Aquatics

SEPTEMBER 1984

BULK RATE
U.S. Postage
PAID
Stuart, Florida
Permit No. 83

EDITORIAL

Aquatic plant managers in Florida have made great strides since the early Seventies in achieving maintenance control of exotic species. Due to state and federal permitting and funds, operational planning and constant control efforts, most of the public lakes are now open for multiple water use activities. This effort and trend must be continued in order to meet the growing water demands of the state.

The recent expressed concerns by some of the fisheries biologists with the Fla. Game and Fresh Water Fish Commission may be detrimental to these efforts and to the lakes themselves. The concern is with over-control of Hydrilla *in a number of lakes that have historically had tremendous infestations of this exotic nuisance. Structure is the issue here. But we can definitely have structure without it being in the form of* Hydrilla. *Research has indicated that rocks, dead orange trees, logs, or native vegetation will have the same results for increasing sport fish populations. Let's not reverse the control efforts and "manage for* Hydrilla."

Fisheries management is a very important aspect of lake management programs and the Fla. GFC is doing their job to identify the importance of structure. Let's work together. Through the proper use of the tools available to the aquatic plant manager, we can continue to reduce Hydrilla *levels and encourage beneficial native plants to reestablish. One of the Dept. of Natural Resources' research priorities is to study revegetation utilizing native plants. Members of our Society should support the Department in initiating this type of work.*

Instead of preserving exotics like Hydrilla, *Eurasian watermilfoil and water hyacinths, we should be making every effort to turn these into endangered species throughout the U.S.A.*

Mike Mahler

THE COVER

Aquatic weeds pose a serious threat to electrical production by clogging cooling water intake pumps—Carolina Power and Light Co., Wilmington, N.C. Photo by David P. Tarver

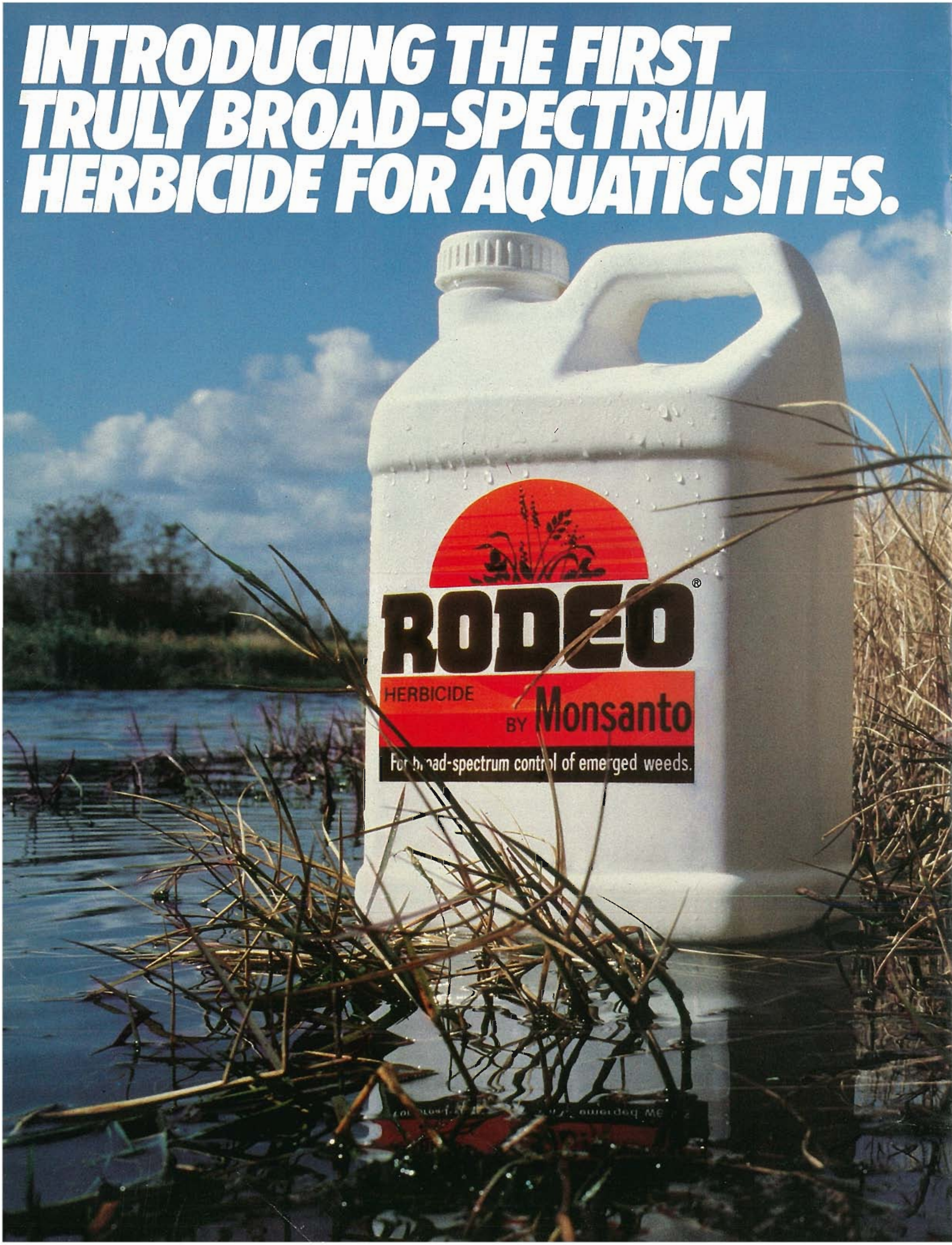
Aquatics

SEPTEMBER 1984/Volume 6, NO. 3

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.

CORRESPONDENCE: Address all correspondence regarding editorial matter to David P. Tarver, Editor, "AQUATICS" Magazine, 2416 McWest St., Tallahassee, Fla. 32303


INTRODUCING THE FIRST
TRULY BROAD-SPECTRUM
HERBICIDE FOR AQUATIC SITES.
RODEO®
HERBICIDE
BY Monsanto
For broad-spectrum control of emerged weeds.

NEW RODEO IS LABELED FOR YOUR TOUGHEST GRASSES AND BROADLEAF WEEDS, INCLUDING:

ALLIGATORWEED*	JOHNSONGRASS	REED CANARYGRASS
CATTAIL	MAIDENCANE	SPATTERDOCK
GIANT CUTGRASS*	PARAGRASS	TORPEDOGRASS*
GUINEAGRASS	PHRAGMITES*	*Partial Control.

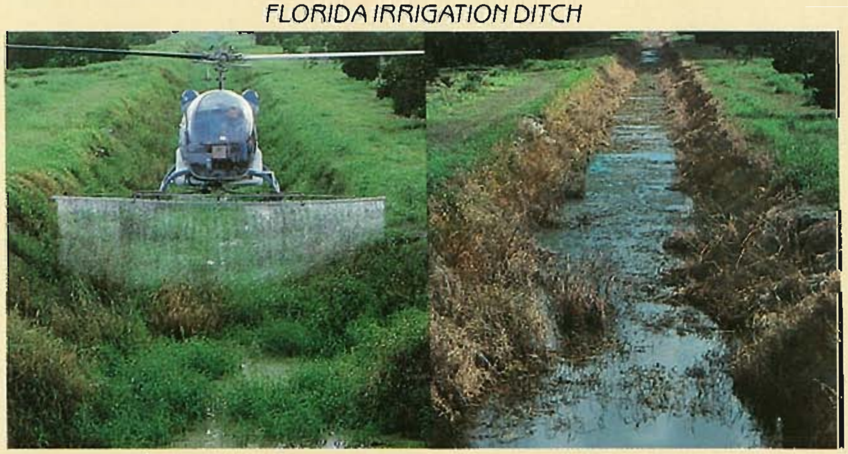
Now there's one aquatic herbicide that can handle a broad spectrum of obstructive emerged weeds. New Rodeo® herbicide† keeps the constant spread of even your toughest weeds within manageable limits, from perennial grasses like torpedograss and paragrass, to broadleaf weeds like alligatorweed, to brush species like willows. In fact, Rodeo does the job of many aquatic herbicides, controlling more than 90 kinds of weeds, roots and all.

When applied with surfactant[I] to the foliage of emerged, labeled weeds, Rodeo translocates to the root system, destroying the entire plant.

RODEO KEEPS WEEDS IN CHECK, LEAVES NATURE IN BALANCE.
Rodeo is compatible with your environmental standards. When applied according to label directions it is virtually non-toxic to mammals, birds and fish. Rodeo breaks down into natural products and does not bioaccumulate in the food chain. What's more, Rodeo has no residual soil activity so it won't leach into non-target areas.

RODEO CLEARS THE WAY IN FLOWING OR STANDING WATER.
You can use Rodeo in most aquatic sites, in recreation or utility areas, in flowing or standing water. This includes canals, ditches, lakes, rivers, streams and ponds.[II]

FLORIDA IRRIGATION DITCH



Treated 10/21/82 — Results 11/23/82

Get to the root of your toughest weed problems with this truly broad-spectrum aquatic herbicide. Ask your herbicide dealer for details about how Rodeo can make your waterways more manageable. Or call TOLL FREE for a technical manual on Rodeo, 1-800-621-5800.

†Label approval pending in California.

I. X-77 at 0.5% v/v.

II. Rodeo cannot be applied within a half mile upstream of domestic water intake points, in tide-water areas, or rice levees when flood water is present.

RODEO. BROAD-SPECTRUM CONTROL FOR AQUATICS.

Monsanto

ALWAYS READ AND FOLLOW LABEL DIRECTIONS FOR RODEO.

Salvinia Molesta Mitchell Does it Threaten Florida?

by Brian Nelson
Florida Department of Natural Resources

Salvinia molesta is a fitting scientific name for this large free floating aquatic fern which is a troublesome plant nearly every place it occurs. Ranked on the basis of actual or potential problems, "giant salvinia" or "African pyle" is second behind water hyacinth on a list of the ten most important aquatic weeds in Southeast Asia (Soerjani, 1975). This aggressive species has caused major problems in the Chobe-Linyati-Kwando River System (Africa), the Zambezi River (Africa), Lake Naivasha (Africa), Kakki Reservoir (India), Lake Moondarra (Australia), and the Sepik River (New Guinea), (Mitchell 1979). In the waters of Sri Lanka giant salvinia spread over 22,000 acres of paddy fields and 2,000 acres of waterways within twelve years after being reported (Cook and Gut, 1971).

By far the largest and most publicized infestation of this species occurred in Africa's Kariba Reservoir. In 1962, just three years after the formation of this enormous 120 mile long reservoir, thick blankets of giant salvinia covered approximately twenty-one percent of its surface (Mitchell and Tur, 1975).

Originally reported as a form or variety of the closely related South American species *S. auriculata* Aubl., giant salvinia was described as a distinct species by Mitchell in 1972. At that time it was believed to have recently originated in South America as a botanical hybrid. Giant salvinia was thought to be of hybrid origin because while morphologically similar to other South American species it was not known to naturally occur there. The only recorded collection of giant salvinia from South America, at this time, was from a botanical garden where it was collected along with other indigenous species (Mitchell, 1972). The reported sterility and aggressiveness (hybrid vigor) of giant salvinia also seemed to indicate a hybrid species (Cook and Gut, 1971). In 1979, however, Forno and Harley (1979) discovered and delineated the indigenous range of *S. molesta* in southeastern Brazil.

Giant salvinia is the most vigorous and robust of all the *Salvinia* species. Mature plants with leaves up to six centimeters in width are several times larger than our naturalized species, common salvinia (*S. rotundifolia* Willd.). Doubling times as low as 2.2 days have been recorded for giant salvinia in Queensland Lake, Australia (Farrell, 1978).

Like water hyacinth and hydrilla, giant salvinia is well equipped for vegetative reproduction. When introduced into new areas, colonizing or flat-stage plants are formed (Cook and Gut, 1971). These plants are characterized by small leaves, up to 2 cm in width, which float flat on the water surface and long thin fragile stems which fragment easily when disturbed. The regeneration of these small stem fragments coupled with a fast rate of growth enable giant salvinia to quickly colonize new areas. As giant salvinia becomes crowded, the larger mature plants are formed. These mature plants which form tight, intertwined mats, are characterized by large leaves up to 6 cm in width which no longer float flat on the water surface but grow nearly perpendicular to it (Mitchell, 1979). These thick mats of *S. molesta* interfere with rice cultivation, taint water storages, clog fishing nets, disrupt watering

Mature, mat form S. molesta *next to lens cover with a diameter of 5 cm. Note large, upright and tightly folded leaves. Photo courtesy of Dr. Bill Haller.*

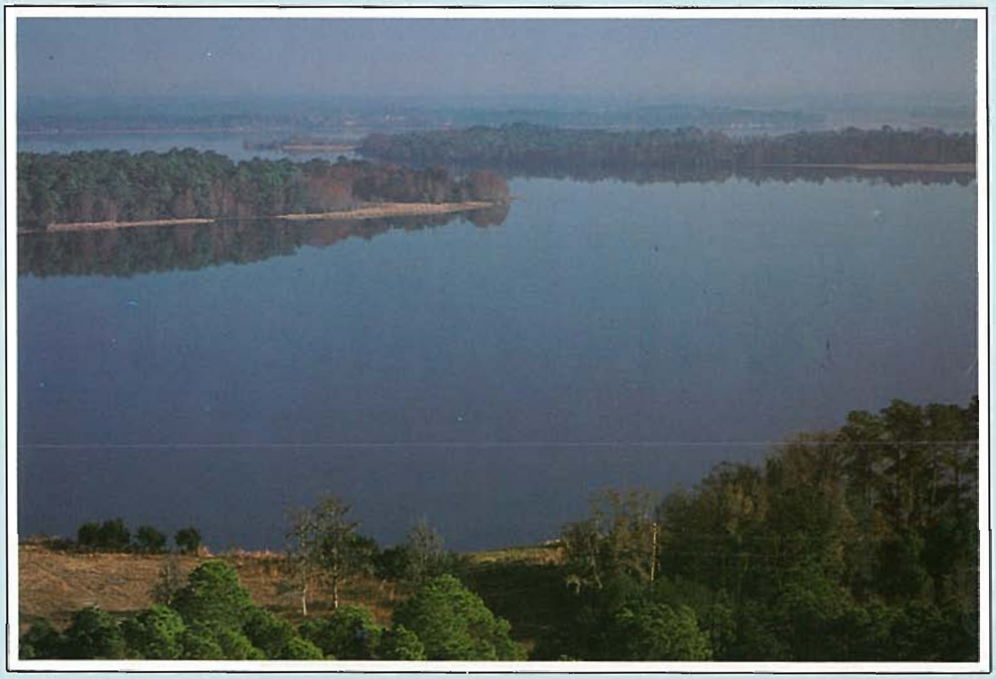
and feeding habits of humans, livestock and wildlife, render recreational areas useless and impede boat transportation, irrigation, and hydroelectric generation.

Salvinia rotundifolia *(left) shown with flat-stage, colonizing* S. molesta

The noxious potential of this warm water species is obvious in tropical areas, but could it thrive and cause these problems in Florida? Since suitable habitat, namely eutrophic water bodies occur here, climate would be the most important factor affecting the survival of giant salvinia. Its distribution is not limited to tropical areas. Troublesome infestations of this plant are reported in warm temperate areas including Sydney, Australia (Sainty and Jacobs, 1981) and Capetown, South Africa (Guillarmod, 1971). The annual mean and daily mean maximum temperatures experienced by South and Central Florida are warmer than the corresponding temperatures recorded for these areas (Muller, 1982). Since the growth of giant salvinia increases as water temperature increases from no growth below 10°C to maximum growth at 29°C (Cary and Weerts, 1983), the growth and aggressiveness of giant salvinia could be even greater here.

The daily mean minimum temperature in Florida is also higher than either Sydney, Australia or Capetown, South Africa, although, we do experience colder absolute minimum winter temperatures (Muller, 1982). While giant salvinia is adversely affected by cold and freezing temperatures it does survive (Mitchell, 1979; Sainty and Jacobs, 1981). New leaves produced beneath the water surface are protected from damaging cold air temperatures. Room and Kerr (1983) indicate that the cold climate limits of giant salvinia will most likely be where the formation of ice occurs or where water temperatures remain below 10°C, the minimum required for growth, longer than

Responsible aquatic weed management



Lake Rousseau, Florida: For over ten years, water resource managers at Lake Rousseau have relied on Pennwalt aquatic herbicides, confident that they will obtain effective control of submersed aquatic weeds without harm to the aquatic environment.

Since 1960, those responsible for aquatic weed management have relied on Pennwalt aquatic herbicides and algicides. All of Pennwalt's aquatic herbicides are based on endothall, and offer these important advantages:

- **Rapidly biodegrade into natural products**
- **No bioaccumulation in the food chain**
- **Will not bind or leave residues in the hydrosoil**
- **No significant movement from the treatment site**
- **Highly effective against algae and most problem submersed aquatic weeds, such as Hydrilla, Milfoil and Pondweeds**

Pennwalt's endothall formulations have a long history of being effective tools in weed management without causing adverse effects on man, other mammals, fish, shellfish or fish food organisms.

To manage your aquatic resources responsibly, you can rely on Pennwalt aquatic herbicides.

Contact Pennwalt Corporation, Three Parkway, Philadelphia, PA 19102, (215) 587-7219, for more information.

Pennwalt aquatic herbicides are available in four formulations:

AQUATHOL® K
AQUATIC HERBICIDE

AQUATHOL®
GRANULAR AQUATIC HERBICIDE

HYDROTHOL® 191
AQUATIC ALGICIDE AND HERBICIDE

HYDROTHOL® 191
GRANULAR AQUATIC ALGICIDE AND HERBICIDE

AGCHEM
PENNWALT
CHEMICALS ■ EQUIPMENT
HEALTH PRODUCTS

Use pesticides effectively. Read and follow label directions.

the plants can remain viable. Since winters in most of Florida consist of occasional cold spells of short duration, giant salvinia would probably thrive here much like the water hyacinth, another noxious, cold sensitive, floating species also from Brazil.

Giant salvinia is believed to have been spread from South America to areas where it is currently troublesome as a botanical curiosity and aquarium plant (Mitchell, 1979). It appears on the Federal Noxious Weed List and the Department of Natural Resources Prohibited Aquatic Plant List and is therefore illegal to import. Giant salvinia has been detected and eradicated in several botanical gardens within the United States (Myers, 1982). This troublesome plant was also recently found at two aquatic plant nurseries in Florida, apparently the restult of a contaminated aquatic plant shipment from Sri Lanka. The chances of giant salvinia being imported into Florida are great due to the large number of aquarium plant shipments we receive from countries where it is already established. Aquatic plant managers should therefore be familiar with this noxious species so that in the unfortunate event giant salvinia is introduced, it can be detected and eradicated as soon as possible.

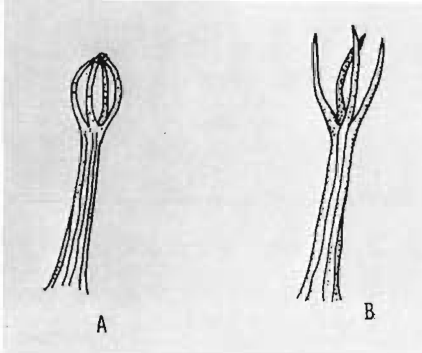


Figure 1. Upper surface leaf hairs of (A) S. molesta *showing its cage-like structure and (B)* S. rotundifolia *with its unattached filaments.*

Distinguishing mature giant salvinia from common salvinia currently found in Florida is not difficult because the more troublesome species is unusually large. Giant salvinia found in the colonizing or flat growth stage, however, while generally larger than common salvinia (1 to 2 cm in diameter vs. 0.5 to 1 cm) cannot always be accurately separated by size. The two species can be easily differentiated at any stage of growth by using a hand lens to view the structure of the nonwettable hairs on their upper leaf surfaces. The leaf hairs of giant salvinia are divided into four filaments which rejoin at their terminal ends, forming cage-like structures (Fig. 1). The leaf hairs of common salvinia are also divided into four filaments but their terminal ends remain unattached.

In addition to giant salvinia these peculiar, cage-like leaf hairs are present on three other South American salvinia species which together comprise the *S. auriculata* complex. Differentiating the species in this group is more difficult. For additional information on the taxonomy and distribution of the *S. auriculata* group, see Forno (1983).

Literature Cited

Cary, P. R. and Weerts, P.G.J., 1983. Growth of *Salvinia* molesta as affected by water temperature and nutrition I. Effects of nitrogen level and nitrogen compounds. Aquat. Bot., 16: 163–172.

Cook, C. D. K. and Gut, B. J., 1971. *Salvinia* in the state of Kerala, India. PANS 17:438–447.

Farrell, T. P., 1979. Control of *Salvinia molesta* and *Hydrilla verticillata* in Lake Moondarra, Queensland. Australian Water Resources Council Seminar on Management of Aquatic Weeds, Canberra, 15-16 Feb., pp. 57–71.

Forno, I. W. and Harley, K. L. S., 1979. The occurrence of *Salvinia molesta* in Brazil. Aquat. Bot. 6:185–187.

Guillarmod, J. A., 1979. Water weeds in Southern Africa. Aquat. Bot. 6:377–391.

Mitchell, D. S., 1972. The Kariba weed: *Salvinia molesta*. Brit. Fern Gas. 10:251–252.

Mitchell, D. S., 1979. The incidence and management of *Salvinia molesta* in Papua New Guinea. Draft report, Office of Environment and Conservation, Papua, New Guinea, 60 pp.

Mitchell, D. S. and Tur, N.M., 1975. The rate of growth of *Salvinia molesta (S. auriculata* Auct.) in laboratory and natural conditions. J. App. Ecol. 12:213–225.

Muller, M. J., 1982. Selected climatic data for a global set of standard stations for vegetation science. Dr. W. Junk Publishers, The Hague, 306 pp.

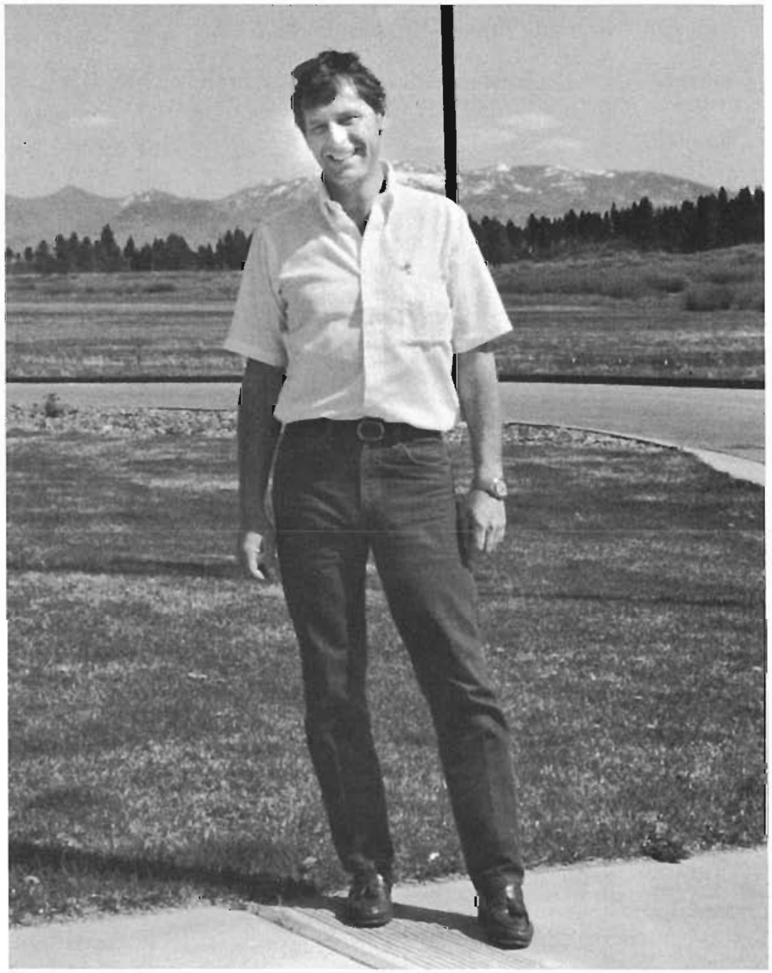
Myers, F. D., 1982, Memo to state and territory agricultural regulatory officials. U.S. Dept. of Agriculture, Plant Protection and Quarantine, DA# 82-12.

Room, P. M. and Kerr, J. D., 1983. Temperatures experienced by the floating weed *Salvinia molesta* Mitchell and their prediction from meteorological data. Aquat. Bot., 16:91–103.

Sainty, G. R. and Jacobs, S. W. L., 1981. Water plants of New South Wales. Water Resources Commission, New South Wales, 550 pp.

Soerjani, M., 1977. Aquatic weed problems and their control. Philipp. J. Weed Sci. 5:44–53. □

In Memoriam



William L. Maier, Bill to everyone, passed away in Tallahassee on Sunday, August 19, 1984. During his 35 years he met more people and touched more hearts with his optimism and contagious smile than most people could in two lifetimes. Many of our lives were enriched by knowing Bill and working with him to further the objectives of Aquatic Plant Control and the professional attitudes that accompany these goals.

Bill was a charter member of the Florida Aquatic Plant Management Society, served on its Board of Directors from 1978-1980 and was president of FAPMS in 1981-1982. *Aquatics* Magazine was conceived and developed singlehandedly by Bill in his desire to provide authentic, readable information to aquatic applicators. He was the Editor of *Aquatics* for the first two years, the difficult and formative years, of its publication (1979-1981). At the time of his death he also was serving on the Board of Directors of the National Aquatic Plant Management Society. His voluntary work and unselfish efforts on behalf of Aquatic Weed Control is a matter of record which should serve as an inspiration to all.

Bill's work in Aquatic Plant Management in Florida began in 1972 when he moved from Ft. Lauderdale after receiving his B.S. Degree from Northeast Missouri State University. In Ft. Lauderdale he worked at the University of Florida Agricultural Research Center conducting research on biocontrol of water hyacinth. In 1974 he became the first Regional Botanist in the South Florida area where he was employed by the Florida Game and Freshwater Fish Commission. In 1976, he became a section administrator in the Bureau of Aquatic Plant Research and Control, Florida Department of Natural Resources, where his duties included overseeing the matching grants and weed control program. In March 1984, Bill resigned from service to the State of Florida and became a marketing specialist with Monsanto Agricultural Products in Chico, California.

The statements above briefly summarize Bill's dedication, experience and service to Aquatic Plant Management, but he will be most remembered by those of us who knew him by his enthusiastic attitude, optimism and everpresent smile. Whether overseas, out of state, at the hunting camp or in the field studying aquatic weeds he was always first to greet a stranger, talk to a colleague, grab a shovel or help lay-out plots. Since he was first diagnosed with cancer in 1978 he led his friends through the hard times providing encouragement to all of us. During the following years we had the opportunity to get to know Bill better and value life and friends like we never had before. His illness never stymied his goals of professionalism and dedication to Aquatic Plant Management. Bill believed that the value is in the worth, not in the number, so he dedicated his time to serving others whether it be telling hunting stories to a young boy or giving weed control advice to a private applicator. He did it with class, his heart and his best with malice toward none.

We mourn Bill's death but he wouldn't want us to. He said "Hi ya guy, okay fine, no problem, I'll be okay." And you know, we believe him.

Editor's Note: The FAPMS is establishing a scholarship fund in Bill's memory. Further information and requests for donations will be available soon. □

Monoecious Hydrilla Produces Viable Seeds in the United States[1]

by
Richard D. Conant, Jr., Thai K. Van and Kerry K. Steward[2]

The submersed aquatic plant *Hydrilla verticillata* (L.f.) Royle was probably first introduced into Florida in the late 1950's by the aquarium plant industry. Its eventual spread and rapid colonization of diverse aquatic habitats has made it one of the most troublesome aquatic weeds in the nation today. The plant originally introduced into Florida was a dioecious female, and propagation up to this time has been by vegetative means, i.e., plant fragmentation and the production of axillary turions and/or subterranean tubers. Since its establishment, this dioecious female hydrilla has spread throughout peninsular Florida, across the country to California, and northward along the eastern seaboard into Georgia and South Carolina.

A monoecious biotype, which has both male and female flowers, was recently identified in the United States (Steward et al., 1984), and its range centers in the Mid-Atlantic area of Washington, D.C., Virginia, Maryland, Delaware, and North Carolina. In 1981, monoecious plants were obtained through the National Park Service, USDI, from Kenilworth Aquatic Gardens, Washington, D.C., for culture at the U.S. Department of Agriculture, ARS laboratories in Fort Lauderdale, Florida. Additional collections were obtained in 1982 from North Carolina, Delaware, and Maryland. These specimens were planted in separate 1000-liter outdoor aquaria at the USDA facilities, and were allowed to establish themselves under the ambient conditions in Southern Florida.

In Florida, hydrilla from the Kenilworth Gardens was first observed to produce both female and male flowers in August of 1982. Subsequently, male flowers were also noted in the aquaria containing hydrilla from North Carolina, Maryland, and Delaware in May of 1983 (Vandiver et al., 1982). These were the first confirmed reports of monoecious hydrilla in the United States. Later observations of flowering hydrilla in North Carolina (Laneland and Schiller, 1983) confirmed these findings.

In response to the confirmation of having monoecious hydrilla under culture, precautions were taken in order to minimize the potential for plant escape by fixing screened covers over each aquaria and installing filters in all drainage outlets. The plants were observed throughout 1983 to evaluate possible seed production. Immature ovary formation was noted, but it was not until December of that year that a maturing seed was first observed in a fruit pod from the Delaware stock culture. The fruit pod, resulting from the female flower, was an elongate (1-3 cm) tapered receptacle containing one opaque, greenish seed of approximately 2 mm in length with sharply tapered ends (Figure 1). The configuration of the fruit pod and the maturing seed agreed with morphological descriptions of Asian hydrilla (Cook and Luond, 1982).

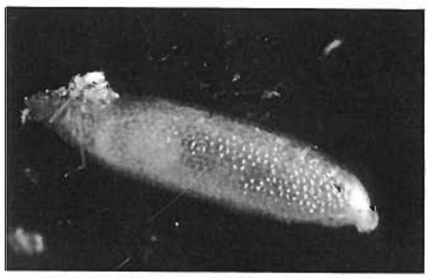


Figure 1. Maturing Hydrilla seed. Note the textured seed coat and faintly visible embryo in the left base of the seed.

Fruits were sampled from the Delaware and North Carolina plants to examine fecundity and possible seed fertility. One hundred fruit pods from each tank were randomly collected on weekly intervals, examined for seeds and stored in the lab for further observation. Seven hundred fruit pods from the Delaware cultures were examined from December 14, 1983 to January 21, 1984. In total, seven seeds were discovered. The average seed production for the plants was 1.0 seeds ($\pm$0.38) per 100 fruits. Likewise, 670 fruit pods from North Carolina plants were examined and three seeds found for an average of 0.45 ($\pm$0.32) seeds per hundred fruits. This second collection period lasted from December 11, 1983 until February 2, 1984. In both instances, no seeds were observed to form after the initial inspection of the fruit pods. Seed production rates of plants in natural conditions have not yet been observed.

The seeds that were collected were placed in deionized water at approximately 24°C under long day conditions (14 hours). On February 10, 1984, the first seed collected in early December still showed no sign of germination and was subjected to two complete dessications, each of approximately four days duration. This was done in order to encourage seed coat scarification and subsequent germination. On March 19, 1984, a seed from the Delaware stock culture showed signs of germination with the formation of a protuberant radicle. Further development of the seed after a two week period is shown in Figure 2. On April 10, 1984 a seed taken from the North Carolina culture germinated. This seed had not been previously subjected to a dessication regime as had the Delaware seed.

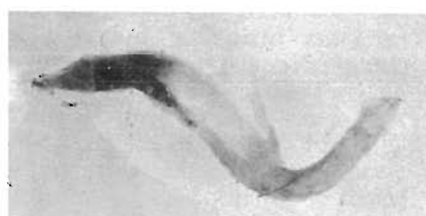


Figure 2. Delaware seedling at approximately two weeks showing signs of emergent leaves.

This confirms that monoecious hydrilla in the United States is producing viable seeds. Sexual reproduction provides potential for the development of diverse and more adaptable biotypes, and may have serious consequences for the management of this weed. □

Due to space limitations, Literature Cited was omitted, please contact author.

[1]Cooperative Investigations of the U.S. Department of Agriculture, Agricultural Research Service and the University of Florida, Institute of Food and Agricultural Science, Agricultural Research and Education Center, Fort Lauderdale, Florida 33314.
[2]USDA, ARS, Aquatic Plant Management Laboratory, 3205 College Avenue, Fort Lauderdale, Florida 33314.

Status of *Hygrophila polysperma* In Florida

by
Don C. Schmitz and Larry E. Nall
Florida Department of Natural Resources Biologists
Bureau of Aquatic Plant Research and Control

Recent field collections of *Hygrophila polysperma* from many areas in Florida waters prove that this exotic species has become established within the state. It is commonly called "hygro or hygrophila" and has also been called "Miramar weed."

Hygrophila polysperma is a popular and widely distributed aquarium plant and is presently cultivated in many areas of Florida by the aquarium plant industry. It is a native of India (Rataj and Horeman, 1977) and can also be found growing in Sri Lanka (Senaratna, 1945) and Cambodia (Ridley, 1923). The introduction of this species to the United States occurred in early 1945 and it was believed to be a species of *Ludwigia* (Innes, 1947). Initially, it was distributed by Loveland Aquatic Nurseries of Ohio. During the cultivation of this plant in Ohio, it produced flowers and was later identified at the University of Pennsylvania as a member of the Acanthaceae, *Hygrophila polysperma* T. Anders.

The genus *Hygrophila* contains about 80 species (Long, 1970) found in all warm regions, particularly in Africa and southeast Asia (Muhlberg, 1982). A number of *Hygrophila* species are so similar in general appearance and gross morphology that epidermal features are used to distinguish one species from another (Ahmad, 1976). The native United States species, *H. lacustris*, occurs from southwestern Georgia and western Florida to eastern Texas, with its greatest abundance occurring in the lower Mississippi River valley and delta region (Long, 1970). The native United States species, *H. lacustris*, and the exotic species, *H. polysperma*, can be distinguished by size and habitat. Les and Wunderlin (1981) described *H. lacustris* as typically an erect emergent frequently over 50 cm tall while the emergent portion of *H. polysperma* is prostrate and creeping, rarely over 20 cm tall. Also, *H. lacustris* has very distinct axillary verticels of flowers, while *H. polysperma* has flowers somewhat hidden in crowded apical leaf axils. According to Les and Wunderlin (1981), *H. lacustris* is typically a marsh plant while *H. polysperma* usually occurs in riverine habitats.

Most of the scientific literature describing *H. polysperma* is taxonomic with little information about its ecology. The plant grows primarily submersed in water, rooted to the hydrosoil, with stems extending upward to the surface (Vandiver, 1980). Unlike hydrilla, it does not undergo extensive branching. It has been found growing in canals, rivers, marshes, ponds, and lakes (Reams, 1953; Rataj and Horeman, 1977; Spencer and Bowes, 1984). According to Spencer and Bowes (1984) the occurrence of *H. polysperma* both in water and on moist terrain seems to be a result of its growth habit rather than differing morphological forms. The submergent portion of the plant produces more biomass than the emergent portion when found in the field.

Baseline physiology tests of *H. polysperma* (funded by the Department of Natural Resources) indicate that this species possesses a HCO_3 utilization system similar to native submersed species which are not considered to be noxious (Spencer and Bowes, 1984). However, in this same investigation, *H. polysperma* was found to have a lower light compensation point than native submersed species indicating that this plant can compete with native species at low light conditions. Hydrilla also possesses a low light compensation point in photosynthesis.

Hygrophila polysperma may withstand very cold water temperatures and may prefer slightly acidic waters. Although *H. polysperma* is tropical in origin and thought by many to be restricted to Florida by temperature, Reams (1950, 1953) reported the plant species can tolerate freezing temperatures and he stated that it was established in Richmond, Virginia area lakes for 15 to 20 years until the Richmond area experienced extremely cold winter temperatures for prolonged periods in the early 1970's (personal communication, W. Reams, 1984, University of Richmond). In laboratory tests, the optimum photosynthethic temperature for *H. polysperma* was found to be at 25 C and was also adequate between 10 and 35 C indicating that this species will not be severely restricted by water temperature in Florida (Spencer and Bowes, 1984). Little information exists about *H. polysperma* depth distribution, preferred substrate, or competition between itself and other species. In a Miramar canal, *H. polysperma* grew to the surface in over 2 m of water depth (Vandiver, 1980) and in a Coral Springs drainage canal, it was found to be growing to the surface in 3.3 m of water depth. Spencer and Bowes (1984) grew *H. polysperma* in large field tanks resulting in significantly less biomass when compared to hydrilla and concluded that hygrophila will probably never outcompete hydrilla except at pH values approaching near 5.0. Also, *H. polysperma* does not appear to possess the shading ability of hydrilla even though it does produce mats of floating vegetation. They concluded that *H. polysperma* will provide significant competition to native submergent plants in shallow water.

Vegetative reproduction is well developed in *H. polysperma*. Fragments of the stem will root and produce new plants (Les and Wunderlin, 1981). Also, the plant has extremely brittle stems which are easily fragmented (Vandiver, 1980). *Hygrophila polysperma* forms many adventitious roots at nodes along the stem which probably aids the rooting of dispersed fragments (Vandiver, 1980). *Hygrophila* does not produce vegetative propagules (tubers or turions) like hydrilla although laboratory experiments have shown this species to grow substantially from plant fragments exceeding that of hydrilla (Spencer and Bowes, 1984). Due to the high percentage of seed set in the Florida populations of *H. polysperma*, Les and Wunderlin (1981) believe the species is autogamous. Mature seed capsules from *H. polysperma* populations growing in the Tampa Bay area have been observed during the cooler months, December and February (personal communication, R. Wunderlin, University of South Florida).

Hygrophila polysperma was first collected in Florida near Tampa in 1965, but was misidentified as *Dyschoriste sp.* until 1977 when Dr. Dieter C. Wasshausen (Smithsonian Institution) properly identified it (Les and Wunderlin, 1981). Les and Wunderlin (1981) believe the Tampa population was an escape from cultivation. Presently, *H. polysperma* is established in many areas of Florida (Fig. 1). In Coral Springs, over 100 acres of drainage canals are heavily infested with *H. polysperma* causing problems with their pump intake screens (Fig. 2).

It is not known why after the approximately twenty years that *H. polysperma* has been in the state that it is only now causing problems. Several reasons have been suggested: 1) the plant species has adapted to Florida's waterways, 2) the plants have been cultivated in out of the way places and are only now reaching public waterways, 3) the increase of nutrients in Florida's waterways due to population growth may have exceeded a critical level to stimulate *H. polysperma* rapid spread in the state, 4) the minimal effect of aquatic herbicides on *H. polysperma* in hydrilla control programs may be providing a selective advantage, and 5) the similarity to alligator-weed may have contributed to the failure of aquatic plant managers to identify early occurrences of the species.

Hygrophila polysperma is presently undergoing an evaluation to determine if this plant should be put on the Department of Natural Resources prohibited aquatic plant list. The prohibited list and the Administrative Rule are now being revised subsequent to the passage of increased statutory authority to enforce this program (Nelson, 1984). By restricting the importataion, transportation, and cultivation of prohibited aquatic plant species, the Department hopes to reduce or retard their spread in Florida. *Hygrophila polysperma* is listed as a noxious weed (U.S.D.A. Federal Register, Vol. 48, No. 87, May 4, 1983). The U.S.D.A. noxious weed regulations regulate the movement of listed noxious weeds into and through the United States, but do not affect the movement of these weeds that are moved solely interstate. Hence, this species can be legally cultivated, transported, and sold within the entire United States.

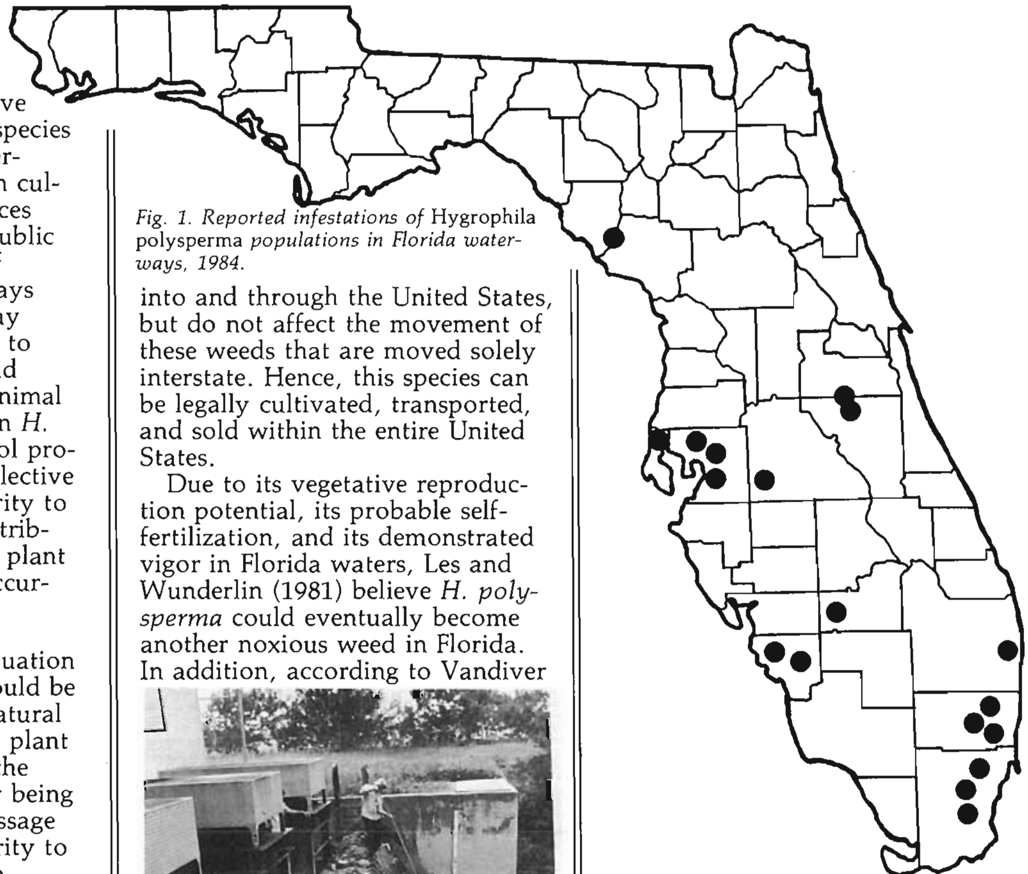


Fig. 1. Reported infestations of Hygrophila polysperma *populations in Florida waterways, 1984.*

Due to its vegetative reproduction potential, its probable self-fertilization, and its demonstrated vigor in Florida waters, Les and Wunderlin (1981) believe *H. polysperma* could eventually become another noxious weed in Florida. In addition, according to Vandiver (1980) and several aquatic plant managers, *H. polysperma* is difficult to control using maximum label rates of numerous aquatic herbicides. Spencer and Bowes (1984) recommended that the safest policy regarding *H. polysperma* is the restriction of the importation of this species into the state and the prohibition of all inter- and intra-state transportation with con-

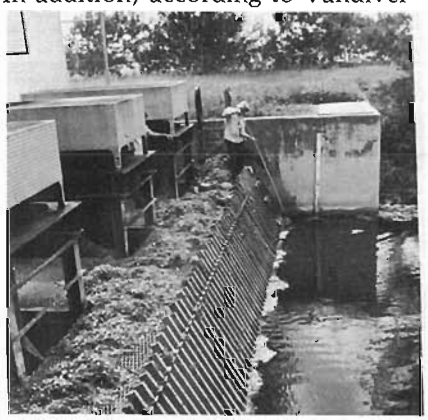


Fig. 2. Hygrophila polysperma *clogging the pump intake screens of a drainage canal located in Coral Springs, Florida.*

sideration of a state-wide management scheme with eradication as an objective.

Hygrophila polysperma is one of the largest 'crops' of the aquarium plant industry. Many members of the industry have stated that if *H. polysperma* becomes a prohibited plant species, it will have a significant negative economic impact on their industry and may cause some of the smaller dealers to close. They believe they will lose customers to aquarium plant cultivators located outside of Florida who are exempt from Florida's rules and regulations. One Florida grower estimated a $30,000.00 annual loss. It has also been suggested that banning of such a commercially viable species only in Florida would only be effective on the larger dealers who grow the plants in enclosures on their property. The smaller independent dealers may actually be encouraged to plant *H. polysperma* in public waters to avoid these regulations. These plants could then be picked and shipped out of state. Such activity would be very difficult to regulate. The most effective method to stop this activity would be a federal ban on interstate shipments of this species thus eliminating the demand.

This article briefly summarizes the information that we presently have on *H. polysperma*. To further document the problems caused by this plant or additional information on its ecology, we invite comments.

Literature Cited

Ahmad, K. 1976. Epidermal studies in some species of *Hygrophila* and *Dyschoriste* (Acanthaceae). J. Indian bot. Soc. 55:41-52.

Innes, W. T. 1947. *Hygrophila*, a new aquarium plant. Aquarium 16:30.

Les, D. H. and R. P. Wunderlin. 1981. *Hygrophila polysperma* (Acanthaceae) in Florida. Fla. Sci. 44:189-192.

Long, R. W. 1970. The genera of Acanthaceae in the southeastern United States. J. of Arnold Arbor. 51:257-309.

Muhlberg, H. 1982. The Complete Guide to Water Plants. German Democratic Republic: EP Pub. Ltd. 392 p.

Nelson, B. 1984. Section 403.271 Florida Statutes to be revised. Aquatics 6:14.

Rataj, K. and T. L. Horeman. 1977. Aquarium Plants. TFH Pub. New Jersey 448 p.

Reams, W. M., Jr. 1950. Some data on aquarium plants at low temperatures. Aquar. J. 21:205.

Reams, W. M., Jr. 1953. The occurrence and ontogeny of hydathodes in *Hygrophila polysperma* T. Anders. New Phyto. 52:8-13.

Ridley, H. N. 1923. The flora of the Malay Peninsula. Vol. II Amsterdam: A. Asher. (Reprinted 1967). 672 p.

Senaratna, J. E. 1945. Systematic notes on the flora of Ceylon. Ceylon J. Sci., Sect. A, Bot. 12:161.

Spencer, W. and G. Bowes. 1984. Baseline physiology of the potential problem plants, *Limnophila sessiliflora* and *Hygrophila polysperma*. Final project report submitted to the Florida Department of Natural Resources, 34 p.

Vandiver, V. V. 1980. Hygrophila. Aquatics 2:4-11.

Aerial Application - Cost Effective Method for Aquatic Vegetation Control

M. J. Mahler

Polk County Environmental Services

The use of aerial application in an aquatic plant control program can be a very useful and cost effective method of control. Polk County Environmental Services has used this method for a number of years. The two options for aerial application are in-house aircraft or contractual services.

The key to making in-house activities feasible is year-round aircraft utilization. Polk County is also responsible for mosquito control within the county which necessitates the use of rotorcraft as well as fixed wing planes. The aircraft are used for aquatic weed control, surveillance, inspection, mosquito cntrol adulticiding and larviciding.

The second option is contractual services. There are a number of commercial aerial applicators in Florida which do aquatic work. Any large treatments are far more economically accomplished with aircraft.

Polk County's aerial spray unit consists of two parts. A Bell 47 G2A equipped with a Simplex spray system, 100 gallon tank, and 45 foot boom with Raindrop nozzles and a nurse truck. The nurse truck is equipped with a 1,200 gallon tank, transfer pump and spare aircraft fuel. On an average day we can treat up to 100 acres in a five hour period. The application costs (excluding herbicides) are broken down as follows:

helicopter	5 hours @	$109.29/hr. =	$546.45
pilot	5 hours @	17.50/hr. =	87.50
nurse truck	5 hours @	8.26/hr. =	41.30
ground crewman	5 hours @	7.75/hr. =	38.75
TOTAL			$714.00
$714.00 ÷ 100 acres =			$ 7.14/acre

A normal boat operation will average twenty acres controlled in a ten hour day. The costs of control during a boat operation (excluding herbicides) are as follows:

airboat	10 hours @	$ 9.12/hr. =	$ 91.20
4×4 pickup	10 hours @	4.27/hr. =	42.70
crew chief	10 hours @	9.00/hr. =	90.00
herb. appl.	10 hours @	7.75/hr. =	77.50
TOTAL			$301.40
$301.40 ÷ 20 acres =			$ 15.07/acre

As an example, application costs for a 200 acre operation using a helicopter would cost $1,428 and take a full 10 hour day. Using an airboat crew the costs would be $3,014 and would take ten full days. Using a helicopter would save $1,586 and nine crew days of work.

In the past commercial aerial applicators have charged approximately $1.00 per gallon of mix applied for large operations. The standard aerial application rate is 15-20 gallons of mix per acre. The overall application costs for a commercial operator would be roughly equal to a boat operation; however, there would be a tremendous savings in personnel time. In addition to the time and money savings, with aerial application you get more thorough coverage (less need for touchup) and you can control plants in less accessible areas.

Anyone with large areas to treat should consider the use of aircraft as cost effective alternatives to airboat crews.

*Rental figures are based upon U.S. Army Corps of Engineers Rental Reimbursement Rates.

Surfactants as Adjuvants

by Dan Thayer[1]

By definition, adjuvants are materials that when added to the spray solution facilitate or modify the action of the herbicide. Thus, an adjuvant is an all inclusive term used to define all spray tank additives including surfactants, thickening agents, spreaders, penetrants, oils, and antifoaming agents. Surfactants, defined by the Weed Science Society of America (WSSA), are materials "that facilitate and accentuate the emulsifying, dispersing, spreading, wetting or other surface-modifying properties of liquids." Generally speaking, the term adjuvant would be used to group spray tank additives and the term surfactant would be used to describe those additives that modify the distribution of spray on plant foliage.

Before the turn of the century, increase in toxicity of arsenical insecticides was indicated with the addition of soap. Whale oils or fish oils were the most commonly used base materials for soaps as surfactants. Prior to the 1950's, household detergents were often used due to the infrequent request for commercial surfactants. The request for agricultural adjuvants had escalated to the point by the 1960's that household detergents were no longer recommended and investigators began looking into new formulations of surfactants that would be most applicable to agriculture. Today there are more than 3,000 chemicals presently being marketed as surfactants. The technology of surfactants has evolved to complex synthetic formulations designed for specific purposes, and slight changes in the structure of surfactants can greatly alter their action. Household soaps and detergents are undesirable as surfactants because they contain only 10 to 20% surfactant and may contain up to eight additives that interfere with the activity of a herbicide.

The primary reason many people use surfactants is in hopes of increasing the percentage of control received from a herbicide application. Penetration of herbicides may be suppressed by leaf hairs and the lipid (fat and wax) barrier in the leaf cuticle and epidermis. Research indicates that under these circumstances, the herbicide may only exhibit 10% of its potential. The increase in herbicide penetration is probably the single most important function of surfactants.

Laboratory tests conducted here at the Center with radioactive 2,4-D on water hyacinths, have shown that surfactants may enhance the initial uptake of 2,4-D, which would be useful as a rain protectant. Although initial uptake had increased total uptake after 8 hours was the same between plants treated with 2,4-D plus surfactants and 2,4-D alone. Tests with over seventy surfactants in combination with glyphosate on several plant species attributed increased leaf wettability and cuticle penetration to enhancement of herbicide toxicity. Surfactants reduce contact angle of spray droplets and surface tension which serve to magnify the degree of wetting. Research has shown that surfactants may maintain the spray in a fluid state for a longer period of time enhancing herbicide activity 2 to 5 fold over that of water controls. Studies with the herbicide amitrole found that 80% of foliar applied material was detected within the leaf tissue after six hours when a surfactant was added, while 80% of the applied amitrole remained on the leaf surface after four days when applications were made in water only.

The ionic nature of surfactants may influence the effectiveness of the herbicide solution. Cationic or nonionic surfactants added to paraquat may enhance herbicide phytotoxicity as much as 60 to 80%, however anionic surfactants combined with the strongly cationic paraquat result in a lack of any enhancement. Studies have also indicated that anionic surfactants can negatively influence the action of glyphosate on grass species, while the nonionic and cationic surfactants increased the activity. With some herbicides (e.g. Rodeo) the label states that a nonionic surfactant is required in order to achieve the desired result. Many

[1]Assistant in Aquatic Weed Control, Center for Aquatic Weeds, University of Florida, Gainesville.

herbicides already have surfactant in the formulation and may not require further additions. Little research has been conducted with aquatic herbicides and will require the knowledge of the applicator to decide what surfactant and how much is necessary to get the results they desire. Figure (1) lists many of the adjuvants and surfactants presently used in the state and their ionic state.

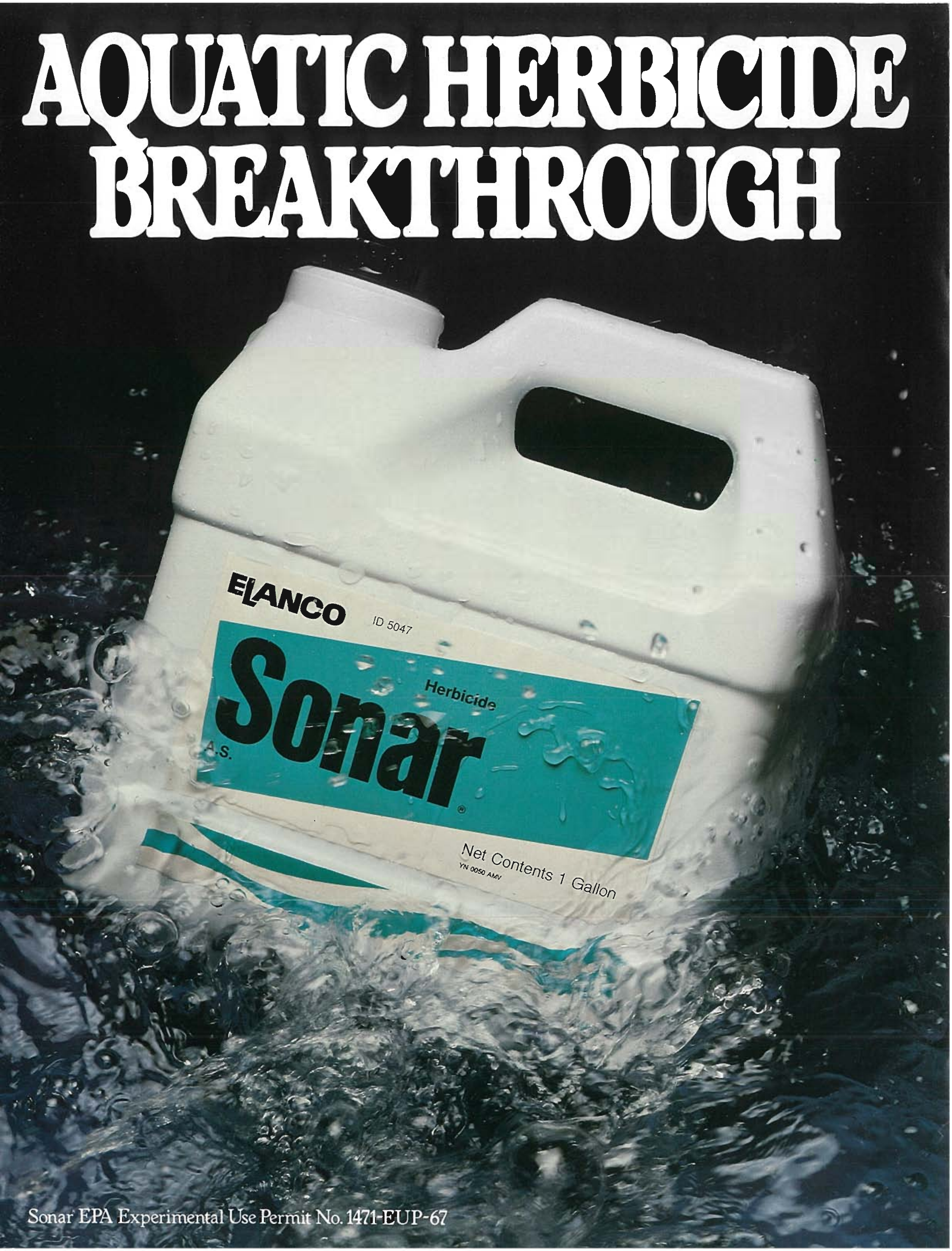
Surfactants are often added to the spray tank to insure the activity of the herbicide; however, surfactants may not always be necessary to enhance the action of the herbicide. The effects of surfactants on johnsongrass control with dalapon demonstrated that low surfactant concentrations were too low for maximum herbicide effectiveness, while herbicide efficiency was reduced by excessive quantities of surfactant. Studies with the amine salt and the ester formulations of 2,4-D with several surfactants found that the 2,4-D amine activity was suppressed at higher concentration of surfactants while the activity of the ester formulation was progressively increased with increasing surfactant concentration. Field studies conducted here at the Center, found that with 2,4-D and diquat on water hyacinths, surfactants were not necessary and did not significantly increase control. In fact, higher surfactant concentrations suppressed the action of the herbicides. It may be that with many herbicides surfactant additional is not necessary, because 80% of the herbicides marketed in the United States today contain anywhere from 2 to 15% emulsifier in their formulation.

Depending upon the circumstances, surfactants may play an important role in a herbicide spray program. However, not enough is know about surfactants to predict just how valuable they may be under varying conditions. Thus, they are often used whether they are necessary or not. Manufacturers create vast number of surfactants annually with technology exploring the potentials of new products, such as the silicone surfactants. Research continues to look at many of the questions and myths about surfactants; however, various combinations of plant species, herbicides, surfactants, and weather parameters often create new problems and unexplored questions. □

Figure 1. The following is a list of adjuvants presently marketed in Florida and known to have been used or are presently being used as spray tank additives for aquatic weed management. The list was compiled from information obtained through contacts with various chemical supply dealers, commercial applicators, industry representatives, and aquatic biologists and scientists around the state. The list is not all-inclusive, since adjuvants are not registered through the Environmental Protection Agency, any of more than 3,000 adjuvants marketed in the United States today could potentially be used in the aquatic environment. Any adjuvants not listed that should be included, please send information on the product to the author for future reference.

ADJUVANT LIST

Adjuvant Tradename	Type of Activity	Ionic State (Where applicable)
Activate Plus	Surfactant-Penetrant	Nonionic
Ad-Spray 101	Wetting Agent	
Ag-Foam	Foaming Agent-Spreader	
Agri-Dex	Phytobland Oil	Nonionic
Amway Spray Adjuvant	Wetting Agent	Nonionic
Amway Spray Defoamer	Antifoaming Agent	
Aqua-Gel	Thickening Agent	
Aqua-Grow	Soil Penetrant	Nonionic
Armix 300	Copolymer-Drift Control	Nonionic
Asgrow "403"	Invert Emulsifier	
Asgrow Passage	Surfactant	
Basic-H	Surfactant	Nonionic
Big Wet (F-239)	Wetting Agent	Anionic-Nonionic Blend
Bivert-AMX	Inverting Oil	
Bivert-PH	Emulsifier	
Blendex	Compatibility Agent	Anionic
Cide-Kick	Wetting Agent-Penetrant	Nonionic
Citrufilm	Spray Oil-Surfactant	Nonionic
Dupont-WK	Soil Penetrant	Nonionic
Foam Buster	Antifoaming Agent	
Foamer	Foaming Agent	Nonionic
Fomex	Foaming Agent	
Helena 573	Drift Control Agent-Polymer	Anionic
Herbex	Activator-Adjuvant	Nonionic
Induce	Spreader	Nonionic
Instemul DA 120	Inverting Oil	
I'VOD	Inverting Oil	
Kover II	Adjuvant Agent	Nonionic
Liqua-Wet	Wetting Agent	Nonionic
Nalco-Trol I	Drift Control Agent-Polymer	
Nalco-Trol II	Drift Control Agent-Polymer	Nonionic
Nalquatic	Sinking Agent Polymer	Anionic
Nu-Film 17	Sticker-Extender	
Ortho Spray Sticker	Sticker	
Ortho X-77	Spreader	Nonionic
Penetrator 3	Surfactant	Nonionic
Plyac	Spreader-Sticker	
PolyControl	Sinking and Drift Control Agent-Polymer	Anionic
Polysar Latex 968	Stabilizing Agent	
Re-Duce	Phytotoxic Oil-Surfactant	
S-96	Spreader-Sticker	Nonionic
SMCP Spreader Sticker	Spreader-Sticker	Nonionic
SMCP Wetting Agent	Wetting Agent	Nonionic
Spray-Aide	Compatibility-Acidifying Agent	Anionic
Spray-Mate	Invert Emulsifier	
Submerge	Drift Control Agent-Polymer	Anionic
Surfactant WK	Surfactant	
Surfix	Spreader-Sticker	Nonionic
Triton B-1956	Wetting Agent	Nonionic
Triton CS-7	Wetting Agent	
Unite	Compatibility Agent	
Visko-Rhap	Inverting Oil	
Wex	Surfactant	Nonionic


AQUATIC HERBICIDE BREAKTHROUGH
ELANCO
ID 5047
Sonar
Herbicide
A.S.
Net Contents 1 Gallon
Sonar EPA Experimental Use Permit No. 1471-EUP-67

Sonar®
gently puts the balance back in nature.

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

Weed management.

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

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,

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.

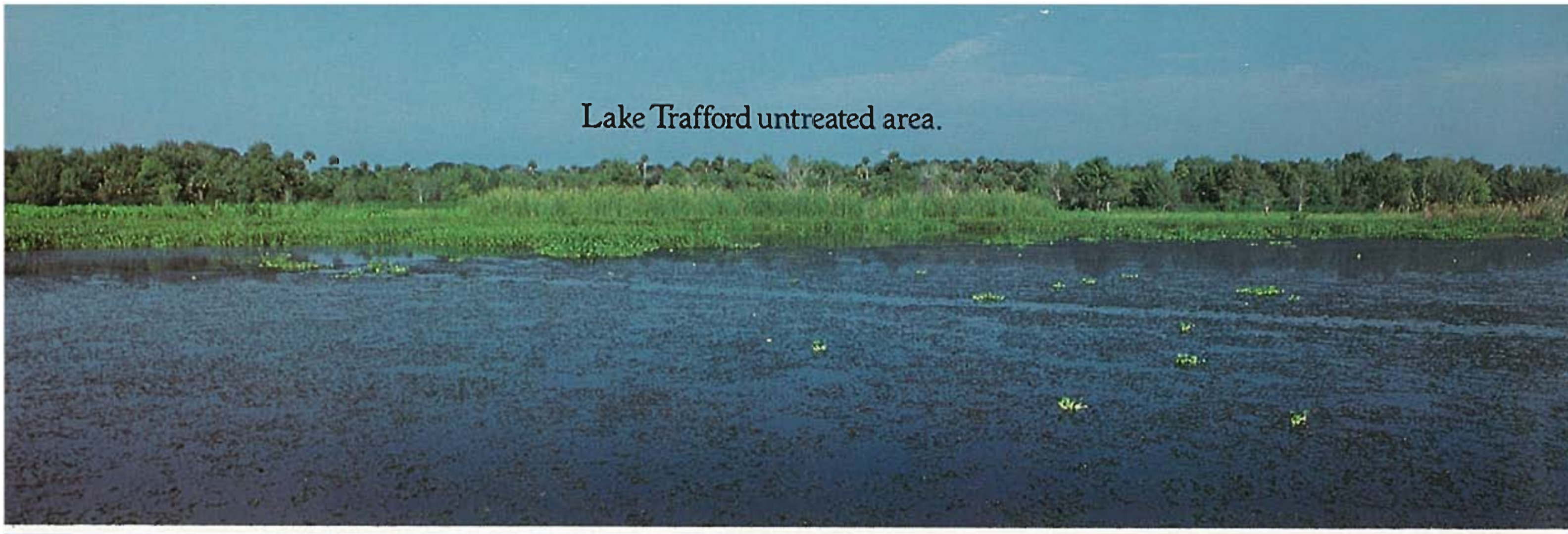
Pond weeds

Torpedograss

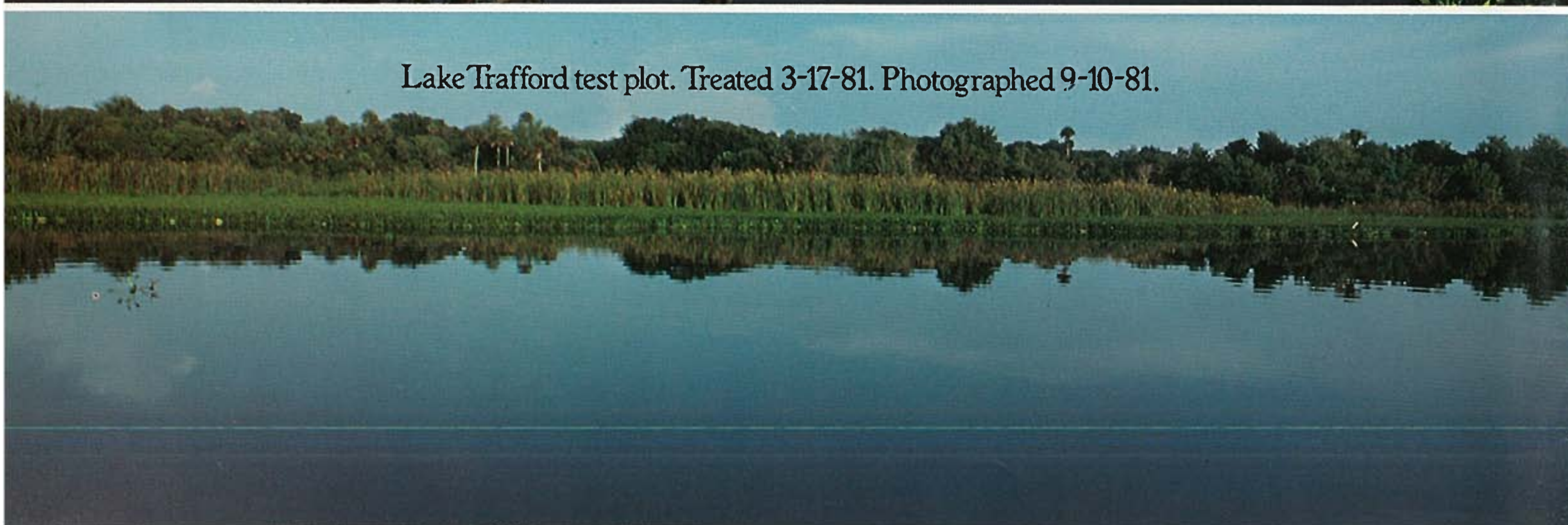
Inherent value.

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.

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) 386-8533

History of Aquatic Weeds In Lake Seminole

by A. K. Gholson, Jr.*

The Jim Woodruff Dam and Lake Seminole Project were authorized by Congress for the purposes of navigation and production of hydroelectric power. Funds were appropriated, and construction was initiated in 1946. Construction of the Jim Woodruff Dam and clearing of the floodplain areas for the impounded waters (Lake Seminole), were underway for eleven (11) years. Final completion of the project occurred in February 1957.

Lake Seminole has an area of 37,500 acres and a shoreline of 250 miles. It is a relatively clear, shallow lake, averaging less than 10 feet in depth. The lake receives drainage waters from an extensive area, that has been intensively farmed down through the years. The area's climate is mild, affording long and ideal growing conditions. The clear, shallow, and nutritious waters of Lake Seminole, coupled with the ideal conditions of mild temperatures and a long growing season, renders a very suitable habitat for the growth of aquatic vegetation.

Serious aquatic weed problems did not exist in the area that was to become Lake Seminole prior to 1945. Numerous species of aquatic and wetland plants common to the area were frequently found in ponds, lakes, and drainages located in the impoundment area. These plants, however, were not problems, since they were components of habitats neatly and naturally biologically balanced.

Impoundment of the waters of Lake Seminole was scheduled for 1956. Due to unexpected difficulties encountered with construction of the Jim Woodruff Dam Powerhouse, impoundment of the lake was delayed for about one and one-half years, until 1957. However, the lake was impounded to the intermediate elevation of 65 feet, mean sea level, 12 feet below the permanent lake elevation of 77 feet, mean sea level. During mid 1955, a significant influx of water hyacinths was observed entering Lake Seminole, via the Flint River Arm, in vicinity of Bainbridge, Georgia. It was determined that the water hyacinths were reaching Lake Seminole from impoundments on the Flint River at Albany, Georgia and above. With this beginning, as we look back, Lake Seminole was early introduced to ever-increasing aquatic plant problems.

Lake Seminole's Aquatic Weeds And Control Efforts: By Year

1955

As mentioned above, a sizeable infestation of water hyacinths was noted in the vicinity of Bainbridge, Georgia on the Flint River Arm of the lake early in this year. The seriousness of this infestation was readily recognized, and plans were immediately made to have hyacinth control crews, with boats and necessary equipment, from the Corps' Mobile, Alabama area office, to come to Lake Seminole to eradicate the hyacinths. Two boat crews sprayed all hyacinths that could be located with 2,4-D at the rate of 2 pounds of the acid equivalent per acre. An inspection performed several weeks after the spraying indicated that a thorough job had been accomplished.

1956-57

Inspections of the Lake Seminole areas in vicinity of Bainbridge, Georgia revealed that a few hyacinths were continuing to enter Lake Seminole from upstream impoundments, however, it was not considered feasible to treat the areas at this time. *Little did we know of the capability of the water hyacinth.*

1958

Inspections during early 1958 revealed that approximately 3,000+ acres of water hyacinths were present on Lake Seminole. This was a big surprise, however, it was more surprising, when it was learned that the plant had spread throughout the Flint River Arm and had reached the lower portions of the Chattahoochee River Arm of the lake. The spread was almost unbelievable.

Late in 1958, two helicopter contracts were awarded to spray the hyacinths and eliminate the problem. In July, the first contract was let, and 1,054 acres of hyacinths were sprayed with 2 pounds of active ingredient of 2,4-D per acre at a cost of $10,700. In September, the second contract was let, and 2,015 acres of hyacinths were sprayed at a cost of $12,150. "Mop-up" work with boat crews, early in October, completed a very thorough eradication effort, we thought!

1960-1970 (The Water Hyacinth and Alligatorweed Years)

1960

Lake Seminole's first comprehensive aquatic plant survey was performed during the growing season of this year. In addition to learning that Lake Seminole must be a very desirable habitat for a diversified aquatic flora, it was noted that the water hyacinth was ubiquitous, and that alligatorweed and giant cutgrass were present in several areas along the Flint River Arm of the lake. Reports of the survey results were compiled in detail and distributed to the proper authorities.

1961

High Spring in-flows flushed a sizeable quantity of the hyacinths through the Jim Woodruff Dam into the Apalachicola River. Also, as the high lake level receded, many hyacinths were stranded along shorelines and in bushes above the normal level of the lake. This unexpected occurrence offered a brief relief from the hyacinth menace.

A suitable boat was obtained and equipped with necessary spray equipment for purpose of initiating efforts to control Lake Seminole's mounting aquatic plant problems. Spray operations were begun by project employees this year. Two pounds of the active ingredient of 2,4-D were applied to each acre of hyacinth, parrot's feather, and alligatorweed that could be effectively reached during the growing season. Efforts to keep the problem aquatics contained was of prime consideration in these efforts.

1962

Control operations continued by project personnel. As before, prime consideration was directed toward containment of the problem weeds. It was noted that spray operations were effective to reduce alligatorweed to the surface of the water, but re-growth began shortly after spraying from the underwater

*Retired Resource Manager, Recreation-Resource Management Branch, Operations Division, U.S. Army Corps of Engineers, Mobile, Alabama Lake Seminole).

stems. A rapid expansion of alligatorweed was noted during this year.

1963

Usual spray operations were continued. Expansion of alligatorweed and giant cutgrass were noted. Control efforts appeared to be somewhat effective in preventing the general spread of water hyacinths, however, the plant was spreading rapidly in those areas that could not be reached by the boat crews.

It was noted, early this year, that alligatorweed began its growth very early in the spring, and as a result, was effective in out-competing the water hyacinth. Spray operations which reduced alligatorweed to the water surface were also effective in releasing water hyacinths for a flush of growth and expansion.

This year, the Corps entered a contract with Auburn University to conduct research for a possible chemical control of alligatorweed.

1964-65

Spray operations were continued in an effort to prevent further spread of Lake Seminole's problem aquatics.

Research work by Auburn University consisted of applying many herbicides and/or combinations of herbicides to test plots in an effort to find suitable control of alligatorweed.

Alligatorweed continued to outcompete the water hyacinth, and as a result, was successful in rapidly infesting new areas of the lake.

This year an effort was begun to collect and identify Lake Seminole's aquatic and wetland plants.

This year Eurasian watermilfoil was identified on the Spring Creek Arm of Lake Seminole. When this plant was first noticed, sizeable areas had been infested without detection.

1966

Spray operations were continued with some success in containing the spread of hyacinth, however, alligatorweed and Eurasian watermilfoil continued to infest additional and contiguous areas.

Research efforts were continued by Auburn University. Effective chemical control, within allowable rates, were not found even though many hundreds of chemicals and combinations of chemicals were utilized on alligatorweed test plots.

Inspections revealed that several hundred acres on Lake Seminole's Spring Creek Arm were infested with Eurasian watermilfoil. Efforts to obtain funds for treatment of this submerged aquatic failed.

Several hundred Agasicles beetles were obtained this year for release on alligatorweed. Research had indicated that this small beetle was host specific on alligatorweed, and that it had great promise as a biological control agent. The release sites were monitored periodically without indication that the beetles had survived. Later checks, by personnel familiar with the beetles, revealed that some activity by the beetles was present in one of the release sites.

1967

Spray operations were continued during 1967.

Research efforts by Auburn were continued through the year without dramatic breakthroughs.

Rapid expansion of giant cutgrass was noted along shorelines, including islands.

Hydrilla and Limnophila were discovered on Lake Seminole at the Cypress Pond Landing this year.

A second release of the Agasicles beetle was made on the Flint River Arm of Lake Seminole. The release was made by agricultural research personnel in accordance with proper release techniques. This proved to be a very successful release, since the beetles progressed eleven miles upstream from the release site before cold weather arrived in the early winter.

1968

Spray operations were continued this year. Operations were somewhat successful in containing water hyacinth, but considerably less effective with other problem species.

Eurasian watermilfoil was observed to be spreading at a very alarming rate in the Spring Creek Arm of Lake Seminole.

The Agasicles beetle was definitely established on Lake Seminole's alligatorweed, and its effect on alligatorweed was everywhere apparent.

During 1968, 12,000 Agasicles beetles were collected and shipped to alligatorweed infested areas of Alabama, South Carolina, North Carolina and Mississippi.

Research efforts were continued by Auburn University personnel this year.

1969

Spray operations were continued this year.

Approximately 14,400 Agasicles were shipped to other areas with alligatorweed problems for possible biological control.

The effectiveness of the Agasicles beetle on alligatorweed at the Lake Seminole project was phenomenal. The reduction of alligatorweed biomass to the water surface by the beetle is now observed commonly. It is noted, however, that the reduction of alligatorweed by the beetle is releasing the water hyacinth.

Research efforts continued by Auburn University personnel this year. It is becoming evident at this time that the Agasicles beetle will control alligatorweed on Lake Seminole which is an accomplishment that could not be obtained with chemicals.

1970

Annual spray operations using 2,4-D were continued this year.

Research efforts by Auburn University began "winding-down" this year.

It was apparent early in 1970 that the Agasicles beetle would definitely control alligatorweed on Lake Seminole. It was also obvious that the beetle would over-winter without difficulty.

The reduction of alligatorweed, however, has released the water hyacinth to many new areas. As expected, the water hyacinth has wasted no time in taking advantage of the release from competition. It was obvious during this year that the water hyacinth had replaced alligatorweed as a problem on Lake Seminole.

1971

Spray operations were continued this year. Release of the water hyacinth, as a result of the Agasicles beetle's effectiveness on alligatorweed, greatly increased the work load for the spray crew. Water hyacinths were observed to be spreading at the characteristic alarming rate.

Lake Seminole's second comprehensive aquatic plant survey was performed this year. This survey revealed significant aquatic problems viz., Eurasian watermilfoil, giant cutgrass, *Hydrilla*, and water hyacinths. This survey also revealed that giant cutgrass, Eurasian watermilfoil and water hyacinth were expanding at alarming rates.

History of Aquatic Weeds in Lake Seminole by A. K. Gholson, Jr., will be continued in the December 1984 issue of *Aquatics* Magazine. □

AQUA-VINE

DNR

The regional biologist for DNR's Bureau of Aquatic Plant Research and Control have been recently modified. A new regional office has been added in Tampa. John Rodger is the new biologist at that position. For additional information concerning specific region boundaries contact: Jeff Schardt (904) 488-5631.

Dan Thayer has left his position as regional biologist, South Fla. Region, DNR. Dan is now working for the Univ. of Fla. in Gainesville as an Assistant in Aquatic Weed Control, Center for Aquatic Weeds.

Arizona

Tom Camp, Phoenix, Az., reports that *Hydrilla* has recently been found and positively identified in five small ponds. This is the first detection of *Hydrilla* in Arizona — who's next?

Graduate Student Assistantship

Half-time assistantship — Masters Level — available in the area of aquatic plant biology and control.

Send resume to:
Ken A. Langeland
North Carolina State University
Weed Science Center
3123 Ligon Street
Raleigh, NC 27607

Aqua-Trivia

Who was the first president of FAPMS?

The first to call the editor with the correct answer will win a FAPMS cap.