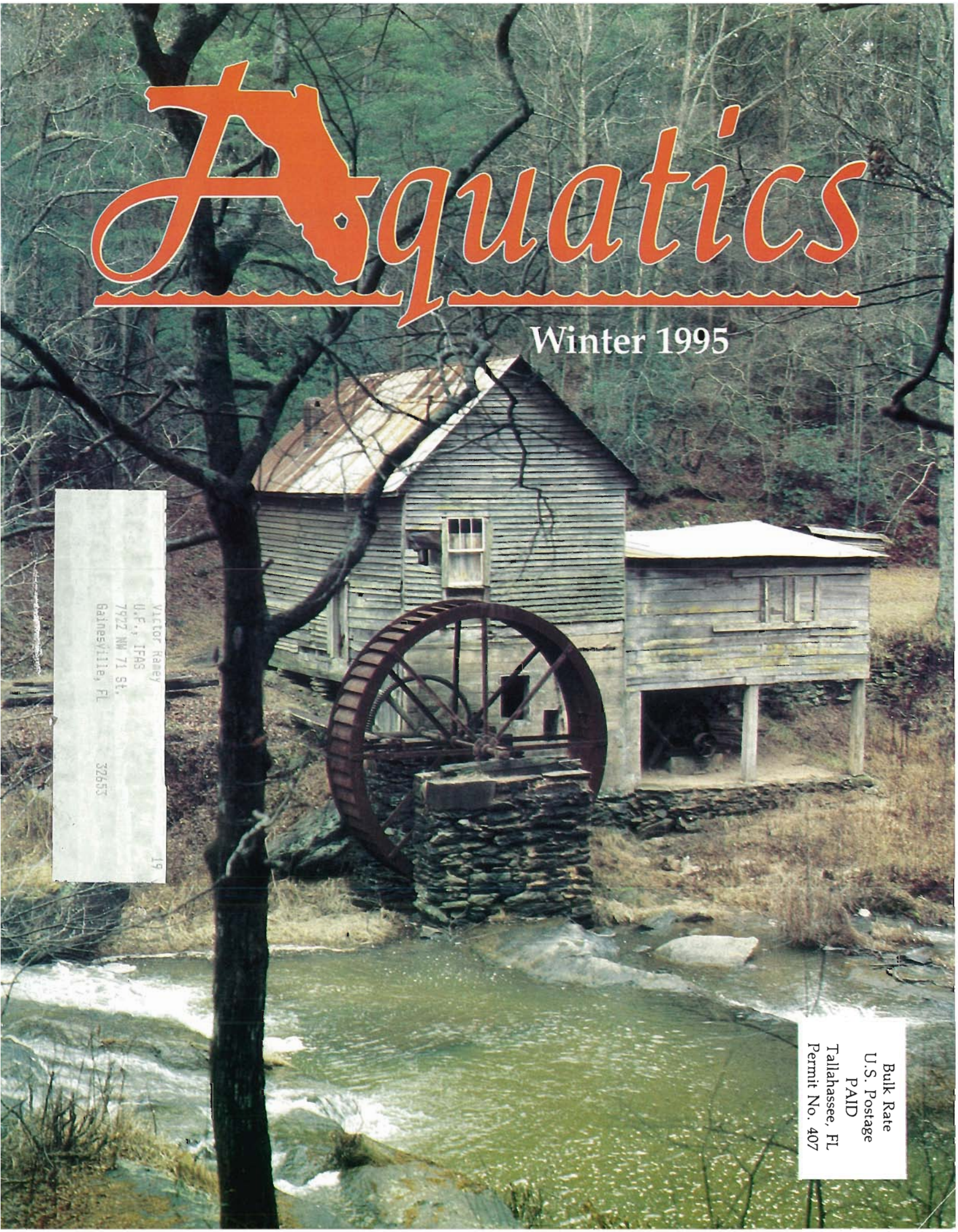

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Dr. Randall K. Stocker, wife Shelley, and youngest of two daughters Shevy recently moved from Imperial Valley, California to Gainesville where Dr. Stocker is the new Center Director for the UF Center for Aquatic Plants. I asked Dr. Stocker to pencil out his first impressions about life in Florida.

Letter to the Editor

I promised the esteemed Editor of Aquatics that I would provide something resembling my initial impressions of the world of aquatic plant management for his next issue, and unlike many pulls on my available time, this one is housed too close to let slide. Dr. Langeland can be relentless when he is in pursuit of material to fill his pages; and like the neighborhood beagle that howls all night, the problem isn't necessarily that the dog barks, it's that the house is too close. The same dog barking next to your house wouldn't affect me in the least...Now that I've insulted one of my favorite people, I'll see what I can say about aquatic plant management in the great state of Florida.

As a newcomer I don't claim to understand the forces and factors that shaped aquatic plant management in Florida today. I was around for some of the early FAPMS annual meetings in 1979 and 1980 (if memory serves), and the growth in the organization is matched only by the continued energy of the participants. But, newcomer though I am, I do see some real differences. Let me suggest that the biggest difference between aquatic plant management in Florida and aquatic plant management in the western U.S. is quite simply the size of the problems, and the size of the group dealing with the problems.

The problems, and the number of participants combating the problems, are fewer in California, but the complexity of issues associated with each problem is nearly the same, east or west: competing water uses, interest groups, endangered species, water quality, available dollars, and individual and collective "agendas" (which has somehow become a dirty word in the 1990's—a list of things to be done, which is what an agenda is, is a good thing; "hidden agendas" somehow implies that politics was once a thing of sunshiny public scrutiny...hmmmm).

There is a story that takes many forms, but a common one brags about the abilities of the legendary Texas Rangers. While large contingents of various federal, state, and local law enforcement are mounting up to head off an impending attack on a western outpost, they notice a lone Texas Ranger trotting off by himself toward the ominous dust clouds on the horizon. When they ask him what he thinks he is going to do by himself he responds, "One problem, one Ranger."

California may come as close as any state to this approach with aquatic plant research and regulatory management. Those of you that attended the 29th Annual Meeting of FAPMS in St. Petersburg in October met Nate Dechoretz, who heads a small but aggressive

Continued on page 20

Fall colors cascade over the hydroelectric plant at Ausable Chasm, New York, separated by Lake Champlain from Burlington, Vermont, site of the 1996 APMS convention.
Photo by Jeff Schardt

Aquatics
Winter 1995/Vol. 17, No. 4

CONTENTS

AQUATICS (ISSN 1054-1799): Published quarterly as the official publication of the Florida Aquatic Plant Management Society Registration No. 1,579,647. 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 FAPMS and receive the Society newsletter and Aquatics magazine, send $20.00 plus your mailing address to the Treasurer.
EDITORIAL: Address all correspondence regarding editorial matter to Ken Langeland *Aquatics* Magazine.

Utilization of Pennyworts (*Hydrocotyle* spp.) as Food Plants by the Southern Armyworm, *Spodoptera eridania* (Cramer) (Lepidoptera: Noctuidae)

by
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University of Florida
Gainesville, Florida 32611-0620

Introduction

Floating pennywort, *Hydrocotyle ranunculoides* L., and water pennywort, *H. umbellata* L., are emersed aquatic plants belonging to the Apiaceae (=Umbelliferae, or parsley family) (Tarver et al. 1979, Dressler et al. 1987). Both species of pennywort are found rooted at or near the margins of lakes, ponds and streams in Florida, but grow equally well on the surface of the water as floating mats. As these floating mats continue to grow, they can break loose from the shore and behave like other floating macrophytes, impeding water flow and stream navigation.

Figure 1. Mature larvae of southern armyworm are distinguished by their uniform yellowish-brown head coloration, large triangular shaped black spots on the top to the first abdominal segment, and distinctive markings.

Periodically, floating pennywort mats growing along the shoreline inFlorida's waterways undergo severe defoliation by the southern armyworm, *Spodoptera eridania* (Cramer) (Habeck pers. comm.; Cuda pers. observ.). The southern armyworm is a common species in Florida (Kimball 1965) and occurs throughout the Neotropics, westward to Texas and California (Chittenden and Russell 1909), and extending as far north as Washington, D.C., and Kansas in the U. S. (Todd and Poole 1980). A detailed description of the biology of the southern armyworm was reported by Chittenden and Russell (1909) and is briefly summarized here.

Eggs are deposited in masses on the foliage of food plants and are covered with scales from the body of the female moth. The egg stage lasts 4 to 6 days. The larvae develop through six instars in about 17 days. The pupal stage follows, lasting 9 to 13 days. The entire life cycle is normally completed in 31 to 36 days and there are 4 or 5 generations per year in Florida depending upon ambient weather conditions. The young larvae are gregarious and may or may not disperse as they mature.

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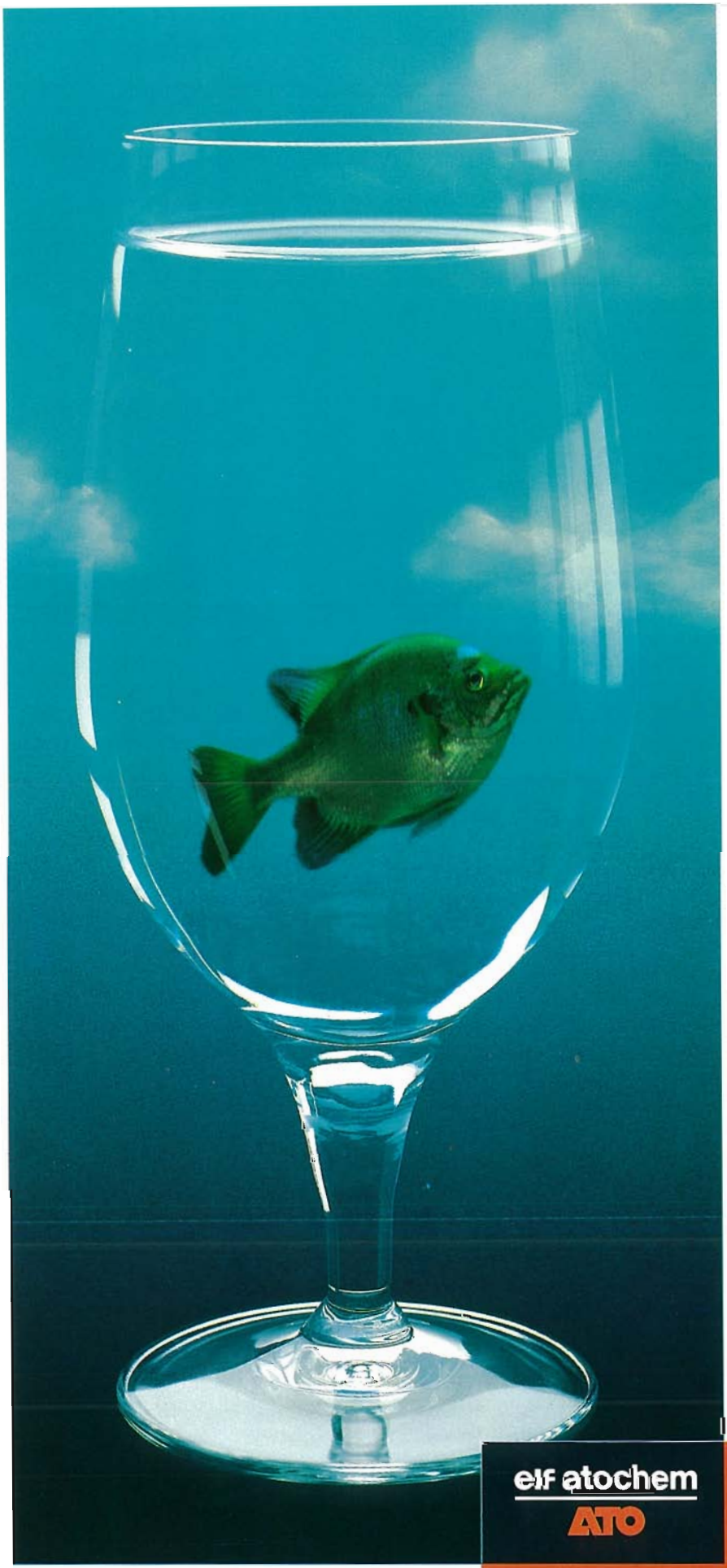

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In the latter case, the larvae migrate en masse causing severe defoliation of the attacked plant (Crumb 1929). Larvae have been observed feeding on various food plants in the daytime at extremely high temperatures (Chittenden and Russell 1909, Scriber 1986). Mature larvae (Figure 1) are distinguished from other species of *Spodoptera* by their uniform yellowish-brown head coloration, large triangular shaped black spots onthe top of the first abdominal segment, and distinctive markings (Levy and Habeck 1976, Passoa 1991).

A review of the literature documenting the plant species attacked by the southern armyworm revealed that no species of *Hydrocotyle* has been previously reported as a larval host plant (Chittenden and Russell 1909; Berger 1920; Crumb 1927, 1929, 1932; Soo Hoo and Fraenkel 1966a,b; Tietz 1972; Brattsten *et al.* 1977; Scriber 1984).

The purpose of this study was to conduct simple no-choice feeding tests in the laboratory to compare the suitability of floating and water pennyworts as food plants for the southern armyworm.

Materials and Methods

Larvae of the southern armyworm used in this experiment were obtained from egg masses collected from a floating pennywort mat located at Morris Bridge Park, Hillsborough Co., Florida, in April 1990. Late-instar larvae were also collected at this time, and preserved in alcohol for species identification.

Floating pennywort leaves with individual egg masses were placed on moistened filter paper inside a 9 cm diam. covered petri dish. The eggs were examined twice daily until hatching was obsreved. Using a small brush, newly hatched larvae were placed individually in clear plastic vials(3.5 cm diam. by 6.0 cm high) with small punctures in the lid for air exchange. Young larvae were provided with fresh leaves of floating pennywort or water pennywort until they pupated or died. The larval food plants were maintained in outdoor concrete vaults.

Leaf consumption was determined by recording the number of leaves added to each vial and consumed during larval development. The number of molts (instars) and development period between molts (stadium) was also recorded for each larva in both test groups. Thirty larvae were tested on each species of pennywort.

The vials containing the pennywort leaves and larvae were held in a rearing room at a mean daily maximum temperature of 25.7 ± 1.2°C, mean daily minimum temperature of 22.4 ± 1.7 °C, and a 14:10 L:D photoperiod. Data were analyzed with the TTEST procedure in SAS (SAS Institute 1990) at the 5 % probability level.

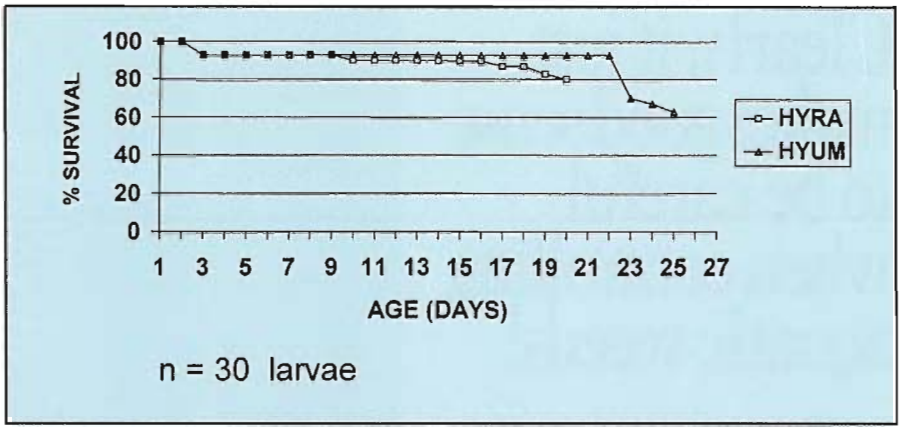


Figure 2. Survivorship curves for larvae of Spodoptera eridania *reared to the pupal stage on* Hydrocotyle ranunculodes *(HYRA) and* H. umbellata *(HYUM).*

Results and Discussion

Survival and development of the southern armyworm on both species of pennywort are presented in Figure 2. Percent survival was greater than 60% for both cohorts of larvae. However, development to the pupal stage was faster and mortality was less on floating pennywort.

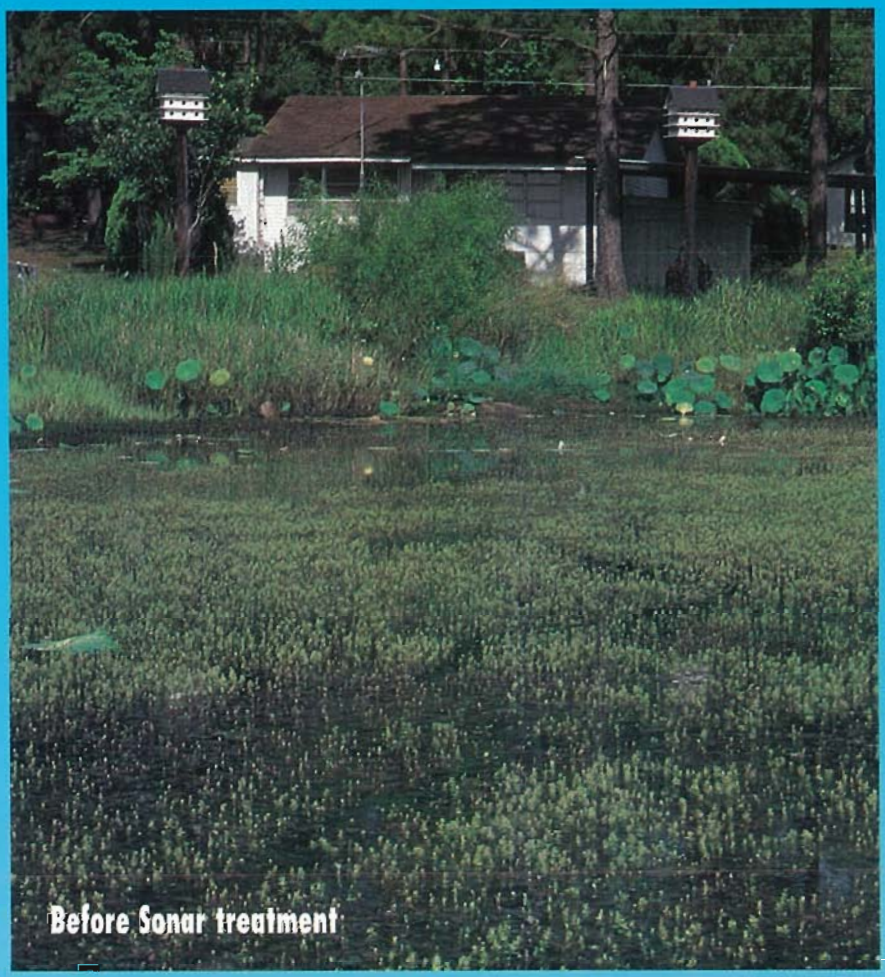
Differences were also observed in the number of larval instars,stadia duration, and leaf consumption for larvae reared on floating and water pennywort (Table 1). The 24 larvae reared on floating pennywort completed six instars and pupated normally. These larvae consumed an average of 10.15 ± 1.46 leaves during their total development time

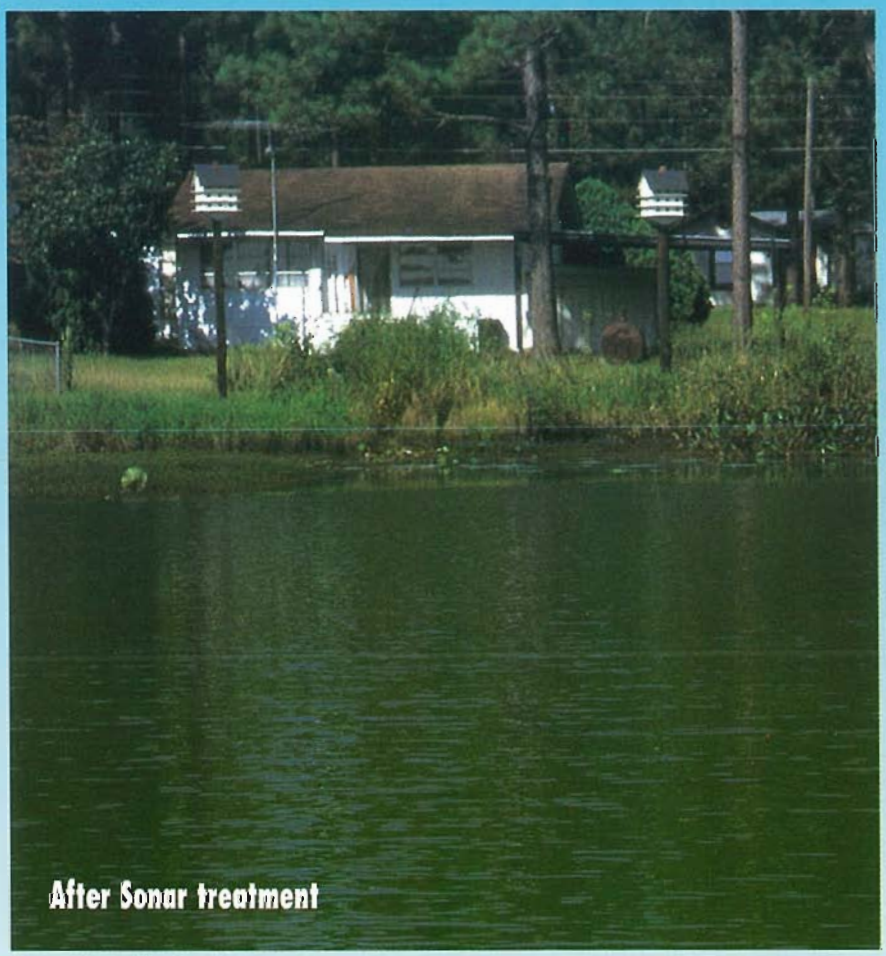
Table 1. Duration (in days) of each instar and total leaf consumption by larvae *Spodoptera eridania* on *Hydrocotyle* spp.

	HYRA[1]		HYUM[1]	
	n	(± SD)	n	(± SD)
Instar 1	2	3.00(0.00)*[2]	28	3.10(5.57)*
Instar 2	27	3.00(0.00)	28	2.14(5.24)
Instar 3	27	2.00(0.00)	28	2.00(2.72)
Instar 4	27	2.93(0.27)*	28	2.46(0.74)*
Instar 5	27	1.04(0.19)*	28	1.89(0.67)*
Instar 6	24	6.30(0.72)	14	6.48(3.84)
Instar 7	-	-	5	8.60(3.13)
Total(days)	24	17.26(0.66)*	19	21.39(2.15)*
# Leaves Consumed	24	10.15(1.46)*	19	8.50(0.92)*

[1]HYRA - *Hydrocotyle ranunculoides*; HYUM - *Hydrocotyle umbellata.*

[2]Values followed by an asterisk (*) are statistically different (*t*-test, $p < 0.05$).





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of 17.26 ± 0.66 days. These data compared favorably with the number of instars and larval development time reported by Chittenden and Russell (1909). In contrast, only 19 larvae completed their development on water pennywort. These larvae required 21.39 ± 2.15 days to complete their development, and consumed only 8.5 ± 0.92 leaves before pupating. Over 16 % of this larval cohort also exhibited a seventh instar (Table 1). The protracted development time and additional instar displayed by some of larvae reared on water pennywort suggests this species may be less suitable as a food plant for the southern armyworm (Gay 1938).

It was also observed in this study that a single mature leaf of either floating or water pennywort was sufficient to support larval development to the fifth instar (approximately 10 days). However, a sixth instar larva was able to consume a full-grown floating pennywort leaf in less than 90 minutes. This phenomenon is a common occurrence among noctuid pests (Oliver and Chapin 1981), and may explain why larval damage to pennywort mats goes undetected until larvae of the southern armyworm reach the last two or three instars.

The southern armyworm is notorious for its ability to attack a wide range of plants (Soo Hoo and Fraenkel 1966a,b, Tietz 1972). Crop as well as non-crop species are equally capable of supporting its growth and development. Therefore, the ability of the southern armyworm to feed and reproduce on floating and water pennywort is not unexpected because other plant species in the Apiaceaae (e.g., carrot, *Daucus carota* v. *sativus* Hoff.) are suitable food plants (Soo Hoo and Fraenkel 1966a, Tietz 1972).

In conclusion, the southern armyworm is one of the most destructive insect pests of crops in Florida. The caterpillars are occasionally observed causing extensive damage to pennywort mats. The damage is only temporary since the plants quickly recover from the defoliation. Under natural conditions, floating pennywort may be more susceptible to attack by the southern armyworm because the results of this study indicated floating pennywort was utilized more efficiently by the developing larvae compared to water pennywort.

Acknowledgments

This project was supported in part by Hillsborough County Mosquito and Aquatic Weed Control. Appreciation is extended to J. B. Heppner, Florida Department of Agriculture, Division of Plant Industry, for the larval identification, and D. H. Habeck and R. L. Goodson, Entomology andNematology Department, University of Florida, for critically reviewing the manuscript. Photographs of the larvae were provided by D. H. Habeck.

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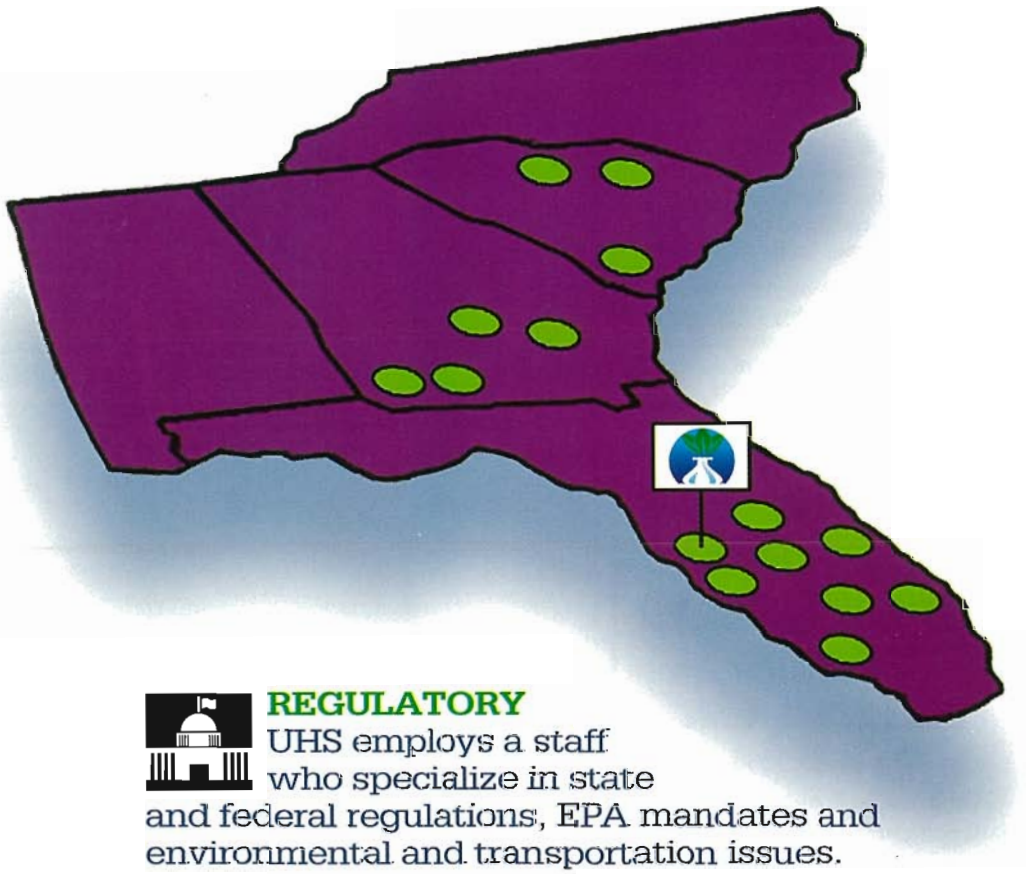

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The Spikerushes of Florida (*Eleocharis spp.*)

by
Christine A. Horsburgh

While some spikerushes comprise important native plant communities and are important aquascaping plants, proliferating spikerush, shown here is often a difficult to control weed in ponds.

The genus *Eleocharis* is a member of the *Cyperaceae* family. *Cyperaceae*, commonly called the sedge family, contains 90 genera and 4,000 species world wide (Zomlefer, 1989). Sixteen genera and 253 species of the *Cyperaceae* family are found in Florida. The major genera of the *Cyperaceae* family found in the state are *Carex* (70 spp.), *Cyperus* (43 spp.), *Rhynchospora* (48 spp.), and *Eleocharis* (29 spp.) (Zomlefer, 1989).

The name *Eleocharis* was given to the genus by Robert Brown in 1810 and was derived from the Greek words ελος (a marsh) and χα'ρις (grace) and refers to the plant's aquatic habitat (Svenson, 1929). The species in the genus *Eleocharis* are commonly called the spikerushes or club rushes (Long and Lakela, 1971). Species of *Eleocharis* inhabit both aquatic and semi-aquatic situations and are found in salt marshes, bogs, ditchbanks and the shallow water regions along pond and lake margins. Species of *Eleocharis* can be found from the tropics to the polar regions of both hemispheres (Svenson, 1929).

The stems, seeds and rhizomes, and in some cases the entire plant of many species of *Eleocharis* are utilized by several species of waterfowl (Tarver et al. 1986). Some *Eleocharis* species can form dense stands which provide cover for small fish and invertebrates, and when growing along lake margins, can help to reduce erosion. *Eleocharis dulcis* (Chinese Water-chestnut) is widely grown in the Orient and is important to Chinese cookery. In Florida, it is occasionally sold as an aquarium or fishpond plant (Ward and Leigh, 1975).

Eleocharis is a genus characteristically without leaves and therefore without the complex foliar variations of leafy plants; it has the photosynthetic activities transferred to the culm (Svenson, 1929). The major difference among the species of *Eleocharis* lies in the character of the achene. Species of *Eleocharis* can be either annual or perennial, tubular in shape with sheaths enclosing the base of the culm. The spikelets are solitary and terminal with many imbricated scales (polystichous) or infrequently 2-ranked (distichous). *Eleocharis* flowers are perfect with perianth represented by 6 often minutely retrorsedly barbed bristles and 1 to 3 stamens. The *Eleocharis* achene is trigonous or biconvex and can be smooth or variously reticulated to pitted. The base of the style is enlarged and usually sharply distinct from the body of the achene, forming a persistent tubercle (Ward and Leigh, 1975). Four species of Florida *Eleocharis* regularly reproduce by vegetative shoots produced from sterile spikelets at the apex of the culms when the plant is submersed (Ward and Leigh, 1975). Those species are *Eleocharis elongata*, *Eleocharis vivipara*, *Eleocharis baldwinii*, and *Eleocharis microcarpa* .

The genus *Eleocharis* is represented by 29 species in Florida. These 29 species are distributed throughout the state from the panhandle to the Florida keys. Several species occur frequently and state wide while others are found only occasionally and in one or two counties. Each of the Florida species of *Eleocharis* will be listed below with a brief description of any distinct characteristics and any

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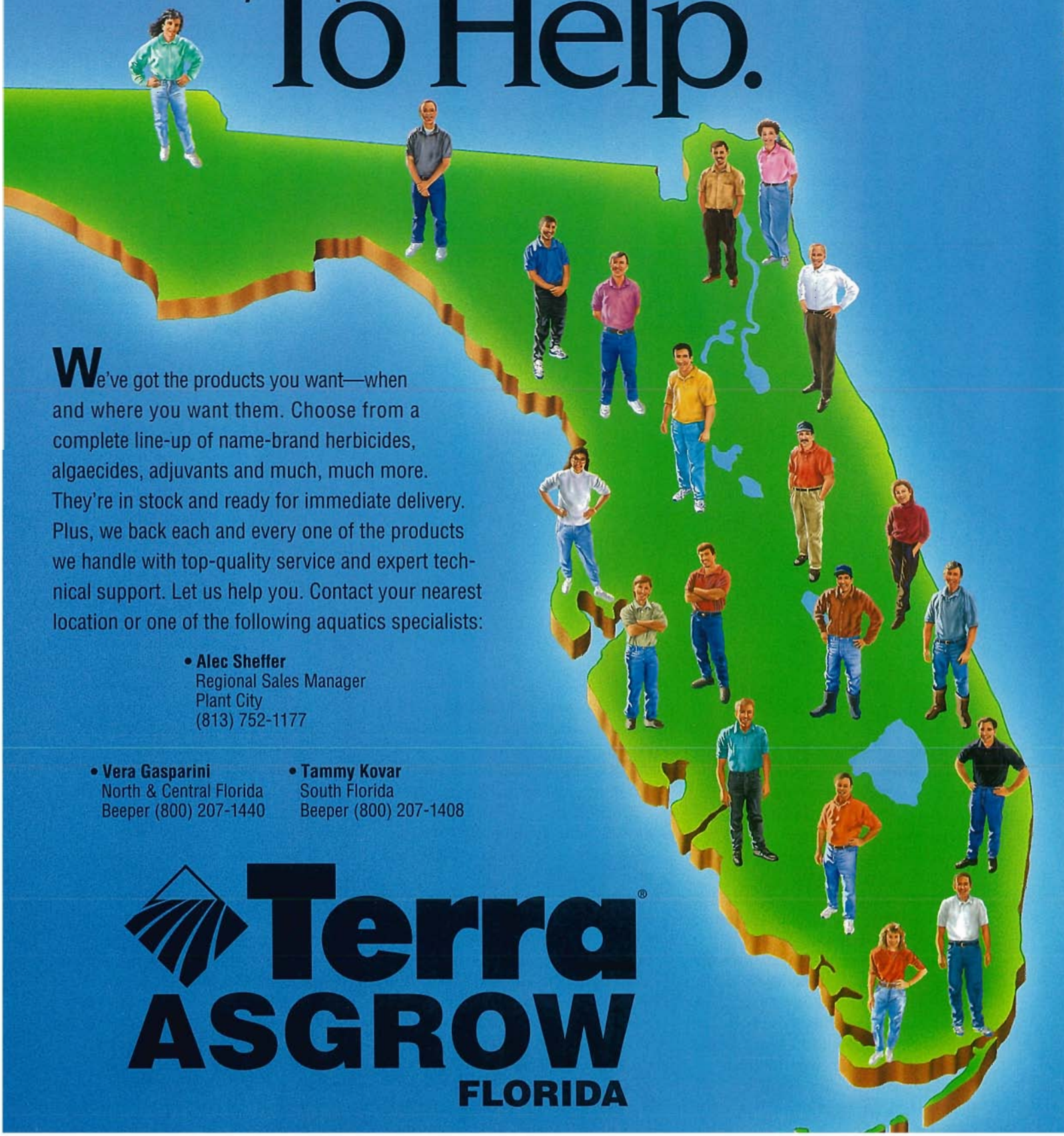

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FLORIDA

additional facts of interest. Detailed line drawings of many of the species of *Eleocharis* can been seen in Godfrey and Wooten's 1979 book *Aquatic and Wetland Plants of Southereastern United States: Monocotyledons*.

Eleocharis acicularis: This species of *Eleocharis* is a mat-forming perennial with capillary runners. The stems are 2 to 20 cm tall, furrowed and filiform in shape with flattish ovate-lanceolate to linear spikes (Godfrey and Wooten, 1979). The achenes are terete with several faint longitudinal ribs connected by ladder-like trabeculae (Ward and Leigh, 1975). *Eleocharis acicularis* is found from Greenland to Alaska, south to northern Florida, Mexico and Eurasia. The common habitat of *E. acucularis* is the wet soil around the edge of freshwater lakes. The wide distribution indicates that this species tolerates a wide range of water conditions (Weldon et al., 1973). In Florida, this species is rare and has only been collected from Lake Jackson in Leon County (Ward and Leigh, 1975).

Eleocharis albida: *Eleocharis albida*, commonly called Saltmarsh Spikerush, is a mat-forming perennial with slender rhizomes (Hotchkiss, 1972). The stems tend to be ankle to knee high, about 10 to 40 cm. The spikelets are oval or oblong and yellowish. *Eleocharis albida* is the only southeastern member of the genus with shiny brown trigonous achenes (Ward and Leigh, 1975). The common habitat of *E. albida* is in or near brackish marshes and less commonly on wet but nonsaline sites. This species is found along the Coastal Plain, Maryland to Mexico and Bermuda (Godfrey and Wooten, 1979).

Eleocharis atropurpurea: *Eleocharis atropurpurea* is a wiry tuft-forming annual only 3 to 12 cm tall. The leaf sheaths are purplish with smooth shiny black achenes that are biconvex and obovate in shape. This species is occurs on moist sands, silt, or muck from Florida to Nebraska and westward (Ward and Leigh, 1975).

Eleocharis baldwinii: The perennial *Eleocharis baldwinii* is very proliferous especially when submersed. This mat-forming *Eleocharis* covers large areas by sexual and vegetative reproduction, frequently proliferating where the recurved stolon touches the hydrosoil (Tarver et al., 1986). The stems are 3 to 20 cm tall with reddish leaf sheaths. The achene is trigonous and smooth and tends to be whitish to gray in color (Radford et al., 1964). *Eleocharis baldwinii* is commonly called Slender Spikerush and is found from North Carolina to Louisiana.

Eleocharis cellulosa: Gulf Spikerush or *Eleocharis cellulosa* is a coarse perennial that forms dense colonies (Hotchkiss, 1972). This plant can reach a height of 70 cm and is 3 to 5 mm thick. The stem is three sided with a 3 to 4 cm long spike (Long and Lakela, 1971). Gulf Spikerush is found in brackish or saline coastal marshes to fresh lagoons from North Carolina to Texas and Central America, Bermuda, and the West Indies (Ward and Leigh, 1975).

Eleocharis elongata: Commonly called Water Spikerush, this is a sterile, fully aquatic member of the genus *Eleocharis*, which spreads by stolons on the bottoms of shallow cypress ponds and other acidic fresh water lakes (Ward and Leigh, 1975). It can be found along lake shores in a fruiting condition. This species is common in Florida and is found in Georgia and Alabama.

Eleocharis equisetoides: Northern Jointed Spikerush is a tall coarse rhizomatous perennial (Hotchkiss, 1972). The stem is round in cross section with cross partitions about the same distance apart. The spikes are cylindrical and 2 to 4 cm long with yellowish to brown achenes. This species of *Eleocharis* is emergent along lake shores or in shallow water. It is distributed from Massachusetts to Louisiana and inland to Michigan and Missouri (Ward and Leigh, 1975).

Eleocharis fallax: Rarely seen in Florida, *Eleocharis fallax* has conspicuous purplish red rhizomes with wiry stems that stand 70 cm tall (Godfrey and Wooten, 1979). This species is found in fresh water or brackish marshes of the Coastal

Plain, and from Massachusetts to Texas and Cuba. *Eleocharis fallax* has been collected near St. Augustine in St. Johns County, Suwannee in Dixie County, and in a swamp near Portland in Walton County (Ward and Leigh, 1975).

***Eleocharis flavescens*:** *Eleocharis flavescens* is a mat-forming, delicately rhizomatous perennial member of the *Cyperaceae* family (Godfrey and Wooten, 1979). This species is common in Florida and is readily identified in the field by the often very large clumps of culms, each with a pale, membranous, and inflated upper portion of the sheath (Ward and Leigh, 1975). This species is found in wet sand, muck, or emergent from non-saline standing water. *Eleocharis flavescens* is widely distributed from the Coastal Plain, Delaware to Mississippi, and south to Central and South America and the West Indies.

***Eleocharis geniculata*:** This dense tuft growing annual with stems 40 cm tall has shiny smooth achenes that are biconvex and obovate in shape and black or purplish black in color (Godfrey and Wooten, 1979). *Eleocharis geniculata* inhabits moist to wet sand and muck and is found from the Coastal Plain, South Carolina to Texas, and infrequently westward to California (Ward and Leigh, 1975).

***Eleocharis interstincta*:** Southern Jointed Spikerush resembles Northern Jointed Spikerush *(Eleocharis equisetoides)* except that the cross partitions in the stem are much closer to each other just below the spikelet then farther down the culm (Hotchkiss, 1972). *Eleocharis interstincta* inhabits the emergent zone of shallow freshwater lakes and ponds of Southern Florida and Texas and the New World Tropics (Ward and Leigh, 1975).

***Eleocharis melanocarpa*:** This perennial species of *Eleocharis* grows 10 to 60 cm tall with trigonous, obpyramidal shaped achenes (Godfrey and Wooten, 1979). It is found in moist to wet ditches and along lake and pond margins of the Coastal Plain, Massachusetts to Texas and occasionally in Indiana and Michigan (Ward and Leigh, 1975).

***Eleocharis microcarpa*:** Another tufted annual of the genus *Eleocharis*, *Eleocharis microcarpa* has pinkish to straw colored leaf sheaths and trigonous, narrowly obovate, pearly white to pale greenish gray achenes (Godfrey and Wooten, 1979). This aquatic species inhabits the wet sand to muck soils of fresh water lakes of the Coastal Plain, Connecticut to Texas, and inland to Indiana (Ward and Leigh, 1975).

***Eleocharis minima*:** Perennial *Eleocharis minima* is a small plant only 3 to 6 cm tall. This species of *Eleocharis* has a wide range and is very abundant in the Tropics, but rare in Florida (Svenson, 1937). Its range outside the Tropics is from Georgia through Florida and west to Texas and California (Godfrey and Wooten, 1979).

Glossary

Achene: a hard, dry, indehiscent, 1-seeded fruit, 1- locular.
Bi: A prefix signifying two, twice or doubly.
Capillary: Very slender, threadlike.
Convex: rounded on the surface.
Culm: A term for the aerial stem of a grass or grasslike plant.
Ob: A prefix meaning inversely.
Perianth: The calyx and corolla taken together, or either one if one is absent.
Pyramidal: Pyramid-shaped.
Reticulate: Netted.
Retrorse: Having hairs or other processes turned toward the base.
Sub: A prefix to denote somewhat, slightly, or in a less degree; as subacute, somewhat acute.

***Eleocharis montana*:** *Eleocharis montana* is a perennial *Eleocharis* with stout rhizomes and stems up to 1 meter tall (Godfrey and Wooten, 1979). The spikes are ovate-lanceolate to oblong in shape with many flowers. The achene is biconvex and finely reticulated with bristles of variable length. *Eleocharis montana* inhabits marshy shores and peaty depressions of Florida and Southern Georgia to Texas and Arizona and the Tropics (Godfrey and Wooten, 1979).

***Eleocharis montevidensis*:** Another perennial *Eleocharis*, this species possesses very noticeable slender reddish rhizomes (Radford et al., 1964). The culm is wiry and up to 40 cm tall with reddish leaf sheaths. The achenes are subtrigonous and obovoid in shape and dark reddish brown to almost black in color. *Eleocharis montevidensis* is found in tidal and brackish waters, freshwater marshes, swamps and flatwoods depressions of the Coastal Plain region, South Carolina to Florida, and west to California and Central and South America (Ward and Leigh, 1975).

***Eleocharis nana*:** This species is rare throughout its range of Florida, Cuba and South America, and has only been collected in the United States on a few occasions (Ward and Leigh, 1975). *Eleocharis nana* is a tufted annual with coarse white roots with ovate to elliptical shaped spikelets (Svenson, 1937). In Florida, *Eleocharis nana* was found near Lake Alfred in Polk County and south of Land O'Lakes in Pasco County (Ward and Leigh, 1975).

***Eleocharis nigrescens*:** *Eleocharis nigrescens* is a tufted annual with white fibrous roots or perennial with ascending rootstock (Long and Lakela, 1971). The culms are 3 to 7 cm tall and three ribbed, with purplish red leaf sheaths. This species inhabits moist to wet sand or muck of disturbed sites and forms dense clumps. The range of this species is from South Carolina to Florida, and it is also found in the West Indies and Central and south America (Ward and Leigh, 1975).

***Eleocharis obtusa*:** Blunt Spikerush, as *Eleocharis obtusa* is commonly called, is a densely tufted annual (Hotchkiss, 1972). This species is 10 to 50 cm tall and is found in the inland freshwater marshes of British Columbia to Newfoundland, most commonly seen in the eastern half of the United States. The smooth achenes are pale to dark brown in color and biconvex and obovate in shape (Godfrey and Wooten, 1979).

***Eleocharis olivacea*:** This species is similar to *Eleocharis flavescens* , yet grows in flowing water, and is rare to Florida except along south-flowing rivers (Ward and Leigh, 1975). Its range is from Nova Scotia to Wisconsin and south to Georgia and Florida.

***Eleocharis parvula*:** Dwarf Spikerush is a densely tufted plant with a spongy stem 20 to 70 cm tall. Ward and Leigh (1975) mentioned that some scientists feel that this species of *Eleocharis* should be

FWSS SCHOLARSHIP

The Florida Weed Science Society will award a $600 scholarship to a deserving Weed Science student at the 1996 Annual Meeting. Studerits who are majoring in a field of study with an emphasis on Weed Science are encouraged to apply. Interested students should contact:

Ken Langeland
UF/IFAS Center for Aquatic Plants
7922 NW 71st Street
Gainesville, FL
32653-3071

included in the genus *Scirpus*. *Eleocharis parvula* is found on wet organic soils usually in saline or brackish coastal marshes of Newfoundland to Florida and Mexico.

***Eleocharis quadrangulata*:** Squarestem Spikerush is a course rhizomatous perennial with a stout 4-sided stem (Hotchkiss, 1972). The spike is cylindrical with many flowers and yellowish brown achenes. This species is found in wet soils and along riverbanks, but rarely is seen in Florida. The native range of *Eleocharis quadrangulata* is from Massachusetts to Wisconsin and south to Florida and Texas (Ward and Leigh, 1975).

***Eleocharis radicans*:** This species is rare in Florida, yet with a range and habitat similar to *Eleocharis acicularis* (Ward and Leigh, 1975). *Eleocharis radicans* can be found as floating mats in freshwater lakes from Michigan to Florida, and west to California. Outside the United States, it has been located in the West Indies and Central and South America.

***Eleocharis robbinsii*:** Trianglestem Spikerush, as it is commonly called, is a slender rhizomatous perennial with 20 to 80 cm tall stems and acutely triangular leaf sheaths (Godfrey and Wooten, 1979). It has only been collected in Florida near the shore of a sinkhole lake 13 miles south of Tallahassee and in a lake in Walton County (Ward and Leigh, 1975).

***Eleocharis rostellata*:** Walking Spikerush is rare in Florida, but more common from British Columbia to Alberta, Nova Scotia to Minnesota, and south to California and Texas (Hotchkiss, 1972).This species inhabits brackish to saline marshes.

***Eleocharis tortilis*:** Another rare species to Florida, yet there are reports by Svenson in 1937 of early collections of this plant. *Eleocharis tortilis* inhabits wet non-saline sites of the Coastal Plain from New York to Texas (Ward and Leigh, 1975).

***Eleocharis tricostata*:** Perennial *Eleocharis tricostata* has flattened stems 20 to 60 cm tall with ellipsoid-cylindrical to ovate- lanceolate spikes 6 to 15 mm long with many flowers (Godfrey and Wooten, 1979). This species inhabits wet soil along pond and lake margins, and infrequently saline marshes from Massachusetts to Florida and sometimes inland to Michigan (Ward and Leigh, 1975).

***Eleocharis tuberculosa*:** Perennial *Eleocharis tuberculosa* is a tufted stiff wiry plant. The culm is compressed and up to 80 cm tall with ovoid to lance-ovoid shaped spikes that resemble the non-flowering inflorescence of *Xyris* (Ward and Leigh, 1975). This species is found in the wet soil of stream banks and seepage areas form Nova Scotia to Florida and Texas and inland to Arkansas.

***Eleocharis vivipara*:** This perennial species of *Eleocharis* is among the most common of the genus in central and northern peninsular Florida (Ward and Leigh, 1975). It can be often overlooked because of its failure to produce fruiting stems except on terrestrial sites. The plant is wiry

and up to 30 cm tall with linear-cylindrical to slenderly lanceolate spikes (Godfrey and Wooten, 1979). *Eleocharis vivipara* inhabits moist sandy to peaty seepage areas, and can be submersed or emergent. It is found from Virginia to Florida.

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Pesticide Information Fact Sheets

The following fact sheets are available by contacting the IFAS Pesticide Information Office at 904/392-4721, or writing to PIO, Bldg 847, PO Box 110710, Gainesville, FL 32611-0710.

PI-1	Best Management Practices to Protect Ground Water from Agricultural Pesticides
PI-2	Factors Influencing Pesticide Movement to Ground Water
PI-3	Pesticide Container Rinsing
PI-4	Inspection Checklist for Recycling Plastic Pesticide Containers
PI-5	Notification of Pesticide Sensitive Persons
PI-6	Posting of Lawn and Ornamental Pesticide Applications
PI-7	Licensing of Lawn and Ornamental Pesticide Applicators in Florida
PI-8	How to Make a Pressure-Rinse Nozzle for Cleaning Pesticide Containers, July 1992
PI-9	Storm-Damaged Agrichemical Facilities, September 1992
PI-10	Certification and Licensing of Structural PesticideApplicators in Florida
PI-11	Florida Endangered Species Protection Program
PI-12	Understanding Pesticide Registration: Regulation of Registered Pesticides, October 1993
PI-13	Toxicity of Pesticides, October 1993
PI-14	Understanding Pesticide Regulation: New Pesticide Registration, October 1993
PI-15	What You Should Wear for Pesticides
PI-17	Managing Heat Stress When Mixing, Loading, and Applying Pesticides
PI-18	Proper Disposal of Pesticide Wastes

WILLIAM L. MAIER, JR. MEMORIAL SCHOLARSHIP

The Florida Aquatic Plant Management Society Scholarship and Research Foundation, Inc. will award its annual William L. Maier, Jr. Memorial Graduate Student, and Applicator Dependent Scholarships in 1996. For application forms and additional information contact Joe Joyce at: University of Florida, IFAS, Office of the Vice President, 1008 McCarty Hall, PO Box 110180, Gainesville, FL 32611-0180; 904/392-1971.

Aquatic Herbicide Compliance

by
Judy Ludlow
Department of Environmental Protection
and
Brian Nelson
Southwest Florida Water Management District

Introduction

A meeting with representatives of the Florida Department of Agriculture (DACS), the U.S. Environmental Protection Agency (EPA), and cooperators under the Cooperative Aquatic Plant Control Program was organized by Mr. Brian Nelson of the South West Florida Water Management District to discuss water use restrictions and notification procedures related to aquatic herbicide use. Cooperators from throughout Florida submitted questions which were discussed at this meeting. The following is a summary of the questions posed to DACS and EPA, and their response.

QUESTIONS and *ANSWERS*

Aquatic plant control operations are not covered under the General Worker Protection Standards which apply to greenhouse and crop production operations. Some language under General Worker Protection Statements on the Weedar 64 and Reward label, however, appear to pertain to other persons who may be within treatment areas or areas where there may be drift. Boaters and other persons are normally present on or around public waters while aquatic plant control operations are conducted. Are ongoing operations being conducted contrary to label language? If the treated area must be vacated, how is it delineated when one acre of plants is treated along the shoreline of a 100 acre lake, a 1,000 acre lake, or a river?

Delineation of the treatment area was defined at this meeting as the actual area upon which herbicides are applied provided the treated water is still or stagnant. Appropriate adjustments must be made for moving or flowing waters(see below). If applicators are careful not to spray near boaters or other persons, or otherwise expose them to drift,aquatic plants may be treated on a water body being utilized by the public.

Some aquatic herbicide labels vary as to what waters the restrictions apply. For example, the Aquathol K label says "...do not use water from treated areas." The Reward and 2,4–D labels say "...do not use treated waters." Does this language mean water use restrictions apply to the entire water body on which the treatment occurred, or only to the site that was treated?

The above definition of the treatment area helps clarify this language. In still, non–flowing waters, water use should be restricted per label instructions from within areas where herbicide has actually been applied. In flowing waters, water use should be restricted per label instructions from within areas where herbicide has actually been applied and as far downstream as impacts from herbicides are reasonably expected to occur. Physical, chemical, and environmental variables may be considered to help determine how far downstream herbicide impacts are reasonably expected to occur.

The majority of aquatic plant management operations conducted on public waters throughout the state involves the spot treatment of waterhyacinth and waterlettuce in a maintenance control program. Herbicides such as 2,4–D and Reward are applied frequently to small populations of these floating plants, usually totalling less than 1% of the water body surface area. For these reasons it would be unlikely that the concentration of 2,4–D in the water would ever exceed 0.1 ppm (the concentration on the 2,4–D label which requires water use to be restricted for irrigation) as a result of floating plant control. Conducting assays to determine the concentration of 2,4–D at each treatment site is difficult and water use must still be restricted until the results are known. Therefore, most aquatic plant managers restrict water use for the required period even though it is probably not necessary. Is posting, therefore, necessary for spot treatments on large water bodies ? Can the calculated or expected concentrations of 2,4–D at the time of application be substituted for the approved assay requirements for the purpose of irrigation and animal consumption?

Although posting per se is not required, treated waters must not be used for certain purposes, as specified by the product label. Posting may be used to comply with theselabel restrictions, but there may be other notification techniques that would also work and would be acceptable for compliance with label directions (i.e. notification via local newspapers). Notification of water use restrictions is necessary when 2,4–D assays cannot be conducted. Calculated or expected concentrations of 2,4–D cannot be substituted for the approved assay requirements.

The proposed Reward label, scheduled for release in December 1995, will restrict use of treated water for livestock consumption for one day (the current Reward label restricts animal consumption, spraying, and irrigation of treated water for 14 days). Does the livestock consumption restriction refer to penned or fenced livestock for the purposes of meat and milk tolerances, or all animals in general? Is there an acceptable notification procedure or method to prevent animals from consuming treated water from lakes or rivers where there are no fences preventing access?

The animal consumption restriction refers to domestic animals and livestock. When restricting livestock from treated areas is not practicable, then a different product with no livestock watering restrictions should be used. When a label describes specific use restrictions, those restrictions must be followed.

Attempting to notify all potential water users of restrictions is difficult. The type and amount of posting done depends upon the product used, the size of the water body, the number of people living on the water body and the number of potential access and irrigation points. On some of the larger, more populated waters several hundred homeowners may require notification in addition to persons entering the system through public access areas. What are the acceptable methods of notification for the above water users and for weekend or seasonal residents who have automatic sprinkler systems?

Unless notification procedures are specifically described on herbicide labels, notificationshould be tailored to each individual case. Compliance for notification is, many times, determined by the type of effort implemented by aquatic plant managers. Water users should be notified to the best of your abilities.

The following questions relate to language on 2,4–D labels that prohibit application of 2,4–D when a temperature air inversion exists. Does this language pertain to small aquatic plant control operations? Must applicators check for an inversion every day they apply 2,4–D or only when conditions like fog, mist or haze indicate the potential for an inversion? Does an inversion at any altitude preclude application? Because it is not practical or advisable to build a fire on a boat to produce a smoke column to check for inversions, what method is recommended for an airboat spray crew in a remote location to determine the existence of an inversion? What do you consider to be an acceptable local weather service and what documentation is needed by an applicator to prove that an inquiry about air inversions was made?

The intent of the air inversion language is geared towards large–scale aerial agricultural applications, however, this language also applies to aquatic plant control operations. When an air inversion exists there is a greater chance of herbicide drift occurring, therefore, checking for an inversion must be done every day. To determine the presence of an inversion, using readily available devices such as smoke generators and/or calling the National Weather Service and keeping a copy of the phone log is sufficient documentation. An inversion at any altitude precludes application if there is a label prohibition against herbicide use when there is an inversion. There is no altitude limitation or exemption unless stated on the label. Some 2,4–D labels have a recommendation to check for inversions rather than a prohibition against applying during an inversion. In those cases, it is the applicator's responsibility to consider the weather conditions and take responsible action accordingly.

Summary

When applying aquatic herbicides, the bottom line is, and always has been, to use common sense. Do

what you can to prevent drift, make reasonable attempts to notify potential users of label restrictions, keep accurate records and documentation of treatment conditions, and follow label directions.

An important recommendation that was made at this meeting was to schedule periodic inspections with a DACS pesticide compliance inspector[1]. This action helps build a cooperative working relationship with the inspector. It is undoubtedly much better to work with an inspector that understands the unique aspects of your job, rather than one who does not appreciate the challenge of applying herbicides in the aquatic environment.

[1] Phone numbers for DACS inspectors in your area can be found in the fourth quarter 1994 edition of the Newsletter of the Florida Aquatic Plant Management Society, or by calling the Pesticide Compliance Office at 904-488-3314.

Letter

Continued from page 3

group tasked with regulatory oversight of all state aquatic plant programs, and eradication of specific noxious aquatics (hydrilla, alligator weed, some others). Dr. Lars Anderson heads an efficient and effective team for USDA in Davis, CA, which conducts research on aquatics in some of the most contentious waters in the world. Not exactly just one Ranger solving one problem, but close. Looking at other western states there is, of course, a mixture of situations: one problem, no Rangers; no problems, too many Rangers (OK, I've never really seen this one); many problems, way too few Rangers.

Florida has, by dedicated research, regulatory, resource and industry effort, brought aquatic plant management to its appropriately meaningful level for at least parts of the aquatic plant puzzle. It now appears to be struggling to make aquatic plant management a "given" part of the formula for sustainable use of aquatic ecosystems.

At the state funding level, plant management efforts are being waged species at a time, with water hyacinth in the "controlled" category, and hydrilla, melaleuca, and others in the "help" category. The next step could be establishing an ecosystem and resource management system that looks at broader issues, and includes particular species for control because of their potential impacts to the resources, and not just because it's their turn on the list.

I'll be watching for signs of things to come, and optimistic that this dedicated industry can continue to provide much needed tools for applicators, regulators, resource managers, and decision makers. We also need to remember that we won't just be benefitting the future of Florida. There are Rangers out there quite happy to implement good ideas when they appear, and to pass on a few of their own.

AQUAVINE

To All FAPMS Membership:

As chairperson of the 1995 Awards Committee, I would like to take a time out to thank all the individuals that helped to make this years' meeting a huge success. Serving on a committee and Chairing a committee have much different perspectives. The demand for helping hands is great when you take into account all the different contests, awards, door prizes, contests and program demands. So whether you volunteered or were delegated these responsibilities, I am thankful that I was able to be a part of this successful team. I sincerely thank you all for your support.

The following is a summary of our endeavors:

1995 FAPMS ANNUAL AWARDS

Aquatic Plant Manager of the Year - The prestige that this award holds was carried away by the team of: George Robinson & John Pierce, Central Florida Aquatic Consultants, Orlando Florida. Congratulations and keep up the good work.

Best Applicator Paper - The competition this year was very intense. The honor of "BEST" was bestowed on Randy Snyder of St. Johns River Water Management District, Melbourne, Florida.

A plaque was presented for each presentation to: Fred Floyd, James O'malley, Charles Beddard & Johnny Drew, Lewis Darling & Arnold Milstein and Rusty Spencer & Billy Boles who were runners up.

Photo-Contest
Aquatic Scenes:
1st Place - Mike Bodle, S.F.W.M.D.
2 nd Place - Nancy Allen, C.O.E.
Operations:
1st Place - John Teevens, S.F.W.M.D.

F.A.P.M.S. Sharpshooting Competition - This was the first competition designed by the Program Committee to emphasize the impact that environmental factors can have on spray operations. A plaque and all bragging rights were bestowed on Bruce Burley of Highlands County as being the #1 Sharpshooter with a winning score of 132. However, it was voted by a voice count at the Annual Banquet that Bruce be summoned to a "SHOWDOWN at the DOGGETT CORAL" at the annual meeting in October 1996.

Exhibitor's Award - There were nineteen commercial exhibits present at this year's annual meeting. The Brewer International Inc., display hosted by Jim Brewer and Norma Magee was recognized as the "NICEST" display and awarded a plaque in recognition.

Plaques for Recognition Service - Mailing List Coordinator Plaque was awarded to John Rodgers for his outstanding contributions to FAPMS for the years of 1990 - 1995.

Applicator Dependent Scholarship - $1000 was awarded to Sally Ann McGill

Lucky Lotus Bean Contest - A check for $55.00 was awarded to Walt Pillows for guessing the number of Lotus Seeds. $55.00 was donated to the Scholarship Society from this contest drive.

The Grand Door Prize of a Camp site setup(tents, sleeping bags, lanterns, cooole etc..) was won by Lewis Darling, S.F.W.M.D.

Blue Light Special Supporters / Recipients:

G.P.S. System
Donated By Sepro
Won by Lynn Wilhoit, S.F.W.M.D.

25 Gallon, 12 Volt Spray System
Doanted by Cross Equipment
Won by Rick Cockrell,S.J.R.W.M.

BackPack Sprayer / 1 Gal.
Roundup Pro
Donated by Weed Systems / Monsanto
Won by Steve Weinsier, Aqua Jet Lake Services

$100 Cabela's Gift Certificate
Donated by Terra Asgrow
Won by Clifford Kirk, D.O.T.

Boobox Radio
Donated by Brewer International
Won by Greg Lancaster

$100 Bass-Pro Gift Certificate
Donated by Elf Atochem

Many Thanks to the following Companies for their Support:

Bruce Wilson Photography
Weed Systems Inc.
UF/IFAS Center for Aquatic Plants
Terra Asgrow
SeaPro Corp.
Brewer International
Elf Atochem
Aquarius Systems
Cross Equipment
United Horticultural Supply
Helena Chemical
Aquatic Eco Systems
Applied Biochemists
Aquatic Vegetation Control Inc.

Aquagenix' Subsidiary, Environmental Waterway Management, Signs Contract to Acquire Ameriquatic

Aquagenix, Inc. announced on October 20, 1995 that Environmental Waterway, Inc., its surface water management subsidiary, has executed a contract to buy the assets of Deerfield Beach-based Ameri–quatic, Inc. According to Andrew Chesler, President of Environmental Waterway Management, Inc., the aquisition of Ameriquatic, Inc. positions Environmental Waterway Management, Inc. as the largest provider of aquatic-related vegeta-tion management services in the United States.

Aquathol® K Aquatic Herbicide Receives Label Amendments

Elf Atochem North America, Inc. announced on October 3, 1995 approval by the US Environmental Protection Agency (EPA) of three amendments to its Aquathol® K Aquatic Herbicide label (**pending state approvals**). EPA granted these amendments because of new data generated by Elf Atochem in support of reregistration of Auathol K. The amendments include:

> Removal of the twenty-four hour swimming restriction. The amended label has no swimming restriction.
> Removal of the skull and cross-bones and poison signal word.
> Revision of the precautionary statements to include removal of wording, "Fatal if absorbed through skin."

For copy of the amended Aquathol® K label contact Elf Atochem at 800/438-6071 or your local distributor. In Florida contact Bill Moore at 904/242-2360.

Giant Salvinia Found in South Carolina

Giant salvinia (Salvinia molesta), also known as Kariba–weed, was found in South Carolina during July, 1995, by Cindy Aulbach-Smith, a botanist in Columbia, SC. The infestation occurred in a 1.5 acre pond at Pineland Plantation off secondary road 87 about 10 miles south of Walterboro. The owner of the plantation lives in California. Giant Salvinia, a free floating aquatic fern that forms very dense mats, is listed as one of the world worst weeds. It is a major problem in Africa, Asia, Australia, and other areas. It is not known to occur any where else in the United States, and is listed as a Federal Noxious Weed. Hopefully successful, eradication efforts were conducted through the summer. For additional information contact Danny Johnson at 803/765-9080.

MEETINGS

Florida Aquatic Plant Management Society Annual Meeting, Sheriton Harbor Ploace Ft. Myers, Florida, October 8-10, 1996. Contact Don Dogget, President 941/694-2174.

Southern Weed Science Society Annual Meeting, Adams Mark Hotel, Charlotte, January 15-17, 1996 NC. Contact Barry Sims 901/855-1472.

Weed Science Society of America 1996 Annual Meeting, Norfolk, Virginia Marriot and Omni Hotels, February 6-9, 1996. Contact Dr. Henry P. Wilson 804/442-6411.

Weed Science Society of America 1997 Annual Meeting, Orlando, FL, Clarion Hotel, February 2-6, 1997.

Florida Weed Science Society Annual Meeting, Hilton Ocala, February 29-March 1, 1996. Contact Bert McCarty, President 904/392-7938.

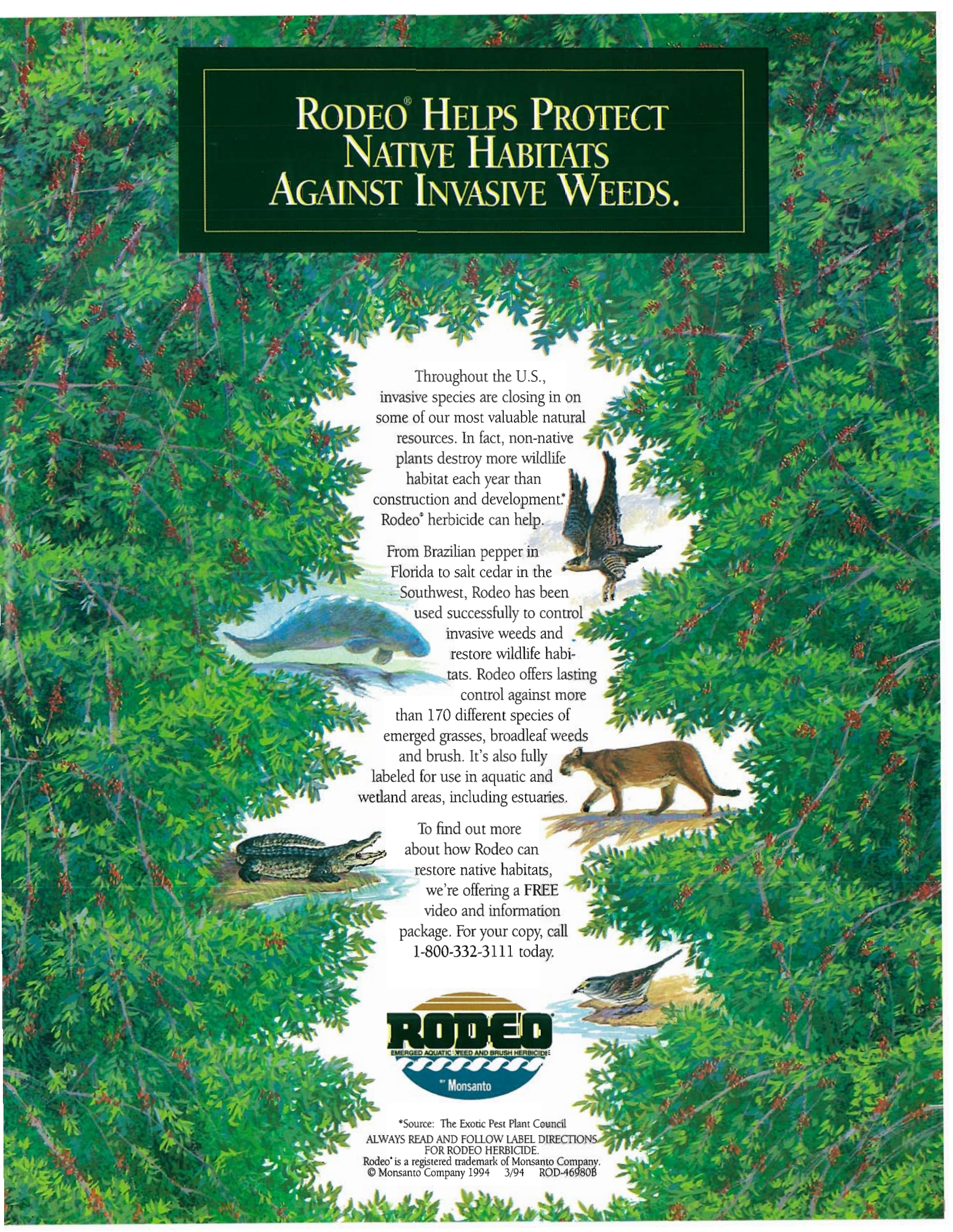
Florida Weed Science Society Meeting—Issues, Invasives, Innovations

The Florida Weed Science Society will hold its 19th Annual Meeting on February 29th and March 1st, 1996, at the Ocala Hilton, 3600 SW 36th Avenue, Ocala, FL 34474. Up to seven CEU (Continuing Education Unit) credits towards renewal of Restricted Use Pesticide Applicator Licenses will be available to participants. Registration fee is $20.

CEUs will be offered as follows:

Thursday - 1.0 Regulatory or 1.0 Private Appl. Ag., 2.5 Aquatic
Friday - 1.0 Ornam. & Turf, 0.5 Ag. Row Crop, 1.0 Right-of-Way, 1.0 Demo. & Research or 1.0 Private Appl. Ag.
Both days - 7.0 CEUs Total

RODEO® HELPS PROTECT NATIVE HABITATS AGAINST INVASIVE WEEDS.



Throughout the U.S., invasive species are closing in on some of our most valuable natural resources. In fact, non-native plants destroy more wildlife habitat each year than construction and development.* Rodeo® herbicide can help.

From Brazilian pepper in Florida to salt cedar in the Southwest, Rodeo has been used successfully to control invasive weeds and restore wildlife habitats. Rodeo offers lasting control against more than 170 different species of emerged grasses, broadleaf weeds and brush. It's also fully labeled for use in aquatic and wetland areas, including estuaries.

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*Source: The Exotic Pest Plant Council

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