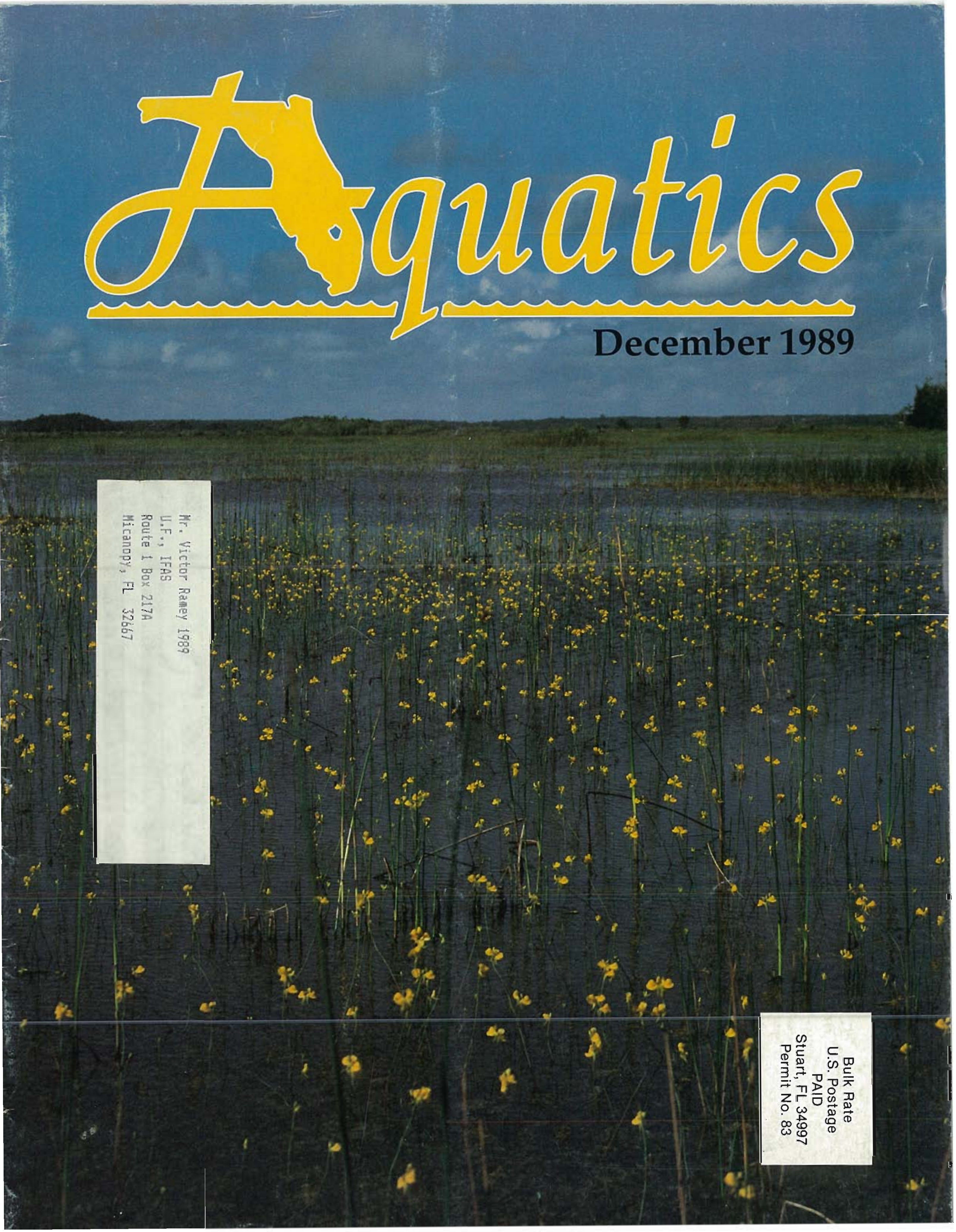
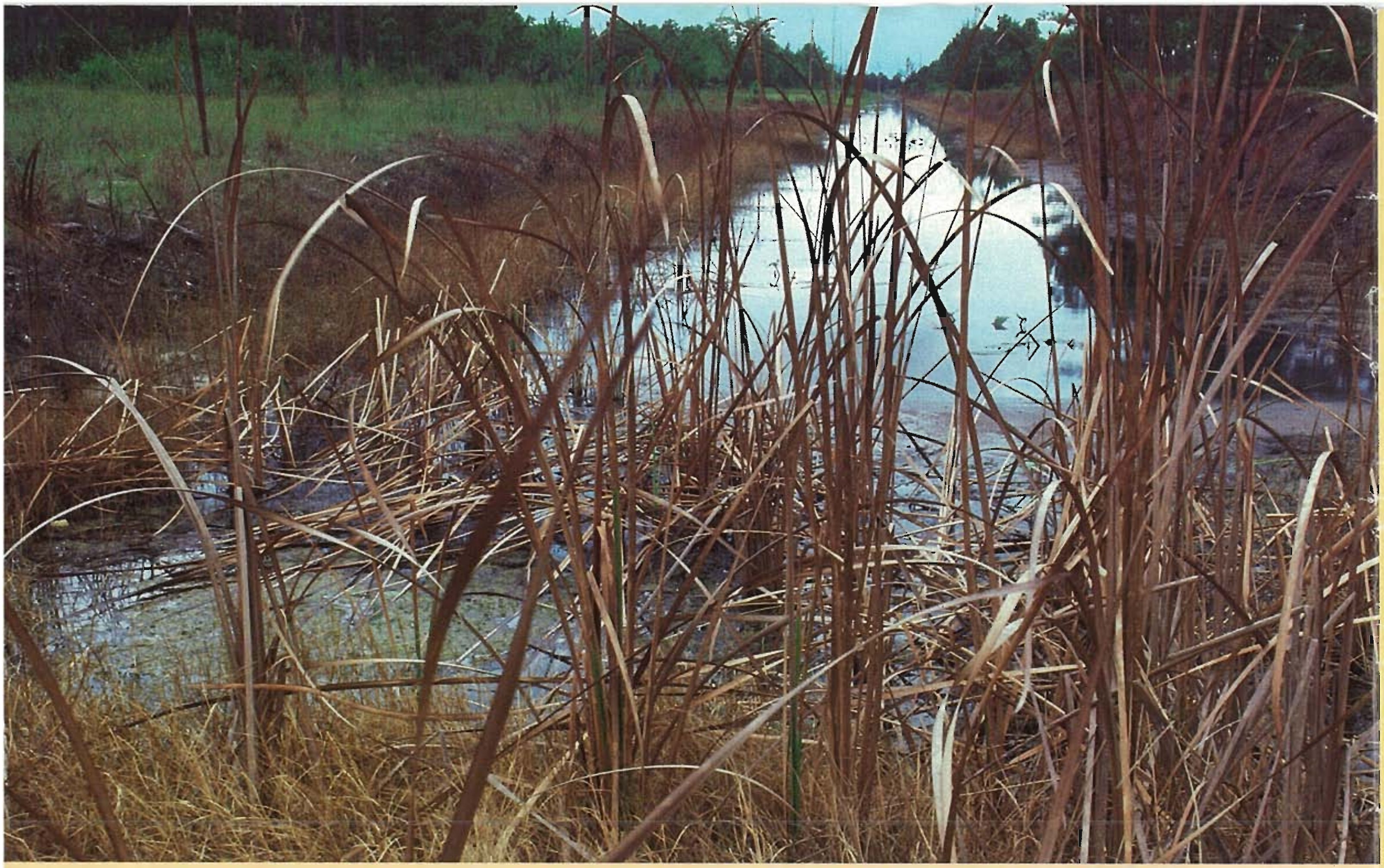
Aquatics

December 1989






RODEO
AQUATIC HERBICIDE

EDITORIAL

Aquatic plant managers, especially FAPMS members, have much to be proud of. Membership in the Society continues to increase with approximately 850 current members. Attendance at the recent annual meeting broke last year's record exceeding 400 registrants. Water hyacinth, once aquatic plant managers' biggest problem, are most likely at the lowest level of this century. New selective and relatively long term hydrilla control methods give us the potential to better manage hydrilla in large systems. An effective biological control agent for water lettuce appears to be a reality and could become another aquatic plant management tool. The production of effective, easily utilized public education materials has finally begun through a joint IFAS/DNR program.

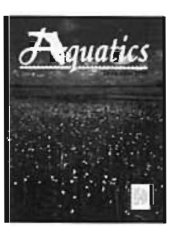
Have we finally solved the most important problems facing aquatic plant managers? Can we sit behind our desks or on our airboats in the shade and marvel at these accomplishments? No way, as the popular saying goes, there is always something.

Depletion of the Aquatic Plant Management Trust Fund will make maintaining existing levels of noxious aquatic plants, especially hydrilla, a difficult if not an impossible task within public waters. Proposed endangered species and groundwater protection legislation will create coordination challenges which need to be recognized and resolved. Uncertainty over the status and make up of the Aquatic Plant Advisory Council has caused much concern. The long time problem of public education and perception still plagues our profession.

These are some of the challenges which we, as aquatic plant managers, will face this coming year. All of us should familiarize ourselves with these issues and become involved however and whenever possible.

Brian Nelson

About The Cover



Bladderwort blooming in the Moonshine Bay area of Lake Okeechobee.
Photo by: Dan Thayer

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AQUATICS: Published quarterly as the official publication of the Florida Aquatic Plant Management Society. This publication is intended to keep all interested parties informed on matters as they relate to aquatic plant management particularly in Florida. To become a member of the FAPMS and receive the Society newsletter and Aquatics magazine, send $10.00 plus your mailing address to the Treasurer.
EDITORIAL: Address all correspondence regarding editorial matter to Mike Bodle, Editor, Aquatics" Magazine, P.O. Box 24680, West Palm Beach, FL 33416.

Custard Apples

by
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Fruit of the Custard Apple.

One of the most spectacular sights along the shores of Lake Okeechobee that greeted the first white settlers was a belt of tropical trees which stretched from Clewiston's Sand Point on the southwestern shore of the lake around the south end of the lake and up the eastern side all the way to Port Mayaca. In some places the woods was two miles or more in width without a break or opening. It is estimated that there were 32,000 acres of Custard Apple woods, most of which was blanketed with a moonvine cover.

In the Book, *A Cracker History of Okeechobee*, by Lawrence E. Will, he vividly describes the area.

"The custard apple tree itself was nothing much for looks. It wasn't tall, it wasn't broad, it didn't have a shape and it was no account, too. You couldn't saw it into boards and you couldn't eat its fruit. I reckon it was near about the ugliest, most useless tree the good Lord ever made, and yet He made a heap of them," Will said.

Author Patrick Smith also gave a vivid description of the phenomenon in his fictional account of life in the early central Florida, *A Land Remembered.* To demonstrate the thickness of the moonvine cover, Smith had one of his characters scramble to the top and walk across the woods, using the denseness of the cover as a primitive sidewalk.

In the early part of 1886, a scientific expedition funded by the Wagner Free Institute of Science in Philadelphia explored the west coast of Florida and up the Caloosahatchee River to the mysterious Lake Okeechobee. In the report that was published as a result of that research, Angelo Heilprin, a professor of geology at the Institute reported seeing this tree when the group reached Observation Island.

"Along its western and southern borders it is well-nigh inaccessible, owing to a heavy growth of small cypress and custard-apple (?), whose gnarled stems and stumps form an effective barrier to approach," Heilprin wrote.

Heilprin's question mark about the species he observed is well taken.

While the tree is commonly known as a Custard Apple, the tree which grew along the shores, and on the islands within the lake, its roots loving the wet, swampy muck land, was not a true Custard Apple.

According to *Field Book of American Trees and Shrubs*, by Mathews F. Schuyler published in 1915, the "true" Custard Apple tree requires a light, well-drained soil. The Custard Apple *(Asimina triloba)*, a member of the pawpaw family, produces a fleshy fruit, 3-5 inches long, which is a dull sepia brown when ripe. It is sweet and edible in October after a frost.

The leaves alternate and the blossoms are bisexual, radially symmetrical, solitary or in various arrangements. There are six petals to a blossom, which are thickish, and in two series.

This species is still plentiful and is often grown as a yard plant in South Florida, according to A Dictionary of Trees.

The Pond Apple tree *(Annona glabra)*, while a member of the same family, grew in swamps near Lake Okeechobee. It has also been known as the Alligator Apple. Its leaves are persistent, thick and veined. The flowers are solitary or in few-flowered clusters. The six petals on the flower are arranged with three on the inner and three on the outer edge.

Will describes its fruit in his book *Swamp to Sugerbowl.*

"...the yellow, fragrant fruit, no bigger than an apple. Like a cantaloupe in taste it was, or something like a ripe persimmon, but good grief, you couldn't eat the cussed fruit, for it was nothing but a mass of seed in a tough inedible pulp." The fruit a deep yellow in color, is covered by brown patches when it is ripe. The flesh beneath the outer skin of the fruit is very thin.

(Note: While Will described the fruit tasting similar to a cantaloupe or ripe persimmon, the author found the taste to be very bland, and the consistency somewhat stringy and grainy.)

The tree had large cream colored blossoms, which had a deep crim-

son splash of color in their centers. Will describes the pre-civilized area with a vivid narrative.

"When these woods were in their prime, exploring their shadowy domain was an experience you'd not forget. Under leafy branches covered with a solid blanket of white blossomed vines which made twilight at mid-day, you might walk for miles and scarcely glimpse the sky. Some folks complained that these dark woods had a depressing effect. There was a peculiar fascination in walking through this murky forest, zigging and zagging between outreaching roots, dodging under crooked branches which tangled overhead, always wondering what discovery might lie just beyond. Sometimes you'd be stopped by a barricade of wind-felled trees with their meshing branches bound by vines and laced by spider webs, but travel usually was not too bad. Between the close growing trees the ground was bare except for lacy ferns among the angles of the roots, or again, some giant fern, head high to a tall hunter, which unrolled its brown back leaves in Ionic volutes. Gourd vines with their green pendant fruit, looping and lacing from branch to branch were less a barrier than those yellow strands, tough as piano wire, spun by enormous brown and yellow spiders. High among the branches pineapple-like air plants displayed red and orange blossoms, while gorgeous painted buntings flitted busily about the squirrels leaped from limb to limb. The cathedral silence was broken only by the occasional scream of some lonesome sentinel hawk."

So the 50-mile long woods was shadowy, dark, mysterious, peaceful, silent and exotic. Today, for all purposes, it is all gone. It disappeared in almost an instant when a white man arrived on the shores of Lake Okeechobee, decided he needed canals for access to the outside world, and discovered the rich mucklands would provide some of the best farmland in the world.

While the general feeling prevailed that the custard apple or pond apple was a totally useless tree, Lola Upthegrove Williams, who came to live at the edge of those woods as a ten-year-old child in 1914, said recently that her family of commercial fishermen did find uses for those trees. When the family arrived on the eastern shore of Lake Okeechobee, they settled at Sand Cut, which is located about half-way between Port Mayaca and Canal Point.

"There was still all those custard apple trees there. I would love to have some of those seeds to plant. We used to play in those custard apple trees and with the moonvines. We used to eat the seeds. The seed was a big old seed like a pumpkin seed. My mother would roast them in the oven," said the 84-year-old resident of the Okeechobee Health Care Facility.

"The roots of that custard apple tree was what the fishermen used for floats on their lines. They're light. They would cut those roots. It would keep the nets from laying on the bottom. You didn't have to hurt the tree to get the roots," she said.

In *A Cracker History of Okeechobee*, Will supports Lola's story.

"The wood was soft and brittle. It wasn't even good to burn. The wood itself was light in weight with spongy roots as light as cork. In fact, you could use chunks of it to float your seine if you didn't have real corks to use," Will said.

The beginning of the demise of this unique forest came about when the level of the lake was lowered. Before drainage and canals were dug, the lake shore was moist, partially under water several months out of the year. But, when the lake level went down, the ground dried and cracked open three or four feet deep. The trees began to die out.

With the digging of the Palm Beach Canal, the St. Lucie Canal, and other navigable waterways, more and more of the trees disappeared.

When settlers realized that the muckland was ideal for agriculture, that just about sounded the death knell for the Pond Apple. Will again described it in *Cracker History*.

"Because the custard apple land could produce such top notch crops without a pound of fertilizer, settlers flocked here from the coast, from the sawgrass muck, and from the whole wide world besides. Then, first with axes, then with mules, then as they got more prosperous, with tractors, too, they cleared and burned those trees in a mighty short span of years. It used to be a rare day on the lake when you couldn't see somewhere on shore the smoke from burning piles of trees and elderberry bushes. The few trees still remaining were finished off in the hurricanes of 1926 and 1928 when wind and water from the breaking dikes uprooted and washed so many of them away," Will said.

When Will wrote his book in 1964, he said of the millions and millions of trees, only a dozen or so lonesome and scraggly trees remained on the marshy western shores of Torry Island at the south end of the lake. Will stated that Sherlock Holmes himself couldn't find a dozen more.

But closer to home (Okeechobee), indeed within a few short miles of the city of Okeechobee, a few Custard Apple trees have begun to grow again, their roots once again resting in soft, swampy soil. The spot where they have chosen to grow is more than 20 miles further north than their original habitat in the days before civilization.

The location of these trees, while in the open and readily accessible to the general public, is being protected in the hope they will continue to expand and grow, and possibly give people in the 1980's and beyond, a glimpse into the past of how one of Lake Okeechobee's natural wonders appeared.

What is even more amazing than the discovery of the trees once more attempting to gain a foothold, is the fact that where the trees are growing, the moonvines are also growing again, once more providing the shade as they did more than 60 years ago, but also serving as a shelter to hide the trees from public view.

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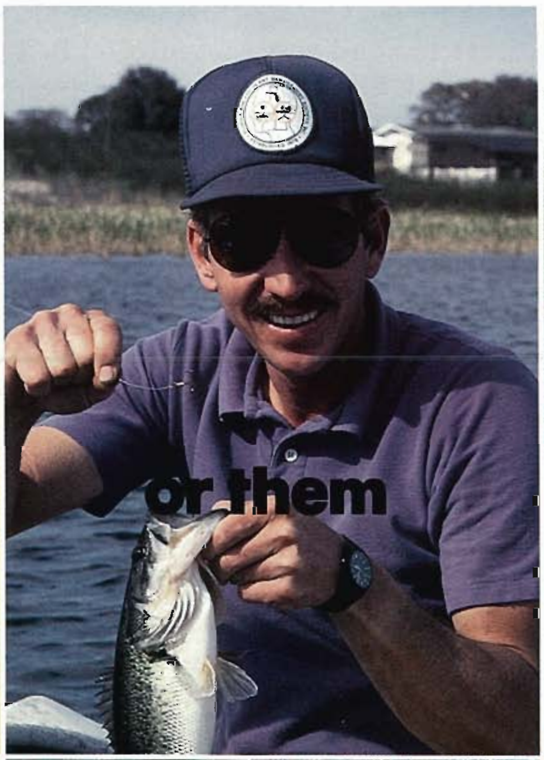

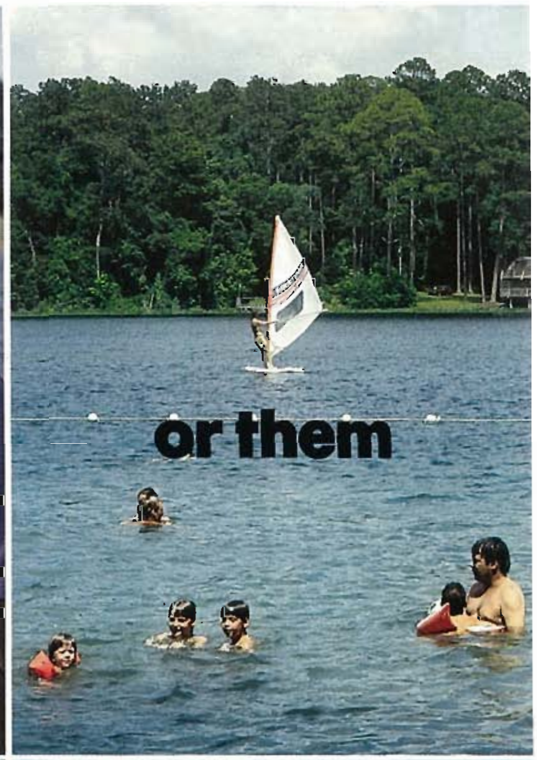

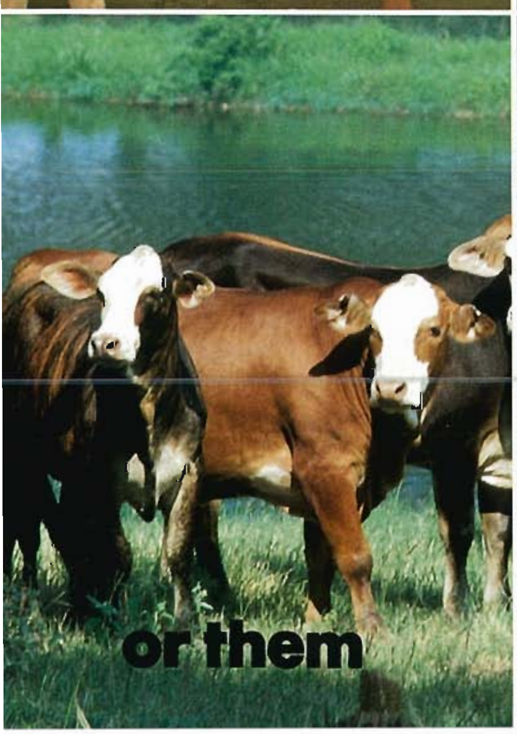

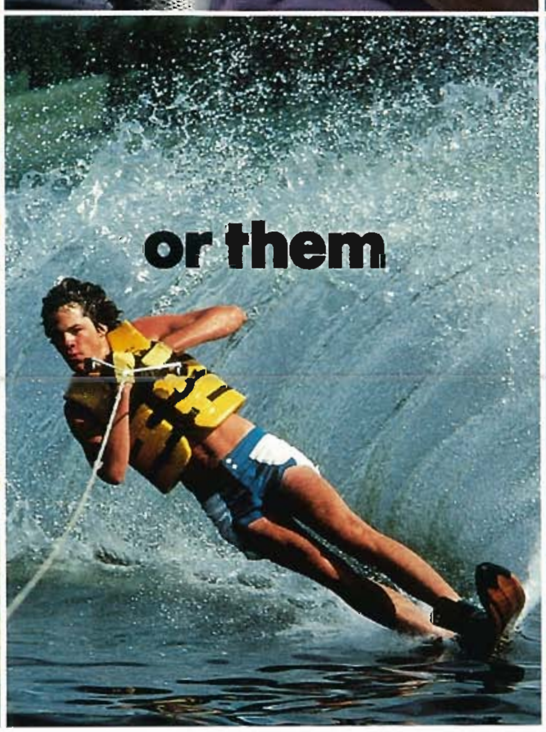

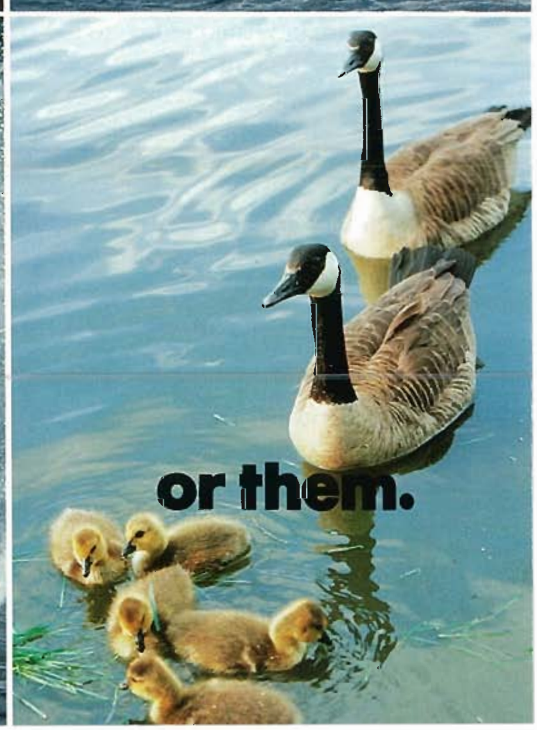

Final Recommendations of the American Assembly Conference of Management and Control of Aquatic Weeds in Florida

by
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During the past few months, there has been considerable interest in the recommendations of the American Assembly Conference in the Management and Control of Aquatic Weeds in Florida, which was held in Tallahassee on September 25-27, 1979. Although the recommendations were previously published in *Aquatics*, it was felt that it would be of benefit to publish them once again so we could reflect upon the recommendations and how they were implemented and how they apply to today's situation.

The conference was called in order to resolve the legislative, operational, research and funding issues which we associated with aquatic plant management. Over 80 personnel from all backgrounds and interests were assembled to address a series of 26 issues. The participants were broken into four groups, each of which made simultaneous recommendations concerning the 26 issues. These recommendations were then modified and voted upon by all participants. The final votes are indicated below to the right of each issue.

It is obvious from the vote that a clear consensus was reached on each issue. As we contemplate future changes in the State's aquatic plant management program, it would be wise to reflect upon the past.

Statutes, Rules, Permits and Recommendations

1. The current jurisdiction of public agencies for aquatic plant management and control should be more clearly defined. Furthermore, statutes, rules and permits for jurisdiction of both public and private waters should be reviewed by the Florida Department of Natural Resources which shall recommend revisions, to insure the protection of public health, safety, welfare, and to insure continued health of our environment. 69-7
2. It is the opinion of this Assembly that the Department of Environmental Regulation Water Classification System is sufficient for aquatic weed management and control. However, Class III waters need to be further subdivided for aquatic plant management and control purposes. This subdivision should be based upon a recognition of principal use or uses of each body of water. 75-2
3. The coordination of field operations and treatment of aquatic plants in public waters will be the responsibility of the lead agency. 70-4
4. The jurisdiction of public agencies for applicator's training and certification is clearly defined. 72-2
5. The Assembly strongly recommends that aquatic weed management and policy formulation be the responsibility of one agency. Furthermore, the Assembly recommends that the Florida Department of Natural Resources be designated as that agency. 75-5
6. The Florida Department of Natural Resources is charged with overall coordination of the statutes, rules and permits and may delegate responsibility to other agencies where appropriate. However, we strongly recommend that the legislative authority and expertise of local and regional entities be retained. 75-1
7. The Assembly strongly recommends that an Advisory Council consisting of multi-discipline interests, agencies, and representatives of user groups be created to provide the Florida Department of Natural Resources with recommendations on policy and procedures for aquatic plant management and control. Furthermore, the creation of a strong and active Advisory Council is vital to the success of the state's aquatic plant program. 73-0
8. We, the Assembly, recommend that: (1) the Florida Department of Natural Resources exotic plant inspectors be given the power of arrest; (2) a more effective quarantine procedure be instituted; (3) the state seek stronger enforcement under the Federal Noxious Weed Act; and (4) the Florida Department of Natural Resources 68-7

meet with responsible representatives of the Aquatic Plant Industry to review and update the existing rules as needed.

9. We recommend that industry or persons 66-2
not be allowed to import, export or transfer exotic or native aquatic plant species within the state's public waters without strict compliance with the terms of all permits, rules and statutes.

10. We recommend that the permit system for 65-1
aquatic plant management be retained. The procedure for obtaining permits is detailed in Recommendation Number eight.

Operations Recommendations

11. The Assembly recognized that operational 71-3
jurisdiction in some cases is inadequate due to: (1) the lack of public and private waters; (2) the lack of effective operation; (3) overlapping agency responsibility; and (4) definition of watershed boundaries. We recommend that the Florida Department of Natural Resources clarify and coordinate responsibility in these cases. In keeping with Recommendations two, three and nine, the Florida Department of Natural Resources should delegate the operational authority to regional agencies such as the water management districts, state agencies such as the Florida Game and Fresh Water Fish Commission, and local governments where appropriate and feasible. Such delegation may be terminated only upon majority recommendation of the Advisory Council.

12. No agency should have both operational and regulatory responsibilities for aquatic plant management.

13. The Assembly recognizes that previous 70-0
conflicts between agencies have been detrimental. However, we are confident that adoption of these recommendations will be beneficial in the furtherance of effective aquatic plant management programs.

14. Private industry involvement in aquatic 71-1
plant management should be encouraged where cost effectiveness can be demonstrated.

15. Public funds should be expended 67-6
to manage aquatic plants as determined by the responsible operating entities in public waters. Public funds should not be utilized for the management of aquatic plants in private waters except in the case of threats to public health, safety, or welfare, or the presence of a new exotic or native aquatic plant species new to the area.

16. The Assembly recognizes that the Florida 65-3
Department of Natural Resources has a State Plan for aquatic plant research and control. We recommend that: (1) this plan be improved by the incorporation of local and regional input; (2) this plan be implemented; and (3) the plan be

made available to the public.

Research Recommendations

17. The Assembly recommends that the coordination of the state's aquatic plant management research program shall be conducted by the Aquatic Weeds Research Center. The Center shall administer the research priorities established by the Florida Department of Natural Resources utilizing the program priorities recommended by the Advisory Council. Furthermore, the Aquatic Weeds Research Center shall utilize the best available scientific expertise through contracts to agencies, other institutions, and industry for the conduct of aquatic weed research. The payments for such contracts will be made by the Florida Department of Natural Resources from previously identified or specified research funds. 60-3

18. The funding of the aquatic plant research program shall be specifically identified as research items in the overall aquatic plant control program budget submitted annually to the Legislature. Transfers of additional trust fund monies into and out of the research program will be done under the guidelines established by the Advisory Council. Furthermore, the Center shall be provided base sustained support funds as appropriated by the Legislature in establishing the Aquatic Weeds Research Center. 63-1

19. The Assembly recommends that the stated research program should be interfaced with ongoing federal programs through the Executive Director of the Florida Department of Natural Resources and the Director of the Aquatic Weeds Research Center or their delegates, as appropriate. 60-1

20. The participants of this American Assembly Conference believe that the research program is not adequately addressing all research problems contained in Question 5, including chemical research needs due to such constraints as insufficient coordination, level of funding, transfer of research information, etc. 62-0

Funding Recommendations

21. Funding for the management and control of aquatic plants is inadequate for state and local programs due to the increasing magnitude of the problem. We therefore recommend that the cap for the Aquatic Plant Control Trust Fund be increased. 63-1

22. Management of funding for programs needs to be modified to establish a revolving fund for the disbursement of monies to participating units in a more timely fashion. The Assembly encourages all participants to evaluate programs to insure increased efficiency. 65-0

23. The Florida Department on Natural Resources should coordinate the state budget request for aquatic plant management. The Department shall obtain input from the Advisory Council and other affected groups. 65-1

24. Participants of this Assembly recommend that federal funds be increased to support aquatic plant management programs where desired and where such funds would enhance defined state programs. 60-4

25. We recommend that state funds be increased for use when requested by local groups, where efficiency will be increased, and where programs will be enhanced. Furthermore, we recommend that the state's share of the state/ local matching program be increased for control purposes only. 63-2

26. State participation in aquatic plant management and control by local users should be apportioned on the basis of public utilization and benefits. 65-0

Derivation of Aquatic Plant Names

by
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I. Introduction

Early civilizations developed along waterways and aquatic plants played an important role as ornamentals, food, medicine, and shelter for our ancestors. Historically, as well as today, the need for proper identification of a particular aquatic plant is essential to avoid confusion when one person is communicating to another individual the qualities of that aquatic plant.

Taxonomy, the orderly classification of plants according to their presumed natural relationships, is one of the older botanical sciences. Because of the close association which exists between humans and plants, correct identification of plants is essential to avoid confusion among the myriad of known plants. Classification of plants began even before the written record.

Theophrastus who lived from 370 to 285 B.C. classified and described about 480 kinds of plants based primarily on their form and texture. Albertus Magnus (1193-1280) was the first to recognize the differences between monocotyledonous and dicotylendonous plants. Johann Bauhin (1541-1631) was one of the first taxonomists to give a generic and specific epithet to about 5000 plants he classified and described. This binary nomenclature of listing the genus and species along with the name or initials of the individual or individuals describing the plant, which comprises the plant's scientific name, is still in use today.

Many other taxonomists provided insights into the classification of plants, but it was Carolus Linnaeus (1707-1778) who is generally considered as the most prodigious taxonomist of all time. The "L." attached at the end of the scientific name of many plants attests to the extraordinary effort which Linnaeus exerted in classifying plants.

Early classification of plants was based on habit of the plant. But today, taxonomists attempt to develop systems based on phylogeny, the evolutionary history of a taxonomic group. As new information becomes available, it may become necessary to change the grouping or name of a plant. Therefore, it is not uncommon to see several different names in the literature that refer to the same plant.

In the classification of plants, the genus (from Latin "gen"–the root and "genus"–birth, origin, descent) is the fundamental unit which provides basic classification units for groups of plants having common reproductive characteristics. The concept of the genus as a category for groups of plants occurred long before taxonomic science came of age, and perhaps even before the written language existed. In the classification system, the genus is the main subdivision of a family.

The scientific name is written in italics or underlined with the genus (i.e., the *generic* name) capitalized but the species is not capitalized. The scientific name provides for the exact identification of a particular name as opposed to a common name. Common names are given to plants because of the ease in which the name can be remembered. In contrast, scientific names may be difficult to pronounce and to recall as many of them are composed of words from Greek or Latin origin. For some aquatic plants, the genus name is also the common name for one or more species in the family. For example, the genus name *Azolla* is commonly used to refer to all the species in this group since they are all very similar in appearance.

The following is a list of aquatic plants grouped by families and genus. The derivation of the generic name is presented. Common names are presented for some species, and in a few cases, several common names are given for the same species. This list is by no means complete, and it is presented to provide some understanding as to some of the reasons or origins for the name, or names, associated with a particular aquatic plant.

II. List of Aquatic Plant Names

A. Alismaceae or water plantain family

1. *Sagittaria:* from Latin "sagitta"–an arrow. Common name: common arrowhead, duckpotato, or wapato refers to *S. latifolia* Willd.

2. *Echinodorus:* from Greek "echinos"–hedgehog, and "dorus"–a leather bag or fruit; in reference to the spiny fruit of some of the species. Common name: Amazon sword plant.

B. Araceae or arum family

1. *Cryptocoryne:* from Greek "crypto"–hidden and "coryne"–club. Common name: crypts.

2. *Pistia:* from Greek "pistos"–liquid. Common name: Water lettuce refers to *P. stratiotes.*

C. Ceratophyllaceae or hornwort family

1. *Ceratophyllum:* from Greek "ceratos"–a horn, and "phyllon"–a leaf; because the foliage resembles little horns. Common name: Coontail or Hornwort.

D. Cabombaceae or water-shield family

1. *Cabomba:* derivation of name unknown but is probably a native name in French Guiana. Common name: Fanwort or cabomba generally refers to *C. caroliniana* Gray; green fanwort or green cabomba to *C. caroliniana* var. *multipartia;* and purple fanwort or purple cabomba to *C. pulcherrima* (Harper) Fass. Some taxonomists include this genus in the water-lily family.

E. Cyperaceae or sedge family

1. *Cyperus:* an ancient Greek name. Common name: flat-sedge refers to *C. odoratus* L.

2. *Eleocharis:* from Greek "helos" a marsh, and "chairein"–to rejoice or "charis"–grace, favor. Common name: spikerush. Slender spikerush is the common name for *E. baldwinii* Michx.

F. Gramineae or grass family

1. *Panicum:* from Latin "panicum"–panic grass. Common name: torpedograss refers to *P. repens.*

2. *Phragmites:* from Greek "phragmos"–a fence; in reference to its compact hedge-like growth along ditches. Common name: giant reed or common refers to *P. australis* (Cav.) Trin. ex Steud.

G. Haloragaceae or watermilfoil family

1. *Callitriche:* from Greek "kalos"–beautiful and "thrix"–the hair; in reference to its attractive style of growth. Common name: Water Starwort.

2. *Hippuris:* from Greek "hippos"–horst, and "oura"–a tail. Common name: Mare's Tail.

3. *Myriophyllum:* from Latin "myrios"–myriad or numberless, and from Greek "phyllon"–a leaf; in reference to the numerous divisions of the foliage. Common name: Eurasian watermilfoil refers to *M. spicatum* L., variable-leaf milfoil to *M. heterophyllum* Michx., and parrot's-feather to *M. aquaticum* (Vell.) Verdc. formerly called *M. brasiliense* Camb.

4. *Proserpinaca:* from Latin "proserpo"–to creep. Common name: Mermaid-weed refers to *P. palustris* L.

H. Hydrocharitaceae or frog's-bit family

1. *Egeria:* After Egeria, a nymph in Roman mythology who acted as advisor and dictated laws to Numa, a second king of rome. Common name: Brazilian elodea, anacharis, and egeria refers to *E. densa* Planch.

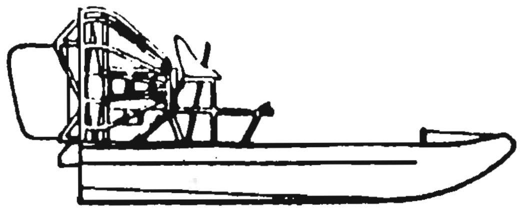
2. *Elodea:* from Greek "helodes"–a marsh; which refers to the habitat in which these plants grow. Common name: Canadian pondweed or elodea refers to *E. canadensis* Rich. A synonym for this plant is *Anacharis canadensis* Planch. as in some literature the genus is written as *Anacharis*–from Greek "ana"–up and "charis"–grace.

3. *Hydrilla:* from Greek "hydor"–water; in reference to its habit of growth. Common name: hydrilla or Florida elodea refers to *H. verticillata* Royle.

4. *Hydrocharis:* from Greek "hydochares"–delighting in water, and "chairein"–to rejoice or "charis"–grace, favor. Taxonomists now call this genus *Limnobium.* Common name: frog's-bit refers to *L. spongia* (Bosc.) Steud. which means "a living sponge in pools." Frog's-bit is commonly mistaken for waterhyacinth plants because of their similar appearance but they have flowers that are quite different.

5. *Lagarosiphon:* from Greek "lagaros"–thin, lanky, and "siphon"–tube. Growth of these plants is prohibited in Florida because of their similar habit of growth to hydrilla. Common name: African elodea.

6. *Vallisneria:* named in honor of Antonio Vallisneri, an Italian botanist. Common name: Tape



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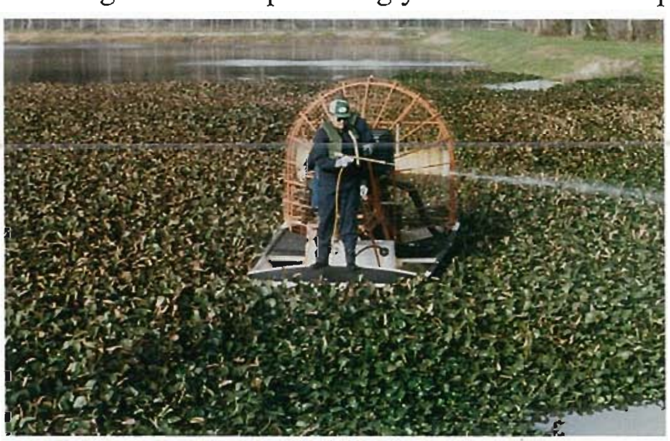

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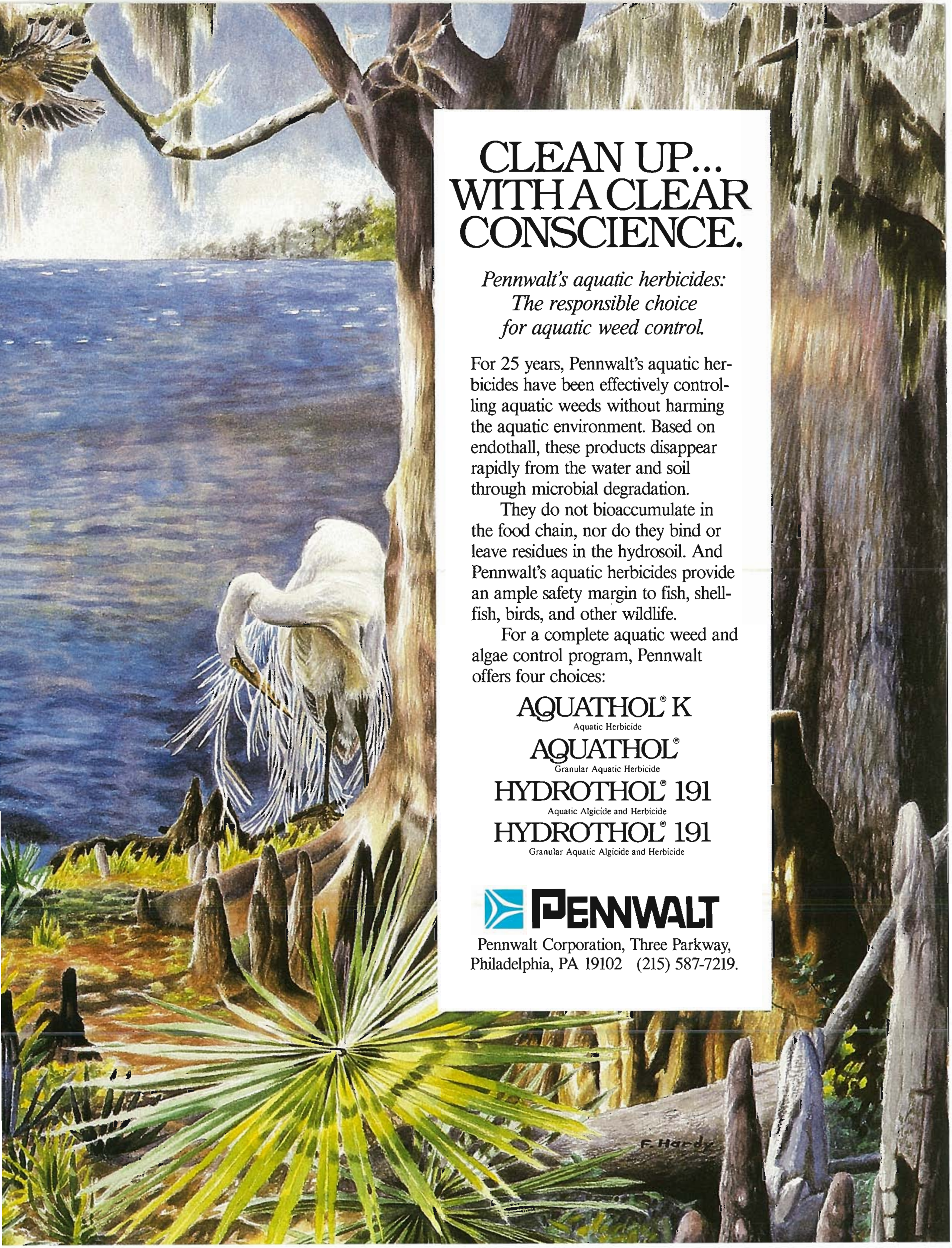
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Grass or Eelgrass. Often called 'Wild Celery' because this plant seems to impart a celery-like flavor to waterfowl that feed on it. *V. americana* is common throughout North America while *V. neotropicalis* Marie-Victorin with its much broader leaves than the former is present in Florida.

I. Isoetaceae or quillwort family

1. *Isoetes:* from Greek "isos"–equal, and "etos"–the year; because these plants retain their fronds throughout the year. Common name: quillwort.

J. Juncaceae or rush family

1. *Juncus:* from "juncere"–to join; because of its use in wickerwork. Common name: soft rushes refers to *J. effusus* L. and black rush to *J. roemerianus* Scheele.

K. Lemnaceae or duckweed family

1. *Lemna:* from Greek "lemna"–a water plant. Common name: common duckweed or lesser duckweed refers to *L. minor* L.

2. *Wolffia:* named in honor of J.F. Wolff who published a work on *Lemna* in 1801. Common name: water-meal.

L. Lentibulariaceae or bladderwort family

1. *Utricularia:* from Latin "utriculus"–a little bag or bottle. Common name: cone-spur bladderwort refers to *U. gibba* L., big floating bladderwort refers to *U. inflata* Walt., purple bladderwort refers to *U. purpurea* Walt.

M. Najadaceae or water nymph family

1. *Najas:* from "naias"–a water nymph. Common name: southern naiad refers to *N. guadalupensis* (Spreng.) Magnus; maine naiad to *N. marina* L.; and slender naiad to *N. minor* All.

N. Nelumbonaceae or lotus family

1. *Nelumbo:* from Sinhalese (Ceylon) "nelumbu." American lotus, yellow-lotus, or water-chinquapin refers to *N. lutea* Pers., and sacred-lotus which has pink flowers and is used primarily as an ornamental to *N. nucifera* Gaertn.

O. Nymphaeaceae or water-lily family

1. *Nuphar:* from Greek "nouphar" a waterlily. Common name: spatterdock, yellow cow lily, and yellow pond lily all refer to *N. luteum* (L.) Sibth. and Smith.

2. *Nymphaea:* from Latin "nymphaea"–a water lily. Common name: fragrant water-lily, fragrant white water-lily, and pond-lily refer to *N. odorata* Aiton; yellow water-lily to *N. mexicana* Zucc.; cape blue to *N. capensis* Thunb.; and blue water-lily to *N. elegans* Hook.

P. Onagraceae or evening primrose family

1. *Trapa:* from Late Latin "calcitrapa"; in reference to the resemblance of the hornlike projections of its fruit to a dangerous iron instrument with four points used for maiming the legs of advancing cavalry troop's horses. This instrument also termed 'caltrop' or 'caltrap.' Common name: water chestnut.

2. *Ludwigia:* named after Kristian Gottlieb Ludwig (1709-1773), a professor at Leipzig. Common name: red ludwiga refers to *L. repens* Forst.

Q. Pontederiaceae or pickerelweed family

1. *Eichhornia:* named after Johann A.F. Eichhorn, a Prussian Minister. Common name: floating water-hyacinth refers to *E. crissipes* (Mart.) Solms., and rooted or anchored water-hyacinth to *E. azurea* (Swartz) Kunth.

2. *Pontederia:* named after Giulo Pontedera, an Italian botanist. Common name: Pickerelweed refers to *P. cordata* L. and tropical pickerelweed to *P. rotundifolia* L.

R. Potamogetonaceae or pondweed family

1. *Potamogeton:* from Greek "potamos"–a river, and "geiton"–a neighbor. Common name: Illinois pondweed refers to *P. illinoensis* Morong, and sago pondweed to *P. pectinatus* L.

S. Salviniaceae or salvinia family

1. *Azolla:* from Greek "azein"–to dry and "ollynai"–to kill; meaning these plants are killed by drought. Common name: azolla.

2. *Salvinia:* named after Antonia Maria Salvini (1633-1729), an Italian scientist. Common name: salvinia.

T. Schrophulriaceae or figwort family

1. *Limnophila:* from "limne"–a pool, and "philos"–dwelling in or loving; in reference to its manner of growth. Common name: limnophila.

U. Parkeriaceae or floating-fern family

1. *Ceratopteris:* from Greek "keras"–a horn, and "pteris"–a fern. Common name: water sprite refers to *C. thalictroides* L.

V. Typhaceae or cat-tail family

1. *Typha:* from Greek "tyhe"–cattail. Common name: cattail.

W. Umbelliferae or parsley family

1. *Hydrocotyle:* from the Greek "hydor"–water, and "cotyle"–a cavity, referring to the habitat and the leaves being hollowed out like a cup. Common name: water pennywort refers to *H. umbellata* L.

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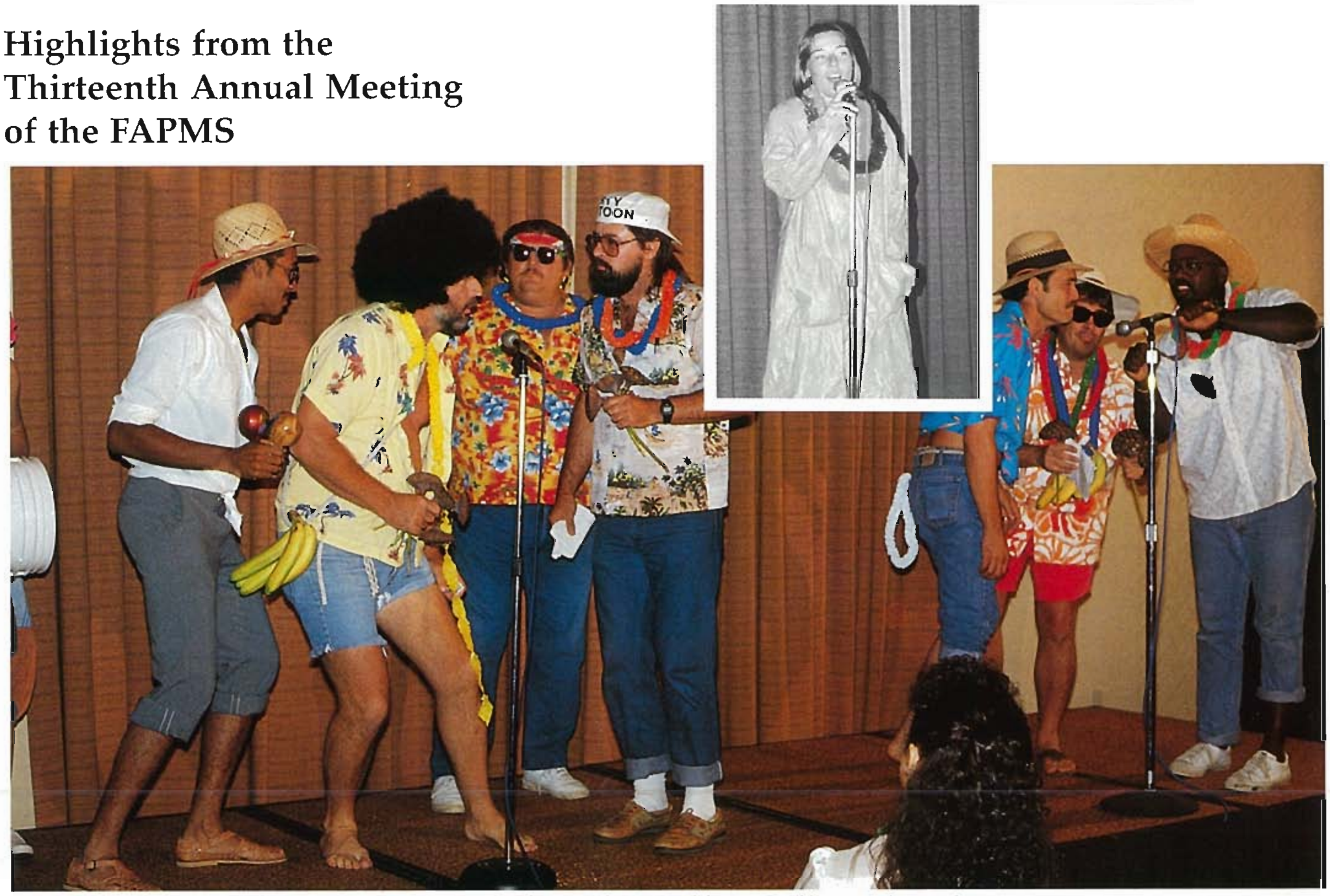
Highlights from the Thirteenth Annual Meeting of the FAPMS



Alison Fox introduces "Alex West and the Weed Wackers", who recently returned from a Caribbean weed excursion.

AWARD WINNERS

Photo Contest:
Operations
1st Place – Steve Johnson
2nd Place – John Teevens
3rd Place – Nancy Allen
Aquatic Scenes
1st Place – Wendy Andrew
2nd Place – Jim Kelley
3rd Place – Don Doggett

Membership Drive:
Bill Moore
(which he donated to the William L. Maier Scholarship Foundation)

Applicator of the Year:
Frank "Donnie" Chandler

Outgoing President Plaque was presented to Bill Moore at the annual banquet/luau.

Applicator Paper of the Year:
Jessie Griffin
(which he donated to the William L. Maier Scholarship Foundation)

Exhibitor Award:
Agrolinz

Presidential Award:
Ken Langeland
Vic Ramey

Unofficial winner of the unofficial Hawaiian dress contest goes to Wayne Jipsen for his impersonation of **Don Homely**.

Special Recognition Award:
Mike Dupes
Donnie Kinard

Distinguished Service Award:
Orie Lee Wills
David Bruner
Lonnie Taylor
Ron Morgan

Raffle Winners:
Mike Mahler –
Duck Decoy, by Donnie Kinard
Marty Allsup –
Color TV, by Valent
Stanley Stringer – Hunting Knife

Scholarship Award Winners:
Elsie D. Gross –
University of South Florida
Tammera M. Lee –
University of Florida

The raffle team of Cummings and Haller generated close to $3600 for the William L. Maier Scholarship Foundation.

Waterlettuce Seeds In The U.S.

by
F. Allen Dray Jr.
University of Florida, IFAS
Fort Lauderdale, Florida 33314
and
Ted D. Center
United States Dept. of Agriculture
Fort Lauderdale, Florida 33314

Waterlettuce plant showing mature fruits. Inset shows germinating seed.

Waterlettuce (*Pistia stratiotes* L.) is a floating aquatic weed found in tropical and subtropical regions of the world (3,8,9,11,18). Most botanists consider it foreign to North America (17), having invaded the U.S. with the earliest European settlers. John and William Bartram's reports of extensive waterlettuce infestations along the St. Johns River and its tributaries (17) demonstrating that it was well established in Florida by the late 18th century, however.

Waterlettuce populations expand mainly through vegetative propagation (14). Growth tips (meristematic tissue) in the center of the rosette produce new plants (also called offsets) that remain attached to the primary plant for an indeterminate period.

Although vegetative propagation is the main method by which waterlettuce infestations increase, seed production occurs in Africa, India, Southeast Asia, and South America (9,14,17), but purportedly not in the United States (8,9,18). However, we recently discovered waterlettuce fruits at the Arthur R. Marshall Loxahatchee National Wildlife Refuge in Palm Beach County, Florida (6) (Figure 1). The waterlettuce mat averaged 238 rosettes per square meter at the Loxahatchee site during April 1987 (6). Over half the primary plants, and 25% of the offsets, bore berry-like fruits. There were usually 2 fruits on each sexually reproducing rosette. Seed abundance varied from 1 to 17 per fruit (Figure 2), but averaged 4 seeds. More recently, we have found that both the number of fruits per plant and the number of seeds per fruit vary seasonally. For example, rosettes in a canal in St. Lucie County bore up to 300 seeds in July 1988 with fruits frequently bearing more than 10 seeds.

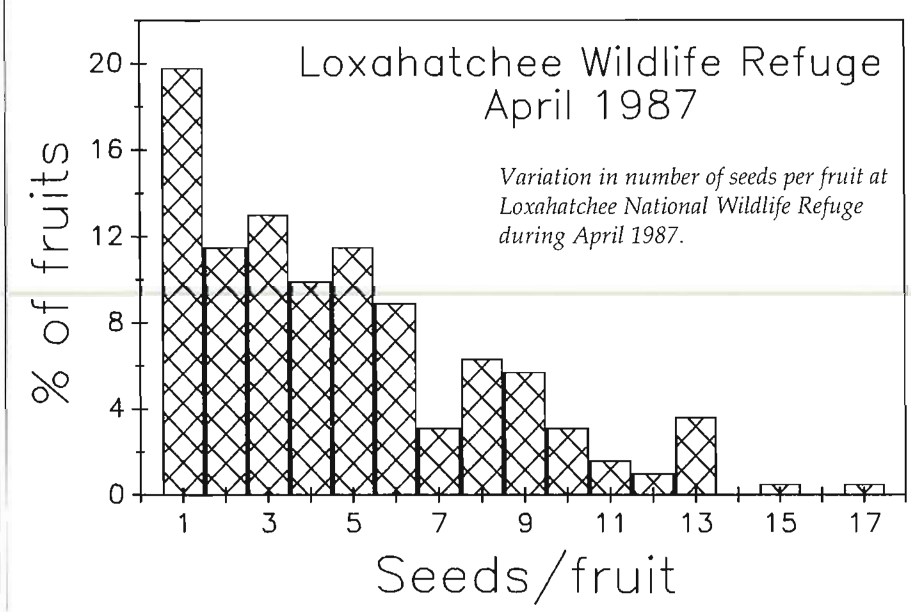
There were 726 seeds per square meter of plant mat at Loxahatchee in April 1987 (6). Sediments below the plants contained over 4,000 seeds per square meter. These data suggest that ramets comprise only a small percentage (5%) of the total waterlettuce population at this site. Seeds (each representing a single plant) constituted 95% of the population during our study, 85% of which resided in the sediments.

Germination experiments showed that over 80% of the seeds collected at Loxahatchee were viable (6) (Figure 3). Because proper light intensity and spectral composition are critical to successful germination, waterlettuce seeds deposited in deep water, covered by silt and detritus, or deposited in shallow waters with high turbidity will probably not germinate unless conditions change. However, seeds in shallow clear waters, on islands of floating muck and vegetation, in decomposing herbicide-treated mats, or stranded along receding shorelines are very likely to germinate. Also, seeds trapped in tangled waterlettuce root masses are often exposed to conditions suitable for germination when the plants are overturned.

Waterlettuce seeds can remain dormant for months, withstand freezing and drought, and still germinate when favorable conditions become prevalent (12). Studies at Philippine rice fields (2) and Dutch canals (12) indicate seed production plays an important role in re-establishing populations after catastrophic destruction. This evidence has important implications for aquatic weed management schemes. Herbicide application is very effective at eliminating infestations, particularly in waterways closed to re-introduction of the weed from other areas. However, viable seeds on benthic sediments will germinate under favorable conditions. These seedlings provide an initial stock which, through vegetative propagation, will reinfest a waterbody.

The absence of sexual reproduction has been used as evidence that waterlettuce is not native to the U.S. (17). Our data show that sexual reproduction is common, thus refuting this evidence. This does not mean, however, that waterlettuce is a North American native. Additional evidence must be considered before such a determination can be made.

Paleobotanical studies show the subtropical North American floras of the Eocene epoch included the genus *Pistia*, but it remains unclear whether these fossils represent *P. stratiotes* or some other, now extinct, species (15). Further, extant waterlettuce populations in regions with ancient geologic records do not necessarily reflect an uninterrupted presence in the region. For example, *Pistia* seeds, belonging to the extinct *P. siberica*, have been recorded from late Miocene deposits in Europe. One could argue that this species is really the same species as the waterlettuce currently found in the Netherlands, and that these facts indicate that *P. stratiotes* is a European native. However, *P. stratiotes* was only recently introduced on the



Variation in number of seeds per fruit at Loxahatchee National Wildlife Refuge during April 1987.

European continent. It would, therefore, be premature to assert that the presence of fossil *Pistia* in North American indicates *P. stratiotes* is a native North American species. This is especially true since these fossil records occur prior to the drastic climatological shifts brought about by the Pleistocene glaciations. The extent to which herbivorous insects have come to utilize a particular plant may also provide clues as to how long that plant has been in a particular region. If, as some believe, *P. stratiotes* has a long history in North America, then it would be reasonable to expect that the fauna associated with waterlettuce would include several insects that feed exclusively on this plant (16). If, however, this plant arrived in North America only a few centuries ago, then one could expect to find nearly as many generalist insects attacking waterlettuce in North America as in other regions, but relatively few specialist species (16). A recent survey found that of the dozen plant-feeding insects associated with waterlettuce in Florida, only one was potentially monophagous (feeding exclusively on one plant) (7). Yet in the province of Chaco, Argentina (roughly comparable in size to Florida) at least 3, and perhaps as many as 7, species feed exclusively on waterlettuce (1,13). This suggests South America is the center of origin for waterlettuce (1,4). The Old World tropics harbor several species of insects whose diets are restricted to this plant, and there are potentially many more since the waterlettuce fauna of this region is poorly known. Thus, faunistic evidence is inconclusive concerning the origins of waterlettuce although it suggests this species is not native to the U.S.

Regardless of whether *P. stratiotes* is native or non-native to the United States, waterlettuce is a problem in Florida and needs to be addressed. The fact that it produces seeds here means aquatic weed managers must be aware that seed germination can result in a re-infestation of chemically treated waterbodies. Biological control agents, a recently added tool for controlling waterlettuce, may help reduce seed set thereby increasing the overall effectivenesss of control efforts. However, production of seeds by waterlettuce ensures this species will never be completely eliminated from Florida.

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Sonar Technical Conference Reveals Answers and Insights

by
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Public Relations Editor
Carmichael Lynch
Kansas City, Missouri

At a national technical conference on Sonar aquatic herbicide, held by Elanco Products Company in Indianapolis earlier this year, more than 50 speakers and participants had a chance to compare notes on the product's features. Among those listed were safety, effectiveness against exotic weeds like hydrilla, and potential selectivity.

In his opening remarks, William Culpepper, director of marketing for Dow Elanco Specialty Products, admitted that fluridone, the active ingredient in Sonar, is more than a manufacturer could have hoped for 10 or 15 years ago. In reality, he admits, the company got lucky and discovered a unique molecule in the quest for a new cotton herbicide. According to Culpepper, it soon became apparent through initial screening that fluridone held more potential in the aquatic environment than it did in cotton fields. Discovered in 1974, it took 11 years, however, to get the product tested, approved and on the market. Even today researchers and applicators continue to learn new things about Sonar, as they revealed at the seminar.

For example, research conducted at the University of Florida by Dr. Bill Haller has shown that unanswered questions remain, especially when it comes to controlling hydrilla in flowing canals and tidal basins. With two tides a day of two types, spring and neap, the question is, "What stage of which tide do you treat on?" To find the answer University of Florida researchers have begun using dye to analyze water movement.

Although most people would expect a canal to have a predictable flow rate, dye experiments indicate that water moves at different speeds in different parts of the canal. For example, when a foot-wide band of dye was applied across the width of one canal, dye was found 30 seconds later all the way from the starting point to 150 feet downstream. So, in reality, the flow rate ranged from 300 feet per minute to zero.

On the other hand, dye experiments in lakes and standing water have helped reveal the effects of photolysis, water stratification, thermoclines and water temperature on the movement of water and conversely, on any herbicides applied to the water body. A dramatic relationship was found between the time of day and the top to bottom dissipation of any dye applied to the water surface.

Additional research has revealed a close relationship between the way the dye moves in the water and the way herbicides are dispersed, which should help scientists learn even more about what herbicides are doing, where they can be used and how to predict their effectiveness.

In Florida, early weed control efforts targeted water hyacinth. Today, the target continues to be water hyacinth, as well as hydrilla, which has recently overshadowed its predecessor in terms of cost.

Although herbicides are applied to more acres of water hyacinth a year compared to hydrilla, the latter can account for more of a typical aquatic plant management department's budget. In addition, because beneficial plants and detrimental plants are mixed together, the key is to control the problem vegetation without really harming the beneficial natives. By using systemic herbicides, it has been found that hydrilla control can be attained with minimal impact to eel grass, Illinois pondweed, nitella and chara, which are considered to be good fisheries and wildlife plants.

Treatment locations selection can be critical to minimize the impact on native vegetation. Success also has to do with timing. For example, treatments done in the early spring affect hydrilla when it is just beginning to grow strongly, yet the natives are still idle or not growing quite as rapidly. Because Sonar is a systemic product rather than a contact herbicide, it tends to control the hydrilla, while the desirable vegetation can recover.

A case in point was 3,000 acres of hydrilla in 4,000 acre Lake Jackson, in Tallahassee. Sonar was initially applied in March, 1987. Approximately one-third of the hydrilla was knocked back. Then, in a second treatment in 1988, the ratio of liquid to pellet Sonar formulations was modified concentrating more on the latter. Because hydrilla was lower in the water column than normal, it was felt the product would concentrate where the problem was the worst and eliminate the need to treat the entire water column. As a result of the two year treatment, hydrilla frequency dropped significantly in all transects while coontail and nitella either increased or were not affected.

Also, there was change in the vegetation cross section. At the time of the first treatment with Sonar, 99 percent of the treated transects were vegetated. Following the treatment, it dropped to 97 percent, only to increase to 98 percent prior to the second Sonar application. However, instead of the plots being covered by one or two species like hydrilla, there are now anywhere from 18 to 23 plant species in a transection.

Product safety was another subject addressed at the two day conference. In general, acute toxicity studies reveal that fluridone has a very low order of toxicity with median lethal dosages being greater than 10,000 milligrams per kilogram in both rats and mice. Subchronic studies resulted in no-effect levels ranging from 9.3 milligrams per kilogram in mice to 200 mg/kg in dogs. Teratology and reproductive studies revealed no toxic reproductive effects along with no mutagenicity in bacteria.

Using this information, Dr. Ray Pohland, Senior Toxicologist for Lilly Research Laboratories, explained how a risk factor, or margin of safety, may be obtained. For example, if the no-effect level for a compound was 10 mg/kg and the human exposure level was one milligram per kilogram, one would calculate a 10-fold margin of safety. However, potential exposure of humans to fluridone could come from more than one source, including consumption of water, game fish or animal products from fluridone-treated lakes or ponds. Therefore, potential human daily exposures were calculated assuming (1) continuous tolerance of fluridone residues, (2) a normal rate of dissipation of levels of fluridone, and (3) actual analytical data for fluridone residues. These potential daily exposures were then compared to a calculated acceptable daily intake value for man based on the no-effect level for fluridone in a chronic rat study.

Given that the no-effect level in the chronic rat study was 8.35 mg/kg/day, a 100-fold safety factor yields an acceptable daily intake for man of 0.0835 mg/kg/day. As a result, the acceptable daily intake is almost 65-times greater than the actual human exposure. This implies a 6,500-fold margin of safety. Exposure based on continuous tolerance, would yield a greater than 1,400-fold safety factor.

Dr. Roger Meyerhoff, environmental toxicology scientist with Lilly, conducted tests on potential fluridone animal risk prior to release of the product. No significant risk was found after EPA standard tests were conducted on bobwhite quail, mallard ducks, catfish, bluegill, fathead minnows, rainbow trout and seven aquatic invertebrates.

N-methylformamide (NMF) was also a subject of discussion at the conference. There have been doubts in some minds since 1983, when it was discovered that fluridone, under laboratory conditions, could be degraded by light to produce several products. Among these was NMF, an organic compound that can permeate human skin. At high dosage levels, NMF was shown to be a teratogen in tests with rabbits, meaning it has the potential to cause birth defects and liver problems. As a result of this discovery, concerns were voiced about the potential of NMF being formed in the natural environment after the application of Sonar.

Elanco and the Florida Department of Natural Resources supported independent tests by Dr. John Osborne at the University of South Florida and François Larouche at the University of Florida to monitor the degradation of fluridone and the potential formation of NMF. Also, Nate Dechoretz with the California Department of Food and Agriculture conducted his own NMF study while using Sonar for hydrilla control. More than 750 water samples were collected by all three researchers and not one has contained NMF at a detection limit of two parts per billion.

Ray Pohland's assessment of a worst case theoretical calculation of NMF formed from fluridone in the laboratory, independent of "real world" events, resulted in a 30,000-fold margin of safety for causing teratogenetic (birth defects in progeny of exposed individuals) effects. Putting it another way, Pohland explained that a person would have to drink 16,000 gallons of fluridone-treated water per day in order to reach the level of no teratogenetic effects in the worst case for theoretical NMF formation. This increased to more than 78,000 gallons per day in a more realistic case based on the limit of detection of NMF in actual field trials. Again, NMF has yet to be found at these detection limits outside the laboratory.

Similarly, for absorption through the skin (percutaneous exposure) to reach the teratogenetic no-effect level, one would have to swim the equivalent of more than 1,000 years in a single day. Based on the limit of detection in the field trials, that number would be the equivalent of more than 5,000 swimming years in a day to equal the level at which no effects are seen.

Armed with knowledge of this product's low toxicity rating and the fact that aquatic managers are getting better each year at predicting its efficacy, Sonar has found a place in aquatic plant management.

The toxicity rating of a given herbicide is not usually the issue with aquatic specialists and researchers. The determination of the management objectives for a particular lake or water body can be the bigger obstacle. Is it managed for wildlife, fisheries, recreation, flood control or a combination of these? Once that is determined, aquatic specialists can select the agents of control most suitable to these objectives.

HALLER'S HISTORICAL HIGHLIGHTS

Plant Introductions

Ever wonder why many of Florida's exotic weeds were first introduced around the turn of the century? These would include brazilian pepper, water hyacinth, torpedograss, paragrass, napier grass, and melaleuca, among many others. Do you know that at about this same time such valuable crops as mango, wheat, rice, alfalfa, and soybeans were introduced to American Agriculture?

It all began in the late 1800s as world wide transportation by steam ships, and intercountry travel by rail opened up the interiors of far off places to plant explorers. In 1889, a young Kansas State Agriculture College graduate named David Fairchild was hired by the U.S. Department of Agriculture in Washington, D.C. He organized and was the Director of the Office of Seed and Plant Introduction for the department from 1904 to 1928. He worked in various capacities for the department for 44 years (1889-1933), during which time it is estimated that 200,000 plants were introduced into the United States, an annual rate of over 4500 introductions/year (12/day).

Why were so many introductions made? American farmers were having to feed growing urban populations as industry and manufacturing were drawing labor from the agricultural sector. Population growth in America was high, and famines in Ireland and other countries resulted in many of our ancestors immigrating to the land of opportunity. Higher yielding crops and even improved cattle production was necessary to maintain a balanced food supply. Many scientists were involved in collecting plants for possible economic benefits in America. Vegetable production, crop production, ornamental horticulture, and plant breeding disciplines were new fields and needed new materials to evaluate and work with. Nearly all agriculture colleges were founded between 1860 and 1900.

Fairchild was concerned about introducing "future weeds" and introduced plants were evaluated in Federal Plant Introduction Gardens. Problem was, many plants became weeds only after many years, and little was known about the new species in their native lands. Obvious weeds were destroyed as Fairchild wrote concerning a plant he saw in 1940 in the Celebes Islands: "Covering the ground between the palms was a tangle of what I am sure is the most viciously spiny legume in the world, *Mimosa invisa*. In 1926 I had sent seeds of it to Florida, and two years later, when it threatened to spread too fast, I became alarmed, poured gasoline over it, and burned it up."

A visit to the grocery store, local nursery, or Fairchild Botanical Gardens in Coral Gables proves the great benefits our generation has derived from plant introductions by early botanists. As in the late 1800s, the problem remains today as how to tell the good plants from the potential "weeds" as plants continue to be introduced for agricultural and even medicinal studies.

■ Bill Haller

AQUAVINE

CITRUS COUNTY

Arthur J. (Jeff) Nigels had been with Citrus County's Aquatic Services for 11 years when he permanently injured his back on May 31, 1988. This injury occurred while Jeff was on the job. After undergoing surgery and an extensive rehabilitation program, it is now apparent that Jeff will not return to the job and profession that he so dearly loved.

Jeff started work as a sprayman with what was then called the County's Weed Control Department in July, 1977. He advanced to the position of Crew Chief and finally held the title of Field Foreman in September, 1982.

Jeff has been a long time member of FAPMS.

We will miss Jeff and join Citrus County in wishing him only the best.

CORPS

Michael Dupes, longtime Biologist in the Corps of Engineers Natural Resource Management Section, has recently accepted a position in the Corps Environmental Resources Planning Division. Mike will now be writing Environmental Impact Statements for the Corps, as well as many other projects. Mike has been replaced by Ann Galloway, who transferred into the position from Regulatory Permitting. Ann received her B.S. degree from Jacksonville University in Environmental and Biological Sciences. Ann's responsibilities include administering the aquatic plant management program for Florida and Puerto Rico, and assisting Bill Zattau with the Operational Support Center.

POSITION AVAILABLE

Clarke Outdoor Spraying Co. of suburban Chicago is looking for a full time employee to manage its aquatic weed control division. This position involves chemical application supervision of summer crews and off-season sales work. An energetic, experienced person to control and expand the business is desired. A bachelor's degree, field and sales experience are ideal but not required. Call 1-800-323-5727 or write:

Clarke Outdoor Spraying Co.
159 N. Garden Ave.
Roselle, IL 60172
ATTN: Pete McNeil

DNR – WEST PALM BEACH

In February of 1990, Robbie Lovestrand will transfer from the South Florida Regional Office to the Southwest Florida Regional Office in Floral City. Robbie has been in the West Palm Beach area office for nearly one year. Permitting demands have steadily increased for the Southwest Region and require the additional position to assist Jim Kelly – lone Southwest biologist – with the increasing work load.

DNR – TALLAHASSEE

Rob Kipker has been selected to fill the Tallahassee position of Biological Administrator in the Survey and Control Permitting Section of the DNR Bureau of Aquatic Plant Management. This position was vacated by Bill Caton as he filled Larry Nall's former position of Environmental Administrator of the Survey and Control Section. Rob has been in the Research section of the Bureau heavily involved in control of new exotic infestations such as *Mimosa pigra* and water spinach, *Ipomoea aquatica*. In his new position, Rob will oversee the regional biologists' activities. Congratulations, Rob!

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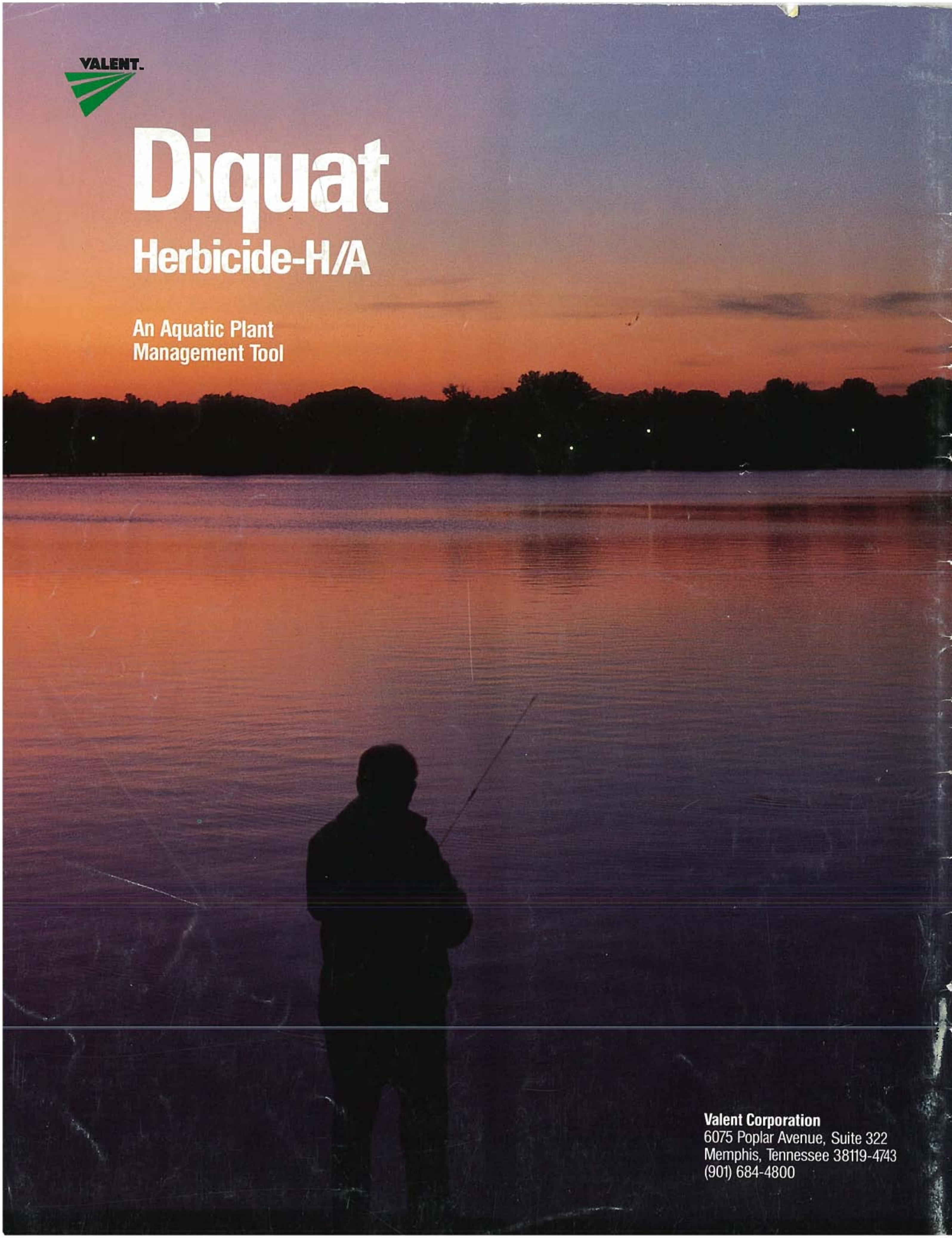

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