

# **THE AQUATIC PLANT MANAGEMENT SOCIETY, INC.**

**23rd ANNUAL MEETING  
ABSTRACTS**



**July 10-13, 1983  
LAKE BUENA VISTA, FLORIDA**

## Herbicidal Control of Aquatic Vegetation in Rangeland Dugouts

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The productivity of rangeland in the Prairie region of Canada can vary with the availability and distribution of fresh water. In Canadian ranching regions, watering facilities are generally man-made developments such as dams and dugouts which are fed by surface runoff from snowpack and spring rains. This surface runoff enriches the water with mineral nutrients and stimulates the growth of aquatic vegetation. This study has shown that fenac (Fenatrol) and fluridone (Sonar) provide effective, economical, and environmentally acceptable control procedures for aquatic vegetation management in rangeland dugouts.

## Explants of Hydrilla verticillata in Bioassays for Herbicides and Plant Growth Regulators

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Hydrilla verticillata can reproduce and grow by several vegetative means, one of which is formation of new lateral shoots from axial buds. The axial buds are located on nodes along the hydrilla stems. Pairs of nodes ("two-node explants") placed in a small volume of 1% Hoagland's medium will produce new lateral shoots within 5-7 days under proper conditions. Response of these explants to fluridone, sulfometuron, and various plant growth regulators is similar to responses of whole plants. Responses that have been quantified include (1) chlorophyll-a content, (2) new lateral shoot length, (3) frequency of new lateral production, and (4) senescence-type responses. This system can greatly reduce time and space required for early detection of potential herbicides and plant hormones.

Herbicide Residues in the Sacramento Delta Following Applications of Diquat and 2,4-D for Control of Waterhyacinth

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Applications of 2,4-D (2,4-dichlorophenoxy acetic acid, dimethylamine salt) were made to control waterhyacinth (Eichhornia crassipes) in the Sacramento Delta, California. Replicate water samples were taken before and after application inside and adjacent to sprayed plants. Analysis by high performance liquid chromatography (HPLC) showed that levels of 0.5-8.0 ppmw 2,4-D resulted immediately after application inside treated plots, and that levels adjacent and ca. 50-75 meters downstream did not exceed 0.016-.020 ppmw 30-90 min. after treatment. Concentration of 2,4-D in floating 500 ml entrapment bottles positioned under plant foliage ranged from .051 to 5.4 ppmw and averaged 1.047+.59 and 2.27+.80 ppmw in two separate applications. Results indicate that current federal tolerance for 2,4-D (0.1 ppmw) will not be exceeded adjacent to sprayed mats 1-2 h after treatment.

Activity of Naturally Occurring Hydrilla Growth Inhibitors

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Naturally occurring hydrilla growth inhibitors have been isolated from sediment of Lake Starvation in northwest Hillsborough County and other locations [cf. P. M. Dooris and D. F. Martin, Water Resource Bull., 16, 112 (1980)]. Separation of the aqueous extracts of HPLC yields two components, one of which is notably active in affecting the rate of photosynthesis and the rate of respiration of hydrilla leaves.

Hybrid Grass Carp in California: An Update on Research

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Hybrid grass carp are being tested in two southern California irrigation systems for their ability to control aquatic macrophytes and their impact on other components of the canal ecosystems. During 1982, all canal sections stocked with hybrid grass carp contained significantly fewer plants than enclosure-controls. Plant species controlled included hydrilla (Hydrilla verticillata), milfoil (Myriophyllum spicatum), sago pondweed (Potamogeton pectinatus), and curly-leaf pondweed (P. crispus). Research in 1983 includes refinements in required stocking densities, sterility evaluation, movement studies, and comparative evaluations with surgically sterilized grass carp.

Wing Muscle Development in Waterhyacinth Weevils

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Field collected adult waterhyacinth weevils, Neochetina eichshorniae and N. bruchi, were dissected biweekly to monitor the condition of the flight muscles. The percentage of weevils with fully developed flight muscles thus able to fly varied between species and seasonally. Laboratory experiments were conducted to determine the factors responsible for flight muscle development.

The Efficacy of the 1981 Hybrid Grass Carp at Weed Control

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The morphological comparison between the 1981 hybrid grass carp and the 1979 and 1980 hybrid grass carp and 1980-81 grass carp revealed that the 1981 spawn was more uniform, had fewer deformities, had a longer gut length, and better formed gill rakers; however, due to the higher efficiency of food conversion it consumes less vegetation than other spawns. In several small pond trials, the 1981 hybrid grass carp failed to control hydrilla, even when the plant biomass was reduced with herbicide. The 1981 hybrid grass carp is considered to lack the ability to become a weed control agent for noxious submersed aquatic plants.

Prediction of Chlorophyll a Concentrations in Lakes:  
The Importance of Aquatic Macrophytes

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An analysis of chlorophyll a data from Lake Baldwin and Lake Pearl, Florida demonstrated that chlorophyll yields were reduced as the percentage of the lake's total volume infested with aquatic macrophytes increased. Using data collected from a survey of 32 Florida lakes having a wide range of limnological characteristics, we demonstrate that predictions of chlorophyll a concentrations can be improved by including a term for the percentage of the lake's total volume infested with macrophytes in existing nutrient-chlorophyll models. An analysis is presented which assesses the potential effect of aquatic macrophytes on chlorophyll yields and Secchi disc transparencies in lakes of different trophic status.

The Efficacy and Environmental Impact of Hybrid Grass Carp on  
Lake Jasmine, Florida: First Year Post-stocking Results

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Data on aquatic vegetation biomass, water quality, and other environmental parameters will be presented in relation to the use of hybrid grass carp for aquatic weed control in Lake Jasmine, Florida. Additional information regarding the efficacy of hybrid grass carp for aquatic weed control at other sites in Lee County, Florida will also be presented.

Status of Development of Cercospora rodmanii as a  
Biological Control Agent for Waterhyacinth

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Cercospora rodmanii (CR) is undergoing experimental evaluation for possible registration as a microbial herbicide for waterhyacinth. A CR formulation, produced by Abbott Laboratories, yielded 99 percent control when used in combination with insect biocontrol agents. Control was achieved seven months after spraying CR. The feasibility of using CR in an operational waterhyacinth management program is being studied. Also, a combination of CR and a sublethal rate of 2,4-D is being field-tested for possible augmentation of disease severity by 2,4-D.

EPA Update

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Protection Agency, Region IV, Atlanta, Georgia 30365

Considerable controversy, allegations and resignations have occurred in the Environmental Protection Agency during the year. The intense media scrutiny may have created the perception that the Agency has become paralyzed and that work was halted. This is not true. Rather than being mired in inaction, the Agency is in full gear. Concrete accomplishments and positive progress will be examined.

A Ropewick Applicator for Ditchbanks

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Application of herbicides by ropewicks has gained wide acceptance on cropland and on roadsides. However, applicators developed for these sites are not well suited to the uneven, sloping terrain characteristic of most ditchbanks. We are developing and evaluating a ropewick applicator for ditchbanks that consists of dangling ropes that terminate in a brush for wiping the herbicide solution onto plants. A 1:2 mixture of Roundup® and water applied through the ropewick controlled 95% of the reedn canarygrass and released redtop, a desirable ditchbank grass.

Aeration of a Small, Hypereutrophic Florida Lake: Changes  
in Physical-Chemical Parameters, Primary Production  
and Phytoplankton Standing Crops

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A multiple inversion aeration system installed and operated for 2 years in an 11.3 ha. lake in Hillsborough County Florida eliminated thermal stratification, hopolimnetic oxygen deficits and H<sub>2</sub>S concentrations. Nutrient concentrations (N and P compounds) were stabilized at the lower ends of ranges observed during pre-aeration sampling. Metals chemistry showed reduction in iron and slight increases in other compounds (K, Ca, Na, Mg). Primary productivity did not change between pre- and post-aeration sample periods but chlorophyll *a* concentrations and phytoplankton cell volumes were reduced markedly and monospecific blooms were eliminated.

Detritus Production and Decomposition of the  
Waterhyacinth (Eichhornia Crassipes)

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Waterhyacinth detritus production was found to be dependent on plant standing crop and nitrogen availability: dense, nitrogen-enriched plants produced four times as much detritus as sparse, nitrogen deficient plants. Nitrogen availability also influenced waterhyacinth decomposition, primarily by affecting the root/shoot ratio and nutritive quality of the plant substrate. Plant morphological and nutritive characteristics may thus be used as a management tool in determining sedimentation and nutrient release beneath both natural and herbicide-treated waterhyacinth stands.

A New Look at the Striped Mullet, Mugil cephalus L., as a Potential Biological Control Agent for Algae

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Although the Striped Mullet has shown some potential as a biological control for filamentous algae, poor survival after capture and transport made the fish unacceptable. The use of a fish tranquilizer, quinaldine, greatly improved the survivability after capture with electrofishing gear. Survival as great as 97% was achieved. The fish appeared to have controlled a dense filamentous algae bloom in an experimental pond on the UCF campus in less than eight months at the rate of 150 fish per acre.

Hydrilla Consumption by Hybrid Grass Carp Related to Water Temperature and Size Class of Fish

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Imperial Irrigation District, USDA Imperial Valley Conservation  
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During 1982 field trials, plant biomass consumption by stocked hybrid grass carp (Ctenopharyngodon idella X Aristichthys nobilis) may have varied with size class of fish and with canal water temperature. Laboratory investigations were conducted to determine the relationship between water temperature (18° to 30° C) and Hydrilla consumption for 200, 250, and 300 mm size class hybrid grass carp. Results were placed on percent body weight per day basis.

Requirements to Register Rodeo® Herbicide for Aquatic Uses

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Rodeo® herbicide was recently registered by the EPA for use on emerged aquatic weeds. The approved label allows the broadest use of a herbicide on aquatic sites that has ever been granted. This registration is supported by an extensive data base that demonstrates a low level of potential toxicity to animal life and the environment. This presentation reviews the requirements for registration of Rodeo®, and some of the conclusions drawn from the supporting research data.

Seasonal Biomass Patterns of Hydrilla verticillata and Egeria densa in Impoundments in Piedmont, North Carolina

G. J. Pesacreta,<sup>1</sup> D. Schiller,<sup>2</sup> R. Hodson,<sup>1</sup>  
S. Harlan,<sup>1</sup> and G. Davis,<sup>3</sup>  
Department of Zoology,<sup>1</sup> N. C. State University  
Carolina Power and Light Company<sup>2</sup>  
Department of Biology,<sup>3</sup> East Carolina University  
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Hydrilla breaks up and dies back in early winter with renewed growth from tubers and turions beginning in the spring. Egeria remains green and grows throughout most of the year with some decrease in biomass in early winter.

Silicone Benthic Barriers: A New Concept in Aquatic Weed Control

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The Dow Gardens and Dow Corning Corp.  
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Various materials have been used to control nuisance aquatic weed growth by shading and/or compression (Armour et al., 1979; Born et al., 1973; Lewis et al., 1982; Mayhew and Runkel, 1962; Perkins, 1980; Pullman and Craig, 1980; Cooke, 1983). From these studies it is clear that the ideal benthic barrier for aquatic weed control must be opaque, penetrable by benthic generated gases, negatively buoyant, easy to install, durable, and impenetrable by the vegetative portions and roots of aquatic weeds. Silicone benthic barriers possess all of these characteristics. Light penetration and diffusivity data will be presented. Comments on the 1982 field trials will also be offered.

Removal of Nutrients from a Simulated Wastewater Using Aquatic Macrophytes

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Potential of selected aquatic macrophytes to reduce nitrogen and phosphorus levels of wastewaters was evaluated in 100 aquaculture systems at a water residence time of 7 days. Plants studied include waterhyacinth (Eichhornia crassipes), pennywort (Hydrocotyle umbellata), water lettuce (Pistia stratiotes), salvinia (Salvinia rotundifolia), giant duckweed (Spirodela polyrhiza), common duckweed (Lemna minor), azolla (Azolla caroliniana), and elodea (Egeria densa). Nitrogen was found to be significantly correlated with the growth rate of aquatic plants, while phosphorus removal was found to be independent of plant type.

A Review of Cutrine-Plus Field Evaluations, Labeling and Uses

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Field evaluations with Cutrine-Plus algaecide over the past ten years have provided an expansion of label uses. Research has shown herbicidal activity against copper-sensitive macrophytes when used alone or tank mixed with endothal or diquat. EPA registration for use in irrigation conveyance systems and fish and shrimp aquaculture facilities have further increased its utility. New investigations with spray additives and thickeners incorporated into Cutrine-Plus show future promise.

Aquatic Plants and Wetland Disposal Areas

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This paper will discuss the findings of a project where treated wastewater is discharged into a wetland. The paper reviews in detail the type of aquatic plants that are being utilized in this wetland for the removal of nutrients from the wastewater. This project is one of the largest in nature as this wetland is successfully treating approximately 500,000 GPD. Data on uptake rates and types of plants will be presented.

Growth and Photosynthetic Rates of Phytoplanktonic Algae  
Following Treatment with Aquashade

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The influence of Aquashade on growth and photosynthetic rates for phytoplanktonic species of green and blue-green algae was measured under laboratory conditions. Algae grown in small volume batch cultures displayed decreased growth rates at 5-10 ppm Aquashade. Photosynthetic rates decreased when cultures received the light passing through a 1 m column of water treated with 1-3 ppm Aquashade.

Modelling the Growth of the Filamentous Algae  
Pithophora oedogonia

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and Department of Botany & Plant Pathology,  
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The seasonal growth of Pithophora was modelled for an Indiana lake using a modification of the Michaelis-Menton or Monod-type function relating growth to external nutrient concentration. Data on nutrient (N and P) levels and temperature collected from the lake in 1979 and 1981 were used in conjunction with laboratory growth kinetics to predict seasonal Pithophora abundance. The usefulness of such a model in developing management schemes for this alga will be discussed.

Effects of Glyphosate on Hydrilla in Dewatered  
Irrigation Canals and Ponds

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Desiccation of plants during canal and pond drawdowns (48 to 72 hours duration) may be the limiting factor in glyphosate uptake by Hydrilla in low altitude desert climates. Results of greenhouse and field trials indicate glyphosate may provide control under ameliorated conditions.

Culture of Hydrilla in a Hydrosol Composed of Sand  
and Slow-Release Fertilizers

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Little information is available on the influence of nutrients in the hydrosol on growth and development of Hydrilla. A hydrosol was developed with sand and slow-release fertilizers as a means to regulate nutrient availability in the root zone of Hydrilla. Information will be presented indicating the influence of various nutrient concentrations on growth of Hydrilla.

Status Report of Sonar, 1983

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A technical report of Sonar use and performance after 1.6 years under an experimental use permit is presented. The data include efficacy of Sonar in lakes and ponds on target aquatic plant species, length of control, selectivity and product safety.

Production and Mortality of Aquatic Macrophytes as  
Measured by a Hierarchical Cohort Method

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Production and mortality of five macrophyte species were measured using a cohort method that includes mortality of individuals and sub-units. In two ponds studied, net production of the macrophyte population exceeded maximum standing crop (P/B max) by factors of 1.43 and 2.77 and mortality rates for those ponds were 0.80 and 2.83 g day<sup>-1</sup>. P/B max values of Potamogeton crispus and Najas flexilis, two dominant species, ranged from 1.30 to 1.64 and 0.83 to 2.20 respectively.

Evaluations of Controlled Release Herbicides  
for Aquatic Weed Control

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The efficacy of controlled release herbicide formulations in management of aquatic plant growths was evaluated by subjecting susceptible plant species to various concentrations of the released chemicals under flowing water conditions. Qualitative and quantitative measures of growth response provided estimates of the formulations' effectiveness.

Isozymes as Genetic Markers in the Study of Aquatic Plants

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Gel electrophoresis was employed to estimate allelic differentiation among taxa of weedy aquatic plants. Divergence was measured using Nei's genetic identity statistic (I). Little difference (I = 0.95) was found among populations of Hydrilla verticillata with the exception of one population from Washington, D.C. which possesses male flowers. Very little differentiation (I = 0.99) was found among the fanworts Cambomba caroliniana var. caroliniana, C.c. var. multi-partita, and Cambomba pulcherrima. A substantial amount of divergence (I = 0.886) was discovered among broad and narrow-stemmed forms of the alligatorweed Philoxeroides alternanthera.

Developmental Constraints: Effect on Rates of Population  
Growth in Waterhyacinths

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A comparison of ramet population growth rates in flowering and nonflowering populations of Eichhornia crassipes Solms., the waterhyacinth, indicates that inflorescence production is inversely correlated with clonal growth rate. The differences in patterns of resource allocation exhibited to the two populations are explained in terms of developmental constraints acting on the differentiation and growth of a limited meristem population. The meristem population is limited in size by the developmental morphology of the ramets.

Establishing Slender Spikerush (Eleocharis acicularis  
(L.) R. & S.) in Canals

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Four canals were each planted with four 4.8 ft<sup>2</sup> plots of sod of slender spikerush on April 14, 1982. After the canals were dewatered in September 1982, the slender spikerush in two canals was observed to be spreading. The successes were attributed to low water turbidity (62 NTUs and less) that occurred during the summer. By April 20, 1983, the average area in one canal had increased by 311% and was encroaching onto the aquatic weeds.