COVER STORY

MANAGING AQUATIC WEEDS

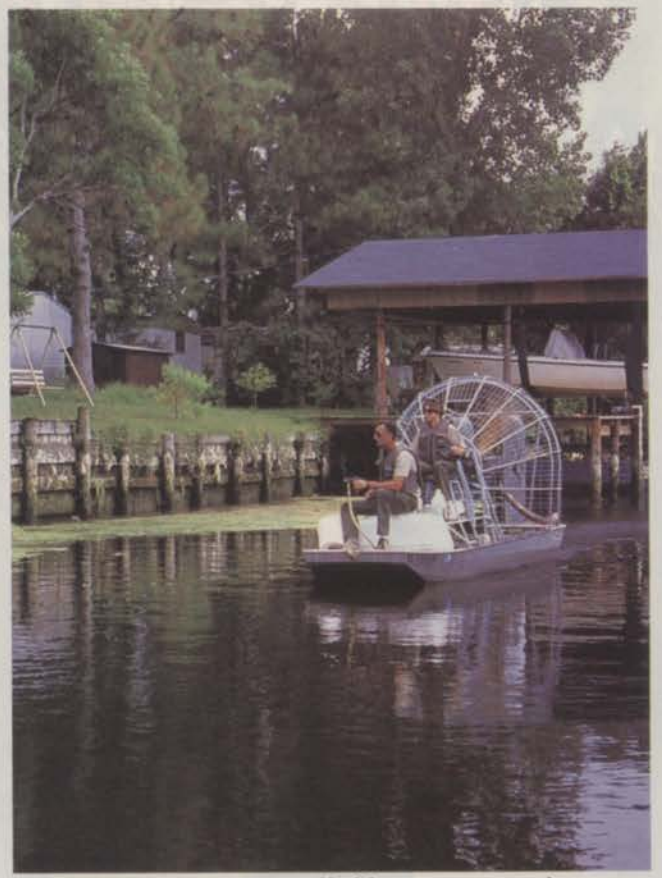
A challenge of the '90s will be to achieve a realistic balance between habitat requirements and the public's concern for recreational access and lake aesthetics.

by Joe Hinkle, Florida Dept. of Natural Resources

Aquatic vegetation growth can be one of the most frequent and frustrating problems associated with living on or near a body of water.

Plant or algae growth can be seen as destroying the aesthetic value and health of a body of water. While this is sometimes true, a little public and professional education on the value and importance of aquatic habitat could eliminate many perceived "weed" problems.

In natural bodies of water, several hundred species of native plants rarely produce population levels that would be considered a nuisance. These aquatic plants and algae function as primary food producers and, in natural systems, should cover 10 to 40 percent of a water body to provide optimum habitat for fish and wildlife.



Filamentous algae is controlled by copper complex, diquat dibromide, simazine, endothall and triploid grass carp.

Ideal vegetation

The ideal vegetation coverage would have intermediate native plant densities and be composed of a high diversity of submersed and emergent plants, with some planktonic algae present in the water column.

Yet even "good" aquatic plants become weeds when their populations become detrimental to fish and wildlife or restrict the intended use of a water body. Defining excessive plant growth depends on many factors, such as type of water body, intended use and geographic location.

The major causes of aquatic weed infestations include:

New plant species. Preventing the introduction of new plant species is the most important factor in weed management.

Many times these species dramatically expand their populations due to the lack of natural enemies that would normally regulate excessive plant growth. In addition, these exotic plants usually have growth adaptations that allow them to out-compete the native species.

This loss of native plant diversity through "unfair" competition results in an unstable monoculture that is not beneficial to fish, wildlife or use of the resource.

Encourage homeowners to leave native shoreline vegetation alone. Clearing the shoreline may promote less beneficial exotic plants that are usually more difficult to manage. And tell them about the potential problems of introducing exotic plants to the lake.

Inorganic fertilizers, organic litter and other pollutants introduced through poor watershed drainage patterns can contribute to uncontrolled plant growth. Berms and swales can be used around the shoreline to trap nutrient sources before they reach the water body.

Organic pollutants. Other sources of organic fertilizers for plant and algae growth are waste products from domestic animals in rural areas and domestic waterfowl in urban locations.

Lack of wind. Artificially-created waters should be built with the long axis of the pond oriented to take advantage of prevailing winds. This will provide natural aeration and discourage floating plants. Water bodies surrounded by extensive areas of brush and trees hinder natural wind aeration and can encourgae species such as duckweed.

Shoreline vegetation. Increasing the slope of land banks can discourage shoreline vegetation, and overall deeper water depths will discourage growth of submersed plants.

Poor fish management. Improperly conducted fish management practices such as pond fertilization, liming, overfeeding and overstocking can increase available nutrients, resulting in accelerated plant growth.

TABLE 1.

PROBLEMS ASSOCIATED WITH EXCESSIVE PLANT GROWTH

*Restricts recreational and navigational pursuits
*Decreases sportfish harvest
*Stunts sunfish populations
*Interferes with largemouth bass and bluegill feeding
*Increases cannibalism in largemouth bass
*Increases susceptibility of largemouth bass to anglers
*Causes extreme daily fluctuations in temperature, oxygen and pH, which can result in fish kills
*Reduces revenue because of decreased recreational use and a perceived decrease in property values by lakefront property owners

BENEFITS OF A MAINTENANCE PROGRAM

*Less use of herbicides in chemical programs
*Reduction in management costs
*Less organic matter decomposition on the lake bottom
*Reduction in complaints from the public
*Increased recreational use and revenues
*Reduction of environmental impacts associated with excessive plant growth

BENEFITS OF A QUALITY ENVIRONMENT

*An abundance of invertebrate foods such as insects, snails, grass shrimp
*More small fish
*Increased survival of young-of-the-year largemouth bass
*Increased sport fish population
*More spawning areas for certain fish species
*Oxygen production
*Sediment stability
*Food and cover for waterfowl

Having exhausted all the possibilities for prevention—or at least limiting the factors that contribute to weed problems—the next step is to develop a management strategy. Since it is usually impossile to eliminate "weed species," the next-best solution is low-level maintenance of these plants.

Known nuisance exotic plants should be managed as soon as they are detected in a water body. However, native species should be managed only when they reach populations which restrict navigation, the intended use of the water, or are a bio-

Granular herbicide applied to hydrilla plants.

Aquatic troops serve the biological battle plan

Native aquatic plants have natural biological deterrents which normally regulate plant growth. The best biological control program would be to locate natural pests from their native region for each particular problem species.

Benefits of host-specific biocontrol agents include:

- Long-term control, which is not labor intensive;
- Elimination of non-target impact to beneficial plants;
- Reduced public apprehension by elimination of herbicide use.

Florida's best example of a successful bio-control agent is the alligator weed flea beetle (*Agasicles hygrophilia*), which has reduced that species from a major problem to a minor nuisance without impacting non-target habitat.

Agents released for water hyacinth control include two weevils (*Neochetina*), a fungus (*Cercospora*), and the water-hyacinth mite (*Orthagalumna*).

A weevil (*Neohydronomous affinis*) has recently shown promise for management of water lettuce, and will continue can be used. A permit is required in Florida as well as many other states. It may be prohibited entirely in some states.

Although the grass carp will not manage all species of aquatic plants, it can control a wide variety of species and, if stocked in sufficient numbers, is likely to remove all vegetation from a water body.

Benefits of grass carp control include low cost, little increase in algae, no unpleasant decaying vegetation, no water use restrictions and long-term control.

Adverse factors associated with a grass carp management program include minimal selection of plant species removed, loss of beneficial native plants, and the adverse effects of total elimination of submersed plants on fish populations.

Stocking rates for grass carp can vary from a few fish per acre to over 100 per acre depending on the management approach, plant type, plant biomass and the length of the growing season. —*Joe Hinkle*□

Control products are diverse, effective

Aquatic herbicides are the mainstay for many management programs, having the potential for relatively rapid control of many problem species.

Advantages of herbicide control include moderate cost, selectivity for site and plant type, and less elimination of vegetation.

Drawbacks to herbicide use include public apprehension of chemicals, water-use restrictions, nutrient release into the water, unpleasant appearance from decaying vegetation, and in a few cases, toxicity to non-target organisms.

Major herbicides used in aquatic plant control include copper sulfate, copper complexes, 2, 4-D, diquat dibromide, endothall, glyphosate, fluridone, simazine and dichlobenil.

Table 3 provides a listing of the major companies which can be contacted to provide current labeling information. Since many companies may not normally provide special local need labeling, it is advisable to specifically request it for your region.

Environmental factors such as water temperature, pH, carbonate hardness, turbidity, and water movement can have consequential effects on both efficacy and toxicity to non-target organisms.

The contact herbicides diquat dibromide, copper, and endothall are usually recommended to be used when temperatures are a minimum of 60°F. The systemic 2,4-D can be effective at lower temperatures but the rate normally is increased to offset slow plant growth. Labeling for simazine products recommend treatment before 75°F to avert fish kills resulting from low oxygen levels from rapid dieoff of vegetation.

Uptake of 2,4-D and Rodeo is more effective at a pH of around 6; uptake decreases as pH rises.

Toxicity and efficacy of copper sulfate increases as carbonate hardness drops below 50 ppm; however, the complexes of copper are not as susceptible to hardness level variations.

The use of diquat dibromide should be avoided in areas of high turbidity due to reduced herbicide activity from the product being tied-up on mud and clay particles.

—*Joe Hinkle*□

TABLE 2.

PLANT SUSCEPTIBILITY

Plant	Copper Complex	Diquat Dibromide	Amine 24D	Ester 24D	Simazine	Fluridone	Dichlobenil	Glyphosate	Endothall	Triploid Grasscarp
Algae, Filamentous	•	•			•				•	•
Algae, Planktonic	•	•	—	—	•	—	—	—	•	—
Alligator Weed	—	—	•	•	—	•	•	•	—	—
Arrowhead	—	—	•	•	—	•	—	—	—	•
Azolla	—	—	—	—	—	•	—	—	—	•
Banana Lily	—	—	—	—	—	—	—	—	—	•
Barnyard Grass	—	—	—	—	—	•	—	•	—	—
Bladderwort	—	•	—	•	—	•	•	—	—	•
Bog Moss	—	—	—	—	—	—	—	—	—	•
Bullrush	—	—	•	•	—	•	—	—	—	—
Bureed	—	—	—	—	—	—	—	—	•	—
Cattail	—	•	•	—	—	•	•	•	—	•
Chara	•	—	—	—	•	—	•	—	•	•
Coontail	—	•	—	•	•	•	•	—	•	•
Cut-Grass, Giant	—	—	—	—	—	•	—	•	—	—
Duckweed, Lemna	—	•	•	•	•	•	—	—	—	•
Eel-Grass	—	—	—	—	—	•	•	—	•	—
Elodea	•	•	—	—	—	•	•	—	•	•
Fanwort	—	—	•	•	•	—	—	—	—	•
Frog's-Bit	—	—	•	—	—	—	—	—	—	—
Hydrilla	•	•	—	—	—	•	•	—	•	•
Hygrophila	—	—	—	—	—	—	—	—	—	•
Loosestrife, Purple	—	—	—	—	—	—	•	•	—	—
Lotus, American	—	—	—	—	•	•	—	•	—	—
Maidencane	—	—	—	—	—	•	—	•	—	•
Milfoil	—	•	•	•	•	•	•	—	•	•
Naiad	•	•	•	—	•	•	•	—	•	•
Nitella	•	—	—	—	—	—	—	—	—	•
Nutsedge	—	—	—	—	—	—	—	•	—	—
Paragrass	—	—	—	—	—	•	—	•	—	—
Parrot-Feather	—	—	•	•	—	•	—	—	—	—
Pennywort	—	•	•	•	—	—	•	—	—	—
Phragmites	—	—	—	—	—	—	—	•	—	—
Pickerelweed	—	—	•	•	—	—	—	—	—	•
Pondweed	—	•	—	—	•	•	•	—	•	•
Salvinia	—	•	—	—	—	•	—	—	•	•
Smartweed	—	—	•	•	—	•	—	•	—	—
Spatterdock	—	—	—	•	—	•	•	•	—	—
Spikerush, Slender	—	—	•	—	—	•	—	—	—	•
Torpedo Grass	—	—	—	—	—	•	—	•	—	—
Vaseygrass	—	—	—	—	—	—	—	•	—	—
Water Chestnut	—	—	—	•	—	—	—	—	—	—
Water Primrose	—	—	•	•	—	•	•	•	—	—
Water-Grass, Southern	—	—	—	—	—	•	—	—	—	•
Water-Lettuce	—	•	—	—	—	—	—	•	•	—
Water-Meal	—	—	—	—	•	•	—	—	—	—
Water-Paspalum	—	—	—	—	—	•	—	—	—	—
Water-Shield	—	—	—	•	—	—	—	—	—	•
Water-Willow	—	—	—	—	—	•	—	—	—	—
Waterhyacinth	—	•	•	•	—	—	—	•	—	—
Waterlily, Fragrant	—	—	•	•	—	•	•	—	—	•
Widgeongrass	—	—	—	—	—	—	•	—	—	•
Willow	—	—	•	•	—	—	—	•	—	—

logical detriment to the system.

Program tools

The most important first steps in a management program are to (1) become familiar with the most common species of nuisance plants and (2) conduct regular inspections of the entire water body to provide early detection of these potential weed problems. Plant species will dictate the availability and effectiveness of control measures.

Plant identification is usually available through a state university, state conservation agency, or a county extension agent.

Mechanical harvesting of aquatic plants can be a highly selective method of management that provides immediate results, removes nutrients from the lake system and does not have water use restrictions associated with the operation. However, this type of control is usually time consuming, expensive, short term, has the potential to spread small infestations of troublesome exotics to other locations, and can result in loss of food fish and juvenile sport fish.

Harvesting disadvantages

The logistics and expense associated with commercially-made mechanical harvesters severely limit their compatibility with a small lake control program.

However, in small lakes, physical hand removal or cutting combined with early detection can be an effective and inexpensive way to control new infestations of floating plants (such as water hyacinth) or emergent plants (such as cattails).

Mechanical control may be the only available option for plant control in water bodies with a high degree of water exchange that may decrease herbicide contact time below minimum levels for efficacy.

A water control structure is a desirable feature to be designed into new water bodies. The feature should incorporate an overflow system which removes organic-rich and low oxygenated bottom water.

De-watering large sections of the lake bottom will solidify suspended mud and consolidate bottom sediments, which can improve fish spawn-

Aeration benefits virtually unlimited

Aeration is a relatively new plant management technique that can be a preventive and/or control measure.

Eutrophication is a common problem associated with water bodies in urban areas. Aeration can help eliminate such undesirable characteristics as fish kills from oxygen depletion, blue-green algae blooms and odors.

One of the main functions of aeration is to eliminate thermal and dissolved oxygen stratification. Studies indicate that total lake aeration can also decrease water quality parameters such as pH, iron, hydrogen sulfide (rotten egg smell), total nitrogen, ammonia and turbidity. Dissolved oxygen concentrations in water near the bottom and water transparency increase with lake aeration.

Effective on blue algae

Aeration does not significantly change primary production of algae. However, aeration impact on oxygen, pH, temperature and alkalinity can result in population shifts from troublesome blue-green algae to a more diverse population of green algae.

Aeration is not a cure-all or quick fix to eutrophication and algae problems. Benefits from the process nay not be observed for more than a year after the program is begun, and may have to be continued for several years to maintain desirable results.

Aeration systems that are designed to deliver air to a grid or diffusers near the lake bottom are usually a more cost effective and efficient system than systems which agitate or move water.

—Joe Hinkle□

TABLE 3.

HERBICIDE COMPANIES

COMPANY	STREET ADDRESS	CITY	STATE ZIP CODE
A & V, Inc.	N62 W22632 Village Dr.	Sussex	WI 53089
Agrolinz, Inc.	1755 N. Kirby, Suite 300	Memphis	TN 38119-4393
Allstates Chemical Corporation	P.O. Box 619	Katy	TX 77449
American Cyanamid Company	P.O. Box 400	Princeton	NJ 08540
Applied Biochemists, Inc.	5200 West County Line Rd	Mequon	WI 53092
Aquacide Company	1627 Ninth Street	White Bear Lakes	KT 55110
Aquashade, Inc.	P.O. Box 198	Eldred	NY 12732
Bada Company	P.O. Box 1908	Casselberry	FL 32707
Certified Laboratories	P.O. Box 2493	Fort Worth	TX 76113-2493
Ciba-Geigy Corp.	P.O. Box 18300	Greensboro	NC 27419
Dow Chemical Company	P.O. Box 1706	Midland	MI 48640
E.I. DuPont De Nemours & Co., Inc.	Walker's Mill Building	Wilmington	DE 19898
Elanco Products Company	P.O. Box 708	Greenfield	IN 46140
Excel Chemical Co., Inc.	2385 Corbett. St.	Jacksonville	FL 32204
Great Lakes Biochemical Co., Inc.	6120 W. Douglas Ave.	Milwaukee	WI 53218
Griffin Corp.	P.O. Box 1847	Valdosta	GA 31603-1847
Inter-Ag Corp.	5100 Poplar Ave.	Memphis	TN 38137
Lesco, Inc.	P.O. Box 16915	Rocky River	OH 44116
Lubar Company	1700 Campbell	Kansas City	MO 64141
Walter International Corp.	P.O. Box 6099	New Orleans	LA 70174
Mantek	P.O. Box 660196	Dallas	TX 75266
Momar, Inc.	P.O. Box 19567 Station N	Atlanta	GA 30325
Monsanto Agricultural Products Co.	800 N. Lindbergh Blvd.	St. Louis	MO 63166
National Chemsearch	2727 Chemsearch Blvd.	Irving	TX 75062
Oxford Chemicals	P.O. Box 80202	Atlanta	GA 30366
PBI Gordon Corporation	P.O. Box 4090	Kansas City	MO 64101
Pennwalt Corporation	Three Parkway	Philadelphia	PA 19102
Rhone-Poulenc Ag Company, Inc.	P.O. Box 12014	Research Triangle	NC 27709
San-Mar Laboratorie	P.O. Box 93188, Martech Sta.	Atlanta	GA 30381
Sandoz Crop Protection Corp.	1300 East Toughy Ave.	Des Plaines	IL 60018
Selig Chemical Industries	840 Selig Dr. SW	17.3/19.9x36.10Atlanta	GA 30336
Sentry Chemical Company	P.O. Box 748	Stone Mountain	GA 30086
State Chemical Manufacturing Co.	3100 Hamilton Ave.	Cleveland	OH 44114
Tennessee Chemical Co.	3475 Lenox Road N.E. Ste 670	Atlanta	GA 30326
UniRoyal Chemical Co., Inc.	74 Amity Road	Bethany	CT 06525
Valent U.S.A. Corporation	1333 N Calif. Blvd. Ste. 600	Walnut Creek	CA 94596-8025
Van Water & Rogers, Inc.	Subs. of Univar, 2256 Junt.	San Mateo	CA 95131
Venus Lab., Inc.	855 Lively Blvd.	Wooddale	IL 60191

ing and decrease nutrient availability for plant growth.

Proper timing

Proper timing (fall-spring) and adequate exposure (1/2 to 2/3 of the lake) are necessary for an effective program. An improperly conducted program may encourage expansion of the present problems or allow new species to establish.

In conjunction with a drawdown program, burning the shoreline vegetation and dredging can be integrated into the program.

Burning is limited mainly to cattail, brush and other types of emergent plants. In many cases, it provides a more desirable cover along shorelines by encouraging grass species.

Lakes can be dredged to eliminate accumulated organic matter and restore original depth, while at the same time removing problem vegetation.

Revegetation of shoreline plant communities has become common in many parts of Florida as a result of mitigation programs, for simple aesthetic improvement, or for the enhancement of fish and wildlife habitat. Plantings can also help stabilize shorelines and provide competition to help restrain problem exotic species.

Aquascaping

In aquascaping, nursery stock of native plants (free from contamination by exotic species or problem native species) is preferred. Selection of plants from the wild should be limited to areas which are not infested

with non-native species, and which have adequate plant numbers to compensate for the loss of some. Commonly-used species include bullrushes, sedges, iris, cordgrass, canna, pickerelweed, arrowheads and waterlilies.

For the aquascaping program to be a success, the planted area has to be free of exotic plants and troublesome native plants such as cattails. This may require detailed herbicide application or simple hand removal.

Regulations and permits

Various state and federal agencies may regulate many of the aquatic plant manager's techniques and tools. In addition to following all the aspects of U.S. EPA labeling instructions for herbicides, there may be state agencies which regulate activities related to:

- Pond construction
- Lake drawdown
- Burning

Clearing the shoreline may promote the establishment of less beneficial exotic plants, which are usually more difficult to manage.

- Dredging bottom material associated with mechanical plant harvesting
- Herbicide use, record keeping, and labeling
- Certification of herbicide applicators
- Vegetation removal and planting
- Importation, cultivation or transporting aquatic plants
- Stocking of non-native fish

With existing management tools, the capability exists in many small and large lakes to eliminate all aquatic vegetation. The challenge of the '90s will be twofold. One, to resolve the question of what vegetation types and abundance are essential for a healthy environment. Two, to use plant management techniques to achieve a realistic balance between habitat requirements and the public's concern for recreational access and lake aesthetics. **LM**

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