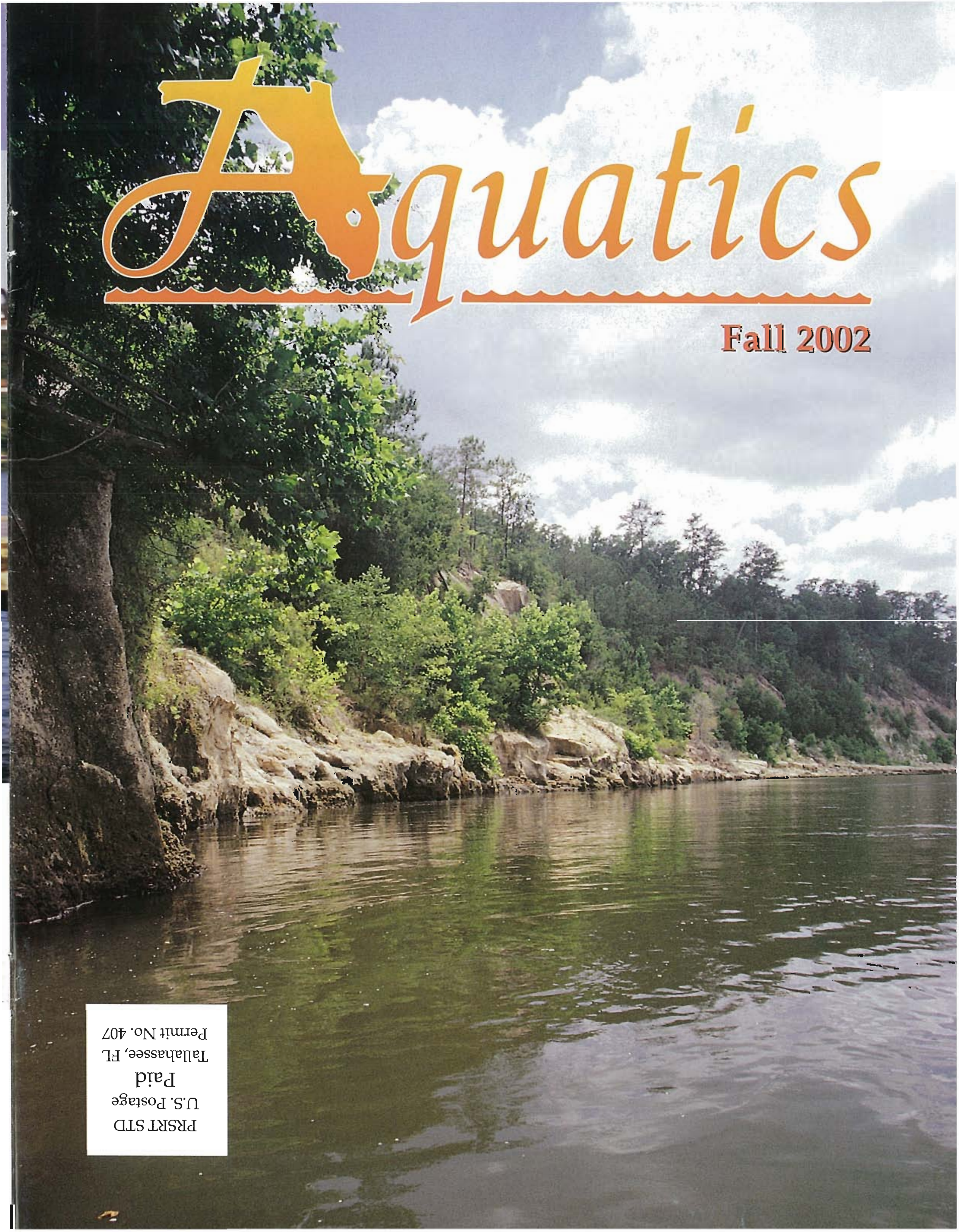
Aquatics

Fall 2002



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Aquatics

Fall 2002 / Vol. 24, No. 3

Editorial

For decades, managers have agonized over the public's lack of understanding of invasive aquatic plant control. Often, the consequences of this ignorance have been severe, not just to the environment and general economy, but also to managers' livelihoods. A recent example is from the northwest where aquatic plant management has been substantially impaired by unrealistic permitting and monitoring regulations brought on by poor communication and technology transfer among managers, the public, regulatory agencies, and the legal system. (see Summer 2001 *Aquatics* Editorial) Beyond annual conferences and training sessions, aquatic plant managers still do little to further their cause with the public. Town meetings get our messages across to a few. Reports, articles, booklets, and brochures reach a few thousand more. Internet web sites can avail information to millions, but only if we tailor information to a target audience and lead significant numbers of this audience to the information.

Aquatic plants are rarely recognized by the public for their invasive capacities even after they become widespread. More often, invasive species draw attention through high profile problems caused by animals like sea lampreys, Africanized bees, and fire ants. Aquatic plant managers have an opportunity to expand upon the current wave of public awareness of invasive species spawned by the mid-1990s arrival of zebra mussels. The APMS elementary education booklet *Understanding Invasive Aquatic Weeds* featured in the Spring 2002 issue of *Aquatics*, and the plant posters and associated teaching points distributed to teachers by the University of Florida are examples of good first efforts. Both of these projects were supported

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FAPMS Website:
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The steep bluffs of the Apalachicola River in panhandle Florida are quite striking especially during current drought conditions.

Photo by Judy Ludlow

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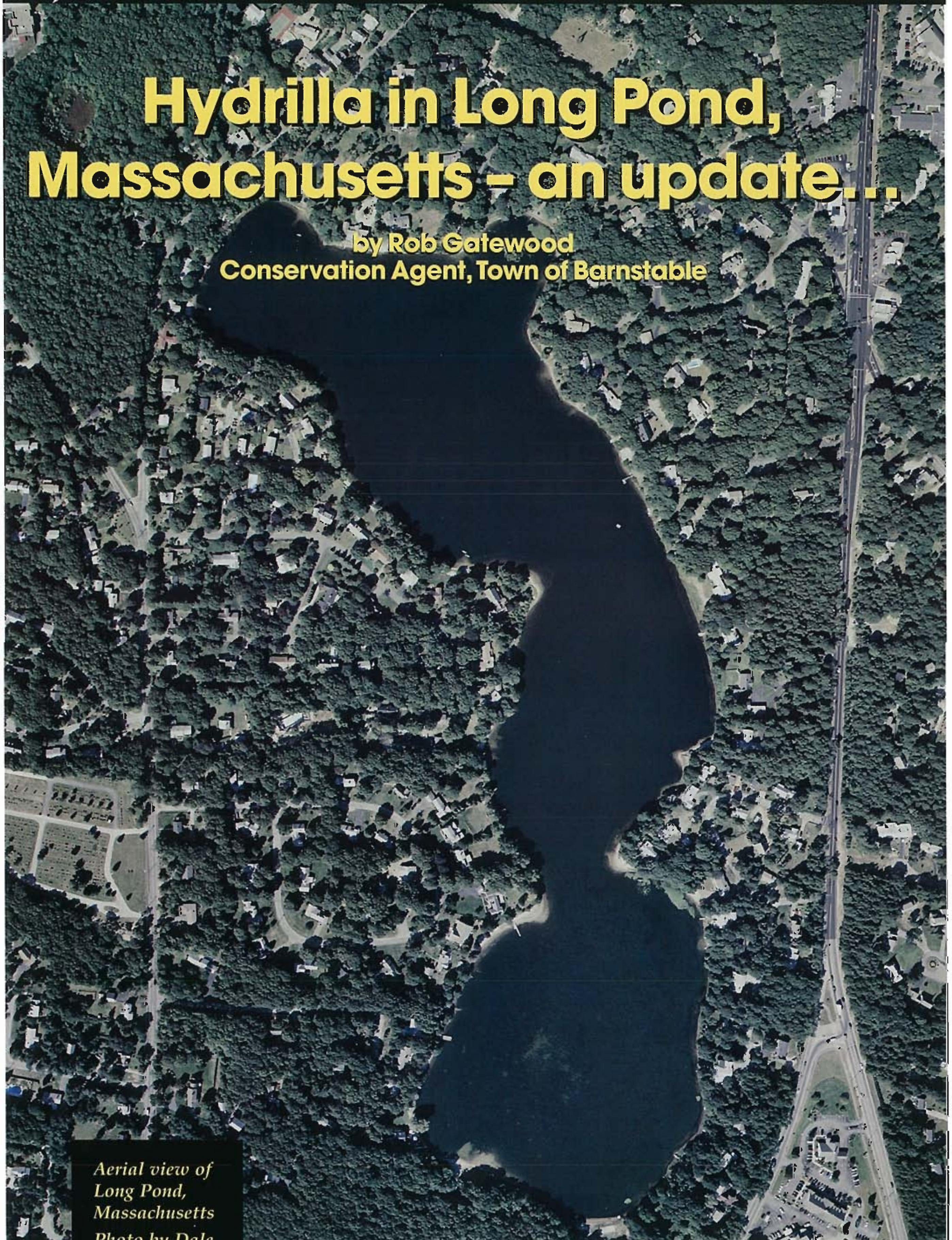
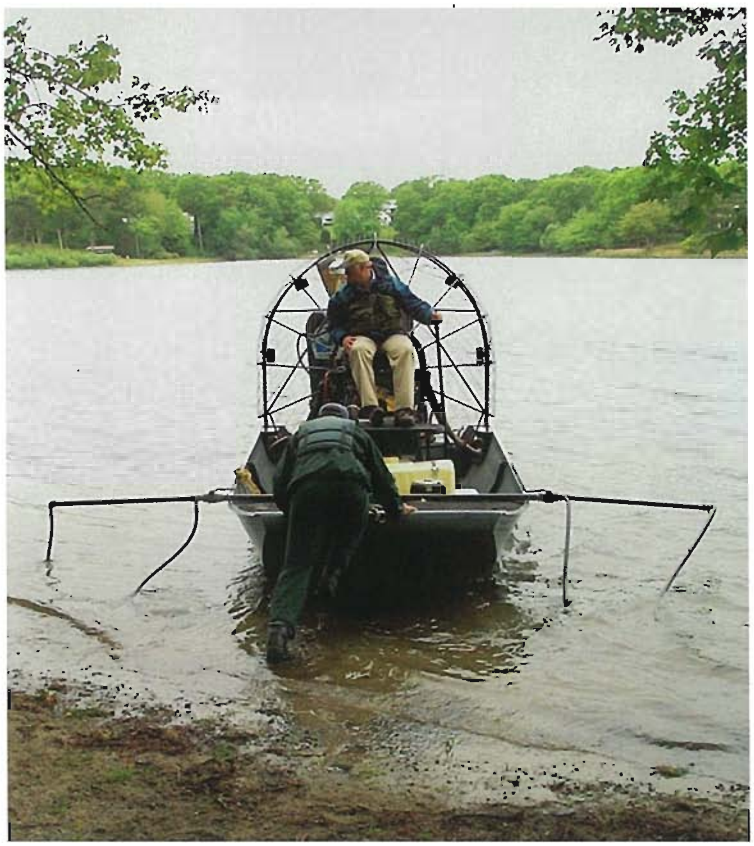
Hydrilla in Long Pond, Massachusetts - an update...

by Rob Gatewood
Conservation Agent, Town of Barnstable



Aerial view of Long Pond, Massachusetts
Photo by Dale Saad



Employees of Aquatic Control Technology prepare to treat the hydrilla with fluridone herbicide. Photo by Dale Saad

This is an update on the hydrilla management activities in Long Pond. Please see Aquatic's Spring 2002 Aquavine for more information.

Long Pond is located in Centerville, within the Town of Barnstable on Cape Cod, Massachusetts. Hydrilla was identified in this 49-acre kettle pond in 2001. Mr. Ron Sirch of the Association for the Preservation of Long Pond collected samples of this invasive plant, which were subsequently identified as hydrilla by botanist Barre Hellquist. Immediately after the positive identification, public boat access to Long Pond was closed until further notice.

Since its discovery, the Town of Barnstable and the Association for the Preservation of Long Pond have worked together to develop and implement a hydrilla management plan. Here is what has occurred:

- The Massachusetts Department of Environmental Management awarded the Town of Barnstable a $25,000 Lakes & Ponds matching grant to assist with the hydrilla control project.
- The Town retained Aquatic Control Technology, Gerry Smith Pres., to prepare a management plan and to treat the pond.
- A Sonar (fluridone herbicide) treatment occurred on June 6, 2002
- A "bump-up" treatment occurred June 11, as ambient concentrations dropped below target levels.
- Gerry Smith will also be gathering data on effects of the herbicide treatment on tuber vitality and doing reconnaissance on nearby ponds for hydrilla presence.
- The local hydrilla population has lost all vitality; plants very small (6") and chlorosed.
- Water clarity is poor compared to usual; perhaps biomass decomposition is the cause.

Hydrilla in Long Pond. Photo by Dale Saad

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- Pond side residents, however, are very pleased with our progress so far!
- The Town has maintained closure of the 2 public boat launches.

Postings read....

> NOTICE
>
> LANDING CLOSED
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> DUE TO HYDRILLA
> INFESTATION
>
> POLICE DEPARTMENT
> WILL ENFORCE
>
> QUESTIONS?
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> DIVISION
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> PER ORDER TOWN
> MANAGER

The Barnstable Conservation office credits Dr. Bill Haller and Dr. Ken Langeland of the University of Florida, Center for Aquatic and Invasive Plants, with helping turn around a focal funding climate, which was not immediately favorable to the hydrilla control project. Their timely and expert advice coming from afar was critical to developing a local-level understanding of the imperative of controlling the infestation without delay. The Town of Barnstable appreciates their kind assistance.

Editorial *from page 3*

in part by aquatic plant managers through APMS and regional chapter donations, but for only two years for the booklets and on a one-time basis for the posters.

Clearly, cultural changes are needed in the ways the public perceives invasive aquatic plant control before it is accepted, and more importantly, endorsed as a necessary component of waterways management. Just as importantly, aquatic plant managers must change the ways in which they attempt to reach their constituencies. A definition of insanity is to continue current practices and expect change. Successful environmental management programs like fire suppression and recycling acquired public support in great part through education campaigns in the schools. Plant management associations have many demands on their limited financial resources including meeting and conference expenditures, scholarship contributions, and internal training and outreach material. Each of these educational strategies results in differing measures of support for aquatic plant control, but generally reach few numbers of people who already know of and promote the efforts. Members of aquatic plant management associations must help their leaders develop outreach programs that result in the greatest levels of public support. Help them choose wisely – their actions, or inactions, will shape the future of aquatic plant management and your livelihoods.

By Jeff Schardt

The State of Toxic Freshwater Algae in Florida

by Dr. Ed Phlips
University of Florida

Arabaena circinalis, from lake Okeechobee
Photo by Mary Cichra

Whether you call it green water, algae blooms or just plain scum there are few people who welcome the sight of this phenomena that frequents many of Florida's lakes and rivers. At times local accounts of algal blooms take on the flavor of an extraterrestrial event, *'it appeared suddenly, seemingly from no where, covering our lake with an eerie fluorescent green tint, killing fish, fowl, alligators, almost anything it came into contact with, then as fast as it came it slipped away into the dark abyss, everyone knowing it would return.'* It seems strange that a phenomenon that has been around for over 3 billion years should evoke such mystery and fear. Actually the precursors of algal blooms are second nature to anyone who has tried to achieve suburban nirvana, a thick, deep green lawn, namely sufficient light and fertilizer, principally phosphorus, nitrogen and a pinch of iron. Many of Florida's lakes and rivers have ample supply of all these ingredients. In water management and limnological circles such lakes are called eutrophic, Greek for 'well-fed'. For the gourmand among lakes this may be elevated to hypereutrophic, a term used to define lakes subject to exceptionally high abundance of algae or aquatic plants, like Lake Apopka or Lake Griffin in central Florida.

One of the common misconceptions among the public is that eutrophic conditions are a certain sign of the influence of human activity. Actually, eutrophic lakes and rivers can arise naturally due to accumulation of organic matter over time or adaphic factors, like surface or ground water input from naturally nutrient-rich sediments. These phenomena, in part, explain the high frequency of eutrophic lakes in certain regions of central Florida, where phosphorus-rich sediments are widespread, as indicated by the phosphate mining activities in the region. This does not imply that humans do not play a major role in promoting algal blooms. There is substantial evidence that the explosion of human development in Florida over the past century has elevated the trophic status of many lakes and rivers, in some cases dramatically. With this elevation in trophic status, the frequency and intensity of algal blooms has increased. One group of algae has been exceptionally successful in taking advantage of the increase in bloom potential, the blue-green algae. The blue-green algae are unique among the world of photosynthetic organisms by having many of the basic physiological characteristics of bacteria, thereby the synonym they go by, cyanobacteria. Unfortunately, this oldest of all algal groups, dating back some 3.5 billion years, contains a number of species capable of producing toxins. It is very likely that blooms of toxic algae have been occurring on earth throughout all the biological epochs, from the earliest animal development, through the age of the dinosaurs and into the entire period of human presence on earth. We take this opportunity to examine in some detail this most feared of all algal phenomena, particularly as it pertains to the lakes and rivers of Florida.

Toxic Algae and Their Toxins

Among the thousands of species of algae that inhabit the earth's freshwater environments several dozen have been discovered to produce chemical compounds injurious to the health of animals and in some cases the overall integrity of individual ecosystems. A majority of these toxic species fall within one algal group, the blue-green algae, although there are a number of other groups that contain toxic species (Table 1). There are two basic classes of algal toxins, in terms of their mode of action:

(1) Neurotoxins – Toxins that affect the nervous system, often leading to rapid neurological problems, including paralysis, respiratory distress and brain disfunction.

(2) Cytotoxins – Toxins that attack the integrity of cells and organs associated with them. The specific targets of the toxin vary, with the most common form being hepatotoxins that affect the liver and digestive tract. Another form of cytotoxin produced by certain freshwater flagellates causes damage to the gills of fish, including hemolytic activity, and has been associated with fish kills.

Table 1. Major groups of toxins, their primary site of action and the algae groups that contain species and strains capable of producing the toxins. Underline indicates the group(s) it is most commonly associated with. Note that the potential for toxin production is restricted to certain strains within the algal groups and can vary depending on environmental conditions. (After Chorus and Bartram 1999, see reference section).

Toxin	Site of Action	Algal Group
Microcystin	Hepatotoxin – liver damage	*Microcystis, Anabaena, Nostoc, Planktothrix (Oscillatoria), Hapalosiphon, Anabaenopsis*
Cylindrospermopsin	Hepatotoxin – liver and other associated organs	*Cylindrospermopsis, Umezakia, Aphanizomenon*
Nodularin	Hepatotoxin – liver	*Nodularia*
Lyngbyatoxin	Dermatoxin – skin and GI-tract	*Lyngbya*
Aplysiatoxin	Dermatoxin – skin	*Lyngbya*
Prymnesin	Cytotoxin – fish gills	*Prymnesium*
Anatoxin	Neurotoxin – nerve synapse *Planktothrix (Oscillatoria)*	*Anabaena, Aphanizomenon,*
Saxitoxin	Neurotoxin – nerve axons	*Anabaena, Aphanizomenon, Lyngbya, Cylindrospermopsis*

One of the first blue-green algal toxins to be described in detail was microcystin, a cyclic peptide produced by certain strains (i.e. subspecies or genetic varieties) of the blue-green alga *Microcystis aeruginosa*. In 1959 Bishop and his coworkers coined the name 'Fast Death Factor' for this toxin because of the rapid lethal impact (i.e. within hours or days) it had on mice injected with the toxin. Since its discovery microcystin has become the most extensively studied of all freshwater algal toxins. It is a hepatotoxin that can result in severe necrosis of the liver. The development of sophisticated detection methods for microcystin over the past few decades has greatly expanded our understanding of its distribution. It has been linked to intoxications of animals, and occasionally humans, around the world. However, only a small fraction of these reports include direct evidence of a chemical linkage between the effect and the toxin. Most reports involve the coincidence of algal blooms with animals demonstrating symptoms putatively attributable to algal toxin exposure. This problem of interpretation is encountered in many reports of algal toxin-related health incidents and is an inherent consequence of the fact that health problems associated with algal toxins can be confused with other health issues, or visa versa. More often than not samples of algae from suspected toxic events are not taken, or are taken too late to corroborate a linkage.

Another group of hepatotoxins that has received considerable attention over the past few decades is the alkaloid cylindrospermopsin. First reported in association with a major algal toxin incident involving over a hundred persons in Australia in 1979, concerns over the toxin have spread throughout the world, including Florida. One reason for this widespread concern is the broad distribution of the blue-green algal group *Cylindrospermopsis*, which contains species and strains responsible for the production of the toxin.

Shortly after the discovery of microcystin, in 1964 Gorham described another potent algal toxin that exhibited an even more rapid lethal effect on mice injected with it, killing them in a matter of minutes to hours. He appropriately gave the toxin the somewhat less than imaginative name of 'Very Fast Death Factor', and later the more formal name anatoxin, after the main species that produces it, *Anabaena flos-aquae*. The rapidity of its lethal action is based on the fact that it is a neurotoxin with potency similar to that of cobra venom, and generally causes death in lab animals through respiratory failure. Anatoxin production has also been attributed to certain strains of several other species of blue-green algae, most prominently *Aphanizomenon flos-aquae* and *Oscillatoria formosa*.

Another neurotoxin produced by certain blue-green algae is saxitoxin, a toxin more commonly associated with paralytic shellfish poisoning (PSP) caused by certain species of marine dinoflagellates. Research on

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this toxin has shown that it comes in a number of forms that differ slightly in chemical structure. These differences, while relatively minor, have a major impact on the toxicity of the compound, some forms of saxitoxin demonstrating very little toxic effect. Similar observations have been made for other toxins, like the many varieties of microcystin discovered over the past forty years. This somewhat complicates the interpretation of risk associated with the presence of certain algal toxins and may require relatively rigorous chemical analysis of the exact structure of suspected toxins.

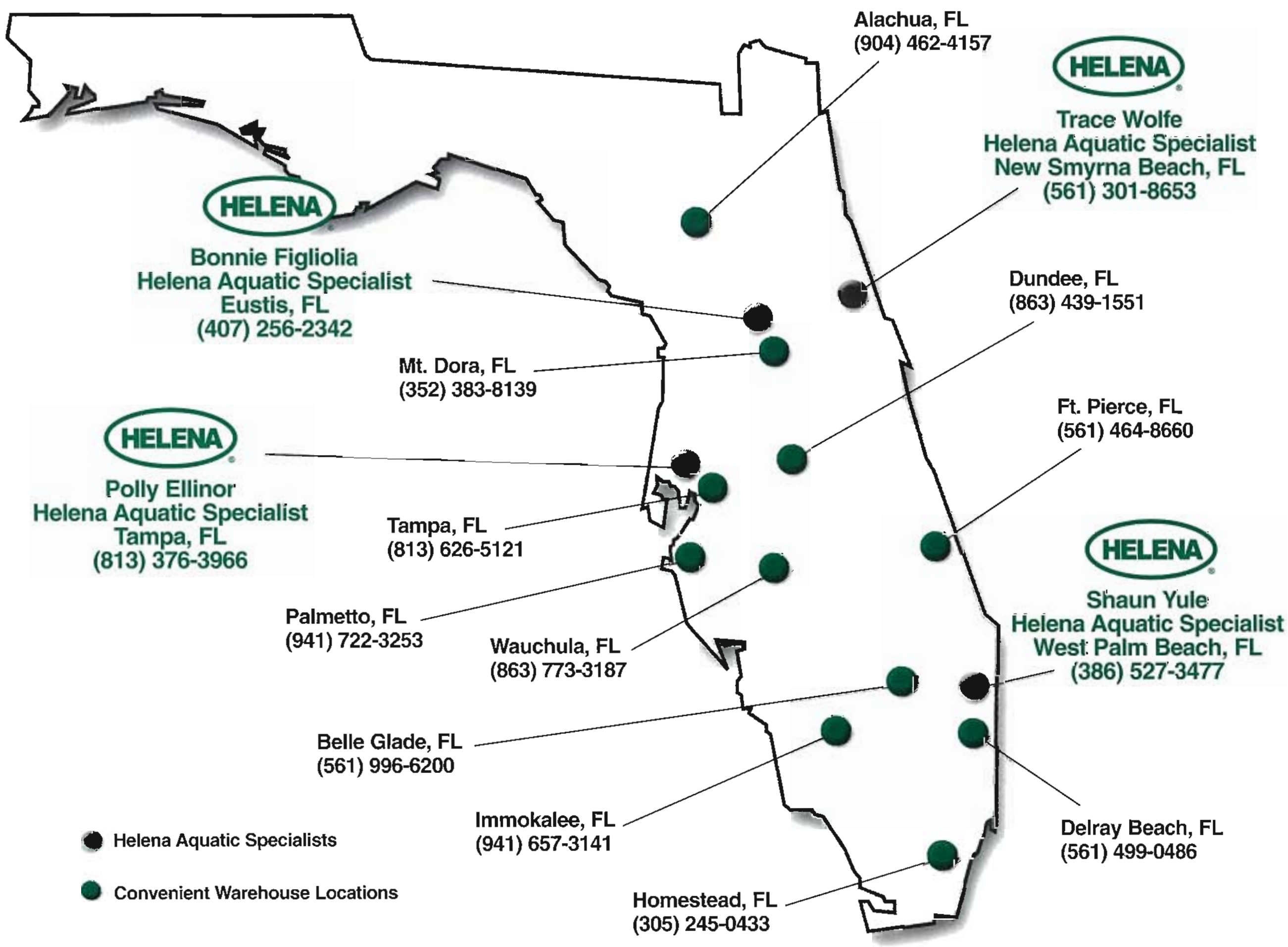
Since the discovery of algal neurotoxins, surveys of toxic algae events have shown that occurrences of these toxins in freshwater environments are relatively rare by comparison to other major groups of toxins, like hepatotoxins.

Defining the Toxic Risk

In the marine environment clear cut cases of the direct impact of algal toxins on aquatic animals and humans abound. Mass mortalities of marine fish and mammals associated with algal toxins are well-documented. The respiratory and eye irritation caused by near shore red tides is familiar to millions of coastal dwellers and recreationists in Florida. But perhaps the most dramatic issue, at least from a human perspective, has been the transfer of dinoflagellate toxins to humans via shellfish consumption, resulting in scores of reported deaths over many centuries of written record. By contrast, the impact of algal toxins in freshwater environments is less clear cut. In part, this is attributable to three important distinctions from the marine environment; (1) blue-green algae rather than dinoflagellates are the dominant toxin producers in lakes and rivers, (2) the most commonly occurring blue-green algal toxins are hepatotoxins rather than neurotoxins, and their clinical effects can be less dramatic, less immediate and easy to confuse with more generalized medical conditions, like pathogen-induced gastroenteritis, and (3) freshwater bivalves are not a major food item for humans and even if they were, the transferability of hepatotoxins through freshwater animals to humans may be less efficient or catastrophic than the link between dinoflagellate toxins, shellfish and humans.

The latter observations do not, however, eliminate the need for concern. One of the principle areas of human concern is the consequence of exposure to algal toxins via drinking water consumption. This concern stimulated the World Health Organization (WHO), along with researchers around the world, to establish guidelines for acceptable and unacceptable levels of exposure to freshwater algal toxins. This is a difficult task in light of the very limited information on the affects of human exposure to freshwater algal toxins. Consequently, the guidelines developed by the WHO in the 1990s depend on extrapolation of information derived from trials with lab animals. The primary safety threshold level for drinking water established by the WHO is 1.0 μg/liter. This number was originally developed for the toxin microcystin because of the relatively large amount of information available for this toxin and its wide spread occurrence. The number is based on the 'No Observable Effects Found Level' (NOEFL) established in experiments with mice administered microcystin orally. The NOEFL for mice is 40 μg/kg body weight/day. To arrive at an NOEFL estimate for humans this number was divided by 1000 to account for potential sources of underestimation of human sensitivity to the toxin (i.e. margin of error). Using the latter number, 0.04 μg/kg body weight/day, it was further estimated that an adult weighing 60 kg (132 lbs) may drink 2 liters (2 quarts) of contaminated water per day, of which 80% of the toxin could be absorbed by the body, yielding a Tolerable Daily Intake (TDI) estimate of 1.0 μg/liter. This is obviously a very conservative number, as one might expect from the WHO. Since the WHO released its TDI estimate for microcystin, a similar value has been suggested for the other commonly occurring hepatotoxin cylindrospermopsin. The justification for the use of this TDI estimate is the recent observation that the median lethal dose range for mice given cylindrosperopsin orally is similar to that observed for microcystin, namely 5,000-10,000 μg/kg body weight.

Given the estimated TDI guideline of 1.0 μg/liter, the next most



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Helena Chemical Company • 2405 N. 71st Street • Tampa, FL 33619 pressing question is how many lakes in Florida achieve this level of microcystin and how often do they reach or exceed this level. There is unfortunately only limited information available on the levels of algal toxins in Florida's lakes. In a recent survey of 167 samples from 125 lakes in Florida (Williams et al., 2001, Special Tech. Report, St. Johns River Water Management District, Palatka, Fl.) only two samples from one lake, Lake Griffin, showed concentrations of microcystin that might pose a problem for oral water consumption. Even in lakes where such levels may be attained there are few situations where individuals in a region like Florida might consume two quarts of untreated water in a day from a lake where an algae bloom is in progress.

Another potential pathway for human exposure to toxins is through the consumption of fish from lakes subject to toxic algae blooms. The very limited data available on this issue indicates that certain herbivorous (algae or plant eating) fish, like tilapia, can accumulate microcystin in their muscle tissue. However, the concentrations in the muscle tissue are typically low. In one of the few studies published on this issue (Magalhaes, *Toxicon*, 2001, Vol.39: 1077-1085), 43 fish samples, analyzed over a three year period, showed microcystin concentrations ranging from 0 to 325 ng microcystin/gram of muscle tissue, with all but four samples containing 50 or less ng microcystin/gram. Unfortunately, there are currently no guidelines for safe levels of microcystin in fish products for human consumption. If one were to assume that humans were as sensitive to microcystin as mice, then a 150 lb person should be able to eat 16.4 lbs per day of the most contaminated fish sample (325 ng/g) found in this study without showing any observable adverse effects, a hearty meal by any standards. To get a lethal dose one would have to consume approximately 2,000 lbs of the same fish, a tilapia Jonah-esque proportions. However, without further information such extrapolations are more of heuristic than real value. No information is currently available on the accumulation of the toxins in Florida game fish, like bass. Once again much needs to be learned before risk to human health can be confidently established.

Bison on a private ranch, Alligator Lake, Columbia County, Florida "Not your normal Florida wetland wildlife!"

Photo by Joe Hinkle

It appears that acute exposure to algae toxins in Florida leading to immediate and severe health problems is unlikely, given the current evidence available. This observation is corroborated by the lack of direct reports of severe algal-related health crises associated with freshwater environments in Florida, despite the heavy use of Florida's lakes and rivers for recreation and water consumption. A more complex issue facing the research community is the potential health consequences of long term exposure to relatively low levels of algal toxins. On the top of the list of concerns for many people is the potential carcinogenic affects of exposure to toxins. Research to date indicates that prolonged exposure to algal toxins may stimulate the rate of growth of certain types of pre-existing cancers, at least in mice. Efforts to demonstrate the direct induction of cancers by toxins have not yielded conclusive results. This line of research is continuing and hopefully will yield a more concise view of the potential threat in the future. Epidemiological research on cancer and other health problems is also underway to examine whether patterns of toxic algae blooms are correlated to any patterns in human and animal health problems.

It is clear that many uncertainties remain about the risks associated with algal toxins. It is also clear, however, that freshwater algal toxins, which were largely unknown before 1950 and largely ignored until 1980, deserve careful consideration now. This is particularly true in light of the likely increase in the distribution and frequency of algal blooms around Florida.

Water Treatment Options

Perhaps the best news about freshwater algae toxins, at least from a human perspective, is that most appear to be readily degraded using a number of relatively simple and existing treatment technologies. All of the major toxins, including microcystin, cylindrospermopsin, and saxitoxin, are de-activated by chlo-

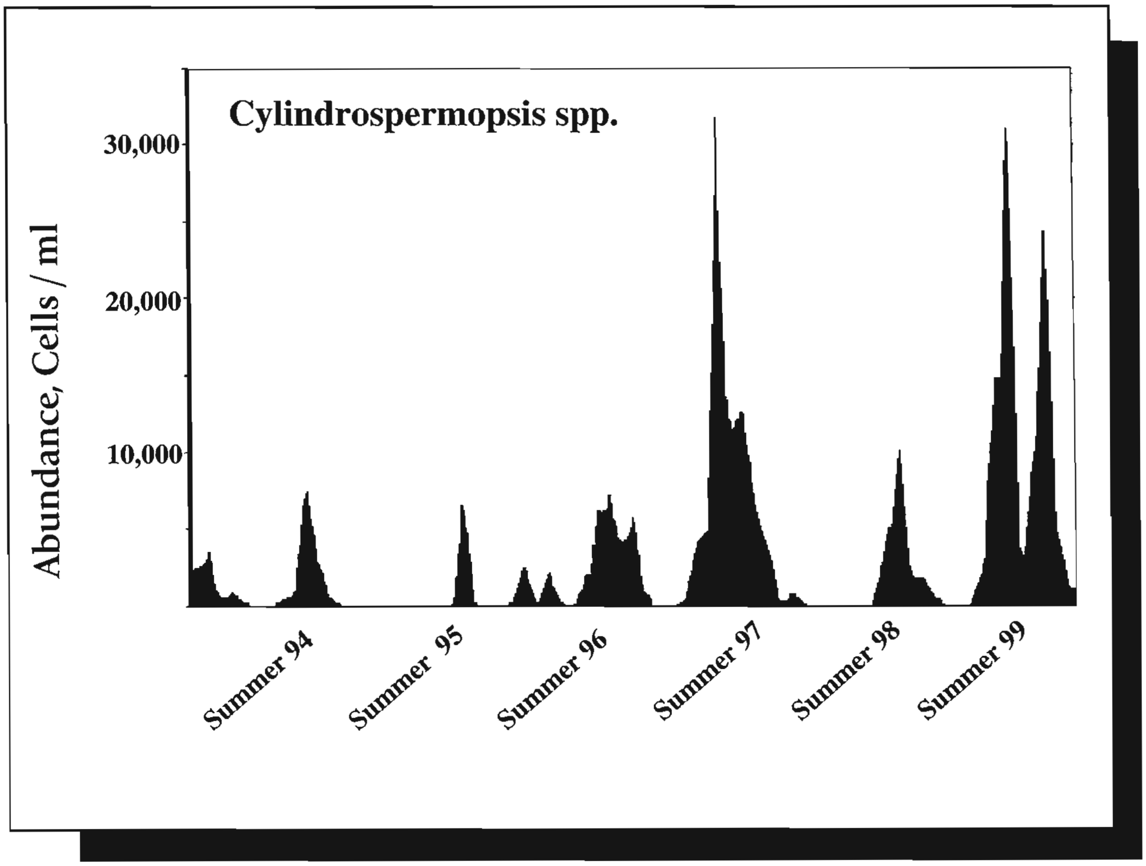

Figure 1. *Cylindrospermopsis* concentrations near Palatka in the St. Johns River (Cichra and Phlips, 2002, in preparation for submission to J. Plank. Res.).

rination at chlorine levels commonly used in the treatment of municipal drinking water. Two other treatment methods, ozonation and carbon filtration are also effective in treating certain toxins including anatoxin, although their efficacy varies according to the specific toxin in question. The key to the use of any of these treatment options is the maintenance of sufficient concentrations of the active ingredient in the system to ensure proper deactivation or removal of the toxin.

The Distribution of Potentially Toxic Algae in Florida

For most lakes and rivers in Florida the historical record of algal composition is absent or very sparse, making it almost impossible to define the distribution of potentially toxic algae species in years past. Even where significant data sets are present information on the toxicity of the algal species found is largely absent. Therefore, it is only possible to discuss the distribution of 'potentially' toxic algae species, which currently includes the species listed in Table 1. The five genera (groups) that contain the most feared freshwater species of toxic algae are the blue-green algae Microcystis, Oscillatoria, Anabaena, Clindrospermopsis and Aphanizomenon. Since the greatest risk associated with freshwater algae toxins is found under bloom conditions it is obvious that eutrophic and hypereutrophic lakes and rivers should be the focus of the search for these key genera. As expected, recent surveys of Florida lakes and rivers indicate that the aforementioned blue-green algae are common features of elevated trophic status. Even in such lakes and rivers the abundance of potentially toxic algae species exhibits significant variability over time and space, and is constantly changing in response to changes in the environment. Sometimes these changes follow a recurring pattern. For example, blooms of *Cylindrospermopsis* in the St. Johns River occur in the summer, although the intensity of blooms can vary from year to year (Figure 1). In contrast, blooms of *Microcystis* in the same river are less predictable, occurring at any time during the year.

In some lakes blooms of key species can persist for extended periods of time. For example, bloom concentrations of *Cylindrospermopsis* in the hypereutrophic Lake Griffin can be sustained over an entire year. The ability of algae blooms to persist for long periods of time in Florida is in part attributable to the sub-tropical climate experienced over the peninsula. Because only the southern tip of Florida is truly tropical in character, seasonality of algal blooms in the rest of Florida can vary from year to year, due to the relative severity of meteorological conditions.

Geographically, there are few regions of Florida where blooms of the major species of algae outlined above can not be found in a multitude of nutrient-rich lakes. While some regions of Florida have a higher proportion of eutrophic and hypereutrophic lakes and rivers than others, recent research indicates that over half the lakes surveyed may be subject to algal blooms. There are also factors other than trophic status that encourage the predominance of blue-green algae in Florida. For example, *Anabaena, Clindrospermopsis* and *Aphanizomenon* all fall into a select category of photosynthetic organisms that can convert biologically unusable elemental nitrogen (which comprises 80% of the air) into the plant nutrient ammonia through a process known as nitrogen fixation. Since the growth of algae in many of Florida's lakes and rivers is periodically limited by the supply of nitrogen fertilizer (like ammonia) the ability of these organisms to carry out nitrogen fixation places them at a distinct selective advantage over all other algae and plants, which are incapable of fixing nitrogen.

Another example of an advantageous feature shared by *Microcystis, Oscillatoria, Anabaena, Clindrospermopsis* and *Aphanizomenon* is buoyancy regulation. Unlike most species of algae that depend on mixing energy to stay afloat, these five blue-green algae can adjust their position in the water column by inflating or deflating gas chambers in their cells. This ability is a great advantage in highly productive lakes and rivers where light available for photosynthesis can be restricted to only the top portion of the water column. This attribute also explains why blooms of the aforementioned blue-green algae are often observed as the dreaded surface scum.

Control of Toxic Algae Blooms

The first reaction of most citizens to algae blooms, particularly those which are considered to pose a health threat, is 'to get rid of it quickly'. However, treating potentially toxic algal blooms with traditional algaecide applications, like copper-based products, may not be an ideal approach. In fact, such applications can worsen the problem by accelerating the release of toxins stored inside algal cells. In dealing with toxic algae blooms it may be necessary to employ an alternative approach that removes algae from the water column without killing the cells. Research is underway to explore alternative methods for treating blooms, like flocculation.

The ideal long-term strategy for dealing with toxic algae is to prevent or reduce the occurrence of blooms. There are lakes and rivers in Florida where appropriate water management efforts can be used to achieve this goal. The restoration of lakes and rivers is a major on going activity in many regions of Florida. There are of course lakes and rivers where it may be impractical, too expensive or fundamentally impossible to eliminate the occurrence of potentially toxic algae blooms. In such cases it may be necessary to carefully weigh the risk associated with certain activities in the system and make appropriate use recommendations or requirements. Unfortunately, there is currently insufficient information for most systems to make a meaningful risk determination at the present time. To make such a determination a number of important pieces of information about individual lakes and rivers need to be available to water managers, including: (1) the distribution of potentially toxic algal species in time and space (i.e. temporal and spatial patterns) and (2) the amount and relative strength of the specific toxins associated with blooms of the strains of potentially toxic algae species present in the ecosystem in question.

It is well known that different strains of potentially toxic algae species can vary in toxicity. Some of this variation is due to genetic differences between populations of algae, some of the variation is due to the impact of environmental variables (e.g. temperature, light, nutrient levels) and some of the variation is due to the life cycle of the algae (e.g. young versus old blooms). Therefore, determining the risk associated with algal toxins in individual lakes and rivers requires a well-designed and implemented monitoring program that can be used to gather essential information.

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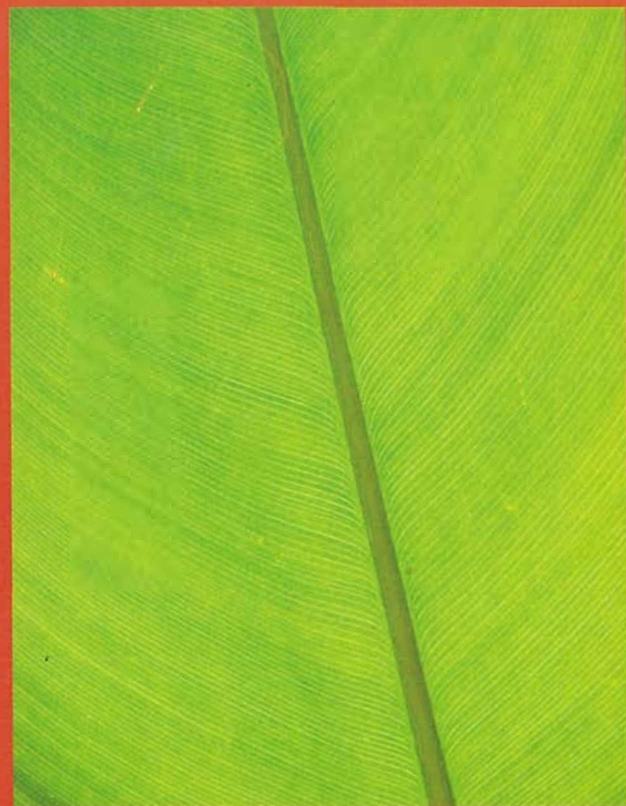


Can you guess this wetland plant species?

Photo by John Rodgers

See Aquavine for answer

Observations of a Marine Lyngbya

by John Rodgers
Department of Environmental Protection, Tampa, FL

Mention *Lyngbya* to a member of the Florida Aquatic Plant Management Society and you'll soon learn that it's a fresh water blue-green algae that is very difficult to control.

Copper based algaecides do not effectively control this type of algae and grass carp in high numbers has produced only limited success. And because the filamentous strands of *Lyngbya* intertwine to form large dense mats, manual removal is often so labor intensive that it is cost prohibitive. Mechanical harvesting is used to manage severe infestations, on a continuous basis, for example in Crystal River.

Interestingly, there are several species of *Lyngbya* found in the marine environment.

Lyngbya majuscula is a marine alga that is found world wide and frequently observed on the bottom sediment of Florida's coastal areas during the warmer months of the year.

It is black to brownish in color, slimy in texture, and has a foul odor.

Lyngbya majuscula has in recent years caused numerous aesthetic and recreational problems along the lower and central West Coast of Florida from Charlotte Harbor north to Cedar Key. Extensive mats of *Lyngbya*, up to 12 inches thick, form on the bottom and on the surface of coves and coastal shorelines. High tide causes the algae to wash up on the shoreline followed by low tide in which the algae becomes exposed on the wet sand or mud bottom. Fishing becomes arduous when the long filamentous strands of the algae cling to one's hook or line. An outboard motor could easily overheat if its water intake became clogged. Swimming or walking on the slimy plant is not pleasant and probably not safe.

Algae blooms can cause low dissolved oxygen levels, although no fish kills resulted from these occurrences of marine *Lyngbya*. Apparently, warmer than normal water temperatures that occur early in the year can cause the algae to expand. Mechanical removal is the only control option available, but along miles of shoreline, within mangrove areas, and in shallow coves, this is not cost effective. In addition, mechanical control in some areas would remove submersed grasses that are extremely beneficial to the marine environment. As in past years, Mother Nature or a cold winter, will have to do its job again.

PRE-REGISTRATION FORM

Florida Aquatic Plant Management Society
26TH Annual Conference
November 13-15, 2002

Date_______________

Name ____

Mailing Address ____

City________________________State_____________Zip_____________________________

Phone______________________Fax____________________E-mail ____________________

$_________Dues for year______at $20.00/year, $5.00/year for students
(includes a subscription to *Aquatics* and the Newsletter)

$_________Annual Training Conference Registrations: $60 pre-registered; $75 at the door

$_________Extra Banquet tickets at $25 each

$_________Other (please specify, i.e. donation)

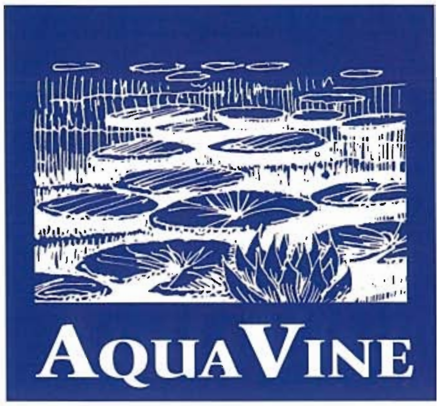
$_________CONTRIBUTION to Scholarship Fund

$_________TOTAL (Payable to FAPMS)

Mail to: Rebecca V. Gubert, Treasurer
Reedy Creek Improvement District
P.O. Box 10170
Lake Buena Vista, FL 32830-0170
Phone # 407-824-7318

- For hotel reservations call the Adam's Mark at (386) 254-8200.
- The address of the hotel is 100 N. Atlantic Ave. Daytona Beach, Florida 32118.
- Please make room reservations **30 days** in advance and reference FAPMS when you call to get the special room rate of $79.00 per night.

- Note: Continuing Education Units (CEU's) will be offered at this conference.



FAPMS Board Meeting-all are invited!

November 12, 2002, 4:00 pm, Todd Olson 800-327-8745

FAPMS Annual Conference,

November 13-15, 2002, Daytona Beach. SEE YOU THERE!!

National Invasive Species Act (NISA)

The Union of Concerned Scientists (UCS) is pleased to announce the posting of an informative paper on the National Invasive Species Act (NISA). This law plays a key role in protecting aquatic ecosystems. It is up for reauthorization now - which provides a rare opportunity to move environmental issues forward.

The UCS paper provides background information on NISA, its successes and shortcomings, and provisions to strengthen this law. UCS Senior Staff Scientist Phyllis Windle prepared this paper. To download a pdf copy of this paper, please visit the UCS web site at www.ucsusa.org/environment/bio_nisa.html .

For more information contact, Jason Mathers, Global Environment Program, Union of Concerned Scientists, jmathers@ucsusa.org

Tie one on – fishing knots that is!

For everything you ever wanted to know about knots for boating, fishing, etc., check out this website. www.fishingworks.com/fishing_knots/index.cfm

Invasive Species in Florida's Saltwater Systems

November 5-6, 2002, The Florida Aquarium, Tampa Florida. For more information, contact Mr. Chuck Jacoby, 392-352-9617, ext 272

Avoid West Nile Virus Risk!!

The National Institute for Occupational Safety and Health (NIOSH) has posted ways to avoid the West Nile Virus. These precautions are especially important for those of us (most *Aquatics* readers) who work outdoors. Please visit the following website for more information. www.cdc.gov/niosh/westnileupd.html

Rhandy Helton Retires

Rhandy Helton has retired after 31 years as an Aquatic Habitat Biologist with the Texas Parks & Wildlife Department. In Rhandy's own words: After retiring, "I hope to do some consulting work…but I have been offered a job cooking good ole Texas BBQ in Junction, Texas. I will probably do both…although someone said I might eat the BBQ establishment out of their inventory!! I have always appreciated Aquatics publication and FAPMS. Many of its members were always helpful when I needed information. I have relocated from Jasper, Texas to the beautiful Texas Hill Country town of Junction, Texas."

Rhandy worked on all aquatic habitat-related projects including the integrated control of invasive aquatic plants, brush shelter and tire reef construction, and native plant restoration projects. In 1998 he and his co-worker Larry Hartmann, first identified giant salvinia in Texas and has been actively involved with the management/eradication of this plant. He was chosen to chair the Giant Salvinia Task Force that prepared the action plan currently being used to deal with giant salvinia.

Good Luck Rhandy, and enjoy that BBQ!

Answer to **Can you Guess** on page 19. *Thalia geniculata*

You might be a nozzlehead if...

- You routinely sight-in your spray handgun on the weekends
- Your dog drinks from the bottom half of a well-known plastic 5 gallon herbicide container – and he's 18 years old
- You name your fifth baby girl Pollymer
- You like to think of invasive alien weeds as terrorists and don't plan on taking any prisoners

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Hopefully to be considered as light humor by most, this column is written for all the hardworking and caring professionals who dedicate their work afield to excellence in aquatic plant management. David Tarver

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