Aquatics

FALL 2009
Publication of the Florida Aquatic Plant Management Society

Hydrilla Control by American Coots
Observations Suggest the Possibility

Muck Accumulation Rates of Three Plants
Organic Muck Production of Water Hyacinth, Cattails, & Hydrilla

Water Hyacinths in Thailand
A Unique Approach to an Aquatic Infestation

Striving to Thrive
Aquatic Plant Survival in the Highly Acidic Lakes of The Ocala National Forest

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FAPMS

Cover photo: Small flock of American Coot feeding on topped out hydrilla found in the Kissimmee Chain of Lake, Kissimmee, FL. page 7
Photo by Keshav Setaram, SFWMD.

Emergent and river bottom vegetation page 9

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Aquatic herbicides are not the same. So choose carefully. Luckily, if you want long-term control of floating, emerged and shoreline weed species such as cattail, common salvinia, phragmites and more … with minimal irrigation restrictions … greater application flexibility … and selectivity that won't harm desirables such as cypress, willow, button bush, gum trees and more … the choice is clear: **Clearcast® herbicide.**

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Editorial

What is the Meaning of Aquatic Plant Control?

The article "A Manager's Definition of Aquatic Plant Control" in the last issue (Spring 2009/Vol. 31, No. 1) inspired a lot of debate among aquatic plant managers. Most agreed that aquatic plant control programs should, at a minimum, outline the aquatic plant species to be controlled, the amount of plant control needed, and the user group that the control is intended to satisfy. The topic of plant management for all user groups was too broad to obtain a consensus.

To narrow the debate to the central Florida area, I sent out an email requesting feedback from local lake and aquatic plant program managers. My favorite response to the definition of aquatic plant control was the following: *"For me control depends on the context. For individual treatments I want to see a complete knockdown of the standing crop that was targeted. Lake wide or system wide I consider control to be keeping the target plant(s) within a predetermined percent of aerial coverage. The amount of accepted coverage will depend on the plant, the water body and the individual plant manager. For me I want to have hydrilla at or below ten percent coverage at any given time, and water hyacinths at well under one percent. That said, the onset of fluridone resistance in (our) lakes caused me to re-evaluate what amount of hydrilla coverage I would consider acceptable. In the end I decided to keep our goals the same, and while we are struggling to get there on a couple of lakes, changing our control methods has allowed us to reach and maintain the desired level of control on many lakes for the past 24 months."*

Do you agree with this definition? Do the details of your management program fit into this definition of aquatic plant control? Maybe the FAPMS Board of Directors should revisit this topic and craft a standard or guideline to define aquatic plant control. The guideline should address herbicide resistance and the need for alternating control with varying modes-of-action. The Board should also consider how EPA's new NPDES permit regulations may change our definition of control. Will NPDES-related monitoring requirements provide data to support our control definition? Will proposed nutrient-criteria limits require aquatic plant managers to factor in nutrient release-rates as part of future plant control programs?

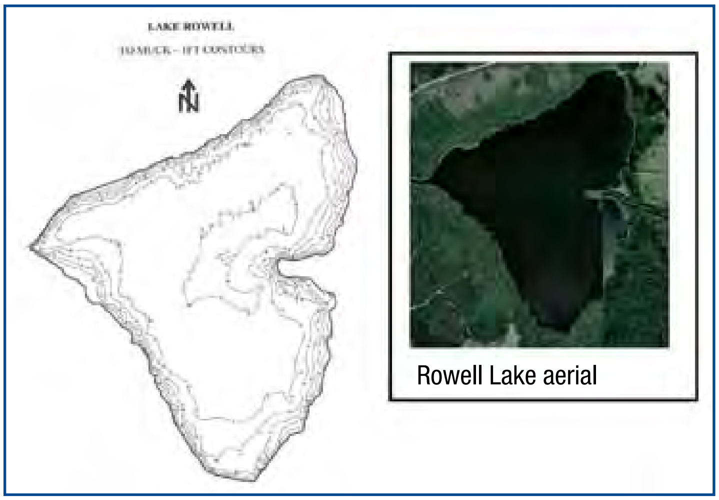
This magazine is distributed to a wide variety of aquatic plant applicators and managers with a wealth of knowledge, so we certainly should be able to address this universal issue of plant control with a wide range of feedback. So don't sit back and complain about the direction aquatic plant control is taking without stepping forward and providing your input to the dialogue. Most magazines have a section for letters to the editor, and if enough response is provided, we will provide a similar section in the next issue.

I welcome your comments on articles and issues presented in Aquatics magazine,

Editor,
jholland@rcid.dst.fl.us.

Coot Factor in Hydrilla Management

By Joe Hinkle
Florida Fish & Wildlife Conservation Commission


Rowell Lake aerial

Contour map of Rowell Lake showing maximum depth of six feet.

Shallow Lake with Native and Non-native Plants

Rowell Lake is a shallow 364–acre waterbody located in Bradford County Florida near the town of Starke. Bathometric surveys conducted in 2000 indicated the lake had 1,560 acre–feet of water with an average depth of 4.7 feet. The lake had approximately 980 acre–feet of muck that averaged 2.9 feet deep. For the period of observations (420days) conducted in this report the lake elevation fluctuated only 1.6 feet (130.6 -132.2 ft).

During the 1990's, Rowell Lake was subjected to urban runoff from the City of Starke and the discharge from a municipal sewage treatment plant by way of Alligator Creek, the major inlet into the lake. The outfall is a canal discharging to Sampson Lake, which subsequently flows into the Santa Fe River on the west side the lake.

Water hyacinth control operations have been conducted on Rowell Lake since at least 1972 and continue to the present. Hydrilla has been present in the lake since 1976 and other non-native species include wild taro, torpedo grass and alligatorweed. Native species make up less than 5% of the plant coverage, with the dominant plant species consisting of cattails, willow, pickerelweed, American lotus, pennywort, buttonbush, primrose willow, coontail, and giant bulrush (planted by FWC).

Reduced Hydrilla Associated with American Coot Feeding

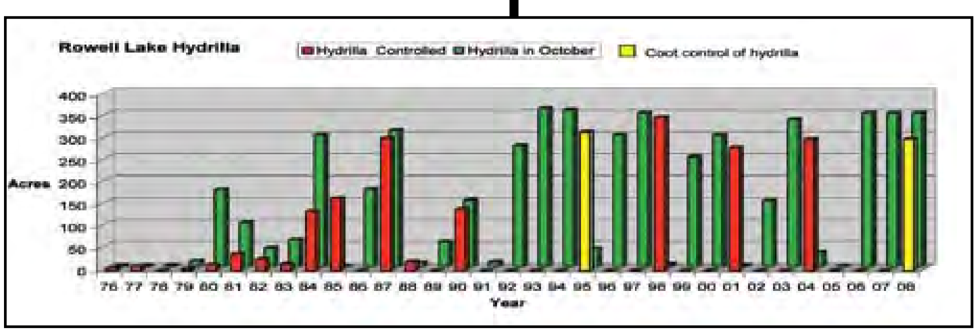
On several occasions, fall and winter feeding by large numbers of American Coot has reduced hydrilla biomass to acceptable levels for access during the spring fishing season and eliminated the need for a spring fluridone treatment. With the exception of 1994-1995, coverage and biomass returned to pre-coot feeding levels by the end of the summer. Hydrilla coverage was reduced from 357 acres in September 1994 to 61 acres in April 1995, and the control from American Coot feeding lasted for over one year. Coot feeding provided control of over 300 acres of hydrilla in the fall and winter of 2008. Large areas of control by coots were also observed in 2008 in Sampson, Lochloosa, and Orange Lakes, which delayed large scale treatment on all these systems.

A Lake with a Hydrilla History


Toppedout hydrilla in Rowell Lake, September 1994

Hydrilla was first discovered in Rowell Lake in August of 1976 at the mouth of Alligator Creek in the town of Starke, 3.5 miles from its connection to the lake. By November of 1977, hydrilla was scattered around the entire shoreline. Over 50% of the lake was covered in 1980 and the entire lake was topped out with hydrilla within eight years (1984) of its discovery.

From 1976 to 1983, contact herbicides were used for spot treatment of hydrilla. Fluridone was used successfully to control hydrilla in Rowell Lake in 1984, 1985, 1987, 1990, 1998, 2001, and 2004. The 2003 fluridone program was not successful as a result of 11 inches of rainfall during the month following the herbicide application. A Clearcast® treatment conducted in 2007 resulted in very little control of hydrilla and made the fluridone treatment of 2008 necessary. The fluridone treatment resulted in short–term control, and hydrilla returned by the end of summer.



Estimates of hydrilla coverage and yearly changes, 1976 to 2008.

Number of American Coots within four sections of Rowell Lake

An estimate of American Coots on Rowell Lake was made on February 16, 1995, by counting individual birds in four different sections of the lake. The acreage for the section surveyed was determined by GPS, and the number of birds per acre was determined for each section. A total of 1,465 coots were counted in 70 acres of Rowell Lake, which translates to 20.9 coots per acre or approximately 7,600 for the entire lake. With a majority of the lake depth less than 5 feet and with little or no disturbance from boats, optimum conditions existed for coot feeding and achieved 83% hydrilla control .

Changes in Phytoplankton and Water Quality

In May 1990, a 30–acre fluridone (10 gallons A.S.) treatment was conducted on Rowell Lake, which resulted in control of approximately 80 of the 230 acres of hydrilla present by August of that year. An additional 30–acre treatment with fluridone was conducted in September 1990, and by August 1991, only 10 acres of hydrilla remained. This was the last herbicide treatment conducted on Rowell Lake until 1998.

A comparison of phytoplankton data collected by the St. Johns River Water Management District's between the 1990 partial fluridone treatment and the 1995 phytoplankton data indicates some obvious differences in community structure.

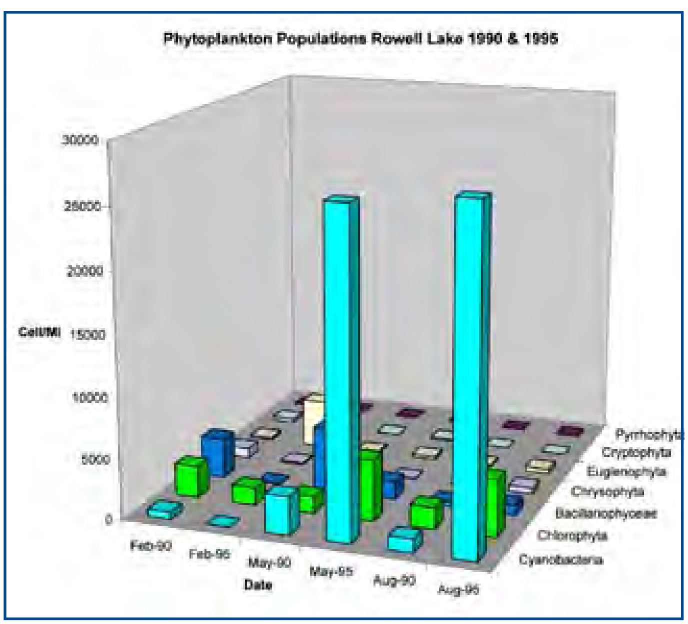
In May 1990, the dominant group was Bacillariophyceae (diatoms) followed by Cyanobacteria (blue-green algae). Five year later in May 1995 the dominant group was Cyanobacteria followed by Chlorophyta (green algae).

Typical fall /winter population of American Coots on Rowell Lake.

Characteristic feeding by coots on hydrilla stems.

In 1990, the dominant group was green algae followed by blue-green algae. However in 1995 the algae population shifted to a blue-green dominated community. The shift to blue-green algae went from 32% in 1990 to 81% in 1995.

With the American Coot's removal of hydrilla from Rowell Lake it appears that changes in water quality parameters included an increase in turbidity, water color, and ammonia levels. A corresponding decrease in secchi depth, ortho-phosphate, and sulfate levels was also observed. There was also a small increase in total nitrogen and total phosphorus with a slight drop in total alkalinity.



Comparison between 1990 and 1995 phytoplankton samples.

Summary of Evidence

It is evident that the American Coot can drastically reduce hydrilla populations from observations conducted on Rowell Lake. Dr. Esler reported coot feeding in 1989 on Fairfield Lake in Texas reduced hydrilla dry weight by 72% over a 72–day period.

Observations in Rowell Lake and other lakes suggest that coots prefer hydrilla over native species. Hydrilla populations have declined drastically in adjoining Sampson Lake over the last two years, while eel-grass, Illinois pondweed and Nitella expanded to historic levels of approximately 700 acres.

Removal of hydrilla by coot herbivory reduced water clarity mainly as a result of increased domination by blue-green algae with a higher cell density. Wastes generated by coot feeding on hydrilla resulted in an increase in ammonia levels.

The removal of hydrilla by American Coots eliminated the need for a fluridone treatment in 1995, saving the state of Florida $60,000. In the winter of 2008-2009, coot feeding eliminated planned spring control programs on Lake Rowell, Sampson Lake, Lochloosa Lake, Orange Lake, and Alligator Lake, saving an estimated $585,000.

Understanding Organic Accumulation of Selected Aquatic Plants in Florida

By Dana L. Bigham
University of Florida-IFAS

Most aquatic applicators and plant management programs are accused by the public of creating "muck-filled lakes." How many times have you heard "this lake had a sand bottom before those control programs started?" The best way to counter these claims is by increasing your understanding of the role of organic matter in lake biology.

Florida lakes are generally shallow and highly productive, because climate conditions and naturally occurring nutrients allow aquatic and wetland plants to rapidly grow in rivers, floodplains, and littoral areas which create large amounts of organic matter. The natural production of organic matter is essential for healthy, productive ecosystems and is the natural basis of lake aging and secession. The organic matter is also the base of the food chain supporting large populations of fish and wildlife in Florida aquatic ecosystems.

Dead Plant Material Drives the Food Chain

Organic compounds contain carbon molecules and are produced primarily through photosynthesis. Decomposition is the breakdown of these formerly living organisms and is driven primarily by microflora, such as fungi, bacteria, and invertebrates. Deposited organic material that remains in a system is called detritus. Detritus accumulation on lake and river bottoms occurs over time and is typically a very slow process.

Annual and perennial plants, trees, and submersed aquatic plants differ from one another in productivity. Productivity is a measure used to compare growth per unit area over time. The productivity of a particular plant plays a role in how much organic matter the plant is capable of depositing in a system. Production can be expressed in many ways, but for the purpose of this paper we will define productivity as the amount of dry weight produced per acre per year.

The standing crop of biomass is usually measured by collecting the plants in a specific area (square foot, square yard, etc.), drying the plants, and calculating a value that is converted to pounds per acre. This is a one-time measurement that can be repeated periodically to measure the change in biomass within a given system. The standing crop of biomass can then be used to estimate productivity.

Some Plants Produce Too Much

Organic detritus is the portion of decomposing plant material that accumulates over time. This portion is usually much less than the plant's total production due to organisms that consume detritus, including microbes, detritivores, insects, some fish, worms, etc... Plants require sunlight for growth, but they need nutrition as well. The cycle of organic production and decomposition replenishes the essential nutrients in the aquatic system and supplies energy in the form of carbon to plants and a host of microorganisms. Lakes with higher nutrient levels generally have greater biological productivity. Lakes with higher biological productivity are able to support a greater number of macrophytes, macroinvertebrates, fish, wildlife, and algae.

Nothing lives forever, and plants grow at different rates, so natural organic accu-

Emergent and river bottom vegetation such as cattails and cypress trees product large amounts of organic matter, which contributes significantly to the detritus in Florida waterways. This photo was taken by Lyn Gettys on Lake Ocklawaha in March 2009. Note the dead cattail leaves from last year's growth and the new leaves on the Cypress trees.

mulation due to plant productivity varies from site to site. Organic deposition from macrophytes occurs mostly in autumn and winter in temperate locations, whereas this process is almost continuous in tropical and subtropical areas. Balanced ecosystems typically lose organic matter at about the same rate new organic matter is produced. Less balanced systems, however, may accumulate excessive organic detritus and nutrients. High nutrient levels can cause algal blooms, which often reduce water clarity and limit light penetration to aquatic plants. Also, decomposers use oxygen to break down organic material in a system. Therefore, when large amounts of organic matter are produced by algae or plants, oxygen in the water column is depleted by decomposers and becomes unavailable to the flora and fauna that require oxygen for growth.

Water hyacinth, hydrilla, and cattails behave like annual plants in both the northern states and most of Florida. Most of the plant material produced by waterhyacinth and hydrilla throughout the year dies back in the winter, and in the spring, new growth arises from a few buds, stems, and tubers. The aboveground growth of cattail also dies back each year, and the plants regrow in the spring from underground rhizomes. During the fall, the production of new growth ceases, and dead tissue is decomposed by microfauna. Some of this dead tissue, however, is deposited on the bottom of the system.

There is a season-long balance between production of new growth and senescence of old growth. The annual productivity of undisturbed hydrilla ranges from 1 to 3 tons of dry weight per acre per year, whereas undistributed populations of waterhyacinth and cattail typically produce as much as 10 to 20 tons of dry weight per acre per year. Annual organic matter accumulated in tanks with undisturbed populations of hydrilla, waterhyacinth, and cattails are shown in Table 1. Accumulated organic matter attributable to these plants varies from 1 to 5 tons of dry weight per acre per year, which is about 1/4 to 1/3 of the total annual production of the plants.

Untreated Water Hyacinth Doubles Muck Production

The use of herbicides in aquatics is a contentious issue. Some people fail to consider the amount of organic matter produced by uncontrolled plant populations. Instead some people focus on the organic matter deposited to lake bottoms or aquatic ecosystems when herbicide-treated plants die. Any management activity, mechanical harvesting, or herbicide treatment that reduces growth will reduce organic production and detritus accumulation in the long run. For example, Dr. Haller at the Center for Aquatic and Invasive Plants (IFA) treated a pond in 1981 to control waterhyacinth and practiced maintenance control for six years. A total of 4.8 tons per acre of organic matter accumulated in the first year of treatment. In subsequent years, there was essentially no hyacinth growth and no additional accumulation of organic matter. An adjacent control pond with untreated water hyacinth accumulated 1.7 tons or organic matter per acre per year, for a total of 10.2 tons per acre over the six-year period. Therefore, maintenance control of waterhyacinth reduced organic matter accumulation by 5.4 tons over the six-year period.

A number of studies have examined the effect of litter fall in river forests and mangroves on organic cycling in aquatic systems, but little research has been conducted to study the role of aquatic plants in these systems. It may not be possible to directly compare data regarding these different sources of organic matter, but together, these data can provide a general understanding of the value and magnitude of organic matter production and cycling. It is important to recognize that organic deposition from undisturbed populations of macrophytes is a natural occurrence, and that emergent aquatic plants and river forests likely add significant amounts of organic matter to Florida waterways, although annual deposition of organic detritus varies greatly between water bodies. Organic matter cycling plays an important role in the ecological health of water bodies. The control of waterhyacinth and other invasive aquatic plants reduces their productivity and also reduces organic detritus accumulation over time.

The organic matter contribution of river forests and mangroves to aquatic systems is different in many ways from the contributions of true aquatic plants. Most trees that colonize the fringes of rivers and other bodies of water are long-lived perennial species, with much of their annual productivity stored as wood, above-ground branches, leaves, and below-ground roots. These species contribute organic matter mostly in the form of cellulose-rich, slowly decaying twigs and leaves. These cellulose-rich forms are very important to nutrient cycling and the support of aquatic and marine fauna. Leaf and litter fall in river forests is highly variable, and the amount of organic matter contributed to rivers and lakes is largely dependent on the area of the floodplain. The annual organic matter contribution of these ecosystems is similar to that of floating and emergent plants, ranging from 1.5 to more than 5 tons of dry weight per acre per year.

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ORGANIC MATTER PRODUCTION RATES	ANNUAL TONS DW/ ACRE/ YEAR	REFERENCE
WATER HYACINTH	5.3	MOORHEAD ET AL., 1988
	5.2	JOYCE, 1985
CATTAIL	3	KIRSCHNER ET AL. 2001
	4.2	ALVAREZ AND BÉCARES, 2006
HYDRILLA	1.3	JOYCE ET AL., 1992
FLORIDA CYPRESS (FLOODPLAIN)	3.2	DUEVER ET AL., 1984; CARTER ET AL., 1974
FLORIDA CYPRESS (STILL-WATER)	1.6	BURNS, 1978; CARTER ET AL. 1974
FLORIDA CYPRESS DRAINED (FLOODPLAIN)	1.4	BURNS, 1978

Annual organic matter production (tons dry weight per acre per year) from undisturbed plant populations of cattails, water hyacinths, and hydrilla compared to leaf-litter production of cypress river bottoms and mangroves.

WORLD

Thailand's Century-Old

Water Hyacinth Problem

Stylish baskets made of Thailand waterhyacinth petioles.

By Akeapot Srifa and Purin Charoensuks
University of Florida, Gainesville, FL

Removing Water Hyacinths, Hand Crafter's Offer a Solution

Thailand, like Florida, has been dealing with problems associated with infestations of water hyacinth for over a century. The presence of the species in Thailand was first recorded in 1901 when it was introduced to the royal ponds by assistants to the Thai King following a visit to Indonesia. The water hyacinths were grown on the palace grounds in Bangkok, but the pond flooded that year and plants were washed into nearby rivers and other natural areas. Water hyacinth quickly spread around the country as farmers planted it in flooded paddies to increase fish production. Also, many Thai people collected and grew plants for their beautiful flowers. The result of these intentional relocations is that water hyacinth now occurs in almost all provinces of Thailand, where it causes serious problems in canals, rivers, reservoirs, and almost any aquatic habitats.

Control programs were begun by the Royal Thai Government in 1913, 12 years after the introduction of water hyacinth. The primary goal of the 1913 law was to encourage physical removal of plants from important waterways and to prohibit further spread into new areas of the country. Currently, mechanical and herbicidal controls of water hyacinth in the national waters of Thailand are the responsibility of the Ministry of Transportation and the Ministry of Agriculture and Cooperatives.

From Weeds to Banknotes

Although water hyacinth is a serious problem in Thailand, several individuals, groups, and organizations have been able to develop interesting commercial uses for this weed. Despite the fact that the plants are 95% water and have relatively low nutrient and cellulose levels, some farmers regularly collect fresh water hyacinth, chop it up and feed it to pigs as about 10% of their daily ration. Water hyacinths are also mixed with animal manure and other plant waste to generate biogas. This biogas is produced in small-scale generators and is used for cooking meals in rural areas. Water hyacinth was also tested as a nutrient removal system to mitigate polluted waters, and small-scale projects using this technique exist countrywide.

Thai restaurants can be found in most major cities (and a number of small towns) around the world and are popular because of the delicious dishes created by Thai chefs. Water hyacinth has been used in homeopathic and traditional medicine, but it is also an ingredient in Thai cuisine. Young shoots, leaves and flowers are eaten as a raw vegetable by dipping these plant parts into chili paste or red curry. An operation just outside Bangkok makes dessert cookies from young leaves and has test-marketed the treats. Public attitude toward these cookies has been neutral to negative because of concerns about the cleanliness and safety of water hyacinth ingredients. Thai food technology scientists also emphasize the importance of using water hyacinth from clean sources to make wine (with no sewage or heavy metals). After at least three months of brewing, wine produced from young plant leaves and petioles sells for about US$5 per bottle.

Assorted Handcrafts

Thailand is known throughout the world for the wide array of handcrafts produced by individual artisans and groups of citizens using local resources. For example, Chiang Mai in northern Thailand is famous for its locally produced hand-carved furniture and other wood products. People from communities near sources of water hyacinth have developed and been taught how to use water hyacinth to create an amazing array of handicrafts. Despite being 95% water, water hyacinths produce fairly long fibers which give strength to handicrafts.

Products commonly made from water hyacinth include paper, mats, pads, curtains, baskets and ornate boxes. Some items are more difficult (and more expensive) to

Factory manager displaying lamps made of water hyacinth petioles for sale in Thailand. Water hyacinth handicrafts can also be located and purchased from the internet, but its best to visit Thailand to obtain the best bargains.

make; these include electric lamps, tables, chairs and even beds.

These products are made from the dried petiole of water hyacinth leaves. Leaf petioles are harvested and categorized by length, then dried in the sun for 7 to 14 days. Dried petioles are treated with sulfur or sodium benzoate to prevent spoilage, then woven or made into the desired handicrafts. The finished product is again dried and painted with several coats of clear lacquer. These water hyacinth handicrafts have been very popular in Thailand and also on the international market, which is facilitated by the internet. Due to the increasing popularity of these unusual crafts, product standards and guidelines have been developed to assure the quality of exported products.

Despite all this, water hyacinth remains a weed problem in Thailand, but skilled Thai artisans have developed a means to derive some commercial value from this weed. So next Christmas, when you can't think of what to buy for the person who has everything, well, order early!

Typical Ocala National Forest Lake surrounded by a Pine forest.

Aquatic Plants Surviving in the Acidic Lakes of the Ocala National Forest

By Clayton Coates
Ocala National Forest, US Forest Service

Contributing Factors to pH Levels Below Five

There is a unique piece of land nestled between the Ocklawaha and St. Johns Rivers in central Florida called the Ocala National Forest. This 380,000 acre forest is distinctive for many reasons; it is the oldest National Forest east of the Mississippi River, it is dominated by the largest contiguous sand pine scrub forest in the world, it contains a lake filled with several feet of a prehistoric organic "ooze" found in only two other lakes in the world (Mud Lake - Greis, 1985), and the forest sits atop ancient sand dunes. These sand dunes played a key role in the development of more than 600 highly acidic lakes unique to the Ocala National Forest.

The lakes vary in size, depth, color, and nutrient levels. They range in pH levels from 6.8 to 4.1, with an average pH of 5.0 (Greis, 1985). The lakes with pH ranges between 4.1 - 4.4 are of particular interest and have been classified by the Forest Service as highly acidic. Low pH values below 5.0 affect the survival of juvenile aquatic organisms such as fish, invertebrates and plants. The acidic water also slows the decomposition rate of organic matter which reduces the nutrients available for plants (Greis, 1985). In the lakes of the Ocala National Forest aquatic plants survive and even thrive in these highly acidic conditions.

An Abundance of Aquatic Plants

Despite a highly acidic nature and low nutrient levels, each water body supports a wide variety of aquatic plants. Dr. Canfield from the University of Florida identified eight dominant species during his aquatic vegetation survey of the lakes in the Ocala National Forest. These aquatic species include *Fuirena scirpoidea* (Rush Fuirena), *Leersia hexandra* (Southern Cut Grass), *Nuphar luteum* (Spatterdock), *Utricularia floridana* (Florida Yellow Bladderwort),

Four Highly Acidic Waters of Interest

There are four major lakes within the forest that are considered highly acidic: Clay Lake, Gobbler Lake, Lake Mary and Lawbreaker Lake; with pH values of 4.4, 4.1, 4.4 and 4.3, respectively. The low pH of each lake is most likely a result of several factors working in concert. One component is the lakes are surrounded by very acidic sands associated with ancient dunes, and their highly acidic nature directly affects the pH of the lake water. Another factor is the contribution from acid rain, with pH values ranging from 4.2 to 5.0. Acid rain has the potential to greatly affect the pH of weekly buffered lakes. Since none of these lakes are spring fed, surface water is their sole source of recharge. Surface water originates as precipitation and either falls directly into a lake or on land, where it seeps through or across low pH soils and into the lakes. Any acid rainfall within the lake's drainage basin further reduces the pH of the surface water.

Gobbler Lake is the only lake in the group that is not a seepage lake but rather a drainage lake, meaning it has an inflow and an outflow in the form of a creek (Schiffer, 1998). The other three lakes are seepage lakes and have no stream flow into or out of them. All water entering those lakes is either delivered as rain directly to the lake or as stormwater drainage from the relatively small, heavily forested watersheds.

Another contributing factor to the highly acidic water within these lakes is the lack of natural buffering. Acidic water can be buffered or neutralized by interaction with any substance having a higher pH than the water. Two key pathways for buffering acidic surface water in Florida are through contact with alkaline soils or dilution with ground water. None of the four lakes are influenced by ground water, and only Gobbler Lake has any overland surface input. This lack of natural buffering further contributes to the low pH of these particular lakes.

Lakes of the Ocala National Forest support a variety of aquatic plants despite their acidic nature.

Utricularia purpurea (Eastern Purple Bladderwort), *Panicum hemitomon* (Maidencane), *Nymphaea odorata* (Fragrant Water Lilly) and *Websteria confervoides* (Algal Bullrush). Maidencane and Rush Fuirena occur in three out of the four lakes, and the other six species only occurred in two of the four lakes (Canfield, 1985).

The mere presence of these plants indicates a high tolerance for low pH conditions. While the existing plants appear well adapted, conditions in the more acidic lakes may hinder the introduction of less tolerant species. According to Dr. Canfield, the aquatic plant coverage in Clay Lake is 58%, while Lake Mary is 3%, and both Gobbler and Lawbreaker Lakes are less than 1%. Clay Lake is the shallowest lake in the group, which may account for the higher percentage of plant cover. Lake Mary is more similar to Gobbler and Lawbreaker Lakes, which display the lowest percentage of plant cover and the lowest species diversity, each having only two dominant species present.

Further investigation is needed to answer the questions: Are the pH levels in these lakes stable or are the levels slowly decreasing? If they are decreasing, what are the implications? When the pH level in a lake reaches 4.3 or lower, aquatic plant coverage and species diversity appear to decline. If that is the case, at what pH level does aquatic plant life disappear? Will the lakes of the Ocala National Forest ever reach that point?

So if you tire of getting your prop or paddle bound up in weed–choked lakes, load up your boat and visit the lakes in the Ocala National Forest, because these lakes are like no other.

Aquavine

Aquatic Plant Membership Benefits

Membership to the Florida Aquatic Plant Management Society (FAPMS) is open to everyone who is concerned about Florida's aquatic ecosystems, flood control, irrigation systems, and aquatic-based recreation. Benefits of membership include: quarterly issues of *Aquatics* magazine, quarterly issues of the society's newsletter, notification of public workshops and meetings about aquatic plant control, and eligibility for dependent scholarships. Visit www.famps.org for your membership application.

Final Rule on Water Transfers, June 2009

EPA is publishing a final rule to exclude water transfers from regulation under the NPDES permitting program. The final rule defines a water transfer as an activity that conveys or connects waters of the United States without subjecting the transferred water to intervening industrial, municipal, or commercial use. This does not apply to pollutants introduced by the water transfer activity itself to the water being transferred.

Water transfers are activities that divert water between waterbodies, typically through the use of pumps or passive redirection through tunnels, channels, and/or natural stream water features. Water transfers are necessary to allocate water resources to meet the water needs of those downstream in the receiving waterbody. Such needs include public water supply, irrigation, power generation, flood control, and environmental restoration. The Bureau of Reclamation administers significant transfers in western States to provide approximately 140,000 farmers with irrigation water. With the use of water transfers, the Army Corps of Engineers keeps thousands of acres of agricultural and urban land in southern Florida from flooding in former areas of Everglades's wetlands. Many large cities in the west and the east would not have adequate sources of water for their citizens were it not for the continuous redirection of water from outside basins. For example, both the cities of New York and Los Angeles are dependent on water transfers from distant watersheds to meet their municipal demand. www.epa.gov

New NPDES Permitting for Aquatic Herbicide Applications?

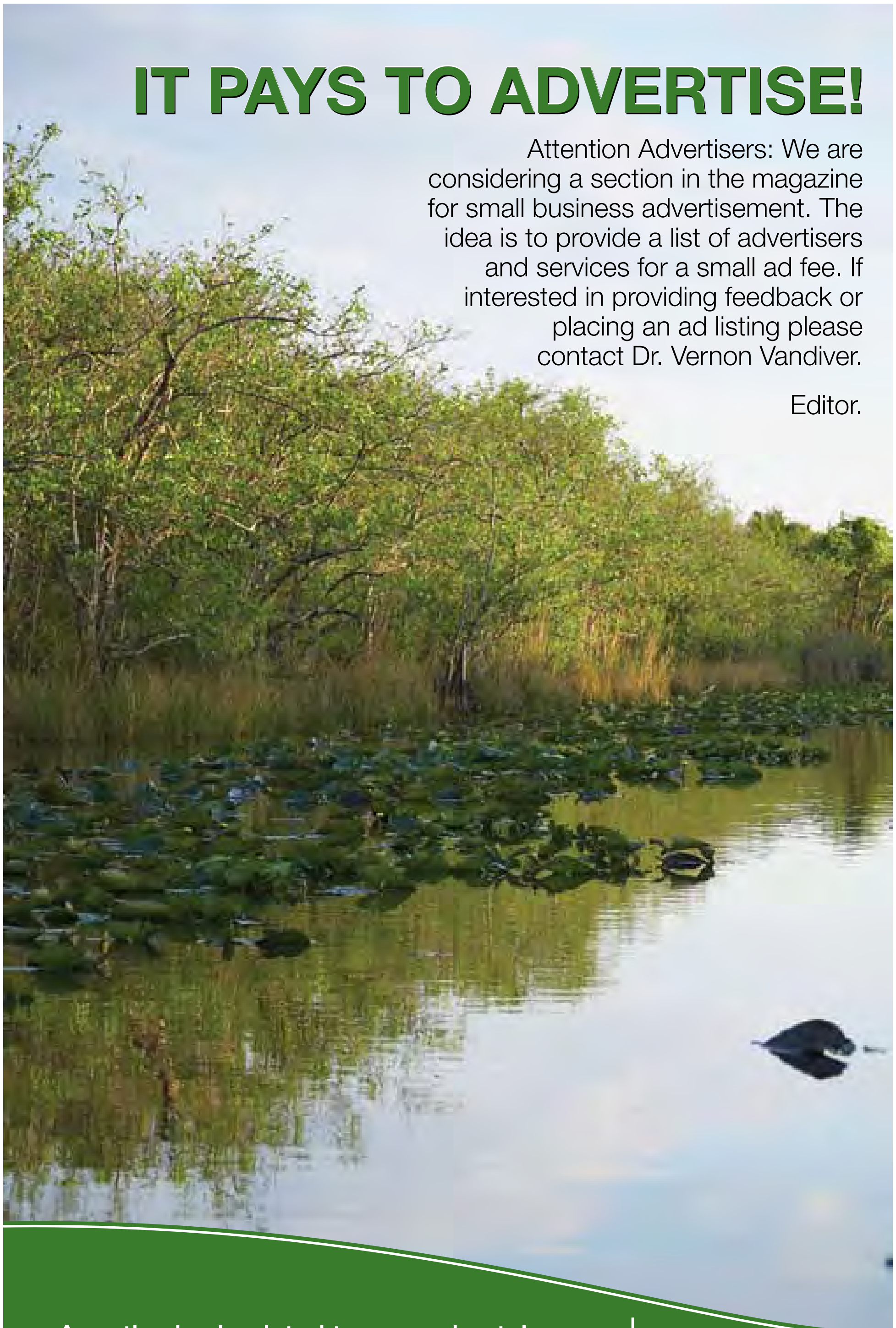
National Cotton Council et al vs. EPA: EPA plans, before the ruling takes effect (April 9, 2011), to issue a final general NPDES permit for covered pesticide applications, to assist authorized states to develop their NPDES permits, and to provide outreach and education to the regulated community. EPA will work closely with state water permitting programs, the regulated community and environmental organizations in developing a general permit that is protective of the environment and public health. www.epa.gov

Noxious Weed List for Florida

The Florida Administrative Code under Rule Chapter 5B-57 defines the Noxious Weed List of 78 plants. www.flrules.org

State-wide Job Listings

The student subunit of the Southern Division of American Fisheries Society offers a detailed job-finding resource guide. The website offers a variety of job listings for each individual state. Visit the "Job Search Guide" link on the Florida AFS webpage: www.sdafs.org/flafs for more information.



IT PAYS TO ADVERTISE!

Attention Advertisers: We are considering a section in the magazine for small business advertisement. The idea is to provide a list of advertisers and services for a small ad fee. If interested in providing feedback or placing an ad listing please contact Dr. Vernon Vandiver.

Editor.

- Aquatics is circulated to approximately 2000 environmental managers, landscape managers, governmental resource managers, and commercial applicators.
- Aquatics is a resource for the people who buy and use aquatic products and services.
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Calendar

March 28-31, 2010

Western Chapter Aquatic Plant Management Society (WAPMS) Annual Meeting

During the 2009 conference in Hawaii it was brought to light that of the approximately 13,000 species of plants introduced to Hawaii, about 1% (130 species) have become invasive. The upcoming Washington conference proves to be equally informative. Visit the website for the registration form.

Sheraton Seattle Hotel, WA www.wapms.org

April 25-29, 2010

National Water Quality Monitoring Council (NWQMC) Seventh Conference

The conference will focus on the many facets of water quality and quantity monitoring for improved understanding, protection, and restoration of our natural resources and communities.

Denver, Colorado www.nalms.org

July 11-14, 2010

50th Annual Meeting of the Aquatic Plant Management Society (APMS)

Hyatt Regency, Bonita Springs, FL www.apms.org

Sept 12-16, 2010

140th Meeting of the American Fisheries Society (AFS)

David Lowrence Convention Center, Pittsburgh, PA www.fisheries.org


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