

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

**22nd ANNUAL MEETING  
ABSTRACTS**



**July 11-14, 1982  
LAS VEGAS, NEVADA**

**Target and Non-Target Effects of the Algicide  
PH 4062 in Small Ponds**

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Replicated applications of PH 4062 [N-(4 cyclohexylphenyl) -N', N'-diethylenediamine] in 6.5 x 114 m impoundments at 1.0 ppmw resulted in significant reduction of filamentous algae, but did not affect rooted vascular plants, planktonic unicellular algae, or *Chara* sp. Bioassays indicated that algicidal activity in the water was lost 4 to 7 days after treatment. Dissolved oxygen declined in the treated pond from ca 10-12 ppm to ca .5-1.0 ppm, but gradually increased to near pre-treatment levels 28 days after treatment.

**Performance of Aquatic Plant Biogas Systems**

Larry O. Bagnall, Institute of Food and Agricultural Sciences,  
University of Florida, Gainesville, Florida 32611

Waterhyacinth and hydrilla were harvested, processed and digested in seven different systems. Relative performance of the systems, in terms of gross and net energy production, processing requirements and operating requirements, were evaluated. Chopped waterhyacinth produced the most gas, but was the most difficult system to manage. Waterhyacinth juice was the easiest system to manage and showed the highest conversion of organic solids, but had one of the lowest gas production rates due to loss of the fibrous components of the plants.

**Current Research on the Identity of a Naturally Occurring  
Hydrilla-Growth Inhibitor**

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Services (CHEMS) Center, Department of Chemistry,  
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Investigations on the chemical identity of a naturally occurring hydrilla-growth inhibitor are being continued. The material can be isolated from sediment in Lake Starvation in Northwest Hillsborough County, Florida. This particular lake is notable for very poor growth of hydrilla. The extracts have been tested against *Scenedesmus obliquus*, *Chlamydomonas reinhardtii*, and lettuce seeds. The results of these and chemical studies will be discussed.

**Natural Desalinization of Water by Aquatic Macrophytes**

Robert W. Bosserman, Systems Science Institute/Biology Department,  
University of Louisville, Louisville, Kentucky 40292

Elemental concentrations in tissues of aquatic macrophytes were measured in Okefenokee Swamp, Georgia. Several plants, such as *Nymphaea*, *Nuphar* and *Pontederia*, had high concentrations of mobile cations: sodium, potassium, calcium, and magnesium. Dissolved cation concentrations in Okefenokee Swamp are low, so these plants must have concentrated the cations across large gradients. This ability to sequester cations suggests that these plants may be useful for removing salts from water. Combined with harvesting techniques, cultivation of aquatic macrophytes may be a useful management strategy for desalinizing water for irrigation and other purposes.

### **Impact of Selected Habitat Control on Fisheries and Macrophyte-Periphyton Communities**

Chris C. Carter and Russell F. Theriot, Center for Aquatic Weeds, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611

Selective chemical treatments to encourage fisherman use of maidencane beds (*Panicum hemitomon* Schul.) surface matted with *Hydrilla verticillata* Royle were investigated in Orange Lake, Florida. Creel data indicated a greater fish catch can be expected in maidencane in which hydrilla has been controlled. Fisherman use also reflected a preference for the treated sites. No adverse environmental effects were observed within the maidencane periphyton community as normal seasonal trends continued.

### **Cattail and Water Hyacinth Control in Irrigation Reservoirs in Mexico**

Tom Camp, Ecolotecnica Div. of Aquatic Management Co., 5033 N. 66th Ave., Glendale, AZ 85301

Two 100 hectare agricultural irrigation systems contained water hyacinth (*Eichhornia crassipes*), cattails (*Typha glauca*) and slender spikerush (*Eleocharis acicularis*). This treatment area is located approximately 360 km northeast of Mexico City near the town of Tulancingo in the State of Hidalgo. The water is used in the government supported 1 to 6 hectare farmers program in which various field crops are produced. Split applications of a mixture of herbicides were applied in December thru May. The initial material (Dalapon, 2,4-D and Dicamba) was applied in December when irrigation water was not being used. The treatments controlled 70% of the cattails and 98% of the water-hyacinths. The spikerush was injured, but began to recover in the spring.

### **Hybrid Grass Carp: Problems and Prospects for Aquatic Weed Control**

J. R. Cassani, W. E. Caton and T. W. Miller, Jr., Lee County Hyacinth Control District, P.O. Box 06005, Fort Myers, Florida 33906

Hybrid grass carp resulting from the cross of female grass carp and male bighead carp were studied with respect to growth, diet, morphology, intensive culture, selective preference for various aquatic plants, and practical management of aquatic weeds. A brief overview of each study topic will be discussed emphasizing problems encountered for the first three year classes (1979-1981) of hybrid grass carp and improvements and prospects for the fish in the future.

### **Evaluation of SAN 356 for the Control of Aquatic Plants**

Nathan Dechoretz and L. W. J. Anderson, USDA / ARS Aquatic Weed Control Laboratory, Botany Department, University of California, Davis, CA 95616

Greenhouse studies were conducted to determine the herbicidal activity of SAN 356, an experimental compound developed by Sandoz, Inc., on sago and American pondweed. Surface and subsurface soil applications at 11.2 kg/ha provided excellent control of both species four weeks after treatment. On a dry weight basis, preemergence water applied treatments at 1.0 ppmw inhibited the growth of sago and American pondweed by 50 and 65%, respectively.

### **Feasible Strategies for Controlling Eurasian Watermilfoil in an Oregon Oxbow Lake**

Stan N. Geiger, Beak Consultants, Incorporated, 317 Southwest Alder, Portland, Oregon 97204

Eurasian Watermilfoil (*Myriophyllum spicatum* L.), chemically similar to nuisance species in British Columbia, was first reported in Oregon in 1979 in Blue Lake, a 63 acre oxbow lake near the Columbia River. USEPA, Clean Lake Phase I funding was used to examine the feasibility of lake drawdown as a control technique during the winter of 1981-1982. Drying and freezing of plant shoots and roots were followed by new and profuse turion growth from remaining root crowns in spring. Field growth was dissimilar to laboratory growth of exposed milfoil plants. Forcing exclusively sediment surface new growth of milfoil through drawdown provided an opportunity for an effective lake-wide application of granular 2,4-D. Preliminary monitoring results indicate this combination of control techniques will be a feasible milfoil management strategy.

### **Aquatic Habitat Enhancement Program**

Kirby Gholson and L. V. Guerra, Texas Parks and Wildlife Department, 134 Braniff, San Antonio, Texas 78216

The integration of the vegetation control program and artificial reef programs has improved production by utilization of work crews during dormant periods. Waters are not only cleared of problematic vegetation, they are often improved by the installation of underwater fish attractors, marked with buoys and publicized. The net products are improved navigation, shoreline fishing opportunity, water quality, boat fishing, and, primarily, more fish in the creel.

### **Grass Carp in Texas**

L. V. Guerra, Texas Parks and Wildlife Department, 134 Braniff, San Antonio, Texas 78216

Pre- and post- stocking data on grass carp has been collected to determine relative effectiveness of the herbivorous fish in large bodies of water. This will be correlated to information gathered by research institutions. To date, no significant changes have been noted.

### ***Salvinia molesta*, *Mimosa pigra* and Other Potential Alien Problems in the United States**

William T. Haller and Dale Habeck, Center for Aquatic Weeds and the International Plant Protection Center Program, University of Florida, Gainesville, Florida 32611

*S. molesta* is growing profusely in many parts of the world and is causing serious social and economic problems. Also, *M. pigra* is spreading rapidly in Thailand and Northern Australia. The only benefits known of this weed are to harbor rats and snakes. Both species have already been introduced into the United States in various botanical gardens and arboretums. Fortunately, Australian scientists have been conducting research on both problems and promising insect biocontrol agents have been found. This presentation will include a short discussion on why it is impossible to keep alien plants out of the United States and the importance of international collaboration.

### Copper-Diquat Residues in Crystal River After Hydrilla Treatment

William T. Haller, D. E. Canfield, and J. V. Shireman,  
Center for Aquatic Weeds,  
University of Florida, Gainesville, Florida 32611

Diquat (2 gal/acre) and chelated copper compounds (4 gal/acre) were applied to 2 ten acre plots in Kings Bay, Crystal River, Florida, in late September 1980. Water, soil, and plant samples were collected before, 4 hours, 12 hours, 2, 4, 8, 16, 28, and 56 days after treatment. Copper residues were determined on over 1,000 each of water, soil and plant samples. Diquat residues (total approx. 400) were determined on plant and water samples. Diquat residues were extremely variable and bordered on the limits of detection. Copper residues in the soils was also variable, those in the water and plants were less variable and the data suggested only short term-temporal increases in copper levels.

### Weed Control Using the Hybrid Grass Carp in Florida

Rue S. Hestand III, Florida Game and Fresh Water Fish Commission,  
P.O. Box 1903, Eustis, Florida 32726

In search of a safer biocontrol than the grass carp (*Ctenopharyngodon idella*, Val.) the hybrid grass carp (*Aristichthys nobilis* X *Ctenopharyngodon idella*) was produced in the United States by Malones Fish Hatchery in 1979. The Florida Game and Fresh Water Fish Commission has been working with the hybrid since October 1979 when fingerlings were brought to the Richloam Fish Hatchery. Since that time several areas have been stocked with the hybrid grass carp.

### Effects of GA on 2,4-D Control of Waterhyacinth

Joe Joyce, U.S. Army Corps of Engineers, Jacksonville, FL 32232 and  
W. T. Haller, University of Florida, Gainesville, FL 32611

Various combinations of the dimethylamine salt of 2,4-dichlorophenoxyacetic acid and gibberilic acid (GA<sub>3</sub>) were applied to waterhyacinths (*Eichhornia crassipes* (Mart.) Solms) in order to evaluate possible enhancement of 2,4-D activity. Results indicate an interaction between 2,4-D and GA<sub>3</sub> which significantly reduces the amount of 2,4-D required for waterhyacinth control. The enhancement appears to be due to increased translocation of 2,4-D in the treated plants.

### The Corps Aquatic Plant Control Operations Support Center

Joseph C. Joyce and James T. McGehee,  
Corps of Engineers, Jacksonville District,  
Box 4920, Jacksonville, FL 32232

The Corps of Engineers established an Operational Support Center at the Jacksonville District in October 1980 in order to assist other Corps Districts and Federal and State agencies in aquatic plant control functions. Services provided include assistance in program establishment and operational planning; applicator training; herbicide recommendations; plant identification; and biological control. Since formation, Center personnel have responded to over 140 requests.

### Relationships of Nutrients to Hydrilla Growth in Six Florida Lakes

Ken Langeland, D. E. Canfield and W. T. Haller, Center for Aquatic Weeds,  
University of Florida, Gainesville, Florida 32611

Abatement of nutrient inputs to lakes has been suggested as a means of suppressing the growth of aquatic weeds. In order to predict what the effects of lowering nutrient levels in lakes will be on submersed weeds, a complete understanding of the mineral nutrition of this group of plants is necessary. Recent laboratory studies have indicated an importance of nutrients in the substrates. Our studies, however, indicate little importance of substrate nutrients to plant growth and an intense dependence on levels of nitrogen and phosphorus in the water. This effect is moderated by levels of phytoplankton.

### Estimation of Submersed Macrophyte Biomass Using a Recording Fathometer

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University of Florida, Gainesville, Florida 32611

A recording fathometer, in combination with a device for sampling vegetation, or by itself, has been used for several years for estimating submersed macrophyte biomass. The mathematical and statistical handling of tracing data has been refined, and some limitations of the method have been defined. Fathometer tracings can be employed to generate accurate and quantitative data pertaining to total percent cover and percent volume of submersed plants inhabiting a water body. The method is flexible and economical enough to be practical for both research and operational personnel.

### Hydrilla Control with Sonar Herbicide in the St. Johns River Water Management District

John L. Layer, St. Johns River Water Management District,  
P.O. Box 1429, Palatka, Florida 32077

Sonar (Fluridone) is an experimental herbicide which appears to control a broad range of aquatic problem plants, submersed, emergent and floating. The St. Johns River Water Management District has included the use of Sonar in its 1982 hydrilla control program in four bodies of water ranging in size from 20 to 5000 hectares. Application techniques, preliminary results, and impact on non-target vegetation will be discussed.

### Summary of Section 18 Exemption for Glyphosate in Florida

Carlton Layne, U.S. Environmental Protection Agency,  
Room B-2, Federal Building, Lakeland, Florida 33801

An Emergency Exemption of Section 18 of FIFRA was granted to the State of Florida Department of Agriculture and Consumer Services, April 1982, for the use of glyphosate to control emerged aquatic weeds, most importantly, *Typha* species. The program is now being developed for operational use and it will be described in terms of however it evolves by the time of the meetings.

### Evaluation of Terratrack and Aquascreen for Control of Aquatic Macrophytes

D. H. Lewis, I. Wile, and D. S. Painter, Ecocern Limited, Toronto, Ontario;  
Ontario Ministry of Environment, Toronto, Ontario; and  
National Water Research Institute, CCIW, Environment Canada,  
Burlington, Ontario, Canada, L7R 4A6, respectively

Terratrack, a woven polypropylene material was compared to Aquascreen for aquatic plant control and the two products were evaluated for environmental impact. Terratrack has maintained good control for the last three years whereas Aquascreen was only effective for the first year. No adverse environmental impacts were observed.

### Criteria for a Management Agent for *Ptychodiscus brevis*

Dean F. Martin, Chemical and Environmental Management Services  
(CHEMS) Center, Department of Chemistry,  
University of South Florida, Tampa, Florida 33620

Periodic and sporadic blooms of the unarmored dinoflagellate *Ptychodiscus brevis* have been responsible for massive fish kills along the west coast of Florida. The costs associated with a three-month outbreak that affected a seven county area in Florida in the summer of 1971 were estimated at \$20 million. Attempts to systematically find a control agent have been relatively limited since 1960 for various reasons. Several criteria for a successful management agent were reviewed and progress with one control agent, a blue-green alga *Gomphosphaeria aponina*, and the chemicals that it elaborates are considered.

### Mapping the Spread of Aquatic Weeds by Aerial Color Infrared Photography

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Remote Sensing Center, Texas A & M University,  
College Station, TX 77849

Aerial photographic surveys using Kodak 2443 color infrared film were conducted over Lake Conroe each October and June since October 1979. Vegetation maps delineating infested areas were compiled for each survey (except June '80) and acreage figures calculated for hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil (*Myriophyllum spicatum*) and coontail (*Ceratophyllum demersum*). The submersed aquatic weed infestation in Lake Conroe has increased almost 50% in the last two years, from 5,813 acres in October 1979 to 8,637 acres in October 1981. Since October 1979, the weeds infested an additional 14% of the lake and now occupy 43.6% of the lake's surface area. Of the three dominant species present, hydrilla accounts for the majority of the infestation. In October 1981, there were 7,425 acres of hydrilla. This was a 62% increase over the 4,578 acres present in October 1979. The greatest amount of hydrilla occurred in July 1981 (8,434 acres). Concurrently, this was also the lowest levels of milfoil and coontail, 106 and 469 acres, respectively. From July 1981 to October coontail increased from 469 to 991 acres. Most of this change was attributed to a single large area in the northern section of the lake which experienced a rapid "fall-out" and decline of hydrilla. Small amounts of existing coontail quickly expanded and occupied much of the vacated space. The largest single change in total acres occurred from June 1980 to October 1980. During this time the weeds increased from 6,652 to 8,054 acres (+21%).

### The Use of Cutrine Plus in Western Irrigation Systems for Aquatic Weed Control

Terry McNabb, Applied Biochemists, Inc.,  
P.O. Box 3145, La Habra, CA 90631

The arid western states are among the top agricultural production regions in the world. Water, the key to this growth, is scarce. Elaborate systems are utilized to store water and move it to the field. These systems can be severely impacted by aquatic weeds and algae. Cutrine Plus, a complexed copper herbicide, has been tested for effect on a number of species and the results to date will be presented.

### Aquatic Weeds and Mosquitoes

John A. Mulrennan, Jr., Florida Department of Health and  
Rehabilitative Services, Office of Entomology,  
P.O. Box 210, Jacksonville, FL 32231

Aquatic weeds and mosquitoes are closely related in certain habitats and with certain species of mosquitoes in Florida. Mosquitoes associated with aquatic weeds are potential vectors of diseases such as encephalitis and also, some are voracious biters of man. Control of these mosquitoes is linked to the control of aquatic vegetation. Species of mosquitoes, weeds with which they are associated, and their control are discussed.

### Limited Operational Experiences with Sonar in Florida

Paul C. Myers and John L. Layer, Polk County Environmental Services,  
P.O. Box 39, Bartow, Florida 33830 and St. Johns River  
Water Management District, P.O. Box 1429, Palatka, Florida 32077

The experimental use herbicide Sonar, has been marketed in Florida since the fall of 1981. Application methodology and efficacy on hydrilla in several north central and central Florida lakes are discussed. Both negative and positive reports of operational use to date are reviewed.

### Environmental Impacts of Aquatic Herbicides Used to Control *Hydrilla verticillata* on the Imperial Valley Fisheries'

J. L. Nelson and B. J. Finlayson, California Department of Fish and Game,  
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A two-phased program was developed to determine the acute and chronic toxicities of herbicides used to control *Hydrilla verticillata* to fish in Imperial Valley canals. In one phase, herbicide toxicity data on resident aquatic organisms is being determined on-site in a specially designed laboratory because the unusual water quality (temporary hardness) in the Imperial Valley has been shown to affect referenced toxicity values. The other program is determining the singular and combined effects of Hydrilla infestation and experimentally applied herbicides on fish populations inhabiting the lined and unlined portions of canals in the infested and uninfested areas of the Imperial Valley. The program outline, methods used in the program, and preliminary findings will be discussed in detail.

### Utilization of Grass Carp for Hydrilla Control

John A. Osborne, Department of Biological Sciences, University of  
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Based upon empirical data collected from seven Central Florida lakes since 1976, the control and/or elimination of hydrilla can be predicted from knowledge of fish size, stocking rate, amount of hydrilla within the lake, and time of stocking. Grass carp are cost effective when they are stocked at a rate sufficient to eliminate the hydrilla within two years. The number of grass carp to control hydrilla should be determined from hydrilla biomass data to insure elimination. Insufficient numbers of stocked grass carp results in the return of hydrilla to pretreatment levels by the third year following initial stocking.

### **Fate and Effect of 2,4-D Formulations as Herbicides in Aquatic Ecosystems**

D. S. Painter, B. F. Scott, E. Nagy, B. J. Dutka and W. D. Taylor,  
National Water Research Institute, CCIW, Environment Canada,  
P.O. Box 5050, Burlington, Ontario, Canada, L7R 4A6

The effect on the aquatic ecosystem of dimethylamine and butoxyethyl ester formulations of 2,4-D applied to six ponds for *Myriophyllum spicatum* control will be discussed. Nutrient release or oxygen declines were not observed. However, alkalinity and calcium concentrations increased. Fish mortalities of approximately 30% occurred if the pH was near neutral. Snail populations increased in treated ponds. Recolonization of the ponds by *Myriophyllum* was possible if the 2,4-D concentrations in the water column were less than 0.1 ppm.

### **Nutrient Release from Decomposing *Myriophyllum spicatum* Treated with Diquat, 2,4-D or Fluridone**

D. S. Painter, National Water Research Institute, CCIW, Environment Canada,  
P.O. Box 5050, Burlington, Ontario, Canada, L7R 4A6

Diquat, 2,4-D and Fluridone were compared in greenhouse trials for their effect on nutrient release from *Myriophyllum spicatum*. Diquat exhibited minimal influence on nutrients in the water column. 2,4-D affected the community's response and resulted in an increase of phosphorus and nitrogen for a one month period. Fluridone inhibited algal development and resulted in increased phosphorus and nitrogen levels that persisted to the completion of the experiment.

### **Effects of Mechanical Control on Hydrilla in an Irrigation System**

Michel Remington and Randall K. Stocker, USDA Conservation  
Research Center, 4151 Highway 86, Brawley, California 92227

Mechanical control of aquatic macrophytes in the southwestern United States typically includes discing, chaining, scooping, and lining. Although this technology has been in practice for many years, little has been recorded about its effects on subsequent regrowth, propagule formation, soil and water quality, and downstream recruitment. This paper discusses the results of studies with mechanical control on hydrilla (*Hydrilla verticillata* Royle) in lateral canals of the Imperial Valley, California.

### **Changes in Plankton and Benthos in Three Central Florida Lakes Following Grass Carp Introduction**

David I. Richard and James W. Small, Jr., Biology Department,  
Rollins College, Winter Park, FL 32789

Plankton and benthic macroinvertebrates were monitored in three Central Florida lakes (Clear, Little Lake Fairview, and Orienta) for a 36 month period during which grass carp were introduced at different stocking rates. Submersed vegetation was subsequently eliminated. Similar shifts in composition and proportion of major planktonic and benthic taxa were reflected; annual characteristics of both showed species richness decreasing and higher density and frequency blooms of a few opportunistic dominants. Cooler months (December-February) showed highest annual species richness for benthos and lowest for plankton.

### **Environmental Impacts of Aquatic Disposal of Chopped Hydrilla**

Bruce M. Sabol, U.S. Army Engineer Waterways Experiments Station,  
P.O. Box 631, Vicksburg, MS 39180

Operational costs of the LIMNOS mechanical harvester could be halved if chopped aquatic plant matter could be disposed in water. Environmental effects of this practice were studied in hydrilla infested Orange Lake, Florida, using no harvest, harvest, and harvest with aquatic disposal treatments. Oxygen, temperature, chlorophyll, and fragment regrowth were monitored in situ. Plant removal by harvesting resulted in improved mixing, decreased afternoon oxygen concentrations, and increased chlorophyll. Excluding larger chlorophyll increases, adverse water quality effects of aquatic disposal were not detected. A small percent of the hydrilla fragments repropagated.

### **Field Trials of Hydrilla Control with Komeen, Aquathol K, and Magnacide H**

Randall K. Stocker and Michel Remington,  
Hydrilla Control Research Program, USDA Conservation Research Center,  
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Trials with Komeen and Aquathol K (alone and in combination, with and without adjuvants), and Magnacide H have been conducted in irrigation canals as part of the overall effort to develop an operational control program for hydrilla (*Hydrilla verticillata* Royle) in the Imperial Valley, California. Results of field trials with these herbicides, including their effects on biomass, propagule production, and regrowth will be discussed.

### **Abundance of Vegetative Propagules of Hydrilla in Areas Stocked with Grass Carp for Regrowth Control.**

David L. Sutton, Vernon V. Vandiver, Jr., and Ted R. Batterson,  
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Lakes and ponds infested with hydrilla stocked with grass carp for regrowth control showed a reduction in the abundance of hydrilla propagules after the parent plants had been eliminated. Data indicates that the grass carp can reduce the number of tubers and turions by consuming young shoots of germinated hydrilla propagules.

### **Plant Preference and Feed Conversion Efficiency of Hybrid Carp (*Aristichthys nobilis* Rich. X *Ctenopharyngodon idella* Val.)**

David L. Sutton, University of Florida, Agricultural Research and  
Education Center, 3205 SW College Avenue, Fort Lauderdale, Florida 33314

Hybrid fish from a cross of male bighead (*Aristichthys nobilis* Rich.) and female grass carp (*Ctenopharyngodon idella* Val.) are being evaluated for use as a biological control method. Since these fish are sterile, they eliminate the potential risk of natural reproduction which has been attributed to one of the parents, the grass carp. Results will be presented on studies conducted in outdoor plastic-lined pools to evaluate aquatic plant preference and feed conversion efficiency of 200 to 1,200 g hybrids.

### Effects of Surface-Active Agents on the Translocation of 2,4-D-<sup>14</sup>C in Waterhyacinth

Dan Thayer and W. T. Haller, Center for Aquatic Weeds,  
University of Florida, Gainesville, Florida 32611

The effect of surface-active agents (surfactants) on the translocation of <sup>14</sup>C-labelled 2,4-D was studied. The treatments were applied within a lanolin ring and distribution patterns were measured using leaf sections with liquid scintillation counting.

### Success of Grass Carp in Management of Aquatic Weeds in Florida

Lowell L. Trent, Debbie Valin, and Clayton L. Phillippy,  
Florida Game and Fresh Water Fish Commission,  
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The overall success rate of grass carp (*Ctenopharygodon idella*) in controlling general aquatic weed problems was determined to be between 40 and 60% as determined by a two year bi-annual survey. Problems with security, the possibility of reproduction in the wild, and unpredictability as to effectiveness and human factors make consideration of its use of dubious value when the potential risk to fisheries and water fowl habitats statewide are considered.

### Electrophoretic Identification of Genetically Differentiated Aquatic Plant Populations

Richard P. Wain, William T. Haller, Center for Aquatic Weeds,  
University of Florida, Gainesville, FL 32611 and Dean F. Martin,  
Chemical and Environmental Management Services (CHEMS) Center,  
Department of Chemistry, University of South Florida, Tampa, FL 33620

Techniques of horizontal starch gel electrophoresis are being employed to determine the genetic structure of natural populations of several aquatic weeds including *Hydrilla verticillata*, *Alternanthera philoxeroides* (alligator weed), and *Eichhornia crassipes* (waterhyacinth). In particular, isozyme banding patterns of plants from several collection sites are being compared for purposes of species or biotype verification. Electrophoresis is an effective method for analyzing genetic affinities within and among species at the molecular level. The detection of large genetic differences is often indicative of underlying physioecological differences and can therefore be of great importance to aquatic plant management and research programs.

### Bank Erosion and Stabilization as Related to Aquatic Plant Management

Thomas L. Wiley, Gulfstream Land and Development Corp.,  
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Many species of domestic ground covers and naturally-occurring shoreline vegetation can be effectively utilized in an aquatic weed control program to control runoff and bank erosion. This can be advantageous, especially for the commercial applicator who maintains smaller residential, recreational, or golf course lakes. Control of runoff reduces bank erosion, turbidity, and nutrient input and can influence the composition of an aquatic plant community. As such, this can reduce overall operating expenses, while increasing environmental quality and aesthetic value.

### Influence of Copper-Diquat on Apple Snails in Southern Florida

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and Donald P. Schultz, and W. Waynon Johnson,  
U.S. Fish and Wildlife Service, Atlanta, Georgia 30303

Apple snail (*Pomacea paludosa*) populations have declined recently in canals surrounding Loxahatchee National Wildlife Refuge in southern Florida. Field and laboratory studies were designed to assess the effects of copper-Diquat used in the treatment of the aquatic weed hydrilla (*Hydrilla verticillata*) on apple snails. Acute toxicities (96 hour LC50s) of Cutrine and Komeen (chelated formulations of copper) to immature apple snails were 22 and 24 ppb, respectively. Diquat had a toxic concentration of 1,800 ppb and did not increase the toxicity of copper when used in combination. Mean copper concentrations in field samples of plants, detritus, and mud from the canals were 9.8, 33.9 and 12.3 ppm, respectively, compared with 5.0, 9.7 and 5.4 ppm in samples from the Refuge interior. Copper associated with detritus (up to 150 ppm) had no effect on growth or survival of apple snails in field cage and tank studies. Also, no effect on survival of caged adult and immature snails was found with field applications of copper-Diquat to hydrilla. Copper from field applications was rapidly taken out of solution by plants and organic material in the water and subsequently incorporated into the bottom detritus. Treatment of hydrilla with copper-Diquat does not appear to have been responsible for the apple snail population decline, and application at recommended rates should pose no threat to these snails in the organic-laden waters of southern Florida.

### Aquatic Weed Control Methods in Moving Water

Winn Winkyaw, Salt River Project, P.O. Box 1980, Phoenix, AZ 85001

Chemical, mechanical, mechanical and chemical combination, and biological aquatic weed control were tried on an experimental and operational basis. Chemical methods, such as Acrolein, Hydrothol 191, Copper Sulfate and Klox; mechanical methods with teleskoops, dragline and backhoe; mechanical and chemical combination methods using teleskoops and graders during dryup periods followed by chemicals; and biological control will be discussed in detail.

### Status of Controlling Submersed Aquatic Weeds with Mirror Carp

Richard R. Yeo, Jon R. Thurston and Robert L. Coykendall,  
Botany Department, University of California, Davis, CA 95616 and  
P.O. Box 726, Yuba City, CA 94995

In small farm ponds, mirror carp were successfully used to control sago, American, and leafy pondweeds, southern naiad, and filamentous algae in one year at stocking rates varying from 614 to 714 fish per ha. Control of vegetation was affected by their feeding and roiling activities. The fish muddied the water creating turbidities of approximately 40 to 50 NTU's. The percent incident light at 0.6 m deep decreased correspondingly as turbidity increased.