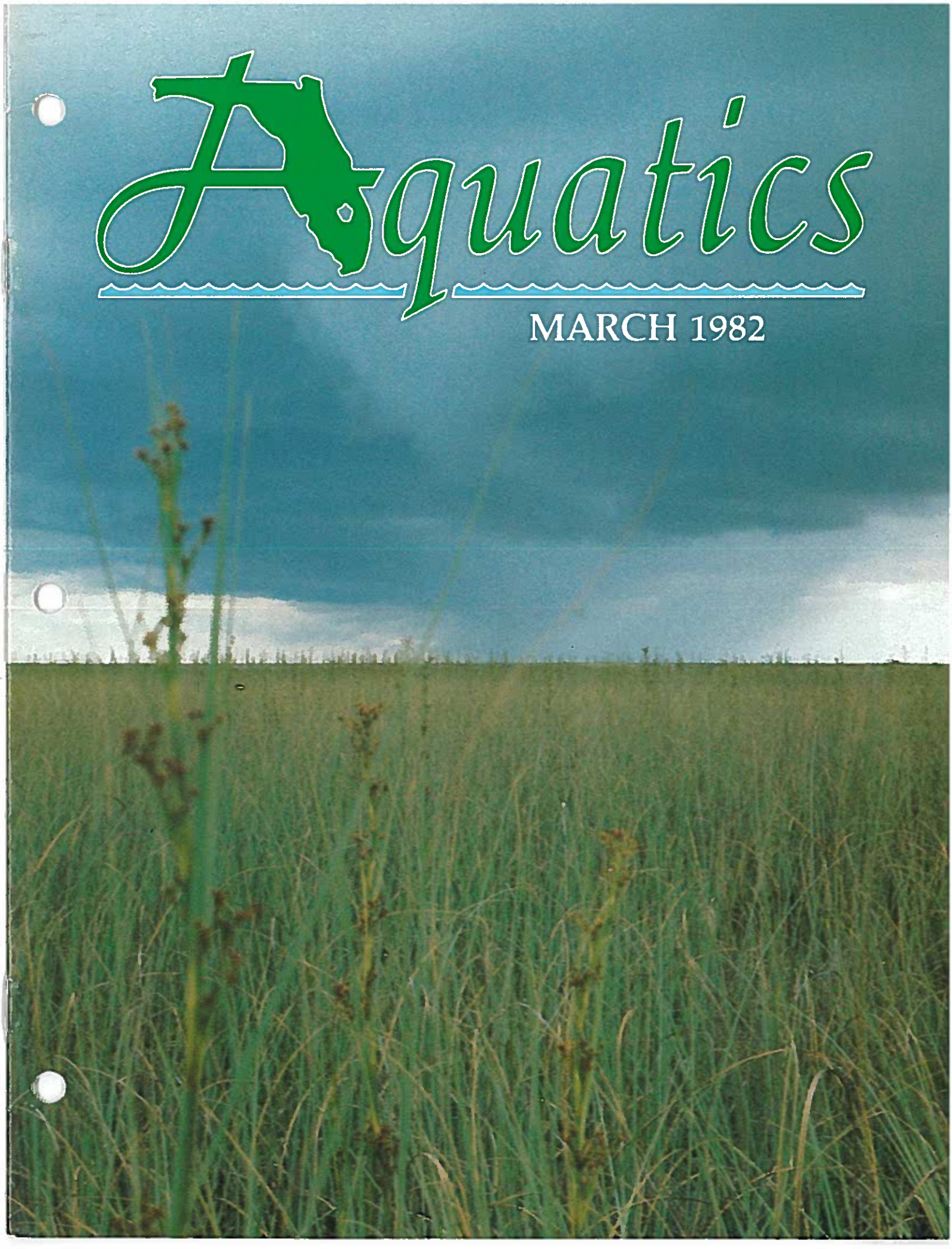
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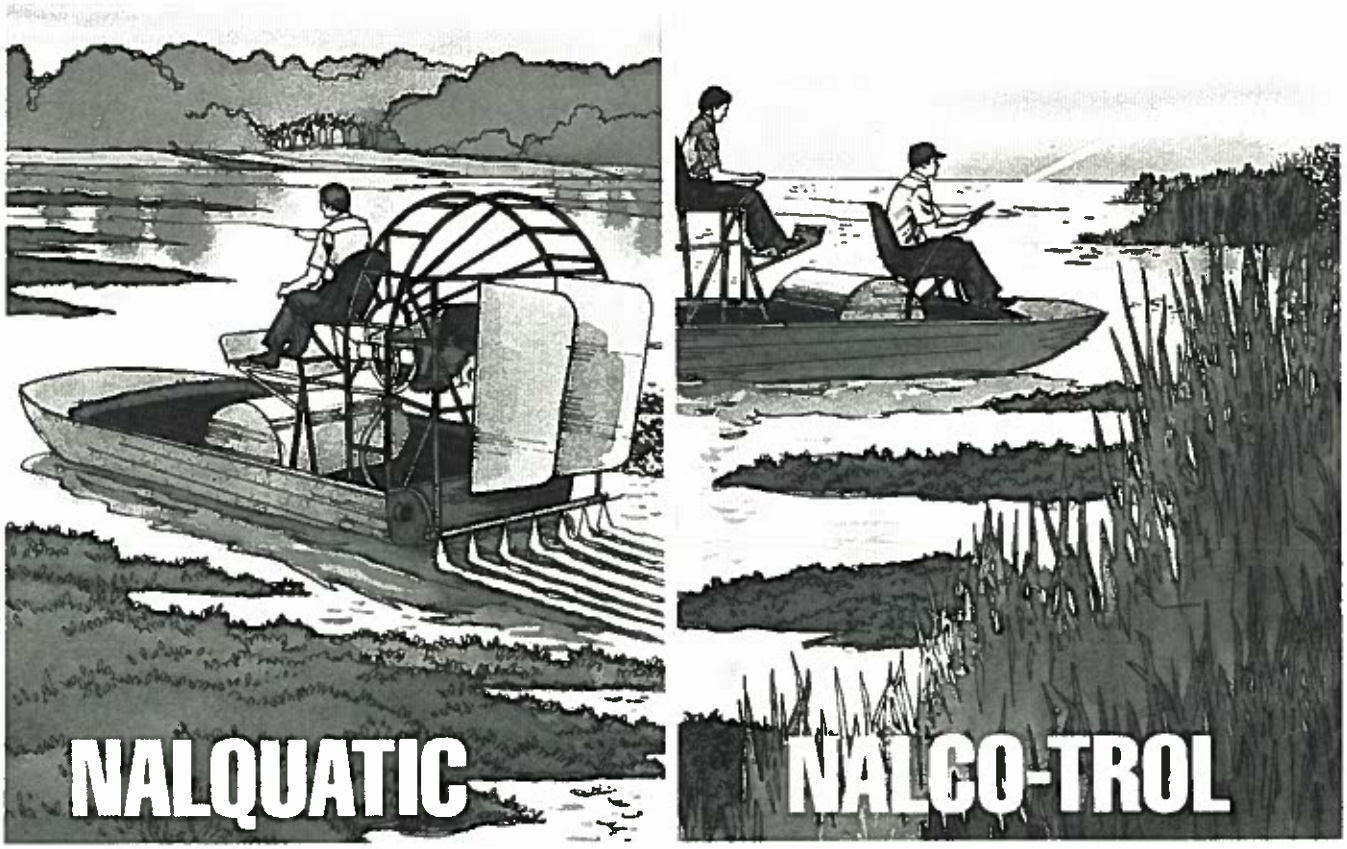
GOOD NEWS FOR AQUATIC WEED FIGHTERS:



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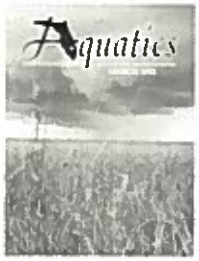
Presidential Message

As we approach a new year, after five successful years in the society's existence, the challenges and opportunities continue to increase. It has to make one look back to the way many things were accomplished in the years past. As your president, I look forward to the issues facing our profession this year. At our first board meeting we will establish a list of goals for the society to work toward. Committee chairmen have been selected. Most are members who have never served the society in that capacity before but will be assisted by previous chairpersons. This should provide greater input into the functions of the society from a broader direct representation of the membership. The chairman of these committees will have a fine choice to select other members to assist them. I have received a few responses from our last newsletter requesting volunteers, however, I would encourage each and every member to become actively involved. We will publish in our next newsletter, a complete listing of the committees, as well as the goals the board establishes and a schedule of our board meetings. Our efforts will continue to concentrate on improving the professional quality of aquatic plant control, educating the people it serves, and provide constructive input for reasonable regulations.

Pass along your thoughts and ideas to the officers, directors and committee members.

We have a very challenging year ahead of us. Let's all work together to make it as productive as possible.

WILLIAM L. MAIER



THE COVER

Sawgrass (*Cladium jamaicense* Crantz) in conservation Area 3, Dade County Florida. Plant with seedheads in foreground.

Photo by Kerry Steward

Aquatics

MARCH 1982 / VOLUME 4, NO. 1

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AQUATIC PLANT SHORT COURSE / *June 21-25, Gainesville*
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FAPMS BOARD MEETING / *August 27, Bartow*
FAPMS ANNUAL MEETING / *October 27-29, Orlando*

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: 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, FL 33850.

Charophytes

by
Ted R. Batterson
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University of Florida, IFAS
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Fort Lauderdale, 33314

Photograph by Diane L. Johnston

Close-up of an apical portion of a Chara *showing both gametangia*

What is a charophyte? The term means "Chara plant," a division of the plant kingdom that includes all present day chara-like plants of the family Characeae. They are widely distributed and commonly found in lakes and rivers throughout the world in both fresh and brackish water, excluding the polar regions. There are six living genera of plants in this family but only three are found in North America, *Chara*, *Nitella*, and *Tolypella*. Only species of the first two genera are found here in Florida. Many times they are referred to as muskgrasses because of their odor or stoneworts because of their heavy encrustation with marl. Both terms are inappropriate for the group as a whole since only *Chara* is ill-smelling and *Nitella* is rarely encrusted. The odor of *Chara* is thought to come from a chemical that is closely related to that producing the odor of crushed garlic.

The plants range in size from 6 cm to 1.5 m and because of this large size are commonly mistaken for a higher plant, but they are an algae. Therefore, the plant body shows no differentiation into root, stem, and leaf and technically is termed a thallus. It has a vertical axis consisting of alternating short nodes and long internodes, with whorls of branchlets occurring at the nodes (Figure 1). In *Chara* the branchlets are never forked while in *Nitella* they are. The internodes are single cells and in some species may be up to 15 cm in length and 0.3 cm in diameter. The nodes are more complex, being composed of many cells that give rise to the branchlets and in certain species, especially in the genus *Chara*, a one-cell thick layer (the cortex) that lies flat and covers the internode. The plant anchors itself to the sediment by root-like structures called rhizoids.

These plants have unusual sexual organs that are typically borne at the nodes of the branchlets, usually in the upper portion of the plant. The male structures are called antheridia and female ones called oogonia. Though small (1 mm in length) they are quite conspicuous because of their coloration; oogonia vary from golden brown to the more typical black, while the antheridia are red, yellow, or orange. Most species in Florida are monoecious (which literally means "one house"), in which the gametangia (sex organs) are both found on the same plant, usually growing closely together. The zygote that forms from the union of an egg and a sperm develops a heavy enclosing wall, the entire structure being called an oospore. What conditions are necessary for the germination of oospores are not fully understood, but in temperate latitudes it appears they must undergo a resting stage. Some researchers have found that passage of an oospore through a ducks alimentary canal facilitate germination. This probably serves as an important function in aiding in the dispersal of these plants since waterfowl feed on them and then could transport the ingested oospores from one water body to another. The germinated oospore undergoes a meiotic division in which the chromosome number is halved; of the four cells produced, three degenerate. The remaining cell produces the first filamentous stage, called the protonema, from which the haploid plant body that we are familiar with develops. The remarkable uniformity which is often found amongst individuals growing in the same body of water, is in part, due to the haploid nature of these plants. However, there can be varying conditions even within a single clone of charophytes depending on environmental conditions. In shallow, well-lighted water the plants tend to be shorter, stouter, with longer appendages and more gametangia, whereas in deeper water with dim light the plants are longer, slenderer, with reduced appendages and more gametangia. Some deep-water forms may never form the sexual organs.

It has been found that most charophytes are shade-tolerant and in those lakes conducive to growth they will extend to a greater water depth than do the vascular plants. The reason seems to be that they can withstand greater pressures than the tracheophytes since they have no vascular structures. The greatest well-established depth to which any charophyte has been found growing is 65.5 m in Lake Tahoe.

Chara usually occurs in hard water while most *Nitella* species grow in soft water that is mildly acidic. It must be remembered that these chemical boundaries are only generalities and there is a fair amount of overlap. In hard water there is a considerable amount of bicarbonate which *Chara* can readily use as a carbon source in photosythesis. In so doing, other chemical reactions take place that lead to deposits of marl accumulating on the surfaces of the plant

Continued on page 18

Photograph by L. Johnston

Characteristic growth habit of a Chara *plant*

Pennwalt– commitment to clean water for over 20 years.

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New Role in Aquatic Plant Management

by
Lowell L. Trent

The Florida Game and Fresh Water Fish Commission initiated a noxious vegetation control program on November 1, 1951.

The Commission's involvement in vegetation control was the result of a Federal Aid research project designed to develop a method of controlling water hyacinth in the State's recreational waters. Numerous complaints had been received by the Commission's Tallahassee office concerning the unavailability of prime recreational waters from sport fishermen, fish camp owners, duck hunters and other water-oriented users because of large jams of water hyacinth.

The Hyacinth Control Division, as the original group was named, treated 3,209 acres of water hyacinth with 2,4-D in 39 bodies of water by the end of 1952.

By 1980, the Bureau of Aquatic Plant Management had 67 authorized positions to (1) conduct aquatic weed control operations; (2) provide aquatic vegetation control extension service; (3) conduct aquatic weed control permitting duties; (4) coordinate spraying activities between the Commission's spray crews and the personnel of other agencies conducting operations; (5) document the effect of stocking grass carp in Lake Wales for vegetation control; and (6) conduct research on new mechanical biological or chemical methods of aquatic weed control.

Operations

The Bureau of Aquatic Weed Control operational section had 19 spray crews located as close as possible to their normal assigned work areas in order to keep travel time and per diem cost to a minimum.

Field supervisors were located in Crawfordville, Hernando, Umatilla, Lake City and Lakeland to coordinate the Commission's spraying operations concerned with aquatic weed control.

The Commission's spray plane, a Piper PA-36-C, was stationed in Lakeland because the city was centrally located and the plane with loader and tank truck could be dispatched to all work areas within a matter of hours.

Work assignments for the plane, which operated statewide, were made from the Tallahassee office after reviewing requests for aerial spraying assistance from the five regional aquatic botanists.

The primary function of the operational arm of the Bureau of Aquatic Plant Management was to manage the water hyacinth population on intercounty waters of the State. The Commission was responsible for chemical control of water hyacinth in the Apalachicola River, Santa Fe and Suwannee Rivers, Oklawaha River, Upper St. Johns River, Withlacoochee River, Kissimmee River, Alafia, Manatee and Little Manatee River, Myakka River and Peace River watersheds. Effective January 1, 1981, these areas of responsibility were assumed by the appropriate water management districts.

Extension Service and Permitting

Regional Aquatic Botanists were stationed in De Funiak Springs, Lake City, Leesburg, Lakeland and Ft. Lauderdale and were responsible for supervising the operational water hyacinth spraying activities as outlined in a cooperative agreement between the U.S. Army Corps of Engineers and the Commission. They issued permits for aquatic vegetation control operations conducted in their respective regions. They also provided an extension service for weed control to the private sector by providing information in the form of recommendations for management of undesirable aquatic vegetation.

The coordination of aquatic vegetation control operations between the Commission and other agencies active in controlling undesirable aquatic vegetation was the responsibility of the Regional Aquatic Botanist and his area supervisor. The areas of responsibility for field operations were resolved by either formal meetings, telephone conversations or in some cases, memoranda of understanding.

Effective January 1, 1981, these duties became the responsibility of the Department of Natural Resources.

Aquatic Vegetation Survey

The five Regional Aquatic Botanists conducted an annual inventory of all inter-county waters to document the increase or decline in aquatic vegetation with special emphasis on water hyacinth, hydrilla and eurasian watermilfoil.

Effective January 1, 1981, this duty became the responsibility of the Department of Natural Resources.

Aquatic Vegetation Control Philosophy

The Florida Game and Fresh Water Fish Commission recommends a maintenance control program to prevent water hyacinth from interfering with recreation, water movement and navigation in the State's public waters. We believe this type of program keeps damage to the aquatic environment to a minimum because of the reduction in the volume of herbicide required to treat lower population levels of the plants.

The Commission's approach to hydrilla control is to provide access to the lake or stream through boat trails and open fishing areas for sport fishermen using E.P.A. approved herbicides. Fishing reports following this approach to hydrilla control on Lake Trafford revealed that fishing improved. Largemouth bass over seven pounds were caught in the boat trails and open fishing areas provided through the joint efforts of Collier County and the Commission.

Commission's Role Effective January 1, 1981

Effective January 1, 1981, the Department of Natural Resources Bureau of Aquatic Plant Research and Control assumed responsibility for all aquatic weed control activities conducted in the State of Florida. The spraying duties have been sub-contracted to the five water management districts while the permitting, extension service and survey functions have been retained by the Department of Natural Resources.

The Commission reorganized the Bureau of Aquatic Plant Management, deleted 55 positions and established a new Aquatic Plant Control Assessment Section.

The Aquatic Plant Control Assessment Section presently consists of 12 full-time positions. A section leader and secretary are stationed in Tallahassee to conduct administrative and coordination functions.

A Senior Biologist and two Game / Fish Management Specialists stationed in Leesburg are responsible for permit review activities in the 44 counties

located in the Northeast and Central regions of the State.

A Senior Biologist, secretary and two Game / Fish Management Specialists stationed in Lakeland are responsible for permit review activities in the 23 counties located in the South and Everglades regions.

A Biologist Supervisor I and two Biologists stationed at the Eustis Research Laboratory are assigned to the triploid hybrid grass carp project which is designed to determine the long-range effect of stocking hybrid grass carp. Control of undesirable vegetation by this hybrid will be assessed. Research is being conducted on Lake Wildmere, Lake Sybelia, Lake Dianne and Palm Lake. Commission personnel have been assigned to monitor changes in the aquatic habitat, collect water quality information, sample fish populations and analyze data following the stocking of grass carp hybrids to control hydrilla in these Central Florida lakes.

Aquatic Plant Control Permit Review

The Department of Natural Resources is in the process of developing Rule 16C-20, Aquatic Plant Control Permits. This rule will present guidelines and regulations for the issuance of permits to conduct aquatic vegetation control activities in the State of Florida.

A task assigned to the Florida Game and Fresh Water Fish Commission by an agreement with the Department of Natural Resources directs the Division of Fisheries through the Aquatic Plant Control Assessment Section to review and comment on all applications for chemical control, received by the Department, in waters where fish and wildlife are of prime importance.

The review of these aquatic plant control permits, including the submission of comments to the Department of Natural Resources in a timely manner, is of the highest priority.

Monitoring Field Operations

Section personnel monitor aquatic weed control operations, including those conducted by the five water management districts, where fish and waterfowl are of prime importance. Presently we are trying to develop a mechanism to keep Commission personnel advised to location and time of spraying operations conducted by the various agencies in areas of critical concern.

Hybrid Grass Carp Inspection Program

The Aquatic Plant Control Assessment Section has the responsibility for

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What is IAWM?

by
Roy P. Clark
Chief Pestisides & Toxic Substances Branch
Environmental Protection Agency
Region IV

The magnitude of the national aquatic weed problem is not known, but from reports it seems to be growing larger. The environmental impact of all the tactics currently being used in an attempt to control aquatic weeds is not known either.

Recognizing this, Congress demanded that the Environmental Protection Agency (EPA) develop a research program "...with the purpose of eventually providing environmentally sound solutions to the problems of aquatic weed control" (H.R. 2676, Congressional Record, November 9, 1979). In February 1980, EPA responded with the Integrated Aquatic Weed Management (IAWM) Research Program.

An Integrated Pest Management (IPM) approach was selected because of its success and recognition as the state-of-the-art management technique for agricultural ecosystems. IPM, as an advanced scientific system, relies on the best experience of many disciplines to develop modern pest management strategies that are practical, effective, economical, and protective of both public health and the environment.

The IAWM Program is a four-year project from 1980 to 1984. EPA has established two basic goals for the IAWM Research Program to accomplish during its limited time frame.

One goal is to develop an understanding of the problems of aquatic weed management nationwide and establish priorities for regional problems. The temporal and localized nature of pest management programs require a carefully tuned and sensitive approach that uses knowledge and information about the pest itself, the condition of the host, the prevailing climatic factor, the potential for biological and natural controls, and the proper timing of chemical application.

The other goal is to prepare and disseminate IAWM manuals for selected regions of the U.S., using long term strategies which result in minimal socio-economic and environmental impacts. While there is still a lot to learn from research, many of the means necessary to implement IAWM strategies are available and are being used. Others will become available in the near future.

To achieve the goals of understanding the scope of the aquatic weed problem and of preparing and disseminating IAWM information, EPA has set four objectives to be met:

1. Assure the EPA-sponsored research complements other on-going aquatic weed research programs and provides for maximum cooperation among agencies involved in aquatic weed management;
2. support specific research projects which improve EPA's ability to use IAWM approach, either nationally or regionally;
3. assure dissemination of appropriate information throughout the course of the program for use by those who must deal with weed control problems;
4. evaluate the future role of the integrated approach at the conclusion of the program.

EPA views the IAWM Research Program as a complement to the Federal Aquatic Plant Management Working Group's activities. It is not a replacement or competitive program. EPA confirmed this view by publishing a compendium of on-going research to facilitate cooperation and avoid duplication. The compendium is expected to be updated on a regular basis.

There are several major research needs wherein EPA can contribute. The first involves the development of an economic threshold decision model and a

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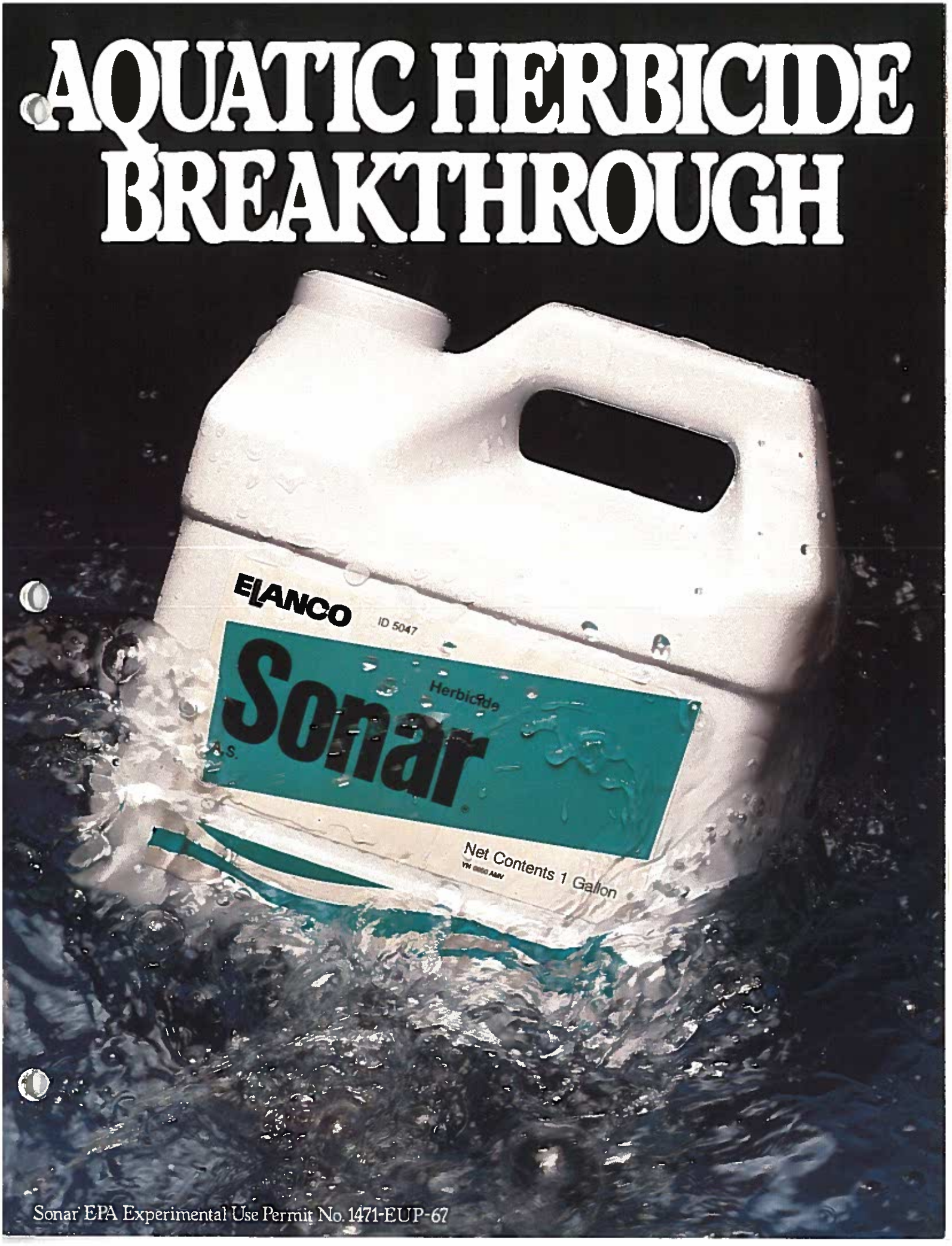
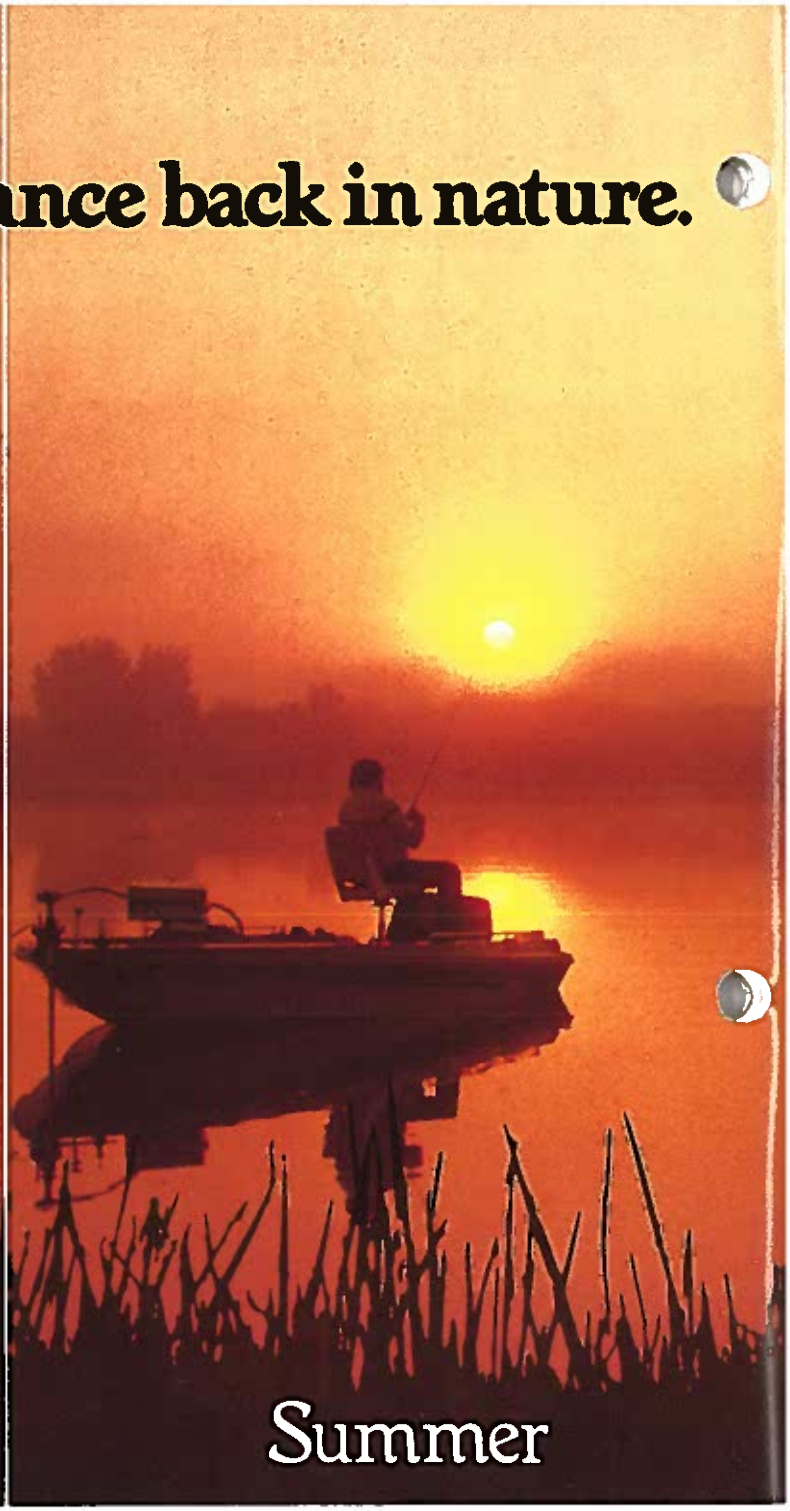
AQUATIC HERBICIDE BREAKTHROUGH



Sonar EPA Experimental Use Permit No. 1471-EUP-67

Sonar® gently puts the balance back in nature.



At last there's a new generation aquatic herbicide that manages a host of undesirable vascular plants without mismanaging the good life. Sonar® from Elanco.

Weed management.

One treatment of Sonar provides control during the critical growing season of many submersed and emersed aquatic weeds. Weeds controlled include hydrilla, elodea, water milfoil, pond weeds, torpedograss, paragrass, southern naiad and numerous other troublemakers.

Hydrilla

When you make Sonar part of your weed control program, you get effective management of your valuable water resources.

Slow but sure action.

Four to six weeks after treatment, Sonar takes its toll on undesirable vegetation. And because of its slow action, there is no rapid oxygen depletion. This makes Sonar highly compatible with the aquatic environment and makes fish kills a thing of the past. Applied as directed, Sonar will not harm fish,

Elodea

Water milfoil

wildlife, or nearby trees and shrubs.

Flexible application.

Sonar can be applied to the entire surface of a pond or up to ten percent of larger bodies of water. Depending on existing equipment and user preference, Sonar is available as an aqueous suspension or 5% pellet and can be applied any time during the year. For best results, the label recommends applying Sonar when weeds are actively growing.

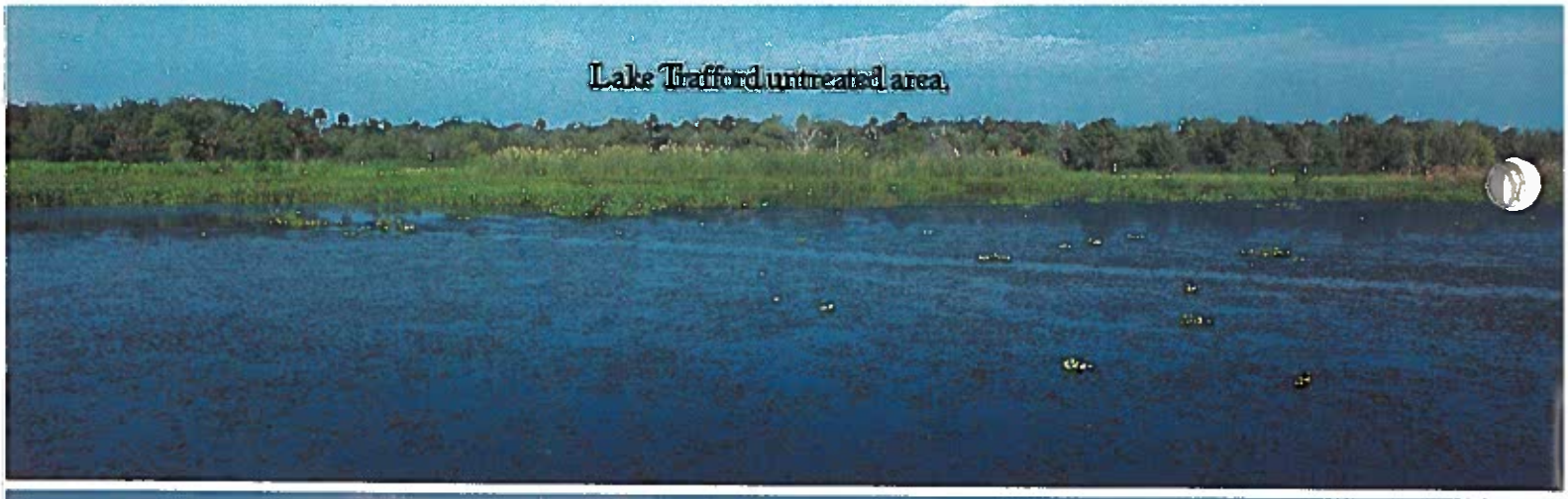
Inherent value.

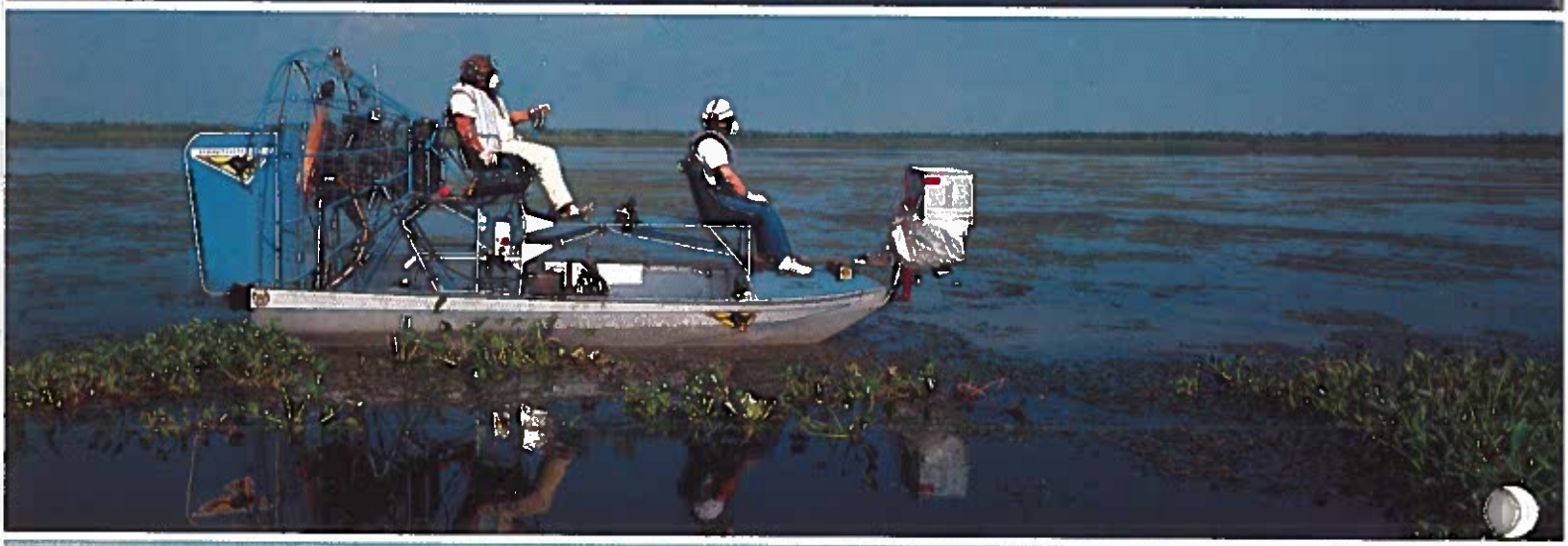
There are few restrictions after application, and they are detailed on the product label. Make Sonar part of your management program. It's the simple, gentle way to put nature back in balance.

Pond weeds

Torpedograss

Paragrass





Sonar® aqueous suspension can be applied to the water surface or under the water surface or placed along the bottom of the water just above the hydrosoil. Any conventional application equipment can be used.

Sonar 5% pellet can be applied to the water surface from the shore or from a boat. Refer to the Sonar label for complete application instructions.

Always follow label directions. Sonar is available in limited quantities under EPA Experimental Use Permit No. 1471-EUP-67.

For further information write or phone:
David P. Tarver, Aquatic Specialist, 2416 McWest Street, Tallahassee, FL 32303 (904) 386-8533

Elanco Products Company, A Division of Eli Lilly and Company, Indianapolis, IN 46285, U.S.A.

DNR Revises Aquatic Plant Rules

The annual aquatic plant survey will be expanded to cover lakes and reservoirs which pertain to Chapter 16C-20 as well as rivers and canals.

The rules of Chapter 16C-19, to regulate the importation, transportation and cultivation of aquatic plants, are nearing completion and should be promulgated by mid-1982. The most progressive programs to be initiated by the rules are:

1) a mechanism whereby the department will screen exotic aquatic plants prior to their importation into Florida;
2) the formation of an Aquatic Plant Regulatory Board composed of representatives from the Department of Natural Resources, Department of Environmental Regulation, Department of Agriculture and Consumer Services, university community, aquarium industry and aquatic plant control industry. The board will meet to review the screening procedures and advise DNR when assembling the approved and prohibited aquatic plants lists.

The rules of Chapter 16C-15, F.A.C., for the application and utilization of state funds for aquatic plant control are currently being evaluated by the staff of the Bureau of Aquatic Plants Research and Control to determine the effectiveness of the requirements as presently written.

Special emphasis will be placed on changes that will ultimately benefit the Cooperator and the Department in administering the aquatic plant control funding program. It is recognized that portions of the rule in its current form need revision. Therefore, we would like to encourage grant recipients as well as other persons or associations involved in aquatic plant control activities to participate in the refinement of the provisions of this rule. Each Cooperator currently in the state aquatic plant control funding program will be provided a draft copy of the proposed revisions. However, any other interested persons who wish to be placed on our mailing list should contact Judy Locke, Grants Coordinator, 904 / 488-5631 or Douglas Building, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303.

The policy changes under consideration are planned for implementation for fiscal year 1982-83.

From Nightmare to Fairy Tale

(or how two small town boys won the Aquatic Plant Manager of the Year award).

Imagine 20,000 acres virtually covered with surfaced hydrilla. Imagine 13 fishcamp owners with blood in their eyes and hundreds of fishermen screaming for something to be done to make all that weed growth disappear overnight.

It's the first of May. It's just you and your partner and one antique airboat.

No, this is not the nightmare of an applicator who just ate a double cheese, anchovy, pepperoni and pistachio ice cream pizza. This is a true story of two country boys who made it big on the big lakes. Only the names of the innocent have been changed to protect the guilty.

This is the True Story of how fishcamp owner Leapin' Lena doesn't leap near as much as she used to, and the fish are leaping more. It all began when St. Johns River Water Management District's, Jim Wilmoth and Jim Ducote were given the responsibility for controlling the hydrilla growth on Orange Lake and Lake Lochloosa in Alachua County in April of 1981. (The next time you read that hydrilla originated in Africa, don't believe it. It originated here.)

Did they weep and wail and gnash their teeth? You bet they did! But not for long. With the hydrilla growing at the rate of "five feet" a day there was no time for self pity! They had to get busy and meet each and every one of the fishcamp owners and as many of the lake front property owners as they could, see what their individual problems were, find out where the best fishing areas were that needed treatment, assure them that they could be everywhere on the lakes at the same time, and assure them that the herbicides wouldn't turn all the bass into alligators! Using an application system devised by a hillbilly in Polk County consisting of applying the herbicides, in conjunction with a polymer, to the surface of the water, (kind of a poor man's helicopter operation), allowed them to cover a 30 foot path with each

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Harvesting: the Future of Aquatic Plant Control?

by
Nicholas M. Sassic
Aquatic Plant Control Supervisor
Orange County Pollution Control Department
2002 East Michigan Street
Orlando, Florida 32806

With the current trend to close federal scrutiny of herbicide labels, and thus the removal of many of the tools used in day to day aquatic plant management, harvesting may be the future.

While historically, harvesting has been considered cost ineffective, labor intensive and somewhat of an undesirable method of aquatic plant control, it has a place in today's broad management plan.

There are several situations where a harvester is applicable, and these are: areas where the water flow is sufficient to upset the amount of control normally associated with herbicide treatment; areas where fisheries are the prime use, thus allowing boat access and the open water / vegetation gradient that has been reported important to fisheries; areas where aquatic vegetation has been restricted water flow and the need to move water immediately is necessary.

Presently, there are many different types, sizes and designs of harvesters. Each has its advantages and disadvantages.

The type and design of harvesters required by an operation is determined by the amount of vegetation to be controlled, accessability to the areas being harvested, and the funding available.

The predominant advantages to harvesting are; 1) the effect of plant removal is immediate, 2) no restriction of water usage is imposed, 3) certain forms of selectivity can be used, and 4) nutrients and plant biomass are removed from the water. The predominant disadvantages are: 1) fragmentation can cause infestation of otherwise clear areas, 2) the cost of harvesting, and, 3) time consumption.

This article will address the cost of harvesting and show that with modern harvester design, this may not be a significant disadvantage.

The cost of harvesting is based on several factors, 1) capital outlay, 2) labor costs, 3) maintenance and repair, 4) the logistics of disposal of the harvested material. The areas to be harvested, the prime use of the water and distance to disposal sight can alter the cost greatly, up or down. Utilization of the harvested material can be used to offset some of the cost of harvesting, such as compost production or methane production, and with on-going and future research, a harvesting program could become self-supporting.

Today's harvesters are very efficient in doing what is required of them — harvest aquatic plants. The problem, and this relates to cost, is the time consumption between actual harvesting and disposal. In situations where the spoil material must be removed from the water, the cost of disposal can double harvesting costs.

The following is a cost breakdown of harvesting based on two harvesters, 650 cubic feet capacity and 160 cubic feet capacity and will show that although the cost of harvesting is high, it can be comparable to herbicide treatment.

EAST COUNTY WATER CONTROL DISTRICT
(LEE COUNTY)
Calculations on cost of harvesting

New H650: $70,000	
Interest over three years at 10%	
Hourly rate = 70,000 × 10% × ½ average balance divided by 2,000 hours =	$ 1.75 / hr.
Mortgage payments per hour:	
70,000 divided by (3 yrs. × 2,000 hrs.) =	11.66 /hr.
Interest and Mortgage payments / hour =	13.41 / hr.
Gasoline Consumption: max. 16 gal. / day =	3.00 / hr.
Labor: One person @ $14,000 / yr. =	6.73 / hr.
Maintenance: $6,000 / yr. =	3.00 / hr.
Vehicle & gas: $4,200 / yr. =	2.02 / hr.
Total	$ 28.16 / hr.

If H650 harvest 0.5 acre / hour, it harvests 4 acres / day at a cost of $28.16 × 8 hrs. = $225.28 / day or	$ 56.32 / acre
At 3 acres / day, the cost becomes	75.09 / acre
Competitive weed control techniques:	
Contracting of harvesting:	$266.00 / acre
Draglines:	$300-$400.00 / acre
Herbicides:	$150-300.00 / acre

(Source: Gary Pruitt, Gen. Mgr. East County Water Control District)

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FLORIDA AQUATIC PLANT MANAGEMENT SOCIETY — 1982

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Harvesting *continued from page 14*

COST ESTIMATE FOR HARVESTER PURCHASE FOR LAKE JESSAMINE MSTU

Costs:

1. Harvester	$27,800.00
2. Trailer	5,400.00
3. Shipping Charges	2,790.00
Total	$35,990.00

Life of Equipment

1. 880 hrs./yr. — 5 years or 4,400 hours.
2. Equipment utilized 220 hrs./yr.

Usage Costs per Hour

1. Equipment $\frac{\$35,900}{2200 \text{ hr.}} = \$16.36/\text{hr.}$
2. Maintenance costs — based on manufacturer estimates
   a) parts — $4,750.00 = $2.16/hr.
   b) labor — $9,500.00 = $4.32/hr.
3. Disposal Costs
   a) 4×4 ¾ ton trucks (2) @ $4.27/hr. = $8.54/hr.
   b) refuse dumping — $2.00/load — 15 loads/10 hrs. = $3.00/hr.
4. Personnel — 2 men @ $6.87/hr. = $13.74/hr.
5. Fuel & Lubricants — $2.50/hr.

Total Hourly costs = $50.62/hr.

Harvesting Rate

1. Aquatic vegetation — 15 tons wet weight/acre average*
2. Aquatic vegetation — 90% water = 1.5 tons/acre-dry weight
3. Aquatic vegetation — 15 lb./cu. ft. = 2000 cu./ft./acre-wet weight
4. Harvester capacity — 140 cu./ft. = 14.25 loads/acre
5. Time/load* — approx. 3 load/hr. = 1 acre/5 hours
   *includes disposal
6. Acres harvested/yr. — $\frac{440 \text{ hrs.}}{1 \text{ acre}/5 \text{ hrs.}} = 88$ acres

* based on reported data of 10-20 tons/acre

Cost per acre = 1 acre/5 hrs. = 5 × $50.62 = $253.10/acre

Nutrient Removal*

1. Phosphorus — 0.134% of dry weight of vegetation
   a) 3000 lb. dry weight/acre
   b) 3000 lb. × 0.134%P = 4 lb. P/acre
   c) 88 acres × 4 lb. P = 352 lb. P/yr.
2. Nitrogen 1.73% of dry weight of vegetation
   a) 3000 lb. dry weight/acre
   b) 3000 lb. × 1.74% N = 52 lb. N/acre
   c) 88 acre × 52 lb. N = 4576 lb. N/yr.

* Based on Lake Conway aquatic plant analysis

In summary, if your aquatic plant program has any situations where fisheries are important, immediate water movement is required, the water flow is sufficient to reduce herbicide effectiveness, or any environmentally sensitive areas, you should not allow the cost of harvesting to be a deterrent against investigating the possible use of this method of aquatic plant control. It may fit your need perfectly. □

New Role *continued from page 7*

inspecting, approving or disapproving all requests for stocking fish for the biological control of aquatic vegetation using the criteria outlined in Commission's Rule 38-9.

Hybrid Grass Carp Management Program

Aquatic Plant Control Assessment personnel will assist in developing a management program for the use of the triploid hybrid grass carp by investigating, selecting and stocking study lakes to evaluate the effectiveness of the fish to control noxious aquatic vegetation.

Nine water areas have been stocked under this program. Job objectives under these studies include the monitoring of submergent vegetation cover, determining volume of vegetation by means of fathometer transect lines, preparation of a quarterly vegetation map and compiling a list of vegetation species affected for each lake.

Grass Carp Monitoring Program

As the result of the implementation of Department of Natural Resources Rule 16C-21, the grass carp has been stocking in approximately 60 small privately owned ponds or lakes under 25 acres in size. Complete files, including permits to import, possess and release grass carp for each stocked body of water, are located in the Tallahassee office. These files were made available to biologists located in Leesburg and Lakeland.

A program designed to monitor required security barriers and to measure effectiveness of this biological control agent to manage aquatic vegetation has been implemented utilizing Aquatic Plant Control Assessment personnel.

Biannual inspections conducted in the spring and fall will ensure that fish barriers are secure and will provide the Division of Fisheries with knowledge concerning the effectiveness of the Department's grass carp stocking program. □

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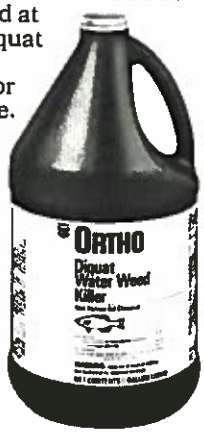

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Chemical and Trophic State Characterisics of Florida Lakes

In Relation to Regional Geology

by
Daniel E. Canfield, Jr.
Center for Aquatic Weeds Institute of Food and Agricultural Sciences University of Florida 32611

A limnological survey of 165 Florida lakes was conducted between September 1979 and August 1980 to determine the chemical and trophic state characteristics of lakes located in different physiographic and geological regions. At each lake, a number of parameters including pH, total alkalinity, phenolthalein alkalinity, specific conductance, total hardness, calcium hardness, sodium, potassium, chloride, sulfate, silica, total iron, total nitrogen, total phosphorous, chlorophyll *a*, color, Secchi disc and temperature were measured. As might be expected, a wide range of limnological conditions was found. For example, average lake pH ranged from 4.1 to 9.2 and mean total alkalinity ranged from 0 to 204 mg/l as $CaCO_3$. Mean lake specific conductance ranged from 11 to 5600 μmhos/cm. Average lake total hardness concentration ranged from 2 to 730 mg/l as $CaCO_3$ and lake calcium hardness concentrations averaged between 1 and 215 mg/l as $CaCO_3$. Mean total nitrogen concentrations ranged from 63 to 4600 mg/m^3 and mean total phosphorous concentrations ranged from 3 to 834 mg/m^3. Mean chlorophyll *a* concentrations ranged from 0.5 to 157 mg/m^3 and water clarity as measured by use of a Secchi disc averaged between 0.1 and 8.1 m. Lake trophic states ranged from ultra-oligotrophic to hyper-entrophic: As a group, however, Florida lakes can be characterized as productive, soft-water lakes. Over 75% of the sampled lakes had total alkalinity concentrations below 40 mg/l as $CaCO_3$ and total hardness concentrations below 75 mg/l as $CaCO_3$. Total phosphorous concentrations ranged above 10 mg/m^3 in over 75% of the study lakes. Consequently, most Florida lakes are either mesotrophic (42%) or entrophic (35%).

Similar to the findings of regional limnology studies in other parts of the world, there is a strong relationship between the mineral composition of Florida's freshwater lakes and surface geology and physiography. For example, the limnological characteristics of a group of northwest Florida lakes. These lakes are located on a high ridge, the Greenhead Slope, and in a geologic formation, the Jackson Bluff Formation, which is dominated by sands. Consequently, the lakes are extremely low in mineral content and oligotrophic. Another example is the limnological characteristics of a group of lakes located in Florida's Central Valley. In the northern part of the Central Valley, the geology is dominated by deposits of the phosphatic Hawthorn Formation while the middle and southern reaches are dominated by nutrient rich, calcareous deposits of the Crystal River, Fort Preston and Fort Thompson formations. Consequently, all lakes in the Central Valley are naturally entrophic. Lakes in the northern portion (Lochloosa, Newnans, Orange and Wauberg) are typically soft-water lakes while lakes in the southern portion (Apopka, Dora, Eustis, Griffin, Harris and Yale) are typically hard-water lakes. For this reason, edaphic (soil) factors must be strongly considered when developing management plans for Florida's lakes. Information from this regional study should provide a basis for understanding the general limnological capabilities and potentials of Florida lakes.

A limited number of copies of this report are available for those concerned with managing Florida lakes. Contact the Center for Aquatic Weeds, Institute of Food and Agricultural Sciences, University of Florida, Gainsville, Florida 32611.

Charophytes *continued from page 4*

which gives it a characteristic coarse, rough texture. There is some evidence that excessive phosphate is inhibitory to most or all species of charophytes and it may prove to be an important ecological factor that regulates their distribution, excluding them from very eutrophic environs.

As for the worth of these unique algae, it seems in most cases to be of a positive nature. They are beneficial to the aquatic ecosystem by fixing solar energy and incorporating nutrients, by providing food for waterfowl and protection for larval fish, and harboring large numbers of food organisms. Usually there is excellent water clarity in areas in which these plants are growing. If there is excessive growth and they do become a nuisance, it is most likely to be a species of *Chara*. The situation can usually be rectified by the prudent application of copper sulfate or complexed copper chelates. Other compounds that provide chemical control, but are usually less effective than the copper compounds, are dichlobenil, simazine, and endothall.

Figure 1. Charophyte morphology. A, node region of *Chara* showing branchlets with gametangia; B, habit sketch of *Nitella* showing branching branchlets; C, habit sketch of *Chara* (Illustration by B. E. Benner).

IAWM *continued from page 8*

decision matrix. An economic threshold decision model should enable Federal, State, local agencies and private parties to apply one of the basic principles of IAWM: Manage Ecosystems According to Economic Thresholds.

If damages caused, or predicted to be caused, by the aquatic weed remains below a certain economic level, then management is not necessary. In other words, unless there are enough aquatic weeds to justify management efforts economically, a *real* problem doesn't exist. This principle has had a major beneficial impact in agricultural pest management. It can perhaps have a similar effect in aquatic weed management, even though economic thresholds in non-agricultural systems are usually more difficult to define given the diverse and indirect nature of economic benefits including aesthetic aspects.

A grant has been given to the North Texas State University, Denton, Texas, to prepare the threshold decision model and matrix. The model is to be applicable to all waterbodies types. The model will be demonstrated in two regions of

the U.S. The model is to incorporate three thresholds, each based on a question which must be answered "yes" or "no." These questions are:

1. Is there significant input from various sources which indicates an aquatic weed problem?
2. Are there significant economic losses to the uses of the waterbody resulting from the weed problem?
3. Is there a control methodology with a positive cost to benefit relationship to solve the aquatic weed problem?

This decision tool is expected to help aquatic weed managers to easily and quickly identify appropriate IAWM strategies consistent with the specifics of the aquatic weed problem at hand. Candidate strategies would include techniques approved for use in the area by appropriate government agencies and for which case histories or adequate testing reviews are available. Strategies to be considered include combinations of physical (e.g., drawdown), chemical (e.g., herbicide), biological (e.g., Neochetina weevils), and mechanical (e.g., harvesting machines) tactics.

Life cycle information on pest species is critical to cost effective management since most plant species do have certain periods in their life cycles when they may be more susceptible to control. None of the 124 on-going Federal research programs were addressed to this need. The University of Wisconsin — Stevens Point was awarded a grant to analyze and summarize life data for six pest species and identify life cycle stages most susceptible to integrated strategies. The results of this effort will be incorporated into the decision model and matrix.

Investigation of the feasibility of using the hybrid grass carp as a biological tactic in an overall strategy is being conducted by the University of Florida. Conclusions will be based on food habits, compatibility with other strategy components, cost of mass production and environmental impacts.

Another biological control research program is the determination of the role of Eurasian watermilfoil diseases. This program, being conducted by the University of Wisconsin — Madison may provide guidance on how aquatic weed managers can identify susceptible populations of this pest.

An IAWM Manual for the Southeastern U.S. is near completion. Upon its completion, EPA is to prepare a status report on aquatic weed problems and control programs for the entire U.S. The absence of overview information on the aquatic weed problem nationally has been a major concern of the Federal Aquatic Plant Management Working Group. This national status report should alleviate that concern and:

- Allow EPA to set priorities for further national research by qualifying aquatic weed problems and impacts on a national level;
- identify priorities for preparation of other regional IAWM manuals;
- provide baseline data against which to measure the effectiveness of future management programs.

In summary, EPA's contribution to aquatic weed management is well underway. As a complement to current Federal, State and local aquatic weed management efforts, EPA's role is to a large extent one of pulling together and organizing existing work; identifying and filling information gaps critical to the full implementation of IAWM strategies; and then disseminating such information. The success of IAWM will depend significantly on EPA's active solicitation and receptivity to aquatic weed researchers and managers' participation and input.

Constructive criticisms, useful directions, identification of real problems and/or solutions are welcomed and should be forwarded to:

Darwin R. Wright, Director
Integrated Pest Management
Research Programs
Office of Environmental
Processes & Effects Research
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

This material includes excerpts from various EPA documents but is, in the main, the heart of a talk given by EPA Deputy Assistant Administrator Edwin Johnson to the Aquatic Plant Management Society. Appreciation is extended to Ed for allowing me to paraphrase, plagiarize and otherwise take liberties in preparing this information.

Fairy Tale *continued from page 13*

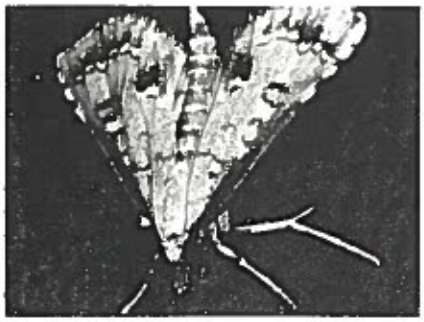
pass of the boat, as opposed to 6-8 feet with the standard boom application and gave them an honest 25 acres a day. (Honest!)

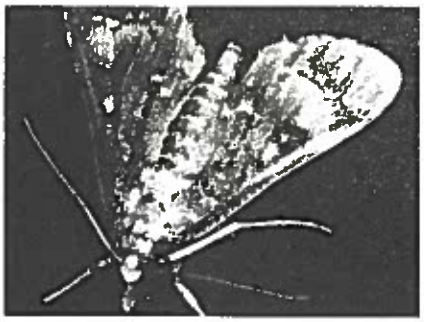
Each fishcamp and public access area was treated on a rotating basis to allow free passage to open water areas of the lakes. Boat trails were chemically cut from fishcamp and public boat ramps to other fishcamps and fishing areas. Special fishing areas of 25 acres were maintained. Wilmoth and Ducote, though involved in a heavy treatment schedule, maintained their contacts with the fishcamp owners and lake front property owners and visually monitored the treated areas on a regular basis to assess results. It wasn't long before their efforts began to pay off. Fishermen were catching more fish (which made them happy), fishcamp owners were making more money (which made them happy). They started sending complimentary letters to the District (which made us happy). Wilmoth and Ducote were nominated for the Aquatic Plant Manager of the Year award and won it (which made them happy), and they all lived happily everafter. (Well, at least 'til spring.)

Aquatic Plant Managers of the Year
Left — Jim Wilmoth; Right — Jim Ducote

CORRECTION

In the December 1981 issue, the caption for the Sameodes albiguttalis *pictures was incorrect. Actually, the male was shown in the top picture and the female in the bottom. For your reference, the male is shown below to the left, and the female to the right.*





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