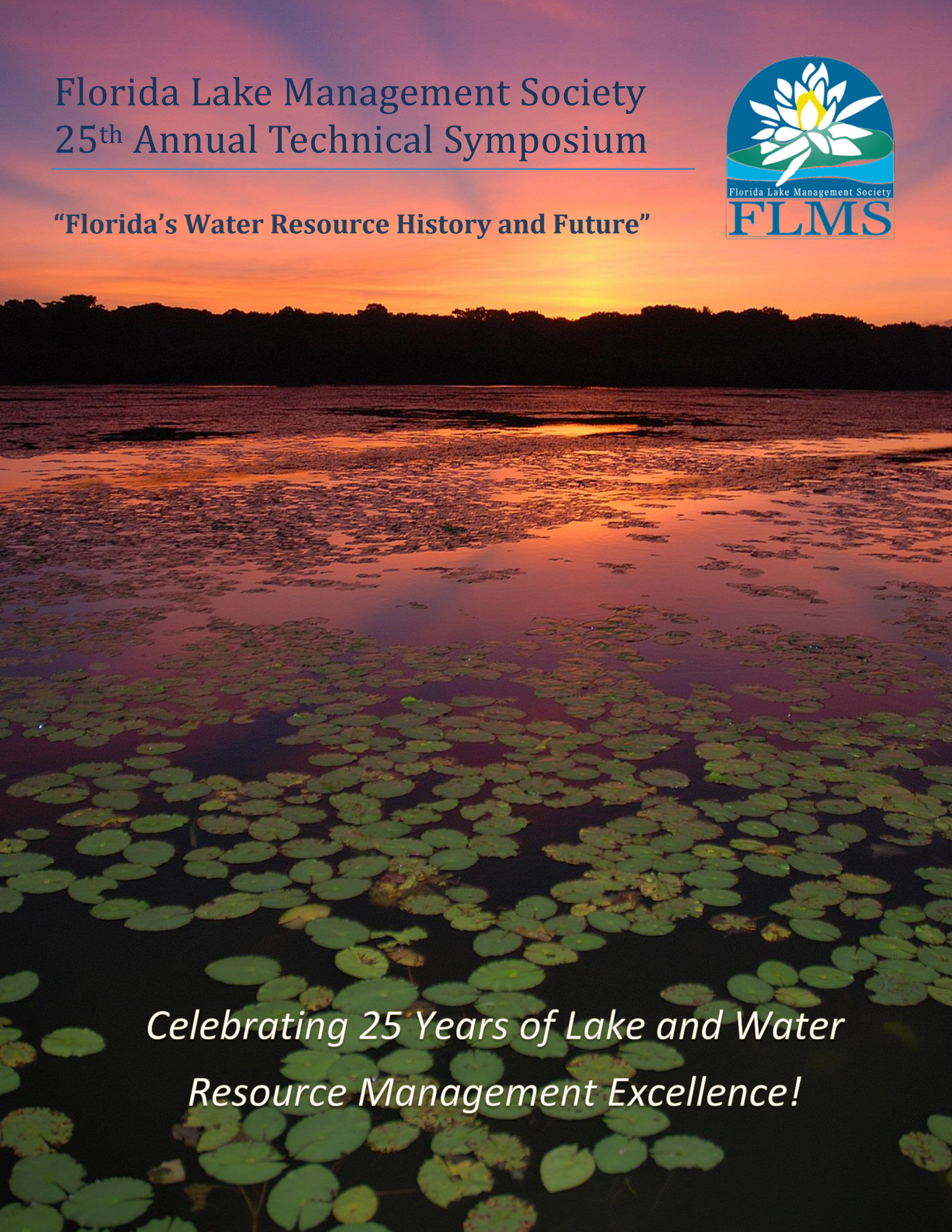
Florida Lake Management Society
25th Annual Technical Symposium

"Florida's Water Resource History and Future"



Celebrating 25 Years of Lake and Water Resource Management Excellence!

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Florida Lake Management Society

25th Annual Technical Symposium

SYMPOSIUM PROGRAM

* Designates a student paper.

Florida Lake Management Society's

25th Annual Technical Symposium

Florida's Water Resource History and Future

June 16-19, 2014

Welcome!

MONDAY – JUNE 16, 2014 – WORKSHOPS

8:00 AM – 4:00 PM	**CHECK-IN AND REGISTRATION** (Plantation Foyer)
9:45 AM– 10:00 AM	**MORNING BREAK** (Egret Foyer)
8:15 AM – 11:45 AM	**Workshop 1: Numeric Nutrient Criteria Implementation.** Julie Espy and Nia Wellendorf, Florida Department of Environmental Protection - Egret Room
8:15 AM – 11:45 AM	**Workshop 2: Blooming Bad: Nuisance and Harmful Freshwater Algae.** Andrew Chapman, Phycologist, GreenWater Laboratories/CyanoLab - Crane Room
8:15 AM – 11:45 AM	**Workshop 3: Florida's Water Resources, the issues and the science behind the issues.** Jim Griffin, Associate In Research, University of South Florida, Water Atlas Program – Blue Heron Room
12:00 PM – 1:15 PM	**Lunch** (Piano Foyer & Stuart Terrace – for those with full day workshops)
1:30 PM – 4:30 PM	**Workshop 4: Climate Change: The conversation behind the civic movement.** Kenneth Rainer, Guana Tolomato Matanzas National Estuarine Research Reserve and Lauren Watkins, Florida Park Service **-** Blue Heron Room
1:30 PM – 4:30 PM	**Workshop 5: Innovative Teaching of Watershed Concepts.** Dana Bigham, College of Agricultural and Life Sciences, University of Florida **-** Crane Room
1:30 PM – 4:30 PM	**Workshop 6: Overview of DEP SOPs for Surface Water Sampling (Classroom and Field Activity).** Julie Espy and Nia Wellendorf, Florida Department of Environmental Protection **-** Egret Room and Indian River Lagoon
2:45 PM – 3:00 PM	**AFTERNOON BREAK** (Egret Foyer)

TUESDAY – JUNE 17, 2014 – MORNING

8:00 AM – 4:00 PM	**CHECK-IN AND REGISTRATION** (Plantation Foyer)
7:00 AM – 8:30 AM	**BREAKFAST** (Exhibit Hall - Salons 2, 3, 4)

Opening Program: "Celebrating a Quarter Century of Water Resource Management Excellence"

(Elliott Amphitheater)

8:30 AM – 8:45 AM	**Opening Remarks**	**Jennifer Sagan***,* Outgoing FLMS President **Todd Olson/Jim Griffin**, Symposium and Program Chairs
8:45 AM – 9:00 AM	**Opening Celebration**	**Jennifer Sagan**- Celebrating 25 Years of Lake and Watershed Excellence
9:00 AM – 9:45 AM	**Keynote Speaker**	**Marty Kelly**, Principal Technical Professional, Atkins North America, past Program Director of MFLs, SWFWMD, contributing editor of the journal *Lake and Reservoir Management* and columnist and editor for *LakeLine* magazine. One of the first FLMS board members (1990) and a much called-upon speaker for FLMS and NALMS
9:45 AM - 10:00 AM	**Question Period**	

9:45 AM – 10:15 AM	**MORNING BREAK** (Exhibit Hall - Salons 2, 3, 4)

Session 1: The Indian River Lagoon, its past, present and future (Elliott Amphitheater)
Moderator: Leesa Souto, Marine Resources Council

10:15 AM – 10:35 AM	Session introduction and opening presentation: The Indian River Lagoon Action Assembly: Looking at the past, but focusing on the future – Leesa Souto
10:35 AM – 11:05 AM	Major ecological challenges facing the northern and central IRL- Margaret Lasi
11:05 AM – 11:20 AM	The Indian River Lagoon Research Institute, IRLRI at FIT – Robert Weaver
11:20 AM – 11:35 AM	Application of the watershed depositions tool to a Total Maximum Daily Load analysis of nitrogen inflow to the Indian River Lagoon – Noreen Poor
11:35 AM – 11:50 AM	Restoring health to the Indian River Lagoon: Are traditional stormwater treatments the solution? – Virginia Barker
11:50 AM – 12:10 PM	Panel Discussion – Leesa Souto

TUESDAY – JUNE 17, 2014 – AFTERNOON

12:15 PM – 1:45 PM	**LUNCH** (Exhibit Hall - Salons 2, 3, 4)
1:00 PM – 1:45 PM	**SPECIAL LUNCH SPEAKER –** Florida State Senator Joe Negron (invited)

Session 2: Aquatic Systems Science and Management (Elliott Amphitheater)
Moderator: Shannon Wetzel, Seminole County Public Works

2:00 PM - 2:05 PM	Session Introduction – Shannon Wetzel
2:05 PM - 2:20 PM	Black Hammock Creek restoration and floodplain treatment system – Shannon Wetzel
2:20 PM - 2:35 PM	Lake Down-Sub-Basin 9 nutrient source evaluations and remediation plan – Sergio Duarte
2:35 PM - 2:50 PM	Bioassay assessment of sediment contamination: Its role in Florida Sediment Quality Assessment Guidelines– Jennifer Sagan
2:50 PM - 3:05 PM	Saving Jordan Lake: The first large reservoir application of a systems approach to freshwater management – Kenneth Hudnell
3:05 PM - 3:25 PM	Panel Discussion – Shannon Wetzel

3:30 PM - 3:45 PM	**AFTERNOON BREAK** (Exhibit Hall - Salons 2, 3, 4)

Session 3: Florida Lake Restoration Science and Management (Elliott Amphitheater)
Moderator: Mike Britt, City of Winter Haven

3:50 PM - 3:55 PM	Session Introduction – Mike Britt
3:55 PM - 4:10 PM	Nutrient transport and load reduction from Bear Gully Creek to Lake Jesup – Lance Lumbard
4:10 PM - 4:25 PM	Comparison of techniques used for developing water quality and load reduction for Florida lakes: Empirical vs. mechanistic modeling approaches – David Tomasko
4:25 PM - 4:40 PM	Comparative Effectiveness of Alum and Phoslock for inactivation of sediment P release in Silver Lake – Harvey Harper
4:40 PM - 4:55 PM	Evaluation of Phoslock, and innovative phosphorus control technology in South Florida Lake – Gerold Morrison
4:55 PM - 5:10 PM	How to prevent and reduce harmful algal blooms and excess turbidity within water bodies without harming aquatic organisms – Seva Iwinski
5:10 PM - 5:30 PM	Panel Discussion – Mike Britt

5:30 PM - 6:30 pm	**FLMS CHAPTER MEETINGS** (Elliott Amphitheater)

TUESDAY – JUNE 17, 2014 – EVENING POSTERS & EXHIBITOR SOCIAL

6:30 PM - 8:00 PM	**EXHIBITORS' SOCIAL** (Exhibit Hall - Salons 2, 3, 4)

Session 4: Poster Session (Exhibit Hall - Salons 2, 3, 4)

- History of lake management in Lake Apopka – Zachary Caple, University of Santa Cruz, Santa Cruz, CA*
- Comparing microscopic algal counts to counts obtained by fluid imaging, the flowcam – Dawn Davis, Fisheries and Aquatic Sciences, School of Natural Resources, University of Florida, Gainesville, FL*
- Spatial and temporal variability of bromide-to-chloride ratio in coastal groundwater: Literature review and field data – Kaitlyn Flower, University of Florida Gainesville, FL*
- Quantifying effects of invasive apple snails (Pomacea Maculata) in a large reservoir: An outline for research – Nick Marzolf, Joseph W Jones Ecological Research Center, University of Georgia, Athens, GA*
- Seasonal variations in planktonic communities and environmental factors in a shallow, low-gradient, nutrient rich, high color, subtropical lake – Akeapot Srifa, University of Florida Gainesville, FL*

Number of Posters and Topics Subject to Change
(Student Posters will be judged in a manner similar to Student Papers)

WEDNESDAY – JUNE 18, 2014 – MORNING

8:00 PM – 4:00 PM	**CHECK-IN AND REGISTRATION** (Plantation Foyer)
7:00 AM – 8:30 AM	**BREAKFAST** (Exhibit Hall - Salons 2, 3, 4)

MORNING PROGRAM (Elliott Amphitheater)

8:45 AM - 9:00 AM	**Announcements**	**Jim Griffin**, Symposium Program Chair
9:00 AM - 9:45AM	**Keynote Speaker**	**Julie Espy**, Program Administrator, Water Quality Assessment Program, Florida Department of Environmental Protection, which includes the Watershed Monitoring and Watershed Assessment Sections. She is responsible for the overall planning, design, and implementation of all program activities within these sections.
9:45 AM - 10:00 AM	**Question Period**	

10:00 AM - 10:30 AM	**MORNING BREAK** (Exhibit Hall - Salons 2, 3, 4)

PROGRAM TRACK A: Florida Water Resource Science (Salon I)

Session A1: Florida Aquatic Species Science and Management
Moderator: Bruce Sharfstein, South Florida Water Management District

10:30 AM - 10:35 AM	Session Introduction – Bruce Sharfstein
10:35 AM - 10:50 AM	Wading bird foraging trends in Lake Okeechobee – Michael Baranski
10:50 AM - 11:05 AM	A method for estimating egg number in egg clutches of exotic apple snail *Pomacea maculata* without affecting clutch viability – Mike Cantaloube*
11:05 AM - 11:20 AM	Determining consumption behavior of *Pomacea maculata* on *Vallisneria americana* – Adriana Olavarria*
11:20 AM - 11:35 AM	*Pomacea maculata* spatio-temporal invasion trajectory agent-based model within a large freshwater managed system – Dean Monette
11:35 AM - 11:50 AM	An assessment of submersion as a mechanical control technique of *Pomacea insularum* eggs in southern Florida, USA – April Ostrom
11:50 AM - 12:10 PM	Panel Discussion – Bruce Sharfstein

WEDNESDAY – JUNE 18, 2014 – MORNING *(continued)*

PROGRAM TRACK B: Water Resource Management in Florida (Elliott Amphitheater)

Session B1: Florida Water Resource Monitoring
Moderator: Kate Muldoon, Florida Department of Environmental Protection

10:30 AM - 10:35 AM	Session Introduction – Kate Muldoon
10:35 AM - 10:50 AM	Central Florida Water Initiative – Janet Llewellyn
10:50 AM - 11:05 AM	Florida LAKEWATCH 2014 – Mark Hoyer
11:05 AM - 11:20 AM	Choctawhatchee Basin Alliance of NWF State College: A community-based model for water resource monitoring restoration and research – Julie Terrell
11:20 AM - 11:35 AM	What's In it for you? New Products from the Florida Water Resources Monitoring Council – Kate Muldoon
11:35 AM - 11:50 AM	Enhancements to the Water-Cat: next steps for a new water resource monitoring tool – Jan Allyn
11:50 AM - 12:10 PM	Panel Discussion – Kate Muldoon
12:15 PM - 1:50 PM	**BANQUET LUNCH/FLMS ANNUAL MEETING** (Exhibit Hall - Salons 2, 3, 4)

WEDNESDAY – JUNE 18, 2014 – AFTERNOON

PROGRAM TRACK A: Florida Water Resource Science (Salon I)

Session A2: Florida Springs Science, Issues and Future:
Moderator Erich Marzolf, Suwannee River Water Management District

2:00 PM - 2:05 PM	Session Introduction – Erich Marzolf
2:05 PM - 2:20 PM	Springs restoration efforts within the Suwannee River Water Management District – Erich Marzolf
2:20 PM - 2:35 PM	Springs restoration within the Southwest Florida Water Management District – Sean A. King
2:35 PM - 2:50 PM	Florida Springs and Aquifer Protection Act – Jeff Priddle
2:50 PM - 3:05 PM	Springs restoration efforts within the St. Johns Water Management District – Robert Mattson
3:05 PM - 3:25 PM	Panel Discussion – Erich Marzolf

PROGRAM TRACK B: Water Resource Management in Florida (Elliott Amphitheater)

Session B2: Florida's Numeric Nutrient Criteria
Moderator: Julie Espy, Florida Dept. of Environmental Protection

2:00 PM - 2:05 PM	Session Introduction – Julie Espy
2:05 PM - 2:20 PM	Florida Numeric Nutrient Criteria – Now what? – Scott McClelland
2:20 PM - 2:35 PM	Is your lake really impaired for nutrients? – Jan Mandrup-Poulsen
2:35 PM - 2:50 PM	Implementation of Florida's new NNC: Where does your waterbody fit in? – Nia Wellendorf
2:50 PM - 3:05 PM	Applying the new Florida Numeric Nutrient Criteria to better evaluate estuaries, streams and lakes – Jim Griffin
3:05 PM - 3:25 PM	Panel Discussion – Julie Espy
3:25 PM - 3:40 PM	**AFTERNOON BREAK** (Exhibit Hall - Salon 2, 3, 4)

WEDNESDAY – JUNE 18, 2014 – AFTERNOON *(continued)*

PROGRAM TRACK A: Florida Water Resource Science (Salon 1)

Session A3: Major Pollutants in Florida Waters
Moderator: James Mihelcic, University of South Florida, School of Engineering, Civil & Environmental Engineering

3:40 PM - 3:45 PM	Session Introduction –James Mihelcic
3:45 PM - 4:00 PM	An overview of the new EPA National Research Center for Reinventing Aging Infrastructure for Nutrient Management (RAINmgt) – James Mihelcic
4:00 PM - 4:15 PM	Diffuse release of nutrients from residential lawn management - Melissa Butcher*
4:15 PM - 4:30 PM	Managing mercury contamination in local waters – Ted Lange
4:30 PM - 4:45 PM	Bioaccumulation of aluminum in Florida Apple Snail *Pomacea paludosa* – Bruce Sharfstein
4:45 PM - 5:00 PM	Using sediment core data to establish Lake Management Targets for phosphorus loading – William Kenney
5:00 PM - 5:20 PM	Panel Discussion – James Mihelcic

PROGRAM TRACK B: Water Resource Management in Florida (Elliott Amphitheater)

Session B3: Urban Pond Management
Moderator: Serge Thomas, Florida Gulf Coast University

3:40 PM - 3:45 PM	Session Introduction – Serge Thomas
3:45 PM - 4:00 PM	Stormwater ponds: thousands of ticking time bombs for water quality in southwest Florida – Serge Thomas
4:00 PM - 4:15 PM	Assessment of aquatic resources in the town of Miami Lakes, Florida USA – Leonard J. Scinto
4:15 PM - 4:30 PM	Managing aging stormwater ponds – Kevin Ripp
4:30 PM - 4:45 PM	Examining the interactions between wet detention pond water and groundwater: potential implications for stormwater treatment – Mark Lucius*
4:45 PM - 5:00 PM	Engaging homeowner associations to reduce nutrient runoff in stormwater ponds – Michelle Atkinson
5:00 PM - 5:20 PM	Panel Discussion – Serge Thomas

5:25 PM - 6:00 PM	**FLMS BOARD MEETING** (Evinrude Room)
6:00 PM - 8:00 PM	**FLMS SPECIAL EVENT** (Florida Oceanographic Society)

THURSDAY – JUNE 19, 2014 MORNING

8:30 AM - 11:00 AM	**CHECK-IN AND REGISTRATION** (Plantation Foyer)
8:00 AM - 9:15 AM	**BREAKFAST** (Exhibit Hall - Salon 2, 3, 4)

MORNING PROGRAM (Salon 1)

9:15 AM - 9:30 AM Announcements: Jim Griffin, Symposium Program Chair

PROGRAM TRACK C: Florida Water Resource Technology and Management

Session C1: Florida Water Resource Technology & Management – Vegetation (Salon 1)
Moderator: Mark Hoyer, University of Florida, LAKEWATCH Program

9:30 AM - 9:35 AM Session Introduction – Mark Hoyer

9:35 AM - 9:50 AM A win-win solution – Donald Schrager

9:50 AM - 10:05 AM An assessment of the relationship between submerged aquatic vegetation and water clarity in Florida lakes – Doug Robison

10:05 AM - 10:20 AM How do plants grown hydroponically control algal blooms? – Dana Dettmar*

10:20 AM - 10:35 AM Semi-automated identification and bio- volume estimation of plankton using an imaging cytometer (Flowcam) – Brandon Rieff

10:35 AM - 10:50 AM Panel Discussion – Mark Hoyer

Session C2: Florida Water Resource Technology & Management – Physical & Chemical
(Elliott Amphitheater)
Moderator: Brian Catanzaro, Pentair Aquatic Eco-Systems, Inc.

9:30 AM - 9:05 AM Session Introduction – Brian Catanzaro

9:35 AM - 9:50 AM Integrating current communication and data collection technology into modern lake management – Brian Catanzaro

9:50 AM - 10:05 AM Potential applications for phosphorus removal and recovery from freshwater non-point sources – Edward Weinberg

10:05 AM - 10:20 AM Anna River culvert replacement project: sediment control using polymer enhanced best management practices – Seva Iwinski

10:20 AM - 10:35 AM Changes in sediment P speciation resulting from alum sediment inactivation in Central Florida lakes – Harvey Harper

10:35 AM - 10:50 AM Altamonte-FDOT Integrated Reuse and Stormwater Treatment (A-FIRST) – Danielle Marshall

10:50 AM - 11:05 AM Panel Discussion – Brian Catanzaro

11:05 AM - 11:15 AM	**STUDENT AWARDS & CLOSING REMARKS**, Lawrence Keenan, Incoming FLMS President (Salon 1)

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Seva Iwinski
Applied Polymer Systems
678-494-5998

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519 Industrial Drive
Woodstock, GA 30189
678-494-5998
www.siltstop.com

Aquatic Vegetation Control, Inc. (AVC)

Aquatic Vegetation Control, Inc. (AVC) is a Florida corporation founded in 1986 offering vegetation management and general environmental consulting services throughout the southeast. Since its establishment as an exotic/nuisance vegetation management company specializing in the control of invasive wetland and upland species, AVC has broadened its scope of capabilities to include chemical mowing, certified lake management, re-vegetation, restoration services, roadside and utility vegetation management, and general environmental/ecological consulting.

Todd Olson
Aquatic Vegetation Control, Inc.
1860 West 10th Street
Riviera Beach, FL 33404
561-845-5525 or 800-327-8745
Fax 561-845-5374
Email: tolson@avcaquatic.com

Chemtrade

Chemtrade operates a diversified business providing chemicals and services to customers in North America and around the world. Chemtrade is one of North America's largest suppliers of Coagulants for water treatment. Chemtrade operates the largest North American manufacturing footprint for Inorganic Coagulants with 43 production facilities and a unique platform to rapidly deliver new products and technologies. Products are typically shipped via bulk transport from production facilities to customer sites.

Safety, integrity and organizational excellence are some of the core values forming Chemtrade's vision. All employees of Chemtrade incorporate an emphasis on safety into their daily work. Chemtrade's commitment to the Responsible Care® ethic and the RC14001 environmental, health, safety and security management system further demonstrates the importance of safety and product stewardship in all of Chemtrade's activities.

Stephen Robinson

Sales Representative, Southeast
Chem*trade*
srobinson@chemtradelogistics.com
Mobile: 386-679-6251

CHEMTRADE LOGISTICS

Dredge America

Dredge America Inc. is a national marine contractor that specializes in Portable Hydraulic Dredging. We specifically work to preserve lakes, lagoons, waterways, and wetlands throughout the United States and Caribbean. Our clients include federal, state and local governments, golf courses, power plants, private lake association and others. Because no two projects are the same, we work together with our clients to develop individualized solutions to the unique problems on each project. We also offer consulting services for feasibility and value engineering of projects.

Dan McDougal

816-330-3100

dan@dredgeamerica.com

DREDGE AMERICA

ESA

ESA is an employee-owned environmental science and planning firm of more than 350 professionals in 15 offices, including offices in both Tampa and Orlando. Over 65 percent of our work is done for government agencies and non-profit organizations, and our staff specializes in all aspects of project planning, environmental analysis and assessment, and regulatory compliance. For more than four decades we've guided integrated decision-making, developing innovative and workable solutions that inform development and restoration projects based on sound science, policy, and planning

David Tomasko, PhD
4350 West Cypress St, Suite 950
Tampa, FL 33607

Tel: 813-207-7200

Email: dtomasko@esassoc.com

Eureka Water Probes

Eureka was formed by industry veterans in 2002 to design a new generation of water-quality multiprobes best suited to practical needs. Its flagship instrument, the Manta2 multiprobe, is prized for its ease of use, reliability, data quality, and low cost of ownership. Eureka provides all the standard water-quality sensors, plus advanced sensors such as chlorophyll, refined fuels, total dissolved gas, and CDOM. The Manta2 is used around the world in short-term surveying, long-term logging, and telemetered-data applications.

Gary Miller
2113 Wells Branch Pkwy #4400
Austin, TX 78728
Tel: 513-302-4333 ext. 1105
gmiller@waterprobes.com

Greenman-Pedersen, Inc.

Greenman-Pedersen, Inc. (GPI) is a leading, multi-disciplinary engineering firm that has been providing professional design, planning, and construction inspection services to all levels of government and industry throughout the United States for over 47 years. With a staff of over 1200 professionals, 17 offices throughout the United States, and access to specialized services, GPI is able to provide the required resources to complete each client's specific assignment. Aerial Cartographics of America (ACA), an affiliate of GPI, is a full service photogrammetric firm providing digital aerial imaging, LiDAR, LAMP, Orthos, and GIS services. Underwater Engineering Services Inc. (UESI), is a GPI subsidiary with construction contractor and dive inspection capabilities.

GPI

Jennifer Ciccarelli
Marketing Manager
813-830-7765
jciccarelli@gpinet.com

HAB Aquatic Solutions

HAB Aquatic Solutions, LLC specializes in improving surface water quality through the use of aluminum-based products (e.g., alum and sodium aluminate). HAB's research and development efforts improved upon traditional alum treatment approaches by developing treatment systems to address the unique challenges of today's water resource management projects.

HAB has over 60 years of combined experience and provides the most comprehensive alum services available, including pre-project water quality monitoring, algae identification, chemical dose determination, GPS-guided chemical application, alum injection systems for the treatment of storm water/stream water, and post-project water quality monitoring and evaluation. HAB's co-founders (John Holz and Tadd Barrow) are two of only a handful of scientists qualified to provide complete alum treatment services: from dose calculation, to application, to project evaluation.

HAB Aquatic Solutions, LLC
3120 S. 72nd Street Suite 157
Lincoln, NE 68506
402-430-6813
www.habaquatics.com

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Hach Hydromet

Hach Hydromet helps water resource professionals generate reliable data throughout the entire cycle of water, from measuring precipitation to monitoring estuaries and ground water, and everything in between. Hydrolab multi-parameter water quality instruments are built using the industry's leading sensor technology. OTT products have been leading level, discharge, and precipitation measurement for over 130 years. Our technology, combined with expert technical support and service, delivers results you can depend on.

Hach Hydromet
Jennifer Zimmerman
5600 Lindbergh Drive
Loveland, CO 80539
jzimmerm@hach.com
561.729.0060 office
561.578.0184 cell

Helena

Helena began operating in Helena, Arkansas, in 1957. The company was a formulator/distributor serving regional markets. In 1975, Helena moved its headquarters to Memphis. Today, Helena is owned jointly by Marubeni America Corp. and Marubeni Corp. of Tokyo, Japan.

The history of Helena mirrors the dramatic evolution of U. S. agriculture since 1957. Farm mechanization was replacing human labor, and local formulation of pesticide products was being displaced by "package" goods that were developed and sold by basic manufacturers and distributed by Helena and other companies.

Helena was on the leading edge of this trend and accelerated its expansion. In the late 1980's, it began acquiring companies and opening wholesale locations in the Midwest and other northern regions, including the Great Lake states and the Pacific Northwest. Helena's Specialty Division also expanded its market presence in turf & ornamental, forestry, aquatics and vegetation management markets with similar product mixes and chemistries that are used in agriculture. The Specialty sales force now operates across the country in key markets in these unique and growing industries.
The company has also diversified into service areas such as lending, variable rate technologies, and tissue analysis to fine-tune product application techniques and increase productivity.
Today, Helena does business in all 48 contiguous states in the U. S. and has a growing international presence. Expansion within the U.S. is continuing as business conditions dictate.

People...Products...Knowledge...

James Boggs
Tel: 352-521-3538
Email: boggsj@helenachemical.com

Lake & Wetland Management

Lake and Wetland Management has been providing professional environmental services since 1992. Our company is a premier contractor for Golf Courses, Residential Homeowner Associations, Community Development Districts, Commercial properties, Water Management Districts, and Municipal authorities to protect and enhance all of your environmental assets. Lake and Wetland Management is a full service environmental resource management company providing services for Lakes, Wetlands and Preserves for algae and aquatic weed control, aquatic plantings, erosion restoration, preserve maintenance, large-scale invasive/exotic plant removal, fish stocking, mosquito/midge larvae control along with our eco-friendly fountain and aeration systems for installation and maintenance. We continue to grow and expand always keeping up with the most current and effective techniques ensuring our customers and accounts benefit from the best quality of care and attention.

Lake & Wetland MANAGEMENT

Brian Fischer Tel: 561-303-1013 brian.fischer@lakeandwetland.com

Pentair Aquatic Eco-Systems

Pentair Aquatic Eco-Systems, Inc. (PAES) of Apopka, FL, is the largest source of aquatic products and systems worldwide. Since 1978, PAES has offered unmatched selection, service and solutions to the aquaculture community. PAES is your single-source partner for aquatic design, products, engineering, technological innovation, technical support and management consultation. With Pentair Aquatic Eco-Systems, you'll have a partner who understands your business and offers extraordinary solutions that no one else can match. Our extensive services and product offerings have established Pentair Aquatic Eco-Systems as the global leader in all aspects of aquatics. Our team of technicians and biologists provides service, expert advice, and troubleshooting and custom design solutions to hobbyists and professionals alike.

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AQUATIC ECO-SYSTEMS™

Brian Catanzaro
Lakes Team Leader
Pentair Aquatic Eco-Systems
2395 Apopka Blvd
Apopka, FL, 32703, USA
Office 1.407.992.5601
Brian.catanzaro@Pentair.com
www.PentairAES.com

SePRO Corporation

SePRO Corporation is recognized as an industry leader in providing the highest level of technical services to customers who operate in specialty niche markets of the USA. SePRO's key business segments include the U.S. Aquatics Industry, Horticulture/Greenhouse Markets, and Professional Turf Management. After 19 years, SePRO has established itself as the world's largest manufacturer of aquatic plant protection products and has grown into the largest dedicated sales, research and marketing organization in the aquatics industry. Learn more about SePRO Corporation, its products, services and technologies at the Se PRO website: www.sepro.com

Michael Shaner	Shaun Hyde
317-580-8282	317-580-8097
michaels@sepro.com	shaunh@sepro.com

Shoresox

Shoresox Eco-Friendly Erosion Control System has, for over a 13-year period of research and product development, had one objective and that is to find a way for naturally degradable materials and product configurations that would not only halt and reverse shoreline erosion, but also conform to the guidelines of state and local governing agencies. The search for an environmentally friendly and effective solution to shoreline erosion included research and development activities completed in compliance with guidelines of the Department of Natural Resources, Watershed Districts and Land and Water Offices. Shoresox is a bioengineered erosion control solution that immediately arrests shoreline and hillside erosion, providing a foundation for vegetation reestablishment, which is nature's most effective means of erosion control. The system has superior abilities providing a high quality, easy-to-use and cost-effective solution for erosion management.

Shoresox
Revive Renew Reclaim

Joe Harms
386-366-5709
j.harms@lakeandwetland.com

SUNTREE TECHNOLOGIES, Inc.

Suntree Technologies Inc. **designs and manufactures a complete line of innovative and effective stormwater treatment products ranging from inlet filters to the high volume Nutrient Separating Baffle Box®. Suntree Technologies products and services meet, and exceed, NPDES permitting and TDML requirements for environmental protection. Our experienced team can recommend the best treatment options for your next stormwater retrofit or new construction project. All our products are manufactured in the U.S.A.**

Exhibitor: Tom Happel and Carol Happel
798 Clearlake Road, Suite # 2,
Cocoa, FL 32922
321-637-7552 Fax: 321-637-7554
info@suntreetech.com

Suntree Technologies Inc.®
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Syngenta is the industry leader in creating dependable pest management solutions for professional markets. Our expertise helps guide customers toward solutions in: Turf, Ornamentals, Aquatics and Pest Management.

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Scott Jackson
scott.jackson@syngenta.com
Syngenta Professional Products

Tel: (561) 402-0682
Fax: (561)784-4309

University of South Florida

Florida Center for Community Design and Research

The mission of the Water Atlas program is to provide a comprehensive information resource that helps citizens, scientists and resource managers make informed decisions concerning our vital water resources.

Jan Allyn
Web Content Manager
Florida Center for Community Design & Research (FCCDR)
University of South Florida
4202 East Fowler Avenue, HMS 301
Tampa, FL 33620-8340
(813) 579-3381/ janallyn@usf.edu

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The Marjory Stoneman Douglas Award *- is given to individuals in the media who report on aquatic resource issues. This award is named in honor of Marjory Stoneman Douglas who authored the book "Everglades: River of Grass", founded the Friends of the Everglades and who has been environmentally active in south Florida.*

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Senator Charles Dean and Senator Joe Negron

The Bob Graham Award *is given to persons elected to office who demonstrate a commitment to lake and aquatic resource conservation. Bob Graham is remembered for his support of many environmental initiatives including the purchase for preservation of thousands of acres of Gulf Coast wetlands.*

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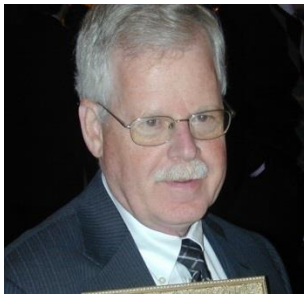
Meet the Guest Speakers

1st Keynote Speaker

Marty Kelly
Principal Technical Professional, Atkins North America



Dr. Marty Kelly has more than 30 years of experience working with environmental and water resource regulatory agencies. Marty retired from the Southwest Florida Water Management District (SWFWMD) in 2011 where he worked since 1987. During that time he served as a senior environmental scientist in the Surface Water Improvement and Management (SWIM) section. In 1998, he became the manager of the District's Ecologic Evaluation Section, and director of SWFWMD's Minimum Flows and Levels (MFL) program. Prior to that, he served as an environmental specialist for Pinellas County and the Illinois Environmental Protection Agency. Since his retirement, Dr. Kelly has worked part-time for Atkins North America, where his responsibilities include development of environmental flow recommendations, in-stream flow assessments, and development of watershed management plans and related analyses. Marty has most recently worked on environmental flow issues on the Apalachicola-Chattahoochee-Flint (ACF) System, and was a member of a peer review team that provided recommendations to the California State Water Resources Control Board for determining regional instream flow criteria for priority tributaries to the Sacramento-San Joaquin Delta.

Dr. Kelly, drawing primarily on personal observation and experiences, will provide his perspective on water quality and quantity issues affecting Florida's water resources over the past 25 years to include the Surface Water Improvement and Management (SWIM) Act and the minimum flows and levels (MFLs) program. The SWIM Act became law in 1987, and directed considerable resources toward water quality related issues on water bodies across the state. Dr. Kelly developed SWIM management plans for four of the Southwest Florida Water Management District's (SWFWMD) SWIM priority water bodies and assisted District staff with work on several others. Although state statute required development of MFLs as early as 1973, little work was done in this regard until the mid-1990's when additions to the statute directed that MFLs be set on certain water bodies by a time certain and that each water management district develop a priority list of water bodies with a projected timeline for adoption of MFLs within their respective jurisdictions. SWFWMD staff developed methodologies for establishment of MFLs on wetlands, lakes, rivers, springs and estuaries, and adopted MFLs on over 150 water bodies by 2012. MFLs as required by state statute protect water bodies from "significant harm" due to withdrawals. Unlike SWIM which addressed water quality issues, MFLs are concerned with ensuring sufficient water quantity to protect the state's water resources and ecology.

2nd Keynote Speaker

Julie Espy

Program Administrator, Florida Dept. of Environmental Protection

Julie Espy is a Program Administrator of the Water Quality Assessment Program, consisting of the Watershed Monitoring and Watershed Assessment Sections. She coordinates the overall planning, design, and implementation of all program activities.

The history and diversity of Florida's water resources tells an interesting story, one that can be explored through Restoration and Protection. These elements will be examined through a brief review of sources of pollution, conservation efforts, restoration challenges and alternatives and will highlight specific Florida water resources such as Tampa Bay, several springs, the Everglades, Lake Tohopekaliga, and lesser known waterbodies. The address will focus on restoration and protection efforts throughout Florida.

Special Lunch Speaker (invited)

Senator Joe Negron

Florida Senate District 32 (Indian River, St. Lucie, Martin and Palm Beach Counties)

Joe Negron represents District 32 in the Florida Senate, where he serves as Chairman of the Appropriations Committee and Select Committee on Indian River Lagoon and Lake Okeechobee Basin.

He is a native Floridian, born in West Palm Beach. Joe has an undergraduate degree from Stetson University, a law degree from Emory University and a master's degree in public administration from Harvard University. He practices law with the statewide law firm of Gunster.

Joe and his wife, Rebecca, live in Stuart and have three children. Joe has focused his legislative efforts on the budget, insurance issues and protection of individual liberties.

Special Lunch Speaker

Senator Charlie Dean

Florida Senate District 5

(Baker, Citrus, Columbia, Dixie, Gilchrist, Lafayette, Levy, Suwannee Union

and part of Marion Counties)

State Senator Charles S. Dean (R-Inverness) is currently serving in his second term in the Florida Senate. Elected during a special election in the summer of 2007, and re-elected subsequently in 2008 and 2012, Senator Dean brings a unique perspective to Tallahassee by being the only former sheriff currently serving in the Florida Senate.

Prior to being elected to the Senate, Senator Dean served as a member of the Florida House of Representatives for 5 years. During that time he became active in criminal justice and water policy as well in criminal justice appropriations. His business experience made him an active participant in Business Regulation Committee during his entire tenure in the House.

Senator Dean is a life-long resident of Citrus County where he and his wife Judy raised their two children Charlie and Shannon. He is a veteran of the United State Marine Corp and Marine Corp Reserve. He earned a bachelor's degree in police administration and criminology along with a master's degree in criminal justice before being elected Sheriff of Citrus County in 1980 where he served for 16 years. Senator Dean is life-long cattle rancher and continues to work on his ranch when in the district.

Workshops

WORKSHOP 1: NAVIGATING DEP'S NUMERIC NUTRIENT CRITERIA

Nia Wellendorf and Julie Espy
Florida Department of Environmental Protection

Who: This training is intended for resource managers at the state, regional, and local level who want to learn how DEP is implementing Numeric Nutrient Criteria.

What: This workshop will teach participants how Numeric Nutrient Criteria will be implemented in Florida, including an overview of the associated biological assessment methods. Participants will learn about the rule itself (62-302.531 and 62-302.532, Florida Administrative Code [F.A.C.]), how to determine which numeric nutrient criteria apply to which waters, and for which waters the narrative nutrient standard still applies. Biological assessment methods are used in conjunction with water quality data to assess certain waters in the rule, so participants will get an overview of those methods and when they are used. Participants will also learn about when stakeholders can apply for site specific alternative criteria (SSAC), and DEP considerations for approval of SSACs.

Topics to be covered include:

- Numeric Nutrient Criteria (NNC) in Chapter 62-302 (F.A.C), the Water Quality Standards
- NNC in Chapter 62-303, the Impaired Waters Rule
- Role of Bioassessment methods in NNC Implementation
    - Stream Condition Index (SCI)
    - Stream and River Habitat Assessment (HA)
    - Linear Vegetation Survey (LVS)
    - Rapid Periphyton Survey (RPS)
- How to determine which criteria apply where
- Alternative criteria – when are they appropriate and how to apply for them
- Assessment schedule related to NNC

Why: The Florida DEP has adopted a very complex set of numeric nutrient criteria (NNC) that it will begin implementing in 2014. Many stakeholders provide data to DEP for water quality assessment, and other stakeholders are involved with water quality restoration when criteria are not met. It is critical that these stakeholders understand the new NNC, the context in which the data will be interpreted, so how they can help DEP to make appropriate assessments.

About the Instructors: Nia Wellendorf is the administrator of the DEP Aquatic Ecology and Quality Assurance Section within the Water Quality Standards Program, and focuses on bioassessment, quality assurance, and water quality standards development. Nia was involved with numeric nutrient criteria development, and currently works with stakeholders and DEP staff to interpret biological data to inform assessment of nutrient criteria. Julie Espy is the administrator of the DEP Water Quality Assessment Program, and focuses on monitoring and assessment of surface and ground water throughout the state. These activities include the coordination of monitoring programs, the Status and Trends monitoring networks, as well as the implementation of the Impaired Waters Rule for surface water.

WORKSHOP 2: BLOOMING BAD: NUISANCE AND HARMFUL FRESHWATER ALGAE

Andrew Chapman
Phycologist, GreenWater Laboratories, Palatka FL

Who: Anyone interested in learning about those algae found in lakes, ponds and streams that can potentially be problematic from recreational, water management or health concern perspectives. Course will be geared toward lake managers and lake stakeholders but will prove useful to aquatic scientists looking to learn more about nuisance algae.

What: Workshop will cover possible negative impacts of algae including bloom formation, taste and odor production and toxicity. Nuisance algae from a variety of habitats will be discussed. Participants will learn to recognize common potentially harmful freshwater algae.

About the instructor: Andrew Chapman is the phycologist at GreenWater Laboratories in Palatka, Florida. He received his Master's Degree in Botany from the University of Oklahoma in 1993. Andrew worked at the St. Johns River Water Management District before becoming one of the founding members of GreenWater Laboratories in 2001.

WORKSHOP 3: FLORIDA'S WATER RESOURCES, THE ISSUES AND THE SCIENCE BEHIND THE ISSUES

Jim Griffin
Florida Center for Community Design and Research, Water Atlas Program,
University of South Florida, Tampa Campus

Who: Anyone interested in learning a bit more about Florida's water resources and exploring the current issues related to these water resources and the science behind the issues. This workshop is a good primer for the symposium in that attendees will learn about the springs, rivers, lakes, ponds and coastal water resources and resource science and issues that will be presented in symposium papers.

What: The workshop is a scaled down version of a six week course taught through the USF, Osher Lifetime Learning Institute. The workshop begins with the history of Florida's water resources and then goes on to discuss groundwater, springs and spring run stream, streams and wetlands, lakes and ponds and coastal resources. The workshop will also cover the issues that we face in Florida related to water resources. This will include major issues such as *global warming and sea level rise*, and a discussion of the concept of a *carbon foot print* and how we can reduce it. You will learn a little geography, geology; water chemistry, habitat ecology and how to better understand and discuss water related issues with factual information. You will also learn where information is available and how to manage this information to develop positions related to specific issues.

About the instructor: Jim Griffin spent most of his life on or around the water. He grew up on the Winter Park Chain of Lakes, learning to enjoy skiing, fishing, diving and just being on the water. He received his bachelor's degree at USF (chemistry) and also was a member of the USF ski team. After college he worked as a chemist for the Food and Drug Administration, leaving FDA to serve 22 years as a naval flight officer where he spent much of his time flying on and off aircraft carriers in all of the major world oceans and seas. While in the service he earned an MS degree in systems engineering technology at the Naval Postgraduate School in Monterey California. After retiring from the Navy he went back to school earning his PhD in Environmental Science (chemistry of natural waters) at the Florida Institute of Technology in Melbourne Florida. While at FIT he worked at Harbor Branch and at the Marine Resources Council of East Florida (MRC). After graduation, Dr. Griffin was employed by Hillsborough County as their lakes manager and then with the Southwest Florida Water Management District as a senior scientist and presently as an instructor and research associate with the Florida Center for Community Design and Research at the University of South Florida. He is a long time FLMS member, director and past president.

WORKSHOP 4: CLIMATE CHANGE: THE CONVERSATION BEHIND THE CIVIC MOVEMENT

Kenneth Rainer[1], Lauren Watkins[2]
[1]Guana Tolomato Matanzas National Estuarine Research Reserve, [2]Florida Park Service

Who: This session will help individuals build a toolkit that better engages them with their audiences in the climate change discussion.

What: Participants will be able to incorporate climate change, in a mission-friendly manner, into programs and roving interpretation using:

(1) Social science research that provides an understanding of where the American public stands on the issue of climate change;
(2) Techniques to 'frame' the climate change conversation and pivot it from the negative to the positive;
and
(3) Climate science research that educates and prepares interpreters to answer potentially tough questions from audiences.

Why: Interpreting climate change can be a difficult endeavor. However, if you understand how to navigate the conversation and alter the climate change discourse to lead to civic-minded solutions, then climate change conversations should not be something feared or ignored.

About the instructors:

Kenneth Rainer has a Master's Degree in Biology from Texas A&M University, Corpus Christi, with a focus in marine population genetics, and a Bachelor's Degree in Biology from Texas A&M University at Galveston, with a focus in marine biology. Kenneth's passion for informal environmental education stems from his work as the lead for the Laguna Outreach Project. This overnight, experiential program was hosted on an island where students and teachers were immersed into the environment. Kenneth believes that his science background has allowed him to approach scientific research translation in creative and refreshing ways.

Lauren Watkins is a Park Services Specialist for the Florida Department of Environmental Protection, currently assigned to Ravine Gardens and Dunns Creek State Parks. In that role she Implements the parks' interpretive program by developing programs supporting the park's resources and working with the media and the community to increase attendance to the parks. She provides interpretive training for staff and volunteers, and acts as Volunteer Coordinator for 40 regular service volunteers and more than 350 occasional volunteers. She also participates in hands-on land management activities such as invasive species removal, prescribed burns,

Workshop 5: Innovative Teaching of Watershed Concepts

Dana Bigham
University of Florida, College of Agricultural and Life Sciences

Who: Anyone that is interested in teaching and wants to explore teaching and learning approaches with creative ingenuity.

What: We explore strengths and challenges of teaching and learning to gain an overall understanding of how to promote authentic learning for students. Through examination of what we really do when we teach and how we know if we are actually helping students learn, workshop participants have the opportunity to design or redesign teaching and learning approaches to connect student achievement to desired learning outcomes. Upon completion of the workshop, participants gain competencies and confidence to begin to shift their teaching and learning approaches. Although interactive examples focus on water resource science, skills and competencies may be applied among scientific disciplines.

Why: Not only do individual students learn differently, but the way in which the student population learns is ever-changing. Teachers who are adaptable to different learning environments and student needs can create an authentic learning environment that equate to student success. Currently, students lack preparation to be competitive in science, technology, engineering, and mathematic (STEM) disciplines. Coming together to share and assess teaching and learning approaches fosters collaborative development of students who will be successful in the STEM workplace.

Instructor: Dana Bigham is a postdoctoral associate in the College of Agricultural and Life Sciences at the University of Florida. Dana is both a limnologist and science education specialist, combining her passions with the goal to enhance communication of water resource challenges and train future water resource leaders.

Workshop 6: Overview of DEP SOPs for Surface Water Sampling

Nia Wellendorf and Julie Espy
Florida Department of Environmental Protection

Who: This training is intended for anyone who collects or plans to collect water quality data from Florida surface waters and provide those data to the Florida Department of Environmental Protection (DEP).

What: This workshop will give participants an overview of the DEP Standard Operating Procedures (SOPs) within the DEP Quality Assurance Rule (62-160, F.A.C) and teach them how to collect and preserve surface water samples in accordance with DEP SOPs. The class will also provide instruction in the proper calibration and verification of field instruments used to measure common field-testing parameters in water samples (pH, DO, conductivity). The course consists of a classroom session to review the relevant SOPs and perform instrument calibrations and verifications, and a hands-on segment outdoors for sample collection. Questions and discussion about "real-world" scenarios encountered in the field are welcomed. Relevant SOPs will be provided. Feel free to bring your field sheets and meter calibration sheets if you have questions about whether or not they satisfy DEP documentation requirements.

Topics to be covered include:

- General quality assurance considerations (SOPs FA 1000, FC 1000, FM 1000)
- Documentation requirements (SOP FD 1000)
- Surface water sampling, including use of equipment (SOPs FS 1000, FS 2000, FS 2100)
- Quality control samples (FC 1000)
- Field testing procedures, including calibration and verification of meters (SOP FT 1000)

NOTE: Please bring your field testing meter and calibration standards, if possible. Instructors will only have supplies for one instrument.

Why: Resource managers and consultants that wish their data to be evaluated by DEP for the assessment of Water Quality Standards, including Numeric Nutrient Standards, must comply with the SOPs and QA requirements, and also must understand the context in which the data will be interpreted, so that the data can be used appropriately.

About the Instructors: Nia Wellendorf is the administrator of the DEP Aquatic Ecology and Quality Assurance Section within the Water Quality Standards Program, which oversees the QA Rule. Nia focuses on bioassessment, quality assurance, and water quality standards development toward better management and protection of Florida's surface waters. Julie Espy is the administrator of the DEP Water Quality Assessment Program, and focuses on monitoring and assessment of surface and ground water throughout the state. These activities include the coordination of monitoring programs, the Status and Trends monitoring networks, as well as the implementation of the Impaired Waters Rule for surface water.

Session Abstracts

Session 1: The Indian River Lagoon, its past, present and future

Moderator: Leesa Souto, Marine Resources Council
Tuesday, June 17, 10:15 am to 12:10 pm – Elliott Amphitheater

THE INDIAN RIVER LAGOON ACTION ASSEMBLY: LOOKING AT THE PAST, BUT FOCUSING ON THE FUTURE

Leesa Souto
Marine Resources Council, Palm Bay, FL

The Indian River Lagoon is at a crisis point with the massive die off of animals in 2013 and the loss of an estimated 47,000 acres of seagrass habitat. The economic loss to the region is estimated to be in the billions of dollars. With more than 200 organizations working in the Lagoon, it quickly becomes a challenge to get people on the same page. There is a need for vigorous and focused action to preserve this global treasure.

Marine Resources Council coordinated the Lagoon Action Assembly on May 15-17, 2014 in partnership with the Florida Institute of Technology (FIT) to bring together 100 diverse leaders to represent the community's voice for what can and should be done to help restore the Indian River Lagoon. One important goal of the Assembly was for diverse stakeholders to recognize each other's potential and the stake they have in restoring water quality in the Indian River Lagoon estuary. Another was reaching consensus on the priority actions that should be considered for policy and program implementation. The Inaugural Night included political leaders, scientist and delegates in an evening of inspiring presentations by speakers such as Wayne Mills past Chair of the Chesapeake Bay Foundation who described the success story of how their estuary plan came together through community participation and local leadership. Thereafter delegates were given a primer on the most up-to-date science and were engaged in two days of facilitated working sessions conducted in accordance with the American Assembly process first developed by President Eisenhower in 1950.

MRC organized American Assemblies from 1983 through 1997 to focus lagoon-wide leaders on preserving the health of the Lagoon. Among the outcomes from past Assemblies were the Indian River Lagoon Protection Act that stopped cities from dumping sewage into the Lagoon, the Federal designation of the Lagoon as an "Estuary of National Significance, and the funding of the IRL National Estuary Program.

The health of the Lagoon requires support from both private and public sources and by coordinating efforts around the community's priorities, investments can produce more effective results and maximize the efficiency of limited resources.

MAJOR ECOLOGICAL CHALLENGES FACING THE NORTHERN AND CENTRAL IRL

Margaret Lasi[1], Robert Chamberlain[1], Charles Jacoby[1], Jan Landsberg[2], Lori Morris[1], and Edward Phlips[3]
[1] St. Johns River Water Management District, Bureau of Environmental Sciences, Palatka, FL.
[2] Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg,
[3] University of Florida, Fisheries and Aquatic Sciences Program, Gainesville, FL.

After more than a decade of improving trends in water quality and seagrass coverage the Indian River Lagoon (IRL) estuary took an unexpected turn for the worse in late 2010 and 2011. Following two unusually cold weather events in early and late 2010, a noticeable increase in dissolved nutrient concentrations (particularly phosphorus), and drought-induced higher-than-normal salinities, the northern IRL experienced a phytoplankton "Superbloom" with a composition, magnitude, and duration never before observed in nearly 20 years of monitoring the IRL.

The 2011 Superbloom originated in the Banana River Lagoon in early spring (mid-March), preceded by an intense, albeit short-lived, winter bloom of diatoms. During the next several months, the Superbloom spread westward into the Indian River, and then expanded northward into the southern Mosquito Lagoon, senescing in late fall, more than eight months after its first appearance. The 2011 Superbloom was dominated by a green microflagellate (Pedinophyceae) in combination with a mixed assemblage of picocyanobacteria. During the peak of the bloom, densities of Pedinophyceae reached 1 billion cells/L, and water column Chlorophyll *a* (Chl *a*) concentrations exceeded 130 µg/L. The bloom covered over 130,000 acres of the IRL, resulted in murky green waters, and dramatically reduced subsurface light available to seagrasses. Seagrasses are the key indicator of ecosystem health in the IRL, as they provide critical habitat for many species of fish and invertebrates and vital support for estuarine and marine food webs.

The 2011 Superbloom was preceded in 2010 by a more widespread bloom of mixed composition and moderate intensity (15-20 µg/L median Chl *a*), that extended throughout the northern and central IRL. This bloom persisted into 2011 beyond the boundaries of the Superbloom area. The blooms of 2010 and 2011 were followed in 2012 by another record-breaking bloom that, like the 2011 Superbloom, was confined to the northern region of the IRL, although it was surprisingly absent from Banana River. This 2012 bloom was dominated by the presumed non-toxic, brown tide pelagophyte, *Aureoumbra lagunensis*. This species had not been reported in the IRL, nor was it known to bloom outside coastal lagoons in Texas. At its peak, the brown tide in Mosquito Lagoon surpassed to the Superbloom by reaching 3 billion cells/L and maximum Chl*a* concentrations of almost 200 µg/L. The 2012 brown tide event was linked to poor water quality that contributed to widespread fish kills and hard clam die-offs in Mosquito Lagoon. Although brown tide returned in 2013, it was much less intense and extensive, and other blooms (dinoflagellates in particular) once again became dominant.

The cumulative impacts of consecutive years of decreased water clarity and subsurface light availability that began in 2010 led to a historic loss of approximately 31,700 acres of essential seagrass habitat, or 44% of the 2009 coverage of 72,600 acres (based on August 2011 seagrass mapping). This loss translates to a potential reduction in the value of commercial and recreational fisheries estimated at 190-317 million dollars (a conservative estimate based on $6,000-$10,000 per acre of seagrass). The actual commercial loss is expected to have been much greater due to additional seagrass loss resulting from subse-

quent blooms. Among the areas most affected was Banana River Lagoon, which lost 87% of its 2009 coverage and has only recently begun to recover.

Other major ecological losses for which a monetary value has not been calculated are the significant and unusual marine mammal and bird mortality events during 2012/2013, involving approximately 80 bottlenose dolphins (*Tursiops truncatus*), 133 Florida manatees (*Trichechus manatus latirostris*) and 250 brown pelicans (*Pelecanus occidentalis*). The cause(s) of mortality for these seemingly unrelated, yet largely spatially concurrent events, remain under investigation by the Florida Fish and Wildlife Conservation Commission (manatees, birds), the National Oceanic and Atmospheric Administration (dolphins), other state and Federal entities, and a multidisciplinary team of national partners. To what degree the extensive seagrass die-off might have triggered the unusual mortality events remains unknown, but manatees, in particular, had to switch from a seagrass diet to one dominated primarily by macroalgae.

The post 2010 blooms were likely a consequence of a cascade of multiple physical, chemical, and biological factors that augmented the IRL's bio-available nutrient pool, thereby fueling the explosive growth of microalgae that led to further shifts in the trophic structure and function of the ecosystem. Among these factors is the other (often underappreciated) group of benthic primary producers in estuarine systems, drift macroalgae, which provide important habitat benefits like seagrasses and biomass that exceeds seagrasses at times. Drift macroalgae are an important component of estuarine nutrient budgets, typically taking up nutrients in the spring and summer and releasing them in varying amounts in late summer through early winter. Observational and anecdotal evidence suggests that a die-off of drift macroalgae in the summer-fall of 2010 followed by a lack of normal regrowth in the first half of 2011 may have contributed to an increase in nutrient availability that helped feed the 2011 Superbloom. This connection is supported by preliminary nutrient budget estimates for 2011 that indicate that the amount of carbon lost from submersed aquatic vegetation (SAV) was approximately equal to that gained by the Superbloom microalgae.

In order to better understand the factors contributing to and/or causing the recent IRL blooms, the St. Johns River Water Management District has launched the Indian River Lagoon Protection Initiative, which has at its core the IRL Algal Blooms Investigation. Ongoing and future efforts include sampling and experiments to better understand: (1) "bottom-up" stimulation of phytoplankton blooms by nutrients, especially nutrient cycling and nutrient inputs from sediment, groundwater and SAV, and (2) "top-down" control of phytoplankton blooms by grazers ranging from microzooplankton to infauna and epifauna. The inter-disciplinary Algal Blooms Investigation Team involves regional and state agencies and research institutions working in close collaboration and building upon the knowledge acquired through existing core monitoring programs to better understand and manage changing trophic conditions in the IRL.

THE INDIAN RIVER LAGOON RESEARCH INSTITUTE, IRLRI AT FIT

Dr. Robert J. Weaver
Indian River Lagoon Research Institute, Florida Institute of Technology, Melbourne, FL

The Indian River Lagoon Research Institute, IRLRI, at Florida Institute of Technology, was founded help ensure the health of the IRL for future generations. With the Mission to develop and implement sustainable solutions for the revitalization of the Indian River Lagoon, the IRLRI seeks to engineer the recovery of the IRL through sound science and engineering. Our members consist of over 20 faculty experts in the fields of Ocean Engineering, Oceanography, Marine Biology, Science Education, Civil Engineering, Environmental Science, Meteorology; some of whom have been conducting research in and around the IRL for over 25 years. Our group is focused on a research based approach to addressing the issue of coastal water quality and ecosystem sustainability, understanding that the solutions and methodologies developed for the IRL can translate to any impaired coastal lagoon worldwide.

APPLICATION OF THE WATERSHED DEPOSITION TOOL TO A TOTAL MAXIMUM DAILY LOAD ANALYSIS FOR NITROGEN INFLOW TO THE INDIAN RIVER LAGOON

Noreen D. Poor[1], Donna B. Schwede[2], Bach V. McClure[3], Virginia H. Barker[3]
[1]University of South Florida, College of Engineering, Tampa, FL
[2]US EPA, National Exposure Research Laboratory, Research Triangle Park, NC
[3]Brevard County Natural Resources Management Dept., Viera, FL

The Indian River Lagoon (IRL) is a long, narrow, and shallow estuary along the central east coast of Florida and is classified by the USEPA as an Estuary of National Significance for its biological diversity and habitat for endangered species. We applied USEPA's Watershed Deposition Tool with the Community Multi-Scale Air Quality (CMAQ) Model v4.7 output of reactive nitrogen (N) deposition for 2002 to 2006 to estimate atmospheric reactive nitrogen (N) deposition rates and loads to the portion of the IRL under the jurisdiction of St. John's River Water Management District (SJRWMD). We sought to update the estimates of direct atmospheric nitrogen loads to the Indian River Lagoon for a broader suite of nitrogen species and with better spatial resolution than is possible with a limited monitoring program, and to examine for these nitrogen loads the potential impact of federal regulations that are designed to reduce air pollution emissions.

Modeled direct atmospheric N loads were ~50% higher than previous estimates made in support of TMDL development, which were based on wet and dry deposition monitoring within the IRL basin. Direct atmospheric N deposition was a significant fraction of the existing and TMDL N loads for the Banana River Lagoon and North IRL, less so for the Central IRL (Table 1, Figure 1). For a CMAQ-modeled 2002 base case and a 2020 future scenario of N emissions inventories, the potential impact of federal regulations that reduce oxidized N emissions from power plants and mobile sources was a ~30% reduction in atmospheric N loads to the IRL, with higher segment-specific reductions in the North IRL and Banana River Lagoon and lower reductions in the Central IRL (Table 1, Figure 1).

Table 1. Direct atmospheric N loads to the IRL by bay segment, existing and TMDL N loads, and the potential impact of slated reductions in oxidized N emissions on N loads to the IRL

Segment	Lagoon Area	2002 Direct AD	2020 Direct AD	Δ Direct AD	Exist-ing*	TMDL	Δ Total N	Δ Direct AD/Δ To-tal N
	ha	N Loads, metric tons						%
North IRL								
IR1-3	8807	61.5	40.2	-21.4	122	80.4	-42.4	50.4%
IR4	958	7.91	5.18	-2.73	17.3	10.5	-6.77	40.3%
IR5	6700	53.1	35.0	-18.1	110	68.0	-42.1	42.9%
IR6-7	6492	53.5	37.7	-15.8	109	66.9	-42.0	37.7%
IR8	1539	11.6	8.46	-3.13	22.6	14.3	-8.36	37.5%
IR9-11	4941	35.8	26.1	-9.67	109	71.5	-37.4	25.8%
Banana River								
BR1-2	7590	51.2	36.0	-15.2	109	52.8	-56.7	26.8%
BR3-5	8635	39.0	29.3	-9.72	79.3	56.0	-23.3	41.7%
BR6	1567	11.1	8.23	-2.86	32.1	13.9	-18.1	15.7%
BR7	771	6.47	4.70	-1.76	25.3	9.68	-15.6	11.3%
Central IRL								
IR12	3467	22.0	16.1	-5.86	253	119	-134	4.4%
IR13	1475	9.76	7.12	-2.64	38.2	19.4	-18.8	14.0%
IR14-15	5611	35.7	26.8	-8.87	366	173	-194	4.6%
IR16-20	2432	15.2	11.7	-3.51	245	119	-126	2.8%
IR21	1030	7.11	5.45	-1.66	12.7	7.21	-5.49	30.2%

** Existing N loads were corrected for CMAQ-modeled atmospheric deposition rates: Existing N load - original AD estimate + CMAQ-modeled AD estimate*

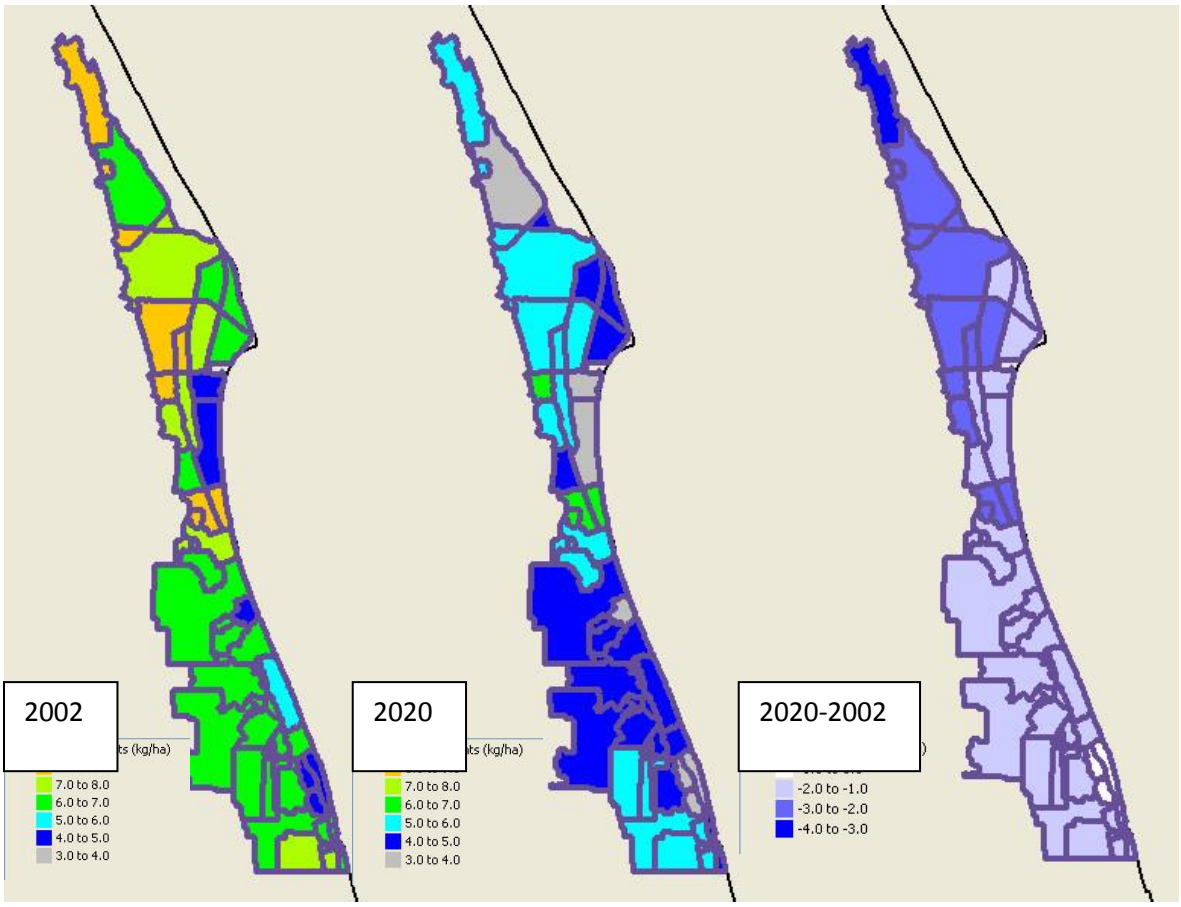


Figure 1. CMAQ-modeled total N deposition rates to North and Central IRL and Banana Lagoon for 2002 (left) and 2020 (middle), and the difference between total N deposition rates for these two years (right).

RESTORING HEALTH TO THE INDIAN RIVER LAGOON: ARE TRADITIONAL STORMWATER TREATMENTS THE SOLUTION?

Virginia Barker
Brevard County Natural Resources Management Dept., Viera, FL

The Indian River Lagoon (IRL), one of the nation's most diverse estuarine ecosystems, stretching 156 miles across a coastal convergence of temperate North America and subtropical peninsular Florida, is suffering from eutrophication and numerous other anthropogenic stressors. To date, protective actions have focused on reducing nutrient and sediment loading from wastewater and stormwater discharges. This presentation looks at the potential for these actions to eliminate nutrient impairment and restore lagoon health.

Recently, Brevard County, all municipalities in Brevard, FDOT District 5, and the Air Force partnered to update the watershed loading model that was used to estimate nutrient inputs, set target loads for each segment of the lagoon and allocate load reductions to responsible entities. The resulting model update

indicates that more than half of the watershed load is conveyed through groundwater. Traditional stormwater treatment projects reduce loading from surface water runoff, not groundwater.

The Super bloom of 2011, brown tides of 2012 and 2013, and unusual mortality events of 2013 occurred despite two decades of increased stormwater treatment, 15 years of decreasing nutrient concentrations measured in the lagoon and a decade of seagrass bed expansion. This juxtaposition of facts indicates that internal nutrient cycling has the potential to significantly alter the assimilative capacity of the lagoon. Internal cycling has been modified over time by decades of pollution stored in the living biota, decaying organic matter and bottom sediments. Due to limited inlet connections to the ocean and minor tidal prism, flushing is so low that residence time is measured in years, therefore legacy loading accumulates in ever expanding muck deposits. Traditional stormwater treatment projects reduce current and future loading, however they do not address the legacy load left by prior generations.

Brevard County continues to implement traditional stormwater treatment projects to reduce loading carried to the IRL in stormwater. We are experimenting with non-traditional project designs and materials to reduce groundwater loading that is conveyed to the lagoon year-round in canal baseflow. We have begun oyster restoration to filter nutrients and sediment from the water column and we are seeking funds to measure the denitrification benefits of microbial populations that thrive beneath oyster reefs. We are imploring state and federal agencies to fund environmental dredging to remove the mucky legacy of our past that amplifies internal nutrient cycling. In sum, we are supplementing our traditional stormwater programs with projects to more efficiently and effectively reduce pollutant loading, remove legacy loads, and restore natural filtration in order to re-establish mesotrophy, assimilative capacity and ecosystem health to the Indian River Lagoon.

Session 2: Aquatic Systems Science and Management

Moderator: Shannon Wetzel, Seminole County Public Works
Tuesday, June 17, 2:00 pm to 3:25 pm – Elliott Amphitheater

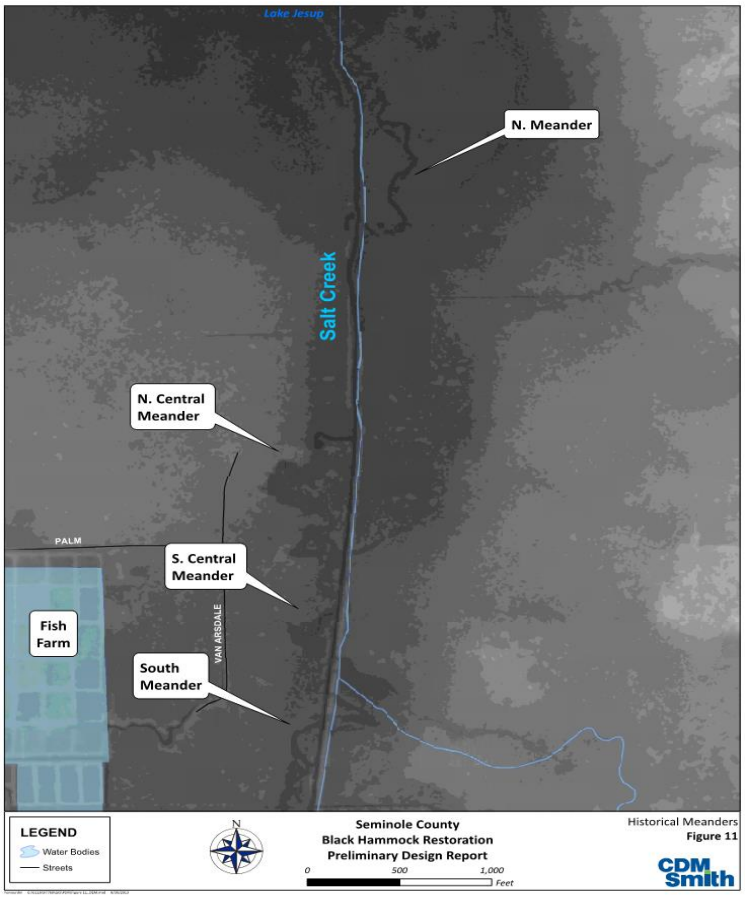
BLACK HAMMOCK CREEK RESTORATION AND FLOODPLAIN TREATMENT SYSTEM

Danielle Honour[1], Jim Wittig[1], Sherry Brandt Williams[2],
Mark Flomerfelt[3], Kim Ornberg[3], Shannon Wetzel[3]
[1]CDM Smith, Inc., Maitland, FL
[2]St. Johns River Water Management District, Palatka, FL
[3]Seminole County, Public Works, Sanford, FL

The Black Hammock is located on the southeast shore of Lake Jesup in Seminole County, Florida. Stormwater runoff in the Black Hammock area is generally conveyed to Lake Jesup via three main tributaries that flow through the Black Hammock and ultimately discharge to Lake Jesup through Shortcut Canal, Sweetwater Creek and Salt Creek. During the 1920s, portions of Salt and Sweetwater Creeks were dredged and straightened to enable agricultural activities in the area. Much of the excavated fill was deposited along the straightened banks of the excavated creeks, effectively cutting off normal creek flow to the historical meanders within the floodplain. Today, both Sweetwater and Salt Creeks are channelized systems that convey storm flows to Lake Jesup for flood control purposes and there are currently very few best management practices (BMPs) in place to control nutrients or other pollutants in the Sweetwater and Salt Creek tributary areas (SJRWMD, 2012). The Salt and Sweetwater Creeks tributary area encompasses approximately 6.5 percent of the overall Lake Jesup watershed. The Black Hammock area was identified in the Lake Jesup interagency restoration strategy as an area with potential sources of high nutrient runoff. The SJRWMD expanded upon the interagency plan recommendations and developed the Preliminary Design Considerations for the Rehabilitation/Reconstruction of Salt and Sweetwater Creeks in the Black Hammock of Lake Jesup (2012). The restoration plan was to re-channel the flow in the area through serpentine creek beds utilizing passive treatment that requires little to no long-term maintenance, thereby increasing residence time and nutrient uptake. The preliminary design work was performed in support of and compliance with a Florida Department of Environmental Protection (FDEP) Grant Agreement.

Load calculations performed by SJRWMD for Salt and Sweetwater Creeks estimated that these systems contribute 12.5 and 2.1 tons/year of TKN and TP, respectively (SJRWMD, 2012). The average in-stream nutrient concentrations also currently exceed the downstream targets for the lake established by the Lake Jesup TMDL. The County has been working on this restoration project to determine stream restoration alternatives that would maximize nutrient removal. Detailed field survey data were collected along both creeks as well as review of existing hydrological, hydraulic, soil and land use data. The evaluation performed for the proposed project indicates flows from Salt Creek can be conveyed to four historic floodplain meanders in order to promote attenuation and water quality treatment under baseflow and low-flow conditions. Floodplain rehabilitation will be accomplished by the removal of a portion of the spoil berm to re-establish the historical connection of Salt Creek to the meander and inclusion of a 1-foot high (low flow) diversion weir in Salt Creek at the entrances to the South and North meanders.

These activities will significantly increase the flow frequency and rates associated with baseflow and moderate storm events that are conveyed to the meanders compared to existing conditions. Increases in stages to the surrounding areas are minimal and the surrounding wetlands will benefit from the increased frequency of inundation without changing the existing community types.



Based on a literature review, the most recent and comprehensive work that standardizes an approach for pollutant load reduction credits for stream restoration BMPs is associated with the Chesapeake Bay TMDL. Depending on the characteristics of the floodplain reconnection, removal efficiencies for TN and TP can range from 0 to 16 percent and 0 to 24 percent, respectively. Using the available floodplain storage volume at each of the proposed Salt Creek meander restoration sites and the effective depth of rainfall that can be treated in the floodplain, the resulting removal efficiency for TN and TP is estimated at 7 and 11 percent, respectively, for Salt Creek. Based on the pollutant load removal estimates for TN and TP and a probable construction estimate, the resulting cost effectiveness is $22/lb of TN removed and $80/lb of TP removed over the project life cycle for the stream restoration BMP. Additional BMPs could be added onto this creek restoration to increase pollutant removal efficiencies.

Based on the areas evaluated, Sweetwater Creek did not afford as many readily available opportunities for stream restoration during this phase of the investigation. This is mainly due to property ownership and topographic constraints of the areas that were investigated. Future phases of this project will investigate possible restoration BMPs in Sweetwater Creek and other potential BMPs to further increase pollutant removal efficiencies in both creeks.

LAKE DOWN SUB-BASIN 9 NUTRIENT SOURCE EVALUATION & REMEDIATION PLAN

Sergio Duarte[1] and Lance Lumbard[2]
[1]Orange County - Environmental Protection Division (EPD), Orlando, FL
[2]AMEC Environmental & Infrastructure, Inc. Orlando, FL

The Lake Down Sub-basin 9 is located within the Cypress Creek and the upstream portion of the Butler Chain of Lakes drainage basin. The Lake Down Sub-basin 9 encompasses a 416-acre basin which contributes 13.1% of the stormwater and baseflow phosphorus load to Lake Down (~138 lbs of TP/year) and 7.5 % of the total annual phosphorus (TP) inputs to the Butler Chain of Lakes (2007 Butler Chain of Lakes Study, ERD Inc.).

The objective of the Lake Down Sub-basin 9 Study was to identify the source of the elevated total phosphorus concentrations and to develop conceptual management recommendations to reduce phosphorus concentrations and loadings discharging from Sub-basin 9 into Lake Down.

Orange County contracted AMEC in June 2013 to evaluate and characterize the quantity and quality of various stormwater / baseflow discharges within Lake Down Sub-basin 9; and to identify potential sources for the elevated total phosphorus concentrations at nine stormwater ponds and the Windermere Ridge HOA wetland.

AMEC reviewed the existing Lake Down Sub-basin 9 delineation and established the actual water flow patterns. AMEC developed, based on the dry and wet season-water quality monitoring program: (1) A hydrologic and phosphorus budget for the Lake Down Sub-basin 9, (2) Conceptual alternative BMPs and (3) Cost-benefit analysis to address phosphorus loading found primarily at the Windermere Ridge wetland.

The BMPs recommended by AMEC for the Lake Down Sub-basin 9 included: (a) Installation of a second generation nutrient separating baffle box near the pipe end, (b) Restoration of 3.66 acres of the Windermere Ridge wetland to increase amount of stormwater runoff volume to be retained (restoration and upgrade of existing weir, wetland hydro-period restoration, erosion stabilization, exotic and invasive plant control, and native plant enhancements) and (c) Upgrades of wet and dry retention ponds off Willow Park Drive.

BIOASSAY ASSESSMENT OF SEDIMENT CONTAMINATION: ITS ROLE IN FLORIDA'S SEDIMENT QUALITY ASSESSMENT GUIDELINES

Jennifer Sagan[1], Gerold Morrison[2], Ed Sherwood[3], Pamela Bellotti[1], William Tucker[1]
[1]AMEC Environment & Infrastructure, Gainesville, FL
[2]AMEC Environment & Infrastructure, Lakeland, FL
[3]Tampa Bay Estuary Program, Tampa, FL

Florida's Sediment Quality Guidelines can provide effective guidance for identifying potential management actions involving a contaminated site. While the guidance outlines conditions where no biological effect is likely (below Threshold Effects Levels or TELs) and when biological effects are highly likely

(above Probable Effects Levels or PELs), there exists a gray area between these levels where additional bioassay data can help determine real impacts to biota.

McKay Bay, located in the northern, urbanized extent of the Tampa Bay Estuary, is an area with high sediment contaminant levels and poor benthic biotic communities. The analytical results of a bay-wide sediment sampling effort in McKay Bay were used to identify areas in which contaminant levels were above TELs or PELs. These data were used to identify smaller, sediment quality management areas (SQMAs) within the embayment of high priority that would be the focus of additional studies to determine if the contaminants of concern were truly affecting resident biota. A multi-tiered study evaluated the acute toxicity of contaminated sediments and the bioaccumulation of contaminants in benthic organisms. The study also included an examination of contaminant tissue concentrations in resident macroinvertebrates and ichthyfauna. Results of the acute toxicity study indicated significant reduction in survival in organisms exposed to test sediments corresponding to areas that had greater than 5 PEL exceedances or greater than 10 TEL exceedances. Bioaccumulation studies found PAHs, total PCBs, and chlordane in organism tissues at levels associated with potential ecological effects and/or levels known to be associated with potential human health related effects. Analysis of contaminant tissue concentrations in resident biota found metals, PCBs, PAHs, and pesticides at levels associated with potential ecological effects and levels known to be associated with potential human health related effects.

Results from this study will be used for a variety of purposes. This includes defining the areal extent and magnitude of sediment contamination; identifying probable cause(s) of localized sediment degradation; and evaluating the feasibility of controlling existing sources of contamination and conducting site remediation activities, considering costs as well as benefits.

SAVING JORDAN LAKE: THE FIRST LARGE RESERVOIR APPLICATION OF A SYSTEMS APPROACH TO FRESHWATER MANAGEMENT

H Kenneth Hudnell
Medora Corp. & UNC-CH, New Bern, NC

The North Carolina government suspended the nutrient management rules for Jordan Lake, a 14,000-acre reservoir constructed in 1982 on low-lying farmland and filled with water that can take more than a year to traverse the lake. Jordan has always been impaired. Jordan is eutrophic, having high nutrient levels and quiescent, stagnant water that enable detrimental blue-green algae (cyanobacteria) to predominate the beneficial algae at the base of the aquatic food web. Cyanobacterial "blooms" cause high chlorophyll-a, pH, and turbidity levels, Jordan's "official" impairments. These surrogates indicate the potential for serious effects on health and the sustainability of aquatic ecosystems.

North Carolina officials do not believe watershed management alone will enable Jordan to attain water quality standards. The rules aim to reduce phosphorus input by only 5% at a cost-estimate of $2 billion. Watershed management alone has never attained or restored water quality standards in any eutrophic lake of at least 1,000 acres in size and 90% of nutrient input from runoff. And the problem is increasing. Whereas EPA estimated in 1972 that 10-20% of lakes and reservoirs were eutrophic, the Agency now esti-

mates that ~50% are eutrophic or hypereutrophic. EPA river-and-stream data from 2008-2009 indicate 66% contain excessive phosphorus, up from 47% in 2004. Trends are worsening under current policy

North Carolina officials believe a systems approach that combines cost-effective watershed management practices with waterbody treatments is needed for Jordan to attain standards. This talk will discuss a water circulation study for assessing cyanobacterial suppression in Jordan, and other treatments to be evaluated for nutrient removal from the lake and inlets where they are more accessible and concentrated. An optimal strategy for Jordan would combine cost-effective watershed management input controls with waterbody management treatments to form a dynamic system providing a relatively high likelihood of success, short time to restoration, downstream protection, and low cost. It's time we complement "preventive medicine" (input control) with "supportive therapy" (waterbody treatments) to save "ill" (impaired) reservoirs like Jordan.

Session 3: Florida Lake Restoration Science and Management

Moderator: Mike Britt, City of Winter Haven
Tuesday, June 17, 2:00 pm to 5:30 pm – Elliott Amphitheater

NUTRIENT TRANSPORT AND LOAD REDUCTION FROM BEAR GULLY CREEK TO LAKE JESUP

Lance M. Lumbard[1], Michael Howe[1], Moris Cabezas[1], Nirjhar Shah[1], Mark Flomerfelt[2], Shannon Carter-Wetzel[2], Kim Ornberg[2]
[1]AMEC Environment & Infrastructure, Inc., Orlando, FL
[2]Seminole County Public Works, Sanford, FL

Lake Jesup, located in Seminole County about 14 miles northeast of Orlando, FL, is approximately 10,600 acres (4,290 hectares) and is listed as impaired for nutrients (phosphorus and nitrogen) and unionized ammonia. The Lake Jesup Total Maximum Daily Load (TMDL) was completed in 2006 and the Basin Management Action Plan (BMAP) was completed in 2010. As part of the BMAP, Seminole County has identified several alternatives to reduce nutrient loading to Lake Jesup including reducing nutrient transport from Bear Gully Creek (BGC). BGC is one of main tributaries of the Howell Creek Basin (HCB) which is estimated to contribute more than a third of the nutrient and hydrologic budget to Lake Jesup. AMEC determined the hydrologic and nutrient load contribution from BGC for the period between March 2013 and February 2014. Hydrologic inputs were modeled for the BGC by updating the existing Environmental Protection Agency Storm Water Management Model (EPA SWMM) developed for the HCB by CDM Smith for Seminole County and others. AMEC modeled several alternatives involving construction of weirs and diversion of flow through existing ponds to increase BGC retention time and facilitate load reduction. The alternatives developed are estimated to result in load reductions in excess of 100 kg total phosphorus and 1,600 kg of total nitrogen and will make use of additional capacity within existing infrastructure to reduce construction cost.

COMPARISION OF TECHNIQUES USED FOR DEVELOPING WATER QUALITY AND LOAD REDUCTION TARGETS FOR FLORIDA LAKES: EMPIRICAL VS. MECHANISTIC MODELING APPROACHES

David A. Tomasko
Environmental Science Associates, Tampa, FL

The two main water quality modeling approaches that are used to develop management guidance Florida Lakes involve mechanistic or empirically-derived water quality models. Both of these types of models are considered to be "deterministic" in that predicted outcomes are determined through known relationships among states and events, with the objective of reducing random variation. In a data poor lake, the only option available for examining the relationships between potential lake management strategies and possible system responses is a mechanistic model such as EPA's Water Quality Assessment Program (aka WASP). In mechanistic models, there are two main model components, state variables and rate coefficients. State variables refer to water quality parameters such as levels of dissolved oxygen or nutri-

ent concentrations, while rate coefficients represent biological processes, not concentrations. Empirical models, also called data-driven or statistically-based models, differ from mechanistic models in a number of ways. Unlike mechanistic models, empirical models do not require the incorporation of assumed rates of various biological processes. Relationships between model parameters are inferred, based on statistical comparisons using correlation and/or regression procedures, but the specific processes through which parameters are related to each other do not have to be known. These two approaches will be compared to each other, and examples of problematic versions of each will be discussed, with the intent of better informing lake managers on the issues they should be aware of as they develop plans based on modeling system responses to potential management actions.

COMPARATIVE EFFECTIVENESS OF ALUM AND PHOSLOCK FOR INACTIVATION OF SEDIMENT P RELEASE IN SILVER LAKE

Harvey H. Harper[1] *Sarah Malone*[2]
[1]Environmental Research & Design, Inc. (ERD); Orlando, FL
[2]Pinellas County Watershed Management; Clearwater, FL

Silver Lake is an 8.44-acre shallow (mean depth = 3.2 ft.) eutrophic lake located in Pinellas County, Florida which forms the headwaters of Joes Creek. A 2010 nutrient source evaluation study concluded that the sediments of Silver Lake contribute a significant loading to Joes Creek, and sediment inactivation was recommended. Isolation chamber experiments were conducted over a 91-day period to evaluate the relative effectiveness of alum and Phoslock for inactivation of sediment phosphorus release. Six limno-corral isolation chambers (6 ft. diameter) were installed, with one pair of chambers dosed with alum, one pair dosed with Phoslock (based on manufacturer's recommendations), and one pair used as a control. Field monitoring was conducted bi-weekly, and Creek inflow was added to each of the chambers (5% of chamber volume). The alum treated chambers exhibited significantly lower concentrations of SRP, particulate phosphorus, total phosphorus, color, and chlorophyll-a than the Phoslock or control chambers. Mean chamber total phosphorus concentrations were 21 ppb for alum, 66 ppb for Phoslock, and 138 ppb for the control.

At the completion of the incubation period, 2-inch and 6-inch diameter sediment core samples were collected in each of the 6 isolation chambers and the open lake. The 2-inch core samples were analyzed for general parameters, nutrients, and phosphorus speciation. Both alum and Phoslock reduced saloid phosphorus in the sediments, but Phoslock had little impact on iron-bound phosphorus. The 6-inch samples were incubated under aerobic and anoxic conditions for 60 days, and release of total phosphorus and total nitrogen into the water column was monitored every 2-3 days. The anoxic release rate for total phosphorus in the alum treated core samples was 8% of the control, compared with 25% of control for Phoslock.

EVALUATION OF PHOSLOCK®, AN INNOVATIVE PHOSPHORUS CONTROL TECHNOLOGY, IN A SOUTH FLORIDA LAKE

Gerold Morrison[1], Brian Gentry[2], Andy Studt[2], Lance Lumbard[1], Walt Reigner[1], Shaun Hyde[3]
[1]AMEC Environment & Infrastructure, Inc., Lakeland, FL
[2]Palm Beach County, Dept. of Environmental Resource Management, West Palm Beach, FL
[3]SePRO Corporation, Carmel, IN

Phoslock® is an innovative lake management tool that was developed by an Australian government agency (the Commonwealth Scientific and Industrial Research Organization) to address phosphorus-related water quality issues. The technology, a lanthanum-modified bentonite clay, strips soluble reactive phosphorus (SRP) from the water column and settles to form a thin layer that intercepts and binds SRP at the sediment-water interface. Lanthanum binds phosphorus over a wide range of DO and pH conditions, sequestering it in a stable and biologically unavailable mineral form. (In addition to its water quality management uses, lanthanum is also the active ingredient in a human drug [Fosrenol®] that is used to reduce excessive phosphorus levels in patients with advanced kidney disease.) Phoslock® has been used to improve water quality in numerous phosphorus-impaired water bodies in Australia, New Zealand, China, the EU and UK, Canada and the United States. Palm Beach County conducted an application of Phoslock® in one of its highly-urban phosphorus-impaired lakes in January, 2013. Monthly post-application water quality monitoring, which is being conducted by the County's Department of Environmental Resource Management, is currently underway in the treated lake and an untreated control. A BACI (before-after, control-impact) statistical design is being used to compare levels of phosphorus and other water quality parameters in the two lakes. Rainfall and stormwater runoff were unusually high throughout the project area during the 2013 rainy season, affecting water quality in both lakes. Despite the unusual hydrologic conditions, analysis of the data available to date (from sampling completed through December 2013) indicates that the Phoslock® treatment has provided a statistically significant reduction in TP concentration in the treated lake relative to the untreated control. The County monitoring program is ongoing, and will provide a long-term record of the magnitude and duration of treatment effects.

HOW TO PREVENT AND REDUCE HARMFUL ALGAL BLOOMS AND EXCESS TURBIDITY WITHIN WATER BODIES WITHOUT HARMING AQUATIC ORGANISMS

Seva Iwinski
Applied Polymer Systems, Inc., Atlanta, GA

Excess nutrients and turbidity have negative effects on the overall water quality of ponds and lakes; which, in turn, can have harmful effects on the entire food chain from benthic organisms to larger fish and other animal populations. Excess turbidity and nutrients can be due to erosion and sedimentation, runoff from fertilized areas, and areas that have been disturbed. The influx of sediment and organics can result in algal blooms, decreased oxygen and sunlight penetration, lack of food for aquatic organisms, and ultimately causing stress on aquatic life. Many of the methods and products are available to prevent and decrease algal blooms and turbidity can be very toxic and harmful to aquatic organisms. Non-toxic and non-invasive methods using anionic polymers are available to both prevent the influx of sediment

and nutrients, and reduce those which are already in the water body. If the water body has already been infiltrated by sediment and nutrients then a mixing apparatus (i.e. waterfall, aeration system, or fountain) can be used with this anionic polymer based technology for removal. Field research has shown a 75-90 percent reduction of phosphorous and a 95 percent reduction in NTU's through using the proper Best Management Practices (BMP's) in conjunction with anionic polymers. Polymer enhanced BMPs can also be used as a preventative measure by stabilizing the soil and stopping the influx of sediment, as well as nutrients from other sources.

Session 4: Poster Session

Tuesday, June 17, 6:30 pm to 8:00 pm – Salons 2, 3, 4

THE HISTORY OF LAKE MANAGEMENT IN LAKE APOPKA

Zachary Caple
University of California Santa Cruz, Santa Cruz, CA

Lake Apopka is a large shallow lake in Central Florida currently undergoing restoration for nutrient pollution from large-scale vegetable farms. This poster describes the pollution history of Lake Apopka and the array of lake management strategies that have been proposed and employed since the 1960s to the present. In this poster, I give special attention to events in the 1990s that resulted in the state buyout of the farms and the first restoration efforts of the St. Johns River Water Management District. Today restoration is pursued through wetland treatment of lake water and mass harvests of gizzard shad. I conclude this paper with a short status report on water quality improvements and overall restoration effectiveness.

COMPARING MICROSCOPIC ALGAL COUNTS TO COUNTS OBTAINED BY FLUID IMAGING, THE FLOWCAM

Dawn Davis
Fisheries and Aquatic Sciences, School of Natural Resources, University of Florida, Gainesville, FL

Determining the species composition and relative abundance of different algal groups in a community are essential elements because alteration in the phytoplankton community composition can lead to negative ecological impacts. This study is a comparison between the traditional counting method, the inverted microscope, and a new advanced instrument, the FlowCAM (Fluid Imagining Technologies). Phytoplankton communities in two Florida lakes of different trophic status were examined to assess community composition and biomass. Samples analyzed were archived phytoplankton samples that were preserved with Lugol's solution. The FlowCAM does not allow the user to effectively identify all algal species, thus a microscope will be needed to meet that objective if required. However, the FlowCAM and the microscope tools both effectively identify genera present. The FlowCAM can quickly calculate the volume of total seston using either volume equivalent spherical diameter (ESD) or volume area based diameter (ABD). This volume estimate can also be divided into the volume of organisms or the volume of non-living matter (detritus), which is often not done with the microscope. Comparisons are being made to ascertain how estimates of bio-volume differ for each of these counting tools. Preliminary analyses clearly demonstrate that the FlowCAM is the fastest tool for obtaining estimates of bio-volume when examining large numbers of samples. The FlowCAM therefore offers an effective tool for the study of phytoplankton dynamics within a large number of Florida lakes.

SPATIAL AND TEMPORAL VARIABILITY OF BROMIDE-TO-CHLORIDE RATIO IN COASTAL GROUNDWATER: LITERATURE REVIEW AND FIELD DATA

Kaitlyn Flower and Treavor H. Boyer
Department of Environmental Engineering Sciences, Engineering School of Sustainable Infrastructure & Environment (ESSIE), University of Florida, Gainesville, FL

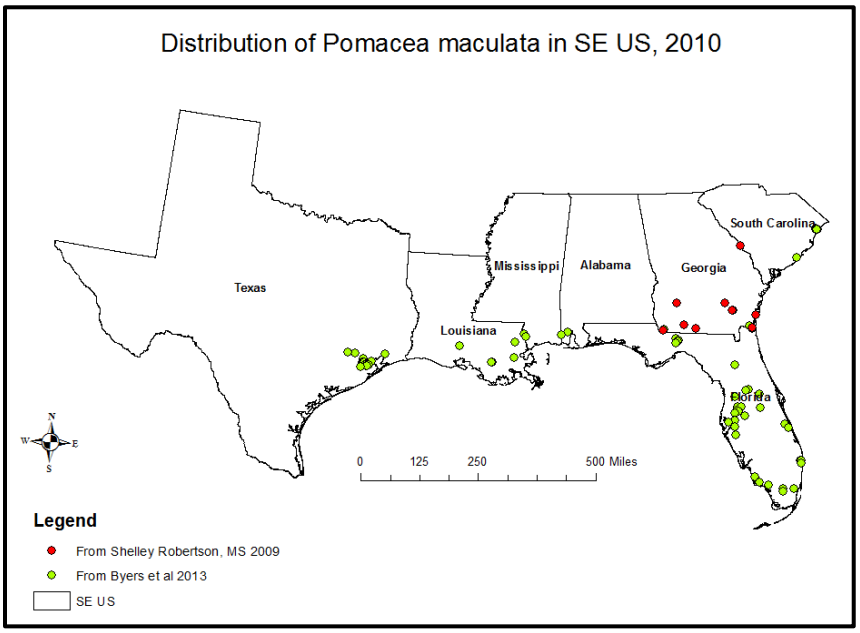
Seawater intrusion, which can be caused by groundwater pumping, changes in recharge, and sea-level rise, will increase the potential for the contamination of freshwater with seawater constituents such as bromide, an ion that is frequently overlooked due to its very low concentration in seawater and lack of direct health consequences. However, elevated bromide levels may increase the formation of carcinogenic brominated byproducts during the disinfection of drinking water. Therefore, the objective is to evaluate the fluxes of bromide from seawater to freshwater thereby quantifying the potential of seawater intrusion to alter groundwater chemistry. This will be accomplished by investigating the ability of the bromide-to-chloride ratio to demonstrate a constant linear relationship for various gradients of seawater intrusion throughout space and time, specifically by 1) conducting a comprehensive review of the literature to assess the regional variability of the bromide-to-chloride ratio and 2) assess temporal variability of the ratio through groundwater sampling at selected coastal aquifers. An experimental matrix will include field sampling for one year at each location to account for seasonal variations, and samples will be analyzed for total dissolved solids, sodium, chloride, magnesium, sulfate, calcium, potassium, and bromide. The aim is to explore the application of the bromide-to-chloride ratio as a predictable indicator of bromide concentration and the subsequent formation potential of brominated disinfection byproducts. The significance of this work is to develop an understanding of how population growth, urbanization, and climate change may impact drinking water resources and thus influence human health risks that need to be incorporated into the long-term planning and management of drinking water treatment.

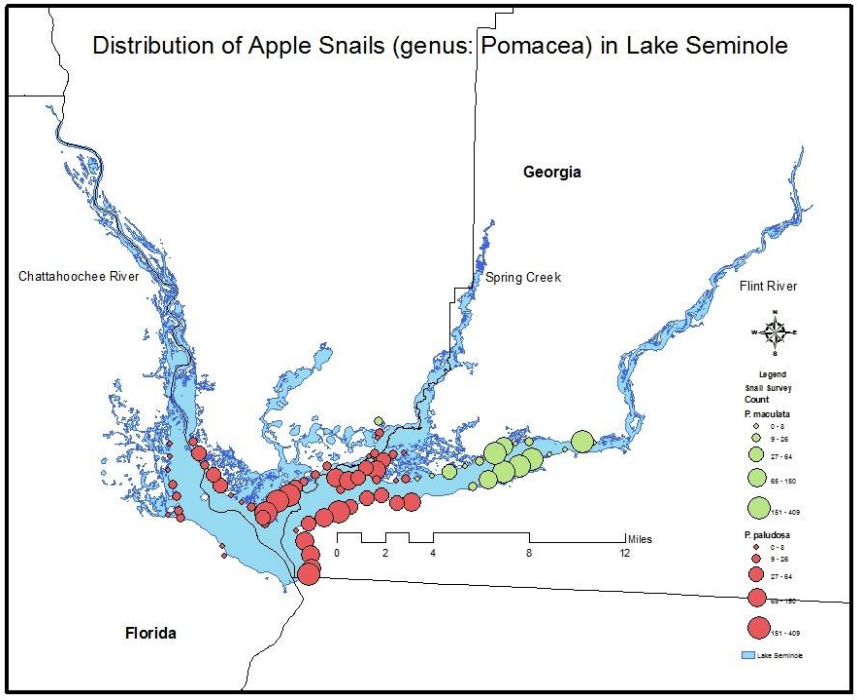
QUANTIFYING EFFECTS OF INVASIVE APPLE SNAILS (*POMACEA MACULATA*) IN A LARGE RESERVOIR: AN OUTLINE FOR RESEARCH

Nick Marzolf
University of Georgia Joseph W Jones Ecological Research Center

Lake Seminole, the reservoir formed at the Jim Woodruff Dam, forming the border of Florida and Georgia, and the confluence of the Flint River, Chattahoochee River and Spring Creek, provides a unique example to study the effects of invasive species. The lake is home to several invasive macrophytes, most notably Hydrilla and Water Hyacinth, along with invasive invertebrates Corbicula fluminea and Pomacea maculata. Current research is aimed at examining the interaction between the various invasive species on the function of the lake as a sink for nutrients. Work has showed that Hydrilla acts as a sponge for nutrients during the growing season, and filtration by Corbicula act to significantly reduce nutrient concentrations discharged from the dam. The presence of Pomacea, especially in high abundance, may alter this interaction by consuming available SAV in the lake, releasing stored nutrients to the water column. Other research examines juvenile Pomacea as an energy subsidy to predators. A single egg masses can contain upwards of 1000 eggs, which produces a large number of juvenile snails in the water column, and easy prey for a variety of predators in the lake. We predict a high number of predators will utilize juvenile snails as an energy source, and use it readily as the number of juvenile snails available has been

predicted at upwards of 400,000 in certain areas around the lake. The final area incorporates the spread of the snails in the ACF basin as a result of climate change and direct human movement. Developing a temperature gradient for which snails find suitable, and expanding the gradient across the lake and the lower ACF will help predict areas likely to be invaded by the snails.





SEASONAL VARIATIONS IN PLANKTONIC COMMUNITIES AND ENVIRONMENTAL FACTORS IN A SHALLOW, LOW-GRADIENT, NUTRIENT-RICH, HIGH-COLOR, SUBTROPICAL LAKE

Akeapot Srifa, Mary F. Cichra, Karl E. Havens and Edward J. Phlips
Program of Fisheries and Aquatic Sciences, University of Florida, Gainesville, FL

A long-term historical data set (from 1993 – 2011) from a site in Lake George (Volusia County, Florida) was analyzed for the relationships between dynamics of planktonic communities and possible environmental drivers including blooms of cyanobacteria, nutrient availability, rainfall pattern and discharge rates. In term of carbon biomass, copepods dominated zooplankton community year-round, and their monthly means peaked in May and June, a month after peaks in rotifers and cladocerans. This pattern may be related to shifts in resource availability due to cyanobacterial blooms from spring to early fall. Low nutrient levels (silica in early spring, dissolved inorganic nitrogen and phosphate during summer months) and warmer temperature may play major roles in shifts in phytoplankton community structure from diatoms to cyanobacterial blooms in summer. Increases in precipitation, discharge rates, and colored dissolved organic materials perhaps limit cyanobacterial bloom potential later in fall. These results may provide insights and strategies in lake and aquatic resource management.

Session A1: Florida Aquatic Species Science & Management

Moderator: Bruce Sharfstein, South Florida Water Management District
Wednesday, June 18, 10:30 am to 12:10 pm – Salon 1

WADING BIRD FORAGING TRENDS IN LAKE OKEECHOBEE

Michael J Baranski
South Florida Water Management District, West Palm Beach, FL

The littoral zone of Lake Okeechobee has been surveyed since 2010 to determine the distribution of foraging wading birds during nesting season in Lake Okeechobee. Analyzing trends in wading birds can be used as an indicator of habitat quality and an important tool as a function of hydrology, restoration efforts, and changes at other trophic levels. Locations of foraging flocks are primarily driven by lake water levels which influence the availability of prey. Abundance of wading birds is influenced by suitable foraging conditions on the lake and condition of wetlands outside of the lake. An increase of foraging wading birds was documented in 2013. This increase was likely the result of a continued rebound in prey densities after the driest period on record in 2011 left the marshes completely dry in excess of six months. A benefit of the large size of the lake is that it acts as a buffer against all but very large localized and regional rain events. This emphasizes the importance of the lake as a refuge during seasons with poor hydrological conditions in the Everglades and is likely a contributing factor to the overall success of wading birds in other parts of the system. Continuing to monitor wading bird foraging trends will help further our understanding of how management of lake levels influences foraging conditions for nesting wading birds.

A METHOD FOR ESTIMATING EGG NUMBERS IN EGG CLUTCHES OF THE EXOTIC APPLE SNAIL *POMACEA MACULATA* WITHOUT AFFECTING CLUTCH VIABILITY

Bruce Sharfstein[1], Mike Cantaloube[2], and Therese East[1]
[1]South Florida Water Management District, West Palm Beach, FL
[2]Florida Atlantic University, Boca Raton, FL

The exotic apple snail *Pomacea maculata* (previously classified as *Pomacea insularum*) appears to be gradually extending its range and increasing its density through much of south Florida; as well as in other locations in the southern United States. As a consequence, there is increasing interest in understanding its life history. While some of this information is currently available in the literature, there has been a great deal of taxonomic confusion regarding the correct identification of the species resulting in the need to confirm much of what is available in print.

One difficulty encountered in studying *P. maculata* is that it lays large, multilayered clutches of very small eggs that are impossible to count without disaggregating the egg mass; which results in the loss of viability and renders the eggs useless for life history studies. Using a previously described dis-aggregation technique, we weighed, dis-aggregated, photographed, and counted 70 egg masses of *P. maculata* collected from various locations in Lake Okeechobee over the course of much of the breeding

season (May – September). Using the resulting mass and egg numbers we developed an algorithm that reliably relates clutch mass to the number of eggs in a clutch allowing the estimation of the number of eggs in a clutch without impacting the eggs' viability and paving the way for investigations into studies on fecundity, hatching rate and etc.

Egg masses attached to their original substrate were collected from areas of high density in Lake Okeechobee, suspended by clips in a specially designed carrier and transported to the laboratory. Egg masses were left in the lab for one to two days allowing the plant substrate to dry and shrink. Intact egg masses could then be easily detached from their substrates. Upon weighing, the egg masses were assigned a number and placed in small plastic beakers with enough 1.0 M NaOH to cover the eggs. The beakers were then covered with parafilm to avoid excessive evaporation and placed on a rotary shaker table to speed up the disaggregation process.

Complete disaggregation took place within a week or less. After disaggregation, the free floating eggs were transferred to a sieve and rinsed with DI water. Eggs were then transferred to a flat translucent dish and photographed using a digital camera. Counting of the egg masses was accomplished using Image J® software, which keeps a running tally as the counter marks each egg in the field of view. To ensure the reliability of the counting method, a subsample of the clutches were counted by 3 individuals and the counts were compared for accuracy.

Regression analysis of the log transformed data resulted in an r^2 of 0.85 and a linear equation of the form y = 1.0079x + 2.4441 which can now be used to estimate egg numbers for *P. maculata* clutches by their mass, without destroying the integrity and viability of the clutch (Figure 1).

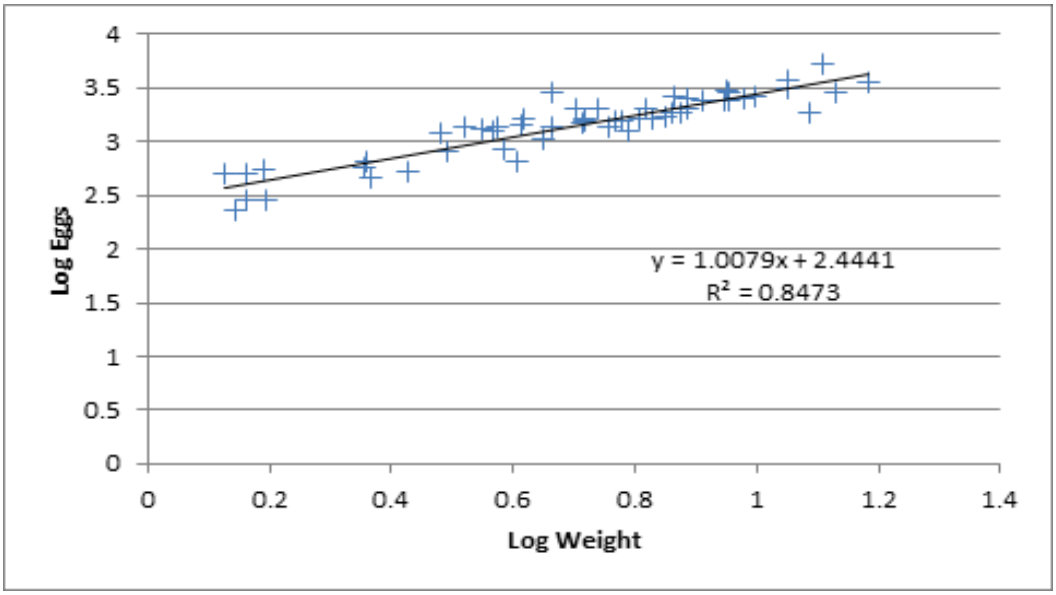


Figure 1. Regression analysis of egg mass weights and egg numbers for *P. maculata* collected from May to September in Lake Okeechobee.

DETERMINING CONSUMPTION BEHAVIOR OF *POMACEA MACULATA* ON *VALLISNERIA AMERICANA*

Adriana Olavarria
Florida Atlantic University, Boca Raton, FL

Pomacea maculata is invading Florida's freshwater ecosystems. *P. maculata* is potentially competing with native *Pomacea paludosa*. However very little work has looked at the consumption behavior to *Vallisneria americana*. *V. Americana,* a restoration plant used by resource managers provides important habitat to nursery species. This study examines *P. maculata* and *P. paludosa's* rate of physical, herbivory, and total damage on *V. americana.* Our results show *P. maculata* and *P. paludosa w*ith an average rate of physical damage of 2.5 cm/hr and 1.2 cm/hr, herbivory rates of 1.8 cm/hr and 0.2 cm/hr and total physical damage rates of 4.2 cm/hr and 1.4 cm/hr respectively; and with t-values of 0.180, 0.006, and 0.024 for each study respectively. This study illustrates *P. maculata* is statistically significant compared to *P. paludosa* herbivory, and total damage rates but not physical damage. Resource managers need to consider these higher rates when planning to use *V. Americana.*

POMACEA MACULATA SPATIO-TEMPORAL INVASION TRAJECTORY AGENT-BASED MODEL WITHIN A LARGE FRESHWATER MANAGED SYSTEM

Dean Monette[1], *Scott Markwith*[1], *Richard Salter*[2], *Sharon Ewe*[1]
[1]Florida Atlantic University, Boca Raton, FL
[2]Oberlin College, Oberlin, OH

Invasive species spatio-temporal models are becoming an important tool for resource managers in predicting invasion trends and their potential impacts. Determining the abiotic and biotic factors or factor influencing animal distributions over a temporal scale is critical for model accuracy and predictive capabilities. Understanding how these determinants differ at various scales can provide insight to species movement patterns responding to natural or anthropogenic change events at local and landscape level. This variation between spatial scales is an important component in understanding gaps or linkages in a model's performance. This multi-scale approach in model develop provides a framework for the exchange of environmental parameters for analyzing temporal species occurrence patterns. Spatio-temporal models are designed to incorporate these datasets of changing abiotic and biotic parameters allowing managers to predict and identify exotic invasion locations by manipulating these environmental parameters. The aim of this paper is to introduce a spatio-temporal agent based model using Nova Software Platform that integrates known factors influencing spatial patterns with associated environmental parameters for analyzing *Pomacea maculata* spatial distributions in a large freshwater managed system.

AN ASSESSMENT OF SUBMERSION AS A MECHANICAL CONTROL TECHNIQUE OF *POMACEA INSULARUM* EGGS IN SOUTHERN FLORIDA, USA

April S. Ostrom[1] and Thomas C. Chesnes[2]
[1]South Florida Water Management District, West Palm Beach, FL
[2]Palm Beach Atlantic University, Department of Biology, West Palm Beach, FL

Pomacea insularum is a freshwater snail native to various regions of South America. In the 1990's invasive populations of *P. insularum* began to establish in Texas, Florida, and Georgia. These snails have a high fecundity rate and feed on macrophytes. Water bodies in southern Florida undergo frequent fluctuations in water levels; most are controlled by pumps, culverts, gates and levees. A proposed control method for these snails is the inundation of the egg clutches. This study compared the hatching success of unsubmerged egg clutches with the hatching success of partially submerged egg clutches, the growth rates of snails hatched in the treatments, and determined if snails hatched in submerged conditions are viable to a shell length that exceeds 25 mm, a size typically capable of reproduction. Hatchling success was not significantly different amongst treatments; likewise, growth rates were similar despite inundation. *Pomacea insularum* egg clutches submerged at various times during their incubation can become detached from the vegetation and sink or float. Floating egg clutches can be transported through water control structures and canals, thus facilitating the spread to non-impacted areas. Manual methods for removal of egg clutches and adults may prove more effective in control efforts.

Session B1: Florida Water Resource Monitoring

Moderator: Kate Muldoon, Florida Department of Environmental Protection
Wednesday, June 18, 10:30 am to 12:10 pm – Elliott Amphitheater

CENTRAL FLORIDA WATER INITIATIVE

Janet G. Llewellyn
Florida Department of Environmental Protection, Tallahassee, FL

The Central Florida Water Initiative (CFWI) is a collaborative effort by the Department of Environmental Protection, the St. Johns River, Southwest Florida and South Florida Water Management Districts, the Florida Department of Agriculture and Consumer Services, area utilities and other stakeholders to address current and long-term water supply needs in a five-county area of central Florida where the three districts' boundaries meet. Historically, the Floridan aquifer system has supplied the vast majority of fresh water used in this area, but sustainable withdrawal limits are being reached or exceeded in some locations. Demand projections in the CFWI area for 2010-2035 predict a 40 percent demand increase to about 1,100 mgd. Public water supply demands constitute two thirds of this total projected increase. The CFWI process has determined that the Upper Floridan Aquifer in the CFWI area has a sustainable groundwater withdrawal limit of 850 mgd. To meet the projected demands through 2035, an additional 250 mgd will be needed from alternative water supply or non-traditional groundwater sources. The CFWI process has utilized Steering and Management Committees to guide the work of Technical Teams consisting of both agency and stakeholder participants to analyze water resource conditions, develop modeling tools, and formulate a draft regional water supply plan. During 2014, a Solutions Planning Team will build on the Regional Water Supply Plan to further develop water conservation and project alternatives for meeting future water needs and achieving resource recovery, identify potential partnerships to encourage regional interconnects and maximize economies of scale and efficiencies, and identify funding needs and options.

FLORIDA LAKEWATCH IN 2014

Mark V. Hoyer
UF/IFAS, School of Forest Resources and Conservation, Gainesville, FL

Florida LAKEWATCH is a successful volunteer water quality (primarily nutrients, chlorophyll and water clarity) monitoring program. LAKEWATCH started in 1986 following the University of Florida's land-grant ethic of promoting teaching, research, and outreach/extension with the goal of collecting credible data on Florida's aquatic systems. Monitoring with LAKEWATCH volunteers is cost effective sampling, which requires a lower level of Quality Assurance/Quality Control (QA-QC) than is required for setting standards or mitigation by Florida Department of Environmental Protection (FDEP). However, two comparison studies (Canfield et al. 2002, Hoyer et al. 2012; both in Lake and Reservoir Management) have shown that the data collected by volunteers and processed by LAKEWATCH staff are equivalent to data collected and processed by Florida Department of Environmental Protection (FDEP) professionals under strict

QA-QC procedures. These comparison studies allow FDEP to use LAKEWATCH data for the following regulatory decisions:

1. Development and implementation of numeric nutrient criteria for proposed water quality standards in Chapter 62-302, F.A.C.;
2. Impairment assessment of surface waters according to requirements in Chapter 62-303, F.A.C.;
3. Development of Total Maximum Daily Loads; and,
4. Development of Basin Management Action Plans.

Moving forward, LAKEWATCH is increasing interactions and leveraging resources with other UF/IFAS extension programs and is currently cultivating a volunteer groundwater monitoring program called Aquifer Watch.

CHOCTAWHATCHEE BASIN ALLIANCE OF NWF STATE COLLEGE: A SUCCESSFUL COMMUNITY-BASED MODEL FOR WATER RESOURCE MONITORING, EDUCATION, RESTORATION AND RESEARCH

Julie B. Terrell
Choctawhatchee Basin Alliance of NWF State College, Niceville, FL

In early 1996, representatives from FDEP; other municipal government agencies; environmental organizations; and members of the business community met with concerned citizens and elected officials at NWF State College to discuss environmental quality and economic development. The sharing of concerns from participants along with the discussion on philosophies of ecosystem management from the FDEP and Eglin AFB sparked a partnership for sustainable development that is now called the Choctawhatchee Basin Alliance of NWF State College (CBA).

To accomplish its mission to help sustain and provide optimum utilization of the Choctawhatchee Basin watershed, CBA operates four program areas: Monitoring, Education, Restoration, and Research. CBA's four programs will be described, the annual operating budget presented, as well as several quantifiable benefits of each program.

- **Monitoring**: CBA coordinates monitoring to collect base-line data that can be used to assess the ecological health of our water resources. Over 100 water quality stations are sampled monthly; over 100 sea grass sites are ground-truthed from satellite imagery annually; and created oyster reefs are monitoring periodically for recruitment, growth, utilization, and sediment retention.
- **Education:** CBA creates and with the assistance of AmeriCorps presents hands-on science curriculum about our local natural resources in K-12 schools, conducts public workshops that teach homeowners how to be good stewards in our environment, and attends various community events that help educate the local community about the value of our natural resources.
- **Restoration:** CBA restores and protects critical habitat by coordinating various restoration projects that improves storm water treatment, enhances utilization, removes exotic or invasive plants and increases critical habitat throughout the watershed.

- **Research:** CBA coordinates and assists with scientific research projects to collect information to better understand the natural resources within the Choctawhatchee Basin.

WHAT'S IN IT FOR YOU? NEW PRODUCTS FROM THE FLORIDA WATER RESOURCES MONITORING COUNCIL

Kate Muldoon
Florida Dept. of Environmental Protection, Tallahassee, FL

The Florida Water Resources Monitoring Council (FWRMC or Council) is a product-driven council of 21 state, federal, local, and volunteer monitoring entities responsible for water resource monitoring throughout the state. Its most recent products include:

- the statewide Catalog of Florida Monitoring Programs (Water-CAT);
- the Florida Groundwater Level Index;
- a draft statewide long-term monitoring plan for future adverse events.

The above products meet specific goals of the Council, whose mission is to expand knowledge of water resource monitoring activities, increase coordination among monitoring entities, enhance data comparability, and improve consistency of monitoring strategies. The Council, revived in autumn 2011, benefits all monitoring stakeholders during a time of limited resources by leveraging member resources through the combined efforts of the greater monitoring community.

FWRMC's tiered oversight structure includes a central statewide council and five regional councils throughout the state, which facilitates communication among all levels of participants, including local entities. The Council holds quarterly meetings to exchange information about existing monitoring programs and emerging water resource concerns, review workgroup progress, and act on workgroup recommendations.

The Council's ad hoc workgroups develop and vet its products. The Council's Salinity Net workgroup, which coordinates existing ground water monitoring efforts into a statewide salinity monitoring network, authored the Florida Groundwater Level Index. The Catalog workgroup developed Catalog criteria, reviewed numerous atlases, catalogs, and data portals, developed the metadata elements list, and continues working with USF, the Catalog contractor. The Coastal Monitoring Network workgroup is developing a statewide adverse events long-term monitoring plan. Representatives from the Regional Councils also meet to identify, discuss, and elevate key regional issues to the FWRMC.

The Council is currently chaired and staffed by the Florida Dept. of Environmental Protection (FDEP).

ENHANCEMENTS TO THE WATER-CAT: NEXT STEPS FOR A NEW WATER RESOURCE MONITORING TOOL

Jan Allyn
USF Florida Center for Community Design & Research, Tampa, FL

In 2013 USF's Florida Center for Community Design & Research began a project to compile a searchable, spatially-mapped, web-accessible database of water resource monitoring sites within the state of Florida. The resulting "Water-Cat" product is now available for the public, policy makers, and water resource management professionals to use. It allows users to search, visualize and download detailed information about water monitoring efforts now and in the past. Even before the project reached completion, the Florida Center began receiving inquiries about how it could be expanded to include other environmental monitoring efforts besides water quality and hydrology. This presentation outlines the capabilities of the Water-Cat system and puts forward some ideas about how the same approach might be used to provide more visibility for, and facilitate collaboration among, other types of environmental projects.

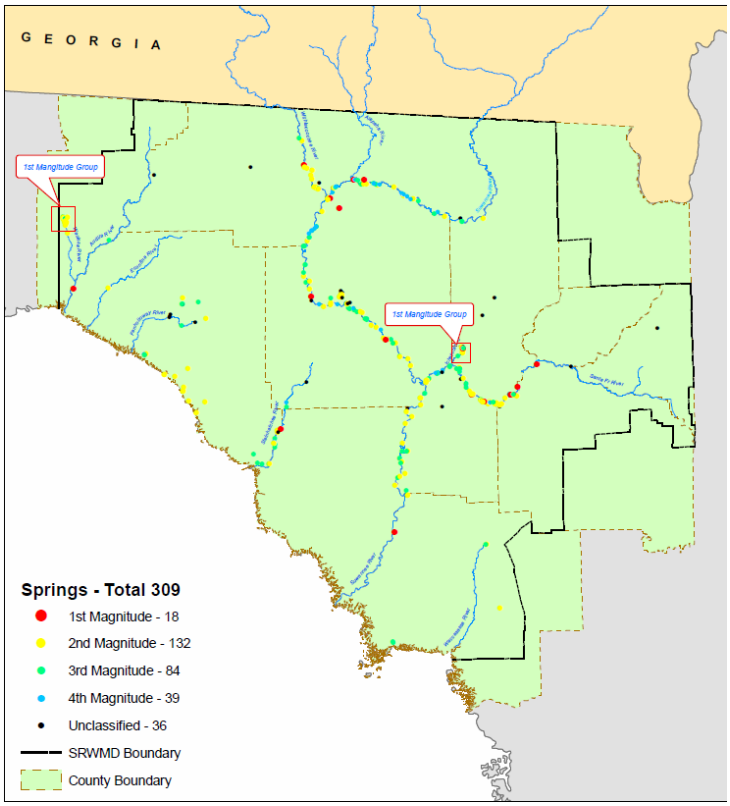
Session A2: Florida Springs Science, Issues and Future

Moderator: Erich Marzolf, Suwannee River Water Management District
Wednesday, June 18, 2:00 pm to 3:25 pm – Salon 1

SPRINGS RESTORATION EFFORTS WITHIN THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT

Erich R. Marzolf, Ph.D. and Ann B. Shortelle, Ph.D.
Suwannee River Water Management District, Live Oak, FL

Springs are among the most visible and prized natural and recreational water resources of the Suwannee River Water Management District (SRWMD). SRWMD has the highest concentration of first magnitude springs in the United States and the highest concentration of springs in Florida. There are 305 known springs within SRWMD. During low flow periods the Suwannee River, Santa Fe River, and Withlacoochee River essentially become spring runs due to substantial groundwater inputs. Other rivers such as the Ichetucknee and Wacissa are primarily spring-fed year round.



The health of Florida springs is challenged by nutrient enrichment, primarily nitrate, and declining discharge. In addition, some springs suffer from disturbance impacts, often related to our recreational use of springs. Elevated nitrate levels have been implicated in ecological changes in some springs, primarily proliferation of filamentous and epiphytic algae. In addition, many Florida springs are experiencing declining discharge with some ceasing to flow completely. The SRWMD is implementing programs and projects to address various threats to springs' health. Utilizing legislation passed last year, the SRWMD requested the Florida Department of Environmental Protection (FDEP) adopt its first minimum flow and levels (MFLs), for the lower Santa Fe and Ichetucknee Rivers and priority springs. FDEP adoption will require multiple water management districts to assess potential cross boundary groundwater level declines and their resulting springflow reductions to these rivers. The District has an aggressive schedule to complete MFLs throughout the District.

The SRWMD is also implementing projects designed to increase aquifer recharge and water storage, often with the ancillary benefit of reducing flooding. These projects involve the hydrologic restoration of

drained areas using simple water control structures. These projects involve both District-owned and private lands. On SRWMD's 31,000 acre Mallory Swamp tract, the restoration has rehydrated wetlands over much of the area and the next phase involves rerouting water from surface drainage canals to aquifer recharge areas. This will benefit water users and springs in the Middle Suwannee region. The SRWMD is also working with private landowners on similar projects that should lessen rapid surface water runoff and increase aquifer recharge.

In addition, the SRWMD and a variety of partners are implementing projects to reduce nutrient loading to springs. These include projects to increase municipal wastewater treatment, cost-share programs to assist agricultural operations retrofit equipment for greater water and nutrient use efficiency and testing novel agricultural better management practices. Utilizing 2013 Legislative appropriations, the SRWMD is working with Lake City and Columbia County to retrofit the City's wastewater sprayfield to a treatment wetland as a means to reduce nitrate loading to the Ichetucknee Springs system. The City's sprayfield is located near the Ichetucknee Trace, an area closely connected via sink holes to the Ichetucknee Springs system. The SRWMD and FDEP's agriculture irrigation retrofit cost-share projects have increased water use efficiency and in some cases conversion to fertigation systems which apply nutrients at a rate closer to the crops' needs and avoid the application of large nutrient loads which are vulnerable to runoff or loss through the root zone via rainfall. The 203 retrofitted irrigation systems will reduce groundwater pumping by 11.65 mgd and reduce nitrogen application by 1.65 million pounds per year. The SRWMD, FDEP and the Florida Department of Agriculture and Consumer Services (FDACS) are working with a local dairy to install an innovative groundwater restoration project. Scavenger wells will supply nitrate enriched groundwater to a denitrifying bioreactor. The treated water will be subsequently recharged back to the aquifer.

The SRWMD is also working with the Florida Geological Survey to delineate springsheds along the Middle Suwannee River, including several first magnitude springs, such as Troy, Lafayette Blue, and Falmouth and second magnitude springs associated with parks, such as Royal, Little River and the Peacock Springs complex. This delineation will aid in focusing future restoration efforts to where they can most effectively benefit springs.

The SRWMD is working with local governments to repair disturbance related harms to a variety of springs. These typically include the removal of eroded sediments from the spring vents and runs and improving access points so our enjoyment of springs does encourage additional erosion. There is ongoing work of this type at Otter, Hart, Wacissa and Charles springs.

FLORIDA SPRINGS AND AQUIFER PROTECTION ACT

Jeff Priddle
Environmental Regulation Consultant, Tallahassee, FL

Each Florida Spring is a unique freshwater resource that provides a "window" into the Floridan Aquifer System (FAS). The FAS is a limestone aquifer that has enormous storage and transmission capacity. Springs exist where flow of groundwater in the FAS is forced out through natural openings in the

ground. An "Outstanding Florida Spring" (OFS) as defined by the Florida Springs and Protection Act (the Act) includes all historic first magnitude springs and six additional springs that are considered of significant recreational and/or environmental importance. OFSs account for 39 of over 700 recognized springs in Florida, and 33 of the 39 OFSs discharge at least 64 million gallons of water per day.

Surface discharge from an OFS is a major source of stream flow into rivers, lakes, and/or bays in the north central region of Florida. Therefore, additional names/terms are identified in the Act to note critical areas of spring recharge and/or spring discharge such as a "spring protection and management zone", "spring run", springshed", and "spring vent". The 2014 Florida Legislature recognized that the quality and quantity of water discharging from OFSs are decreasing and/or being threatened by: (1) polluted surface and storm water runoff caused by under-treated wastewater and sewage, (2) reduced regional groundwater levels in the FAS caused by recent droughts and/or over-pumping, (3) ecological and environmental imbalances caused by surrounding land use and development, and (4) excessive nutrient loading caused by urban and agricultural fertilizer usage.

The Act directs the primary responsibilities for the following entities to work together in a coordinated manner to restore and maintain the water quality and quantity for OFSs. *The Department of Environmental Protection (DEP)* - water quality, *the Water Management Districts (WMD)* - water quantity, *the Department of Agriculture and Consumer Services (DACS)* – development and implementation of best management practices, and *the Department of Health (DOH) and local (county/city) governments* – identify all onsite sewage treatment and disposal systems in the springshed, and provide options for increased waste-water and storm-water management and treatment.

The Act states that DEP and the WMDs must meet certain assessment and restoration timetables. One of the timetables is for the completion by DEP, in coordination with the WMD, of the delineation of a "Spring Protection and Management Zone" (SPMZ) for each OFS prior to July 1, 2015. Where appropriate, more than one SPMZ may be established in a springshed. A SPMZ is a defined area within a springshed where the FAS is vulnerable to sources of contamination or reduced water levels and flow.

Other timetables in the Act state that each WMD shall establish minimum flows and water levels (MFLs) for OFSs in its jurisdiction by July 1, 2015. For those MFLs already determined by July 1, 2014, a revision must be made by the WMD prior to July 1, 2017. The purpose of MFLs is to ensure there is sufficient water to satisfy the allowable consumptive uses without causing significant harm to the resource. The calculations for establishing MFLs by the WMD for an OFS may take into consideration previously recorded seasonal changes in rainfall, changes in type of land use, and changes in water consumption, where appropriate.

The Act states that a total maximum daily load (TMDL) be established for each OFS. The TMDL is the maximum allowable target concentration limit for nitrogen and phosphorus that would restore a spring's discharge to applicable water quality values for nutrients. Elevated nutrient levels in a spring contribute to an overgrowth of algae. The goal of the TMDL is to help prioritize restoration efforts and to alter if possible the water or land use in a springshed, that would help foster a reduction of algae smothering of native plants around the spring and in the spring run. Another timetable in the Act states

that where a TMDL as been adapted by DEP for an OFS prior to July 1, 2014, the DEP, in coordination with the WMD, shall initiate the process for development of a basin management action plan (BMAP).

The Act states that DEP may use other water quality and protection programs for implementation of TMDLs and BMAPs. The TMDL/BMAP development process provides an opportunity for local stakeholders, local government and community leaders, and the general public to collectively determine and share responsibilities in water quality and/or water quantity improvement projects, and any related clean-up goals or timetables. The Act states that a BMAP for an OFS shall be adapted within three years of its initiation and include, at a minimum, the following information:

1. A list of all specific projects identified to implement a nutrient TMDL.
2. A list of all specific projects identified in an onsite sewage and disposal system remediation plan, if applicable.
3. An estimate of each project's nutrient load reduction.
4. A priority rank for each listed project.
5. The estimated cost and completion date for each listed project.
6. The source and amount of financial assistance to be made available by DEP, a WMD, or any other entity.
7. A map depicting the established SPMZ and associated legal description.
8. Identification of each point source or category of nonpoint sources and an estimated allocation of the pollutant load.
9. An implementation plan to achieve the adapted nutrient TMDL within 15 years of adaption of a BMAP.

The Act directs DEP and the WMDs to prepare an Annual "Outstanding Florida Springs" Report. The first report will be submitted by July 1, 2015, to the Governor, President of the Senate, and Speaker of the House of Representatives. The report will include the status of each TMDL, BMAP, MFL and any recovery or preventative strategies adapted during the previous year. In addition the report will include the status of each project identified to achieve a TMDL and/or MFL, as applicable. If the report indicates that any interim 5 or 10 year milestones, or 15 year deadline, will not be met, the report must include specific corrective actions that will be taken to achieve these milestones or deadline.

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT SPRINGS PROTECTION INITIATIVE

Robert A. Mattson
St. Johns River Water Management District, Palatka, FL

Florida's diverse aquatic ecosystems include freshwater springs, and the St. Johns River Water Management District is home to more than 80 springs. These significant natural resources are recognized for their rich history as well as the present-day popularity, however changes in the ecological character of many of Florida's springs has raised a heightened awareness of them. The changes include reduced flow rates, increased levels of nitrate and other solutes, increased biomass and cover of algae and invasive

aquatic plants, decreased abundance of native submerged aquatic vegetation, and changes in fish and invertebrate communities. These changes threaten the ecologic and economic values of the springs and of the surface water ecosystems to which they contribute flow.

The St. Johns River Water Management District has identified the Springs Protection Initiative as a key strategic priority. The initiative will include a multidisciplinary investigation to provide a scientific foundation for development of cost-effective approaches for the management of factors that influence the hydrology, hydrodynamics, physicochemistry, and biology of spring ecosystems. The District has developed a partnership with the University of Florida to support the collaborative effort to address key issues and interactions related to springs and their springsheds. The initiative will combine science, projects, planning and regulatory programs to address reduction of nitrate loading and protection and/or restoration of spring flows.

Session B2: Florida's Numeric Nutrient Criteria

Moderator: Julie Espy, Florida Department of Environmental Protection
Wednesday, June 18, 2:00 pm to 3:25 pm – Elliott Amphitheater

FLORIDA'S NUMERIC NUTRIENT CRITERIA – NOW WHAT?

Scott McClelland
CDM Smith Inc., Tampa, FL

Environmental interests in Florida filed a complaint in the U.S. District Court in July 2008 (amended in January 2009), alleging that the Environmental Protection Agency (EPA) had failed to perform its "non-discretionary duty" to set numeric nutrient criteria (NNC) for Florida according to the Clean Water Act (CWA). In January 2009, EPA issued a determination that, for the state of Florida (and only Florida), new or revised nutrient criteria were necessary to meet the requirements of the CWA. In December 2009, EPA entered into a consent decree with the environmental plaintiffs, requiring EPA to issue draft NNC for flowing streams and lakes in Florida in January 2010 and for estuaries in January 2011. EPA promulgated the criteria in November 2010 with an extended implementation period. After a considerable amount of legal activity and significant interaction with EPA, in June 2012, the Florida Department of Environmental Protection (FDEP) submitted new and revised water quality standards including NNC for streams, lakes, spring vents and some estuaries, which EPA approved in November 2012. In September 2013, FDEP announced EPA's approval of the final set of nutrient criteria for estuaries and confirmed that the state had completed its obligations to EPA in this regard. Most recently, EPA has filed to modify their consent decree from 2009 to confirm that Florida has met the requirements on NNC.

The basic elements of the Florida NNC include a hierarchical consideration of how the narrative criterion (i.e., "not cause an imbalance in natural populations of aquatic flora and fauna") is to be interpreted depending on the situation:

- Highest priority will be given to water bodies with site-specific definitions of nutrient effects – Nutrient TMDLs, Site Specific Alternative Criteria analyses, Water Quality Based Effluent Limits and similar studies (e.g., Reasonable Assurance Plans)
- Second priority will be studies with demonstrated cause and effect relationships (e.g., for springs and lakes)
- Third priority will be related to reference-based thresholds confirmed by biological assessment.

If no other demonstration such as these three can be made, then the narrative applies.

For both Florida lakes and spring boils, clear cause and effect relationships were defined from the available data. For lakes, data identified three categories: colored lakes (greater than 40 platinum cobalt units, or PCU); non-colored lakes with high alkalinity (measured as CaCO3); and non-colored lakes with low alkalinity. The chlorophyll a threshold for colored lakes and non-colored lakes with high alkalinity is 20 µg/l, while, for non-colored lakes with low alkalinity, the threshold is 6 µg/l. The criteria for chlorophyll a, total nitrogen and total phosphorus are expressed as annual geometric means not to be exceeded more than once in three years.

Of particular concern for the regulated community is the application of NNC to streams as well as other waters in Florida that may not be considered "streams" such as man-made ditches. For streams, a decision tree is applied using information about the biological health of the water body as well as the ambient nutrient content: the biological health "trumps" the nutrient content. The rule also defines what a stream is and what it is not; this definition will engender new demonstrations on waters that are not to be considered streams, such as concrete and/or gabion lined ditches used for flood control.

IS YOUR LAKE REALLY IMPAIRED FOR NUTRIENTS?

Jan Mandrup-Poulsen
Dynamic Solutions, LLC, Tallahassee, FL

The Florida Department of Environmental Protection (DEP) has developed over 200 Total Maximum Daily Loads (TMDLs) identifying nutrient reductions needed to restore Florida's surface waterbodies, including 51 that have been adopted for lakes. Together with EPA, the DEP has recently adopted numeric interpretations of its narrative nutrient criteria (NNC) that subsequently will be used to reassess these and other lakes. This presentation will take a closer look at seven of those TMDL lakes, located near each other in the urbanized area just north of Orlando, FL. Insights will be provided as to whether they will pass or fail the NNC, and what affected stakeholders should do based on the outcome. This presentation will also offer a brief overview of the Keep It Simple and Cost Effective (KISCE) approach to deciding which modeling tools may be right for stakeholders facing future TMDL development.

IMPLEMENTATION OF FLORIDA'S NEW NNC: WHERE DOES YOUR WATERBODY FIT IN?

Nia Wellendorf
Florida Department of Environmental Protection, Tallahassee, FL

The Florida Department of Environmental Protection (DEP) developed a hierarchical approach for numeric interpretations (numeric nutrient criteria [NNC]) of its long-standing narrative nutrient criteria in Rule 62-302.530(47b), Florida Administrative Code (F.A.C.), which states that "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna." DEP adopted numeric interpretations for waterbody types with supporting scientific evidence linking nutrient concentrations with adverse biological effects, including lakes, springs, and waters with site-specific nutrient analyses. For streams, DEP adopted nutrient thresholds based on reference streams in five regions of Florida, but assessment of attainment also involves biological assessment of the floral and faunal communities per DEP protocols. The narrative criteria continues to apply to all other waters.

The DEP document "Implementation of Florida's Numeric Nutrient Standards" (Implementation Document) describes the hierarchical approach, which waters are defined as streams under the rule, how to use biological information to assess NNC for streams, and provides examples of various scenarios. The DEP stream and river habitat assessment is used in the determination of whether a flowing waterbody is defined as a stream. The DEP linear vegetation survey, rapid periphyton survey, and stream condition

index are used in conjunction with regional numeric thresholds to determine if streams attain the nutrient standard. Assurance of downstream waters protection is required for attainment of NNC, so evaluations at more than one tier and/or more than one waterbody type is often required.

DEP accepts applications for site specific alternative criteria (SSAC) if it can be demonstrated that there is no imbalance of flora or fauna in a waterbody. Water quality based effluent limits (WQBEL) for nutrients may also serve as site-specific interpretations of the nutrient standard if it is established pursuant to the Level II WQBEL process in Rule 62-650.500, F.A.C., and is publicly noticed as a site specific interpretation of the narrative.

APPLICATION OF THE NUMERIC NUTRIENT CRITERIA TO LAKE, STREAM AND ESTUARY WATER RESOURCE ASSESSMENTS

Jim Griffin and David Eilers
University of South Florida, Tampa Florida, Tampa FL

Background: In 2011 the Water Atlas (www.wateratlas.org) added it first Numeric Nutrient Criteria (NNC) based component as part of the Sarasota County Bay Conditions Report (see Ref. 1). This report estimates the condition of individual bays by comparing the annual mean of bay nutrient data to the bays NNC and to the water quality target for a bay which is set by the Sarasota Bay Estuary Program. This simple approach allows us to develop an annual bay condition report that is easily understood by citizens and approved by the scientific community. This was our first effort to apply the NNC to an actual report of a waterbody's "condition". Figure 1 shows the Water Chemistry Rating for Dona Roberts Bay. The condition is given a rating of "excellent" if the mean value is below both the target (a value set by the Sarasota Bay Estuary Program) and threshold (NNC), a "good" rating if it is between the target and the threshold and a "caution" rating if it is above the threshold.

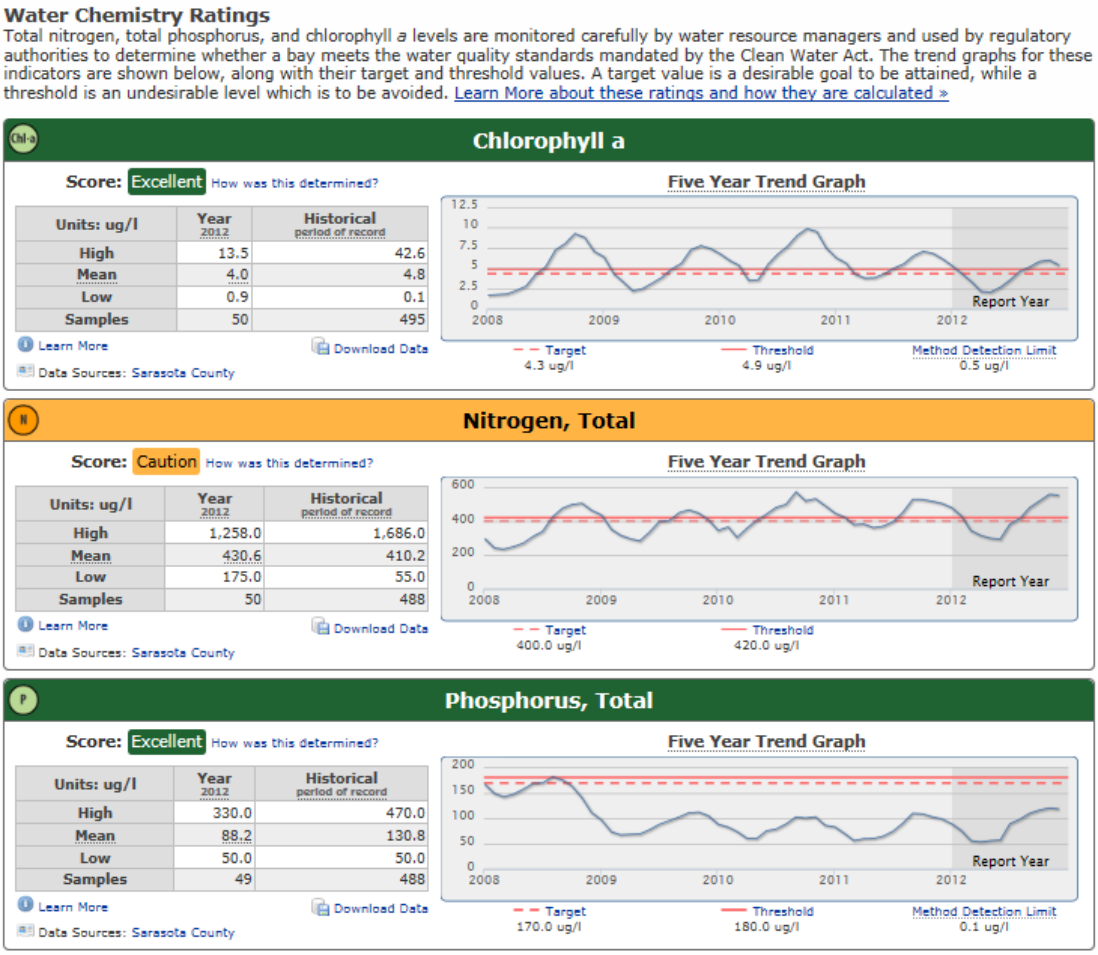


Figure 1. The 2012 Dona Roberts Bay Water Chemistry Rating based on the NNC (Threshold) and the SBEP Target.

Discussion: The Water Atlas program also conducts lake and stream assessments to include the tidal portion of streams. The program began to use the NNC as one of the methods for estimating impairment with the 2012 lake and stream assessments. We continue to use traditional Trophic State Index and Lake Vegetation Index results in our lake assessments and vegetation abundance and the Water Quality Index in our stream assessments, but we now add the NNC as a third water quality index for both type systems. This second application of the NNC rules required extensive data management and data evaluation since the lake and, to some extent, stream NNC rules are more complicated than those used for estuaries' and typically the data that are available for a single lake or stream reach is significantly less than for a well-studied estuary system.

Recently the Water Atlas program has been requested to develop an informatics approach (web-based data and data visualization approach) to tidal and freshwater stream segments in the development of a Creek Condition Report for coastal watershed in Sarasota County and also to develop and informatics approach for the application of NNCs in Lake Condition Reports. These new initiatives have required the program to conduct significant research into the best way to manage nutrient and dissolved oxygen data so that an NNC can be properly applied. As we have done in the Bay Condition Report, we are estimating creek and lake conditions based on the available data and the NNC rule.

Conclusion: The use of informatics components such as those found on the Water Atlas can help scientists and citizens better understand and apply the NNC rules to the evaluation and the understanding of the condition of a water resource. There are still many challenges; however the over three years of experience in the Water Atlas Bay Condition report and lessons learned from our present efforts, leads us to conclude informatics based applications of the NNC are both possible and valuable.

References:

1. http://www.sarasota.wateratlas.usf.edu/coastal/conditions-overview.aspx
2. Florida Administrative Code, Chapter 62-303 Identification of Impaired Surface Waters, p12. (http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf)
3. Florida Numeric Nutrient Criteria History and Status http://www.dep.state.fl.us/water/wqssp/nutrients/docs/fl-nnc-summary-100109.pdf

Session A3: Major Pollutants in Florida Waters

Moderator: James Mihelcic, University of South Florida
Wednesday, June 18, 3:40 pm to 5:20 pm – Salon 1

OVERVIEW OF THE NEW EPA NATIONAL RESEARCH CENTER FOR REINVENTING AGING INFRASTRUCTURE FOR NUTRIENT MANAGEMENT (*RAINMGT*)

James R. Mihelcic, Melissa R. Butcher, Colleen C. Naughton, Emma V. Lopez
Dept. of Civil & Environmental Engineering, University of South Florida, Tampa, FL

Researchers in the University of South Florida's Department of Civil & Environmental Engineering have been awarded a competitive $2.2 million grant by the U.S. Environmental Protection Agency as part of its Science to Achieve Results program to establish the Center for Reinventing Aging Infrastructure for Nutrient Management (*RAINmgt*). This research center will address nutrient inputs from domestic wastewater and stormwater, an issue plaguing our nation's waterways that is critical to the economic and social well-being of current and future residents of Florida.

This talk will provide an overview of the *RAINmgt's* research and demonstration projects. The mission of *RAINmgt* is to achieve sustainable and cost-effective health and environmental outcomes by re-imagining aging coastal urban infrastructure systems for nutrient recovery and management contributing to sustainable and healthy communities. The overall goal is to develop the science behind new technology and management innovations and a deep understanding of the integrated system while demonstrating and assessing these innovations to provide new knowledge for students, community members, and other stakeholders. Systems approaches will allow the center to evaluate and optimize an integrated system of technologies and management strategies. Three research thrusts focus on innovative technologies and strategies in an integrated system that: 1) address point and diffuse sources of nutrients, 2) consider different scales (i.e., household, building, community, city), and 3) prioritize source reduction and reuse. Research Thrusts 1 and 2 develop and demonstrate innovative and sustainable nutrient management technologies and strategies for management of point and non-point sources of nutrients in collaboration with community partners. Research Thrust 3 applies systems and life cycle thinking approaches, and socioeconomic and environmental analyses, to the science and demonstration projects developed in Research Thrusts 1 and 2. Importantly, *RAINmgt* will quantify social, environmental, and economic benefits and costs, and define barriers to implement new technological approaches.

DIFFUSE RELEASE OF NUTRIENTS FROM RESIDENTIAL LAWN MANAGEMENT

Melissa R. Butcher and Dr. James R. Mihelcic
Dept. of Civil & Environmental Engineering, University of South Florida, Tampa, FL

Florida water bodies have historically had problems with water quality, commonly seen in the form of nutrient induced algal blooms. The most common of these pollutants are nitrogen and phosphorus. Once nutrients have entered different types of water bodies at various thresholds, other complications may result such as increased turbidity or oxygen depletion, which is harmful to both aquatic plants and

animals. Improvements in regulations and rulemaking for point source pollution reduction have been successful in recent years. As scientists and engineers tasked with addressing ongoing water quality issues, attention has begun to shift to non-point, or diffuse, pollutant sources such as stormwater runoff. This project aggregates and critically reviews research on nitrogen and phosphorus loadings found in residential stormwater runoff, with a portion addressing the Tampa Bay Estuary. Our work involves attempting to identify socio-demographic and geographic influencing factors (such as household income, use of lawn maintenance services, presence of seasonal fertilizer sales bans, and citizen focused fertilizer application education) on nutrient loading associated with residential stormwater runoff. We hope to identify factors that may directly or indirectly correlate with improvement to water bodies by reducing nutrients in origin waters from diffuse sources. Ultimately this knowledge will aid in quantifying the benefits of various best management practices (BMPs) and low impact development (LID) strategies and technologies.

MANAGING MERCURY CONTAMINATION IN LOCAL WATERS

Ted Lange[1] *, J Mark Higgenbotham*[2] *and David Tyler*[3]
[1]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Eustis, FL
[2]Bureau of Epidemiology, Division of Disease Control and Health Protection,
Florida Department of Health, Tallahassee, FL
[3]Division of Environmental Assessment and Restoration,
Florida Department of Environmental Protection, Tallahassee, FL

Atmospherically derived mercury (Hg) has become a significant water quality problem in Florida fresh, estuarine, and coastal waters. Of relevance to lake managers is the fact that methyl-mercury (meHg) integrates into aquatic food webs, reaching levels in predatory fish that pose ecological and human health risks. Decades-long research and monitoring efforts have led to some understanding of the distribution of, and causes for, high meHg in biota; consumed by humans and wildlife and ultimately to fish consumption advisories to protect consumers from potential health threats, particularly from consumption of sport-fish. Since 1983, the Florida Fish and Wildlife Conservation Commission (FWC), the Florida Department of Environmental Protection (DEP), and the Florida Department of Health (DOH) have been actively investigating the occurrence of mercury in Florida's freshwater and marine environments. Current management of the Hg water quality problem include 1) development of a mercury Total Maximum Daily Load (TMDL) for state fresh waters, 2) development of a Gulf of Mexico TMDL, and 3) public health messages that provide for safe use of fishery resources in state waters (i.e. Fish Consumption Advisories). Management is based on obtaining detailed scientific knowledge about the environmental behavior of mercury, coupled with identification of at-risk groups so that appropriate fish consumption advice can be promulgated. In order for managers to better understand the management implications of mercury in local fisheries, various monitoring programs related to mercury will be discussed with emphasis on sources, distribution and human risk due to consumption of fish from fresh waters.

BIOACCUMULATION OF ALUMINUM IN THE FLORIDA APPLE SNAIL *POMACEA PALUDOSA*

Bruce Sharfstein[1] *and Rachael Pierce*[2]
[1]South Florida Water Management District, West Palm Beach, FL
[2]U.S. Fish and Wildlife Service, East Lansing, MI

Native Florida apple snails (*Pomacea paludosa*) were cultured in a rehydrated wetland receiving flow from an alum based nutrient abatement treatment facility which resulted in water in the wetland having mean elevated total aluminum concentrations of 240 g/L and deposited aluminum floc on underwater surfaces on the order of 120 kg/hectare under conditions of circumneutral pH; probably rendering the aluminum relatively insoluble. Snails were found to have accumulated dry, soft tissue aluminum loads in excess of 100 mg/kg total aluminum compared to control snails collected from various locations which had dry soft tissue aluminum loads ranging from 4.56 to 60 mg/kg. Aluminum concentrations in snails in the experimental wetland appeared to increase with length of exposure, despite the older snails having been rinsed with deionized water prior to analysis; although the difference was not statistically significant (Figure 1).

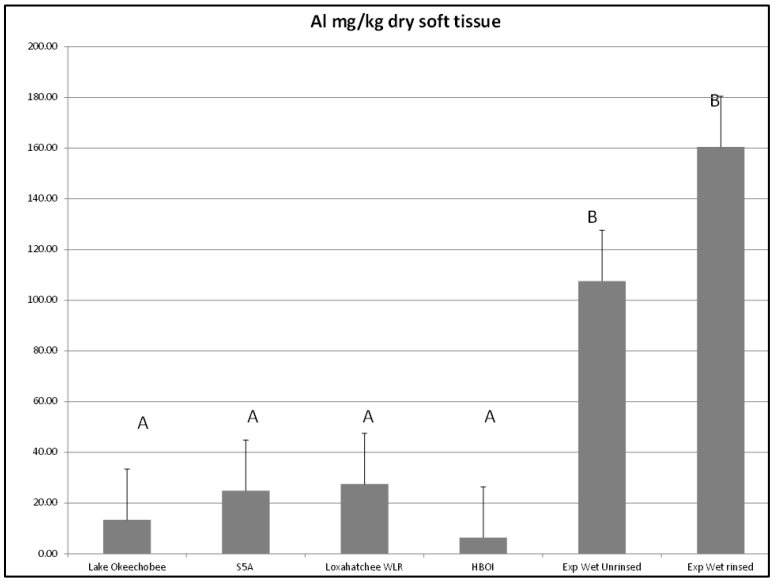


Figure 1. Snail dry soft tissue aluminum content for the 4 reference sites; Lake Okeechobee, S5A, Loxahatchee Wildlife Refuge and HBOI, and the experimental wetland. Letters over the bars reflect statistical relationship between values according to the Tukey pairwise comparison test.

Analysis of egg clutches, and comparative clutch size and hatching rate measurements from snails with elevated tissue aluminum concentrations and control populations indicated that aluminum was not transferred to reproductive products and appeared to have no impact on apple snail fecundity, at least in the first generation (Table 1).

Table 1. Rate of Egg Laying, Clutch Size, and Hatchability for *Pomacea paludosa* reared in the experimental wetland, in the wild, and at the Harbor Brach Oceanographic Institute's intensive apple snail rearing facility.

Location	Clutches/Female/Week	Eggs/Clutch	Hatch Rate %
Experimental Wetland	0.75-2.0	39 (33-45)	76 (69-85)
HBOI	1.5	44	80.3
Various Wild Populations	NA	25.8[a]	82 (61-89)[b]

Due to the small number of alum-based nutrient abatement projects currently in operation it is highly unlikely that there would be any impacts from the ingestion of snails with elevated aluminum content on the snail kite (*Rostrhamus sociabilis*) or on other species that predate heavily on snails such as the limpkin (*Aramus guarauna*). However, as it is likely that this technology will expand due to its efficacy at dealing with nutrient removal under the flashy conditions characteristic of many watersheds in south Florida, further investigation of this topic, including expansion of the study to include the exotic invasive apple snail *Pomacea maculata* which appears to be overtaking native populations in much of their range, is probably warranted.

USING SEDIMENT CORE DATA TO ESTABLISH LAKE MANAGEMENT TARGETS FOR PHOSPHORUS LOADING

William F Kenney[1], Thomas J Whitmore[2], Jason H Curtis[3], David G Buck[4] and Mark Brenner[1, 3]
[1]Land Use and Environmental Change Institute, University of Florida, Gainesville, FL
[2]Department of Biological Sciences, University of South Florida, St. Petersburg, FL
[3]Department of Geological Sciences, University of Florida, Gainesville, FL
[4]Biodiversity Research Institute, Gorham, ME

Many shallow lakes in Florida that have abundant algae and turbid water are perceived as impaired. Reduction of external phosphorus loading is often considered as one component of a strategy to manage such lakes to a more desirable, clear-water state. But how can the target, external phosphorus-loading value be determined? We developed an approach that uses comprehensive sediment mapping and analysis of sediment cores to identify the target phosphorus-loading rate for Lake Lochloosa, FL. Our approach utilizes the inventory of bulk sediments in the lake, along with analyses of total phosphorus, sediment accumulation rates and a specialized interpretation of algal microfossils (diatoms) to estimate past water quality. Individual cores accurately reflect the phosphorus loading history of the lake, but analysis of multiple cores was necessary to precisely identify the target phosphorus-loading rate. Our results compare favorably with estimates derived from alternative approaches applied to other shallow Florida lakes. Overall, these estimates are consistent with the fundamental concept that a lake's flushing rate largely dictates the target phosphorus-loading rate. Shallow Florida lakes that flush about once a year have a target P-loading rate of ~100 kg P km^{-2} yr^{-1}. Lakes that flush more rapidly, in less than a month, have a target-loading rate of ~1,000 kg P km^{-2} yr^{-1}. Considering that the total atmospheric deposition of phosphorus in Florida ranges between 20 and 80 kg P km^{-2} yr^{-1}, some lakes may receive almost

all-of-the target-loading rate from direct atmospheric fallout. Atmospheric fallout to the lake's drainage basin can augment phosphorus loading from direct fallout onto the lake. Depending on the amount of atmospheric phosphorus loading, relative to the target phosphorus-loading rate, management of Lake Lochloosa and other shallow Florida lakes, to achieve the desired clear-water state, may prove to be difficult.

Session B3: Urban Pond Management

Moderator: Serge Thomas, Florida Gulf Coast University
Wednesday, June 18, 3:40 pm to 5:20 pm – Elliott Amphitheater

STORMWATER PONDS: THOUSANDS OF TICKING TIME BOMBS FOR WATER QUALITY IN SOUTHWEST FLORIDA

Serge Thomas
Florida Gulf Coast University, Fort Myers, FL

The thousands of the 10,000 wet stormwater ponds in Lee and Collier counties were built in association with urban developments. Ponds indeed regulate downstream freshwater deliveries and retain about 80% of the pollutants. Runoffs are thus detained in the pond during the dry season and escape from it through the outfall box during the rainy season. Pollutants such as nutrients (mainly phosphorus and nitrogen) are absorbed by the algae/aquatic plants which additionally filter out particulates (e.g. silts, clays, metals). Particulates also physically settle by gravity on the pond's bed. However, ponds morphed into real estate appealing convoluted lakes surrounded by excessively fertilized lawns. Excessive (reclaimed) watering, nutrients and sometimes grass clippings subsequently finish up in the lakes which inexorably trigger recurrent (toxic) algal/submerged aquatic vegetation blooms. In the most severe cases oxygen depletion, H_2S release and fish kills occur. Blooms are treated with mainly copper based chemicals to clear the water but they also adversely impact the predators of algae/plants so that lakes become reliant on chemicals to remain clear. These dysfunctional lakes thus release nutrients and chemicals to the downstream hydrosystems which become impacted too. Nutrients and copper are also stored in the lake sediment for long-term pollution. Our research shows that fixing the problem should ideally involve pond sediment dredging. However, when dredging is evaluated, sediment analysis shows e.g. metals at toxic concentrations which render the sediment unsafe to dispose inexpensively. Aerators are thus currently used as an alternative to dredging through the oxidation of the organic sediment. However such a digestion releases nutrients as well as help the diffusion of copper to the water column which are exported to the natural downstream ecosystems.

ASSESSMENT OF AQUATIC RESOURCES IN THE TOWN OF MIAMI LAKES, FLORIDA USA

Leonard J. Scinto, Ph.D.[1], Serge Thomas, Ph.D.[2]
[1]Southeast Environmental Research Center, Department of Earth and Environment.
Florida International University, Miami, FL
[2]Florida Gulf Coast University, Fort Myers, FL

The Town of Miami Lakes (TOML) is a community of 27,000 residents located in Miami Dade County, Florida and contains 32 man-made lakes. These lakes were constructed to provide fill material for site development and to hold water for flood control. Lakes range in age from 3 to 45 years and vary in size from 10,000 m^2 to 300,000 m^2. Our objectives were to assess the aquatic resources of TOML especially regarding water quality and ecological health, in an effort to inform recommendations and promote ur-

ban conservation and environmental education. Thirty one (31) lakes were identified, mapped, surveyed, and assessed. Water clarity, physicochemical profiles, sediment characteristics, and water and sediment chemistry was determined using field probes or by laboratory analysis of field-collected samples. Lake morphology, shoreline land-use, and assessments of potential ecological habitats were determined using satellite imagery and bathymetric sampling. The trophic state index (TSI) was determined each lake and showed 87.1% or 27 out of 31 lakes had a trophic status of oligotrophic or mesotrophic. Only 4 lakes (12.9%) were eutrophic. Sediment anoxia was found in 4 of 5 lakes with functioning fountains while all 7 lakes with benthic bubblers had oxic sediments. Currently, each lake is managed by the surrounding property owners and all groups are self-monitored however there is a desire by some members of the community to establish town-wide quality criteria and management plans. Education and consensus building among the affected community are important endeavors to achieve overall satisfaction with a community lake management program.

MANAGING AGING STORMWATER PONDS

Kevin Ripp
Aquafix, Inc., Madison, WI

Many times in treating lakes and ponds we focus on killing what is growing in the water body. This presentation will focus on prevention. That is we will talk about how to use bacterial cultures, and the many different types, and how proper knowledgeable application of the right culture in the right environment will help to lower nutrient loadings. We will focus not only on fixating phosphate but ammonia and other forms of nitrogen.

We also discuss how to use herbicides to kill a plant softly and the importance of getting a thorough degradation of the base cells in the plant to stop its return. In this way we can use less herbicide, slow the return of many aquatic plants and improve the environment through a broad range of natural methods. In Florida we have used this approach to help on algae like Pithophora and Lyngbya and weeds like spike rush. We teach how to use the process on Natural Selection to steer a pond towards a desirable outcome.

Our company is fundamentally a lab and in this lab we grow many species of bacteria, aquatic fungus, algae and aquatic plants. We grow the algae and aquatic plants in order to understand the limiting factors which drive their growth. We use this information to develop mechanisms to naturally help change the environment in which they live.

EXAMINING THE INTERACTIONS BETWEEN WET DETENTION POND WATER AND GROUNDWATER: POTENTIAL IMPLICATIONS FOR STORM WATER TREATMENT (FT. MYERS, SW FL, USA)

Mark Lucius and Serge Thomas
Florida Gulf Coast University, Fort Myers, FL

The use of wet detention ponds as storm water treatment has become a wide spread practice throughout the world. A wet detention pond is a man-made pit used to retain storm water runoff in urban areas and allow it to be purified by biological and chemical processes before releasing the water slowly over time back into the hydrosystem. In southwest Florida, wet detention ponds are extremely prevalent and their use is considered vital to the protection of the area's watershed. Unfortunately, many wet detention ponds in the area become oversaturated with nutrients due to poor maintenance habits and over fertilized landscapes. These hyper-eutrophic ponds no longer work in favor of the health of the watershed, but actually become a source of nutrients themselves, potentially leaching nutrients into downstream systems and the into groundwater. It has been found, however, that even ponds maintained in a healthy manner are becoming nutrient rich. Groundwater seepage may be the cause, adding to the overall nutrient load and affecting the potential water processing ability of these ponds. Little has been done to assess the relationship between these wet detention ponds and ground water. This study sought to evaluate this relationship by employing the use of ground water seepage meters in a pond on Florida Gulf Coast University campus to determine where ground water is interacting with pond water, how it is interacting, at what rates the interaction occurs, and the composition of the groundwater flowing into the pond. Fifteen seepage meters constructed from inverted halves of 55 gallon steel drums were placed evenly spaced at selected depths throughout an unfertilized, relatively new pond located just east of the solar panel field at Florida Gulf Coast University (Ft. Myers, FL). Each meter sealed a 0.27 m2 area of pond bed and was equipped with a siphon emptying into a two liter collection bag filled with 500 ml of deionized water. Measurement of water losses or gains in the collection bag pertained to water flow direction (i.e. pond seepage or groundwater infiltration). Spatial variability over the pond and temporal variations over 24 hour periods were assessed to determine the hydrological relationship between the pond and the groundwater. In addition, nutrient analysis (TP, TN) was performed on samples taken from collection bags with an influx of groundwater to determine if groundwater flow is a significant source of nutrients into the Solar Pond.

ENGAGING HOMEOWNER ASSOCIATIONS TO REDUCE NUTRIENT RUNOFF IN STORMWATER PONDS

Michelle Atkinson[1], Paul Monaghan[2], Emily Ott[2], and Gail Hansen[2]
[1]UF/IFAS Manatee County Extension, Palmetto, FL
[2]UF/IFAS Depart of Agricultural Education and Communication, Gainesville, FL

Community stormwater ponds are important for water quality because of their ecological function, they also serve an aesthetic purpose and increase property value. Homeowners in communities desire a clean look to their stormwater ponds which demands pond managers to utilize short-term solutions like copper sulfate which could create long-term problems for water quality and pond health.

This project, through a community based social market approach, emphasizes that by helping to keep the ponds in good condition with preventive measures like Florida-Friendly Landscaping practices, homeowners are helping the environment and their own property investment. The techniques of social marketing include identifying specific target audiences for behavior change; key secondary audiences that influence behavior; deciding on behaviors to be promoted; reducing the barriers to change; determining the best ways to make change easy and enjoyable and finally, testing effective methods of promotion.

One goal of this project is to encourage homeowners to be more engaged in the health of their ponds, and creating a community advisory board is an excellent guide to doing that. The advisory board is involved with helping to develop strategies to increase homeowner engagement with pond health, helping design strategies to work with homeowners' associations for neighborhood ponds, and helping determine what type of shoreline plantings and buffer zones homeowners would be more receptive to being introduced in their neighborhoods.

The next steps are to develop an education outreach program with four points that we would like to accomplish. First, let homeowners know what the ponds do and how they can be maintained. Second, make sure homeowners are talking to their landscapers about the fertilizer ordinance and how it affects pond health. Third, make sure homeowners know about the fertilizer ordinance and follow it. Lastly, help homeowners become more comfortable with buffer zones and shoreline plantings to help improve pond health.

Session C1: Florida Water Resource Technology and Management – Vegetation

Moderator: Mark Hoyer, University of Florida, LAKEWATCH Program

Thursday, June 19, 9:30 am to 10:50 pm – Salon 1

A WIN-WIN SOLUTION

Donald Schrager
City of Palm Coast, FL

This presentation will demonstrate that this new contracting method proved to be a winning solution for both the City and the contractor. The City of Palm Coast is a planned community that was constructed in the 1970s by ITT community Development Corporation. ITT enhanced many of the natural drainage features to construct the community wide drainage system. The primary feature of this drainage system is made up of 58 miles of freshwater canals. During the 1970s until 2000 maintenance of this extensive system was in the control of a private corporation that took a functional approach to weed control and maintenance, providing service on an as needed basis. In 1999 the City incorporated and, shortly thereafter, the private entity became the City's Engineering and Stormwater Department. For budgeting purposes maintenance of the canals was performed under continuing service contracts at a functional level at a rate of 5 times per year with an option for a sixth application. As population increased and the desire for more aesthetic maintenance was demanded canal maintenance was increased to monthly applications for herbicide, quarterly weed harvesting and structure spraying 3 times per year, with each contract being rebid each year.

In 2010 it became very apparent that this level of service was no longer acceptable to the residents of the City. The three maintenance contracts were combined into one contract. This new contract was changed from a functional/scheduled basis to a performance-based contract. This new contract required no schedule or referenced means and methods to accomplish the level of service outlined by the contract scope. The City experienced a decrease in overall maintenance cost and a raised level of service to its freshwater canal system. The contractor experienced a reduced amount of herbicide used, lowering their costs and a guaranteed three-year contract with the City.

AN ASSESSMENT OF THE RELATIONSHIP BETWEEN SUBMERGED AQUATIC VEGETATION AND WATER CLARITY IN FLORIDA LAKES

Doug Robison, M.S., PWS
Environmental Science Associates (ESA), Tampa, FL

While there is strong anecdotal evidence that submerged aquatic vegetation (SAV) abundance and water clarity in Florida lakes are positively correlated, the relationship between these two variables is likely complex. Numerous studies have suggested that SAV abundance can play an important role in the regulation of water column nutrient and chlorophyll-a concentrations; however, these relationships are not as clearly evident as the relationship between nutrient concentrations and phytoplankton biomass

(Moreno 2010; Bachmann et al. 2002). Furthermore, there is documentation that lakes have changed from a clear water state to a turbid water state (i.e., with a higher concentration of nutrients and suspended solids) when SAV was removed by herbicide treatment (O'Dell et al. 1995) or stocked herbivorous fishes (Scheffer et al. 2001); and that lakes have transitioned from a turbid to a clear water state when planktivorous fishes were removed, triggering increased water level and SAV growth (Ozimek et al. 1990). This paper will summarize the existing literature on the relationship between SAV abundance and water clarity, and discuss likely response mechanisms and feedback loops, with an emphasis on Florida lakes. In addition, the ramifications of these findings on Florida lake management alternatives will be discussed.

HOW DO PLANTS GROWN HYDROPONICALLY CONTROL ALGAE BLOOMS?

Dana L. Dettmar and Dr. Serge Thomas
Florida Gulf Coast University, Fort Myers, FL

Anthropogenic nutrient pollution has been negatively impacting both artificial and natural water bodies by triggering (at times harmful) algal blooms. These blooms are typically controlled by algaecides, which can be injurious to other organisms present, further damaging the system. Cutting of the external supply of nutrients may not be sufficient because internal loading of nutrients that still present in the sediments will most likely still occur. Internal loading of nutrients can be reduced through i) demucking, ii) chemical treatment, and iii) hypolimnetic aeration. However, these practices tend to be expensive. Artificial floating islands (AFIs) are a new type of green technology that is being used to remediate eutrophic systems. Plants are grown hydroponically on a floating mat allowing the roots of the plant to take up nutrients directly from the water column. The nutrients become tied up in the mature plants, which are then harvested to remove the excess nutrients from the system to reduce internal loading. AFIs have been shown to decrease the occurrence of algae blooms. However, nutrient removal performed by these AFIs is limited, therefore, the apparent success of AFIs is not completely understood. Thus, we hypothesize that other mechanisms are involved in controlling algae blooms. The purpose of this study will be to determine whether 1) the roots of the plants grown on these AFIs secrete allelochemicals that suppress the growth of their algal competitors, 2) the roots of the plants harbor beneficial (e.g. denitrifying) bacteria, and 3) the plant roots offer protection for zooplankton that graze on algae. Should these hypotheses be verified, AFIs would prove to be an economical and sustainable practice for treating eutrophic systems.

SEMI-AUTOMATED IDENTIFICATION AND BIOVOLUME ESTIMATION OF PLANKTON USING AN IMAGING FLOW CYTOMETER (FLOWCAM®)

Brandon Rieff[1], *Suzanne DeLorenzo*[2], *Tracy Triplett*[2],
Rachel Sansom[2], *Peter Wolfe*[1], *Harry Nelson*[1]
[1]Fluid Imaging Technologies Scarborough, ME
[2]Clackamas River Water Clackamas, OR

Responding to the need for the "rapid counting and measurement of individual plankton cells in natural populations", researchers at the Bigelow Laboratory for Ocean Sciences in 1999 developed an imaging flow cytometer (FlowCAM) designed specifically to support aquatic microbial research. Fifteen years later, the need for rapid and precise methods that provide a means to better understand plankton community structure and size is of critical importance in developing an understanding of the effects of climatic change on ecosystems, harmful algal blooms, freshwater microbial food webs and more. Here we present an update on recent advances made to the FlowCAM's software that specifically address the image recognition and semi-automated capabilities of the technology for the classification of plankton and estimation of plankton biovolume. Included will be an overview of the methodology along with a review of data from recent studies.

Session C2: Florida Water Resource Technology and Management – Physical & Chemical

Moderator: Brian Catanzaro, Pentair Aquatic Eco-Systems, Inc.
Thursday, June 19, 9:30 am to 11:05 pm – Elliott Amphitheater

INTEGRATING CURRENT COMUNICATION AND DATA COLLECTION TECHNOLOGY INTO MODERN LAKE MANGEMENT

Brian Catanzaro, Jason Harrington, Kelly Santana, and Robert Sheridan
Pentair Aquatic Eco-Systems, Inc. Apopka, FL
Orange County Environmental Protection Division, Orlando, FL

Modern communication technology is changing rapidly and new techniques seem to be developing each year. This advancing technology provides lake managers with powerful new tools to facilitate data collection, transfer, and usability in automated systems. In the past, lake managers would have to spend time in the field collecting water samples from various sites and send them to a lab for processing. Data typically had a lag time before it was useable for a lake manager. Now, with improved water quality sensors, extended duration field deployment with remotely operated equipment is possible. A single platform utilizing an output converter allows for the use of multiple probes with different communication protocols for collecting data. The data can then be transmitted wirelessly from a remote solar powered station to a programmable logic controller (PLC) that interprets the information. Real time data allows a PLC to make system adjustments as needed to maintain predetermined conditions and record exact water quality responses. This technology is particularly useful when trying to maintain specific water quality parameters such as pH, dissolved oxygen, or total phosphorus.

Real time data acquisition and storage is now accessible through cloud based systems. Advancements in internet, cellular, or satellite communication technology allows us to remotely operate and control multiple PLC's and related devices from a desktop pc or even a smart phone. This eliminates the need to spend unnecessary time in the field to make complex system adjustments or data transfers. The ability to easily access historical and real time data simultaneously allows a lake manager to compare current operational considerations with historical system performance. The data collection, communication, and automation abilities currently available allow the lake manager to implement strategies in countless new ways.

POTENTIAL APPLICATIONS FOR PHOSPHORUS REMOVAL & RECOVERY FROM FRESHWATER NON-POINT SOURCES

Edward Weinberg
ESSRE Consulting, Inc., Richboro, PA

Nutrient pollution continues to be one of the top causes of degradation in impaired watersheds. Pathways of phosphorus sources to surface waters include wastewater treatment plants (point sources),

stormwater and livestock and farm runoffs (non-point sources) where phosphate runoff into rivers, lakes and other fresh water reservoirs can lead to algae blooms and eutrophication.

The present work describes research upcoming field demonstrations that apply high surface area nano-materials for the enhanced chemical removal and recovery of dissolved phosphate via adsorption and ion exchange mechanisms. Two nanomaterials are discussed: (1) novel Synanomet nanocomposites invented and synthesized by the UALR Nanotechnology Center Little Rock AR: (2) commercially available MetaMateria - Phosphate Red. These nano-adsorbents are adaptable for point source or non-point source nutrient pollutant control.

The nano iron oxides used in these nano-adsorbents are regenerable via a weak caustic rinse and regeneration to "fresh" material not only lowers operating costs, it also provides a "rich" phosphate fertilizer solution for sustainable reuse of finite resourced P nutrient. In a sense, the nanotechnology has the potential to restore impaired watersheds and the natural "P" cycle.

The upcoming applications are diverse nutrient pollutant overload scenarios: (1) phosphorus removal and recovery at a horse farm small pond and drainage ditch in Maryland, (2) the enhancement of Floating Island™ technologies applied in a wastewater treatment lagoon to simulate P overloads in River Lee, London, and (3) deployment in an expanded constructed wetlands at Grand Lake St. Mary's, Ohio. The features/benefits of novel high surface area adsorbents are presented.

The widespread application of nano-based, disruptive technology for all sources of pollutant P control will help restore impaired local lakes and reduce nutrient pollution of local Florida streams that source these nutrient impaired water bodies.

ANNA RIVER CULVERT REPLACEMENT PROJECT: SEDIMENT CONTROL USING POLYMER ENHANCED BEST MANAGEMENT PRATICES

Seva Iwinski
Applied Polymer Systems, Woodstock, GA

The Anna River culvert replacement project demonstrates the combination of multiple polymer enhanced BMPs working simultaneously to reduce any environmental impacts. This passive treatment system proved to be environmentally friendly while also being cost and time effective. The Anna River culvert replacement project took place in the fall of 2010 in the Upper Peninsula of Michigan. The Anna River is a 7.1 mile long river located within Alger County which is just southeast of the city of Munising. There was concern that an old metal culvert would collapse and bury the Anna River due to its poor rusted condition. This project was both time and environmentally sensitive due to a live salmon stream running through the culvert and the culvert being the only access for homeowners on Perch Lake and for loggers in the area.

The Alger County Conservation District chose to use anionic water soluble polyacrylamides in conjunction with current Best Management Practices (BMPs) to control the inevitable sediment and turbidity caused by construction. Anionic polymer enhanced BMPs were put in place both downstream and on

site while a diversion channel was created to isolate the culvert during replacement. This controlled erosion and sedimentation while ensuring the capture of any turbidity escaping into the river. The Anna River culvert replacement was completed within five days and had no impact on the salmon run. The polymer enhanced BMP's that were implemented for stabilization held through the winter and there was no erosion or sedimentation during the spring.

CHANGES IN SEDIMENT P SPECIATION RESULTING FROM ALUM SEDIMENT INACTIVATION IN CENTRAL FLORIDA LAKES

Harvey H. Harper
Environmental Research & Design, Inc. (ERD), Orlando, FL

During 2011-2013, alum sediment inactivation projects were completed on 3 urban lakes in Central Florida, including Lake Holden (266 ac.), Lake Pineloch (66 ac.), and Lake Jessamine (292 ac.). Dosage calculations were based on total available sediment P determined using a sequential speciation procedure which divides sediment P into saloid (soluble + easily exchangeable), iron-bound, aluminum-bound, calcium bound, and recalcitrant organic P. Total available P is assumed to be the sum of the saloid and iron-bound P fractions. Pre-treatment sediment core samples were collected at 45 sites in Lake Holden, 30 sites in Lake Pineloch, and 45 sites in Lake Jessamine, and the 0-10 cm layer was sectioned off for speciation. The aluminum dose was calculated using an Al:available P ratio of 5:1 in Lake Holden and 10:1 ratios in Lakes Pineloch and Jessamine, resulting in areal dosage rates of 54.7 g Al/m^2 in Lake Holden, 60.0 g Al/m^2 in Lake Pineloch, and 65.0 g Al/m^2 in Lake Jessamine. Each of the treatments was conducted using multiple applications spread out over a 2-5 year period. Approximately 3-6 months following the final application, post treatment sediment core samples were collected at each of the pre-treatment monitoring sites and evaluated for sediment P speciation. Available sediment P was decreased by 78-87% in the 3 lakes, with higher reductions at the 10:1 Al:P ratio, while aluminum-bound sediment P increased from 74-85%. Each of the treatments was successful in reducing available forms of sediment P and increasing bonding with aluminum.

ALTAMONTE FDOT INTEGRATED REUSE AND STORMWATER TREATMENT A-FIRST - A PROJECT OVERVIEW

Danielle Marshall, Ed Torres, Chris Rader
City of Altamonte Springs, Public Works and Utilities

Altamonte-FDOT Integrated Reuse and Stormwater Treatment (A-FIRST) is the first partnership of its kind in Florida. The project combines traditional alternative water supply measures with innovative approaches to stormwater management for a highly urbanized area and a major FDOT highway project (the Interstate 4 widening project). Over 4.5 MGD of alternative water supply will be created in the planning horizon by 1) transmitting excess reclaimed water from the Altamonte Springs Regional Water Reclamation Facility (also known as project Apricot) and by 2) collecting, treating, and reusing stormwater generated from Cranes Roost (a landlocked basin with pumped discharge) and from impervious areas associated with the Interstate 4 widening project. The overall project results in 4.5 MGD of alter-

native water supply and a substantial pollutant load reduction to the Little Wekiva River; 28,043 lbs/yr of TP and 62,659 lbs/yr of TN. Some of the project benefits include:

- Alleviates unmet water supply demands in west Central Florida (Apopka area)
- Substantially reduces groundwater augmentation pumping of reclaimed water in Apopka and Altamonte Springs springshed which will benefit spring flows
- Significantly reduces nutrient loading from non-point (surface waters/Cranes Roost) and point sources (RWRF) to the Little Wekiva River
- Addresses national NNC and TMDLs as well as the State's regional Wekiva Parkway Protection Act goals for the area
- Addresses stormwater treatment needs for Interstate 4 in Altamonte Springs

PRESENTER CONTACT INFORMATION
2014 FLORIDA LAKE MANAGEMENT SOCIETY 25TH ANNUAL SYMPOSIUM

PRESENTER	AFFILIATION	EMAIL ADDRESS
Allyn, Jan	University of South Florida	janallyn@usf.edu
Atkinson, Michelle	UF/IFAS Extension, Manatee County	michelleatkinson@ufl.edu
Baranski, Michael	Southwest Florida Water Management District	mbaransk@sfwmd.gov
Barker, Virginia	Brevard County	virginia.barker@brevardcounty.us
Bigham, Dana	University of Florida	dlbigham@ufl.edu
Britt, Mike	City of Winter Haven	mbritt@mywinterhaven.com
Butcher, Melissa	University of South Florida	mbutcher@mail.usf.edu
Cantaloube, Mike	Florida Atlantic University	mcantalo@gmail.com
Caple, Zachary	University of California Santa Cruz	zcaple@ucsc.edu
Catanzaro, Brian	Pentair Aquatic Eco-Systems	brian.catanzaro@pentair.com
Chapman, Andrew	Greenwater Technologies/CyanoLab	achapman@greenwaterlab.com
Davis, Dawn	University of Florida	dawnkdavis@ufl.edu
Dettmar, Dana	Florida Gulf Coast University	ddettmar24@gmail.com
Duarte, Sergio	Orange County	sergio.duarte@ocfl.net
Espy, Julie	Florida Department of Environmental Protection	julie.espy@dep.state.fl.us
Flower, Kaitlynn	University of Florida	kaitlynflower@ufl.edu
Griffin, Jim	University of South Florida	jimgriffin@usf.edu
Harper, Harvey	Environmental Research & Design (ERD)	hharper@erd.org
Hoyer, Mark	University of Florida	mvhoyer@ufl.edu
Hudnell, Kenneth	Medora Corp.	ken.hudnell@medoraco.com
Iwinski, Seva	Applied Polymer Systems	info@siltstop.com
Kaplan, David	University of Florida	david.kaplan@ufl.edu
Kelly, Marty	Southwest Florida Water Management District	martykellyvrod@yahoo.com
Kenney, William	University of Florida	kenney@ufl.edu
King, Sean	South West Florida Water Management District	sean.king@swfwmd.state.fl.us
Lange, Ted	Florida Fish and Wildlife Conservation Commission	ted.lange@myfwc.com
Lasi, Margaret A.	St. Johns River Water Management District	mlasi@sjrwmd.com
Llewellyn, Janet	Florida Department of Environmental Protection	janet.llewellyn@dep.state.fl.us
Lucius, Mark	Florida Gulf Coast University	malucius1786@eagle.fgcu.edu
Lumbard, Lance	AMEC	lance.lumbard@amec.com
Mandrup-Poulsen, Jan	Dynamic Solutions	jmandrup-poulsen@dsllc.com
Marshall, Danielle	City of Altamonte Springs	dmarshall@altamonte.org
Marzolf, Erich	Suwanee River Water Management District	erm@srwmd.org
Marzolf, Nick	University of Georgia	nmarzolf@uga.edu

PRESENTER	AFFILIATION	EMAIL ADDRESS
Mattson, Robert	St. Johns River Water Management District	rmattson@sjrwmd.com
McClelland, Scott	CDM Smith	mcclellandsi@cdmsmith.com
Mihelcic, James	University of South Florida	jm41@usf.edu
Monette, Dean	Florida Atlantic University	dmonette@my.fau.edu
Morrison, Gerold	AMEC	gerold.morrison@amec.com
Muldoon, Kate	Florida Department of Environmental Protection	kathryn.muldoon@dep.state.fl.us
Olavarria, Adriana	Florida Atlantic University	aolavar2@my.fau.edu
Ostrom, April	South Florida Water Management District	aostrom@sfwmd.gov
Poor, Noreen	University of South Florida	npoor@usf.edu
Priddle, Jeff	Environmental regulation consultant	ercfla@live.com
Rainer, Kenneth	Guana Tolomato Nat'l. Estuarine Research Reserve	kenneth.rainer@dep.state.fl.us
Rieff, Brandon	Fluid Imaging Technologies Inc.	brandon.rieff@fluidimaging.com
Ripp, Kevin	Aquafix, Inc	bugman@teamaquafix.com
Robison, Doug	Environmental Science Associates (ESA)	drobison@esassoc.com
Sagan, Jennifer	AMEC	jennifer.sagan@amec.com
Scinto, Leonard	Florida International University	scintol@fiu.edu
Sharfstein, Bruce	South Florida Water Management District	bsharfs@sfwmd.gov
Shrager, Donald	City of Palm Coast	dschrager@palmcoastgov.com
Souto, Leesa	Marine Resources Council of East Florida	leesa@mrcirl.org
Srifa, Akeapot	University of Florida	asrifa@ufl.edu
Terrell, Julie	Northwest Florida State College	terrellj@nwfsc.edu
Thomas, Serge	Florida Gulf Coast University	sethomas@fgcu.edu
Tomasko, David	Environmental Science Associates (ESA)	dtomasko@esassoc.com
Watkins, Lauren	Florida Park Service	lauren.watkins@dep.state.fl.us
Weaver, Robert	Florida Institute of Technology	rjweaver@fit.edu
Weinberg, Edward	ESSRE Consulting, Inc.	edweinberg_essre@verizon.net
Wellendorf, Nia	Florida Department of Environmental Protection	nijole.wellendorf@dep.state.fl.us
Wetzel, Shannon	Seminole County	swetzel@seminolecountyfl.gov

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