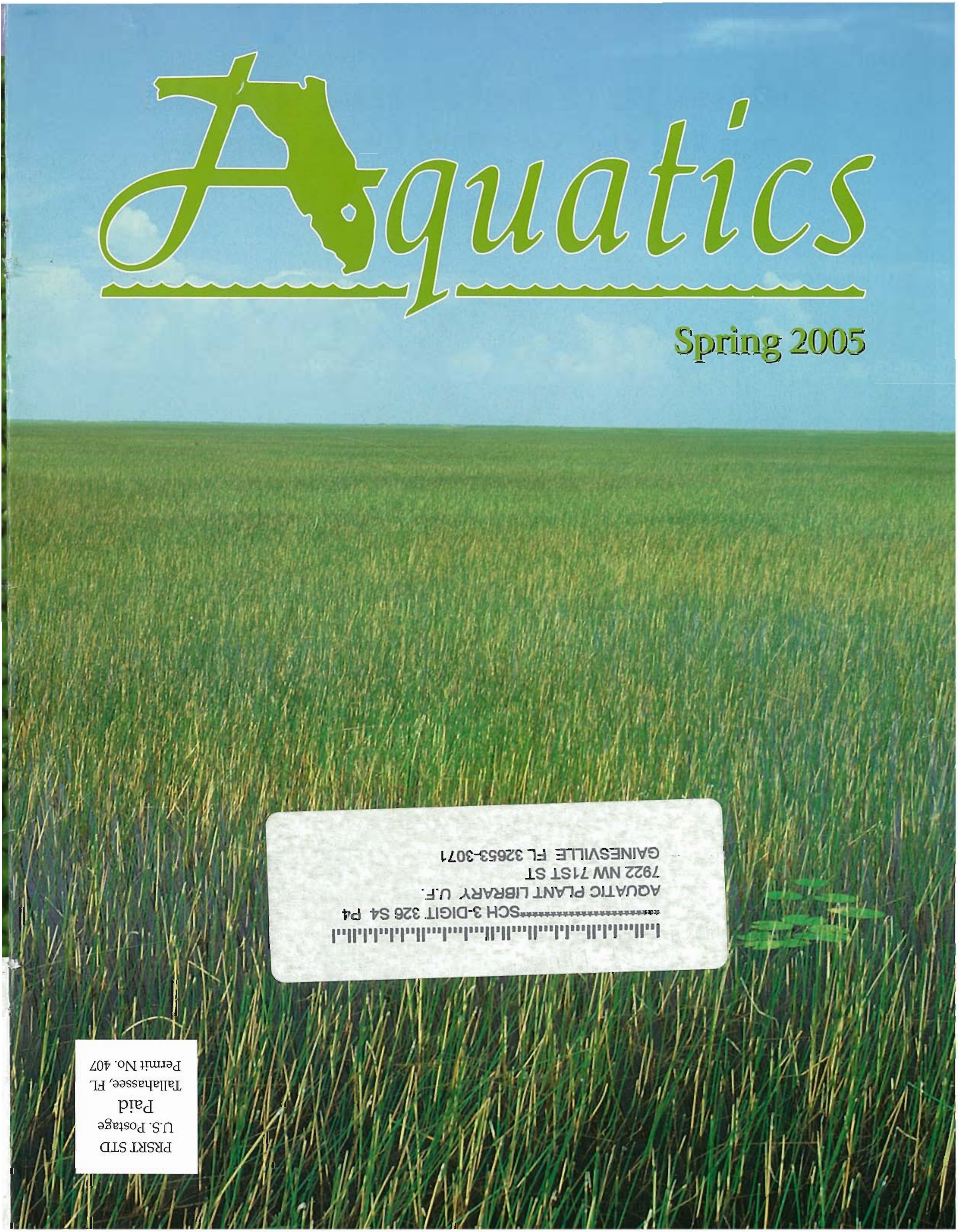
Aquatics

Spring 2005



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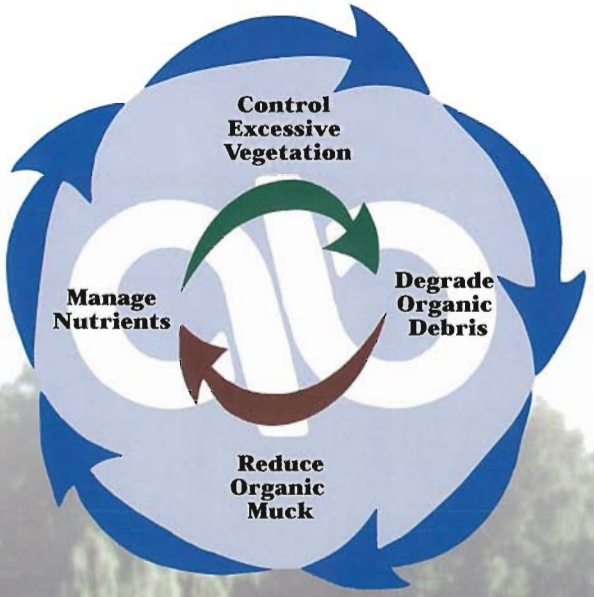

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Editorial

By now, most FAMPS members are aware of the escalating challenges in conducting large-scale hydrilla control in Florida public waterways. Hydrilla's increasing tolerance to fluridone herbicide was first presented at the 2000 APMS and FAPMS conferences. Since then, much research has been commissioned, conducted, and reported by private businesses as well as federal and state governments and universities to better understand the issues and to develop new strategies for large-scale hydrilla management.

Dozens of meetings have also been held among resource managers, regulators, and researchers to raise awareness about potential threats to waters containing large hydrilla infestations, and compromises that may be necessary to bring or keep hydrilla under legislatively mandated maintenance control. Some examples of these meetings include: field trips organized by the University of Florida (UF) for EPA and herbicide manufacturers, and the US Army Corps of Engineers (USACE) stationing staff at EPA Washington Headquarters to expedite review of new herbicide compounds and expanded uses of existing formulations. DEP staff has traveled several times to Washington and many times across Florida generating awareness among regulators and resource managers of the increasing difficulties controlling hydrilla and the need for closer cooperation to develop management plans that adequately address each agency's concerns. DEP has restructured its Field Operations Section to more adequately develop and monitor hydrilla management programs, and respond to changing hydrilla conditions in public waters. Several companies including SePRO and Cerexagri have likewise expanded their efforts to understand the problems and work with agencies and applicators to implement new formulations and hydrilla control strategies.

Although postponed several times by hurricanes, the above efforts resulted in a December 2004 Summit at UF among federal, state, and local agency representatives charged with plant, water, fish, and wildlife management in public waters with large hydrilla infestations. Potential threats from hydrilla and issues associated with available hydrilla management tools were discussed over a two-day period culminating in an unprecedented level of understanding and respect of the multitude of uses, functions, and regulatory requirements linked to Florida's hydrilla infested waters. The next steps are for the UF and USACE to prepare a draft summary of the

Continued on page 20

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Spikerush in Lake Okeechobee. Photo by Dr. David Sutton, Ph.D, University of Florida

Aquatics

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Aquatic Plant Management from the Perspective of the Hydrilla Tuber

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It is inevitable that all presentations regarding the management of hydrilla (*Hydrilla verticillata* L.f. Royle) in Florida mention the role of the tuber in thwarting our long-term control efforts. While the hydrilla tuber is a very simple vegetative propagule, it defies an easy explanation and its value to the persistence of the "perfect weed" is unquestioned. In this article, I will provide some basic information on hydrilla tubers, address a few misconceptions regarding tubers and their response to management, and provide a couple of hypotheses suggesting that the Florida climate results in different patterns for hydrilla tuber production and sprouting, as well as longevity. This article will focus on the dioecious female biotype of hydrilla that is found throughout Florida.

Figure 1. Newly forming hydrilla tubers growing from positively geotropic shoots coming from a hydrilla root crown. Detached tubers can remain quiescent in the sediment for years.

The Hydrilla Tuber

Given some of the misinformation that exists regarding the hydrilla tuber, it is fitting that this propagule is not even a true tuber, but is technically a subterranean turion (Figure 1). This is not just an esoteric observation, as there is an important distinction to be made between a tuber and a hydrilla turion. Tubers typically contain numerous buds (think of a potato) and can therefore sprout multiple times, while the subterranean turion of hydrilla is simply a compressed individual shoot meristem surrounded by leaf scales and leaves, and it can only sprout once. For brevity and consistency with the literature, subterranean turions will be referred to as tubers in this article. For the hydrilla tuber, sprouting is a committed step and the newly emerging shoot meristem may often enter an environment that is not favorable to the plant's survival (Figure 2). To increase the odds of establishment, the newly sprouted shoot can survive solely off of stored carbohydrates from the tuber for several weeks (Spencer and Ksander 1996); however, the emerging plant must ultimately be exposed to a favorable light, temperature, and nutrient regime in order to become established.

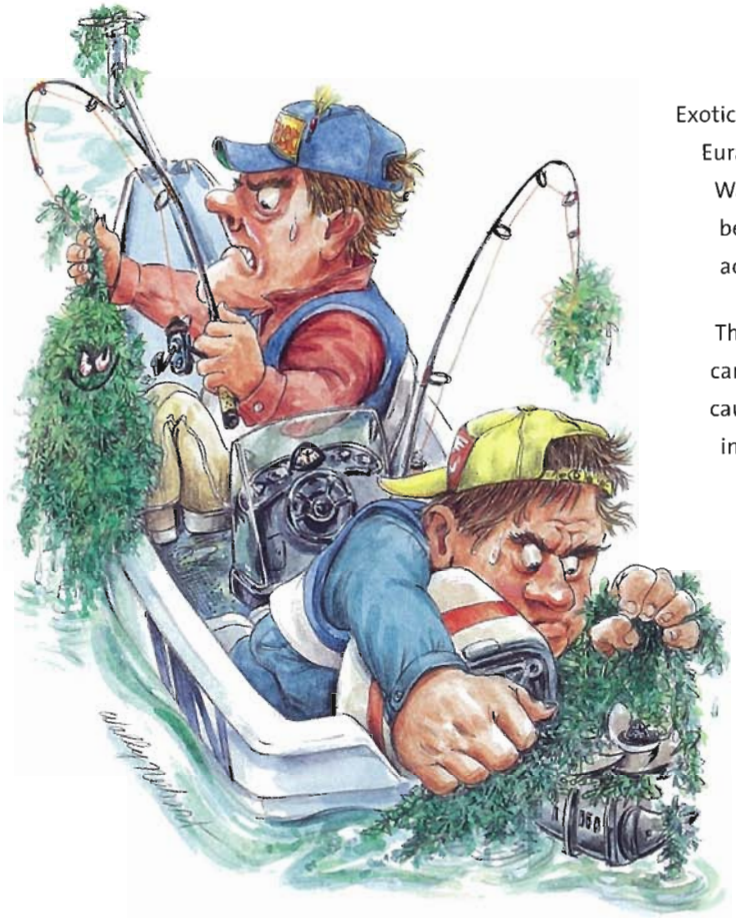
Figure 2. Hydrilla tubers readily sprout following removal from sediments. This sediment core containing three sprouting tubers, demonstrates that the plant can be particularly vulnerable immediately following emergence from the sediment surface.

Our understanding of the environmental cues that stimulate the formation of new hydrilla tubers far exceeds our knowledge of the conditions that trigger a tuber to sprout (Netherland 1997). Tuber formation begins when new shoots generated from the root crown become positively geotropic, that is, shoots begin growing downward into the sediment and carbohydrates are transported to the shoot tip. This process is initiated in the late summer or fall when day lengths shorten to 12 hours or less. Hydrilla will continue initiating new tuber production until the day length exceeds 12 to 13 hours during the spring. While water temperatures can impact the rate of tuber production, the short days are the critical environmental cue. Once formed, the tuber becomes detached from the plant within 1 to 2 months, and it then remains "quiescent" for months or several years until it sprouts

Despite evidence that hydrilla tubers can remain quiescent for years, it is often stated that an environmental cue stimulates tuber sprouting. To date, only artificial lake drawdowns have been shown to significantly impact sprouting, with rates often exceeding 75 to 90% after the site is re-flooded (Haller et al. 1976). The response of the tuber to this wet-dry-wet cycle has been linked to hydrilla being native and adapted to areas of Southeast Asia with a monsoon climate. Tuber

[1]*Dr. Netherland is stationed at the University of Florida Center for Aquatic and Invasive Plants in Gainesville, FL 32653*

Too Many Weeds Spoil the Fishing



Exotic invasive aquatic plants such as Hydrilla, Eurasian Watermilfoil, Curlyleaf Pondweed, Water Chestnut and Water Hyacinth can be detrimental to a healthy fishery in lakes across the country.

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response to a drawdown can be quite rapid, with a very short period of drying required to stimulate sprouting (Netherland 1999). This is reinforced by the observation that removing tubers from the sediment elicits a sprouting response within days. Unfortunately, personal experience suggests that manual removal of tubers from the field is an extremely labor intensive, and not a terribly productive management technique. Aside from drawdowns and physical removal, there is no evidence of a simple definitive environmental cue for tuber sprouting in Florida. Based on sampling efforts in a number of South Florida lakes, Sutton and Portier (1985) suggested that tuber sprouting was non-seasonal and random. In other words, you are likely to find a tuber sprouting at any place in a lake during any month of the year. Factors such as increasing water temperatures in the spring, while often cited as a trigger for sprouting, have not been shown to have any impact on whether or not a tuber will sprout in Florida.

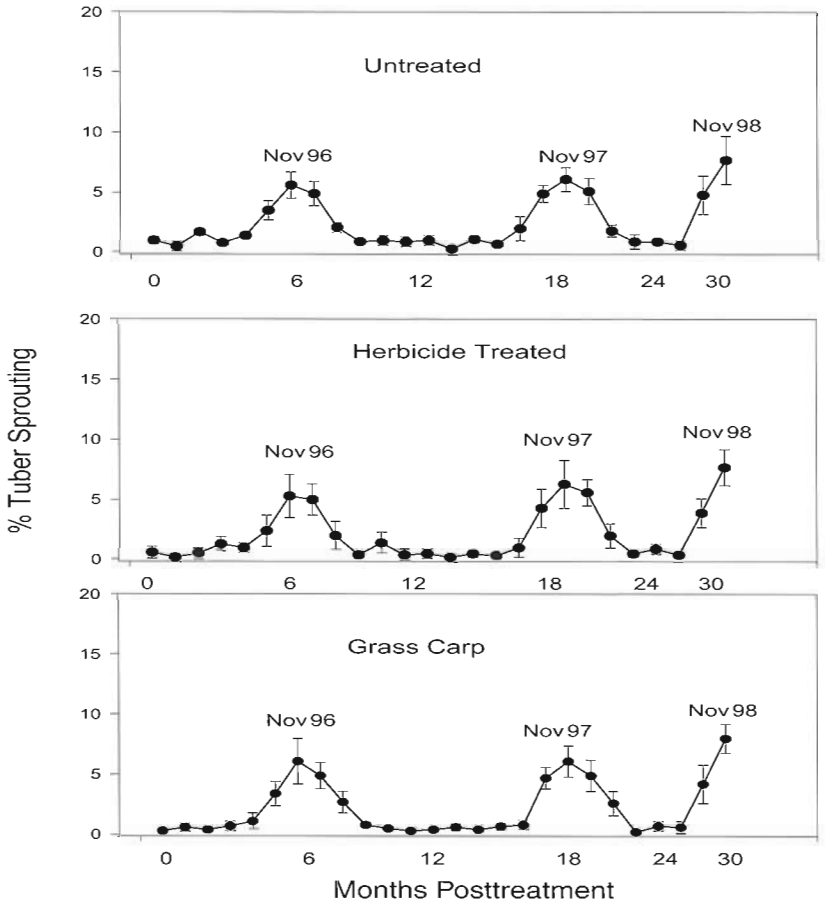

Figure 3. Tuber sprouting over a 30-month period following management techniques applied to control hydrilla in research ponds at Austin Cary Forest, FL. Each point represents the mean (± 1 SD) of 80 core samples

Management Impacts on Hydrilla Tubers

There are many claims that management of hydrilla stimulates tuber sprouting. Following multiple years of research on the impacts of various management techniques on tuber sprouting, there is no strong evidence that management influences sprouting (Netherland 1999). Removing hydrilla biomass through chemical means or by grass carp had no impact on tuber sprouting through a 30-month period (Figure 3). I often hear that rapid recovery of hydrilla following a treatment came from a massive sprouting of hydrilla tubers. My observations to date suggest that in most cases rapid recovery by hydrilla is likely coming from stems and root crowns that were not controlled by the initial treatment. Applications that result in complete removal of the vegetation typically result in a slower recovery that is related to tuber sprouting and subsequent expansion of the new plants. Sampling indicates that it is incorrect to think of tubers as being randomly distributed throughout a water body. Therefore, due to simple percentages, an area of a water body that supports several million tubers per acre is likely to show a more rapid recovery versus an area that supports just a few thousand tubers per acre.

Tuber densities have been reported in numerous publications, and given the inherent difficulties in sampling tubers, any reported value is subject to a significant level of variation. Nonetheless, it is not unreasonable to estimate a population of 1 million tubers per acre. Monthly sampling of ponds in the Gainesville area suggested that *in situ* sprouting rates were in the range of 1 to 3%, with a peak sprouting rate of 5 to 7% in October through December (Figure 3). Once removed from the sediment, greater than 90% of these tubers would typically sprout within two weeks. Using a 4 % sprouting value in the field, roughly 40,000 tubers per acre would be sprouting at any given sample date. This value equates to roughly 1 tuber per square foot. When the hydrilla canopy is removed via management, the sprouting of tubers is easy to see given reasonable water clarity. This observation has likely been the culprit in leading people to say that management stimulates sprouting. Sampling suggested that the same number of tubers were sprouting in the untreated ponds under the hydrilla canopy, but this phenomenon can only be observed through core sampling. Another interesting observation from this research involved the ability of the herbicide fluridone to control newly sprouted tubers at concentrations in the range of 2 to 5 ppb. Some of the early fluridone treatments throughout Florida were noted for their ability to give long-term hydrilla control. This

research showed that tubers continued to sprout in the presence of fluridone, but were unable to survive at concentrations as low as 2 ppb. This resulted in the failure of hydrilla from sprouted tubers to become established for almost 2 years following the initial application.

The low percentage, but long-term and continuous sprouting response is an excellent survival strategy. For example, tubers that sprout during periods when the water is especially turbid may not be able to establish under the low light intensities, whereas tubers that sprout when the water clarity and environmental conditions are favorable can thrive and rapidly expand. Once established, hydrilla can begin the process of replenishing the tuber bank. A good example of the role of the hydrilla tuber would relate to the recent hurricanes. While hurricanes Charley, Frances, and Jeanne in 2004 resulted in increased turbidity and the uprooting and loss of vast amounts of vegetative hydrilla growth in several large Central Florida lakes, the majority of tubers were not exposed to conditions that would impact the overall population or sprouting response. In anthropomorphic terms, tubers tend to remain oblivious to management activities or natural disasters that impact the water column.

Hydrilla Tubers and the Florida Climate

Based on observations over the years, I would propose two hypotheses regarding hydrilla tubers and the climate of Florida. First, the Florida climate may be particularly favorable to the formation of tubers by the dioecious strain of hydrilla and this may partially explain the southern distribution of this biotype in the US. Second, the sprouting response and longevity of dioecious hydrilla tubers may be different in Florida versus more northern latitudes (e.g. the Carolinas to Maine).

The response of dioecious hydrilla to a day length of less than 12 hours would suggest that tuber initiation would begin near the fall solstice throughout the US. While the critical day length would be equally favorable for tuber formation, the rapidly cooling water temperatures in northern latitude lakes (e.g. the upper Midwest or Northeastern states) would likely slow the process of tuber formation considerably. Tuber production is occurring from October through early April in Florida, with a reduction in the initiation of new positive geotropic shoots noted during the cooler months of December through February. The conditions in northern climates would likely result in a narrow window of tuber formation in the early fall for dioecious hydrilla. From a research and management standpoint, recognizing how the plant may respond to different environments could help in formulating management plans as dioecious hydrilla expands northward. As dioecious hydrilla moves north, the plant will rely heavily on the tuber or axillary turion for year to year survival. The vegetative biomass will be greatly reduced or removed due to the colder water and shorter days. It has also been speculated that in the cooler climates, dioecious hydrilla would shift to the production of axillary turions as a means of producing over-wintering propagules. These phenological patterns have been observed for the monoecious biotype of hydrilla

While the sprouting response of dioecious hydrilla has been described as non-seasonal and random in Florida, there is evidence that sprouting of dioecious hydrilla tubers in northern latitudes is related to temperature (Spencer and Ksander 2001). This and other work speculate that following exposure to low temperatures in the winter, hydrilla tuber sprouting is based on accumulation of degree days. It is therefore possible that we never experience the low temperature requirement in many areas of Florida, and therefore sprouting is not related to seasonal changes in temperature. There

would be no advantage for dioecious hydrilla tubers to show a pattern of non-seasonal sprouting in northern latitudes. While low temperatures have been shown to inhibit sprouting, a large percentage of dioecious tubers would likely need to sprout in response to the warming spring temperatures, or the plant may have significant problems in gaining a competitive advantage on cool water plants such as Eurasian watermilfoil, native pondweeds, elodea, and monoecious hydrilla. In contrast, conditions for establishment of a sprouting tuber can remain favorable in Florida throughout the year.

Another piece of interesting evidence comes from work done by Van and Steward (1990), with monoecious hydrilla in the Fort Lauderdale area. This work showed that monoecious hydrilla tubers persisted in the South Florida climate for up to four years. It is ironic to note that while this is one of the most cited publications regarding tuber longevity, the closest monoecious hydrilla population resides over 600 miles to the north. There is limited evidence of long-term persistence of monoecious hydrilla tubers in more northern latitudes, and this may further suggest the Florida climate plays a major role in hydrilla tuber quiescence.

Given the fact that tubers remain buried in several inches of lake sediment, it is unlikely that we will ever devise a strategy to "control" hydrilla tubers. Nonetheless, as the tuber and axillary turions are the key structures that allow hydrilla to persist, it is important that we continue to work to understand how tuber and turion populations respond to our management practices.

Acknowledgements

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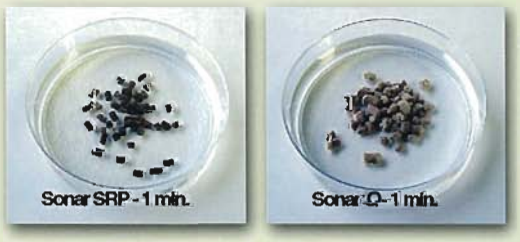

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Fighting water hyacinth in Orange Creek

Florida Water Management District Restores Wetland to Its Natural State

At first glance, Florida would not seem a likely candidate for elaborate water conservation efforts. The state is filled with expansive wetland ranges and surrounded on three sides by water.

However, not all water surrounding the state – nor in its many wetlands, lakes, rivers and streams – is suitable for drinking or other human use. Fickle weather patterns include long spans of wet weather followed by extended dry periods that create highly unpredictable water tables and produce a complex water management challenge.

Fortunately, Florida's leaders and water experts recognized many decades ago the state's need to conserve water. As a result, legislators passed the 1972 Water Resources Act to ensure its continued availability. The act established five water management districts covering the entire state, with responsibilities including conservation and allocation of water supply, water quality, flood protection and natural systems management.

One such district, the St. Johns River Water Management District, covers a massive 12,283 square miles – about 7.8 million acres, or 23 percent of Florida's total area. Within its 18-county service area in northeast and east-central Florida, the St. Johns District serves 100 municipalities and employs about 700 people. The St. Johns District owns or manages more than 560,000 acres of land, acquired for the purposes of water management, water supply and the restoration, conservation and protection of water resources. These lands largely consist of wetlands or historically wet areas.

Striking a balance between restoration and public needs

When the St. Johns District buys land, it provides the public with far-reaching benefits, including protecting wildlife and plant habitats, opening land for recreation, providing a place for environmental education and preserving a "natural" part

of Florida for future generations. The district looks for priority lands needing protection, such as floodplains, sensitive wetlands and groundwater recharge areas.

Ninety-eight percent of the District's land is open to the public for activities compatible with conservation, such as hiking, biking, wildlife viewing, canoeing, camping, hunting and fishing. The remaining land is closed for ongoing construction or conservation projects.

Every year, the St. Johns River Water Management District develops a land management plan to balance traditional land, recreation and water uses with water resource protection, habitat diversification, and wildlife habitat restoration goals. The district carefully responds to demands from public and private interests for numerous land uses, including recreational activities such as hunting, camping and boating, and commercial uses, such as radio tower sites, utility easements and agriculture.

From farmland to creek: restoring a waterway

A leader in many ambitious restoration projects, the St. Johns District began work on the Orange Creek Restoration Area in 1998. The Orange Creek Restoration Area covers a 3,415-acre tributary waterway located about 20 miles north of Ocala, Fla., near Florida's Orange Lake.

In partnership with the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS), the St. Johns District purchased the tributary waterway for $5.2 million in 1998 in an effort to improve water quality and restore wetlands.

The Orange Creek project presented significant engineering challenges because the District wanted to remove virtually all man-made drainage features. By removing the drainages, St. Johns could restore the former wetland and wildlife communities, while also creating important wetland functions, such as improved flood control and water quality maintenance.

In the 1930s, private landowners excavated a canal through vast sawgrass marshes and wet prairies in the eastern portion of Orange Lake. The man-made channel, Orange Creek, became part of a massive levee and canal system that converted 1,500 acres of marsh for agricultural use – primarily row crop production and cattle grazing.

Water from Orange Lake entered the channel to flow through the property, eventually reaching the Ocklawaha and St. Johns rivers. While the resulting land was fertile for agriculture, its drainage created significant water quality problems for the St. Johns River. "Because Orange Creek flowed into the river, large amounts of nutrients from the farm fed into the St. Johns River, making it difficult to maintain the water quality," said Johnnie Drew, Invasive Plant Technical Supervisor, St. Johns River Water Management District.

With the 1998 land acquisition, the District planned to restore the area to its natural state and reduce

the chemical load flowing into the St. Johns River. The final restoration phase, completed during the summer of 2001, involved removing 3.4 miles of levee, including 270,000 cubic yards of material, constructing eight habitat islands and planting more than 40,000 cordgrass plugs to restore the marsh grasses for erosion control and wildlife habitat.

Thanks in part to the restoration project, Orange Creek soon became home to a growing number of native species, including wood storks, bald eagles, Florida sandhill cranes and snowy egrets. A variety of waterfowl, including the mottled duck, hooded merganser and blue-winged teal, also use the wetland prairies and former farm fields as foraging and roosting sites. And, the area provides habitat for glossy ibis, northern harrier, turkey, alligator and white-tailed deer.

Water hyacinth takes control in creek

When the St. Johns District bulldozed the levees and first flooded the Orange Creek Restoration Area in 2000, open water allowed recreationalists, fishermen and bird watchers to easily navigate the area with canoes and small boats. However, dry periods in 2002 and 2003 left water levels at less than a foot deep, restricting access and reducing food sources and habitat. Receding water levels allowed seed germination from several species of native and exotic plants in the substrate.

When the water levels rose again, floating invaders such as frogs-bit and water hyacinth grew rapidly, and the water became thick with invasive plants. The site was virtually solid vegetation, with waters unnavigable except by airboat. Dense, invasive vegetation such as cattail, frogs-bit and water hyacinth crowd out wildlife species by diminishing desirable food sources and habitat.

The leaves and extensive roots of water hyacinth intertwine to form extensive, impenetrable mats in the water. Water hyacinth has long, fibrous roots that float freely beneath the plant, rather than anchoring the plant in the substrate.

Mats of water hyacinth, intermixed with native vegetation from the drought years, impeded navigation by most watercraft and caused a decline in submersed aquatic vegetation. In addition, the thick mats of vegetation created undesirable conditions for many native wildlife species. Water beneath these mats was anaerobic and unsuitable for fish and most other invertebrates.

Restoring a creek with native vegetation and wildlife

In the spring of 2004, the St. Johns District set out to restore access to the Orange Creek area. Specifically, the District aimed to create watercraft trails in two different locations, with one area as a boat launch where duck hunters can paddle into the marsh, and the other a recreational canoe launch for bird-watchers, fishermen and other outdoorspeople. In addition, the District sought to create more open water to attract additional wildlife.

To control the frogs-bit and water hyacinth mats, the District turned to imazapyr, for which BASF recently received full label approval for controlling emergent, shoreline and woody wetland aquatic vegetation. Imazapyr breaks down quickly in water, allowing desirable vegetation to germinate and repopulate a treated site. Because it is considered a low-volume herbicide, it provides more control with less chemical load on the environment, compared to other herbicides.

"Frogs-bit and water hyacinth are among the toughest plants that we have to control," Drew said. "Using imazapyr we hope to give the public some of their land back. Other products are available for similar applications, but they haven't work as well on these plants."

Using airboats fitted with spray tanks, St. Johns District applicators sprayed 25 acres of frogs-bit, cattail and water hyacinth with a tank mixture of 100 gallons of water and 32 ounces of imazapyr per acre. In collaboration with researchers from the University of Florida, the District is also experimenting with rates as low as 16 ounces of the herbicide per acre to evaluate selectivity and species diversity.

"In other areas, we've used 32 ounces of imazpyr per acre with excellent results," Drew said. "With that rate, you can take out Chinese tallow in standing water as well as eliminate frogs-bit and water hyacinth."

The St. Johns District determines the effectiveness of herbicide treatments by measuring re-growth rate and percent of target species controlled. While applicators can eliminate most target plants on the first treatment, the District continually monitors sites at regular intervals for re-growth, watching for new infestations or resprouting from seed banks in the substrate. If any re-treatments are needed, the District makes a second spot application.

The District expects native wildlife such as ducks, herons and egrets to return to their nesting areas in the Orange Creek area in a matter of months once the frogs-bit and water hyacinth mat is reduced and the waters open. Ultimately, the District hopes that boaters, duck hunters, fishermen and bird watchers will take advantage of the restored habitat in the Orange Creek area.

Imazapyr Fuels Future Successes

Based on previous successes with imazapyr, the St. Johns River Water Management District will continue to use the herbicide in future restoration projects. For example, the District's next project involves managing invasive plants on Lake Apopka, a 30,000-acre public lake in Central Florida. Lake Apopka is menaced by 300 acres of floating tussock islands infested with aquatic vegetation such as cattail, wild taro and water primrose.

Each floating island – essentially a layer of muck held together by the root mass of the invasive weeds and exotic vegetation – can grow as large as 1-2 acres in size. The islands blow across the massive lake to block boat ramps, destroy docks and wipe out native plants on the shoreline. By treating invasive vegetation on the islands with herbicide, the District will help restore the lake to nature's intended state.

Water management remains one of state's greatest challenges

Conserving, protecting and restoring natural systems, while ensuring an adequate supply of water, remains one of Florida's greatest challenges. Through dedicated management methods, including mechanical removal, prescribed burning and herbicide treatments, the St. Johns River Water Management District has made real progress in reducing and controlling the spread of invasive and exotic plants. The District also has increased the number of acres returned to native states, which has led to increased native wildlife and wetland plant species.

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FAPMS has joined the Habitattitude™ Campaign

Florida Aquatic Plant Management Society has joined a partnership with the Aquatic Nuisance Species Task Force & U.S. Fish and Wildlife Service in the national Habitattitude™ campaign. Habitattitude™ encourages aquarium owners and water gardeners to avoid unwanted introductions of non-native species by adopting simple prevention steps when faced with an unwanted aquatic plant or fish. A new website, www.habitattitude.net, will help consumers to learn more about responsible behaviors and how to prevent the spread of potential aquatic nuisance species.

Snakeheads and Asian carp are high-profile species because both have the potential of causing ecological chaos to massive bodies of water, such as the Great Lakes, if they are able to colonize them. The consequences go beyond ecology: The Great Lakes has a commercial and recreational fishing industry that provides 75,000 jobs and has a combined value of $4.7 billion, officials said. Enter "Habitattitude," a tongue-twister of a national campaign in which consumers are being told about the pitfalls of releasing non-native fish and plants they have had in aquariums, back-yard ponds, and water gardens. Read the full story and check out the campaign website to get the details or visit www.fapms.org to see how our society is contributing to this national campaign.

New Law Strengthens Fight Against Invasive and Noxious Weeds

News Release Issued by the Invasive Weeds Awareness Coalition (IWAC)

WASHINGTON, D.C. – Feb. 16, 2005 – A recently enacted law is expected to significantly strengthen the fight against invasive weeds in the United States, helping restore native plants and ecosystems nationwide. Signed last October by President Bush, the Noxious Weed Control Act enables the Secretary of Agriculture's office to assist eligible weed management agencies in responding to noxious weed problems on public and private lands.

Passage of the Act will be noted throughout the 6th Annual National Invasive Weeds Awareness Week Conference in Washington, D.C., Feb. 27 through March 4. The conference spotlights the problems caused by invasive weeds and other types of invasive vegetation, and highlights the successes of hundreds of projects designed to curb the spread of invasives.

"With invasive plant species infesting an estimated 100 million acres across the United States, the Noxious Weed Control Act is a strong step in the right direction," said Rob Hedberg, director of science policy, Weed Science Society of America. "It will provide funding for planning initiatives to control invasive vegetation, which is what we really need in this country. Early detection and rapid response are the first lines of defense against noxious and invasive weeds – which are a growing threat to our nation's native ecosystems."

In the United States alone, invasive plant species displace native species by a rate of eight to 20 percent each year, often causing serious environmental problems. For example, thirsty invasive brush such as saltcedar can threaten vital water supplies. A single plant is capable of consuming as much as 300 gallons of water a day – or about 6,000 gallons per month. In comparison, the average American household uses about 8,000 gallons of water per month.

During National Invasive Weeds Awareness Week, representatives of weed management agencies will host a conference to increase the understanding of invasive plant management issues in the United States. The conference is sponsored and hosted by the Invasive Weeds Awareness Coalition (IWAC), a Washington, D.C.-based coalition dedicated to increasing awareness of invasive weed problems and associated research and management needs.

The U.S. Botanic Garden in Washington, D.C., will showcase displays designed by state and federal agencies that demonstrate how to identify harmful invasive plants and highlight successful partnership projects that are controlling and managing invasive plants and restoring ecosystems. The public is invited and encouraged to visit the displays, which will include information exhibits on menacing invasive weeds, including:

- **Saltcedar:** This aggressive colonizer (also called tamarisk) often forms single-species, or monotypic, stands that replace willows, cottonwoods and other native vegetation in communities nationwide. A single plant can consume 300 gallons of water a day, lowering groundwater levels and threatening water sources for communities and wildlife alike.
- **Giant Hogweed:** Grows mostly in the Northeast and contains sap that can cause long-lasting swelling and blisters in people and animals, and may cause temporary or permanent blindness in certain cases.
- **Kudzu:** A highly invasive weed, kudzu currently infests approximately seven million acres throughout the southern United States. The weed creates a safety hazard by reducing visibility on highways and causing transmission failures on power lines, while choking trees and any other plant in its way.
- **Salvinia:** An aquatic weed notorious for dominating slow-moving or quiet freshwaters, its rapid growth, vegetative reproduction and tolerance to environmental stress make it an aggressive, competitive species that negatively affects aquatic environments, boating and other recreational uses, and economies of nearby communities.

About IWAC

IWAC works to educate individuals and organizations on steps they can take to protect land, such as learning more about invasive weeds, recognizing plants that are out of place, and alerting appropriate local agencies to their presence. IWAC also hopes to teach people how to responsibly select noninvasive plants for landscaping and prevent inadvertent transportation of invasive plant species or their seeds to new areas.

IWAC works cooperatively the Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), a partnership of the EPA and 15 federal agencies from the Departments of Agriculture, Interior, Defense, Energy and Transportation.

IWAC also works closely with industry, other federal and state agencies, and non-government organizations such as the Weed Science Society of America and The Nature Conservancy.

For more information contact: Gina Ramos (202- 452-5084) or Rob Hedberg (202-408-5388) Bureau of Land Management, Weed Science Society of America.

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A Story of Invasive Animals in Florida

Edited with permission from a newsletter article written by Mike Bodle, SFWMD.

"When among wild beasts, if they menace you, be a beast."
- Herman Melville

If Melville were to wander through today's South Florida, he'd need to "be a beast" more than ever. Florida is naturally the home of thousands of diverse species of fish and fowl and things that slither and stomp. But we're gaining more critters, almost daily, that are not native to the State. Some are aggressive, some aren't, and some displace native species and disrupt ecosystems while others may cause little impact. But, whether they have small or large effects, lots of non-native animals are already here and more are coming all the time.

Sliding and Slithering

Snakes tend to invoke fear in some corners; despite the essential roles they play controlling rodents and other rapidly reproducing animals. Our native snakes grow to maximum lengths of six or eight feet. What a surprise to those who have encountered ten to fifteen foot long Burmese pythons in the Homestead region of Florida. Over the past several years, Everglades National Park staffers have spotted many such serpents lying in the park's main road at night, absorbing residual heat. They say that a twelve-foot long, eight-inch thick snake amounts to quite a "speed bump" in the night. Also, more recently, SFWMD's mowing contractor has "mowed" as many as five of these behemoths in one day's mowing on the C-111 levee. These encounters have shocked the mower operators, to say the least, and outright killed the massive snakes.

These snakes have found their ways into wild Florida as escaped pets or have been purposely released by folks who no longer want a fully-grown twelve-foot snake around the house. To date, exotic snakes that have fully established and are breeding in Florida include the South American boa constrictor (scientific name – *Boa constrictor*) and the Burmese python (*Python molurus*).

The ecological implications of the arrivals of these new snakes aren't good. They aren't poisonous, but hunt very effectively by overcoming their prey with constriction and suffocation. They climb trees readily and may strip the Everglades tree islands of birds and their nestlings. They are also expert swimmers. At full size, up to 33 feet for the Burmese python in its native Asian range, the pythons eat just about anything that moves. This includes our terrestrial mammals like deer, raccoons, and opossums, and many of Florida's reptiles and fish species. Since exotic snakes to date are all truly tropical species, they feed more frequently than many North American snakes and may have greater impacts on native animal populations than our resident snakes. These invasive snakes can feed as often as weekly, whereas native snakes may get by with one meal per month or less. In time, their populations may swell into such great numbers that they could wipe out native wildlife. Very large alligators are the only likely native predators that could possibly control mature pythons.

New Swimmers In The Pool

Floridians are encountering many new non-native fish problems as well. Some of these aquatic threats include the suckermouth or "plecos" catfish which are native to the tropical Americas. Many species of this group occur in the world, but probably the most popular one in the aquarium trade is termed "*Hypostomus plecostomus*." They may quickly establish very sizeable populations after being released into a body of water. In aquaria, they clean detritus and algae from surfaces, yet in Florida's wilderness, their soaring numbers may denude wetlands and lakes of aquatic plants. An additional threat is occurring as these catfish burrow into banks to make breeding tunnels that offer males a place to protect their young and give the fish a place to survive drought conditions. These burrows are significant to South Florida water managers as they can severely erode shorelines, degrade banks, and undermine canal levees and embankments. This fish is now found in most southern and Western states, and its ultimate impacts in Florida may remain to be seen.

A few of the many non-native fish already reproducing, or at least reportedly present, in Florida waters are: butterfly peacock "bass" (*Cichla ocellaris*), swamp eel (*Macrognathus siamensis*), walking catfish (*Clarias batrachus*), piranha (*Serrsalmus rhombeus*), snakeheads (*Channa morulius*) and common carp (*Cyprinus carpio*).

Winged Interlopers

The monk, or Quaker parakeet (*Myiopsitta monachus*) is another non-native species fully established in Florida as escapees from the pet trade. They are also currently found in California, Texas, Illinois and New York. Native to temperate Argentina, these hardy birds can handle any climate found in the continental U.S. Their noisy flocks are becoming extremely familiar to South Floridians. And, like all parrots, they tend to chew and chew and chew, sometimes just for the "fun" of it. That may be all right if all that they chew is vegetation. In their native South America they pose a serious threat to agriculture, especially fruit crops. But they also chew power lines, connections and hardware. Furthermore, groups of monk parakeets construct large

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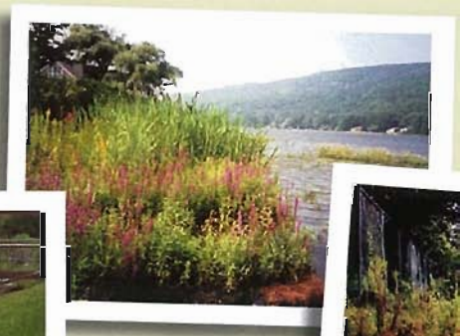

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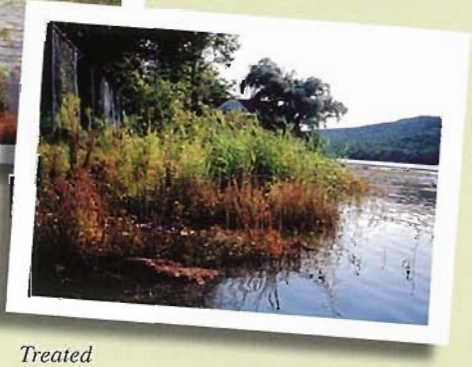

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shared nests, often on and around power transformers and power grid equipment. These nests degrade power systems, cause shorts circuits and encourage rot and moisture damage.

Numerous other non-native birds now established in Florida including the common Australian budgerigar (*Melopisittacus undulates*), South American canary-winged parakeet (*Brotogeris versicolurus*), European ring-necked dove (*Streptopelia risoria*) and the Asian mynah (*Gracula religiosa*).

Got Any Good Ole Anoles?

The native green anole lizard (*Anolis carolinensis*) that many call "chameleons" are becoming harder and harder to find in Florida. Native throughout the southeastern U.S., they are being driven out of their Florida habitats by more aggressive, and often larger, non-native lizards including the Cuban Knight anole (*Anolis equestris*) and Central American brown anole (*Anolis segrei*). These introduced anoles are known to out compete the lesser green anole and even include them in their diets. Many native birds, mammals and other reptiles also include the green anole in their diets and find the larger non-native anoles to be a more aggressive and elusive prey. It remains unclear what the long-term results of the green anoles decline will be to Florida's ecosystem.

Large green Central American iguanas (*Iguana iguana*) are becoming thick as thieves throughout South Florida. They may look threatening, but since their diets are limited to plants they pose little threat to humans and other wildlife. However, their bites can be severe and they may transmit diseases including *Salmonella sp.* They have become so common along South Florida waterways that they can be said to be "here to stay." Like all reptiles, they are most visible on clear, sunny days sunning themselves on the banks of lakes, rivers and canals or on overhanging branches. When threatened, iguanas usually scamper away, lunging into nearby waterways or up into trees. People hunt iguanas for food throughout most of their native range and often call them "jungle chicken" or "bamboo chicken."

Is There A Future In Our Animals' Future?

As non-native species are introduced around the globe many fear for the health of native ecosystems. Delicate relationships that have evolved over millennia connect the species found in any given locality. Even small disturbances to the network of relationships may seriously disrupt the strength of the web and cause ecological collapse. Efforts to control invasive species must be developed anew for each new organism and often, by the time management plans are devised, it's just too late. Time will tell whether effective controls and containments can be mounted to protect our native animals from the wide range of immigrating interlopers.

Aquatic Plant Management Society

Announces Annual Student Paper Contest for Upcoming July 2005 Meeting in San Antonio, Texas

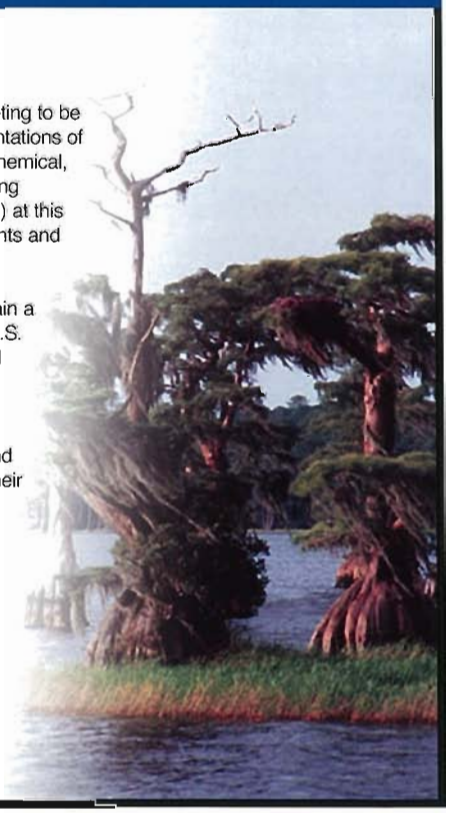
The Aquatic Plant Management Society is soliciting student papers for their upcoming 45th Annual Meeting to be held July 10-13, 2005, at the Hyatt Regency San Antonio on the Riverwalk at Peseo Del Alamo. Presentations of original research on the biology or ecology of aquatic and wetland plants, control methods (biological, chemical, cultural, mechanical) for invasive exotic or nuisance native plant species, and restoration projects involving wetland or aquatic plants are solicited. With a special session planned on Harmful Algal Blooms (HABs) at this year's meeting, papers that emphasize control, causative factors, or general ecology of such bloom events and their associated water quality impacts are also highly encouraged.

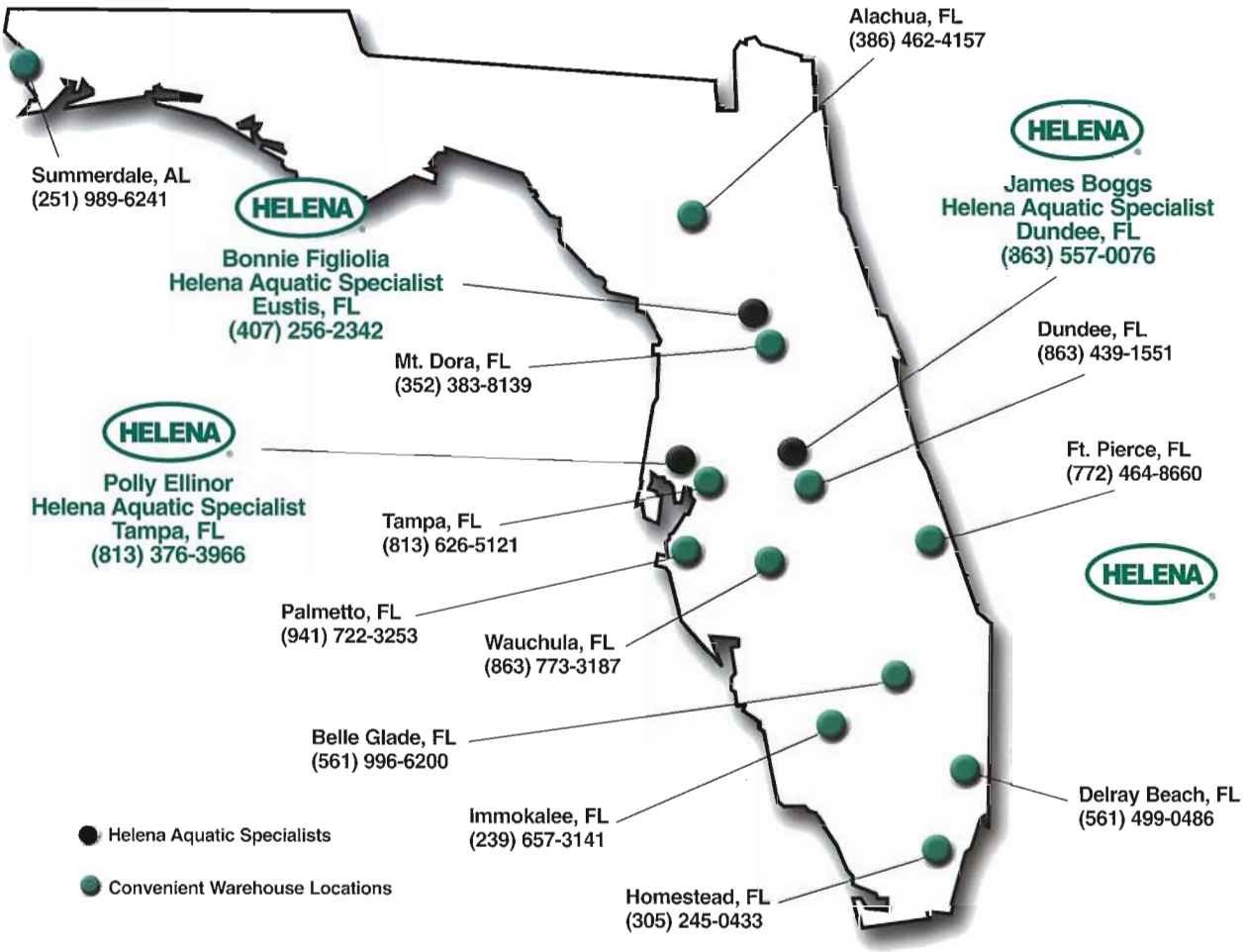
The Society encourages students that have conducted original research to present their findings and gain a valuable perspective on aquatic plant problems and various management applications throughout the U.S. The meeting locale in San Antonio, Texas provides an excellent opportunity for students from Texas and nearby states to attend and present research on aquatic plant management in this region.

The APMS has a strong ethic of student support and all qualified attendees will be provided room accommodations (based on double occupancy) and waiver of registration fees. In addition, 1st, 2nd, and 3rd place prize money will be awarded. This meeting presents an opportunity for students to develop their presentation skills, learn about the field of aquatic plant management, and meet with key Government, University, Industry representatives and peers with similar educational and professional interests.

Please log on to **www.apms.org** to learn more about the Aquatic Plant Management Society.
For information about the contest, please contact:

Dr. Mark A. Heilman, Ph.D.
SePRO Research and Technology Campus
16013 Watson Farm Seed Road
Whitakers, NC 27891
E-mail: markh@sepro.com
Phone: (252) 437-3282 ext. 223





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Editorial *continued from page 3*

meeting and for managers to reconvene in April 2005 to develop alternative hydrilla management strategies and specific recommendations for control in the hydrilla-filled reservoirs of Central Florida.

It is both ironic and fortunate that this threat comes at a time when hydrilla is at its lowest level since the DEP began inventorying aquatic plants in Florida public waters in 1979. Fewer than 30,000 acres of hydrilla stranding crop were reported in 2004 – 70,000 fewer acres than during the high water mark year of 1994. This is a tribute to the increased strategy and management efforts, and of course to the hurricanes that ripped up much of the hydrilla in Central Florida lakes in 2004. We know that tubers still infest tens of thousands of acres of Florida public waters and that regrowth is inevitable, if not relentless. The challenge that now awaits us is sustaining current low levels of hydrilla long enough to develop and implement cost-effective and environmentally responsible management solutions.

Jeff Schardt
Environmental Administrator
Bureau of Invasive Plant Management
Florida Department of Environmental Protection

Mark Zeller

Mark Zeller, a loving father and wonderful friend, passed suddenly from this life in November 2004. Mark will be remembered for his generous nature, his willingness to share his time, his quiet but keen sense of humor, and his warm sincere smile. He worked for the Florida Department of Environmental Protection's Bureau of Invasive Plants, Upland Management Section as a Biological Scientist III. In lieu of flowers, the family has asked that donations be made to a memorial fund for their children, Zachary and Anna Zeller. The memorial fund has been set up in their names at Wachovia Bank. Any branch will accept the donations. Melissa Mitchell is the contact person with the bank (850-425-6030).

Florida Aquatic Plant Management Society

Membership Application

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If this is a renewal application, please indicate the year(s) dues are payable for: _____

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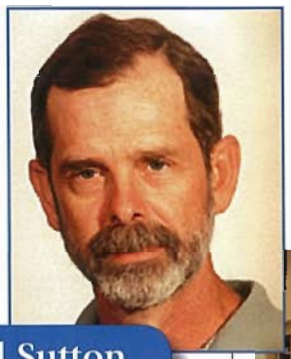
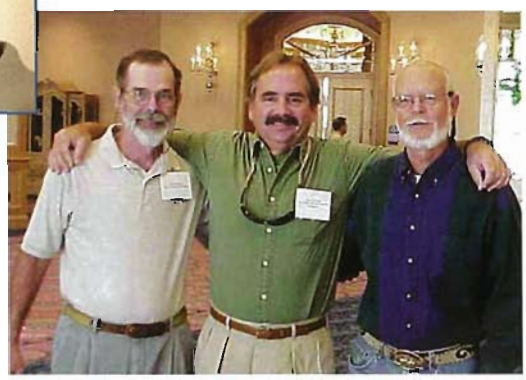


Dr. David Sutton

Dr. David Sutton, Professor of Agronomy at IFAS Fort Lauderdale Research and Education Center is scheduled to retire in April, 2005. Dr. Sutton has contributed a tremendous amount to the field of aquatic plant management and we wanted to share with our readers a short story we received about his work:

"Hardworking and Humble",
by Jess Van Dyke

In late 1971, Dr. Sutton hired me at the IFAS Lab as a Graduate Research Assistant. For me, that meant leaving a Fish Management Specialist position at Florida Fish and Wildlife Conservation Commission (FFWCC) under Rue Hestand, a great boss and my first real mentor. However, the title "Fish Management Specialist" was really code for "one who picks bugs from formalin-laced bottom samples when he is not handling gelatinous gizzard shad three days after a rotenone application." Needless to say, I was excited that I would finally explore the academic side of aquatic science at the impressive IFAS Lab in Fort Lauderdale.



Left to right: Dr. David Sutton, Jess Van Dyke, Rue Hestand.

Much to my surprise, the first "scientific instrument" Dave Sutton handed me was a flat-nose shovel. He asked that I remove the sediment from a dozen or so large, aboveground pools. This material consisted of rotting hydrilla, most of which had made the short trip through the bowels of grass carp. Let's see, think 50% boiled spinach and 50% cow manure. O.K., now stir and let it ferment awhile.

About 8 hours into the project under the warm South Florida sun, and just when I was starting to really miss rotten gizzard shad, "Dr. Dave" drove up in a golf cart and said, "Well, you're still here. Welcome to your new job! I spent many years shoveling chicken coops. It gives you time to think. A good scientist doesn't mind hard work and is served well by a little humility." Wiping the sweat from my face, I smiled and realized I had somehow found another great mentor.

AQUAVINE

Graduate Assistantship Announcement

The Aquatic Plant Management Society's research and education organization, and the Aquatic EcoSystem Restoration Foundation (AERF) are offering a graduate assistantship in the area of aquatic plant management and ecology. Applications must be postmarked no later than April 30, 2005. For details contact: Mr. Donald W. Doggett for details, 239-694-2174, FAX 239-690-2785, doggett@lchcd.org or Mr. Carlton Layne, 3272 Sherman Ridge Dr., Marietta, GA 30064, 678-773-1364, FAX 770-499-0158, <clayne@aquatics.org.

FAPMS Dependent Scholarship Available

The Florida Aquatic Plant Management Society Scholarship and Research Foundation Inc., announces the availability of a scholarship that provides up to a $1,500 to deserving dependents of FAPMS members. Applications must be postmarked no later than June 1, 2005. For further information or to request an application to apply for the scholarship, please contact Don Doggett, Lee County Hyacinth Control District, P.O. Box 60005, Ft. Myers, FL 33906.

Calendar

April 13-15, 2005. **14th Annual Southeastern Lakes Management Conference.** "Lakes, Reservoirs, Watersheds – Challenges and Opportunities." Asheville, NC. www.nalms.org

April 30, 2005. Application deadline for APMS & AERF Graduate Assistantship. For details contact Mr. Don Doggett, 239-694-2174, doggett@lchcd.org or Mr. Carlton Layne, 678-773-1364, clayne@aquatics.org for details

May 9-11, 2005. **20th Annual Symposium of the Florida Exotic Pest Plant Council.** "Weed Be Jammin," Back to our Tropical Roots. Wyndham Casa Marina - Resort and Beach House - Key West, Florida

May 16-20, 2005. **IFAS Aquatic Weed Control Short Course.**

"Aquatic, Upland and Invasive Weed Control; Aquatic Plant Identification." University of Florida, IFAS Extension. Fort Lauderdale, FL. www conference.ifas.ufl.edu/aw/

June 1, 2005. Application deadline for **FAPMS Dependent Scholarship Program.** For details visit web link www.fapms.org/Scholarship_Foundation.html or contact Mr. Don Doggett, Lee County Hyacinth Control District, P.O. Box 60005, Ft. Myers, FL 33906.

June 3-4, 2005. **New England Chapter of North American Lake Management Society Annual Conference**. "On Golden Pond: 21st Century Lake Management." Plymouth State University, Plymouth, NH

June 6-9, 2005. **16th Annual Florida Lake Management Society Conference**, Hawk's Cay Resort, Duck Key, FL. http://flms.net/index.html.

July 10-13, 2005. **45th Annual Meeting of the Aquatic Plant Management Society.** Hyatt Regency, San Antonio, TX. www.apms.org or http://www.apms.org/2005/2005.htm.

November 8-10, 2005. **29th Annual Florida Aquatic Plant Management Society Conference & Resource Demonstration**, Hilton Hotel, St Petersburg, Florida.

November 9 –11, 2005. **25th International Symposium NALMS 2005**. "Lake/Effects: Exploring the Relationship between People and Water." Madison, WI. www.nalms.org

Grants/Scholarships	Web Site Link
FAPMS Scholarship and Research Foundation Inc.	www.fapms.org/Scholarship_Foundation.html
Aquatic Plant Management Society	http://apms.org
Aquatic EcoSystem Restoration Foundation (AERF)	www.aquatics.org/

Invasive Plant Resources	Web Site Link
Florida Aquatic Plant Management Society	www.fapms.org/
Aquatic Plant Management Society	http://apms.org
University of Florida **Center for Aquatic and Invasive Plants, IFAS**	http://plants.ifas.ufl.edu/
Florida Exotic Pest Plant Council (EPPC)	http://plants.ifas.ufl.edu/
Natural Resources Conservation Service (NRCS), US Department of Agriculture	http://plants.usda.gov/
Southeast Exotic Pest Plant Council (SE-EPPC)	www.se-eppc.org/

Non-native Animal Resources	Web Site Link
Habitattitude™ campaign	www.habitattitude.net/
U.S. Fish and Wildlife Services	www.fws.gov/
Pet Industry Joint Advisory Council	www.pijac.org/
National Oceanic and Atmospheric Administration (NOAA)	www.noaa.gov/

On-line Databases	Web Site Link
EDIS, UF/IFAS Electronic Data Information Source.	http://edis.ifas.ufl.edu/
Journal of Aquatic Plant Management	www.apms.org/japm/japmindex.htm
National Institute of Health Scientific Journal Database,	http://home.ncifcrf.gov/research/bja/or www.library.ncifcrf.gov/onlinejournals.asp
APIRS Biliographic Plant Database, IFAS Center of Aquatic & Invasive Plants	http://plants.ifas.ufl.edu/ or http://plants.ifas.ufl.edu/search80/NetAns2/

Aquatics Magazine Submission Guidelines
Florida Aquatic Plant Management Society, Inc

Aquatics magazine is published quarterly as the official publication of the Florida Aquatic Plant Management Society. This publication is intended to keep all interested parties informed on matters as they relate to aquatic plant management, particularly in Florida. The magazine accepts informative articles, summaries of scientific papers, and editorial reviews that focus on aquatic plant management, aquatic wildlife, or related topics. Articles that clearly advertise specific products or technologies will not be accepted unless coauthored by an impartial party (such as a university or public agency) and worded in such a way as to inform the readers without necessarily soliciting purchases of said products or technologies.

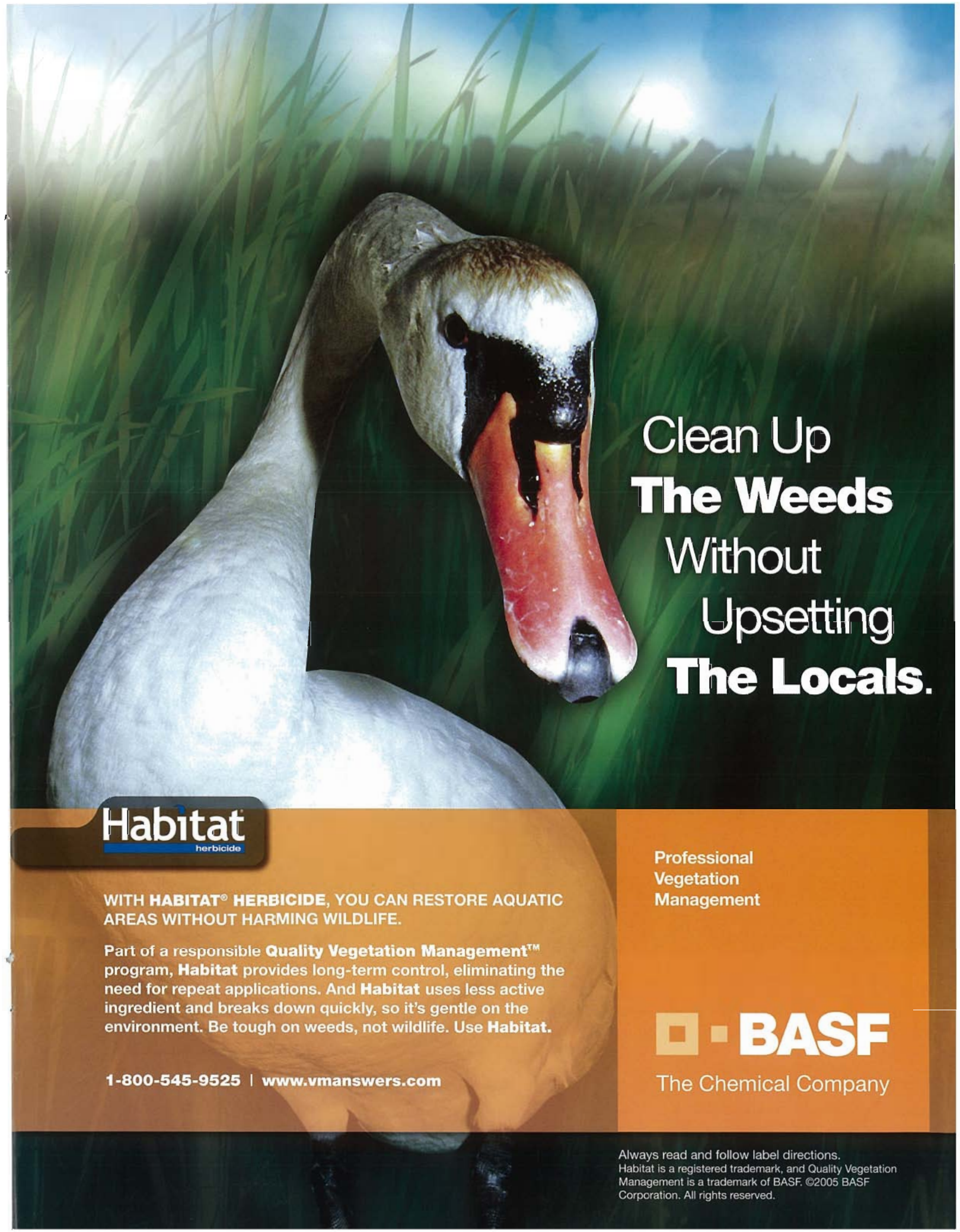
All members are encouraged to submit articles regarding techniques, "tips of the trade", equipment reviews, research in process, helpful web sites, summaries of scientific papers, or any information associated with aquatic plant management. Please contact the editor via email.

Editorial Calendar

Quarterly Issue	Submission Deadline
Spring	February 1st
Summer	May 1st
Fall	August 1st
Winter	November 1st

Submission Guidelines:
Please visit the Florida Aquatic Plant Management Society's web page, www.fapms.org for details on article submittal.

Send all magazine submittals to:
Editor: Jeff Holland
email: jholland@rcid.dst.fl.us
RCID Environmental Services
2191 South Service Lane, Lake Buena Vista, FL 32830
407-824-7324



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