Florida Lake Management Society
27th Annual Technical Symposium

June 7-10, 2016
Daytona Beach Shores, Florida

Program Theme: Aquatic Resources in Changing Climates

SYMPOSIUM PROGRAM

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AQUATIC RESOURCES IN CHANGING CLIMATES

June 7-10, 2016

Welcome!

TUESDAY - JUNE 7, 2016 – WORKSHOPS

(Each workshop is eligible for 4 Engineering PDHs)

8:00 AM-5:00 PM	**Check-In and Registration**- Bill France Lobby
8:15 AM-12:15 PM	Morning Workshop 1: **Development and Analysis of Nutrient Budgets for Lakes**. *R. Thomas James, Ph.D., South Florida Water Management District* (River Room, Rooftop)
10:00- 10:15 AM	**Morning Break**
12:15-1:00 PM	**Lunch**
2:45-3:00 PM	**Afternoon Break**
1:00 PM-5:00 PM	**Part I: DEP Measures of Floral Health: Procedures and Uses.** *Nia Wellendorf, Florida Department of Environmental Protection* (Dolphin Room, Second Floor) This workshop is eligible for DACS CEUS: either 4 Private Applicator Ag or 4 Aquatic Weed Control.
1:00 PM- 5:00 PM	Afternoon Workshop 4: **Fish Identification and Sampling Methodologies in Various Habitats**. *John Benton, Florida Fish and Wildlife Conservation Commission and Robert Robins, Florida Museum of Natural History* (River Room, Rooftop)

WEDNESDAY - JUNE 8, 2016 MORNING – SYMPOSIUM

(* - Denotes student paper)
(Wednesday is eligible for 6 Engineering PDHs)

8:00 AM-5:00 PM	**Check-In and Registration** (Bill France Lobby)
7:00 AM-8:30 PM	**Breakfast** (Azure Restaurant)

Opening Program (Richard Petty Ballroom)

8:30-8:45 AM **Welcome & Opening Remarks:** John Walkinshaw, FLMS President
Ron Hart, Symposium Chair

8:45-10:00 AM **Keynote Speaker –** Dr. Robert (Skip) Livingston

Long-term Responses of Aquatic Ecosystems to Changes in Climatological Trends: Ecologists as Original Climate Change Deniers

10:00-10:25 AM	**MORNING BREAK** (Exhibit Hall – Bill France Ballroom)

Track A: Water Resources Science and Technology (Richard Petty Ballroom)

Session A1: Nutrient Reduction and Management

DACS CEUS: either 1.5 Private Applicator Ag or 1.5 Aquatic Weed Control.

Moderator: Harvey Harper

10:25-10:40 AM	Session Introductions -Harvey Harper
10:40-10:55 AM	Effects of Unconsolidated Sediments on Alum Dosage and Buffer Amount Estimates for a Florida Waterbody - Jodi B. Slater
10:55-11:10 AM	Lake Seminole Restoration Efforts-a Multi-Tool Approach to Regulatory Compliance of a Shallow Urban Hypereutrophic Lake - Robert Burnes, Sarah Malone, and Mark Flock
11:10-11:25 AM	Impacts of Application Methods on Longevity of Alum Sediment Inactivation Projects - Harvey Harper
11:25–11:40 AM	A Conceptual Model of Phosphorus Dynamics in Shallow Florida Lakes - William Kenney
11:40-11:55 AM	A Novel, Long-Term Investigation on Sediment P Flux and P Inactivation Techniques in Nutrient - Impacted Everglades Marshes - Forrest Dierberg

WEDNESDAY – JUNE 08, 2016 AFTERNOON

12:00-1:30 PM	Annual Business Luncheon (River Room, Rooftop)

Track B: Climate Changes & Water Resources (Richard Petty Ballroom)

Session B1: Impacts of Climate Change on Florida Water Resources

DACS CEUS: either 1 Private Applicator Ag or 1 Aquatic Weed Control.

Moderator: Sergio Duarte

1:30-1:35 PM	Session Introduction – Sergio Duarte
1:35-1:50 PM	Water Quality Changes at an Outstanding Florida Water: Influence of Stochastic Events and Climate Variability - Mark V. Hoyer
1:50-2:05 PM	The Climate Drivers of Florida's Hydroclimate Variations and Change. Vasu Misra
2:05-2:20 PM	Climate Change in Florida. Sean E. McGlynn
2:20-2:35 PM	Panel Discussion – Sergio Duarte

Track A: Water Resources Science and Technology (Richard Petty Ballroom)

Session A2: Springs and Springshed Restoration Session

DACS CEUS: either 1 Private Applicator Ag or 1 Aquatic Weed Control.

Moderator: Andy Canion

2:35-2:40 PM	Session Introduction –Andy Canion
2:40-2:55 PM	Ichetucknee Springshed Water Quality Improvement Project: Status Report- Sara Miller*
2:55-3:10 PM	Springshed Sleuthing: Tracking Nitrogen with Dissolved Gases and Isotopes- Dean R. Dobberfuhl
3:10-3:25 PM	Submerged Aquatic Vegetation Restoration in Florida Spring Systems: The Kings Bay Revegetation Project - Sean A. King
3:25-3:40 PM	Predicting elevated groundwater nitrate concentrations using random forests and regression kriging in the Silver Springshed, Florida - Andy Canion

AFTERNOON BREAK 3:40-4:00 PM (Exhibit Hall – Bill France Ballroom)

Track A: Water Resources Science and Technology (Richard Petty Ballroom)

Session A3: Lake Fish Habitat and Population Management

DACS CEUS: either 1 Private Applicator Ag or 1 Aquatic Weed Control.

Moderator: John Benton

3:55-4:00 PM	Session Introduction – John Benton
4:00-4:15 PM	Assessing the Influence of Lake Trophic State on Littoral Zone Fish Communities, Dissolved Oxygen Regimes and Habitat Composition - Chris Anderson
4:15-4:30 PM	The FWC's Long-term Monitoring Program in Freshwater Lakes – Ten Years of Standardized Data Collection are Beginning to Pay Dividends - Eric Sawyers
4:30-4:45 PM	Integrating Lake Vegetation Data into FWC's Freshwater Fisheries Long Term Monitoring Program - Kevin Johnson
4:45-5:00 PM	Using Habitat Data and Stakeholder Involvement to Create a Comprehensive Management Plan for Orange Lake - Ryan Hamm
5:00-5:15 PM	FWC Aquatic Habitat Restoration and Enhancement Sub-section - Bruce Jaggers
5:00-5:30 PM	Development of Models Correlating Water Temperatures with Air Temperatures and Seasonal and Limnologic Factors -Earl Lundy

WEDNESDAY – JUNE 08, 2016 EVENING

6:00-8:00 PM	**EXHIBITORS' SOCIAL** (Exhibit Hall – Bill France Ballroom)

6:00-8:00 PM **Session A4: Poster Session** (Exhibit Hall – Bill France Ballroom)

Session Lead: Shannon Wetzel & April Verpoorten

- Creating a Stakeholder Engagement Plan for Orange Lake, Florida - *S. Fay Baird*
- Small-Scale Soil Compositional Differences within D Hooded Pitcher Plant (*Sarracenia minor* Walter) Bog in Central Florida - *E. Renee Moody**
- Monitoring Water Quality Parameters in the Canal Street Canal, New Smyrna Beach, Florida -*Samantha Edel**
- Climate Change Concerns in the Lake Powell Watershed in Bay and Walton Counties - *Richard Bryan*
- Relationship between land use and trophic state parameters in Florida lakes. Chao Xiong*
- A GIS Tracking Project for Detecting Sanitary Sewer Overflows (SSOs) Impacts on Water Bodies - *Zachary Frame, Julie Bortles*
- Stream Condition Index I: Sample Collection - *Ashley Craft, Tina Richards, Marcia Anderson*
- Stream Condition Index II: Sample Processing - *Sarah Parker, Tina Richards, Marcia Anderson*
- Membrane Filtration Technique for Fecal Coliforms - *Romina Lancellotti Rueda, Edna Arroyo*

THURSDAY– JUNE 09, 2016 MORNING

(* - Denotes student paper)
(Thursday is eligible for 5 Engineering PDHs)

8:00 AM-5:00 PM	**Check-In and Registration** (Bill France Lobby)
7:00 AM-8:30 AM	**Breakfast** (Azure Restaurant)

Morning Program (Richard Petty Ballroom)

8:45-9:00 AM	Announcements:	John Walkinshaw, FLMS President
9:00-9:45 AM	Keynote Speaker:	Ann Shortelle, Executive Director St. Johns River Water Management District
9:45-10:00 AM	Question Period	

10:00-10:30 AM	**MORNING BREAK** (Exhibit Hall – Bill France Ballroom)

Program Track A: Water Resources Science and Technology (Richard Petty Ballroom)

Session A5: Lake Okeechobee - Restoration Science and Management

DACS CEUS: either 1.5 Private Applicator Ag or 1.5 Aquatic Weed Control.

Moderator: Sergio Duarte

10:30-10:35 AM	Session Introduction - Sergio Duarte
10:35-10:50 AM	Suspended Solids Affect Recent Phosphorus Trends in Lake Okeechobee - R. Thomas James
10:50-11:05 AM	Istokpoga Marsh – A Hidden Hot Spot for Phosphorus in the Lake Okeechobee Watershed and What is Being Done About It - Clell J. Ford
11:05-11:20 AM	Creating a Water and Nutrient Budget for Lake Trafford, FL, USA - Mark Lucius*
11:20-11:35 AM	Nutrient Budgets of the Kissimmee Chain of Lakes - R. Thomas James
11:35-12:00 PM	Panel Discussion - R. Thomas James

12:00-1:30 PM	**FLMS Annual Awards Luncheon** (River Room, Rooftop)

THURSDAY – JUNE 9, 2016 AFTERNOON

Program Track A: Water Resources Science and Technology Program (Richard Petty Ballroom)

Session A6: Lake Apopka - Restoration Science and Management

DACS CEUS: either 1 Private Applicator Ag or 1 Aquatic Weed Control.

Moderator: Ron Hart

1:30-1:35 PM	Session Introduction - Ron Hart
1:35-1:50 PM	Re-Plumbing Lake Apopka's North Shore: Implications for Water Management and Water Quality - Pam Bowen
1:50-2:05 PM	Strategic Dredging as an Alternative to Assist with Restoration Efforts on Lake Apopka - Lance Lumbard
2:05-2:20 PM	Filtering and Fishing for Phosphorus: Lake Apopka Nutrient Removal Projects - Margaret Q. Guyette
2:20-2:35 PM	Impacts of Reduced Phosphorus Loading and Droughts on Water Quality in Lake Apopka - Michael F. Coveney
2:35-2:50 PM	Panel Discussion - Ron Hart / Lance Lumbard

2:50-3:20 PM	**AFTERNOON BREAK** (Exhibit Hall – Bill France Ballroom)

Track B: Climate Changes & Water Resources (Richard Petty Ballroom)

Session B2: Watershed and Water Resources Management

DACS CEUS: either 1 Private Applicator Ag or 1 Aquatic Weed Control.

Moderator: Sam Arden

3:20-3:25 PM	Session Introduction - Sam Arden
3:25-3:40 PM	A Tale of Two Lakes: How Hydrologic Division Highlights Human Influence on a Large Shallow Lake - Nia Wellendorf
3:40-3:55 PM	Development of a Water Level Recovery Metric for Xeric-Associated Lakes and Wetlands in the Northern Tampa Bay Area - Dan Schmutz
3:55- 4:10 PM	Identification of Potential Lake Management Strategies for Lake Tarpon (Pinellas County) - David Tomasko
4:10-4:25 PM	Beneficial Reuse of Organic Sediments Dredged From Coastal Systems: Bench Scale Desalination Study - Katherine Y. Deliz Quiñones

4:30-5:00 PM	FLMS Board Meeting – Sandpiper Room

FRIDAY – JUNE 10, 2016 MORNING
(Friday is eligible for 3 Engineering PDHs)

8:00 AM-12:00 PM	**Check-In and Registration** (Bill France Lobby)
8:00 AM-9:00 AM	**Breakfast** (Azure Restaurant)

Track B: Climate Changes & Water Resources (Richard Petty Ballroom)

8:45-9:00 AM Announcements: Ron Hart, Incoming FLMS President

Session B3: Aquatic Plants and Harmful Algae Management

DACS CEUS: either 1 Private Applicator Ag or 1 Aquatic Weed Control.

Moderator: John Walkinshaw

9:00-9:05 AM	Session Introduction - John Walkinshaw
9:05-9:20 AM	A Risk-based Decision Matrix for Managing Noxious Algae - West M. Bishop
9:20-9:35 AM	Field Testing a New IPM Approach for Hydrilla Management: Preliminary Results - James P. Cuda
9:35-9:50 AM	EPA Movement toward Cyanotoxin Regulation and Improved Freshwater Management Policy - Steve Beeman
9:50-10:05 AM	Rapid Assessment of Submerged Aquatic Vegetation Communities on a Large 2,500 Acre Lake in West-Central Florida - David Eilers
10:05-10:20 AM	Quantification of Nutrient Assimilative Capacity of Chara (sp.) in a Previously Hypereutrophic Lake in Southwest Florida: Implications for Lake Management - Emily Keenan

10:20-10:40 AM	**MORNING BREAK** (Exhibit Hall – Bill France Ballroom)

Program Track A: Florida Water Resource Technology (Richard Petty Ballroom)

Session A7: NPDES Permit Compliance

DACS CEUS: either 2 Private Applicator Ag or 2 Aquatic Weed Control. (Requires Session A6 AND A7)

Moderator: Shannon Wetzel

10:40-10:45 AM	Session Introduction - Shannon Wetzel
10:45-11:00 AM	Stormwater Program Compliance with NNC: Lessons Learned at the County Level - Shannon Wetzel
11:00-11:15 AM	Designing Public Awareness and Volunteer Programs to Reduce Pollution and Meet NPDES Permit Requirements - Timothy J. Egan
11:15-11:30 AM	How to Improve Water Quality by Mitigating Sediment and Turbidity Impacts Using Anionic PAM Blends - Eddie Snell

Program Track A: Water Resource Science & Technology (Richard Petty Ballroom)

Session A8: Lake and Pond Restoration – Science & Management

Moderator: Patrick Goodwin

11:30-11:35 AM	Session Introduction - Patrick Goodwin
11:35-11:50 PM	Trophic state shifts in Florida's coastal dune lakes - Dana Bigham Stephens
11:50-12:05 PM	Importance of in lake nutrient mitigation and effective approaches- West M. Bishop
12:05-12:20 PM	Providing a Natural Habitat for Wildlife in a Stormwater Pond Situated in an Urban Environment - Ernie Franke

12:20-12:30 PM	Student Awards and Closing Remarks **-** Ron Hart, FLMS 2016-2017 President

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FLMS 2016 AWARDS

The Board of Directors is pleased to announce this year's annual award winners!

THE EDWARD DEEVEY, JR. AWARD

Dr. Ann Shortelle

***The Edward Deevey, Jr. Award** - is given to an individual for contributing to our scientific understanding of Florida's water bodies. Edward Deevey was an internationally recognized limnologist and affiliated with the State Museum of Florida at the time of his death.*

THE RICHARD COLEMAN AQUATIC RESOURCES AWARD

Robert Kollinger

***The Richard Coleman Aquatic Resources Award** - is given to a professional who has worked to restore, protect and/or advance our understanding of Florida's aquatic resources.*

THE MARJORY STONEMAN DOUGLAS AWARD

Leslie Kemp Poole

***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.*

THE DR. DANIEL E. CANFIELD, JR. VOLUNTEERISM AWARD

Florida LAKEWATCH

***The Dr. Daniel E. Canfield, Jr. Volunteerism Award** is given to a volunteer organization or outstanding volunteer for significant contributions to the research, restoration and/or preservation of our water resources. The award is named after Dr. Daniel Canfield, founder of Florida LAKEWATCH, the pioneering citizen-volunteer water quality monitoring program involving over 1,200 lakes statewide, and now being emulated across the United States.*

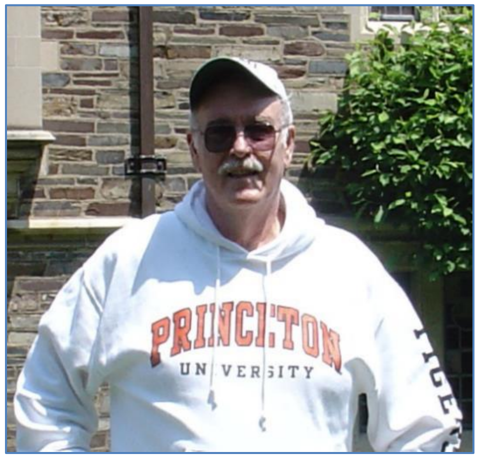
THE FLMS YOUNG PROFESSIONAL AWARD

Dr. Dana Bigham Stephens

***The FLMS Young Professional Award** is presented to a young lake management professional who exhibits exemplary professional accomplishments and a commitment to water resource protection and management of our lakes and watersheds*

Wednesday Keynote Speaker

Dr. Robert (Skip) Livingston



Robert J. (Skip) Livingston is Professor Emeritus of the Department of Biological Science, Florida State University. He has worked as a field ecologist for the past 53 years in a series of aquatic systems of the southeastern United States. His overall research effort has involved continuous, long-term analyses of lakes, rivers and coastal systems along the Gulf and Atlantic coasts. His team has completed ontological feeding analyses on many of the fresh water and marine fishes and invertebrates that have been transformed into detailed trophic models for the various aquatic ecosystems under study. A 43-year ecosystem-level database has been coupled with laboratory and field experimentation to evaluate how aquatic systems work and how they are affected by human activities.

Dr. Livingston has been extremely productive since 1970. He has been the principal investigator on more than 100 projects and has authored 8 books, more than 170 scientific papers, and numerous technical reports. Dr. Livingston has served as the director of the Center for Aquatic Research and Resource Management at the University of Florida. Dr. Livingston has graduated 47 graduate students (M.S., Ph. D.) whose research was based on behavioral and physiological ecology of individual aquatic populations and communities.

He has published a series of books and peer-reviewed scientific papers on his research. His more recent book, *Climate Effects on Coastal Ecosystems*, was published by CRC press last November. The main theme of his book includes climate change, climate change effects, and eutrophication. The book has incorporated a climate database of more than 40 years and has provided a narrative on how climate change affects anthropogenic nutrient loading and biotic responses, in particular Apalachee Bay, Apalachicola Bay and Perdido Bay.

Thursday Keynote Speaker

Ann B. Shortelle, Ph.D.
Executive Director, St. Johns River Water Management District

Dr. Ann Shortelle is the executive director of the St. Johns River Water Management District, where she began work June 1, 2015. Dr. Shortelle has more than 25 years of professional experience in lake, riverine and reservoir management for water quantity and quality. Her experience also includes surface water/wetlands restoration, surface water modeling, permitting and environmental assessments.

She previously served as executive director for the Suwannee River Water Management District (SRWMD) for three years, where she had been actively involved in the North Florida Regional Water Supply Partnership and springs protection. Prior to taking the helm at SRWMD, she was the director of the Office of Water Policy for the Florida Department of Environmental Protection (DEP), where she helped develop water policy for water supply planning and alternative water supplies, minimum flows and levels, reuse, water conservation, water quality protection and consumptive use permitting.

Dr. Shortelle worked as a consultant in the private sector before her employment at DEP. Dr. Shortelle is a member of the North American Lake Management Society, the American Water Resources Association, and other professional organizations. She served on the North American Lake Management Society's Board of Directors, and was a former two-term member of the Florida Lake Management Society Board of Directors and served on the policy advisory committee to DEP for designated use and classification refinement for surface waters.

She holds a doctorate degree in limnology from the University of Notre Dame and a bachelor of science degree in biology from Mercer University. She has authored/co-authored more than 40 publications and presentations on environmental topics.

Tuesday Workshops

Tuesday Morning - Workshop #1

DEVELOPMENT AND ANALYSIS OF NUTRIENT BUDGETS FOR LAKES

R. Thomas James, Ph.D.,
South Florida Water Management District

Nutrient budgets are an underused but useful tool in the Lake Manager's Toolbox. They summarize both water quality and hydrology data and can be used to evaluate lake status and trends. They can provide information on fate of nutrients as well as improve understanding of changes in water quality observed over time. Nutrient budgets also are useful in the development and evaluation of lake water quality models. This half day workshop will cover:

1. Monitoring data
a. Water Quality
b. Hydrology
c. Data sources available on the web
d. Stage and storage relationships

2. Hydrology and water quality load calculations
a. Surface flows Inflow and discharge loads
b. Rainfall atmospheric deposition
c. Evapotranspiration
d. Lake volume and mass

3. Net changes
a. Net loads
b. Change in mass over time

4. Evaluation
a. Use of conservative tracers (chloride)
b. Reality checks c. Uncertainty/noise d.

Differences between change in lake mass and net loads Budgets created for Lake Tohopekaliga for the years 2011 to 2015 will be used as an example. Participants are encouraged to bring a laptop to participate in exercises. The instructor will provide a Microsoft Excel spreadsheet to assist participants with the development of nutrient budgets.

About the instructor: Dr. James is a Lead Environmental Scientist with the Lake and River Ecosystems Section of the South Florida Water Management District. He has worked on various aspects of Lake Okeechobee water quality for the past 25 years, including the Lake Okeechobee Water Quality Model, nutrient budgets and water quality trends and analyses. He has also developed nutrient budgets for the upper Kissimmee Chain of Lakes, a periphyton stormwater treatment area, and recently began some field experiments in Lake Okeechobee.

Tuesday Afternoon Workshop #3

DEP MEASURES OF FLORAL HEALTH: PROCEDURES AND USES

Nia Wellendorf, M.S.
Florida Department of Environmental Protection

Who: This training is intended for anyone who will conduct sampling for, or otherwise use, Florida Department of Environmental Protection (DEP) bio assessment tools in lakes and streams to assess floral health. These tools include the Lake Vegetation Index (LVI), Linear Vegetation Survey (LVS), and Rapid Periphyton Survey (RPS).

What: The LVI is an assessment tool developed by DEP to determine the condition of the plant community in lakes relative to a minimally disturbed condition. The LVS and RPS are tools that will be used to assess biological health in streams, in association with numeric nutrient thresholds and the Stream Condition Index. This workshop will teach participants about the standard operating procedures (SOPs) for these tools, what roles they play in Florida water quality standards and impaired waters determinations.

Topics to be covered include: • Lake Vegetation Index (LVI) Standard Operating Procedures (SOPs) • Linear Vegetation Survey (LVS) Standard Operating Procedures (SOPs) • Rapid Periphyton Survey (RPS) Standard Operating Procedures (SOPs) • Role of LVI, LVS, and RPS in Chapters 62-302 and 62-303, Florida Administrative Code (F.A.C.), Water Quality Standards and Impaired Waters Rule, respectively.

Why: If resource managers and consultants plan to provide biological data to DEP for consideration, it is critical that they understand the SOPs and QA requirements, as well as the context in which the data will be interpreted, so that the data can be used appropriately.

About the Instructor: Nia Wellendorf is the administrator of the DEP Aquatic Ecology and Quality Assurance Section (AEQAS). The AEQAS maintains the DEP Quality Assurance Rule, 62-160, F.A.C., including its field sampling standard operating procedures (SOPs), and coordinates DEP bio assessment tool development and implementation. Nia has a Master's degree in Aquatic Ecology from the University of Alabama.

Tuesday Workshop #4

FISH IDENTIFICATION AND SAMPLING METHODOLOGIES IN VARIOUS HABITATS

John Benton. M.S.
Florida Fish and Wildlife Conservation Commission

Robert H. Robins, M.S.
Florida Museum of Natural History

Fish Communities in Florida Lakes: What's in your lake and why?

- What factors influence fish community composition and abundance?
- How would you begin to identify a fish that you don't know?
- What resources are there for fish identification and information about fish?
- How do you assess a fish community?
- How does aquatic habitat and water quality affect a fish community?
- What would you do with data that you collect?

This workshop is focused on questions that lake managers and the public that they serve often have about fish communities in the lakes that they work on. We will emphasize the smaller and lesser known species that are common to Florida lakes. We will use the FWCs statewide database to assemble lists of frequently found fish and descriptions of the habitats that they are associated with. Staff from the Florida Museum of Natural History will use high quality images, museum specimens, and freshly collected fish to illustrate examples of common species and techniques of fish identification.

The FWC will cover typical collection gear and ways to consider species abundance and diversity. Lake managers can have a large impact on the aquatic habitat through aquatic plant and nutrient management. This workshop will give attendees tools to work with in considering the fish communities that they are involved with.

About the Instructors:

John Benton is a Biological Scientist with the Florida Fish and Wildlife Conservation Commission in the Eustis Fisheries Research Laboratory. He coordinates research on Black Crappie and the Lake Eustis Pupfish in Florida, and uses GIS to investigate fish/habitat relationships. John served as project leader of the Upper Ocklawaha chain of lakes from 1987 until 2009. John is a graduate of Rhodes College in Memphis, TN (1979) and received his Master of Science degree in Fisheries Biology from Auburn University (1987).

Robert H. Robins is an Ichthyologist with the Florida Museum of Natural History on the campus of the University of Florida in Gainesville, FL. As Collection Manager of one of the largest University based fish collections, Rob manages 2.4 million preserved specimens of 9,300 species. Day to day duties include sorting, identifying and loaning specimens to research scientists worldwide and public outreach. Rob is coauthor of the forthcoming book "Freshwater Fishes of Florida." He is a graduate of the University of Miami and received his Master of Science degree from the University of Florida.

Session Abstracts

Session A1: Nutrient Reduction and Management

Moderator: Harvey Harper
Wednesday, June 8, 2016. 10:25 am to 11:55 am

EFFECTS OF UNCONSOLIDATED SEDIMENTS ON ALUM DOSAGE AND BUFFER AMOUNT ESTIMATES FOR A FLORIDA WATERBODY

Jodi B. Slater, Vickie Hoge
St. Johns River Water Management District, Palatka, FL

Results from previous alum treatments at Lake Harris Conservation Area (LHCA) near Leesburg, FL revealed discrepancies between the predicted (jar testing) and actual buffering capacities. In every case where buffering was recommended, less chemical was required to maintain alkalinity and pH during the alum treatment than was originally predicted. The high cost of using sodium aluminate as a buffer during alum treatment necessitates accurately predicting the inherent buffering capacity of the treatment area. Previous research by others indicated that the acid neutralizing capacity (ANC) of lake sediments can contribute to neutralize inputs of acidity to the water column. Others have shown ANC attributable to ion-exchange to be strongly related to organic content. Field observations of the alum treatment barge stirring up sediment in the shallow water of the treatment area indicated that ANC processes may be contributing to higher than predicted alkalinities during treatment. Previous jar tests performed on Lake Apopka North Shore sediments indicated a significant increase in both alkalinity and pH with increased amounts of sediment. In an effort to investigate in more detail the influence of unconsolidated sediment on the alum dosage estimate for a treatment area, water column samples of water and unconsolidated sediment were collected and composited from five sites within the LHCA. Jar testing was performed with 3 different concentrations of unconsolidated sediment. These data were compared to each other and to ambient water sampling of a water sample composited from the same five sites. Results indicated differences in unconsolidated sediment concentrations would likely impact estimates of buffering chemical necessary for alum treatment projects in shallow areas with unconsolidated sediments. These data will inform future alum treatment dosage estimates for shallow treatment areas with a high likelihood of sediment resuspension.

LAKE SEMINOLE RESTORATION EFFORTS-A MULTI-TOOL APPROACH TO REGULATORY COMPLIANCE OF A SHALLOW URBAN HYPEREUTROPHIC LAKE

Robert Burnes M.S.[1], Sarah Malone M.S.[1], and Mark Flock M.S.[1]
[1] Pinellas County Public Works Environmental Management, Clearwater, FL

Lake Seminole, a shallow sub-tropical Lake located in west-central Florida, has experienced decades of water quality and habitat declines. Studies conducted in the late 1990's and early 2000's identified numerous man-

agement approaches for increasing water quality and habitat. With the aid of the suggested management options, Pinellas County and FDEP adopted a reasonable assurance plan (RAP) for Lake Seminole in 2007. This RAP focusses on restoring water quality and priority habitats throughout the lake. Since that time Pinellas County has implemented, or is currently implementing, a variety of management approaches to meet goals listed in the RAP. These approaches include public education and outreach, local ordinances aimed at reducing fertilizer runoff, construction of alum treatment facilities which aim to improve water quality in stormwater systems that flow into the lake, restoration of wetlands and priority uplands adjacent to the system, increased flushing of the system and dredging accumulated organic sediments within the system.

IMPACTS OF APPLICATION METHODS ON LONGEVITY OF ALUM SEDIMENT INACTIVATION PROJECTS

Harvey H. Harper, Ph.D., P.E.
President - Environmental Research & Design, Inc., Belle Isle (Orlando), FL

Sediment inactivation projects are conducted using a variety of methods and techniques for dose determination and chemical application throughout the world. However, virtually all of the sediment inactivation projects performed in Florida have been conducted by ERD using similar methods for dose determination which allows an evaluation of impacts of application chemicals and methods on longevity. All Florida projects have been conducted using multiple applications to apply the recommended alum volume to provide a more gradual change in lake productivity and food web alteration, while also providing multiple scrubbing events for sediment phosphorus to increase the fraction of phosphorus which is inactivated. The multiple applications allow most treatments to be conducted using alum alone without the need for supplemental buffering compounds, such as sodium aluminate, although the need for a buffering agent still occurs in some poorly buffered waters. Water quality monitoring in treated Florida lakes suggests that lakes which received a combination of alum and sodium aluminate have shorter longevity compared with lakes that used alum alone. As alum floc ages in lake sediments, it forms a series of crystalline ring structures which become more stable and less reactive to sediment phosphorus over time. A hypothesis is presented which suggests that the combination of alum and sodium aluminate creates a denser and more aged crystalline structure which reduces the time available for sediment phosphorus uptake before the crystalline structure becomes inert. Using alum alone creates a relatively unstructured and less dense floc which requires a longer period to become inert and is capable of inactivating larger quantities of sediment phosphorus.

A CONCEPTUAL MODEL FOR PHOSPHORUS DYNAMICS IN SHALLOW FLORIDA LAKES

William F Kenney
Land Use and Environmental Change Institute, University of Florida, Gainesville, Florida

Algae and cyanobacteria (i.e. phytoplankton) are essential biotic components of the phosphorus (P) cycle in shallow Florida lakes. Phytoplankton convert available P into particulate organic forms and are the primary biological pathway for sedimentation of P in both macrophyte-dominated and phytoplankton-dominated shallow lakes. Once in the sediment, phytoplankton-P has two possible fates: (1) return to the water column and (2) permanent sequestration in the sediment. Recent sediments (i.e. deposited after *ca*. 1900) of shallow Florida lakes contain many water-column equivalents of P, such that a small flux of P from the sediments may have a large impact on P dynamics in the overlying

water column. For example, resuspension of a few centimeters of unconsolidated surface sediment can double the water column P concentration. Repeat-coring studies indicate that sediments < 50 years old may lose P to the water column, but also show that coincident sedimentation of new water column P is two- to four-fold greater than the P lost from the sediment over the same time interval. The thick lens of P-rich sediment that covers the bottom of shallow Florida lakes suggests that these deposits are a net sink for P. In most such lakes, these sediments are several meters thick and accumulated over much of the Holocene, i.e. the last 8-12 ka. In shallow Florida lakes, a fundamental component of the P cycle involves assimilation of available P into phytoplankton cells, which are deposited on the lake bottom, thereby creating a long-term sink for P.

A NOVEL, LONG-TERM INVESTIGATION ON SEDIMENT P FLUX AND P INACTIVATION TECHNIQUES IN NUTRIENT - IMPACTED EVERGLADES MARSHES

Forrest E. Dierberg[†], *Thomas A. DeBusk*[†], *Scott D. Jackson*[†], *Michelle D. Kharbanda*[†], *Janelle A. Potts*[†], *Stacey C. Galloway*[†], *Patrick D. Owens*[†], *and Delia B. Ivanoff*[††]
†DB Environmental, Inc. Rockledge, FL
††Delia Ivanoff, Applied Sciences Bureau
South Florida Water Management District, West Palm Beach, FL

The recent implementation of agricultural best management practices (BMPs) and treatment wetlands called Stormwater Treatment Areas (STAs) have reduced phosphorus (P) concentrations and loadings to the Everglades Protection Area (EvPA) in Florida (USA). There is a concern that despite reductions in external P loadings, internal loading from the legacy P enrichment of the soils may continue to elevate water column P concentrations, which could delay restoration outcomes. In an effort to explore ways to reduce soil P efflux, we retrieved intact, vegetated (cattail, *Typha domingensis*) soil monoliths from two P-enriched areas of the EvPA and deployed them at a location where they received pre-treated (low P) surface water as ex-situ flow-through mesocosms for 21 months with a mid-study 7-week dry down to mimic natural hydroperiod conditions. Two treatments (iron and limerock) were tested for soils from both sites, using triplicate mesocosms for each treatment.

After applying a herbicide (glyphosate) to eliminate the cattail vegetation, iron (Fe as liquid $FeCl_3$) amendments provided no P retention benefits in the organic soils from the two sites, yielding significantly higher ($P \leq 0.05$) flux rates (6.09 and 3.46 mg P m^{-2} d^{-1}) than the herbicide/no soil amendment control (3.92 and 2.11 mg P m^{-2} d^{-1}). A combination of low oxidation-reduction potential, high pH, and sulfide production acted interactively to enhance Fe and P mobilization in the Fe-amended mesocosms. The herbicide/limerock ($CaCO_3$)-amended soils exhibited significantly lower ($P \leq 0.05$) P flux (1.29 and 1.07 mg P m^{-2} d^{-1}) than the herbicide/no soil amendment control soils, but it remains unknown whether the observed reduction in P efflux (ranging from 48 to 67%) would justify the expense and potential environmental impacts of applying a surficial limerock amendment to large regions of the P-enriched wetlands.

Session B1: Impacts of Climate Change on Florida Water Resources

Moderator: Sergio Duarte

Wednesday, June 8, 1:30 pm to 2:35 pm

WATER QUALITY CHANGES AT AN OUTSTANDING FLORIDA WATER: INFLUENCE OF STOCHASTIC EVENTS AND CLIMATE VARIABILITY

Daniel E. Canfield Jr. and Mark V. Hoyer
Fisheries and Aquatic Sciences, School of Forest Resources and Conservation,
University of Florida, Gainesville, FL

The Santa Fe Lake System (SFS) is an Outstanding Florida Water system (OFW) in northern peninsular Florida and receives special protection from governmental agencies to prevent impairment of water quality due to anthropogenic activities. Since 1986, there have been periods of sudden nutrient increases and declines along with changes in water clarity documented within a 28-yr monthly database. Changes were linked to stochastic events like an influx of gulls in 1986, the adjacent 5,100-ha Dairy Road forest fire in 2007, three CAT-3 hurricanes that struck Florida in 2004, and droughts. There were also increasing trends at SFS for the yearly measured minimum water chemistry values. Synchonous changes in these baseline conditions were also observed at other nearby lakes, suggesting the lakes were being impacted by a regional environmental factor.

Examination of specific conductance at 66 lakes located across Florida further demonstrated a pattern of increasing specific conductance between 1979/1981 and 2011/2012 periods. These changes corresponded to a period of decreasing precipitation. Long-term trends in water quality at SFS may reverse if Florida enters a period of increasing precipitation due to climate variability.

THE CLIMATE DRIVERS OF FLORIDA'S HYDROCLIMATE VARIATIONS AND CHANGE

Vasu Misra
Dept. of Earth, Ocean, and Atmospheric Science & Center for Ocean-Atmospheric Prediction Studies, &
Florida Climate Institute, Florida State University, Tallahassee, FL

In this talk I will elaborate the role of the seasonal variations, inter-annual variations, decadal variations, and weather extremes like land falling tropical cyclones on the hydroclimate variations and change over Peninsular Florida. A case will be made that the very slowly changing hydroclimate changes over Peninsular Florida is likely to have strong seasonal footprint and changes in summer could be better anticipated than in other seasons.

CLIMATE CHANGE IN FLORIDA

Sean E. McGlynn, Ph.D.
McGlynn Laboratories Inc., Tallahassee, FL

Our state is particularly susceptible to the ravages of climate change. Florida, with its vast and growing coastal communities and changing and growing demography will be significantly impacted by climate change. Some of the most apparent impacts are as follows:

1. Increased salt water intrusion from sea level rise is already becoming an issue for the freshwater demands of highly populated areas along the southeast coast. This issue may further worsen and become more widespread over time with climate change.
2. More frequent and intense storm events will increase flooding, erosion and damage from storm surge will cause the displacement of communities, destruction of infrastructure and terrestrial ecology.
3. Change in the statistics of Atlantic tropical cyclone intensity has huge implications for the sustenance of coastal and inland communities in terms of damage to infrastructure and property, human mortality, and the modulation of the accumulated fresh water source in the summer, especially in South Florida.
4. Remote impacts of climate change of El Niño and Southern Oscillation will have an implication on the seasonal climate variability over Florida, especially in winter and spring seasons.
5. The uncertainty in the anticipated changes in Florida red tide (a harmful algal bloom) due to changes in ocean temperatures, long term variations of local scale terrestrial runoff can make the fishing industry and the human population vulnerable.
6. The coastal dunes and associated biota like, shore birds that breed on coastal dunes, will be heavily impacted.
7. Salt marshes and freshwater wetlands will be heavily impacted as is currently the case in Louisiana.
8. Florida's coastal reefs, which serve as a habitat for a variety of biota, are threatened by ocean acidification from increased levels of dissolved carbon dioxide.
9. Marine food webs and fisheries will shift and the migratory patterns will be disrupted as food webs shift.
10. There is anticipation of inevitable future increases in the wealth of Florida coastal communities, which would lead to further infrastructure development that will make the coastal regions far more susceptible to even moderate (and unanticipated) changes in climate

Session A2: Springs and Springshed Restoration Session

Moderator: Andy Canion
Wednesday, June 8, 2016. 2:35 pm to 3:40 pm

ICHETUCKNEE SPRINGSHED WATER QUALITY IMPROVEMENT PROJECT: STATUS REPORT

Sara Miller[1]; Charlene Stroehlen, PE[1]; Katherine Deliz Quiñones[1]; Tiffany Davies[1]; Grant Gatson[1];Chris Keller[2]; William Tucker[1]; Dave Dickens[3]
[1]Amec Foster Wheeler, Newberry, FL
[2]Wetland Solutions, Inc., Gainesville, FL
[3]Suwannee River Water Management District, Live Oak, FL (currently with the St. Johns River Water Management District, Palatka, FL)

The springs of Florida have received considerable attention due to increased nitrate concentrations within springsheds. In the SRWMD, a key to reducing nitrate levels in springs is focusing on nitrate leaving the landscape in karst regions. In some settings this is challenging since nitrate concentrations must be reduced quickly before water enters the Floridan aquifer through direct conduits. The land application system for the St. Margaret's Wastewater Treatment Facility (WWTF) in Lake City, Florida is located on the Ichetucknee Trace. The WWTF distributes treated effluent across approximately 350 acres of spray fields within the project area, and this project modifies approximately 250 acres. Surface infiltration from locations near the land application system has been shown to reach the Ichetucknee Springs Group in a matter of days. Pre-existing soil profile modifications at the project site likely provide a direct connection of surface infiltration to the springs. Thus, nitrate from the WWTF effluent is expected to contribute to nitrogen loads to the Ichetucknee springshed.

Water quality data for effluent shows average concentrations of NO_x and total nitrogen are 1.9 mg/L and 6.4 mg/L. The Ichetucknee Springshed Water Quality Improvement Project (ISWQIP) was developed to address the nitrogen load reduction required by the Santa Fe River BMAP in order to meet the TMDL for nitrate. However, the unique hydrogeology and topography of this karst landscape makes ensuring adequate treatment difficult. In order to treat effluent to the desired extent over the necessary landscape area (to meet effluent disposal volume requirements), a combined technology approach was developed. The ISWQIP uses a surface-flow treatment wetland coupled with subsurface denitrification walls to provide nitrate reduction in effluent. This combination allows for a cost-effective reduction in nitrate that lets the WWTF continue to meet its objectives while simultaneously providing protection to karst features. This novel approach is expected to result in an approximate reduction of 77,000 pounds of nitrogen per year from entering the Floridan aquifer when compared to existing permitted facility limits. The construction phase of the ISWQIP began in November 2015 and is expected to reach completion in September 2016.

SPRINGSHED SLEUTHING: TRACKING NITROGEN WITH DISSOLVED GASES AND ISOTOPES

Dean R. Dobberfuhl[1], Andy Canion[1], Patrick W. Inglett[2], Xiaolin Liao[2], D. Katelyn Foster[2]
[1]St. Johns Water Management District, Palatka, FL
[2]University of Florida, Gainesville, FL

Springs throughout Florida have shown evidence of eutrophication and corresponding ecological changes. The St. Johns River Water Management District and the University of Florida began a comprehensive spring's research project in 2014. The project involved seven workgroups and was designed to identify principle drivers affecting the primary producer community structure in various springs. We will present preliminary data from the Nitrogen Biogeochemistry workgroup collected in the Silver Springs springshed. This work is intended to identify major sources of nitrogen primarily within the springshed (e.g., manure, septic, fertilizer). We also plan to characterize the dominant biogeochemical transformations that modify and attenuate nitrogen fluxes as they transit through the vadose zone and into the aquifer. We sampled 59 groundwater sites throughout the springshed for physical and chemical constituents. A subset of twelve of those wells were new and drilled in locations to characterize effects of specific land uses on underlying groundwater. Samples were analyzed for standard water quality constituents and for $\delta^{15}N$, $\delta^{18}O$, and the dissolved gasses N_2O, N_2, Ne, and Ar. Bivariate plots of the stable isotopes provide information regarding sources and transformation of nitrate in samples. However, many of the samples from the Silver springshed had signatures suggestive of mixed sources, including fertilizer, normal soil processes, and manure/septic inputs, making it difficult to identify individual sources. Dissolved gas data suggests that denitrification is likely occurring in many areas as surface loads of N transit the soil and vadose zones to the aquifer. Preliminary results are demonstrating the difficulty in tying specific anthropogenic effects on the land surface to local aquifer conditions.

SUBMERGED AQUATIC VEGETATION RESTORATION IN FLORIDA SPRING SYSTEMS: THE KINGS BAY REVEGETATION PROJECT

Sean A. King
Southwest Florida Water Management District, Brooksville, FL

Dense submerged aquatic vegetation (SAV) communities are the foundation of Florida spring ecosystems by maintaining water quality and providing habitat for fish and wildlife. Many spring systems have experienced substantial changes to their ecological drivers over the past century including nitrogen enrichment, riparian development, nuisance vegetation expansion, manatee population growth, recreational use, and sea-level rise. These changes tend to favor a plant community shift from SAV to filamentous algae dominance that is associated with an overall degradation of the ecosystem. A pilot restoration project was initiated in 2014 for the Crystal River/Kings Bay spring system to test several innovative techniques to address these plant community shifts and their drivers. This project is addressing key drivers that inhibit the re-establishment of SAV by deploying temporary herbivory exclusion barriers and managing filamentous algae and other nuisance species. Eelgrass (*Vallisneria americana*) is the primary focus of this restoration effort because it was historically a dominant SAV species in this system and has the ability to persist in a wide range of conditions. An experimental eelgrass "sod" mat was cultivated offsite and transplanted into three quarter-acre plots within Crystal River/Kings Bay in the fall of 2015. Early results show that the eelgrass mats have expanded by over two feet; however filamentous algae and hydrilla (*Hydrilla verticillata*) are also beginning to colonize these areas and are being managed to promote eelgrass colonization. Monitoring is ongoing to assess the SAV community and to evaluate changes in water quality, sediment characteristics, and invertebrate and fish communities as a result of SAV restoration. In the spring of 2017 the exclusion barriers will be removed to determine if the newly established SAV community can persist despite heavy grazing pressure. If this restoration project is successful, then the goal is to apply this approach to additional areas within Crystal River/Kings Bay and other spring systems in the region.

PREDICTING ELEVATED GROUNDWATER NITRATE CONCENTRATIONS USING RANDOM FORESTS AND REGRESSION KRIGING IN THE SILVER SPRINGSHED, FORIDA

Andy Canion, Dean Dobberfuhl, Lori McCloud
St. Johns River Water Management District, Palatka, FL

The Upper Floridan Aquifer (UFA) receives nitrogen loads from a variety of sources varying through space and time, the fate of which is influenced by a range of hydrogeologic and biogeochemical factors. Mechanistic models of nitrogen fate and transport are difficult to construct because of the complicated karst geology and high potential for conduit flow. As an alternative, we developed a statistical model using spatially explicit geologic, land use, and nutrient loading data to predict occurrence of elevated aquifer nitrate concentrations. We retrieved nitrate monitoring data for groundwater wells within the vicinity of Silver Springs, including public water system (PWS) wells, private drinking wells, and monitoring wells from multiple government agencies. The well monitoring data was used to create a training dataset of approximately 700 points within the 574,000-acre springshed, and a random forest algorithm was used to predict the probability of exceeding 1.2 mg/L NOx-N (the current concentration at the main spring at Silver Springs).

Variable importance plots indicated that subsurface geology was the strongest predictor of elevated nitrate concentration, and land use, soil drainage, and nutrient loading were less important, but significant, predictors. The prediction surface from the random forest model was further refined through kriging of the residuals (i.e., regression kriging). The current modeling framework provides a promising approach for describing karst areas, where the Floridan aquifer is minimally confined and there is a tight spatial and temporal link between land surface activities and aquifer contamination.

Session A3: Lake Fish Habitat and Population Management

Moderator: John Benton

Wednesday, June 8, 2016. 3:55 pm to 5:30 pm

ASSESSING THE INFLUENCE OF LAKE TROPHIC STATE ON LITTORAL ZONE FISH COMMUNITIES, DISSOLVED OXYGEN REGIMES, AND HABITAT COMPOSITION

Chris Anderson[1], *T. Lange*[2], *J. Moran*[2], *D. Richard*[2], *and G. DelPizzo*[2]

[1] Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Freshwater Fisheries Research, Gainesville Fisheries Research Laboratory, Gainesville, FL

[2] Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Freshwater Fisheries Research, Eustis Fisheries Research Laboratory, Eustis, FL

We deployed mini-fyke nets and dissolved oxygen (DO) sondes in the littoral zones of four Florida lakes to assess the influence of trophic state on fish community composition, habitat composition, and diel dissolved oxygen regimes. Randomly selected sites were sampled in replicate across back-to-back weeks for each lake to assess temporal variability of the fish community and dissolved oxygen data collected at each site. Community composition was similar (Bray-Curtis > 75%) between weeks for all four lakes individually, but differed among lakes. Duration of hypoxia was compared within and among lakes to assess variability in diel dissolved oxygen regimes across a trophic gradient. Within lakes, duration of hypoxia did not differ between weeks, indicating low temporal variability of littoral zone DO within individual lakes. However, duration of hypoxia differed between lakes of lower productivity (i.e., oligotrophic and mesotrophic) and higher productivity (i.e., eutrophic and hypereutrophic), with lakes of higher productivity having significantly longer durations of hypoxia. Differences in habitat variables compared within lakes were not common, but significant differences were detected among lakes for a variety of habitat variables including aquatic macrophyte density and organic sediment thickness. Understanding how trophic state influences the relationships between physical habitat, dissolved oxygen regimes, and fish communities in near shore lake environments is important for effective aquatic resource management and policymaking.

THE FWC's LONG-TERM MONITORING PROGRAM IN FRESHWATER LAKES – TEN YEARS OF STANDARDIZED DATA COLLECTION ARE BEGINNING TO PAY DIVIDENDS

Eric Sawyers

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Eustis Fisheries Field Lab, Eustis, FL

In 2006, the Florida Fish and Wildlife Conservation Commission (FWC) established its long-term monitoring (LTM) program to monitor fish assemblages and sport fishes on 38 important Florida lakes and rivers using a variety of approaches. Since most statewide sampling efforts support management actions, species-specific or fish community monitoring,

or research interests, a manual was developed to standardize data collection procedures to meet these objectives. Standardized methodology was established for electrofishing, gill net, mini fyke net, trawl, and angler creel survey data to reduce sampling bias, meet statistical requirements and allow general comparison among systems and across years. These data are stored in a database system that facilitates electronic data validation and entry, error-checking, centralized data storage, and data retrieval. Prior to LTM, data collection varied among offices and even over time for a single system. Unsurprisingly, the widespread adoption of new standardized methods and new data entry procedures by staff were early challenges.

Ten years later, the value of the database and of the standardized methods has become widely accepted as these data have become more available and useful for looking at data trends. The database has grown to contain data from over 31,000 sample sites representing 188 water bodies and over 210 fish species. The monitoring of submersed aquatic vegetation was added to the program in 2015. We receive data requests from a variety of state agencies, universities, and the general public. Additionally, we are making summary data publicly available using an online interactive map interface to better inform stakeholders on the trends occurring on these waterbodies.

INTEGRATING LAKE VEGETATION DATA INTO FWC'S FRESHWATER FISHERIES LONG TERM MONITORING PROGRAM

Kevin Johnson, Eric Sawyers, Rob Eckelbecker, Dan Kolterman, John Saxton
Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute,
Eustis Fisheries Research Lab, Eustis, FL

The Freshwater Fisheries Long Term Monitoring (LTM) Program of the Florida Fish and Wildlife Conservation Commission (FWC) began in 2006 with the intent to obtain standardized data that could be used by managers to determine trends in sportfish abundance, species composition, mortality, growth, size structure, and utilization by anglers for Florida's important freshwater fisheries. The LTM Program has 30 core lakes that are sampled annually for these metrics. With this program in place, there was a growing need to develop an efficient method of collecting habitat information in these lakes so that habitat quality and quantity could be monitored over time. Managers and researchers in FWC also thought that collecting habitat information could help explain changes in sport fish or fish community data and could help to focus future research and/or management actions. Therefore, our objective was to develop sampling protocols that would provide accurate lake-wide estimates of percent area covered and percent volume infested with submersed and emergent vegetation in lakes that are part of the LTM Program. After investigating different techniques used for sampling aquatic vegetation, we determined that two methods of remote sensing fit our objective. These include hydroacoustic sensing for mapping submersed vegetation and the interpretation of satellite imagery for mapping emergent vegetation. With sampling protocols developed, annual mapping efforts will take place during the peak growing season, and began in the summer of 2015.

USING HABITAT DATA AND STAKEHOLDER INVOLVEMENT TO CREATE A COMPREHENSIVE MANAGEMENT PLAN FOR ORANGE LAKE

Ryan Hamm, Eric Nagid, and Craig Mallison
Florida Fish and Wildlife Conservation Commission, Gainesville, FL

Orange Lake is a large (5,000 ha) and shallow (mean depth 1.7 m) eutrophic water body located in Alachua County that undergoes drastic water level fluctuations and habitat changes which presents a unique set of management challenges. In order to identify and evaluate the effects of habitat enhancement projects, Florida Fish and Wildlife Conservation Commission (FWC) drafted the Orange Creek Basin Habitat Management Guidelines which utilizes aerial mapping and GIS analysis to quantify habitat value for focal fish and wildlife taxa. Using habitat target ranges and a relative habitat value for eight focal taxa, biologists can identify potential management projects.

As dynamic as the lake is, its stakeholder groups are equally dynamic. FWC's mission statement is: Managing fish and wildlife resources for their long-term well-being and the benefit of people. Consequently, people are a critical component when planning habitat enhancement work. To best incorporate stakeholder input FWC hired an outside contractor to guide our stakeholder outreach. This outreach consisted of four public meetings, interviews with stakeholders that represented various interests, and online surveys. The information that was gathered was used to draft the Orange Lake Habitat Management Plan, which combined data driven habitat analysis and a focused stakeholder engagement process to better define management goals and promote stakeholder buy-in.

FWC'S AQUATIC HABITAT RESTORATION AND ENHANCEMENT SECTION

Bruce V. Jaggers
Florida Fish and Wildlife Conservation Commission, Eustis, FL

The Florida Fish and Wildlife Conservation Commission's (FWC) Aquatic Habitat Restoration and Enhancement Subsection (AHRE) was first known as the Lake Restoration Section. AHRE now conducts aquatic habitat restoration projects on fresh water lakes, rivers, streams, marshes and even ephemeral ponds throughout Florida. Projects are developed by AHRE staff in some cases. Projects may also be submitted by other entities (e.g. cities, counties, other state agencies) with assistance of a local AHRE staff member.

After a restoration project is developed it may be submitted to AHRE for funding consideration. Projects go through several levels of review which include but are not limited to review by pertinent regional FWC staff (e.g. wading bird, fisheries experts), an AHRE Standing Team review (includes a biological review and ranking), FWC Tallahassee review and final approval by FWC Commissioners. Projects are funded on an annual basis funding decisions are typically made approximately May/June each year. Projects that have multiple funding partners score higher in the ranking process and therefore are more likely to be approved for funding. In recent years AHRE has typically had a statewide budget of $5 - $10 million annually.

Monitoring is a part of each AHRE funded project. Minimal monitoring requirements consist of photo stations and data is entered into an FWC database. AHRE projects are extremely varied ranging from large scale lake projects (e.g. drawdown and scraping to remove organic deposits), to stream restoration (e.g. hydrologic restoration) to improving habitat for a specific species (e.g. ephemeral pond habitat enhancement for the flatwoods salamander).

DEVELOPMENT OF MODELS CORRELATING WATER TEMPERATURES WITH AIR TEMPERATURES AND SEASONAL AND LIMNOLOGICAL FACTORS

Earl Lundy and Jay Holder
Florida Fish and Wildlife Conservation Commission, DeLeon Springs, FL

We selected 49 lakes and reservoirs throughout the state of Florida as monitoring sites based on size, trophic state, and location. Data loggers gathered hourly water temperature data over a two-year period. National Weather Service monitoring stations and other publicly available data sources provided local air temperatures. We modeled the relationship between seasonal lake water temperature, area air temperatures, and additional factors with multiple linear regressions. We used winter and summer as thermal maxima and minima. Lake latitude, longitude, surface area, maximum depth, mean depth, mean Chlorophyll *a*, Mean Total Phosphorus, Mean Total Nitrogen, Mean Secchi Depth, and Trophic Index Number were also used in initial regressions to see if these had an effect on lake thermal characteristics. Pooling statewide winter lake data with latitude and trophic index gave adequate correlation, with an R2 value of 0.79 ($p<0.001$). Pooled statewide summer data gave a poor overall model, with the greatest R2 of 0.40 ($p<0.001$). Grouping the lakes in summer by Huc-8 river basins gave greater correlation, with R2 values ranging from 0.57 to 0.87.

Session A4: Poster Session

Session Lead: Shannon Wetzel & April Verpoorten
Wednesday, June 8, 2016. 6:00 pm to 8:00 pm

CREATING A STAKEHOLDER ENGAGEMENT PLAN FOR ORANGE LAKE, FLORIDA

S. Fay Baird, M.S. and Christine Denny, M.S.
Normandeau Associates, Inc., Gainesville, FL

Orange Lake, Florida is a 13,000-acre karst depression lake that is well known as one of the most productive bass fisheries in the United States, as well as for its unique floating islands. This poster will present background on Normandeau Associates' approach to developing a Stakeholder Engagement Plan (SEP) for the Florida Freshwater Fish and Game Commission (FWC), to incorporate input from a wide range of stakeholders during preparation of a Habitat Management Plan for the lake. An inventory of stakeholders revealed a wide range that includes recreational fishermen, shoreline property owners, environmental organizations, fish camps, and fishing equipment businesses. We based the SEP on a number of tools that included the IAP2 Public Participation Spectrum, detailed interest and values analysis early in the project, online surveys, and a commitment to provide specific opportunities for stakeholder input over an 18-month period. The final Plan goals and objectives are based on stakeholder input, with FWC action strategies that are based on maximizing stakeholder support.

"SMALL-SCALE SOIL COMPOSITIONAL DIFFERENCES WITHIN D Hooded PITCHER PLANT (*Sarracenia minor* Walter) BOG IN CENTRAL FLORIDA"

E. Renee Moody, Raymond T. Emmett, PhD and Debra W. Woodall, PhD
Daytona State College, Daytona Beach, FL

Central Florida is home to many fascinating and uniquely adapted plants. This includes carnivorous plants such as *Sarracenia minor*, the hooded pitcher plant. However, habitat loss and over harvesting for retail sales of *S. minor* have led to this plant being listed as a threatened species. In addition, *S. minor* is often sparsely distributed within the wetlands and bogs they prefer to call home. The goal of this research is to determine if soil composition is the cause for this scattered distribution. To accomplish this, soil was sampled at the root zone of five reference specimens at Longleaf Pine Preserve; a contrasting sample was taken three feet from the reference plant. Soils were tested for pH and redox potential. Soil subsamples were sent to the IFAS Analytical

Services Laboratories to be tested for various metals and nutrients. Preliminary results indicate that there is no significant difference between pH and redox potential measurements for the *S. minor* root-zone soil and the contrasting soil ($p > .05$).

MONITORING WATER QUALITY PARAMETERS IN THE CANAL STREET CANAL, NEW SMYRNA BEACH, FLORIDA"

Samantha Edel, *Debra W. Woodall, PhD*, *Sandra Horikami, PhD*,
Jody Benet, Chris Browne, Lillian Elliott
Daytona State College, Daytona Beach, FL

The Indian River Lagoon (IRL) is a unique, highly diverse shallow water estuary of national significance, stretching along 40 percent of Florida's east coast. Within the IRL are natural and man–made inlets, point source and non-point source discharges that significantly affect the health of aquatic life. Canal Street Canal is a point source, subterranean canal located in New Smyrna Beach, Florida. The contributing watershed is 170.6-acres, collecting mostly untreated street runoff through numerous storm drains that eventually discharge into the canal. The objective of this research focuses on measuring various water-quality parameters to determine if they exceed acceptable Florida Department of Environmental Protection (FDEP) regulations. The study involves physical, biological and chemical parameters of surface water at discharge point, including; Dissolved Oxygen (DO), pH, salinity, total nitrates and total phosphates (nutrients), water temperature, as well as chlorophyll-a. Preliminary results indicate this body of water as hypoxic, with DO measurements at 1.23 mg/L during Institute of Marine and Environmental Studies basic water quality sampling. With reference to FDEP hypoxic waters are defined as any measurement below 2 mg/L. Surface-water Total Phosphate levels ranged from 0.05-0.49 mg/L exceeding FDEP acceptable nutrient criterion (0.049 mg/L) within every sample taken. Micro plastics have also been discovered within the water column of Canal Street Canal along with a presence of numerous colony-forming units of coliform that were too numerous to count (TNTC). The drainage basin within the canal is a consequential element in maintaining the water quality discharge standards into the IRL. This dissemination, with valuable data will inform policy and increase public awareness of the water quality within the Canal Street Canal along with the canals significance to the Indian River Lagoon.

CLIMATE CHANGE CONCERNS IN THE LAKE POWELL WATERSHED IN BAY AND WALTON COUNTIES

Richard Bryan
Lake Powell Community Alliance, Panama City Beach, FL

The poster will display one large graphic representation of Lake Powell with additional smaller graphic representations of the watershed indicating geographical aspects relevant to climate change vulnerabilities on the large representation and on the borders of the poster. Explanatory notations and photos with additional historical information will accompany the graphics to complete the poster layout. The Lake Powell Community Alliance management plan will be available for review. Water quality data from the LAKEWATCH monitoring program will also be available for viewing.

RELATIONSHIP BETWEEN LAND USE AND TROPHIC STATE PARAMETERS IN FLORIDA LAKES

Chao Xiong
Fisheries and Aquatic Sciences, Florida LAKEWATCH Program, University of Florida, Gainesville, FL

A spatial and temporal analysis will be conducted on watershed land use and trophic state parameters of 120+ Florida lakes using long-term data (> 20-years). Studies of land use and relationship to water nutrients suggest that urban and agricultural land practices contribute significant nutrients to nearby water bodies. Based on these studies I hypothesize that lakes in watershed with the highest percentage of land use in urban and or agricultural use will result in higher lake nutrient levels. I will be using trophic state data from the Florida LAKEWATCH program and land use maps derived from the St. John and Suwannee River Water Management Districts. Statistical analysis will be conducted using the R programming language and the Jmp statistical software. Spatial analysis will be conducted using Arc GIS. Objectives are to 1) Classify the land use in watershed of Florida LAKEWATCH lakes that have 20-years or greater of trophic data; 2) Compare the watershed land use to their respective lake nitrogen, phosphorus, and chlorophyll-a concentration; and 3) Analyze additional factors, such as precipitation, lake water level and macrophyte density, that can also potentially explain the variation in trophic state of the respective lakes.

A GIS TRACKING PROJECT FOR DETECTING SANITARY SEWER OVERFLOWS (SSOs) IMPACTS ON WATER BODIES

Zachary Frame, Julie Bortles
Orange County Environmental Protection Division, Orlando, FL

The Orange County Environmental Protection Division currently conducts surface water quality monitoring at over 750 locations within Unincorporated Orange County. Although fecal coliform is frequently detected in water bodies monitored by the OCEPD, the source of the pathogen is not always known at the time of sample collection. Therefore, unidentified sources can result in pathogen loads being delivered to water bodies on a continual basis. In response, the Orange County Environmental Protection Division has investigated the relationship between Sanitary Sewage Overflows (SSOs) and surface water concentrations of fecal coliforms in water bodies. In this study, the sites of over 230 SSOs were compared with water quality data collected at nearby locations. The authors report that after comparing the time/date stamps of overflow events and water quality data, there appears to be a correlation between SSO events and spikes in fecal coliform concentrations in receptor surface waters. The authors go on to report that in areas of three or more SSOs have been reported, it appears that the high concentrations of fecal coliform overflows were due to contractors rupturing lines or failing infrastructure.

STREAM CONDITION INDEX I: SAMPLE COLLECTION

Ashley Craft, Tina Richards, Marcia Anderson
Orange County Environmental Protection Division, Orlando, FL

The Stream Condition Index (SCI) is a metric used by the Florida Department of Environmental Protection to determine the health of riverine water bodies. The SCI is a composite macroinvertebrate index used for flowing streams and is considered by the FDEP to be the primary indicator of stream health. In this poster presentation the authors explain several aspects of collecting samples during the SCI including: the equipment needed, types of habitats, and procedures for sample collection.

STREAM CONDITION INDEX II: SAMPLE PROCESSING

Sarah Parker, Tina Richards, Marcia Anderson
Orange County Environmental Protection Division, Orlando, FL

The Stream Condition Index (SCI) is a composite macroinvertebrate index used for flowing streams and is considered by the FDEP to be the primary indicator of stream health. In this poster presentation the authors describe the processing of field samples retrieved for laboratory processing. Sorting, picking, identification processing as well as data storage operations are described.

MEMBRANE FILTRATION TECHNIQUE FOR FECAL COLIFORMS

Romina Lancellotti Rueda, Edna Arroyo
Orange County Environmental Protection Division, Orlando, FL

Fecal coliform bacteria are common microbiological contaminants and are frequently found in freshwater bodies throughout Florida. These same water bodies can be used for recreation and require microbiological monitoring in order to identify increases in pathogen concentrations that can result in human illness. In Central Florida, sustained fecal coliform concentrations above acceptable limits can result in a waterbody being added to the impaired water list maintained by the Florida Department of Environmental Protection. The authors present the in-house method used by the Orange County Environmental Protection Division to monitor fecal coliform concentrations in impaired water bodies and to respond to intra-governmental requests for rapid sample collection and analysis.

A5: Lake Okeechobee - Restoration Science and Management

Moderator: Sergio Duarte

Thursday, June 9, 2016. 10:30 am to 12:00 pm

SUSPENDED SOLIDS AFFECT RECENT PHOSPHORUS TRENDS IN LAKE OKEECHOBEE

R. Thomas James
Lead Environmental Scientist
Lake and River Ecosystems Section, South Florida Water Management District, West Palm Beach, FL

Phosphorus concentrations in the pelagic region of Lake Okeechobee, the largest lake in Florida, more than doubled from the early 1970s to the late 1990s. Hurricanes Frances and Jeanne in September 2004 and Hurricane Wilma in October 2005 went over the lake resulting in resuspension of sediments and creation of an enhanced layer of flocculent sediments that resuspends very easily. TP concentrations in the Lake increased to the highest average value for the period of record in the May 2004 to April 2005 water year (WY2005) and slowly declined to pre-hurricane levels in 2010. A number of hypotheses for this decline were evaluated: (1) reduced TP load and/or inflow TP concentrations, (2) increased acreage of submersed aquatic vegetation which sequesters more phosphorus, (3) increased calcium concentrations which co-precipitated with phosphorus into the sediments and (4) consolidation of sediments resulting in reduced internal loads from the sediment. The latter appears to be the best explanation as TP concentrations and suspended solids are strongly related. After WY2009 the average TP concentrations were not significantly different from pre-hurricane water years (prior to WY2005).

ISTOKPOGA MARSH - A HIDDEN HOT SPOT FOR PHOSPHORUS IN THE LAKE OKEECHOBEE WATERSHED AND WHAT IS BEING DONE ABOUT IT

Clell Ford
Highlands County Parks and Natural Resources Department, Sebring, FL

The Istokpoga Marsh Watershed Improvement District sits on approximately 20,000 acres of muck and pasture south of Lake Istokpoga in Highlands County. The deep, rich muck soils that are found here originated as organic matter in Lake Istokpoga, which flooded seasonally into the area that now defines the Marsh District when it was allowed to fluctuate naturally. This rich soil, and drainage improvements installed in the 1960s along with the Central and South Florida Flood Control District, have contributed to the Istokpoga Marsh District being home to the production of 95% of the caladium bulbs that are sold around the world. As with many other parts of South Florida, the soil disturbing nature of this agricultural activity has led the Marsh District to the top of the list when it comes to the concentration of phosphorus discharged to Lake Okeechobee. There is no retention or treatment of surface water in the Istokpoga Marsh Watershed Improvement District; during calendar year 2015, the average total phosphorus concentration discharged from the Marsh District was 379 µg/L, which is certainly in the top 10 of all phosphorus concentrations in the Lake Okeechobee watershed; just considering the average total phosphorus concentration from the caladium area in 2015, which was 971 µg/L, this would rank as one of the hottest spots for phosphorus in the whole Okeechobee basin.

As part of the Lake Okeechobee Basin Management Action Plan, plans are underway to construct two above ground impoundments on land purchased by Istokpoga Marsh, adding treatment and storage capacity to a basin that had none previously. Some things have become readily apparent during this process of designing and permitting above ground impoundments on muck soils, and this talk will give an update on those insights as well as the conditions that led to such high nutrient levels.

CREATING A WATER AND NUTRIENT BUDGET FOR LAKE TRAFFORD, FL, USA

Mark Lucius
Florida Gulf Coast University, Fort Myers, FL

Water and nutrient budgets quantify all hydrological and nutrient inputs and outputs of a hydrosystem. The ability to determine the dominant sources of water and nutrients into these systems can be quite valuable. This is particularly true for Lake Trafford (WBID 3259W). Lake Trafford is a natural shallow polymictic lake located near the city of Immokalee in SW Florida. Like most hydrosystems in Florida, Lake Trafford has been impacted by cultural eutrophication, which lead to the invasion of *Hydrilla verticillata*. The subsequent herbicide treatment of this plant beginning in the 1970's resulted in a regime shift to a hypereutrophic state plagued by recurrent phytoplankton blooms, fish kills and excess organic sediment. A twenty-one million dollar dredging effort removed 6.3 million cubic yards of sediment by the end of 2010. Despite dredging, native rooted vegetation planting by FGCU and the FWC, and efficient chemical treatment of *Hydrilla* and other exotics by FWC, the lake water quality has not significantly improved. FDEP thus awarded FGCU to create a water and nutrient budget for L. Trafford. In 2015, the balance between water and nutrient influxes (i.e. rainfall, dead end canals, groundwater and atmospheric dry deposition) as well as effluxes (i.e. evaporation and seepage) will be measured. Two unknown influxes left aside will be the determination of nutrient internal loading (e.g. sediment) and diffuse runoff. Point source surface water loading will be assessed bi-weekly by measuring the water discharge from each of the five dead-end canals with a SONTEK™ IQ which will trigger at a set discharge threshold the take of a water sample with an ISCO 4500 auto-sampler. The water drawn by the ISCO sampler will be commensurate to the duration and extent of the discharge measured. Rainfall, wind direction, humidity, dew point, solar radiation, net radiation will be monitored and recorded onsite with a Davis Vantage Pro weather station and a net radiometer. The net radiometer will be used to calculate evaporation. Groundwater influx and seepage will be measured every 14 days using twenty seepage meters: fourteen evenly spaced around the lake's periphery and six meters covering the open water. Groundwater will be sampled with wells adjacent to each meter and placed 2-3 feet deep. Atmospheric wet/dry deposition and will be directly measured while evaporation will be indirectly calculated. Water volume changes in the lake will be determined from lake level variations logged with a SOLINST™ sensor. Water column nutrients will be sampled every 14 days as a grab sample in the center of the lake. Water samples from the ISCO, grab and groundwater will be sent overnight within 48h of collection to the FDEP laboratory in Tallahassee for the analyzes of TP, TKN, TOC, NOx, NH_4 and SRP.

NUTRIENT BUDGETS OF THE KISSIMMEE CHAIN OF LAKES

R. Thomas James
Lead Environmental Scientist
Lake and River Ecosystems Section, South Florida Water Management District, West Palm Beach, FL

Water and nutrient budgets were developed for East Lake Tohopekaliga, Lake Tohopekaliga and the combined system of lakes: Kissimmee, Cypress and Hatchineha (KCH). Daily net inflows were calculated from evaporation, rainfall, and measured inflows and outflows. These measured net inflows were summed by month and year and compared to the net change of in-lake volume (determined from stage storage calculations). This comparison showed that between 12 and 33% of the net inflow was not measured.

Daily estimates of chloride, a conservative tracer, nitrogen and phosphorus were determined by linear extrapolation of water quality monitored at inflows and in the lakes on a monthly basis. These daily estimates were multiplied by the appropriate daily flows or daily volumes to determine loads and in-lake mass of chloride, nitrogen and phosphorus. Measured inflow and outflow loads were summed by month and year to obtain a net load estimate for each year. These yearly net loads were compared to the yearly changes of in-lake mass to determine the unmeasured amount of chloride load. This comparison verified that between 22 and 33% of the loads to the lakes were not measured.

Budgets revealed that unmeasured sources contributed between 25 and 43% of the phosphorus and 15 to 40% of the nitrogen loads to these lakes. Small tributaries are likely the major source of these missing flows and loads. Budgets also indicated that these lakes removed between 21 and 57% of the phosphorus load and 19 to 46% of the nitrogen load. Despite variations in hydrology, nutrient loads and some environmental changes there was only one statistically significant trend of reduced nutrient removal in these lakes, which was found in the KCH system for phosphorus from 1993 to 2005. This was attributed to hurricane events in 2004. From 2006 to 2014 the trend was no longer significant and values were very similar to values before 2004.

Session A6: Lake Apopka - Restoration Science and Management

Moderators: Ron Hart & Lance Lumbard

Thursday, June 9, 2016. 1:30 pm to 2:50 pm

RE-PLUMBING LAKE APOPKA'S NORTH SHORE: IMPLICATIONS FOR WATER MANAGEMENT AND WATER QUALITY

Pam Bowen[1], Bob Naleway[1], and Maria Zondervan[2]
[1]St. Johns River Water Management District, Palatka, Florida
[2]St. Johns River Water Management District, Mount Dora, Florida

The Lake Apopka North Shore (LANS) includes 20,000 acres on the north shore of Lake Apopka in Florida. It was purchased by the St. Johns River Water Management District with funds from the Florida legislature and federal appropriations to restore Lake Apopka. The area was originally a shallow marsh and was extensively farmed from the 1940s to the 1990s. Farmers applied fertilizers and organochlorine pesticides (OCPs) to bolster and protect their crops. Nutrient runoff from the farms affected water quality in Lake Apopka. Between 1988 and 2002, the District purchased the farms and took them out of production to reduce phosphorus (P) loading to the lake. Legacy P still remained in the former farm fields along with OCP residuals. In 1998, a large avian mortality event occurred on the LANS. The USFWS determined it was caused by OCP toxicosis. The District agreed to keep most of the LANS dry until remediation of OCP residuals could be studied and implemented. In 2000, all water discharged from the LANS was treated with alum, but due to insufficient settling, a part of the alum floc reached the lake.

The lake also received nutrient runoff from agricultural and industrial operations through Lake Level Canal and McDonald Canal. Since then, the District has made numerous infrastructure improvements to the LANS. In 2011, the District plugged Lake Level Canal and McDonald Canal and diverted the agricultural and industrial discharge into the LANS to be treated before being discharged. Between 2008 and 2013, levee improvements were made to increase water storage on the LANS, allowing water to be stockpiled on the LANS rather than being discharged into the lake.

The District also re-built the alum treatment systems to improve the efficiency of P removal and to reduce discharges from the Unit 1 system. Successful remediation of OCPs has allowed reflooding of the LANS to restore wetlands. These changes have allowed the District to reduce the amount of P loading to the lake and to increase the amount of water available for other water management needs.

STRATEGIC DREDGING AS AN ALTERNATIVE TO ASSIST WITH RESTORATION EFFORTS ON LAKE APOPKA

Lance M. Lumbard, Scott Wuitschick
Amec Foster Wheeler, Inc., Orlando, FL
Jay Brawley, Robert Naleway
St. Johns River Water Management District, Palatka, FL

Restoration of Lake Apopka near Orlando, FL began with the passage of the Lake Apopka Restoration Act (LARA) in 1985. The St. Johns River Water Management District (SJRWMD) has been largely responsible for implementation of projects designed to restore water quality within the lake since the 1985 mandate. The SJRWMD's 2003 Surface Water Improvement and Management (SWIM) plan identified four key restoration project objectives including:

1) Reduction of phosphorus (P) loading
2) Improvement of food web structure
3) Restoration of lake habitat
4) Removal of P and flocculent sediments

Reduction of P loading is currently being addressed through prior land acquisition and ongoing restoration of the historic muck farm areas along the North Shore. Gizzard shad harvesting and re-vegetation efforts continue to be implemented by the SJRWMD to improve the food web structure and habitat within the lake. Removal of P and flocculent sediments has primarily been accomplished through the SJRWMD's Marsh Flow Way (MFW). The SJRWMD is currently investigating additional methods which may provide additional internal P reduction by removing flocculent sediments from strategic locations within the lake.

Amec Foster Wheeler is assisting the SJRWMD with a dredging demonstration project designed to work with the current flow patterns within the lake. The aim of the project is to construct depressional areas, or "sumps", within the lake bottom at locations that will facilitate the removal of a portion of the existing flocculent and consolidated organic sediments. Once constructed, the sumps may provide an opportunity to collect flocculent sediments and pump them to a disposal location using a stationary dredge. Flocculent sediments typically contain highly concentrated sources of P and nitrogen (N), reduce light transmission following resuspension, and cause smothering of submerged aquatic vegetation.

Targeting the flocculent sediments could provide a more economical approach to nutrient removal than standard dredging which requires an operator and continuous dredge movement. If the project is successful, permanent fixed dredge stations could be established to provide continuous or frequent removal of the targeted sediments resulting in both improved water quality and sediment conditions which could support additional habitat restoration.

FILTERING AND FISHING FOR PHOSPHORUS: LAKE APOPKA NUTRIENT REMOVAL PROJECTS

Margaret Q. Guyette and John Higman
St. Johns River Water Management District, Palatka, FL

The goal of the St. Johns River Water Management District's (District) Lake Apopka North Shore program is to restore Lake Apopka's water quality and ecosystem health. The long-term degradation of this central Florida lake accelerated in the 1940s, as farms drained the lake's historic marshes to support the war effort. Millions of gallons of water, laden with nutrients and other chemicals, were pumped from farm fields into the 31,000-acre lake. In addition, significant historic nutrient loads were discharged to the lake from industrial and municipal point sources. The Lake Apopka North Shore program focuses on reducing external loading to the lake combined with cost effective approaches to reduce phosphorus already in the lake. Two District-run projects specifically designed to remove phosphorus from Lake Apopka are the Marsh Flow-Way and rough fish harvesting. The Marsh Flow-Way is a 310 hectare constructed treatment wetland with four treatment cells. Operational since 2003, the wetland acts as a filter, removing nutrients and particulates from Lake Apopka. Water quality, water level, precipitation, and evapotranspiration data are combined to calculate nutrient and particulate removal efficiencies. Median phosphorus removal efficiency from lake water is about 30%, and median removal of phosphorus is about 2.5 metric tons annually. The wetland treats about 40% of the lake volume per year.

The District's rough fish harvesting project started in 1993 and has removed from 125 to 880 metric tons of fish, primarily gizzard shad (*Dorosoma cepedianum*), from Lake Apopka per year. The project removes phosphorus in the fish biomass and reduces phosphorus recycling caused by gizzard shad feeding in bottom sediments. The direct removal of phosphorus in fish biomass varies with catch and has ranged from 1 to 7 metric tons removed annually.

IMPACTS OF REDUCED PHOSPHORUS LOADING AND DROUGHTS ON WATER QUALITY IN LAKE APOPKA

Michael F. Coveney
Bureau of Water Resources, St. Johns River Water Management District, Palatka, FL

The primary step in the comprehensive restoration program for Lake Apopka is a large reduction in external phosphorus (P) loading. This step has been achieved through progressive restoration of former farms on the Lake Apopka North Shore area to wetlands after remediation of residual pesticides in soils to ecologically safe levels. Long-term (1987 to present) changes in water quality in Lake Apopka largely are explained by three factors: improving trends due to reduced P loading, cyclical oscillations since 2000 due to alternating periods of extremely low and normal lake levels, and seasonal cycles.

The restoration program reduced annual P loading from about 62 metric tons to average 11 metric tons over the past five years, although that recent average represented drought years. Reduction in P loading to Lake Apopka resulted in improvements in key water quality indicators total phosphorus (TP), chlorophyll-a (Chl-a), and Secchi transparency. However, since 2000, recurring low lake stage during three droughts at 5 to 6-yr intervals caused periodic degradation of all water quality indicators. TP, total suspended solids, total nitrogen, and Chl-a concentrations increased greatly at low lake levels in part because their lake water masses were concentrated in a smaller lake volume. Further, the normal net sedimentation of TP to sediments was interrupted. Native submersed aquatic vegetation (SAV) began to grow in the littoral zone of Lake Apopka in 1995 but almost was eliminated in subsequent droughts. SAV declined during the most recent drought as well, but losses were much less than previously, which showed greater resilience by the SAV community. Under current conditions, sustained improvements in TP, transparency, and SAV in Lake Apopka can occur only during sustained periods without the extended and extreme low lake levels typical of the past sixteen years.

Session B2: Watershed and Water Resources Management

Moderator: Sam Arden
Thursday, June 9, 2016. 3:20 am to 4:40 pm

A TALE OF TWO LAKES: HOW HYDROLOGIC DIVISION HIGHLIGHTS HUMAN INFLUENCE ON A LARGE SHALLOW LAKE

Nia Wellendorf and Meghann Niesen
Florida Department of Environmental Protection, Tallahassee, FL
ORISE Fellow, US EPA Office of Water

Lake Jackson is a large shallow "disappearing" lake in Leon County, Florida, so described because much of the lake's water can drain through sinkholes under certain conditions. Under low rainfall conditions, the lake is hydrologically divided into two sides, a small southeastern segment and a larger northwestern segment. The southeastern basin is bordered by residential land use and includes two major stream inputs that have historically brought stormwater from the City of Tallahassee into the lake. The northwestern basin is bordered by a mix of residential and natural land uses, and has not received appreciable stormwater input. Evaluation of water quality over the period of record and Lake Vegetation Index data from recent years shows that these two sides of the lake have different water chemistry and plant community characteristics. The southeastern basin has significantly higher pH, alkalinity, and total phosphorus concentrations, and lower LVI scores than the northwestern basin. These documented differences likely reflect changes in the southeastern basin due to the historical and ongoing contributions of urban stormwater, and make Lake Jackson an example of how human disturbance can alter water quality and associated aquatic plant communities.

DEVELOPMENT OF A WATER LEVEL RECOVERY METRIC FOR XERIC-ASSOCIATED LAKES AND WETLANDS IN THE NORTHERN TAMPA BAY AREA

Dan Schmutz, M.S.[1] and Christopher Shea, M.S., P.W.S.[2]
[1]Greenman-Pedersen, Inc., Orlando, FL
[2]Tampa Bay Water, Clearwater, FL

Past studies have documented hydrologic differences between lakes and wetlands that are situated in xeric versus those situated in mesic vegetation-dominated landscapes. In general, lakes and wetlands located in a xeric landscape setting (e.g., sandhill) tend to show greater ranges of fluctuation than those embedded in a matrix of mesic vegetation types (e.g., pine flatwoods). Tampa Bay Water is in the process of assessing the hydrological and ecological recovery occurring in a large number of lakes and wetlands in the Northern Tampa Bay area in response to the regional groundwater production cut-backs which were implemented in January, 2003. At that time, average groundwater production was greatly reduced in an effort to improve surface water levels and hydroperiods.

Minimum Flows and Levels law (i.e., 373.042 FS) and rules (e.g., Chapter 40D-8, FAC) provide guidance for understanding hydrologic regimes appropriate to maintain certain types of lakes and wetlands, but lack specific guidance for xeric landscape-associated features. We implemented a variety of data analyses to develop a water level recovery metric specific to the xeric landscape setting, including: documentation of methods for classifying surrounding soils into the xeric and mesic categories, empirical evaluation of aquifer recovery using ArcGIS spatial interpolation, percent exceedance

analyses of water levels and Floridan aquifer levels for selected time periods, development of a dataset of reference time series from sites and time periods identified as having minimal anthropogenic influence, determination of a threshold metric best separating sites known to be ecologically stressed from those presenting recovered or unchanged conditions, and application of the approach to a dataset of xeric-associated "ridge" lakes and wetlands provided by the Central Florida Water Initiative. The resulting metric includes both an elevation relative to indicators of historic inundation and a duration sufficient to promote ecological recovery.

IDENTIFICATION OF POTENTIAL LAKE MANAGEMENT STRATEGIES FOR LAKE TARPON (PINELLAS COUNTY)

[1] David Tomasko, [1] Doug Robison, [1] Emily Keenan, [2]Robert Woithe,
[2]Joe Walter, [2]Jonathan Gale, [2]Daniel Parsons, [3]Robert Burnes, and [3]Sarah Malone
[1] Environmental Science Associates
[2]ATKINS North America
[3] Pinellas County Public Works Environmental Management, Clearwater, FL

Lake Tarpon is the largest freshwater lake in Pinellas County, and a SWIM priority waterbody of the Southwest Florida Water Management District. Pinellas County recently contracted with Atkins North America and Environmental Science Associates to develop a water quality management plan for the lake. Water and nutrient budgets were developed for the lake, including atmospheric deposition, groundwater inputs, and stormwater runoff from both gaged and ungaged portions of the lake's watershed. The hydrologic model also allowed for the determination of the "age" of water in the lake. Also available were data sets on the abundance of nuisance SAV (mostly Hydrilla sp.) and the amount of nuisance SAV treated via traditional herbicide applications.

An extensive water quality data set was then compared against estimates of pollutant loads, water level, fluctuations in water level, water age, and both the abundance and amount of treatment of nuisance SAV. Careful examination of empirically derived relationships between the most important factors influencing water quality has resulted in the identification of potential management projects that have the greatest likelihood of protecting the water quality of this high profile lake.

BENEFICIAL REUSE OF ORGANIC SEDIMENTS DREDGED FROM COASTAL SYSTEMS: BENCH SCALE DESALINATION STUDY

Katherine Y. Deliz Quiñones, PhD[1]; Wendy Blondin[2]; Jeremy Paris[2]; Stephen Hanks[3]; Ronda Haag[4]
[1]Amec Foster Wheeler, Newberry, FL
[2]Amec Foster Wheeler, Miami, FL
[3]Amec Foster Wheeler, Pensacola, FL
[4]Monroe County, Key Largo, FL

Monroe County has undertaken a Canal Restoration Demonstration Program to improve water quality in residential canals, and one of the data needs involved methods to encourage beneficial reuse of organic muck. This study was designed to identify the most efficient technology to reduce the salinity of organic muck dredged from residential Florida Key canals from >18 millisiemens per centimeter mS/cm to levels below 4 (mS/cm), which will allow the use of dredged muck as soil amendment. These dredged materials have been determined to meet Soil Cleanup Target Levels (SCTLs).

Salinity of dredged sediments was reduced through four different technologies, (1) sediment washing, (2) sediment flushing, (3) sediment washing and decanting of supernatant, and (4) sediment washing and flushing. The first technology evaluated salinity reduction as a function of time under ponding conditions, while the other technologies evaluated reduction in salinity content as a function of water additions or pore volume (pv). Efficiency of treatment was evaluated based on reduction of sediments' sodium adsorption ratio (SAR) and the exchangeable sodium percentage (ESP). Results showed all technologies were effective at reducing salinity to levels that will allow beneficial reuse of the organic muck as a soil amendment. Thus, preferred technology was selected based on water consumption and implementation effort. The preferred technology was washing, because it consumed two to nine times less water than compared technologies, and required the least effort to implement. Salinity leaching curves developed in this study can assist in the development of field salinity leaching treatment procedures at future dredging projects.

Session B3: Aquatic Plants and Harmful Algae Management

Moderator: John Walkinshaw
Friday, June 10, 2016. 9:00 am to 10:20 am

A RISK-BASED DECISION MATRIX FOR MANAGING NOXIOUS ALGAE

West M. Bishop
SePRO Corporation, SePRO Research and Technology Campus, Whitakers, NC

This presentation will discuss the risks of implementing management actions versus not taking effective action for noxious cyanobacteria species. Understanding risks associated with toxin producing cyanobacteria including toxin types, potential exposure routes and impacts on humans and wildlife will be covered. These will be put in comparative context of risks associated with potential management approaches, in particular copper-based algaecides. Advanced copper formulations were developed to more efficiently address problematic algae afflictions. Data regarding efficiency and effectiveness of recently developed copper formulations can decrease overall environmental loading of copper and attain increased control of noxious algae. Compared with other copper formulations tested, Captain XTR produced greater absorbed (infused) copper (average 36%) and large decreases (>50%) in amount of copper needed for control of nuisance cyanobacteria. Also, SeClear treated ponds required an average of 31% less number of algaecide applications year one and 39% less year two compared with copper sulfate. Increased understanding of negative impacts associated with toxin producing cyanobacteria coupled with advancements in targeted effectiveness of algaecides provides water resource managers key information to make informed, risk-based decisions regarding noxious algae management.

FIELD TESTING A NEW IPM APPROACH FOR HYDRILLA MANAGEMENT: PRELIMINARY RESULTS

James P. Cuda[1], Emma N.I. Weeks[1], Jennifer Gillett-Kaufman[1], Mark V. Hoyer[2], and Mark A. Jackson[3]
[1]Entomology & Nematology Department, University of Florida, Gainesville, FL
[2]School of Forest Resources & Conservation, University of Florida Gainesville, FL
[3]USDA ARS Crop Protection Research Laboratory, Peoria, IL,

Resistance and/or tolerance to the herbicides fluridone and endothall have been confirmed in several populations of the aquatic weed hydrilla (*Hydrilla verticillata*) in Florida, USA. This is a serious problem because these herbicides have been widely used in aquatic systems for over 30 years. In this study, we tested a novel IPM approach for hydrilla control by integrating selective insect herbivory by the hydrilla tip miner *Cricotopus lebetis* with a disease causing fungal pathogen *Mycoleptodiscus terrestris* (Mt) and low concentrations of the acetolactate synthase (ALS) inhibiting herbicide imazamox recently registered for aquatic use.

Limnocorrals were installed in three ponds at the UF/IFAS Center for Aquatic and Invasive Plants. Each limnocorral is a floating tube that is open at the bottom and placed over the substrate containing growing hydrilla. Four limnocorrals were placed in each of the three ponds, allowing four treatments to be replicated three times. Over a period of one year, all possible combinations of the three tools described were tested to determine the most effective combination for use in hydrilla management. To measure the impact of the management tools on hydrilla, surface area coverage measurements are taken as well as depth of the hydrilla mass from the surface. Establishment of the biological control agents and hydrilla damage was measured by collecting apical meristem samples at the beginning, halfway through and at the conclusion of the experiment. At the end of the experiment, the hydrilla in each of the limnocorrals was collected and dried to calculate biomass. Preliminary results were consistent with laboratory studies that demonstrated the aforementioned tools could be integrated to reduce overreliance on herbicides and improve hydrilla control.

EPA MOVEMENT TOWARD CYANOTOXIN REGULATION AND IMPROVED FRESHWATER MANAGEMENT POLICY

H Kenneth Hudnell[1], *Steve Beeman*[2], *Van McClendon*[3]
[1]Medora Corp., New Bern, NC
[2]Beemats LLC, New Smyrna Beach, FL
[3]Due Diligence, LLC, Freshwater Management, Little Rock, AR

The EPA appears to be moving toward the regulation of cyanotoxins and improved freshwater management policy through full implementation of the Clean Water Act (CWA). The state and trends of freshwater quality indicate changes are needed. Despite almost three decades and $billions applied to EPA's Nonpoint-Source Management Program (NSMP), nutrient and other pollutant inputs to freshwater are increasing, as are eutrophication, cyanobacterial harmful algal bloom, cyanotoxin, and noxious compound incidences. Increasing cyanotoxin events prompted EPA to address the occurrence and health effects data needed to make cyanotoxin regulatory determinations, including: 1) proposing required utility monitoring of cyanotoxins through the Unregulated Contaminant Monitoring Rule 4; 2) helping develop a satellite-based cyanobacteria surveillance system; and 3) issuing drinking water health advisory guidelines for microcystins and cylindrospermopsin.

All required data should be available by 2020. States followed EPA policy in developing and implementing over 69,000 Total Maximum Daily Load (TMDL) strategies, even as impairment incidence increased and recovery was rare. Although the Point-Source Management Program is successful, accounting for only 5-10% of inputs, the NSMP is limited by high cost and marginal effectiveness. EPA's policy shift eliminating the Waterbody Management (Clean Lakes) Program in the early 1990s compounded the problem. Sustainable physical, chemical, and biological waterbody treatments can quickly and cost-effectively suppress cyanobacteria, remove accessible and concentrated nutrients, and strengthen beneficial trophic cascades. NALMS and others called for full Clean Water Act implementation using an Adaptive Systems Approach (ASA). An ASA uses rigorous scientific and cost-benefit analyses in selecting options from all three programs based on merit alone, and periodically evaluates outcomes and options for cost-effective improvements. Recent EPA actions signal movement towards an ASA, including: 1) a long-term vision document allowing approaches alternative to TMDLs; and 2) hosting a webinar, developing a webpage, and publishing a document on waterbody treatments. Addressing cyanotoxins and policy can greatly improve health protection and water quality recovery.

RAPID ASSESSMENT OF SUBMERGED AQUATIC VEGETATION COMMUNITIES ON A LARGE 2,500 ACRE LAKE IN WEST CENTRAL FLORIDA

David Eilers, Matthew Jarrett, Robert Rosbough
Water Institute, School of Geosciences, University of South Florida, Tampa, FL

Submerged Aquatic Vegetation (SAV) plays a vital role in nutrient management and habitat in Florida lakes. From a management perspective, knowing the percent of the surface area of a lake covered by SAV can aid in proper decision making between biological needs and recreational user interests. Tracking which species are present in the lake and their relative community dominance can be a useful tool in monitoring and managing native and invasive SAV communities. Using a combination of sampling techniques including bathymetric mapping and manual submerged vegetation sampling, the submerged aquatic vegetation community of a large 2,500 acre lake was analyzed for species present, Percent Volume Inhabited and Percent Area Covered. This rapid, low cost approach is a useful monitoring tool to track vegetation changes as well as the extent of invasive species.

As part of a larger study of Lake Tarpon, the USF Water Institute was tasked with generating a list of observed SAV species as well as the percent area covered and percent volume inhabited by the SAV community. The project was conducted under a minimal amount of time (9 working days) allowed for field data collection and data processing. A combination of techniques using a sonar/GPS combo and the deployment of a frodus allowed for complete field data collection and data processing within the time period. The results of the study identified 9 species of SAV present in Lake Tarpon comprising 20.67% of the total surface area and 12.81% of the water volume. The average deep edge of the submerged vegetation community was estimated at 6.25'. The only non-native invasive species, *hydrilla verticillata*, was found in 2.92% of SAV samples. Periodically repeated SAV studies of this type would be useful to monitor the growth of potentially rapidly spreading species such as *hydrilla* on many temporal scales such as yearly or beginning of growing season versus end of growing season.

QUANTIFICATION OF NUTRIENT ASSIMILATIVE CAPACITY OF CHARA (SP.) IN A PREVIOUSLY HYPER-EUTROPHIC LAKE IN SOUTHWEST FLORIDA: IMPLICATIONS FOR LAKE MANAGEMENT

David Tomasko[1], Emily Keenan[1], Joanne Vernon[2], and Matt Logan[2]
[1]Environmental Science Associates, Tampa FL
[2]Charlotte County, FL

The Sunshine Lake/Sunrise Waterway system, located in Greater Port Charlotte, experienced extensive and persistent algal blooms. In response to these conditions, and as recommended in an assessment of the lake's problems (Atkins 2012) an extensive dredging operation was completed to remove the algal material from the Sunshine Lake/Sunrise Waterway system. Additionally, a watershed-wide investigation of water chemistry to determine the source of increased nutrients causing the persistent algae bloom was recently completed (Atkins and ESA 2015). Quarterly sampling of the amount of algae associated with the bottom of the lake and waterway was undertaken, and results will be discussed.

After the lake's cyanobacterial mat was dredged, various water management projects were implemented, including raising the lake level by approximately 1 foot, as well as the use of groundwater wells to supplement dry season lake levels. As the phosphorous load to the lake was determined to be natural, it was anticipated that either phytoplankton, attached algae or another cyanobacteria bloom was likely to occur. The plant community that came back was mostly a monoculture of *Chara* sp. Guidance provided to Charlotte County was that the County would be best served by physically removing the *Chara*, rather than treating it with herbicides and killing it in place. The benthic sampling program put into place allowed for the quantification of the amount of nutrients removed from the lake in the harvested *Chara* biomass. Based on an assessment of the project cost and the nutrient load removed, it appears that harvesting and removal of *Chara* was more cost efficient (dollar per pound of phosphorous removed) than the typical stormwater treatment pond approved for funding by the Southwest Florida Water Management District in 2016, even if harvesting was done for 20 years straight, and the stormwater pond was given a 20 year performance horizon.

Session A7: NPDES Permit Compliance

Moderator: Shannon Wetzel
Friday, June 10, 2016. 10:40 am to 11:30 am

STORMWATER PROGRAM COMPLIANCE WITH NNC: LESSONS LEARNED AT THE COUNTY LEVEL

Beck Frydenborg and Shannon Wetzel
Frydenborg EcoLogic, Tallahassee, FL
Seminole County, FL

Achieving compliance with Numeric Nutrient Criteria (NNC) is challenging, especially in physically altered stormwater conveyances. See how a local program (Seminole County) provided a technical demonstration that their conveyances comply with NNC and hear a discussion on the management implications.

There are 3 basic options to comply with Numeric Nutrient Criteria (NNC). The first involves achieving the stream floral metrics, and either achieving the fauna (SCI) metric, or attaining the reference stream-based nutrient thresholds. The second option involves qualifying for the "ditch exception" to NNC, and subsequently showing there are no imbalances due to nutrients. The last option consists of changing the classification to Class III-Limited and conducting a Use Attainability Analysis. Physical, chemical and biological data were systematically collected from stormwater conveyances located in Seminole County to determine the most appropriate compliance option. A Stressor Identification analysis (EPA's Causal Analysis/Diagnosis Decision Information System, or CADDIS) was conducted for Salt Creek. The scientific results are summarized, followed by a discussion of the management implications in the context of city and county stormwater program decisions.

DESIGNING PUBLIC AWARENESS AND VOLUNTEER PROGRAMS TO REDUCE POLLUTION AND MEET NPDES PERMIT REQUIREMENTS

Timothy J. Egan and Amy L. Giannotti
City of Winter Park Lakes Division, Winter Park, FL

Public education and awareness programs, including citizen volunteer programs, can be designed to meet several requirements in Phase I and Phase II NPDES permits in addition to fostering pollution prevention. To develop effective public awareness programs, managers must have a clear set of goals that they wish to accomplish through the program, including the identification of specific pollution sources that are problematic to their water bodies and/or MS4. Understanding the target audience and choosing the appropriate blend of media to deliver the organization's message is critical to achieving positive results. In order to remain effective through changing demographics and environmental conditions, awareness programs must be ongoing and flexible enough to include new media and address the public's changing information gathering patterns. Quantitatively determining pollutant load reductions from a public awareness program is not possible in most cases, making justification of program costs inherently difficult. To adequately evaluate the effectiveness of a program, managers will need to consider all known and estimated benefits that are provided, including regulatory compliance requirements met (including the avoidance of fines), relative costs of pollution prevention vs. treatment, economic losses from water pollution and public acceptance if your lake and stormwater management program.

HOW TO IMPROVE WATER QUALITY BY MITIGATING SEDIMENT AND TURBIDITY IMPACTS USING ANIONIC PAM BLENDS

Eddie Snell
Applied Polymer Systems, Woodstock, GA

Turbidity from erosion and sedimentation has many negative effects upon a water body. Sediment and excess nutrient loads, including phosphorous, enter our waters from erosion, fertilizers, biosolids, crop runoff, construction activities and other land disturbing activities. These materials cause eutrophic conditions that lead to algal blooms and surface water quality degradation. Unpleasant aesthetic effects caused by eutrophication do not compare to detrimental effects that turbid ponds, lakes, and various water bodies can have on overall water quality, aquatic organisms, and other animal populations. Such negative effects include high nutrient levels, such as phosphorous, that produce algal blooms that die and decay, in turn using up available dissolved oxygen. Fish need oxygen to survive and if oxygen is depleted fish kills can result. Fine particulates in the water column are a point of attachment for contaminants of not only nutrients but also bacteria, heavy metals, pesticides, and endocrine disruptors. Studies have shown that in turbidity levels as low as 10-100 NTUs aquatic organisms will begin to show signs of stress. This happens through decreased light, food and oxygen, mechanical effects, and temperature increases due to darker water.

Using water soluble polymer technologies to enhance current Best Management Practices (BMPs) we are able to greatly reduce the loss of sediment from a site as well as mitigate impacts of sediment and or nutrients to a given water body. Water treatment versions of PAM in the anionic form have shown very low to no aquatic toxicity potential to the environment. Through various research and tests using polymer enhancement in conjunction with known BMPs have achieved 70-95% reduction in phosphorous along with 95% reduction in turbidity NTUs.

Polymer Enhanced Best Management Practices (PEBMPs) can be used to stabilize soil at the source, preventing sediment discharges into our water and reducing turbidity within the water column.

Discussions of these will include: soil stabilization including polymer enhanced soft armoring systems, de-watering systems, pond and lake clarification including nutrient reductions, de-mucking, and Sediment Retention Barriers (SRBs).

Session A8: Lake and Pond Restoration - Science & Management

Moderator: Patrick Goodwin
Friday, June 10, 2016. 11:30 am to 12:20 pm

TROPHIC STATE SHIFTS IN FLORIDA'S COASTAL DUNE LAKES

Dana B. Stephens
Mattie M. Kelly Environmental Institute, Northwest Florida State College, Niceville, FL

Trophic state indicators total phosphorus, total nitrogen, chlorophyll concentrations, and Secchi disk measurements were assessed in 15 coastal dune lakes located in the panhandle of Florida. Annual means analyzed were derived from monthly measurements and range from 13 to 24 years in length. Kendall-Tau coefficients indicated increased total phosphorus in 4 lakes, increased total nitrogen in 3 lakes, increased chlorophyll-a concentrations in 3 lakes, and decreased water clarity in 3 lakes. One lake experienced decreased total phosphorus, 3 lakes decreased total nitrogen, 2 lakes decreased chlorophyll-a concentrations, and 2 lakes experienced increased water clarity over the examined period of time.

Trend analysis of trophic state indicators, however, did not well capture individual lake variance and trophic state shifts within lakes. For example, for a given trophic state indicator, some lakes shifted among oligotrophic, mesotrophic, and eutrophic categories. Other lakes, despite fluctuations in a given trophic state indicator over time, did not shift trophic state categories. Discussion explores magnitude of shifts in trophic state categories within individual lakes and among the 15 coastal dune lakes. Overall, efforts to describe long-term trophic state shifts in Florida's coastal dune lakes are needed as the Northwest Florida Water Management District is updating their Surface Water Improvement and Management plan.

IMPORTANCE OF IN LAKE NUTRIENT MITIGATION AND EFFECTIVE APPROACHES

West M. Bishop
SePRO Corporation, SePRO Research and Technology Campus, Whitakers, NC

Efficiencies of external BMP's may not be sufficient to address in lake water quality issues especially in light of additional inputs that are difficult to curtail (groundwater, wildlife, and atmospheric deposition). Additionally, watershed accumulation of P is expected to be a continuous source for decades in many Florida waters. Even examples where point source discharges of P have had measured decreases to lakes (e.g. Okeechobee), chronic cyanobacteria blooms still dominate and aqueous P increases have been observed from legacy *in situ* sources. External load reduction of P can promote cycling from benthic P stores (aka sediment nutrient pump) and can have a proportionally greater impact on nuisance algae growth.

Exploitation of sediment phosphorus is an important component of cyanobacteria ecology and many can bloom in this location or access these stores with buoyancy capabilities to form epilimnetic blooms even when minimal P in the water column. This reinforces the need for managing the phosphorus that has already accumulated and that may not be able to be effectively decreased from external inputs. The in lake focus is where the negative impacts are often manifested and also where a large portion of management should be focused. The ultimate fate of phosphorus following binding in a system will be assessed between Phoslock and other technologies as well as risks to non-target species and undesired impacts to water quality. Phoslock® is a lanthanum-based phosphorus locking technology that provides an effective approach to mitigate in situ phosphorus accumulation in water resources to restore water quality and combat the eutrophication process. Phoslock was able to rapidly (<2 weeks) and significantly ($p<0.0005$) decrease total (>80 %) and free reactive (>95 %) phosphorus in the water column and significantly shift potentially releasable sediment phosphorus fractions to residual forms after treatment in field applications across the country. This shift in P availability altered the subsequent N:P ratio as well as sediment fractions able to be acquired. Algae assemblages either maintained beneficial types (i.e. offset nuisance cyanobacteria from arising) or shifted away from cyanobacteria dominance. Phoslock® is a

novel phosphorus locking technology that provides an effective and ecologically friendly approach to combat the eutrophication process and restore water quality.

PROVIDING A NATURAL HABITAT FOR WILDLIFE IN AN URBAN ENVIRONMENT

Ernie Franke
Chairman of the Wetlands Committee
The Shores of Long Bayou Condominiums, St Petersburg, FL

Housing developments have invaded much of our state. Native flora and fauna has been replaced with ornamental species, many being invasive. Man is the invasive specie, grabbing choice waterfront lots, displacing native vegetation and wildlife. If current trends continue, our population will double by 2050 - or twice the 2000 census. The good news is that we have estuaries and stormwater ponds that can provide a natural habitat in this urban environment.
Three items have put a slight dent in the displacement of Florida wildlife and a halt on invasive species: public demand for green spaces, the requirement for stormwater ponds, and the use of volunteers to combat invasive species.
Our condominium community has set aside a nature reserve on our 77-acre campus, with a Wetlands Committee to oversee it. In a small way, this has reversed this tide of habitat-loss through the construction of a habitat for breeding common moorhens, the development of basking islands for turtles and the maintenance of a nature trail. We have successfully used borders to safely bring wildlife into our urban community.

The committee formulated written guidelines, in accordance with state, regional and local regulations, to provide a consistent vision for preserving these green spaces. Volunteers have restored and maintained a nature trail and several stormwater retention ponds. In keeping with an old German maxim "sweep the street in front of your house", we have stressed adoption.

The evidence of change is seen in three ways; increased pride and resultant property values, increased numbers of animals and decreased invasive species, and a change in attitude of the unit owners as evidenced by their HOA voting practices and volunteerism.

PRESENTER CONTACT INFORMATION
2016 FLORIDA LAKE MANAGEMENT SOCIETY 27TH ANNUAL SYMPOSIUM

PRESENTER	AFFILIATION	EMAIL ADDRESS
Anderson, Chris	FWC	Christopher.Anderson@MyFWC.com
Baird, S Fay	Normandeau Associates	fbaird@normandeau.com
Benton, John	FWC	john.benton@myFWC.com
Bishop, West	SePRO Corporation	westb@sepro.com
Bowen, Pam	St. Johns River WMD	pbowen@sjrwmd.com
Bryan, Richard	Lake Powell Community Alliance	richardbryan1944@yahoo.com
Burnes, Robert	Pinellas County	rburnes@co.pinellas.fl.us
Canion, Andy	St. Johns River WMD	acanion@sjrwmd.com
Coveney, Michael	St. Johns River WMD	mcoveney@sjrwmd.com
Cuda, James	University of Florida	jcuda@ufl.edu
Dierberg, Forrest	DB Environmental	woody@dbenv.com
Deliz Quiñones, Katherine	Amec Foster Wheeler	katherine.deliz@amecfw.com
Dobberfuhl, Dean	St. Johns River WMD	ddobberfuhl@sjrwmd.com
Edel, Samantha	Daytona State College	Samantha_edel@daytonastate.edu
Egan, Tim	City of Winter Park	Tegan@cityofwinterpark.org
Eilers, David	University of South Florida	eilers@usf.edu
Ford, Clell	Highlands County	Cford@hcbcc.org
Franke, Ernie	Shores of Long Bayou	eafranke@tampabay.rr.com
Guyette, Margaret	St. Johns River WMD	mguyette@sjrwmd.com
Hamm, Ryan	FWC	ryan.hamm@myfwc.com
Harper, Harvey	Environmental Research & Design	hharper@erd.org
Hoyer, Mark	University of Florida	mvhoyer@ufl.edu
Hudnell, H Kenneth	Medoraco Corporation	ken.hudnell@medoraco.com
Jaggers, Bruce	FWC	bruce.jaggers@myfwc.com
James, R. Thomas	South Florida WMD	tjames@sfwmd.gov
Johnson, Kevin	FWC	kevin.johnson@myfwc.com
Keenan, Emily	Environmental Science Associates	EKeenan@esassoc.com
Kenney, William	University of Florida	kenney@ufl.edu
King, Sean	Southwest Florida WMD	Sean.King@swfwmd.state.fl.us
Livingston, Robert	Florida State University	livingstonr@comcast.net
Lucius, Mark	Florida Gulf Coast University	Malucius1786@eagle.fgcu.edu

PRESENTER	AFFILIATION	EMAIL ADDRESS
Lumbard, Lance	Amec Foster Wheeler	lance.lumbard@amecfw.com
Lundy, Earl	FWC	Earl.Lundy@MyFWC.com
McGlynn, Sean	McGlynn Laboratories Inc.	mcglynnlabs@gmail.com
Miller, Sara	AMEC Foster Wheeler	sara.miller@amecfw.com
Misra, Vasu	Florida State University	vmisra@fsu.edu
Moody, E. Renee	Daytona State College	Elizabeth_Moody508@daytonastate.edu
Robins, Robert	Florida Museum of Natural History	rhrobins@flmnh.ufl.edu
Sawyers, Eric	FWC	eric.sawyers@myfwc.com
Schmutz ,Dan	Greenman Pedersen, Inc.	dschmutz@gpinet.com
Shortelle, Ann	St. Johns River WMD	ashortelle@sjrwmd.com
Slater, Jodi B	St. Johns River WMD	JSlater@sjrwmd.com
Snell, Eddie	Applied Polymer Systems	egsnell@hotmail.com
Stephens, Dana Bigham	Northwest Florida State College	stephed@nwfsc.edu
Tomasko, David	Environmental Science Associates	DTomasko@esassoc.com
Wellendorf, Nia	FDEP	nijole.wellendorf@dep.state.fl.us
Wetzel, Shannon	Seminole County	swetzel@seminolecountyfl.gov
Xiong, Chao	University of Florida	chao.xiong@ufl.edu