Lake Management in a Time of Budget Cuts

FLMS

23rd Annual

Florida Lake Management Society
Conference and Technical Sessions

June 18 – 22, 2012

Paramount Plaza, Gainesville

Mission Statement

The mission of the Florida Lake Management Society is to promote protection, enhancement, conservation, restoration and management of Florida's aquatic resources; provide a forum for education and information exchange; and advocate environmentally sound and economically feasible lake and aquatic resource management for the citizens of Florida.

Cover photo: Newnans Lake, July 2006, Alachua County, Florida, entrance to Prairie Creek, photo by Jian Di, SJRWMD

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FLMS AWARDS 2012

The Marjorie Carr Award

Posthumous award to Roy G. Harrell, Jr.

***The Marjorie Carr Award** - is the Society's highest award and is given for life time work on behalf of Florida's aquatic resources. This award is named in honor of Marjorie Carr who, among other things, organized citizens and brought to an end the proposed Cross Florida Barge Canal.*

The Edward Deevey, Jr. Award

Roger W. Bachmann

Professor,

University of Florida

***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 Scott Driver Award

Fritzi Olson

Executive Director of Current Problems, Inc.,

***The Scott Driver Award** - is given to an "activist" who has promoted the restoration, protection and/or appreciation of Florida's aquatic resources. Scott was a well know activist on behalf of Lake Okeechobee and a member of the steering committee that founded the FLMS at the time of his death.*

The Richard Coleman Aquatic Resources Award

Mike Britt

City of Winter Haven Natural Resources Dept.

***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

Cynthia Barnett

Author of “Mirage: Florida and the Vanishing Water of Eastern US”

and Blue Revolution: The Unmaking of America’s Water Crisis

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

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CONFERENCE PROGRAM

23rd ANNUAL FLORIDA LAKE MANAGEMENT SOCIETY CONFERENCE

Lake Management in a Time of Budget Cuts

June 18-22, 2012

Welcome!

MONDAY - JUNE 18, 2012 – WORKSHOPS

8:00 am – 5:00 pm	**Check-In and Registration** (main lobby)

8:15 – 12:15 am **Workshop 1: Usi[illegible] t[illegible] [illegible]derstand and Manage Our Water Resources: How t[illegible] [illegible]d Spatial Models and On-Line Resources.** Jim Griffin, Ph.D., Flo[illegible] [illegible]mmunity Design + Research, School of Architecture and Community Design, [illegible]ersity of South Florida. **(Location: Paynes Prairie Room)**

Cancelled

8:15 – 12:15 am **Workshop 2: Advanced Data Management & Exploration with MS Excel.** Erich Marzolf, Ph.D., St. Johns River Water Management District, **(Location: Lakeview North)**

8:15 – 12:15 am **Workshop 3: Part I: DEP Measures of Floral Health: Procedures and Uses.** Russ Frydenborg and Nia Wellendorf, Florida Department of Environmental Protection, (**Location: Lakeview South)**

10:00 – 10:15 am	**MORNING BREAK** (Lower Level Lobby)
12:15 – 12:45 pm	**LUNCH** (*provided with full-day Workshop registration*) (Lower Level Lobby)
2:45 – 3:00 pm	**AFTERNOON BREAK** (Lower Level Lobby)

12:45 – 4:45 pm **Workshop 3: Part II: DEP Measures of Floral Health: Procedures and Uses.** Russ Frydenborg and Nia Wellendorf, FDEP, **(Leave for field right after morning session)**

12:45 – 4:45 pm **Workshop 4: Use of Alum in Lake Management.** Harvey H. Harper, Ph.D., P.E. – President Environmental Research & Design, Inc., **(Location: Lakeview North)**

1:00 – 5:00 pm **Volunteer Service – Exotic aquatic plant removal at an Alachua County Park.** Meet in Lower Level Lobby

TUESDAY - JUNE 19, 2012 MORNING

8:00 am – 4:00 pm	**Check-In and Registration** (Lower Level Lobby)
7:00 am – 8:30 am	**Breakfast** (Ballroom B/C)

Plenary Sessions	**Location (Bivens Ballroom)**	
8:45– 9:00 am	**Opening Remarks:**	Dean Dobberfuhl, Outgoing FLMS President Sherry Brandt-Williams, Conference and Program Chair
9:00 – 9:30 am	**Plenary Talk**: **Ecological engineering and lake management**	Mark Brown, Professor and Director, Center for Environmental Policy and the Howard T. Odum Center for Wetlands
9:30 – 10:00 am	**Plenary Talk:** **Integrating water resource monitoring agencies throughout Florida**	Mark Hoyer, The Florida Water Resources Monitoring Council

10:00 – 10:30 am	**MORNING BREAK** (Ballroom A/B)

Session 1: FDEP Staff Discuss the Changes in Responsibilities with new Numeric Criteria
Location Bivens Ballroom
Moderator: Sherry Brandt-Williams

10:30 – 10:35 am	**Session Introduction - Moderator**
10:35 – 10:50 am	**New Numeric Criteria in Florida: Nutrients and Dissolved Oxygen.** FDEP staff
10:50 – 11:05 am	**Role of Bioassessment Methods in Florida's Numeric Nutrient Criteria Rules.** Russ Frydenborg and Nia Wellendorf
11:05 am– 12:00 pm	**Question Period**

12:00 – 1:30 pm	**LUNCH** (Ballroom B/C)	**GUEST SPEAKER: ANN SHORTELLE** **Water Policy Director, FDEP** **Water and the Other Q Word**

TUESDAY – JUNE 19, 2012 AFTERNOON

Session 2: Meeting Regulatory Requirements Location Bivens Ballroom
Moderator: Kym Rouse Campbell

1:30 – 1:35 pm	**Session Introduction - Moderator**
1:35 – 1:50 pm	**Lake Tohopekaliga - An Alternative Approach to Total Maximum Daily Loads.** Jordan Williams, Danielle Honour, D. Wre, and Kimberly Lawrence
1:50 – 2:05 pm	**Phosphorus Limitation and the Case at Bay Lake: Do We Really Know What We Think We Know?** Lance M. Lumbard, Sam Arden, Judith Dudley, Ronald Novy, Brian Catanzaro
2:05 – 2:20 pm	**Using a Metals Translator for Establishing NPDES Limits: A Case Study.** Larry J. Danek, and Gary P. Dalbec
2:20 – 2:35 pm	**Macroinvertebrate Indicators for Establishment of Minimum Flows and Levels for the Crystal River, Florida**. Douglas G. Strom, David L. Evans, and Lynn Mosura-Bliss
2:35 – 3:00 pm	**Question Period**

3:00-3:30 pm	**AFTERNOON BREAK** (Ballroom A/B)

Session 3: Policy, Ecological Economics and Grassroots Programs Location Bivens Ballroom
Moderator: Mike Perry

3:30 – 3:35 pm	**Session Introduction - Moderator**
3:35 – 3:50 pm	**The Ecosystem Services of Florida Lakes.** Kym Rouse Campbell and Joseph Nicolette
3:50 – 4:05 pm	**Secrets to A Successful, Community-Initiated, Retention Pond Restoration** Ernie Franke
4:05 – 4:20 pm	**Improved Policy for Regaining Designated Uses of Clean Water Act Section 303(D) Impaired Waters.** H Kenneth Hudnell
4:20 – 4:35 pm	**Vanishing Point - A Photo Documentary of Drought Impacted Lakes and Streams.** Matthew Dubé
4:35 – 5:00 pm	**Question Period**

5:00 – 5:30 pm	**FLMS Chapter Meetings** (Bivens Ballroom)
5:30 – 6:30 pm	**POSTER SESSION** (Ballroom A/B)
5:30 – 7:00 pm	**EXHIBITORS' SOCIAL** (Ballroom A/B)

TUESDAY – JUNE 19, 2012 EVENING POSTERS

Session 4: Poster Session (Ballroom A/B)

5:30 – 6:30 pm **A GIS-Based Model to Predict Interannual Variability in the Abundance of Small Fishes Produced on the Floodplain of the St. Johns River in Central Florida.** Steven J. Miller, Sandra Fox and Lawrence Keenan

5:30 – 6:30 pm **Trends in Nutrient Data for Suwannee River Water Management District Lakes.** Laura Line, David L. Evans, Matthew Fellows, Robert Giambrone, Meagan Putts, and Douglas Strom

5:30 – 6:30 pm **Developing a Long Term Monitoring Program on Campus: Student Monitoring of Lake Water Quality at University of North Florida.** Patrick Goodwin* and Kelly Smith

5:30 – 6:30 pm **Where is the Party? Habitat Use by the Fish of Plant Park Stream, Tampa Florida.** Lyndi F. Jordan*, Raymond A. Schlueter and Mark G. McRae

5:30 – 6:30 pm **How to Combat the Detrimental Effects of Eutrophication, Control Algae Blooms and Meet Water Quality Standards.** Seva Iwinski

5:30 – 6:30 pm **Dissolved Oxygen Dynamics and Limitation of Fish Habitat Utilization Due to Hypoxia in *Hydrilla*.** Erin Bradshaw Settevendemio, Merrill Rudd, Michael S. Allen, and Michael Netherland

5:30 – 6:30 pm **High Levels of Phosphorus, Poor Water Quality: A Novel In-Situ Solution.** Shaun Hyde and West M. Bishop

5:30 – 6:30 pm **Assessment of Ecosystem Restoration in Lake Istokpoga, Florida.** Zhemin Xuan*, Ni-Bin Chang, Jamie Jones, and Kamrul Islam

5:30 – 6:30 pm **Assessment of Best Management Practices of Sediment Dredging in Lake Apopka-Beauclair System, Florida.** Jamie Jones*, Kamrul Islam, Ni-Bin Chang and Lance M. Lumbard

5:30 – 6:30 pm **Submerged Aquatic Vegetation Field Survey Versus Aerial Photograph Interpretation.** Shannon McMorrow, Joy Ryan, Judith Dudley

WEDNESDAY - JUNE 20, 2012 MORNING

8:00 am – 4:00 pm	**Check-In and Registration** (Lower Level Lobby)
7:00 – 8:30 am	**Breakfast** (Ballroom B/C)

Session 5: Florida's Springs Location Bivens Ballroom
Moderator: Robert Mattson

8:30 – 8:35 am **Session Introduction - Moderator**

8:35 – 8:50 am **Florida Spring Ecosystems – Introduction.** Robert Mattson

8:50 – 9:05 am **Relationships Between Discharge and Nutrient Concentrations in Florida Springs.** Erich Marzolf and Robert Mattson

9:05 – 9:20 am **Experimental evidence of top-down control of algal proliferation in Florida springs.** Dina Liebowitz*, Matthew Cohen, James Heffernan, Thomas Frazer, and Lawrence Korhnak

9:20 – 9:35 am **Flow Velocity Control of Filamentous Algae in a Sub-Tropical Spring-Fed River.** Sean King*

9:35 – 10:00 am **Question Period**

10:00-10:30 am	**MORNING BREAK** (Ballroom A/B)

Session 6: New Technology and Established BMPs Part I Location Bivens Ballroom
Moderator: Shannon Carter-Wetzel

10:30 – 10:35 am **Session Introduction - Moderator**

10:35 – 10:50 am **Cross-Resistant Hydrilla in the Winter Park Chain of Lakes; Considerations for Management Strategies and Treatment Options.** Amy L. Giannotti And Timothy J. Egan

10:50 – 11:05 am **The Application Of New Aquatic Herbicides And Their Role In Rotation, Selectivity And Efficacy For Hydrilla Management.** Alicia Knecht

11:05 – 11:20 am **Can Sediment Inactivation Be Successful In Shallow Lakes? - A New Look At An Old Paradigm.** Harvey H. Harper

11:20 – 11:35 am **Lake Seminole Sediment Removal Project.** Scott Wuitschick

11:35 – 12:00 **Question Period**

12:00 – 1:30 pm	**BANQUET LUNCH/FLMS ANNUAL MEETING** (Ballroom B/C)

WEDNESDAY - JUNE 20, 2012 AFTERNOON

Session 7: New Technology and Established BMPs Part II Location Bivens Ballroom
Moderator: Lawrence Keenan

1:30 – 1:35 pm	**Session Introduction - Moderator**
1:35 – 1:50 pm	**Phosphorus Removal in Natural Waters through Calcium Co-precipitation; Effects of Natural Organic Matter.** Hugo Sindelar*, Treavor Boyer, Mark Brown
1:50 – 2:05 pm	**The Use of a Polyacrylamide (PAM) Blend to Flocculate and Control Algae In Freshwater.** Kyla J. Iwinski*
2:05 – 2:20 pm	**Optimizing Stormwater BMPS with Real-Time Controls.** Thomas Amstadt, Mark Ellard, and Marcus Quigley
2:20 – 2:35 pm	**Lake Levels and Water Quality.** Clell Ford
2:35 – 3:00 pm	**Question Period**

3:00 – 3:30 pm	**AFTERNOON BREAK** (Ballroom A/B)

Session 8: New Technology and Established BMPs Part III Location Bivens Ballroom
Moderator: Lance Lumbard

3:30 – 3:35pm	**Session Introduction - Moderator**
3:35 – 3:50 pm	**City of Winter Park Chain of Lakes: Twenty Years of Stormwater Utility Implementation**. Timothy J. Egan
3:50 – 4:05 pm	**Restoration approaches for urban pond system in HIllsborough County Florida.** Jim Griffin
4:05 – 4:20 pm	**Geofilter Tube Technology helps in Successful Restoration of Lake Down Canal (Butler Chain of Lakes).** Sergio Duarte
4:20 – 4:35 pm	**A Prioritization Tool for Aquatic Restoration and Enhancement of Florida Public Lakes.** Jessica L. Griffith, Michael Allen, and J. Beacham Furse
4:35 – 5:00 pm	**Question Period**

5:00 – 6:00 pm	**FLMS BOARD MEETING** (will be announced at the end of Session 8)
7:00 pm – Midnight	**Gainesville Downtown**

THURSDAY – JUNE 21, 2012 MORNING

8:00 – 8:30 am	**CHECK-IN AND REGISTRATION** (Lower Level Lobby)
7:00 – 8:30 am	**BREAKFAST** (Ballroom B/C)
10:00 am – Noon	**EXHIBITOR BREAKDOWN**

Session 9: Effective Monitoring Location Bivens Ballroom
Moderator: Dana Bigham

8:30 – 8:35 am **Session Introduction - Moderator**

8:35 – 8:50 am **Assessing Fish Communities in Dense Submersed Aquatic Vegetation with Underwater Video Cameras.** Wilson, Kyle L., Micheal S. Allen, and Michael D. Netherland

8:50 – 9:05 am **Use of Selected Organic Microconstituents as Markers for Nutrient Loading from Reclaimed Water Plants in Florida.** Erich Marzolf, Joan A. Oppenheimer, Mohammad Badruzzaman, Joseph G. Jacangelo

9:05 – 9:20 am **Low Cost Bacteria Sampling… Is There Such a Thing?** Sam Arden

9:20 – 9:35 am **The good news from the 2007 National Lakes Assessment: US lakes are not as bad as we thought.** Roger W. Bachmann, Dana L. Bigham, Mark V. Hoyer, and Daniel E. Canfield, Jr.

9:35 – 10:00 am **Question Period**

10:00 – 10:30 am	**MORNING BREAK** (Ballroom A/B)

Session 10: Low Cost – High Quality Analysis Tools for the Trade Location Bivens Ballroom
Moderator: David Evans

10:30 – 10:35 am **Session Introduction - Moderator**

10:35 – 10:50 am **Water Atlas Spatial On-Line Library: A New Tool for Water Resource Investigations, New Technology and BMPs**. Jan Allyn

10:50 – 11:05 am **Accessing St. Johns River Water Management Data: GIS, Water Quality and Quantity**. Bill Van Sickle

11:05 – 11:20 am **An Inexpensive, Low-Maintenance Dissolved Oxygen Recorder Designed for Long-Term Deployment.** Lawrence Keenan

11:20 – 11:45 am **Question Period**

11:45 am – Noon **Student Awards and Closing Remarks.** 2012- 2013 FLMS President

12:00 pm	**TECHNICAL SESSIONS ADJOURNED**
1:30 pm	**Field Trip 1: GRU Kanapaha Reclaimed Water Facility and TREEO Water Garden**
Friday, June 22, 8 AM	**Field Trip 2: Paynes Prairie w/FWC and FDEP guides**

Workshop Descriptions

Workshop 1
Using Spatial Analysis to Better Understand and Manage Our Water Resources: How to Effectively Employ GIS and Spatial Models and On-Line Resources.

Cancelled

Jim Griffin, Ph.D., Florida Center for Community Design + Res[illegible] Sc[illegible]o[illegible] [illegible]chitecture and Community Design, University of South Florida

Who: This workshop would be va[illegible]w more about the use of spatial data (maps and related information) in wate[illegible]nts and management.

What: The concept of spatial da[illegible]esented as well as various methods of building simple spatial databases that can be valuable to lake managers. Additionally, the basic shapefile will be explored as a common file that can be used between various GIS systems and the KLM (Google Earth basic layer file) file will be discussed as a way of moving GIS data to web applications.

Workshop 2
Advanced Data Management & Exploration with MS EXCEL

Erich Marzolf, Environmental Scientist VI, St. Johns River Water Management District

Who: Anyone is interested in learning effective techniques for managing and exploring data within Excel. Some experience in Excel suggested, but not required. **It is *highly* recommended that each participant show up with their own laptop with Excel to be able to work on their own!**

What: This workshop will introduce the advantages of using a "single record per line" approach to data management. Techniques for data mining via Excel's PivotTable feature will be explained and demonstrated. Automation of graphs (including titles) and statistics. Examples will include water quality data and spatial datasets of soil pesticides. The main categories to be addressed include:

- Introduction to data management in Excel
- Introduction to PivotTables
- Use of PivotCharts and other linked charts
- Automating column titles, headers, chart axes, etc.
- Automating statistical tests
- Getting around some of Excel's odd limitations

Why: Do you manage your water quality data in columns by site and parameter? If so, this workshop is for you. Do you wish all the data for a project could be kept together in a single place along with its associated metadata and not spread out over many sheets or files? Do you routinely produce charts with updated data only to have to update legends and titles. Wish this was done automatically?? Want to spend more time thinking about your data, rather than formatting and twiddling with charts. Help is here.

About the Instructor:

Erich Marzolf is an Environmental Scientist with the St. Johns River Water Management District. Dr. Marzolf has been the District since 1994 and has worked on lake, river, spring and wetland restoration projects in the Upper & Middle St. Johns River, Orange Creek and Ocklawaha Basins. Prior to coming to the District, he worked at Oak Ridge National Laboratory and received graduate degrees in Ecology from the University of California Davis. He has been working with Excel since 1986 (that's version 1 for the Mac).

Workshop Outline

1. Introductions
    1.1. Erich
    1.2. Single Row Per Line Vs. Columns
2. Pivot Tables
    2.1. Introduction
    2.2. Benefits
        2.2.1. All your data in one place
        2.2.2. Meta data with your data
    2.3. How to build the table
        2.3.1. Layout
            2.3.1.1. Count, Average, Maximum, Minimum
        2.3.2. REFRESH !

- 2.3.3. Sequence of columns (alphabetical or manual)
- 2.4. Limitations
  - 2.4.1. Dates & Time Series
  - 2.4.2. Pivot Charts - Too Ugly for Documents & Presentations

3. Work Arounds - Mirrors of PTs
   - 3.1. Using If, Then, Else formula
   - 3.2. For Plotting
     - 3.2.1. The null Command in If formula
     - 3.2.2. Charting mirror data
       - 3.2.2.1. Automated Titles
         - 3.2.2.1.1. The Vlookup Formula & absolute references
       - 3.2.2.2. Calculating a decimal year surrogate for actual dates
       - 3.2.2.3. Turn off resizing
       - 3.2.2.4. Making a copy for dark background PowerPoint slides
   - 3.3. For Stats
     - 3.3.1. Using blanks in If formulas
4. Data Sources
   - 4.1. Excel sheet
   - 4.2. Access tables
   - 4.3. Text files (.csv)
   - 4.4. ? How to manage into Single-Record-Per-Line?
5. Examples
   - 5.1. Apopka WQ
     - 5.1.1. Mean Monthly Plotter
       - 5.1.1.1. Decimal year
       - 5.1.1.2. Plotting & Stats
       - 5.1.1.3. Automated Titles
     - 5.1.2. 2X Annual Plotter
       - 5.1.2.1. Two parameters
     - 5.1.3. Mean Month & Year Plotter
       - 5.1.3.1. Subtotals
       - 5.1.3.2. Null formula
   - 5.2. Apopka Pesticide Data
     - 5.2.1. Data & Metadata
     - 5.2.2. Normality Test
     - 5.2.3. Soil & PT chart
       - 5.2.3.1. Title with summary stats
     - 5.2.4. Export
       - 5.2.4.1. Vlookup for coordinates and export to ArcView
     - 5.2.5. Sample Type Comparison
       - 5.2.5.1. Bars with both StDev and SE
   - 5.3. Hydrology Data
     - 5.3.1. Frequency Distribution Plots
     - 5.3.2. Box Plots
6. Questions and Work on Own Time

Workshop 3
DEP Measures of Floral Health: Procedures and Uses

Russ Frydenborg and Nia Wellendorf , 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) bioassessment tools in lakes and streams to assess floral health. These tools include phytoplankton chlorophyll a, 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. The workshop will also review basic water sampling techniques and associated quality assurance requirements for entities that submit water quality data to DEP.
Part I (AM Session): 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
- Basic water quality sampling Quality Assurance (QA) considerations

Part II (PM Session): In the afternoon, we will go out into a nearby stream and lake to practice the LVI, LVS, and RPS. Participants will learn how to conduct the assessments, including field judgments required. The field portion of the workshop will be an excellent opportunity for plant ID training. NOTE: Participants in the field portion should wear appropriate protective gear (hat, sunscreen, waders), and bring field-appropriate plant ID aids. Boats will not be needed.

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 Instructors: Russ Frydenborg is the administrator of the Standards and Assessment Section at the Florida Department of Environmental Protection (DEP). He was born in Miami, Fl, graduated from FSU with a degree in Biological Science, and has been working for DEP since 1979, performing ecological assessments. His emphasis is on the objective evaluation and interpretation of environmental data and development of water quality standards to protect Florida's aquatic systems. Nia Wellendorf works in the DEP Standards and Assessment Section, and focuses on biocriteria, quality assurance, and water quality standards development toward better management and protection of Florida's surface waters. Nia has a Master's degree in Aquatic Ecology from the University of Alabama.

Workshop 4
Use of Alum in Lake Management

Harvey H. Harper, Ph.D., P.E. – President Environmental Research & Design, Inc

Who: This workshop is designed for lake managers, scientists and engineers who are responsible for evaluation, selection and implementation of nutrient management programs and projects and are interested in learning more about alum as a nutrient management technique.

What: This workshop will cover methods for managing nutrient inputs to lakes from both external and internal sources using alum. The session will begin with a discussion of the environmental chemistry of aluminum, including a comparison with metal salts of iron and calcium. Emphasis will be placed on identification and quantification of external inputs from stormwater runoff, baseflow and groundwater seepage. Potential alum based management techniques will be discussed, including effectiveness, applicability, costs, and comparison with other BMPs. The workshop will also address identification, quantification and management of phosphorus inputs from internal recycling. Environmental impacts of alum use will be discussed. Case studies will be presented which address alum use for both stormwater treatment and sediment inactivation.

Meet the Guest Speakers

1st Plenary Talk

Ecological Engineering and Lake Management

Mark Brown, Professor
Department of Environmental Engineering Sciences
University of Florida

Dr. Mark Brown is Professor of Environmental Engineering Sciences and Program Director of the Center for Environmental Policy at the University of Florida (UF). He is also currently Acting Program Director of the Howard T. Odum Center for Wetlands. Professor Brown is a systems ecologist, whose research focuses on several areas that can broadly be described as natural resource management, including systems ecology, wetlands ecology, ecological engineering, environmental policy and energy analysis. He has served as consultant on development and sustainability issues to the USEPA, USAID, UNEP, and numerous governments and private consulting firms worldwide. For six years Dr. Brown was consulting ecologist to The Cousteau Society working with their research teams to develop appropriate solutions to a wide array of resource management problems that affect marine resources throughout the world. Current research includes projects to develop ecological indicators of ecosystem health, sustainable technologies for pollutant removal from surface waters, evaluation of the greenhouse gas emissions from alternative transportation, and modeling the impacts of nutrient enrichment in Florida watersheds. He is the author of over 100 peer reviewed journal articles, 2 books, and 24 book chapters. In his career at UF he has mentored 21 PhD students and 30 master's degree students.

Dr. Brown has received numerous honors including the Parthenope University (Italy) Research Scholar of the Year; University of Florida Graduate School Advising and Mentoring Award; Distinguished Lecturer, The Ohio State University; and University of Florida Teaching Improvement Program Award for outstanding teaching. Dr. Brown has been appointed as visiting lecturer in the Department of Environmental Sciences and Engineering, University of North Carolina, Chapel Hill, Parthenope University of Naples, Italy; and China Agricultural University, Beijing. He serves on the Editorial Board, of *Ecological Modeling* and *Ecological Engineering* and is past president of American Ecological Engineering Society. He is a former Fulbright Scholar, serving as Distinguished Fulbright Chair of Energy and Environment, Parthenope University of Naples

2nd Plenary Talk

Integrating water resource monitoring agencies throughout Florida

Mark Hoyer
The Florida Water Resources Monitoring Council

Mark is currently the Assistant Director of Research and Program Services/LAKEWATCH at the University of Florida. He received a Bachelor of Science in Fisheries and Wildlife Biology from Iowa State University and his Master of Science in Limnology from the University of Missouri, Columbia.

Mark has been with the University of Florida for 29 year participating in many research projects on streams, lakes and estuaries authored/co-authored over 85 peer reviewed papers and four books related to lakes management. Mark helped start the Florida LAKEWATCH program in 1986, which currently works with over 1000 citizen scientists who monitor the water chemistry of approximately 500 lakes, 130 near shore coastal stations and 125 river stations.

Mark has been active in FLMS since the beginning in the early 1990's receiving FLMS awards for Best Paper (1993), The Presidents Award (1996) and the Edward Deevy, Jr. Award (2008) along the way. Mark has not yet served on the FLMS Board, spending more committee time with the Mother Ship NALMS including a NALMS Presidential term from 2009 – 2011. Mark is also an active member of the American Fisheries Society (AFS) and Aquatic Plant Management Society (APMS). Mark is a NALMS Certified Lake Manager (CLM) and an AFS Certified Fisheries Scientist (CFS).

Currently, Mark serves on the Executive Board for the National Reservoir Fisheries Habitat Partnership, representing NALMS. He also serves on the Florida Water Resources Monitoring Council and under that entity is actively working with the Groundwater Salinity Network Working Group.

.Guest Speaker Tuesday Lunch

Water and the Other Q Word

Ann Shortelle
Water Policy Director, FDEP

Session Abstracts

Session 1: FDEP Staff Discuss the Changes in Responsibilities with New Numeric Criteria

Location Bivens Ballroom

Tuesday, June 19, 10:30 am to noon

ROLE OF BIOASSESSMENT METHODS IN FLORIDA'S NUMERIC NUTRIENT CRITERIA RULES

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The Florida Department of Environmental Protection, in collaboration with the United States Environmental Protection agency and Florida stakeholders, crafted numeric nutrient standards and implementation strategies that recognize the diversity of waters within the state and the unique status of nitrogen and phosphorus as non-toxic pollutants. Revisions of Florida water quality standards (62-302, Florida Administrative Code [F.A.C.]) and impaired waters (62-303, F.A.C.) rules provide numeric interpretations of the existing narrative criterion (62-302.530[47][b]) for most waters. Biological assessments of flora and fauna will be utilized in streams and rivers to inform decisions of potential waterbody impairment related to "imbalances of aquatic flora or fauna". In addition, the Lake Vegetation Index will be employed as a measure or aquatic life use support and as information for potential site specific alternative criteria (SSAC).

For stream segments, the narrative criterion is achieved if:

- Information on chlorophyll *a* levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition do not indicate an imbalance in flora or fauna; AND EITHER
- The average score of at least two temporally independent stream condition index (SCI) assessments performed at representative locations and times is 40 or higher, with neither of the two most recent SCI scores less than 35 (*i.e*., no faunal imbalances), OR
- The Nutrient Thresholds (expressed as annual geometric means) are not exceeded more than once in a three year period.

The rapid periphyton survey (RPS) and linear vegetation survey (LVS) will be used in streams to determine if the floral components of the community are within the range of conditions observed for reference sites. DEP does not have thresholds at which the algal and plant community in streams is known to be met, but if the community at a given site exhibits RPS and LVS results within the bounds of reference conditions, there is reasonable assurance that the designated use is being met. All RPS, LVS, and SCI sampling must follow DEP standard operating procedures (SOPs).

Session 2: Meeting Regulatory Requirements

Location Bivens Ballroom

Tuesday, June 19, 1:30 to 3:00 pm

LAKE TOHOPEKALIGA - AN ALTERNATIVE APPROACH TO TOTAL MAXIMUM DAILY LOADS

Jordan William[1], Danielle Honour[2], P.E., D.WRE, and Kimberly Lawrence[3]
[1,2] CDM Smith, Maitland, Florida
[3]Osceola County, Kissimmee, Florida

Lake Tohopekaliga (Toho) was placed on the Florida Department of Environmental Protection's (FDEP) Verified List of Impaired Waters in 2010 for nutrients [increasing trend in trophic state index (TSI)]. Local stakeholders, including Osceola County and the City of Kissimmee objected to the TSI assessment during the listing process. FDEP recognized that Lake Toho is a macrophyte-dominated lake and agreed to reconsider the listing, thus delaying development of a total maximum daily load (TMDL). As part of the agreement with FDEP, local stakeholders were required to provide assurance, in the form of a Nutrient Reduction Plan (NRP), that proactive nutrient reductions (source controls) are being implemented within the watershed until the lake nutrient dynamics are better understood and appropriate water quality targets can be developed.

Local stakeholders initiated the development of the NRP in mid-2011. The plan evaluated existing watershed nutrient loads, assessed load reduction benefits of existing and proposed best management practices (BMPs), identified research priorities, proposed a water quality monitoring plan, and explored methods for adaptive management and means of tracking plan implementation.

The NRP is the first of its kind in the state of Florida and never before has this alternative approach to a TMDL been pursued by local stakeholders. The stakeholder proactivity during the listing process delayed a traditional TMDL regulatory process that may have set unrealistic nutrient loading targets. Lake Toho has a long and complex history of management activities and the impact of these on water quality in the lake is not clearly understood. Until a better understanding of lake dynamics is gained through the implementation of the NRP, stakeholders have the opportunity to reduce nutrient discharges to the lake through projects identified in the NRP, continue monitoring lake and tributary water quality, and pursue further research that will help regulatory agencies and local governments define the appropriate water quality targets for Lake Toho. The NRP establishes the foundation for a host of activities, all with the common goal of working toward solving the puzzle of how water quality fits into the management of this lake.

Phosphorus Limitation and the Case of Bay Lake: Do We Really Know What We Think We Know?

Lance M. Lumbard, Sam Arden, Judith Dudley
AMEC Environment & Infrastructure, Inc., Orlando, FL

Ronald Novy, Brian Catanzaro
Orange County Environmental Protection Division, Orlando, FL

Bay Lake is a 36-acre lake in the Little Wekiva watershed located partially within the City of Orlando in the northwest quadrant of Orange County. Total Maximum Daily Loads (TMDLs) for both total phosphorus (TP) and total nitrogen (TN) have been established for the lake. The lake is completely surrounded by residential and commercial land uses; most of which are serviced by septic systems. Water quality monitoring began on the lake in 1990 and, with the exception of total phosphorus, has generally trended negatively. Secchi and chlorophyll-a (chl-a) data prior to 2000 suggest that the lake experienced intermittent algal blooms, while data after 2000 indicate that the lake has maintained a persistent algal bloom.

In response to declining water quality within Bay Lake, Orange County commissioned two lake studies. The first study, completed in 2006, involved an assessment of sediment phosphorus speciation and was followed by a whole-lake alum treatment. After treatment, mean annual TP improved thirty-nine percent to 27 ppb, but other water quality parameters of interest continued to deteriorate. Despite the relatively low TP concentration, mean annual Secchi depth was less than 0.5 m in 2010 and mean chl-a concentration was greater than 50 ppb. The lake is currently dominated by the nitrogen-fixing cyanobacteria *Cylindrospermopsis*, spp. This species has been shown to flourish under both low and high phosphorus concentrations and does not appear to follow conventional wisdom regarding TP limitation.

AMEC was contracted by Orange County to perform a second study for the lake in 2011 involving a nutrient and hydrologic budget and management plan. As part of the study, AMEC proposed several BMP alternatives to reduce the remaining load reaching the lake, but nitrogen fixation and other internal dynamics appear to be contributing significantly to water quality problems as well. While controlling external loading is critical in any lake restoration plan, water quality data from Bay Lake demonstrates that lake managers should not discount the effects of internal processes. Furthermore, internal nutrient control measures may not always produce the desired biological response even though the supposed limiting nutrient is being addressed.

USING A METALS TRANSLATOR FOR ESTABLISHING NPDES LIMITS: A CASE STUDY

Larry J. Danek, Ph.D. and *Gary P. Dalbec*
Environmental Consulting & Technology, Inc., Gainesville, Florida

Water quality criteria for metals are used to establish NPDES limits for effluent discharges into waters of the state. The limits are set based on total recoverable metals analysis. However, the toxicity of most metals results primarily from the dissolved fraction, which can lead to overly restrictive criteria. To account for this, EPA published guidelines in 1996 for calculating a total recoverable permit limit based on a dissolved metals criterion. FDEP adopted its own Guidance for Establishing a Metals Translator (Guidance) (December 17, 2001) based on EPA's guidelines. These FDEP procedures for establishing a metals translator were used at the City of Tallahassee's Arvah B. Hopkins Generating Station, which became one of the first successful applications in the state. The Hopkins facility had been operating for decades under a mixing zone allowance for copper in its discharge. During the recent NPDES renewal period, FDEP and EPA denied the continuance of the mixing zone, which required the City to address the copper levels in the discharge.

A plan of study (POS) to address the copper issue was prepared and submitted to FDEP for review and approval. The POS followed the criteria listed in the Guidance and included 10 sampling events to be conducted over a 1-year period. The samples were collected at the discharge point and three locations downstream. The samples were analyzed for total and dissolved copper using ultra-clean sampling techniques and low detection limit laboratory analysis (EPA Method 1638) to accurately determine the ratio between total and dissolved copper.

The results of the sampling events showing the dissolved copper fraction (presented in Figure 1) indicate the dissolved fraction remained below 40 percent and was generally less than 20 percent of the total copper. The Guidance requires that geometric means be calculated at each station, and the highest value used for calculating the copper translator. The geometric mean values are plotted on Figure 1, and the highest value of 20.43 percent occurred at Station D1.

Copper has a hardness-based criterion, which means the copper standard varies depending on the hardness of the water. The standard is expressed as:

$$\text{Total copper standard} = e^{0.8545(\ln H) - 1.702} \quad (1)$$

where: H = hardness.

The Guidance requires that the total copper criteria be corrected to produce a dissolved copper standard, which accounts for the relative toxicity of the dissolved fraction. For copper, the value is 0.96, indicating that nearly all the toxicity results from the dissolved copper.

Consequently, Equation 1 is modified to:

$$\text{Dissolved copper standard} = 0.96\, e^{0.8545(\ln H) - 1.702} \quad (2)$$

The final copper criteria using the translator becomes:

$$Final\ criteria = \frac{Dissolved\ criteria}{Translator} = \frac{0.96}{0.2043} e^{0.8545(InH)-1.702} \quad (3)$$

Table 1 presents comparisons of the results of Equation 3 with Equations 1 and 2 for several hardness values. The results indicate that a less restrictive yet environmentally protective permit limit is available because the dissolved copper fraction is relatively small.

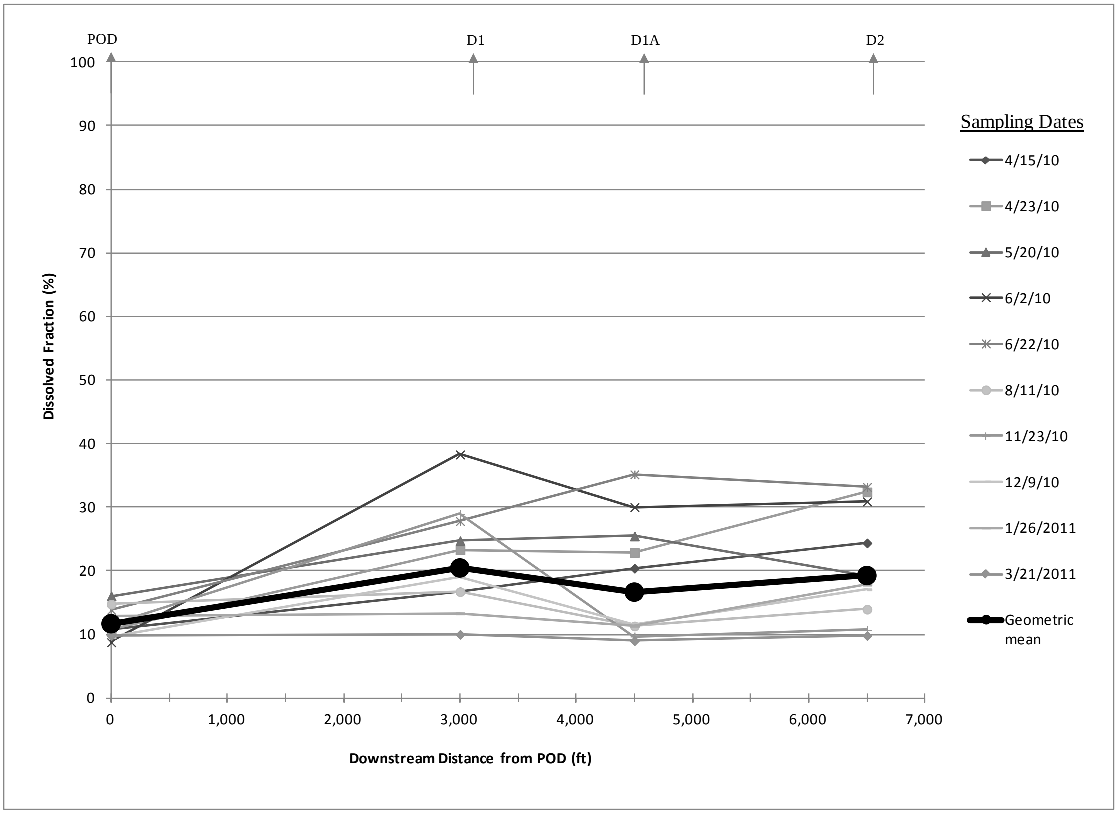

Figure 1. Dissolved Fraction of Copper at Locations Downstream from the POD

Table 1. Total and Dissolved Copper Criteria and Translator-Based Copper Criteria for a Range of Hardness Values

	Florida Class III Water Quality Standard		Translator-Based
Hardness (mg/L as $CaCO_3$)	Total Copper Criterion (µg/L)	Dissolved Copper Criterion (µg/L)	Total Copper Criterion (µg/L)
150	13.19	12.66	61.99
200	16.87	16.19	79.26
250	20.41	19.59	95.91
300	23.85	22.90	112.08
350	27.21	26.12	127.86
400	30.50	29.28	143.32

Source: ECT, 2011.

MACROINVERTEBRATE INDICATORS FOR ESTABLISHMENT OF MINIMUM FLOWS AND LEVELS FOR THE CRYSTAL RIVER, FLORIDA

Douglas G. Strom[1], David L. Evans[1], and Lynn Mosura-Bliss[1]
[1]Water & Air Research, Inc., Gainesville, Florida

In order to establish minimum flow for tidal rivers, it is necessary to establish quantitative relationships between flow or factors influenced by flow (e.g., salinity) and important biological communities, including benthic infauna. One objective of this work was to document quantitative relationships that explain the spatial distribution of the benthic invertebrate assemblages. The project was conducted in the Crystal River/Kings Bay watershed along the Gulf of Mexico coast in Citrus County, Florida. The 11-kilometer river starts as a complex of 30 springs, combining to create a first magnitude spring flow that empties into Crystal Bay and the Gulf of Mexico.

There was a zone of rapid change in salinity along the longitudinal river axis between the river mouth and river kilometer 2.5 that roughly represented the transition between the mesohaline zone (salinity of 8 to 18 ppt) and the oligohaline zone (salinity of 0 to 7 ppt). This may be an important zone of transition with a strong influence on benthic community structure during low flow conditions.

Live oysters (*Crassostrea virginica*) were observed from the river mouth upstream to river kilometer 7.8 where mean water column salinity was approximately 4 ppt at the time of sample collection. The amphipods *Apocorophium louisianum* and *Cerapus benthophilus*, and the bivalve mollusc, *Cyrenoida floridana*, were ranked highest in dominance. These three species made up 67.5% of the total number of organisms collected by petite Ponar dredge during this study. Other important bioindicator species are discussed in relation to salinity. Number of taxa and Shannon-Wiener diversity (SWDI) declined longitudinally from the river mouth upstream to a low at river kilometer 9.4 and then increased in Kings Bay.

Forward stepwise regression revealed significant relationships between number of taxa and salinity, and between SWDI and salinity and sediment percent silt plus clay. Rank correlation analysis indicated a significant decline in number of taxa with decreasing salinity. Number of taxa declined from 52 taxa at the river mouth to 22 taxa observed at river kilometer 9.4. The decline in number of benthic species with decreasing salinity is a commonly observed spatial pattern in estuaries that may, in part, be attributed to relatively wide fluctuations in environmental conditions along the river longitudinal axis. Total macroinvertebrate density (number per square meter) did not show any regular longitudinal relationship.

One-way Analysis of Variance (ANOVA) revealed a significantly higher number of taxa and higher SWDI in the Gulf than in Crystal River and Kings Bay. Number of taxa and SWDI were not significantly different between Crystal River and Kings Bay. Organism densities were not significantly different between these three subareas. Multivariate analysis demonstrated that the benthic community structure varied longitudinally along the Crystal River axis. Primer© ANOSIM procedure results demonstrated a significant difference between benthic infauna assemblages in the Gulf and assemblages in both Crystal River and Kings Bay. The Crystal River assemblage also significantly differed from the Kings Bay assemblage. Based on the Primer© BEST procedure, Principal Components Analysis, rank correlation, and one-way ANOVA results, these differences were most strongly driven by the response of benthic community structure to the salinity gradient.

Although dipnet and petite Ponar samples cannot be compared quantitatively with validity, it is interesting to note that within Kings Bay many of the dominant macroinvertebrate taxa associated with vegetation represented in the dipnet samples were not among the most dominant taxa in Kings Bay petite Ponar samples collected in areas where vegetation was absent. Although similar patterns in benthic community structure may be revealed by using either method of collection, differences in species dominance and benthic community structure can be attributed to variation in habitat structure (vegetated vs. non-vegetated).

Sustained decline in river flow and resultant elevated salinity concentrations might lead to an increase in number of taxa, an increase in number of salt-tolerant taxa, and a decrease in taxa presently characteristic of oligohaline and freshwater zones of the Crystal River system. The polychaetes, *Hobsonia florida*, *Laeonereis culveri* and *Streblospio* sp., which were generally absent from the fresher portions of Kings Bay during the current study may become more prevalent in those portions of the bay. The potential for salinity-driven shifts in benthic fauna may be most prevalent in the northeastern portion of the bay where freshwater or near freshwater conditions have existed historically and susceptibility to tidal influx via the Crystal River is greatest.

Session 3: Policy, Ecological Economics and Grassroots Programs

Location Bivens Ballroom

Tuesday, June 19, 3:30 to 5:00 pm

THE ECOSYSTEM SERVICES OF FLORIDA LAKES

Kym Rouse Campbell[1] *and Joseph Nicolette*[2]
[1]ENVIRON International Corp., Tampa, FL
[2]ENVIRON International Corp., Atlanta, GA

In recent years, there has been a growing recognition of the numerous and varied services that ecosystems provide through a wide range of ecological functions and processes (USEPA, 2009). Ecosystem services are the benefits obtained from ecosystems. The ecosystem services provided by Florida lakes are rarely considered during assessments and evaluations; they are typically evaluated as existing along a gradient from healthy to impaired. However, an ecosystem services perspective adds another dimension to lake management. The purpose of our presentation is to highlight the ecosystem services offered by Florida's lakes and present methodologies for quantifying and valuating their ecosystem services, with the anticipation that the ecosystem services offered by these lakes will begin to be considered in lake management decisions.

The Millennium Ecosystem Assessment (2005) uses the following categorization of ecosystem services:

- Provisioning services, which are services from products obtained from ecosystems. These products include food, fuel, fiber, biochemicals, genetic resources, and fresh water. The majority of these products are traded in markets.
- Regulating services, which are services received from the regulation of ecosystem processes. This category includes services that improve human well-being by regulating the environmental in which people live. These services include flood protection, human disease regulation, water purification, air quality maintenance, pollination, pest control, and climate control. These services are generally not marketed; however, many have clear value to society.
- Cultural services, which are services that contribute to the cultural, spiritual, and aesthetic dimensions of people's well-being. They also contribute to establishing a sense of place.
- Supporting services, which are services that maintain basic ecosystem functions and processes. They include soil formation, primary production, photosynthesis, nutrient cycling, biogeochemistry, and provisioning of habitat. These services affect human well-being indirectly by maintaining processes necessary for provisioning, regulating, and cultural services.

The ecosystem services of lakes can also be separated into goods and services extracted from lakes and services that depend on lake structure or local ecosystem processes.

The ecosystem service benefits offered by a lake are typically similar to the lake's designated use category. All lakes provide a variety of ecosystem service benefits simultaneously, and these benefits are affected by the physical characteristics and the water quality of the lake, as well as increasing anthropogenic influences. Maintaining multiple ecosystem service benefits while ensuring that the overall health of a lake is maintained can be a significant challenge to lake managers. However, the implications of lake management decisions on the various ecosystem services and benefits offered by a lake needs to be considered. Ecosystem services can be quantified with both ecological and economic metrics so that they can be included in cost-benefit analyses and lake management decisions.

An ecosystem services perspective of lakes acknowledges that they have value, and the value can be measured and used to support environmental management decisions. A variety of methods are available to valuate the ecosystem services offered by lakes. They include measures of attitudes, preferences, and intentions; economic methods; civic valuation; decision science approaches; ecosystem benefit indicators, biophysical ranking methods, and cost as a proxy for value (USEPA, 2009). In this presentation, we utilize a net environmental benefit analysis (NEBA) approach for quantifying and valuating the ecosystem services associated with alternative management scenarios of Florida lakes.

NEBA is a methodology for comparing and ranking the net environmental benefit associated with multiple management alternatives (Efroymson et al., 2003, 2004; Nicolette, 2011). The NEBA framework shares the same theoretical foundation as benefit-cost analysis, and the needed resources, data inputs, and limitations are associated with whatever ecological models and valuation tools are selected (Efroymson et al., 2003, 2004). NEBA is comprised of a set of agency-approved and litigation-tested tools and techniques for quantifying the benefits of alternative land uses or actions that affect the environment (Nicolette, 2011). We demonstrate how the NEBA approach can be used to estimate the value of environmentally sensitive areas and land management approaches; develop and evaluate a suite of alternatives; provide a basis for balancing economic, human, and natural resource drivers affecting proposed alternatives; support measures to weight and rank alternatives that meet cost-effective objectives; provide a means to expand the range of potentially acceptable alternatives; provide documentation that provides a defensible alternative analysis and selection; provide basis for establishing appropriate mitigation measures; and provide performance-based measures that can be used to conduct monitoring and adaptive management activities.

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SECRETS TO A SUCCESSFUL, COMMUNITY-INITIATED, RETENTION POND RESTORATION

Ernie Franke
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It may sound like the headlines from a supermarket tabloid, but there are several proven methods to a successful restoration of an unsightly or unhealthy retention pond. These guidelines are a reflection of the heart-aches and the joys experienced during the restoration of three retention ponds. These do not come from a university-trained biologist, but from a retired electrical engineer struggling to meet budget, fight weeds, placate condominium owners, but mostly to improve his very local environment, the quality of the water and to provide local critters with a better home.

These guidelines are:

1. Obtain written permission from all the stake-holders. This includes the owners of the pond, tenant organizations and government regulators.
2. Seek out a leader, an experienced pond person that has a passion for the job. A committee is nice as a backer, but you need a leader to get it done. Leadership transitions as ownership moves from restoration to maintenance.
3. Develop a written plan, schedule and budget, for maintenance as well as restoration. Then get buy-in from the participants and secure sources for financial assistance.
4. Limit the selection of aquatic plants. Otherwise the choice is overwhelming. Use only Florida-native, non-invasive plants. It not only helps the environment, but it has a better chance at success. Don't fight Mother Nature, you'll lose.
5. Involve everyone. Give everyone a chance to participate, even if it's simply providing refreshments during "work days". Involvement builds ownership. Residents learn to aquascape through “hands-on” learning.
6. Communicate both the vision and the saga of the pond. People need encouragement as they reflect on the past, as well as to look to the future, capturing the “before and after" pictures, as well as the planting “work days”. Part of that communication will be lecturing and publishing the results to encourage others. Documentation is simply clarifying the thought process during the course of the project.
7. Educate the participants concerning the environmental goals of the project. These same folks become disciples as they show and tell their friends of what they have accomplished.

On close examination, these secrets are actually embedded in the questionnaire for most financial assistance (grant) applications. There is a good reason for this, the guidelines help ensure project success.

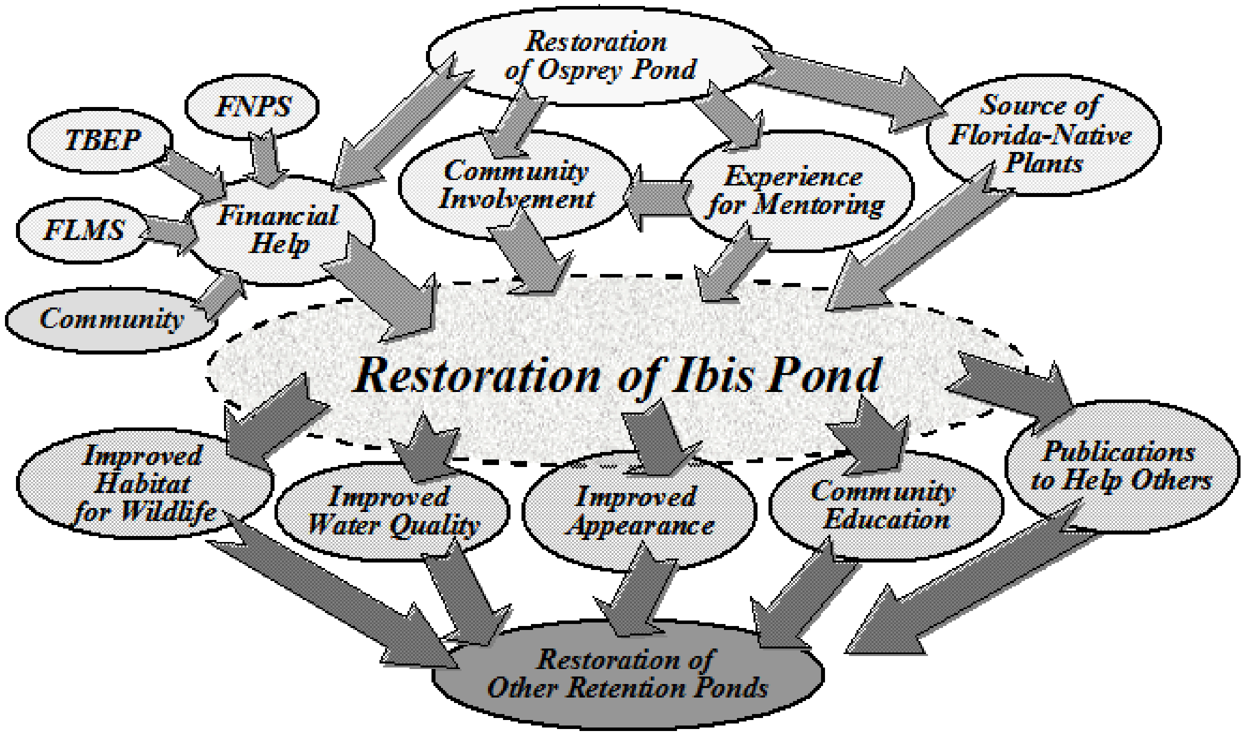
> ***Restoration begins with “I want our pond to look like so-and-so pond,” and ends with “Why can’t we also restore so-and-so pond?”***

Restoration begins with a single retention pond. Success at this stage demonstrates what can be done and builds confidence. Owners of a retention pond will not give permission and support until they have seen demonstrated ability and commitment. It's truly a learning experience, on both sides.

What are the benefits? A restored pond reaps the tri-fold benefits of improved water quality, a more inviting appearance (less subject to invasive species), and a better habitat for wildlife nesting and foraging.

Community education should naturally follow. A successful restoration serves as an example of what the community can do and it will inevitably lead to the restoration of other retention ponds.

Restoration of a Retention Pond Requires Many Key Components



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IMPROVED POLICY FOR REGAINING DESIGNATED USES OF CLEAN WATER ACT SECTION 303(D) IMPAIRED WATERS

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US policy for freshwater management is insufficient for preventing and restoring impaired waterbodies effectively and cost efficiently. Approximately 44% of river and stream miles, and 64% of lake and reservoir acres are impaired pursuant to Clean Water Act (CWA) Section 303(d). Eutrtophication impairs over 50% of U.S. lakes and reservoirs relative to 10-20% in 1972. Excessive nutrient loading causes eutrophication, a condition characterized by repeated harmful algal blooms (HABs). Freshwater HAB organisms, primarily cyanobacteria (a.k.a., blue-green algae), make some of the most potent toxins known. Cyanotoxins cause near-term acute, and long-term chronic, health effects in human and animal. The toxins and huge algal biomasses disrupt aquatic ecosystems, challenging their sustainability. HABs in source waters adversely impact water utilities operations through carbon overloads and taste and odor events, 91% of which are accompanied by toxin expression according to the USGS. Although securing a sustainable supply of usable freshwater is a national priority, the U.S. EPA has no regulations or guidelines concerning HABs. The Agency's freshwater management policy, watershed management, is limited to reducing the flux of pollutants to receiving waters. Watershed management policy centers on TMDLs, Nutrient Management Strategies, NPDES point-source permits, and non-point source BMPs to reduce pollutant inputs. The restoration of designated uses typically is not anticipated for 2-3 decades, and costs are exorbitant. A policy that complements watershed management with sustainable waterbody management technologies is needed to suppress HABs and reduce nutrient and other pollutant levels in the near term at reduced costs.

An impaired water body is analogous to an ill person in need of supportive therapy to reduce stress on biochemical processes and enable recovery. Eutrophic waterbodies need enhanced circulation, such as solar-powered, long-distance circulation, to suppress HABs. HAB suppression enables nutrients to ascend the trophic levels of the food web, and reduces carbon loads and taste and odor events at utilities. Floating islands and side-stream floways further reduce nutrient loads to protect downstream waters. Waterbody management technologies also degrade toxic substances through enhanced bacterial digestion, kill pathogens through increased ultraviolet light exposure, precipitate manganese and other metals from the water column through oxidization, and prevent the methylation of mercury by eliminating anoxic zones. Satellite monitoring of HAB intensities and phosphorus concentrations in the past and into the future assists treatment-plan development and results evaluation. Waterbody management technologies can restore designated uses in the near term. Restoration enables delisting from Section 303(d), and restoration prior to TMDL development obviates their need.

A policy that complements watershed management with waterbody management provides states with the flexibility to optimize Nutrient Management Strategies so that each impaired waterbody can be treated in the most effective and cost efficient manner. Funding is available from CWA 319 grants and the state revolving-loan program. This ecologically-based, systems-approach to freshwater management can reverse the trend of increasing eutrophication and impairment by other pollutants, restore water quality and designated uses in the near term, reduce overall management costs, and ensure a sustainable supply of useable freshwater.

VANISHING POINT - A PHOTO DOCUMENTARY OF DROUGHT IMPACTED LAKES AND STREAMS

Matthew Dubé
Gainesville, FL

Lakes and streams have long factored into the identity, culture and economy of Alachua County. The ongoing drought has significantly impacted these waters and thus changed the behavior of residents to adapt to new low-water conditions. For example, as waters recede, new land areas are “reclaimed” for forms of recreation that have been unprecedented until now. These adaptations pose new challenges to lake managers facing a landscape changed for the foreseeable future. It is important that conversations between various stakeholders take place to ensure that whatever the new normal becomes, timely decisions for the long-term sustainability of these waters can be made. Landscape photography is a medium that has influenced conservation movements. Images can raise important questions such as “what are the changes underway?”, “who is affected”, “what is at stake?” and “where do we go from here?”. In late-2011, the author initiated a photo documentary project focusing on area water bodies currently under severe drought stress. The images revealed waterways greatly changed from their appearance from historical memory. A closer look provides clues to what the future of these waters may look like. The author will present recently created images to stimulate an audience exchange of ideas, concerns and potential calls to action related to these changing aquatic landscapes.

Posters

Location Ballroom A/B

Tuesday, June 19, 5:30 to 6:30 pm

A GIS-BASED MODEL TO PREDICT INTERANNUAL VARIABILITY IN THE ABUNDANCE OF SMALL FISHES PRODUCED ON THE FLOODPLAIN OF THE ST. JOHNS RIVER IN CENTRAL FLORIDA

Steven J. Miller, *Sandra Fox and Lawrence Keenan*
St. Johns River Water Management District

Fish communities of the more permanent shallow marshes and seasonally inundated floodplain of the St. Johns River are dominated in numbers and diversity by small livebearers (poecillids) and killifishes (cyprinodontids and fundulids). These small fishes can be quite abundant and are critical in the food web because they provide important prey for higher-level consumers such as alligators, larger fish and wading birds. Studies in the Everglades have demonstrated that >60% of the variation in the abundance of small fishes is directly related to duration of flooding, with highest densities being reached in areas flooded > 9 months. To attempt to quantify potential ecological effects of water withdrawals on fish communities of the St. Johns River, we developed a simplistic hydroecological model from the Everglades data predicting maximum annual small fish density from duration of seasonal flooding. Fish densities derived from the model were assigned to one of four categories of flooding duration: (1) < 1 month, (2) 1 to 6 months, (3) 6 to 9 months and (4) > 9 months. A modified version of the Hydroperiod Tool (developed for the South Florida Water Management District) was then used to derive the area of the floodplain that was flooded annually for each of the duration categories to calculate a total maximum fish abundance estimate. The Hydroperiod Tool was designed to assess wetland hydroperiod using ArcGIS, Spatial Analyst, and Tracking Analyst (and originally Model Builder) by creating an interpolated water surface raster from stage data and then subtracting terrain elevation (digital elevation model), producing a raster of ponded water depth. Automation of these functions provides the opportunity to assess temporal patterns, produce annual and seasonal statistics for wetland ponded depth and duration. To demonstrate the maximum potential interannual variability in floodplain production of small fishes on an 18,256 ha area of the St. Johns River floodplain surrounding Lake Poinsett we compared estimated maximum fish abundance derived for a drought (2000) and a high water (1995) year. The estimated maximum small fish abundance on the floodplain during the drought year was 160 X 10^6 fish weighing an estimated 48, 111 kg. During the high water year, estimated maximum abundance was 816 X 10^6 fish weighing 245,816 kg. (Presented at the American Water Resources 2012 Spring Specialty Conference, GIS and Water Resources VII, March 26 – 28, 2012 New Orleans, LA)

TRENDS IN NUTRIENT DATA FOR SUWANNEE RIVER WATER MANAGEMENT DISTRICT LAKES

Laura Line, David L. Evans, Matthew Fellows, Robert Giambrone, Meagan Putts, and Douglas Strom
Water & Air Research, Inc., Gainesville, Florida

The Suwannee River Water Management District (SRWMD) has been collecting surface water data for lakes in the district since 1989. Water & Air Research, Inc. reviewed nutrient data for key lakes in the SRWMD and looked for trends over time and correlations with rainfall, phytoplankton, and macroinvertebrate data. Multivariate methods were applied to explore relationships between biotic and abiotic variables. Conventional parametric and non-parametric statistical techniques were applied for testing the significance of hypotheses. Data were also tested for significant trends (trend analysis).

DEVELOPING A LONG TERM MONITORING PROGRAM ON CAMPUS: STUDENT MONITORING OF LAKE WATER QUALITY AT UNIVERSITY OF NORTH FLORIDA.

Patrick Goodwin and Kelly Smith
University of North Florida, Department of Biology, Jacksonville, FL

The University of North Florida has 42 lakes within its boundaries, varying in basin morphology, surrounding landscape, and management practices. Although campus lakes are managed for algal load and appearance, there was no committed effort to examine impacts of management practices or lake usage on water quality. Lake monitoring was initiated in 2007 to fulfill 2 objectives: establish a background data base of lake condition over time that could serve as a reference as the University grew in size and development; and serve as a training opportunity for students interested in freshwater ecology and environmental science. The monitoring effort is constrained by budget, so most analyses had to be relatively inexpensive. Monthly monitoring results from 2008, 2009, 2011, and 2012 are summarized including chlorophyll-a, nitrates, phosphates, pH, ammonium, conductivity, dissolved oxygen, and temperature, for four campus lakes. Lakes were selected because they represented a range of management goals: water withdrawal, reclaimed water input, retention pond, and recreational lake. Several of these lakes (particularly those influenced by reclaimed water) show reduced water quality, elevated conductivity, high phosphate levels, and low oxygen levels. This monitoring effort can serve as background information for more experimental approaches to assess lake quality as well as educational purposes that involve lake sampling (Limnology and Ecology classes).

WHERE IS THE PARTY? HABITAT USE BY THE FISH OF PLANT PARK STREAM, TAMPA FLORIDA.

Lyndi F. Jordan, Raymond A. Schlueter and Mark G. McRae
The University of Tampa, Tampa, FL 33606

Plant Park Stream (PPS) is a 1st order spring fed tributary of the Hillsborough River, located in Downtown Tampa. The assemblage of fish includes both native and introduced species, with habitats ranging from estuarine (tidal influence) to pure freshwater (near the spring). The null hypothesis of no spatial segregation among the resident fish species was tested using Principal Component Analysis (PCA). The null was rejected when PCA showed salinity and the distance from the Hillsborough River were the most important variables influencing the spatial segregation of the fish. All fish present belonged to the order Cyprinodontiformes. The Poeciliid *Xiphophorus hellerii (GST)* utilized only areas upstream of tidal influence. The Poeciliids *Gambusia affinis (MOSQ)* and *Poecilia latipinna (SFM)* were the most widespread, utilizing all areas of PPS (freshwater and estuarine). *Cyprinodon variegatus (SHM), Lucania parva (RWK)*, *Fundulus grandis (GK)*, and *F. confluentus (MK)* were restricted to areas under tidal influence, and were likely limited in their distribution by dense stands of emergent vegetation which blocked their upstream movement.

HOW TO COMBAT THE DETRIMENTAL EFFECTS OF EUTROPHICATION, CONTROL ALGAE BLOOMS AND MEET WATER QUALITY STANDARDS

Seva Iwinski
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Turbidity has many negative effects when entering a water body from erosion and sedimentation. Sedimentation and excess nutrient loads, including phosphorous, entering our water bodies from erosion, fertilizers, manures, crop runoff, construction activities and other land disturbing activities, 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. Through various studies it has been found that as low as 10-100 NTU's aquatic organism 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 sediment and nutrients from leaving a site as well as reduce the amount of sediment and or nutrients in 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, a 70-95% reduction in phosphorous has been found as well as a 95% reduction in NTU's. Therefore Polymer Enhanced Best Management Practices (PEBMP's) including water clarification systems to reduce turbidity from a water column and soil stabilization used to control sedimentation at the source so that it is not transported into our waters will be discussed and illustrated. These 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).

DISSOLVED OXYGEN DYNAMICS AND LIMITATION OF FISH HABITAT UTILIZATION DUE TO HYPOXIA IN *HYDRILLA*

Bradshaw Settevendemio, E.[1], Merrill Rudd[1], Michael S. Allen[1], and Michael Netherland[2]
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The fast growth and dense structure of some macrophyte species can alter water chemistry and impact fish habitat utilization. *Hydrilla verticillata* is an invasive aquatic weed which exhibits rapid, dense growth and may contribute to low dissolved oxygen (hypoxia, DO <2.0 mgL^{-1}) levels during warm summer months. The management of hydrilla is difficult and costly, and current block-treatment methods result in unfavorable fish habitat, such as large areas devoid of vegetation. An alternate method recently proposed is to remove hydrilla in channels through dense beds, increasing 'edge' habitat to promote higher water circulation and thus increasing dissolved oxygen levels. We evaluated the spatial and temporal dynamics of dissolved oxygen in three habitats: open water, edge, and dense hydrilla beds, and assessed the percentage of habitat limitation due to hypoxia. Our results showed there are significant interactions influencing DO by habitat, month, time of day, and depth. Both, dense and edge habitats saw 100% habitat limitation at the peak of hydrilla growth and water temperature in September, suggesting that increasing edge habitat may not greatly influence DO concentrations during summer.

HIGH LEVELS OF PHOSPHORUS, POOR WATER QUALITY: A NOVEL IN-SITU SOLUTION.

Shaun Hyde[1], West M. Bishop[2]
[1] SePRO Corporation, Carmel, IN
[2] SePRO Corporation, SePRO Research and Technology Campus, Whitakers, NC

A devastating culprit has polluted numerous aquatic systems causing degradation of water quality and subsequent harmful ecological and economic consequences. The objectives of this presentation are 1) to correlate phosphorus levels to algae densities and classification; 2) to illustrate water quality impacts of increased phosphorus levels; and 3) to highlight technical laboratory and field research data on the efficiency of Phoslock at removing phosphorus and improving water quality parameters (chlorophyll, turbidity, etc.). Laboratory and field research studies documented significant decreases (50 - 90%) in both total and free reactive phosphorus (i.e. ortho-phosphorus) at all treatment sites within 24 hours and continually decreased throughout the studies. Immediate and long-term improvements were measured in water quality and prior water resource use restrictions were diminished (i.e. beach closures due to toxin levels). Phoslock provides an efficient proactive approach and restoration tool to select for a healthy aquatic system.

Assessment of Best Management Practices of the Ecosystem Restoration in Lake Istokpoga, Florida

J.L. Jones[1], K. Islam[1], J.B. Furse[2], S. Gornak[2], N.B. Chang[1], M. Wanielista[1], P. Bohlen[1], and Z. Xuan[1]
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[2]Florida Fish and Wildlife Conservation Commission, FL, USA

The stabilized water level in the past few years has caused a drastic change of ecosystem and a rapid accumulation of organic toxics at the sediment bed in Lake Istokpoga, Florida. The removal of some emergent and submerged aquatic vegetation becomes essential to restore the ecosystem in the marsh way and littoral zone. Barge-mounted excavators with a rake attachment or bucket that allows excess water to be decanted are used to remove the bulk of the aquatic plant material at the prespecified five sites. Floating aquatic harvesters are also used to perform clean-up of plant and organic material that is floating or that has been dropped to the bottom during the removal process. Several BMPs for aquatic plant removal are implemented in this restoration project to prevent water quality standard violations, particularly those pursuant to Chapter 62-302 of the Florida Administrative Code (F.A.C.), during or after plant removal activities. There are 42 man-made islands have been used to pile up the removed aquatic plants around the lake, in which Island BMPs for the removed may be applied. This floating-type mechanical-removal system capable of removing aquatic plants and associated organic sediments up to three feet thick has been found effective with appropriate turbidity control Best Management Practices (BMPs). When dealing with the issue in shallow water, such a floating-type mechanical-removal system becomes unable to be applied, In this case, various types of herbicides will be sprayed to control aquatic species by using the aircraft. The combination of these restoration strategies will lead to the improvements of ecosystem dynamics in the end.

Assessment of Best Management Practices of Phosphorus Removal and Sediment Dredging in Lake Apopka-Beauclair System, Florida

Jamie Jones[1], Kamrul Islam[1], Ni-Bin Chang[1], Marty Wanielista, Patrick Bohlen and Lance M. Lumbard[2]
[1]Stormwater Management Academy, University of Central Florida, Orlando, FL,
[2] AMEC Environment and Infrastructure, Inc., Orlando, FL

Deterioration of Lake Apopka water quality likely began in the 1890s when the Apopka-Beauclair Canal was first constructed. Continued efforts to improve the canal significantly reduced lake level and additional degradation resulted from nutrient-rich agricultural discharges, treated wastewater, and effluent from a citrus processing plant. As the headwater of the Harris Chain of lakes, controlling the pollutant discharge from Lake Apopka is critical to the restoration of the downstream lakes. The Lake County Water Authority's Nutrient Reduction Facility (NuRF) is one Best Management Practice (BMP) of phosphorus reduction which uses off-line liquid alum injection technology and the natural flow of water upstream from Apopka-Beauclair Canal. Phosphorus-containing compounds, which are a primary food source for algae, combine with alum to flocculate and precipitate to the bottom of the settling ponds. Using prescribed polymer coupled with centrifugation, alum floc is dewatered and dried for potential use in a variety of beneficial applications.

Sediment dredging within Lake Beauclair is designed to address nutrient-enriched deposits that compromise the quality of the aquatic habitat in Lake Beauclair and impede navigation during low water conditions. Fine-grained, organic-bearing sediments are currently being hydraulically dredged from a 255-acre footprint in the western portion of the lake, and from an additional 6.3 acres of residential canal segments. Several BMPs for dredging are implemented in this dredging project to prevent water quality standard violations, particularly those pursuant to Chapter 62-302 of the Florida Administrative Code (F.A.C.), during or after dredging activities. BMPs for the dredged material disposal to reduce turbidity are essential and many are applied in this project. Additional BMPs that could potentially be applied to the dredging of this project are addressed.

SUBMERGED AQUATIC VEGETATION FIELD SURVEY VERSUS AERIAL PHOTOGRAPH INTERPRETATION

Shannon McMorrow[1], *Joy Ryan*[1], *Judith Dudley Ph.D.*[1]
[1]AMEC Environment and Infrastructure, Inc., Gainesville, Florida

AMEC Environment and Infrastructure, Inc. (AMEC) completed a submerged aquatic vegetation (SAV) survey at a site in St. Andrew Bay in June 2011. Prior to initiating the field investigation, AMEC consulted the Florida Fish and Wildlife Conservation Commission (FWC) 2010 Florida's Statewide Seagrass Geographic Information System (GIS) layer to estimate the extent of seagrasses in St. Andrew Bay. This layer provides approximate location and extent of seagrasses primarily based on aerial photograph interpretation from sources ranging in date from 1987 to 2010. The AMEC field survey was conducted by visual in-water reconnaissance along regularly spaced transects. When the edge of the seagrass beds was identified a Geographic Positioning System (GPS) point was logged, a 1 meter quadrat was dropped in the water, and species identification and densities within the quadrat were recorded. Additional quadrat measurements were taken along the transect approximately every 50-100 feet. The AMEC field survey revealed the presence of Turtle, Shoal, and Widgeon grasses in the samples area, in addition, several species of macroalgae were observed intermixed with the seagrasses. Based on the point data collected in the field, the approximate extent of SAV (seagrass and macroalgae) was plotted on maps. The approximate extent of SAV was very similar between the FWC data and the AMEC 2011 field survey; however, the landward extent of SAV was underestimated in the FWC maps in several sample areas. SAV mapping by aerial photograph interpretation can be useful, proven by the similarity of results between these two datasets; however, aerial interpretation does not provide reliable information on species composition or density. In addition, the AMEC survey found that in several areas the SAV was dominated by macroalgae, not seagrass. The aerial photograph signatures are the same for seagrass and macroalgae; therefore, changes in SAV composition cannot reliably be measured by aerial interpretation.

Session 5: Florida's Springs

Location Bivens Ballroom

Wednesday, June 19, 8:30 to 10:00 am

FLORIDA SPRINGS – AN INTRODUCTION

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

The Florida Geological Survey has a database with over 700 identified springs in the state. These are unique resources, hydrologically, geologically, and ecologically. They contribute an important source of baseflow to many Florida streams and serve as critical habitat to a wide array of imperiled flora and fauna. Springs can be classified hydrologically, most commonly by their mean annual discharge. The largest springs, in terms of discharge, are the first magnitude springs, defined as those with a mean annual discharge of >100 cubic feet/second (cfs; equates to about 65 million gallons per day). There are 33 identified first magnitude springs in the state, most of these occurring in the Suwannee River drainage. Depending upon the groundwater origins, springs may also exhibit different water chemistries; ranging from "softwater" or low-ionic strength spring to "salt" springs with an ionic composition similar to seawater. Some of the larger springs create a distinct type of stream type know as a spring-run stream. The flow and water chemistry in these streams is dominated by the discharge of the headspring(s) and consists of clear water reflecting the outflow from the headspring(s). Ecologically, springs and their spring-run streams are characterized by extensive coverage of submerged aquatic vegetation (SAV), which forms a major source of primary production, plays important roles in biogeochemical cycles, and provides important structural habitat for epiphytic algae and fauna. Benthic macroinvertebrate communities tend to be similar to those of other Florida stream ecosystems, although mollusks and crustaceans tend to be a larger component of the fauna due to the calcium-rich water. Fish community composition also tends to be similar to that seen in other Florida stream types; dominated largely by Centrarchidae (sunfish and bass) and Cyprinidae (minnows). Many Florida springs have been undergoing significant changes over the past several decades, exhibiting declining water quality (dramatically increased nitrate levels and increasing concentrations of dissolved ions) and reduced discharge. These have been accompanied by numerous biological changes, including reduced coverage of SAV, increased algal biomass and coverage (both epiphytes and macroalgae), and reduced fish biomass. With financial resources supporting springs monitoring and management currently being significantly reduced, Florida needs to develop a strategy to continue to focus on these aquatic resources to insure their protection.

Relationships between discharge and nutrient concentrations in Florida springs

Erich R. Marzolf *and Robert A. Mattson*
St. Johns River Water Management District, Palatka, Florida

A major water quality management issue in Florida springs is nutrient enrichment, primarily nitrate. Elevated nitrate levels have been implicated in ecological changes in springs, primarily proliferation of filamentous and epiphytic algae. While the existence of long-term temporal trends in nitrate concentrations in springs is established, less is known about shorter-term temporal dynamics in both nitrogen and phosphorus concentrations in springs. Here we present evidence that there are significant positive relationships between flow and nutrient concentrations in Wekiwa, Rock and other springs. In Wekiwa Springs, there are significant positive correlations between flow and nitrate concentration (as NOx-N). We also show that there is a significant positive correlation between flow and orthophosphate concentration at Wekiwa Spring, and strong positive (but not significant) relationships between flow and dissolved forms of P in Wekiwa and Rock Springs. These relationships have implications for sources of dissolved N and P. The relationship between flow and nitrate suggests that much of the anthropogenic N is coming from relatively "young" water; the relationship between flow and various forms of P suggest that some of the phosphorus in Wekiwa and Rock Springs may be due to anthropogenic loading, and not weathering from P-bearing geologic formations. This interpretation is supported by a significant negative relationship between discharge and calcium.

Experimental evidence of top-down control of algal proliferation in Florida springs

Dina Liebowitz [1,2], *Matthew Cohen*[3], *James Heffernan*[4] , *Thomas Frazer*[3] , *Lawrence Korhnak*[3]
[1]School of Natural Resources and the Environment, UF [2]NSF IGERT Program [3]School of Forest Resources and Conservation, UF [4]Nicholas School of the Environment, Duke University

Many of Florida's almost 1000 springs have undergone dramatic shifts in autotroph dominance, changing from abundant submerged aquatic vegetation to nuisance blooms of benthic filamentous algae, yet the drivers of these changes remain ambiguous. While nitrogen enrichment has been implicated, new data suggest other drivers are at play in these unique spring-fed karst ecosystems. Recent surveys revealed a negative relationship between gastropod biomass and filamentous algae biomass across and within springs. In this study we expand on these observational findings by conducting *in situ* grazing experiments to examine three linked hypotheses developed to help explain patterns of algal biomass in Florida springs. These are (1) that the dominant gastropod grazers can control algal accumulation; (2) that there is potential for hysteretic behavior, i.e. once an algal bloom forms, even abundant grazers cannot exert enough grazing pressure to induce a low-algae state; and (3) dissolved oxygen (DO) influences the distribution and grazing efficiency of gastropods.

We conducted grazer enclosure experiments (*in situ* cages containing high grazer densities, zero grazers, or partially caged controls) in four connected springs with similar water chemistry, but varying DO regimes (steady high DO, steady low DO, and two fluctuating DO regimes).We ran the first enclosure experiments with initial conditions of low algal biomass, and observed strong, significant grazer impacts at all sites, with grazing rates and algal accumulation varying due to mediating environmental factors. The second experiment was run at three sites, with initial conditions of high algal biomass, in order to explore potential hysteresis and density dependent removal efficiency. Grazers were unable to return the substrate to a low algal state during the duration of the experiment. These experiments allowed us to investigate the mediating effects of DO regimes on grazing efficiency, and the ability for grazers to control algal accumulation under algal bloom and non-algal bloom initial conditions. Additionally, we report preliminary results from laboratory mesocosm experiments conducted to closely examine the mechanism of DO stress as it affects grazing efficiency.

FLOW VELOCITY CONTROL OF FILAMENTOUS ALGAE IN A SUB-TROPICAL SPRING-FED RIVER

Sean King
Department of Environmental Engineering Sciences, University of Florida, Gainesville, Florida

The hydraulics of lotic systems are a strong determinant of the amount of filamentous algae that that may accumulate and persist within a given area. A field survey and an experiment were conducted in a spring-fed river in Florida, USA in order to quantify the relationship between flow velocity and filamentous algae. The field survey consisted of detailed velocity and algal cover measurements at three transects every two months from 6/21/10 to 12/14/11, during a period of below-average flow rates. To experimentally test the effect of flow velocity on both filamentous algae and submerged aquatic vegetation (SAV), plastic baffles were installed at multiple locations to create high and low flow channels which were harvested after seven weeks. The results suggest an upper threshold of 10-15 cm/s average velocity (25-30 cm/s maximum velocity) above which filamentous algae was minimal, and a lower threshold of 5 cm/s below which 100% cover occurred in many locations. Variation in local flow velocities over the course of the study period were mostly related to changes in the overall flow rate. SAV beds also altered local hydraulics by reducing velocities near the benthic surface and increasing turbulence just above the beds. A positive correlation between filamentous algae and SAV biomass indicates that SAV acted as a substrate for algae where velocities were moderate. Overall flow velocity was a significant control on filamentous algae and constrained the maximum amount of algae that could potentially occur, suggesting that any alteration of flow rates or hydraulics which causes velocities to decrease below the identified thresholds could create conditions favoring algal proliferation.

Session 6: New Technology and Established BMPs Part I

Location Bivens Ballroom

Wednesday, June 19, 10:30 am to Noon

HYDRILLA SHOWS INCREASED TOLERANCE TO FLURIDONE AND ENDOTHALLIN THE WINTER PARK CHAIN OF LAKES; CONSIDERATIONS FOR MANAGEMENT STRATEGIES AND TREATMENT OPTIONS

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

Hydrilla has long been a nuisance on the Winter Park Chain of Lakes. Historically, mechanical harvesting was the primary method of controlling and removing biomass. The long-term benefits and ease of use of Fluridone in the 1990s significantly reduced the manpower required to keep Hydrilla under control; however, as fluridone resistance spread, managers focused on spot-treating with contact herbicides to maximize selectivity and efficacy, and minimize non-target damage. Endothall-tolerant Hydrilla was first documented on Lakes Maitland and Minnehaha in the winter of 2009/10, and marked the first record of an aquatic plant demonstrating tolerance to more than one herbicide mode of action. In response, innovative application techniques and unique treatment strategies have been implemented in an effort to keep the plant under control and better understand hydrilla maintenance control and regrowth on these urban lakes. Specifically, low rates of sterile grass carp are being used in an effort to target hydrilla while maintaining native SAV. In addition to herbicide tolerance, the Winter Park Chain of Lakes presents some challenging considerations for hydrilla managers due to its proximity to residential communities and hydrologic flow within the watershed. With a thriving recreational fishery and ecotourism base on the Chain, preserving SAV habitat and water quality is critical, as is preventing the establishment and further spread of a herbicide tolerant strain of hydrilla.

THE APPLICATION OF NEW AQUATIC HERBICIDES AND THEIR ROLE IN ROTATION, SELECTIVITY AND EFFICACY FOR HYDRILLA MANAGEMENT

Alicia Knecht
Florida Fish and Wildlife Conservation Commission: Invasive Plant Management Section, Orlando, FL

Rotation, selectivity and efficacy are the three key concepts that form the foundation of responsible aquatic plant management and are being utilized for the successful treatment and control of Hydrilla. In times of economic constraints and herbicide resistance, it is imperative to incorporate these concepts when choosing an appropriate herbicide for a waterbody, the users groups and the plant communities present. Several new herbicides (Clipper and Tradewind) are available to successfully combat the growth of Hydrilla, and these are just two of the innovative chemistries that have been considered in conjunction with other aquatic herbicides. The Florida Fish and Wildlife Conservation Commission (Invasive Plant Management Section) has conducted several treatments using these novel herbicides in Orange County lakes within the past year, providing diverse and unique opportunities to collect data and document the Hydrilla response while maintaining control of this exotic plant species. Based on the treatments conducted in Orange County and utilizing the above concepts, Clipper and Tradewind can provide effective control and biomass reduction of Hydrilla under the right environmental conditions. In addition, the data illustrates the significance of rotation, selectivity and efficacy for conscientious lake management.

CAN SEDIMENT INACTIVATION BE SUCCESSFUL IN SHALLOW LAKES? - A NEW LOOK AT AN OLD PARADIGM

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Current wisdom in the field of sediment inactivation suggests that sediment P inactivation is ineffective in shallow lakes due to the possibility of resuspension of the alum floc and upper sediment layers by wind and boating activities. Sediment inactivation using metal salts was introduced in Florida during 1981, and since that time, more than 30 sediment inactivation projects have been conducted in "shallow" Florida lakes. Surface areas for treated lakes have ranged from 8-920 acres, with mean depths ranging from 4-20 ft. Application rates have ranged from 9.2-215 g Al/m^2, with water column doses from 3-54 mg Al/liter. Molar Al:P (available sediment P) ratios have ranged from 2 in early projects to 10 in recent projects. Immediate improvements in water quality have been observed in each of the treated waterbodies, with more than half exhibiting improvements for 10 years or more. As examples, substantial reductions in TP concentrations have been consistently observed in Lake Conine (d_{avg} = 8 ft) for more than 15 years following sediment inactivation. Lake Mizell (d_{avg} = 10 ft) has exhibited steadily increasing water clarity and decreasing algal concentrations for 13 years and has converted from eutrophic to oligotrophic status. The success in Florida suggests that properly designed sediment inactivation can be effective in shallow lakes. A theory is proposed that sediment inactivation may also be effective in extremely shallow lakes (d_{avg} = 3-5 ft) due to sediment partitioning of the stable and mixed sediment layers.

LAKE SEMINOLE SEDIMENT REMOVAL PROJECT

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Lake Seminole is a moderately large (684 acre), shallow (average depths between 4.1 and 5.5 feet) freshwater body located in west central Pinellas County (SWFWMD 1992). Prior to the mid 1940s Lake Seminole was an estuarine water body, the northern portion of the Long Bayou embayment of Boca Ciega Bay. It was converted to a freshwater system by the construction of a roadway (Park Boulevard) which acts as a dam. In addition to altering the lake's salinity regime from brackish to fresh, the construction of the dam and several additional hydrologic modifications in the watershed have substantially reduced its flushing rate and increased its hydraulic residence time (SWFWMD 1992).

The lake's 3,500 acre watershed is highly urbanized, with commercial and residential land uses comprising most of the land surface. The western shoreline of the lake is entirely urban, consisting of mobile home parks, apartment complexes, and single family dwellings. The east shoreline is dominated by a wide band of relatively undeveloped shoreline and a few residences in the north lobe.

Although concerted efforts have been made to improve stormwater treatment levels in recent years, a large proportion of the watershed was developed prior to the adoption of modern stormwater treatment requirements. As a result, the lake received discharges of untreated or minimally treated stormwater runoff from a variety of urban land uses for many decades. Prior to 1971 it also received discharges of nutrient-rich treated effluent from the City of Largo municipal wastewater treatment plant (SWFWMD 1992).

Lake Seminole is a highly eutrophic lake that is currently listed by the Florida Department of Environmental Protection (FDEP) and the U.S. Environmental Protection Agency (USEPA) as an impaired waterbody pursuant to Section 303(d) of the federal Clean Water Act. The pollutants linked to the impairment are nutrients (primarily phosphorus forms) that are present at elevated levels in the lake's water column and sediments. Nitrogen forms are also present in the lake at elevated levels.

In accordance with USEPA reporting guidelines Lake Seminole's is listed as a Category 4b water body based on the US EPA and FDEP approved Lake Seminole Reasonable Assurance Plan and supporting documents, which provides a framework for addressing the Lake Seminole impairment outside of the TMDL process. The Lake Seminole Sediment Removal project is an important element of the Lake Seminole RAP. The primary purpose of the project is to remove nutrient rich ("muck") sediments present within the lake basin that have been linked to its nutrient-related impairment (e.g., SWFWMD 1992). Various design aspects of the project will be discussed including unique challenges associated with the potential utilization of the former Largo Landfill site for disposal of dredged sediments.

Session 7: New Technology and Established BMPs Part II

Location Bivens Ballroom

Wednesday, June 19, 1:30 to 3:00 pm

PHOSPHORUS REMOVAL IN NATURAL WATERS THROUGH CALCIUM CO-PRECIPITATION; EFFECTS OF NATURAL ORGANIC MATTER

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Phosphorus (P), calcium (Ca) and natural organic matter (NOM) naturally occur in every aquatic ecosystem. However, excessive P loads can cause eutrophic or hyper-eutrophic conditions in these waters. These conditions are characterized by excessive primary productivity, reduction or depletion of dissolved oxygen, stressed aquatic organisms, and simplified trophic structure. As a result, P regulation is important for these impaired aquatic systems, and *Ca-P co-precipitation is a vital mechanism of natural P removal in alkaline systems, such as the Florida Everglades.* Studies have shown, however, that NOM concentrations as low as 5 mg C/L can inhibit pure Ca precipitation and significantly reduce calcite growth. Thus, NOM may negatively affect removal of P in natural systems by inhibiting Ca-P co-precipitation. Determining the role of NOM in Ca-P co-precipitation is important for identifying mechanisms that may limit P removal in natural systems where high P levels are a concern. The main goal of this research is to assess the role of NOM in inhibiting Ca and P co-precipitation by: (1) measuring how Ca, NOM, and P concentrations affect NOM's potential inhibition of co-precipitation; (2) identifying the mechanism of inhibition if NOM does interfere with co-precipitation; (3) evaluating whether NOM and P react to form NOM-P compounds that may inhibit Ca-P co-precipitation. Results from this research will help clarify internal P dynamics in alkaline water bodies where Ca, P, and NOM interact. This information can then be used to predict P removal through Ca-P co-precipitation using quantifiable water chemistry parameters, such as Ca, P, and NOM concentrations.

THE USE OF A POLYACRYLAMIDE (PAM) BLEND TO FLOCCULATE AND CONTROL ALGAE IN FRESHWATER

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Toxin producing cyanobacteria are widespread and increasing across the globe. Cyanobacteria cause harmful blooms and can release cyanotoxins as well as starve out other aquatic organisms for light and nutrients. Although there are treatment methods and current research being done to combat this growing problem, few environmentally benign solutions have been found. The objective of this study is to test the effectiveness of an anionic polyacrylamide (PAM) blend at removing the cyanobacteria *Microscyctis aeruginosa* in comparison with two beneficial algae species *Cyclotella sp.* (diatom) and *Psuedokirchneriella subcapitata* (green algae). Many studies have shown tremendous success using PAM in agricultural, erosion, and nutrient control practices. However in studies of the use of PAM on algae, negatively charged anionic PAMs had no effect at flocculating algae specifically. This is surprising considering that comparisons have been made between negatively charged inorganic colloids and negatively charged algal cells. An important and possible explanation that was not addressed is the well known fact that anionic PAMs bind with clay and other negatively charged colloids by using calcium and other positively charged ions as a bridging agent. This study looks at using an anionic PAM blend that contains a calcium additive in attempt to form a bridging reaction between the anionic PAM and the algal cells. This presentation will discuss the background research and previous studies of the use of PAM as well as the results to date on this thesis study.

Optimizing Stormwater BMPs with Real-Time Controls

Thomas Amstadt, PE, CFM[1]*, Mark Ellard, PE, CFM*[2]*, and Marcus Quigley, PE, CPESC, D.WRE*[3]
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State and local governments as well as private enterprises have made significant investments in stormwater BMPs for flood attenuation and water quality treatment in Florida. As regulations become more stringent due to changes in NPDES permits, TMDL requirements, and numeric nutrient criteria, investment in enhancing stormwater BMPs will be needed to meet future pollutant reduction requirements. Despite these more stringent water quality regulations, many State and local governments continue to experience budget cuts that limit their ability to invest in water quality BMPs. As a result, innovative approaches are needed to optimize the effectiveness of BMPs in both retrofit and new construction scenarios to provide the maximum cost benefit.

BMPs such as wet/dry detention, retention ponds, exfiltration trenches, etc. have traditionally been passive systems governed by a fixed control structure designed to achieve a target water quality and/or quantity objective (i.e., treatment volume, attenuation). Passive systems however, rarely represent optimal solutions. For example, a typical wet detention pond detains then discharges a fixed amount of runoff downstream through a static control structure regardless of storage volume remaining within the pond at any given time. Runoff that could be retained during inter-event periods to increase residence time (for treatment) or used as a resource for irrigation (harvesting), is simply discharged through the fixed control structure. As a result, the full pollutant load reduction and stormwater harvesting potential of the pond is not realized.

Recent advances in information technology infrastructure, hardware systems, and software are providing a foundation for a future of digitally connected and dynamically controlled stormwater BMPs. Due to the advances in low cost, internet accessible controller systems and wired and wireless communications, real-time and dynamic controls of BMPs are now viable, cost-effective options for new construction as well as retrofits. These technologies allow these BMPs to be monitored in real time via the internet using a non-proprietary, non-vendor specific web based interface.

The presentation will focus on the engineering aspects of recent research, modeling, and case studies performed by the authors where dynamic real time controls of stormwater BMPs have been implemented for optimized BMP performance. The pollutant reduction and flood control benefits of utilizing real time controls to optimize the use of available storage to extend detention time, harvest stormwater, and optimize volume recovery in otherwise traditional BMPs will be presented. The promise of real time controls to maximize the cost benefit of several types of BMPs including wet detention ponds, treatment wetlands, stormwater harvesting, etc. will also be presented.

LAKE LEVELS AND WATER QUALITY, REVISION 7

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Highlands County is home to more than 100 lakes, many of which have hydrologic alterations which have the effective of lowering, raising or "flattening" them; rarely is this the intent of these alterations. There two dominant Florida Lake Regions (Griffin et al. 1996) lake types on the Lake Wales Ridge. This study compares Lake Wales Ridge Transition Lakes (75-34 in Griffin et al.) that have had their historic level fluctuation ranges artificially raised with those that fluctuate within an accepted healthy range (Hoyer et al. 2005). The working hypothesis is that lakes Glenada and Josephine, which have relatively low lake level fluctuation ranges due to artificially raised lake levels also have relatively high trophic state indicies compared with lakes such as Red Beach and Sebring, which have lake levels that fluctuate as they did historically. Using these analyses, restoration of lakes with altered hydrologies may not be fruitful with out the consideration of restoration of natural lake level fluctuations.

Session 8: New Technology and Established BMPs Part III

Location Bivens Ballroom

Wednesday, June 19, 3:30 to 5:00 pm

CITY OF WINTER PARK CHAIN OF LAKES TWENTY YEARS OF STORMWATER UTILITY IMPLEMENTATION

Timothy J. Egan
City of Winter Park, Florida

The City of Winter Park implemented a stormwater utility in 1991 in response to declining water quality in the Winter Park chain of lakes. Prior to the utility implementation, stormwater management activities were dependant on the general fund and were limited to street sweeping and end of pipe leaf/debris traps. When the utility went online, the city began a systematic retrofit of existing stormwater systems that included retention ponds, exfiltration systems, alum injection and liquid solid separators. An accelerated street sweeping program and a public education program were also implemented. Between 1991 and 1997, water quality trends stabilized and declines were halted. Between 1997 and present, improvements in water clarity and reductions in nutrient levels have been observed. Currently, over 75% of the outfalls to the chain of lakes have had retrofits installed and the City is reevaluating the capital and O&M programs to develop the most effective course for future action.

RESTORATION APPROACHES FOR URBAN POND SYSTEM IN HILLSBOROUGH COUNTY FLORIDA

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Urban lake and pond systems are becoming an increasingly larger water resource group. These manmade systems originated as borrow pits, phosphate pits, and stormwater ponds. They have become "lake front property" for many homeowners and apartment dwellings and over the years have introduced thousands of Floridians to the joys and tribulations of lake living. The majority of these systems are detention ponds although some are designed to retain all water entering the pond. The systems are designed to reduce the initial flow from heavy rain events and capture and treat pollutants that are washed from the structures, lawns and soils within the ponds drainage area.

There are 278 ponds in the Hillsborough County Adopt-A-Pond program (see Figure 1) as compared to 236 named, natural lakes in the County. The named ponds make up a fraction of the stormwater ponds within the county. Stormwater ponds are primarily within residential areas and the majority of these systems are under chemical and biological stress because of the pollutant loading from urban watershed. Urban watersheds in Florida may contain a mix of urban and natural lands where housing communities, transportation systems and commercial establishments were built on and around the fringes of wetlands. Urban development, like the one shown in Figure 2, has replaced wetlands with built systems. Many ponds are constructed in an effort to mitigate the loss of wetland processes; however, studies show that ponds do not fully replace the wetland processes (Hammer, 89; Rushton, 1993; Rushton, 2004; Stormwater Research Summary 1990-2005, SWFWMD).

Figure 1. Named pond which are listed in the Hillsborough County AAP program. Ponds are gray and shown within Hillsborough County Watersheds.

This paper focuses on an urban pond system within the Lake Forest Community and to lesser extent ponds in the New Tampa Community. Both study areas are in north-central Hillsborough County and lie within the USGS Hillsborough sub-basin and the Hillsborough County Cypress Creek and Hillsborough River Watersheds. The outflow of these ponds enters Cypress Creek and the Hillsborough River, two primary streams in Hillsborough County. The Lake Forest Community was designed and permitted in the early 1970s prior to current storm water rules.

Figure 2. New Tampa Development with primary streams of Trout Creek (far left) and Clay Gully (middle) and the four named ponds and large number of unnamed ponds.

New Tampa was permitted later, and primarily after the Florida's original stormwater rule was adopted in 1981. The Lake Forest system is of special interest because, recent stormwater system changes have increased the volume of water that the system must process and have connected the ponds in such a way that they may afford an effective means of properly treating this stormwater prior to it entering the Cypress Creek wetland.

Figure 3. The Lake Forest pond system is a flow through system that takes water primarily from the Cypress Creek watershed and delivers that water back to Cypress Creek.

The goal of the paper is to demonstrate the importance of urban pond systems and the potential of better utilizing these systems to meet their water quality design goal. While it is not possible to replace the wetlands that have been lost to development, a more comprehensive approach to pond management may, if properly supported, better mitigate these losses.

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GEOFILTER TUBE TECHNOLOGY HELPS IN SUCCESSFUL RESTORATION OF LAKE DOWN CANAL (BUTLER CHAIN OF LAKES)

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The $120,733 Lake Down Canal Restoration Project approved by the Windermere Water & Navigation Control District and Orange County - Environmental Protection Division (EPD); included the use of hydraulic dredging to restore the water depth at the canal and the on-site recycling of canal sediments with Geofilter Tubes to reduce canal bank erosion and stormwater pollution (i.e. runoff of yard chemicals such as fertilizers, pesticides, and herbicides)

Maintenance dredging and shoreline restoration of urban lakes and canals has been a challenge because of the lack of access for heavy equipment or the space available for the dewatering, storage and hauling of sediments. The use of Geofilter Tubes constructed of high strength polyester and filled with dredged material, is the latest technology in the recycling, dewatering of sediments and shoreline protection to avoid the impact of dredging excavators & hauling trucks on seawalls, streets and home's backyards.

The canal & shoreline restoration project conducted during November and December 2011 included:

(1) Removal of approx. 1,000 cu. yards of muck/sand to restore the original 5 -6 ft depth of the Lake Down Canal during its construction in 1940's.
(2) The use of a SCUBA diver to conduct the pumping of sediments along a 20' wide- center corridor to preserve the submerged plants and wetland, as well as the trees growing along the west side of the canal
(3) Pumping of canal sediments to fill 3,000 linear feet of Geofilter Tubes (7.5' and 12.5'in diameter)
(4) The cut/grading of selected Geofilter Tubes for the installation of 2,000 linear feet of berms and swales
(5) Installation of 3,100 square feet of sod needed to protect the Geofilter Tube fabric against the U.V light and the planting of 5,000+ beneficial aquatic plants

The use of Geofilter Tubes avoided the importation of soil to restore the canal banks eroded after the hurricanes that afflicted Central Florida in 2004; and formed a long lasting fully contained "sand filter barrier" that will stabilize the bank from erosion, and filter rainwater or irrigation runoff. The Lake Down project was an excellent opportunity for a partnership with the local canal residents and to retrofit the properties with berms/swales as part of the process to arrest the degradation of the Butler Chain of Lakes.

The hydraulic dredging / recycling of sediments into Geofilter Tubes resulted in a capital savings of $257,000, as compared to the cost of dredging the canal with an excavator. The Lake Down Canal Project is the second "geofilter tube project" accomplished by EPD after the successful Fish-Pocket Canal Project completed in 2009.

If you desire to obtain more information on the Lake Down Canal Restoration Project please contact Sergio Duarte, Senior Environmental Specialist at 407-836-1505 or e-mail at Sergio.Duarte@ocfl.net

A PRIORITIZATION TOOL FOR AQUATIC RESTORATION AND ENHANCEMENT OF FLORIDA PUBLIC LAKES

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The development of a restoration prioritization method was considered a critical component of executing a more expedient and cost effective framework for freshwater ecosystem management in Florida. Because lake ecosystems provide unique habitat for numerous fish and wildlife species and substantial socio-economic benefits, management and protection of high quality habitats and restoration of degraded habitats are considered paramount. Therefore, the Florida Fish and Wildlife Conservation Commission's (FWC) Aquatic Habitat Conservation and Restoration Section (AHCR) created an Aquatic Restoration Prioritization and Evaluation Tool (ARPET) based on a Geographic Information System (GIS) framework. ARPET is a science-based planning tool that identifies and prioritizes public lakes based on socio-economic importance, benefits to aquatic resources as assessed by fish and wildlife function and ecological value, and restoration opportunities and needs.

The prioritization of 324 lakes greater than 50 acres that have public access was performed. Automated GIS tools were developed for 21 parameters. Parameters were selected based on pre-existing data that emphasized public use, fish and wildlife utilization, and the desire for restoration. Examples of data-sets used include public boat ramps, public recreational trails, lake size, surrounding land use contiguous to each lake, and threatened and endangered species. Analysis of each parameter was based on a quantitative scoring system and was implemented with automation techniques available in ArcGIS 9.3. Calculated values and standardized parameter scores were generated to group lakes into five priority management classes. Four prioritized lists have been generated utilizing GIS, including an overall prioritized lake list, consisting of a combination of three categories, Socio-Economic Importance, Fish and Wildlife Populations, and Management Emphasis, as well as a list for each of the individual categories.

With more than 300 public lakes located throughout the state and the large number of potential restoration opportunities, the prioritization of these lakes will help resource managers focus aquatic habitat restoration efforts on high-priority aquatic resources.

Session 9: Effective Monitoring

Location Bivens Ballroom

Thursday, June 21, 2012 8:30 to 10:00 am

ASSESSING FISH COMMUNITIES IN DENSE SUBMERSED AQUATIC VEGETATION WITH UNDERWATER VIDEO CAMERAS

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Submersed aquatic vegetation (SAV) provides important habitat for many fishes. Vegetation serves as nursery habitat for freshwater fish and provides refuge and foraging opportunities due to increased structural complexity, buffering water-movement and recycling nutrients. However, not all SAV coverage provides quality habitat for all fish, and dense SAV habitat can have mixed impacts upon both abiotic (e.g. dissolved oxygen dynamics) and biotic factors (e.g. growth rates and foraging interactions). There is concern that dense invasive aquatic plants including hydrilla *Hydrilla verticillata* can reduce habitat quality and thus reduce the presence/abundance of some fishes due to reduced dissolved oxygen (DO) when hydrilla occurs in dense surface mats. Thus, managers need to assess how and which fish utilize dense hydrilla as habitat in order to inform aquatic plant management decisions and more effectively monitor fish for the potential impacts from invasive SAV.

Unfortunately, understanding fish use within SAV is difficult owing to issues associated with sampling via traditional methods. Attributes of SAV, including plant species, morphology and density, can reduce the capture efficiency of sampling gears (e.g. rotenone and electrofishing), making fish community assessments in dense SAV difficult. The objectives of this study are (1) to develop a new sampling method to assess fish in dense hydrilla and (2) evaluate how fish habitat use is influenced by hydrilla by examining fish presence across habitat covariates such as DO and plant density.

Here, we used an innovative, non-lethal method using underwater video cameras to obtain fish counts in dense, surface-matted hydrilla. Three 0.405 ha experimental ponds were used from July-October 2011; two ponds were stocked with 75 and 150 adult *Lepomis spp.* (*L. macrochirus* and *L. microlophus*). The third pond had a multi-year fish community with *Lepomis* spp. and largemouth bass *Micropterus salmoides*.

We used a portable underwater video camera and DVR-recorder to capture point counts of fish beneath the hydrilla canopy layer in each pond (depth 1.3-2.1 m). We conducted 15-20 video point counts (10 minute durations) per month in each of three 0.405 ha ponds (>300 total point counts) infested with hydrilla. We measured DO, relative stem density and both fish presence, and fish counted at each point count. The relative stem density was estimated from video analysis by counting the number of visible stems across a horizontal grid from the video. From video analysis, fish were identified down to functional group (small fish), family (*Lepomis* spp.) or species (largemouth bass). We noted fish as present or absent from the point count, and we counted fish at each site as the maximum number of fish onscreen at any one time. We analyzed fish presence and fish counts using linear regressions to examine whether fish were influenced by DO and stem density. We combined all fish species together in this analysis. All ponds were drained in October 2011 and total fish populations were obtained via fish collections.

The camera worked well identifying and capturing video counts on both juvenile and adult lepomids (*Lepomis macrochirus* and *L. microlophus*), and largemouth bass *Micropterus salmoides* in dense, surface-matted hydrilla. The end of season collections showed the ponds held different levels of fish populations. Pond 1 started at 75 adult *Lepomis* spp. and ended at 21 fish with no recruitment. Pond 2 started at 150 adult *Lepomis* spp., had recruitment and ended at 5,000+ fish. Pond 3 had no initial reference point but ended at 15,000+ fish. Fish counted increased with fish abundance among ponds, suggesting that video counts captured proportional changes in abundance. Both fish presence (logit-linked binomial regression) and fish counted (negative binomial regression) were positively influenced by DO and negatively influenced by hydrilla stem density (p-value < 0.05). Overall, ponds that had low fish abundance indicated that fish were less likely to be present in low DO habitats. Conversely, ponds with highly abundant fish populations showed increased fish use of low DO habitats.

These results indicate that there may be density-dependent impacts to fish habitat selection in dense hydrilla. When fish density is high, fish will utilize low DO locations but at lower rates and abundance than high DO locations. Additionally, fish will utilize areas of high stem density, but at lower rates and abundance than low stem density. When fish density is low, fish occupied areas of high DO and avoided low DO habitat. In lake ecosystems where hydrilla generally lowers DO and grows at high densities, we anticipate that fish will seek out patches that have higher DO and lower stem densities. This new ability to assess fish communities with video cameras shows high potential to help fish and aquatic plant managers to address critical questions on how fish might be impacted by dense hydrilla. Our future work will be examining the relationship of fish detection probability in hydrilla to evaluate how our fish counts are influenced by changes to fish abundance versus detection probability.

USE OF SELECTED ORGANIC MICROCONSTITUENTS AS MARKERS FOR NUTRIENT LOADING FROM RECLAIMED WATER PLANTS IN FLORIDA

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Nitrogen and phosphorous loading into waterways from point and non-point sources is of increasing concern throughout Florida and the country. The rise in nutrient levels, leading to water body impairment from designated beneficial uses, frequently occurs in tandem with escalating urbanization. Florida is a national leader in water reuse with a total reuse system permitted capacity exceeding 1.4 billion gallons per day – about 58 percent of the state's total permitted capacity of all domestic wastewater treatment facilities. The beneficial use of reclaimed water is extremely important to reduce demand on potable quality water consumption in Florida. However, the ecological impact to receiving water bodies from potential nutrient loading associated with reclaimed water is, however, not adequately understood.

To date, there are limited analytical reconnaissance techniques that can assist in elucidating the origins of the nutrients contributing to the impairment of surface water and groundwater. By establishing the capability to distinguish between the sources of nutrient loadings, resources can be appropriately targeted to control nitrogen and phosphorus loading into waterways. To address this issue, a study was undertaken with the overall goal of developing a tool that could be employed to identify the source(s) of nitrogen and phosphorus volumetric loading into impaired surface waters. The specific objectives of the project were to:

- Conduct a broad assessment of nitrogen and phosphorus levels at selected water reuse plants throughout the state;
- Conduct an assessment of potential markers for water reuse, stormwater and septic influence on waterways;
- Assess the environmental fate characteristics of the markers;
- Determine the suitability of the markers in selected lakes, ponds and waterways; and
- Construct a proposed tool to determine the source of nutrient loading in an impaired waterbody by integrating markers within a sampling assessment and data analysis scheme.

An initial review indicated that approximately 425 water bodies including 27% of the estuaries and coastal waters, 39% of the lakes, and 33% of the streams in Florida are classified as impaired water bodies according to the narrative criteria set by the Impaired Water Rule. While there is ample evidence of nutrient enrichment of water bodies, assessment of contributing sources is a difficult task due to uncertainties in the nutrient ranges of contributing sources and poor characterization of the complex hydrological transport pathways. No visual association could be made between the location of impaired water bodies and reuse facilities.

The nutrient survey of selected reuse plants around the state showed that 40% of the sampled reuse facilities in Florida had a total nitrogen concentration less than 5 mg-N/L and 70% had a total nitrogen concentration less than 10 mg-N/L. The higher total nitrogen levels were primarily from facilities with limited nitrification and, as such, they contained much higher levels of ammonia. The majority of the facilities had total Kjeldahl nitrogen (TKN) levels ranging from 1-6 mg-N/L with the median value less than 2.5 mg-N/L with the exception of one Class 4 facility, indicating less nitrification efficiency with a biofilm activated sludge processes. Regarding total phosphorous concentrations, 40% of the 40 sampled facilities were below 1 mg-P/L and 90% had levels below 5 mg-P/L.

Numerous potential markers for nutrients were assessed as part of this study. Through a parsing process, a short-list was established. Some of the more salient markers evaluated included sucralose (an artificial sweetener), carbamazepine (a mood stabilizer), atenolol (a beta blocker), iohexol (a contrast media used in hospital diagnostics), galaxolide (a polycyclic musk fragrance), and gadolinium anomaly (a contrast media used in magnetic resonance imaging). These compounds, in addition to stable isotope ratios of nitrogen, oxygen, and carbon and additional inorganic compounds such as boron, strontium, and uranium were analyzed in various media, including: (1) reuse effluent; (2) septic tank effluent; (3) retention pond stormwater; (4) rainfall; (5) regional fertilizer; (6) reuse effluent augmented with fertilizer (fertigation); and (7) groundwater used for irrigation. The results demonstrated that high levels of sucralose in the wastewater sources and its absence in the sources without wastewater. Carbamazepine, atenolol, iohexol, and Gd anomaly were significantly higher in reuse water, with concentrations in septic systems only slightly elevated above quantifiable levels observed in the sources without wastewater. It should be noted that the sample sizes in were limited and further study is needed to validate the observations made.

Evaluation of markers and nutrients in selected waterbodies was performed in order to understand the boundary conditions under which analysis of sucralose, Gd anomaly, and carbamazepine could assist in discerning the volumetric load contribution from wastewater sources and to possibly distinguish between reuse effluent and septic system inputs. Toward this end, a canal system in a region with only septic sources, a lake with only reclaimed water input (Lake Marden), and several small ponds in a county with reuse irrigation but no septic systems were evaluated. The Gd anomaly/sucralose ratios developed for reuse effluents ranged from 0.5-5.5 which was much higher than the ratios observed in septic tank sources. However, further research needs to be undertaken in order to generate a sufficiently sizable database from which statistical significance can be demonstrated. The utility of the ratio data in assessing whether a water body has received its sucralose contribution from a reuse or septic source is dependent upon the level of dilution occurring in the receiving water.

In summary, this study provided an alternative methodology for distinguishing between sources of nutrients found in waterbodies through the use of selected organic and inorganic microconstituents. The development of a proposed tool was developed based on the data; the final product will be useful to other parts of the country due to the ubiquitous presence of the markers incorporated within the assessment and data analysis scheme. However, a greater data set needs to be developed to refine the ratios and marker concentration decision point levels employed in the tool; further, a full validation study of the final tool is still required.

LOW COST BACTERIA SAMPLING… IS THERE SUCH A THING?

Sam Arden
AMEC E&I, Inc., Jacksonville, FL

Meaningful data collection for environmental monitoring can be a challenge in any economic climate – let alone the one in which we currently find ourselves. For bacteria monitoring, a significant portion of data cost is associated with laboratory fees, and even greater costs may be associated with logistical problems related to collection and submission of samples within short hold times and during non-business hours. This is particularly true for storm related sampling efforts, which are an important component in quantifying bacterial loadings to lakes. Accurate and economical bacteria sampling methods are critical components of general ecosystem health monitoring, TMDL monitoring, or BMP performance monitoring. New methods have recently been developed that may provide both qualitative and quantitative advantages compared to existing methods, including reduced (or completely eliminated) laboratory costs, reduced labor costs, and more timely analysis capabilities. Potential beneficiaries of the reduced costs could range from MS4s, permit holders, site designers, stakeholders and environmental managers.

This presentation will focus on the practical uses, technical merits and limitations of new bacteria culturing media that the stormwater management community is considering in several states including Florida. The discussion will include the precision and accuracy of the product; scenarios where it can be used directly or in support of TMDL requirements; and several examples that will show when it can be economically viable. The information will allow lake managers to make informed decisions about this type of product and whether or not it can be effectively used for their application.

The good news from the 2007 National Lakes Assessment: US lakes are not as bad as we thought

Roger W. Bachmann, Dana L. Bigham, Mark V. Hoyer, and Daniel E. Canfield, Jr.
Florida LAKEWATCH, School of Forest Resources and Conservation,
University of Florida, Gainesville, FL

The US Environmental Protection Agency conducted a survey of 1000 lakes and reservoirs across the United States in the summer of 2007. The lakes were selected using a probabilistic process in order to obtain a representative sample of the lakes of the United States. In addition to standard measurements of water quality, estimates were made of lake “health” as calculated from the species composition of the plankton and the species composition of diatoms collected on the sediment surface. They also used short sediment cores to determine if total phosphorus concentrations had changed from earlier times before significant anthropogenic modifications of the landscape.

Based on the total phosphorus concentrations in US lakes prior to human settlement as inferred from the diatom communities at the bottom of the short sediment cores, 52% of the US lakes were initially oligotrophic, 18% were mesotrophic and 28% were eutrophic to hypereutrophic. The management implication of this finding is that not every eutrophic lake in the US is the result of pollution with phosphorus or nitrogen.

The study found that on average the TP concentrations in US lakes have not increased since prior to the time of European settlement. This was determined by comparing the current TP concentrations in the sampled lakes with the TP concentrations inferred from the diatoms at the bottoms of the cores. The TP concentrations dropped by 0.074 log10 units, which is equivalent to a decrease in TP content of 15%. The management implication is that cultural eutrophication with phosphorus is limited to a small percentage of lakes in the US and is not widespread.

Neither of the two biotic indices could be related to changes in TP in these lakes. The management implication is that the diatom index and the plankton index as developed by the USEPA for the National Lake Assessment cannot be used to assess cultural eutrophication in lakes.

Session 10: Low Cost – High Quality Analysis Tools for the Trade

Location Bivens Ballroom

Thursday, June 21, 2012 10:30 am to Noon

WATER ATLAS SPATIAL ON-LINE LIBRARY, A NEW TOOL FOR WATER RESOURCE INVESTIGATIONS, NEW TECHNOLOGY AND BMPS.

Jan Allyn

The Water Atlas Digital Library is an online repository for references that explain the scientific meaning of water resource data and give it environmental and societal context. The goal of this project was to improve the Digital Library by adding the capability to (1) support additional media formats, (2) display on a map those Digital Library entries with a geographic connection, and (3) search/filter the library by means of a graphic, interactive interface that allows the user to specify keywords and and/or to identify a geographic area of interest.

Accessing St. Johns River Water Management Data: GIS, Water Quality and Quantity.

Bill Van Sickle
St. Johns River Water Management District

An Inexpensive, Low-Maintenance Dissolved Oxygen Recorder Designed for Long-Term Deployment.

Lawrence Keenan
St. Johns River Water Management District

FIELDTRIPS

Thursday tour: 1:30 – 5 PM

Kanapaha Water Reclamation Facility and TREEO Center water garden Field Trip

GRU staff (plant supervisors, engineers or managers) will host this tour of the facility that will provide you with a close-up look at the operations of the plant. This 150 acre site was previously used as a rest stop for Seminole Indians traveling in the area. The first reuse site from this plant was the nearby Kanapaha Botanical Gardens in 1993. The Kanapaha Botanical Gardens demonstrates the beauty of reclaimed water to create natural looking spring boils, waterfalls, streams and bog gardens that feature plants, trees and a wildlife sanctuary. Another destination for this reclaimed water is the TREEO CENTER water garden, another beautiful example of well managed reuse water. We will tour the plant first and then move on to the nearby water garden. Arrangements will be made to carpool from the hotel. The Botanical Gardens are not open on Thursday, but you can return on Friday on your own if you would like to see this reuse destination.

https://www.gru.com/YourHome/ProductsServices/WaterWastewater/kanapahaHistory.jsp
http://www.treeo.ufl.edu/About.aspx

Friday tour: 8 – 11 am

Sweetwater Branch/Paynes Prairie Sheetflow Restoration Field Trip

The Sweetwater Branch/Paynes Prairie Sheetflow Restoration Project is a multi-million dollar multi-partner project designed to target multiple restoration goals. Some of these goals include treating nutrients contained in Sweetwater Branch water, constructing a 125 acre treatment wetland, filling in a canal currently carrying Sweetwater Branch water directly to Alachua Sink, restoring sheetflow to positively impact a 1300 acre portion of Paynes Praire and establish a public viewing and education center. During our field trip we will view Alachua Sink, the canal carrying Sweetwater Branch water to Alachua Sink and the site where the treatment wetland will be constructed. Arrangements will be made to carpool from the hotel .

http://www.cityofgainesville.org/GOVERNMENT/CityDepartmentsNZ/PublicWorks/PaynesPrairieSheetflowproject/tabid/648/Default.aspx

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2012 FLORIDA LAKE MANAGEMENT SOCIETY 23ND ANNUAL CONFERENCE

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