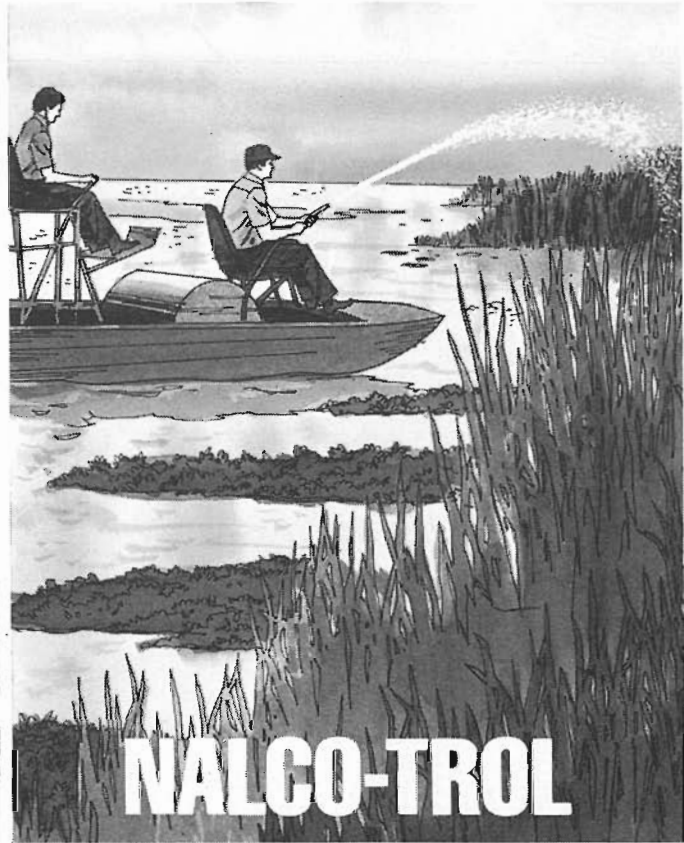
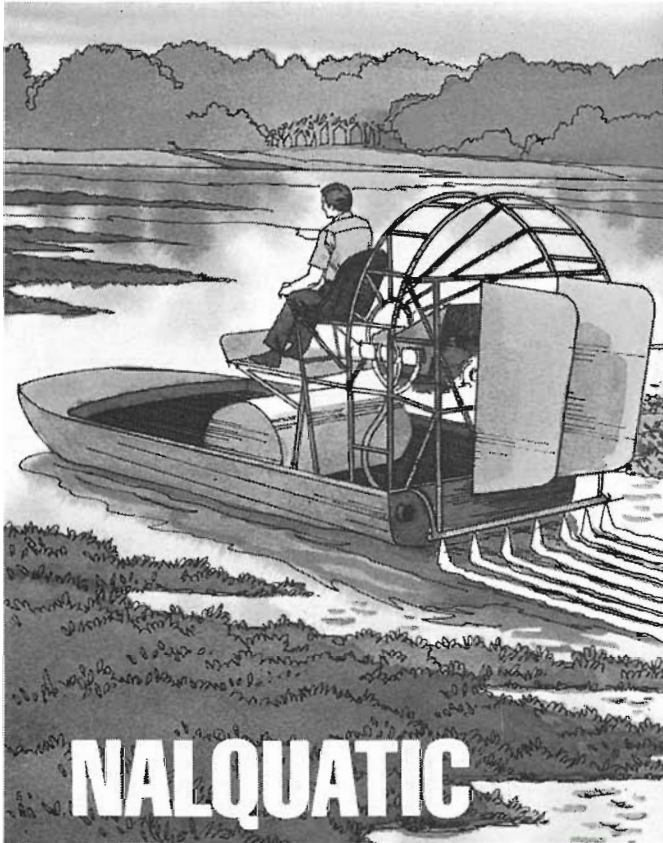




Aquatics

DECEMBER 1981

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PRESIDENTIAL ADDRESS

Future of Aquatic Plant Control in Florida

Joseph C. Joyce
1981 President, Florida Aquatic
Plant Management Society, Inc.

I was recently asked by a distinguished group of aquatic plant managers, "What is the future of aquatic plant control in Florida?" My first thought was surprise that the question was being asked, until I reflected upon the changes which have occurred within our industry during the last year, and the amount of concern and uncertainty which has resulted from these changes. Before I convey my response to their question, and in order to better understand why the question was asked, I would like to list for you the changes and situations which have occurred during this year:

1. Reductions in Federal aquatic plant control budgets.
2. Losses in personnel spaces.
3. A change in philosophy and policies within the Department of Natural Resources.
4. The Chief of the Bureau of Aquatic Plant Control and Research position being vacant in DNR for 10 months.
5. The loss of several effective and widely used herbicides.
6. An extended permitting rule (16C-20) promulgation process.
7. Perceived ineffectiveness of the Aquatic Plant Advisory Council.

Upon reviewing this list, you will quickly realize that almost every aspect of our industry has been affected. Perhaps the most frustrating aspect of the situations mentioned previously is the lost expectations we have experienced since the American Assembly Conference in September 1979. During the 1979 annual meeting, just two years ago, this society was extremely optimistic and confident due to the success of the conference. The conference was composed of both lay and professional people actively involved or affected by the aquatic plant industry. This diverse group of individuals unanimously recommended solutions to all of the pressing needs of the aquatic plant industry which we as a society had fought for over the preceding years. At the 1979 meeting, then President Harold Brown commented on the conference,

Presidential Address continued on page 6

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."

The Florida Aquatic Plant Management Society, Inc., has not tested any of the products advertised in this publication nor has it verified any of the statements made in any of the advertisements. The Society does not warrant, expressly or implied, the fitness of any product advertised or the suitability of any advice or statements contained herein.

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Aquatics

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COVER



Suwannee River photo by David Tarver

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.

Bulrush

Scirpus spp.

by Ken Langeland

Bulrush communities, with their tall, slender green stems, are a conspicuous and aesthetic feature along the margins of many of our lakes and slow-moving rivers in Florida. In addition to their aesthetic value, these communities are of great ecological value, and the individual plants exhibit many biological adaptations, which are of interest to the aquatic botanist.

The common name, bulrush, is actually a misnomer because it indicates membership in the rush family, or Juncaceae. The bulrushes, however, are represented by the genus *Scirpus* which is included in the sedge family, or Cyperaceae. The genus is quite large, comprising about 300 species worldwide. According to Godfrey, (1979) 12 species listed below occur in Florida.

- Scirpus koilolepis*
- S. erismana*
- S. americanus*
- S. olneyi*
- S. etuberculatus*
- S. californicus*
- S. validus*
- S. cubensus*
- S. robustus*
- S. cyperinus*
- S. pendulus*
- S. lineatus*

Long (1971), however, reports only three of these species south of Lake Okeechobee, *S. americanus*, *S. validus*, and *S. robustus*.

Two species are of particular interest to us, *S. californicus*, and *S. validus*. The giant bulrush (sometimes called Southern bulrush) and soft-stem bulrush, respectively, form the familiar colonies in the shallow water along lake, river, and ditch margins. These colonies



In cross section, the numerous air spaces of the bulrush stem are evident.



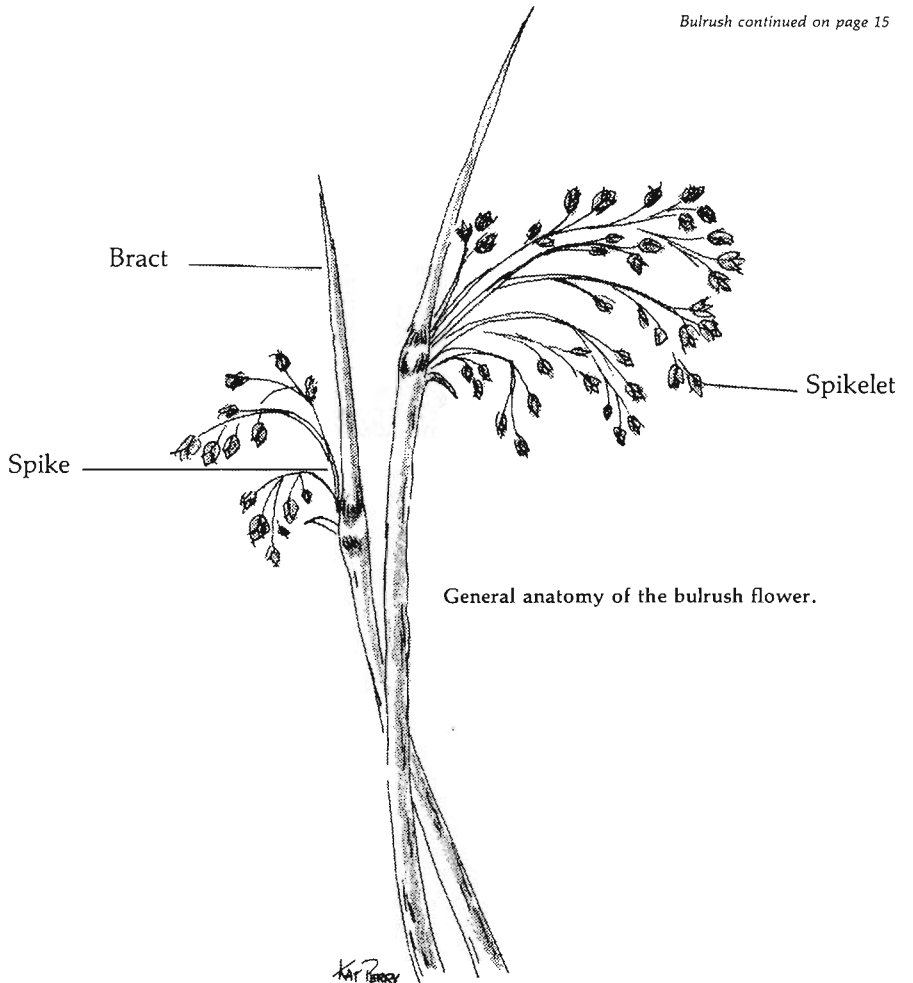
The elongate cylindrical bulrush stems are able to bend in the wind, current, and waves, without being injured.

are recognized immediately by the 1-3 m tall, dark green stems with a cluster of brown scaly flowers toward the apex.

The stems of giant bulrush rise from knotty, 8-10 mm diameter rhizomes. The 1-3 m tall stems are obtusely three angled, dark green, and smooth. An important distinguishing characteristic amongst the *Scirpus* species is the absence or occurrence of a bract (modi-

fied leaf) which appears as a continuation of the stem. Giant bulrush possesses such a bract which is 1.8 - 7 mm long, and is usually shorter than the inflorescence. The inflorescence consists of a number of drooping branches which bear clusters of many-flowered, chestnut brown spikelets. Up to 150 spikelets may occur. Soft-stem bulrush is very similar in appearance to giant bulrush, with the

Bulrush continued on page 15



General anatomy of the bulrush flower.



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"We the members of FAPMS must now, and in the immediate future, dedicate ourselves and our efforts to a determination which will insure that all the time and efforts expended in the conference shall not be wasted. When will we again have such an opportunity?" Quite frankly, I believe we as a society became complacent and felt as if all of our problems were solved. Shortly thereafter, the administration in DNR changed and the philosophy towards the aquatic plant control industry shifted from that of operational support to a more regulatory nature due to the shifting of the permitting authority from the Game and Freshwater Fish Commission to DNR. To date, only a few of the resolutions of the conference have actually been enacted.

Recently, there have been numerous comments concerning the effectiveness of the Aquatic Plant Advisory Council since it was the cornerstone of the recommendations made by the American Assembly Conference. This was the first year of operation by the council and it was basically an organizational year upon which increased effectiveness should result. Additionally, attempts are still being made to establish the Council by legislation.

At the Federal level, the budget cuts and personnel reductions which are occurring under the new administration will cause a change in the priority and level of control which has been available in the past. An additional impact of this action will be an increase in commercial contracts. The recent announcement of the cancellation of the State special and local needs labels for hydrilla control for flowing waters will cause us to modify our treatment programs and methods unless these labels can be reinstated. These situations point out one important fact — this society can never relax in our efforts to promote our industry and to pursue our goal of professional aquatic plant management. As a group, we have proven we can be extremely effective but it will take a rededication by each of us to regain the impetus and momentum we had at the conclusion of the American Assembly Conference. To accom-

plish this, the Society should provide helpful and appropriate input to those agencies, legislators, companies or individuals who are responsible for aquatic plant management in Florida.

For a brief moment, I would like to discuss the status of our society, since it is a key to the future of Aquatic Plant management in Florida. During the past year, our membership reached 610. We reached financial security and purchased a \$5,000 savings certificate. Under the leadership of Paul Myers, *Aquatics* has continued to be a first class and respected publication with a mailing list of 1500 individuals. The Board of Directors has established a special committee to draft criteria for awarding annual scholarships to students pursuing a career in aquatic plant management. This committee is also going to investigate other activities which the Society can pursue in order to promote our industry. In conclusion, FAPMS is strong and viable.

Now back to my answer to "What is the future of Aquatic Plant Control in Florida?" As I told the group that particular day, as long as there is any type of water resource management in Florida, whether it be for flood control, navigation, agricultural irrigation, recreation, fish and wildlife conservation or public health, there *will* be Aquatic Plant Management in the State of Florida. However, in these tight economic situations and changing administrative climates, we will modify our methods and approaches in order to maintain an optimum level of control.

Finally and most importantly, I would like to leave you with one thought. No one cares more about Aquatic Plant Management in Florida than the people assembled at this annual meeting, and the future of our industry is up to you. □

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AQUA-VINE



Advisory Council Update

As the Florida Aquatic Plant Advisory Council enters its second year, the membership will change with Dr. John Osborne, University of Central Florida, being named to replace Dr. Leslie Ellis as the State University System representative. Mr. Les Bitting of the Old Plantation Water Control District will replace Mr. Joe Schweigart.

The new officers for 1981-82 are: Chairman — Arnett C. Mace, Jr.; Vice-Chairman — Harold Brown; and Secretary — Dennis Riley. Committees for 1981-82 will include: 1) Research — John Osborne (Chairman), Dennis Holcomb, and Dennis Riley; 2) Operations — Joe Joyce (Chairman), E. D. Vergara, Les Bitting and Vince Gigilio; and 3) Legislative — Harold Brown (Chairman), Beverly Birkitt, and Tom Lawton.

The new officers and committee chairmen will meet on November 5, 1981, at Crystal River to discuss programs, goals and activities of council for 1981-82.

The Council seeks your input on ways to improve its effectiveness and aquatic weed management programs for Florida. □

AQUA-VINE continued on page 7



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Dan Riley Heads Bureau of Aquatic Plant Research and Control

"Several employees of the Department of Natural Resources have changed positions within the Bureau of Aquatic Plant Research and Control. Danny Riley has been promoted to Bureau Chief from his former position as Senior Biologist administering the state funding program. Bill Maier is now Danny's assistant, moving up from Administrator of the Field Operations and Permitting Section. Jess Van Dyke's job has changed from Senior Biologist in the Research Section to Regional Biologist of Northwest Florida." □

Bob Gates to Retire?

Robert J. Gates has recently retired from the Southwest Florida Water Management District after 18 years, plus six months, in advisory capacity.

Bob is too young to retire, so he has elected to mix in a little golf and travel, staying active assisting operational groups with consultation in aquatic plant control. He has for many years (seems like a hundred) been active as an aquatic weed warrior here in the States and half-way around the world, through the National Academy of Sciences. He is a Past President of the Hyacinth Control Society and was instrumental in organizing the Florida Chapter of the Aquatic Plant Management Society.

He will be offering his expertise more in the administration disciplines than the physical application of chemical or mechanical endeavors. Seminar workshops for managers, resource work plans, drift control systems and aeration of small lakes are just a few areas of responsibility that will be addressed. Time will also allow Bob to pursue his old haunts and to attend his agriculture and construction interests in the urban area of Chicagoland, where he received his early training in Mechanical and Construction Engineering at C.I.T. His central control of operations will be at his present address and phone number in Port Richey, Florida.

His wish to all of you that have worked with him in agency work is — "Keep the effort for Plant Management in Good Hands." □

5th Annual Florida Aquatic Plant Management Society Meeting

The Society once again had an extremely successful meeting. Much was learned and shared at the formal sessions, equipment demonstrations and informal social exchanges. The Society was honored by having Florida Com-

missioner of Agriculture, Mr. Doyle E. Connor, as guest speaker.

This year the Center for Aquatic Weeds, IFAS, University of Florida, held its Aquatic Weed Research and Extension and Coordination Meeting at the Orlando meeting site. This review meeting was prior to the F.A.P.M.S. meeting but was not widely publicized. It is our understanding that the Center will again have a similar review prior to the 1982 FAPMS meeting.

Awards: The Society, in a special presentation, presented Al Burkhalter with a beautiful plaque that read:

Dr. Alva P. Burkhalter

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3rd. David Tarver

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Sameodes albiguttalis, a New Biocontrol Agent for Waterhyacinth¹

by Ted D. Center²
Research Entomologist

Sameodes albiguttalis (Warren) is a member of the family Pyralidae, a large and diverse group of moths. Originally discovered in the Amazon basin in 1874, very little was known about this insect until the exploration for natural enemies of waterhyacinth began in South America in the early 1960s. A scientist from Uruguay, A. Silveira-Guido, while working on a special foreign currency grant (PL-480) project with the USDA, discovered that *S. albiguttalis* larvae fed upon waterhyacinth and was probably the first to recognize its potential as a biocontrol agent. Drs. F. D. Bennett and H. Zwolfer, of the Commonwealth Institute of Biological Control (CIBC), also found this insect to be quite common on waterhyacinth in Trinidad, Guyana, Surinam, and Brazil. Subsequently the U.S. Army Corps of Engineers Aquatic Plant Control Research Program (APCRP) and the Florida Department of Natural Resources sponsored further research on this and other potential natural controls of waterhyacinth. In 1973, a USDA scientist, Dr. C. J. DeLoach, stationed at Hurlingham, Argentina, began studying the biology of *S. albigut-*

talis and determined that it would not feed and could not survive on any host plant species other than waterhyacinth. Hence, in biocontrol parlance, it was deemed to be "host-specific" and, if released in the United States, was unlikely to feed upon economically important crops of beneficial plants. As a result, permission to introduce *S. albiguttalis* into quarantine was requested and subsequently granted by the Working Group on the Biological Control of Weeds (WGBCW), an advisory committee for the Animal and Plant Health Inspection Service (APHIS, USDA). The first consignment of insects was received by a USDA scientist, Mr. N. Spencer, working in the quarantine facility located at the Florida Department of Agriculture and Consumer Services, Division of Plant Industries in Gainesville in 1976. The purpose of the quarantine procedure was to screen the insects for possible parasites or pathogens, and if found, to exclude them as well as to further test the insects on plant species that may not have been available in Argentina. This testing and screening was completed, a report was submitted



Sameodes albiguttalis adults showing the color differences between the sexes. The female is above, the male below.

to the WGNE, and permission was obtained for field releases. The first insects were liberated at 3 sites in Florida in October 1977 by Mr. C. F. Zeiger of the U.S. Army Corps of Engineers (COE) and Dr. B. D. Perkins of the USDA, but these first releases were not very successful. After I succeeded Dr. Perkins at

Sameodes albiguttalis continued on page 10

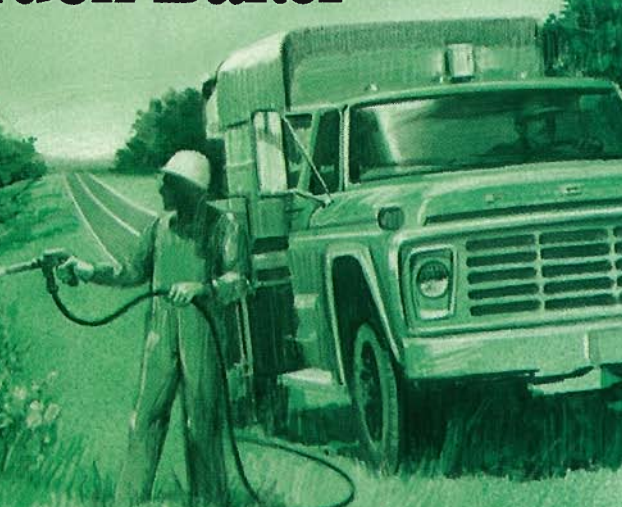
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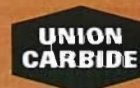
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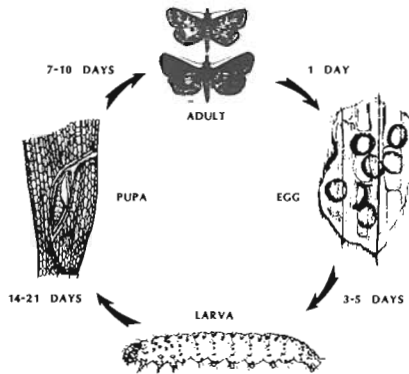


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Ft. Lauderdale, we continued to release insects during 1978 and ultimately released *S. albiguttalis* at 17 sites, primarily in southern Florida. By June 1979, we had determined that it had become well established at several sites and had begun to disperse throughout the state. In 1980 we cooperated with Mr. R. Theriot and Dr. D. Sanders of the Vicksburg, MS, Waterways Experiment Station (COE, APCRP) on releasing the insects in southern Louisiana. Presently, populations are established at several sites there and are beginning to disperse throughout the state.

Now that *S. albiguttalis* has been released and is widely established in Florida (Fig. 1), we are beginning to see a few isolated instances in which the effects of infestations of these insects are devastating to waterhyacinth stands. Although this devastation is not widespread, it is becoming increasingly important for aquatic weed management specialists to be aware of and to capitalize upon the potential benefits resulting from biological control. Viable insect populations may be completely eliminated by management practices which cause a dramatic decline in the plant populations and result in the loss of the insect's food supply. It would be valuable for aquatic applicators to recognize situations in which biological

control is being effective and to act to protect or enhance it. First, however, one should recognize the insect, the damage it causes to waterhyacinth, and the signs of effective control. The purpose of this article is to provide some of this information.



The life cycle of *Sameodes albiguttalis*. The eggs are shown inserted into an abraded area of the leaf. The pupa is shown in its cocoon in a cavity within a section of the leaf petiole. (Illustration by B. Benner)

The life cycle of *Sameodes albiguttalis* is illustrated in Fig. 2. The eggs are small (ca. 0.3mm), spherical and creamy-white. The shape of the egg is often irregular because the chorion (egg shell)

is soft and the adult female often pushes them into cracks and crevasses in the plant thus distorting their shape. As the embryo develops the egg becomes progressively darker. Just prior to hatching it appears black due to the visibility of the black head of the larva within the egg. Complete development of the embryo usually requires 3-4 days at room temperature (ca. 75°F).

The newly emerged larva measures ca. 1.5mm in length, is brownish with darker spots and its head is black to dark brown. As the larva grows it sheds its skin and passes through 5 stages (instars). The fully grown 5th instar larva is ca. 2 cm long, has a dark orange head and a cream-colored body, and is covered with conspicuous dark brown spots. Completion of the 5 larval stages requires ca. 2 weeks.

When the larva is fully grown it seeks out a fairly large, relatively intact waterhyacinth leaf petiole and burrows into it. It excavates an elliptically shaped cavity in the middle of the petiole with a tunnel extending from one end. This tunnel leads from the cavity to just beneath the outside surface of the petiole and the end remains covered by the leaf epidermis. The larva then forms a cocoon by spinning silk around itself and creates a lining within the cavity which extends up the entire length of the tunnel. Soon afterwards it sheds its last-instar larval skin and becomes a pupa. It is inactive during this stage (which lasts 7-10 days) while many complex internal changes take place which alter its structure to that of an adult moth. After it is fully formed it breaks out through the head end of the pupal skin, crawls through the silk lined tunnel and breaks through the thin layer of epidermis at the end to exit from the petiole. The exit tunnel is necessary since the adults no longer have chewing mouth parts and could not otherwise escape from within the petiole.

The adult moths are frequently found resting on the underside of waterhyacinth leaves. The females are generally darker in color than the males (Fig. 3), but color is extremely variable in both sexes. The forewings range in color from brown to golden with the hindwings more consistently golden. There is usually a distinct white spot at mid-length towards the leading edge of the forewing and a dark spot in the center of the hindwing. The hind edges of the segments of the body are almost always white, giving the appearance of white rings around the abdomen. The adults probably live no more than a week to 10 days and many fall prey to dragonflies, spiders, lizards, frogs, and other predators.

Mating occurs shortly after emergence from the pupa and the female lays the majority of her eggs the following night. A female will deposit ca. 450 eggs but up to 600 is not unusual. The entire life cycle from egg to egg requires 3-4 weeks.

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A few other species of lepidopteran larvae feed on waterhyacinth but the only one likely to be confused with *S. albiguttalis* is *Samea multiplicalis* Guenée. The larvae of this species also have the conspicuous brown spots but these are generally not as dark as on *S. albiguttalis*. Curiously, when *S. multiplicalis* feeds on other host plants, such as *Pistia stratiotes* L., (as they are likely to do) the spots are not at all conspicuous. A fully grown *S. multiplicalis* larvae is smaller (ca. 13mm) than *S. albiguttalis* (ca. 18mm) and has a pale brownish head instead of a dark brown or orange one. The pupae and mode of pupation are also similar in these two species, as are the adults. The pupa, at 7-8mm, is ca. $\frac{2}{3}$ the length of a *S. albiguttalis* pupa, and the wingspread of the adult moth is ca. $\frac{3}{4}$ that of *S. albiguttalis*. Considerable overlaps in the size of various stages occurs, however, between large *S. multiplicalis* and small *S. albiguttalis* specimens and positive identifications require an expert.



The distribution of *Sameodes albiguttalis* in Florida.

Locating *Sameodes albiguttalis* in the field necessitates recognizing the damage it does to the plant since the insects are small and easily overlooked. Just as the presence of the weevils (*Neochetina* spp.) can be detected by the characteristic round feeding spots on the leaves, *S. albiguttalis* can be found by recognizing a few characteristic symptoms of the damage it does (Fig. 4). The most common type of damage is apparent as small dark spots on the leaf petioles. This results from the internal burrowing of small larvae which often feed just under the epidermis. These areas of damaged tissue eventually become waterlogged and necrotic and are manifested as small brown spots visible just under the epidermis. This damage is usually seen on older leaves, especially on plants with inflated "float-type" petioles.

The most important type of damage is caused by the older larvae which seem to prefer to feed on the youngest leaves.

They are often found directly in the center of the crown feeding on the apical bud and the base of the central leaf, often completely severing it. As a result, wilting of the central leaf occurs. At first this is apparent only on the tip of the leaf blade but eventually the entire leaf dies and turns brown. This wilted or brown leaf in the middle of the rosette is very obvious and often flags the presence of *Sameodes*. If this feeding destroys the apical bud the shoot is unable to produce new leaves and it ultimately dies. Prior to its death, however, it may succeed in producing numerous daughter plants but these too are a preferred food source for the older larvae and are often heavily attacked. Although both *Samea* and *Arzama densa* Walker produce similar damage, there are subtle recognizable differences which become apparent as one gains experience.

Sameodes albiguttalis tends to occur most abundantly where young, small plants are present and it is in these areas where the damage is often the greatest. This includes sites where extensive regrowth is occurring, particularly at the growing fringes of the mats. They do, however, also attack the larger, older plants, sometimes creating extensive damage. Heavy infestations often result in patches of "brown-out." This is usually not apparent until after the insects are gone, however, since it requires sev-

eral weeks for the plant to die. Damage to the apical bud results in the inability of the shoot to produce new leaves but the remaining leaves are apt to maintain a healthy green appearance until they naturally senesce several weeks later. Hence, without close observation one might conclude from the green appearance of the plants that the insects are not effective. Later, when the plants have died after all signs of insect activity have ceased, decline may erroneously be attributed to other factors. Biological control of waterhyacinth by *S. albiguttalis* is, therefore, often unrecognized and not afforded the credit due to it.

Many individuals and agencies have participated in efforts to release and disseminate biocontrol agents in various regions in the Southeast. Unfortunately, no similar effort has been made to conserve them after populations are established. The contribution of biological control to waterhyacinth management is either taken for granted or ignored. This is basically due to a lack of knowledge by scientists and weed management specialists alike on the fundamental aspects of integrating chemical and biological control approaches in aquatic systems. At the Aquatic Plant Management Laboratory in Fort Lauderdale, our team of scientists, comprised of plant physiologists, ecologists, and entomologists, is

Sameodes albiguttalis continued on page 12



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A waterhyacinth plant showing signs of heavy attack by *Sameodes albiguttalis* larvae. (Illustration by B. Benner)

conducting research on integrated approaches that will make the best use of biocontrol agents yet still provide a desirable level of control. In a fully integrated management scheme we envision close monitoring of insect, pathogen, and plant populations and the use of low level herbicide applications, strategic placement or optimal timing of herbicide usage, and the possible use of plant growth regulators to avoid interference with large populations of the insects. We feel that we can develop management strategies that will provide waterhyacinth control when and where it is needed yet not result in the unnecessary

decimation of populations of biocontrol agents through the catastrophic loss of their food source. The loss of this food supply as a result of intensive herbicide applications reduces or eliminates the populations of biocontrol agents and thereby limits their potential effect. The key to a successful management program will be the ability to determine when and under what circumstances a particular chemical, mechanical, or biological control strategy may be used in the most cost effective manner. □

¹Cooperative Investigations of the U.S. Department of Agriculture, Agricultural Research Service and the University of Florida, Institute of Food and Agricultural Science, Agricultural Research and Education Center, Fort Lauderdale, Florida 33314.

²U.S.D.A., A.R.S., Aquatic Plant Management Laboratory, 3205 S.W. 70th Avenue, Fort Lauderdale, Florida 33314

PEOPLE ON THE MOVE

David Tarver Joins Elanco

David Tarver has recently joined Elanco Products Co. as Aquatic Specialist to work with the development of Sonar.

David was formerly with DNR, Bureau of Aquatic Plant Research and Control.

LES

by David L. Sutton¹

Few people are known just by their first name, but just about everyone who is involved with aquatic weed management in Florida knows Les. If it had not been for the bitter cold winters in western Nebraska, the Bitting family may not have moved to Florida in 1939. Nebraska's loss was Florida's find of an individual who could ride herd for Mr. Peters 10,000 acre cattle ranch adjacent to the North New River Canal in Broward County. Mr. Peters was looking for someone to treat his cattle for the dreaded screwworm fly, and Les showed he could handle the problem. Les has not stopped since then.

Cattle ranches and vegetable farms in Broward County have given way to a burgeoning urban population faced with a problem which the farmers faced for many years. The low, flat lands flood easily during periods of wet weather and the sandy soils dry quickly when the rains stop. Control of water is essential for drainage and irrigation in this area.

As the screwworm fly problem was slowly brought under control and the cattle industry declined, Les' attention began to shift to water related problems.

In 1947 the Old Plantation Water Control District (OPWCD) was formed to control the water in and around the Peters' farm. In 1962 Les began working for this District because of his expertise in aquatic weed control on the Peters' farm.

Les' first experience with aquatic weed control was in the mid 1950s with the use of "sour gas" (a poorly refined petroleum distillate) at 75 ppm for control of southern naiad. Even at a cost of \$1.25 per gallon, control was quite effective for 6 to 12 months before the plants regrew.

Les has always been in the forefront of the search for new and effective means for controlling aquatic weeds. He still

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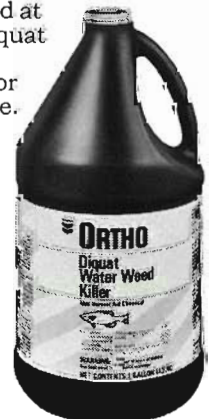
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remembers the thrill of a new experimental herbicide (diquat) which would kill southern naiad at the unheard rate of 0.5 ppm. Quite a contrast to the 75 ppm for sour gas.

Soon after Les began work at the OPWCD, hydrilla began its spread throughout south Florida. Les worked closely with USDA scientists at Fort Lauderdale and others in their search for effective herbicides that would control this nuisance weed. Les further expanded work on the invert system and found it to be quite effective for duckweed control.

Hydrilla is no longer the major problem plant in Les' canals. However, a continual vigilance on Les' part is necessary to keep hydrilla under control. Algae, duckweed, and torpedograss are now the most troublesome vegetation in the OPWCD.

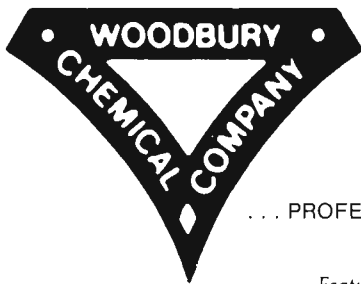
Les gives the following as the major reasons for aquatic weed problems in his area: "In addition to the growth pressures characteristic of a sub-tropical climate, the greatest single factor causing excessive aquatic weed growth in the District is the pressure of sewage plant effluent in the waterways. Drought periods resulting in "No Flow" circumstances greatly increase algae and duckweed stands."

Les would like to see more attention given to the development of selective herbicides which degrade rapidly after they are applied.

For the future, Les feels that improvements in aquatic weed control methods are needed in "(a) equipment to accurately proportion several herbicides and adjuvants into a spray system at varying flow rates; and (b) equipment adaptable or adjustable to allow spraying of widely varying widths of floating weed stands on canal edges, or varying strips of bank growth." Additionally Les states "the need for effective herbicides that can be readily labeled is apparent to all in the aquatic field."

Les is not only active in seeking better solutions to problems in his district, but promotes communication of aquatic weed control information through professional societies. Les is a Charter member of the Aquatic Plant Management Society. He was instrumental in the forming of the Florida Chapter, and was its first president in 1977.

Florida's aquatic weed problems are unlikely to diminish in the foreseeable future. But through the efforts of individuals such as Les Bitting, they can be managed to an acceptable level. □



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¹Professor and Aquatic Weed Physiologist
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exceptions that it 1) has round stems versus the slightly triangular stems of giant bulrush; 2) has longer spikelets; and, 3) is of slightly smaller stature.

The specialized anatomy and physiology of these species reflect their ability to inhabit the harsh environment of lake and river margins. The elongate, cylindrical stems, with highly reduced leaves, are able to bend in wind, current and waves, without being injured. Closer, microscopic examinations of the stem reveal the presence of elastic tissues which also allow bending. Another striking feature of the stem, which is noticed in cross-section (without the aid of a microscope), is the presence of numerous air spaces, or lacunae. These air spaces are continuous with similar air spaces in the rhizomes and allow for diffusion of ambient air as well as oxygen produced during photosynthesis from the emergent organs to those organs below the substrate. This anatomical feature is an adaptation which allows the species to grow in anaerobic substrate. The plants are also able to respire in the absence of oxygen which further adapts the species for existence in its anaerobic environment. Studies by Seidel (1966) have shown the ability of soft-stem bulrush to reduce the levels of organic compounds, BOD, phosphate, nitrogen compounds, and bacterial levels in laboratory systems. Similar water quality improvement probably occurs under natural circumstances as a result of the presence of littoral bulrush communities.

One of the more important ecological benefits of the bulrush community is its role as wildlife habitat and in wildlife food production. Bulrush rhizomes are an important forage for mammals such as deer, beaver, and muskrat. It is also reported that bulrush rhizomes are an important food for hippopotamus, and without this food source our Florida hippo population would certainly become extinct. Bulrush seeds are of great food production value to duck, coot, and geese, and to a lesser extent to game birds, including bobwhite quail. As a fisheries habitat, bulrush communities provide a spawning medium, shade and shelter and food production.

The Florida Game and Fresh Water Fish Commission has had a growing interest in the fisheries production value of bulrush in recent years. According to Freddie Langford of the Commission, anything such as aquatic vegetation which increases the surface area above the hydrosol, increases the area for attachment of aquatic organisms on which fish feed and, hence, increases fish production.

The Commission has found that giant bulrush is an ideal aquatic macrophyte to plant as a natural "fish attractor." The loose arrangement of stems in a bulrush

colony (as compared to cattails) allows fish to move about and feed. From a sportfishing viewpoint, this loose arrangement is important as it allows the fisherman to drop a plug into the colony where fish can be caught. This situation also provides a protected habitat in which floating macrophytes such as duckweeds can grow, providing additional wildlife forage.

According to Mr. Langford, the economics of establishing such natural fish attractors is excellent. For an initial investment of approximately 6 man-hours, several bulrush stems can be planted which yield 100-200 yards of vegetated shoreline in about two years. Since the beginning of this project, the

Commission has expanded their bulrush plantings across the state in such lakes as Lake Thonotatosassa, Lake Henry, Lake Walking Water and Lake Tarpon. The people involved in this project are quite excited about its benefits to aquatic habitat and we look forward to hearing of their progress in the future.

Public complaints of weed infestations of bulrush are few. When problems do occur, it is usually infestation in wet pasture or around boat docks. In these cases bulrush can be easily controlled by manual removal or by application of a 2,4-D formulation.

In the final analysis, we can rank giant bulrush and soft-stem bulrush as two of our very desirable aquatic plant species. □

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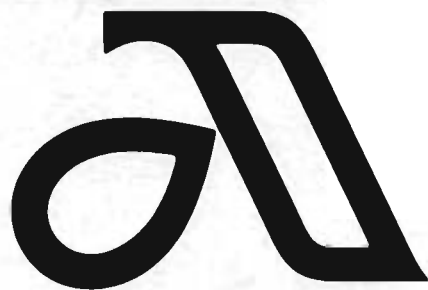
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