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Florida LAKEWATCH

Dedicated to Sharing Information About Water Management and the Florida LAKEWATCH Program Volume 82 (2018)

Florida LAKEWATCH and Aquatic Plants

For the last several years we have recorded all of the questions volunteer asked during our annual Florida LAKEWATCH Regional meetings. Questions about some form of aquatic plant management continue to dominate that list accounting for about 40% of the questions asked (320 questions out of about 800). The following is a small sample of the type of questions that have been asked about aquatic plants:

Are herbicides safe to use in a small lake?

Can grass carp be used to control floating plants?

How can I control cattails so I can see my lake?

How many aquatic plants do I need to have a healthy lake?

Florida LAKEWATCH has a long history of research, teaching and extension activities (e.g., answering question like those above) around aquatic plants. Throughout that history we have always worked closely with the Center for Aquatic and Invasive Plants (CAIP: http://plants.ifas.ufl.edu/). We would like to take this opportunity to have Dr. Jason Ferrell, the new Director of CAIP introduce himself as LAKEWATCH continues to work extensively with the Center.

Message from the Director of the Center for Aquatic and Invasive Plants

On July 15, 2017 I started a new phase of my career as Director of the Center for Aquatic and Invasive Plants. Though I am new to aquatic weeds, I am not new to weed science or Florida. I began my career at the

In this issue:

University of Florida in 2004 as an Assistant Professor in Weed Science. My responsibilities included agronomy crops, pastures, and rights-of-ways. Almost immediately I started working on the invasive tropical soda apple (*Solanum viarum*) that was infesting pastures and natural areas across the southeast. This inevitably led to many discussions with Ken Langeland and Bill Haller about invasive plants the role the Center has played over the years. As these discussions continued, their passion for aquatic and invasive plants started to rub off on me. In 2013 I was elected as Editor for the *Journal for Aquatic Plant Management*, pulling me further into the water (so to speak). When the directorship position was announced, I knew it was time to complete my transformation to the aquatic arena.

The Center currently standing at a critical nexus for its future. Early in 2018, Dr. Bill Haller and Karen Brown (two stalwarts of class and productivity) retired and left large shoes to fill in our research program and Information Office. Those these two can never be replicated, we are looking to fill both positions soon. With that, we are also looking to expand our teaching mission with a new thrust in distance education. Our desire is to offer a series of courses online that are specifically tailored to increase knowledge and understanding of aquatic plant management. The University of Florida and the Center for Aquatic and Invasive Plants is uniquely suited to do this and we hope that students and practitioners here, and all over the world, we will take advantage of these web-based courses. We firmly believe that these efforts will cement our institution as the global leaders in invasive plant management.

The future of the Center for Aquatic and Invasive Plants is bright as faculty and staff in Gainesville and around the state are as excited and zealous about invasive plants as ever before. With their help, we have the opportunity to craft the direction for the Center that will extend for the next several decades. I am thrilled about this opportunity and look forward to continuing what began here in 1979.

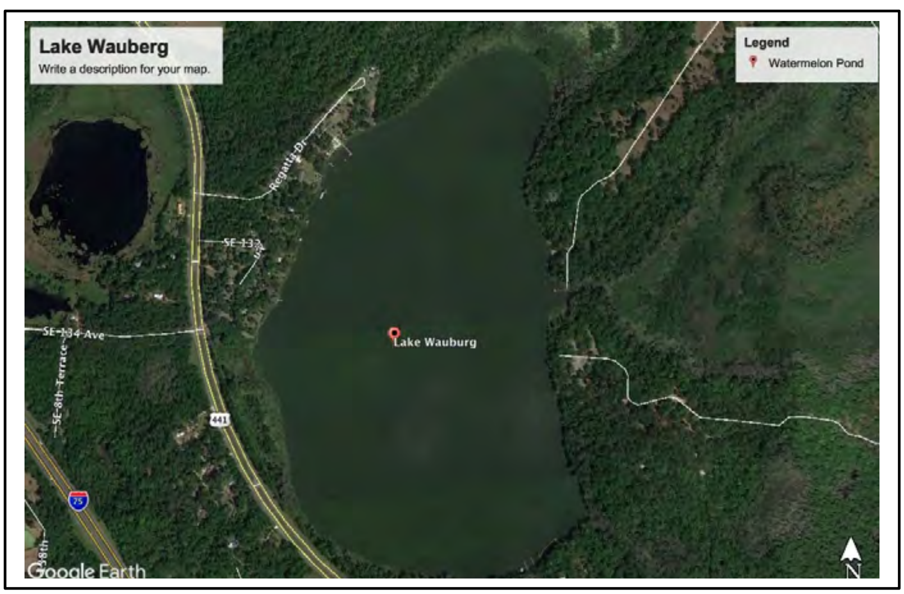
Lake or Pond? That is the Question!

Mark Hoyer, Director Florida LAKEWATCH

From a general naming convention there is no precise difference between a lake and pond, although waterbodies named "lakes" are generally thought of as larger and/or deeper than waterbodies named "ponds." From an ecological or limnological perspective, there are subtle difference between the two but it is somewhat arbitrary and not consistent or precise.

The term "lake" or "pond" as part of a waterbody name is arbitrary and not based on any specific naming convention. In general, lakes tend to be larger and/or deeper than ponds, but numerous examples exist of "ponds" that are larger and deeper than "lakes." For example, “Lake” Wauberg in Alachua County 370 acres in surface area with a maximum depth of about 12 feet, while Watermelon “Pond” also in Alachua County is larger at nearly 500 acres and also has a maximum depth of about 12 feet. Names for lakes and ponds generally originated from the early settlers living near them, and the use of the terms "lake" and "pond" was completely arbitrary. Some have even changed names throughout the years, sometimes changing from a pond to a lake with no change in size or depth. Often these changes in name were to make the area sound more attractive to perspective home buyers.

In limnology (the study of inland waters), surface waters are divided into lotic (waters that flow in a continuous and definite direction) and lentic (waters that do not flow in a continuous and definite direction) environments. Waters within the lentic category are thought to gradually fill in over geologic time and the theoretical evolution is from lake to pond to wetland. This evolution is slow and gradual, and there is no precise definition or end point of the transition from one class to the next. This is even more complicated by seasonal, annual and decadienal fluctuations in rainfall amounts that can actually deepen systems by



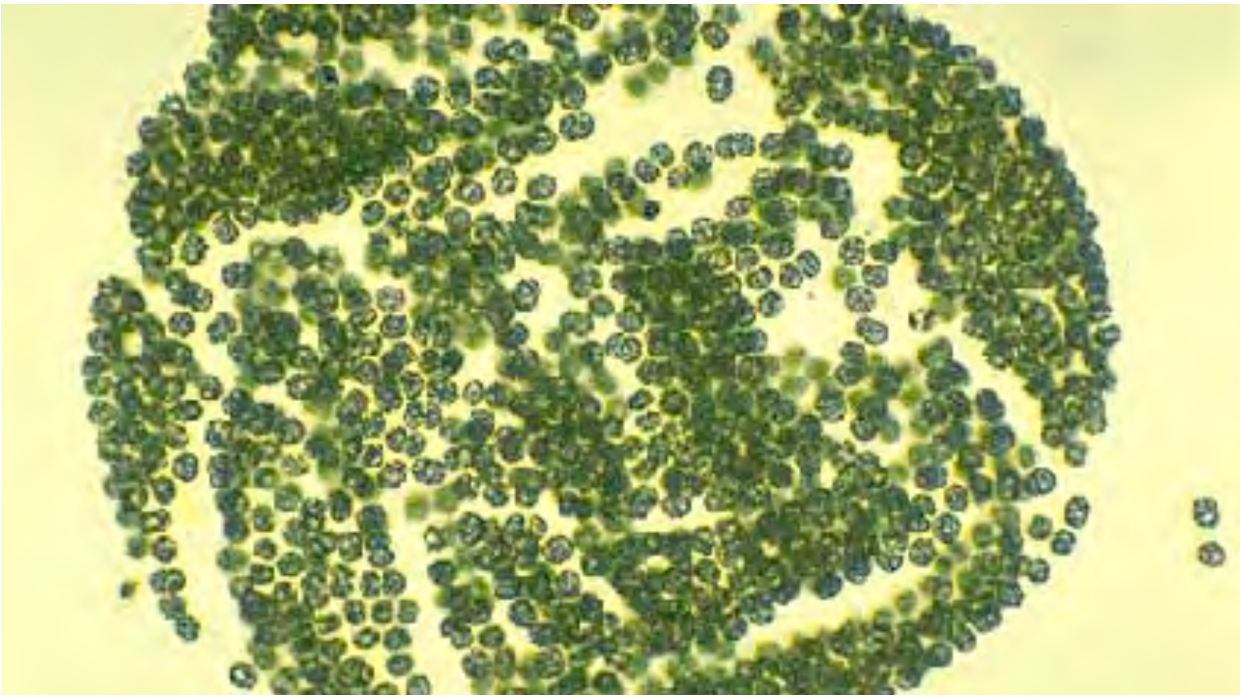
flushing sediments out of a waterbody and down-stream.

Early limnologists in the late 18th, early 19th centuries attempted to define the transition from a lake to a pond in various ways. Area, depth or both were an essential part of most definitions, but the actual defined area and/or depth varied considerably. Some used thermal stratification: a lake is a body of water that is deep enough to thermally stratify into two or three layers during the summer but a Pond is continually mixed. Others used plant growth: a pond is shallow enough that sunlight can penetrate to the bottom and support rooted plant growth across its entire length and width. Some included all plant growth (including submerged plants) while others said a pond was shallow enough to support emergent or floating-leafed rooted plants throughout. Attempting to define the distinction between a pond and wetland is even more difficult and less precise, a pond with emergent plants throughout would frequently be considered a wetland (marsh) by many observers.

Limnologists today recognize that nature can't be divided into precise, neat categories and accept the fact that there will never be a precise definition. However, they also recognize that "deep" lakes and ponds function differently than "shallow" lakes and ponds, and modern limnology texts often discuss the two separately. The generally accepted definition of a "shallow lake or pond" is that class of shallow standing water in which light penetrates to the bottom sediments thus potentially supporting rooted plant growth throughout the waterbody. Lack of thermal stratification and the presence of muddy sediments are also common characteristics of this class of water. In contrast, a "deep lake or pond" has both a shallow shoreline area that may potentially support rooted plant growth and a deeper portion where sunlight does not penetrate to the bottom. These waterbodies frequently stratify into distinct thermal layers during the summer.

Whether you waterbody name includes “Pond” or “Lake,” it is still secondary to the name of the most important Pond or Lake in Florida, “My Pond, My Lake.”

Toxic Algae: Should Floridians Be Worried?



A microscopic view of *Microcystis aeruginosa*. (www.biol.tsukuba.ac.jp)

It is hard not to read or hear about toxic algae in the news lately, with all of the Red Tide problems on the South West Coast of Florida and Bluegreen algal blooms in Lake Okeechobee. A few years ago LAKEWATCH examined toxic algal in a number of Florida Lakes and Dr. Dana Stephens (then graduate student Dana Bigham) conducted the study. She wrote an excellent article on the toxic algae study for our LAKEWATCH Newsletter (Vol 42) in 2008 and since the information is still extremely relevant for the majority of Florida lakes we felt it was time to print it again.

Toxic algae are an issue of increasing concern for scientists and community members alike. Especially in Florida, we hear and see media headlines claiming the dangers and adverse effects caused by toxic algae. The fear of these microscopic organisms is ever present and escalating, therefore, gaining a better understanding and awareness of toxic algae will provide the average citizen with the ability to determine if these claims are a cause for concern.

When reading about toxic algae blooms, sometimes people are confused as to whether marine or freshwater algae are responsible. Take for example the organism that causes the dreaded Red Tide that causes massive fish kills along our Florida beaches. The dinoflagellate algae species that scientists have named *Karenia brevis* can produce a toxin called brevetoxin. When these algae bloom in large numbers they are responsible for causing the toxic conditions known as Red Tide. While dinoflagellate algae are found both in freshwater and marine water, the dinoflagellates

Table 1. Trophic states for the water samples analyzed for microcystin concentration and percent of water samples that met or exceeded the WHO drinking water standard (1 µg/L) and WHO recreational water contact standard (20 µg/L).

Trophic state of water samples analyzed	# of water samples for each trophic state	% of water samples with microcystin ≥1µg/L	% of water samples with microcystin >20µg/L
Oligotrophic	102	0%	0%
Mesotrophic	221	0%	0%
Eutrophic	378	4%	0%
Hypereutrophic	161	27%	2%

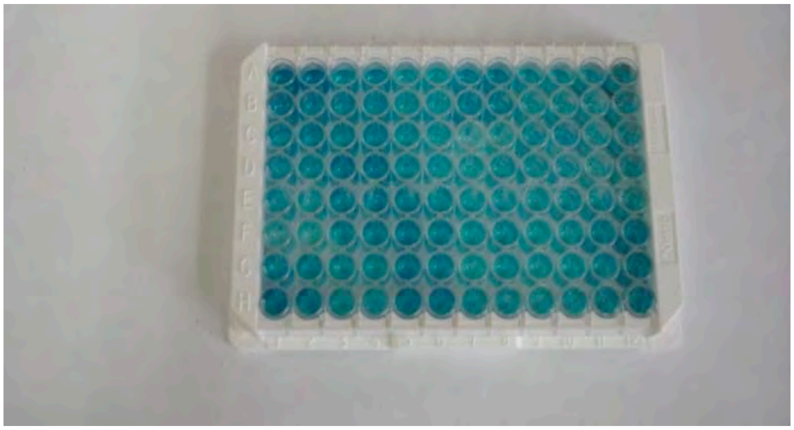
responsible for causing the red tide only occur in marine waters.

When examining toxins produced by algae in freshwater systems, the focus of concern should be directed to the type of algae known as blue-green algae or cyanobacteria. Blue-green algae predominate in freshwater systems and generally proliferate in warmer waters with high nutrient concentrations. Because many of Florida's freshwater systems exhibit these characteristics, blue-green algae blooms have the potential to occur frequently.

There are many species of cyanobacteria that can contribute to these blooms, but the blue-green algae called Microcystis aeruginosa is one of the most common. Some strains of blue-green algae produce a toxin called microcystin. Microcystin is a hepatotoxin (or liver toxin) and may also act as a tumor promoter in studies completed in rats and mice. Reported cases of animal sickness and death have been attributed to microcystin. Many of these cases involved cattle or dogs that had ingested water containing extremely high microcystin concentrations as a result of intense algae blooms. Rare instances of human deaths have occurred when patients received contaminated water containing high microcystin concentrations during their dialysis treatments.

In response to these microcystin studies and reported cases, the World Health Organization (WHO) developed provisional safety standards for microcystin concentrations in water. The WHO drinking water standard was set at 1 µ g/L and a recreational water contact standard was set at 20 µ g/L. Because the

A Microsystis aeruginosa bloom on the surface of a lake. (M J Wargo)



An ELISA plate ready for analysis. (Dana Bigham)

possibility of adverse effects from microcystin exists, water samples collected by Florida LAKEWATCH volunteers were analyzed for microcystin concentrations to identify potential problem lakes or areas of concern.

From January-December 2006, Florida LAKEWATCH collected 862 individual water samples from 187 Florida lakes that were analyzed for microcystin. These samples were analyzed using an enzymelinked immunosorbent assay known as ELISA. An ELISA kit consisted of a plate with 98-wells and into each well the lake water sample was loaded. After treatment with several different chemical processes, the absorbance of each water sample was read with a microplate reader. From the absorbance value, the microcystin concentration was calculated. The following are three major findings from his study.

(1) Of a total of 862 water samples that were analyzed:

Only 7 % of the water samples exceeded the 1 µg/L World Health Organization standard established for drinking water.

Only 3 individual water samples (0.3%) exceeded the 20 µg/L World Health Organization standard established for recreational water contact.

Therefore, microcystin does not seem to pose a major threat to lake recreational activities such as boating, fishing, swimming, and water skiing. However, concerns could arise if the lakes were used for drinking water sources.

(2) Water samples collected from eutrophic and hypereutrophic lakes tended to have higher microcystin concentrations and were the only water samples in this study that exceeded the WHO drinking water and recreational water contact standards.

All water samples were classified into trophic states based on the amount of biological productivity as estimated using chlorophyll concentration and the criteria of Forsberg and Ryding (1980). The following four trophic state classifications are based on chlorophyll concentration: oligotrophic < 3 µg/L, mesotrophic 3 – 7 µg/L, eutrophic 7 - 40 µg/L, and hypereutrophic > 40 µg/L. The results are shown in Table 1.

The data show that as the trophic state of the water samples increases, the percentage of water samples containing microcystin concentrations that meet or exceed the WHO drinking water standard (1 µg/L) and recreational water contact standard (20 µg/L) increases as well.

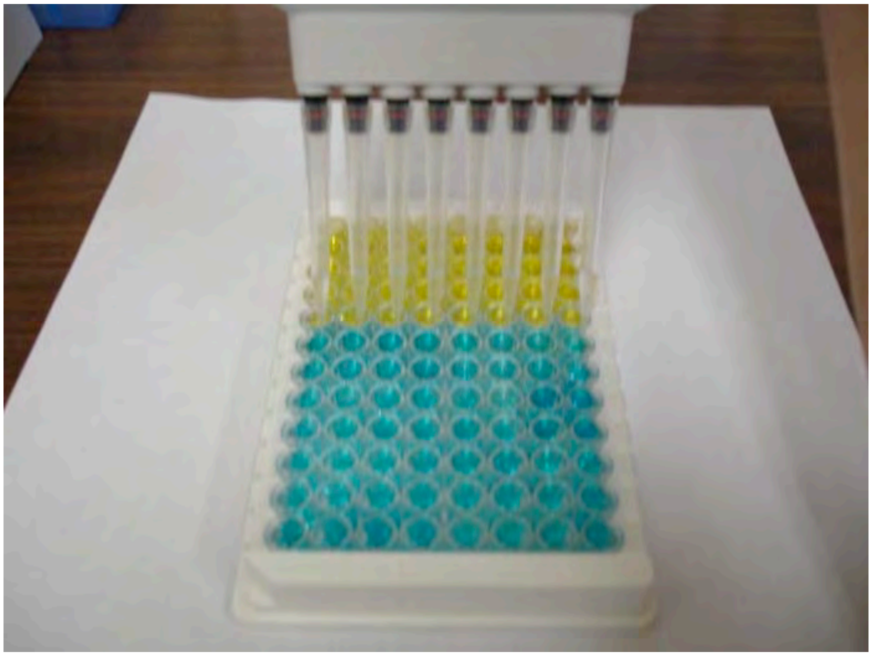
In other words, eutrophic and hypereutrophic lakes have the potential for higher microcystin concentrations. Although some oligotrophic and mesotrophic lakes had water samples with detectable microcystin concentrations (0.1 µg/L was the detection limit), none of these lakes had concentrations that met or exceeded the WHO drinking water standard of > 1 µg/L.

(3) In some hypereutrophic Florida lakes, microcystin concentrations begin increasing in late summer with the highest concentrations occurring during the months of September through December.

At any time throughout the year in the eutrophic and hypereutrophic Florida lakes tested in this study, there was a potential for microcystin concentrations that were > 1 µg/L. However, starting in September and going through December, microcystin concentrations in some hypereutrophic lakes increased with the highest values (> 20 µg/L) occurring during this time period.

Now that the data has been presented, pose the question "Is microcystin contamination the greatest threat to users of Florida's freshwaters?" Let's think of the possibility versus the probability. The possibility is there because intense bluegreen algae blooms will occur and could potentially create high microcystin concentrations. However, based on the evidence the probability of encountering high microcystin concentrations in Florida lakes that exceed the WHO recreational water contact standard seems to be low, at least based on the results of this study done during 2006. To be on the safe side, remember that if a major algae bloom is observed or reported, it is probably best to keep both humans and animals out of the water as a precautionary measure until the bloom subsides.

Dana Stephens, Ph.D.
Director Mattie M. Kelly Environmental Institute
Mattie M. Kelly Chair in Environmental Science



An ELISA plate during the analysis process. (Dana Bigham)

To learn more about microcystin, take a look at the book Toxic cyanobacteria in water: A guide to their public health consequences, monitoring, and management Edited by Ingrid Chorus and Jamie Bartram. This book is available from the Internet at the following link: http://www.who.int/water_sanitation_health/resourcesquality/toxicyanbact/en/

An assessment of Largemouth Bass fin rays and spines for use in non-lethal aging in Florida

Summer Lindelien, Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, University of Florida

Hello, LAKEWATCH community! My name is Summer Lindelien, and I am pursuing a Master of Science here at the University of Florida in the Fisheries and Aquatic Sciences program. As a graduate research assistant, my work focuses on aging a popular game fish (my favorite fish to catch), the Largemouth Bass *Micropterus salmoides* LMB. Typically, fisheries biologists in Florida utilize whole or sectioned sagittal otoliths for aging LMB, which is lethal.

My research aims to identify and verify a non-lethal aging structure (fin rays or fin spines) that will provide viable age estimates and potentially reduce and/or eliminate mortality during age sampling and enable age-determination of angler-caught LMB (e.g., during tournaments and/or TrophyCatch submissions).

Figure 1. Left to right, A) Clipping a LMB anal fin, B) dorsal fin rays thawing prior to being excised, and C) seven fin structures (pectoral rays 3-5, anal spine III, anal rays 3-5, pelvic spine I, pelvic rays 2-4, dorsal spines III-V, and dorsal rays 3-5) properly excised.

LMB are a highly sought-after sport fish in the state of Florida. Many anglers fish for them recreationally, whereas others study them extensively. I happen to be both a trophy bass angler and a researcher. My love for fishing brought me into this field of study. I have always believed in conserving our bass fisheries for future generations, and when I saw the opportunity to attempt a methodology that has not been applied as frequently to warm-water fishes, I was eager and intrigued. Non-lethal aging of bass in Florida has not been fully assessed, and it would benefit fisheries scientists and the public to know more about bass population structure (growth, mortality, and recruitment), especially when it can be difficult to find and capture a large number of trophy bass during field sampling, and killing fish is not the ideal option.

For my study, LMB were captured using daytime boat electrofishing on Rodman Reservoir. Sagittal otoliths as well as dorsal, pelvic, and anal fin spines, and pelvic, pectoral, anal, and dorsal fin rays were taken from individual fish (Fig. 1). The bony structures were cleaned and stored for later processing. Otoliths were mounted to slides and sectioned with a low speed saw to 0.5 mm in width, and fin structures were mounted in two-part epoxy then differentially sectioned from 0.7 mm to 1.4 mm. These sections were permanently mounted to slides and ultimately aged under dissecting or compound microscopes (Fig. 2).

Aging the otolith sections (Fig. 3) was relatively easy compared to learning how to age each fin structure since fins all grow differently. After aging over 1,000 sections (Fig. 4), I was able to identify which fin structure

Figure 2. A) Dorsal rays 3-5 excised and cleaned, prepped for the drying box, B) dorsal spines III-V imbedded in two-part epoxy, C) sectioning a fin structure with the low speed saw, and D) cross-sections (~0.7-1.4 mm) of several fin structures permanently mounted to slides.

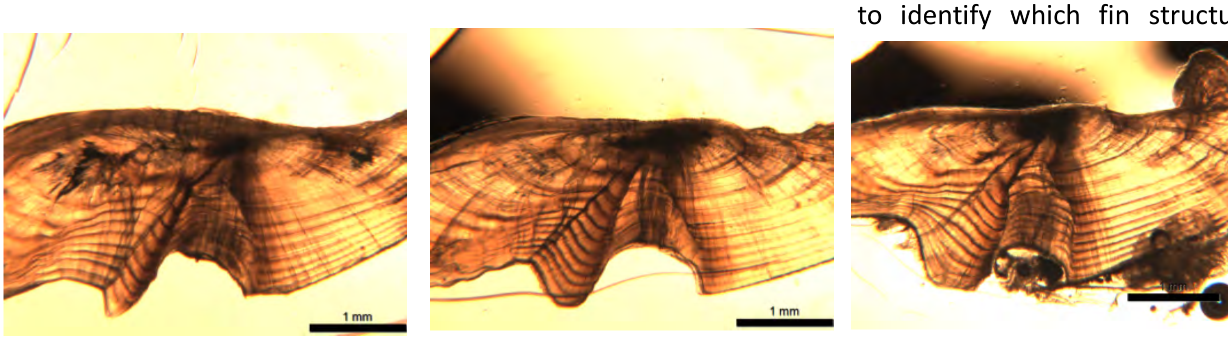


Figure 3. Left to right, A) A 0.5 mm otolith section from a 10-yr old LMB, B) an otolith section from an 11-yr old LMB, and C) an otolith section from a 12-yr old LMB.

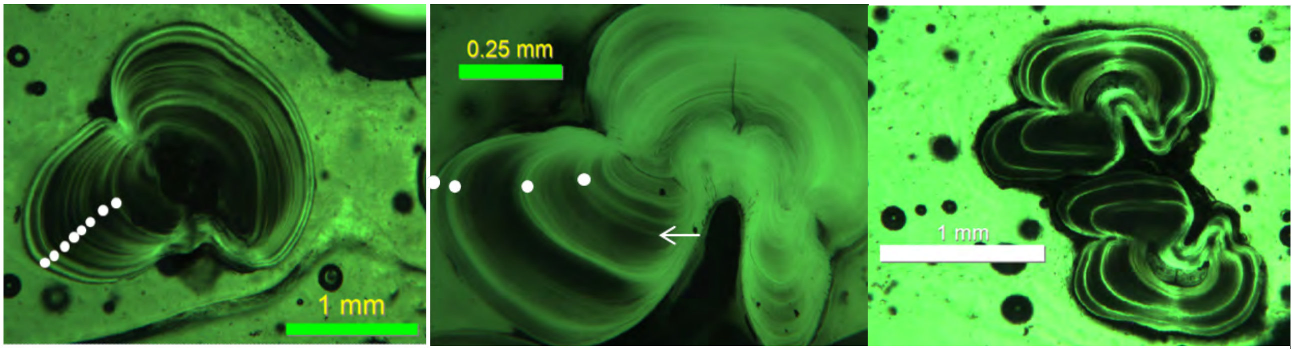


Figure 4. Left to right, A) Dorsal spine section from a 9-yr old LMB, white dots represent enumerated translucent bands, B) anal fin ray section from an age-4 LMB, white arrow represents the end of the first annulus which is a double band, and C) dorsal fin ray section from an age-4 LMB.

provided the most accurate (between otolith-based ages and fin structure-based ages) and precise (within-reader and between-reader ages) aging estimates. I used age biplots (Fig. 5) to understand age differences and potential reader biases. The dorsal fin spine (*n*=122) provided the most precise and accurate ages relative to the other fin structures, and therefore was identified as the best non-lethal aging structure.

I hope to further investigate these non-lethal methods for aging LMB in additional waterbodies around the state of Florida to better understand dorsal spine growth. I also will be testing the survival of LMB after clipping their dorsal spines, and I plan to finalize and apply the aging method I have developed using dorsal spines. I appreciate everything Florida Fish and Wildlife Conservation Commission (FWC) has done for me both as a student and as a biologist. I am grateful to LAKEWATCH and the University of Florida for providing this opportunity for me to share my research. Thank you for taking the time to read about my project, I hope you have plenty of questions. I am open to answering them! Feel free to contact me at summer.lindelien@ufl.edu for more information.

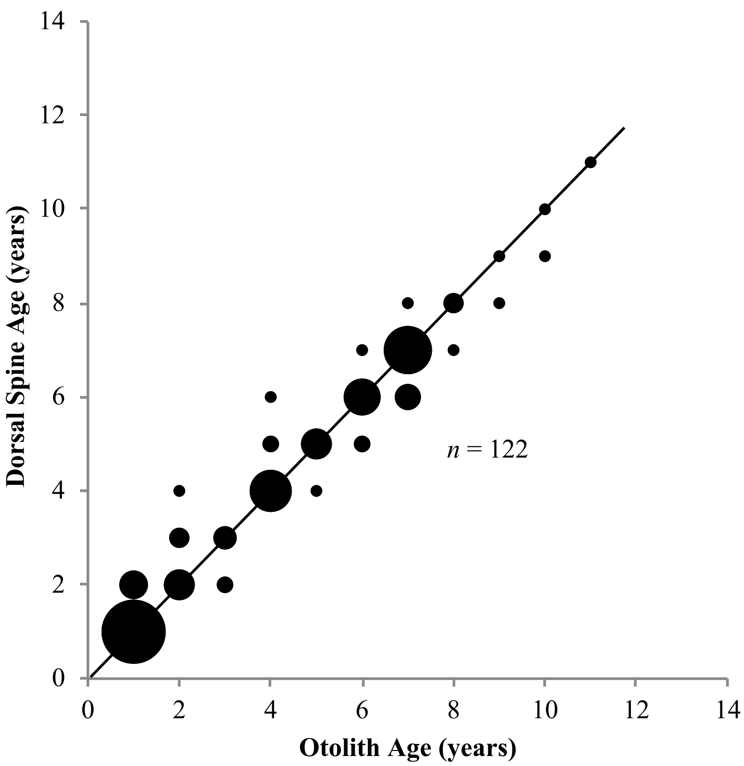


Figure 5. Scatter plot comparison of age estimates obtained from otoliths versus dorsal fin spines for Reader 1. Diagonal line represents comparisons where otolith age=estimated dorsal spine age. Circle size represents sample size of a particular age combination relative to the largest subsample.

Volunteer Bulletin Board

Notice to all Florida

LAKEWATCH active samplers keep those samples flowing! Please be sure to deliver all frozen water and chlorophyll samples to your collection center as soon as possible. This will allow us to collect and process then in a timely.

Thanks for your help.

This newsletter is generated by the Florida LAKEWATCH program, within UF/IFAS. Support for the LAKEWATCH program is provided by the Florida Legislature, grants and donations. For more information about LAKEWATCH, to inquire about volunteer training sessions, or to submit materials for inclusion in this publication, write to:

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From the Water Lab

Before finishing your lake monitoring duties, please check your data sheets and water bottles for accuracy. Be sure to double-check the stations locations and their numbers and remember that sampling stations should be consistent for each sampling event. In other words: Stations 1, 2 and 3 do not simply refer to the order in which you happen to collect water on a given day, but should instead refer to fixed GPS locations. Thanks you and keep up the good work!

No longer sampling?

If you are no longer able to monitor your lake, please let us know as soon as possible so that we can find a new volunteer to train and continue the work that you have started! It will also enable us to maintain consistent data if we can train someone before the next sampling date arrives.

Kit Roundup

If you are no longer able to sample and you have sampling materials that are in your way, collecting dust, let us help! Please give us a call and we'll make arrangements to pick up the materials so that we can revamp them and re-use them. Like everything else these days, the kits have become more expensive, so we need to be more diligent in collecting and re-circulating the unused materials.

Thanks for your help!