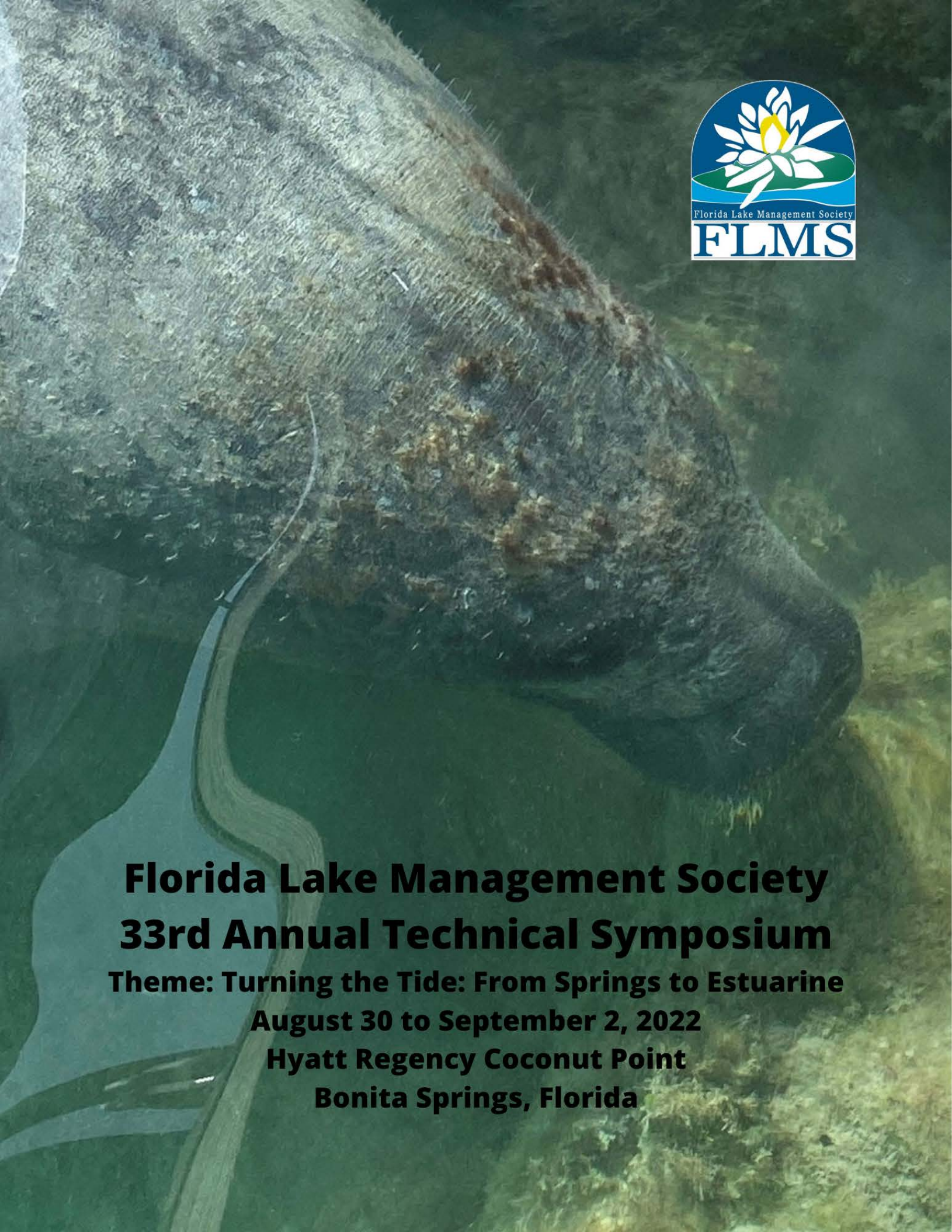

Florida Lake Management Society
33rd Annual Technical Symposium

Theme: Turning the Tide: From Springs to Estuarine

August 30 to September 2, 2022

Hyatt Regency Coconut Point

Bonita Springs, Florida

Florida Lake Management Society

33rd Annual Technical Symposium

August 30th - September 2nd, 2022

Hyatt Regency Coconut Point, Bonita Springs, Florida

Program Theme:

Turning the Tide: From Springs to Estuarine

SYMPOSIUM PROGRAM

TABLE OF CONTENTS

TUESDAY – AUGUST 30, 2022 - WORKSHOPS

7:30 AM-5:00 PM	**Check-In and Registration** (Calusa Foyer)

8:15 – 12:00 pm	**Workshop 1 Blue Heron Room: Algal Identification in the Environment - Part 1**. Dr. Dail Laughinghouse, Assistant Professor and Dr. David Berthold, M.S., Biological Scientist – Applied Phycology, University of Florida/IFAS, Fort Lauderdale Research and Education Center. (If you have capability of bringing your own microscope, it is highly recommended but not a requirement for the workshop. FLMS will have some on hand.)
8:15 – 12:00 pm	**Workshop 2 Great Egret Room: Trend and Time Series Analysis with R – Part 1.** Dan Schmutz, M.S., Greenman Pedersen, Inc.

	All workshop food breaks are located in the Calusa Foyer
10:00 – 10:15 am	**MORNING BREAK**
12:00 – 12:45 pm	**LUNCH** (*provided with full-day Workshop registration*)
2:30 – 2:45 pm	**AFTERNOON BREAK**

8:15 – 12:00 pm	**Workshop 3 Blue Heron Room: Algal Identification in the Environment - Part 2**. Dr. Dail Laughinghouse, Assistant Professor and Dr. David Berthold, M.S., Biological Scientist – Applied Phycology, University of Florida/IFAS, Fort Lauderdale Research and Education Center. **(Part 1 morning workshop required)**
12:45 – 4:15 pm	**Workshop 4 Great Egret Room: Geospatial Data Science with R – Part 2.** Dan Schmutz, M.S., Greenman Pedersen, Inc. **(Part 1 morning workshop required)**
12:45 – 4:45pm	**Workshop 5 Captiva Room: Oxygenation and Circulation Techniques to Improve Water Quality. -** Patrick Goodwin M.S., CLM – Good Aquatic, LLC.
5:00 – 7:00pm	**Citizen Science Workshop** – Ernesto Lasso de la Vega, Lee County Hyacinth Control District and Ron Hart, Surface Water Professionals, LLC

WEDNESDAY – AUGUST 31, 2022 MORNING – SYMPOSIUM

(* - Denotes student paper)

7:30 AM-5:00 PM	**Check-In and Registration** (Calusa Foyer)
7:00 AM-8:30 AM	**Breakfast** (Calusa Ballroom)

Opening Program (Calusa Ballroom)

8:45-9:00 AM **Welcome & Opening Remarks: Gloria Eby, Outgoing FLMS President**

9:00-10:00 AM **Morning Keynote Address**

An Evidenced-based Approach to Lake and Estuary Management

David Tomasko, Ph.D., Executive Director, Sarasota Bay Estuary Program

10:00-10:45 AM **MORNING BREAK** (Exhibit Hall - Calusa Ballroom)

Session A1: Water Quality in Lake Management (Calusa Ballroom)

Moderator: Ernesto Lasso De La Vega, Ed.D.

10:45-10:50 AM	*Session Introduction*
10:50-11:05 AM	A Limnological Yardstick Based on Phosphorus Limitation- *Mark V. Hoyer*
11:05-11:20 AM	First Year Results of a Remote Monitoring Sonde Network in Lake Okeechobee, Florida (USA)- *Daniel Marchio*
11:20-11:35 AM	Estimating Nutrient Loads in Reclaimed Water Used for Irrigation in Residential Communities- *L. Donald Duke Ph.D.*
11:35-11:50 AM	Trends in Water Quality and Nutrient Loading to Lakes in the Upper St Johns River Basin- *Joshua Papacek*
11:50-12:00 PM	*Session Q&A*

12:00-1:30 PM Annual Business Luncheon, Board Member Induction, NALMS Update (Calusa Ballroom)

WEDNESDAY – AUGUST 31, 2022 AFTERNOON

(* - Denotes student paper)

1:30-2:30 PM **Afternoon Keynote Address** (Calusa Ballroom)

Conserving Audubon's Corkscrew Swamp Sanctuary Within a Developing Landscape

Shawn Clem, Ph.D., Research Director, Audubon Florida's Western Everglades Research Center

Session A2: Springs Management (Calusa Ballroom)

Moderator: Tiffany Trent

2:30-2:35 PM	*Session Introduction*
2:35-2:50 PM	Florida Springs – Where are we in 2022? - *Robert Mattson*
2:50-3:05 PM	Estimating Salinization of Spring-Fed Rivers using Submerged Aquatic Vegetation - *Madison Trowbridge Ph.D.*
3:05-3:20 PM	A Multi-Year Study of Submerged Aquatic Vegetation and Epiphytic Algal Coverage in the Silver River. - *Tiffany Trent*
3:20-3:30 PM	*Session Q&A*
3:30-4:00 PM	**AFTERNOON BREAK** (Exhibit Hall - Calusa Ballroom)

Session B1: Lake Mapping (Blue Heron Ballroom)

Moderator: Eesa Ali

2:30-2:35 PM	*Session Introduction*
2:35-2:50 PM	The Ecology of a Submersed Aquatic Vegetation Community under Management in Lake Sampson, FL - *Jacob Thayer*
2:50-3:05 PM	Surveying and Mapping Florida Fresh Water Lakes with LiDAR, Multi Beam, and RTK GPS - *David O'Brien*
3:05-3:20 PM	Using Machine Learning to Map Plant Communities in the Kissimmee Chain of Lakes - *Camille Carroll*
3:20-3:30 PM	*Session Q&A*
3:30-4:00 PM	**AFTERNOON BREAK** (Exhibit Hall - Calusa Ballroom)

WEDNESDAY – AUGUST 31, 2022 AFTERNOON (Cont.)

Session A3: Advances in Algal Research (Calusa Ballroom)

Moderator: H. Dail Laughinghouse IV, Ph.D.

4:00-4:05 PM	*Session Introduction*
4:05-4:20 PM	Algaecidal Effects on Microbial Community Structure during a Cyanobacterial Bloom in Lake Okeechobee, Florida, USA. - *Forrest W Lefler**
4:20-4:35 PM	Effectiveness of USEPA-Registered Algaecides to Control the Red Tide Forming Dinoflagellate Karenia brevis and Brevetoxins - *Jing Hu**
4:35-4:50 PM	Bioaccumulation of Cyanobacterial Metabolites in Tilapia (Oreochromis niloticus). - *Jessica Moretto Altarugio**
4:50-5:05 PM	Effects of Herbicide Related Phosphonates on Toxic Bloom-Forming Species of Cyanobacteria - *Natalia Pritchard**
5:05-5:20 PM	Spatial and Temporal Trends in Protist Communities of Lake Okeechobee and the St. Lucie Estuary (Florida, USA)- *Maximiliano Barbosa**
5:20-5:30 PM	*Session Q&A*

Session B2: Lake Management Tools (Blue Heron Ballroom)

Moderator: Harvey Harper P.E.

4:00-4:05 PM	*Session Introduction*
4:05-4:20 PM	The Upper St. Johns River Basin Project: Past, Present, and Future. Evolution of a Modern-Day Multipurpose Flood Control/River Restoration Project. - *Steven J Miller*
4:20-4:35 PM	Coastal Zone Soil Survey: A Pedological Approach to Inventorying Subaqueous Soils - *Rex Ellis Ph.D.*
4:35-4:50 PM	Peace River Watershed Threats Assessment, Focal Area Prioritization, and Restoration - *Greg Knothe*
4:50-5:05 PM	Solids Deposition from Alum Sediment Inactivation - *Harvey Harper P.E.*
5:05-5:20 PM	How to Catch a Lake Killer: Cool Forensic Tools Limnologists Can Use - *Lance Lumbard M.S., CLP*
5:20-5:30 PM	*Session Q&A*

WEDNESDAY – AUGUST 31, 2022 EVENING

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

6:00-8:00 PM **Poster Session** (Exhibit Hall – Calusa Ballroom)

Moderator: Rob Burnes, M.S.

1. Harmful Algal Bloom Monitoring in the Indian River Lagoon Using Continuous Water Quality Sensors
   - *Ashley Parks*
2. Hydrology Drives Dissolved Oxygen Fluctuations in the Upper St. Johns River Basin, Florida
   - *Dean Dobberfuhl Ph.D.*
3. Comparative Study of Microbial Community Structures of 45 Ponds in Bonita Bay Community
   - *Haruka Urakawa Ph.D.*
4. Identifying Ecosystem Control Points by Detecting Hot Spots and Moments of Denitrification in the Guana River Estuary
   - *Jenna Reimer*
5. Four Applications of Biobase™ Sonar Mapping Technology Used in Central Florida Monitoring Projects
   - *Jim Peterson*
6. A Sediment Record of Cultural Eutrophication in Shallow Subtropical Lake Conine, Florida
   - *Lucy Trosper*
7. Esri's Arc Hydro Hydroperiod Tool and MFLs Determination for Lakes in the St Johns River Water Management District
   - *Sandra Fox*
8. Banana Lake: The Efficacy of Dredging to Manage Eutrophication
   - *Susan Iott*
9. Expanding the Black Band Disease Genus *Roseofilum* with Description of Three New Species
   - *Yi Wang*
10. The Restoration of Lake Apopka: Reintroducing the Extirpated Native Species of Potamogeton Illinoensis
    - *Jodi Slater*

THURSDAY – SEPTEMBER 1, 2022 MORNING

(* - Denotes student paper)

7:30 AM-5:00 PM	**Check-In and Registration** (Calusa Foyer)
7:00 AM-8:30 AM	**Breakfast** (Calusa Ballroom)

Morning Program (Calusa Ballroom)

8:45-9:00 AM **Welcome & Opening Remarks:** Eesa Ali, Incoming FLMS President

9:00 -10:00 AM **Keynote Address**

Florida on the Move: Coastal Conservation and Restoration

Linda Walters, Ph.D., Pegasus Professor of Biology, University of Central Florida

10:00-10:45 AM	**MORNING BREAK** (Exhibit Hall – Calusa Ballroom)

Session A4: Approaches for Lake Management (Calusa Ballroom)

Moderator: Ron Hart, MPA

10:45-10:50 AM	*Session Introduction*
10:50-11:05 AM	A Multi-decade Assessment of the Marsh Flow-Way Functionality for Improving Lake Apopka's Water Quality - *Jennifer Mitchell*
11:05-11:20 AM	Lake Management within a Built-Out Watershed - *Emily Keenan*
11:20-11:35 AM	The Orlando Easterly Wetlands Nutrient Removal Project - *Mark Sees*
11:35-11:50 AM	Utilizing Stakeholder Input to Develop a Lake Management Plan for the Harris Chain of Lakes - *Scott Bisping*
11:50-12:00 PM	*Session Q&A*

12:00-1:30 PM	**FLMS Annual Awards Luncheon** (Calusa Ballroom)

THURSDAY – SEPTEMBER 1, 2022 AFTERNOON

(* - Denotes student paper)

Session A5: Sediments in Aquatic Resource Management (Calusa Ballroom)

Moderator: Jason Danaher, Ph.D.

1:30-1:35 PM	*Session Introduction*
1:35-1:50 PM	Impacts of Sediment Pollution on Communities and the Environment -*Eddie Snell*
1:50-2:05 PM	Development of a Science-Based Update to the Orange County Fertilizer Ordinance - *Mitchell Katz Ph.D.*
2:05-2:20 PM	Reconstructing HABs and Cyanotoxin Production in Florida over the Last 4000 Years: a Paleolimnological Perspective. - *Matthew Waters Ph.D.*
2:20-2:35 PM	Hypereutrophic conditions on the millennial-scale: The paleolimnological record of Lake Wauberg, Florida - *Savvas Paradeisis-Stathis**
2:35-2:50 PM	A Paleolimnological Approach to Identifying Management Signatures in Urban Subtropical Lakes - *Savanna Wooten**
2:50-3:00 PM	*Session Q&A*

Session B3: Ocklawaha 1 (Blue Heron Ballroom)

Moderator: Casey Fitzgerald

1:45-1:50 PM	*Session Introduction*
1:50-2:20 PM	Ocklawaha River Restoration: An Overview, A Tale of Four Ecosystems, and Benefits to Manatees and the Florida Wildlife Corridor- *Casey Fitzgerald*
2:20-2:35 PM	A Reanalysis of the Nutrient Delivery from a Free-Flowing Ocklawaha and Potential Benefits to the Pelagic Ecology of the Lower St. Johns River - *John Hendrickson*
2:35-2:50 PM	Potential Implications for Fish Populations of a Restored Free-Flowing Ocklawaha River - *Stephen Walsh*
2:50-3:00 PM	*Session Q&A*

2:45-3:15 PM	**AFTERNOON BREAK** (Exhibit Hall –Calusa Ballroom)

Session A6: Algae Research and Management (Calusa Ballroom)

Moderator: Dana Stephens, Ph.D.

3:30-3:35 PM	*Session Introduction*
3:35-3:50 PM	Phytoplankton community composition in a Northwest Florida ICOLL - *Dana Stephens Ph.D.*
3:50-4:05 PM	Routine Plankton Monitoring Project of the South Florida Water Management District: Past, Present, and Future - *Anna Swigris*
4:05-4:20 PM	"So You Work on Florida Waters: Occupational HAB Exposures and How to Protect Yourself" - *Rick Clark*
4:20-4:35 PM	The Have to Have for HABS: A Coordinated Response to a Harmful Algae Bloom - *Gloria Eby*
4:35-4:50 PM	Microcystis Bloom Mesocosm Response to High Concentration Hydrogen Peroxide Treatment - *Taylor Hancock**
4:50-5:00 PM	*Session Q&A*

Session B4: Ocklawaha 2 (Blue Heron Ballroom)

Moderator: Casey Fitzgerald

3:30-3:35 PM	*Session Introduction*
3:35-3:50 PM	Ocklawaha Restoration: A Focus on Economics, Outdoor Recreation, and Social Marketing - *Margaret Hankinson Spontak*
3:50-4:05 PM	Ocklawaha Restoration and the Recovery of Silver Springs and the Twenty Lost Springs - *Robert Knight, Ph.D.*
4:05-4:45 PM	Documentary: The Fellowship of the Springs (30-minute version)
4:45-5:00 PM	*Session Q&A*

6:00 PM	H2O-LYMPICS STUDENT SCHOLARSHIP FUNDRAISER – Cypress Courtyard & Waterfall Pool Deck, (Sign up at Registration Desk)

FRIDAY – SEPTEMBER 2, 2022 MORNING

(* - Denotes student paper)

7:00 AM-8:45 AM	**Breakfast** (Exhibit Hall - Calusa Ballroom)

8:45-9:00 AM Announcements: Eesa Ali, FLMS President

Session A7: Innovations in Lake Management (Calusa Ballroom)

Moderator: Rob Burnes, M.S.

9:00-9:05 AM	*Session Introduction*
9:05-9:20 AM	Evaluation of the Field Performance of a Baffle Box with a Bold & Gold Upflow Filter for Nutrient Removal - *Mike Hardin P.E., Ph.D.*
9:20-9:35 AM	Phosphorus Adsorptive Media Reduces Dissolved P for Proactive HABs Mitigation - *Ed Weinberg P.E.*
9:35-9:50 AM	Novel Technologies for Phosphorus Mitigation and Water Quality Restoration in Aquatic Systems - *West Bishop Ph.D.*
9:50-10:05 AM	Employing Sucralose, Stable Isotopes, Microbial Communities, and Modern Statistical Methods to Determine Sources of Fecal Indicator Bacteria in a Florida River - *Michael Kratz**
10:05-10:15 AM	*Session Q&A*

10:15-10:45 AM	**MORNING BREAK** (Exhibit Hall – Calusa Ballroom)

Session A8: Evaluation Methods in Lake Management (Calusa Ballroom)

Moderator: Dan Schmutz, M.S.

10:45-10:50 AM	*Session Introduction*
10:50-11:05 AM	Evaluating Ecosystem Services of Urban Stormwater Ponds - *Audrey Goeckner**
11:05-11:20 AM	Monitoring and Assessment of Sandhill Lakes - *Chris Shea*
11:20-11:35 AM	Development and Implementation of a Wetland Evaluation Method for Xeric-associated Wetlands in the Northern Tampa Bay Area - *Dan Schmutz, M.S.*
11:35-11:45 AM	*Session Q&A*

11:45 -12:00 PM	Student Awards and Closing Remarks – Eesa Ali, FLMS President

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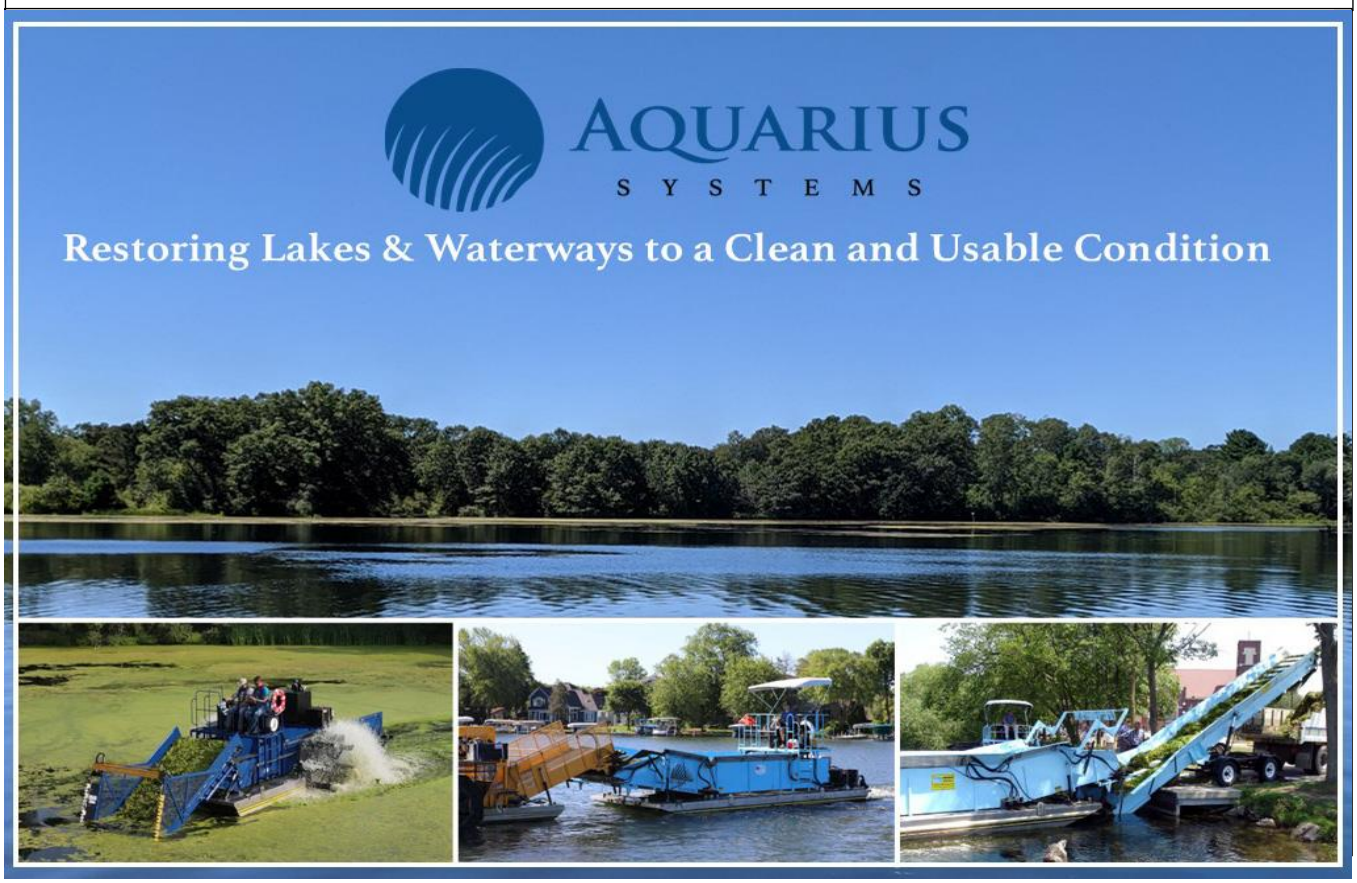
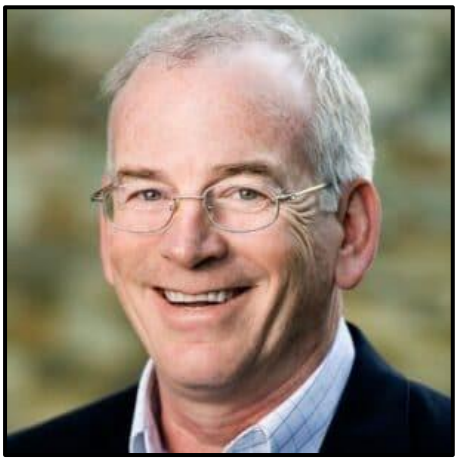


Wednesday Keynote Speakers

David Tomasko, Ph.D.



Dr. Dave Tomasko has more than 30 years of experience in water quality assessments and the development of science-based natural resource plans in the Gulf of Mexico and international locations. He is currently the Sarasota Bay Estuary Program Executive Director and oversees their goals to improve water quality, increase wildlife habitat, and enhance the natural resources of the area for use and enjoyment by the public.

He holds a Ph.D. in biology from the University of South Florida, a Master of Science in marine biology from the Florida Institute of Technology, and a Bachelor of Science in biology from Old Dominion University. Dr Tomasko previously worked for Environmental Science Associates, Atkins, and SWFWMD. Dr. Tomasko was also the first-ever Sarasota Bay Estuary Program Program Scientist.

Shawn Clem, Ph.D.

Dr. Shawn Clem is the Research Director of Audubon Florida's Western Everglades Research Center, located at Corkscrew Swamp Sanctuary. Dr. Clem is a community ecologist with twenty years of experience in researching and describing the ecology, hydrology, and impacts from environmental stressors on our region, with past positions and projects at Everglades National Park, Audubon's Everglades Science Center in Tavernier, and Big Cypress National Preserve.

Dr. Clem earned her Ph.D. in Biology from Florida International University and B.S. in Marine Science and Mathematics from Eckard College. Dr. Clem is the founder and leader of the annual Corkscrew Watershed Science Forum, co-director of Corkscrew's Conservation Internship program; co-organizer of Audubon Florida's Conservation Leadership Initiative; adjunct graduate faculty at Florida Gulf Coast University (FGCU); and a Research Affiliate of FGCU's Everglades Wetland Research Park.

Thursday Keynote Speaker

Linda Walters, Ph.D.

Dr. Linda Walters joined the faculty of UCF in 1997 as an Assistant Professor in the Department of Biology. She is now a Pegasus Professor of Biology with research focused on marine conservation, restoration, and communication. Dr. Walters was the Director of the UCF Center for Success of Women Faculty from 2011 to 2020. She's received more than $14 million in grant funding and published more than 110 peer-reviewed journal articles.

Dr. Walters completed her bachelor's degree in biology at Bates College. She then attended the University of South Carolina for her master's and PhD in Biology. For her postdoctoral studies, she studied at the University of Hawaii, Manoa, the Université Laval in Canada, and took part in the Indo-American Fulbright Fellowship in Cochin, India.

Ongoing research in her lab, called CEELAB (Coastal and Estuarine Ecology Lab), focuses on a wide variety of problems impacting our coastal waters, especially the Indian River Lagoon (IRL) system on the east coast of central Florida. Walters has led community-based oyster reef restoration and shoreline stabilization since 2007 and 2011, respectively. This has allowed her, her students, and colleagues to conduct long-term monitoring of lagoon changes. Current research topics include: 1) developing successful, biodegradable materials to use for restoration, 2) understanding the sources and impacts of microplastics in the IRL, especially on filter feeders, 3) acidification of oyster reefs due to mangrove encroachment, and 4) oyster reef resilience to numerous threats, including invasive species, algal blooms, storms, etc.

Additionally, the lab focuses on sharing this information with children, educators, families and stakeholders throughout the region through dozens of hands-on events each year that are primarily led by CEELAB students. Walters has also produced 10 children's storybooks and oyster storytelling yoga routine that combines large muscle movement with science content.

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FLMS 2022 AWARDS OF EXCELLENCE

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

THE MARJORIE CARR AWARD

presented to

Rob Mattson

The Marjorie Carr Award *is the Society's highest award and is given for lifetime 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

presented to

John Hendrickson

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 MARJORY STONEMAN DOUGLAS AWARD

presented to

Audacity

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

THE SCOTT DRIVER AWARD

presented to

Chuck O'Neal

The Scott Driver Award *is given to an environmental advocate 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.*

THE RICHARD COLEMAN AWARD

presented to

Troy Attaway

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 DR. DANIEL E. CANFIELD, JR. VOLUNTEERISM AWARD

presented to

Lake Cane Restoration Society

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

THE MARISSA L. WILLIAMS YOUNG PROFESSIONAL AWARD

presented to

Dana Dettmar

The Young Professional *Award is presented to a young lake management professional who exhibits exemplary professional accomplishments and a commitment to water resource protection and management of our lakes and watersheds. The award is named after Marissa Williams who devoted her life to promoting an understanding of, and active involvement in, Florida's aquatic resources.*

THE BOB GRAHAM AWARD

presented to

Peter Simmons

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

Session Abstracts

Session A1: Water Quality in Lake Management
Moderator: Ernesto Lasso De La Vega
Wednesday, August 31, 2022. 10:45 am to 12:00 pm
Calusa Ballroom

A LIMNOLOGICAL YARDSTICK BASED ON PHOSPHORUS LIMITATION

Mark V. Hoyer
University of Florida/IFAS, Gainesville, FL

A new tool called a Limnological Yardstick was developed using long-term (15 to 35 years) lake chemistry data collected by volunteers of the Florida LAKEWATCH program. The Yardstick can assist managers of aquatic systems with identifying where there is a great probability that phosphorus is not only the limiting nutrient, but the limiting environmental factor. When a lake's phosphorus-chlorophyll data lie below the Yardstick's lower 95% confidence interval, phosphorus may be the limiting nutrient but not the limiting environmental factor, indicating where phosphorus control strategies will most likely fail. The Limnological Yardstick cannot directly identify the limiting environmental factor(s) as this requires a thorough limnological study of the lake because each lake has unique properties. Limiting environmental factors discussed are nitrogen, true color (Pt-Co units), non-algal suspended solids, flushing rate and aquatic macrophytes. The potential impacts of limiting environmental factors on the classification of lake trophic state and eutrophication are also discussed.

FIRST YEAR RESULTS OF A REMOTE MONITORING SONDE NETWORK IN LAKE OKEECHOBEE, FLORIDA (USA)

Daniel Marchio
South Florida Water Management District, West Palm Beach, FL

Advancements in technology have given lake managers new tools to assess lake health at a variety of temporal and spatial resolutions. This study used two anchored buoys and four stationary platforms outfitted with multiparameter sondes and satellite telemetry systems to collect high-resolution time series water quality data on Lake Okeechobee. The objective of the study is to analyze the differences between chlorophyll a, phycocyanin, turbidity, dissolved oxygen, and temperature measurements from deployed sonde data with NELAC certified laboratory data for a period of one year. Determining the reliability and accuracy of near-continuous measurements over long-term deployments is paramount to identifying important short-term trends and relationships in water quality data. Results will indicate how reliable data obtained from remote monitoring stations are and any discrepancies in sonde telemetry data when analyzed

against laboratory data. Reliable real time data will allow lake managers to act on the most recent data that may affect surrounding communities and the health of the lake.

ESTIMATING NUTRIENT LOADS IN RECLAIMED WATER USED FOR IRRIGATION IN RESIDENTIAL COMMUNITIES

L. Donald Duke Ph.D. P.E. and Henna Gavem
Florida Gulf Coast University Water School
Department of Ecology and Environmental Studies, Fort Myers FL

Reclamation of treated municipal wastewater is encouraged by Florida and U.S. regulations and policies and widely used for irrigation of non-food systems in Florida, comprising more than 50% of Florida's centrally treated wastewater. SB 64 (2021) specifies utilities achieve 100% reclamation by 2032, and Clean Water Act regulations favor reclamation because utilities not discharging to waters of the US need not comply with NPDES surface water protections. This is desirable because landscape vegetation can take up and sequester nutrients that might otherwise cause environmental problems in receiving waters. As a result, municipal wastewater directed to irrigation is regulated at most WWTPs to eliminate substances potentially affecting human health but with no numeric targets for nutrients, i.e. compounds of nitrogen and phosphorus (N and P). This study evaluates water usage by Bonita Bay Community Association, responsible for common-area landscaping in a 3,000-resident community in Bonita Springs, Florida, which for decades has contracted with a purveyor to acquire treated wastewater effluent from Bonita Springs Utilities' (BSU's) wastewater reclamation facility, for use as non-potable irrigation water for community landscaping. The question has not been fully investigated as to whether long-term application of treated wastewater with its relatively high nutrient loads may generate conditions in soils and surficial groundwater where nutrients may accumulate and be transported into communities' stormwater detention ponds and other systems that lead to waters of the US. This research used data from BSU to document nutrient concentration in facility effluent – found to vary monthly by up to an order of magnitude – and conservation-minded irrigation practices at BBCA to compute ranges of expected nutrient load in a typical period. In some circumstances, the load of N and P in irrigation water exceeds the mass per unit area and time by scientific guidelines for fertilization, i.e. in excess of landscape vegetation's capacity to sequester nutrients, leading to sporadic conditions when N and P may be transported with runoff or groundwater into receiving waters.

RECENT TRENDS IN WATER QUALITY & NUTRIENT LOADING TO LAKES IN THE UPPER ST. JOHNS RIVER BASIN

Joshua Papacek
St. Johns River Water Management District, Palatka, FL

The Upper St. Johns River Basin (USJRB) contains over 116,000 ha of floodplain, including 65,000 ha of natural and restored wetlands and shallow reservoirs managed by the St. Johns River Water Management District (SJRWMD) as part of the USJRB Project. Watershed sources of nutrients to the expansive headwater wetlands and nutrient cycling within these wetlands are the dominant drivers of water quality in

the downstream river-lakes. In 2003, the SJRWMD established a Pollutant Load Reduction Goal (PLRG) for the USJRB river-lakes based on a 0.09 mg L-1 total phosphorus (TP) concentration limit to reduce the frequency of cyanobacteria blooms. The same target TP concentration was adopted for three TMDLs set by the Florida Department of Environmental Protection (FDEP) within the USJRB in 2006. The most recent Impaired Waters Rule (IWR) analysis indicated several additional waterbodies within the USJRB are not meeting numeric nutrient criteria for TP, including the historically pristine Blue Cypress Lake. A reevaluation of the PLRG TP target based on additional phytoplankton monitoring data indicates that the TP concentration threshold for cyanobacteria dominance is still appropriate. However, modeling of TP loading to PLRG river-lakes showed a significant increase over the last several years in exceedance of established reduction targets. This trend appears to be primarily driven by loading from tributaries on the western side of the river. For Blue Cypress Lake, a preliminary TP budget highlighted significant uncertainties in the degree of nutrient exchange between the lake and surrounding marsh as well as internal nutrient fluxes within the lake. Overall, these trends in water quality are likely to have a significant impact to USJRB lake ecology, as recent monitoring of blooms by SJRWMD and FDEP shows frequent dominance of toxin-producing cyanobacteria taxa in multiple lakes, as well as concerns for increased export to downstream basins.

Session A2: Springs Management
Moderator: Tiffany Trent
Wednesday, August 31, 2022. 2:30 pm to 3:30 pm
Blue Heron Ballroom

FLORIDA SPRINGS – WHERE ARE WE IN 2022?

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

Previous papers and symposia at FLMS have highlighted the management issues affecting Florida springs, including water quality degradation, reductions in flow, and changes in habitat. This paper will discuss the current status of Florida springs, with an emphasis on springs of the St. Johns River basin.

Significant increases in concentrations of dissolved nitrogen (as Nitrate-Nitrite N; NOx-N) have been a focus since the 1980s. Initially these were thought to be responsible for driving the shifts in submerged plant communities seen in springs; primarily increases in the abundance of epiphytic and filamentous algae and loss of rooted macrophytes (i.e., the traditional "eutrophication effect"). There is scientific evidence that supports this and evidence that clearly indicates no effect on plant communities. Other effects could be inhibition of macrophyte growth, toxicity to aquatic fauna, and export of N to downstream communities. Again, evidence for these is mixed.

Decreases in spring discharge/flow have been documented over the past few decades. These are attributed to a combination of changes in rainfall and recharge patterns, probably due to global climate change, with additional impacts caused by groundwater withdrawal for human uses. There is evidence that reductions in flow may promote the proliferation of algae due to decreased current velocities affecting physical scouring/removal of algal accumulations. An emerging water quality issue that is driven by hydrologic changes in the Floridan Aquifer is increases in dissolved solids concentrations in springs.

The proliferation of algae in Florida springs appears to be part of a global issue in lotic ecosystems. Research has shown that algal habitat, primarily macroalgal mats, may support increased abundance in benthic macroinvertebrate and small fish communities, but reduced diversity. Changes in submerged vegetation communities, from macrophyte to macroalgal dominance, has an overall negative effect on spring ecosystems via food web effects; these involve changes in availability of prey items for higher trophic levels, including recreationally significant fish species such as spotted sunfish and other centrarchids.

ESTIMATING SALINIZATION OF SPRING-FED RIVERS USING SUBMERGED AQUATIC VEGETATION

Madison Trowbridge Ph.D.
Southwest Florida Water Management District, Brooksville, FL

Florida spring-fed rivers are known for their submerged aquatic vegetation (SAV), which provides habitat for fish and aquatic crustaceans and food for the Florida manatee, which can reduce SAV habitats. Salinization of coastal spring-fed rivers due to climate change and sea level rise have been documented. This study investigated patterns and relationships within the SAV communities of the Chassahowitzka River (Florida, USA) as a model of river salinization. A distinct dichotomy was seen in the SAV community structure: communities where salt tolerant *Chaetomorpha* spp. was present and communities where freshwater filamentous algae species were present. Freshwater filamentous algae demonstrated an inverse relationship with salinity. *Chaetomorpha* spp. replaced the freshwater filamentous algae in regions too salty for filamentous algae to grow. These patterns in the SAV community resulted in three different ecological zones in the Chassahowitzka River: a freshwater zone, a transition zone, and an estuarine zone. While freshwater filamentous algae and *Chaetomorpha* spp. were characteristic of the freshwater and estuarine zones respectively, both species were identified within the transition zone. Utilizing the presence/absence of these macroalgae types could allow for an *in-situ* approach of characterizing regions of coastal spring-fed rivers that show increased salinization.

A MULTI-YEAR STUDY OF SUBMERGED AQUATIC VEGETATION AND EPIPHYTIC ALGAL COVERAGE IN THE SILVER RIVER

Tiffany Trent
St. Johns River Water Management District, Palatka, FL

Comprehensive line-intercept observations were made with Braun Blanquet measurements on 4 transects along the Silver River. Results show the variations in the vegetation species and epiphytic algal coverage in different seasons and within different proximities to the main spring head.

Session B1: Lake Mapping
Moderator: Eesa Ali
Wednesday, August 31, 2022. 2:30 pm to 3:30 pm
Calusa Ballroom

THE ECOLOGY OF A SUBMERSED AQUATIC VEGETATION COMMUNITY UNDER MANAGEMENT IN LAKE SAMPSON, FLORIDA

Jacob Thayer
Center for Aquatic and Invasive Plants, University of Florida, Gainesville, FL

Submersed aquatic vegetation (SAV) is a major ecological component of Florida's shallow lake systems. Hydrilla (*Hydrilla verticillata* [L.F.] Royle) is a non-native SAV dominating many of these lakes and is often observed to be growing in large monotypic cultures exclusive to other native SAV community members. This invasive species is the number one priority for aquatic plant management in the state of Florida with desired outcomes to conserve native SAV diversity. We are studying the effects on SAV community ecology from selective hydrilla management activities. This investigation is being conducted in two mesotrophic systems, Lake Sampson (804 hectares) in Bradford County and Lake Mann (107 hectares) in Orange County. Surveys have been conducted before and after selective herbicide treatments that were administered in early spring of 2021. Data on species and abundance were recorded with point intercept, hydroacoustic, and airborne imagery surveys on monthly intervals offering community structure data with high spatial and temporal resolution. Here, we present on some of the basic attributes in community ecology consisting of native and non-native patch networks along with local and lake-level diversity indices to describe patterns of environmental filtering and competitive exclusion. Furthermore, replacement series competition experiments were conducted in mesocosms between native and invasive species as a complement to the field trials. Selective hydrilla management should enhance local composition of native SAV communities.

SURVEYING AND MAPPING FLORIDA FRESH WATER LAKES WITH LIDAR, MULTI BEAM, AND RTK GPS

David O'Brien
SurvTech Solutions, Tampa, FL

SurvTech mapped numerous freshwater lakes in the central Florida region for the Southwest Water Management District, utilizing a combination of UAV (unmanned aerial vehicle) LiDAR, multi beam sonar, and RTK (real-time kinematic) GPS. SurvTech combined all three datasets into a seamless high definition subaqueous and upland bare earth surface model, providing the water management district with superior base mapping to study the lakes. Using UAV LiDAR the cost of data acquisition is lowered, while simultaneously providing superior data density and accuracy to LiDAR from a fixed-wing airplane. Combining the LiDAR data with multi-beam data for the subaqueous portion of the lake provides a high-

definition bathymetric survey of the lakes. These two data sets are then combined to create a seamless surface model for the subaqueous and upland portions of the lake and surrounding area. RTK GPS is used to fill in any gaps between the multi beam and LiDAR datasets and to provide ground checks of the remotely collected data.

USING MACHINE LEARNING TO MAP PLANT COMMUNITIES IN THE KISSIMMEE CHAIN OF LAKES

Camille Carroll
Leading Edge Aerial Technologies, Daytona Beach, FL

We describe a new mapping procedure that incorporates machine learning to identify plant communities on lakes Kissimmee, Cypress, and Hatchineha and the interconnecting terrestrial marsh. Preliminary results identify distinct assemblages of communities present in the littoral zone versus the terrestrial marsh, and relative coverage of each community. We discuss how maps will be compared over time to measure the response of plant communities to changes in hydrological management, specifically the adoption of a new lake management schedule that is part of the Kissimmee River Restoration Project. Comparisons between recent (2020) littoral zone maps to those previously developed by the FWC (2009, 2015) are presented as an example.

Session A3: Advances in Algal Research
Moderator: H. Dail Laughinghouse IV Ph.D.
Wednesday, August 31, 2022. 4:00 pm to 5:30 pm
Blue Heron Ballroom

ALGAECIDAL EFFECTS ON MICROBIAL COMMUNITY STRUCTURE DURING A CYANOBACTERIAL BLOOM IN LAKE OKEECHOBEE, FLORIDA, USA.

Forrest Lefler[1], *David Berthold Ph.D*[1], *Maximiliano Barbosa*[1], *Rory Roten Ph.D*[2]., *SePRO, West Bishop Ph.D.*[2], *and H. Dail Laughinghouse IV Ph.D.*[1]
[1] University of Florida/IFAS, Davie, FL
[2] SePRO, Carmel, IN

Lake Okeechobee is a large shallow subtropical lake that frequently experiences cyanobacterial harmful algal blooms. In 2021, a microcystin-producing Microcystis-dominated cyanoHAB occurred within the Pahokee Marina in Lake Okeechobee. The bloom was treated with the granular peroxide herbicide, PAK27, and sampled before, 4 hours, 24 hours, and 48 hours after treatment to assess the algaecides effect on microbial community structure and toxin degradation. The change in microbial community structure was assessed via amplicon sequencing using general bacterial and protists specific primers. Amplicon sequencing revealed that the bacterial community was dominated by Proteobacteria, and the cyanobacterial community was dominated by Microcystis and Prochlorococcacean taxa. A significant shift in microbial

community structure was seen 48 hours after treatment. The abundance of Microcystis decreased after 48 hours, as did the concentration of microcystins. These results indicate that peroxide-based herbicides affect the cyanobacterial community more than other bacteria, and is important when assessing potential effects on non-target beneficial microorganisms.

EFFECTIVENESS OF USEPA-REGISTERED ALGAECIDES TO MANAGE THE RED TIDE FORMING DINOFLAGELLATE *KARENIA BREVIS* AND BREVETOXINS

Jing Hu[1,2], *David E. Berthold[1], Yi Wang[1], Xi Xiao[2], and H. Dail Laughinghouse IV[1*]*

[1] University of Florida/IFAS, Davie, FL
[2] Department of Marine Science, Ocean College, Zhejiang University, Zhoushan, People's Republic of China

Karenia brevis is an indigenous toxic dinoflagellate and the primary causative organism of red tides in the Gulf of Mexico. Blooms of this species occur almost annually in the West Florida Shelf and have been a problem for decades. The effectiveness of USEPA-registered algaecides for managing algae in lakes and reservoirs has been extensively evaluated and confirmed in laboratory studies, mesocosm studies and *in situ* treatment. However, the use of registered algaecides in marine environments remains largely unknown. We investigated the efficiency of six USEPA-registered algaecides, three copper-based and three hydrogen peroxide-based on *K. brevis* with a natural bloom density of 1.79 $\times 10^7$cells/L. Population growth, chlorophyll-a concentration and brevetoxin levels were examined over a 72 hour period following exposure. Hydrogen peroxide decomposition rate in three peroxide-based algaecides was also analyzed using different matrices. Our results indicate that the application of as low as 0.3 mg/L of copper-based algaecides led to rapid eradication of *K. brevis* cells and reduced the total brevetoxin level by 49.60% within 24 h after treatment, while hydrogen peroxide-based algaecides required a relatively higher concentration for the effective removal of *K. brevis* cells (> 6 mg/L) and toxins (≥2 mg/L), bust still lower than maximum label rate. The decomposition dynamics of three hydrogen peroxide-based algaecides revealed that organisms and salinity have a pronounced impact on the stability of hydrogen peroxide, and Oximycin@ showed the highest stability among tested algaecides with a degradation rate at 0.467 mg/d in natural seawater. Hence, our laboratory work verified the effectiveness of registered algaecides on the control of *K. brevis* and brevetoxins, providing insight into potential emergency treatment methods for immediate mitigation of this harmful algal bloom (HAB) species, especially in enclosed areas. Pilot studies on marine non-targets are still needed for further investigation before application of this method on HABs in open waters.

BIOACCUMULATION OF CYANOBACTERIAL METABOLITES IN TILAPIA (*OREOCHROMIS NILOTICUS*).

Jessica Moretto Altarugio
University of Florida/IFAS, Davie, FL

Freshwater cyanobacteria can produce toxic and non-toxic secondary metabolites that accumulate in other organisms. These can negatively impact aquaculture, as different secondary metabolites can alter the quality of fish. The aim of this study was to evaluate the bioaccumulative effects of secondary metabolites from cyanobacterial blooms in tilapia fingerlings (*Oreochromis niloticus*). The experiments were carried out with 80 fish per aquarium of 58L, divided into negative control and different concentrations of the cyanobacteria biomass extract for 30 days. Cyanobacteria biomass and fish tissues were analyzed by LC/MS to detect secondary metabolites. The analysis showed different variants of microcystins, such as MC- LR (m/z 995) and MC-YR (m/z 1045) and mycosporines: palythine (m/z 245), shinorine (m/z 333), porphyra-334 (m/z 347) and mycosporine-glycine-alanine (m/z 317) in the cyanobacterial biomass. Microcystin was not found to accumulate in fish during the studied exposure time. Overall, the biomass concentrations used in the bioaccumulation experiment were not lethal to fish, as they remained alive until the end of the experiment. We found that mycosporines accumulated in muscle (palythine, shinorine and mycosporine-glycine-alanine) and liver (palythine and shinorine) of those fish exposed to higher concentrations of cyanobacterial biomass. Thus, these metabolites are capable of bioaccumulating in fish.

EFFECTS OF HERBICIDE RELATED PHOSPHONATES ON TOXIC BLOOM-FORMING SPECIES OF CYANOBACTERIA

Natalia A. Pritchard, Forrest W. Lefler, Maximiliano Barbosa, David E. Berthold Ph.D., and H. Dail Laughinghouse IV Ph.D.
University of Florida/IFAS, Davie, FL

Glyphosate is a commonly used broad-spectrum herbicide applied by farmers, landscapers, and water managers. Glyphosate is a phosphonate; such compounds are characterized by a stable covalent bond between carbon and phosphorus atoms making them very hard to break down. Bacteria have been shown to produce an enzyme known as carbon-phosphorous (C-P) lyase that allows them to cleave the recalcitrant carbon-phosphorus bond. Here we investigate the effects of phosphonates, such as glyphosate, on the growth rate and toxin production of common bloom forming strains of cyanobacteria (e.g., *Raphidiopsis*, *Dolichospermum*) isolated from Florida's fresh waters. Additionally, genomes of cyanobacteria were screened to determine which taxa possess the necessary genetic components to breakdown phosphonates, such as glyphosate. Elucidating the effects of these phosphonates allows for increased understanding of bloom dynamics in water ways with glyphosate runoff and application, which is of direct relevance for water managers, federal and regional governments, and waterworks.

SPATIAL AND TEMPORAL TRENDS IN PROTIST COMMUNITIES OF LAKE OKEECHOBEE AND THE ST. LUCIE ESTUARY (FLORIDA, USA)

Maximiliano Barbosa, Forrest Lefler, David Berthold Ph.D, and H. Dail Laughinghouse IV Ph.D.
[1] University of Florida/IFAS, Davie, FL

Lake Okeechobee is a large freshwater eutrophic lake in central Florida that consistently experiences cyanoHABs. The lake provides vital ecosystem services such as natural habitat for fish and other wildlife, and supplies water for people, farms and the environment. Lake Okeechobee provides flood protection for surrounding communities and prevents water from inundating surrounding populated areas. Excess water from Lake Okeechobee is sometimes released to the Atlantic Ocean through dredged canals, such as St. Lucie Canal to the St. Lucie River and St. Lucie Estuary. The release of excess water can result in degradation of water quality due to the downstream transport of nutrients and microorganisms into the St. Lucie Estuary. Degradation in water quality is often associated with degradation in ecosystem functioning and microbial composition of freshwater ecosystems. Here, we investigated the spatial and temporal trends of the protist communities in Lake Okeechobee, St. Lucie Canal, St. Lucie River and St. Lucie Estuary. Sampling occurred monthly from September 2019 to January 2020. The protist community was highly diverse with Bacillariophyta and Cryptomonads dominating throughout Lake Okeechobee and the St. Lucie Estuary. We observed a shift in dominance over time between Cryptomonads and Bacillariophyta within Lake Okeechobee, but a consistent dominance of Bacillariophyta in the St. Lucie Estuary. An NMDS ordination showed that protist communities were similar within location, but different along time. We conducted a PERMANOVA found that protist community compositions were significantly different along space and time. Results indicate that protist communities are driven by seasonality and locality.

Session B2: Lake Management Tools
Moderator: Harvey Harper Ph.D.
Wednesday, August 31, 2021. 4:00 pm to 5:30 pm
Calusa Ballroom

THE UPPER ST. JOHNS RIVER BASIN PROJECT: PAST, PRESENT, AND FUTURE. EVOLUTION OF A MODERN-DAY MULTIPURPOSE FLOOD CONTROL/RIVER RESTORATION PROJECT.

Steven J Miller, and Kimberli Ponzio
St. Johns River Water Management District, Palatka, FL

In 1949, the U.S. Congress authorized the U. S. Army Corps of Engineers (Corps) to initiate a project addressing flood control issues in the southern half of Florida, including the Upper St. Johns River Basin. This act initiated a major water resource construction project in the St. Johns River Basin (Upper Basin Project) that has taken the Corps and the State of Florida over 60 years to complete. In this paper, we describe the history of the Upper Basin Project and its transformation from a highly structured flood control/navigation project to a modern-day multipurpose river restoration project. In 2008, the project received Australia's prestigious International Thiess River Prize, which gave it global recognition as one of

the top river restoration projects in the world. In addition, to an overall description of the current project and its success in meeting multiple objectives, we will describe current challenges facing project managers as we move into the future of an ever-changing Florida.

COASTAL ZONE SOIL SURVEY: A PEDOLOGICAL APPROACH TO INVENTORYING SUBAQUEOUS SOILS

Rex Ellis Ph.D.
St. Johns River Water Management District, Palatka, FL

In the 1990s and early 2000s, the United States Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) digitized their paper soil surveys for counties into the Soil Survey Geographic Database (SSURGO), the precursor to the existing Web Soil Survey. This digital survey inventories the upper 2 m of soil resources across most US lands and is arguably the most detailed and complex layer of geospatial data for those lands. During that same time, soil scientists expanded their pedological paradigm into estuaries and bays. Research along coasts in the northeast, mid-Atlantic, and southeast demonstrated that underwater soil/landscape relationships could be developed and combined with bathymetry and aerial photography to map subaqueous, coastal soils. In 2016, the USDA-NRCS formed the Coastal Zone Soil Survey (CZSS) program to officially extend terrestrial methods into aquatic areas. CZSS began in Florida in 2019 with a project in the Banana River Lagoon. In the coming years, surveys will extend into Mosquito and Indian River lagoons, as well as along coasts in southwest Florida and the northeast.

PEACE RIVER WATERSHED THREATS ASSESSMENT, FOCAL AREA PRIORITIZATION, AND RESTORATION

Gregory Knothe
Polk County Parks and Natural Resources, Lakeland, FL

The Peace River (106 miles) is a large black water river in peninsular Florida that flows through an unconfined alluvial valley of unconsolidated quartz sand, silt, and clayey sand sediments. The watershed has experienced high levels of habitat degradation due to urbanization, agriculture, industry, mining, and altered flow regimes. The objectives of the threats assessment were to: (1) identify and inventory the location and magnitude of habitat degradation within the Peace River riparian corridor including navigable tributaries; (2) identify and inventory fish passage impacts at road crossings in the watersheds; (3) develop restoration recommendations at each impacted location; and (4) develop a prioritized Basin Restoration Plan for state, federal, and local agencies and private landowners to implement conservation and restoration efforts. We assessed approximately 167.7 river miles in the Peace River Watershed and evaluated 512 impairment sites. Restoration recommendations for impairment sites were developed into 3 summarized options based on river geomorphology and the cause of degradation. Impairment sites were prioritized into focal areas for restoration using Geographic Information System heatmaps that were weighted by site abundance, site length, and calculated severity scores. Our Basin Restoration Plan recommends that focal

areas take restoration priority, since they are concentrated areas of habitat degradation where multiple sites could be restored concurrently to minimize costs. Moving forward, the next logical step following the Peace River Watershed threats assessment project was to implement restoration based on the results. Funding was secured to restore and monitor three severely degraded streambanks along the main stem river. We partnered with the United States Fish and Wildlife Service to restore the streambanks utilizing Natural Channel Design methodologies. Monitoring has included pre-and-post restoration assessment of fish communities, permanent cross-sections, photo-points, side-scan-sonar, and FDEP stream condition index assessments.

SOLIDS DEPOSITION FROM ALUM SEDIMENT INACTIVATION

Harvey Harper P.E., Ph.D.
Environmental Research and Design, Orlando, FL

Alum sediment inactivation is an essential tool in lake management to address internal recycling of nutrients from bottom sediments. Sediment nutrient release in eutrophic lakes commonly exceeds loadings from runoff, and impaired waters cannot be restored without addressing internal recycling loadings. In some cases, sediment inactivation will provide sufficient load reductions to restore an impaired water without addressing other sources. Recently, concern has been raised about potential "fill" caused by addition of the alum floc. A typical areal alum dose of 100 g Al/m2 will deposit approximately 0.2 cm (1/16 of 1 inch) of dry "fill" into the waterbody. The average normal solids deposition rate for a eutrophic lake is about 0.5 cm/yr, with some as high as 1 cm/yr. If the alum application reduces algal growth and sediment deposition by 50%, a typical value, future solids deposition and "fill" will be reduced, and after approximately 18-24 months the net "fill" from the floc and natural deposition will be neutral. After this point overall rate of deposition in the waterbody will be reduced for the longevity of the application.

HOW TO CATCH A LAKE KILLER: COOL FORENSIC TOOLS LIMNOLOGISTS CAN USE

Lance Lumbard
Wood Environment & Infrastructure Solutions, Inc, Orlando, FL

Treating direct surface water discharge and the associated pollutant loading is often a primary focus of lake and river restoration programs. While addressing these untreated outfalls is imperative, implementation of stormwater best management practices alone is rarely sufficient to restore water quality within an impaired lake. Therefore, it is important to understand the relative contribution of additional sources of pollutants that can enter the water column through unseen sources including internal sediment flux and groundwater seepage. Sediment core incubation, stable isotope analysis, chemical indicators such as sucralose, and genetic markers are just some of the tools available to limnologists to support a line-of-evidence approach to identifying pollutant sources and developing appropriate management strategies for water quality restoration.

Poster Session
Moderator: Rob Burnes
Wednesday, August 31, 2022. 6:00 pm to 8:00 pm
Exhibitor Hall

HARMFUL ALGAL BLOOM MONITORING IN THE INDIAN RIVER LAGOON USING CONTINUOUS WATER QUALITY SENSORS

Ashley Parks
St. Johns River Water Management District, Palatka, FL

Harmful algal blooms can typically be detected with in situ chlorophyll sensors, and our continuous water quality monitoring network was designed with that in mind. Previous blooms of *Aureoumbra lagunensis* were detected by chlorophyll sensors, but a shift in species to picoplanktonic cyanobacteria, which require different excitation and emission wavelengths, were not detected. We were able to use turbidity data imported from the continuous water quality sensors to monitor the bloom remotely instead of a chlorophyll sensor.

HYDROLOGY DRIVES DISSOLVED OXYGEN FLUCTUATIONS IN THE UPPER ST. JOHNS RIVER BASIN, FLORIDA

Dean Dobberfuhl, Ph.D.
St. Johns River Water Management District, Palatka, FL

The river channel and lakes in the Upper St. Johns River basin are tightly coupled to extensive floodplains and marshes. Precipitation events can flush these wetlands and produce dissolved oxygen sags in receiving water bodies. Low DO pulses can persist as they move downstream.

COMPARATIVE STUDY OF MICROBIAL COMMUNITY STRUCTURES OF 45 PONDS IN BONITA BAY COMMUNITY

Haruka Urakawa Ph.D.
Florida Gulf Coast University, Fort Myers, FL

Phytoplankton are key primary producers in aquatic ecosystems and important indicators for detecting human-induced environmental changes. Thus, the monitoring of the succession of phytoplankton could be used for water management. We used cyanobacterial/eukaryotic algae-specific 16S rRNA gene amplicon

sequencing to assess the phytoplankton community compositions in 52 integrated water samples collected from 45 ponds at Bonita Bay Community from June 15, 2021, to June 30, 2021. In addition to the 16S rRNA gene sequencing, water temperature, pH, dissolved oxygen, chlorophyll a, nutrients, sucralose, and copper concentrations were measured. A total of 30 genera of cyanobacteria and 53 genera of eukaryotes were found in those water bodies. Among those algae, some toxic species such as Microcystis and Anabaena were found at certain ponds. The highest relative count of Anabaena was found at Pond 20 and reached to 35% in cyanobacteria, totaling for 32% of the total phytoplankton communities (i.e., cyanobacteria and eukaryotes combined). The most abundant species in Pond 20 were Synechococcus and Cyanobacterium, which are nontoxic cyanobacteria. The relative abundance of Microcystis was highest in Pond 38 followed by Pond 31. In Pond 38, the ratio of Microcystis to cyanobacteria was 9% and 5% when related to the total phytoplankton communities. The Shannon diversity index of 45 ponds indicated that the lowest diversity was found in Pond 20 and followed by Pond 38. Our data suggested that keeping more phytoplankton diversity may prevent the succession of the toxic cyanobacterial species.

IDENTIFYING ECOSYSTEM CONTROL POINTS BY DETECTING HOT SPOTS AND MOMENTS OF DENITRIFICATION IN THE GUANA RIVER ESTUARY

Jenna Reimer
University of Florida/IFAS, Gainesville, FL

Denitrification is a microbially-mediated process that permanently removes nitrate from the biosphere and is known to be highly variable both spatially and temporally. To better understand how this spatiotemporal variability influences hot spots and hot moments of nitrogen removal in a coastal estuary, we are measuring sediment denitrification potential at 10 locations along a salinity gradient in the Guana River Estuary (GRE). Since January 2022, I have been conducting monthly denitrification sediment slurry incubations with sediment from the Guana Lake and Guana River. During these incubations, N2 gas, the product of denitrification, is produced, and denitrification is estimated based on the rate of production of N2 gas over time. Preliminary data shows a shift from denitrification to nitrogen fixation along the increasing salinity gradient, and is positively correlated with nitrate availability. As we continue to conduct denitrification sediment slurry incubations, we expect to see increased denitrification in summer months due to warmer temperatures and increased nutrient inputs. Detecting hot spots and moments of denitrification in the GRE will allow us to identify ecosystem control points that provide opportunities to reduce downstream N export.

FOUR APPLICATIONS OF BIOBASE TM SONAR MAPPING TECHNOLOGY USED IN CENTRAL FLORIDA MONITORING PROJECTS

Jim Peterson[1], *Jodi Slater*[1], *Bill VanSickle*[1], *and Nathalie Visscher*[2]
[1]St. Johns River Water Management District
[2]Florida Fish and Wildlife Conservation Commission

BioBase is a commercial cloud platform that uses data collected from off-the-shelf fish finder sonar units to create maps. Using automation and cloud processing, BioBase allows users to log sonar data in the field and then upload those data. Once uploaded, BioBase performs automated processing of raw logged data files using algorithms that create user data reports. The user data reports can be opened and by selecting various options, create maps or export shape files displaying tracks, bottom contours, sediment hardness, and submersed aquatic vegetation (SAV) heat maps.

Scientists at the St. Johns River Water Management District began using BioBase mapping technology in 2014. This poster gives examples of four recent projects where sonar and BioBase processing were used to generate maps. Some maps combine GPS features and GIS base map layers. Two projects use vegetation heat maps to show changes in SAV cover and density. Two projects use sonar generated data to produce bottom contour maps displaying preliminary pre- and post-river channel contours following a de-snagging project and preliminary post dredging contours.

A SEDIMENT RECORD OF CULTURAL EUTROPHICATION IN SHALLOW SUBTROPICAL LAKE CONINE, FLORIDA

Lucy Trosper
Auburn University, Auburn, AL

Illinois pondweed (*Potamogeton illinoensis*) disappeared from Lake Apopka in the 1950s, along with all of the submerged aquatic vegetation (SAV) due to persistent algal shading. Although other SAV species began recolonizing the lake in 1995 as water quality improved, pondweed did not naturally recolonize. The District strove to determine the best restoration path forward to improve water quality and provide fish and wildlife habitat by embarking on a project with the University of Florida (UF) to determine locations and conditions that would provide the best likelihood of successful native SAV plantings. As part of this process, UF researchers tested plots in different areas but also planted pondweed with eelgrass (*Vallisneria americana*). This was the first time pondweed grew in Lake Apopka in more than 65 years! Since that time the District has continued to reintroduce pondweed to Lake Apopka. By the end of 2022, we will have planted more than 30 acres of *Potamogeton illinoensis* all around lake. The pondweed is doing well and reproducing, providing a seed source for the natural expansion of this historically important part of the native SAV community which provides fish and wildlife habitat, while continuing to help improve water quality.

ESRI'S ARC HYDRO HYDROPERIOD TOOL AND MFLS DETERMINATION FOR LAKES IN THE ST JOHNS RIVER WATER MANAGEMENT DISTRICT

Sandra Fox, Raymond Deschler, Nathaniel Mouzon, Andrew Sutherland and Fatih Gordu
St. Johns River Water Management District, Palatka, FL

Water management involves the balancing of multiple demands on this precious resource. The Minimum Flows and Levels (MFLs) program of the St Johns River Water Management District (SJRWMD, in northeast Florida) is tasked with establishing the limits at which further water withdrawals would be significantly harmful to the water resources or ecology of an area, including lakes, rivers and springs. The SJRWMD MFLs program has made extensive use of a geospatial modeling tool dubbed the "Hydroperiod Tool" (HT). Originally this tool was designed to be a "relatively simple tool to model changes in inundation over time and under different hydrologic scenarios" for various surface water resources. The HT has been used to evaluate area of inundation, changes to fish and wildlife habitat, and changes in depths important for various recreational uses in both lakes and wetlands.

The tool is simple in that it makes use of geospatial data (topobathymetric digital elevation models –DEMs, and stage values) and routine functions in ArcMap (interpolation, raster math, raster reclassification, etc.). The DEMs used as input for the MFLs program are based on LiDAR-derived elevations, corrected for vegetation as needed, incorporated with interpolation of bathymetry data taken from a variety of sources. The HT makes use of the geoprocessing power of ArcMap, iterating through multiple time steps (stage values) and allowing for rapid comparisons of area or depth at various elevations for resources such as lakes and wetlands.

Output from the HT was an integral part of the SJRWMD's recent development of minimum levels for Lake Butler, in Volusia county, Florida, which will be featured in the presentation.

BANANA LAKE: THE EFFICACY OF DREDGING TO MANAGE EUTROPHICATION

Susan Iott
Auburn University, Auburn, AL

Alterations to land use and urban development around lake ecosystems can lead to the influx of nutrients and the formation of dense algal and cyanobacteria blooms, called cultural eutrophication. While most monitoring programs successfully document eutrophication, the development of eutrophic characteristics often occurred prior to recent monitoring efforts. To reconstruct historic lake change, paleolimnological techniques and the sediment record can be used to provide data preceding monitoring programs. Here, we measured nutrients (C, N, P) and photosynthetic pigments in a sediment core collected from Banana Lake, Florida, a shallow (mean depth 1.2m) and hypereutrophic lake located in Polk County, Florida. In addition to materials entering from the landscape, shallow lakes can experience internal nutrient cycling through resuspension due to their high surface area to volume ratio. In the case of Banana Lake, excess nutrients have allowed cyanobacteria to become the dominant primary producers utilizing lake nutrients and creating a positive feedback loop that intensifies eutrophication. By combining nutrient and pigment data, our results

show that cyanobacteria existed in the lake long before monitoring efforts began in the system. Maximum P levels appear to be substantially higher than those of comparable lakes, likely caused by the lake's proximity to phosphate mines and the development of a viable meroplankton community. Additionally, toxins associated with cyanobacteria were found in large quantities in sediments spanning the last ~30-40 years. An attempt to manage eutrophication was made in 1991 by removing approximately one million cubic yards of sediment through dredging. Despite these efforts, Banana Lake is still classified as an impaired water body with high sedimentary P, viable meroplanktonic cyanobacteria, and high microcystin concentrations; a fish consumption advisory is also in effect. Management efforts would benefit from coupling monitoring and management efforts with sediment analysis in shallow systems where internal nutrient loading could be the primary driver of persistent eutrophication.

EXPANDING THE BLACK BAND DISEASE GENUS *ROSEOFILUM* WITH DESCRIPTION OF THREE NEW SPECIES

"Yi Wang, David E. Berthold Ph.D., and H. Dail Laughinghouse IV Ph.D.
University of Florida/IFAS, Davie, FL

Overgrowth of benthic cyanobacterial mats (BCMs) is prevalent in marine environments, partly driven by nutrient loading and climate change. Reports of BCMs occurring across coastal marine environments have increased, demonstrating a need to understand the diversity involved in the blooms and potential toxicity of the BCMs. Furthermore, marine cyanobacterial mats are observed growing and affecting the health of corals with one specific cyanobacterial genus dominating the microbial mats associated with black band disease. To explore the diversity of the genus Roseofilum, cyanobacterial mats were sampled, and individual isolates were identified based on morphology and 16S rRNA phylogenies and 16S-23S rRNA sequence dissimilarities. From marine mats, three novel species of the genus Roseofilum were isolated, two species from the Florida coast and a third from the French coast. Quantification of toxins using ELISA demonstrated high concentration of microcystins. Future works aims to identify and quantify potential secondary compounds found within these novel species.

THE RESTORATION OF LAKE APOPKA: REINTRODUCING THE EXTIRPATED NATIVE SPECIES OF POTAMOGETON ILLINOENSIS

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

Potamogeton illinoensis (Illinois pondweed) disappeared from Lake Apopka in the 1950s, along with all of the submerged aquatic vegetation (SAV) due to persistent algal shading. Although other SAV species began recolonizing the lake in 1995 as water quality improved, pondweed did not naturally recolonize. The District strove to determine the best restoration path forward to improve water quality and provide fish and wildlife habitat by embarking on a project with the University of Florida (UF) to determine locations and conditions that would provide the best likelihood of successful native SAV plantings. As part of this process, UF

researchers tested plots in different areas but also planted pondweed with eelgrass (Vallisneria americana). This was the first time pondweed grew in Lake Apopka in more than 65 years! Since that time the District has continued to reintroduce pondweed to Lake Apopka. By the end of 2022, we will have planted more than 30 acres of Potamogeton illinoensis all around lake. The pondweed is doing well and reproducing, providing a seed source for the natural expansion of this historically important part of the native SAV community which provides fish and wildlife habitat, while continuing to help improve water quality.

Session A4: Approaches for Lake Management
Moderator: Ron Hart
Thursday, September 1, 2022. 10:45 am to 12:00 pm
Calusa Ballroom

A MULTI-DECADE ASSESSMENT OF THE MARSH FLOW-WAY FUNCTIONALITY FOR IMPROVING LAKE APOPKA'S WATER QUALITY

Jennifer Mitchell
St. Johns River Water Management District, Palatka, FL

The St. Johns River Water Management District has been actively working to improve water quality within Lake Apopka, once considered one of Florida's most severely polluted lakes, since the 1980s. Substantial reductions in nutrient loading have been achieved by conversion of 7,285 hectares of muck farms on the North Shore to a mixture of open water and wetland systems with limited discharge to the lake. Another technique to improve water quality in Lake Apopka is the 308-hectare constructed recirculating wetland system known as the Lake Apopka Marsh Flow-Way (MFW), which has been in operation for nearly 20 years. These continuous flow through wetlands have the capacity to treat 30% of the lake's volume per year and have treated approximately 5.7 lake volumes since startup. The dominant emergent vegetation in the MFW, includes *Pontederia cordata*, *Typha* spp., and *Thalia geniculata* to increase settling of particulates as water flows through the cells. The MFW is operated at a mean hydraulic loading rate (HLR) of 29 m/yr, which allows total suspended solids and the associated nutrients to settle out of suspension while minimizing the release the legacy soluble soil P. Under optimal conditions, 40% mass removal of TP and over 90% mass removal of TSS are achieved by the MFW. Water quality improvements by the MFW are now dominated by the removal of TSS which improves lake water clarity. Continued operation of the MFW is an important management tool to sustain recent water quality improvements as Lake Apopka continues its recovery.

LAKE MANAGEMENT WITHIN A BUILT-OUT WATERSHED

Emily Keenan
ESA, Tampa, FL

The City of Lakeland, named for its water resources, contains 38 named lakes. Several of these waterbodies have been designated as "impaired" due to elevated nutrients and phytoplankton production. Lake Parker, headwater to the Peace River, is an approximately 2,185- acre lake that has been identified as impaired with an established Nutrient Reduction Plan which outlines proposed restoration activities and anticipated achievable water quality criteria. Internal nutrient loading has been identified as the dominant nutrient source, particularly total phosphorus, attributing to degraded water quality conditions. The implementation of traditional pollutant load reduction techniques focused on external loads only such as stormwater treatment would not be sufficient to meet nutrient reduction requirements in order for notable water quality improvement. The City of Lakeland Lakes and Stormwater Division and ESA are developing water quality improvement projects focused on internal nutrient load reductions through wetland enhancement or creation. We will present an overview of the challenges, solutions and funding opportunities explored through project development.

THE ORLANDO EASTERLY WETLANDS NUTRIENT REMOVAL PROJECT

Mark Sees
City of Orlando, Orlando, FL

The Orlando Easterly Wetlands (OEW) serve as a model for nutrient reduction and ancillary benefits. The Orlando Easterly Wetlands is a 1,200-acre manmade wetland treatment system designed to remove excess nutrients from up to 35 million gallons per day. In 2021, the system polished nutrients from more than 5.9 billion gallons of water. Nitrogen was reduced by 50.2% from an average of 1.51 mg/L to 0.62 mg/L. Total Phosphorus was reduced by 81.1% measuring 0.237 mg/L at the influent to 0.037 mg/L at the outfall of the wetland project. Muck removal projects and prescribed fire are used as management tools that help maintain this system's ability to continually remove excess nutrients from incoming water.

In addition to the benefit of water quality enhancement, the wetland system is providing incredible biodiversity. More than 33 species of dragonflies, 63 species of butterflies, and 220 species of birds have been observed using the created wetlands. Driving the biodiversity are the macroinvertebrates. One-thousand to 13,000 individuals per square meter have been sampled throughout the treatment wetlands.

The water quality improvements coupled with high biodiversity make this system attractive for education and public recreation. The OEW serves as an educational facility for local universities and offers educational tours for thousands of school-aged children and the general public. The system also serves as a public park attracting more than 60,000 visitors per year offering opportunities for public education and outreach centering on the importance of wetlands for water quality and ecological enhancement.

UTILIZING STAKEHOLDER INPUT TO DEVELOP A LAKE MANAGEMENT PLAN FOR THE HARRIS CHAIN OF LAKES

Scott Bisping
Florida Fish and Wildlife Conservation Commission, Eustis FL

In 2019, the Florida Fish and Wildlife Conservation Commission (FWC) began developing fish, wildlife, and habitat management plans on three major systems in Florida; one being the Harris Chain of Lakes. This plan is meant to guide future management decisions by the FWC that improve fish and wildlife resources within the Harris Chain of Lakes. We prioritized stakeholder input into these plans by involving them throughout the process using various outreach methods including workshops, interviews, surveys, focus groups and public meetings. The development of this plan was executed in a manner to enhance stakeholder trust in the agencies decision making process, encourage stakeholder engagement, and provide transparency. Due to the COVID-19 pandemic, we had to significantly alter the way we communicated with stakeholders and receive input into the plan. Even with the uncertainty of the pandemic, over 600 stakeholders, representing various user groups (e.g., anglers, recreational boating, homeowners, hunters, and wildlife viewers) participated to learn about and provide input into the plan. Part way though the planning process FWC contracted Inwood consulting group to help with writing and facilitating public outreach. The Harris Chain has a very diverse set of stakeholders (e.g., anglers, boaters, hunters and homeowners) with differing views of successful management. Common concerns throughout the process included the importance of quality habitat, positive/negative impacts regarding hydrilla, and improved communication. FWC attempted to address and balance, where feasible, the needs of all stakeholder groups to create goals, objectives, and actions associated with management on the lakes. This plan is set to be completed and ready for implementation in Summer 2022.

Session A5: Sediments in Aquatic Resource Management
Moderator: Jason Danaher
Thursday, September 1, 2022. 1:30 pm to 3:30 pm
Calusa Ballroom

IMPACTS OF SEDIMENT POLLUTION ON COMMUNITIES AND THE ENVIRONMENT

Eddie Snell
Technical Specialist, Applied Polymer Systems, Inc., Woodstock, GA

Sediment pollution is the single most common source of pollution in U.S. waters. Sediment pollution can have long-term impacts on aquatic insects, fish, and other wildlife in affected waterways. Contaminated sediments present short and long-term toxic risks to human health and wildlife. These include persistent organic pollutants, heavy metals, nutrients, bacteria, viruses, and chlorinated pesticides.

Thirty percent of this pollution is from natural causes, and the remaining 70% is from human activities. The USEPA estimates that sediment pollution causes approximately $16 billion in environmental damage annually.

Sediment pollution has long-term impacts on aquatic life (insects, fish) and other wildlife in affected waterways. Turbidity clouds water making it difficult for aquatic life to see food sources. The suspended particulate blocks sunlight, interrupting photosynthesis, which affects aquatic plant growth. Those sediments that end up on the bottom impact habitat, affecting the benthic communities. Sediments smother aquatic insect larvae and destroy spawning areas for fish. In extreme cases it can clog fish gills and lead to their death. These impacts cause crucial declines in ecosystem diversity.

Human impacts from sediment pollution include physically filling streams, lakes, pond, bays, and other waterways that are important for commerce and flood control. Billions of dollars are spent annually dredging these materials from affected water bodies. Disposal of these dredge spoils often transports pollutants into greater water depths. This leads to negative impacts in drinking, groundwater, and recreational resources causing long-term harm.

Minimal pollutant mitigation measures to reduce the spread of sediment pollution include sediment barriers and velocity reduction Best Management Practices (BMPs) often used on construction projects. Most states only require minimal controls at best. Within recent times, sediment pollution control has become a political topic. Enforcement of existing Federal and State regulations has dramatically laxed in recent times. This has only exacerbated the problem. Protection of basic natural resources should never be a political item.

DEVELOPMENT OF A SCIENCE-BASED UPDATE TO THE ORANGE COUNTY FERTILIZER ORDINANCE

Mitchell Katz, Ph.D.[1]*, and Lee Mullon, PE, CFM, D.WRE, PMP*[2]
[1]Water Sciences, Orange County Environmental Protection Division, Orange County, FL
[2]Principal, Drummond Carpenter, PLLC, Orlando, FL

Orange County is experiencing explosive population growth and the commensurate change in land use, which have contributed to impaired surface waters and subsequent adoptions of TMDLs by the state of Florida. The financial burden of attaining a TMDL falls upon local governments and frequently exceeds the resources available to satisfy the competing needs demanded by growth. Water quality best management practices (BMPs) to restore water resources can range in cost from hundreds to tens of thousands of dollars per pound of nutrient pollutant removed. BMPs can take the form of engineering solutions or institutional controls. This presentation will describe the data-driven adoption of an institutional control, a revision to the Orange County Fertilizer Ordinance, that is intended to decrease nutrient pollutant loading to groundwater and freshwater resources of the County.

Multiple lines of evidence were explored in assessing fertilizer's contribution to waterbodies, primarily through the groundwater pathway, including statistical water quality data analysis and fate and transport modeling. Isotopic signatures of groundwater nitrate found that fertilizer represents a dominant nitrogen

load at several monitored groundwater locations, while groundwater fate and transport modeling corroborated the nitrogen concentrations found at monitored wells and downgradient impaired waters.

These data-driven approaches were reviewed in context with fertilization practices within Orange County, and the need to maintain healthy turf grass, to formulate a practical fertilizer ordinance revision for the County.

RECONSTRUCTING HAB AND CYANOTOXIN PRODUCTION IN FLORIDA OVER THE LAST 4000 YEARS: A PALEOLIMNOLOGICAL PERSPECTIVE.

Matthew Waters, Ph.D.
Auburn University, Auburn, AL

Harmful algal blooms (HABs) and cyanotoxin production in coastal and lake environments negatively impact both ecological services and human health. Whereas recent monitoring programs and experimental results have increased knowledge of modern toxic HABs, very little is known if these events have historic analogs or are a modern phenomenon. Likewise, monthly or seasonal monitoring of aquatic environments might miss certain episodic aspects of toxic HAB dynamics. Here, we collected surface sediment samples (47 lakes) and sediment cores (7 lakes) to match cyanobacteria abundance and cyanotoxin production with nutrient dynamics from 4000 years ago to the present. Paleolimnological measurements were applied to each surface sediment and sediment core sample including nutrients (C, N, P), additional elements (Fe, Al, Ca, S), photosynthetic pigments (chlorophylls and carotenoids) and cyanotoxins (microcystin, cylindrospermopsin). Results from surface sediment samples show that sedimentary cyanotoxins could provide a viable monitoring tool integrating longer timescales (2-10 years) where monitoring programs do not exist. Using multivariate analysis sedimentary microcystins ordinated with P and cyanobacteria abundance and negatively related to Fe. Sediment cores spanning the last ~150 years demonstrated extremely high microcystin concentrations in the last ~50 years capable of impacting cyanotoxin water column values upon resuspension events. Cores collected from lakes in the Ocklawaha chain (Apopka, Griffin, Harris) demonstrate that cyanobacteria dominance and cyanotoxin production precede modern toxic HAB development and could be utilized for targeted future management of HABs in these systems. Collectively, these results suggest the novel approach of sedimentary HAB analysis, which could be coupled with monitoring programs to effectively manage future HAB dynamics throughout Florida.

HYPEREUTROPHIC CONDITIONS ON THE MILLENNIAL-SCALE: THE PALEOLIMNOLOGICAL RECORD OF LAKE WAUBERG, FLORIDA

Savvas Paradeisis-Stathis
Auburn University, Auburn, AL

Lake management practices are primarily based on extensive monitoring of water column conditions over the past few decades. Whereas monitoring data provides trajectories of future conditions and management

practices, most hypereutrophic systems developed well before monitoring efforts began. To identify the drivers of eutrophication and develop management strategies to reduce the dominance of harmful algal blooms in lake systems, longer time sequences are needed. Here, we collected a 410-cm sediment core from Lake Wauberg in Alachua County. Lake Wauberg contains natural phosphorus deposits creating a continual hypereutrophic condition since the lake's beginning. We measured nutrients (C, N, P), other elements (S, Fe, Ca, Al), and photosynthetic pigments (chlorophyll and carotenoids) to reconstruct nutrient inputs with algal and cyanobacteria responses. High concentrations of P, S, Fe, Ca, and Al were observed throughout the record. High organic matter content matched the high values of organic C and total N soon after the beginning of the lake sedimentary sequence. C/N recorded several historic alterations to an algal-dominated signal demonstrating that despite continual nutrient inputs, the phytoplankton community has been quite dynamic. Pigment data indicates similar fluctuations in the algal and cyanobacteria communities through time with strong cyanobacteria signals throughout the core. As a result, Lake Wauberg has sustained a continuous hypereutrophic state throughout its existence. This study serves as an example of matching long-core paleolimnological studies with recent monitoring efforts to determine achievable management decisions based on historic background conditions.

A PALEOLIMNOLOGICAL APPROACH TO IDENTIFYING MANAGEMENT SIGNATURES IN URBAN FLORIDA LAKES

Savanna Wooten
Auburn University, Auburn, AL

Urban lakes are uniquely impacted by altered hydrology and temperature as well as nutrient, stormwater and heavy metal inputs which can result in abrupt and enduring trophic state shifts. As such, attempts to mitigate these impacts to urban lakes can include alum treatment, hydrological manipulation, macrophyte removal and herbicide treatment. Many of these management strategies are costly, and their long-term successes and ecological consequences are unclear. Here, we analyzed sediment records from three shallow urban lakes in Polk County Florida (Lakes Hunter, Howard, and Parker) to investigate management impacts to elemental deposition and primary producer ecology. Historically, each lake has been treated with varying combinations of alum addition, canaling, stormwater remediation, and herbicide application, providing the opportunity to identify elemental signatures associated with specific management strategies within the sediment record. Cumulatively, these systems have experienced abrupt shifts in heavy metals, increased nutrient input, and changes in algal community structure in conjunction with anthropogenic influence. These results, compared with more variable annual monitoring data, reveal persistent patterns of eutrophication over the long term and could provide valuable contexts of historic lake trophic structure when making management decisions or assessing management effectiveness.

Session B3: Ocklawaha Session 1
Moderator: Casey Fitzgerald
Thursday, September 1, 2022. 1:45 pm to 3:30 pm
Blue Heron Ballroom

OCKLAWAHA RIVER RESTORATION: AN OVERVIEW, A TALE OF FOUR ECOSYSTEMS AND BENEFITS TO MANATEES AND THE FLORIDA WILDLIFE CORRIDOR

Casey Fitzgerald
Retired, Palatka, FL

Ocklawaha River Restoration would effectively undo the aborted Cross Florida Barge Canal project that was terminated by Presidential order in 1971 by breaching Rodman Dam and reestablishing both hydrologic and biological flows that span an area from Silver Springs to the South Atlantic Bight. Accordingly, it would significantly improve the ecological health of four significant ecosystems: Silver Springs and River, the Ocklawaha River, the Lower St. Johns River and estuary and the South Atlantic Bight. This project also represents the last, major restoration project for the entire 310-mile St. Johns River system. Few efforts to restore Florida's biological wealth hold the prospect of such far reaching benefits and at a remarkably modest cost. Two of the significant environmental and ecological benefits featured in this presentation are with regard to manatees and the Florida Wildlife Corridor.

Manatees have experienced unprecedented mortality over the past two years. Loss and degradation of natural habitat that provides forage and warm water refugia essential to manatee survival remains their greatest present and long-term threat. Breaching Rodman Dam would reestablish historical access to Silver Springs, Silver River and the Ocklawaha's twenty currently inundated springs thereby providing essential warm water winter habitat for hundreds of manatees with proximate food sources.

The Ocklawaha River is located within the Florida Wildlife Corridor and is part of the "O2O" Corridor which runs from the Ocala National Forest north to the Osceola National Forest. The Rodman reservoir, Rodman Dam and seven-mile long barge canal create barriers to wildlife movement. Black bears, Florida panthers, white-tailed deer and other large terrestrial wildlife are averse to crossing these features. Ocklawaha restoration would dewater the 16-mile long reservoir, open a 2000-foot wide river corridor through the earthen dam and fill in 5 miles of the canal – collectively resulting in greatly reduced habitat fragmentation and significantly improved wildlife movement.

A REANALYSIS OF THE NUTRIENT DELIVERY FROM A FREE-FLOWING OCKLAWAHA AND POTENTIAL BENEFITS TO THE PELAGIC ECOLOGY OF THE LOWER ST. JOHNS RIVER

John Hendrickson
Retired, Palatka, FL

In 2012, with additional data, improved analysis tools, and an adopted TMDL for the downstream Lower St. Johns River (LSJR), the St. Johns River Water Management District sought to refine the prior estimate of nutrient load from a free-flowing Ocklawaha River. Regression models were developed relating inflowing and outflowing NOx, TKN, and TP concentrations to Ocklawaha River discharge, for discrete annual time intervals corresponding to reservoir management and LSJR phytoplankton productivity, with separate outflow models distinguishing reservoir-full and maintenance drawdown years. Drawdown-year models accounted for nutrient spikes and discharge variances associated with this intermittent maintenance practice. The flow-weighted inflow concentration to the reservoir reach, absent any processing and assimilation, was used to represent a hypothetical free-flowing river condition. This comparison predicted a free-flowing river median annual TP load increase of 7.7 MT, lower than the 30 MT predicted in the original 1994 Alternatives Analysis. The predicted median annual TN load increase, composed entirely as NOx, was 311 MT, also below the original 878 MT estimate. An examination of interannual time series data for the freshwater LSJR indicate that the disappearance of water column NOx regularly coincides with the expansion of nitrogen-fixing cyanobacteria in this strongly N-limited river estuary, and that occasional high NOx concentration spring "freshets" exhibit lower proportions of cyanobacteria and overall lower spring bloom biomass. The replenishment of Si supply, currently attenuated by the reservoir, may also help to sustain spring diatom dominance in the phytoplankton. Given the relatively small and manageable increase in TP load to the LSJR, the potential enhancement of downstream phytoplankton composition, and the ancillary benefits to dissolved oxygen regime and seasonal freshwater inputs, this conservative analysis concludes that the restoration of free-flowing conditions would result in net water quality benefits to the downstream lower Ocklawaha and St. Johns River estuary.

POTENTIAL IMPLICATIONS FOR FISH POPULATIONS OF A RESTORED FREE-FLOWING OCKLAWAHA RIVER

Steven Walsh
Retired, Gainesville, FL

Dams and their associated impoundments have a myriad of impacts to native riverine aquatic communities. Adverse effects include habitat loss and fragmentation, altered flow regimes, impaired water quality, increased sediment deposition, barriers to migratory species, and establishment of non-native plants and animals. Most of these factors apply to the impounded Ocklawaha River. There are concerns that breaching of Kirkpatrick (=Rodman) Dam might eliminate a world-class recreational largemouth bass and black crappie fishery. Many scientists agree that there would be a shift in fish diversity, abundances, and local distributions of some species, resulting in a different aquatic ecosystem than currently established. However, improved habitat integrity and water quality would be expected to provide a viable angling environment

with novel opportunities for anglers, including increased abundance of lesser-targeted species. Additionally, a restored free-flowing system would benefit both game and nongame lotic species that have experienced historic declines from habitat alterations, including several rare or uncommon taxa. Another expected positive outcome of improved fluvial connectivity of a restored river would be greater access to upriver segments and tributaries, including the Silver River, for diadromous and other fishes that make long migrations between the Atlantic Ocean, estuaries, or freshwater habitats for critical phases of their life history.

Session A6: Algal Research and Management
Moderator: Dana Bigham Stephens Ph.D.
Thursday, September 1, 2022. 3:30 pm to 5:00 pm
Calusa Ballroom

PHYTOPLANKTON COMMUNITY COMPOSITION IN A NORTHWEST FLORIDA ICOLL

Dana Bigham Stephens Ph.D.[2], *Alicia McGrew*[1,2], *Mae Giddings*[2], *Isaac Todd*[2], *and Richard Gray*[2]
[1]Institute for Watershed Studies, Western Washington University, Bellingham, WA
[2]Mattie M. Kelly Environmental Institute, Northwest Florida State College, Niceville, FL

Floridian coastal dune lakes, or intermittently closed and open lakes/lagoons (ICOLLs), are dynamic coastal ecosystems and largely understudied. To increase understanding of the biological communities associated with these systems, monthly water samples were collected and preserved for phytoplankton in 2018 and 2019 within an ICOLL located in northwest Florida. These samples were analyzed to assess phytoplankton community composition and spatiotemporal dynamics. Phytoplankton samples were filtered using a 100-mm mesh, then individual particles from the sample were imaged and classified into major phytoplankton groups using FlowCam technology. Derived relative abundance and densities of major phytoplankton groups provided ability to assess compositional differences across months, years, and ICOLL lobes using a two-way analysis of variance, non-metric multidimensional scaling, and permutational multivariate analysis of variance. Cyanobacteria and cryptomonads dominated this size-range of the phytoplankton community, accounting for 30-80% of relative particle abundance. However, there were no differences in relative abundances between lobes, years, or lobe-year combinations. Phytoplankton community composition based on densities differed between month and year of sampling, ICOLL lobe, and all interaction combinations. There were differences in the dispersion of phytoplankton communities between sampling years and various pairs of summer and winter sampling months. These results provide a foundational assessment of biological communities in a Floridian coastal dune lake and demonstrate spatiotemporal variation in phytoplankton within this system.

ROUTINE PLANKTON MONITORING PROJECT OF THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT: PAST, PRESENT, AND FUTURE

Anna Swigris
South Florida Water Management District, West Palm Beach, FL

Planktonic organisms serve as the bottom of the aquatic food chain for many lake ecosystems in Florida and around the world. Phytoplankton respond quickly to nutrient inputs and can create algal blooms in waters with high nutrients, such as Lake Okeechobee. Zooplankton also play an important role in the lake's ecosystem by functioning both as a regulator of phytoplankton dynamics and as an energy link between fish and lower trophic levels. Thus, the South Florida Water Management District (SFWMD) began Lake Okeechobee's Routine Plankton Monitoring (RPM) project in 1994 as a measure of long-term Lake Okeechobee phytoplankton and zooplankton dynamics. Here, we review the RPM project history and describe several trends identified by the data collected over the last 28 years. Additionally, we discuss the present state and future direction of the project, illustrating how it will continue to aid in furthering our understanding of plankton dynamics in Lake Okeechobee. Information from this project will continue to provide SFWMD staff with ecological knowledge necessary to make adaptive management recommendations for Lake Okeechobee operations.

SO YOU WORK ON FLORIDA WATERS: OCCUPATIONAL HAB EXPOSURES AND HOW TO PROTECT YOURSELF

Rick Clark
Florida Department of Health, Tallahassee, FL

In Florida, where water-dependent industries abound, potential occupational exposures to harmful algal blooms (HABs) are a topic of concern for workers and employers whose jobs may require them to work on an affected Florida beach or waterway. Though the Florida Department of Health (FDOH) does not yet have official guidance specific to worker populations, the purpose of this presentation is to educate on resources and recommendations available for use in decision-making and HABs exposure mitigation to protect employee populations.

THE HAVE TO HAVE FOR HABS: A COORDINATED RESPONSE TO A HARMFUL ALGAE BLOOM

Gloria Eby
City of Winter Park, Winter Park, FL

Harmful algae blooms (HABs) have gained more attention from the public in recent years and local governments have been leading the effort in both working to diminish the blooms and providing accurate and timely information to the public. All the while, ensuring the safety of staff and the public at large. This presentation will review the City of Winter Park's coordinated response to harmful algae blooms. It will

focus on communications with other organizations and the public, city operations in response to the blooms, and management efforts focused on curtailing future blooms.

MICROCYSTIS BLOOM MESOCOSM RESPONSE TO HIGH CONCENTRATION HYDROGEN PEROXIDE TREATMENT

Taylor Hancock
University of South Florida, Tampa, FL

Hydrogen peroxide has recently gained popularity as an environmentally friendly treatment for cyanobacterial harmful algal blooms (HABs) when used at low concentrations. However, the general populace desires rapid removal of HABs. High concentration treatments can achieve this but may introduce an increased risk to the environment. Most susceptible is the microbial community, with hydrogen peroxide noted to have temporary but recoverable impacts at low concentrations. This is concerning as the importance of HAB-associated microorganisms has been highlighted recently, shown to directly impact HAB succession and nutrient modulation. Over the course of four days, we monitored Microcystis bloom biomass retrieved from Lake Okeechobee in six mesocosms filled with 300 L of sieved river water on the bank of the Caloosahatchee River. Three mesocosms received a hydrogen peroxide spray treatment of 92x the lethal dose for Microcystis (theoretical concentration of 11 mM). This treatment achieved rapid (< 24 hour) bloom collapse followed by drastic change in microbial community composition. The treatment group also saw large increases of ammonia (13.9x higher) and nitrate/nitrite (14.5x higher). Our study identified hydrogen peroxide resilient microbial components of a South Florida Microcystis HAB, specifically Planctomycetes (0.58% to 46.85%) and Gammaproteobacteria (0.81% to 17.38%) which steadily increased in relative abundance post-treatment. Theses taxa are different from previously reported hydrogen peroxide resilient bacteria and even show opposite trends in studies from other geographic regions. This further highlights the importance of understanding local systems and populations with respect to water resources and HAB management.

Session B4: Ocklawaha Session 2
Moderator: Casey Fitzgerald
Thursday, September 1, 2022. 3:30 pm to 5:00 pm
Blue Heron Ballroom

OCKLAWAHA RESTORATION: A FOCUS ON ECONOMICS, OUTDOOR RECREATION, AND SOCIAL MARKETING

Margaret Hankinson Spontak
Free the Ocklawaha Coalition for Everyone, Gainesville, FL

The Kirkpatrick Dam and Rodman Reservoir, a remnant of the halted Cross Florida Barge Canal, destroyed more than 7,500 acres of forested wetlands, twenty springs and 16 miles of river. During the last two and a half years, a coalition has used economic and environmental benefits, outdoor recreation opportunities and

social marketing to shift public opinion particularly in Putnam and Marion counties. This has dramatically shifted public awareness and support as evidenced by scientific polls and a St. Johns River Water Management survey that obtained 10,000 responses.

OCKLAWAHA RESTORATION AND THE RECOVERY OF SILVER SPRINGS AND THE TWENTY LOST SPRINGS

Robert Knight, Ph.D.
Florida Springs Institute

The ecological health of many of Florida's artesian springs is impaired by reduced flows, increasing nitrogen pollution, and excessive recreation. For some springs, the presence of downstream dams is an additional factor impacting springs functions. The 25+ springs feeding the Silver River and the 20+ springs inundated by the Rodman pool have significantly reduced ecological structure and function due to all of these stressors. Restoration of a free-flowing Ocklawaha River is an essential action for holistic recovery of these springs.

Session A7: Innovations in Lake Management
Moderator: Rob Burnes
Friday, September 2, 2022. 9:00 am to 10:15 am
Calusa Ballroom

EVALUATION OF THE FIELD PERFORMANCE OF A BAFFLE BOX WITH A BOLD & GOLD UPFLOW FILTER FOR NUTRIENT REMOVAL

Mike Hardin P.E., Ph.D.
Geosyntec, Orlando, FL

A 2nd Generation Nutrient Separating Baffle Box (NSBB) with a Bold & Gold upflow filter was monitored for an approximate 1-year period for TN and TP reduction. Autosamplers were used to characterize the inflow to the NSBB, the inflow to the upflow filter, and outflow from the system. Additionally, debris removed from the NSBB during maintenance events were also sampled and the TN and TP removed due to these activities quantified. Performance results will be presented as well as lessons learned and recommendations for future designs.

PHOSPHORUS ADSORPTIVE MEDIA REDUCES DISSOLVED P FOR PROACTIVE HAB MITIGATION

Ed Weinberg P.E.
ESSRE Consulting Inc., Richboro, PA

Phosphorus Adsorptive Media (PAM) treatment solution for dissolved Phosphorus (P) reduction is readily applicable to many surface water sources and pathways of nutrient pollutant P within a watershed. PAMs

can be safely applied to HAB impaired lakes or streams without the need for chemicals and are adaptable for in-situ or ex-situ treatment of Legacy P. This presentation will describe PAMs serving as a protective barriers to pollutant nutrient loadings to lakes from agricultural or urban use lands when integrated with stormwater or agricultural Best Management Practices (BMPs), including shoreline erosion/protection projects or cover crops.

NOVEL TECHNOLOGIES FOR PHOSPHORUS MITIGATION AND WATER QUALITY RESTORATION IN AQUATIC SYSTEMS

West Bishop Ph.D.
SePRO, Carmel, IN

This presentation will provide an overview of recent advancements in phosphorus interception and inactivation technologies. Data on the technologies will be presented on incorporation to improve lake management.

EMPLOYING SUCRALOSE, STABLE ISOTOPES, MICROBIAL COMMUNITIES, AND MODERN STATISTICAL METHODS TO DETERMINE SOURCES OF FECAL INDICATOR BACTERIA IN A FLORIDA RIVER

Michael Kratz
Florida Gulf Coast University, Ft. Myers, FL

Fecal indicator bacteria (FIB) are the most frequent impairment of recreational waterways in the U.S and are notoriously difficult to study due to non-point source pollution and extra-enteric growth on various substrates. The Estero River in southwest Florida has been listed as impaired with high FIB for years and the source has not been determined. In order to aid FIB source determination in this river, we combined nutrients, sucralose, NOx (nitrite + nitrate) stable isotope (15N and 18O), and microbial community data along with *Escherichia coli* and enterococci enumeration from surface water, groundwater, ditch water, and sediments to determine potential river water FIB sources. Groundwater next to a residential wastewater treatment plant (WWTP) had extreme values for sucralose (median = 29124 ng/L) and soluble reactive phosphorous (median = 2129 ug-P/L) but very low FIB levels (median = 0 for both FIB types), showing that even though the groundwater was impacted by human wastewater, FIB were likely eliminated. Microbial communities from the upper and midstream sections of the river and groundwater did not have taxa common to the sewage microbiome, indicating WWTP effluent was not the source of FIB in these samples. Peculiarly 15N and sucralose, which should be positively correlated when coming from the same source, displayed a negative correlation (r = -0.80) in surface waters. We found that *E. coli* displayed strong seasonal patterns not mimicked by enterococci and were highest at the downstream sites during the dry season. This coincides with higher usage of septic systems in the downstream portion of the river along with higher human population levels during the dry season, indicating that septic systems in that area are not

functioning properly. Further work should be carried out to see if downstream septic systems require maintenance or, if the water table is unsuitable for septic, sewer system conversion may be considered.

Session A8: Evaluation Methods in Lake Management
Moderator: Dan Schmutz
Friday, September 2, 2022. 10:50 am to 12:00 pm
Calusa Ballroom

EVALUATING ECOSYSTEM SERVICES OF URBAN STORMWATER PONDS

Audrey Goeckner
University of Florida, Gainesville, FL

Urban stormwater wet ponds (SWPs) are constructed to capture runoff and retain sediments, organic matter, and nutrients (N, P) before water is discharged downstream. Although SWPs are designed to perform these ecosystem services and can provide additional services to humans and wildlife, their capacity to transform and transport biologically and chemically significant resources is often overlooked. Due to a variety of natural and anthropogenic factors, small ponds can be biogeochemical regulators of N and carbon (C) in urban landscapes, and we are only recently uncovering the mechanisms within SWPs that drive the processing of resources and energy. As the density of SWPs continues to increase with ongoing urban development, it is critical to quantify internal rates of N and C processing and to consider the impact that SWP discharge has on downstream ecosystems or at larger scales. Here we present results from recent projects investigating SWP biogeochemistry & ecosystem functioning to highlight the role constructed aquatic ecosystems play in elemental cycling. We will discuss nutrient limitation of phytoplankton, water column and whole-pond denitrification vs. N2-fixation, greenhouse gas production, C storage, and ecosystem metabolism. We will also compare SWPs to natural ponds and present preliminary results from an ongoing study evaluating the effect of SWPs on nutrient and energy dynamics of the Braden River (Bradenton, FL). Continuing to improve our understanding of the biogeochemical drivers of nutrient and energy cycling within SWPs will allow for more targeted design and management strategies to enhance the myriad ecosystem services provided by these often over-looked aquatic ecosystems.

MONITORING AND ASSESSMENT OF SANDHILL LAKES

Christopher Shea[1] and Danyel Schmutz[2]
[1]Tampa Bay Water, Clearwater, FL
[2]Greenman-Pedersen, Inc., Orlando, FL

Tampa Bay Water and the Southwest Florida Water Management District monitor hundreds of wetlands and lakes in the northern Tampa Bay area. A unique subset of these water bodies are sandhill marshes,

ponds, and lakes, which occur in landscapes dominated by droughty, xeric soils. These systems are characterized by large interannual variations in water levels and ecological conditions. This presentation will discuss how Tampa Bay Water has assessed the relative ecological health of these wetlands and lakes, particularly with respect to their recovery from previous high levels of groundwater pumpage.

In 2020, Tampa Bay Water completed a recovery assessment that documented the hydrologic and ecologic recovery of 515 monitored lakes and wetlands after the historical reduction in pumpage from its central system wellfields in the northern Tampa Bay area. (Production from the eleven wellfields that comprise the central system has been cut approximately in half since 2002.) The goal of the recovery assessment was to document the current condition of wetlands and lakes in the vicinity of the potable supply wellfields, in relation to ecological health (or recovery) metrics. While regulatory minimum levels existed for 45% of the monitored lakes and one type of wetland (cypress domes) at the start of the recovery assessment, Tampa Bay Water needed to establish recovery metrics for the remainder of the lakes and wetlands assessed. Earlier studies identified the need for a separate metric for wetlands, ponds, and lakes located in xeric landscapes (e.g., sandhill). The metric developed is based on comparing a long-term median water level to a relatively high water level, the 97th percentile, from either the Period of Record or post-cutback period. The application of this method to sandhill lakes, and related ecological and hydrological analyses performed during the recovery assessment will be discussed.

DEVELOPMENT AND IMPLEMENTATION OF A WETLAND EVALUATION METHOD FOR XERIC-ASSOCIATED WETLANDS IN THE NORTHERN TAMPA BAY AREA

Danyel Schmutz[1], *Diane Willis*[2], *and Christopher Shea*[3]
[1]Greenman-Pedersen, Inc., Orlando, FL
[2]Greenman-Pedersen, Inc., Tampa, FL
[3]Tampa Bay Water, Clearwater, FL

The existing Wetland Assessment Procedure (WAP) method provides a field-based approach to assess the ecological condition of wetlands in the Northern Tampa Bay Area for water supply management purposes. In recognition of fundamental differences in the ecology and hydrology of those wetlands described as "xeric-associated" from the types of wetlands considered most appropriate for evaluation using the WAP method, we developed a new field-based method for evaluation of the xeric sites.

The new method relies on development of a reference water level regime specific to each site derived from water level data recorded after a large groundwater production cutback and existing groundwater modeling results. Topographic/bathymetric data are also required to identify specific zones for field data collection. The zones are based on the developed reference water level regime.

Our talk summarizes key methods, findings, and assumptions leading to the development of the new evaluation method for xeric-associated wetlands, results from a pilot implementation, and recommendations for method application and enhancement.

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