34nd Annual
Western Aquatic Plant Management Society
Annual Conference

March 30 – April 1, 2015

Crowne Plaza Portland ~ Portland, OR

WWW.WAPMS.ORG

Past WAPMS Meetings Sites and Presidents

2014	Reno, NV	Patrick Akers
2013	Coeur d'Alene, ID	Mark Sytsma
2012	San Diego, CA	Toni Pennington
2011	Westminster, CO	Thomas Moorhouse
2010	Seattle, WA	Robert Leavitt
2009	Honolulu, HI	Tom McNabb
2008	Tahoe City, CA	Scott Shuler
2007	Coeur d'Alene, ID	Ross O'Connell/ Lars Anderson
2006	San Diego, CA (25th Meeting)	Jenifer Parsons
2005	Denver, CO	George Forni
2004	Bellevue, WA	Terry McNabb
2003	Sacramento, CA	Shaun Hyde
2002	Coeur d'Alene, ID	Mike Mizumoto
2001	Las Vegas, NV	Ron Crocket
2000	Bozeman, MT	Valerie Van-Way
1999	Reno, NV	Stuart Perry
1998	San Diego, CA	Kathy Hamel
1997	Seattle, WA	Mark Sytsma
1996	Portland, OR	Vanelle Peterson
1995	Sacramento, CA	Fred Ryan
1994	Coeur d'Alene, ID	Paul Beatty
1993	Tucson, AZ	Lars Anderson
1992	Salt Lake City, UT	David Spencer
1991	Seattle, WA	Richard Thiery
1990	Sparks, NV	Tom McNabb
1989	Honolulu, HI	Barbra H. Mullin
1988	Fresno, CA	Fred Nibling
1987	Boise, ID	Winn Winkyaw
1986	San Diego, CA	Randall Stocker
1985	Phoenix, AZ	Nate Dechoretz
1984	Spokane, WA	Les Sonder
1983	Las Vegas, NV	Terry McNabb
1982	Denver, CO	First Business Meeting Terry McNabb (President); Paul Beaty (VP)
1981	Formation Interest meeting, San Diego, CA - Floyd Colbert and Lars Anderson (Co-chairs)	

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The objectives of the Society shall be to:

1. Establish a forum for the exchange of information on aquatic vegetation management techniques, strategies, and research through periodic meetings and other appropriate means.
2. Cooperate with local, state, regional, and national agencies, both public and private, in the identification of and solution to aquatic vegetation problems.
3. Promote uniformity and coordination of activities among agencies concerned with the regulatory aspects of aquatic plant management.
4. Encourage scientific research and assist in promoting the control and management of aquatic plants through scientifically sound procedure.
5. Recognize and promote scientific advancement of the members and facilitate the education of aquatic plant scientists through scholarship and other assistance programs.
6. Extend and develop public interest in, and understanding of, aquatic plant management problems and solutions.
7. Cooperate with local chapters and other organizations with similar and related interests.

The Western Aquatic Plant Management Society geographic region includes the states of:
Alaska, Arizona, California, Colorado, Hawaii, Idaho, Oregon, Nevada, New Mexico, Montana, Utah, Washington, and Wyoming

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PROGRAM

Monday, March 30

1:00 - 2:00	**Board of Directors Meeting (Windsor C)**
2:00 - 6:00	**Registration (Bellmont Foyer)**
2:00 - 6:00	**Exhibitor Setup (Bellmont BC)**
6:00 - 8:00	**President's Reception, hosted by Patrick Akers, President, WAPMS (Bellmont A)**

Tuesday, March 31

7:00 - 8:00	**Continental Breakfast (Bellmont BC)**
Session I (Bellmont A)	**Moderator: Patrick Akers (President, WAPMS), California Dept. of Food and Agriculture**
8:00 - 8:10	**Welcome:** Patrick Akers (President, WAPMS), California Dept. of Food and Agriculture
8:10 - 8:40	**Preventing an Alien Invasion: Protecting the Pacific Northwest from Aquatic Invasive Species** Phil Rockefeller; Northwest Power and Conservation Council
8:40 - 9:10	**TAME Melaleuca: The End of an Error** Paul Pratt; U.S.D.A, A.R.S
9:10 - 9:40	**USDA ARS: Research on Aquatic Weeds: An Overview** John D. Madsen; U.S.D.A, A.R.S

9:40 - 10:00	**Break (Bellmont BC)**
Session II (Bellmont A)	**Moderator: Joseph Vassios (Vice President, WAPMS), UPI**
10:00 - 10:20	**Flowering Rush - Update on Control Trial Results and Status in Washington** Jenifer Parsons; Washington Department of Ecology, Laurel Baldwin; Whatcom County NWCB
10:20 - 10:40	**Bonneville County Search and Rescue Divers Help Fight Flowering Rush in HydroElectric Dam Project to Protect Irrigation Waters** Jeffrey Pettingill; Bonneville County
10:40 - 11:00	**Flowering Rush Management: Moving Towards a Long-term Biologically-based Management Approach** John Madsen; U.S.D.A, A.R.S., Gray Turnage; Mississippi State University
11:00 - 11:20	**Spectrum and Efficacy of Stingray® for Control of Flowering Rush (Butomus umbellatus) in Aquatic and Riparian Areas** Andrew Z. Skibo and Ben Willis; SePRO Corporation
11:20 - 11:40	**Experimental Trials for The Removal of Flowering Rush in the Pend Orielle River System Using Diver Assisted Suction Dredging** Randy K. Polito and J.J. Polito; Diversified Diver Specialties
11:40 - 1:10	**Lunch (On Your Own)**
Session III (Bellmont A)	**Moderator: Cody Gray (Past President, WAPMS), UPI**
1:10 - 1:30	**Mapping of Creeping Waterprimrose (*Ludwigia* spp. L.) with Conventional Color Geo-referenced Imagery in the Willamette Basin** Alexander G. Park and Glenn Miller; Oregon Department of Agriculture, Crystal Durbecq; Benton SWCD, Aaron G. Day, Michael D. Halbleib, and Douglas E. Johnson; Oregon State University
1:30 - 1:50	**"Natural" Variability of Aquatic Plant Communities in Glacial Lakes: Results from Repeated Hydroacoustic and Species Surveys in Unmanaged Lakes** Ray Valley; Navico, Inc.
1:50 - 2:10	**Introducing a New But Not So New Aquatic herbicide To Add To Your Tool Box "AquaSweep"** Jon Storr; Nufarm Americas
2:10 - 2:30	**How to Get More Bang for Your Buck** Patrick A. Simmsgeiger; Diversified Waterscapes, Inc.

2:30 - 2:50	**BioSafe System's Activated Peroxygen: An Essential Tool for NPDES Guidelines, Treatment Studies from California Cyanobacteria and Their Associated Toxins to Tough Lyngbya in Florida** Tom Warmuth, BioSafe Systems, LLC.
2:50 - 3:10	**Break (Bellmont BC)**
Session IV (Bellmont A)	**Moderator: Lauren Courter (Director, WAPMS), Mount Hood Environmental**
3:10 - 3:30	**Community Driven Eradiation of Ludwigia peploides from a Private Palustrine Wetland in Portland, OR: Lessons Learned** Alex Staunch; Portland State University
3:30 - 3:50	**Investigating Monoecious Hydrilla (Hydrilla verticillata) Phenology in a Lotic System** Shannon Auell, Justin J. Nawrocki, and Robert J. Richardson; North Carolina State University
3:50 - 4:10	**Monoecious Hydrilla Tuber Dynamics Following Various Management Regimes** Justin J. Nawrocki; North Carolina State University
4:10 - 4:30	**Use of Hydrothol 191 in Controlling Cyanobacteria Blooms in Steilacoom Lake, WA** Doug Dorling; Northwest Aquatic EcoSystems
4:30 - 4:50	**Mechanical Control of Water Hyacinth in the Sacramento/ San Joaquin Delta System** Tom McNabb; Clean Lakes, Inc.
4:30 - 5:00	**Annual Business Meeting (Bellmont A)**
5:30 - 6:00	**Reception (Windsor BC)**
6:00 – 8:30	**WAPMS Annual Banquet (Windsor BC)**

Wednesday, April 1

7:00 - 8:00	**Continental Breakfast (Bellmont BC)**
Session V (Bellmont A)	**Moderator: Curt Cress (Director, WAPMS), Lonza**
8:00 - 8:10	**Conference Announcements and Updates**
8:10 - 8:30	**Update on the State of Washington's Aquatic Plant Control Activities**

Jenifer Parsons; Washington Department of Ecology

8:30 - 8:50	**An Update on the State of Idaho Aquatic Plant Control Program (Pending)** Tom Woolf; Idaho State Department of Agriculture
8:50 - 9:10	**An Overview of the Oregon State Aquatic Invasive Species Program** Rick Boatner; Oregon Department of Fish and Wildlife
9:10 - 9:30	**California's Hydrilla Eradication Program: 2014 Update** Patrick Akers; California Department of Food and Agriculture
9:30 - 9:55	**Break**
Session VI (Bellmont A)	**Moderator: Amy Ferriter (Director, WAPMS), Crop Production Services, Inc.**
9:55 - 10:00	**APMS Update** Cody J. Gray; UPI
10:00 - 10:20	**AERF and National NPDES Update** Carlton Layne; Aquatic Ecosystem Restoration Foundation
10:20 - 10: 40	**Aquatic Invasive Species (AIS) Management and Environmental Compliance in the Sacramento- San Joaquin Delta** Wendy B. Pratt; Crowe Horwath LLP
10:40 - 11:00	**Washington State Aquatic Plant and Algae Management NPDES General Permit Revision and Reissuance** Nathan R. Lubliner; WA Department of Ecology
11:00 - 11:20	**The Role of OWRC in Aquatic Plant Management in Oregon** April Snell; Oregon Water Resource Congress
11:20 - 11:40	**Changing Aquatic Herbicides for a Changing World** Kevin Waller; Northern Colorado Water Conservancy District
11:40 - 12:00	**Improvements in Endothall Usage in Irrigation Canals** Joseph D. Vassios, UPI
12:00 - 1:30	**Lunch (On Your Own)**
Session VII (Bellmont A)	**Moderator: Thomas Moorhouse (Director, WAPMS), Clean Lakes, Inc.**
1:30 - 1:50	**Clear Lake has a New Outlook on Scientific Research** Carolyn Ruttan; County of Lake

1:50 - 2:10	**Coeur d'Alene Lake Milfoil Control Program Update** Ben D. Scofield; Coeur d'Alene Tribe
2:10 - 2:30	**Strategies for Invasive Watermilfoil Management using Sonar Aquatic Herbicide and Related Herbicide Combinations** Scott Shuler and Mark Heilman; SePRO Corporation
2:30 - 2:50	**Operational Experience with two NSF Certified Technologies to Combat Cyanobacteria in Potable Water Supplies** Terry M. McNabb; Aquatechnex, LLC
2:50 - 3:10	**Case Studies of Endothall and Combination Treatments for EWM Control in the Midwest** Cody Gray; UPI
3:10	**MEETING ADJOURNED**
2:30 - 4:30	**Vendor and Exhibitor Breakdown (Bellmont BC)**
3:10 - 4:30	**WAPMS Board of Directors Meeting (Windsor C)**

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ABSTRACTS
In Alphabetical Order by Presenting Author

Patrick Akers. **California's Hydrilla Eradication Program: 2014 Update.** California Department of Food and Agriculture, Sacramento.

California's Hydrilla Program has been in existence since 1976, when hydrilla was first discovered in Marysville. Since that time, about 29 separate infestations have been discovered, of which about 23 have been eradicated. At the present time, there are about six active infestations. There are two separate sets of ponds near Redding that are very close to eradication. No plants have been seen there since 2007, and they have been out of treatment for three years. Two more years without plants and they will reach the threshold for eradication. There is a set of three small ponds in Nevada County northeast of Sacramento, where only a few plants have been found in any of the last four years. There are two separate infestations in the Sierra foothills about half-way between Marysville and Grass Valley. One of them is a small pond, where three plants have appeared in the last four years. The other infestation involves about the lowest 3 miles of a small water delivery canal and about 14 small ponds fed by the infested section of the canal. Eradicating the infestation in the canal has proved difficult. The final infestation is in 43,000-acre Clear Lake. Hydrilla populations in the lake are extremely low, but each year since 2010 we have found between six and 26 plants. Slowly, areas are being taken out of treatment as they reach specific criteria for time without plants. Surveys still continue at full intensity in the areas that are taken out of treatment. So far, only a few such areas have had to be returned to treatment.

Shannon Auell, Justin J. Nawrocki, and Robert J. Richardson. **Investigating monoecious hydrilla (*Hydrilla verticillata*) phenology in a lotic system.** North Carolina State University.

Monoecious hydrilla (*Hydrilla verticillata*) has been a growing problem in North Carolina's lakes and reservoirs since it was first discovered in 1980. However, it is now invading other systems such as rivers and natural lakes. One recent site of invasion is the Eno River near Durham, NC. This is a tributary of the Neuse River and is host to several rare species including the panhandle pebble snail. Despite its potential to invade a variety of aquatic systems, there is a lack of research documenting monoecious hydrilla's behavior in lotic systems. This study

focuses on hydrilla in the Eno River in North Carolina's piedmont region. Efforts included a mapping survey, preliminary phenology studies, tuber sampling, and an evaluation of management options. Biweekly phenology studies began in late September, 2014 at four spatially separated sites on the Eno. Female flowers and fruit were present during the first monitoring in September, but were absent by the next check in mid-October. Tuber formation was already underway in late September and continued into late November. Turion production began in October and turions were present on shoots into late November. By early December, shoots had detached from the sediment and were no longer present at any of the sites. Tuber and turion density studies were conducted at the same four sites. Average tuber density was 303 tubers per m^2 and average turion density was 48 turions per m^2.

Alan Bo J. Burns. **Introducing a New But Not So New Aquatic herbicide To Add To Your Tool Box "AquaSweep".** Nufarm Americas.

AquaSweep is the first liquid premix with a full terrestrial and aquatic uses label. Controls invasive and noxious weeds from the top of a mountain to the bottom of the river or lake including wetlands as well as rangeland and pasture. AquaSweep contains the active ingredients 2,4-D (34.2%) and Triclopyr (15.2%). Recent trial and demonstration work will be revealed to show the effectiveness of this product, while showing the selectivity for grasses, allowing excellent recolonization of native non-invasive plants. This product can control emergent, floating and submerged aquatic weeds and has shown excellent control of water primrose and many forms of milfoils.

Doug Dorling. **Use of Hydrothol 191 in Controlling Cyanobacteria Blooms in Steilacoom Lake, WA.**
Northwest Aquatic EcoSystems.

Each year lakes throughout the United States experience toxic cyanobacteria blooms, creating the need to develop an effective, economical and preventive treatment protocol essential to residential lake communities. Modeling for such events allows for uninterrupted recreational use throughout the summer months. Steilacoom Lake is a 320 acre highly developed residential water body supporting numerous salmonid species. Historically and currently the lake ecosystem supports numerous blue green algae populations that have produced toxins requiring health department warning postings. Over the years the homeowners association has been aggressive in investigation control alternatives that meet the budgetary restraints of the organization, provide a safe confident recreational platform for lake use while also supporting the fisheries and biological activities throughout the system. The presentation today will explore the history of treatment technologies evaluated and implemented during the past 30 years and the current use of Hydrothol 191 in managing the lake system.

Cody J. Gray. **Case Studies of Endothall and Combination Treatments for EWM Control in the Midwest.** UPI.

Eurasian watermilfoil and curlyleaf pondweed have long been problematic invasive aquatic species across the northern tier of the United States. Water managers have battled these species

for multiple years using a variety of techniques including herbicide applications, mechanical techniques, and biological control. Recently, a new species has started to become extremely problematic, hybrid watermilfoil. Hybrid watermilfoil is a hybrid cross between the non-native Eurasian watermilfoil and the native Northern watermilfoil. The hybrid species takes on characteristics of both parent species. Research has found many traditional applications using auxin herbicides has not been effective in controlling hybrid watermilfoil. This presentation will outline multiple lake management strategies targeting Eurasian watermilfoil, hybrid watermilfoil and curlyleaf pondweed.

Nathan R. Lubliner. **Washington State Aquatic Plant and Algae Management NPDES General Permit Revision and Reissuance.** Washington Department of Ecology.

The current Aquatic Plant and Algae Management NPDES General Permit will expire in March 2016. The process of revising and reissuing this permit will begin in spring 2015. Changes being considered by Ecology for inclusion in the next issuance of the permit will be presented. Ecology would also like to solicit input from permit users on what they feel needs revision in the upcoming reissuance of the permit.

John Madsen and Gray Turnage. **Flowering Rush Management: Moving Towards a Long-term Biologically-based Management Approach.** USDA ARS and Mississippi State University.

Flowering rush (*Butomus umbellatus*) is an invasive emergent plant that has created nuisance problems in the eastern US and Canada, the Midwest, and in the western US. Ecologically, it demonstrates tremendous plasticity in being able to thrive as a fully or largely submersed plant or an emergent plant, in standing water or water that fluctuates widely over the year, and across a range of climatic conditions. Research on management has not revealed a widely-applicable operational use pattern of herbicides or other technique. Flowering rush produces large numbers of buds on their rhizomes, as many as 400 buds per square meter, or over one million per acre. The rhizome bud is the key life history feature for targeting control. For long term success, the density of rhizome buds must continue to decline over time. Detroit Lakes (MN) utilizes two diquat treatments per year that both provides nuisance release, and results in a decrease in rhizome bud density each year. Much more work, however, needs to be done to achieve the goal of long-term management.

John D. Madsen. **USDA ARS: Research on Aquatic Weeds: An Overview.** USDA ARS.

The USDA ARS Exotic and Invasive Weed Research Unit have a long history of researching aquatic weeds in California and the West. Rather than survey the entire history and overview of recent research and future directions will be presented. The unit has two scientists in Albany focused on the biological control of aquatic and terrestrial weeds. They are evaluating insects that feed on water hyacinth, hydrilla, egeria, water primrose, giant reed, and others. The Albany scientists are housed in the USDA Western Regional Research Center, and utilize greenhouses and a quarantine facility there. The unit has three scientists at the Davis location are co-located with the Plant Sciences department of University of California-Davis, and have a research station

with the experimental farms. These scientists examine the biology, systematics, and ecology of aquatic weeds, as well as evaluate other management techniques. Weeds of interest include algae, egeria, Eurasian watermilfoil, giant reed, hydrilla, water hyacinth, water primrose and other species, and work in systems across the West including the Russian River, Sacramento-San Joaquin River Delta, and others. The EIWRU works with many federal, state and local government agencies, user groups, and others to improve management of invasive weeds.

Alexander G. Park and Glenn Miller, Crystal Durbecq, Aaron G. Day, Michael D. Halbleib, and Douglas E. Johnson. **Mapping of Creeping Waterprimrose (*Ludwigia* spp. L.) with Conventional Color Geo-referenced Imagery in the Willamette Basin.** Oregon Department of Agriculture, Benton SWCD, Oregon State University.

Land managers have only recently become aware of the rapid establishment and expansion of *Ludwigia hexapetala* (Hook) and *L. peploides* (Kunth) in the Willamette Basin of Oregon. Plant surveys for these species thus far have been limited and ground-based only because of complex ownership patterns and difficulty traversing low lying wetlands. Imagery from four aerial surveys of the Southern Willamette Valley were generated and examined for baseline *Ludwigia spp*. characteristics that can be applied to future surveys. Confusion with other aquatic species such as wapato (broadleaf arrowhead) (*Sagittaria latifolia* Willd.), parrot's feather and smartweed can occur. Since Ludwigia flowers are yellow, large, and distinctive, aerial images with ground resolution of finer than 2.4cm could be used for initial detection. In addition to flower color, the growth form, position along riverine channels, and texture of the Ludwigia mat allowed us to identify probable infestations. Potential Ludwigia sites were documented and made available to local land management organizations for ground-truthing in summer 2015. Through the use of fixed wing aircraft, productivity of the survey was high. An aerial survey of a 120 km (70 mile) river channel can be completed in a day.

Justin J. Nawrocki. **Monoecious Hydrilla Tuber Dynamics Following Various Management Regimes.** North Carolina State University.

Hydrilla [*Hydrilla verticillata* (L.f.) Royle] is the most economically damaging aquatic weed in the United States. Long term hydrilla control is complicated by persistent subterranean turions (tubers) that have been shown to remain viable for at least 6 years. Elimination of the tuber bank is essential for long term control or eradication efforts. Research was conducted on four North Carolina lakes to evaluate monoecious hydrilla tuber dynamics and to determine the effects of specific management techniques on monoecious hydrilla tuber numbers over time. Lake Gaston, Lake Tillery, Shearon Harris Lake, and the Tar River Reservoir were sampled for up to 7 years. Management practices and their effects on tuber density were assessed on each lake. Chemical control sites using fluridone were assessed on Lakes Tillery and Gaston whereas a combination of fluridone use, biological control through sterile grass carp, and physical control through drought induced summer drawdown was assessed on the Tar River Reservoir. Sites on Lake Gaston and Shearon Harris Reservoir with no active management were used as a control. De-watering and fluridone application in 2007 thru 2012 as well as a low density of grass carp stocking in 2013 resulted in an overall decrease in tuber density of 100% in the Tar River Reservoir. Two tubers found on the Tar River Reservoir in fall 2012 were assumed to be 6 years or older and were still viable. Lake Gaston sites subjected to fluridone treatment every other year demonstrated a tuber bank reduction of 26% after 2 years and 60% after 4 years. Sites on

Lake Gaston that were treated consecutively for 2 years exhibited a 75% reduction in tuber density. On the unmanaged Shearon Harris Reservoir, average whole lake densities ranged from 838 to 2,050 tubers per m^2 from 2008 to 2013. At a single sample site a density of 3,244 tubers per m^2 was recorded in the fall of 2008, which is higher than previously reported *in situ*.

Jenifer Parsons, Laurel Baldwin. **Flowering Rush - Update on Control Trial Results and Status in Washington.** Washington Department of Ecology, Whatcom County NWCB.

Flowering rush was first discovered in Washington in 1997, at which time it appeared to be limited to one lake. Since then it has been found in several major river systems, reservoirs and one additional lake and wetland. Containment and control methods have included hand pulling, covering, digging and herbicides. An update will be provided on hand removal in river systems, and on-going field trials with diquat.

Jeffrey Pettingill. **Bonneville County Search and Rescue Divers Help Fight Flowering Rush in HydroElectric Dam Project to Protect Irrigation Waters.** Bonneville County.

Flowering rush was recently found in one of four hydro-electric reservoirs belonging to the City of Idaho Falls. Off of this system flows a small irrigation system that covers a small 9 miles of ditches and canals of which irrigates many agricultural field, pastures, home lawns, and one Mom-and-Pop golf course. The Idaho State listed noxious weed was found in 30% of the irrigation system. Bonneville County Weed Control solicited the help of the Bonneville County Sheriffs Office Search and Rescue Dive team to help remove the weed from the Reservoir. The divers would dive down, hand remove the roots, and transport the weeds to the surface where crewman were collecting them for proper disposal. Bonneville County then worked with the local irrigation company to start herbicide treatments of the irrigation system for the weed. Applications of three different herbicides were utilized as soon as the water was out of the system in October, of which involved home-owners, farmers, and government agencies to pull it off.
A differnt approach at getting communities involved to solve a community problem. Tough weed, but with collaboration from unique sources we will contain the problem. County Weed Departments key activity is to get people to work together with different agencies, all to protect our valuable natural resources.

Randy K. Polito and J.J. Polito. **Experimental Trials for the Removal of Flowering Rush in the Pend Orielle River System Using Diver Assisted Suction Dredging.** Diversified Diver Specialties.

Flowering Rush (*Butomus umbellatus* L.) is an invasive species plant that has proven difficult to control in flowing water. We began experimenting with diver assisted suction dredging in the Pend Oreille River in the fall of 2014 under the auspices of the Pend Oreille County Weed Control Board. Working in flowing water, with flows up to 40,000 cfs, our divers experimented with various harvesting techniques in depths ranging from over ten feet to the shoreline. Utilizing the same equipment that we employ for the harvesting Eurasian watermilfoil

(*Myriophyllum spicatum*) as a foundation for our experiment, we made several modifications to our equipment to take into account the structure of the rhizome and the small size of the bulbils.

Paul Pratt. **TAME Melaleuca: The End of an Error.** USDA ARS.

Since its introduction into Florida, *Melaleuca quinquenervia* (melaleuca) has come to symbolize one of the most significant threats to biodiversity: the spread of aggressive, non-native plants into wetland systems. In south Florida, melaleuca has colonized almost every vegetation community, from sawgrass marshes to pine uplands, forming dense forests that crowd out native vegetation and the birds and animals that depend on it. The South Florida Water Management District (SFWMD) and other members of the Florida Exotic Pest Plant Council began an aggressive campaign to suppress melaleuca populations in south Florida using available mechanical, chemical and cultural controls, and documented their approach in the Melaleuca Management Plan. After a decade, melaleuca acreage on public lands decreased dramatically, but it continued to spread on private properties and reinvade neighboring public lands.

An even more comprehensive approach was available after new biological control agents were introduced to assist in the management of melaleuca. However, serious questions remained regarding how these insects could be integrated into the existing control options and if they would aid in controlling the weed where management efforts ended: on private lands. In 2001 the USDA's Agricultural Research Service (ARS), SFWMD, the National Parks Service, Army Corps of Engineers, and several other agencies created the TAME Melaleuca project to continue promoting melaleuca management on public and private lands, and to demonstrate effective inclusion of biological control in management strategies.

Demonstration sites were established and "Melapaleuza" events were created as a series of training workshops and field tours. As a result of these educational programs, land managers from over 40 agencies that are responsible for invasive species control efforts on over 1.4 million acres were equipped with the information needed to implement an integrated melaleuca management program on the majority of infested acres in the state.

Wendy B. Pratt. **Aquatic Invasive Species (AIS) Management and Environmental Compliance in the Sacramento- San Joaquin Delta.** Crowe Horwath LLP.

The California Department of Parks and Recreation, Division of Boating and Waterways (DBW) has legislative authority to conduct control programs for three AIS: water hyacinth *(Eichhornia crassipes)*, Brazilian elodea *(Egeria densa)*, and South American spongeplant *(Limnobium laevigatum)*. These control programs take place in a complex tidal environment that is arguably one of the most environmentally and politically sensitive regions in California. The programs were authorized by separate state legislation in 1982, 1996, and 2012. In 2013, California created a new process for authorizing new AIS control programs in the Delta, eliminating the need for separate legislation to establish each new AIS control program.

The regulatory and permit compliance requirements for the three current control programs are complex. DBW, with their federal and local partners, complies with the federal Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Clean Water Act, California Environmental Quality Act, California Endangered Species Act, and County

Agricultural Commissioner requirements. Navigating this regulatory environment on a species-by-species basis has been dynamic, complex and time-consuming.

Recent initiatives to better understand and address plant AIS challenges in the Delta have highlighted the complexity of these programs and the regulatory environment in which they operate. DBW and other federal, state, and local stakeholders are developing a more holistic and comprehensive approach that could better address and manage the on-going, expanding, and challenging issues facing AIS control in the Delta. This presentation will examine the current environmental compliance landscape in the Delta, and discuss steps DBW and their partners will be taking to develop a comprehensive Delta Aquatic Invasive Species Management Plan, including a longer-term approach to support federal Endangered Species Act compliance.

Phil Rockefeller. **Preventing an Alien Invasion: Protecting the Pacific Northwest from Aquatic Invasive Species.** Northwest Power and Conservation Council.

The Northwest Power and Conservation Council (the Council) is an interstate compact agency created by Congress under the Northwest Power Act of 1980 and formed by the four Pacific Northwest states of Idaho, Montana, Oregon and Washington. I will provide background information about the Council and what we do in terms of regional energy and fish and wildlife planning. In late 2014, the Council amended its Fish and Wildlife Program for the Columbia River Basin. Key provisions in the Program will be highlighted, with a focus on those measures aimed at preventing, controlling and managing non-native and invasive species in the basin. I will discuss the implications of hybrid habitats and the degradation that can occur as a result of a successful invasion of non-native flora or fauna in the Columbia Basin. I will mention the vital role Pacific Northwest residents can take to protect our natural and built environments from being overwhelmed by invasive species. I will also summarize conclusions from the Council's Independent Economic Analysis Board's 2013 report on the economic risk of quagga and zebra mussels becoming established in the Columbia River Basin. More recently, the Council has been actively involved and collaborating with regional groups on aquatic invasive species efforts and issues, including coordinated efforts to build a regional perimeter defense system against dreissenid mussels and aquatic invasive species in general.

Carolyn Ruttan. **Clear Lake has a New Outlook on Scientific Research.** County of Lake, CA.

Clear Lake is the largest lake within California's state lines, 63 square miles, and oldest lake in North America, possibly 2.5 million years. It has all the challenges of a highly eutrophic and recreationally, very well used lake: presence of noxious invasive weeds, prevention of noxious invasive species, cyanobacteria blooms, public health issues from cyanotoxins, TMDLs for nutrients and mercury, and an endangered fish.

We are a disadvantaged community with a very small population meaning we get very little financial help from local, state or federal sources. Three people who want to see Clear Lake used as a valuable resource for scientific research have created the Clear Lake Environmental Research Center. We will no longer be described as a neglected water body but one providing solutions to the world's water challenges.

Ben D. Scofield. **Coeur d'Alene Lake Milfoil Control Program Update.** Coeur d'Alene Tribe.

Both *Myriophyllum spicatum* and the hybrid *M. spicatum* × *M. sibiricum* are present in Coeur d'Alene Lake, Idaho. Annual control efforts for these invasive milfoils began in 2006. Control techniques have included herbicide, bottom barriers, diver suction dredging, and hand pulling. Treatment efficacies have varied widely and issues contributing to variable efficacies will be discussed. For herbicide treatments, water exchange and maintaining adequate contact times has been identified as a major challenge. Long term and within season plant community response to treatments will also be discussed.

Scott Shuler and Mark Heilman. **Strategies for Invasive Watermilfoil Management using Sonar Aquatic Herbicide and Related Herbicide Combinations.** SePRO Corporation.

Management of invasive watermilfoil--both common parental Eurasian watermilfoil and now emerging issues with hybrid crosses of Eurasian and Northern watermilfoil--requires a balance between optimizing long-term control and selectivity to native aquatic vegetation. Low-dose use patterns for Sonar® Aquatic Herbicide (ai. fluridone) were developed in the 1990's to attempt to balance these key technical factors. Recent management efforts utilizing various pellet formulations and different timing of initial application and duration of exposure as well as combinations with other different herbicides provide complementary, alternate strategies for future management of invasive watermilfoil. The presentation will review several representative treatment efforts from around the US including herbicide dissipation and vegetation assessment data to describe the benefits and limitations of past use patterns and suggest several directions moving forward to improve further upon a history of successful management outcomes.

Patrick A. Simmsgeiger. **How to Get More Bang for Your Buck.** Diversified Waterscapes, Inc.

Undesirable aquatic plants can have a plethora of undesirable effects on aquatic ecosystems. These negative effects run the gamut from aesthetic, such as unattractive water coloration and foul odors, to the ecological, including lowered D.O. levels and interruption of natural food chain. The solution has been the application of herbicides to achieve high degrees of success. Knowing this, we intend to show how we cut the costs of herbicide application without sacrificing overall effectiveness. In our study, we demonstrate how combination of the herbicide Clipper and our proprietary algaecide and enzyme solution have achieved the same degree of efficacy while using lower doses of herbicide. By achieving this, we have ensured the most cost-effective and potent treatment to maintain a balanced aquatic ecosystem.

Andrew Z. Skibo and Ben Willis. **Spectrum and Efficacy of Stingray® for Control of Flowering Rush (Butomus umbellatus) in Aquatic and Riparian Areas.** SePRO Corporation.

Flowering Rush (*Butomus umbellatus*), has spread across the northern United States and is now listed as noxious/invasive in numerous Western US States. Flowering Rush is adapted to areas of seasonal fluctuation, abiotic/ anthropogenic disturbances such as littoral zones, flood plains,

irrigation canals, wastewater areas, other areas of seasonal fluctuation/ disturbances. As this species is commonly found in areas that dictate the use of aquatically labelled herbicides, site managers are significantly limited with regards to effective chemical options and those with restricted uses in and around waters intended for irrigation purposes. A number of herbicide chemistries (imazapyr, fluridone, topramezone, penoxsulam) are known to be effective when applied as pre-emergent treatments to established stands of Flowering Rush, however, these regimens require exposure of the hydrosoil for application. Other active ingredients with more rapid apparent activity (e.g. diquat, endothall), while highly effective at reducing emerged biomass, are relatively ineffective at controlling belowground biomass and require numerous applications over sequential seasons to effectively reduce Flowering Rush biomass in established stands.

Studies were conducted in the greenhouse and in the field to evaluate relative efficacy of Stingray® (a.i. carfentrazone-ethyl), alone and in combinations with Clearcast® for emergent biomass reduction during season of application and rhizome reduction, as measured in stand regrowth during subsequent growing seasons. These trials demonstrated a high level of efficacy in reducing Flowering Rush biomass at 28.6 - 224g/ha; indicating Flowering Rush was extremely susceptible to Stingray even at 15% of the maximum label rate (e.g. 33.6g/ha). Additional microcosm trials investigating the performance of Stingray® in combination with Clearcast® indicated the threshold of 33.6g/ha Stingray in combination with 560g/ha of Clearcast was capable of removing plant biomass and increase the longevity of control to eleven weeks after treatment (WAT). Field assays, treated with Stingray alone (100.8 and 224 g/ha) and in combination with Clearcast (280 and 560 g/ha, respectively) demonstrated similar response with regards to emergent biomass control, (≥90%) 28DAT for all rates of Stingray® alone and Stingray® at 280 g/ha in combination with Clearcast® (280 g/ha). While second season data is yet to be collected, the results of these trials indicate that Stingray alone or in combination with a systemic partner such as Sonar® or Renovate®, is a highly cost effective management option for the management of Flowering Rush in a number of sites as compared to less selective or more expensive options.

Alex Staunch. **Community Driven Eradication of *Ludwigia peploides* from a Private Palustrine Wetland in Portland, OR: Lessons Learned.** Portland State University.

Ludwigia peploides ssp. *montevidensis* is an exotic macrophyte expanding in range throughout Oregon. An established infestation of *L. peploides* has undergone eradication within the three acre Blue Heron Wetland complex of Portland, Oregon since 2012. The removal effort was motivated and managed by residents of the East Columbia Neighborhood with the goal to restore open water habitat for avian species. In concordance with Portland State University, a monitoring program was established to assess the efficacy of 3% glyphosate and hand pulling in the eradication of *L. peploides*. Fifteen 6 m x 6 m test plots were constructed in areas that experienced year-round soil saturation. Biomass sampling and GIS cover class maps were used to assess eradication efforts of chemical and manual control. Ten months after a 2012 fall chemical application, high density (>50% cover) and moderate density (5-50%) were reduced by 60%, shifting to a sparse cover class (<5%) with a 4.5% reduction in overall range. Heaviest infestations of *L. peploides* remained where flowering occurred earlier in the season in response to soil drying. Chemical application was repeated on August 8, 2013 in an attempt to yield more effective control along bank areas. Four hand removal events occurred in 2014 to prevent rapid re-growth and colonization. The early season chemical application and hand removals yielded a

76% reduction in range from base levels in 2014. Monitoring plots, receiving only chemical application, showed rapid reestablishment of *L. peploides* a year after chemical application. Results support the need to couple chemical application and manual removal to improve effectiveness in control within environments similar to the Blue Heron Wetlands. Furthermore chemical application of 3% glyphosate should be applied at times that correlate with the flowering of *L. peploides*.

Ray Valley. **"Natural" Variability of Aquatic Plant Communities in Glacial Lakes: Results from Repeated Hydroacoustic and Species Surveys in Unmanaged Lakes.** Navico, Inc.

A range of disturbances at different scales affect aquatic plant communities. Aquatic Plant managers must understand underlying system variability to judge whether change in aquatic plant growth in a managed lake is due to the management action or natural variability. Past research demonstrates that interannual variability in aquatic plant abundance depends on lake productivity. Eutrophic lake typically exhibit higher variability than mesotrophic lakes regardless of whether aquatic plants are being managed. I present results from multi-year point-intercept and hydroacoustic aquatic plant surveys on an unmanaged, native-only eutrophic Minnesota Lake and eutrophic Wisconsin Lake infested with Eurasian watermilfoil. Results demonstrate large changes in vegetation biovolume and invasive species dominance from year to year with no aquatic plant management. Consequently, monitoring reference conditions should complement any aquatic plant management study or program.

Joseph D. Vassios. **Improvements in Endothall Usage in Irrigation Canals.** UPI, Inc.

Irrigation canals are a major source of water for agricultural production in the western United States. Control of aquatic vegetation and algae in irrigation canals is crucial for efficient water delivery in irrigation canals. While aquatic weeds can have a significant impact on water flow, the tools available to canal managers for control are limited. The In 2010, two endothall formulations were labeled for use in irrigation canals. Cascade is the dipotassium salt of endothall, and works to control a range of aquatic weed species. Teton is an amine formulation of endothall that can control both submersed plants and algae. Since their introduction in 2010, Cascade and Teton have been successfully incorporated into the programs of many irrigation districts. Sago pondweed (*Stuckenia pectinata*) was the main target species identified during the development of endothall for irrigation canals. During their first seasons of use, differential susceptibility was identified, with some species being more difficult to control. Elodea (*Elodea canadensis*) is one species that has been difficult to control. Additional studies conducted on elodea have indicated that Teton applied at 2 ppm or greater can significantly reduce elodea biomass, with longer exposure time resulting in greater control. Chara (*Chara spp.*) is an algae species that commonly occurs in the West, and is often difficult to control in flowing water systems. A trial evaluating chara control using Teton indicated that a concentration of 0.5 ppm for a minimum of 4 hrs can provide excellent control. These and other trials have been used to refine use rates for irrigation canals. In addition to these species, additional trials are being conducted on horned pondweed (*Zannichellia palustris*). Results from field applications and these ongoing trials indicate that Cascade and Teton provide a safer and more effective tool for controlling aquatic weeds and algae in irrigation canals compared to alternative control methods.

Kevin Waller. **Changing Aquatic Herbicides for a Changing World.** Northern Colorado Water Conservancy District

Changes in water use from primarily irrigation to municipal and industry requires a change in the type of aquatic herbicides and methods of control of aquatic pest species. Northern Colorado Water Conservancy (Northern Water) suspended the use of all copper based products for algae and aquatic plant control in 2007 because of State and Federal copper discharge limits to rivers and fish bearing waters. Canal capacity problems soon arose from algal species such as *Ulothrix* (*tenuissima* and zonata) and *Didymosphenia geminate.* Beginning in 2007, Northern Water began applying hydrogen peroxide based products such as *PAK-27* and *Phycomycin* for attached algae control with limited results. In 2012 Northern Water finally had success controlling attached algae in fast flowing, concrete-lined irrigation canals using *Green Clean Liquid*. For canals moving less water, *Phycomycin* and *Green Clean Pro* were applied in 2013-2014 using a custom-made air powered applicator. A combination of dewatering and blowing *Phycomycin/Green Clean Pro* onto attached algae on the canal sides and to True Moss (*Bryophyta*) on the canal bottom proved highly effective.

Elodea and *Eurasian watermilfoil* are hard to control using *Teton*/*Cascade* at labeled rates in flowing water with both domestic and irrigation uses. Higher (but labeled) rates of *Teton/Cascade* can be used to control problem aquatic plants after irrigation canals go off for the season, but before they dry up. Since 2011, Northern Water has successfully made Fall applications with a truck-mounted ground rig when irrigation canals are off but still in a "ponded condition". Water quality sampling has shown that the endothall disappears from ponded water in less than 3 weeks.

Irrigators can control aquatic plants and algae by changing products, changing timing and changing conditions to benefit them and their water users.

Tom Warmuth. **BioSafe System's Activated Peroxygen: An Essential Tool for NPDES Guidelines, Treatment Studies from California Cyanobacteria and Their Associated Toxins to Tough *Lyngbya* in Florida.** BioSafe Systems, LLC.

BioSafe Systems' presentation will be geared towards giving an in-depth overview of the products and services that we offer to businesses in the Aquatic industry. This will include a brief synopsis of BioSafe Systems as a company, our mission, and our products and services. Following this introduction the presentation will move into a PowerPoint presentation that focuses on our Aquatic products GreenCleanPRO, a granular algaecide, and GreenClean Liquid 2.0, a peroxide based liquid algaecide. The PowerPoint will begin with updates on product EPA registrations, as there have been recent changes. After reviewing registration updates there will be an overview on the chemistry of both GreenCleanPRO and GreenClean Liquid 2.0 that will go into more detail on each product's mode of action accompanied by case studies and research. These studies will highlight the effectiveness of both products and their impact upon the environment. Specific studies included in the presentation will include a trial that dealt with treating Microcystis and its associated toxin, a case study on GreenClean Liquid's effectiveness in treating Lyngbya in Florida. The presentation will end with new developments that have been made regarding the ability to tank mix with both GreenCleanPRO and GreenClean Liquid 2.0, a quick discussion regarding the direction BioSafe Systems is heading in

and our willingness to work closely and cooperatively with distributors/applicators/researchers, and finally a few minutes for questions at the end.

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