54th Annual Meeting of the Aquatic Plant Management Society

Program & Abstracts

Hilton Savannah DeSoto
Savannah, Georgia
July 13-16, 2014

The Aquatic Plant Management Society, Inc. is an international organization of scientists, educators, students, commercial pesticide applicators, administrators, and concerned individuals interested in the management and study of aquatic plants. The membership reflects a diversity of federal, state, and local agencies, universities and colleges around the world, corporations, and small businesses. Membership applications are available at the meeting registration desk.

The Objectives of the Society are to assist in promoting the management of nuisance aquatic plants, to provide for the scientific advancement of members of the Society, to encourage scientific research, to promote university scholarships, and to extend and develop public interest in the aquatic plant science discipline.

Our Mission: Promote environmental stewardship through scientific innovation and development of technology related to integrated plant management in aquatic and riparian systems.

The Aquatic Plant Management Society thanks Duke Energy Carolinas for their generous contribution to print and distribute the Program for the 54th Annual Meeting!

DUKE ENERGY.

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Board of Directors

Committee Chairs

Awards	Mike Netherland
Bylaws and Resolutions	Jim Schmidt
Education and Outreach	Jeffrey Schardt
Exhibits	Craig Aguillard
Finance	John Gardner
Legislative	John Madsen
Meeting Planning	Tommy Bowen
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Nominating	Terry Goldsby
Past President's Advisory	Terry Goldsby
Program	Cody Gray
Publications	Jay Ferrell
Regional Chapters	Rob Richardson
Scholastic Endowment	John Gardner
Strategic Planning	John H. Rodgers, Jr.
Student Affairs	Rebecca Haynie
Website	Ryan Wersal

Special Representatives

AERF	Carlton Layne
BASS	Gerald Adrian
CAST	Ryan Wersal
NALMS	Terry McNabb
RISE	Joe Bondra
Science Policy Director	Lee Van Wychen
WSSA	Cody Gray

APMS Presidents and Meeting Sites

1961	T. Wayne Miller, Jr.	Fort Lauderdale, FL
1962	T. Wayne Miller, Jr.	Fort Lauderdale, FL
1963	William Dryden	Tampa, FL
1964	Herbert J. Friedman	Tallahassee, FL
1965	John W. Woods	Palm Beach, FL
1966	Zeb Grant	Lakeland, FL
1967	James D. Gorman	Fort Myers, FL
1968	Robert D. Blackburn	Winter Park, FL
1969	Frank L. Wilson	West Palm Beach, FL
1970	Paul R. Cohee	Huntsville, AL

1971	Stanley C. Abramson	Tampa, FL
1972	Robert J. Gates	Miami Springs, FL
1973	Brandt G. Watson	New Orleans, LA
1974	Alva P. Burkhalter	Winter Park, FL
1975	Luciano Val Guerra	San Antonio, TX
1976	Ray A. Spirnock	Fort Lauderdale, FL
1977	Robert W. Geiger	Minneapolis, MN
1978	Donald V. Lee	Jacksonville, FL
1979	Julian J. Raynes	Chattanooga, TN
1980	William N. Rushing	Sarasota, FL

1981	Nelson Virden	Jackson, MS
1982	Roy L. Clark	Las Vegas, NV
1983	Emory E. McKeithen	Lake Buena Vista, FL
1984	A. Leon Bates	Richmond, VA
1985	Max C. McCowen	Vancouver, BC
1986	Lars W. J. Anderson	Sarasota, FL
1987	Dean F. Martin	Savannah, GA
1988	Richard D. Comes	New Orleans, LA
1989	Richard Couch	Scottsdale, AZ
1990	David L. Sutton	Mobile, AL

1991	Joseph C. Joyce	Dearborn, MI
1992	Randall K. Stocker	Daytona Beach, FL
1993	Clarke Hudson	Charleston, SC
1994	S. Joseph Zolczynski	San Antonio, TX
1995	Steven J. de Kozlowski	Bellevue, WA
1996	Terence M. McNabb	Burlington, VT
1997	Kurt D. Getsinger	Fort Myers, FL
1998	Alison M. Fox	Memphis, TN
1999	David F. Spencer	Asheville, NC
2000	J. Lewis Decell	San Diego, CA

2001	Jim Schmidt	Minneapolis, MN
2002	David P. Tarver	Keystone, CO
2003	Richard M. Hinterman	Portland, ME
2004	Ken L. Manuel	Tampa, FL
2005	Eric P. Barkemeyer	San Antonio, TX
2006	Jeffrey D. Schardt	Portland, OR
2007	Donald W. Doggett	Nashville, TN
2008	Jim Petta	Charleston, SC
2009	Carlton Layne	Milwaukee, WI
2010	Greg MacDonald	Bonita Springs, FL

2011	Linda Nelson	Baltimore, MD
2012	Tyler Koschnick	Salt Lake City, UT
2013	Terry Goldsby	San Antonio, TX
2014	Mike Netherland	Savannah, GA

APMS Award Recipients

Honorary Members (year of honor)

Awarded to persons who have been voting members of the Society for no less than ten years, have contributed significantly to the field of aquatic vegetation management, and must have actively promoted the Society and its affairs during their membership.

William E. Wunderlich	1967
F. L. Timmons	1970
Walter A. Dun	1976
Frank S. Stafford	1981
Robert J. Gates	1984
Herbert J. Friedman	1987
John E. Gallagher	1988
Luciano “Lou” Gallagher	1988
Max C. McCowen	1989
James D. Gorman	1995
T. Wayne Miller, Jr.	1995
A. Leon Bates	1997
Richard Couch	1997
N. Rushing	1997
Alva P. Burkhalter	2002
J. Lewis Decell	2004
Paul C. Myers	2005
David L. Sutton	2006
Dean F. Martin	2007
Robert C. Gunkel, Jr.	2008
Allison M. Fox	2010
Randall K. Stocker	2010
Steven J. de Kozlowski	2010
Carole Lembi	2011
Lars W.J. Anderson	2012
David Tarver	2012
Don Doggett	2013
Richard Hinterman	2013

President’s Award (year of award)

An individual, designated by the current President, who has displayed "*Many Years of Dedication and Contributions to the Society and the Field of Aquatic Plant Management*".

T. O. “Dale” Robson	1984
Gloria Rushing	1991
William T. Haller	1999
David Mitchell	1999
Jeffrey D. Schardt	2002
Jim Schmidt	2003
Robert C. Gunkel, Jr.	2004
Victor A. Ramey	2006
William H. Culpepper	2007
Kurt Getsinger	2008
Richard Hinterman	2009
Steve D. Cockreham	2010
Donald W. Doggett	2012
Carlton Layne	2013

Max McCowen Friendship Award (year of award)

Judy McCowen	1995
John E. Gallagher	1997
Paul C. Myers	2000
William T. Haller	2002
Bill Moore	2006
Vernon V. Vandiver, Jr.	2012

A special recognition given to an APMS member whose demeanor and actions display sincerity and friendship in the spirit of being an ambassador for the APMS. Criteria include warmth and outgoing friendship, sincerity and genuine concern, gracious hospitality, positive attitude/smile.

T. Wayne Miller Distinguished Service Award (year of award)

Gerald Adrian	2005
Linda Nelson	2007
Surrey Jacobs	2009
Amy Richard	2010
Michael Netherland	2011
John H. Rodgers, Jr.	2012
John Madsen	2013

An individual recognized for *"Service to the Society and the Profession"*. Considerations include completion of a relatively short-term project taking considerable effort resulting in advancement of aquatic plant management; performance beyond the call of duty as an APMS officer, chair, or representative; or non-member achievement leading to the advancement of APMS goals and objectives.

Outstanding Graduate Student Award (year of award)

Ryan Wersal	Mississippi State University	2010
Joe Vassios	Colorado State University	2011
Sarah True-Meadows	North Carolina State University	2013

A student recognized for outstanding achievement during graduate studies in the field of aquatic plant management.

Outstanding International Contribution Award (year of award)

Deborah Hofstra	National Institute of Water and Atmospheric Research	2013

An individual or group recognized for completion of research or outreach activities that are international in nature.

Outstanding Journal of Aquatic Plant Management Article Award

James Johnson, Ray Newman	University of Minnesota	2012
A Comparison of Two Methods for Sampling Biomass of Aquatic Plants		

An award voted by the Editor and Associate Editors for research published in the JAPM during the previous year.

Outstanding Research/Technical Contributor Award (year of award)

Michael D. Netherland, Dean Jones, Jeremy Slade	2010
Kurt Getsinger	2011
Mark Heilman	2013

An individual or group recognized for completion of a research project or technical contribution related to aquatic plant management that constitutes a significant advancement to the field.

APMS Graduate Student Research Grant (year and amount of grant)

Mary Bremigan, Michigan State University, 1999 - $34,000
The Indirect Effects of Sonar Application on Lake Food Webs

Katia Englehardt, University of Maryland, 2001 - $40,000
Controlling Non-native Submersed Aquatic Macrophyte Species in Maryland Reservoirs: Plant Competition Mediated by Selective Control

Susan Wilde, University of South Carolina, 2005 - $40,000
Investigating the Role of Invasive Aquatic Plants and Epiphytic Cyanobacteria on Expression of Avian Vacuolar Myelinopathy (AVM)

John Madsen and Ryan Wersal, Mississippi State University, 2007 - $60,000
The Seasonal Phenology, Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vellozo) Verdecourt]

Rob Richardson, Sarah True and Steve Hoyle, North Carolina State University, 2010 - $40,000
Monoecious Hydrilla: Phenology and Competition

Ryan Thum, Grand Valley State University, 2012 - $40,000
A Quantitative Genetics Approach to Identifying the Genetic Architecture of Herbicide Susceptibility, Tolerance, and Resistance in Hybrid Watermilfoils (Myriophyllum spicatum x sibiricum)

Sustaining Members

Alligare, LLC is a leading supplier in industrial vegetation management and a subsidiary of ADAMA, the world's largest manufacturer of post patent crop protection chemicals. Our markets include vegetation management, forestry, right-of-way, range and pasture, and aquatics. Alligare works directly with manufacturers around the world to bring the highest level of product quality and service to our customer. Alligare Specialists provide product and service faster and more cost effectively than a traditional sales force.

Since 1981, **Applied Aquatic Management, Inc**., (AAM) has provided innovative and effective water management services, selective vegetation control, wetland management and exotic weed control. AAM has clients throughout Florida including developers, homeowners associations, golf courses, mobile home communities, utilities, local, state and federal government agencies and industry. Our experienced professional staff provides unique knowledge along with advanced equipment to manage all types of waterway, right-of-way, wetland, and upland systems.

Applied Biochemists®, A Lonza Business., is proud of its active membership and participation with the APMS for over 40 years. As a manufacturer and supplier of algaecides, aquatic herbicides and other water management products, we highly value the science and integrity the APMS brings to our industry. We are part of a leading life sciences company, dedicated to the development, production and application of a wide variety of products to improve the recreational and functional value of water, and quality of life throughout the world.

Aqua Services, Inc. is a full-service, aquatic resource management company that specializes in aquatic vegetation management. Established in 1983, the company has provided aquatic plant management for entities in the southeastern U.S. that include the Army Corps of Engineers, the Tennessee Valley Authority, Southern Company, and the Tennessee Wildlife Resource Agency. Aqua Services also provides lake management consulting including electro-fishing assessments, water quality analysis and enhancement, and recreational lake design.

AquaTechnex, LLC is a lake and aquatic plant management firm that operates in the Western United States. The company is expert in the use of aerial and boat GIS/GPS technologies to assess aquatic environments. The firm is also expert in the management of invasive aquatic weed species and phosphorous mitigation to suppress toxic cyanobacteria blooms. Our web site is www.aquatechnex.com; please drop by regularly to get news updates as we have moved our blog onto the site.
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Aquatic Control, Inc. has been managing aquatic resources since 1966. As a distributor of lake management supplies, floating fountain aerators, and diffused aeration systems, Aquatic Control represents Applied Biochemists, AquaBlok, BioSafe Systems, Brewer International, SePRO, Syngenta, United Phosphorus, AquaMaster, Kasco, and Otterbine. Aquatic Control has five offices that offer aquatic vegetation management plans including vegetation mapping and application services, fountain and aeration system installation, maintenance, and service throughout the Midwest.

Brewer International, located in Vero Beach, Florida, has been a chemical manufacturer since 1973. This location is perfect because the company purchases limonene, a low viscosity oil derived from the peel of citrus fruit. This natural ingredient is used in many of Brewer's formulations including two OMRI Listed Organic surfactants: Organic-Kick and Vin-Kick. The company offers aquatic surfactants Cide-Kick, Cide-Kick II, Cygnet Plus, I'Vod, Sun Wet, and Poly Control 2. Check out our web site at www.brewerint.com and visit us on our Facebook page.

Clarke Aquatic Services is a global environmental products and services company. Our mission is to make communities around the world more livable, safe, and comfortable. By understanding our customers' needs, we tailor service programs that draw on our unmatched breadth of industry experience, expertise, and resources. We pioneer, develop and deliver environmentally responsible mosquito control and aquatic services to help control nuisances, prevent disease, and create healthy waterways.

Crop Production Services, Inc. (CPS) is a national distributor dedicated to providing innovative solutions and quality products for our customers in the aquatic industry. With our experienced sales force and national warehouse network, CPS provides fast, reliable access to the products our customers need, the services our customers want, and emerging technologies that will address vegetation management needs today and into the future. At CPS, we work closely with customers to develop solutions for their vegetation management programs.

Cygnet Enterprises, Inc. is a national single source distributor of aquatic management products with offices and warehouses in Michigan, Indiana, Pennsylvania, North Carolina, California and Idaho. Cygnet is proud of its reputation for outstanding service, friendly, knowledgeable staff and our unmatched support of the aquatics industry. Cygnet Enterprises is the only aquatic distributor at the voting Gold Member level in the Aquatic Ecosystem Restoration Foundation (AERF). Please visit www.cygnetenterprises.com.

Lake Restoration produces products for lakes & ponds including: Mizzen algaecide, LAKEMAID, Goose D-Fence, Sapphire Bay pond dye, and MuckMaid. Mizzen is a copper based algaecide. The patented LAKEMAID eliminates lake weeds automatically. The Goose D-Fence is a retractable solution for goose problems. Founded in 1977, Lake Restoration is based in Minnesota. For more information visit our website www.lakerestoration.com.

Valent Corporation signed a formal agreement with **Nufarm Americas** giving them exclusive distributorship of its products. All of Valent's Professional Products, including its aquatics products Clipper and Tradewind will now be sold by Nufarm. This allows Nufarm to offer a portfolio of 10 products labeled for aquatics. Nufarm provides a wide variety of products labeled for aquatics; both systemic and contact, that can be used selectively or broad spectrum depending on their use

For over 20 years, **SePRO Corporation** has developed innovative technologies to advance the science of water management. The SePRO team provides comprehensive assessment, planning and implementation solutions. Our focused disciplines include aquatic plant and algae management, water quality restoration, laboratory analysis, mapping and data management. Whether you are looking to assess a water resource, design a prescription plan or implement a restoration program, SePRO provides expertise and solutions to preserve our most precious natural resource – water. www.sepro.com

Invasive weeds can devastate both natural and commercial habitats. **Syngenta** provides high performance products to control destructive weeds while helping to restore the habitat of aquatic environments. Syngenta offers proven aquatic herbicides like Reward®, Tribune™ and Refuge™, the most concentrated glyphosate in the aquatics market.

United Phosphorus, Inc. manufactures and markets aquatic herbicides and algaecides for lakes, ponds, and irrigation canals. These products are marketed as Aquathol®, Hydrothol®, Symmetry®, Current®, Cascade®, Teton® and recently approved by EPA, AquaStrike®. UPI is a leader in the development of new uses, techniques, and formulations to improve aquatic plant management strategies. UPI is a worldwide producer of crop protection products with U.S. operations based in King of Prussia, PA. For more information please visit www.upi-usa.com or www.cascadeforcanals.com.

Vertex Water Features, a division of **Aquatic Systems, Inc.** is a science and engineering based aeration system manufacturer that provides custom designed water quality solutions distributed through its dealer network to interested lake owners, lake managers, developers and government agencies throughout North America and internationally. www.vertexwaterfeatures.com 1-800-432-4302 sue@vertexwaterfeatures.com.

Meeting Sponsors

The Aquatic Plant Management Society appreciates the generous support of the following meeting sponsors. Through their support and contributions, we are able to conduct a successful and enjoyable meeting.

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Exhibitors

The Aquatic Plant Management Society thanks the following companies for exhibiting their products and services.

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Davidson, North Carolina

Applied Biochemists, A Lonza Business
Germantown, Wisconsin

Applied Polymer Systems
Woodstock, Georgia

Aquafix, Inc.
Madison, Wisconsin

AquaMaster Fountains and Aerators
Kiel, Wisconsin

Aqua Services, Inc.
Guntersville, Alabama

Aquatic Control, Inc.
Seymour, Indiana

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Biosorb, Inc.
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Brandt Consolidated, Inc.
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Vero Beach, Florida

Crop Production Services
Oviedo, Florida

Cygnet Enterprises, Inc.
Flint, Michigan

Envirosonic, Ltd.
Reading, Oxon, United Kingdom

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Brunswick, Georgia

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Tampa, Florida

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Raleigh, North Carolina

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Lawrenceville, Georgia

SePRO Corporation
Carmel, Indiana

Syngenta
Royal Palm Beach, Florida

United Phosphorus, Inc.
Exton, Pennsylvania

Vertex Water Features
Pompano Beach, Florida

Winfield
Ville Platte, Louisiana

General Information

Program Organization
The Agenda is organized by day and time. Posters and abstracts are organized alphabetically by presenting author.

Name Badges
Your name badge is your ticket for all events and functions at the meeting. Wear it to all activities during the meeting. All individuals participating in meeting events or activities must be registered and have a name badge. Non-registered guests may purchase tickets for the President's Reception, Guest Tour, Poster Session Reception, and Awards Banquet at the meeting registration desk.

Meeting Registration Desk
The meeting registration desk will be located in the Pre-function area between Oglethorpe and Madison Ballrooms for the duration of the meeting. For specific times, please see the Agenda-at-a-Glance pages for each day in this Program. Messages will be posted at the meeting registration desk.

Exhibits
Exhibits will be open from 7:00 p.m. Sunday to 10:30 a.m. Wednesday in Oglethorpe Ballroom.

Posters
Posters will be open from 7:00 p.m. Sunday to 10:30 a.m. Wednesday in Oglethorpe Ballroom. A Poster Session Reception will be held on Monday from 6:00 p.m. to 7:30 p.m. in Oglethorpe Ballroom. Poster presenters are required to attend the Poster Session to answer questions. In addition, presenters are requested to be in attendance during refreshment breaks. The Poster Reception is provided by APMS Silver Level Sponsors.

Continental Breakfasts / Refreshment Breaks
Continental breakfasts and mid-morning and afternoon refreshment breaks, provided by our Bronze Level Sponsors, will be served each day in Oglethorpe Ballroom. Please see the Agenda-at-a-Glance for specific times, locations, and sponsors. Also take time to visit with Exhibitors in Oglethorpe Ballroom while enjoying your breakfast or break.

APMS Student Affairs Luncheon
The Student Affairs Luncheon will be held Monday, 12:00 p.m. to 1:30 p.m. in the Monterey Suite - 2nd floor. All students registered for the meeting are invited to attend. This luncheon is a great opportunity to meet other students, interact with the APMS leadership, and learn how to become more involved in the Society. Rebecca Haynie, Student Affairs Committee Chair, will be the moderator. Please contact Rebecca by noon Sunday, July 13 to confirm your attendance. This luncheon is sponsored by SePRO Corporation.

APMS Annual Business Meeting
The APMS Annual Business Meeting will be held Monday, 4:20 p.m. to 5:00 p.m. in Madison Ballroom. All APMS members are encouraged to attend.

APMS Regional Chapters Presidents' Luncheon
The Regional Chapters Presidents' Luncheon will be held Tuesday12:00 p.m. to 1:30 p.m. in the Telefair Suite - 2nd floor. Representatives from each APMS regional chapter are invited to attend this breakfast. Rob Richardson, APMS Vice President and Regional Chapters Committee Chair, will be the moderator for discussions on aquatic plant management activities in each region. Please contact Rob by 8:00 a.m. Monday, July 14 to confirm your attendance. This luncheon is provided by our Bronze Level Sponsors.

APMS Past Presidents' Luncheon
All APMS Past Presidents are invited to attend the Past Presidents' Luncheon on Tuesday, 12:00 p.m. to 1:30 p.m. in the Monterey Room - 2nd floor. Terry Goldsby, Immediate Past President, will be the moderator. Please contact Terry by noon Monday, July 14 to confirm your attendance. The luncheon is provided by Bronze Level Sponsors.

APMS Special Events

President's Reception: *Sunday, July 13, 7:00 p.m. to 9:00 p.m., Oglethorpe Ballroom*
Join your APMS friends and colleagues at this gathering to "kick-off" our annual meeting, provided by our Silver Level Sponsors. This is an excellent time to visit with colleagues and to meet new friends while enjoying exceptional food and beverage. The President's Reception is open to all registered delegates, guests, and students. Non-registered guests may purchase tickets for this event by submitting the Meeting Registration Form or at the meeting registration desk.

Guest Tour: *Monday, July 14, 10:00 a.m. - 3:00 p.m.*
Guests will be treated to a trolley tour of Savannah sponsored by Applied Biochemists. The experience begins from the Hilton (Harris Street Patio) with a trolley ride through historic Savannah, home to stately Southern architecture and distinctive park-like squares and a visit to the Juliette Gordon Low Birthplace, the founder of the Girl Scouts. We will visit The Cathedral of St. John the Baptist which is compared to some of the most beautiful churches in Europe. Lunch awaits at the Johnny Harris Restaurant and Barbecue Sauce Company. Established in 1924, Johnny Harris Restaurant is one of the most popular full service restaurants in the city. After lunch, we travel back roads with beautiful marsh views, and picture opportunities in front of a mile long oak lined drive of a former plantation, see elegant homes on "The Bluff" overlooking the waterway, and then end for refreshments and cookie sampling at Byrd Cookie Company, a Savannah favorite since 1924.

Poster Session and Reception: *Monday, July 14, 6:00 p.m. to 7:30 p.m., Oglethorpe Ballroom*
This reception, made possible through donations by our Silver Level Sponsors provides for the viewing of posters and exhibits along with professional interactions and discussions in a casual setting while enjoying light hors d'oeuvres and beverages. The Poster Session Reception is open to all registered delegates, guests, and students. Non-registered guests may purchase tickets for this event by submitting the Meeting Registration Form or at the meeting registration desk.

Historic Haunts Tour: *Monday, July 14, 9:00 p.m. to 10:30 p.m.) Meet at the Hotel lobby at 8:45 p.m.*
Every historic city has its share of ghost stories and Savannah is no exception. Join us, if you dare, for this tour featuring the spirited side of our city. You will shiver to the legends, myths and hauntings in this frightfully fun experience. Our Ghost Guide will fill your imagination with tales from Savannah's storied past. Maximum 40.

Awards Reception and Banquet: *Tuesday, July 15, 6:00 p.m. to 10:00 p.m., Savannah River Queen*
All registered delegates, guests and students are invited to the Awards Banquet aboard the Savannah River Queen provided by APMS Silver Level Sponsors. Join us for a pre-banquet reception from 6:00 -7:00 p.m. After dinner, we will recognize those who have served the Society, welcome new officers and directors, and this year's student paper and poster participants. Our evening will conclude with a raffle for several prizes. Raffle tickets may be purchased at the registration desk throughout the week and during the Awards Banquet. Ticket sales promote APMS sponsorship of student initiatives. Round trip transportation between the Hilton DeSoto and the Savannah River Queen will be available via Trolley courtesy of out Contributor Level Sponsors. See the bottom of page 20 for the Trolley schedule to and from the River Queen.

Spur-of-the-Moment Meeting Room
We have a room set up conference style for 25 guests. Please check at the meeting registration desk.

Student Tour
All students are invited to participate in a tour of local aquatic plant management activities on Wednesday, July 16. Tour funding is provided by APMS sponsors and will be hosted by Estate Management Services, Inc. of Brunswick, GA. Our tour will begin at the Savannah National Wildlife Refuge where USFWS biologist Lindsay Coldiron will lead a boat tour of several invasive species control projects on the refuge. We will then visit The Landings where Shawn Burgess will discuss *Ruppia* control efforts in conjunction with tarpon and snook habitat management. Our tour will close, after hitting a GA seafood spot for lunch, with a trip to the Ford Plantation. Manager Mike Womble will discuss selective weed control efforts to sustain *Vallisneria* populations for wildlife habitat. We thank our tour hosts and are looking forward to a wonderful tour in beautiful coastal Georgia!!

Agenda

Sunday, July 13

Sunday's Agenda-at-a-Glance

7:30 am	-	5:00 pm	APMS Board of Directors Meeting *(Harborview Room)*
12:00 pm	-	5:00 pm	Exhibits Setup *(Oglethorpe Ballroom)*
12:00 pm	-	5:00 pm	Poster Setup *(Oglethorpe Ballroom)*
1:00 pm	-	5:00 pm	Registration *(Pre-function area between Oglethorpe and Madison Ballrooms)*
3:00 pm	-	5:00 pm	MAPMS Board of Directors Meeting *(Lafayette Suite)*
7:00 pm	-	9:00 pm	President's Reception *(Oglethorpe Ballroom)*
			Provided by Silver Level Sponsors

Monday, July 14

Monday's Agenda-at-a-Glance

7:00 am	-	8:00 am	Continental Breakfast *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
7:00 am	-	5:00 pm	Exhibits Open (*Oglethorpe Ballroom)*
7:00 am	-	5:00 pm	Posters Open *(Oglethorpe Ballroom)*
7:30 am	-	5:00 pm	Registration *(Pre-function area between Oglethorpe and Madison Ballrooms)*
7:55 am	-	12:00 pm	Session I – Special Avian Vacuolar Myelinopathy Opening Session *(Madison Ballroom)*
10:00 am	-	3:00 pm	Guest Tour – Pre-registered Guests meet at the Hilton Harris Street Patio at 9:45 am *Sponsored by Applied Biochemists*
10:20 am	-	10:40 am	Refreshment Break *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
12:00 pm	-	1:30 pm	Lunch on your own
12:00 pm	-	1:30 pm	APMS Student Affairs Luncheon *(Monterey Suite – 2nd Floor)* *Sponsored by SePRO Corporation*
12:00 pm	-	1:30 pm	Aquatic Ecosystem Restoration Foundation Meeting *(Telefair Suite – 2nd Floor)*
1:30 pm	-	4:20 pm	Session II – General Session and Student Presentations *(Madison Ballroom)*
2:50 pm	-	3:20 pm	Refreshment Break *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
4:20 pm	-	5:00 pm	APMS Annual Business Meeting *(Madison Ballroom)*
6:00 pm	-	7:30 pm	Poster Session and Reception *(Oglethorpe Ballroom)* *Provided by Silver Level Sponsors*
9:00 pm	-	10:30 pm	Historic Haunts Tour – Guests meet in Hotel Lobby at 8:45 pm – Limited to first 40

Session I – Special Avian Vacuolar Myelinopathy Opening Session

7:55 am - 12:00 pm
Madison Ballroom

Moderator: Dr. Cody Gray - APMS President Elect, Program Committee Chair
United Phosphorus, Incorporated, Peyton, CO

7:55 am **Presidential Address**
Michael Netherland
U.S. Army Engineer Research and Development Center, Gainesville, FL

8:00 am **Managing the Savannah River Basin**
Colonel Thomas J. Tickner
Commander, Savannah District, U.S. Army Corps of Engineers

8:20 am **Avian Vacuolar Myelinopathy: Hydrilla, Toxic Cyanobacteria, and Management Efforts to Control Disease in Southeastern Reservoirs**
Susan B. Wilde[1], Rebecca Haynie[2], Brigette Haram[1], and Bradley A. Bartelme[1]
[1]*University of Georgia, Warnell School of Forestry and Natural Resources, Athens, GA*
[2]*SePRO Corporation, Carmel, IN*

8:40 am **Investigating *Hydrilla verticillata* and Avian Vacuolar Myelinopathy Disease on a Southeastern Reservoir (*Student Presentation*)**
Brigette Haram and Susan B. Wilde
University of Georgia, Warnell School of Forestry and Natural Resources, Athens, GA

9:00 am **Impacts of Avian Vacuolar Myelinopathy on Bald Eagles in Georgia**
Jim C. Ozier
Georgia Department of Natural Resources, Wildlife Resources Division, Forsyth, GA

9:20 am **Investigating Stakeholder Perception of Aquatic Plant Management on a Large Southeastern Reservoir (*Student Presentation*)**
Kevin L. Fouts and Susan B. Wilde
University of Georgia, Warnell School of Forestry and Natural Resources, Athens, GA

9:40 pm **Managing Hydrilla in Drinking Water Reservoirs**
Ken S. Presley
Henry County Water Authority, Locust Grove, GA

General Session and Student Presentations

10:00 am **Effect of Substrate Carbon on Topramezone Phytotoxicity to St. Augustinegrass (*Student Presentation*)**
Carl J. Della Torre III[1], William T. Haller[2], and Lyn A. Gettys[1]
[1]*University of Florida, Institute of Food and Agricultural Sciences, Ft. Lauderdale Research and Education Center, Davie, FL*
[2]*University of Florida, Institute of Food and Agricultural Sciences, Center for Aquatic and Invasive Plants, Gainesville, FL*

10:20 am **Refreshment Break** *(Oglethorpe Ballroom)*

10:40 am **The Turion Ecology of *Stratiotes aloides* (*Student Presentation*)**
Nicholas A. Weissflog[1] and Eric Sager[2]
[1]*Trent University, Ecological Restoration, Peterborough, Ontario, Canada*
[2]*Fleming College, Ecological Restoration, Lindsay, Ontario, Canada*

11:00 am **New Aquatic Invasive Species Management: The Effect of Treatment Type and Application Timing on *Stratiotes aloides* in Ontario (*Student Presentation*)**
Robert A. Canning[1] and Eric Sager[2]
[1]*Trent University, Environmental and Life Sciences, Peterborough, Ontario, Canada*
[2]*Fleming College, Ecological Restoration, Lindsay, Ontario, Canada*

11:20 am **Aquatic Invasive Plant Management: Using Modeling to Predict Future Invasions and Prioritize Existing Infestations (*Student Presentation*)**
Elizabeth A. Edgerton[1], Michael P. Masser[1], William Grant[1], Allen Knutson[2], and Lucas Gregory[3]
[1]*Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, TX*
[2]*Texas A&M University, Department of Entomology, College Station, TX*
[3]*Texas Water Resources Institute, College Station, TX*

11:40 am **Field Research of Early-Season Whole Lake Herbicide Strategies for Control of Hybrid Eurasian Water Milfoil**
Eddie J. Heath[1], Tim Hoyman[1], Michelle Nault[2], and John Skogerboe[3]
[1]*Onterra, LLC, De Pere, WI*
[2]*Wisconsin Department of Natural Resources, Madison, WI*
[3]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Madison, WI*

12:00 am **Lunch on your own**

Session II – General Session and Student Presentations

1:30 pm - 4:20 pm
Madison Ballroom

Moderator: Dr. Vernon Vandiver, Jr. - APMS Board of Directors
Professor Emeritus, University of Florida, Gainesville, FL

1:30 pm **Hydrilla Biological Control: Optimizing the Hydrilla Midge Tip Miner (*Student Presentation*)**
Julie A. Baniszewski, Emma N. Weeks, and James P. Cuda
University of Florida, Department of Entomology, Gainesville, FL

1:50 pm **Linking Plant Biology and Management Information to Improve Control of Hydrilla**
Michael D. Netherland1 and Dean Jones2
[1]U.S. Army Engineer Research and Development Center, Gainesville, FL
[2]University of Florida, Lake Alfred, FL

2:10 pm **Attempted Revegetation in Two Piedmont Reservoirs: Establishment Success and Response of Fish and Macroinvertebrates (*Student Presentation*)**
Justin J. Nawrocki
North Carolina State University, Department of Crop Science, Raleigh, NC

2:30 pm **Alien Invasive Aquatic Weeds in Botswana - Historical Perspective and their Successful Control**
Chandrasekara N. Kurugundla
Water Affairs, Maun, Botswana

2:50 pm **Refreshment Break** *(Oglethorpe Ballroom)*

3:20 pm **Potential for Herbicide Resistance Evolution in Hybrid Watermilfoil (*Student Presentation*)**
Lindsey-Ann L. Schulte and Ryan A. Thum
Grand Valley State University, Robert B. Annis Water Resources Institute, Muskegon, MI

3:40 pm **Managing Eurasian Watermilfoil in the Lower Clark Fork River System, Montana**
John D. Madsen[1], Kurt D. Getsinger[2], Gray Turnage[3]
[1]U. S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research Unit, Davis, CA
[2]U.S. Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS
[3]Mississippi State University, Geosystems Research Institute, Mississippi State, MS

4:00 pm **Benefits of Incorporating Genetic Identification of Watermilfoils into Aquatic Vegetation Mapping (*Student Presentation*)**
Syndell Parks[1] and Ryan A. Thum[2]
[1]Grand Valley State University, Department of Biology, Muskegon, MI
[2]Grand Valley State University, Robert B. Annis Water Resources Institute, Muskegon, MI

4:20 pm **APMS Annual Business Meeting** *(Madison Ballroom)*

6:00 pm **Poster Session and Reception** *(Oglethorpe Ballroom)*

9:00 pm **Historic Haunts Tour - Meet in Hotel Lobby at 8:45 pm – Limit first 40**

Poster Session
6:00 pm - 7:30 pm
Oglethorpe Ballroom

Assessment of Six Indicators for Algal Cell Viability (*Student Presentation*)
Alyssa J. Calomeni and John H. Rodgers
Clemson University, Department Wildlife and Fisheries Biology, Clemson, SC

Three Year Summary of Flumioxazin Applications to Delavan Lake, WI
Jason Fausey
Nufarm Americas, Fremont, OH

Sago Pondweed (*Stuckenia pectinatus*) and Horned Pondweed (*Zannichellia palustris*) Control with Endothall Formulations in Greenhouse Flowing Water Mesocosms (*Student Presentation*)
Kallie C. Kessler and Scott J. Nissen
Colorado State University, Department of Bioagricultural Sciences and Pest Management, Fort Collins, CO

Alligator Weed [*Alternanthera philoxeroides* (Mart.) Griseb.] Is Spreading in Kashmir Himalayas (*Student Presentation*)
Ather Masoodi and Fareed A. Khan
Department of Botany, Aligarh Muslim University, Aligarh, India

Ecological Effects of Water-Willow (*Justicia americana*) on Aquatic Invertebrate Species (*Student Presentation*)
Christopher M. Mynatt[1] and Mark A. Webb[2]
[1]*Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, TX*
[2]*Texas Parks and Wildlife Department, Inland Fisheries Division, Snook, TX*

Control of *Phragmites communis* using Reduced Rate Glyphosate Applications and TopFilm Adjuvant
Jonathan R. Newman and Manuel A. Duenas-Lopez
Centre for Ecology and Hydrology, Wallingford, England

Evaluation of Water Willow (*Justicia americana*) Use by Reservoir Fishes (*Student Presentation*)
Ryan C. O'Hanlon[1], Christopher M. Mynatt[1], and Mark A. Webb[2]
[1]*Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, TX*
[2]*Texas Parks and Wildlife Department, Inland Fisheries Division, Snook, TX*

Pond and Lake Clarification during Dredging and When Nutrients Are an Issue
Virginia Iwinski
Applied Polymer Systems, Woodstock, GA

Toxicity of Copper Sulfate and Copper-ethanolamine to *Microcystis aeruginosa* and *Pseudokirchneriella subcapitata* at Different Initial Cell Densities
Kuo-Pei Tsai, Kyla J. Iwinski, and **John H. Rodgers**
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

An Assessment of Aquatic Invasive Plants in the Illinois River: Water Hyacinth Surveillance, Mapping, Persistence, and Potential Seed Dispersal (*Student Presentation*)
Jay A. VonBank, Andrew F. Casper, Heath M. Hagy, and Aaron P. Yetter
Illinois Natural History Survey, Illinois River Biological Station and Forbes Biological Station Prairie Research Institute, University of Illinois, Havana, IL

Factors Influencing Sprouting of Crested Floating Heart Ramets
Leif N. Willey[1] and Michael D. Netherland[2]
[1]*Aquatic Systems, Incorporated, Lauderhill, FL*
[2]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Gainesville, FL*

Establishment of Native Aquatic Vegetation in Conjunction with an Integrated Pest Management Program (*Student Presentation*)
Haley N. Woelfel[1], Michael P. Masser[1], and Mark A. Webb[2]
[1]*Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, TX*
[2]*Texas Parks and Wildlife Department, Inland Fisheries Division, Snook, TX*

Tuesday, July 15

Tuesday's Agenda-at-a-Glance

7:00 am	-	8:00 am	Continental Breakfast *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
7:00 am	-	5:00 pm	Exhibits Open *(Oglethorpe Ballroom)*
7:00 am	-	5:00 pm	Posters Open *(Oglethorpe Ballroom)*
7:30 am	-	5:00 pm	Registration *(Pre-function area between Oglethorpe and Madison Ballrooms)*
8:00 am	-	12:10 pm	Session III – General Session and Student Presentations *(Madison Ballroom)*
10:00 am	-	10:30 am	Refreshment Break *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
12:10 pm	-	1:40 pm	Lunch on your own
12:10 pm	-	1:40 pm	APMS Past Presidents' Luncheon *(Monterey Suite - 2nd Floor)* *Provided by Silver Level Sponsors*
12:10 pm	-	1:40 pm	APMS Regional Chapters Presidents' Luncheon (*Telefair Suite - 2nd Floor*) *Provided by Silver Level Sponsors*
1:40 pm	-	4:50 pm	Session IV – MidSouth APMS Special Session *(Madison Ballroom)*
3:00 pm	-	3:30 pm	Refreshment Break *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
5:00 pm	-	6:00 pm	MSAPMS Board of Directors Meeting (*Lafayette Suite)*
6:00 pm	-	7:00 pm	Awards Reception *(Savannah River Queen)* *Provided by Silver Level Sponsors*
7:00 pm	-	10:00 pm	Awards Banquet *(Savannah River Queen)* *Provided by Silver Level Sponsors*

Session III – General Session and Student Presentations

8:00 am - 12:10 pm
Madison Ballroom

Moderator: Dr. Joe Vassios - APMS Board of Directors
United Phosphorus, Incorporated, Rocklin, CA

8:00 am **Effects of Salinity on Submerged Aquatic Vegetation's Growth and Abundance in North Carolina and Assessment of a SONAR's Accuracy to Measure Vegetation (*Student Presentation*)**
Audrey Pleva and Joseph Luczkovich
East Carolina University, Greenville, NC

8:20 am **Ready to Start Mapping Lakes and Reservoirs? An Introduction to the Capabilities and Requirements of Various Sonar Systems**
Bob Bahn and Susan B. Wilde
University of Georgia, Warnell School of Forestry and Natural Resources, Athens, GA

8:40 am **The use of Optical Properties for Distinguishing between Invasive Aquatic Species with Applications towards Remote Sensing (*Student Presentation*)**
Caroline Wylie[1], Celine Gueguen[1], and Eric Sager[2]
[1]Trent University, Environmental and Life Sciences, Peterborough, Ontario, Canada
[2]Fleming College, Ecological Restoration, Lindsay, Ontario, Canada

9:00 am **Bioaccumulation of Total and Methyl Mercury in Water Hyacinth (*Eichhornia crassipes*) from a South Carolina Coastal Plain River**
Jane L. Guentzel and Julie W. Murphy
Coastal Carolina University, Department of Marine Science, Conway, SC

9:20 am **Efficacy Studies for the Control of Parrot Feather, Alligator Weed, Creeping Water Primrose and Monoecious Hydrilla Utilizing Topramezone (*Student Presentation*)**
Erika J. Haug and Rob J. Richardson
North Carolina State University, Department of Crop Science, Raleigh, NC

9:40 am **Providing Context for Invasive Aquatic Weed Control in Diverse Ecosystems: Sensitivity of Freshwater Molluscs to Hydrilla-Targeting Herbicides**
W. Gregory Cope[1], Jennifer M. Archambault[1], Christine M. Bergeron[1], Rob Richardson[2], Mark A. Heilman[3], J. Edward Corey[4], Michael D. Netherland[5], and Ryan J. Heise[6]
[1]*North Carolina State University, Department of Applied Ecology, Raleigh, NC*
[2]*North Carolina State University, Department of Crop Science, Raleigh, NC*
[3]*SePRO Corporation, Carmel, IN*
[4]*North Carolina Division of Parks and Recreation, Raleigh, NC*
[5]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Gainesville, FL*
[6]*North Carolina Wildlife Resources Commission, Raleigh, NC*

10:00 am **Refreshment Break** *(Oglethorpe Ballroom)*

10:30 am **Blowing Bubbles: Long Range Control of Algae Using Ultrasound**
Jonathan R. Newman
Centre for Ecology and Hydrology, Wallingford, England

10:50 am **Predictive Management of Mat-forming Algae**
West M. Bishop and Ben E. Willis
SePRO Corporation, Whitakers, NC

11:10 am **Post-treatment Fate of Copper Applied as Algaecides and Herbicides**
John H. Rodgers, Alyssa J. Calomeni, and Kyla J. Iwinski
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

11:30 am **Responses of *Microcystis aeruginosa* and *Pseudokirchneriella subcapitata* when Exposed to an Anionic Polyacrylamide Blend (*Student Presentation*)**
Kyla J. Iwinski
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

11:50 am **Research Updates for Concentration Exposure Timings Using Endothall: Elodea, Chara, and Filamentous Algae**
Cody J. Gray[1], Joseph Vassios[2], and Gerald Adrian[3]
[1]*United Phosphorus, Incorporated, Peyton, CO*
[2]*United Phosphorus, Incorporated, Rocklin, CA*
[3]*United Phosphorus, Incorporated, King of Prussia, PA*

12:10 pm **Lunch on your own**

Session IV – MidSouth Aquatic Plant Management Special Session

1:40 pm - 5:00 pm
Madison Ballroom

Moderator: Josh Yerby - MidSouth APMS President-Elect
Alabama Power Company, Environmental Affairs, Guntersville, AL

1:40 pm **Evaluation of Algaecide Applications for Treatment of *Lyngbya wollei* in Lay Lake (*Student Presentation*)**
Alyssa J. Calomeni and John H. Rodgers
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

2:00 pm **Enhancement of Targeted Algal Management**
John H. Rodgers, Alyssa J. Calomeni, and Kyla J. Iwinski
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

2:20 pm **Evaluation of New Herbicide Combinations for Managing Giant Salvinia in Louisiana**
Christopher R. Mudge[1], Alexander J. Perret[2], and Jonathan R. Winslow[2]
[1]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Baton Rouge, LA*
[2]*Louisiana Department of Wildlife and Fisheries, Inland Fisheries, Baton Rouge, LA*

2:40 pm **Managing Floating and Emergent Plants with Stingray® (Carfentrazone-ethyl)**
Ben E. Willis[1], Todd C. Horton[2], Mark Heilman[3], and West M. Bishop[1]
[1]*SePRO Corporation, Whitakers, NC*
[2]*SePRO Corporation, Anderson, SC*
[3]*SePRO Corporation, Carmel, IN*

3:00 pm **Refreshment Break** *(Oglethorpe Ballroom)*

3:30 pm **Phenology of *Potamogeton crispus* in the Southeastern U.S.**
Gray Turnage[1], John D. Madsen[2], and Ryan M. Wersal[3]
[1]*Mississippi State University, Geosystems Research Institute, Mississippi State, MS*
[2]*U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research Unit, Davis, CA*
[3]*Applied Biochemists (A Lonza Business), Alpharetta, GA*

3:50 pm **Contending with Recent Hydrilla Infestation of Georgia Power Company's Chattahoochee System Reservoirs**
Anthony R. Dodd
Georgia Power Company, Department of Environmental Affairs, Atlanta, GA

4:10 pm **Maintenance Control of *Hydrilla verticillata* in Florida's State Managed Waters with Aquathol**
Jeremy G. Slade[1] and Michael D. Netherland[2]
[1]*United Phosphorus, Incorporated, Gainesville, FL*
[2]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Gainesville, FL*

4:30 pm **Rapid Response to Monoecious Hydrilla in Lake Waccamaw**
Steve T. Hoyle
North Carolina State University, Raleigh, NC

4:50 pm **Adjourn**

5:00 pm **MSAPMS Board of Directors Meeting *(Lafayette Suite)***

6:00 pm **APMS Awards Reception *(Savannah River Queen)***

7:00 pm **APMS Awards Banquet *(Savannah River Queen)***

Transportation is provided to and from the Awards Banquet by APMS Contributor Level Sponsors. Please consult the schedule below for transportation between the Hilton and the Savannah River Queen.

Transportation from Hilton to Savannah River Queen

5:15 pm	**1st Trolley**	**When full or no later than 5:35 pm**
5:30 pm	**2nd Trolley**	**When full or no later than 5:50 pm**
5:45 pm	**3rd Trolley**	**When full or no later than 6:10 pm**

Transportation from Savannah River Queen to Hilton

9:15 pm	**1st Trolley**	**When full or no later than 9:30 pm**
9:50 pm	**2nd Trolley**	**When full or no later than 10:10 pm**

Wednesday, July 16

Wednesday's Agenda-at-a-Glance

7:00 am	-	8:00 am	Continental Breakfast *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
7:00 am	-	10:30 am	Exhibits Open *(Oglethorpe Ballroom)*
7:00 am	-	10:30 am	Posters Open *(Oglethorpe Ballroom)*
7:30 am	-	12:00 pm	Registration *(Pre-function area between Oglethorpe and Madison Ballrooms)*
8:00 am	-	12:00 pm	Session V – Public Outreach Special Session and General Presentations *(Madison Ballroom)*
10:00 am	-	10:30 am	Refreshment Break *(Oglethorpe Ballroom)* *Provided by Bronze Level Sponsors*
10:30 am	-	12:00 pm	Poster and Exhibit Breakdown *(Oglethorpe Ballroom)*
12:30 pm	-	5:00 pm	APMS Board of Directors Meeting *(Harborview Room)*
1:00 pm		5:00 pm	AERF Board and RISE Guests (Lafayette Suite)

Session V – Public Outreach Special Session and General Presentations

8:00 am - 12:00 pm
Madison Ballroom

Moderator: Dr. Rob Richardson - APMS Vice President
North Carolina State University, Raleigh, NC

8:00 am **Connecting Management Professionals, Researchers and the Public Sector to Aquatic Plant Management Information**
Karen Brown
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, FL

8:20 am **Invasive Plant Education: Invading a Classroom near You!**
Katie Walters
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, FL

8:40 am **Benefits of Controlling Nuisance Aquatic Plants and Algae in the United States**
Kurt D. Getsinger[1], Eric Dibble[2], John H. Rodgers[3], and David Spencer[4]
[1]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS*
[2]*Mississippi State University, Department of Wildlife, Fisheries and Aquaculture, Mississippi State, MS*
[3]*Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC*
[4]*U.S. Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research Unit, Davis, CA*

9:00 am **APMS Herbicide Resistance Management PowerPoint Lessons**
Jeffrey D. Schardt
Florida Fish and Wildlife Conservation Commission, Tallahassee, FL

9:20 am **Evaluating Efficacy of Aquatic Herbicides on Rotala (*Rotala rotundifolia*)**
Lyn A. Gettys[1], Carl J. Della Torre III[1], and William T. Haller[2]
[1]*University of Florida, Institute of Food and Agricultural Sciences, Ft. Lauderdale Research and Education Center, Davie, FL*
[2]*University of Florida, Institute of Food and Agricultural Sciences, Center for Aquatic and Invasive Plants, Gainesville, FL*

9:40 am **Evaluation of Auxin Herbicide Applications Following Pretreatment with Select Algaecides for Control of Eurasian Watermilfoil in Long Lake, Iosco County, MI**
Ryan M. Wersal[1], Rich DeJonghe[2], Jeff Knox[3], and Bill Ratajczyk[2]
[1]*Applied Biochemists (A Lonza Business), Alpharetta, GA*
[2]*Applied Biochemists (A Lonza Business), Germantown, WI*
[3]*Aquatic Services, Incorporated, Goodrich, MI*

10:00 am **Refreshment Break** *(Oglethorpe Ballroom)*

10:30 am **Aquatic Weed and Algae Control in Irrigation Canals Using Endothall**
Joseph Vassios[1], Cody J. Gray[2], and Gerald Adrian[3]
[1]*United Phosphorus, Incorporated, Rocklin, CA*
[2]*United Phosphorus, Incorporated, Peyton, CO*
[3]*United Phosphorus, Incorporated, King of Prussia, PA*

10:50 am **Sonar® Aquatic Herbicide: Technical Overview of Past and Present Research, Operational Use Pattern Development and Future Outlook**
Mark Heilman
SePRO Corporation, Carmel, IN

11:10 am **APMS Regional Chapters: An Update on Key Initiatives within Each Region**
Rob Richardson, Moderator
North Carolina State University, Raleigh, NC

Western
Texas
South Carolina
Northeast
Midwest
MidSouth
Florida

11:45 am **Clean Water Act, Proposed Rules**
Allison Donaghy, Communications Coordinator
Responsible Industry for a Sound Environment, Washington, DC

12:00 pm **Highlights from the 54th Annual Meeting**
Cody Gray
United Phosphorous, Incorporated, Peyton, CO

12:30 pm **Adjourn 54th Annual Meeting**

1:00 pm **APMS Board of Directors Meeting** *(Harborview Room)*

NEXT YEAR

55th Annual Meeting
Hilton Myrtle Beach Oceanfront Resort
Myrtle Beach, South Carolina
July 12-15, 2015

Abstracts

Abstracts are listed by Session and alphabetically by lead author. Presenting author appears in **bold.**

General Sessions and Poster Session

Ready to Start Mapping Lakes and Reservoirs? An Introduction to the Capabilities and Requirements of Various Sonar Systems

Bob Bahn and Susan B. Wilde
University of Georgia, Warnell School of Forestry and Natural Resources, Athens, GA

Lake and reservoir managers have been challenged by the introduction of non-native aquatic plants and subsequent ecological consequences. When a system becomes inundated with non-native and/or invasive submerged aquatic vegetation (SAV), managers are often faced with tough and costly management decisions. The ability to effectively quantify the amount of nuisance SAV in a reservoir would be a valuable tool for managers to aid in the establishment and execution of management plans. The identification of bottom substrate and the creation of bathymetric maps are also capabilities that would prove very useful to managers and a wide variety of other user groups. Commercial and consumer-grade side and down-scan sonar are low-cost emerging technologies that may be able to provide useful data sets to managers and other users. Several different geo-referenced mapping platforms have been introduced in recent years, ranging from consumer-grade "fish finder" sonar units to a calibrated commercial-grade package. In this presentation, our objective is to provide comparison information about three available mapping platforms (Navico's CI BioBase, USACE's SAVEWS Jr., and BioSonic's MX Aquatic Habitat Echosounder) to potential new users and discuss the capabilities of each along with their financial, logistical, and computing requirements.

Hydrilla Biological Control: Optimizing the Hydrilla Midge Tip Miner (*Student Presentation*)

Julie A. Baniszewski, Emma N. Weeks, and James P. Cuda
University of Florida, Department of Entomology, Gainesville, FL

The Category I invasive aquatic weed hydrilla (*Hydrilla verticillata*), was introduced into Florida's ecosystems in the 1950s through the aquarium industry and has since invaded most of the state's watersheds. Hydrilla disrupts ecosystems by producing surface mats, which clog waterways, prevent sunlight penetration into the water and displace native Florida plants. In addition, herbicide resistance has been recorded in hydrilla, emphasizing the importance of considering other management strategies such as biological control. The herbivorous midge, *Cricotopus lebetis*, has been identified as a potential biocontrol agent. As a larva, the midge mines into the apical meristem of hydrilla, which changes the plant's architecture by preventing further vertical growth and restricting surface mats. The midge is currently being reared in a colony setting for mass release to augment existing populations. Because current rearing protocols have not been evaluated to determine their impact on colony production, it is important to assess these protocols experimentally to optimize mass rearing success. Experiments have investigated: (a) the effect of cold storage on subsequent development, (b) the effect of the biorational species specific product Btk for managing lepidoptertan colony pests, (c) intra-specific, and (d) inter-specific competition. Midge egg hatch success is significantly decreased after 7 days and adult emergence after just 2 days of cold storage. A concentration of 0.2 and 2.0 mL Btk per gallon water can effectively reduce colony pests without harm to the midge colony. Intra-specific competition is present when more than one larva competes for the same hydrilla tip and does not increase adult emergence. Inter-specific competition between the midge and fish reduces midge emergence more than from competition between the midge and moth or the midge alone. By improving mass rearing of *C. lebetis* via methods development studies, an IPM program can be more efficiently implemented to provide sustainable control of hydrilla.

Predictive Management of Mat-forming Algae
West M. Bishop and Ben E. Willis
SePRO Corporation, Whitakers, NC

Accurately predicting responses of mat-forming algae to management programs is critical to achieving desired results, economic efficiencies, and decreased ecological risks. To accurately predict responses of mat-forming algae to treatment programs, laboratory experiments have been engineered and refined to assess site specific control options. Results from these laboratory experiments were further validated and assessed in operational programs on water resources located in the southeastern U.S. This research outlines how to design and translate laboratory results to the field, as well as assess long term integrated initiatives to increase algaecide efficiency and performance when targeting nuisance and noxious mat-forming algae infestations.

Connecting Management Professionals, Researchers and the Public Sector to Aquatic Plant Management Information
Karen Brown
University of Florida, Center for Aquatic and Invasive Plants, Gainesville, FL

The UF/IFAS Center for Aquatic and Invasive Plants (CAIP) has long utilized the internet for communicating with management professionals, researchers and the public sector about invasive aquatic plant issues. The UF/IFAS-CAIP websites provide easy access to information about the problems associated with invasive plants, the accompanying management issues and activities, and the science and collective experience behind management decisions in these unique natural environments. The CAIP Information Office utilizes three distinct websites: the primary UF-IFAS Center for Aquatic and Invasive Plants (CAIP) website provides primary information about aquatic and natural area invasive plants; the Plant Management in Florida Waters site provides information about the management of aquatic plants; and the Florida Invasive Plant Education Initiative & Curriculum site provides educators with resources to teach students about invasive species issues. While researchers and personnel from invasive plant management agencies throughout the state work together for a coordinated approach to invasive plant research and management, the UF/IFAS CAIP websites cohesively present this information under the banner of the University of Florida/IFAS. The confidence and loyalty many citizens feel towards UF is an important asset; we are often trusted to be a reliable and impartial authority on these topics. Using the websites, we describe the complex considerations taken before implementing invasive plant management strategies and the years of research and collective operational experience that inform this process; we also educate the public about why invasive plant management is critical to the well-being of the state of Florida.

Assessment of Six Indicators for Algal Cell Viability (*Student Presentation*)
Alyssa J. Calomeni and John H. Rodgers
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

Reliable accurate and unambiguous response parameters are needed to discern responses of algae to exposures of phytotoxic compounds or elements. The focus of this research was to analyze the utility of six bioindicators using two prokaryotic algae (*Planktothrix agardhii* and *Microcystis aeruginosa*) and one eukaryotic alga (*Pseudokirchnerialla subcapitata*). Chlorophyll a, pheophytin a and 2-(p-iodophenyl)-3-(p-nitrophenyl)-5-phenyl tetrazolium chloride (INT) can be useful for determining responses of an assemblage to a particular stimulus. Cell density, percent staining due to neutral red and erythrosin b can be used to discern differences in an algal population after an exposure. To prepare known mixtures of live and dead cells, algae cultures were boiled for five minutes and mixed with viable algae in the logarithmic growth phase to create cell suspensions containing 0, 25, 50, 75 and 100% viable cells. The six parameters were used to discern differences in the viability of the cell suspensions. For all algae studied, measurable differences could be discerned using chlorophyll a, INT absorbance, cell density, and percent erythrosin b stained cells. Chlorophyll a was highly positively correlated with viability while staining due to erythrosin b was highly negatively correlated with algal viability ($R2 > 0.92$). INT absorbance as well as erythrosin b staining may be added to algal viability determinations in order to more accurately discern responses of either an assemblage or an algal population after a phytotoxic exposure.

Evaluation of Algaecide Applications for Treatment of *Lyngbya wollei* in Lay Lake (*Student Presentation*)
Alyssa J. Calomeni and John H. Rodgers
Clemson University, Department of Wildlife and Fisheries Biology, Clemson, SC

To make informed decisions regarding management of noxious algal growths, water resource managers require information on responses of target and non-target species to algaecide exposures. After nine years, applications of Phycomycin®-SCP followed by Algimycin®- PWF to control *Lyngbya wollei* growths provided an opportunity for a risk evaluation of treated areas or coves in Lay Lake, AL. Abiotic sediment characteristics (acid soluble copper concentrations, acid volatile sulfides, percent organic matter and cation exchange capacity) and survival of *Hyalella azteca* and *Chironomus tentans* were measured in sediments from treated and untreated coves to assess the bioavailability of copper-residuals. In laboratory studies, six algaecide treatments consisting of combinations of copper-based algaecides (Cutrine®-Ultra, Clearigate® and Algimycin®- PWF), a hydrogen peroxide based algaecide (Phycomycin®-SCP) and an adjuvant (Cide-Kick II) were assessed for their efficacy in controlling *Lyngbya wollei* sampled from Lay Lake. The most efficient algaecide treatment was determined based on post-treatment wet weight, chlorophyll a concentrations, and visual observations. To estimate the margin of safety for non-target organisms, *Pimephales promelas* was exposed to the most efficacious treatment and the ongoing treatment of Phycomycin®-SCP followed by Algimycin®- PWF. Results from sediment toxicity testing demonstrated that there were no measureable adverse effects on *Hyalella azteca* and *Chironomus tentans* from copper residuals in sediments following nine years of copper-based algaecide treatments. Based on the laboratory results, an alternative algaecide treatment could be selected to control the growth of *Lyngbya wollei* from Lay Lake, AL and enhance the margin of safety for non-target species (e.g. *Pimephales promelas*).

New Aquatic Invasive Species Management: The Effect of Treatment Type and Application Timing on *Stratiotes aloides* in Ontario (*Student Presentation*)
Robert A. Canning[1] and Eric Sager[2]
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In 2008, a new aquatic invasive plant was discovered growing in the Trent-Severn Waterway in Ontario, Canada. This species was *Stratiotes aloides*, the water soldier. A member of the notorious Hydrocharitaceae family, this plant exhibits several competitive abilities that have enabled it to quickly establish itself as a dominant macrophyte within the ecosystem that it was introduced. This was the first time this species had been found persisting in a natural ecosystem in North America and the ecological, economic and social impacts of this plant have yet to be fully understood. The effect of chemical and manual control measures and their application timing towards the eradication of *Stratiotes aloides* was studied to determine the response of this plant to large-scale management actions. During the spring applications, both herbicide administration and manual raking were found to be ineffective as control methods. In the fall, only the herbicide application was observed to decrease the standing biomass of *Stratiotes aloides* within the study sites. Necessary criteria for a successful treatment measure included both the reduction of *Stratiotes aloides* biomass and the recovery of native aquatic plant species to the site following management.

Providing Context for Invasive Aquatic Weed Control in Diverse Ecosystems: Sensitivity of Freshwater Molluscs to Hydrilla-Targeting Herbicides
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Hydrilla (*Hydrilla verticillata*) is an invasive aquatic weed that has spread rapidly throughout the U.S., especially in the southeast. A common control method is application of systemic and contact herbicides, such as fluridone and

endothall. However, there is limited documentation on effects of herbicides commonly used to control hydrilla and other aquatic weeds on many non-target freshwater species, and no published information exists on the toxicity of these herbicides to freshwater molluscs. We exposed juveniles (96 h) and glochidia (48 h) of the unionid mussel *Lampsilis siliquoidea*, and adults (28 d) of *Lampsilis fullerkati* to a formulation of fluridone (Sonar – PR®) in laboratory toxicity tests. The early life stages of *L. siliquoidea* were also exposed to a formulation of the dipotassium salt of endothall (Aquathol K®) in separate tests. Juveniles of the freshwater gastropod snail, *Somatogyrus viriginicus* (Lithoglyphidae), were exposed (96 h) to the Sonar Genesis® fluridone formulation. Endpoints were survival (all species and life stages), and siphoning behavior and foot protrusion (adult mussels). Median lethal fluridone concentrations (LC_{50s}) were 865 µg/L (95% CI, 729 – 1026 µg/L) for glochidia (24 h), 511 µg/L (309 – 843 µg/L) for juvenile *L. siliquoidea* (96 h), and 500 µg/L (452 – 553 µg/L) for juvenile *S. viriginicus* (96 h). No mortality occurred in the 28-d exposure of adult *L. fullerkati*, and we found no significant effect of fluridone concentration on foot protrusion ($p = 0.06$) or siphoning behavior ($p = 0.08$). The 24-h LC_{50} for the dipotassium salt of endothall was 31.2 mg/L (30.3 – 32.2 mg/L) for glochidia and the 96-h LC_{50} was 34.4 mg/L (29.3 – 40.5 mg/L) for juvenile mussels. Freshwater molluscs were more sensitive to fluridone and endothall than most other species previously tested. Fluridone and endothall concentrations typically recommended for hydrilla treatment (5 to 15 µg/L and 1 to 5 mg/L, respectively) were not acutely toxic to the molluscs we tested, and a 28-d exposure to fluridone was not lethal to adult mussels even at the highest concentration (300 µg/L), indicating minimal risk of short-term exposure effects.

Effect of Substrate Carbon on Topramezone Phytotoxicity to St. Augustinegrass (*Student Presentation*)

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Topramezone is a newly labeled aquatic herbicide with a maximum label rate of 50 ppb. Previous greenhouse studies evaluating the effect of this herbicide in irrigation water revealed that the EC_{10} (the concentration of herbicide that reduces growth by 10% compared to untreated controls) of topramezone was 3.5 ppb on St. Augustinegrass grown in 100% sand. However, these results differed from field observations; most field soils where turfgrasses are grown contain carbon, which can bind with topramezone. The goal of these experiments was to determine the effects of irrigation with topramezone-treated water on St. Augustinegrass grown in substrates with different carbon contents. Topramezone was applied at concentrations ranging from 0 to 120 ppb to mature St. Augustinegrass grown in 19 cm diameter 2L pots. Pots were filled with coarse sand amended with one of five carbon contents: 0, 0.35, 0.65, 1.4, and 3.8%. Plants were irrigated with ½" of topramezone-containing water twice per week for 4 weeks and grown out for 12 weeks after the final topramezone treatment. Plant material was clipped as needed for a total of 8 harvests, then dried and weighed. EC_{10} values for St. Augustinegrass grown in substrates with 0, 0.35, 0.65, 1.4, and 3.8% carbon were 3.74, 7.32, 10.13, 28.10, and 25.70 ppb, respectively. These experiments revealed that substrate carbon content plays an important role in the susceptibility of St. Augustinegrass to topramezone in irrigation water and that carbon contents of 1.4% or greater significantly reduce damage to this warm-season turfgrass.

Contending with Recent Hydrilla Infestation of Georgia Power Company\'s Chattahoochee System Reservoirs

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Hydrilla was discovered for the first time in Georgia Power Company's (GPC) Columbus, GA area hydroelectric reservoirs in late August of 2012. Those six reservoirs include true- and modified-run-of-the-river lower Piedmont impoundments ranging in size from 131 to 5,850 acres. Initial surveys revealed that hydrilla was established in 12% (~750 ac) of the areas surveyed. Because those reservoirs are relatively shallow, it was anticipated that hydrilla infestation, if not controlled, easily has the potential to impact significant reservoir uses. As learned in literature review, aggressive treatments to control hydrilla by one or more integrated methods can diminish growth and spread of hydrilla but the expense of certain treatment types potentially poses cost concerns well beyond GPC's typical aquatic plant control resources. GPC has responded since 2012 by implementing control measures following its Integrated Hydrilla Control Plan (IHCP) which included herbicide and winter drawdown treatments.

GPC's 2013 survey indicated continuing expansion of hydrilla revealing up to as much as seven times more shoreline infestation than in 2012. GPC has augmented the IHCP plan by developing a "first-time-ever" GPC lakeshore homeowner nuisance aquatic plant treatment permit program. The weed treatment permit program became fully activated in 2014 following its pilot test in 2013 following an intensive development process including oversight from the Georgia Wildlife Resources Division and communications with area stakeholders.

Aquatic Invasive Plant Management: Using Modeling to Predict Future Invasions and Prioritize Existing Infestations (*Student Presentation*)

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Determining which non-native aquatic plants have the greatest potential to invade a new area and prohibiting those species prior to their introduction is the key to preventing future injurious invasions. Once introduced however, prioritization and effective control is important to managing infestations. The vast majority of non-native plants, either aquatic or terrestrial, are intentionally introduced to an area for purposes such as food crops, ornamental gardening, or as novelties. While the majority does not pose a serious threat of infestation, a select number can quickly become well established and cause severe damage to both the ecosystem and the economy. Each year, millions of dollars are spent in an attempt to control these invaders in the United States. Weed Risk Assessments, tools for determining the invasive potential of plant species, have been developed and are currently being used around the world. The majority has been adapted from the Australian Weed Risk Assessment, developed in 1999. These risk assessments serve as pre-entry screening tools for testing non-native plant species and identifying those which are likely to be invasive and should therefore be excluded. New Zealand, Chile, and the U.S., as well as individual states in the U.S. such as California and Hawaii all currently use aquatic plant risk assessments. A tool specifically tailored to the unique ecosystems of Texas has not yet been developed, however. This research focused on designing a risk assessment model for Texas, as well as developing an invasion model which simulates spatial and temporal spread of aquatic invasive species. The risk assessment consists of a series of weighted questions, which address factors such as a plant's environmental tolerances, reproductive abilities, and ease of management. Once the questionnaire is completed, the plant receives a score; the higher the score the more likely the plant is to be invasive if introduced. The invasion model was designed using data from the existing hydrilla infestation at Lake Conroe. The model simulates introduction, growth and senescence, and spread of hydrilla throughout the lake. Management techniques like grass carp stocking and herbicide treatment were also simulated. This model serves as a case study for future invasion modeling and could be useful as a visual for educating stakeholders about the importance of prevention and the consequences of a serious invasion.

Three Year Summary of Flumioxazin Applications to Delavan Lake, WI

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Vegetation management in Midwest water bodies is challenging, which often makes it difficult to obtain maximum use of the water to benefit the greatest number of people. Clipper herbicide contains the active ingredient flumioxazin and has been developed by Valent Professional Products and is distributed through Nufarm Americas for use in aquatics to assist in the management of unwanted vegetation. Field applications of Clipper in 2012, 2013, and 2014 to Delavan Lake, WI displayed limitations, yet have proven to be a valuable tool to manage unwanted plants such as filamentous algae and watermeal. Treatments of Clipper in sections of this 1,500 acre lake provided an opportunity to monitor and evaluate the performance of this herbicide when applied under a wide array of conditions. Applications of Clipper were monitored for activity on specific vegetation, movement from the treatment area, and persistence in the water column. Few contact herbicides have been introduced in the aquatics market that display selectivity on floating and submersed weeds. Data taken from these trials will be shared that confirms Clipper is a selective herbicide with a short half-life in the water column that can be used as part of a successful management strategy for selected unwanted vegetation in Midwestern water bodies.

Investigating Stakeholder Perception of Aquatic Plant Management on a Large Southeastern Reservoir
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Hydrilla was first discovered on J. Strom Thurmond Lake (JSTL) in 1994, and is currently the predominant submerged aquatic vegetative species at the reservoir. In 1998, a wildlife disease linked with the presence of hydrilla, AVM, was also observed at JSTL. To assess stakeholder knowledge of this disease and support for management action to remove hydrilla, researchers conducted a mail survey of members belonging to the reservoir's various user groups. Results show that stakeholders are in favor of removing the aquatic macrophyte, regardless of how they utilize the reservoir—including users, such as waterfowl hunters, thought to benefit from its presence. Support for management action to remove hydrilla, including the stocking of triploid sterile grass carp, was shown to be significantly correlated with respondent's awareness of AVM ($r=.151$, $p<.000$). Respondents indicating they had seen signs instructing them to check boats and trailers for aquatic plants also reported doing so 38.1% more often than those unaware of the signage. Taken as a whole, results from the survey suggest that increasing stakeholder awareness of the harmful effects attributed to invasive aquatic vegetation can be an effective tool for increasing support of action to remove those species.

Benefits of Controlling Nuisance Aquatic Plants and Algae in the United States
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Safe, accessible water resources are essential, but various threats are closing the taps. One complex problem comes from nuisance aquatic plants and algae that invade rivers, lakes, and other aquatic ecosystems. They can significantly affect human and animal health, drinking water supplies, water quality, fish and wildlife habitat, flood control, hydropower generation, irrigation, navigation, fishing, recreation, aesthetics, and, ultimately land values. A consensus of experts recognizes the growing sense of urgency for the ecologically sound management of nuisance aquatic plants. Through this paper, scientific insights about this important issue are presented to key regulators, managers, stakeholders, and legislators. Using specific examples and explanation of the situation, the paper examines negative impacts of nuisance plants and the need to be aware, informed, and most importantly, proactive about solutions to the problems. Sections of this paper focus on certain parts of the U.S., but the general need is obvious - invasive aquatic plants and algae are progressively disrupting the ecological balance required for maintaining adequate freshwater resources for flora, fauna, and humans. The authors strongly encourage long-term commitments and funding for management activities and relevant applied research, as well as creative problem solving, in a collaborative push to meet the challenges posed by nuisance aquatic plants. Ultimately, a sustainable civilization depends on clean and abundant freshwater resources.

Evaluating Efficacy of Aquatic Herbicides on Rotala (*Rotala rotundifolia*)
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Rotala was first found in Broward County (FL) in 1996 and has since established large but mostly isolated populations throughout the southern regions of Florida. This amphibious invasive species forms dense, nearly impenetrable monocultures that greatly reduce ecosystem services and restrict water flow. Many flood control canals in FL are infested with rotala. Because these systems must be able to move stormwater to avoid flooding, rotala control is a high priority for many resource managers. In these experiments, we evaluated the effects of foliar treatments of most herbicides labeled for aquatic use in FL. Products were applied at maximum and half-maximum label rates in replicated mesocosm studies. Plants were grown for 3 MAT, then harvested, dried and weighed. Analysis of dry weight data revealed that the three auxins tested resulted in 91 to 100% control. However, auxins can be a poor choice in canals because stakeholders along the banks often use canal water as an irrigation source and many landscape species are sensitive to very low concentrations of auxins. The maximum

label rates of 6 other products – flumioxazin, penoxsulam, bispyribac, imazamox, fluridone and topramezone – reduced biomass by at least 50% compared to untreated control plants. This information is being used to conduct more extensive screening of these products on rotala to identify options that may provide better solutions for resource managers.

Research Updates for Concentration Exposure Timings Using Endothall: Elodea, Chara, and Filamentous Algae

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The task of controlling aquatic vegetation in irrigation canals is an extremely important venture, especially in the western U.S. The waters supplied by these canals are the primary, and in some locations, the only source of water for irrigating agronomic crops. In other locations, these waters supply industrial water users as well. Therefore, the control of aquatic weeds in irrigation canals becomes extremely critical; however, the tools available to canal managers for weed control are limited. Endothall was registered for use in irrigation canals in December 2009 allowing the first commercial use during the 2010 growing season. Prior products didn't require canal managers to identify the weed and algae species within their canals. In the few short years of endothall use, many aquatic species have been identified as problematic in these irrigation systems because of the selectivity of endothall. Therefore, research has been conducted to answer the questions of how to control these nuisance species while in irrigation canals. Data has been collected on elodea (*Elodea canadensis* Michx.), *Chara* spp. and a complex of filamentous algae species. Elodea control in the field has been achieved using 2 ppm of Teton® for 8 hrs. Chara control with an application of 0.5 ppm Teton® for 4 hrs has been highly successful. The results from these trials will be given along with UPI's current herbicide and algaecide control recommendations for the above species. Additionally, UPI is launching a new herbicide, AquaStrike®, a premix of endothall plus diquat. AquaStrike® is the first aquatic product to be produced containing two herbicide mechanisms of action. Research data will be presented and application rates will be outlined for this monumental product.

Bioaccumulation of Total and Methyl Mercury in Water Hyacinth (*Eichhornia crassipes*) from a South Carolina Coastal Plain River

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The Waccamaw River is a blackwater river located along the eastern coastline of South Carolina. Large areas of the shoreline contain floating mats of water hyacinth during the warmer months. These mats can block light and oxygen penetration thus creating low to no oxygen environments in the surface waters that are conducive to the formation of methyl Hg. The purpose of this study was to quantify the chemical and biological parameters of the water column and sediments near and under these mats that may promote the formation of methyl Hg and to quantify the amount of total and methyl Hg in these plants as they mature. Water and plant samples were collected monthly (May 2010 to November 2010) from underneath a water hyacinth mat and from an open water site. Total Hg in the water underneath the mat ranged from 3.2-8.9 ng/L with 10-31% MeHg relative to the Total Hg. Total Hg concentrations at the open water site ranged from 2.9-7.6 ng/L with 9-23% MeHg relative to the Total Hg. Total Hg in the roots ranged from 30.1-71.9 ng/g dry with 25-52% MeHg relative to the Total Hg. Total Hg in the shoots ranged from 2.2-58.7 ng/g dry with 2-63% MeHg relative to the Total Hg. The amount of Hg in a square meter of water hyacinth plants ranged from 8,947-52,420 ng Total Hg/m² dry and 2,759-15,790 ng MeHg/m² dry. The high percentages of methyl Hg in the water and plants suggest that these mats may serve as a site for mercury methylation. These findings also suggest that water hyacinth plants bioaccumulate mercury and may be a source of mercury to organisms that consume these plants.

Investigating *Hydrilla verticillata* and Avian Vacuolar Myelinopathy Disease on a Southeastern Reservoir (*Student Presentation*)

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First documented at DeGray Lake, Arkansas in 1994, the neurologic disease Avian Vacuolar Myelinopathy (AVM) has been implicated in numerous mortalities among waterbirds and their avian predators. Currently, the disease has been confirmed in six species of waterfowl, two bird of prey species and one shorebird species. All the affected species can be found during the fall/winter seasons at J. Strom Thurmond Lake (JSTL), a 28,000 hectare reservoir on the Georgia - South Carolina border. Over seventy-five bald eagle (*Haliaeetus leucocephalus*) deaths have been recorded at this lake since 1998, many of them with confirmed AVM diagnoses. This lake is dominated by hydrilla (*Hydrilla verticillata*), an invasive aquatic plant known to harbor an epiphytic cyanobacterium linked to AVM. Unfortunately, hydrilla is also an important resource for many waterbird species that inhabit the reservoir. This study investigates the effect of hydrilla on avian distribution at JSTL and the potential species susceptibility range for AVM on this reservoir. A historically important bald eagle nesting area, JSTL has shown a decline in successful nesting territories since the introduction of hydrilla. Preliminary data suggest the hydrilla infestation on this reservoir is creating an ecological trap for waterbirds and bald eagles that winter and breed there.

Efficacy Studies for the Control of Parrot Feather, Alligator Weed, Creeping Water Primrose and Monoecious Hydrilla Utilizing Topramezone (*Student Presentation*)

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Parrot feather (*Myriophyllum aquaticum*), alligator weed (*Alternanthera philoxeroides*), creeping water primrose [*Ludwigia grandiflora* (ssp. *hexapetala*)] and monoecious hydrilla (*Hydrilla verticillata*) are all non-native aquatic plant species with rapid growth patterns causing increasing problems in the U.S. Additional effective herbicides for management of these species will allow for rotational treatment protocols to help prevent potential resistance development as well as offer possibly different, improved outcomes for desirable non-target vegetation in terms of selectivity. Our research objective was to determine the level of control of these invasive species achieved utilizing topramezone (trade name: Oasis), a 4-HPPD inhibitor recently registered for aquatic use, as compared to plants treated with a current standard method of control (glyphosate for the three emergent species and fluridone for submersed monoecious hydrilla). Several treatment rates, trial time periods and plant growth scenarios were examined. Efficacy was evaluated using weekly visual percent control ratings and terminal dry weight biomass measurements. Experiments were conducted in Raleigh, NC at the North Carolina State University Weed Control Lab, Aquatic Greenhouse Facility. In these greenhouse trials, topramezone showed promise as an alternative herbicide for the control of alligator weed and monoecious hydrilla. No significant difference in dry weight reduction at four weeks after treatment (4 WAT) was observed between glyphosate (4.2 kg/ha) and topramezone (0.9 kg/Ha and 2.0 Kg/Ha); however, a greater percent control of alligator weed was observed with standard herbicides 4 WAT than with topramezone (0.9 kg/Ha and 2.0 Kg/Ha). Topramezone (40ppb, 20ppb and 10ppb) provided control of monoecious hydrilla similar to fluridone (10 ppb and 5 ppb) with respect to percent control and dry weight at six weeks after treatment. Effective control with topramezone (0.9 kg/Ha and 2.0 Kg/Ha) was not observed for either creeping water primrose or parrot feather. Results and conclusions of the trials will be discussed in further detail.

Field Research of Early-Season Whole Lake Herbicide Strategies for Control of Hybrid Eurasian Water Milfoil

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An ongoing cooperative research project between the Wisconsin Department of Natural Resources, U.S. Army Corps of Engineers, Engineer Research and Development Center, and private consultants have coupled quantitative aquatic plant monitoring with field-collected herbicide concentration data to evaluate efficacy and

selectivity of chemical control strategies implemented on a subset of Wisconsin lakes and flowages. For Eurasian water milfoil (*Myriophyllum spicatum*, EWM) and hybrid water milfoil (*Myriophyllum spicatum* x *M. sibiricum*, HWM), this largely consists of implementing early-season 2,4-D control strategies; either as spatially targeted small-scale spot treatments or low-dose, large-scale (whole lake) treatments. In response to field observations of unexplained reduced success in controlling populations of HWM, researchers conducted scientific case studies to better understand the efficacy of early-season whole lake low-dose 2,4-D treatments on EWM and HWM populations. Preliminary results show that several study lakes with HWM populations demonstrated reduced susceptibility to low-dose 2,4-D treatments in comparison with other pure-strain EWM populations. This is corroborated by recent laboratory and growth chamber research which indicates that some hybrid water milfoil populations are less susceptible to certain auxin herbicides than pure-strains of EWM. The elevated 2,4-D use rates required to control hybrid water milfoil populations would result in native plant selectivity issues; therefore, alternative treatment strategies have been explored that are less commonly used in Wisconsin. This presentation will examine the state-wide results of whole lake 2,4-D treatments targeting HWM as well as highlight several recent case studies in which whole lake use patterns of fluridone and combination 2,4-D/endothall were used.

Sonar® Aquatic Herbicide: Technical Overview of Past and Present Research, Operational Use Pattern Development and Future Outlook

Mark Heilman
SePRO Corporation, Carmel, IN

For approaching three decades, Sonar® Aquatic Herbicide (a.i., fluridone) has provided successful control of a wide diversity of invasive and nuisance aquatic weeds at all scales—from ponds to the largest lakes and reservoirs. The registration of Sonar in 1986 represented a paradigm shift in the management of aquatic vegetation and that shift continues to resonate today for managers and the research community. Along with cooperative laboratory-scale research studies, ground breaking development of the FasTEST analytical platform in the mid 1990's set the stage for field development of improved low-dose use patterns for selective control of major target submersed weeds such as *Myriophyllum spicatum* (Eurasian watermilfoil), *Hydrilla verticillata*, *Egeria densa* and *Potamogeton crispus* (curly leaf pondweed). Improved analytical tools assisted in the development of six different, innovative formulations in the last 15 years that have further optimized Sonar use for different target species management, partial treatment scenarios, sediment types, and other challenging environmental conditions. Utilization of plant susceptibility (PlanTEST™) and genetic assays (GenTEST®) have further improved operational management with Sonar and promoted long-term product stewardship for this valued herbicide technology. From maintenance control of submersed and floating weeds in pond systems to selective, low-dose use patterns in lake and reservoir systems for extended long-term control or eradication initiatives, Sonar use continues to grow and evolve for new use conditions and emerging weed threats. Past and current research and development with Sonar will be reviewed setting the stage for discussion of future study, field development, and prospective new operational uses.

Rapid Response to Monoecious Hydrilla in Lake Waccamaw, NC

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Monoecious hydrilla (*Hydrilla verticillata*) was first confirmed in North Carolina in 1980 and has continued to spread since. In the fall of 2012, hydrilla was discovered in Lake Waccamaw, the first NC natural lake to be infested. Lake Waccamaw (NC) is a 3,642 ha Carolina Bay Lake, which contains many endemic species including several rare and threatened species. This unique lake has a diverse native plant community, which is in stark contrast to the majority of NC water-bodies. Initial surveys were conducted by NC State Parks personnel and reported to various state agencies. These actions quickly led to the formation of a Technical Advisory Committee (TAC) consisting of numerous agencies and groups with the goal of developing a hydrilla management plan for the lake. The management plan was developed and implemented in less than six months following the initial discovery. Components of the plan included: full lake survey, tuber sampling, herbicide toxicological screening, Environmental Assessment (EA), public informational meetings, public awareness (popular press articles), and fundraising. Managers were successful in obtaining first year funding for the project even though project costs were approximately three times greater than the state budget for aquatic plant management. Coordination and

implementation of this project should be considered serendipitous as NC had no rapid response plan and no aquatic invasive species plan.

Responses of *Microcystis aeruginosa* and *Pseudokirchneriella subcapitata* when Exposed to an Anionic Polyacrylamide Blend (*Student Presentation*)
Kyla J. Iwinski
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Responses of the noxious cyanobacterium *Microcystis aeruginosa* and the non-target green alga *Pseudokirchneriella subcapitata* were measured in this study after exposure to a specific anionic PAM blend (703d#3 Floc Log) containing a cationic bridging agent. Noxious algae can cause ecological, economic, water supply, and human health issues and efficient approaches for decreasing populations and risks of harmful algal blooms are continually sought. A range of densities of algae were exposed to 380ppm 703d#3 Floc Log for 24 hours. Responses of *M. aeruginosa* and *P. subcapitata* were measured by analyses of cell density and chlorophyll a for 12 days following exposure. *Microcystis aeruginosa* and *P. subcapitata* responses to PAM exposures differed by species, initial cell density, and time after treatment. Density of algae was visibly (pigmentation) and numerically lower in the exposed samples; however, the effectiveness of the PAM decreased in higher density samples. Results of this study indicated that the specific anionic PAM blend (703d#3 Floc Log) has potential for reducing target algae.

Pond and Lake Clarification during Dredging and When Nutrients Are an Issue
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Applied Polymer Systems, Woodstock, GA

Turbid ponds and lakes, whether caused by sediment or nutrients, are often the cause of eutrophic conditions leading to harmful algae blooms, surface water quality degradation, and in some cases out of compliance discharges. This presentation will focus on clarification of ponds and lakes that have or are currently undergoing dredging practices leading to highly turbid water and ones that have high loads of phosphorus that can or have already led to nuisance algae blooms. When dredging, historically, liquid polymer flocculants have been used by drip feed or injection systems for water quality control before discharge. These systems are many times unreliable in performance or require power sources, injection pumps and metering devices which require a significant amount of manpower to operate. Newer methods will be discussed using polymer logs using passive dosing methods. This technology has shown very high performance results for water quality without personnel oversight and greatly reduced costs. In the process of clarifying lakes high in phosphorous levels that have led to algae blooms, anionic water soluble polymer based technologies have shown through data from various research, tests, and projects, reduction rates in phosphorus of 75-90 percent and overall NTU reductions of up to 95 percent. This anionic polymer based technology is non-toxic to aquatic life and has no adverse effect to the environment. This technology is used in conjunction with various aeration/circulation systems to remove phosphorus and algae and will be discussed and illustrated. The presentation will also address ways to use this same type of technology to stabilize the surrounding areas of water bodies to prevent sedimentation as well as prevent phosphorus from entering a pond or lake due to heavy fertilization.

Sago Pondweed (*Stuckenia pectinatus*) and Horned Pondweed (*Zannichellia palustris*) Control with Endothall Formulations in Greenhouse Flowing Water Mesocosms (*Student Presentation*)
Kallie C. Kessler and Scott J. Nissen
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Sago pondweed (*Stuckenia pectinatus*) and horned pondweed (*Zannichellia palustris*) are important aquatic restoration species; however, when these species persist within water conveyance systems they can become problematic. Control of these two species with two endothall formulations (dipotassium salt, Cascade® and dimethylamine salt, Teton®) was evaluated in greenhouse flowing water mesocosms (simulating irrigation canal conditions). Sago pondweed plants were propagated by placing one tuber in an 8 cm pot containing field soil. Horned pondweed plants were grown in the same sized pots by topping field soil with approximately 18 g of soil containing horned pondweed seed. The soil was collected from an irrigation canal in Washington with a dense

horned pondweed infestation. Both species were allowed to grow in the flowing water system until there was approximately 15 to 20 cm of top growth. The dipotassium salt of endothall was applied at 3 mg/L for 8 hours to control sago pondweed and at 4 mg/L for 6, 8, or 9 hours to control horned pondweed. Dimethylamine salt of endothall was applied at 1, 1.5, or 2 mg/L for 6 hours to control sago pondweed and at 1.5, 2 or 3 mg/L with exposure times ranging from 2 to 6 hours to control horned pondweed. The various treatments were achieved by dosing 20 L of water with the desired herbicide concentration and re-circulating treated water in each canal for the desired exposure time. After the desired exposure times, each canal was rinsed with 60 L of clean water. Plants were grown after treatment in the same canals by circulating water from a common 750 L tank. To evaluate treatment differences, sago and horned pondweed aboveground biomass was collected 3 and 4 weeks after treatment (WAT), respectively. All endothall treatments reduced sago pondweed biomass when compared to the control; however, the 3 mg/L 8 hour CET with the dipotassium salt resulted in the greatest biomass reduction (96%). For the dimethylamine salt of endothall, CET combinations resulted in sago biomass reductions ranging from 78% to 84% and there were no significant difference between herbicide concentrations. For horned pondweed, only the dimethylamine salt of endothall applied at rates of 2 mg/L for 3 hours or 3 mg/L for 4 hour significantly reduced horned pondweed biomass. The efficacy of these two endothall formulations appears to be species dependent. Sago pondweed responded better to the dipotassium salt formulation (Cascade®), while horned pondweed was more effectively controlled with the dimethylamine salt formulation (Teton®).

Alien Invasive Aquatic Weeds in Botswana - Historical Perspective and their Successful Control
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The Okavango Delta on the northwest and Kwando/Linyanti/Chobe River system on the northeast of Botswana have been susceptible to exotic plant invasions due to abundance and variety of wetland habitats. These wetlands are major tourist destinations in the country providing 15% of the national economy and are highly productive encompassing different vegetation types and wild life. The invasion of these wetlands and waterways by the two alien invasive species (AIS), Kariba weed (*Salvinia molesta* Mitchell) and water lettuce (*Pistia stratiotes* L.) has increased the demand for information on their control and management in the country. The two "biological pollutants" have caused extensive socio-economic and water resource use management problems in Botswana's wetlands since 1970s. Sixty (60) salvinia monitoring sites in the Okavango Delta and 49 in the Kwando/Linyanti/Chobe System were identified in 1999 based on accessibility and intensity of salvinia infestations. The weevil, *Cyrtobagous salviniae* (Calder and Sands) introduced and monitored between 1999 and 2000 in the sites yielded substantial control of salvinia. Water lettuce confined to Selinda Canal over a distance of 2.7 km (area 0.248 km^2) and 0.003 km^2 in Zibadianja Lake of Kwando was eradicated in 2004. Management of Water hyacinth (*Eichhornia crassipes* (Mart.) Solms-Laubach) in the transboundary Limpopo River is ongoing jointly with South Africa. The participation of tourist lodges, communities in the control of the weeds, and the implementation of Aquatic Weed Control Act in the weed management are presented. Integrated control technologies for managing the species is discussed in terms of a degree of efficacy, operational status, and/or need for further investigation.

Managing Eurasian Watermilfoil in the Lower Clark Fork River System, Montana
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Eurasian watermilfoil (*Myriophyllum spicatum* L.) was first found in Noxon Rapids Reservoir and Cabinet Gorge Reservoir in 2007. Whole-lake surveys were done in 2008, and repeated in 2009, 2010, and 2013, using a point intercept method. The 2008 surveys found 247 acres of Eurasian watermilfoil in Noxon Rapids and 78 acres in Cabinet Gorge. Since Noxon Rapids is the upstream reservoir of the two, and is more heavily utilized for recreation, management initially focused on Noxon Rapids Reservoir. Innovative herbicide approaches using diquat, endothall, and triclopyr were implemented in 2009 and subsequent years for dense beds and channel-margin infestations, to improve selective management under conditions of high water exchange. Treatment efficacy, as evaluated by point intercept methods, indicated that treatments reduced Eurasian watermilfoil

frequency by 80% by 5 weeks after treatment (WAT), and 94% by 52 WAT. While some level of native plant injury was observed at 5 WAT, all plots had increased native plant frequency and diversity by 52 WAT. By 2013, dense Eurasian watermilfoil was reduced to 97 acres, and 5% of the littoral zone points. Meanwhile, no management has been done on Cabinet Gorge Reservoir, due to budgetary limitations, and the acreage of dense Eurasian watermilfoil has increased to 205 acres and 18% of littoral zone points by 2013. In addition to Eurasian watermilfoil, these reservoirs have populations of curlyleaf pondweed and flowering rush, which may require further innovation to manage them successfully.

Alligator Weed [*Alternanthera philoxeroides* (Mart.) Griseb.] Is Spreading in Kashmir Himalayas (*Student Presentation*)

Ather Masoodi and Fareed A. Khan
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Alligator weed (*Alternanthera philoxeroides*) is an amphibious weed invading worldwide. It was reported very recently from Wular Lake, a Ramsar site in India. The weed forms isolated floating islands of variable sizes in this lake. Monitoring of the weed for 4 years reveals that the total number of patches increased from 6 in 2008 to 82 in 2011 with total area of all patches increasing from 41.3 m^2 in 2008 to 831 m^2 in 2011. We did predictive modeling with four years data using a variable growth rate equation, to estimate the spread rate of the weed assuming the entire lake area available for spread. Our model suggests that this weed may potentially cover the entire lake in 13–19 years from 2008. The robustness of the mathematical model was also determined and validated using data from the first three years and it was in coherence with the previous model. We do caution, the predictive spread model of *A. philoxeroides* presented here has a strong bearing to the uncertainties of climate change, nutrient loading and competition effects. The weed has invaded other lakes and wetlands in the region. The study warrants an urgent need for rapid action involving manual removal before it actually assumes bigger dimensions in the lake and the region as more than ten thousand households completely depend on the resources of Wular Lake, India.

Evaluation of New Herbicide Combinations for Managing Giant Salvinia in Louisiana

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The invasive floating fern, giant salvinia (*Salvinia molesta* Mitchell), continues to spread and cause ecological and economical losses throughout Louisiana and the Gulf Coast Region. In 2013, giant salvinia covered an estimated 45,300 acres of Louisiana public waters and the majority of the populations were treated with a combination of the aquatic herbicides glyphosate and diquat, and two surfactants. This herbicide mixture is the primary foliar treatment in Louisiana and Texas, and has been used operationally for the past three years. At various times of the year and in specific situations, foliar applications shift to glyphosate or diquat only and have resulted in successful control. Although these treatments are highly efficacious when plants are found in single layers, repeat applications are often necessary throughout the growing season when the plant is in the tertiary growth stage and becomes mature and matted. New herbicide combinations are needed to manage thick, surface matted plants and are necessary for resistance management. Therefore, mesocosm trials were conducted in 2013 and 2014 to evaluate glyphosate alone and in combination with diquat, flumioxazin, or with various surfactants. An additional treatment combining endothall and flumioxazin was also included. These studies were conducted at various times of the year to determine seasonal plant responses to the treatments. In the 2013 trial conducted in October, all herbicide treatments reduced mature giant salvinia plant dry weight by at least 65%. In particular, glyphosate alone and combinations with flumioxazin provided 99 to 100% control. Re-growth was noted on most plants treated with glyphosate plus diquat and endothall plus flumioxazin. Although these treatments were efficacious against mature, tertiary plants that were beginning to form multiple layers, further evaluation against thick surface matted plants at the mesocosm or field scale is necessary to determine control under worse-case scenarios.

Ecological Effects of Water-Willow (*Justicia americana*) on Aquatic Invertebrate Species (*Student Presentation*)

Christopher M. Mynatt[1] and Mark A. Webb[2]
[1]*Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, TX*
[2]*Texas Parks and Wildlife Department, Inland Fisheries Division, Snook, TX*

Water-willow (*Justicia americana*) is a perennial aquatic macrophyte that has been used extensively in recent years as a means to increase both vertebrate and invertebrate productivity in freshwater littoral zones. This popularity is in part due to its rapid and dense rhizome growth that allows water-willow to establish itself quickly when introduced into aquatic systems, as well as its provide potential habitats for invertebrate and smaller vertebrate species within its dense rhizomous structure. However, the full ecological effects of water-willow have not been comprehensively studied. For this study, the ecological effects of water-willow will be focused on aquatic invertebrates. To do this, water-willow plots established in Lake Conroe, Montgomery County, Texas will be block-netted and the biodiversity of invertebrates within the plots will be extensively observed. Areas of rhizome growth of water-willow, as well as soil samples, will also be removed to ensure the monitoring of benthic invertebrate species. This data will then be compared to the levels of invertebrate biodiversity in control plots that are absent of vegetation. It is hypothesized that the invertebrate densities within the plots containing water-willow will be higher than the densities observed in the non-vegetated plots due to the increased habitat complexity created by the rhizomous structures of water-willow. This increased density could then result in higher fish densities due to the foraging nature of fish assemblages on invertebrate species. If the hypothesis is shown to be valid, then water-willow could prove to be a very economically important species in the management of reservoir, lake and stream systems.

Attempted Revegetation in Two Piedmont Reservoirs: Establishment Success and Response of Fish and Macroinvertebrates (*Student Presentation*)

Justin J. Nawrocki
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Native aquatic vegetation improves water quality, increases water clarity, reduces shoreline erosion, reduces nuisance macrophyte and algae growth and improves fish and wildlife habitat. A lack of native aquatic vegetation is commonplace in Piedmont reservoirs which in turn makes them ripe for infestations of invasive species like hydrilla. The lack of historic seed banks and remoteness from natural lakes with native plants means revegetation is the only option for establishing native species in these reservoirs. Factors such as water clarity, sediment characteristics, herbivory, wave action and interspecific competition can lead to failure. In June of 2012, work began on Jordan Lake, NC and Lake Gaston, NC & VA to assess the viability of establishing native aquatic plants and the resultant effects on macroinvertebrate and sport fish assemblages. Jordan Lake (14,000ac) is devoid of any submersed aquatic vegetation and has only a small amount of *Justicia americana* present. Jordan Lake is a flood control reservoir; therefore, water levels are subject to rapid and large changes. Lake Gaston (20,000ac) is kept at a relatively constant level and has much greater aquatic vegetation diversity but is dominated by hydrilla. To combat the hydrilla, grass carp and large-scale herbicide treatments are used. Four coves in each lake were selected and range in size from 12.2 – 13.9ac and 8.2 – 19.56ac on Jordan and Gaston respectively. In 3 coves of each lake 15' x 50' exclosures were built to reduce the chances of herbivory while one cove acted as a reference. *Justicia americana*, *Vallisneria americana* and *Brasenia schreberi* were planted in each exclosure save 2 references per cove. Percent cover of each species is being tracked and will be quantified when spread occurs outside the exclosure. Fish assemblages are being monitored by macrohabitat electroshocking in all 8 coves in the spring and fall of each year. In addition, microhabitat electroshocking is also occurring each fall, which assess the use of each individual plant species in the exclosures by fish. Macroinvertebrate sampling in being performed each fall and assesses the use of each individual species as well as the habitat as a whole. In 2013, 95%, 76%, and 19% of the 2012 exclosures had to be replanted with vallisneria, brasenia and justicia respectively. An unusually wet spring resulted in Jordan Lake being some 4' above normal pool level for weeks on end, killing all the plants except the justicia. Herbivory was also noted on the vallisneria in both lakes. Macroinvertebrate sampling resulted in 147 individuals in 18 families on Lake Gaston and 63 individuals in 7 families on Jordan Lake. Macrohabitat electroshocking showed more pelagic species found in Jordan Lake such as white perch and gizzard shad. Only 2.4% of all fish caught were largemouth bass. Lake Gaston was dominated by bluegill while largemouth bass accounted for 7.5% of the total catch. When the plants become established, 2 exclosures will be opened to assess

herbivory, but will also allow larger sport fish access to these areas. Continued growth and spread of these plants will hopefully show increased use by both macroinvertebrates and sport fish. All sampling will be continued out to 5 years.

Linking Plant Biology and Management Information to Improve Control of Hydrilla
Michael D. Netherland[1] and Dean Jones[2]
[1]*APMS President, Gainesville, FL*
[2]*University of Florida, Lake Alfred, FL*

Over the past six years, we have monitored numerous large-scale herbicide applications targeting the invasive plant hydrilla (*Hydrilla verticillata* L.f. Royle) in Florida public waters. Along with these management efforts, we have conducted multiple mesocosm studies to determine factors that influence hydrilla growth and expansion. A picture emerges showing hydrilla can consistently re-establish in the same areas of a lake following multiple management efforts, while a single treatment can result in multiple seasons of hydrilla control in other areas of the same water body. Given the shallow nature of FL lakes, these differences in growth and recovery are often not easily explained and they can greatly confound our efforts to compare efficacy and longevity of management techniques. As managers have increased their focus on targeting areas where hydrilla consistently recovers, we have noted this strategy has reduced the potential for hydrilla to spread to other sites within the water body. Mesocosm studies evaluating the influence of sediment type on hydrilla growth using field collected sediments suggest that several lakes (and sites within certain lakes) contain high bulk density sand sediments that favor growth of native plants like Illinois pondweed (*Potamogeton illinoensis*) over hydrilla across a broad range of sediment nutrition levels. Likewise, sampling sediments from areas that consistently support dense hydrilla growth resulted in hydrilla biomass exceeding that of Illinois pondweed by 6-fold over a 35 day period. While these sediments were also mainly composed of sand, they had higher levels of organic matter. These sediments were full of unsprouted tubers, suggesting a propagule bank that can sustain hydrilla in these sites over an extended period of time. While the observation that an invasive plant can grow better in specific areas of a water body is not new, linking intense management to these “hot spots” where hydrilla readily reestablishes following treatment has had significant impacts on abundance and management strategies for hydrilla.

Blowing Bubbles: Long Range Control of Algae Using Ultrasound
Jonathan R. Newman
Centre for Ecology and Hydrology, Wallingford, England

The mode of action of ultrasound on algae has been variously proposed in laboratory studies as coagulation and promotion of sinking out of suspension, rupture of the vacuole by resonance of the cell, disruption of gas vesicles in filamentous cyanobacteria (N.B. not gas vacuoles as written by many authors, plant vacuoles do not contain gas), and shear stress induced rupture of cells. These processes require reasonably high power (40W) and close proximity to the alga (usually <1cm in laboratory studies). These proposed mechanisms cannot explain the action of ultrasound at distances of more than a few metres in natural systems, whereas I have observed reductions in various mixed phytoplankton communities at distances of 700m from an ultrasound transducer producing only 33W at the transducer face (EnviroSonic Ltd, ES-300 model, 240 V AC) and various other commercially available devices (LG Sonic XXL, published range of 180m) and Sonic Solutions SS 600 (published range of 180m). I propose a mode of action on phytoplankton, benthic algae and bacteria that relies on the interaction of pulsed ultrasound and elevated dissolved gas concentrations in boundary layers surrounding actively growing algae and bacteria. This mechanism has been proposed previously, but only as an action in the waterbody, not in the algal cell boundary layer. The established commercial use of microbubbles in combination with ultrasonic treatment indicates the importance of dissolved gases in water as nucleation sites. This proposed mode of action can also be used to explain some of the different sensitivities to ultrasound, e.g. diatoms are less sensitive than other species.

Control of *Phragmites communis* using Reduced Rate Glyphosate Applications and TopFilm Adjuvant
Jonathan R. Newman and Manuel A. Duenas-Lopez
Centre for Ecology and Hydrology, Wallingford, England

The UK Government Theme Advisory Group on the implementation of the European Water Framework Directive has decided that glyphosate will be proscribed as a specific aquatic pollutant and has produced a recommendation for an Environmental Quality Standard (EQS) for glyphosate in water. The short term level of this EQS has been set at 396 μg l^{-1}, which may result in application of full label rates of glyphosate causing shallow receiving waters to exceed this limit. The long term level of 198 μg l^{-1} is of less concern due to rapid degradation rates of glyphosate in natural waters. The short term EQS value is equivalent to about half the value that might be achieved under normal spray operations, if no herbicide were intercepted by leaves of target plants in water about a foot deep. In order to determine if satisfactory control of emergent aquatic species could be maintained under this proposed new regime we undertook experiments using Roundup Pro Biactive 360 at three application rates, full label rate, half label rate and quarter label rate. We also included these application rates with TopFilm, a UK aquatic approved sticker product, applied at the full label rate with each of the glyphosate rates. Herbicides were applied to replicate sections of agricultural drainage ditch in the East of England in October 2013. Data presented in this paper are from the first screening of regrowth made in June 2013, and include data on stem numbers and stem height. Further data will be collected in October 2014 and June 2015. The aim of this presentation is to provide a template for research on other species to determine the effects of implementation of the EQS in Europe on the effectiveness of aquatic weed control.

Evaluation of Water Willow (*Justicia americana*) Use by Reservoir Fishes (*Student Presentation*)
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[1]*Texas A&M University, Department of Wildlife and Fisheries Sciences, College Station, TX*
[2]*Texas Parks and Wildlife Department, Inland Fisheries Division, Snook, TX*

Water willow (*Justicia americana*) is popular in fish habitat improvement projects because of its ease of establishment and relative resistance to herbivory by Grass Carp (*Ctenopharyngodon idella*). However, the effects on fish ecology have not been well documented. In this study, 9.3 m^2 plots of water willow established by Texas Parks and Wildlife Department in Lake Conroe, Montgomery County, Texas will be surrounded by block nets then electrofished exhaustively to capture all possible fish in the treatment sites. Fish will be identified to species then weighed to the nearest gram and measured to the nearest mm total length. Stomach contents will also be examined to determine food habits. Similar sampling will be conducted in un-vegetated control sites along the same shoreline as the treatment sites. Species composition, size composition by species, fish condition, and stomach contents will be compared between water willow and un-vegetated sites. It is hypothesized that due to the habitat complexity provided by water willow species composition, size composition by species, and fish condition will be positively affected compared to un-vegetated plots. Meanwhile, the stomach contents are not expected to vary in forage type but in the amount of forage consumed.

Impacts of Avian Vacuolar Myelinopathy on Bald Eagles in Georgia
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Avian Vacuolar Myelinopathy (AVM) is a disease of bald eagles, American coots, and other species that appears to be caused by incidental ingestion of a neurotoxin produced by a novel blue-green alga that grows on the surfaces of submerged aquatic vegetation in limited areas of the southeastern U.S. The invasive weed *Hydrilla verticillata* appears to be an especially favorable host. Bald eagles most likely become affected secondarily by preying upon American coots that have been rendered especially vulnerable by the effects of the toxin; the diet of coots consists almost entirely of aquatic vegetation. Although the occurrence of AVM has so far been limited to only a few sites in Georgia, the disease has had significant impacts on bald eagle populations in those areas. Management of hydrilla infestations appears to be the best approach for reducing the impacts of AVM.

Benefits of Incorporating Genetic Identification of Watermilfoils into Aquatic Vegetation Mapping (*Student Presentation*)

Syndell Parks[1] and Ryan A. Thum[2]
[1]*Grand Valley State University, Department of Biology, Muskegon, MI*
[2]*Grand Valley State University, Robert B. Annis Water Resources Institute, Muskegon, MI*

Eurasian watermilfoil (*Myriophyllum spicatum*) is an invasive aquatic plant that is extensively managed to mitigate its large economic and ecological impacts in many lakes. Eurasian watermilfoil hybridizes with the ecologically benign and native northern watermilfoil (*Myriophyllum sibiricum*). These hybrids can differ significantly from Eurasian watermilfoil in patterns of nuisance growth and response to management. However, due to their morphological variability, many hybrids are difficult to distinguish from Eurasian and northern watermilfoil, even for those with aquatic plant identification training. In contrast, genetic methods of identification have proven more reliable. I argue that incorporation of genetic monitoring of watermilfoils into existing aquatic vegetation mapping can inform nuisance watermilfoil management decisions. I also provide practical guidance on obtaining genetic identifications to make the process more user-friendly and informative.

Effects of Salinity on Submerged Aquatic Vegetation's Growth and Abundance in North Carolina and Assessment of a SONAR's Accuracy to Measure Vegetation (*Student Presentation*)

Audrey Pleva and Joseph Luczkovich
East Carolina University, Greenville, NC

Submerged aquatic vegetation (SAV) is one of the most important estuarine habitats supporting commercially and recreationally important fishes and invertebrates, providing species food and shelter from predation. Salinity levels, an important factor in SAV growth and survival, are rising in North Carolina (NC) due to sea level rise bringing salty water from the Atlantic Ocean into NC, posing a threat to freshwater species. SAV species adapted to a certain salinity level are stressed by long and short term changes in salinity, resulting in patchy or smaller beds. In this project, a recently developed survey technique based on a combined video and echosounder system was used to measure the SAV % cover at three sites, each with different long-term and short-term salinity levels. Our hypothesis was that large short-term changes in salinity would be a stressor for SAV, and that as the range in salinity and the average long-term salinity increased, SAV % cover would decrease. We measured changes in water quality including salinity, temperature, and dissolved oxygen, and SAV cover using boat-based SONAR techniques at Jarrett Bay (JBS), Blount's Bay (BLB), and Currituck Sound (CTS) in NC during the beginning of the growth season where salinity is a very important growth factor. SONAR data were collected along 30 transects at 10-m intervals across the study area at JBS and BLB, but 60 transects at 25-m intervals at CTS. The accuracy of the SONAR technique was assessed using underwater video at 100 randomly selected points along transects at each site. Accuracy was very high (87.8%) and relatively equal between all three sites. The salinities and % cover were highly variable among sites, in both the short- and long-term measurements, allowing for an analysis of the relationship between SAV and salinity. Overall mean long-term salinity was negatively correlated (r=-0.7) with SAV percent cover. Short-term salinity increases may cause declines in SAV cover, as freshwater species are displaced by salinity-tolerant SAV species.

Managing Hydrilla in Drinking Water Reservoirs

Ken S. Presley
Henry County Water Authority, Locust Grove, GA

This presentation will include a brief history of the reservoirs owned and operated by the Henry County Water Authority (HCWA) and will discuss the challenges faced to our drinking water supply and recreational activities by the introduction of the non-native aquatic plant hydrilla. It will discuss the considerations from a water utility viewpoint and contain some of the available treatment options and actions that have been taken to control it. It will also include some of the important research information collected and the benefits of that research in making sound reservoir management decisions for HCWA now and in the future.

Enhancement of Targeted Algal Management

John H. Rodgers, Alyssa J. Calomeni, and Kyla J. Iwinski
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Algae can be important contributors to the productivity of aquatic systems and support uses of water resources such as recreation and property values. Noxious algae and excessive growths can interfere with designated uses of water resources. Often efficacious algaecides are used to control growths of noxious algae and to restore the critical uses of impaired waters. Intraspecific differences in responses of noxious algae to algaecides can be measured and these data can inform decisions to achieve successful treatments. Targeted algal management has been enhanced by improvements and expansion in algal challenge testing for both planktonic and benthic algae. These improvements and enhancements have been confirmed by data from field studies where recommendations from the algal challenge tests were implemented with careful attention to exposures in the aquatic system. Data from the field studies and observations from applicators have been beneficial in refining treatments to reliably achieve control of noxious algae while enhancing margins of safety for nontarget species.

Post-treatment Fate of Copper Applied as Algaecides and Herbicides

John H. Rodgers, Alyssa J. Calomeni, and Kyla J. Iwinski
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To accurately estimate the risks associated with the use of copper formulations as algaecides and herbicides in water resources, the fate and effects of copper from these applications are crucial components. Important in risk considerations is the concentration of algaecides and herbicides applied to the aqueous phase or directly to vegetation. The intent in algaecide or herbicide applications is to apply the treatment to maximize the sorption of copper to active sites in or on the target species therefore reducing risks to non-target species. The duration of copper concentrations in the water column and proximity and partitioning to the target species are also crucial to the treatment performance achieved. With a lithic biogeochemical cycle, copper partitions to the sediments where it is bound by ligands. Organic matter and sulfides are important ligands in sediments of water resources controlling the binding strength and bioavailability of copper. The molar ratio of ligands such as acid volatile sulfides to copper applied as an algaecide or herbicide is well in excess of one in the sediments of most aquatic systems indicating that the copper will be strongly bound and not bioavailable. Based on data to date, most of the concerns regarding copper residuals in sediments from applications of algaecides and herbicides are unwarranted.

APMS Herbicide Resistance Management PowerPoint Lessons

Jeffrey D. Schardt
Florida Fish and Wildlife Conservation Commission, Tallahassee, FL

Cases of weed resistance to herbicides have been increasingly documented during the past two decades, especially in crop production venues. Many of these resistance issues are associated with extensive use of newer chemistries that are single site of action compounds – herbicides that target a plant-specific enzyme. Seven of the 14 herbicides now available for aquatic site use were registered during the past 10 years and all are single site of action compounds. Some who are familiar with weed management in agricultural settings have been critical that rotational strategies are not routinely implemented for aquatic herbicide use. Most aquatic plant managers agree that resistance management strategies are increasingly important to conserve long-term availability of the relatively few herbicides approved for use in water. However, issues like efficacy, selectivity, and cost substantially limit effective initial herbicide control options, let alone subsequent rotational strategies. The Weed Science Society of America (WSSA) developed herbicide resistance management Lessons and posted them as PowerPoint presentations on the WSSA web site. WSSA asked APMS to take similar steps to address resistance management for aquatic venues. As a first step toward this goal, APMS held a special session on resistance management at the July 2013, 53rd Annual Meeting in San Antonio. Information was presented from research, industry, and private and public-funded applicator perspectives. While there are similarities between agricultural and aquatic weed management, the venues, plant types, and management objectives can be very different and have substantial impact on herbicide selection and use rates. Yet even when herbicide rotation is not an option, aquatic plant managers incorporate many stewardship practices that help reduce the risk of developing herbicide resistance. This information is summarized in an APMS White Paper entitled Herbicide Resistance Stewardship in Aquatic Plant

Management and three PowerPoint Lessons for posting on the WSSA and APMS web sites. The PowerPoint Lessons will be reviewed during this presentation.

Potential for Herbicide Resistance Evolution in Hybrid Watermilfoil (*Student Presentation*)
Lindsey-Ann L. Schulte and Ryan A. Thum
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The potential for herbicide resistance in aquatic weeds is an emerging concern. For example, it is clear that hybrid watermilfoils (*Myriophyllum spicatum* x *Myriophyllum sibiricum*) can exhibit reduced sensitivity to 2,4-D. However, it is unclear whether the observed reductions in 2,4-D sensitivity in hybrids reflects a general tolerance attributable to hybrid vigor, or whether hybrid populations have an ability to evolve true resistance in response to 2,4-D management. In order for resistance to occur, there has to be heritable genetic variation for 2,4-D response. Here, we present the results of laboratory experiments that measure 2,4-D sensitivity on different hybrid watermilfoil genotypes. Our design partitions out genetic and environmental contributions to growth in response to an herbicide application. The data show significant, heritable genetic variation for 2,4-D response among hybrid watermilfoil genotypes; some genotypes are more sensitive than others. These results, therefore, demonstrate that the raw material for the evolution of 2,4-D resistance (i.e., heritable genetic variation) exists in hybrid watermilfoils as a group. Thus, there is the potential for less sensitive hybrid genotypes to replace more sensitive genotypes following management with 2,4-D.

Maintenance Control of *Hydrilla verticillata* in Florida's State Managed Waters with Aquathol
Jeremy G. Slade[1] and Michael D. Netherland[2]
[1]*United Phosphorus, Incorporated, Gainesville, FL*
[2]*U.S. Army Corps of Engineers, Engineer Research and Development Center, Gainesville, FL*

Hydrilla (*Hydrilla verticillata*) is a submersed aquatic weed that grows prolifically in shallow lakes creating problems for many recreational activities, and negatively impacting native ecosystems. Hydrilla has been problematic in Florida waters since its introduction in the early 1950's and by the 1970's hydrilla could be found state-wide established in a variety of aquatic sites. Currently, the Florida Fish and Wildlife Conservation Commission (FWC) is the primary entity responsible for controlling hydrilla in state waters at a cost of several million dollars annually. By keeping hydrilla density low or at "maintenance levels", the FWC tries to reduce the distribution potential across lakes and reduce competition between hydrilla and native species by using the most efficacious and cost-effective tools. Aquathol (endothall) is a contact herbicide used frequently to control populations of hydrilla after the confirmation of fluridone-resistant hydrilla in many aquatic sites throughout Florida. Since in the 1960's, many formulations of endothall have been used and through rigorous research, several changes have occurred to make endothall more user-friendly, versatile, and cost-effective. Examples of hydrilla treatments, including innovative use patterns with Aquathol alone and in combination with other chemistries will be discussed.

Toxicity of Copper Sulfate and Copper-ethanolamine to *Microcystis aeruginosa* and *Pseudokirchneriella subcapitata* at Different Initial Cell Densities
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Effects of cell density, mass, surface area, and volume of *Microcystis aeruginosa* (prokaryote) and *Pseudokirchneriella subcapitata* (eukaryote) on their responses to exposures of copper sulfate and copper-ethanolamine were measured. For these experiments, *M. aeruginosa* UTEX 2385 and *P. subcapitata* UTEX 1648 were cultured in BG11 medium to three initial cell densities (5×10^4, 5×10^5, and 5×10^6 cells/mL). Exposures ranged from 5 to 20,000 µg Cu/L. Chlorophyll a concentrations and cell densities were measured as response endpoints after 96-h exposures. 96-h EC_{50} values of copper sulfate for *M. aeruginosa* at the three cell densities were 9, 63 and 112 µg Cu/L, respectively; and for *P. subcapitata*, were 192, 1873 and 4619 µg Cu/L, respectively. For *M. aeruginosa* and *P. subcapitata* at 5×10^6 cells/mL, the 96-h EC_{50} values of copper-ethanolamine were 101 and 2579 µg Cu/L. At the same cell density, *M. aeruginosa* and *P. subcapitata* respond differently to copper sulfate and copper-ethanolamine. Copper-ethanolamine was more toxic than copper sulfate to *M. aeruginosa* and *P.*

subcapitata. M. aeruginosa and *P. subcapitata* had similar cell mass (15 and 16 pg/cell, respectively). In terms of cell surface area and cell volume, *M. aeruginosa* (186 μm^2/cell and 255 μm^3/cell) was about two times smaller than *P. subcapitata* (425 μm^2/cell and 416 μm^3/cell). Thus, cell mass, surface area, or volume cannot explain the difference in responses of *M. aeruginosa* and *P. subcapitata* to exposures of copper in this study.

Phenology of *Potamogeton crispus* in the Southeastern U.S.

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Curlyleaf pondweed (*Potamogeton crispus*) is a submersed aquatic plant that is native to Europe, Asia, Africa, and Australia. It first appeared in the U.S. in the 1840's and has since been distributed throughout the lower 48 states. Curlyleaf pondweed spread across the southeastern parts of the U.S. in the 1940's and 50's. Long distance dispersal is thought to occur mainly through fish hatchery activities and in many states the first observance of curlyleaf pondweed was in hatchery ponds. Curlyleaf pondweed is capable of outcompeting native species and forming large monospecific beds. Curlyleaf pondweed primarily reproduces vegetatively via turion production or rhizome elongation. Turions, vegetative structures capable of surviving extreme conditions (i.e. drought, freezing, herbicide treatments) and producing a viable plant capable of reproduction, are typically produced in the weeks before the plant senesces. In northern populations, curlyleaf pondweed has an atypical growth cycle in that it senesces in early summer, is dormant through the summer, and turions sprout in mid to late fall, and produce turions in the spring. Our study was conducted to better understand the phenology of curlyleaf pondweed in the southern U.S. because so little is known about these populations. Total plant biomass peaked in winter. This coincided with minimum annual water temperatures. However, plant growth occurred in all months. Turion production occurred year round but was lowest in summer months but still in excess of 1,000 per m^2 of substrate. It appears that plant growth and turion production occur year round suggesting that southern populations of curlyleaf pondweed have altered their phenology to climatic conditions present in the southeastern U.S.

Aquatic Weed and Algae Control in Irrigation Canals Using Endothall

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Irrigation canals are a major source of water for agricultural production in the western U.S. Control of aquatic vegetation and algae in irrigation canals is crucial for efficient water delivery. While aquatic weeds can have a significant impact on water flow, the tools available to canal managers for control are limited. In 2010, two endothall formulations were labeled for use specifically for 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, 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 three 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. 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.

An Assessment of Aquatic Invasive Plants in the Illinois River: Water Hyacinth Surveillance, Mapping, Persistence, and Potential Seed Dispersal (*Student Presentation*)

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Water hyacinth (*Eichhornia crassipes*) is becoming a re-occurring problem in the Illinois River – Chicago Areas Waterway System (CAWS), but the current extent and potential for future intensification are largely unknown in this system. Because water hyacinth has the potential to substantially degrade aquatic and wetland resources wherever it becomes established, proactive management and prevention are the best methods of control. Risk assessment, surveillance, and control of aquatic invasive plants like water hyacinth rely on a firm understanding of the factors controlling its establishment and dispersal. In the summer and fall of 2013, we conducted aerial surveillance, ground surveillance, seed bank and vector sampling to lay the foundation for an effective surveillance and control program of water hyacinth. We collected sediment core samples from historically and currently infested areas in the upper Illinois River area to investigate the potential for water hyacinth seed to be present and/or viable in the seed bank. We found water hyacinth seed to be present in 61% of sediment core samples taken from historically infested areas, and present in 100% of sediment core samples taken from currently infested areas. We also found water hyacinth plants in 3 disjunct water bodies, and in at least 3 reaches of the Illinois River. We will continue surveillance and sample collection in 2014 and evaluate an aerial survey technique for detection of water hyacinth beds, occurrence in diets of fishes and free-floating in the water column, and test viability of seeds recovered from core samples and fish.

Invasive Plant Education: Invading a Classroom near You!

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The Florida Invasive Plant Education Initiative began in 2004 as part of a long-term education and outreach partnership between the University of Florida/IFAS Center for Aquatic and Invasive Plants and the Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section. The initiative aims to educate the next generation of Florida citizens on the ecological and economic impacts of invasive plants, as well as introduce them to the complexity of natural area management. The long-term goal is to bring about greater acceptance of invasive plant management strategies and methods, while fostering environmental stewardship among this young population. To accomplish this, we direct our energy towards both the students and the teachers of Florida. Over the last ten years, we have developed an extensive program on how to get invasive species issues taught in the classroom - with a combination of training, alignment to curriculum standards, and creation of activities that truly engage students. We would like to expand our initiative outside of Florida and with recent education trends this seems to be the opportune time to go for it. Although our curriculum encompasses much more than one activity, Lakeville - A Natural Resource Management Activity, is a unit that combines several of our most important lessons as well as a fun game-show style activity at the end. We make Lakeville Teaching Kits available to teachers; kits contain everything they need to teach the unit and are ready to be used straight from the box. Lakeville involves interdisciplinary skills and lessons - from debate to public speaking to natural resource management, ecosystems, and food webs. One group of students role-plays as citizens in the imaginary town of Lakeville. These citizens, with their varying and oftentimes conflicting priorities, must vote on which species to allow into their ecosystem. Student citizens are provided with information about the roles they will be playing. The species themselves are represented by groups of students who present the positive facts about the species while also trying to respond to questions about some of their negative traits from informed citizens. Information is provided in the form of “critter cards” to enlighten students about their particular species. This scenario is not only applicable to Florida natural area management, but to management everywhere in the country! APMS has made it possible for two teachers to attend our week-long workshop, PLANT CAMP; one from North and one from South Carolina. The “Carolina Project,” as it has been dubbed by the participating teachers, will then have two teachers who have a real understanding of the entire education initiative who can take the lead on developing and testing a modified Lakeville in both states.

The Turion Ecology of *Stratiotes aloides* (*Student Presentation*)

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Stratiotes aloides (commonly known as Water Soldier) is a plant native to northern Eurasia which has commonly been sold in the aquarium and water garden plant trade. In 2008, *Stratiotes aloides* was sighted for the first time as a wild population in North America in the Trent Severn Waterway in Ontario, Canada. Crucial information on the reproductive ecology of the plant is presenting a barrier to effective control and management strategies. Specifically, it is unknown the extent to which the plant is propagating via the production of turions, offsets, or whether it is producing viable seed. A field study was completed to evaluate the density and biomass of plants as well as the number and fate of turions and offsets produced by eco-biomorphic forms of the plant in order to identify any potential variability in reproduction between forms in the area of infestation. Secondly, an incubation study was done in the laboratory to test turion viability after variable incubation periods of 2, 3 and 4 months to begin testing the overwintering dynamics of this important reproductive propagule. Results will be discussed in the context of informing a period where propaguales and mother plants in the river are most vulnerable to control to meet the provincial goal of eradicating the plant from the waterway.

Evaluation of Auxin Herbicide Applications Following Pretreatment with Select Algaecides for Control of Eurasian Watermilfoil in Long Lake, Iosco County, MI

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Long Lake is a 493-acre lake in Iosco County, MI. Given the large littoral area, this lake can support the growth of aquatic plants. Long Lake has a species rich plant community, though Eurasian watermilfoil (*Myriophyllum spicatum*) has invaded large areas of the littoral zone. In June of 2013, 280 acres of Eurasian watermilfoil were treated with select herbicides and algaecides in an attempt to enhance the control of this species. Treatments were made to four areas in the lake (A, B, C, and D) and included applications of the algaecides Phycomycin® SCP (sodium carbonate peroxyhydrate) at 10 lbs. acre^{-1} or Cutrine-Ultra® (copper ethanolamine complex mixed) at either 0.5 or 1.0 gal. acre^{-1} followed by Navitrol® (liquid triclopyr) at 3 gal. acre^{-1} within the 0 to 10 ft. depth contours. Navigate® (2,4-D, butoxyethyl ester) was applied at 150 lbs. acre^{-1} beyond the 10 ft. depth contour. Twenty biomass core samples were taken in each of the four treatment sites prior to herbicide treatments and at 10 weeks after treatment (WAT). Pretreatment biomass of Eurasian watermilfoil was 42.3 ± 5.6 g DW m^{-2} and was similar ($p=0.94$) between all sites. Pretreatment native species biomass was 4.6 ± 2.0 g DW m^{-2} and was also similar between sites. At 10 WAT, Eurasian watermilfoil biomass was reduced to 0 g DW m^{-2} ($p\leq0.01$) and native species biomass increased ($p\leq0.01$) to 34.8 ± 6.1 g DW m^{-2}. Visual injury and fall of Eurasian watermilfoil from the water column in sites B, C, and D (treated with algaecides followed by Navitrol®) was more rapid than in site A which received only Navitrol®. Site D which was treated with Phycomycin® SCP followed by Navitrol® had greater ($p\leq0.01$) native species richness after treatment than the other three sites. The use of chosen algaecides followed by an auxin herbicide resulted in faster selective control of Eurasian watermilfoil. The native plant community increased by 10 WAT as indicated by biomass sampling. Given the short-term success of this application strategy we intend to sample the plant community next year prior to treatment to assess the long-term effects of using this management regime.

Avian Vacuolar Myelinopathy: Hydrilla, Toxic Cyanobacteria and Management Efforts to Control Avian Disease in Southeastern Reservoirs

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Avian Vacuolar Myelinopathy (AVM), a disease killing bald eagles (*Haliaeetus leucocephalus*) and waterfowl, first occurred in DeGray Lake, Arkansas when 29 bald eagles died during the fall and winter of 1994-1995.

Currently there are 19 reservoirs where AVM has been documented (1994-2014) and almost all (17/19) are dominated by hydrilla (*Hydrilla verticillata*). A novel epiphytic cyanobacterial species is abundant on invasive aquatic vegetation in all locations where birds are dying from AVM. Dense invasive aquatic plants provide abundant substrate for attachment by toxic cyanobacteria associated with the incidence of AVM. Feeding trials and field surveys support the hypothesis that birds ingest a neurotoxin produced by cyanobacteria epiphytic on macrophytes. An additional 137 eagles have been recovered since 1995, with the highest mortalities at J. Strom Thurmond Reservoir (GA/SC). Continued expansion of hydrilla and AVM disease to new aquatic sites, including new water supply reservoirs, have heightened concern for wildlife and people relying on these vital freshwater resources. We conducted sentinel mallard trials in a water supply reservoir to investigate whether removal of the invasive vegetation using triploid grass carp could eliminate disease. Moderate levels of grass carp stocking (15 fish/vegetated acre) required 3 years to substantially reduce hydrilla levels from >500 acres to <50 acres. In the final sentinel trial, only birds with access to hydrilla developed AVM lesions. Hydrilla management has been initiated at 9 of the 19 AVM sites, using chemical and biological controls. AVM disease has not been observed in waterfowl or eagles in locations where they have successfully reduced hydrilla to low/non-detectable levels.

Factors Influencing Sprouting of Crested Floating Heart Ramets

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Crested floating heart [*Nymphoides cristata* (Roxb.) Kuntze] is a rapidly spreading invasive aquatic plant found throughout the Southeastern U.S. The plant produces numerous vegetative propagules called ramets. To date there has been limited focus on the biology or ecology of the ramets. The objectives of this study were to evaluate the effects of burial depth and herbicide exposure on the sprouting of ramets. Quiescent floating heart ramets were removed from culture tanks and planted at 5 depths based on the proportion of the basal tuber cluster that would be covered by sediment. Daily growth observations were recorded as well as the number of days to first leaf emergence. In the second part of the study, ramets were placed in tanks and treated with endothall and diquat herbicide for up to 96 hours then planted. Dry weight was recorded 4 WAT. Despite disturbance (removal from the culture tank) non-buried and ¼ buried ramets did not show signs of growth during the term of the study. Half, ¾, and fully buried ramets all sprouted and formed surface leaves by the end of the study. Diquat treated ramets showed the most evidence of herbicide activity; however, some recovery was observed in all treatments. This study indicates that burial depth may stimulate growth of the ramets and that the ramets may exhibit reduced metabolic activity as suggested by recovery or no effects being observed from herbicide exposure. Further research on sprouting dynamics of these ramets needs to evaluate if the uncovered ramet is metabolically active or truly dormant. Additionally, it would be useful to assess the impact of disturbance, temperature, light availability or combinations of these factors on sprouting and growth.

Managing Floating and Emergent Plants with Stingray® (Carfentrazone-ethyl)

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Stingray® (a.i., carfentrazone-ethyl) was the first protoporphyrinogen oxidase (PPO) inhibitor herbicide registered for aquatic use by U.S. EPA. Since initial registration in 2004, numerous studies have been published on the fast-acting contact efficacy of Stingray® for management of aquatic weeds. Both past peer-reviewed studies and current development activities document Stingray® as highly effective for control of *Salvinia minima* (common salvinia), *Salvinia molesta* (giant salvinia), *Eichhornia crassipes* (water hyacinth), and *Pistia stratiotes* (water lettuce). Further research and development has indicated that Stingray® in combination with systemic herbicides provides benefits of increasing the speed, extent and duration of control of sensitive target species. Specifically, recent studies highlight that combinations with glyphosate can control giant salvinia biomass greater than 95% 6 WAT, and in combination with Galleon (a.i., penoxsulam) can enhance control of both water hyacinth and water lettuce. Additionally, mesocosm and bench-scale efficacy experiments as well as recent field development demonstrate that Stingray® can provide quick control of *Ludwigia grandiflora* (creeping water primrose) and *Azolla caroliniana*

(water fern) biomass, 90% or greater, at fractions of the maximum label rate. Based on published studies and current efficacy trials and demonstrations, control of a variety of floating and emergent weeds can be achieved with Stingray® alone or in combination with other aquatic herbicides.

Establishment of Native Aquatic Vegetation in Conjunction with an Integrated Pest Management Program (*Student Presentation*)

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Aquatic vegetation provides habitat, refuge and food for many organisms making it an important component in most freshwater ecosystems. In some instances, overabundant vegetation, generally resulting from exotic species introduction, can have detrimental effects on fishery resources. Prevention is the most effective and financially feasible method for controlling nuisance aquatic weeds. Disturbed ecosystems, such as reservoirs in Texas, remain un-vegetated because they do not have a propagule bank of native plants. Planting native vegetation in the empty niches of a reservoir can deter establishment or further spread of invasive plants. Native aquatic vegetation establishment can be delayed by herbivory resulting in the need for protection of plants. Lake Raven was chosen as the study site because it contains invasive aquatic plants including hydrilla, water hyacinth, and giant salvinia. The integrated pest management approach is being used to control the invasive plants through herbicide application, biological control, and mechanical means. Niches were opened from control of exotic species giving the opportunity to conduct native plant restoration. Although there are herbivores suspected of feeding on the plants, specific herbivore damage has never been documented. This project should allow for identification of herbivore damage on vegetation and herbivore preferences. There will be 120 cages as protective exclosures with each cage containing 5 plants of a single species with 12 species represented. Cages will be placed at the recommend depth for planting specific species. Plants will be allowed to establish for approximately 2 months before the treatment cages are opened. Measurement and observations will be done for both control and treatment cages for comparisons of vegetation damage. Cameras will be used in an attempt to determine herbivores associated with level and type of damage to the plants.

The use of Optical Properties for Distinguishing between Invasive Aquatic Species with Applications towards Remote Sensing (*Student Presentation*)

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Estimating the extent and spread of invasive aquatic macrophytes (IAMs) using current sampling methods presents challenges due to the size of the invaded systems and remoteness of these areas. The recent improvements in remote sensing resolution (i.e. 0.4 m) have helped make this technology viable for detecting and mapping IAMs and thus have the potential to increase the efficiency of lake surveys for the IAM management. Inland lakes of Ontario, Canada infested with Eurasian watermilfoil (*Myriophyllum spicatum*), fanwort (*Cabomba caroliniana*) and water soldier (*Stratiotes aloides*) were monitored from June to October 2013. Specific reflectance signatures were established for IAMs and native communities. Based on this, seasonal changes were identified, and best sampling times for the detection of these invasive species were found. Integrating these properties with satellite-based technique will enable us to generate maps to help predict and manage the spread of IAMs in inland lakes.