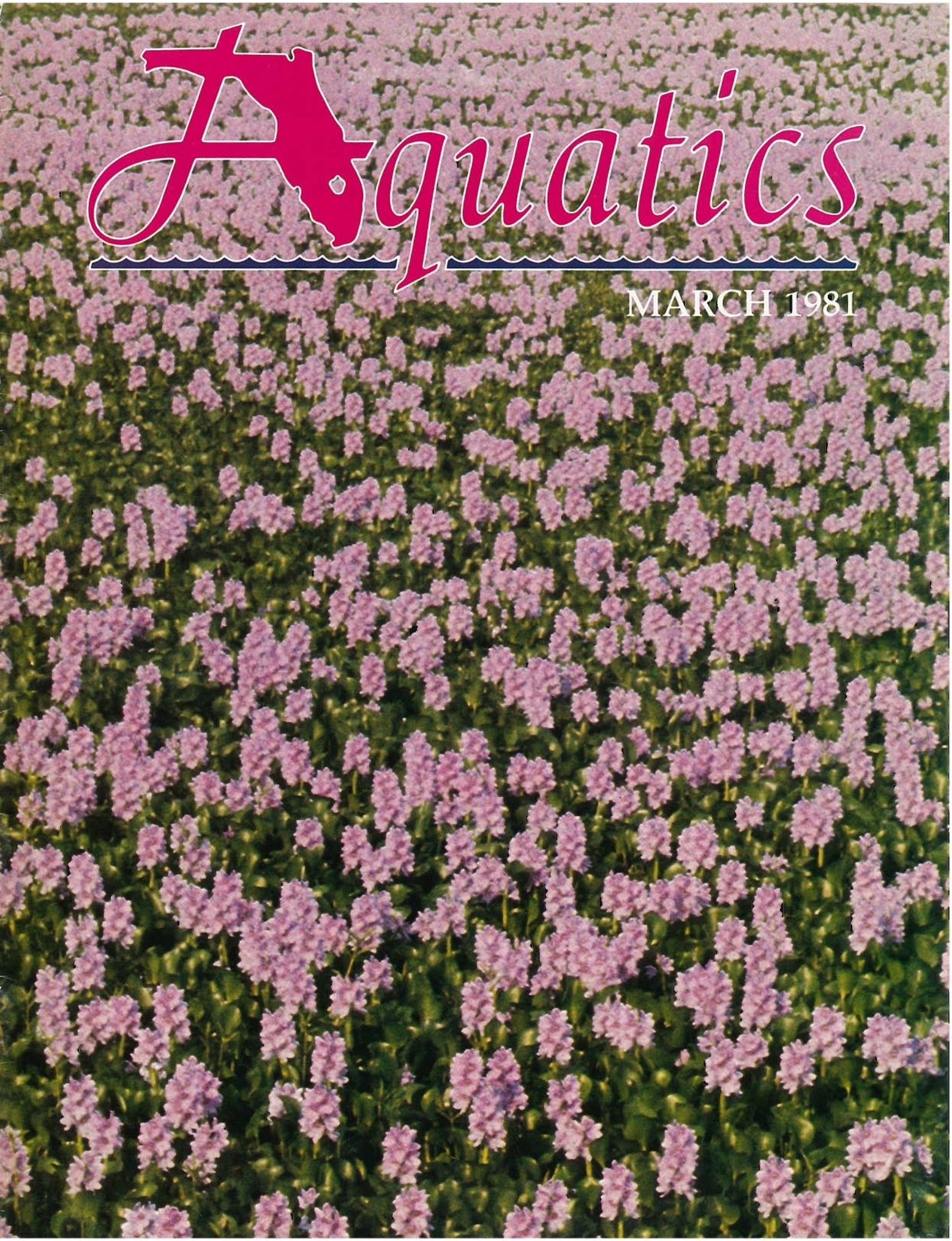
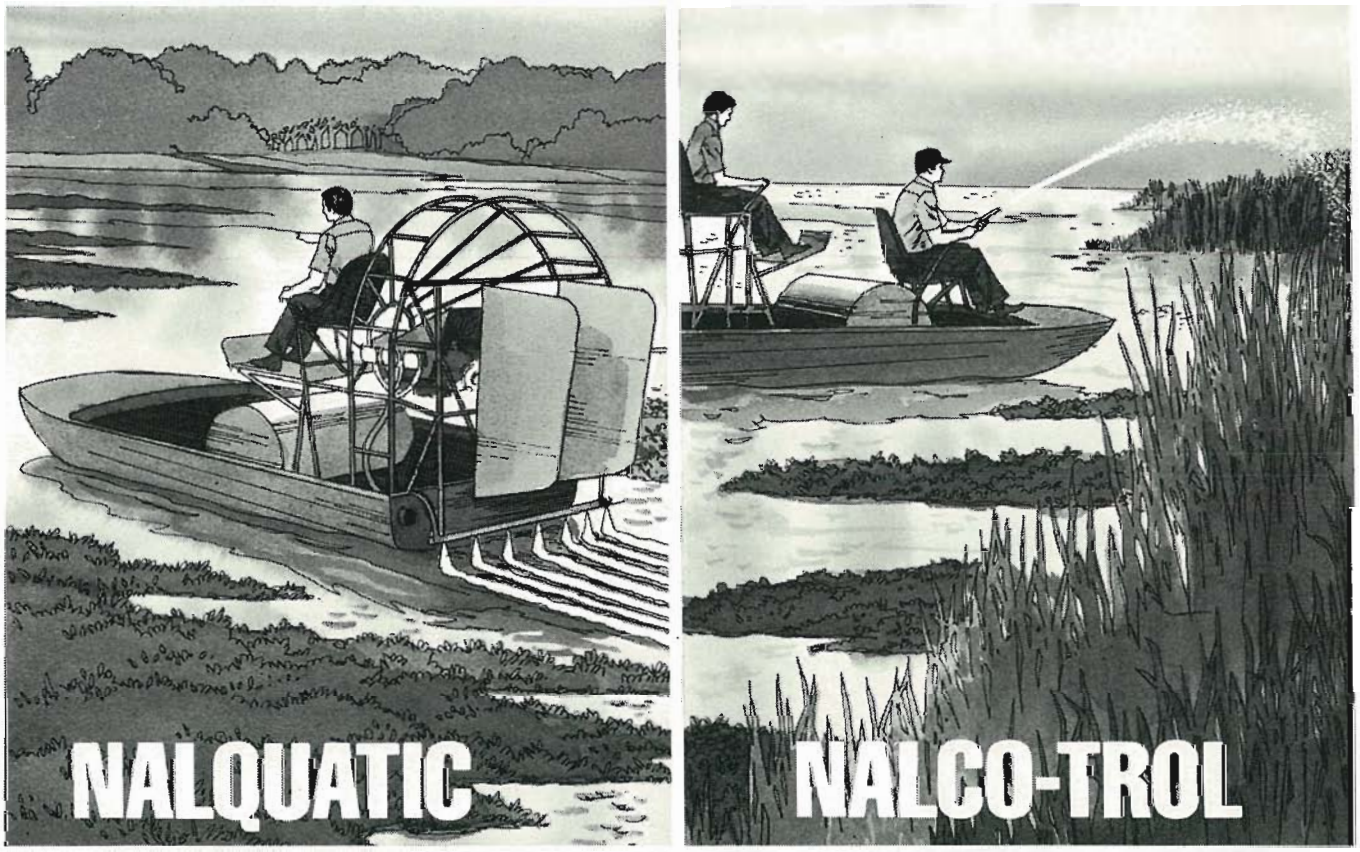
Aquatics

MARCH 1981



GOOD NEWS FOR AQUATIC WEED FIGHTERS:



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Editorial
By Paul C. Myers

It is both a privilege and honor to take over the helm as editor of this fine magazine. It is my intention to keep this publication as interesting and informative as it has been under the editorship of Bill Maier. Through thick and thin Bill has ensured that the official Society publication be a source of information for everyone associated with aquatic plant management.

I would like to reiterate from the first edition of AQUATICS and encourage you as a reader to participate in maintaining this magazine. Your input in the form of an article or simply a letter to the editor with news of interest will be most appreciated. If you have incorporated new ideas or old technology with a new twist into your aquatic plant control operations this magazine can be your vehicle to share your knowledge and experiences with other applicators.

The Aqua-Vine Section of "Aquatics" has been added to provide information on current events and recent publications from industry and government to increase the dissemination of aquatic plant control techniques and regulatory changes. Complete copies of reports mentioned in this section can be obtained on request to the respective authors or the Editor of "Aquatics."

Aquatics

MARCH 1981 VOLUME 3 • NUMBER 1

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CALENDAR NOTES

April 10	FAPMS Board Meeting, Bartow
July 10	FAPMS Board Meeting, Melbourne
July 12-15	Aquatic Plant Management Society's Annual Meeting, Coliseum Ramada Inn, Jackson, Mississippi
Oct. 21-23	FAPMS Annual Meeting, Orlando

COVER

Aquatic Plant Pest Number 1 — no more. Water hyacinth has taken a back seat to hydrilla. Maintenance control is a success story. Photo by Frank Wilson.

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

CORRESPONDENCE: Address all correspondence regarding editorial matter to Paul C. Myers, Editor, "AQUATICS" Magazine, 310 E. Thelma St., Lake Alfred, Fla. 33850.

Duckweeds — Nature's Smallest Flowering Plants

By Brian Nelson[1]

Tangled clump of *Wolffiella floridana* (Smith) Thomps.

Lemna minor L. in a quiet cove on the Wacissa River.

Duckweeds are a unique group of small free-floating aquatic plants that exhibit no distinction between leaf and stem. They are the smallest and simplest of all the flowering plants. Duckweeds consist of one to several interconnected disc-like bodies with or without roots. The disc-like bodies of duckweeds are often referred to as fronds, modified stems, or thalli. The duckweed family Lemnacaea, consists of four genera and approximately 28 species with worldwide distribution. All four genera, *Lemna*, *Spirodela*, *Wolffia* and *Wolffiella*, occur in Florida.

Duckweeds are found in a variety of habitats, often several species occupying the same niche. They are most abundant in stagnant waters with high nutrient levels. Duckweeds are frequently seen covering the surface of shallow peaty bayous, ponds,

Duckweeds continued on page 7

[1]Department of Natural Resources
Bureau of Aquatic Plant Research and Control

Union Carbide aquatic herbicides. 5 ways to make your lakes and streams look like the day they were created.

Weeds in lakes and streams are more than ugly. They can drive out fish, make streams unnavigable, choke vital irrigation and drainage waterways, ruin recreational areas, and even depress shorefront property values.

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The Aquatic Weed — Mosquito Control Connection

by Frank Wilson[1]

A successful fresh water mosquito control program has to involve a knowledge of aquatic plants. Many of the ecological niches that are homes for mosquitos are provided by aquatic vegetation. Without aquatic plants most of our fresh water mosquito problems would not exist.

All mosquitoes spend the larval portion of their lives in water. Each species has its own requirements for water quality. Some live in relatively clean conditions, some require an enriched water environment, while others require variations between these two extremes.

A Mansonia mosquito larvae attached to a water lettuce root. This group of mosquitoes have highly modified air tubes that can be inserted into aquatic plant roots. The mosquito then obtains oxygen from the aquatic plant and no longer has to rise to the water surface to breathe.

[1]Director, Polk County Environmental Services

Approximately seventy species of mosquitoes occur in Florida. Fortunately this large number can be divided into three groups.

— Permanent water mosquitoes — their eggs are laid on the water surface and they occur all year.

— Floodwater mosquitoes — generally are a problem only during June, July, August and September. These mosquitoes lay their eggs on damp soil. The eggs lie there until flooded, then hatch and develop into adult mosquitoes.

— Mansonia mosquitoes — one of our most interesting groups. Most mosquito larvae come to the surface of the water to breathe. In contrast, Mansonia have a modified air tube which they insert into aquatic plants and obtain their oxygen from the plants.

In mosquito control we like to see open water with a clean exposed soil shoreline. This condition allows predators such as minnows access to larvae that may be present. Each minnow is capable of eating one hundred or more mosquito larvae per day. Open water also allows wave or

Aquatic Weed continued on page 9

Duckweeds continued from page 4

and canals. Duckweeds also occur around the margins of lakes, in still areas of clear spring fed rivers, and anchored on "topped out" vegetation.

Species belonging to the genus *Lemna* (duckweed) are characterized by having one root per frond, and fronds that occur single or in small groups. The fronds are usually green, but occasionally have a reddish tinge on their upper surface. This is the largest genus in the Lemnaceae family and includes *Lemna minor* L. (common duckweed). Common duckweed is the most abundant duckweed species in Florida, while other less common species in Florida include *L. perpusilla* Torr., *L. valdiniana* Phil., and *L. gibba* L.

The largest of the floating duckweeds belong in the genus *Spirodela* (Giant duckweed). This genus, unlike the Lemna's, has two or more roots per frond. One of the distinguishing characteristics of giant duckweed is the fronds which are always green on top and reddish colored below. *Spirodela polyrhiza* L. giant duckweed, and *S. punctata* Meyer, both occur in Florida and have fronds in groups of two to five.

The genus *Wolffia*, commonly called watermeal, contains the smallest known flowering plants. These tiny, barely visible plants have no roots and consist of one or two ovid green discs 0.5 to 1.5 mm long. *Wolffia arrhiza* (L.) Wimm., an Indian species not exceeding 0.5 mm, is the smallest of the watermeals. Species in Florida are *W. papulifera* Thomps., *W. punctata* Griseb and *W. columbiana* Karst. These plants which are usually overlooked occur around the larger duckweeds and are visible only after close observation.

Wolffiella or bog-mat, consists of rootless plants with two or more fronds. The fronds of this group are flat, thin, usually curved or bent and often more lanceolate than the other duckweeds. The 5-10 mm long fronds of *Wolffiella floridana* (Smith) Thomps. often connect to a central bud giving this plant a star-like appearance. It is usually found in a tangled clump near the water surface. *Wolffiella oblonga* (Phil.) Hegelm. also occurs in Florida.

Asexual budding is the major reproductive mode of the duckweeds. Reproduction of duckweeds by budding is extremely fast when conditions are

Duckweeds continued on page 16

AQUA-VINE

People On the Move

Richard (Dick) Dumas has recently become Director of the Citrus County Aquatic Plant Control Department, Lecanto, Florida, 904 746-5230.

John Layer is now an Aquatic Weed Supervisor with the St. Johns River Water Management District, Palatka, Florida 904 325-5383.

Porter Lambert is Director, Division of Field Services, St. Johns River Water Management District, Palatka, Florida 904 325-5383.

Equipment Demonstration Committee Formed

To ensure a really good variety of equipment for display and demonstration, for the 1981 annual meeting barbecue, President Joyce has formed an equipment demonstration committee and appointed Herb Cummings committee chairman. Anyone having aquatic weed control equipment that may be of interest to applicators is encouraged to contact Herb. The innovations you think small may be just the answer to someone else's problem. Commercial interests, manufacturers and dealers will be most welcome. For information contact Herb Cummings, 9001 N.W. 58th Street, Miami 33178, 305 592-5680.

Al Burkhalter Departs

We would like to take this opportunity to recognize Dr. Alva Burkhalter, who has retired from the Department after 10 years of outstanding service. During Al's administration as Chief of the Bureau of Aquatic Plant Research and Control, great strides have been made in the science of aquatic plant management. A few of the most significant accomplishments during his ten years were:

The establishment and growth of a comprehensive statewide aquatic plant control program. One in which the 70's found water hyacinths infesting most waters in the state and now is reported under maintenance control.

Fought for and assisted in the development of a diverse research program to provide alternative methods of biological, chemical and mechanical

AQUA-VINE continued on page 12

Aquatic Weed continued from page 6

ripple action on the water surface. Most mosquito larvae breathe by sticking their air tube up through the water surface. Waves or ripples interfere with this method of breathing. Constant ripple action on the water surface will eliminate mosquito production. Aquatic plants tend to protect mosquito larvae from these two natural controls.

The numbers of mosquitoes produced by a body of permanent water is dependent on the amount and type of aquatic vegetation present and by water quality. Open habitats such as that provided by maidencane in our central Florida lakes does not support mosquito production. In contrast plants that form mats provide a great degree of shelter. As a general rule if you see a floating mat of bermuda grass, alligator weed, para grass or a solid cover of water hyacinths, mosquito larvae will be present. In contrast duckweed and salvinia usually indicate very limited mosquito production.

Mosquito larvae feed on phyto and zooplankton plus some organic detritus. Clean water provides very little of this food. Nutrient laden waters such as sewage effluent, food processing waste water and certain manufacturing process waters contain materials that act as food for these microorganisms.

A rim of aquatic vegetation such as hyacinths or a bermuda grass mat in a waste water treatment area provides everything a mosquito larvae needs. The water quality guarantees a bountiful food supply while the aquatic weeds provide protection from predators and surface wave action. This combination of aquatic weed mat and enriched waters produces the largest numbers of mosquitoes per square foot of any condition in fresh water areas.

In mosquito control we use a standard water dipper (approximately 4″ diameter) as a sampling tool. In emergent vegetation around the edge of a lake or pond you might collect 1 larvae

Aquatic Weed continued on page 10

A solid mat of aquatic weeds such as this supports mosquito production. The water hyacinths provide excellent cover for Culex and Anopholinae mosquitoes. The water lettuce is a favorite host of Mansonia mosquitoes. If the cattails are growing in a soft organic ooze they will also support Mansonia mosquitoes.

Aquatic Weed continued from page 9

in 15-20 dips. If we sample an area where a floating mat occurs we may find 1 larvae in 5-10 dips. If that same mat is growing in enriched waters such as sewage effluent or some process waters we can collect mosquito larvae in numbers up to 500 per dip.

A short term mosquito problem is created in permanent water areas when mats of hyacinths or other plants are browned off by frost or killed by herbicides. As the plant parts decompose a condition similar to the enriched water — weed mat environment exists for a few weeks. During this time we have moderate numbers of Culex mosquitoes produced.

Floodwater mosquitoes are best represented by the Glades mosquito, *Psorophora columbiae*. These mosquitoes lay their eggs, which are viable for several months, on damp soil. When the eggs are flooded they hatch and

Aquatic Weed continued on page 11

Fleshy white roots, such as those of water primrose, provide ideal harborage for Mansonia mosquitoes.

Aquatic Weed continued from page 10

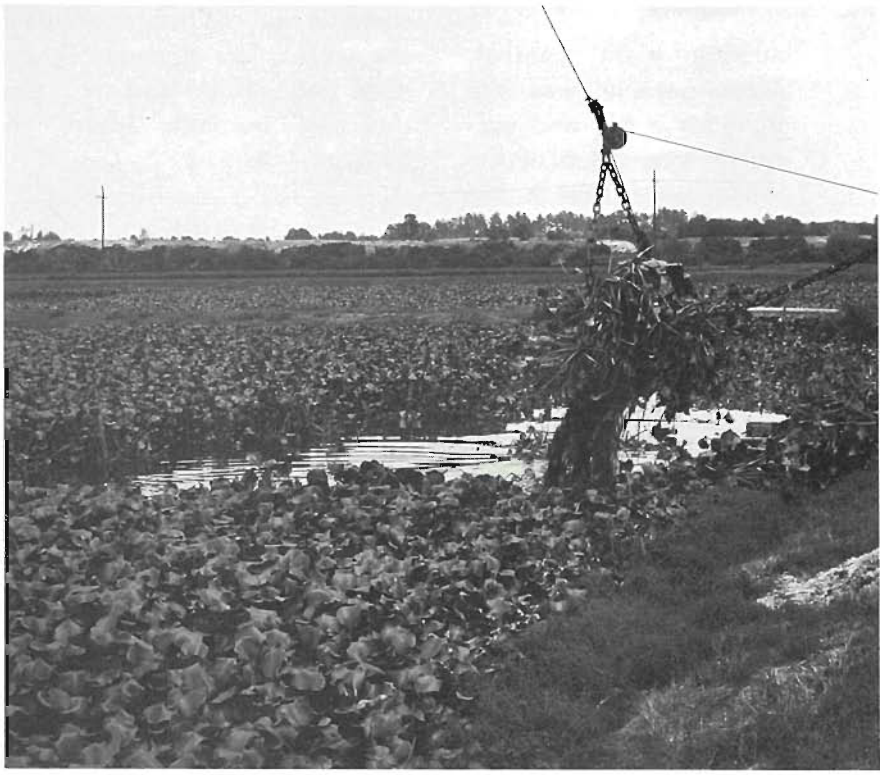
develop into hungry adult mosquitoes that are aggressive daytime feeders.

Floodwater mosquitoes are produced at low levels throughout the pine flat woods and pasture areas. It is interesting that the areas of heaviest mosquito production are usually areas that man has modified or is managing. Old tomato fields with their swale ditches and soil conservation service contour ditches in improved pastures are examples of efficient Psorophora production sites.

Certain plants can be used as indicators of areas that may produce floodwater mosquitoes. The soft rush *Juncus effusus* is probably our best indicator plant. It likes soil conditions that ensure rain water will stand for a period of several days. Areas that contain broom grass, *Spartina bakeri*, are worth checking. In the Peace River Basin we have an ecological niche that is indicated by a crabgrass growing with terrestrial alligator weed. Where these two plants are found growing together we can count on Psorophora production during the early summer.

One of the most interesting groups of mosquitoes that we have in Florida are the Mansonia, a group of three species. Most mosquito larvae have an air siphon, and come to the surface of the water to breathe. In contrast Mansonia larvae have a highly modified air tube that can be inserted into the roots of aquatic plants. They then obtain their oxygen from the plants. Almost any emergent aquatic plant may serve as a host if it has white fleshy roots and grows in a soft mucky ooze.

Aquatic Weed continued on page 14



Aquatic Weeds such as hyacinths, bermuda grass, Para grass or hydrocotyle in waste water treatment areas provide ideal conditions for Culex mosquitoes.

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AQUA-VINE continued from page 8

aquatic plant control. Most notable was the fight for a fair and successful evaluation of the white amur (which has gained the nickname "Burkhalter Bass") for the biological control of hydrilla.

Contributed greatly to professional development in aquatic plant management through applicator training schools and numerous publications on aquatic plant identification and control.

Through his strong principles and diligent efforts, this Big Georgia Bulldog has been a leader in Florida's recognition as having one of the most advanced and comprehensive aquatic plant research and control programs in the world. We sincerely appreciate your efforts and wish you the best in your future endeavors. ►

Aquatic Plant Manager of the Year

The FAPMS initiated the Annual Aquatic Plant Manager of the Year Contest at the Fourth Annual Meeting of the Society in October, 1980. The award provides a means of recognizing field personnel for outstanding achievement in aquatic plant control.

The Society made the first annual award presentation jointly to the Southwest Florida Water Management District Aquatic Weed Control Crew of Lou German and Philip Jones.

They are a hyacinth control crew who work primarily in the Lake Rousseau area of the Withlacoochee River, an area having a variety of special interest groups with diverse needs relating to aquatic weed control. This crew is able to handle both the required control measures and public relations in a very professional manner. They are the prime factor in a successful control program.

Philip Jones

Lou German

They were awarded plaques for their overall effort including public relations, job performance, professionalism, equipment maintenance and plant control innovations. Public support, including a letter of recommendation from local area coordinators (private citizens who donate their time to work with District personnel to solve local aquatic weed problems) and complimentary newspaper articles, played an important role in their selection.

The FAPMS congratulates the recipients on a job well done and for giving us all a goal to shoot for during the coming year. ►

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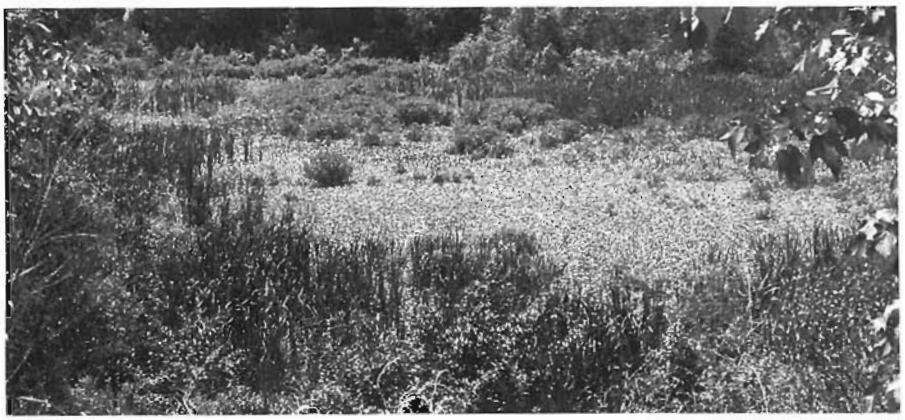


In phosphate pits, hyacinths form a thick mat of detritus. Other plants such as water primrose, cattails and willows become established in this mat. Their fleshy white roots provide an excellent habitat for Mansonia mosquitoes.

Aquatic Weed continued from page 11

Water lettuce is a superior host for this group of mosquitoes. It is not unusual to find 10-20 Mansonia larvae per lettuce plant, other plants that are good hosts include water hyacinth, water primrose, cattail, sawgrass, and Blueflag.

In Polk County we have a specialized problem with old phosphate pits that produce large numbers of Mansonia mosquitoes. If water hyacinths cover a pit they exclude the normal air-water oxygen exchange. The water below the mat loses all of its oxygen and becomes anaerobic. Dead plant parts drop to the water, undergo partial decomposition and develop a floating peat mat. Other plants move in and establish themselves in this mat. Cattail, water primrose, various grasses and willow all grow well in this environment. All of these plants have the preferred type of root and are growing in a substrate that is suitable habitat for Mansonia mosquito larvae.

At present we have no way of treating for Mansonia larvae. No larvicide is effective in penetrating the area where they live. The only way we can attack the larvae is by killing the aquatic weeds that serve as their host. Since water lettuce is such a fine host we try to control this plant when it is growing close to populated areas. Obviously killing all aquatic vegetation is not a practical control method from either an environmental or economic view point.

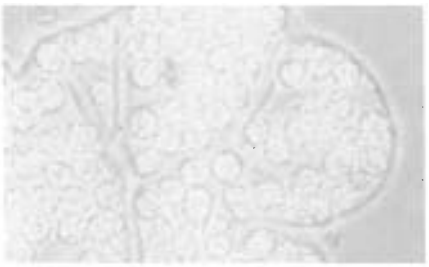
There is no way that fresh water mosquito control can be conducted without becoming involved with aquatic weed problems. The connection between the two disciplines is strong. ►

Microcystis Aeruginosa — A Toxic Algae

By Dr. Lynn M. Hodgson
Asst. Research Scientist,
Center for Aquatic Weeds

Poisoning by waterblooms of blue-green algae is worldwide in distribution; but is most frequently reported from the central states and provinces of North America, as well as Argentina, Australia, Israel, Morocco, Bermuda, Brazil, Finland and Russia. Six species of blue-green algae have been implicated in toxic outbreaks: *Microcystis aeruginosa, Anabaena flos-aquae, Aphanizomenon flos-aquae, Nodularia spumigena, Coelosphaerium kutzingianum,* and *Gloeotrichia echinulata.* The first two listed are the most often reported and most serious of these toxic pests. Toxic blooms may vary in toxicity seasonally or even daily. Toxic and non-toxic strains of *M. aeruginosa* have been isolated from the same culture. Thus the algae itself varies tremendously in toxicity. In addition, animals vary in their sensitivity to the poisons. For instance, Gorham (1964) reports that in cattle poisonings, one full-grown cow may die in half an hour while others in the herd may survive 48 hours. Bacteria grow in association with the algae and may contribute additional toxins, compounding the problem.

The strictly planktonic colonies of the blue-green algae



Microcystis aeruginosa are spherical or irregular and have cells distributed evenly through the colonial matrix. Cells may appear black or reddish due to the presence of refractile gas vacuoles. This species produces at least one toxin which is poisonous to animals ingesting it. The toxin, called "fast death factor," is a cyclic polypeptide of moderate toxicity, known to kill livestock and many other animals. Interestingly, the purified algae does not kill domestic ducks, which apparently have a detoxifying mechanism in their digestive tracts. Toxic *Anabaena flos-aquae,* on the other hand, is very poisonous to waterfowl, causing death in an hour or two.

Of the many blue-green algae blooms in Florida, only a very few are toxic. However, caution is recommended in watering livestock, dogs, or other warm-blooded animals at unproven "pea soup"-green ponds. The accompanying photograph shows *Microcystis aeruginosa* forma *major* from a toxic bloom in Citrus Pond, Citrus County, Florida. ►

References:

Bold, H. C. & M. J. Wynne. 1978. *Introduction to the Algae: Structure and Reproduction.* Prentice-Hall, Inc., Englewood Cliffs, N.J. 706 pp.

Gorham, P. R. 1964. In: D. F. Jackson (ed). *Algae and Man.* Plenum Press, New York, N.Y. pp. 307-336.

Duckweeds continued form page 7

favorable. The amount of duckweed can double in three to four days and completely cover a body of water much like an algal bloom. Flowering and seed production also occur but infrequently. The small flowers and buds of *Spirodela* and *Lemna* protrude from two small pouches one on either side of the frond near the base. In *Wolffia* and *Wolffiella*, there is a single pouch in the upper surface of each frond. Lemnaceae flowers are very simple. The majority consist of a single pistillate flower and one or two staminate flowers, each containing a single pistil or stamen. The flowers are pollinated by the wind or the many aquatic insects which inhabit the surface of duckweeds.

Spirodela polyrhiza **L. easily distinguished by its large size, numerous roots and red coloration beneath.**

Tiny *Wolffia papulifera* **Thomps. Pictures by Brian Nelson and David Tarver.**

In Florida, duckweeds are usually present year round. In their northern ranges however, cold weather often kills the duckweed plants which sink. When these dead plants sink they carry smaller, rootless winter buds to the bottom. In the spring these buds begin to grow and return to the surface. Duckweeds can survive and even reproduce during low water conditions as long as the substrate remains damp.

Duckweeds are a desirable food source for waterfowl which consume the entire plant. Concentrations of duckweeds provide important shade and shelter for fishes and create habitat for many small aquatic insects, which in turn are consumed by fish.

Along with other floating plants which absorb considerable quantities of nutrients, and are easy to remove from water, duckweeds may someday be used for wastewater treatment, animal feed, and fertilizer. Duckweed is even eaten in some less developed countries of Asia as a vegetable. Common duckweed is consumed readily by both the grass carp (*Ctenopharyngodon idella* (Val.)) and the hybrid grass carp (*Ctenopharyngodon idella* × *Aristichthys nobilis* (C. and V.) and is used as a staple food while rearing these fish to a stockable size.

This family rarely poses severe water use problems except when high winds concentrate large amounts in a heavily used area or rapid budding causes the surface of a pond or canal to become completely covered. These large concentrations of duckweeds can shade out desirable submersed vegetation and clog irrigation pumps and outboard motors. Under these conditions duckweed can be easily controlled by low concentrations of Diquat or 2,4-D.►

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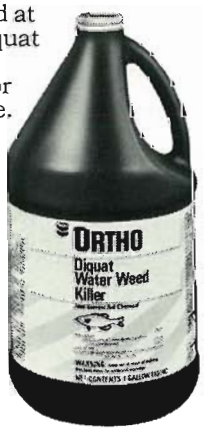

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DIQUAT WATER WEED KILLER

DEDICATION OF CENTER FOR AQUATIC WEEDS

UNIVERSITY OF FLORIDA INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES HELD ON FRIDAY, DECEMBER 12, 1980

Center for Aquatic Weeds

Aquatic plants continue to be an economic, biological and social problem in Florida. State agencies spend over $20 million annually for control of these plants, particularly hydrilla and water hyacinth. These two plants now infest over 1.2 million acres of water in Florida. Also, infestations are increasing throughout the Sunbelt states, making essential the coordination of research and management programs among state and federal agencies and institutions.

The Center and Its Scientists

The Center for Aquatic Weeds conducts research and education programs throughout Florida. The Center, a part of the University of Florida's Institute of Food and Agricultural Sciences (IFAS), was designated by the 1978 Florida Legislature to be the lead agency for coordinating and developing research related to noxious aquatic plant control.

Scientists of the Center in coordination with researchers of the University of Florida, Florida State University, Central Florida University, University of South Florida, the Department of Natural Resources, Game and Fresh Water Fish Commission, U.S. Department of Agriculture, Environmental Protection Agency, Corps of Engineers, and other state and federal agencies form the largest and most diverse group of aquatic weed scientists

in the United States. They have provided signficant information on the management of aquatic weeds.

In creating the Center in 1978, the Legislature provided $300,000 for a new laboratory and an additional $200,000 in recurring funds for three new faculty positions, with supporting career service positions.

The Center's scientists include specialists in aquatic plant ecology, pathology, entomology, fisheries, liminology, physiology, growth and reproduction, phycology, and mechanical and chemical management.

The New Facilities

The Center includes seven faculty offices, a conference room and library, water analysis laboratory, plant tissue laboratory, and a large steel strand combination laboratory storage facility.

Much research conducted is field oriented on public and private aquatic ecosystems throughout the state. Therefore, other laboratories and offices throughout the University, including the Agricultural Research Center at Fort Lauderdale, will continue to function as an integral part of on-going programs.

The Center's Programs

Center personnel will test potential integrated management systems, management strategies, impact of management practices on the aquatic and related ecosystems, and reproductive and growth characteristics of plants.

Although chemical treatment continues to be the most used management system, it is necessary to investigate integrated systems to reduce costs, potential environmental impacts, and energy consumption, and to increase management effectiveness.

A second major emphasis of Center scientists is to evaluate

Dedication continued on page 19

Dedication continued from page 18

the impact of alternative management systems on the aquatic ecosystem. Knowledge in this area is limited, particularly the effect on water quality, native fisheries, other aquatic flora and fauna, and the overall balance of these sensitive ecological systems.

A third major research area focuses on obtaining basic information on the reproduction, growth and succession of the major noxious aquatic plants. This basic information is a prerequisite to developing effective management systems and potential use of the plants for energy and/or food supplies. Production of methane from aquatic plants, the use of the plants for livestock feed, or a means of tertiary treatment of waste water requires additional basic ecological and physiological information.

Programs of the Center are funded from varied sources. In addition to state support, contracts and grants from state and federal agencies fund a significant amount of research at the Center.

PROGRAM

Noon	Bar-B-Que Luncheon
1:30 p.m.	Dedication
Presiding	Dr. Robert Q. Marston President University of Florida
Invocation	Mr. Les Bitting Old Plantation Water Management District
Welcome and Introduction	Dr. K. R. Tefertiller Vice President for Agricultural Affairs University of Florida
Dedicatory Remarks	The Honorable Curtis Peterson Florida Senate 12th District
	The Honorable Gene Hodges Florida House of Representatives 14th District
	The Honorable William Andrews
Other Remarks	The Honorable Don Fuqua Congressman 2nd District
Dedication	The Honorable Jack McGriff Chairman Florida Board of Regents
Acceptance for State of Florida	Dr. Elton Gissendanner Executive Director Department of Natural Resources
Acceptance for University	President Robert Q. Marston
Acceptance for Faculty	Dr. William T. Haller Associate Professor University of Florida
Dedication Prayer	Dr. Arnett C. Mace, Jr. Director Center for Aquatic Weeds

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