Potamogetons

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Nonindigenous Aquatic Plants *"A Garden of Earthly Delights"*

By Donald H. Les

Adapted from Lakeline, (Vol.22, No. 1), North American Lake Management Society

Aquatic plants have been important as a source of food, commodity and religious inspiration to people since the early days of humanity. The aquatic grass known as rice (*Oryza sativa*) was cultivated in Asia more than 3,000 years ago and continues to be a leading staple of the world's food supply. Other edible and medicinal aquatics like sweet flag (*Acorus*), water chestnut (*Trapa*), and cattail (*Typha*) were in wide use by 300 B.C. It is understandable that movements of useful, edible, and ornamental water plants have closely followed patterns of human migration throughout history. The Egyptians were already known to cultivate water plants by 2500 B.C., and they had introduced the water lotus (*Nelumbo*) to Egypt by 500 B.C.

Europeans began to cultivate water plants in the 18th century, but it was not until the discovery of *Victoria*, the magnificent giant water lily, that interest in water gardening burgeoned in both the Old and New Worlds. Yet, despite their many beneficial uses and aesthetic appeal, some aquatic plants have gained reputations as inimical aggressors that threaten to destroy the ecological integrity of natural plant communities. Adaptation to life in water has conferred most aquatic plants with highly efficient vegetative reproduction and dispersal mechanisms. Even disallowing for human introductions, aquatics represent the most widely distributed plants on earth. The same biological characteristics responsible for their success also have enabled certain species to become some of the world's most notorious weeds.

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Phosphorus – What's in Your Lake's Wallet?

Phosphorus has always been of concern to lake managers for its importance to the aquatic plant community and its potential impact on a water body's aesthetic and recreational value. For this reason, it is important to monitor phosphorus closely. In order to do this, lake managers must understand the different forms of this nutrient.

In general, phosphorus can be divided into organic and inorganic forms, and dissolved and particulate phases. Organic phosphorus is bound to the biomass of a lake (i.e. plant and animal tissue), whereas inorganic phosphorus is bound to physical features such as the soil and certain rocks. The phase is an indication of the chemical state of the phosphorus. Particulate phosphorus is suspended in the water column and includes, for example, living and dead plankton, as well as some precipitate forms. Dissolved phosphorus is present in solution. A solution is formed when a phosphorus compound entering the lake breaks down at the atomic level (both chemically and physically) and disperses into the water.

Con't. on page three

Allied Biological Conducts Sonar Application in Finger Lakes

After more than 8 years of hard work, negotiation and fund-raising, the Lamoka-Waneta Lakes Association will finally get control of Eurasian Watermilfoil. This winter, Schuyler County awarded a contract to Allied Biological to apply the herbicide Sonar to 782-acre Waneta Lake. The goal of the application is to rid the lake of watermilfoil, and allow for native plants to re-colonize their original territory.

Waneta Lake sits immediately upstream of 792-acre Lamoka Lake, in the central Finger Lakes region of New York. Both lakes are heavily used for boating and fishing, and support fairly dense seasonal housing along most of their shorelines. Waneta Lake also provides a backup water supply to a nearby New York state hydro-electric power plant. The lake has historically tried to manage watermilfoil using mechanical harvesters, but this had provided only short-term, localized relief.

The spring Sonar application at Waneta Lake represents the first step of a multi-phase project. Following recommendations by the NYS Department of Environmental Conservation and project consultant ENSR Corp., an intensive monitoring program began immediately after application. Monitoring will study plant response, herbicide dissipation and general water quality, and is slated to continue through the next three years. Based on results of the monitoring program, the application of Sonar to Lamoka Lake will be permitted, potentially as soon as the Spring of 2004.

Allied Biological received the contract because of its history of supporting the project through meetings and site surveys, but also because of the professional level of service it offers. Key to its application proposal was the accuracy of application using GPS tracking, the scientific analysis of non-target plant impacts and the extensive experience the company has using Sonar and other fluridone products over the past twenty years.

Mechanical Lake Management Methods – *No Permit Required!*

Whether it's an emphasis on integrated management techniques, or just a love of big, orange metal machines, more lake owners are investing substantial funds in mechanical control programs these days. Aquatic weed harvesters have been around since the olden days, and while they do a fine job of "cutting the grass" (and a fair amount of fish), we all know the grass grows back. But today's lake management machines do more than cut weeds, they rip, rototill and remove plant roots, organic matter and debris from the lake bottom. And, in New Jersey, the best part is, they don't require a permit!

Generally referred to as Hydro-raking or Rototilling, these floating barges with large rake or tiller attachments dig into the lake bottom and dislodge unwanted plants and other materials. Hydro-raking typically involves removal of the material to the lake shoreline, while rototilling leaves the material to resettle on the bottom. Some temporary turbidity results from the work, particularly with rototilling, but water clarity is often restored within a few days. Both hydro-raking and rototilling provide longer term weed control than harvesting, because they affect plant root systems, while harvesting just removes the vegetative top of plants. Hydro-raking is particularly useful for control of waterlilies, whose tubers can grow to 4 inches in diameter and several feet in length.

The reason these mechanical control methods don't require a permit in New Jersey is that they target plant material, not sediment, just like weed harvesters. Of course, with the proper attachments, they can be used to remove

unwanted sediment deposits, as well. Typical productivity rates are from 1-3 acres per day, so they are often used for smaller project areas. One exception was the recent restoration of Blackwood Lake in Gloucester Township. Blackwood Lake is a dammed area of Blackwood Creek, and after years of eutrophication and no management activites, had filled in substantially with emergent aquatic and wetland plants. Under the supervison of Hudson Engineers, Allied Biological used a hydro-rake and a harvester to remove deposits of organic material over a seven-week period. Although the results won't be truly evident until this Spring, the entire upper half of the lake should support improved water flow and recreational access.

Belcher's Creek: More Than Just a Bug Study

If you've ever swam or waded in a stream or creek, you may have noticed some bugs shooting across the water's surface or perhaps tucked in beneath the rocks on the creek's bottom. Whether you were repulsed or intrigued by these creatures, the fact is they are valuable members of the aquatic ecosystem and worth a second look. Indeed, in some ways these bugs – actually macroinvertebrates – can be beneficial to humans.

For this reason, they have been the subject of an ongoing study at Belcher's Creek in West Milford, NJ by Allied Biological personnel. The study originated when of West Milford Township applied, on behalf of the Pinecliff Lake Community Assn., for a grant from the DEP to control non-point-source pollution in the Belcher's Creek corridor. The creek is of particular concern because it flows into Pinecliff Lake, a major recreational source for the surrounding community. The approval of the $90,000 grant allowed for the implementation of numerous measures to curtail the level of pollutants entering Pinecliff Lake and help improve the overall water quality. These measures included creating sedimentation basins to collect pollutants before they enter the lake, as well as a street cleaning and public education program to improve runoff water quality and help cut back on residential practices that might be detrimental for the lake. As part of the DEP stipulations attached to the grant, West Milford must provide evidence showing the reduction in overall non-point-source pollution. As macroinvertebrates are bioindicators of such pollution, Allied Biological was contracted to study them.

Sampling of macro-invertebrates involves using a short rake, or "potato stick" to dislodge the organisms from the rocks along the creekbed. They are then collected using a 1m kick-net and identified at the Allied Biological lab. After they are counted and categorized, they are run through a battery of analyses per EPA's regulations for Rapid Bioassessment of Streams Using Benthic Macroinvertebrates. The resulting indexes, when compared to baseline numbers, indicate the extent to which the community has been impacted by pollution. In this way, macroinvertebrates can provide a quantitative measure that is useful for gauging pollution levels.

Phosphorus... cont. from page 1

One important category of phosphorus compounds is the orthophosphates (PO4), also known as soluble reactive phosphorus (SRP). Orthophosphates are a stable, inorganic form commonly found in natural waters. Although present in some fertilizers and pesticides, they can also be naturally produced by microscopic organisms in the soil or during the breakdown of other chemicals. From a lake management perspective, orthophosphates are most important as a measure of how much phosphorus is available for direct uptake by plants and algae.

The polyphosphates are another important family of phosphorus-containing compounds. As they mainly come from detergents, soaps, and industrial discharge, polyphosphates are a good measure of point-source pollution in the watershed. They are relatively unstable and will eventually break down into other chemical forms.

Total phosphorus includes all forms and phases of the nutrient. It is listed by the Environmental Protection Agency as one of the main criteria for determining a lake's trophic status, or the degree of overall biological productivity.Unlike SRP, which relates only to the amount of phosphorus directly available to plants and algae, total phosphorus gives a comprehensive index of the impact of all watershed activities. Along with SRP, it is the most common form tested for.

Some factors affecting phosphorus concentration in a lake include geology, the shape of the drainage basin, and precipitation. These obviously cannot be controlled. The influence of human activities within the watershed, however, is another important factor and this can be changed. Indeed, responsible land use can greatly improve conditions within a lake and slow eutrophication, the natural process by which a water body turns into a wetland through sediment deposition and vegetative growth.

Garden of Earthly... cont. from page 1

Although many water plants have widespread geographical distributions naturally, nearly all nonindigenous hydrophyte invasions can be traced initially to the activities of people. Notably, more than 75% of all nonindigenous aquatic plants in the northeastern United States originated as escapes from cultivation. Once aquatic plants are released into nonindigenous habitats, most species can easily spread over greater distances due to their efficient dispersal mechanisms. Dispersal of invasive aquatic plants is unwittingly facilitated by people, who carelessly transport viable stem fragments from lake to lake on contaminated boats and trailers.

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The growing popularity of water gardening and "natural" aquariums has exacerbated the problem by increasing the commercial availability of many invasive nonindigenous aquatic plants either directly or indirectly. Some invasive species such as egeria (*Egeria densa*), fanwort *(Cabomba caroliniana*), Miramer weed (*Hygrophila polysperma*), parrot's feather *(Myriophyllum aquaticum*), and water hyacinth (*Eichhornia crassipes*) are readily available from various water garden and aquarium suppliers in the United States. These species are popular in aquariums and water gardens because of their durability and "vigor", which ironically, also indicates their high potential of invasiveness. Even some tropical species, such as water hyacinth, which normally cannot withstand cold winters, can reach nuisance levels in temperate localities within a single growing season.

For more than a century, the United States has experienced a steady accumulation of new invasive aquatic plants with no end in sight. One new invasive aquatic plant species has been added to the flora of the northeastern United States approximately every ten years since 1850. New introductions of invasive aquatics like giant water fern (*Salvinia molesta*) in 1998 and mosquito fern (*Azolla pinnata*) in 2000, continue to materialize elsewhere in the country as well. It comes as no surprise that both of these recent introductions are due to escapes of cultivated plants. To make matters worse, the nonindigenous aquatic plants that were introduced previously have relentlessly continued their stifling expansion into new territories. Water chestnut (*Trapa natans*) was new to Connecticut in 1999, European frog-bit (*Hydrocharis morsus-ranae*) new to Michigan in 2000, Eurasian water milfoil (*Myriophyllum spicatum*) new to South Dakota in 2000, and hydrilla (*Hydrilla verticillata*) new to Massachusetts in 2001, just to name a few of many examples. If these disturbing trends are allowed to continue, it is predictable that a complete demise of our native aquatic plant communities is inevitable.

Half a millennium ago, Hieronymus Bosch painted his infamous *The Garden of Earthly Delight*, which depicts a world indulging in various nefarious pleasures – and the extreme punishments awaiting the revelers. Admittedly, it is a stretch to associate aquatic plant cultivation with Bosch, but perhaps his basic message is pertinent here even after 500 years. As far as aquatic plant invasions are concerned, we have clearly identified the major source of the problem and also an effective solution. It is now a matter of choosing whether or not to proceed with an appropriate course of action, regardless of repercussions to the cultivated aquatic plant trade. Otherwise, we as Bosch's subjects, must be willing to pay the consequences of our actions, if not spiritually, than at least financially and ecologically. Indeed, the escapes of invasive aquatic plants from cultivation and ensuring infestations that have severely degraded our natural habitats, fittingly represent a nonindigenous "garden" of our earthly delights. Sadly, however, it is a garden choked with weeds.

Plant Invader

(Hydrilla verticillata)

Northeast lakes beware! Hydrilla, a native plant to Africa, Australia and parts of Asia, is coming our way. First introduced in the early 1950s via the aquarium trade in Florida, this plant has spread to numerous states by waterfowl and through boat activities. Hydrilla can spread by seeds, tubers, plant fragments and turions (over- wintering buds). This plant forms dense mats that can interfere with recreation, as well as degrade fish and wildlife habitat. Hydrilla has recently been discovered in a small south jersey lake community.

Renovate Aquatic Herbicide Introduced to Aid Wetland Restoration

"Vibrant butterflies, boisterous bullfrogs, crashing cranes, splashing trout and the buzz of zebra dragonflies are just a few of the sounds one might hear in a flourishing ecosystem. But silence sets in when non-native species like purple loosestrife begin to thrive, literally taking over thousands of native species and ruining entire bodies of water and surrounding lands. Purple loosestrife, a perennial that grows up to 8 feet in height, is now growing wild in 42 states and devastating hundreds of thousands of acres of wetlands and marshes. Wetlands infested with purple loosestrife often lose 50 percent of native plant biomass and many become densely covered, significantly changing the native environment. This impacts food and cover for wildlife and decreases sunlight and nutrients for native plants, posing a threat to endangered plant and animal species.

Not more than a month after the National Wildlife Refuge Association released its report, Silent Invasion, documenting hundreds of thousands of acres of damaged wetlands and marshes associated with purple loosestrife, a new aquatic herbicide called Renovate*, has been EPA-approved to combat it.

SePRO Corporation has recently introduced Renovate, which received Federal EPA registration in November 2002 making it the first aquatic herbicide to receive registration since 1988. Renovate, with its highly effective systemic mode of action, provides selective control to help mend torn waterways knotted with nuisance and exotic plants including Eurasian watermilfoil (*Myriophyllum spicatum*), purple loosestrife (*Lythrum salicaria*), alligatorweed (*Alternanthera philoxeroides*) and water hyacinth (*Eichhornia crassipes*)." Renovate was designed to be effective on both emergent and submersed plants – a feature that allows it to treat wetlands, marshes and shorelands as well as lakes, ponds and canals. The herbicide is taken up through the foliage and stems providing a unique fast-acting result. Best of all, Renovate is selective to dicots, leaving monocots such as most grasses, unaffecting by its application. This is particularly useful when managing mixed stands of Purple Loosestrife and other desirable species, before Loosestrife completely crowds out its competition. Renovate is most effective when Purple Loosestrife is at the bud to mid-flowering stage of growth. As with all aquatic pesticide applications in New York and New Jersey, a state permit is required.

Protecting a Natural Treasure - Long Pond, LI

Long Pond Greenbelt, is a unique coastal pond system located in Southampton and is regarded as one of Long Island's most treasured natural wonders. It is home to many rare plants and invertebrates and provides a respite for the residents of the area with scenic hiking trails and recreational access to the lakes. It became obvious to the caretakers, South Fork/ Shelter Island Chapter of The Nature Conservancy, as well as many local residents that their resource was under attack from an invasive plant all too common in our backyard, *Phragmites.*

The Nature Conservancy has been cutting the *Phragmites* since 1999, and although spreading has been slowed by these efforts, it was realized that additional control measures were necessary. Excavation of the *Phragmites* was attempted but the impacts of such an activity was ultimately agreed to be detrimental the seed bank of the native plants and was abandoned.

A pilot herbicide project was conducted several years ago with encouraging results. In 2000, The Conservancy contacted Allied Biological to assist them in formulating another Rodeo application plan.

The plan included the application of Rodeo via backpack wicking units to selected areas of Long Pond. The project would require special approval from the Town of southampton and Suffolk County. A Permit to Use An Aquatic Pesticide from the NYSDEC would also be necessary. Due to sensitive nature of this project and the many factions, whose consent were required, we were pleased to receive approval for a fall 2002 spray. Under the supervision of NYSDEC and The Nature Conservancy, Allied Biological conducted the Rodeo application in October of 2002. To follow the on-going restoration of this coastal pond, visit the South Fork / Shelter Island website at www.tnc.org

Slow Feed Alum Systems

We talked before about the benefits of aluminum sulfate, or alum, as a nutrient inactivation measure. Surface applications by Allied Biological have been extremely successful restoring lakes with high internal phosphorus recycling. But what about external loading problems? Enter Slow Feed Alum injection, a system designed to gradually release small amounts of alum throughout the water column on a regular interval. So as nutrients enter the water, they are inactivated before having a chance to accumulate and contribute to algal productivity.

The Slow Feed Alum System has two main components, a pump to distribute alum, and a compressor to distribute air. The air and alum are piped through separate tubing into the lake or pond, to selected diffuser points. At each diffuser, alum is released above the air, so as the air rises to the surface and radiates out, it disperses the alum. Since this is occurring somewhat continually, the volume of alum used to properly inactivate nutrients is generally extremely small.

Slow Feed Alum Systems weren't invented yesterday, but have been used selectively on long-term, lake restoration projects when substantial funding has been available. Recently, however, system designs have become more accessible, particularly for smaller ponds. Although the initial capital expense of a Slow Feed Alum System may increase the pond maintenance budget temporarily, the reduction in algae control activities can lead to substantial cost savings and much improved water quality.

Here's To Your Pond's Health - Oxygen

Dissolved oxygen is one of the most important measures of waterbody health. Adequate oxygen supports good fish populations, healthy plants and active microorganisms, which are all part of a well-balanced aquatic ecosystem. Disturbance of the ecosystem can adversely affect oxygen levels, particularly in smaller ponds.

Ponds experience great fluctuations in temperature because

[Ponds] can freeze solid in the winter, and reach 95°F in the summer.

of their smaller water volumes. They can freeze solid in the winter, and reach 95° F in the summer. The temperature of the water is tied directly to the oxygen level it can support. Higher summer temperatures support lower oxygen levels, so it's important to check oxygen before conducting any seasonal management activities.

Prior to any herbicide or algaecide application, Allied Biological technicians test the water to assure sufficient oxygen is present to accommodate the decay of any plants or algae. Low oxygen levels, such as 5 parts per million (ppm) or less, raise a warning flag that the system can't support its current biological oxygen demand (BOD), as well as additional demand from decomposition. In these cases, weed or algae control treatments are postponed.

In some cases, oxygen levels are unusually high, such as 15 ppm or above. This is a sign that plant or algal biomass is so abundant that oxygen levels are artificially elevated during the day when plants are photosynthesizing. At night, the reverse is true, and respirating plants can completely remove all available oxygen, resulting in serious harm to fish and other fauna. Generally, these high daytime oxygen levels are also cause for cancellation of treatment.

One way to avoid these situations is to have an aeration system installed in your pond. Aerators can be either submersed

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units, which pump air to the pond bottom, or floating units, which re-circulate water through the air for oxygenation. The appropriate system will depend on your pond's depth. Regardless of which type of system you use, supplemental oxygen can make a significant improvement in your pond water quality and the success of your management program.

Lakeshore Runoff Can Affect Your Lake

Adapted from Virginia Lakes & Watersheds Association Newsletter, Issue 60, Winter 2003

The Wisconsin Department of Natural Resources and the US Geological Survey just concluded a lakeshore runoff study on eleven shoreland areas on four lakes in northern Wisconsin. The studies compared nutrient runoff-phosphorus and nitrogen-from paired lakeshore sites that were covered either by lawns or by natural forest vegetation.

The final report will be available later this year. However, preliminary reports point to an interesting finding – the concentration of phosphorus in runoff from the lawn sites and the natural forest sites were basically the same. However, the volume of runoff was up to 10 times higher from the lawn sites as from the forest sites. Since nutrient loading is simply a product of concentration times volume, the total load of phosphorus coming from the lawn sites was substantially higher. The study points to the value of reducing the volume of runoff. The more rainwater and snowmelt that can be kept on the land to filter into the soil, the fewer nutrients that will be transported in to surface water.

Steve Greb, Wisconsin DNR scientist in charge of the study commented, "Lawns often are smoothed for optimal water drainage, where forest lands tends to be hummocky, with many depressions to catch and hold runoff. A strategy for lake protection may be creating shoreland depressions that can hold and infiltrate runoff from rainfalls up to half inch – much like the "rain garden" practice being used in urban residential areas."

News Briefs

NYS DEC has introduced a new, statewide aquatic pesticide application form this season. In addition to standardizing the form among regions, significantly more information is now required for review. Region 3 (New Paltz) has also adopted a new lake drawdown formula and data, which has increased the difficulty of retaining outflow for certain herbicide treatments. Control of invasive weeds with herbicides may require increased time and patience to obtain the necessary approvals.

The **Northeast Aquatic Plant Management Society** (NEAPMS) held its 4th annual meeting this past January in Sturbridge, Mass. Despite the absence of many state gov't participants due to budget constraints, the meeting was well attended and an excellent forum on aquatic weed control. Next year's conference is already set for January 19-21, 2004 at the Gideon Putnam Hotel in Saratoga Springs, New York.

Congratulations to Allied Biological's aquatic technician **Jonathan Henk**. Jonathan recently received his certification for **solar energy systems installation** following completion of an intensive course sponsored by the New York Solar Energy Industries Association. Jonathan is Allied Biological's first certified installer of residential solar energy systems.

BioSafe Systems recently announced that tests of its algaecide **Greenclean** revealed no Rainbow Trout mortality at rates almost twice the maximum labeled application rate. Greenclean is a peroxide-based algaecide, similar in modality to barley straw. The product is currently under final review with the EPA.

The **North American Lake Management Society** will be holding its 23rd Annual Symposium, "NALMS 2003: Protecting our Lakes Legacy" on November 4-8, 2003. The symposium will be held at the **Foxwoods Resort Casino** in Mashantucket, Connecticut. The NALMS organization is devoted to bringing together scientific professionals, students and citizens to discuss effective lake, reservoir and watershed management.

Employee Profile

Christopher Dickson

Aquatic Biologist / Environmental Scientist

Chris is a 1998 graduate from The Richard Stockton College of New Jersey with a B.S. degree in Environmental Studies. He began work at Allied Biological in the summer of 1996 and accepted a full time position in winter of 1998. Chris's knowledge and experience in aquatic plant and algae management and wetlands restoration projects make him a valuable asset to the company. While his primary responsibilities are as a lake manager, Chris's extensive computer skills also allow him to single-handedly design and maintain ABI's web page.

Chris's interests outside of work include competing in the Penn Jersey Ice Hockey League, playing an occasional round of golf, and most of all spending quality family time with his two year old daughter Rebecca and his fiancée Jennifer.

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