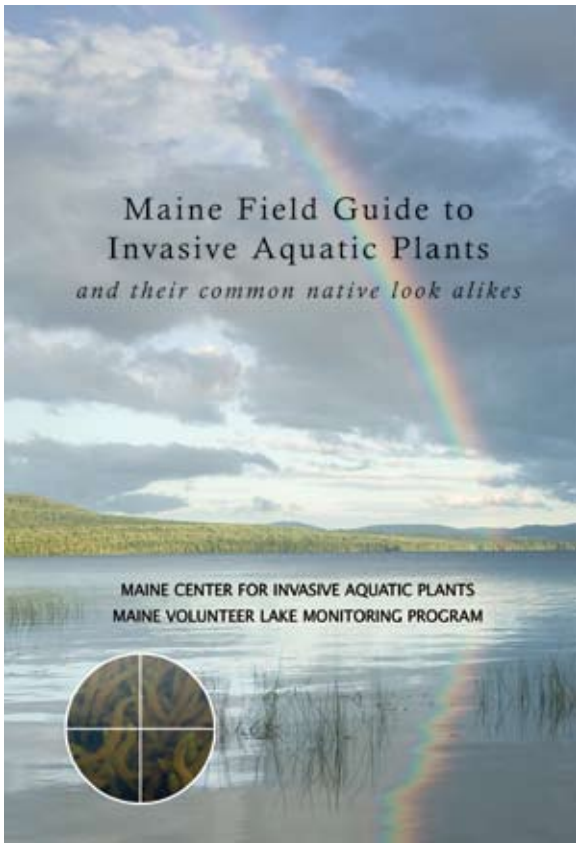
Send your observations to:

vlmp@mainevlmp.org
or
VLMP
24 Maple Hill Rd.
Auburn, ME 04210

New Field Guide for Lake Monitors

The Maine Volunteer Lake Monitoring Program and its Maine Center for Invasive Aquatic Plants are pleased to announce the availability of an important new publication.

Newly updated and expanded, the 160-page *Field Guide to Invasive Aquatic Plants* focuses on the eleven invasive aquatic plants currently listed by Maine law as imminent threats to Maine waters. Also featured are the native aquatic plants commonly confused with these eleven invasive species. Photographs, illustrations and narrative descriptions are presented for each of the featured species, along with a variety of cross-reference tools for easy comparison of similar species. The reference—spiral bound and printed on tear-resistant waterproof paper—is built to hold up well to conditions in the field (including inclement weather and the occasional dunking).



The publication will be distributed free of charge to all volunteers who attend VLMP training workshops, and is sold at a nominal price to others. To order a copy, complete the order form on the back of this newsletter, or order on-line at www.MaineVolunteerLakeMonitors.org. A preview copy of the publication is also available on the VLMP website.

Early detection of invasive aquatic plants is a key component of Maine's action plan to protect lakes and ponds from the spread of invasive aquatic species. The field guide provides an essential reference for VLMP Invasive Plant Patrollers, natural resource agency personnel, educators and students, conservation groups, lake association members, anglers, and others.

Free Field Guides for VLMP Monitors

Invasive Plant Patrollers: If you attended an IPP workshop in 2004, 2005, 2006 or 2007 you should receive your free copy in the mail soon. (If you do *not* receive your field guide by the end of February, please contact us!)

Water Quality Monitors: Please contact us 207-783-7733 or vlmp.@mainevlmp.org to request your free copy of the field guide.

Excerpt from VLMP's New Field Guide

INVASIVE PLANTS

VARIABLE WATER-MILFOIL

Myriophyllum heterophyllum

NOT NATIVE TO MAINE - INVASIVE

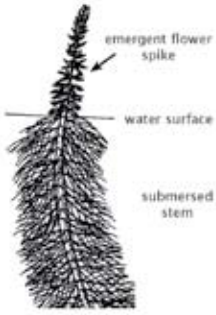
NOTE: All leafy milfoils display a wide range of vegetative variability. Any milfoil found in Maine waters should be considered "suspicious" until a positive identification has been confirmed by someone with the appropriate expertise.

Habitat: Variable water-milfoil is an extremely well adapted plant, able to thrive in a wide variety of environmental conditions. It grows well in still and flowing waters, and can survive under ice. Variable water-milfoil grows rooted in water depths from 1 to 5 meters on various substrates including organic muck, silt, sand and gravel. Plants stranded on dewatered shorelines form erect spikes known as "terrestrial morphs." The morphs, resembling miniature pine trees, will remain in this land-adapted form until the waters return, at which time they will "morph" back into submersed aquatic plants.

Terrestrial morphs

Description: Variable water-milfoil is a submersed, aquatic plant with branching stems emerging from dense, spreading roots. Feather-divided leaves are arranged in densely packed whorls. (Leaves along lower portions of the stem may not be in perfect whorls, i.e., some leaves may be slightly offset.) There are generally 4 to 6 leaves per whorl and 5 to 14 pairs of thread-like leaflets on each leaf. The dense leaf arrangement gives this plant a bottle brush appearance. Stems may be green and slight, but most often they are thick, robust and reddish in color (even bright red). Flowers and bracts are arranged in whorls on an emergent flower spike. The tiny white flowers occur in the axils of the bracts. The bracts are blade-shaped, serrated, and more than twice the length of the flower. Winter buds (or turions) are formed in the fall at the base of the stems or on the rhizomes.

Stem cross-section showing whorl of 6 leaves



Variable water-milfoil (*Myriophyllum heterophyllum*)

SUBMERSED PLANTS WITH FINELY-DIVIDED LEAVES

Origin and US Range: Variable water-milfoil is native to parts of the United States, but *not native to New England.* Variable water-milfoil is present in Maine and all New England states except Vermont. A hybrid of this species (*M. heterophyllum* x *M. laxum*), depicted on the following page, has also been confirmed in Maine.

Annual Cycle: Variable water-milfoil is an extremely hardy aquatic perennial that propagates through root division, fragmentation, turions and seeds. Flowering spikes typically emerge from the water in mid to late summer, but not all colonies produce flowers. Auto-fragmentation may occur during the growing season with stem sections developing roots even before they separate from the parent plant. Toward the end of the growing season some plants break apart and die back to their rootstalks; others overwinter intact. New growth sprouts from turions, roots, overwintering plants and plant fragments as the water begins to warm in the spring, growing rapidly toward the surface. Certain milfoils are able to hybridize with other, closely related, milfoil species.

Look Alikes: May be confused with bladderworts, hornworts, mermaid weeds, water crowfoots, and other leafy water-milfoils.

Whorls of submersed leaves are densely arranged, giving plants a "bottle brush" appearance

Flowers and bracts are arranged in whorls on the emergent flower spike; the blade-shaped serrated bracts are larger than the tiny white flowers that occur in their axils

Critical Acclaim for VLMP's Field Guide to Invasive Aquatic Plants

"The guide is an extraordinary improvement over anything that is available as a reference for freshwater invasive plants…it is apparent that this field guide has the potential to become a U.S. standard reference for freshwater invasive species."

David Littell, Commissioner, Maine Department of Environmental Protection

"It is beautifully done and a fantastic field reference. Great job!!!"

Sgt. Mark Warren, Training Sergeant, Maine Warden Service

"What a gorgeous job…the explanations, botany, descriptions, overall quality and clarity are excellent! It was well worth waiting for."

Ann K. Williams, VLMP Invasive Plant Patroller, Kezar Lake Watershed Association

"On behalf of the Cathance Lake Association, and myself, we thank you for the superb Field Guide! From the glorious cover to the expertise inside…truly a stunning effort."

Peggy Hallee, VLMP Invasive Plant Patroller, Co-Chair of the Cathance Lake Association

Eyes Trained on

The Maine Volunteer Lake Monitoring Program and its Maine Center for Invasive Aquatic Plants announce a major lake monitoring initiative for the Moosehead Lake region. This sixteen-month project is supported by funds from The Betterment Fund, US Environmental Protection Agency and the Maine Department of Environmental Protection, and will be conducted in partnership with other statewide organizations and agencies including the Maine Congress of Lake Associations and the Maine Department of Environmental Protection.

The Moosehead Lake Volunteer Monitoring Initiative will establish a regional group of trained volunteers to screen Moosehead Lake for the presence of invasive aquatic plants, establish baseline information about the lake's native aquatic plant communities, and monitor the lake's water quality. One of the key goals of the project is to coordinate a comprehensive invasive aquatic plant screening survey for Moosehead Lake, to be completed during the 2008 and 2009 field seasons.

The initiative will be one of the largest citizen-based lake monitoring projects of its kind in the US, and by far the largest ever attempted here in Maine. A project of this scale will require many hands and lots of trained eyes, and the VLMP has already begun recruiting volunteers in the Greenville region and enlisting the help of seasoned Invasive Plant Patrollers from elsewhere in the state to assist as team leaders.

Recreational boating is one of the primary vectors for the spread of invasive aquatic plants. As boating activity increases, the possibility that hitchhiking invaders will be inadvertently introduced to Maine waters increases as well. The particular challenge posed to any given lake is determined by a number of factors including: size of the waterbody, the amount of available plant habitat, the number of access points, the level of boating activity, the presence (or absence of) an active invasive plant prevention and early detection program, etc. When one considers how the Moosehead region may be developing in years to come, Moosehead Lake is highly vulnerable on all fronts.

"The Moosehead Lake Volunteer Monitoring Initiative will help activate, train, support, and coordinate individuals committed to the challenge at hand. While many other lakes in Maine have been assessed for aquatic invaders, Moosehead Lake, due primarily to its volume and size, has had only minor assessments conducted," says Scott Williams, VLMP Executive Director. "It is hard to imagine how Maine could get the baseline information that is needed in a timely manner—prior to any increase in development—without enlisting the help of trained volunteers."

The impacts of the spread of invasive aquatic plants are well known: habitat disruption, loss of native plant and animal communities, reduced property values, impaired fishing and degraded recreational experiences, and enormous and ongoing control costs. With over 6000 lakes and thousands of miles of stream habitat in Maine, the task of preventing the spread of invasive aquatic species in Maine waters is one of the greatest environmental challenges of our time. "No matter how comprehensive and aggressive our statewide prevention effort, chances are, some invasive organisms will slip through the cracks. In such cases, it is crucial that the invaders are detected as early as possible, before they have had an opportunity to cause significant damage or to spread to other waterbodies," says Roberta Hill, Program Director of the VLMP's Maine Center for Invasive Aquatic Plants (MCIAP).

Volunteer Invasive Plant Patrollers play a vital role in the effort to protect Maine waters from the threat of invasive aquatic plants. IPP Volunteers receive comprehensive training, including practice identifying live plants (right) and field training on the water (above).

Moosehead Lake

Through its nationally recognized Invasive Plant Patrol program, MCIAP has now trained over 1600 individuals in Maine to screen waterbodies for the presence of invasive aquatic plants.

During this 16-month project period, from February 2008 through December 2009, MCIAP staff will conduct two training events for local citizens, agency personnel, student researchers and others. Participants will learn how to recognize the eleven invasive aquatic plants that have been listed by law as imminent threats to Maine waters, and distinguish them from their native Maine look-alikes, and receive on-lake training in conducting invasive aquatic plant screening surveys. Volunteers will also be trained to collect valuable baseline information regarding the lake's native aquatic plant populations. When the initial training program is complete, a comprehensive, lake-wide invasive aquatic plant screening survey will be conducted on the lake. The survey, coordinated by MCIAP, will be conducted by teams of trained volunteers, each led by an experienced Invasive Plant Patroller. The survey work will be completed over the course of two field seasons: July-September, 2008 and again in 2009.

Workshops will also be offered in the Greenville area for those who are interested in monitoring Moosehead Lake's water quality. Currently there are approximately 500 VLMP volunteers collecting water quality data on roughly the same number of lakes throughout the State of Maine. The water quality data for Moosehead Lake is, however, limited. Monitoring water quality over time is essential for understanding and protecting Maine lakes. Credible water quality data provides resource managers, watershed communities and user groups to track water quality changes over time.

"The VLMP is uniquely poised to lead a project of this kind. The organization has an outstanding track record as Maine's premier organization for training individuals and groups to collect certified lake water quality data and screen waterbodies for invasive aquatic plants," says George Cross, Greenville area resident and Steering Committee member for the Moosehead Lake Volunteer Monitoring Initiative. The project Steering Committee—comprised of area residents, volunteers, natural resource agency personnel, VLMP staff and other interested parties—will help coordinate and guide the initiative.

The Maine Congress of Lake Associations will contribute to the long term effectiveness of the project by providing Courtesy Boat Inspection training for citizens of the Moosehead Lake region. Participants in the CBI training will learn how to raise awareness of the threat of invasive aquatic plants in their communities and especially at points of access to the lake, and to help boaters perform simple and effective inspections of their boats and gear prior to launching. Courtesy Boat Inspectors (CBI's) have been responsible for numerous important "saves" in Maine to date, removing invasive aquatic plants such as Eurasian water-milfoil and curly-leaf pondweed from out-of-state boats prior to launching into Maine waters.

An informational meeting on the project will be held in the Greenville area later this winter. For more information on the Moosehead Lake Volunteer Monitoring Initiative, the informational meeting or the two training events scheduled to take place in later in the summer, please contact: Roberta Hill, Program Director, Maine Volunteer Lake Monitoring Program's Maine Center for Invasive Aquatic Plants, at 207-783-7733 or mciap@mainevlmp.org.

Thank you to our donors.

This list reflects donations received from October 15, 2006 through January 31, 2008. If you feel we have made any errors or omissions, please contact us immediately at (207)783-7733 or tania@mainevlmp.org. Thank you again!

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Quality Counts!

DOo…DOo…DOo…Heartbreaker

by Linda Bacon
Maine DEP Technical Advisor

In the early 1970s, the Rolling Stones recorded a song the title of which applies to some quality assurance nightmares both volunteers and staff wrestle with regarding dissolved oxygen (D.O). Why be heartbroken over D.O.??? What quality assurance nightmare could possibly exist??? For that matter, why does anyone even care about D.O.???

Those of us that spend our time above the waterline take our supply of oxygen for granted. Critters below the waterline require the same life sustaining substance. Lakes that mix year-round are continuously replenished with oxygen as wind blows across the surface of the lake. Deeper lakes mix top-to-bottom only during spring and fall (overturn). As they thermally stratify, the deeper colder waters are isolated from their oxygen supply. The amount of oxygen bottom-waters have in spring must last throughout the growing season. Ice cover isolates the entire lake from its oxygen supply in a similar manner during the winter. All animal life in a lake uses oxygen ranging from single-celled decomposers to trophy pike and salmonids. The more biologically productive the lake, the more oxygen per unit volume required to sustain life. A shallow productive lake having lots of algae, may not have any oxygen limitations during the open water season. In contrast, biological processes in a deep productive lake may use up the oxygen supply in the isolated bottom waters halfway through the growing season. Coldwater fish are generally most stressed when this occurs. Many central Maine lakes no longer support a viable salmon fishery due to low dissolved oxygen (e.g., China L., Messalonskee L). In many areas of the state, loss of DO in the bottom waters brings a double whammy — release of phosphorus by the sediments to overlaying waters. Micro-circulation patterns can recycle phosphorus to upper layers of water resulting in more algal growth.

These processes are not simple. Equally as complex is the measurement of dissolved oxygen. Chemical kits can be purchased to make these measurements yet such determinations take a lot of time. More and more folks are purchasing sophisticated meters to get the job done more expeditiously. These meters are very handy and provide useful data, providing that the somewhat formidable Quality Assurance/ Quality Control (QA/QC) challenges are addressed. To meet these objectives, all data are evaluated in terms of Accuracy and Precision. Accuracy is how close the measure comes to the reality; Precision is how closely repeated measures are grouped. Year-round 'care & feeding' procedures are quality assurance documents designed to get the best possible performance (accuracy) out of a meter. The various checks on readings (e.g., checking readings against the calibration chart, duplicate readings) are quality controls that evaluate both precision and accuracy and alert the user when immediate steps must be taken to correct a poorly functioning meter.

One misconception that we have come across is the notion that a meter that turns on is working properly. This is a somewhat common misconception, one that is difficult to defuse. Unlike a light bulb or a toaster, meters are fussy critters. They come with many-paged operator's manuals that read like another language to most. In addition to the manuals, the QA/QC procedures required for the collection of lake data are necessary so that users of that data can be assured that any number is an accurate representation of the conditions in the lake at the time of data collection. These procedures are referenced by the Maine Lake Assessment Quality Assurance Program Plan (QAPP) that EPA requires before they pass any funding to DEP for the VLMP. Fortunately these QA/QC procedures are fairly straightforward and when explained to meter users,

usually make sense. These procedures fall into 4 categories: Pre-season, Pre-collection, Post-collection, and Post-season. Here is a snapshot of what is involved:

Pre-season. First, the probe needs to be prepared properly. At the beginning of the season, the anode and cathode must be checked for corrosion. If free from corrosion, new electrolyte and a new membrane are installed making sure no air bubbles are trapped under the membrane. Meter marks on the cable should be checked early in the season to make sure none have slipped.

Pre-collection. Before leaving home to collect data — before even turning the meter on, check the probe to make sure there are no air bubbles, no wrinkles in the membrane, no mold, no drops of water or mud on the membrane, and, check that there is moisture in the calibration chamber before the probe is placed back into it. Correct any issues observed. Once the meter is turned on, the user must wait 15 minutes before beginning the calibration process because the calibration process requires that the probe be in water saturated air. Fifteen minutes allows enough time for water in the sponge to evaporate into the chamber so the probe is bathed in 'fog' — or 100% water-saturated air. After warm-up, the user must follow the calibration instructions for that model. At this time, the dissolved oxygen reading inside the calibration chamber at the temperature inside the chamber should be very close to the expected saturation value for that temperature on the chart (plus or minus 0.2 mg/l). This quick scan provides the user one check of the meter's accuracy. It is much easier to correct any issues at home before even getting into a boat. The temperature at home is likely closer to the temperature of the water which makes for a more accurate calibration. A meter that has reached 35 degrees Centigrade from sitting in the sun in the boat is likely to give poor readings.

As you can see, before you even record one reading, there are quite a few procedures that must be followed to make sure the numbers you get are good. The only record of having done these checks on the datasheet is ***your checkmark*** in the little checkbox labeled "**Check for DO Meter Calibration**". So far, all these checks are evaluations of the meters' accuracy — in other words, how close the readings are to reality. In waters that are not blooming, with the calibration chamber removed and the probe being jigged just under the water's surface the very last reality check is making sure the dissolved oxygen reading is close to the expected reading at that temperature on the calibration chart, or within a few percent of 100% saturation. If this reading varies more than 0.5 mg/l from the expected reading, there may be a problem with the meter. Often atmospheric pressure and elevation can causes slight deviations from expected values. Again, this quick scan provides a second check of the meter's accuracy.

Taking a data profile is fairly straightforward. Jigging the probe up and down is critical to replenish the water in contact with the membrane. Making sure the temperature and dissolved oxygen readings have stabilized before recording them is equally as important. Some meters are equipped with an indicator which flashes when stabilization has occurred.

Post collection. Before winding the probe cable up, there are some VERY important extra readings to obtain and record in the lower right hand section of the data sheet labeled "**QA/QC Dups (1 for every 10 readings)**". ***This step is incredibly important because it allows us to evaluate the precision of the meter.*** It is essential that these readings be obtained in a 'stable' region of the profile so that the probe is in water having the same characteristics on the way up as it did going down. 'Stable' means that the readings one meter above and below are nearly the same as those at the depth of the QA/QC reading. If a depth in the thermocline or in an oxycline (where temperatures or oxygen levels are changing) is chosen, there is a very good chance that the variation would be enough to cause the entire profile

Richard Offinger (Cathance Lake Monitor) jigging the probe attached to his YSI Dissolved Oxygen Meter

to be discarded. Sometimes a probe will have sediment trapped in it from touching the lake bottom thus vigorous jigging may be needed to dislodge the mud before you succeed getting that first QA/QC reading.

It is also critical to wait long enough for the probe to reach the same temperature as the water. Probes have weight built into them and often have weight added. On the way down the probe cools gradually because readings are recorded one meter at a time; one hardly notices that the cooling is happening. When obtaining the QA/QC readings, often many depths are skipped while pulling the probe back to the surface thus it is important to wait for the probe to warm up to its surroundings before recording readings. These additional readings should be within 0.2 of the original readings with an occasional variation of 0.3. When one has allowed the probe to stabilize when acquiring the profile data AND the QA/QC readings, obtained the QA/QC readings from a stable region of the profile, AND, the meter is working properly, most often the profile is a keeper. Be sure to shut the meter off between uses.

Post-season. The easiest to implement are the post-season procedures. Remove batteries. Remove membrane or membrane cap. Rinse probe with DW; blot then air dry, cover with plastic to keep dust off. The most damage can occur when these simple steps are ignored. Batteries may corrode, leak acid into the meter and render the unit inoperable. The electrolyte or salt solution in the probe can cause unnecessary corrosion to the anode and cathode if not removed.

It does take some experience using these meters to reach the point where one is confident of the numbers. The checks performed during the calibration step address issues of **accuracy**; the duplicate readings taken at the end are assessments of the meter's **precision**. Both of these evaluations are necessary to assure that the data are credible — credible meaning that the data would 'stand up in court'.

Obtaining dissolved oxygen data is not for the faint of heart; it takes time and careful attention to detail. If at any point you have questions about the reliability of a meter during the calibration process or when collecting the QA duplicates, take action. First steps include checking the batteries, checking for bubbles/corrosion, and replacing the electrolyte fluid and membrane (or membrane cap). If after this the re-calibration indicates that the accuracy or precision is suspect, CALL the VLMP office. Depending on the model of the meter, there are a few other checks that might be possible. Regardless, DO NOT continue collecting dissolved oxygen data until the problem has been solved. There is nothing more heartbreaking than throwing out an entire season's worth of dissolved oxygen profiles. ***You are investing lots of precious time obtaining these data, be sure the data is worth obtaining!*** 2008 will be the third season that the VLMP has offered a Dissolved Oxygen workshop for volunteers in Auburn. I encourage any of you that have not yet attended one of these workshops to join us to learn more and have your meter checked out.

Conference Announcement

Celebrating Lake and Watershed Stewardship

2008 New England Lakes Conference
June 13-14, 2008
Lake Morey Resort, Fairlee, Vermont

Sponsored by:
New England Chapter of the North American Lake Management Society
Federation of Vermont Lakes and Ponds
Vermont Agency of Natural Resources

Please mark your calendars and plan to join us in Vermont for an informative and inspiring conference! This annual event provides a forum for information exchanges amongst lake managers (volunteer or professional) and encourages a proactive and protective approach to lake health and use.

The conference will feature the best New England has to offer:

- Lake Shoreland and Watershed Protection and Management
- Invasive Species Spread Prevention and Management
- Recognizing 30 Years of Volunteer Monitoring in New England

The conference begins Friday afternoon with a diverse selection of workshops and field trips. On Friday evening we'll recognize 30 years of the Vermont Lay Monitoring Program and other New England volunteer monitoring programs, and invite you to join us for a celebratory reception.

Saturday features presentations about a large variety of lake projects and issues from around New England. You'll be able to share information and ideas with others tackling similar issues and leave with new ideas and renewed energy!

Watch for registration materials in early April 2008, or check the website:
www.vtwaterquality.org/lakes.htm

How Far We've Come

In Our Back Yard

By Barb Welch, a Biologist with the Maine Department of Environmental Protection's Bureau of Land and Water. *In Our Back Yard* is a weekly column of the DEP

We rarely think about where our waste water goes when we rinse dishes in the sink, spin the water out of the washing machine or flush the toilet. For about half of us in Maine, that waste water goes to the local sewage treatment plant. Thanks to those sewage treatment plants and the skilled operators that run them, we have much cleaner streams, rivers, lakes, and estuaries.

To see how the municipal treatment plants got their start in Maine and how they have kept pace with development, let's examine one town's history — Rangeley.

In the 1950's and 60's, failing septic and cesspool systems, coupled with straight-pipe raw discharges, were contaminating the local waters. Bacteria levels in Haley Pond, the cove section of Rangeley Lake and the area of the local drinking water intake were climbing. In the summer, unhealthful levels of bacteria were common.

In the mid 1960's, an engineering firm designed a collection system and primary treatment plant to discharge into Rangeley Lake. But state and local officials were worried that the wastewater might harm huge, beautiful Rangeley Lake and by the time problems showed up, it might be a huge problem to fix. Up to this time, no treatment plants in Maine discharged into lakes so no one knew for sure what would happen.

The treatment plant superintendent, Jerome "Frenchie" Guervement, and state biologist Matthew Scott convinced the town, the state and the US Environmental Protection Agency to build a more advanced (secondary) treatment plant. They also put the discharge into smaller Haley Pond rather than Rangeley Lake so it would be easier to study the results..

Sure enough, nuisance algae covered Haley Pond in scum within two years. The discharge was sending nutrients, specifically phosphorous, into the pond and turning it green.

In 1975 the local officials built a partnership of federal, state and local officials to fund even more advanced treatment —the first plant of its kind in Maine. This advanced treatment resulted in the improvement of Haley Pond. The study of the treatment plant discharge to Haley Pond was so new and important it was published in *The Journal of Water Pollution Control Foundation*. The study also led the Maine Legislature to pass laws prohibiting future treatment plant discharges into lakes.

Rangeley continued to grow and the plant could not expand to meet the demands for wastewater treatment. Local, state and federal governments came up with a new solution. In 1996 a new plant was built with no direct discharge to the water, instead there were summer land and winter snow applications. The treated wastewater was sprayed on the land instead of dumped into the water.

The winter application is unique; when the town realized its existing lagoon wasn't big enough, local officials recognized that making snow out of treated water was both cheaper than building a new lagoon and more environmentally sound. Last year, it made almost 18 millions gallons worth of snow that lasted until July 4.

So next time you dump water down the drain or flush the toilet, thank your treatment plant, and its skilled operators, for protecting your local waters.

Photo courtesy: Jerome "Frenchie" Guervemen

Sewage treatment for the town of Rangeley has evolved quite a ways from the 1960's when treated wastewater was discharged directly into Haley Pond. The new plant, built in 1996, has no direct discharge, instead the treated wastewater is used to create snow.

Meet Maine's Lake Monitors

Paula Monaghan

Certified Invasive Plant Patroller

I signed up to become a volunteer after reading a newspaper article about the invasive plant problem in Maine. There was a reference in the newspaper article about the Maine Center for Invasive Aquatic Plants with a link to the Maine Volunteer Lake Monitoring Program website. We had become concerned about the invasive plant problem after one of our lake association members sent a plant sample for testing and it was proven to be a hybrid variable leaf milfoil. I took some of the classes and became a certified plant patroller. I also went to several meetings and an onsite study at an area lake.

As a child, I spent my summers at Collins Pond in Windham. I have spent a lot of good times there with my children and hope that the lake will remain healthy enough so that my grandchildren and great grandchildren will also enjoy it. We have a very concerned lake association group with innovative ideas and a shared concern to do whatever we need to do to save Collins Pond.

Paula Monaghan surveys for invasive hybrid-variable milfoil at a 2007 VLMP Invasive Plant Patrol field training.

Certified Monitors: Share Your Stories

Certified Water Quality Monitors and certified Invasive Plant Patrollers can now share their personal stories of lake monitoring on the VLMP website. Your photo and bio will be linked to the webpage for your lake as well as in the "Meet the Monitor" section of our website.

To submit your bio, please write up a couple of paragraphs about yourself and email it with your photo to vlmp@mainevlmp.org.

Questions you might consider when writing your bio:

- Why did you become a volunteer?
- What is it about your lake that makes it special to you?
- Are you involved with any other activities that you'd like to share?

February 8, 2008

Dear Reader,

We are considering a different format for *The Water Column* and would like your input. We have had great reviews about the current layout, but have determined that there could be several advantages when we looked into using a newspaper type format.

Positive comments concerning the present format include:

- Professional Looking
- Easy to Read (with very few articles continued to a later page)
- Great for Referencing (archival paper quality)

The newspaper format would have the following advantages:

- More Environmentally Friendly (both are recycled but newsprint consumes less materials)
- Full Color Photos
- Lower Cost to Produce

Please help us make this decision by providing your feedback.

How important to you are the easy to read and archiving qualities of our current format versus having full color and an environmentally friendlier newsprint format?

Feel free to call, or send an email to:

vlmp@mainevlmp.org

or

207-783-7733

Your opinions are appreciated!
Sincerely,

Scott, Roberta, Jim, Tania, Jackey & Christine

Upcoming Events

Maine Milfoil Summit

Friday, March 7
Lewiston

For more info or to register contact the Lakes Environmental Association: lakes@leamaine.org

Maine Water Conference

Wednesday, March 19
Augusta

For more info see the UMaine George Mitchell Center website: www.umaine.edu/waterresearch/mwc

New England Lakes Conf.

Fri. & Sat. June 13-14
Fairlee, VT

For more info see the announcement on page 16

VLMP Annual Meeting

Saturday, July 19
Hallowell

More info about the 2008 VLMP Annual Meeting will be available in the Spring/ Summer issue of *The Water Column*.

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Lake Monitoring Program
24 Maple Hill Rd
Auburn, Maine 04210

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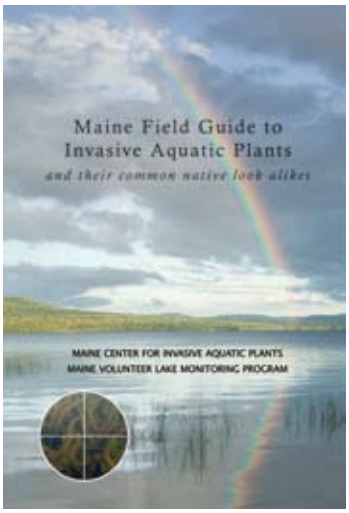

see page 6 for more information

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