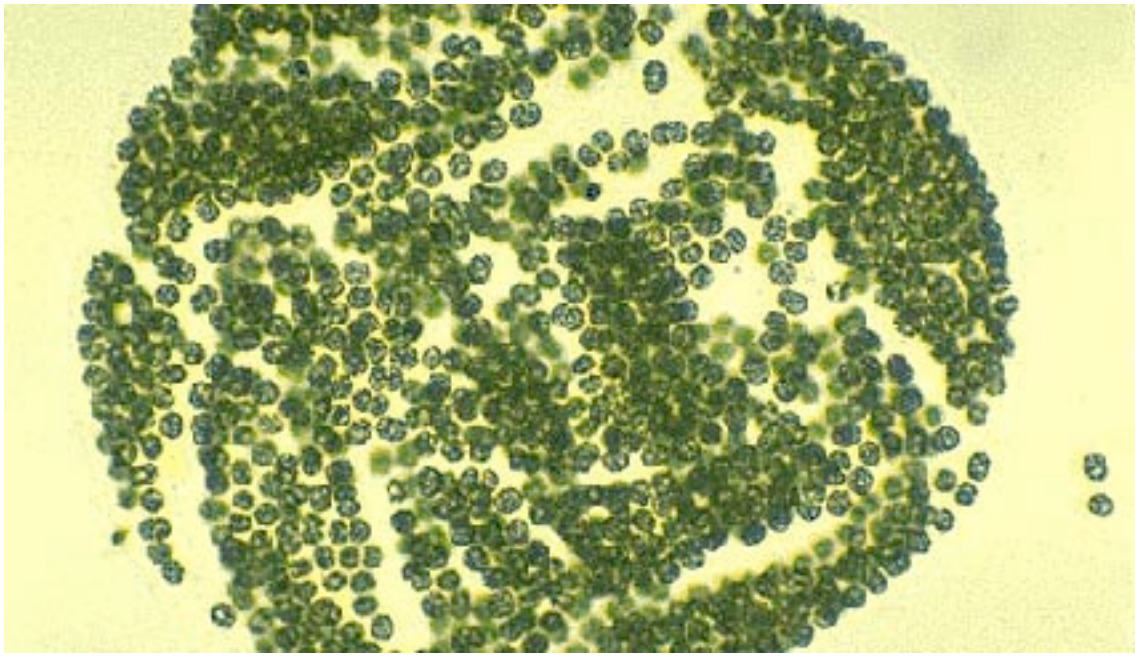
Florida LAKEWATCH

Dedicated to Sharing Information About Water Management and the Florida LAKEWATCH Program Volume 42 (2008)

Toxic Algae: Should Floridians Be Worried?



www.biol.tsukuba.ac.jp

A microscopic view of Microcystis aeruginosa.

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 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

Continued on page 2.

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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 µg/L and a recreational water contact standard was set at 20 µg/L. Because the 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 enzyme-linked 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 the 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.

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%

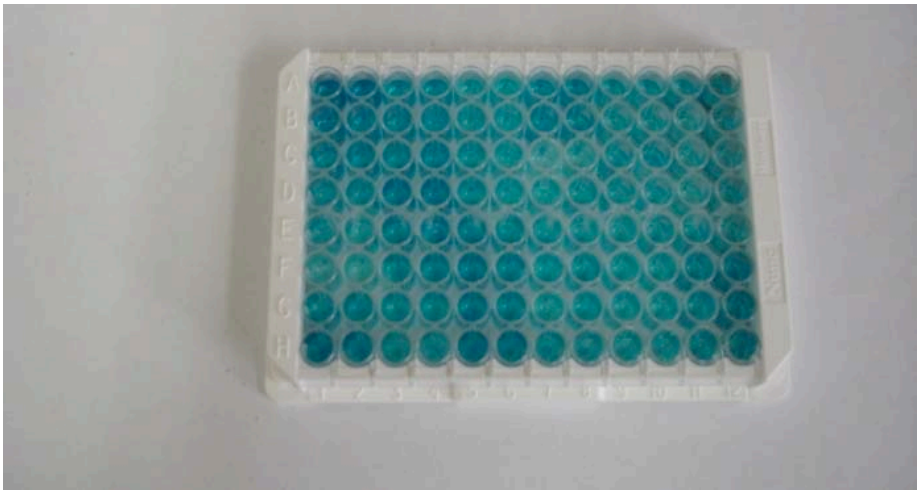
(2) Water samples collected from eutrophic and hypereutrophic lakes tended to have higher microcystin concentrations and were the only water samples in this study that exceeded the WHO drinking water and recreational water contact standards.

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.

M J Wargo

A Microsystis aeruginosa bloom on the surface of a lake.



Dana Bingham

An ELISA plate ready for analysis.

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, we 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 blue-green 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 Bigham, a graduate student with Florida LAKEWATCH at the University of Florida, contributed this article based on research she did to fulfill the requirements for a Masters of Science Degree. If you have any questions or concerns, please feel free to contact Dana at:

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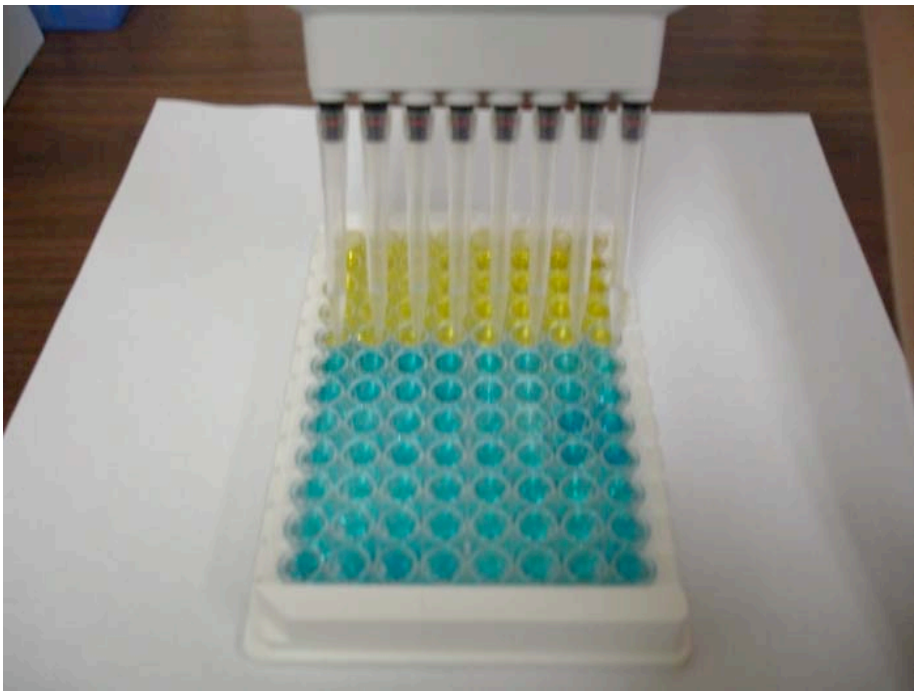

Dana Bingham

An ELISA plate during the analysis process.

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/

Minimum flows and levels (MFLs) and Total Maximum Daily Loads (TMDLs)

Minimum flows and levels

The 2007 Florida Statute Subsection 373.042(2) mandates that the five Water Management Districts set minimum water flows and/or levels (MFLs). The Legislature believed it was necessary to prevent significant harm to the water resources or ecology of an area resulting from surface water withdrawals permitted by the Districts.

The MFLs define how often and for how long high, average, and low water levels should occur to prevent significant harm. The term significant harm however is never clearly defined making it difficult for the Water Management Districts to actually set reasonable MFLs. In fact, each District takes a different method on defining significant harm and some districts like the Southwest District actually uses up to five different methods for setting MFLs. Generally, the hydrologic conditions defined by established MFLs are similar to, but usually lower than the existing hydrologic conditions. In theory, MFLs protect both consumptive and non-consumptive water uses.

Minimum flows and levels identify a range of water levels and/or flows above which water could be permitted for consumptive use. Consumptive use causes the diminishment of the water source at the point of appropriation. Consumptive uses include the use of water in such quantity as is necessary for economic and efficient use for a purpose and manner that is both reasonable and consistent with the public interest. In simple terms, it is for human use for drinking water, Non-consumptive use causes no diversion from the water source or diminishment of the source. Non-consumptive uses include quantities of water necessary for navigation, recreation, and maintaining fish and wildlife habitat

Lake Brooklyn in Clay County showing very low water levels.

as well as other natural resources. It is especially difficult to set MFLs on multi-use lakes because as LAKEWATCH always tries to emphasize "a lake can not be all things to all people."

Another problem with setting MFLs is that many lakes and rivers do not have a long-term data base available for determining the actual historical hydrology. Thus, if the MFL process occurs during a drought period like Florida is currently experiencing, or after significant water withdrawals have already occurred, the minimum high and minimum average levels may not recognize any significant harm that has already occurred. Essentially, current impacts during present low water conditions would not be addressed.

Determining the MFLs based on low conditions could potentially allow for greater water withdrawals when water levels return to historic levels. On the other hand if water levels continue to drop, previously established MFLs would only indicate that significant harm has occurred or is occurring.

If significant harm has occurred, state agencies will try to find a way to correct for the effects endured under continuous minimum lows. For example, the Hillsborough River is used as a drinking water source by several communities and has been under continuous low levels for some time. The Southwest Florida Water Management District (SWFWMD) is attempting to experimentally augment Hillsborough River using water from a flowing sink. They are monitoring ground wells and surface waters of lakes to determine potential impacts. If significant lowering of lake levels occurs (greater than expected based on evaporation) then the pumping from the sink would theoretically

Florida Statutes Subsection 373.042(2) requires the establishment of MFLs. Establishing MFLs is also a requirement of the State Comprehensive Plan, the water implementation rule, and a 1996 Governor's executive order for priority water bodies. How and when MFLs determinations are made are exceedingly important as the program provides input to the water supply planning process (373.0361, F.S.), permitting criteria for consumptive use permits (Chapter 40C-2, F.A.C.) and environmental resource permitting program (ERP).

cease. The use of water from a flowing sink that is connected directly to a deeper aquifer will most likely not impact surface water levels directly. It is essentially a groundwater withdrawal. Results are not in and LAKEWATCH will try to keep you updated.

Generally, MFL development is being done without reference to existing uses and development, with some exceptions. Districts maintain there should be great flexibility in addressing "significant harm" to include regional considerations. The following are how the different Districts look at the concept of "significant harm":

Northwest Florida Water Management District (NWFWMD)
No definition, but states it involves science-based judgments requiring regional governing board to determine what functions are to be protected to ensure a sustainable system.

Suwannee River Water Management District (SRWMD)
No prescriptive definition of significant harm. Staff state the process is science-driven rather than policy-driven.

St. Johns River Water Management District (SJRWMD)
Defines in terms of impact on the structure and function of ecosystems. Staff states they examine long-term biological, physical and hydrological indicators in an effort to evaluate appropriate levels without reference to human uses.

Southwest Florida Water Management District (SWFWMD)
Definition involves protecting existing as well as future consumptive uses of water, and **at the District's discretion may provide for protection of non-consumptive uses.**

South Florida Water Management District (SFWMD)
Definition involves science-based judgments that should **provide for some acceptable level of harm** to water resources from consumptive uses and flood protection.

Total Maximum Daily Load (TMDLs)

During the last century there have been many examples of degraded water quality in the United States as well as other parts of the world. To address these problems and protect our Country's vast water resources the Federal government established a subsection in the Clean water Act of 1972 to address impaired waters. A Total Maximum Daily Load (TMDL) specifies the maximum amount of a specific pollutant a waterbody can receive and still meet water quality standards including pollutant loadings from point and non-point sources. Legislation established means for adopting TMDLs, allocating pollutant loadings among contributing sources and implementing pollution reduction strategies. TMDL development involves determination of the "assimilative capacity" of the impaired water for the pollutant causing the impairment. TMDLs are determined typically by computer modeling that predicts the fate and transport of pollutants.

Lake JoAnna in Lake County during a recent drought.

The Florida TMDL process has been formalized by the Florida Department of Environmental Protection's (FDEP) five step approach which can be summarized as: (1) data collection and assessment; (2) follow-up data collection;
(3) setting the total allowable pollutant load in the form of a TMDL; (4) development of a Basin Management Action Plan (BMAP), and (5) implementation of the plan. During the BMAP development step the FDEP works with stakeholders to allocate pollutant loads to point and non-point sources and determine the party responsible for the specific pollution load, identify funding sources, set forth management strategies (stormwater retrofits, wastewater upgrades, best management practices, etc.), and secure commitments to implement the actions called for in the plan. Each BMAP will be adopted by an order of the Secretary of the FDEP and the implementation of the BMAP is accomplished cooperatively with stakeholders and can be viewed as an adaptive management tool. Its success is measured against objective standards and, where necessary, changes may be made (through Secretarial adoption).

At the Federal level, subsection 305(b) of the 1972 Clean Water Act (CWA) requires states, territories and authorized tribes to develop lists of polluted/impaired waters. This legislation defines how impaired waters are to be determined. The US Environmental Protection Agency under the CWA requires the lists to be ranked according to priority and to develop TMDLs of pollutants for these waters.
At the State level, Chapter 99-223 of the Laws of Florida sets forth the process by which the impaired waters list will be refined through more detailed water quality assessments. The 1999 Florida Wetlands Restoration Act (FWRA) clarifies statutory authority for TMDL development and to define the approval process. This legislation established Florida's 303 (d) list of impaired waters that was submitted to USEPA in 1998 for planning purposes only. The FWRA requires FDEP to adopt listing criteria and methodology by Rule (Chapter 62-303 FAC). Once adopted by Rule, FDEP is required to validate impairment in listed waters for which FDEP will calculate the TMDLs provided for in 403.067 (4) of the Florida Statutes. This impaired waters list along with calculated TMDLs will then be submitted to the USEPA pursuant 303 (d)(1)c of the CWA. In addition, FDEP is required to evaluate whether proposed pollution control programs are sufficient to meet water quality standards.

Volunteer Bulletin Board

No longer able to sample?

If you are unable to collect samples on your lake and would like to resign, please give us a call and let us know. We appreciate all of the hard work that you have done and understand that time does not always allow us to get everything done that we would like. We also ask that you return the sampling equipment to your water collection center or mail to our office as soon as possible. Be sure to label the equipment kit with your name, lake name and county so we can credit you with its return. The equipment used to sample your lake is essential for our program and costs about $400 dollars per kit. It is important that we re-use this equipment to keep our expenses down. If you have already returned your equipment, thank you very much, but give us a call and let us know so we can update our records.

Water levels low?

If you are unable to sample due to low water levels and have not contacted us to let us know please consider giving us a call. We have a toll free number (1-800-525-3928) and it will just take one minute of your time. This will update our records and help us separate which volunteers can no longer sample due to low water from those who can no longer sample due to other reasons such as health, time, or etc.

2007 Fish Report

The 2007 FL LAKEWATCH/Fish and Wildlife Conservation Commission long-term fish monitoring program report for 2007 is now available on the LAKEWATCH website at :

http://lakewatch.ifas.ufl.edu/

The 2007 report as well as a list of the lakes sampled are available to download in pdf format.

Thank You!

We take this opportunity to thank you for your hard work and dedication! Using Florida LAKEWATCH techniques, you are documenting your lake's nutrient levels (nitrogen and phosphorus), its algae content, and its water clarity. These data are compiled to create a long term data base that can be used as an "early warning system" to help spot potential problems in their earlier stages. The Florida LAKEWATCH program also forms a network for communication, education, and understanding among various groups and individuals involved in research, planning, management, and resource use. Without your help this information would never have been generated. Be proud of yourself!

LAKEWATCH NEEDS YOU!

These lakes have been inactive for over one year. If you know of anyone who might want to sample any of these lakes please have them call us at 1-800-525-3928 or e-mail us at fl-lakewatch@ufl.edu.

Highlands County

Angelo
Anoka
Byrd
Chilton
Counterfeit
Crews
Damon
Deer
Diane
Duck
Fox
Granada
Hill
Huntley
Isis
Jackson
Lelia
Little Bonnett
MaryJane
McCoy
Mills Pond
Mirror
Nellie
Olivia
Persimmon
Pioneer
Pythias
Rachard
Saddlebags
Silver
Trout
Tulane
Verona
Viola
Wolf

Polk County

Annie
Arbuckle
Ariana
Aurora
Bentley
Blue 2
Blue South
Bonnet
Bonny
Buffum
Cannon
Clark

Polk County

Clearwater
Clinch
Conine
Crago
Deer
Eagle
Elbert
Eva
Fannie
Garfield
Gibson
Haines
Hamilton
Hancock
Hartridge
Helen
Henry
Howard
Hunter
Ida
Idylwild
Jessie
John
Josephine
Juliana
Little Elbert
Little Hamilton
Little Otis
Little Spirit
Little Winterset
Livingston
Lizzie
Lost
Lucerne
Mabel
Marion
Mattie
Maude
May
Mirror
Mountain 2
Ned
Otter
Pansy
Patrick
Pollock
Ring
Rochelle
Roy
Silver
Smart
Spring
St. Anne
Symphony

Seminole County

Ada
Alma
Ann
Asher
Banana
Baptismal
Bel-Air
Bingham
Brantley
Buck
Cochran
Cranes Roost
Deep
DeForest
Dot
East
East Crystal
Emily
Emma
Florence
Forest
Fruitwood
Gem
Golden
Hayes
Horseshoe
Horseshoe North
Island Pond
Jennie
Kathryn
Long
Marion
Mills
Mirror
Monroe East
Mullet
Myrtle
Pearl
Pine
Plaza Oval
Prairie
Quail Pond
Red Bug
Silver
Tony
Twin East
Wekiva
West Crystal
Wildwood
Willa
Woodlake
Yvonne

Florida Still Reigns Supreme as Fishing Capital of the World

Florida cannot be beat as the No. 1 place to cast a line, pitch a lure or land a lunker. No tall fisher's tale here — this title has been earned, according to a survey by the U.S. Census Bureau.

Every five years the Census Bureau conducts the "National Survey of Fishing, Hunting and Wildlife-Associated Recreation." This survey is the gold standard for comparing outdoor recreational activities between the states. Once again it proves that Florida is the number one fishing destination, according to the 2006 results.

The facts tell where anglers go for the best fishing opportunities. Florida provided 46.3 million days of recreational fishing in 2006 versus 41.1 million days in Texas, the second highest state. Of fishing days spent in Florida, 4.8 million days were by tourists (nonresidents), while Wisconsin, the second highest state for tourist days, provided 3.8 million days. In terms of nonresident anglers, Florida is also number one with 885,000, versus No. 2 North Carolina with less than half that at 395,000.

But the story does not end there. Overall Florida again ranked first in number of fishing participants age 16 and older with 2.77 million. Runner-up Texas had 2.53 million participants. However, in 2001 Florida had 3.10 million anglers, so there has been a decline of approximately 11 percent over five years according to these estimates.

If you look at the decline as a percentage of the population, which has been rapidly increasing, the percent decline is a little more dramatic. In 2001, national rates were 16 percent and in Florida 17 percent of the population fished. Those rates dropped to 13 percent nationally and to 14 percent in the Sunshine State in 2006. On the positive side, the number of fishing days per angler has increased nationally, with the average angler fishing 17 days out of the year in 2006.

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A young angler enjoys success on a Florida lake.

Anglers in Florida spent $4.4 billion in 2006, allowing Florida to claim another No. 1 spot as the place where anglers spend the most money. The Lone-Star State was second best with $4.3 billion spent on fishing. Recreational fishing dollars helped to support 75,068 jobs in Florida, again making it No. 1, with Texas trailing behind with 58,938 jobs. This economic trend is great news for Florida partially because state and local taxes from the sale of fishing-related goods and services generated $441 million for general funds.

In spite of the national estimates of fishing participation for all U.S. anglers (does not include foreign anglers) over 16 years of age decreasing, actual fishing license sales for both freshwater and saltwater have increased in Florida. From 2001-02, with 1,070,577 licenses sold to 2006-07 with 1,188,092, there was an increase of 11 percent in the sale of saltwater licenses. Freshwater license sales increased, from 587,413 sold in 2001-02 to 630,078 in 2006-07, showing an increase of 7 percent. Although not enough to keep pace with the population increase, it is certainly better than competing states.

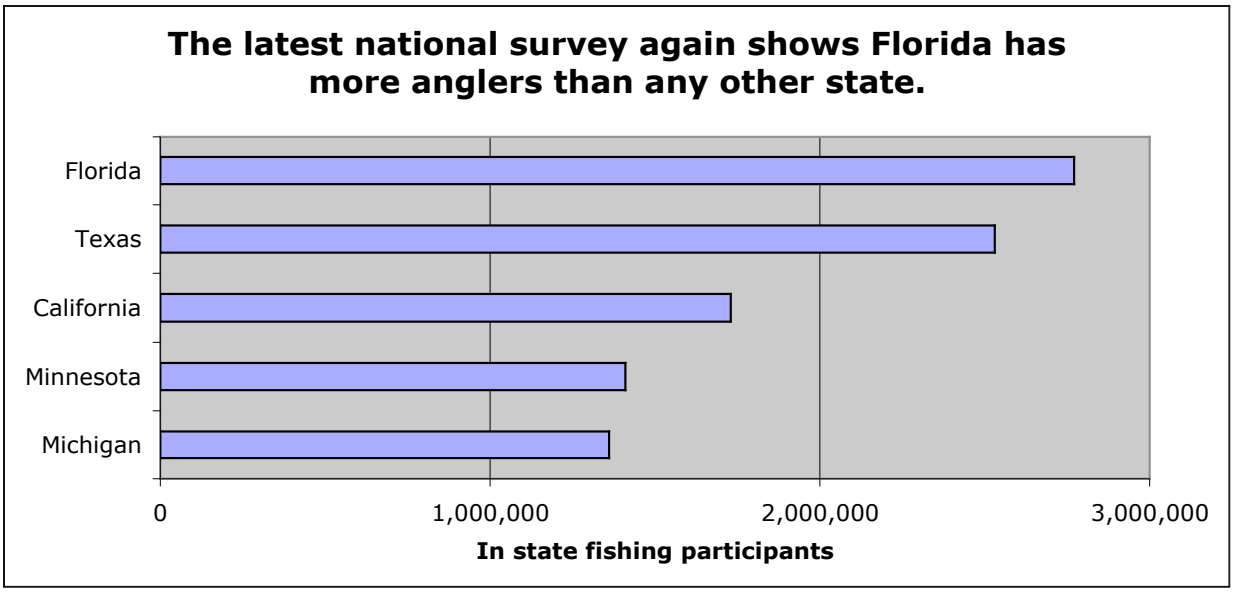
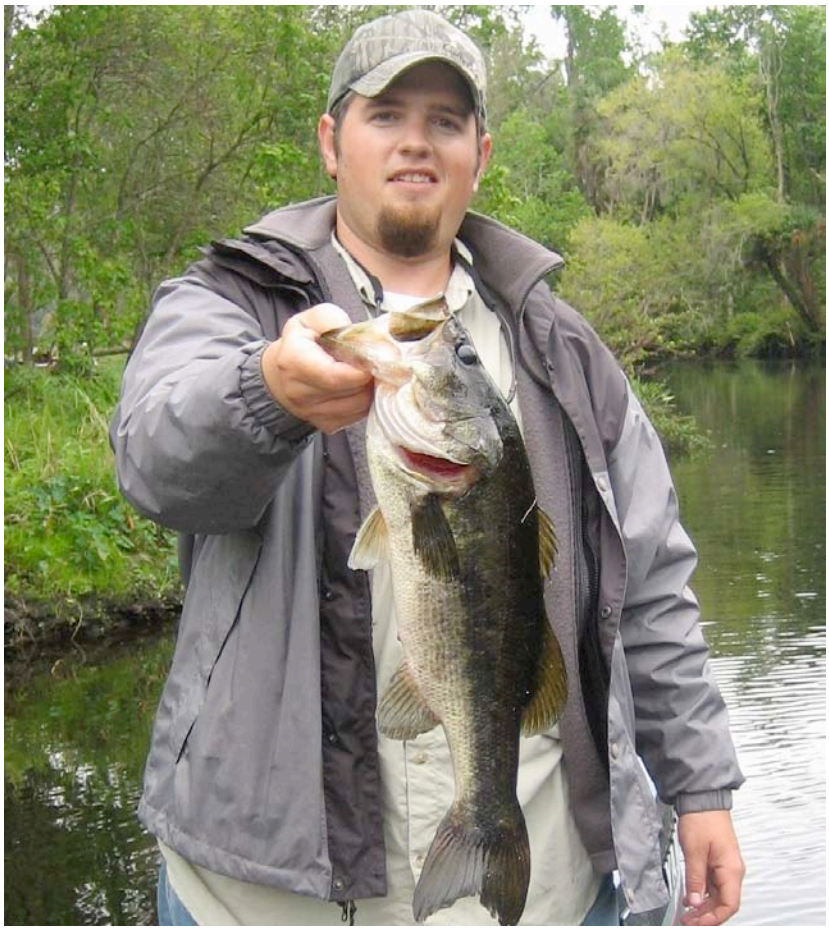


Figure 1. Number of in-state fishing participants estimated in 2006 for the top five states in the United States.

In calendar year 2006, the National Survey estimated 2.77 million anglers fished in Florida, and during fiscal year 2006-07 (July 1 to June 30), 1.55 million fishing licenses were sold. This discrepancy is partially the result of seniors (age 65 and older), resident saltwater shoreline anglers and several other groups, including those fishing from licensed saltwater piers or charter boats, being exempt from licensing. No one can dispute the facts and figures. Florida remains the Fishing Capital of the World because of great resources and responsible management. With a huge variety of fish, fishing waters and fishing styles to choose from, along with year-round fishing weather, there is little doubt that Florida will remain the place to go fishing. You can help ensure a vibrant future with high quality, sustainable and safe fishing opportunities by being an ethical angler, mentoring a youth or friend and keeping your license current.



Jason Dodson

Jason Bennett displays a largemouth bass caught on the Manatee River in Manatee County.

Additional information and relevant links are also posted the Florida Fish and Wildlife Conservation Commission (FWC) Frequently Answered Questions page at www.MyFWC.com/fishing/faqs. Click on "What is the value of Florida's Fisheries?"

This article was contributed by Bob Wattendorf of the FWC. Instant licenses are available online at: MyFWC.com/License or by calling 1-888-FISH-FLORIDA (347-4356)

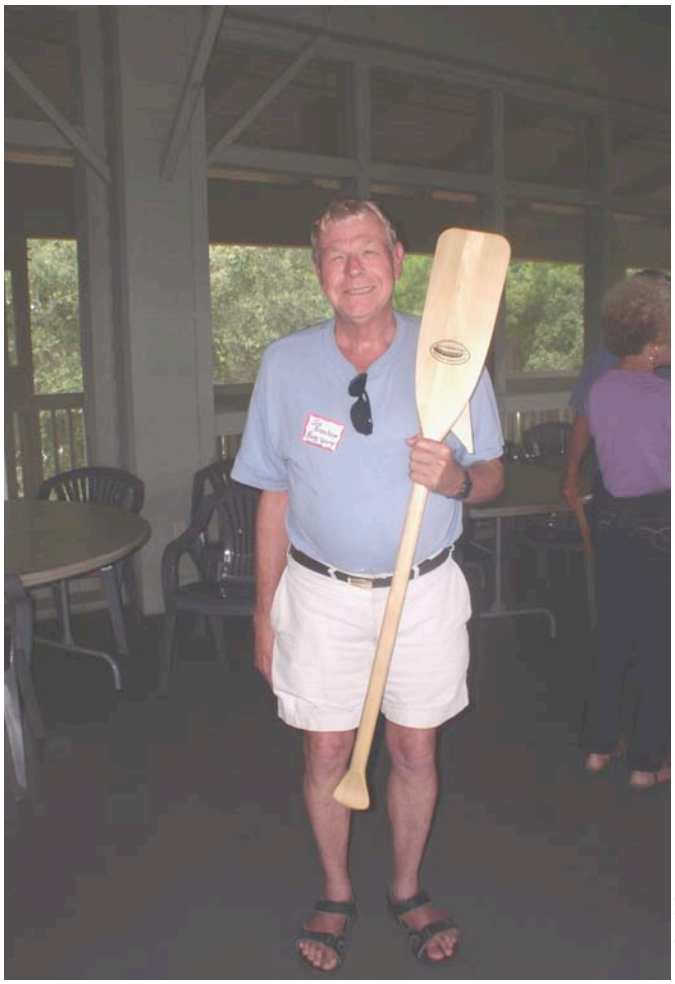
Visit MyFWC.com/Fishing/Updates for more FishBuster columns.

Outstanding LAKEWATCH Volunteer

If you want to know about Bugg Spring, located in Lake County, Florida off CR 470 West of Okahumpka you need to ask Joe Branham. He came to live at Bugg Springs with his father and mother in 1940 from Washington D.C. Joe is now 76 and for nearly 50 years he has lived on the shore of Bugg Spring in his family home, which dates back to 1923. As a child he swam, fished and boated in the spring and the mile long spring run that connects to the Helena Run to Lake Denham, which was at the end of the Hart Line steamboat traffic on the Palatlakaha chain and the original site of the town of Okahumpka.

Joe left Bugg Spring to attend college at the University of Florida and then Florida State University, where he received 3 degrees in zoology, marine biology, and experimental biology. While he worked on his Ph.D. at FSU, he spent two summers with his young family at the Marine Biological Laboratory in Woods Hole, Massachusetts. In 1965, he returned to Woods Hole as a Lalor fellow and met Dr. Alan Beatty of the Institute of Animal Genetics in Edinburgh, Scotland. Also in 1965 he received a National Institute of Health Grant to do post-doctorial work at the University of Edinburgh. He sailed from the United States with his family, wife Margaret, sons Russell and Charles aboard the Empress of Canada to Scotland.

The family spent two years in Edinburgh while Joe worked on problems of sperm motility and capacitation in the lab of Nobel Prize winner C.H. Waddington. Next, they left Scotland for the University of Hawaii in Honolulu. While there Joe was an assistant professor teaching zoology courses in developmental biology. His research interests involved reef ecology, primarily the effects of the giant crown-of-thorns starfish on coral reef habitats of the Hawaiian and Marshall Islands. His work was published in Science and Bioscience and several other journals. Returning to the mainland they spent a year at the University of Utah. There he researched the stone fly larvae in the mountain rivers around Salt Lake City. His work was published in the Canadian Journal of Zoology. Then the family returned to Okahumpka where the family had a citrus business. It was a very happy homecoming for Joe because he could introduce his boys to Bugg Spring, a natural paradise he loved. Once back in Lake County Joe was offered a job teaching at Leesburg High School his Alma Mater. He was going to be a substitute for one year while another teacher was out on maternity leave, but he stayed for 22 years. He taught biology, chemistry, general science, and limnology.



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Dr. Joe Branham with his "outstanding volunteer paddle at the 2008 Lake County Regional meeting.

Joe has been very active as a conservationist in Lake County. He has held many committee chairmanships such as an advisory member of the Lake County Water Authority. He worked on the first Lake County Comprehensive Plan, he helped build Flat Island Nature Trail, served on the Public Land Acquisition Advisory Council of Lake County, and served as a teacher and worker at Trout Lake Environmental Center. Joe has collected over 220 samples for LAKEWATCH since 1990 from Bugg Spring. He has collected nearly 20 years of rainfall, water flow, and lake level data to accompany the nutrient data for Bugg Spring. He has been an advocate for minimum flows and levels that are being established by the St. Johns River Water Management District, and has shared his scientific information on Bugg Spring with other scientists for years.

It is rare to have a professional biologist consistently gathering data on a unique water body, such as Bugg Springs for this long period of time. The 170 foot spring is one of the deepest of Florida's beautiful springs and Joe has carefully watched and enjoyed its beauty and natural history for many long years. He is a model environmental citizen that has worked to preserve a natural Florida gem and it is a pleasure to have Joe as a LAKEWATCH volunteer. Joe's dedication to Bugg Spring goes beyond anything we could have hoped for from a volunteer when the program was created. We do not come across volunteers like Joe very often and commend him for his time, energy and continued service to LAKEWATCH and Lake County.

Walton County Dune Lakes

An aerial photo of a Walton County dune lake.

There are 18 named coastal dune lakes in south Walton County along 26 miles of coastline. These coastal dune lakes are extremely rare. In Florida, they are found only in the Florida Panhandle. Around the world, coastal dune lakes also exist in Madagascar, Australia, New Zealand, the northwest Pacific Coast of the United States and South Carolina. Florida LAKEWATCH volunteers have been sampling 15 of these lakes over the last 10 years.

Coastal dune lakes are unique and generally found within two miles of the coast and are typically shallow and irregularly shaped. The water is composed of both fresh and salt water obtained from groundwater seepage (in both directions), heavy rain, and storm surges. Most of the dune lakes around the world are called freshwater lakes with varying periods of saltwater intrusion. Lake water is generally colored (e.g., tea or black colored) due to watershed contributions of dissolved organic matter. While these lakes are exposed to normal weather conditions, coastal dune lakes are tremendously impacted by hurricane activity (i.e., storm frequency, strength and duration).

The coastal dune lakes of Walton County have an intermittent connection to the Gulf of Mexico. This periodic connection serves as control for flood-level waters by opening a conduit to the Gulf. When a lake reaches a critical pre-flood level, breaching water forms an outlet through the dune system and empties the lake water into the Gulf. Depending on tides and weather conditions, salt water and biota from the Gulf fills the void left behind by the lowered water level of the lake until equilibrium is reached and the opening eventually closes. This exchange forms a brackish water-body, creating a temporary estuarine ecosystem. Each of the coastal dune lakes has individual outlet characteristics, with outlet openings varying in length, frequency and duration. These openings occur based on each lake's critical water level, which is driven by droughts and rainfall. As a result, some of the lakes can be completely freshwater, some brackish, and/some salty, with varying degrees between stages. The

(Continued on page 12)

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Florida
LAKEWATCH

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Walton County Dune Lakes (Continued from page 11)

changing condition of water chemistry in the coastal dune lakes makes them biologically diverse systems with a dynamic nature. Walton County's tremendous population growth, especially in the vicinity of the coastal dune lakes has raised much concern over the "health" of these exceptional systems. For this reason, the Walton County Board of County Commissioners extended provisions in the Walton County Land Development Code and Walton County Comprehensive Plan for the protection of the dune lakes. Additionally, the County Commission established the Coastal Dune Lake Advisory Board (CDLAB) in 2002. The mission statement for this advisory board is as follows: "To serve, protect and perpetuate the Coastal Dune Lakes of Walton County through mitigation of the effects of development." The CDLAB has several objectives, which fall under three major headings; 1) Action, 2) Education and 3) Perpetual Protection. One action item is development of an action plan (essentially a lake management plan) for each lake. The Choctawatchee Basin Alliance has recently requested that Florida LAKEWATCH help with the development of this management plan so stay posted for updates on the process.