The Western Aquatic Plant Management Society

Abstracts

16th Annual Meeting

Seattle, Washington

March 27 and 28, 1997

Wetland Monitoring to Support Lake Herbicide Treatments. DAVID S. LAMB, The Lambert Group, Inc., Spokane, WA

When planning for whole lake herbicide treatment using Sonar® aquatic herbicide, permanent adverse effects to emergent wetland plants are not anticipated. However, in order to protect project proponents against claims of adverse effects, and to document any changes which do take place, wetland monitoring is recommended. Wetland monitoring should include aerial photography as well as ground level assessment of plant species present and their relative health.

The wetland monitoring procedure used at Sacheen Lake (Pend Oreille County, WA) and the Little Pend Oreille Lakes (Stevens County, WA) is described and post-treatment results from Sacheen Lake are presented.

FasTEST for Sonar®, A New Management Tool to Optimize the Efficacy and Application of Sonar® . MARK MONGIN, SePRO Corporation, Carmel, IN

The commercialization of an immunoassay to determine the Sonar® concentration in water has been completed. This test system, Sonar® FasTEST, provides an alternative to conventional chemical assay procedures. Sonar® FasTEST provides the plant manager/applicator an opportunity to monitor the concentration of Sonar® in the water and make adjustments necessary to maintain the optimum concentration of Sonar® in the water over time. The potential use of this new technology with Sonar® will be discussed.

Chehalis River Parrotfeather (Myriophyllum aquaticum) Management. BILL WAMSLEY and KEVIN HUPP, Lewis County Noxious Weed Control Board, Chehalis, WA

In 1994 an aquatic weed was found growing in the Chehalis River in the Southwest region of Washington State. It was identified as Parrotfeather, (*Myriophyllum aquaticum*) a species native to South America. A single population of parrotfeather was collected in a wetland east of Aberdeen, Grays Harbor County, in September of 1944 (Western Washington University Herbarium record). Until this discovery, large populations of parrotfeather in Washington were limited to drainage ditches and sloughs off the Columbia River in Wahkiakum County and Cowliz County.

While parrotfeather may provide some benefit to aquatic organisms, it can cause a serious change to the physical and chemical characteristics of lakes, rivers, and streams. Flooding and drainage problems and increased mosquito habitat have also been associated with infestations of parrotfeather.

In 1996 the Lewis County Noxious Weed Board began a long- term project for the control of parrotfeather in the Chehalis River with the objectives to increase awareness of aquatic noxious weeds, carry out a comprehensive survey, and implement an integrated aquatic weed management plan. The educational efforts are ongoing and the initial survey was completed for the Chehalis River. Forty-nine additional parrotfeather sites were recorded from river mile 33 to 75. The results and lessons learned are reported here. The project was operated with a grant from the Washington Dept. of Ecology, Aquatic Weeds Program.

***Response of Blue-Green Algal Migration and Trophic State to Alum in Green Lake*.** JENNIFER DIANNE SONNICHSEN, David Evans and Associates, Bellevue, WA; EUGENE B. WELCH, University of Washington, Seattle, WA; and JEAN JACOBY, Seattle University, Seattle, WA

The response of sediment-to-water migration of blue-green algae and trophic state indicators to aluminum sulfate buffered with sodium aluminate treatment was studied in a shallow lake. A comparison of results from two summers before treatment and three summers after treatments indicates that migration of both sporulating and non-sporulating blue-green algae was unaffected.

History and Current Progress on the Infestation and Treatment of Eurasian Watermilfoil in Long Lake, Thurston County, Washington. MICHAEL T. MCKAY, SAYWARD J. AYRE, and ERIC J. WILLIAMS, Thurston County Department of Water and Waste Management, Olympia, WA

Eurasian watermilfoil (EWM) (*Myriophyllum spicatum*) was first discovered in Long Lake (near Lacey, Thurston County, Washington) in 1987. The infestation began as a small site located at the public boat ramp that, within four years, covered 75 percent of the 330-acre lake. A five-year eradication plan was developed and implementation began in 1991. The lake was treated in July 1991, with the aquatic herbicide Sonar®, and treatment effectiveness was monitored the following August through diver surveys. The littoral zone was subsequently monitored each year through diver surveys. A few remnant plants were discovered and hand pulled in 1992 and no further plants were discovered until 1995.

In 1995 divers discovered a small bed of EWM. In the fall of 1995 about 800 square yards of bottom barrier material was placed by divers over the EWM bed. Plants outside this area were hand-pulled. During the spring of 1996 large EWM plants were surveyed by boat and diversremoved these by hand. Diver surveys in the fall of 1996 revealed many more plants throughout the same cove where the bottom barrier was installed. The milfoil plants were mapped and hand-pulled. In an effort to understand the growth of milfoil in the winter, divers found vigorous EWM plants growing, producing new growth, and producing new shoots from the root crowns in December and January. The divers also discovered that the winter was an excellent time of year to survey for EWM in water lily beds. Effectively surveying water lily beds for EWM in the summer is difficult, but during the winter the leaves and stems have died down, exposing any milfoil plants. Regular diver surveys and EWM removal have been essential in continuing to control this extremely prolific plant.

An Overview of the Application of Diver Dredging Technologies to a Eurasian Milfoil Infestation in Silver Lake Over Four Years of Operational Control. TERRY McNABB and ERNIE MARQUEZ, Resource Management, Inc., Olympia, WA

The city of Everett discovered advanced pioneering colonies of the noxious aquatic weed Eurasian milfoil in Silver Lake in the early 1990s. This lake is the largest lake within the City limits and the Parks Department maintains both beaches and fishing access to the lake. There is also a well-developed private residential community on the shore of Silver Lake. Of the 180 surface acres, Eurasian milfoil was found to be well distributed throughout the littoral region of the lake in 1992. After consultation with a number of regional consulting groups and state agencies, the City reviewed control options available and selected diver dredging as the tool that best fit its needs.

This paper will discuss the operational methodologies utilized during these past four operational summer programs. There was a significant reduction in Eurasian milfoil presence in the lake system each year and the effort to remove plants decreased each year. In addition, native aquatic plant communities have been restored in areas heavily impacted with Eurasian milfoil as a result of this ongoing management program.

Design and Use of an In-Stream Eurasian Watermilfoil Fragment Fence. MARK SWARTOUT, Thurston County, Department of Water and Waste Management, Olympia, WA

Eurasian watermilfoil (EWM) (Myriophyllum spicatum) was discovered in Scott Lake, a rural private lake. Scott Lake flows to the Black and Chehalis Rivers through Allen Creek. The system of rivers, streams, and lakes provide for a valuable anadromous fish run. There was a concern that milfoil fragments would move downstream from Scott Lake to the Black and Chehalis Rivers while residents on the lake develop a treatment plan and funding source. If milfoil becomes established on the Black and Chehalis Rivers there would be a negative impact to the fisheries.

Thurston County, with cooperation of the Washington Departments of Ecology and Fish and Wildlife, designed, installed, and maintain a fragment fence in Allen Creek in an effort to slow the spread of milfoil fragments downstream. Challenges in the project development were:

1. Setting a realistic goal,
2. Designing a fence that would effectively collect plant fragments,
3. Allowing the passage of anadromous adult fish upstream and smolts downstream,
4. Allowing water to pass through without causing any upstream flooding, and
5. Low cost.

A source of information for the project was provided by Dr. Peter Newroth of the Ministry of the Environment in British Columbia. However, the B.C. work involved placing a fragment fence in a large river. The County's project was a stream of much smaller size. This paper describes the design and use of the in-stream fragment fence with data of species and volume of plants and debris that were collected. During a maintenance visit, an adult salmon was seen above the fence indicating that salmon were able to pass the screen in their upstream migration.

Use of a Native Weevil to Control Eurasian Watermilfoil in Washington State: 1996 Results" MARIANA TAMAYO and CHRISTIAN E. GRUE, Washington Cooperative Fish and Wildlife Research Unit, Seattle, WA; and KATHY HAMEL, Washington Department of Ecology, Olympia, WA

Currently mechanical and chemical treatments are the primary methods used to control Eurasian watermilfoil (*Myriophyllum spicatum*). However, in recent years the weevil *Euhrychiopsis lecontei* has been associated with declines of Eurasian watermilfoil in Vermont. Subsequent studies in Vermont and Minnesota seemed to suggest that the weevil may be an effective biological control for *M. spicatum*. Last summer, Washington State initiated a project to evaluate *E. lecontei* as a control agent of Eurasian milfoil. To determine the distribution of the weevil in Washington, 38 waterbodies with Eurasian and/or northern milfoil (*M. sibiricum)* were surveyed between mid-July and the end of August. Waterbodies were located both east and west of the Cascade Mountains. Surveys consisted of circumnavigating each waterbody to map the general location of both species of milfoil, and then selecting five milfoil sites. At these sites, the relative density of milfoil was determined using a line transect. At each site, three five-minute weevil surveys were conducted by snorkelers. Milfoil plants were checked for adult weevils as well as for larval damage. Water quality data and milfoil specimens were also collected at each site. Overall, adult weevils and/or larval damage were found in nine (24%) of the waterbodies surveyed. Adult weevils or larval damage occurred in seven (32%) of the waterbodies surveyed in eastern Washington, and was associated with the presence of northern milfoil. On the west side of the Cascades, weevils were found in two (13%) of the waterbodies surveyed. Both of these lakes were in King County and the weevils were found on Eurasian milfoil. There is a need to determine the factors governing the distribution of the weevil. In addition to laboratory trials, enclosure experiments will be conducted this summer in a subset of waterbodies containing Eurasian milfoil to identify some of these factors.

Management of Aquatic Plants in Washington State Using Grass Carp: Effects on Aquatic Plants, Water Quality, and Public Satisfaction 1990-1995. SCOTT A. BONAR, BRUCE BOLDING, and MARC DIVENS, Inland Fisheries Research, Washington Department of Fish and Wildlife, Olympia WA

We investigated the effects of grass carp C*tenopharyngodon idella* on public satisfaction, aquatic macrophyte communities, and water quality of 98 Washington lakes and ponds stocked with grass carp between 1990-1995. Noticeable effects of grass carp on macrophyte communities did not take place in most waters until two years following stocking. After two years, submersed macrophytes were usually either completely eradicated (39% of the lakes) or not controlled (42% of the lakes). Control of submersed macrophytes to intermediate levels occurred in 18% of lakes at a median stocking rate of 24 fish per vegetated surface acre. Most of the landowners we interviewed (83%) were satisfied with the results of introducing grass carp. Average turbidity of sites where all submersed macrophytes were eradicated was higher (11 nephelometric turbidity units [NTU's]) than sites where macrophytes were controlled to intermediate levels (4 NTU's) or not affected by grass carp grazing (5 NTU's). Most of this turbidity was abiotic and not algal. Chlorophyll was not significantly different between levels of macrophyte control. Grass carp are effective for controlling most submergent macrophytes in

Washington state, but the effects of a particular stocking rate can vary considerably.

Streamlining Permitting for Noxious Aquatic Weed Control. RANDY CARMAN, PETER BIRCH, and BARBARA MACINTOSH, Department of Fish and Wildlife, Olympia, WA

The Washington Department of Fish and Wildlife (WDFW) regulates activities that impact the flow or bed of salt or freshwaters of the state through administrative codes known as the Hydraulic Code Rules. These regulations are intended to protect fish life through a system of consistent and predictable statewide rules, and involve issuance of a permit called a Hydraulic Project Approval (HPA). Recent legislation (RCW 75.20.108) has decreased HPA regulatory requirements for projects conducted solely for removal or control of spartina or purple loosestrife and further directed WDFW to develop new rules for other types of aquatic noxious weed control.

WDFW has been working with internal and external advisory committees over the past several months to develop new rules to address physical and mechanical control of aquatic noxious weeds. A companion pamphlet is also being developed that will serve as the HPA for aquatic weed control projects that are conducted within the pamphlet guidelines. This will allow project proponents to proceed with control of aquatic noxious weeds as prescribed in the pamphlet without the necessity of obtaining an individual HPA. The rules and pamphlet also address limited control of nonnoxious aquatic plants that grow to nuisance levels.

Aquatic Plant Distribution in 36 King County Lakes. SHARON WALTON, King County Water and Land Division, Department of Natural Resources, Seattle, WA

Thirty-six lakes were surveyed during the summers of 1994 and 1995 to assess the existing and potential threats of invasive, nonnative aquatic plants and to provide current information for developing aquatic plant management strategies for King County lakes. Sixty species were recorded for the 36 mapped lakes which included 27 emergent, five floating, and 28 submergent species. The most frequently occurring species included *Elodea canadensis, Iris pseudacorus, Juncus sp., Naja flexilis, Nitella sp., Nuphar lutea, Nymphaea odorata, Potentilla palustris, Potamogeton pusillus, Spiraea douglasii*, and *Typha latifolia*. Four listed Washington State noxious aquatic or emergent weeds were recorded which included: *Hydrilla verticillata* (2 lakes); *Lythrum salicaria* (12 lakes); *Myriophyllum spicatum* (15 lakes); and *Phalaris arundinacea* (2 lakes). Using the survey results, aquatic plant management recommendations for King County lakes were developed which focused on policy improvements, integrated planning, education, and volunteer monitoring.

***Survey of Rivers and Public Access Lakes in Thurston County*.** MICHAEL T., MCKAY and RICK JOHNSON, Thurston County Noxious Weed Control Board, Olympia, WA

In the summers of 1995 and 1996 surveys were completed of the five rivers and 20 public access lakes in Thurston County, Washington. The purpose of the surveys was to locate and identify pioneer infestations of the noxious weed, purple loosestrife (*Lythrum salicaria*) and any other noxious weed species. In addition to the surveys, a plant inventory and collection was made. A grant awarded by Washington Department of Ecology, Aquatic Weeds Program provided funding for the project. The project was carried out by County staff and volunteers from the community. Noxious weeds were identified and the locations were recorded on a portable GPS. unit. Other noxious weed species were found during the surveys and their locations were also recorded. The species found and lessons learned are reported here.

Plant Establishment at Three Ponds Created for Gravel Extraction Along the Lower Mad River. JANA KNUTSON, McKinleyville, CA

Several ponds were excavated for gravel extraction on river bars along the lower Mad River in Humboldt County near Blue Lake, California. My study comprises mapping plant establishment at three ponds with operations established on two river bars. The vegetation was mapped during the summer and fall of 1995. One pond was three years old, and the other two were one-year-old. All ponds are between 140-150 meters long with varying widths and approximately four meters deep.

Recently the regulation of gravel mining has been intensified along the river. The findings in an Environmental Impact Report evaluated impacts on the lower Mad. Gravel mining was implicated as one practice that should be modified (Kondolf 1993). These ponds were dug for gravel extraction by gravel mining companies in order to avoid impacts on the main channel and interference with the seasonal processes, particularly during a drought cycle when gravel deposits are less plentiful. The ponds were designed on a prescription basis by biologists, geomorphologists, and others in collaboration with the mining companies and the County. They were designed to create more habitat for riverine plants and animals by having contours, slopes, and depths following standards that have worked well from other wetland constructionapplications. The ponds have since become filled with gravel deposits after the heavy flooding of two winters. This result was part of the plan for sustainable gravel extraction.

Plant mixes detected around the ponds were mapped as polygons and each polygon characterized for presence and cover by species. Over ninety species were identified. Plant establishment at the third pond was sparse. Their establishment seems to be most influenced by the distribution of propagules and subsequent inundation. The presence of the plant propagules seems to be influenced by the presence and thickness of fine sediments at each pond site. However, also influencing plant distribution are the wind dispersed species such as grasses, willows, and cattails. Seasonality of rains affects the surface level of the pond. Rains late in the spring support germination and survival of seedlings on the banks. All ponds experienced complete inundation by the river during winter flooding. Cobble-sized gravel as well as fine sediments were deposited in the two one-year-old ponds when forceful upstream flows surged through them. The three-year-old pond was fully inundated by gentler backflows through its mouth only.

Influences on strictly aquatic species such as *Potamogetan natans* and *P. foliosus* were less discernible. It seems the depth, force, and frequency of inundation combined here to either support the increase in cover of the aquatics or not. The one pond with sparse terrestrial and aquatic cover had the least fine sediment present to begin with, and may have experienced the greatest hydraulic forces during winter floods, though its pattern of gravel depositions resulting from these flows resembled the depositions at two other ponds whose *Potamogetan* populations established after one winter and grew abundantly after two. All species establishing in the riverine wetland corridor are adapted to the seasonal flooding. The constructed ponds provided a habitat not naturally occurring here. *Potamogetan* grows in a few side water or backwater environments, though did not appear as plentifully as within the ponds.

Reference

Kondolf, G.M., 1993. *Aggregate Extraction from the Eel and Mad Rivers, Humboldt County. Geomorphic and Environmental Planning Considerations*. Planning Department, County of Humboldt, Eureka, CA.

New Hydrilla Infestation Found in Tulare County, California. ROSS A. O'CONNELL, California Department of Food and Agriculture, Sacramento, CA

A new hydrilla infestation was found in October 1996 near Springville, Tulare County, California. Following an extensive delimiting survey of nearby bodies of water, a total of six ponds were found to be infested. These ponds ranged in size from .02 acres to 10 acres, with a total acreage of all ponds being approximately 20 acres. Hydrilla densities in these ponds varied from a few scattered plants in one pond to nearly complete surface coverage of another pond. The 10-acre pond was the most severely impacted pond with the surface coverage of hydrilla being about 90 percent.

Five of the six ponds were on one property open to the public as a pay to fish facility. The ponds were quarantined to prohibit fishing and the possible spread of hydrilla.

All of the infested ponds were treated with Komeen®, a copper-based contact aquatic herbicide. Partial treatments were made in the heavily infested ponds to open up access lanes for the application of Sonar®, a systemic aquatic herbicide. Partial treatments using Komeen® were also made instead of full surface treatments to prevent oxygen depletion as vegetation decomposed.

By December, complete control of hydrilla was achieved and no plants were detectable. Germination of tubers is expected in the spring of 1997, and treatment with Sonar® will resume until eradication is achieved.

Hydrilla Verticillata* *Management in Two King County Lakes. SHARON WALTON, King County Water and Land Division, Department of Natural Resources, Seattle, WA; and TERRY McNABB and ERNIE MARQUEZ, Resource Management, Inc., Tumwater, WA

The noxious weed, *Hydrilla verticillata* was found in lakes Lucerne and Pipe, King County, Washington during a 1994 aquatic plant survey. Action was taken by county and state agencies to control the onlyknown infestation of *H. verticillata* in the Pacific Northwest. Sonar® (fluridone) was applied during the summer of 1995 to prevent further plant reproduction and spread. In spring 1996 the emergence of *H. verticillata* was monitored using sediment temperature probes and sediment surveys. The plants began to germinate from tubers at temperature of 14^{o} C and emerge from the sediment at temperatures between 15^{o} C and 16^{o} C. Plant coverage was substantially reduced from the previous year based on diver surveys. A second herbicide treatment was performed during Summer 1996 to continue plant eradication management efforts. No viable plant material was observed in September 1996 surveys. Management actions will continue in 1997 to ensure plant eradication occurs.

Influence of Anoxia on Sprouting of Three Species of Aquatic Plant Propagules. DAVID F. SPENCER and GREGORY G. KSANDER, WSDA-ARS Aquatic Weed Control Research Laboratory, Davis, CA

Vegetative propagules of *Potamogeton pectinatus* L., *P gramineus* L., and *Hydrilla verticillata* (L.F.) Royle were exposed to aerobic or anaerobic atmospheres for 7, 14, or 21 days in the dark at 18^{o} C or 7^{o} C. There were no differences in the proportion of sprouting for propagules receiving either treatment. *Potamogeton pectinatus* tubers and *P. gramineus* winter buds exposed to an anaerobic atmosphere sprouted sooner than those exposed to an aerobic atmosphere. *Potamogeton gramineus* winter buds were buried at 5, 15, or 25 cm deep in Byrnes Canal. Those buried at 25 cm for 25 days exhibited discoloration consistent with sulfide deposition. They sprouted more rapidly than winter buds buried at 5 or 15 cm. As the length of the burial period increased, the time required for 100% sprouting decreased. This information will be useful in predicting propagule sprouting in field situations.

Use of Sonar® Aquatic Herbicide to Control and Eradicate Noxious Aquatic Weeds in the Western United States. TERRY McNABB, Resource Management, Inc., Olympia, WA

Sonar® aquatic herbicide has demonstrated in concentration exposure time studies conducted by the U.S. Army Corps of Engineers Aquatic Plant Control Research Program, the ability to provide long term control and in some cases eradicate many of the noxious aquatic weed species in this region. RMI biologists participated in many of the field trials conducted by that agency that verified these laboratory concepts in arge scale tests. Through transfer of these technologies to private sector groups like RMI, the Corps program has provided a basic understanding of how to accomplish the restoration of aquatic ecosystems impacted by these noxious weeds. Over the past six years, RMI biologists have expanded on these research program findings to develop methodologies to eradicate these noxious weeds from Northwest lake systems. These experiences will be discussed.

Trophic Response of Epilithic Algae Community to Coho Decomposition with Implications for Salmonid Production. JON HONEA, Biology Department, Portland State University, Portland, OR

In order to manage the recovery of the declining populations of salmon, sound programs must be developed that incorporate an understanding of each phase of their far-ranging life cycle. To test the hypothesis that salmon carcass decomposition provides a regular infusion of nutrients into streams that stimulates production in the system and may be necessary for the survival of smolt that remain from previous hatchings, approximately 250 coho (*Oncorhynchus kisutch*) carcasses were distributed within a two-mile reach of Still Creek within the Zigzag Ranger District of the Mount Hood National Forest. The enriched reach and a reference reach upstream were monitored for effects on benthic algae, invertebrates, and smolt. This paper will focus on the response of the algae community to decomposition of the carcasses. The chlorophyll and ash-free dry mass measurements among the sites were found to be significantly different, increasing in the treatment reach. Analysis of the species composition of the algae community continues.

***Egeria densa* - An Emerging Problem in the Western United States.** JENIFER PARSONS, Washington Department of Ecology, Olympia, WA

Egeria densa, which is also known by its common names Brazilian elodea or Anacharis, is native to subtropical eastern South America. Due to its attractive growth form and ability to grow under low-light conditions it has been exported around the world as a popular aquarium plant. As a consequence of the intentional or accidental release of these cultivated plants, *E. densa* is now found in lakes and rivers nearly throughout the world. Where conditions are favorable it frequently grows to nuisance proportions, impacting the native plants and animals as well as the chemistry, quality, flow, and aesthetic value of these waters. In western North America *E. densa* has been growing in scattered locations for at least 50 years. It appears that its distribution is increasing, and recently efforts have been put in place to curtail its spread.

A Comparison of the Genetic Structure of Oregon and South American Populations of Egeria densa and Myriophyllum aquaticum Using RAPDs. M. CAROL CARTER and MARK D. SYTSMA, Biology Department, Portland State University, Portland, OR

Egeria densa and *M. aquaticum* plants were collected from several sites in Oregon. Plants were also collected from a region in Chile that is considered within the native range of both species. The samples were subsequently analyzed for genetic variability using RAPD PCR. Although RAPD PCR is considered to have high resolution for detecting genetic variability, relatively little diversity was detected both within the indigenous Chilean collections and within the adventive Oregon collections. *Egeria densa* in particular showed extremely low genetic variability and the Oregon and Chilean collection were remarkably similar and homogeneous. However, RAPD PCR unequivocally distinguished between the morphologically similar species *E. densa*, *E. canadensis*, and *E. nutallii*. Similarly, the method distinguished *M. aquaticum*, *M. sibiricum*, and *M. spicatum*. These findings suggest that these aggressive aquatic weeds may be pandemic clones.

Operational Control Experiences Targeting Egeria densa in the Pacific Northwest. TERRY McNABB, Resource Management, Inc., Olympia, WA

Resource Management, Inc. has conducted operational control programs targeting this noxious aquatic weed in the Pacific Northwest since 1986. *Egeria* is one of the harder exotic aquatic weed species to manage because of it's physiology. From 1986 through 1995, RMI biologists have conducted a number of control programs targeting this plant in Oregon and Washington State using chemical and mechanical control methodologies. These programs were more maintenance oriented in nature, however, and none of these effort were designed to provide eradication or long-term management of this pest.

During the summer of 1996 RMI biologists designed and conducted the largest operational application of Sonar® herbicide targeting this weed in the region. The program consolidated information from researchers small-scale pond studies with work RMI pioneered in maintaining long-term/low-dose contact exposure time treatments with Sonar® aquatic herbicide. This work was performed at Lake Limerick in Mason County, Washington.

This paper will present historical experiences with this weed in the region, review the design and methodology of the Lake Limerick treatment, review the results of that treatment, and provide some ideas for future implementation of control programs targeting this weed.

Grass Carp - Management Tool or Environmental Mistake. HARRY GIBBONS, KCM, Inc., Seattle, WA

The employment of grass carp to control invasive aquatic plants *Egeria densa* (Brazilian elodea) and *Myriophyllum spicatum* (Eurasian watermilfoil) as well as other over productive submersed plants has resulted in serious environmental debate. The plant management benefits versus the environmental system impacts were investigated after grass carp were introduced into Silver Lake, Cowlitz County, Washington. Impacts to the aquatic plants, wetlands, fisheries, waterfowl, birds of prey, invertebrates, and water quality have been assessed in a six-year program. The study has yielded some interesting findings. The implication of these results are discussed relative to the management debate surrounding the introduction of a nonnative organism to control other biotic elements within surface water resources.

Integrated Management of Egeria densa in a Puget Sound Lowland Lake. MARIBETH GIBBONS, Water Environmental Services, Inc., Bainbridge Island, WA

In a Puget Sound lowland lake not too far from Shelton, Washington, a battle is being waged against a tenacious weedy invader from South America. The year 1997 marks the second year of an aggressive, multi-year management program on Lake Limerick targeting an infestation by the noxious, nonnative Brazilian elodea (*Egeria densa*). The management strategy is detailed in the recently completed *Lake Limerick Integrated Aquatic Plant Management Plan* (IAPMP), a **working document** prepared cooperatively by the lake community, Mason County, key resource agencies and limnologists, and funded through an Aquatic Weeds Management Fund Planning Grant by the Washington Dept. of Ecology. Key goals of the multi-year integrated management program are to eliminate populations of the noxious , invasive *Egeria densa* from the lake, reduce future management to a low-cost maintenance level, and restore beneficial uses. The first year of the integrated management program for Lake Limerick was successfully implemented in 1996. Major in-lake management involved phased applications over a 10-week period of the systemic herbicide, Sonar®, the first of an aggressive one-two punch targeting Brazilian elodea. Other Program components activated during 1996 included Waterbody Use Restrictions (irrigation), Public Outreach, Noxious Weed Prevention, Watershed Management, Program Monitoring /Effectiveness Evaluation, Implementing of Funding Plan, and Program Management. A critical part of the Monitoring/Effectiveness Evaluation Program was conducting intensive quantitative aquatic plant surveys during 1996 prior to and following Sonar® treatment to determine control effectiveness. The 1996 pre- and same year post-treatment survey data showed a significant reduction (89%) in *E. densa* biomass and areal coverage by the end of the first growth season (October 1996). One-year carryover (following growth season) effectiveness of the 1996 Sonar treatment on target species *E. densa* will be assessed from data collected during a late spring 1997 macrophyte survey. Results of the upcoming spring macrophyte survey will be critical in determining which of two proposed in-lake management scenarios will be activated in 1997.

Influence of Light Level (Water Depth) on Canopy Structures of Egeria densa and Potamogeton nodosus Growing Together. LARS ANDERSON and CHRIS PIROSKO, USDA-Agricultural Research Service,Weed Science Program UC Davis, CA

Egeria and American pondweed were grown together in temperature controlled columns at 0.4, 0.8, 1.2, and 1.6 m depths under artificial light. Vertical distribution of biomass, shoot abundance, and leaf area were determined. Maximum upper-canopy biomass and winter bud production were obtained in the shallower (higher light) columns. Biomass and shoot production was generally more evenly distributed vertically in the 1.2 and 1.6 m columns. Floating-leaf production in American pondweed was highest in the 0.4 and 0.8 m columns and resulted in severe reduction in downwelling irradiance. Possible differential responses to light levels (depths) of the two species will be discussed in regard to the current expansion of *Egeria* in the Sacrament/San Joaquin Delta