Aquatics

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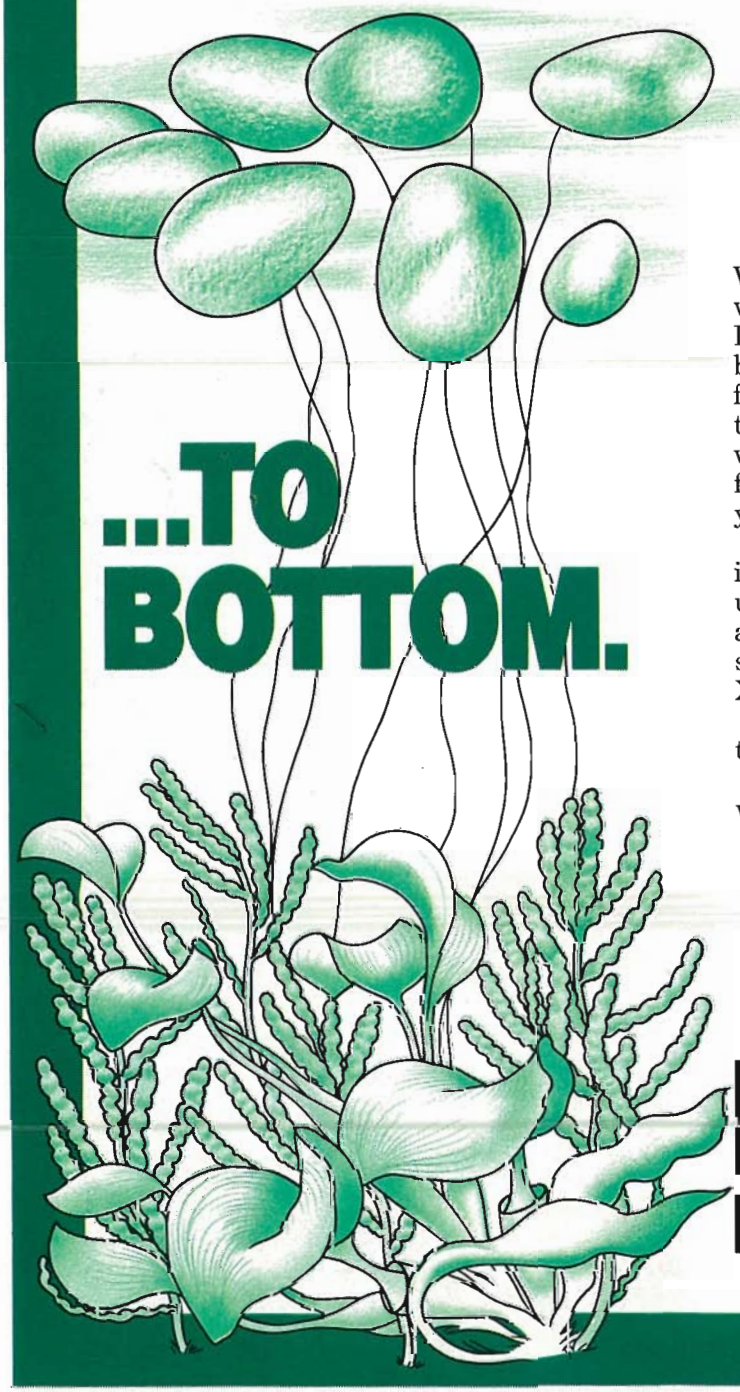

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EDITORIAL

Recently, managers in Florida, as well as in other states where hydrilla has just been introduced, have advocated the use of hydrilla in restoring eutrophic waters for improved fisheries or waterfowl habitat. While hydrilla may provide benefits to a eutrophic system when first introduced such as nutrient absorbtion, decreased turbidity, cover for forage fish and small sport fish and a food source for waterfowl, the potential detrimental effects caused by hydrilla far outweigh any positive short term aspects.

Once introduced in lakes and rivers, hydrilla cannot be effectively managed. Populations have been documented to increase by several thousand acres in one year. Increases of more than 500 acres were recorded during the past two years in 12 Florida waters. The average cost to control hydrilla in Florida was $411 per acre in 1985. A total of $4.5 million tax dollars were thus spent yet hydrilla increased by over 6,000 acres in 1985. Add to this, the loss of more than 10 million fish from oxygen depletion in hydrilla-choked Rodman Reservoir and Lake Winder along with the economic loss surrounding these and other waters afflicted by hydrilla, and it should be clear that hydrilla is a poor choice for management in lakes and rivers.

Rather than encourage the spread of hydrilla because of the ease and up-front low expense of establishment, time must be taken to correct watershed problems and to find native vegetation beneficial to fish and waterfowl which can be planted into systems requiring restoration.

by Jeff Schardt

ABOUT THE COVER

Weed control without a permit? This cattail damage is a response to feeding by the cattail caterpillar, *Simyra henrici*.
Caterpillar photo by: Dale Habeck
Cattail photo by: Jim Kelley

Aquatics

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CONTENTS

AQUATICS: Published quarterly as the official publication of the Florida Aquatic Plant Management Society. This publication is intended to keep all interests informaed on matters as they relate to aquatic plant management particularly in Florida.

EDITORIAL: Address all correspondence regarding editorial matter to Daniel Thayer, Editor, "Aquatics" Magazine, 7922 N.W. 71st Street, Gainesville, FL 32606.

WATER SPRITE

by

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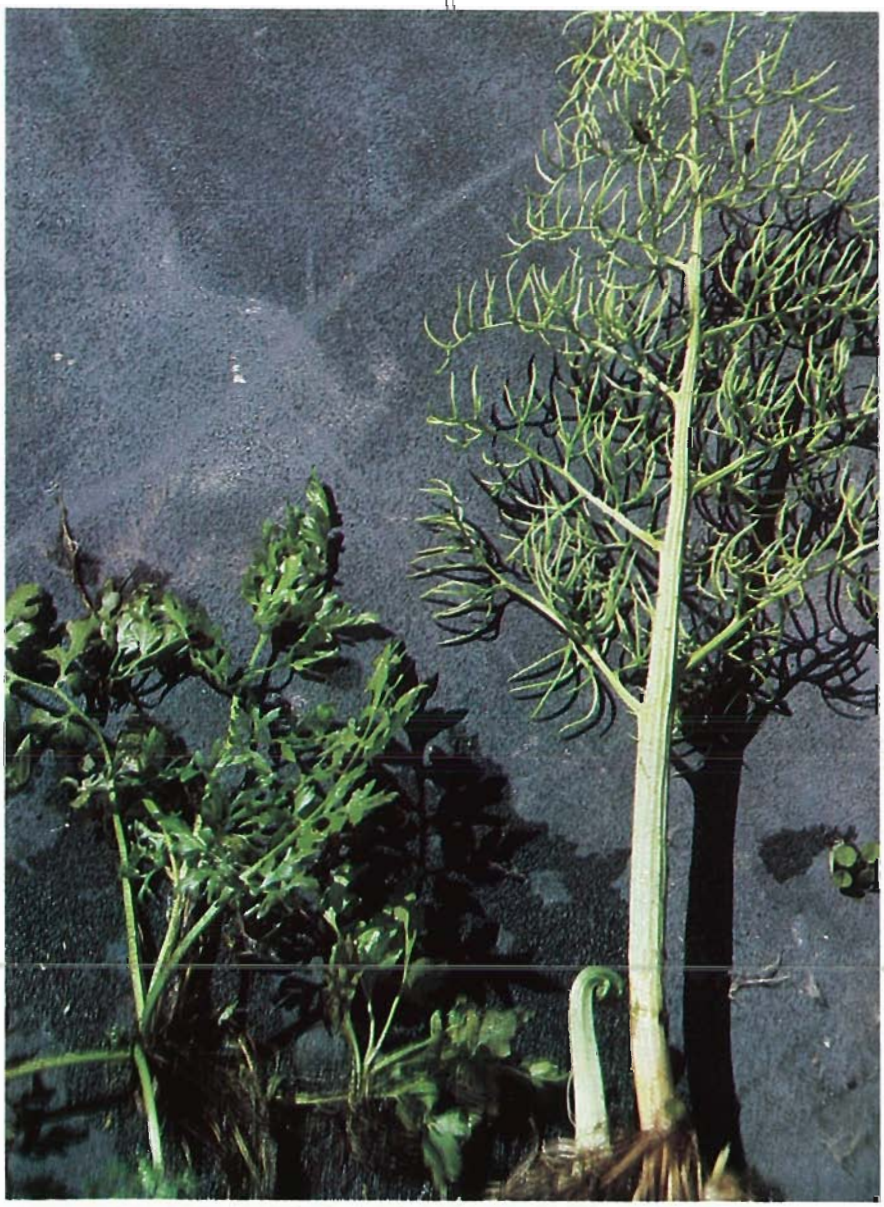
Introduction and Taxonomy

"All is change," said Confucius, or some great sage, yet its true that the familiar may change and present an unexpected new aspect. Such is the case within the family Parkeriaceae or the floating water ferns. Four species are commonly called water sprite and comprise the genus *Ceratopteris*. The species are *C. cornuta, pteroides, richardii,* and *thalictroides*. The members of the genus can change and seem very unfamiliar as their life cycles progress.

Life Cycle and Growth

Water sprite are true ferns and as such exhibit alternation of sexual and asexual reproductive modes. This alternation of generations is most overtly apparent by differences in the fronds themselves. Fertile, spore-bearing fronds differ from sterile, vegetative ones in shape and structure. The sterile fronds are most often found growing entirely underwater. Identification confusion may occur when the fertile, aerial fronds present their filiform, highly dissected and celery stalk-like shapes in the same shallow and littoral waters.



Vegetative fronds (left) and fertile fronds (right) of water sprite.

Distribution

The Parkeriaceae are reported to be South American and African natives. Introduction to North American likely occurred by avian and anemophilous transport. Small plantlets can adhere to migrating birds and the minute spores, when released from fertile frond sporangia, can be carried by the wind. Reports of manatees bearing rucksacks stuffed with sprite have not been confirmed. *C. deltoidea* and *thalictroides* were both reported in Florida along the Gulf Coast as early as 1880, (Small). *Ceratopteris* species may be found in flowing waters but are fragile and easily fragmented. More common habitats are slowly moving and lacustrine waters. The plants are cold-intolerant and distribution is limited to the tropics and sub-tropics. All plant parts except the roots are considered edible with Austalian reports holding that the unopened frond fiddleheads make a nice addition to wallby stew, (Author-personal communication).

Water sprite is widely cultured for sale as an aquarium plant and has, undoubtedly, achieved wider distribution since the advent of this transport mechanism. Pantropical distribution is now reported. Typically, the submersed, sterile adult stage of the plant is sold. When encountered in the field this plant stage may be free-floating, rooted on mud or in "floating island" communities. The sterile fronds are usually three to thirty inches long and two to six inches wide with oblong rounded lobes. They strongly resemble spinach leaves. These fronds may be floating, submersed and, rarely, emersed. Typically pale green, the basal frond stipes may be spongy and air-filled.

Reproductive Modes

As in all true ferns an alternation of generations occurs during the *Ceratopteris* life cycle. These generations are most evident as the fertile and sterile stages of the plant. The vegetative plant is predominant and not sexually reproductive. In Florida, re-establishment of the vegetative plant after cold season dormancy leads to fertile frond formation during the summer and fall. Both frond types may arise from the same plant.

Sexual reproduction occurs as the fertile, emergent frond releases spores that develop into prothalli. The prothallus is a minute plant body which

releases male and female gametes while submersed or on mud. The gametes unite to form and embryo that develops into the plant of the new generation.

Vegetative reproduction occurs in the axils of both fertile and sterile fronds by offsetting of plantlets. Such offsetting of daughter plants genetically identical to the mother plant occurs in many higher plants as in the water-hyacinth (*Eichornia crassipes* [Mart.] Solms.). *Ceratopteris* offsets are first noticed as small buds at frond indentations. These develop into distinct plants following separation from or the death of parent plants.

Habitat and Conclusion

Water sprite can be found in Florida waters floating in mats of water-hyacinth, waterlettuce (*Pistia stratoites L.*), and other floating tussock-forming plants such as sedges, smartweed, and water primrose. Also, it inhabits the shoreline, often in calm embayments and coves. The submersed, vegetative plant has an unique appearance but the emergent fertile sporphylls may be confused with aquatic members of the carrot family (Umbelliferae) or even European celery since the basal stipe is ribbed. The stalk is non-fibrous, though, and the spongy, air-filled tissue is delicate despite its robust appearance.

The Department of Natural Resources *1982 Aquatic Plant Survey*, reported water sprite from only one site. The *1983 Survey* reported five sites and eight sites totalling 12 acres of coverage are reported from 1984. The predominantly submersed infertile growth may hinder field identification of this phase. The aerial growth can be quite substantial yet seem odd and unexpected. When encountered it may have been overlooked, rather hopefully, like an obnoxious cousin at a family reunion.

Water sprite is a well-established and, to date, non-problematic element of the Florida aquatic flora which is encountered in both pristine and disturbed waters. In my experience, although the plants are succulent, they show no apparent signs of having been grazed upon. While the plant may not serve as a major faunal food item the fronds and filamentous roots undoubtedly provide substrate for periphyton and invertebrate growth and as such contribute to the overall richness and diversity of Florida waters.

Small, John K., 1931. *Ferns of Florida*, The Florida Press, New York, 49-51.

PDA: THE NOT-SO NEW APPROACH TO AQUATIC WEED CONTROL

BY

John Barltrop, Barbara B. Martin, and Dean F. Martin

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Introduction

PDA, an abbreviation for "photo-dynamic action," refers to the light-dependent lethal effects that certain colored organic substances have upon organisms. The effect was first observed in 1900 by Raab (1), who treated paramecia with acridine. The term PDA was coined by von Tappeiner 1906 (2). Since then, many studies have been done on this phenomenon, but we believe that the potential for PDA management of noxious aquatic plants has not been well appreciated.

The application of PDA to management of noxious submersed aquatic plants was suggested by several observations (3). First, we saw how effective the approach could be in laboratory studies of the unarmored dinoflagellate *Ptychodiscus brevis* (4,5). Secondly, a review of the literature (6) indicated several instances in England and the United States when hydrilla and similar plants either failed to thrive or spontaneously disappeared in areas where colored organic materials were either present or being produced. Finally, Quimby (7) noted the effectiveness of hydrogen peroxide in limiting the growth of hydrilla in laboratory studies, and we recalled that some investigators have ascribed the effect of PDA to the production of the hydroperoxide radical at critical sites in plant membranes. Also, the effectiveness of Fluoridone is ascribed to inhibition of carotenoid synthesis and subsequent photodestruction of green pigments (8).

PDA is now considered (9) to depend upon the conversion of ordinary oxygen (called "triplet oxygen") into an electronically excited form known as "singlet oxygen." This conversion required transfer of an appropriate amount of energy, usually from visible or ultraviolet radiation. Colored organic substances absorb light energy (photons) from sunlight and upon collision with oxygen molecules transfer the energy. The colored substances are called sensitizers, and the singlet oxygen produced is a violent oxidizing agent that is capable of oxidizing a large range of organic molecules, including, of course, cellular constituents. A cell exposed to light and oxygen will die, unless repair mechanisms can operate faster than the rate singlet oxygen can destroy or inactivate cellular components. Plants do, of course, produce protective agents called quenchers (e.g. carotenoids), whose function is to inactivate singlet oxygen and convert it to ordinary oxygen.

To be effective in a management scheme, the rate of production of singlet oxygen within the plant must exceed the rate of generation within the cell of critical constituents. Obviously, many plants that contain sensitizers, e.g. chlorophyll, manage to play the game and produce quenchers (carotenoids) and survive.

Continued on page 8

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PDA *from page 5*

From extensive investigations, it appears that

(1) no organism thus far investigated is immune to damage or destruction by PDA;
(2) species-dependent selective toxicity is often observed;
(3) for unicellular organisms, variation in the structure of the colored substance causes binding to occur at different locations within the cell, so that the site of PDA is subject to control;
(4) a considerable degree of design by calculating chemists in synthesizing better colored substances for better selectivity is possible.

Research at the CHEMS Center on the applications of PDA is an on-going collaboration, and we have found that some dyes can be used to reduce the growth of single-celled organisms (4), that some dyes affect hydrilla in laboratory studies (3), that sediment components do show PDA toward hydrilla and that singlet oxygen is involved (10), and that not every dye works; some like Aquashade® function by shading, not by PDA (11).

At the CHEMS Center, we believe that PDA is a not-so-new approach to management of problem plants that has the potential for selective control, cost effectiveness, demonstrated success, and even, colorful research. On-going research indicates the potential of PDA for management of undesired aquatic plants; the realization of additional field applications may take a while.

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THE REVEGETATION OF ORLANDO LAKES

BY

Roger M. Cox

City of Orlando

Until recently, hydrilla *(Hydrilla verticillata)* and water hyacinths *(Eichhornia crassipes)* were the main aquatic plant problem that existed in the lakes maintained by the City of Orlando Bureau of Streets and Drainage, Orange County. Orlando's twenty years of aquatic weed control, which has been mainly a spray dominated operation, has now evolved into a multi-faceted concept, covering several aspects of aquatic plant control.

Through past work with the diploid, hybrid and now triploid grass carp, along with herbicides, we have most of the hydrilla infestations at a management level. Herbicides have been the major tool used to control infestation of water hyacinths, although some damage by the water hyacinth weevils (*Neochetina bruchi* and *Neochetina eichhorniae*) has been noticed. With the two problem exotic species at a maintenance level, we decided to develop a work plan to address the shoreline vegetation.

Phase I of the work plan was to survey all aquatic vegetation on the lakes. There are 77 lakes within the city limits which range in size from 1 to 320 acres. The City of Orlando has jurisdiction over 45 sovereign lakes. The remaining 32 lakes are privately owned by homeowners or associations.

The survey was conducted from an airboat to document the location, amounts of vegetation and different species of aquatic macrophytes that were present. Additionally, a city photographer took aerial photographs of Orlando's lakes. From these pictures were made overlays of each lake to map the location of vegetation.

Phase II of the work plan was to review the survey information. We noticed the shorelines were dominated by undesirable vegetation, both exotic and native species. We considered cattail (*Typha* species), water primrose (*Ludwigia octovalis*), alligatorweed (*Alternanthera philoxeroides*) and torpedograss (*Panicum repens*) undesirable because they were limiting boat access, were aesthetically displeasing and prohibiting the expansion of desirable aquatic plants. Since only six lakes have public boat ramps, shoreline access is very important for those people in Orlando who fish from the lake banks.

Phase III was to target undersirable vegetation for aquatic herbicide treatments. The recent introduction of new formulations of aquatic herbicides helped to achieve satisfactory results on sprayed vegetation. We left undesirable native and exotic macrophytes unsprayed to encourage their expansion while treating targeted species. Examples of non-targeted macrophytes already present in Orlando's lakes are maidencane (*Panicum hemitomon*), knot-grass (*Paspalidium geminatum*), fuirena (*Fuirena scirpoidea*), elephant ears (*Colocasia luteum*), arrowhead (*Sagittaria lancifolia*), Spatterdock (*Nuphar luteum*), pickerelweed (*Pontederia lanceolata*) and cyperus *(Cyperus species)*.

Phase IV was to determine and locate desirable macrophytes to introduce. Our survey showed that bulrush (*Scirpus californicus* or *Scirpus validus*) did not exist in any of Orlando's lakes. This is one plant we intended to use to replace treated cattails.

With the assistance of the Department of Natural Resources (DNR) and their statewide aquatic vegetation survey, we were able to locate collection sites for giant bulrush. We checked three potential sites for revegetative plant material. A site inspection of East Lake Tohopekaliga in St. Cloud and Lake Hart in Orange County showed that bulrush was growing in water too deep for retrieval. We selected the St. Johns River as our most promising location because it was close to an adjacent boat ramp and also the shallow depth of the bulrush collection site made it easier to remove the plant.

We also noticed from the survey, the absence of cypress trees in and around the lakes. Areas of undeveloped city

property and ditches adjacent the Beeline Expressway, between Orlando and the St. Johns River, were excellent collection sites for obtaining cypress trees. We may have possibly prevented destruction of several trees by relocating them from the Beeline Expressway. These trees would have been destroyed by mechanical maintenance of the ditches; therefore, we feel the trees were optimally utilized by being transplanted.

Phase V covers the revegetation of desirable native and exotic macrophytes. Our season for herbicide spraying usually concludes during the month of December. Four aquatic technicians, two from the airboat and two from the spray truck crew, are then available to transplant vegetation. Also available for plant revegetation are fourteen maintenance workers. Four personnel normally operated weed-eaters and use backpack sprayers for shoreline vegetation control, while the remaining ten use large mowers and weed-eaters to manage ditch bank vegetation.

Herbicide treatment work and aquatic vegetation schedules for physical removal are submitted to DNR under our aquatic work plan. Upon approval of the work plan, which goes into effect the first day of each October, herbicides are sprayed prior to the physical removal. Probably the most frequently treated undesirable aquatic plant under this program is torpedograss. Past experience has shown that when desirable macrophytes are transplanted into areas where the torpedograss was sprayed and not removed, the torpedograss has re-established with dominance over the revegetated desirable plants.

The winter months may seem like an inopportune season for our personnel to be working in the lakes and the St. Johns River. There are several cold mornings we would rather be doing something else besides digging plants in thigh high water and this is especially true when your hipboots suddenly fill with cold water.

The most important reason for winter revegetation is that plants are more dormant than in any other season. During the winter the plants store extra starches in their roots and rhizomes which allows them to survive the transplant with minimal shock.

The only set back to transplanting during the winter is a hard freeze. The Orlando area has had three consecutive years of hard freezes during which we have lost revegetative plants at collection and transplant sites. Therefore, softer and more succulent plants like arrowhead, elephant-ears and pickerelweed are revegetated during warmer spring months while cyperus, bulrush and cypress trees are collected and transplanted in the colder winter months. Most often these plants are obtained from outlying city ditches and those of Orange County.

Although some isolated transplanting has been done in the past, the first major revegetation of desirable macrophytes was during the winter of '84/'85. Having obtained a DNR 16C-19 Aquatic Plant Importation, Transportation and Cultivation Permit, we vegetated one lake with arrowhead, one with pickerelweed, eight with giant bulrush, nine with elephant-ears and seventeen with cypress trees. All transplanting work was accomplished with only six employees.

The transplanting of cypress trees generated more positive reaction by the community than anything else we did that winter. On one site revegetated with several trees, a citizen had placed supports around four of the trees that were starting to fall over. Another citizen, extremely pleased with the work, wrote the Mayor of Orlando, Bill Frederick, a letter complimenting us on our efforts to re-establish vegetation and cypress trees.

Figure 1. Bulrush and elephant-ear plantings on Lake Lorna Doone.

We did experience a very small amount of vandalism to some of the transplanted trees and macrophytes. At one site, bicycle tire tracks were noticed through some of the revegetated bulrush. At a couple other locations the tops of some small cypress trees had been broken. Also, people were observed using these trees as fishing pole supports.

We feel cypress trees should be dug

and transplanted during their dormancy. If a recently transplanted tree falls over after foliage has established, replanting rarely is successful. We have transplanted established cypress trees during March after foliage had flourished and have had little success with survival rates.

We transplanted cypress trees from standing water and also from areas that were dry. The height of the trees ranged from four to fifteen feet with a diameter of two to six inches. We were interested in transplanting as many trees as possible, so we bare rooted all these trees instead of using the root ball technique. Also, the trees were taken to the lakes and planted in the shallow margins in the same afternoon that they had been dug. The survival rate for these trees have been approximately 80%, which we consider an extremely successful program.

The transplanting of giant bulrush has been the most successful aquatic macrophyte. We learned from past mistakes that by planting the bulrush too deep, the plant survived well but did not expand rapidly. We experienced faster expansion when the rhizomes were anchored slightly into hydrosoil, about three to four inches deep.

Early plantings of elephant-ears were in a straight line around the lakes' edge. We had plants at several locations die when using this method. Later when revegetating the same areas with elephant-ears, we grouped the plants together and had better success.

Now we are using the grouping technique when transplanting all other desirable vegetation. Grouping the plants together provides better protection when the young tender growth starts to flourish and the expansion is faster. This was most evident when transplanting cyperus, arrowhead and pickerelweed.

Figure 2. Arrowhead plantings on Lake Underhill.

In addition to the list of transplanted macrophytes we are planning to use maidencane, knot-grass, *Fuirena*, golden canna (*Canna flaccida*), and *Cyperus elegans*.

Although some of these species are exotic, experience has shown that they can be used effectively in our program and if necessary managed economically with herbicides.

Phase V of our work plan will continue for years to come. Eventually, in Phase VI, we will work with emersed and submerged species of vegetation; such as yellow water-lily (*Nymphaea mexicana*), fragrant water-lily (*Nymphaea odorata*), tapegrass (*Vallisneria americana*). musk-grass (*Chara* species) and stonewort (*Nitella* species).

In summary, when the general public sees us planting vegetation and encouraging the expansion of desirable native and non-native plants, we hope that they will realize we are doing more than killing weeds with chemicals, although we still rely on the use of herbicides to keep the vegetation under control. We feel our program has progressed from a herbicide dominated operation to a more integrated management concept, which expands our motto, "The City Beautiful" into lake management. Therefore, we view the work we are doing as "aquascaping."

We would like to express our thanks to: The Army Corps of Engineers Aquatic Plant Control Section, Palatka; the Orlando Maintenance Section of the Department of Transportation; The Greater Orlando Aviation Authority, and Orange County Pollution Control for their cooperation in allowing us to obtain these plants and trees at no cost. The only expense incurred by the City of Orlando in this program were the costs of equipment and labor.

WHAT'S COOKING IN AQUATICS

BY
Beth Layer

CATTAIL POLLEN PANCAKES

1 package powdered yeast
1½ cups warm water
2 tablespoons safflower oil
1 tablespoon sugar
2 eggs
1 cup whole wheat flower
1 cup toasted wheat germ
3 to 4 tablespoons cattail pollen
¼ cup powdered milk

Stir yeast into warm water. Add the oil, sugar, eggs. Mix well. Then add the remaining ingredients. Let stand in a warm place for 30 minutes. Bake on a hot griddle. This batter can be mixed the previous evening then refrigerated for later use.

Continued on page 22

ELANCO

INTRODUCES

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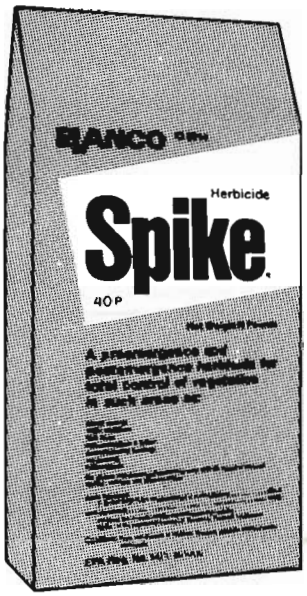

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THE STATUS OF WATER-HYACINTH AND HYDRILLA IN FLORIDA WATERS — 1985

by

Jeff Schardt

A total of 467 water bodies with a combined surface area of 1,221,750 acres of fresh water were inventoried during 1985 for presence and abundance of Florida's two most troublesome aquatic plant species, water-hyacinth (*Eichhornia crassipes*) and hydrilla (*Hydrilla verticillata*). This survey encompassed 326 lakes (1,011,438 acres), 71 rivers (172,543 acres and 70 canal systems (37,769 acres) representing approximately 50% of Florida's reported 2.5 million acres of fresh water (Table 1). The majority of the water not surveyed was in the Everglades National Park, its adjacent wetlands and the water conservation areas of South Florida.

Water-hyacinth and hydrilla distributions recorded during 1985 are compared with survey results from 1982-1984. These two species are of primary importance to the Bureau of Aquatic Plant Reasearch and Control because they have historically posed the greatest biological and commercial restrictions within Florida waters.

TABLE 1
Number of Water Bodies, and Acres of Water Surveyed During 1982 - 1985

	1982	1983	1984	1985
Lakes				
Number	279	327	331	326
Acres	996,777	1,033,816	1,036,961	1,011,438
Rivers				
Number	55	66	69	71
Acres	159,441	171,128	172,251	172,543
Canals				
Number	62	67	61	70
Acres	33,071	46,859	39,288	37,769
Total				
Number	396	460	461	467
Acres	1,189,289	1,251,803	1,248,500	1,221,750

The Department of Natural Resources has been designated by the Florida Legislature as the lead agency in managing aquatic plants within the state, and as such, has designed this survey as part of a statewide plan to monitor and control the spread of harmful or undesirable aquatic growth in Florida's fresh water. The goal of the Department is to reduce the abundance of water-hyacinth and hydrilla along with other exotic or native pest species through a continuing maintenance program while promoting the re-establishment of a diverse community of beneficial native vegetation. By keeping fast growing, exotic plant populations at a minimum, herbicide use (which is the primary means of aquatic plant control in Florida) is reduced, fewer tax dollars are spent to achieve control of aquatic plants and waterways remain accessible allowing the continued exchange of water use related to commerce. To that end, aquatic plant control during 1985 scored one success with water-hyacinth, and one setback — with hydrilla.

Water-hyacinth — Success

For years water-hyacinth was the most formidable problem facing aquatic plant managers in Florida. During the past 10 years, a more centralized approach to water-hyacinth control has been conducted. This, coupled with adequate funding, the introduction of various biological control agents and the several herbicides available, has dropped water-hyacinth far behind hydrilla as a pest species in Florida. Records indicate that in the middle 1970's, approximately 40,000 acres of waterhyacinth were present in Florida lakes and rivers (no records available for canals). In 1985, only 5,800 acres were present.

Water-hyacinth presence in Florida waters remained stable during the past three years, occuring in approximately 63% of the waters surveyed (Table 2). Canals were most often affected as more than 70% of the flood control systems inspected since 1982 harbored water-hyacinth. A peak of 80% was recorded during 1985. The percentage of lakes supporting water-hyacinth slightly increased from 54% in 1982, to 60% in 1985. However, waterhyacinth

presence in rivers declined during the past three years from a high of 73% to 63% in 1985.

TABLE 2
Water-Hyacinth Presence and Abundance in Lakes, Rivers and Canals

	1982	1983	1984	1985
Lakes				
Number	150	191	203	194
Acres	5,289	15,400	7,332	3,329
Rivers				
Number	32	8	46	45
Acres	1,917	3,410	1,123	1,174
Canals				
Number	44	49	43	56
Acres	1,146	1,797	1,054	1,285
Total				
Number	226	288	292	295
Acres	8,352	20,607	9,509	5,788

Water-hyacinth remains scattered throughout the state, primarily in the central and southern regions. However, in 1985, water-hyacinth was under the best maintenance control in years, possibly since problems were first reported along the St. Johns River in the late 1800's. This control has come at a high price. For years, rafts of water-hyacinth uprooted native vegetation, stunted fisheries and contributed to the filling in of Florida's waters at a rate of more than four tons of dry sediment per acre of plants each year. Millions of dollars have been spent researching biological, chemical and mechanical controls and even more millions were spent actively controlling this exotic pest.

More than 90,000 acres of water-hyacinth were chemically treated in Florida during the past two years of a net reduction of only 15,000 acres in the standing crop. That is, roughly six acres were treated to eliminate every one acre of plants. therefore, populations must be maintained at the lowest levels possible to reduce environmental costs and the expenditure of tax dollars in controlling water-hyacinth.

While the total number of systems affected remained fairly constant, plant acres fluctuated widely, due first to weather conditions and then to a strong management effort. Following a two year drought, water levels rose during 1982, germinating dormant water-hyacinth seeds, and the 8,300 acre population blossomed to more than 20,000 acres in 1983.

Cold weather during the winter of 1983 helped to reduce coverage somewhat, but Department of Natural Resources records show that nearly 50,000 acres of water-hyacinth were chemically treated during 1983, using either 2,4-D or diquat formulations. This effort was evident in 1984, an additional 41,000 acres were controlled resulting in a standing crop covering 5,800 acres in 1985.

Water-hyacinth acreage in canals and rivers was maintained at fairly low levels during each survey year because of the importance of these systems to flood control and navigation. The maximum water-hyacinth coverage occurred in 1983 when nearly 1,800 and 3,400 acres were reported in canals and rivers, respectively. Water-hyacinth was reduced in canals to approximately 1,300 acres in 1985; slightly less (approximately 1,200 acres) was present in rivers. The largest reduction (2,124 acres) occurred in the St. Johns River in 1984.

Istokpoga and Lake Hatchineha. The St. Johns River Water Management District removed nearly all water-hyacinth from Lake Lachloosa and continued the reduction to less than 100 acres on Orange Lake, in each case by applying 2,4-D. In 1983, more than 2,000 acres of water-hyacinth were present on Orange Lake. Additionally, the St. Johns River Water Management District reduced water-hyacinth on Lake Sawgrass to only 25 acres in 1985 using diquat. Diquat was also used by the Southwest Florida Water Management District within Lake Rousseau. The COE removed water-hyacinth from Lake George using 2,4-D as did managers from Melbourne-Tillman and Orange County to control water-hyacinth within their flood control canals.

Table 3
Largest Water-hyacinth Population Changes, 1984 - 1985

Water Body	County	Water Acres	Plant Acres	Amount of Change
1. Lake Okeechobee	Okeechobee	448,000	515	1,489 D*
2. Lake Lochloosa	Alachua	5,705	12	368 D*
3. Lake George	Volusia	46,000	175	345 D*
4. Lake Kissimmee	Osceola	34,958	50	290 D*
5. Lake Rousseau	Citrus	4,000	45	280 D*
6. Melbourne-Tillman DD	Brevard	3,026	50	245 D*
7. Lake Istokpoga	Highlands	27,692	172	188 D*
8. Orange County WMD	Orange	2,172	65	185 D*
9. Lake Hatchineha	Osceola	6,665	90	10 D*
10. Lake Sawgrass	Brevard	407	25	155 D*
11. Orange Lake	Alachua	12,706	95	155 D*

D = Decrease, * Significant Change

Most of the statewide water-hyacinth reduction of the past two years occurred in lakes after a 10,000 acre increase was recorded between 1982 and 1983. An 8,000 acre reduction was brought about in 1984, mainly from control in Lake Okeechobee (3,300 acres) and Orange Lake (1,900 acres). An additional 4,000 acres statewide reduction was reported for lakes in 1985, again predominantly from control efforts in Lake Okeechobee (1,500 acres).

Of the water bodies common to the 1984 and 1985 surveys, 124 supported water-hyacinth increases, but only 19 were significant for an increase of 1,039 acres. (Significance, for the purpose of this report, was a change of at least 20 acres and an overall 20% or more change in the population). The largest increases occurred in the upper Myakka Lake (115 acres) and in Barron Water Control District Canals (101 acres) where little or no water-hyacinth control occurred in 1985.

One hundred thirty-seven water-hyacinth population reductions were reported in 1985. Twenty-six were significant accounting for a total reduction of almost 5,000 acres. Table 3 presents the largest water-hyacinth population changes in 1985; all are reductions. The South Florida Water Management District, using a combination of 2,4-D and diquat reduced water-hyacinth on Lake Okeechobee, Lake Kissimmee, Lake

Table 4
Largest Water-hyacinth Population, 1985

Water Body	County	Water Acres	Plant Acres
1. St. Johns River	St. Johns	96,000	529
2. Lake Okeechobee	Okeechobee	448,000	515
3. Lake Tsala Apopka	Citrus	19,285	230
4. Lower Myakka River	Sarasota	640	180
5. Lake George	Volusia	46,000	175
6. Lake Istokpoga	Highlands	27,692	172
7. Withlacoochee River	Citrus	3,600	160
8. Broward County APC	Broward	1,460	150
9. Lake Talquin	Gadsden	8,850	150
10. Puzzle Lake	Seminole	1,300	130

Hydrilla — Setback

Although, water-hyacinth, for the most part, has been reduced to maintenance levels in Florida, hydrilla continues to flourish. Compared to water-hyacinth, the percentage of waters containing hydrilla was low, yet steadily increased during each survey year from 41% in 1982, to just under 50% in 1985 (Table 5). As with water-hyacinth, flood control systems were most often affected. At least 90% of the canals inspected each year contained hydrilla. Hydrilla has

spread to several rivers since 1983, when only 38% were affected. In 1985, 49% of the rivers inspected supported hydrilla as five new populations were found. The number of lakes supporting hydrilla also increased during each survey year from 30% in 1982, to 38% in 1985. Eight lakes in which hydrilla had not previously been identified, contained small populations in 1985.

Table 5

Hydrilla Presence and Abundance in Lakes, Rivers and Canals

	1982	1983	1984	1985
Lakes				
Number	83	120	123	124
Acres	34,482	34,035	39,308	46,589
Rivers				
Number	24	25	30	35
Acres	3,603	5,856	2,391	2,082
Canals				
Number	56	61	58	63
Acres	3,621	5,503	4,539	3,805
Total				
Number	163	206	211	222
Acres	41,706	45,394	46,238	52,476

During 1982, hydrilla was the most abundant aquatic plant species encountered (41,706 acres) covering nearly three times as much water surface as cattails the second most prevalent species. Despite a statewide net increase of 3,700 acres in 1983, hydrilla was replaced by cattails as the most abundant plant species in Florida public waters. During 1984, hydrilla was re-established as the most abundant plant surveyed with more than 46,000 acres reported. Coverage continued to increase in 1985, by approximately 6,200 acres, surpassing 50,000 acres for the first time during the four survey years.

The 1985 total represents an increase of more than 26% over 1982. Although, reduced to its lowest levels in canals and rivers during 1985, hydrilla was more abundant in lakes (46,589 acres) than ever before. The 7,300 acre increase from 1984 is the largest single year increase during the survey. More alarmingly, in just four years, hydrilla acreage in Florida lakes has risen by 37%. The increase has occurred despite more than 50,000 acres and $12 million of control since 1981.

In 1985, 98 hydrilla reductions were recorded in public waters. Nearly half (42) were significant for a decrease of more than 9,300 acres. Major hydrilla reductions in 1985 are listed in Table 6.

Table 6

Largest Hydrilla Population Changes, 1984 - 1985

Water Body	County	Water Acres	Plant Acres	Amount of Change
1. Lake Lochloosa	Alachua	5,705	4,500	4,087 I*
2. Orange Lake	Alachua	12,706	3,500	3,040 I*
3. Lake Rousseau	Citrus	4,000	1,980	1,480 I*
4. Lake Pierce	Polk	3,729	55	1,225 D*
5. Lake Winder	Brevard	1,496	1,200	1,106 I*
6. Lake Worth DD	Palm Beach	1,703	225	975 D*
7. Lake Kissimmee	Osceola	34,948	1,000	865 I*
8. Upper Myakka Lake	Sarasota	1,020	160	790 D*
9. Lake Harney	Volusia	6,058	800	778 I*
10. Withlacoochee River	Citrus	3,600	1,250	770 I*
11. Lake Harris	Lake	13,788	55	595 D*
12. Crystal River	Citrus	1,650	50	590 D*

I = Increase, D = Decrease, * Significant Change

The Polk County Environmental Services applied fluridone to Lake Pierce in 1984 reducing hydrilla by more than 1,200 acres. Illinois pondweed (*Potamogenton illinoensis*- and eelgrass (*Vallisneria americana*) increased almost immediately after hydrilla began to decline and may be partially responsible for retarding hydrilla regrowth. The Southwest Florida Water Management District controlled hydrilla in upper Myakka Lake by treating with fluridone in late 1984, then following up with chemical treatments of endothall and, to a lesser extent, diquat. Almost 1,000 acres of hydrilla were removed from Lake Worth flood control canals through the use of a combination of either endothall or diquat and copper compounds. Hydrilla was reduced by nearly 600 acres in Lake Harris by the efforts of the Lake County Water Authority using fluridone in addition to minor treatments of diquat.

The Crystal River underwent a 600 acre hydrilla reduction in 1985, after Hurricane Elena. Wave action and salt water forced deep within the Kings Bay area from high winds, have both been credited for the decline. About 50 acres of hydrilla remained after the storm, concentrated in the headwater springs and remote canals.

Although hydrilla acreage declined in nearly 100 waters during 1985, 113 population increases were recorded. Thirty-five increases were significant accounting for more than 15,000 acres. The increases are attributable to a lack of funding, the temporary loss of the experimental use herbicide, fluridone, and a reluctance to control hydrilla in several major lakes. The EPA Experiment Use Permit for fluridone expired in June 1985 cancelling scheduled retreatments within Lake

Lochloosa and Orange Lake. Both of these waters, which had been relatively free of hydrilla for two years following 1983 fluridone treatments, experienced rapid hydrilla regrowth in 1985. The 1984 survey reported approximately 400 acres of hydrilla in Lake Lochloosa. By the middle of 1985, 2,300 acres were present; 4,500 acres by the end of the year. Similar results were observed in Orange Lake where hydrilla expanded from 460 acres in 1984 to 1,000 acres by June 1985 and 3,500 acres at year's end.

As tannic water receded from a high level in 1984 in Lake Rousseau and the Withlacoochee River, hydrilla recolonized shallow portions of these waters increasing in Lake Rousseau from 500 to 1,500 acres and from approximately 500 to 1,300 acres in the Withlacoochee River.

More dramatic increases were reported in Lakes Winder, Harney and Kissimmee. The hydrilla population in Lake Winder, part of the headwaters of the St. Johns River, remained below 100 acres from 1982 - 1984 then spread to cover 1,200 acres in 1985. Hydrilla in Lake Harney, also at the head of the St. Johns River, varied between 2 - 25 acres from 1982 - 1984. In 1985, 800 acres were reported. Hydrilla was not recorded in Lake Kissimmee in 1982; less than one acre was found in 1983, 135 acres in 1984 and approximately 1,000 acres in 1985.

TABLE 7

Largest Hydrilla Populations, 1985

Water Body	County	Water Acres	Plant Acres
1. Lake Okeechobee	Okeechobee	448,000	21,918
2. Lake Lochloosa	Alachua	5,705	4,500
3. Rodman Reservoir	Putnam	5,280	3,600
4. Orange Lake	Alachua	12,706	3,500
5. Lake Rousseau	Citrus	4,000	1,980
6. Withlacoochee River	Citrus	3,600	1,250
7. Lake Winder	Brevard	1,496	1,200
8. Lake Kissimmee	Osceola	34,948	1,000
9. Lake Harney	Volusia	6,058	800
10. Lake Istokpoga	Highlands	27,692	600

Thirteen additional lakes supported hydrilla population increases of 100 acres or more during 1985 and are of primary concern to the Department. Several, including Gopher Slough, Lakes Newnan and Patrick contained little or no hydrilla before 1985. Other including Lakes Jackson (Leon County) and Seminole (Jackson County) had stable populations for years until major increase occurred in 1985. Also of concern is Lake Okeechobee. While hydrilla within Lake Okeechobee was fairly stable during 1985, the population has increased by more than 14,000 acres since 1982, crowding out more than 3,400 acres of eelgrass and Illinois pondweed. The largest hydrilla populations recorded in 1985 are listed in Table 7.

Some of the systems discussed in this report which are now choked with hydrilla are important to navigation and nearly all at one time, supported important recreational fisheries. Hydrilla is now present in roughly half of Florida's public waters. Each year several more water bodies either fill with hydrilla or require expensive management programs. The technology to manage hydrilla has not yet been refined but advances in recent years are promising. Funding may soon be adequate, however; without a strong unified approach by all Florida public water managers, the immediate future of Florida's lakes and rivers related to hydrilla is not bright.

NATIVE INSECT ENEMIES OF AQUATIC MACROPHYTES-MOTHS

by

Dale H. Habeck[1], Kim Haag[1], and Gary Buckingham[2]

Introduction

This is the first of a three part series of articles discussing insects that attack aquatic macrophytes in Florida. The series was conceived to provide aquatic plant managers and non-entomologist researchers with a glimpse into the little known world of aquatic plant feeding insects. This world can be entered by simply looking through a small hand lens. We hope this will stimulate you to look for some of the insects we discuss and to observe others that are not discussed and that may be as yet undescribed. Knowledge of the insects and their damage will make your field trips more interesting and better prepare you to respond when others mistake insect damage for spray drift damage. Someday our knowledge of native insects may be sufficient to permit them to be manipulated to help control aquatic weeds.

Insects feeding on aquatic plants illustrate the concept of natural biological control. Biological control is the process in which natural enemies regulate populations of other organisms. When plants are in a habitat for a long time, phytophagous insects are able to find and use them as a food source and place to live. Feeding and other damage by insects helps keep plants in balance in aquatic habitats. A plant accidentally introduced into a country usually comes without its natural enemies and the plant grows unchecked and often becomes a nuisance. Studying the relationships between our native insects and aquatic plants can provide useful information to help us deal with our present and future aquatic weed problems.

Moths and butterflies are common names for the Lepidoptera. The adult mouthparts are siphoning or vestigial and therefore adults are not injurious. However, the early stages called caterpillars have chewing mouthparts and may cause a lot of damage. Most caterpillars possess 3 pairs of thracic legs and five pairs of abdominal prolegs — 4 pair on segments 3-6 and 1 pair on the last segment. Caterpillars most frequently occur as foliage feeders but others may be borers, leaf miners, or gall makers. Sometimes they have one feeding method early in their lives and then change to another later on. Caterpillars must pupate before becoming adults. Pupation is a resting period during which the caterpillar changes its form to a pupa and then to a moth. Pupation may occur on the plant or away from the plant within or without a cocoon.

Noctuidae

The noctuids or owlet moths are the largest family of Lepidoptera. Adults

vary in size from less than 1 cm to 10 cm wing span. Caterpillars are equally variable. Some of the better known terrestrial members of this family are cutworms, corn earworms, cabbage loopers and fall armyworms.

The cattail caterpillar *Simyra henrici*, as the name implies, feeds on cattails. The larvae eat the epidermal layers of the leaves or completely devour the entire leaf. They can be extremely destructive. The larvae are up to 40 mm long and covered with hairs. They are light brown ventrally and orange and brown dorsally with prominent orange tubercles arranged in transverse bands. The dorsal and ventral areas are separated by a lateral light stripe. The head is black with 2 white stripes on top and has a light colored inverted V on the front. The cocoon is formed between two webbed leaves. The adult moth has straw colored forewings and white hindwings.

A closely related species, the smeared dagger moth *Acronicta oblinita* is also commonly found in aquatic situations. It occurs on willow, smartweed, spatterdock, buttonbush, waterhyacinth, pickerelweed, lotus, water pennywort, canna, wax myrtle, and other plants. The caterpillars are easily recognized by the wide bright yellow lateral stripe extending the length of the body. Adults have mottled gray forewings and white hindwings.

The caterpillar of *Bellura gortynoides* is known as the bonnetworm and is frequently used as bait by fishermen. The adult moth is stout and is yellowish-brown with some darker mottling. Eggs are laid in masses on either side of the spatterdock leaves. Egg masses are covered with hairs from the female's abdomen. The young caterpillars hatch and tunnel directly into the leaf or they may leave the mass and wander a short distance before tunneling into the leaf. They continue as leaf miners for the first 2 or 3 stages until they become too large for the thickness of the leaf. Larger caterpillars bore downward through the petiole and only one individual occurs in each petiole. Tunnels extend below the water line and may fill with water if the caterpillar eats a hole in the side of the petiole. Air is obtained by the caterpillar backing up the tunnel towards the leaf until the posterior end of the body is exposed. The last pair of spiracles are very large and open posteriorly, an adaption for this mode of life. While obtaining air, the caterpillar may also defecate leaving a pile of frass on the upper leaf surface. Caterpillars also emerge from the tunnels at night and feed on the leaf surface leaving characteristic gouged patterns. These patterns plus the presence of a hole in the petiole and frass adjacent to the hole indicate that the leaf petiole is occupied by a caterpillar. However, caterpillars may move from petiole to petiole and not every stem is infested. Pupation occurs either within the petiole tunnel or the caterpillars swim to shore where they find shelter under bark or in dead wood. The caterpillars are light green with light brown heads and may be 60 mm long. Two closely related species, the pickerelweed borer *B. densa* and the cattail borer *B. obliqua*, also occur in Florida. Both bore as caterpillars and their life histories are generally very similar to that of the bonnetworm. The pickerelweed borer also attacks waterhyacinth. The USDA has developed a method for rearing it in large numbers to test the feasibility of augmentative releases for waterhyacinth control.

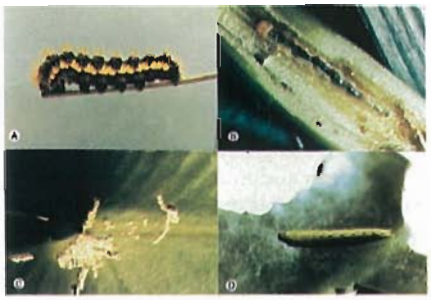


Figure 1. A. smeared dagger moth caterpillar, B. bonnetworm in petiole, C. bonnetworm damage on leaf surface, D. spatterdock caterpillar.

Figure 2. A. lotus borer caterpillar, B. samea caterpillar adult, C. waterlily leafcutter, D. **Parapoynx** *caterpillar.*

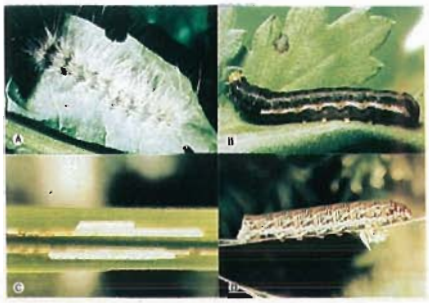


Figure 3. A. yellow woolly bear, B. southern armyworm, C. leafmines of **Cosmopterix nitens**, *D. banded sphinx caterpillar.*

Caterpillars of the genus *Spodoptera* are general feeders and are frequently encountered on waterhyacinth and other aquatic plants. They are also important economic pests of many crop plants. Caterpillars are up to 50 mm long and generally brown with two rows of black triangular markings dorsally. Five *Spodoptera* species attack aquatic weeds, with the velvet armyworm *S. latifascia*, the fall armyworm, *S. frugiperda* and the southern armyworm, *S. eridania* being most common.

The spatterdock caterpillar *Homophoberia cristata* (better known under its old name *Neoerastria caduca*) is frequently observed feeding on the underside of spatterdock leaves. These green caterpillars are up to 30 mm long and have varying amounts of reddish maroon markings on the upper portions of each side.

Arctiidae

Adult tiger moths are generally brightly colored and larvae are more or less densely covered with hairs. Most larvae are known as woolly bears. The hairs arise from raised wart-like areas on the body. The arctiids range in size from 12 to 75 mm wingspan. Caterpillars range from 16-75 mm.

The yellow woolly bear *Spilosoma virginica* is the most common species found in aquatic habitats. The adult is completely white except for a few small dark sports on the wing and a row of yellow spots on the sides of the abdomen. Moths are frequently seen sitting on the leaves of aquatic plants. Eggs are laid in masses of 50 or more eggs. The young caterpillars are gregarious in the early stages but later disperse and occur singly when full grown. Caterpillars range up to 50 mm long and despite their name may be any color from dirty white, light to dark brown or brownish-yellow. Pupation occurs on the plant in a cocoon consisting of silk and caterpillar hairs. They feed on a wide variety of aquatic plants including waterhyacinth, waterlettuce, smartweed, frogbit, and pickerelweed.

Pyralidae

This large family of small to moderate size moths is very diverse in structure and habits. About 1500 species in about 18 subfamilies occur in North America. The European corn borer is a well known species of this family. Most caterpillars feed concealed in tied, rolled, or webbed leaves. Others are scavengers or borers in stems or roots and a few are predators or leafminers. The true aquatic caterpillars are in this family.

The samea caterpillar, *Samea multiplicalis* is a common species in

Florida. The caterpillars are most often collected on water lettuce, but also commonly attack water fern and water velvet and occasionally waterhyacinth. Caterpillars construct a gallery or canopy of silk and hairs of the host plant under which they feed. They may tunnel into the leaves or into the crown and cause severe damage. There are 5 or 6 larval stages. From egg laying to adult emergence requires an average of 25 days at 28°C. Populations gradually increase and are at their highest in the fall. The moths are light brown with many lighter spots on the wings. Caterpillars are up to 22 mm long, light green with a light brown head. The body has many dark hardened plates on it. The caterpillar of the spotted waterhyacinth borer, *Sameodes albiguttalis* is very similar but feeds only in waterhyacinth petioles. It was introduced from South America for control of waterhyacinth.

The waterlily leafcutter, *Synclita obliteralis* is the most common of the 25 species of aquatic pyralid caterpillars known in Florida. The adults are small dark moths with some white and orange fleckings on the wings. Moths are variable in pattern and size although females are generally larger than males. The caterpillars are highly polyphagous and have been recorded from more than 40 different hosts in Florida. The caterpillars live in a portable case usually made up of two pieces of leaf. The case is filled with air and the caterpillars never go very deep in the water and may climb out of the water to feed or to cut leaf portions for their case.

The lotus borer, *Ostrinia penitalis* is common and very destructive to lotus. Young caterpillars are gregarious, whereas older ones disperse, and all stages on the leaves are concealed under silk webbing. The young green seed pods are also heavily attacked. Caterpillar damage to lotus is conspicuous and the devastation may be easily mistaken for herbicide injury. Adult insects are yellowish-brown.

Five species of *Parapoynx* occur in Florida. The caterpillars are easily recognized by the numerous branched gills found over most of the body. First stage caterpillars are leaf miners; later stages construct portable cases which are filled with water. Pupation occurs in the case which is usually attached at one end to a chewed out area on the stem or leaf. Adults are variable and some of the species exhibit sexual demorphism. *P. maculalis* and *P. seminealis* caterpillars feed primarily on waterlilies and floating heart, respectively. *P. allionealis* and *P. obscuralis* are polyphagous and feed on a wide variety of aquatic plants. *P. diminutalis* feeds mainly on hydrilla. All are native except *P. diminutalis* which was accidentally introduced from Asia.

Cosmopterigidae

The cosmopterigids are small moths ranging from about 5 to 28 mm wing span. The biology of the caterpillars is very diverse. They feed internally as leaf miners, gall makers on roots and stems, in seeds, and as scavengers.

Cosmopterix nitens is ofter very abundant in Florida. The small moth has 10 mm or less wing span and the fore wings are brown with transverse yellow and gray bands. The caterpillars are leafminers in the leaves of giant cutgrass, wild rice, and probably other grasses. The mines are elongate and parallel with the leaf veins. The old mined areas dry and turn brown. When the caterpillars are abundant whole patches of grass may appear burned and dead. Several years ago, a heavy infestation caused severe damage to giant cutgrass in Lake Seminole.

Sphingidae

This is a family of large moths ranging up to 17.5 cm wing span. Adults are called sphinx moths or hawk moths while the caterpillars are called hornworms since most species have a dorsal horn on the eighth abdominal segment.

The banded sphinx *Eumorpha fasciata* is common on water primrose and other species of the primrose family growing in moist areas. The large caterpillars, up to 80 mm long are transversely banded with black, red, and white when mature and have seven oblique lateral stripes. Younger stages are generally unmarked and are bright yellowish green or pink. A primrose stem completely or partially defoliated indicates that one of these caterpillars is or has been there.

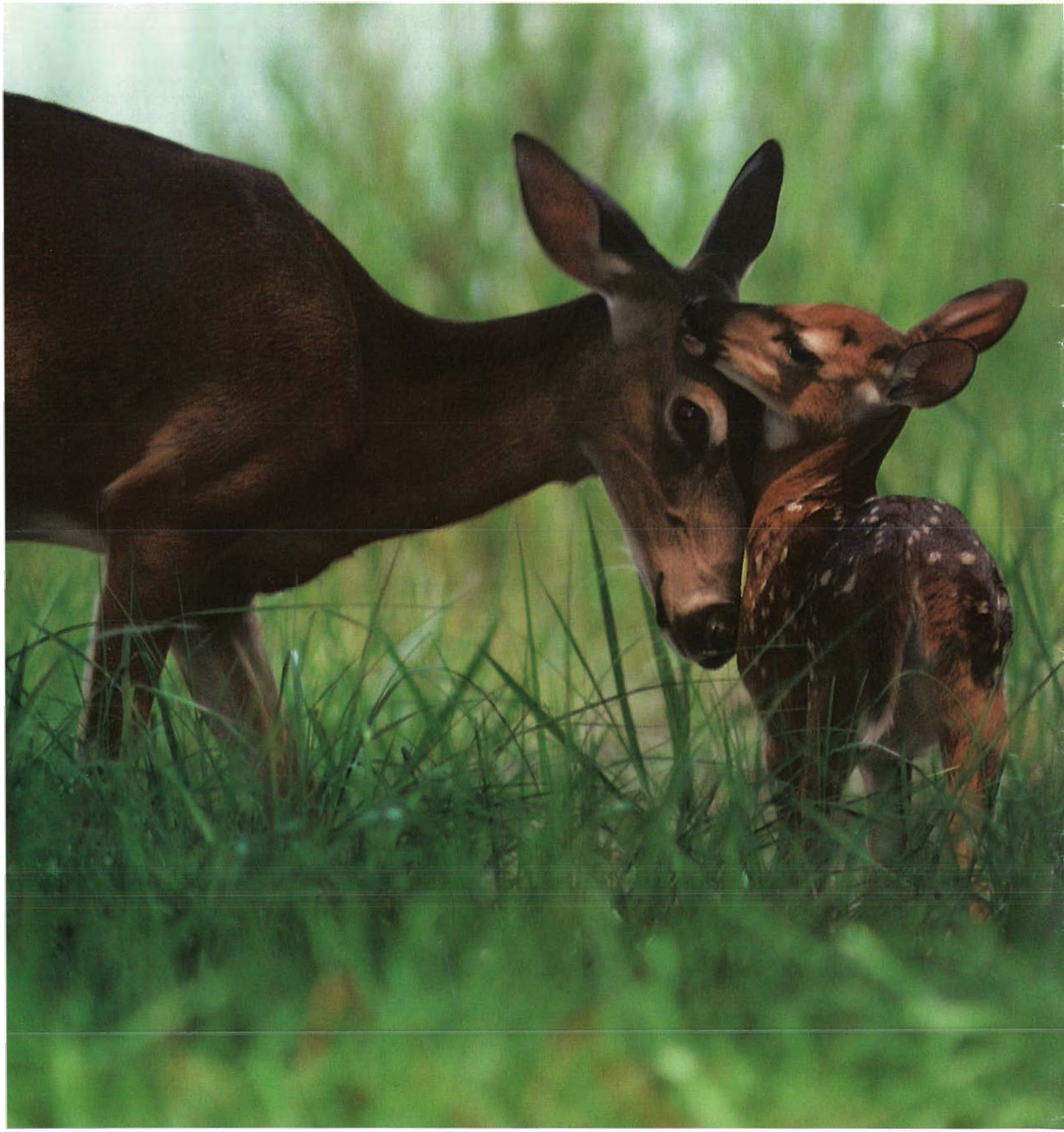
In conclusion

There are many other moth species associated with aquatic and semiaquatic plants. Space limitations have made it necessary to include only a few of the more common and conspicuous species. Available biological information for most species is incomplete and many new species of moths await discovery.

Acknowledgements

We thank V. Jane Windsor for photographs 1 A, B and 3 A, B.

Continued on page 22



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Native Insects *from page 19*

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Footnotes

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What's Cooking *from page 11*

CATTAIL-CARROT CAKE

2 cups flour
2 teaspoons baking powder
1½ teaspoons baking soda
1 teaspoon salt (can be omitted)
2 teaspoons cinnamon
2 cups sugar
1½ cups cooking oil
4 eggs
1 cup grated carrots
1 cup cattail shoots grated in blender
1 8 oz. can crushed pineapple, drained
½ cup butter or margarine
1 8 oz. package cream cheese
1 box confectioners sugar
1 teaspoon vanilla

Sift together first five ingredients. Add sugar, oil, eggs, cattails, carrots and pineapple. Pour into 2 greased-floured cake pans. Bake at 350° for 35 to 45 minutes. Mix cream cheese, butter, sugar and vanilla. Add milk if frosting is too thick. Spread on cool cake.

AQUA VINE

CALL FOR PAPERS

The annual meeting of the FAPMS will again be held in Plant City on October 13-16. Last year's record crowd brought out record numbers of people wanting to give presentations. Don't be left "holding the bag," get your paper titles in early to avoid the last minute rush. If you know what you are going to present, or if you have ideas and/or comments on this year's program, contact Mark McKensie at (813) 961-7885 ASAP.

BOARD MEETING

The next Board meeting for the FAPMS will be held April 11th at the campus of the University of Central Florida, Orlando.

APMS

The Aquatic Plant Management Society will hold its annual meeting July 13-16, 1986 in Sarasota, Florida. The meeting will include papers on the distribution, ecology, physiology, and management of aquatic plants in lakes, reservoirs, rivers, streams, and irrigation systems. For further information please contact Dr. David Spencer, Davis, CA., at (916) 752-6260.

BOARD CHANGE

Bob Arnold has been transferred to Atlanta, Georgia with Monsanto Company and has resigned as Director of the FAPMS. Bob's vacancy will be filled by Ed Cason, Lake & Pond Maintenance, St. Petersburg. Bob has been an asset to the Society and his contributions will be sorely missed. The Society wishes Bob the very best with his new career in Georgia.

AQUATIC PLANT CONFERENCE

A conference on "Aquatic Plants for Water Treatment and Resource Recovery" will be held in Orlando on July 20-24. If you're interested in obtaining more information about this conference, please contact Dr. K. Reddy, programs committee, in Sanford, FL at (305) 322-4134.

DNR

Ms. Barbara Parker has assumed the position of Grants Specialist V with the Department of Natural Resource's Grants Administration Section. Barbara's responsibilities will include the monitoring of administrative and financial functions of the funded aquatic plant control programs and the aquatic plant research grants program. Barbara can be reached at (904) 488-5631.

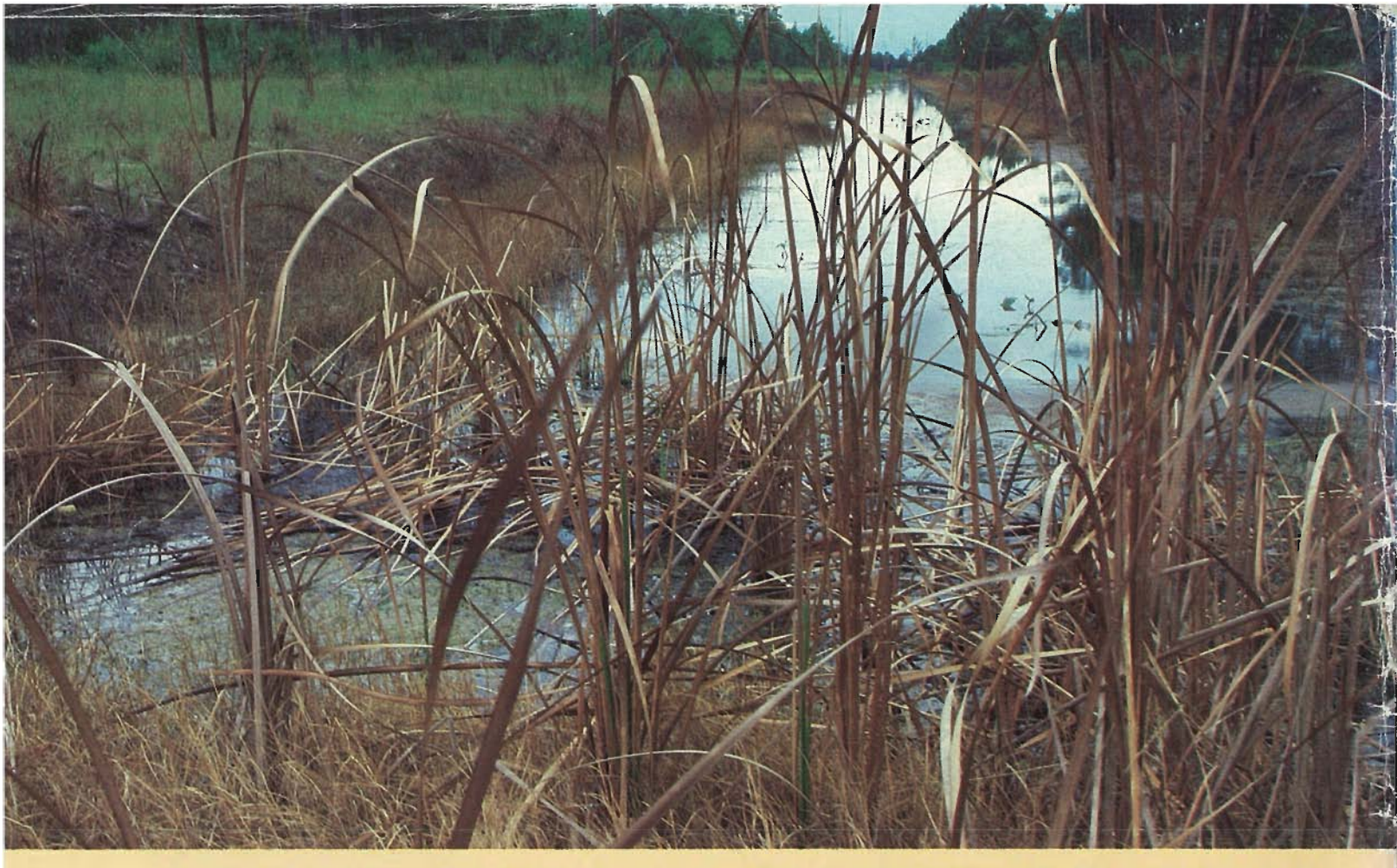
DNR

Dan Thayer has accepted a research position with the DNR, located at the Center for Aquatic Weeds, Gainesville. The position will help develop a technology transfer program, training materials, and assist aquatic plant managers in solving aquatic plant control related problems around the State.

DNR

The Department of Natural Resources announces funding of the following research topics:

1. Dr. George Bowes, UF- An Eco-Physiology Study of the Weed Potential of Filamentous Algae in Florida. $79,694.00.
2. Dr. David Sutton, UF- Use of Seeds for Establishment of Desirable Aquatic Plants. $84,222.00.
3. Dr. Dean Martin, USF- Physiological Properties of Problem Plants: Sensitivity of Filamentous Algae to Photodynamic Action. $25,950.00.
4. John Cassani, Lee Co.- Potential of Triploid Grass Carp for Managing Aquatic Vegetation in a Municipal Canal System. $25,788.00.
5. Dr. Dan Canfield, UF- Relationships Between Aquatic Macrophytes and the Limnology and Fisheries of Florida Lakes. This project was ambitious beyond DNR's available funds, negotiations are currently underway to fund this work at a reduced scope.



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