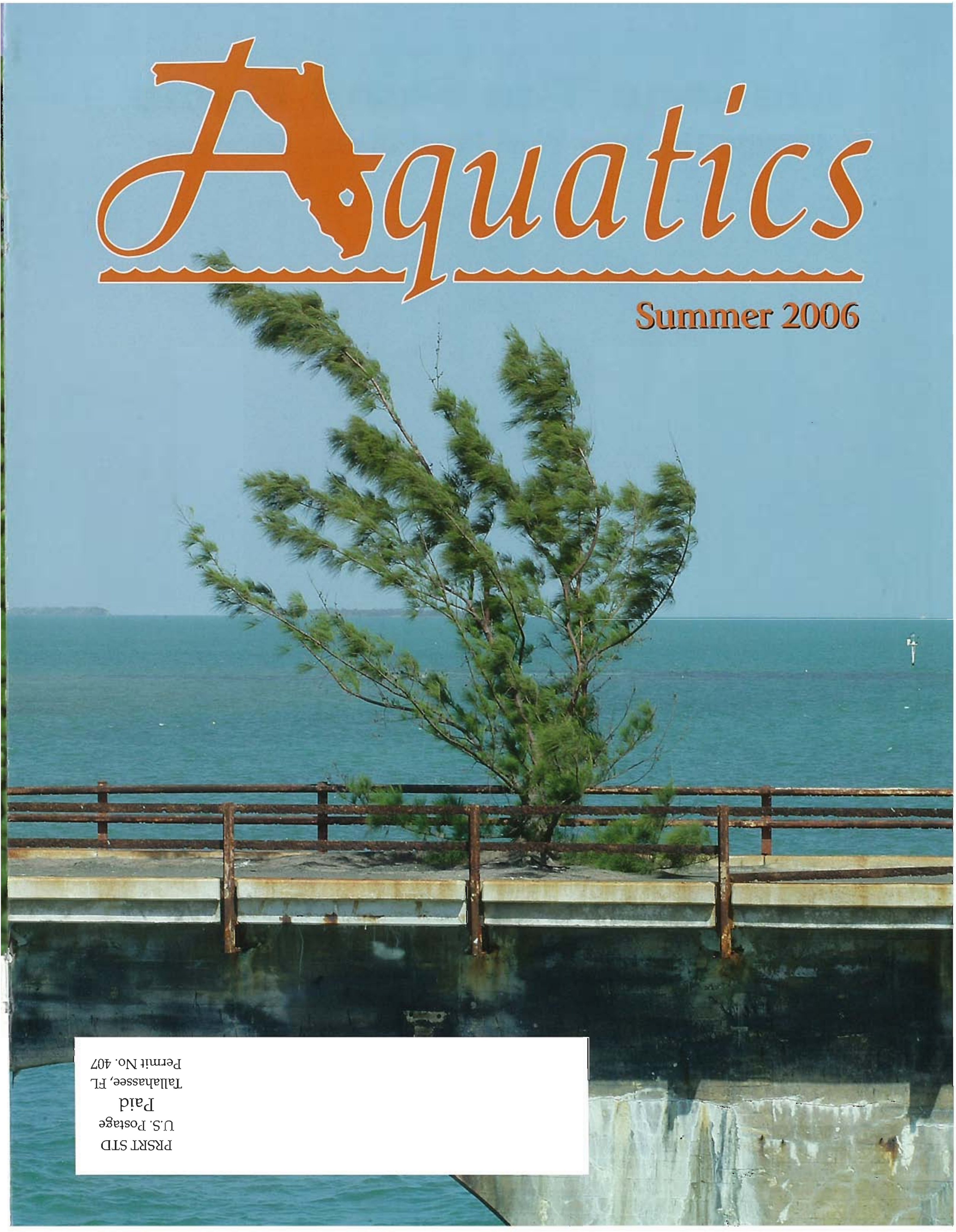
Aquatics

Summer 2006



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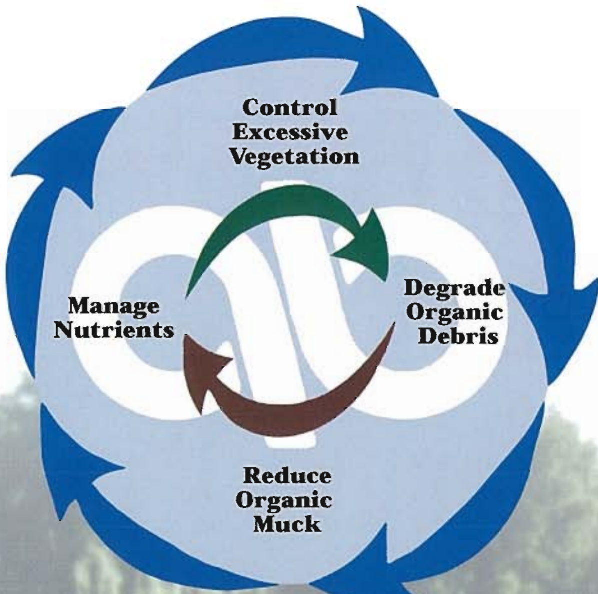

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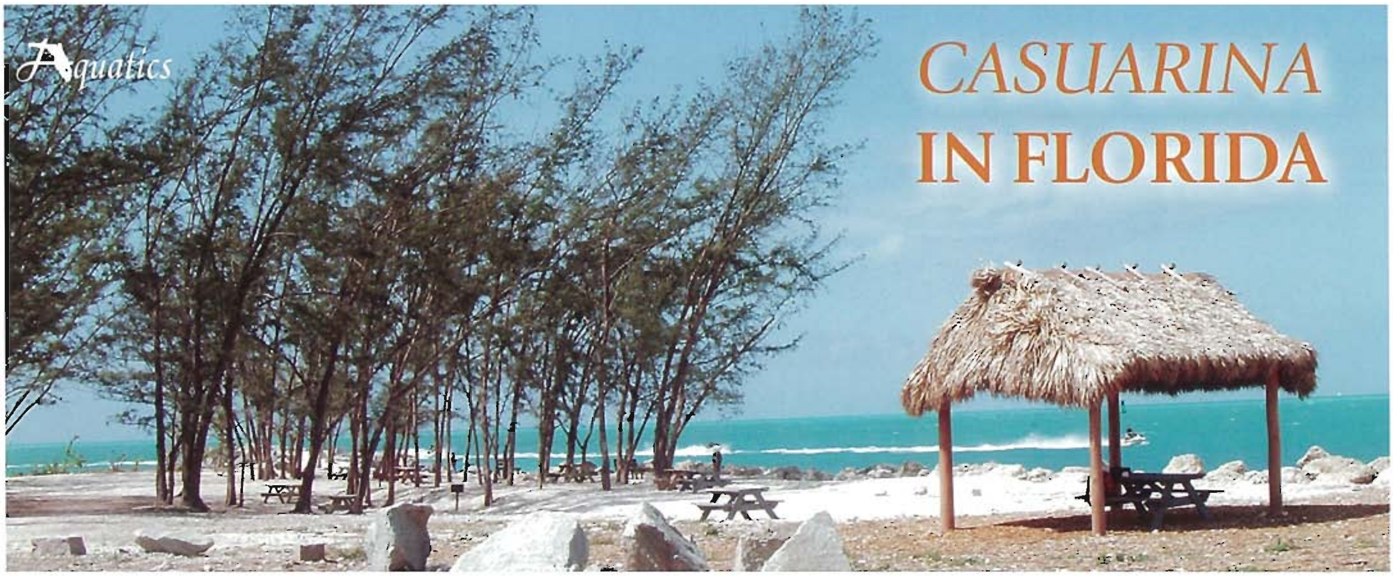
Australian pine (Casuarina) found growing on bridge road base in the Florida Keys. See article page 4. Photo by Vernon Vandiver, 2006.

Aquatics

Summer 2006/Vol. 28, No. 2

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 $35.00 plus your mailing address to the Treasurer.
EDITORIAL: Address all correspondence regarding editorial matter to Jeff Holland, *Aquatics Magazine*.



CASUARINA IN FLORIDA

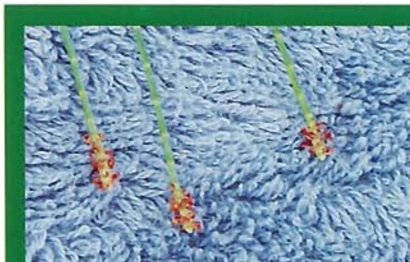
Casuarinas growing on the beach at Fort Zachary Taylor Historic State Park, Truman Annex, Key West, FL. Even with the weedy tree's vulnerability to storm winds as stated in the article, there are emotional, though somewhat misguided, public efforts from some citizens to prevent replacement of the Casuarinas with native, more desirable trees along the upper beach.

By David W. Hall[1] and Vernon V. Vandiver, Jr.[2]

The Australian-pines, *Casuarina*, are in the She-oak Family, Casuarinaceae. The family and genus is native to Australia and the Western Pacific. Three species are planted in the United States. River She-oak, *Casuarina cunninghamiana*, Beach She-oak, *Casuarina equisetifolia*, and Gray She-oak, *Casuarina glauca*. All are medium to large-sized evergreen trees. Leaves are tiny scales that are in a sheathed whorl at nodes on green branchlets. Male and female flowers occur separately. Flowers of only one or of both sexes can occur on the same tree. Seeds occur in cone-like structures. The Roots contain nitrogen-fixing nodules. Often used as windbreaks, hedges, and topiary; one species, Beach She-oak, *S. equisetifolia*, is a salt tolerant pioneer seashore tree. The tall trees, planted extensively as windbreaks in South and Central Peninsula Florida in the 1940's and earlier, are now being removed from canal banks and rights-of-way. The mature trees, with their shallow root systems lacking taproots, are very prone to uprooting by the severe winds of thunderstorms and hurricanes. Australian-pines are planted throughout the warm regions of the world as specimen and street trees and are especially noted as providing excellent firewood. The cone-like fruits are common on tropical beaches of the world. The different kinds of She-oaks can be separated by the numbers of scale-like leaves in a whorl and the diameter of the branchlets.

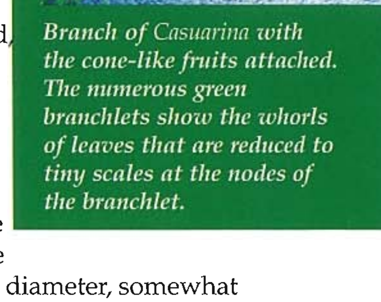
River She-oak, *Casuarina cunninghamiana* Miq., is a non-suckering, large-sized, conical tree, to 20 m tall, with self-pruning branches that hang downward. The bark is ridged, furrowed or scaly. Branchlets are 0.4-0.6 mm in diameter, flexible, and green. The scale-like leaves are 6-9 per node, with a brown band at base. It reproduces by seeds and is not salt tolerant. River She-oak is native to and a protected species in Australia.

Beach She-oak, *Casuarina equisetifolia* L., is a non-suckering, large-sized, conical tree, to 20 m tall, with self-pruning branches that hang downward. The bark is furrowed, dark-brown, and splits into strips. The branchlets are 0.7-0.8 mm in diameter, fragile, and green. The scale-like leaves are 6-8 per node and lack a brown band at base. Salt tolerant, Beach She-oak reproduces by seeds and is commonly found on sandy seashores and in disturbed habitats such as ditch banks. It is native to tropical Australia and Pacific Islands.



Close-up of Branchlets – Three green branchlets showing the whorls of tiny scales at the nodes of the green branchlets. Numerous female flowers are shown at the terminal end of each branchlet.

Gray She-oak, also known as Suckering Australian-pine, *Casuarina glauca* Sieb. ex Spreng., is a suckering, medium-sized, conical tree, to 18 m tall, with numerous rounded and whitish branches. The branchlets are 0.8-1.0 mm in diameter, somewhat rigid, and whitish. The scale-like leaves are 10-15 per node, with a brown band at base. Planted as a roadside tree, Gray She-oak escapes cultivation with its intense suckering habit even though no fruit is produced in Florida plants. Native to Australia, this species grows in dry or wet disturbed sites.



Branch of Casuarina with the cone-like fruits attached. The numerous green branchlets show the whorls of leaves that are reduced to tiny scales at the nodes of the branchlet.

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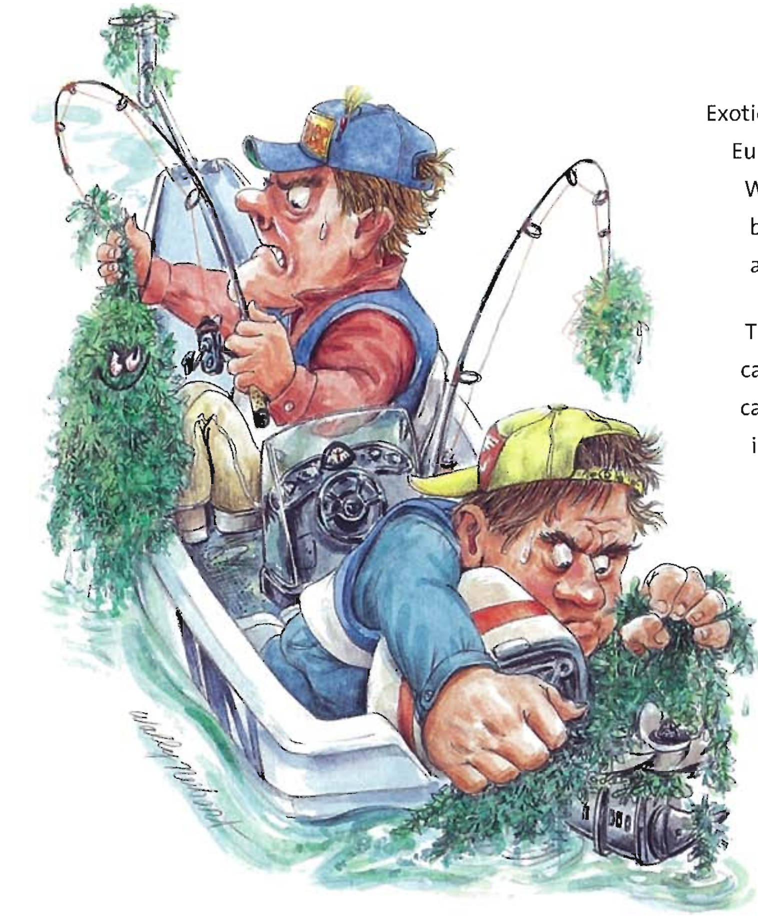
Too Many Weeds Spoil the Fishing



Exotic invasive aquatic plants such as Hydrilla, Eurasian Watermilfoil, Curlyleaf Pondweed, Water Chestnut and Water Hyacinth can be detrimental to a healthy fishery in lakes across the country.

These invasive plants when left unmanaged can alter the ecosystem of lakes and reservoirs, causing a decline in the fishery, as well as interfering with other valued uses of waterbodies.

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Results demonstration trial with eleven treatments.

Herbicide Selectivity Study

By Vernon V. Vandiver, Jr.[1] and C. Elroy Timmer [2]

Planted areas in aquatic sites such as the littoral zones and shorelines of canals, lakes and ponds are now prevalent throughout Florida and other states. Land and property managers may have aquascaping installed on these sites to enhance their appearance, or the plants may

Treatment #	Herbicide Treatment
1	Stingray™ 0.2 lb ai per acre
2	Stingray™ 0.1 lb ai per acre
3	Stingray™ 0.1 lb ai per acre + Hardball® 0.475 lb ae per acre
4	Stingray™ 0.1 lb ai per acre + Hardball® 0.238 lb ae per acre
5	Stingray™ 0.1 lb ai per acre + Reward® 0.250 lb ai per acre
6	Stingray™ 0.1 lb ai per acre + Reward® 0.125 lb ai per acre
7	Stingray™ 0.1 lb ai per acre + Reward® 0.250 lb ai per acre
8	Stingray™ 0.1 lb ai per acre + Hardball® 0.119 lb ae per acre
9	Stingray™ 0.1 lb ai per acre + Hardball® 0.0595 lb ae per acre
10	Stingray™ 0.1 lb ai per acre + Sonar™ 0.250 lb ai per acre
11	Stingray™ 0.1 lb ai per acre + Sonar™ 0.125 lb ai per acre

Figure 1. Treatments used in Herbicide Selectivity Study.

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Most of the shoreline planted areas have one thing in common; they are infested with one or more species of aquatic weeds. This weed problem may be caused by submersed plants such as Hydrilla [*Hydrilla verticillata* (L. f.) Royle]. Frequently the weed problems are caused by emergent plants such as Alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.], Pennyworts [*Hydrocotyle* spp.], and Torpedograss [*Panicum repens* L].

Results demonstration trial with eleven treatments.

Weed management programs in these shoreline planted areas are frequently expensive and the results can be less than desirable in many cases. For example, when designing an herbicide program, it can be difficult to select herbicides that will effectively control one or more of the emergent weeds discussed above while at the same time not cause significant injury to desirable emergent aquatic plants in the proposed treatment area. Also, physical removal of the emergent weeds from the desirable plants in the littoral zones and shorelines is very labor-intensive and can be relatively slow and expensive. The physical removal of emergent weeds can additionally cause significant damage to the desirable littoral zone vegetation.

To increase the herbicide management options of water managers and aquatic herbicide applicators in these littoral zones and shoreline management programs, we planned a trial in cooperation with the Palm Beach County Environmental Resources Management Department, Natural Resources Stewardship Division, Resources Maintenance Section and the Land Management Monitoring Section. The treatment site was a planted, vegetated littoral zone area on Lake Osborne in Palm Beach County. This area historically has had a problem with the floating weeds, Waterhyacinth [*Eichhornia crassipes* (Mart.) Solms] and Waterlettuce

Plant	41 DAT, % Control	70 DAT, % Control
Hydrocotyle	95	92
Eleocharis	85	60
Sagittaria	40	0
Pontederia	10	0
Thalia	20	10

Figure 2. Results of Stingray™ 0.1 lb ai per acre + Hardball® 0.475 lb ai per acre.

Plant	41 DAT, % Control	70 DAT, % Control
Hydrocotyle	75	65
Eleocharis	20	0
Sagittaria	30	10
Pontederia	10	0
Alternanthera	5	0
Canna	70	25
Crinum	10	0
Polygonum	20	10

Figure 3. Results of Stingray™ 0.1 lb ai per acre + Hardball® 0.238 lb ai per acre.

Plant	28 DAT, % Control	43 DAT, % Control
Hydrocotyle	80	70
Eleocharis	20	10
Sagittaria	5	0
Pontederia	0	0
Alternanthera	20	0

Figure 4. Results of Stingray™ 0.1 lb ai per acre + Hardball® 0.0595 lb ai per acre.

Plant	41 DAT, % Control	70 DAT, % Control
Hydrocotyle	10	0
Eleocharis	40	0
Sagittaria	10	0
Pontederia	20	0
Alternanthera	5	0
Canna	25	15
Polygonum	15	0

Figure 5. Results of Stingray™ 0.1 lb ai per acre + Reward™ 0.250 lb ai per acre.

Plant	28 DAT, % Control	43 DAT, % Control
Hydrocotyle	20	0
Eleocharis	50	20
Sagittaria	40	10
Pontederia	10	0
Alternanthera	0	0

Figure 6. Results of Stingray™ 0.1 lb ai per acre + Sonar™ 0.250 lb ai per acre.

[*Pistia stratiotes* L.]. To prevent the many problems that would result from excessive growth, these floating weeds have been under an herbicide management program. Earlier studies had shown that certain herbicide tank mix treatments could control Waterhyacinth and Waterlettuce at rates that would minimize damage to non-target desirable plants. This current study was designed to determine if herbicide treatments could be made to control Waterhyacinth and Waterlettuce in this site in addition to controlling the major emergent weeds also found in this site. The important emergent weeds growing in Lake Osborne were Alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.], Pennyworts [*Hydrocotyle* spp.], and Torpedograss [*Panicum repens* L].

The trial was designed as a results demonstration with eleven treatments. The treatment plots were ten by twenty feet strip plots with one plot per treatment. Treatments used in this herbicide selectivity study are shown in Figure 1.

The plots were sprayed with an air-powered sprayer using a Spraying Systems SS 0004 tip. Total spray mixture volume was based on 100 gal per acre. The spray mixture contained 0.75 % v/v nonionic surfactant (Dyne-Amic®) in treatments 1,2,5,6,7,10, and 11.

To summarize the results of this Herbicide Selectivity Study, no repeat herbicide treatments or split herbicide applications were included in the design. However, observations of the treatment plots at the last rating periods would seem to indicate that, as the non-target plants had largely recovered to pretreatment condition and the Pennyworts were under a minimum of 65 per cent control, additional applications of the tank mixture of Stingray™ at 0.1 lb ai per acre + Hardball® at 0.0595 lb ai per acre would likely substantially remove Pennyworts from similar littoral zone plantings without any significant suppression of the desirable aquatic plants noted in the treatment plots (see figures 2- 6).

Treatment Details:

In Treatment #1, Stingray™ at 0.2 lb ai per acre, and Treatment #2, Stingray™ at 0.1 lb ai per acre, the Stingray™ used alone did not provide sufficient control of Alligatorweed or Pennyworts in this study. Therefore to conserve space these data will not be presented here.

The results of Treatment #3, Stingray™ at 0.1 lb ai per acre + Hardball® at 0.475 lb ai per acre, are shown in Figure 2. At 41 days after treatment (DAT) Pennyworts showed 95 per cent control, and at 70 DAT Pennyworts still were at 92 per cent control in Plot #3. As shown in Figure 2, of the non-target plants in the plot, only *Eleocharis interstincta* showed significant injury at the 41 and 70 DAT rating periods. The *Sagittaria*, *Pontederia*, and *Thalia* showed little injury at the 70 DAT point.

In Treatment #4, the Hardball® rate was one-half the rate used in Treatment #3, the tank mixture used was Stingray at 0.1 lb ai per acre + Hardball® at 0.238 lb ai per acre. The results of Treatment #4 are shown in Figure 3. At 41 DAT the Pennyworts were rated at 75 per cent control, and at 70 DAT the Pennyworts were at 65 per cent control in Plot #4. Figure 3 shows that of the non-target plants in this treatment, only *Canna* still showed significant damage, 25 percent, at the 70 DAT rating.

Treatment #9, the Hardball® rate was lowered by 75 per cent of that used in Treatment #4. The tank mixture used in Treatment #9 was Stingray™ at 0.1 lb ai per acre + Hardball® at 0.0595 lb ai per acre. The results of Treatment #9 are shown in Figure 4. At 43 DAT in this plot the Pennyworts were rated at 70 per cent control. The non-target plants rated in this plot were *Eleocharis*, *Pontederia*, and Sagittaria. In this plot at the 43 DAT point, the *Eleocharis* was rated at 10 per cent injury and the *Pontederia*, and *Sagittaria* were rated at 0 per cent injury.

Also, in this Herbicide Selectivity Study, two additional tank mixture combinations were included. The five additional treatments made in this study were combinations of Stingray™ + Reward® and combinations of Stingray™ + Sonar™. The results of one treatment for each of these two combinations will be described below.

In Treatment #5, the tank mixture was Stingray™ at 0.1 lb ai per acre + Reward® at 0.250 lb ai per acre. The results of Treatment #5 are shown in Figure 5. At 41 DAT in this treatment the Pennyworts were rated at 10 per cent control, and at 70 DAT control had declined to 0 per cent. Under these study conditions we did not feel this was acceptable control of the Pennyworts.

In Treatment #10, the tank mixture was Stingray™ at 0.1 lb ai per acre + Sonar™ at 0.250 lb ai per acre. The results of Treatment #10 are shown in Figure 6. At 28 DAT in Treatment #10, the Pennyworts were rated at 20 per cent control and at 43 DAT the Pennywort control had declined to a rating of 0 per cent. As in Treatment #5, under these study conditions we did not feel this was acceptable control of the Pennyworts.

Implementing AN Invasive Aquatic Plant Management Plan WHEN Non-Target Species of Concern are Present

By Lee Lyman, Lycott Environmental, Inc. and
Dan Nitzsche, Baystate Environmental Consultants, Inc.

For decades the Town of Halifax, Massachusetts has struggled with invasive aquatic plants in the Monponsett Ponds. These two water bodies are divided by a causeway, yet connected by a large culvert. The eastern basin had become inundated with the non-indigenous plants Fanwort (*Cabomba caroliniana*), Eurasian milfoil (*Myriophyllum spicatum*) and Variable milfoil (*Myriophyllum heterophyllum*). This 246-acre basin, with an average depth of seven feet, had its recreational use greatly impaired by the presence of dense plant growth. In addition, the fisheries and wildlife habitat were adversely affected. Beginning in the 1980's numerous strategies were implemented to reduce sediment and nutrient loading into the ponds. Despite these efforts the eastern basin continued to foster the invasive plant growth and the western basin continued to produce microscopic algae blooms.

During the late 1980's and early 1990's harvesting of the aquatic plants took place, but this action did not produce the desired results. A feasibility study conducted by Lycott Environmental for the Town of Halifax reviewed all options for managing the invasive plants. This study concluded that the most viable method for long-term reduction and management of the three species of invasive plants would be to initially treat the eastern basin with the herbicide Sonar® (active ingredient fluridone). There were a considerable number of obstacles that had to be addressed for this recommendation to move forward.

Two municipal water departments and a large cranberry grower were among the stakeholders. The cranberry grower used water from the western basin for irrigation. The Brockton Water Department historically withdraws water from the eastern basin during the fall, winter and spring. The Monponsett Water Department had a production well in close proximity to the ponds. In addition, the Massachusetts Natural Heritage and Endangered Species Program (NHESP) identified these basins as having three species of concern. In the fall of 2003 a survey of the two basins was conducted to determine the presence and abundance of the three species of concern. All three species were found to be present in both basins.

When the Notice of Intent was submitted to the Monponsett Conservation Commission, it voted to deny the use of herbicides. Following an appeal to the Department of Environmental Protection (DEP), a public hearing was held and this led to discussions with the staff of the NHESP to determine if their concerns regarding the species of concern could be addressed.

The specific species of concern in the Monponsett Ponds were two freshwater mussels and a dragonfly species: tidewater mucket (*Leptodea ochracea*), eastern pondmussel (*Ligumia nasuta*), and the umber shadowdragon (*Neurocordulia obsolete*) (Figures 1 and 2).

An extensive literature search did

Figure 1. The Stygian Shadowdragon (Neurocordulia yamaska), a species of concern in the Monponsett ponds.

Figure 2. Mussel species that were placed in cages in the Eastern and Western basins of Monponsett Pond.

not turn up applicable studies or bioassays specific to these three species. Discussion resulted in retention of an independent consultant to work with the NHESP staff to develop a study and/or bioassay that might provide the necessary information, which would allow NHESP to authorize the treatment.

In the summer of 2004, Baystate Environmental Consultants, Inc. (BEC) was retained by the Town of Halifax to develop a protocol for studying the species of special concern, thereby allowing the treatment to be undertaken. A study protocol was developed and approved by NHESP. During this time period, the Brockton Water Department also agreed to cooperate with the understanding that the concentration of herbicide would be below 5 parts per billion (ppb) by the time they would resume withdrawing water from the treated basin.

In May of 2005, the Superseding Order Of Conditions was issued by the DEP. That Order allowed the treatment to be undertaken with special conditions, including implementing the protocol approved by NHESP. The protocol called for a collection of freshwater mussels from both basins being placed into specially built cages that were then set into the sediment in various locations throughout both basins. The western basin was used as a control. A total of twenty cages were used, ten in the western basin and ten in the eastern basin. The species of dragonfly was determined to be in such low abundance that a surrogate species was approved for use by NHESP. Approximately 130 Stygian Shadowdragon (*Neurocordulia yamaska*) nymphs were collected in the late spring of 2005 and subjected to fluridone concentrations similar to that applied to the eastern basin. Eight aquaria were set up utilizing water, sediment and a preferred substrate of submerged logs from the ponds (Figure 3). Each aquarium contained approximately twenty dragonfly nymphs. The collected nymphs were placed into four treatment groups and four control groups, which were made up of various age classes. The treatment groups were exposed to fluridone at a rate of 15 ppb, which was the dosage rate proposed for use in the eastern basin of Monponsett Pond.

Figure 3. Aquarium used for exposing dragonfly nymphs to fluridone. Each treatment and control tank contained 20 dragonfly nymphs. The tanks contained woody debris as a preferred substrate.

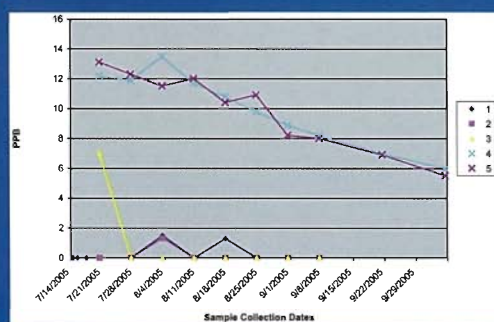


Figure 4. Fluridone Residues in the treatment Basin (sites 4 and 5) and the untreated areas of the Western Basin through approximately 75 days post application. The treatment was conducted on July 13, 2005.

The mussel cages were placed in the two basins in the spring of 2005 and monitored weekly throughout the summer and into the fall. The NHESP dictated that the treatment date be later than usual due to their concern over the hatching of dragonfly larva. On July 13, 2005, Lycott conducted the Sonar™ treatment to the eastern basin of Monponsett Pond. The treatment was conducted successfully, as, one week after the treatment the concentration was at 12 ppb fluridone (Figure 4). Prior to the treatment, a limno barrier was placed across the box culvert to aid in suppressing the dispersion of the herbicide from the eastern to the western basin. Additionally, owners of the cranberry bog required water samples in the western basin be collected at the intake pipe and analyzed for fluridone at 24, 48, and 72 hours post-treatment, as well as weekly throughout the summer.

No additional (booster) treatments were necessary due to the fact that very little rainfall occurred during July and August of 2005. The concentration of Sonar remained at acceptable levels for the targeted forty-five days. All three target weed species were strongly impacted by the treatment based on post-treatment surveys.

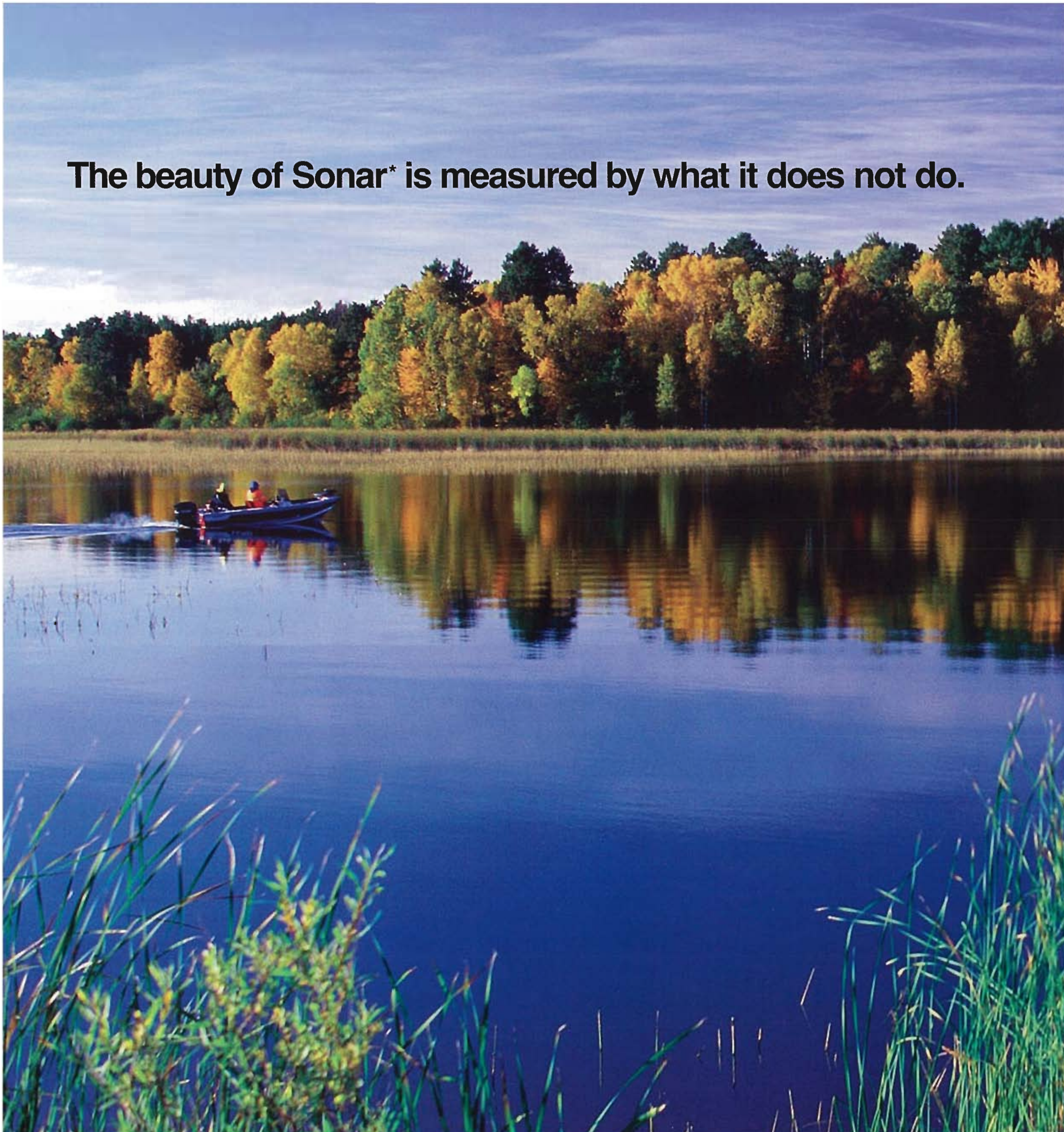
Initial results of the pond and laboratory studies suggest the treatment had no impact on the non-target species of concern.

- Three of the mussels in the cages in the control basin (western) died during the summer.
- No mortality occurred within the cages in the treated basin.
- The nymphs successfully molted to older age classes and several dragonflies emerged as winged adults with no mortality observed.

The mussels in the eastern basin will be surveyed in the summers of 2006 and 2009 to determine if any long-term adverse effects to the special concern species are noted as a result of the herbicide treatment. The follow-up surveys will record overall mussel species abundance and evidence of significant mortality.

Follow-up plant surveys will be conducted to determine the presence and distribution of invasive and native plants in the eastern and western basin during the summer of 2006 and beyond. Sampling is also planned to identify the sources of phosphorous that are responsible for the recurring microscopic algae blooms in the western basin.

While this fluridone treatment represented an initial stage of this project, it demonstrates that invasive plant management activities can be conducted while being mindful of species of concern and for other uses of the water body.



A beautiful lake can turn ugly once invasive aquatic weeds like hydrilla or Eurasian watermilfoil take over. But before you introduce non-selective grass carp or launch a mechanical harvesting program, consider what Sonar Aquatic Herbicide does not do.

Sonar does not eliminate desirable vegetation. SePRO has the technology to manage application rates and monitor the treatment progress to ensure that invasive species are removed with minimal effect on native plants and the lake's ecosystem. After treatment, desirable native species are allowed to thrive and often become more abundant, creating a more diverse habitat.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Hygrophila Screening Trials

By Vernon V. Vandiver, Jr.[1] and C. Elroy Timmer [2]

Hygrophila polysperma (Roxb.) T. Anderson [East Indian Hygrophila] has been recognized as causing serious aquatic weed problems in Florida since the late 1970s. It was reported as being weedy in the City of Miramar, Florida canal system by Mr. Ross Hooks, then manager of the Broward County aquatic weed management group.

Not long after that time Mr. Paul Sand, USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), led a successful effort to have *Hygrophila polysperma* added to the Federal Noxious Weed List[3]. As published in the Federal Register, APHIS, PPQ listed the common name of *Hygrophila polysperma* as "Miramar Weed." By including *Hygrophila polysperma* on the Federal Noxious Weed List, APHIS, PPQ was operationally and administratively recognizing that Federal resources should be used to limit the interstate movement of the weed.

As *Hygrophila* has been very difficult to control in the water management canal systems in South Florida, a number of cooperators conducted a series of herbicide evaluations (screens) to determine if an herbicide or an herbicide tank mixture could

Treatment #	Herbicide or Herbicide Tank Mixture	Product Registrant
1	1.00 ppmw product Aquathol® K + 0.150 ppmw ae Hydrothol®191	Aquathol® K (Cerexagri) Hydrothol® 191 (Cerexagri)
2	1.25 ppmw ae SP 1022	SP 1022 [SePRO (numbered compound)]
3	0.500 ppmw ae Renovate®	Renovate® (SePRO)
4	0.500 % Hardball® + 0.250 % Kammo Plus (in 100 gal spray mixture per acre)	Hardball® (Helena) Kammo Plus (Helena)
5	0.500 ppmw ae Renovate® + 50 lbs product Aqua-Kleen® Herbicide per acre	Renovate® (SePRO) Aqua-Kleen® Herbicide (Cerexagri)
6	50 lbs product Aqua-Kleen® Herbicide per acre	Aqua-Kleen® Herbicide (Cerexagri)
7	100 lbs product Aqua-Kleen® Herbicide per acre	Aqua-Kleen® Herbicide (Cerexagri)
8	1.00 gal per acre Reward™ + 0.25 gal per acre Hydrothol® 191	Reward™ (Syngenta) Hydrothol® 191 (Cerexagri)
9	Control	N/A

Figure 1. Treatments used in the Herbicide Screen on Hygrophila.

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Tanks used for treating the submersed Hygrophila in the Herbicide Screen Study.

be used that would be as effective in the field to manage *Hygrophila* infestations in these slowly-flowing water systems as the 2,4-D ester liquid formulations had been. (The aquatic uses of the 2,4-D ester liquid formulations have now been removed from all the respective herbicide labels.) The herbicide screens were conducted on the University of Florida – IFAS Fort Lauderdale Research and Education Center campus in Fort Lauderdale. The 900–liter outdoor aquaria used were

Treatment #	29 Jun 05	29 Jul 05	13 Aug 05	27 Aug 05
1.00 ppmw product Aquathol® K + 0.150 ppmw ae Hydrothol®191	0	74	88	95
1.25 ppmw ae SP 1022	0	6	7	27
0.500 ppmw ae Renovate®	0	8	8	20
0.500 % Hardball® + 0.250 % Kammo Plus (in 100 gal spray mixture per acre)	0	10	6	13
0.500 ppmw ae Renovate® + 50 lbs product Aqua-Kleen® Herbicide per acre	0	36	91	98
50 lbs product Aqua-Kleen® Herbicide per acre	0	44	90	97
100 lbs product Aqua-Kleen® Herbicide per acre	0	78	98	98
1.00 gal per acre Reward™ + 0.25 gal per acre Hydrothol® 191	0	96	99	99
Control	0	0	0	3

Figure 2. Herbicide Screen on *Hygrophila* Treatment Results Expressed as Per Cent Control.

Washing the Hygrophila plants before bagging during 13 September 2005 harvest of the Screening Study.

graciously provided by the USDA, Agricultural Research Service, Invasive Plant Research Laboratory, Fort Lauderdale.

The average dimensions for the tanks used in the study are as follows: Depth – 1.73 ft; Width – 2.53 ft; and Length – 7.20 ft. For contrasting the herbicide treatment levels, the average sizes of the tanks are: 0.000419 acre and 0.000725 acre-feet. The herbicide treatments used in the latest herbicide screen on *Hygrophila* are shown in Figure 1. Several earlier herbicide screening trials led us to the treatments shown below. In all cases the manufacturers or distributors were consulted on the herbicide treatment rates used in this phase of the *Hygrophila* study.

The *Hygrophila* plants were established on 16 November 2004 in one-gallon containers in a sand potting media. The plants were grown in the emergent habit with sub irrigation.

Emergent shoots of Hygrophila.

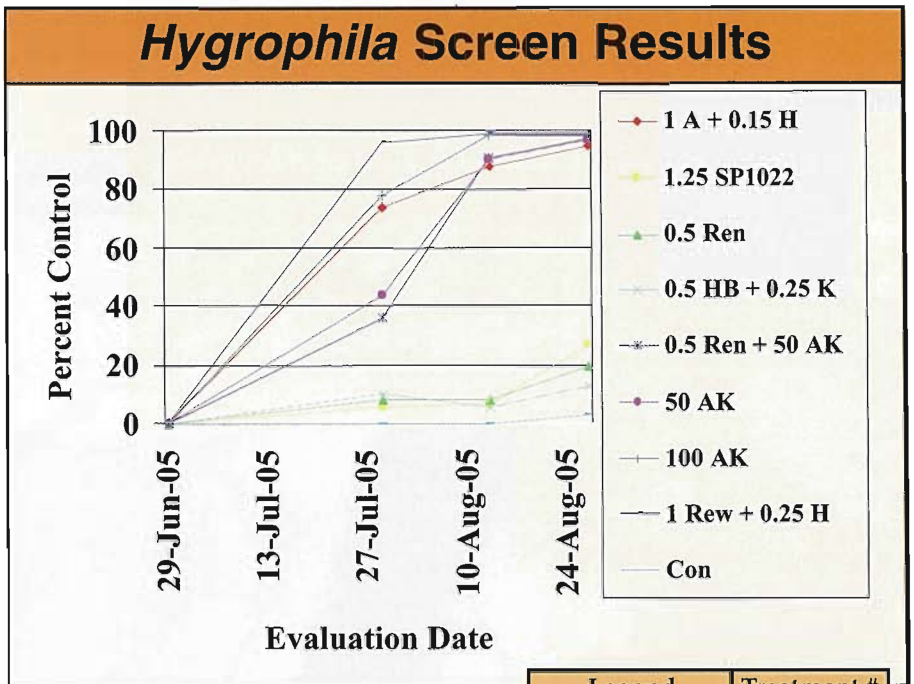
Approximately three week prior to the first of the herbicide treatments, the plants were submersed into the 900-liter tanks. During this three-week period, the *Hygrophila* shoots changed their leaf morphology from the emergent form to the submersed form.

Also the shoots elongated and were just beginning to emerge from the water surface. When the plant containers were submersed in the treatment tanks, water was slowly exchanged in the tanks, at a turnover rate of approximately once every 24 hours. After each herbicide treatment, the water in the tanks was held static, and then flushed just prior to the next herbicide treatment.

The herbicide treatment dates in this trial were: 30 June 2005, 15 July 2005, 29 July 2005, 13 August 2005 and 27 August 2005. The treatments were rated on the following dates: 29 June 2005, 29 July 2005, 13 August 2005 and 27 August 2005. The results of these ratings (per cent control) are shown in Figure 2.

The results of the herbicide test on Hygrophila shown in Figure 2 indicate, under the conditions of this test (rates and split treatment interval), there were four successful treatments. The successful treatments in the container trial were: (#1) 1.00 ppmw product Aquathol® K + 0.150 ppmw ae Hydrothol®191; (#6) 50 lbs product Aqua-Kleen® Herbicide per acre; (#7) 100 lbs product Aqua-Kleen® Herbicide per acre and (#8) 1.00 gal per acre Reward™ + 0.25 gal per acre Hydrothol® 191. All the treatment results are summarized in Figure 3. (Note the shallow depth of the treatment tanks when reviewing the Hardball® and Reward™ treatment rates, as these rates were on an acre-basis and not a ppmw-basis as were most of the other treatments in this study.)

The treatment numbers 1, 6, 7, and 8, described above, have now been taken to the field for further evaluation in canal systems in South Florida. These results will be reported at a later date.



Legend	Treatment #
1 A + 0.15 H	1
1.25 SP1022	2
0.5 Ren	3
0.5 HB + 0.25 K	4
0.5 Ren + 50 AK	5
50 AK	6
100 AK	7
1 Rew + 0.25 H	8
Con	9

Figure 3. Treatment results summary for the herbicide screening on Hygrophila.

[3]*The Federal Noxious Weed List was a provision of the Federal Noxious Weed Act of 1974 — Public Law 93-629 (7 U.S.C. 2801 et seq.; 88 Stat. 2148), enacted January 3, 1975, which established a Federal program to control the spread of noxious weeds.*

Melaleuca Trees Transform "River of Grass"

Using a modified frill and girdle method, the crew treated melaleuca with a herbicide mix.

Aquatic Vegetation Control Aims to Restore Infested Melaleuca Site

By Laura Engelson

Over the past 50 years, broad areas of the Everglades have been dramatically transformed from a pristine, nearly treeless "river of grass" to a thick "river of trees," where melaleuca trees and saplings grow as dense as 132,000 per acre. That's more than four times denser than the average corn field, which typically holds around 30,000 plants per acre. In fact, *Melaleuca quinquenervia* (common name: melaleuca) is now present on 450,000 acres in south Florida, threatening efforts to preserve and restore the state's precious Everglades.

An invasive, non-native plant, melaleuca has become abundant in pine flatwoods and cypress swamps throughout Florida. Melaleuca control efforts within the state cost more than $2.2 million annually. As of February 2004, Florida agencies had spent more than $35 million to control the noxious weed and are succeeding in areas such as Lake Okeechobee and Big Cypress National Preserve.

A Sly Invader

First brought to Florida from Australia in the late 1800s, melaleuca was widely used as an ornamental tree and soil stabilizer for levees and spoil islands. In the 1930s, melaleuca seeds were scattered by airplane over the Everglades in an effort to drain "useless swamps." Without natural enemies such as insects or viruses to keep the plant in check, melaleuca quickly spread beyond its initial planting areas. First reported in Everglades National Park in 1967, melaleuca spread to an estimated 488,000 acres in

South Florida by 1993. The invasive weed eventually colonized up to 20 percent of all natural land south of Lake Okeechobee.

Growing as high as 100 feet tall, melaleuca can produce up to 20 million windborne seeds per year per tree and hold viable seed for massive, all-at-once releases in times of stress. Seeds produced by melaleuca trees are retained in capsules, and any environmental stress (such as cutting or burning) can cause the capsules to release their seeds. Attempts meant to control melaleuca must factor in the staggering numbers of seedlings that will appear within months, as a single mature tree can hold up to 100 million seeds.

Melaleuca grows extremely fast — at a rate of 3 to 6 feet per year — producing dense stands that displace native plants, diminish animal habitat and provide little food for wildlife. A mature melaleuca tree can soak up about 150 gallons of freshwater a day, which can degrade waterways that help improve productivity at fisheries, help regulate runoff quantity and quality and act to mitigate flooding and control erosion.

The threat of fire is one of the greatest threats to people living near melaleuca stands. Fueled by oils in the plant's leaves, a fire in a melaleuca stand burns extremely hot and is difficult to extinguish. Furthermore, melaleuca trees are fire-adapted, which means that fire not only often fails to kill the trees, but actually promotes their spread by inducing the release of seeds and creating ideal soil conditions for seedling establishment.

Because no native North American animals feed on melaleuca, the plant gradually creates an ecological wasteland, where nothing exists but melaleuca trees. In the Everglades region, melaleuca primarily affects grass and sedge communities, known as graminoid marshes, which serve as homes to a diverse range of native animals. The habitat degradation resulting from invading melaleuca affects endangered species like the Cape Sable seaside sparrow, wood stork, snail kite, red-cockaded woodpecker and the Florida panther. Melaleuca forests may look completely natural, but their habitat quality isn't much better than a parking lot.

Restoring the Everglades

Four years ago, Florida's Palm Beach County acquired a 1,500-acre site, known as Lox Slough, in an effort to control exotic vegetation and restore pine flatwoods. Located in the Indian Trail Improvement District, an unincorporated community in Palm Beach County, the site was densely infested with melaleuca trees from 40- to 60-foot tall. The infestation affected the habitat of key species including the endangered red-cockaded woodpecker.

In 2003, the county contracted with Aquatic Vegetation Control (AVC) to address the melaleuca problem using key herbicide treatments. According to the USDA Agricultural Research Service and the South Florida Water Management District[1], herbicide control is currently the most practical method of limiting melaleuca expansion on state and federally owned lands.

To control melaleuca, AVC opted to use Habitat herbicide, which controls target weeds by affecting enzymes found only in plants – not birds, mammals, fish, insects or humans. And, the herbicide breaks down quickly in water and in the soil, allowing desirable vegetation to germinate and repopulate a treated site. Because it is considered a low-volume herbicide, it provides more control of invasive weeds with less chemical load on the environment compared to other herbicides.

"We use Habitat because it's been proven through industry tests, client trials and our own applications to be the most effective herbicide on certain species, particularly melaleuca," said Jim Burney, president, Aquatic Vegetation Control. "The herbicide also helps us effectively control other invasive plants commonly found in south Florida like Brazilian pepper."

The county first treated the Lox Slough site with an aerial application of Habitat, using helicopters to treat dense melaleuca stands. AVC then brought in an 8-10 person ground crew to apply the herbicide around the edges of helicopter zones and work in more sensitive areas near housing developments. Labor intensive, manual herbicide applications continue to be effective for individual outlying trees and small tree stands.

Using a modified frill and girdle method, the crew treated melaleuca by cutting into the tree's cambium layer to remove a band of bark around the tree trunk. The herbicide mix, which includes an aqua-blue marker dye, is immediately sprayed onto the exposed ring around the tree trunk, or cambium layer, for maximum absorption.

Habitat works by inhibiting three key amino acids essential to plant growth. The herbicide translocates to the roots and shoots and inhibits a specific enzyme that causes the melaleuca to stop growing and slowly die as its nutrient reserves are exhausted.

Ensuring Long-Term Control

Once the melaleuca trees are treated with herbicide and decay, native trees and vegetation like pines, palmettos, cord grass, St. John's wort and Dahoon holly will return to establish the native, pine flatwoods community. In turn, the regrowth of natural habitat encourages the return of native animal species, such as bobcat, deer, fox, gopher tortoises, hawks, raccoons, owls, rattlesnakes and quail.

Sites are typically revisited one month after an initial herbicide treatment to check the treatment and make any necessary touch ups. Within a year, control of melaleuca on treated sites is 95 percent or better. If needed, a follow-up herbicide spray is conducted, and return visits are scheduled on a semi-annual basis to ensure the site remains free of melaleuca.

For questions, contact

Laura Engelson, (612) 455-1788, lengelson@psbpr.com or

Padilla Speer Beardsley,
1101 West River Parkway, Ste. 400, Minneapolis, MN 55415

Footnotes

[1] "The Area-wide Management Evaluation of Melaleuca Quinquenervia: TAME Melaleuca." Dr. Paul D. Pratt, USDA-ARS and Amy Ferriter, South Florida Water Management District.

AQUAVINE

2005-2006 Native Plant & Service Directory is now available. If you haven't received a copy in the mail call the Association of Florida Native Nurseries (AFNN) toll free at 1-877-352-2366 or email them at info@afnn.org.

Scholarship Deadline Fast Approaching

The Florida Plant Management Society Scholarship and Research Foundation Inc.

Announces the availability of the following scholarship.

- **WILLIAM L. MAIER JR.: MEMORIAL SCHOLARSHIP**
  - Provides up to $1,000 to a deserving student that meets a series of eligibility requirements. Submission deadline: August 1, 2006.

  To apply for the cholarship please contact Don Doggett, PO Box 60005, Ft. Myers, FL 33906 (239) 694-2174.

Calendar

June 4-9,2006. American Society of Limnology and Oceanography, Victoria, BC. www.aslo.org

June 5-8, 2006. Florida Lake Management Society (FLMS) Annual Meeting St. Augustine, FL. www.flms.net

July 16-19 2006. Aquatic Plant Management Society (AMPS) 46th Annual Meeting Portland, OR. www.apms.org

August 16-18, 2006. South Carolina's APMS Meeting. Springmaid Beach Resort, Myrtle Beach , SC. www.scapms.org.

Student Paper Contest

The Aquatic Plant Management Society is soliciting **student papers** for their upcoming 46th Annual Meeting to be held **July 16-19, 2006**, at the Portland Marriott Downtown Waterfront Hotel in Portland, Oregon. For more information about the contest, please contact:

Dr. Mark A. Heilman,
SePRO Research and
Technology Campus.
16013 Watson Farm Seed Road.
Whitakers, NC 27891.
E-mail: markh@sepro.com
Phone: (252) 437-3282 x223

FAPMS Aquatic Plant Manager of the Year, 2006 Applications Being Accepted

This award is designed to provide a means to recognize outstanding achievements in aquatic plant management field activities and to enhance professionalism in aquatic plant management activities in Florida. Award nominees must be active members in FAPMS and directly involved in aquatic plant management field activities. Those involved exclusively in an administrative capacity or employed in the chemical or equipment manufacturing and distribution industries are NOT eligible for this award. The winner of this award will receive an engraved plaque and $100.00 check. Nomination forms can be obtained from the "Manager of the Year" link on the FAPMS website (www.fapms.org). All nominations must be submitted to Mitch Morgan by October 15, 2006. Fax: 352-334-3110 or email (morganmm@ci.gainesville.fl.us).

Valent U.S.A. Corporation

Valent U.S.A. Corporation's Bispyribac 80 SP has been granted an Experimental Use Permit (EUP) which will allow large-scale testing in aquatic areas in Alabama, Florida, Georgia, Indiana, South Carolina and Texas. Valent's main EUP efforts for 2006 will focus on testing the product in Florida's aquatic areas. For more information contact Lauren Daniel, (901) 523-2000 (ldaniel@archermalmo.com) or Lori L. Theine, (847) 968-4719 (lori.theine@valent.com).

Need An Aquatic Plant Permit?

If you need to apply for an aquatic plant permit or need an update on your aquatic plant removal laws, contact your state's bureau of invasive plants. In Florida, contact Rob Kipker (Rob.kipker@dep.state.fl.us), webpage: www.dep.state.fl.us.

Florida Aquatic Plant Management Society

Membership Application

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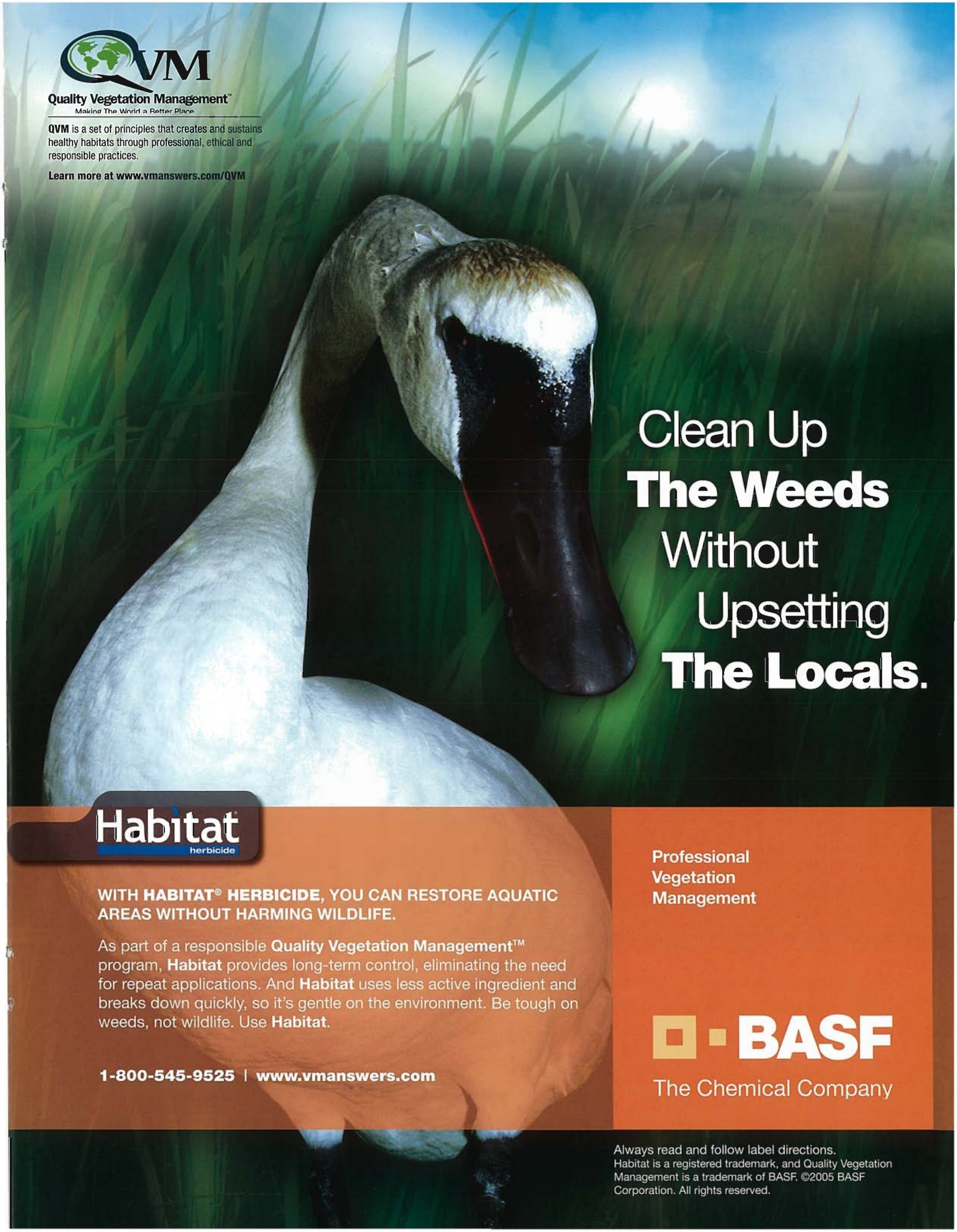
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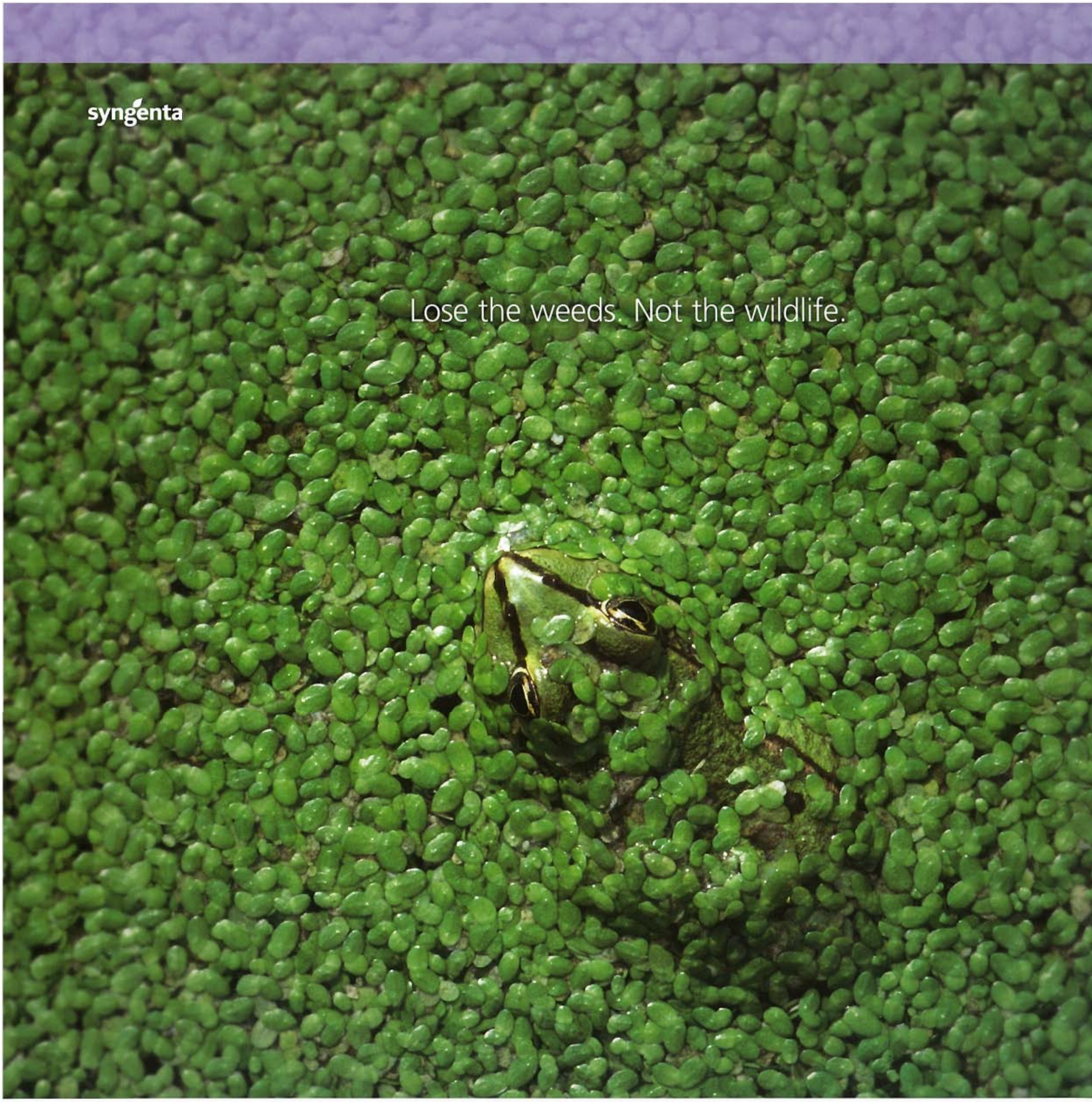
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