UF IFAS UNIVERSITY of FLORIDA

Florida LAKEWATCH

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LAKEWATCH Director Wins Highest Florida Lake Management Society (FLMS) Award

In this issue:

In August 2018 five LAKEWATCH staff attended the 29th FLMS Annual Symposium in Fort Lauderdale Florida. This year's program theme was "Managing Impacts to Water Resources." The program was filled with excellent presentations on all aspects of aquatic resource management. Along with some of the LAKEWATCH staff, University of Florida was well represented with Keynote Addresses by Dr. Lyn Gettys (Assistant Professor of Aquatic and Wetland Plant Science, University of Florida Center for Aquatic and Invasive Plants) and Dr. Karl Havens (Professor, University of Florida IFAS, Director Florida Sea Grant College Program).

Dr. Gettys gave an excellent presentation on introduction pathways for invasive aquatic plants focusing on how these plants got into our waters and the problems they can cause and Dr. Havens discussed the potential effects that climate change could have on shallow Florida lakes, due to such factors as increased temperature, increased evapotranspiration, and greater extremes in wet/dry periods. Both Keynote presentations were very informative as were all of the presentations throughout the symposium. Next year's FLMS symposium will again be in August and I can highly recommend it for professionals as well as non-professionals interested in the management and Florida's vast aquatic resources.

At the meeting I was awarded the Marjorie Carr Award, which is the societies 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. I am honored and thank the members of FLMS who consider me worthy of such an award. Two things came to mind when they surprised me with the award: 1) I hoped that getting a life-time achievement award did not mean that I had to stop working on behalf of Florida's aquatic resources because I have a lot of life and work left to accomplish, and 2) any award I get as the Director of Florida LAKEWATCH rests entirely on the backs of an excellent LAKEWATCH staff and their successes is based on the solid foundation of our LAKEWATCH volunteers. I thank all of the LAKEWATCH staff and volunteers for making our program one of the largest and best volunteer monitoring program in the world!

Mark Hoyer

Director Florida LAKEWATCH

Bacteria in Lake Santa Fe 1-Year After Hurricane Irma

Florida LAKEWATCH

Mark Hoyer, Director Florida LAKEWATCH

The FWC and residents of Lake Santa Fe survey the damage from Hurricane Irma. (Stephen Cabrera / WUFT News)

In August 2017, Meteorologist Jeff Huffman from the University of Florida's WUFT states that:

"Rainesville will never be the same after 2017. Three major rainfall records have been broken at the Gainesville Regional Airport this summer, following the driest start to a year on record:

- Rainiest June on record (16.86 in)
- Rainiest July on record (16.70 in)
- Rainiest summer on record (Jun---Aug)

The most incredible number is 33.56"". That's how much rain has fallen since June 1st, which is now more than any amount ever recorded in the three---month period from June 1 to August 31. We're not sure what's more amazing: the fact that there are 33 more days to add to this record or that it occurred without the help of a tropical storm or hurricane."

Then in mid-September came Irma dumping more than 12 inches of rain across most of Florida causing tremendous flooding. This also cause tremendously high water levels around local lakes including Lake Santa Fe, Alachua County. This extremely high rainfall has continued throughout most of 2018 keeping the landscape continually wet. Lake Santa Fe residents were concerned that the flooding may have caused increases in bacteria concentration in the lake by flooding local septic tanks and by increasing stormwater inputs. Thus, Florida

LAKEWATCH agreed to sample the *Escherichia coli* bacteria (E. Coli) concentrations in three sections of Lake Santa Fe (Little Santa Fe, Santa Fe, and Melrose Bay) over the summer of 2018. The sampling would be accomplished using the same sampling procedures LAKEWATCH used historically in May 2000; June, July and August 2005; August and September 2006. The sampling was conducted to determine if there were any trends in E. Coli bacteria concentrations.

For each sampling date, LAKEWATCH measured *Escherichia coli* (E. coli) bacteria concentrations at twelve sites in Lake Santa Fe, Little Santa Fe and Melrose Bay. Lake Santa Fe is classified as a Class III water body, which are lakes used for Fish Consumption, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. The current Florida Administrative bacteria criteria are based on concentrations of *E. coli* as follows:

Florida Administrative Code (FAC), Rule 62-302.530 (Effective Date: 2/17/2016)

Surface Water Quality Criteria for Class III waters (Fish Consumption, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife).

6) (b) Bacteriological Quality (Escherichia coli Bacteria): Membrane Filter Counts (MFP) shall not exceed a monthly geometric mean of 126 nor exceed the Ten Percent Threshold Value (TPTV) of 410 in 10% or more of the samples during any 30-day period. Monthly geometric means shall be based on a minimum of 10 samples taken over a 30-day period

Tables 1 shows the summary statistics of E. Coli sampling, mean, minimum, and maximum by year and month for the same 12 stations during each sampling event. Using the current Bacteriological Quality Criteria, E. Coli concentrations were above the criteria for only one month (June) and only in in Melrose Bay. These June samples in Melrose Bay had a geometric mean of 147 colonies per 100 ml (arithmetic mean in Table 1 is 342 colonies per 100 ml) exceeding the geometric mean standard of 126 (colonies per 100 ml). While this is an exceedance, it occurred in only one month and only in Melrose Bay. These data suggest that there is not a significant bacterial problem in Lake Santa Fe. The high E. Coli numbers in Melrose Bay during the month of June may possibly be related to the high rainfall amounts recorded at the Gainesville airport for April and May of 2018 (April had 7.5 inches and May had 8.4 inches).

Comparing the means of all monthly samples, however, showed that monthly samples taken in 2000 and 2018 where significantly higher than samples collected in 2005 and 2006. The higher data in 2018 may support the hypothesis that the extreme wet period leading up to and past Irma may have contributed to the elevated E. Coli counts. However, the rainfall records for 2000 from the Gainesville airport show drought conditions with only 34 inches of rain not supporting the hypothesis of wet weather causing increases in E. Coli counts. Without a much more intensive sampling program over the long-term there is no way to understand what is causing the variability in E. Coli counts. The good news is that there is no immediate cause for concern because the current safety standards are not being exceeded.

If you would like to know more about bacteria in Florida's lake systems please read LAKEWATCH Information Circular # 106

Florida LAKEWATCH. 2003. A beginners guide to water management-Bacteria. Information Circular #106. Department of Fisheries and Aquatic Sciences, University of Florida/Institute of Food and Agricultural Sciences. Library, University of Florida. Gainesville, Florida.

(http://lakewatch.ifas.ufl.edu/pubs/circulars/Circ106BacteriaLR.pdf):

Table 1. Summary statistics for concentrations of *Escherichia coli* bacteria concentrations measured from 12 stations in Lake Santa Fe over multiple years. Asterisk show mean samples exceeding the State's current bacteria criteria.

		Escherichia coli (colonies per 100 ml)				
Lake	Year	Month	Samples	Mean	Min	Max
Little Santa Fe	2000	5	12	100	0	500
Little Santa Fe	2005	6	12	0	0	0
Little Santa Fe	2005	7	12	0	0	0
Little Santa Fe	2005	8	12	0	0	0
Little Santa Fe	2006	8	12	0	0	0
Little Santa Fe	2006	9	12	8	0	100
Little Santa Fe	2018	6	12	67	0	400
Little Santa Fe	2018	7	12	158	0	500
Little Santa Fe	2018	8	12	8	0	100
Little Santa Fe	2018	9	12	0	0	0
Melrose Bay	2000	5	12	75	0	200
Melrose Bay	2005	6	12	0	0	0
Melrose Bay	2005	7	12	0	0	0
Melrose Bay	2005	8	12	17	0	100
Melrose Bay	2006	8	12	0	0	0
Melrose Bay	2006	9	12	0	0	0
Melrose Bay	2018	6	12	342*	0	1600
Melrose Bay	2018	7	12	50	0	300
Melrose Bay	2018	8	12	50	0	200
Melrose Bay	2018	9	12	8	0	100
Santa Fe	2000	5	12	50	0	200
Santa Fe	2005	6	12	0	0	0
Santa Fe	2005	7	12	0	0	0
Santa Fe	2005	8	12	0	0	0
Santa Fe	2006	8	12	0	0	0
Santa Fe	2006	9	12	0	0	0
Santa Fe	2018	6	12	108	0	500
Santa Fe	2018	7	12	92	0	300
Santa Fe	2018	8	12	108	0	300
Santa Fe	2018	9	12	17	0	100

UF Forestry Club Helps Clean up Lake Newnan, Alachua County

Samuel Schatz, Vice President, The Forestry Club
School of Forest Resources and Conservation, UF/IFAS

In September , 2018 UF's Forestry Club had a major success at Newnan's Lake clean-up. University of Florida's Forestry Club focused on Palm Point's Nature Park. The park's unique geographic location makes it a magnet for some of the most spectacular migratory and local bird populations. Brilliant wildflowers attract many native butterfly species, while Newnan's Lake provides excellent opportunities for alligator sightings and some of the best bank fishing close to Gainesville.

It turns out that the Forestry Club wasn't the only cleanup crew out on Lake Newnan during the event. An organization called 'Current Problems' had organized multiple different teams to clean up all around the lake! The Forestry Club focused on Palm Point Park and other nearby areas picking up a total of 120 lbs of trash. Combined with all the other groups, the total of all trash collected that day was 1084 lbs!

The Forestry Club sends a special thank you to 'Keeping Alachua County Beautiful' for donating all of the clean-up supplies! The Forestry Club hopes to make their clean-ups a bi-weekly event and encourages everybody to join in.

Basics on the Forestry Club: The Forestry Club is a multi-faceted organization. Their main focuses are on networking within the field of natural resources, the professional development of their members, engaging in community service, and competing yearly in collegiate timber-sports on behalf of the University. We are proud to represent the School of Forest Resources and Conservation both at home in Gainesville and when we travel for the Southeastern Forestry Conclave.

LAKEWATCH Tips Their Hat to the Forestry Club

Well done!

Microorganisms in Florida lakes

Masanori Fujimoto, Ph.D., Research Assistant Professor at Soil and Water Sciences Department
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Lakes mean different things to different people. For some, a lake is a place that provides fish/wildlife, for some a place that provides clean water, and for others a lake may be an aesthetic place to enjoy. Lakes provide different services and resources that we enjoy throughout our lives. But do we know who is actually doing all the jobs of feeding fish and cleaning up the water in lakes that we enjoy? When you look at water closely in a microscope, you will see many small microorganisms that are actually doing many important jobs in lakes. Microbes including bacteria and archaea (a domain of single-celled microorganisms that have no cell nucleus or any other organelles inside their cells) are too small to be seen with our naked eyes, but they play key roles in nutrient cycles and food webs in aquatic environments. Microbes decompose large organic molecules produced in lakes and surrounding environments including algae, macrophytes, leaves, and trees into small molecules so they are available for other aquatic organisms to utilize. Some of microbes serve as primary producers in aquatic food webs; meaning they make organic carbon from carbon

Lake Rowan: one of six lakes studied at Ordway Swisher Biological Station (OSBS)

dioxide through photosynthesis, performing the equivalent role of terrestrial plants.

Many of the microorganisms (i.e. bacteria and archaea) are as small as one micrometer, which is one-thousandth of 1 millimeter. On average, there are about 100,000 to 1,000,000 (one million) bacterial microorganisms in 1 mL (every cubic cm) of water. The biomass of microorganisms in a given lake are substantially higher than the biomass of all of the fish in the lake combined. Microbes are not only found in the water, but are also associated with plant and rock surfaces, and reside in sediments at the bottom of lakes. When you add all those microbes together, there are thousands of microbial species you will find in each lake. Until now only a fraction of microbial taxa in lakes have been identified. The detailed functions of many microbial taxa remains unknown. To make things more complicated, a lake itself is a living entity. Lakes are dynamic and heterogeneous; lake nutrients, pH, temperature, oxygen and vegetation changes seasonally and spatially, as do microbes inhabiting the lakes.

Difference in water colors between swamp-connected lakes (Suggs, Ross, and Rowan) and sandhill lakes (Anderson Cue, McCloud, and Barco).

At a regional and global scale, inland lakes also serve as storage of carbon. Bacterial primary producers fix carbon dioxide and add organic carbon into aquatic environments, while carbon of terrestrial origin (such as from leaves and dead trees) can also enter into lakes. Sediment microbes play key roles in determining the fate (either storage or release) of such carbon. Sediment microbes degrade some large organic molecules into smaller molecules and small carbon molecules are then converted into methane gas. This is in general a slow process. Certain environmental conditions including lower oxygen concentrations and lower pH in the bottom of lake make the carbon even more stable by slowing down this degradation process. While depositions of organic matters in the bottom of a lake are considered a nuisance by some, the storage of organic carbon in inland lakes contributes to decreasing atmospheric carbon concentrations at a global scale.

In addition to carbon, nitrogen and phosphorus cycles are also regulated by lake microbes. Some bacterial phytoplankton, a group of cyanobacteria, can fix nitrogen from the atmosphere (convert N_2 into ammonia) and provide biologically available nitrogen to aquatic food webs. Microorganisms in sediments known as denitrifiers in turn convert nitrate molecules into nitrogen gas (N_2) and release it back to the atmosphere. Phosphorus compounds that are precipitated and/or bound in organic form are sequestered in lake sediment overtime while biologically available phosphorus cleaved by microbial enzymes can be released from sediments.

Not all microbes in lakes are beneficial. Some microbes in lakes affect us negatively including via toxic algal blooms (primarily caused by bloom of the Cyanobacteria species *Microcystis aeruginosa*), and microbial pathogens to fish, plants and to humans. Human pathogens sometimes get into lake systems through wastewater treatment plant effluents, septic tank effluents, animal feces, and sewer overflow. While these microbial human pathogens are less likely to adapt to lake environments in a longer

temporal scale, exposure to such microbial pathogen through bathing and recreational use can occur.

Lake chemistry and biological processes are not isolated from land. Land uses including farm runoff and urban stormwater can affect nutrient concentrations, microbial community compositions and microbial functions in lake water and sediments. Forests alone can introduce nutrients into lakes specifically in the State of Florida where vegetation coverage and biomass are high. It is important to differentiate natural effects (the effect of forest on lake water) from man-made effects (farming and urban land uses) so the relative impact of anthropogenic activities on lake water can be assessed.

Ordway-Swisher Biological Station (OSBS) is an ideal location to assess the effect of pristine forests on lake ecosystems. Both pristine forests and lakes are conserved and maintained in OSBS. Nearly 50 water bodies are present in OSBS. These lakes are typical north-central Florida lakes, which possess characteristics such as shallow depth and acidic pH without sufficient buffering capacity. Among these 50 lakes, the water quality of 8 lakes has been monitored since 2001 by LAKEWATCH. Among these 8 lakes, the water quality of 6 lakes has shown contrasting patterns including differences in colors and nutrient concentrations, although these 6 lakes are closely located within only 5 square miles of one another. Water color is caused by tannic acids that are derived from trees in swamps and serves as an indicator of the strong linkage between forests and lakes. Three lakes (Ross, Rowan and Suggs) are dark colored lakes located adjacent to and receiving inflow from the Mill Creek swamp that accumulates decomposed organic matter from forests. The other 3 lakes (Anderson Cue, Barco and McCloud) are clear lakes located in sandhills without direct surface inflows. We have been collecting both lake water and sediment samples from these 6 lakes for the past 8 months and have been assessing how microbial community compositions and functions differ between colored and clear lakes using DNA sequencing techniques.

Findings from this OSBS study will help us answer how pristine forests can affect lake microbial processes. Data obtained from this OSBS study will also serve as a reference level for microbial compositions and functions in natural pristine environments. Any divergence from this reference level in other Florida lake systems can possibly be attributed to anthropogenic impacts. Through this OSBS project, we used long-term LAKEWATCH water quality data to formulate hypotheses. During our project, whenever we collected water samples for microbial communities, the exact same water samples were analyzed by LAKEWATCH for water quality.

By comparing microbial composition and function data to water quality data, we hope to answer fundamental ecological questions that govern lake microbial processes.

Masanori Fujimoto

LAKEWATCH volunteer from Escambia County donates boat to Panama City school

Alejandro “Alex” Almario is a Florida LAKEWATCH volunteer in Escambia County. Alex recently won a canoe in a local raffle and asked LAKEWATCH staff to help him find a school or group that could put the boat to good use. Jeff Weatherford of St. Andrew’s Bay Resource Management Association (RMA) in Panama City, a LAKEWATCH collaborator and collection center, helped facilitate the boat donation to the AMIkids Panama City Marine Institute. This program teaches marine field techniques to middle and high schoolers in the Panama City area.

The school sustained heavy damage during hurricane Michael, but is in the process of rebuilding. The students will be back out on St. Andrew’s Bay soon!

Thank you for your generosity, Alex!

Dear Florida LATEWATCH Citizen Scientists,

I am excited to write to you about an upcoming opportunity to participate in a research study. Before I provide the details or contact you about this study, I would like to first introduce myself to you. My name is Rachel Damiani, and I am a doctoral student at the University of Florida in communication. I was born in Gainesville, Florida, and I grew up in Jacksonville, Florida. Under the direction of my advisor, Dr. Janice Krieger, my research focuses on citizen science using a social scientific approach. Some of the topics I am especially interested in are how citizen scientists and researchers navigate scientific language and the benefits of citizen scientists for all individuals involved in the collaboration.

My interest in citizen science stems from my background in biology. As an undergraduate major in biology, I spent my afternoons working in a genetics lab and a few summers studying ant-plant mutualism in Kenya. During these experiences in biology, I became fascinated with the natural world and motivated to inspire other people to engage with it. To me, citizen science is such a valuable way to connect the public and scientists with one another. My research allows me to more closely examine the citizen science experience. My long-term goal is to facilitate the engagement of scientists and non-scientists in research.

For this study focused on Florida LAKEWATCH volunteers, I am working with Dr. Krieger and Mark Hoyer to examine the benefits of participating in citizen science through a questionnaire. I had the opportunity to meet some of you at one of the Florida LAKEWATCH regional meetings. At this meeting, I enjoyed learning about your participation in Florida LAKEWATCH, including some of the things that you enjoy about your work and the importance of "my Lake". While existing research on citizen science often focuses on what citizen science can do for science, we are interested in what citizen science can do for the citizen scientist.

Specifically, this questionnaire will delve more into these topics, including asking you about perceived benefits to the work, your connection to your citizen science community, and communication with scientists. Your responses to these questions will help us better understand the benefits and challenges of engaging in citizen science research. We hope these findings will be useful to other citizen science programs who are interested in sustained engagement of their volunteers. To reach a variety of stakeholders, we plan to publish the results in a peer-reviewed journal and present at a scientific conference that attracts diverse researchers. Additionally, we plan to bring our findings to you at one of the Florida LAKEWATCH regional meetings.

We will be sending a link to the online survey to you after the winter holidays. The survey will take approximately 15 minutes to complete and participants can stop the survey at any point. Participants must be 18 years of age or older to participate. Questions will be both multiple choice and open-ended responses. All Florida Lakewatch participants with an active email account will receive the link to the survey. If you have any questions, please feel free to contact me. My contact information is included at the bottom of the newsletter. Thanks so much for your time.

Sincerely,

Rachel Damiani

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We wish you a very Merry Christmas, Happy Holidays, and a Happy New Year!

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