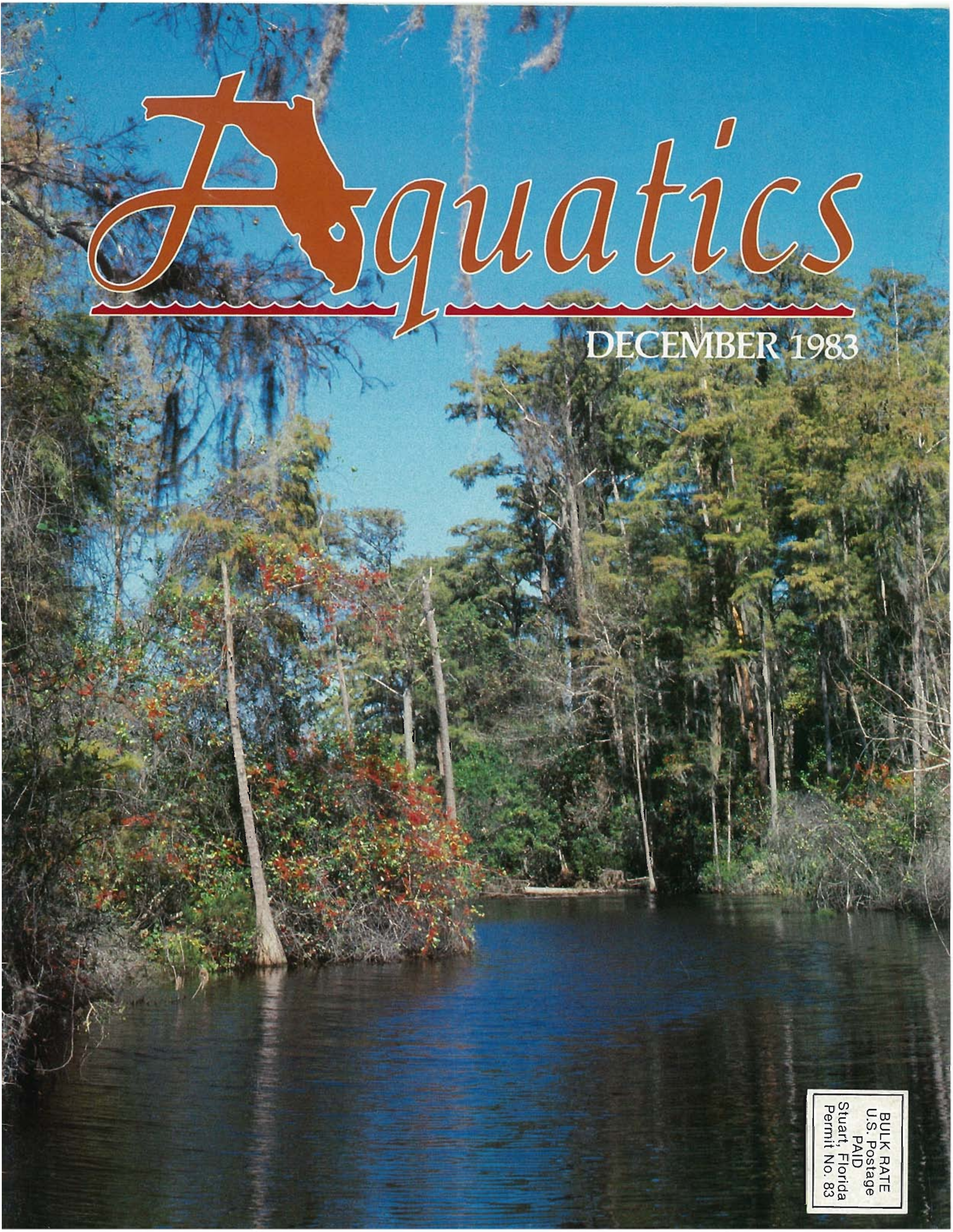
Aquatics
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EDITORIAL

I have always been interested in history. A particular fascination has been to read different accounts of the same historical event and compare similarities and differences. Narratives about a battle, for example, vary widely depending on the perspective of the author: a detached observer moving freely from one scene to another, a soldier in the trenches concerned mainly with personal survival and what is going on directly in front of him, the General removed from the scene concerned with the strategy and tactics of pins on a map, or a latter-day researcher looking for the "truth" (or his version of it).

I have learned that truth is elusive. Even eye-witness accounts are generally unreliable without supporting evidence. A perception of what happened becomes truth in the observer's mind. This perception is passed on in some form and others, accepting the perception as reality, pass it on themselves as truth. This is the stuff that myths are made of. Washington's cherry tree, Nero's fiddling, and Carlton Layne's extraordinary skill with airboats are examples of how history can be innocently distorted. Some myths and misconceptions become such a part of our historical fabric that absolutely no degree of revelation can permanently dislodge them. Regarding myths, President John F. Kennedy, in a speech at Yale in 1962, said: ". . . The great enemy of truth is very often not the lie — deliberate, contrived and dishonest — but the myths — persistent, persuasive and unrealistic."

In the same speech, President Kennedy stated: "As every generation has had to disenthrall itself from an inheritance of truisms and stereotypes, so in our own time we must move on to a new, difficult, but essential confrontation with reality." Myths and half-truths die hard. We must make a concerted effort to seek the truth and make decisions based on reliable facts and not on rumor, innuendo, or historical misconception. We strove this year to eliminate destructive confrontation and encourage open discourse. While total success has been as elusive as absolute truth, I am encouraged by the progress and the responses to our efforts.

President Myers, Officers, and Board of Directors for 1984 — I turn over for your safekeeping a strong and viable Society with a wide diversity of interests, backgrounds, and political persuasions. The goals, objectives, and ideals of the Society are valid and obtainable and are now in your charge. Avoid rash decisions, allow time for dissenting views, and, above all, seek the truth.

Carlton R. Lane
President, FAPMS

THE COVER

A fall scene found on Lake Tibet Butler in Orange Co., Florida
Photo by David P. Tarver

Aquatics

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CONTENTS

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

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Florida's 1983 Hydrilla Survey

by
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Bureau of Aquatic Plant Research and Control

The Department of Natural Resources conducts an annual inventory of aquatic plants in selected public water bodies throughout Florida. This survey is intended to define aquatic plant populations and their extent within individual water bodies as well as on a statewide basis. Management and research efforts can then be directed toward plants which are creating problems or could potentially restrict waters from their intended use.

Each year, from the first of April to mid-November, roughly one-and-a-half million acres of fresh water are inspected, primarily by the six regional biologists. Total acreage is calculated for each species along with totals from each of three major aquatic systems — lakes, rivers and canals. All species are then ranked by the number of systems in which they were found and by the acreage they were reported to cover in each system.

Acreage is condensed to 100% coverage for consistency in comparisons between species and between years. For example, a ten acre lake with hydrilla scattered throughout but covering about 20% of each square meter of bottom, would yield two acres of condensed plants (10 acre lake × 20% coverage = 2 acres of condensed plants).

Finally, a subjective problem rating of none, moderate or severe is scored for each species depending on how it influences the intended use of each water body in which it was found.

During 1982, 427 water bodies were surveyed — 300 lakes, 55 rivers and creeks, and 72 canal systems. Hydrilla was by far the most abundant aquatic plant with a total of 42,055 acres reported in 177 water bodies — 27,000 acres more abundant than the second most prevalent species, the cattails.

The survey was increased during 1983 to include more than 500 water bodies. Approximately 1.33 million acres have been inspected comprised of 355 lakes, 67 rivers and 73 canal systems. At the time this article was written, fewer than 20 systems or about 4% of the survey had not been completed. Most of the remaining systems are thought to contain little or no hydrilla and will therefore not substantially increase the total acreage.

To date, 43,972 acres of hydrilla have been recorded in 191 water bodies. This is an increase of about 2,000 acres over 1982; however, 553 acres (29% of the increase) were reported in 17 of the 67 new waters added to the survey in 1983.

Table 1 compares 1982 hydrilla presence and acreage data with the most recent 1983 results. The statewide totals are presented graphically in Figures 1 and 2. Hydrilla was found in 30% of the lakes surveyed in 1983 compared to 29% in 1982. Although 20 more lakes contained hydrilla in 1983, 600 fewer acres were found. This is for the most part due to extensive management programs in Florida's lakes. If not for a phenomenal increase in the Lake Okeechobee hydrilla population (6,662 acres), the total hydrilla acreage in lakes would have been substantially lower.

Thirty-eight percent of the rivers contained hydrilla in 1983 — down from 44% in 1982. Twelve more rivers were added in 1983, but only two of those contained hydrilla. The 2,200 acre increase over 1982 was almost entirely the result of more hydrilla accounted for in the St. Johns River.

Hydrilla was present in 78% of the canal systems — 12% lower than the previous year. Acreage in canals fluctuated greatly in some systems, but remained nearly constant in most (17 were unchanged). As a result, only 300 additional acres were found during 1983.

Even though the total hydrilla acreage changed very little, many large changes occurred within individual water bodies. Of the 177 waters common to the 1982 and 1983 surveys, hydrilla coverage changed in 153. Fifty-five significant changes were recorded. Significance for the purpose of this article had to meet two criteria: 1) an increase or decrease of at least 25 acres from 1982 values, and 2) at least a 20% change in coverage. The ten greatest acreage changes are listed in Table 2.

Hydrilla was significantly greater in 27 water bodies during 1983 for an increase of 13,573 acres. The largest increase occurred in Lake Okeechobee where 6,662 more acres were reported in 1983 than in 1982. The increase is attributed to a six feet rise in the water level. Not only was more area accessible for surveying, but areas traditionally covered with hydrilla that were dry in 1982 had been reestablished in 1983.

Nearly 500% more hydrilla was recorded for the St. Johns River in 1983. The increase from 580 acres in 1982 to almost 2,900 acres is the result of a more efficient and comprehensive survey of the system in 1983.

Other significant increases were recorded in: 1) Lake Panasoffkee (Sumter County) which had a 780 acre increase from 20 acres reported in 1982, 2) Lake Worth Drainage District canals (Palm Beach County) where 110 acres expanded by nearly 900% to 950 acres, and 3) Lake Pierce (Polk County) where a 1,000 acre population nearly doubled. Lake Pierce was surveyed in mid-June, just prior to commencement of an extensive management program by Polk County Environmental Services. The acreage may be lower in 1984.

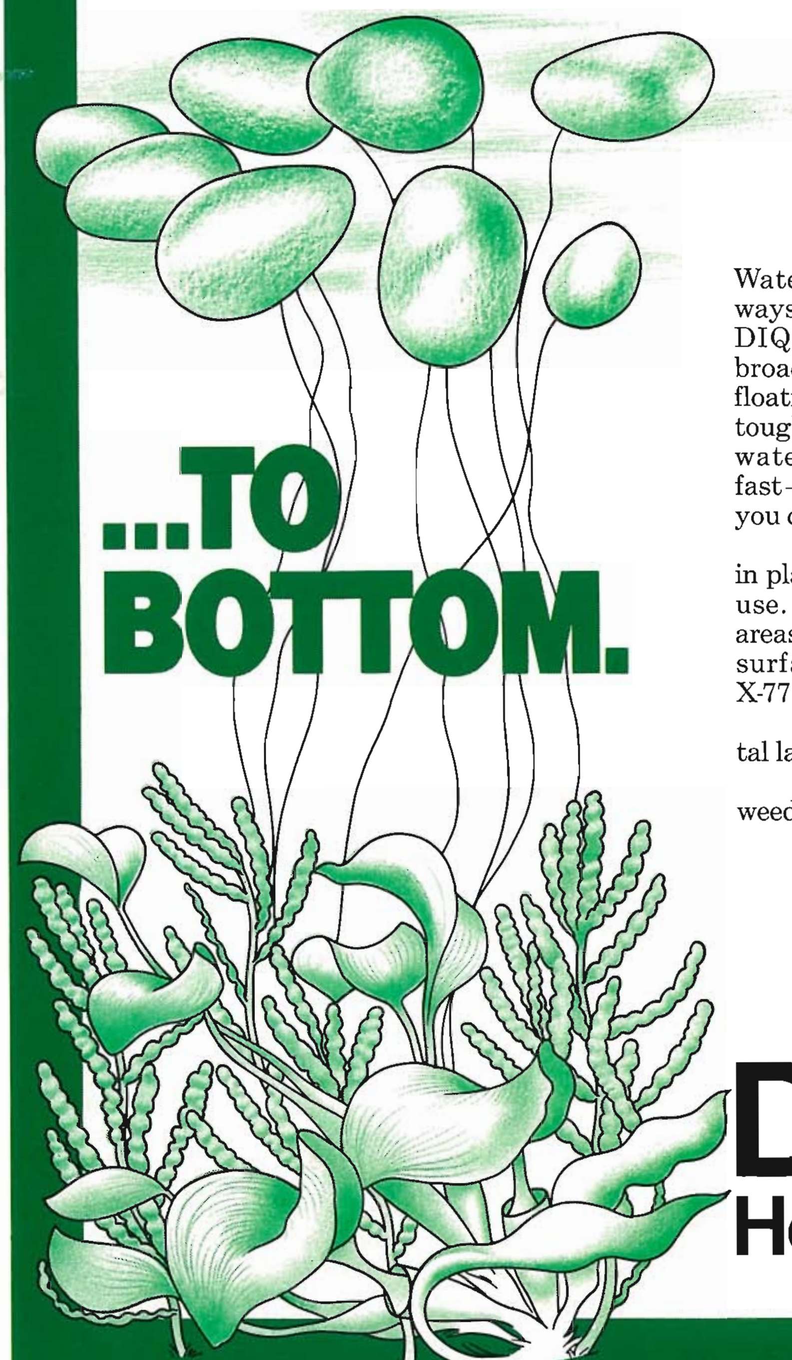
Despite these tremendous increases, management efforts were able to reduce many hydrilla populations to their lowest levels in years. Twenty-eight significant

continued

TABLE 1
Hydrilla Presence and Coverage in Lakes, Rivers and Canals

	Number		Acres	
	1982	1983	1982	1983
Lakes	88	108	34,754	34,127
Rivers	24	26	3,603	5,839
Canals	65	57	3,698	4,006
Total	177	191	42,055	43,972

DIQUAT CLEARS OUT WATER WEEDS FROM TOP...



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Water weeds that clog Florida's waterways are sunk when treated with ORTHO DIQUAT Herbicide-H/A. DIQUAT is a broad spectrum herbicide that kills both floating and submerged weeds—even the tough ones like hydrilla, water lettuce and water hyacinth. And DIQUAT works fast—in just a few days after application you can see dramatic results.

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ORTHO DIQUAT. It sends water weeds straight to the bottom.

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TABLE 2
Ten Most Significant Hydrilla Changes

	Water Body	Type*	Amount
1	Lake Okeechobee	I	6,662
2	Orange Lake	D	4,850
3	St. Johns River	I	2,298
4	Lake Lochloosa	D	1,950
5	Lake Trafford	D	1,274
6	Lake Pierce	I	905
7	Lake Worth Drainage	I	830
8	Lake Panasoffkee	I	780
9	Lake Marion	D	748
10	Dade County Canals	D	300
	Sampson Lake	D	300
	Lake June-in-Winter	D	300

*D = decrease, I = increase

TABLE 3
Ten Largest Hydrilla Populations

	Water Body	Acreage	Rating
1	Lake Okeechobee	14,332	1
2	St. Johns River	2,800	1
3	Lake Rousseau	2,400	2
4	Withlacoochee River	2,000	2
5	Lake Pierce	1,865	1
6	Lake Lochloosa	1,750	1
7	Rodman Reservoir	1,725	1
8	Lake Marion	1,495	1
9	Orange Lake	1,150	1
10	Lake Worth Drainage	941	2

hydrilla reductions occurred to reduce the troublesome plant by a statewide total of 11,803 acres. Of the seven largest reductions, six are primarily attributable to management programs.

In Orange Lake (Alachua County), hydrilla was reduced by 4,850 acres (81%) due to the efforts of the St. Johns River Water Management District. Chemical treatments with the Elanco product Sonar,® have opened areas of Orange Lake which have been choked with hydrilla for more than five years. An increase in water depth and turbidity is thought to have shaded out some of the hydrilla.

Lake Lochloosa, also in Alachua County and also managed in part by the St. Johns River Water Management District, was the site of the second largest decrease (1,950 acres — 53%), also attributable to the use of Sonar.® The Center for Aquatic Weeds and Elanco research personnel began applying Sonar® to experimental plots within Lake Lochloosa during 1979.

Collier County Aquatic Plant Control and Elanco research personnel reduced hydrilla acreage in Lake Trafford by 1,274 acreas (86%) during 1982 and early 1983; again with the use of Sonar.® This 1,500 acrea lake which has been filled with hydrilla since the late 1960's had fewer than 250 remaining acres at the time of the survey.

Hydrilla coverage in Lake Marion (Polk County) was reduced by 748 acres or approximately 50%. The decrease was the responsibility of the Polk County Environmental Services using Sonar.®

Three water bodies had hydrilla populations reduced by 300 acres. A decrease in the Dade County canals of 58% was the result of intensive management using the Chevron chemical, Dequat® and Pennwalt's Hydout® combined with a great deal of mechanical control. A 38% reduction in Sampson Lake (Bradford County) resulted from an increase in water depth. Very tanic and acidic water (pH = 4.6) enters Sampson Lake through one of two inflowing streams. The hydrilla decrease occurred mostly in deep water where the effects of shading were more pronounced. A 30% decrease in Lake June-in-Winter hydrilla resulted from Highlands County aqaatic plant control personnel efforts using the Pennwalt herbicide Aquathol K.®

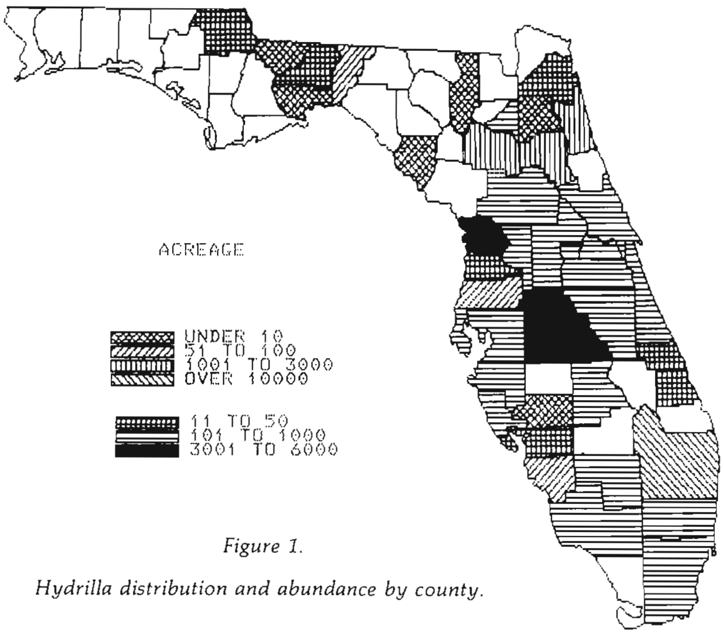

Figure 1.

Hydrilla distribution and abundance by county.

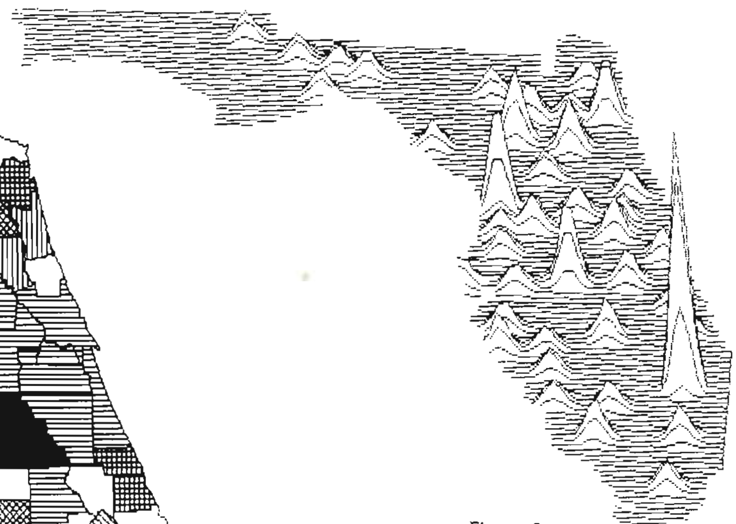

Figure 2.

Relative hydrilla distribution and abundance by county.

Table 3 lists the ten water bodies with the largest hydrilla populations along with their problem ratings. These ten systems account for more than 70% of the hydrilla in the state of Florida. Most of these waters were also included on the list in 1982; however, three of the systems from 1982 have dropped out as hydrilla was brought under control. Three others now have a significantly smaller hydrilla coverage — especially Orange Lake and Lake Lochloosa.

Of these ten waters, all still have problem hydrilla populations, but because of the sheer size of some of the waters in relation to the hydrilla coverage, or because the plants do not now drastically interfere with the intended use of the waters, only three severe problem ratings were scored. Of 191 water bodies which contained hydrilla, 42 moderate and 54 severe problems were attributable solely to hydrilla. This is an increase in both categories. Despite all of the gains in hydrilla control during 1983, there are many problems which must still be faced.

Authors' note: Preliminary analyses indicate that the increased water level in Lake Okeechobee was not only responsible for more hydrilla acreas being surveyed in 1983, but also more cattails — 39,000 more acres. Hydrilla will apparently be the number two aquatic plant in Florida in terms of coverage, but will remain by far the number one problem. A complete report of the 1983 Aquatic Plant Survey is scheduled for distribution by April 1, 1984. □

Hydrilla in North Carolina

A Successful Program Begins

Kenneth A. Langeland
Assistant Professor and Extension Specialist in Aquatic and Non-Cropland Weed Control
Department of Crop Science
North Carolina State University
Raleigh, North Carolina
and
David Schiller
Carolina Power and Light Co. Senior Biologist

Several lakes in the Raleigh, North Carolina area began having serious problems with a submersed aquatic weed during the 1970's. The plant was light green, had whorled leaves, and grew from the lake bottom, in fairly deep water, to form tangled mats on the water surface. Fishing, swimming, and boating became impossible where the plant, which was identified as elodea *(Elodea nuttalii)*, occurred (Figure 1). In 1979 Vernon Vandiver (AREC, Fort Lauderdale, Florida; IFAS, University of Florida) collected the weed which appeared to be hydrilla *(Hydrilla verticillata)* from Big Lake in Umstead Park. In 1980 the identification was confirmed by several experts.

Action Taken

State officials immediately recognized the threat that hydrilla presented to North Carolina's water resources and quickly took steps toward dealing with the problem. Surveys were conducted by the North Carolina Department of Agriculture (NCDA) and the North Carolina Department of Natural Resources and Community Development (NRCD) that revealed thirteen hydrilla infested lakes in the Raleigh area. An ad hoc committee consisting of members from federal, state, and private agencies was organized, and drafted "The Status of Hydrilla in North Carolina." In this report the committee recommended the following:

1. that an agency in North Carolina government be identified as the state's lead agency in the area of aquatic plant regulation and control.
2. that research be initiated in North Carolina to investigate control tactics for hydrilla.
3. that public education be expanded through a coordinated program utilizing education and information resources existing in participating agencies.
4. that an interagency council be established to provide expert advice and to coordinate aquatic weed control, public education, and aquatic weed research in North Carolina.

Toward developing a hydrilla management program in North Carolina, NRCD, in cooperation with the Water Resources Institute (WRRI), held a workshop in May 1981 which brought "hydrilla experts" from around the country to the state. Notables from Florida who attended the meeting included DDT — Dan Thayer, Wild Bill Haller, At-a-boy (Bad Boy) Bill Maier, and Super Gator Fan — Joe Joyce. This meeting got the ball rolling.

Governor Hunt designated NRCD as the lead agency for the hydrilla program. Secretary Grimsley subsequently appointed an Inter-agency Council on Aquatic Weed Control which is a policy level group composed of administrators from several state agencies. To assist in formulating policy, the council appointed members to Control, Education, and Research Committees.

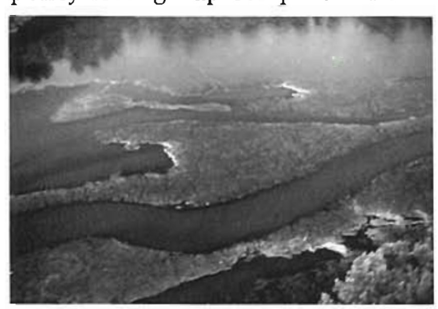

Figure 1. Portion of 25 acre hydrilla infestation in Big Lake (Umstead Park, NC), October, 1983.

The total effort is represented by WRRC, North Carolina Agricultural Extension Service (NCAES), North Carolina State University (NCSU), East Carolina State

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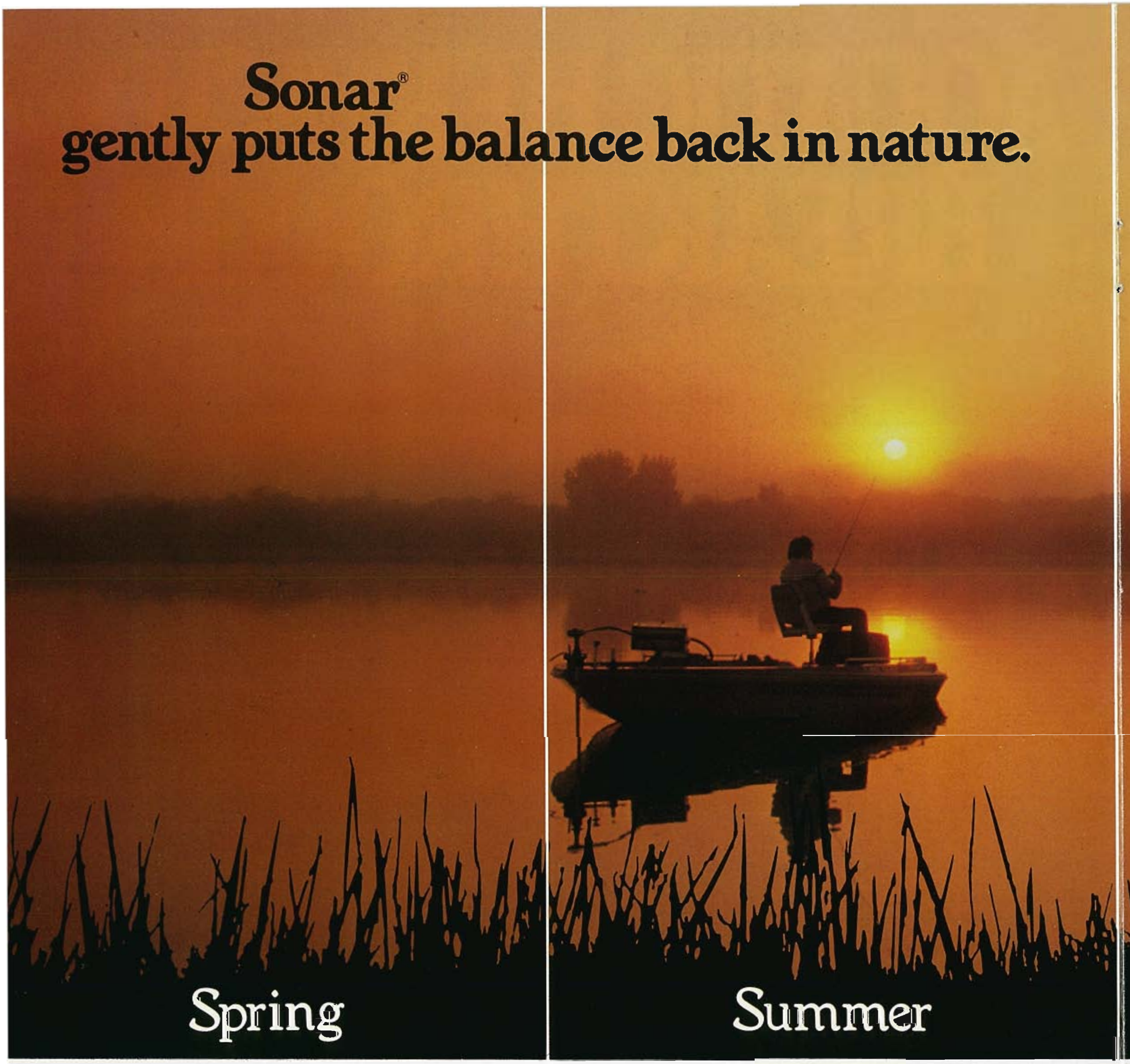
AQUATIC HERBICIDE BREAKTHROUGH

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



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

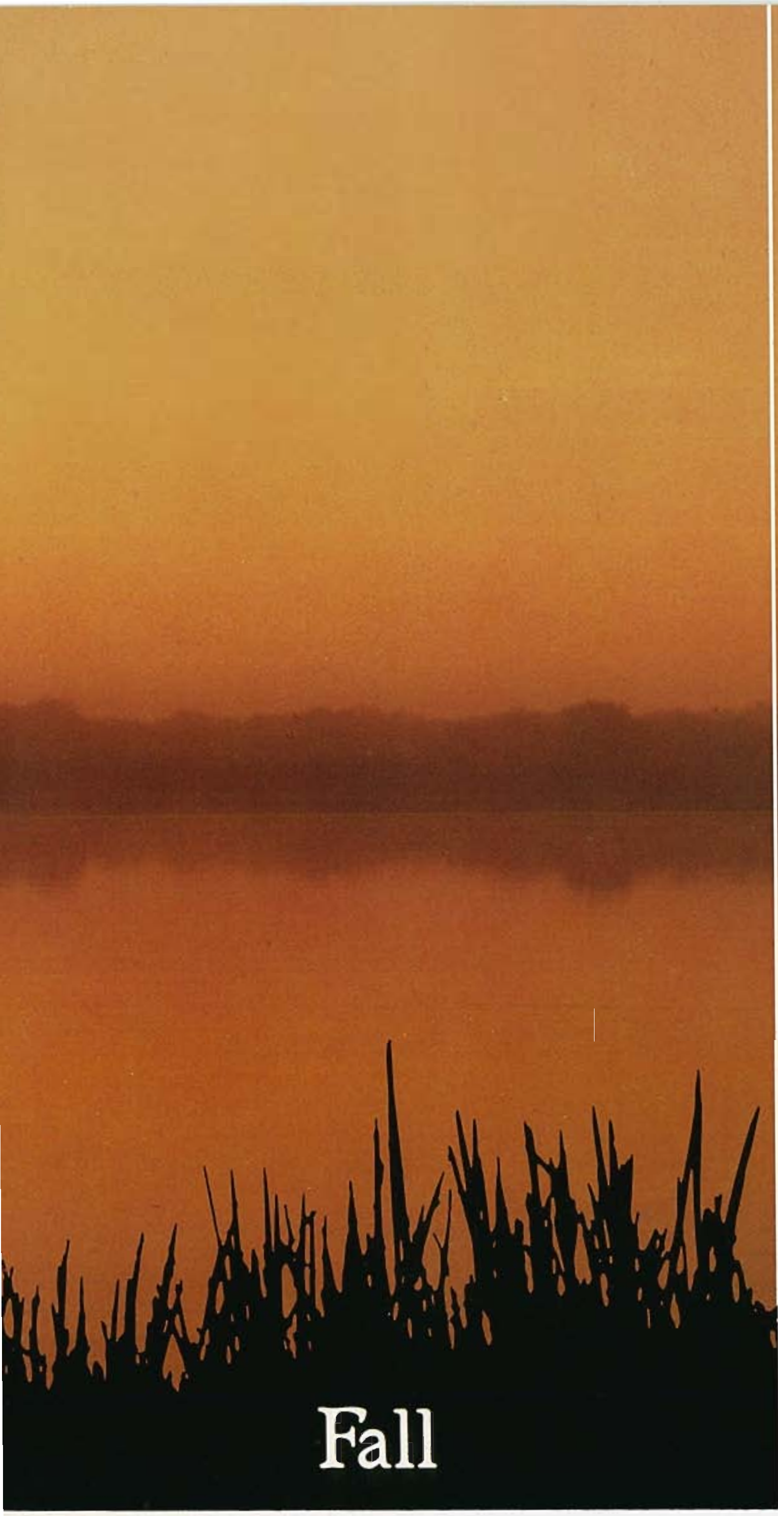
Elodea

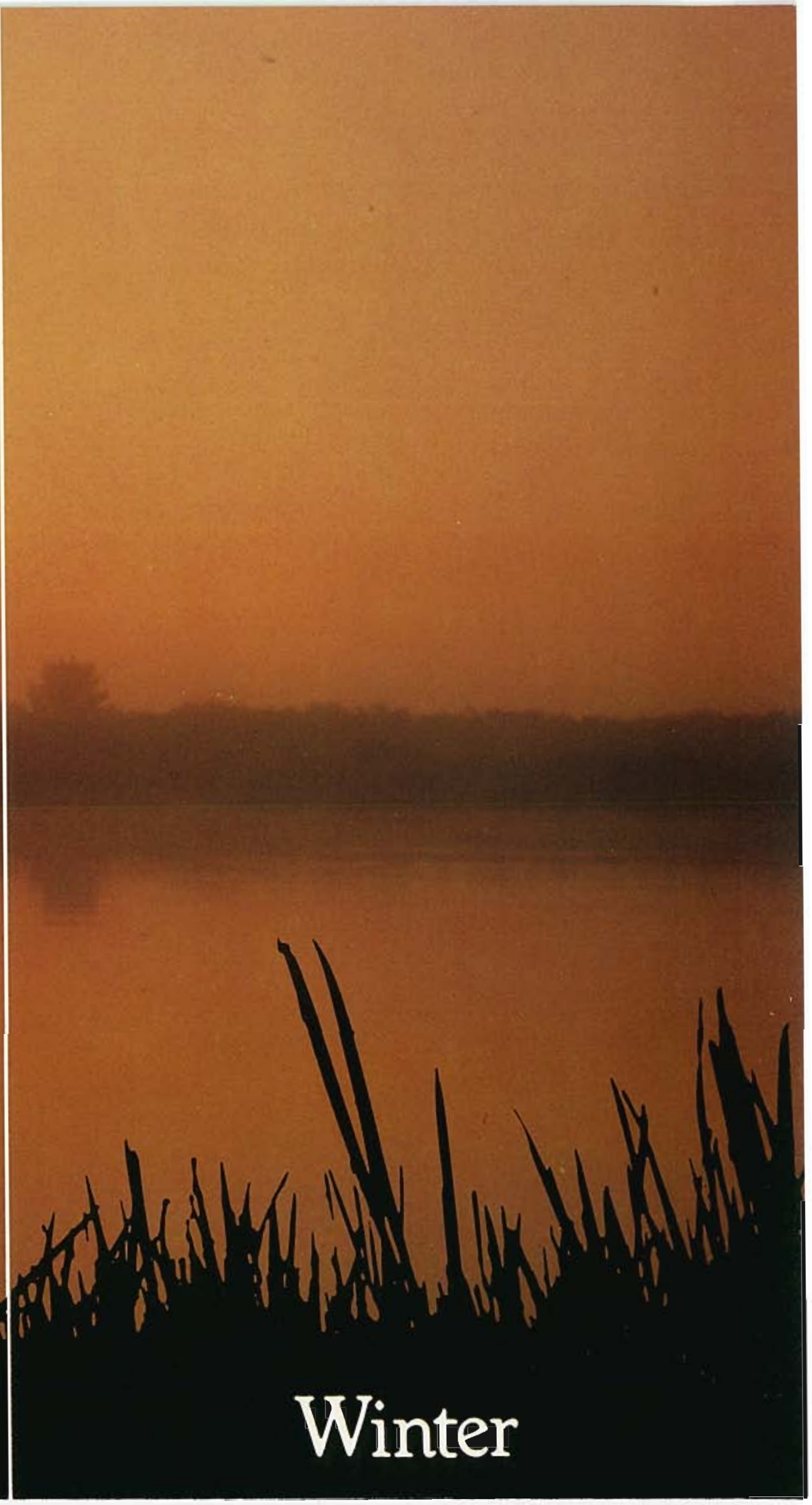
When you make Sonar part of your weed control program, you get effective management of your valuable water resources.

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,

Water milfoil





wildlife, or nearby trees and shrubs.

Flexible application.

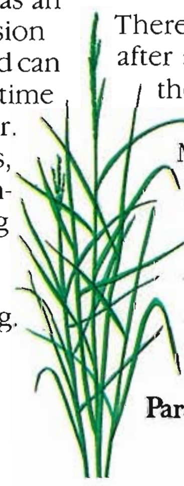
Sonar can be applied to the entire surface of a pond or up to ten percent of larger bodies of water. Depending on existing equipment and user preference, Sonar is available as an aqueous suspension or 5% pellet and can be applied any time during the year. For best results, the label recommends applying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

Inherent value.

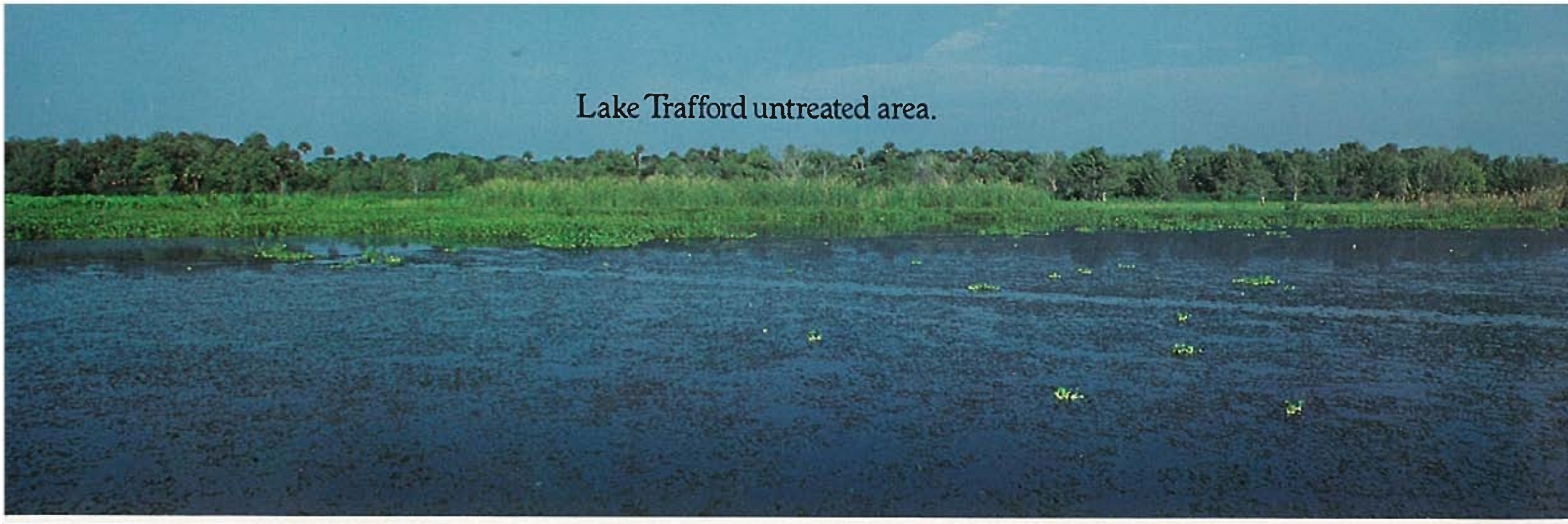
There are few restrictions after application, and they are detailed on the product label. Make Sonar part of your management program. It's the simple, gentle way to put nature back in balance.

Pond weeds

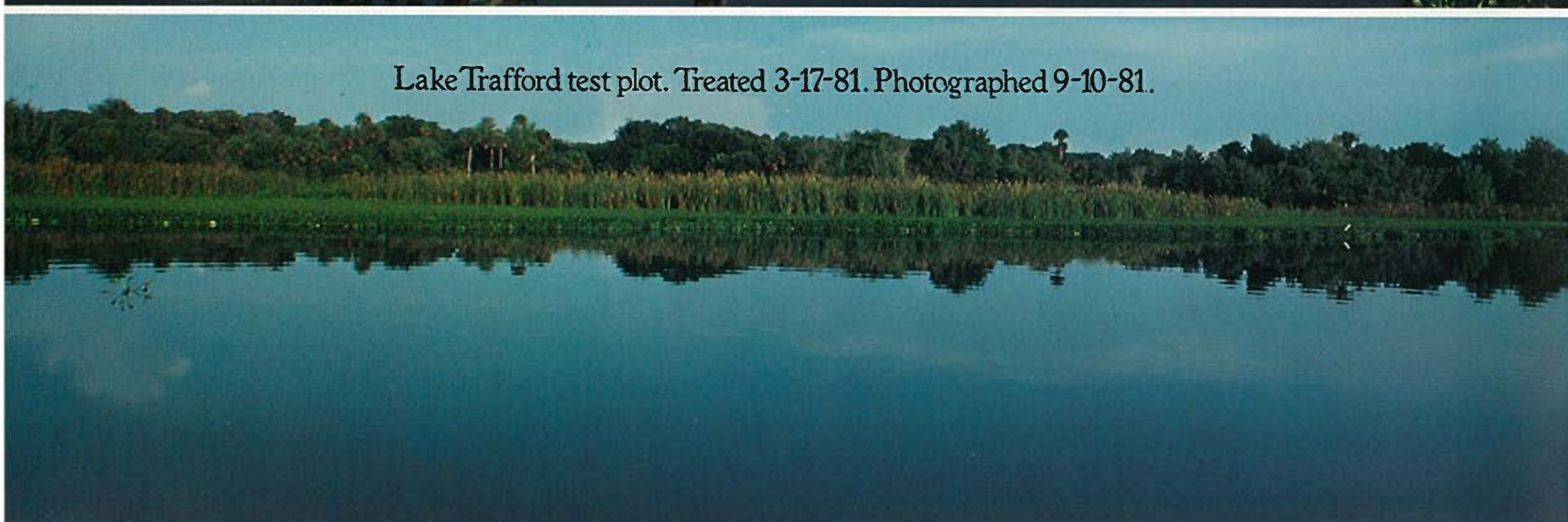
Torpedograss



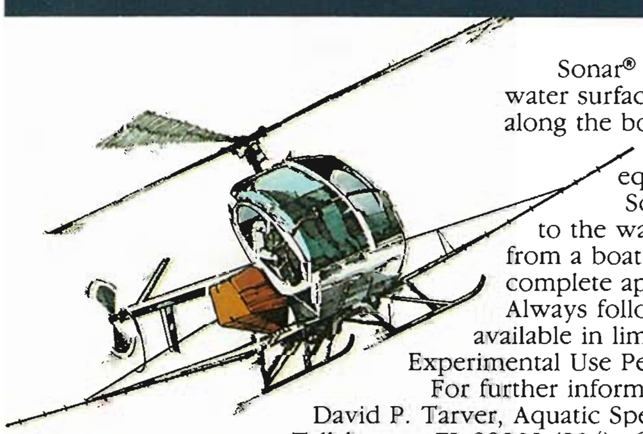
Paragrass



Lake Trafford untreated area.



Lake Trafford test plot. Treated 3-17-81. Photographed 9-10-81.



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) 562-1870

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

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University (ECSU), North Carolina Wildlife Commission (NCWRC), NRCD, Amchem, Corps of Engineers Wilmington District, United States Department of Agriculture (USDA), NCDA, and Carolina Power and Light (CP&L).

Current Distribution

Since early detection is probably the best way to minimize the spread of hydrilla, several means of surveillance have been implemented which involves NRCD, NCAES, and CP&L. NRCD is conducting a statewide hydrilla survey of public waters and placing hydrilla warning signs and posters at strategic locations. NCAES and CP&L are cooperating in a public awareness campaign via county agent training, and hydrilla pamphlets distributed with electric bills.

The early detection and public awareness program has had an excellent response. Following up on all hydrilla reports has been laborious because everything from duckweed to dodder has been reported as hydrilla. This, however, is time well spent. Fifteen hydrilla infestations are presently confirmed in the Raleigh area. The most serious infestation is Lake Wheeler, a 500 acre lake which is a major public water source for the city of Raleigh; and has about 50% hydrilla coverage. The potential threat to the city's water supplies is much greater. The major concern is the proximity of hydrilla infestations to the city's newly constructed future potable water supplies, Falls and Jordon Reservoirs. Approximately half of the 27,000 combined acreage of these reservoirs is potentially colonizable by submersed macrophytes; and will present special problems with respect to current restrictions on the use of herbicides in potable water. Is hydrilla infestation of these water bodies inevitable?

The imminent hydrilla threat to North Carolina's water resources is not confined to the Raleigh area. Once into the Neuse River, which has its headwaters in close proximity to the Raleigh infestations, hydrilla has a vehicle to spread through the Piedmont and Coastal plain, and to the coast at New Bern. Serious hydrilla infestations have also been located in Hyco Reservoir, a 4,500 acre water body on North Carolina's northern border which is heavily used for recreation and provides cooling water for a CP&L steam generated electric plant. This infestation extends the threat of hydrilla infestation into the Roanoke River drainage which feeds an enormous water resource including Bug's Island Lake, Kerr Reservoir and Lake Gaston.

One additional hydrilla occurrence in North Carolina deserves mention. This was located in a small ornamental pond in Southern North Carolina (Figure 2). The pool had been planted with several exotic, ornamental aquatic plants that had been purchased from a supplier. For the probable origin of this hydrilla, and perhaps other hydrilla infestations in North Carolina and neighboring states, see: Haller, W. T. 1982. Hydrilla goes to Washington. *Aquatics*, 4:6.

Figure 2. Ornamental pond in Columbus County, NC that contained hydrilla and waterhyacinth which were purchased from an aquarium and ornamental aquatic plant supplier.

In a nutshell, hydrilla is well established and on the move in North Carolina.

Control Efforts

Funds were acquired for hydrilla control in 1983 through 70/30 matching funds from the Corps and NRCD. Although funds were not sufficient for a major control effort, a program was designed to optimize the amount of control and information that could be derived on efficacy and environmental effects of various management practices from limited funds. Funds for evaluation of treatments were provided by WRRC and several agencies cooperated in the effort: NCASE, NCSU, and CP&L cooperated in herbicide applications and evaluations, NCWRC assisted with biological control, and NRCD performed herbicide residue analysis.

In developing North Carolina's initial hydrilla control and evaluation program the experiences of other states were taken into close consideration. Herbicides, herbicide combinations, and herbicide-drawdown combinations which are labeled and have proven effective elsewhere are being evaluated for hydrilla control in North Carolina where different water chemistry and climatic conditions exist. Timing of herbicide application for optimum hydrilla control is being determined by phenological studies which suggest when tuber formation and sprouting occur. The effect of time of applications is also being evaluated.

Possession and stocking of grass carp *(Ctenopharyngodon idella)* is illegal in North Carolina and is controlled by NCWRC. Grass carp are being evaluated for hydrilla control in North Carolina, however, by several agencies in cooperation, and after permitting by the commission. After evaluation of efficacy data and consideration of potential environmental hazards, policy changes may be enacted by the commission.

Results of evaluating hydrilla management practices in North Carolina will be available from WRRC in 1984.

The greatest effort toward hydrilla control, and perhaps eradication is being conducted in Hyco Reservoir by CP&L. Hydrilla was first observed in Hyco in October of 1982 when a few unrooted fragments were seen floating in a seven acre area where the only public boat ramp in the reservoir is located. The entire cove was treated by CP&L the following day with diquat+copper (4 lb ai+2 lb. ai/acre). Hydrilla was not observed again in Hyco until September 1983 when 12-15 hydrilla "clumps," c.a. 6 feet wide were observed in the cove. The entire cove was treated with Sonar 5p (2 lb. ai/acre) and spot treatments were made throughout the lake whenever hydrilla was encountered. We'll see what happens next year!

Almost as difficult as dealing with hydrilla itself, has been dealing with the emotions of the misinformed public. Strong opposition to the use of herbicides for aquatic weed control in North Carolina has come from the "Raleigh Citizens Against the Use of Toxic Sprays," a group which was initially organized to oppose the gypsy moth eradication program. A member of this group is afflicted with hypersensitivity to "all synthetic organic compounds," a condition known as ecological illness. With respect to this problem and the recent "pesticide scares," this group, and the general public, has legitimate concerns. False public statements by the group however, as appeared in the following commentary, jeopardized initial hydrilla control program efforts.

"Something very ominous occurred in Reedy Creek Lake during the first week in July. State authorities very quietly began applying chemicals to the lake as part of their aquatic weed control program. Two aspects of this treatment are very disturbing.

"First is the fact that one of the herbicides used was Aquathol K., which contains 2-4-D. This substance can form dioxins either in the manufacturing process or after application. Dioxin contamination was the cause of the recent evacuation of Times Beach, Mo.

"Also, there is some question as to whether the treatment of Reedy Creek Lake falls into the category of research or control. Part of the funds used for the treatment came from the Corps of Engineers and were earmarked for control only. The program has been described in a sort of Orwellian double-speak as 'research for control' "[1] Miles Moore, Cary.

Openness to the press, a strong education effort, advance warning of herbicide applications and demonstration of environmental safety have resulted in confidence from most of the public concerning environmental safety that is built in by EPA regulations and insured by competent applicators.

Research Effort

Phenological characteristics of hydrilla growing in the temperate climate of North Carolina are expected to be different from hydrilla growing in the semi-tropical climate of Florida where most of the basic research on hydrilla has been conducted. Understanding hydrilla growth characteristics under various climatic conditions is of academic value and is useful for developing more effective herbicide treatment programs. Funds were therefore acquired from WRRC for a hydrilla research effort in North Carolina. NCSU and ECU cooperated in this effort.

Several interesting hydrilla characteristics have been observed in North Carolina. This data will be available in a report from WRRC in the future. The most surprising observation has been the production of staminate (male) flowers by hydrilla in North Carolina. In comparison to Florida, where staminate flower production has not been observed under natural conditions for the 20 plus years since hydrilla was first observed; staminate flowers are produced in profusion by monoecious (both sexes) hydrilla populations in

Figure 3. Dehisced, staminate, hydrilla flowers (Lake Anne, NC), September, 1983.

North Carolina. These dehiscent flowers can be observed floating in wind-rowed masses (Figure 3); and are apparently produced by all hydrilla populations in North Carolina. The observation of monoecious hydrilla presents two intriguing questions. 1) Is the hydrilla in North Carolina and neighboring states a different genetic strain which originated separately from the Florida introduction or do different environmental stimuli induce the monoecious condition? 2) Does monoecious hydrilla produce viable seed in North Carolina thus allowing for a long distance dispersal mechanism?

Summary

The presence of hydrilla was confirmed in North Carolina in 1980. This has led to asking interesting questions in basic aquatic plant research, and aquatic weed control challenges. With the aid of some experience and expertise from Florida and strong cooperation between agencies in North Carolina we are well on our way to answering the questions and mastering the challenges. □

[1]Reprinted from the Raleigh *News and Observer*, July 12, 1983.

Aquatic Weed Update — Tennessee Valley Authority

by David H. Webb, Earl R. Burns, and A. Leon Bates

Since the 1960's Eurasian watermilfoil *(Myriophyllum spicatum* L.) has been a major problem in several of the Tennessee Valley Authority's (TVA) mainstream reservoirs. In 1982 more than 14,000 acres of watermilfoil occurred in eight reservoirs with over 11,000 acres present in Guntersville Reservoir. About 5,000 acres of spinyleaf naiad *(Najas minor* All.) occur in the TVA system and in conjunction with Eurasian watermilfoil, the two species comprise about 80 percent of the total aquatic weed infestation of approximately 25,000 acres. Other major problem species in the system include American pondweed *(Potamogeton nodosus* Poir.), southern naiad [*N. quadalupensis* (Spreng.) Magnus], coontail *(Ceratophyllum demersum* L.), giant cutgrass [*Zizaniopsis miliacea* (Michx.) Doell. & Asch.], Brazilian elodea *(Egeria densa* Planch.), muskgrass *(Chara* sp.), and various species of filamentous algae.

Hydrilla [*Hydrilla verticillata* (L. fil.) Royle] was discovered on Guntersville Reservoir in August 1982 and will likely be a major problem within the decade. Surveys of Guntersville Reservoir during the latter portion of 1982 revealed hydrilla to exist at scattered localities over about 24 river miles from Tennessee River Mile (TRM) 389.9 to TRM 366.0. Although widespread, the total acreage in 1982 was estimated to be less than 30 acres. Additional colonies of hydrilla were discovered in 1983 and the current known distribution extends from a shallow embayment at TRM 394.2 downstream to TRM 363. Floating fragments have been observed several miles downstream of TRM 363. While accurate estimates of the acreage of hydrilla and other aquatic weeds in 1983 cannot be compiled until aerial photography is processed and interpreted, hydrilla infestations on Guntersville Reservoir are estimated to be less than 250 acres. Surveys of lower Guntersville Reservoir and Wheeler Reservoirs will be continued in 1984 in anticipation of rapid downstream movement of hydrilla.

Drawdowns

Water level manipulations (drawdowns) are used for weed control on reservoirs where other multipurpose activities are not adversely affected. Control is primarily limited to the drawdown zone and is most effective against perennial species such as Eurasian watermilfoil and pondweeds. The most severe aquatic weed infestation in the TVA system occurs on Guntersville Reservoir where the magnitude of the drawdown is normally limited to about 2½ feet. Over the past few years aquatic weed problems have become more severe on impoundments, such as Chickamauga Reservoir where the magnitude of the drawdown exceeds seven feet. The late summer and early fall drawdown, which is standard operating procedure on most TVA reservoirs, allows annual species such as spinyleaf naiad to produce seed prior to the drawdown and survive the drying and freezing of the late fall and winter months in the seed stage. A special summer drawdown on Guntersville Reservoir was conducted during July 1983 in an effort to provide some control of annual species by eliminating the plants from the drawdown zone prior to seed production.

Chemical Control Operations

The primary objective of the TVA aquatic plant control program is to provide a level of control compatible with the full range of uses of the Tennessee Valley water resources. In order for this objective to be reached, herbicides are used to supplement drawdowns to control excessive infestations in high priority area. In 1983 approximately 6,000 acres were treated with herbicides. Only those herbicides which have been thoroughly tested and approved by the U.S. EPA are used. Herbicide applications are closely supervised and label directions and restrictions followed to ensure safety to the applicators and the environment. Treatment is not made within 1/2 mile of potable water intakes, and water supplies are monitored to ensure allowable tolerances are not exceeded.

Historically Eurasian watermilfoil has been the major weed problem requiring chemical control. To control milfoil the dimethylamine salt of 2,4-D is applied using airboats equipped with subsurface injection spraying equipment. The herbicide is applied at a rate to give an approximate concentration of 2.0 ppm in the reservoir. A maximum of 40 pounds of 2,4-D acid equivalent per acre (10 gallons of DMA 2,4-D) is used in water with an average depth of six feet. This rate is reduced proportionately in more shallow water. Spray programs for milfoil are initiated as soon as weed growth is evident in the spring and continued throughout the summer months. Treatment with 2,4-D provides excellent temporary control of milfoil; however it is not effective on many of the other problem species such as spinyleaf naiad and American pondweed.

To control species not responsive to 2,4-D, a broad spectrum herbicide such as diquat or endothall is required. For the past several years, the dipotassium salt of endothall (Aquathol K) has been used more widely than diquat by TVA because it is more effective in turbid or muddy water. Endothall is applied at a maximum rate of 15 pounds of endothall acid equivalent per acre (5 gallons of Aquathol K) in water with an average depth of four feet to provide an approximate concentration of 2.0 ppm dipotassium endothall. Proportional adjustments in the rate are made as water depth changes. Endothall is effective on most submersed species including milfoil but is considerably more expensive than 2,4-D.

Hydrilla Treatment

After hydrilla was discovered in 1982, an intensive effort was initiated to attempt to control existing colonies and minimize its spread. All known colonies on Guntersville Reservoir were treated with endothall during the late summer and fall of 1982. Initial endothall treatments with airboats did not include a polymer and control was variable. Failures were attributed to deep water and fast flows which prevented sufficient herbicide-weed contact time. In an attempt to improve control, a polymer was added to sink and stick the herbicide to the plants. The polymer appeared to improve control and by mid-November, after repeated applications, very few colonies and plants remained on the reservoir surface.

A helicopter was used to treat an 80-acre slough (Sublett Ferry Slough) which had approximately 5 acres of hydrilla scattered throughout. Endothall was applied with a polymer (Nalquatic) to give a concentration of 3.0 ppm of dipotassium endothall. Treatment of the entire area was expensive, but control in this area was considered vital since it was the most upstream infestation and served as a source of fragments that could establish additional downstream colonies.

Surveys made the spring and summer of 1983 showed that the intensive helicopter and airboat treatment effort in Sublett Ferry Slough almost completely eliminated the hydrilla; only a few scatter plants were found. However, such success was not evident in other areas where small colonies were treated without treating large surrounding bodies of water. By mid-summer of 1983, treated colonies had reestablished and spread over much larger areas.

In 1983 all known hydrilla colonies were again treated with endothall and polymer (Polycontrol® or Nalquatic®). Control from this treatment has been variable. It appears that the most that can be expected from such treatment is temporary relief since regrowth occurs rapidly. Unless a more effective control is found, hydrilla is expected to become a major weed problem in the TVA system in the next few years.

Alternative Control Investigations

In addition to its operational control program, alternative chemical, as well as biological and mechanical controls, are being evaluated. Herbicide treatments that are being evaluated include fluridone (SONAR®) and combinations of diquat, endothall and polymer, for control of submersed weeds including hydrilla; controlled release formulations of 2,4-D for extended milfoil control; dichlobenil (Casoron,® Norosac®) as a preemergent control for spinyleaf naiad; and the use of glyphosate (Rodeo®) for control of emergent species.

The Tennessee Valley Authority currently is planning a large scale testing project on Guntersville Reservoir designed to evaluate the use of the herbivorous fish, the white amur, for controlling aquatic vegetation. A large embayment of approximately 500 acres will be screened and stocked with white amur. A year of baseline data will be collected followed by two years post-stocking data to determine the impact of the white amur on aquatic vegetation, fisheries, water quality, waterfowl, and lower food chain communities. These data will then be used in deciding if the white amur will be used as biological control agent on a large scale basis within the TVA system. □

From the Editor:
You know it's gonna be another tough "Aquatic" issue when. . .

Dr. Wild Bill Haller goes to Georgia deer huntin without mailing in his promised article and it's your deadline to print.

You need filler and you've used all of Citrus County's "You Know It's Gonna Be a Bad Day When. . ." except the X-rated ones.

The printer calls at the last minute to inform you, "The cover is really out of focus!"

Dr. Osbone has another article with a lengthy Methods and Materials section. And Jim Malone will probably read that edition.

The lead pages for advertisements are reversed for Rodeo and Sonar.

You print the "Aqua-Vine" without a disclaimer.

Don Schmitz, Weed Lyin's artist, breaks his right hand and calls in to tell you he'll draw it with his other hand.

Carlton Layne asks you to put a shot of his little girl on the cover.

Hydrilla in Florida

William T. Haller
Center for Aquatic Weeds
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Since hydrilla was first noted in Florida some 25 years ago, it has spread and is currently found in every water-shed in peninsular Florida. Hydrilla movement west into the panhandle has been somewhat slower due to the small number and isolated nature of lakes and ponds in the area. New infestations are found periodically in small lakes throughout the state; generally in areas around boat ramps. Usually by the time hydrilla is found growing around a boat ramp, it has fragmented, spread to other parts of the lake, and eradicating even small infestations has rarely been successful.

Major areas of hydrilla increase at this time are in the lower St. Johns River south of Puzzle Lake, and new infestations in lakes in Highlands County and Lake County in Central Florida. Major lakes recently infested include Lake Eustis in Lake County and Newnans Lake in Alachua County.

A rather detailed report on aquatic weeds was recently published by the Department of Natural Resources. The 1982 Aquatic Plant Survey Report was summarized by Schardt in the June 1983 *"Aquatics"*. The survey illustrates well the "plasticity" or ability of hydrilla to grow in many different habitats. Hydrilla is the most abundant plant found in lakes and rivers in Florida — and is the second most abundant (slightly behind torpedograss) plant found growing in canals.

Total acreage of hydrilla varies dramatically in the state with time of year and from year-to-year. The 1982 survey mentioned above, accounted for 42,026 acres of hydrilla in public water bodies. A Corps survey conducted a few years ago estimated the area of hydrilla to be approximately 80,000 acres. It's probably quite safe to assume that the total area of hydrilla in the state is between 75,000 and 100,000 acres, which would include agricultural canals and other infested private waters.

Only a relatively small portion of this hydrilla acreage is controlled annually. Under the Corps and State program, it is estimated that in 1982 around 15,000 acres of hydrilla were treated in public waters (J. Rodgers, personal Comm). Assuming two to three herbicide treatments a year are required to maintain an area weed free, the actual surface area treated may only vary from 5,000 to 7,500 acres/year.

It should be emphasized at this point that the preceding discussion is primarily involved with hydrilla in public waters. The hydrilla infested acreage and acres treated in private waters are impossible figures to determine beyond a best guess! Certainly, there is a lot of hydrilla in the irrigation and drainage canals in the state; the September 1983 cover of *Aquatics* illustrates just such an infested system.

The potential for even greater coverage of hydrilla however still exists. Several thousand acres of hydrilla are found in Lake Okeechobee, but due to wave action, depth, and other unknown factors, it has not spread to vast areas of the Lake as might be expected. The large lakes in Central Florida have also not become widely infested. Lakes Harris, Eustis, Apopka, Kissimmee, Toho, Griffin and many other lakes (consisting of thousands of acres of surface water) have not been infested to any major extent to date. This is most likely due to the tropic conditions of these lakes and the heavy plankton blooms which occur year around. However, Lake Parker and Orange Lake also have had major blooms and poor water clarity, yet hydrilla has invaded these lakes in the past 10 years. Currently, herbicide treatments and high water levels in Orange Lake resulting in a dramatic reduction of hydrilla acreage is a good example of annual variation in hydrilla acreages. In 1977 Orange Lake contained about 10,000 acres of hydrilla, but currently it has only a couple hundred. Reasons for this decline are not entirely known, but high water (2 meters over 1977 levels) certainly plays a major role.

For the purpose of summarizing the major research activities directed towards hydrilla in Florida (recognizing the danger of omitting someones major projects!), I will briefly outline current activities by subject headings.

Chemical Control:

We continue to rely upon the few labelled compounds which have been used successfully over the past 15 to 20 years (diquat, endothal and copper). Floridone remains under an Experimental Use Permit (EUP) and work continues on obtaining full registration. Major effort is being expended in evaluating and formulating slow release or controlled release agents for these herbicides. Other chemical related research includes timing of applications, application methods, surfactants and other carriers and environmental impacts of these treatments. A major problem identified in this area is the inability to control hydrilla in certain flowing water situations.

Mechanical Control:

A few years ago the Corps conducted a major effort in evaluating mechanical control systems for hydrilla. The system was generally not operationally effective, although mechanical harvesting or cutting is being used successfully in certain relatively small areas of the state. Research is being conducted on hydrilla regrowth after cutting, combining chemical and mechanical control methods, and utilization of the cut vegetation. Utilization was a major objective in the early 70's when hydrilla was studied for use in cattle feed, compost, etc. Today, these efforts are directed toward utilization of vegetation in biogas production.

Biological Control:

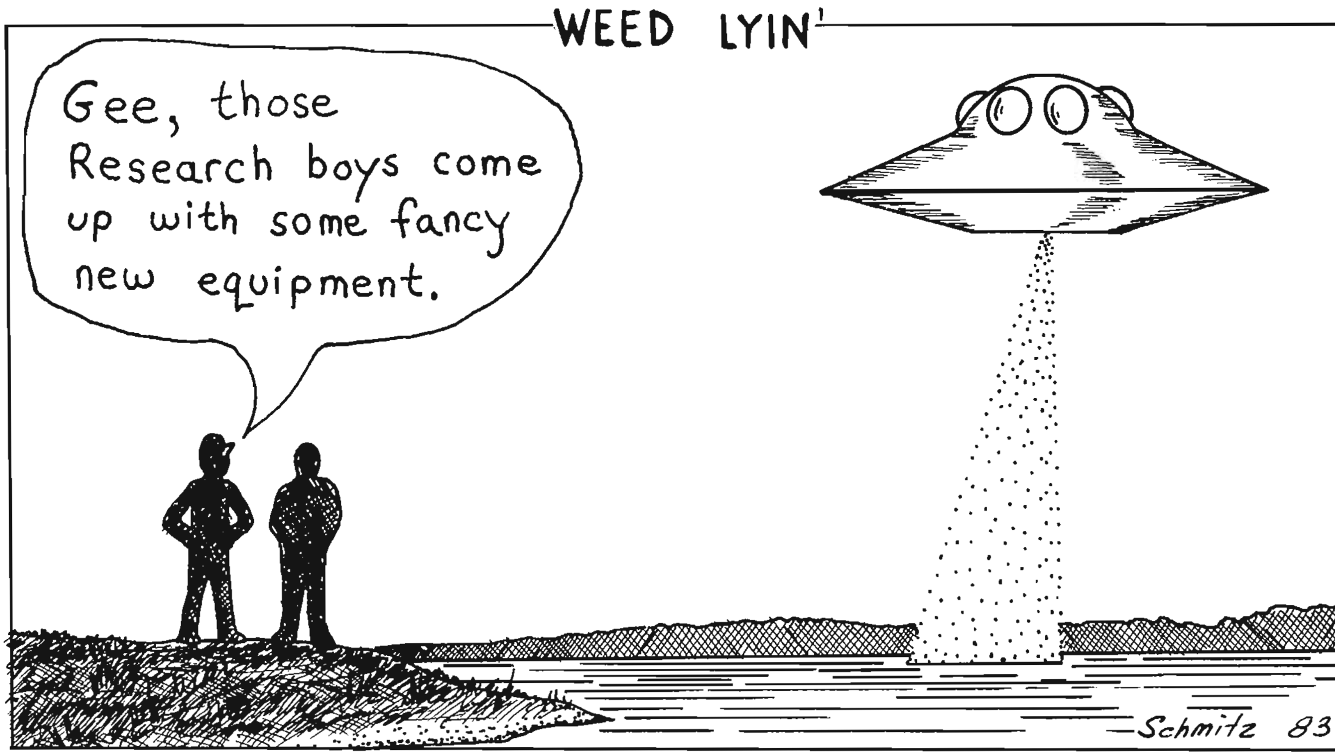
Evaluation of the old triploid grass carp, the new triploid grass carp and "other" (?) grass carp continues. Production of sterile fish is the objective of several projects at this time. Combinations of grass carp and herbicides are being evaluated. Work has apparently slowed on developing pathogens for control of hydrilla, however, insect biocontrol projects continue at a high level. Foreign exploration for biocontrol insects is being conducted and several insects are being evaluated in various parts of the world.

Physiology and Biology:

In one respect, the introduction and spread of hydrilla in Florida has been beneficial; research on control techniques has also provided funds for spin-off research on the ecology, physiology and biology of aquatic plants in Florida which have led to a better understanding of vascular plant, algae, and fish relationships. Prior to 1970, very little ecological information had been published on submersed aquatic macrophytes. In the past 10 to 15 years studies, and consequently scientific interest, in aquatic plants have greatly increased. Much information has been gathered on the photosynthesis, reproduction, growth and nutrient requirements of hydrilla. For example, in 1982 it was discovered that there are at least two "eco-types" or "strains" of hydrilla in the United States. The male plant has flowered in tanks at Ft. Lauderdale, however no seed production has occurred to date. In California studies, male plants have produced viable seeds.

One of the major tourist attractions in Florida remains this states freshwater fisheries resources. Studies have been conducted to determine the impact of various aquatic weed infestations on fish population dynamics and growth. Related work is trying to determine the best levels of control and which plant species are most conducive and compatible with maintaining good, productive sport fishery habitat.

In summary, hydrilla spread through Florida has slowed in the past few years. Progress toward effective and safe aquatic plant management has been great in the past decade as control programs are becoming based more and more upon sound, scientific knowledge.□



AQUA-VINE

Letters to the Editor

Dear Editor:
I have just returned from overseas where I had the opportunity to again look at infestations of *Mimosa pigra, Salvinia molesta, Cyperus papyrus* and many other extremely noxious aquatic plants. Your editorial on 16C-19 in the June 1983 *"Aquatics"* was certainly very timely. Hopefully, the CAST Task Force Report on Importation and Introduction of Exotic Pests will soon be completed and further point out the problems with exotic pests.

The point is this, I believe few people understand the serious problems that some plants could cause if they were to become naturalized in Florida. *Salvinia* has exploded on the Sepik River in New Guinea and now clogs a 60 mile long area of the river, including the extremely important oxbow lakes. Fishing, navigation and disease problems have resulted in complete isolation of many villages in the area. Papyrus islands cover not acres, but square miles of lakes across sub-sahara Africa from Nigeria to Kenya. *Coix* and *Leersia* grasses colonize extremely large areas of floating water lettuce and hyacinth mats in Southeast Asia.

I don't know what action DNR has taken on 16C-19 since your editoral was published, however a reasonable and fair plant importation law should be a priority in Florida.

Sincerely,
William T. Haller
Associate Professor
Center for Aquatic Weeds

Dear Editor,
I heard some complaining about the F.A.P.M.S. meeting that really ticked me off! Some people are griping that the Harold Brown Show lasted a little too long and that he was getting off on watching himself on the little T.V. set. Give the guy a break! Maybe he didn't get much attention when he was little. Besides, he and Dee have a bundle riding on this TEMIK deal. You ask, what does TEMIK have to do with aquatic plant control? Well, if they can take away his TEMIK, they can confiscate our KARMEX!

As you can tell from this letter, I too, have decided to become a *former* environmentalist (Uncle Bob's 2% pay raise tore it!). About those "vicious environmentalists," Ron Arnold doesn't know the half of it. Your whole organization is infiltrated with "shrewd socialists." Hell, I first met Carlton Layne at genocide school in Cuba! And don't be fooled by Lowell Trent's well-rehearsed southern accent. He was born and raised in Stalingrad!

Because I have so much inside information on the bunny-huggers, I will be available for next year's guest speaker at the F.A.P.M.S. meeting. I will discuss my upcoming book, "Jim Watt: Man or Messiah?" and answer such questions as: Did the Sierra Club actually shoot down KOREAN AIR 007? Why did biologist-types conduct so-called telemetry studies on a U.S. Navy base? What is the hidden agenda behind stocking *Red* Chinese grass carp throughout America? You will receive, at no extra charge, a membership to A.I.D.S. (Americans for Insecticides as a Dietary Supplement). Also, because we're buddies, I won't charge anymore than Ron Arnold did: $2,000 or 20% of the F.A.P.M.S. annual budget, whichever is higher (I'm already starting to get the hang of this free enterprise stuff!). Unlike Arnold, I actually have a scientific background, know that you aren't a bunch of farmers, and understand that there is more to aquatic plant control than just "squirt, squirt."

Jess M. Van Dyke

Dr. Joe Joyce recently accepted a faculty position with the University of Florida as Director of the Center for Aquatic Weeds. Joe previously administered the Natural Resource Management program for the U.S. Army Corps of Engineers, Jacksonville District. He had worked with the Corps for 11½ years primarily with their aquatic plant management program. Joe will continue as chairman of the Aquatic Plant Advisory Council. The appointment of Dr. Joyce is a tremendous plus for our aquatic plant management and research programs.

Mr. Clarke Hudson, Chevron Chemical Company, has been appointed to the Aquatic Plant Advisory Council by the Institute of Food and Agricultural Sciences. Clarke has served as an alternate to Dr. Joyce who previously served on the council in this capacity. As director of the Center for Aquatic Weeds, Joe will replace Dr. Arnet Mace on the council. Dr. Mace's interests and active participation in the early stages of the establishment of this council are greatly appreciated.

Northwest Florida Water Management District

Terry Burch Joseph has left the Northwest Florida Water Management District to assume a position with the Department of Transportation in Chipley, Florida. Terry was the biologist with the Aquatic Plant Control Section at the Tallahassee office.

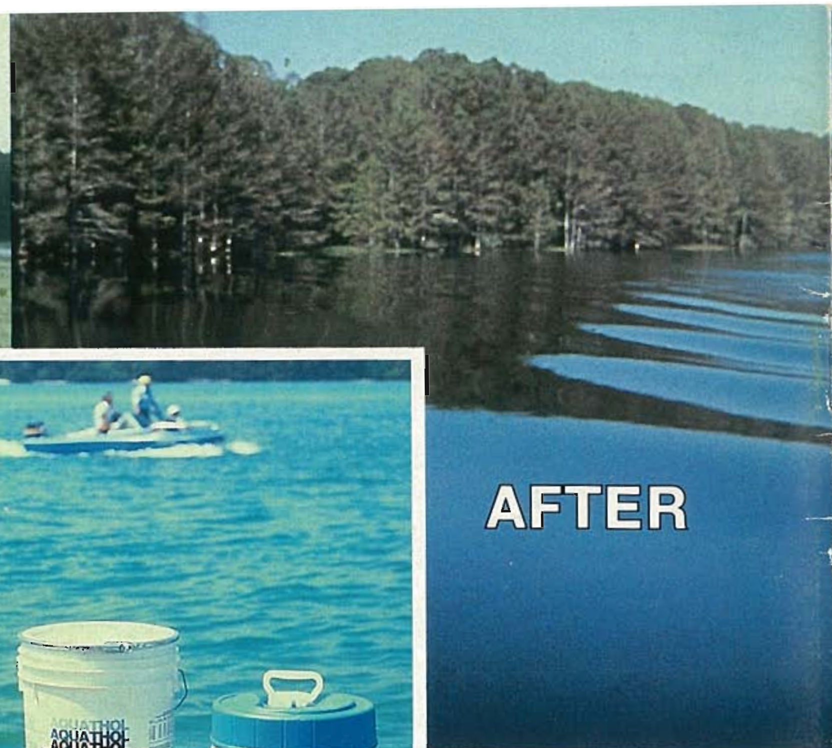
Lake Talquin, west of Tallahassee, is being drawn down for repairs on the dam. The 18 foot drop in water level should also provide additional weed control and improved fisheries.

New Division Director

Charles W. "Bud" Hendry, Jr., state geologist and chief of the Bureau of Geology in Tallahassee, is Resource Management's new division director.

Hendry, who has been bureau chief for the past 12 years, began his distinguished career with the Florida Geological Survey in 1949. He held a number of positions with the Survey, including draftsman, stratigrapher and assistant state geologist, before becoming bureau chief. Hendry also received the first M.S. degree in geology awarded at FSU.

Steve Windham, the bureau's assistant chief, replaces Hendry as bureau chief.



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