



**Symposium on Public Health Implications of
Harmful Algal
Blooms (HABs) in Florida**

Accomplishments and Challenges

**Marie Selby Botanical Gardens
Sarasota, Florida**

September 28 - 29, 2006

Cyanobacteria Assessment of Freshwater Systems in Florida (2005-2006)

Aquatics Toxin Program/FDOH

University of North Florida

Green Water Laboratories/CyanoLab

Collaborators

Aquatic Toxins Program/FDOH

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University of North Florida

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Amanda Foss
Chris Williams**



Outline of Talk

1. General Attributes of Toxin Producing Blue-Green Algae (Cyanobacteria) in Florida
2. Historical Perspective of Toxigenic Cyanobacteria in Florida (1999/2000)
3. Recent Toxigenic Cyanobacteria Monitoring in Florida
 - 2005
 - 2006
4. General Conclusions

Species of Toxigenic Cyanobacteria

Microcystis

aeruginosa
wesenbergii
flos-aquae

Cylindrospermopsis

raciborskii

Anabaena

circinalis
flos-aquae
planctonica
lemermanii

Species of Toxigenic Cyanobacteria

Aphanizomenon

ovalisporum
gracile

Planktothrix

agardhii
viridins

Lyngbya (Plectonema)

wollei
majuscula

Cyanotoxins

Microcystis

microcystins

Cylindrospermopsis

cylindrospermopsin
saxitoxin

Anabaena

microcystins
anatoxin-a
saxitoxins

Cyanotoxins

Aphanizomenon

anatoxin-a

cylindrospermopsin

saxitoxin

Planktothrix

microcystins

anatoxins

saxitoxins

Classification of Cyanotoxins

Microcystins

Hepatotoxins

Cylindrospermopsin

Hepatotoxins

Anatoxins

Neurotoxins

Saxitoxins

Neurotoxins

Lyngbyatoxins

Dermatotoxins

Characteristics of Cyanotoxins

- Water-soluble (microcystins ?)
- Relatively stable
- Intracellular
- Potent toxins (~ 300 ug/kg bw)
 - a) Potential Tumor Promoters
 - b) Genotoxic

St. Johns River bloom- 1999

Anabaena circinalis



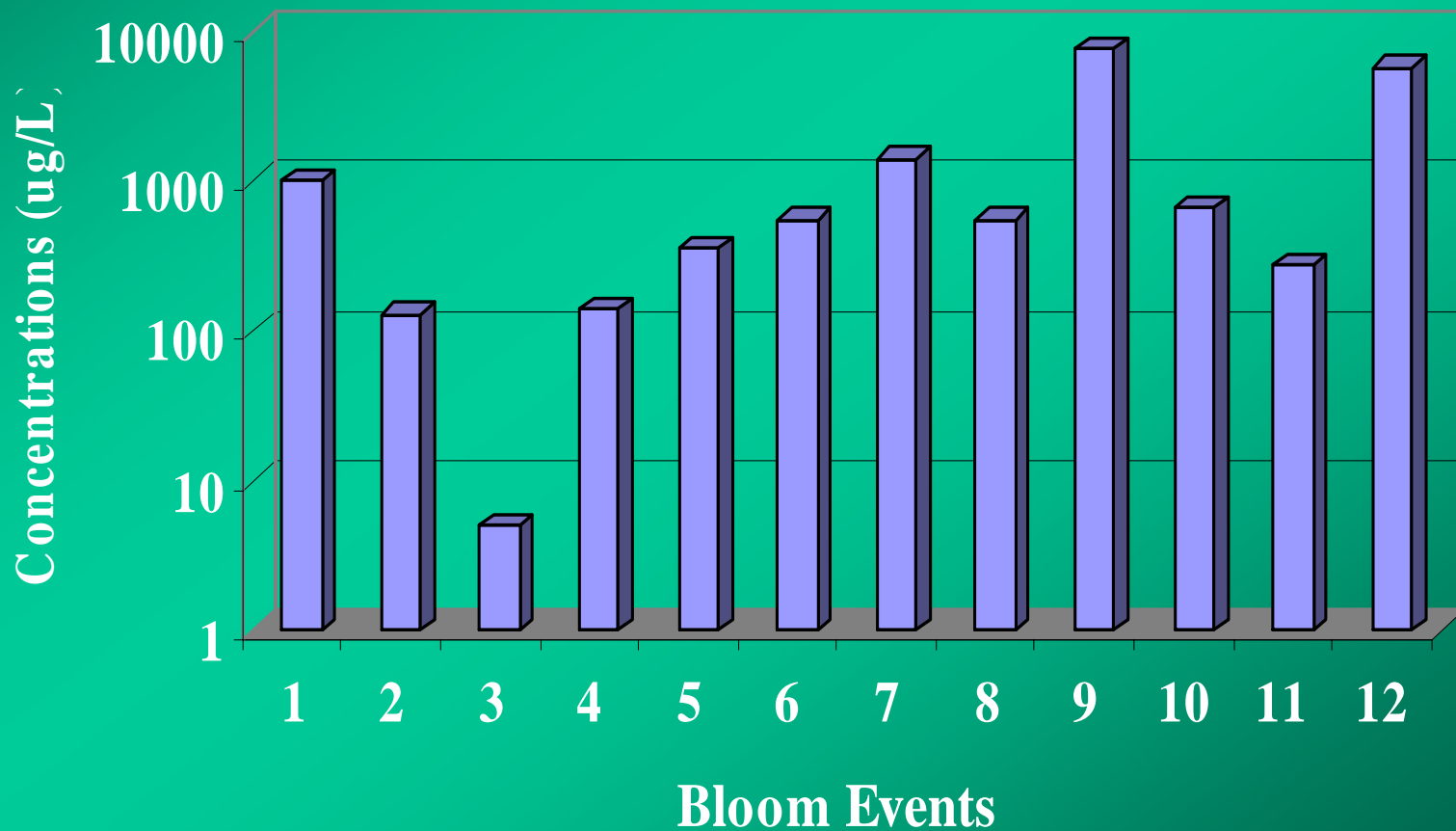
Florida Harmful Algal Bloom Task Force 1999-2000

Microcystins	0-150 ug/L
Cylindrospermopsin	0-202 ug/L
Anatoxin-a	0-156 ug/L
Saxitoxins	not present*
Lyngbyatoxins	0-0.3 ug/g

Central Florida Lakes - 2003/2004

Lake County Water Authority

Microcystins



World Health Organization Suggested Monitoring Levels for Recreational Waters

Alert Level 1

- Approx. 20,000 cells/ml.
- 10 ug/L chlorophyll-a
- 2-4 ug/L MLR

Provide Information to
Users/Surveillance

Alert Level 2

- Approx. 100,000 cells/ml.
- 50 ug/L chlorophyll-a
- 20 ug/L MLR

Daily Inspection/Prevent
Exposure/DOH
Contact

Alert Level 3

Visible Scum Formation
Monitor Constantly (Multiple times/Day)
Prevent Exposure/Restrict Access

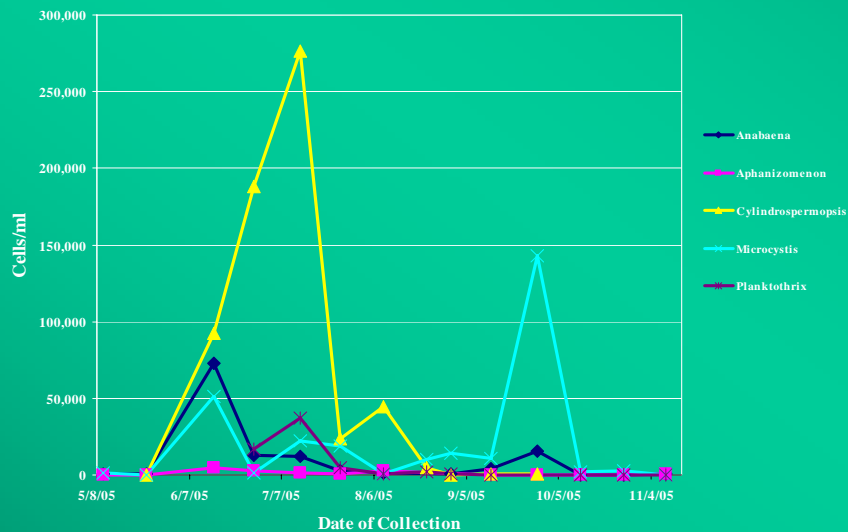
St. Johns River 2005

Green Cove Springs

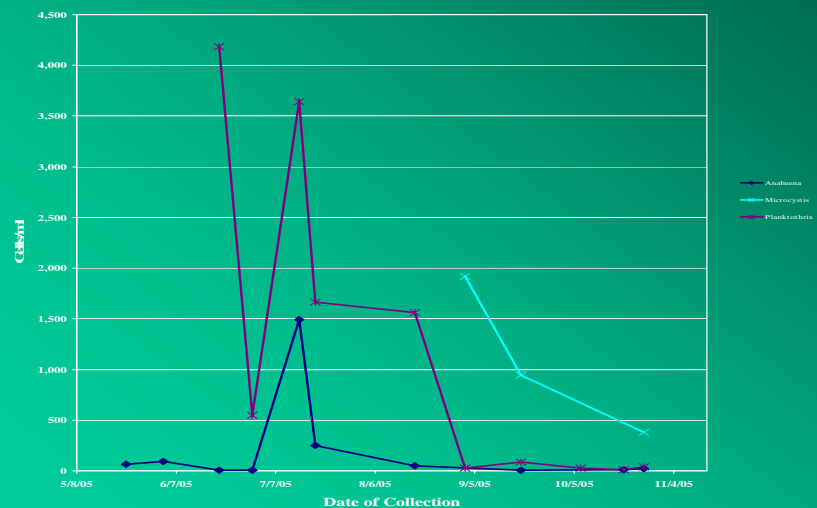


Abundance of PTOX Algal Populations (2005)

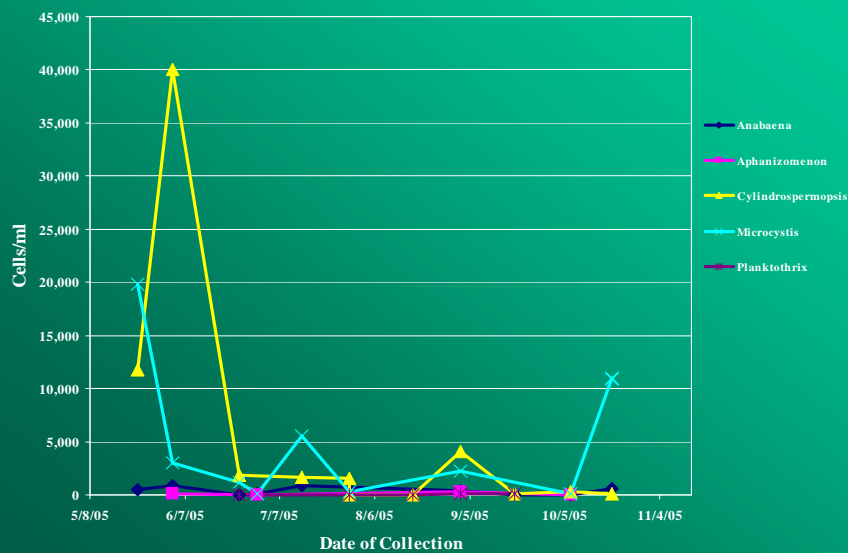
Potentially Toxigenic Algae at Palatka Pier (2005)



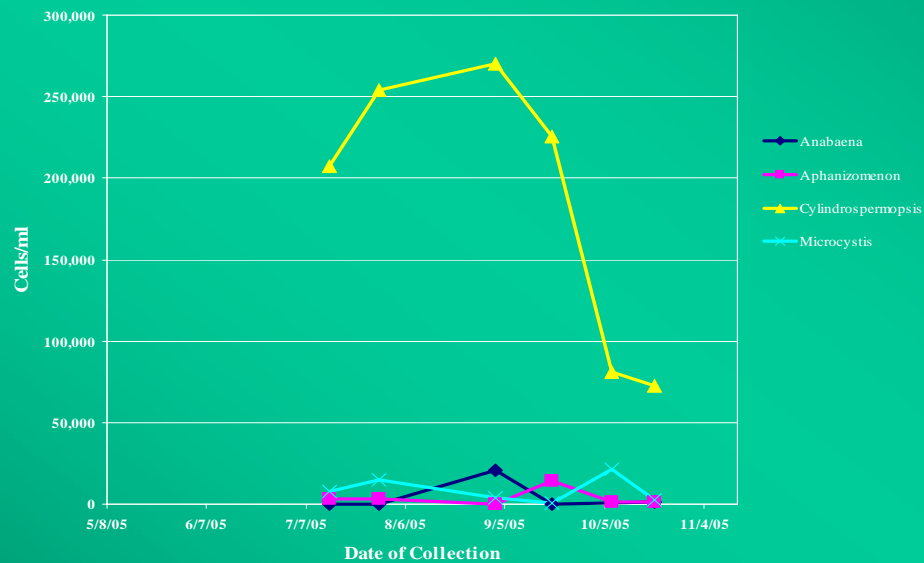
Potentially Toxigenic Algae in Lake Washington (2005)



Potentially Toxigenic Algae in Lake Monroe (2005)

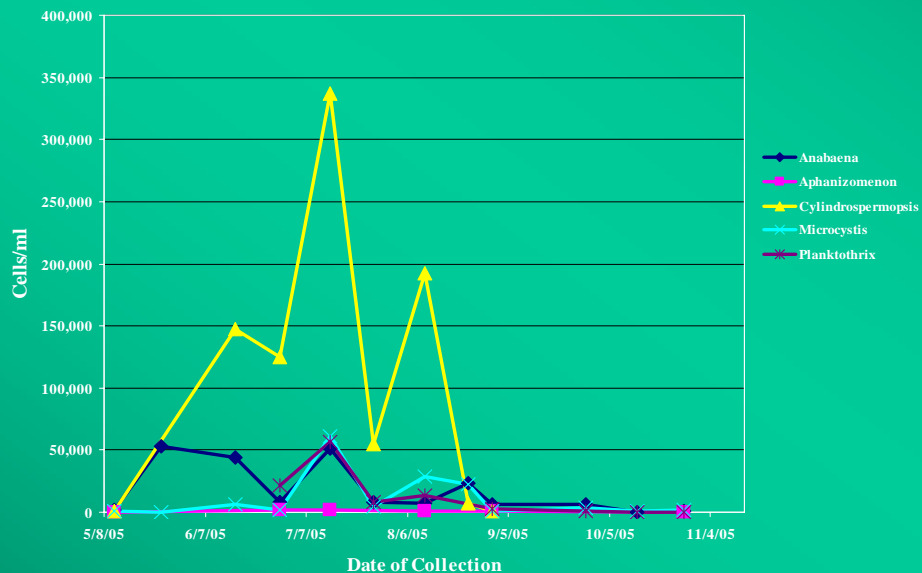


Potentially Toxigenic Algae in Lake Jesup (2005)

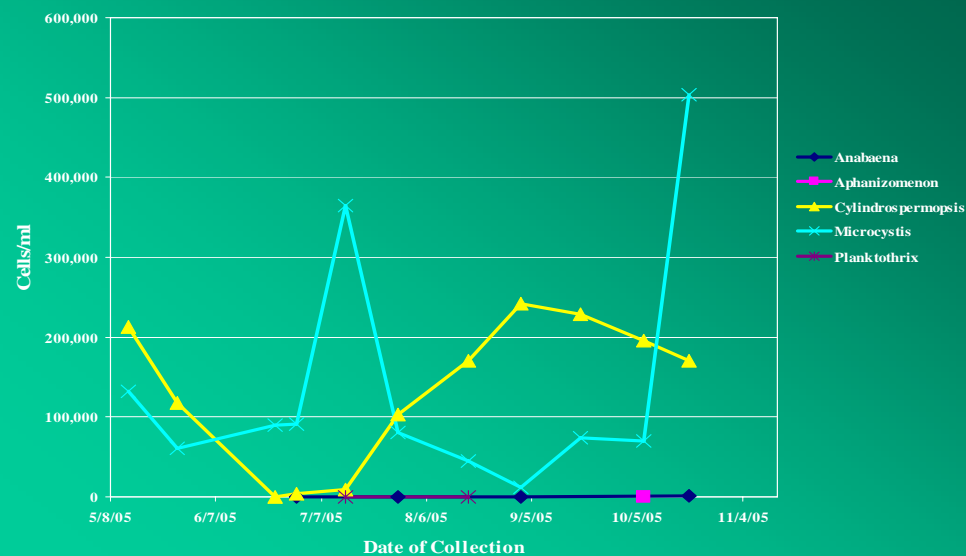


Abundance of PTOX Algal Populations (2005)

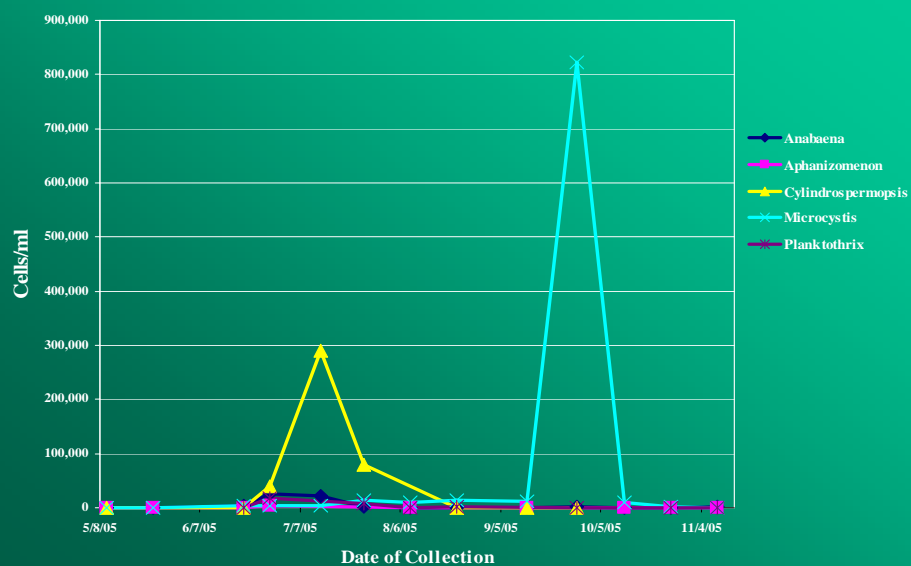
Potentially Toxicogenic Algae in Lake George (2005)



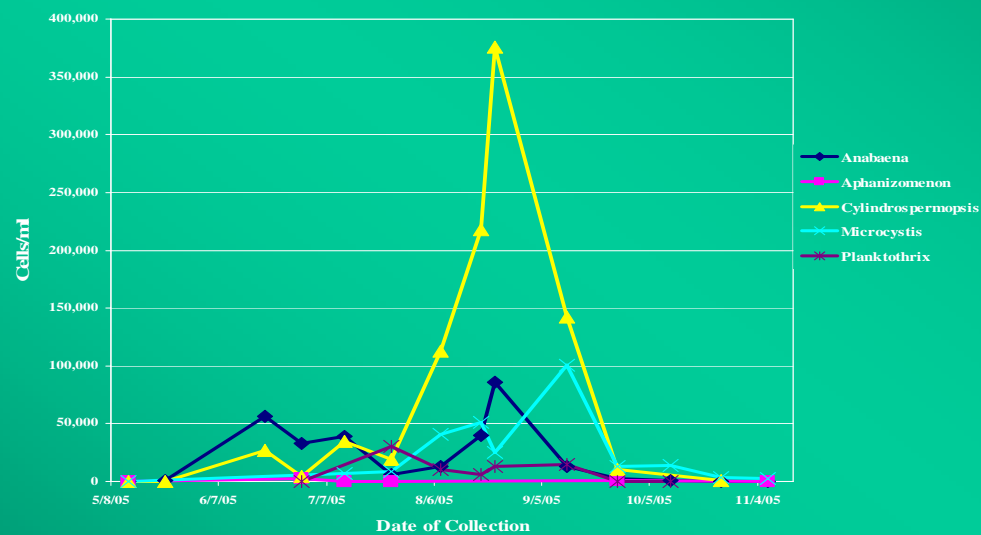
Potentially Toxicogenic Algae at Hickory Point (Bath) (2005)



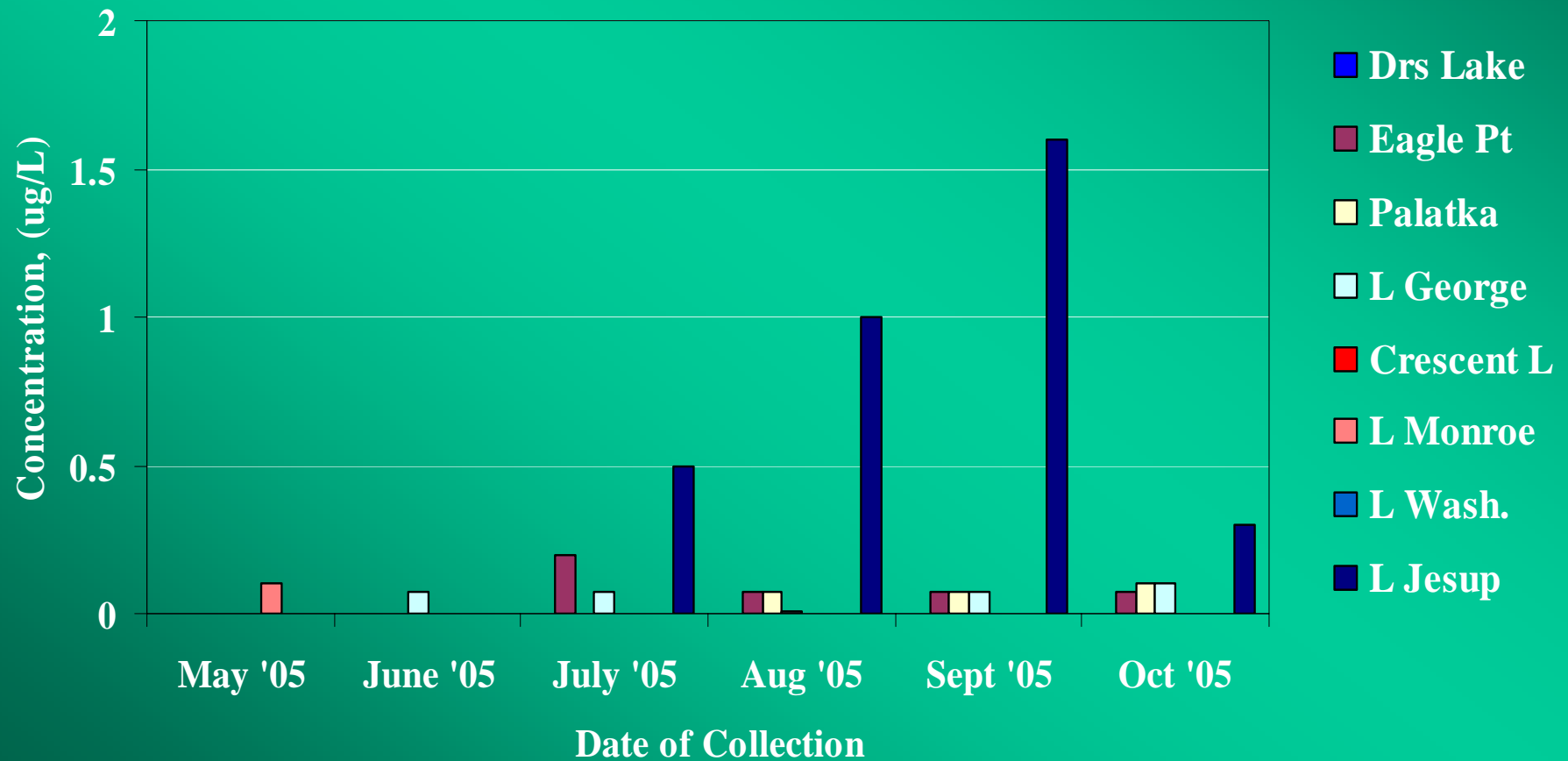
Potentially Toxicogenic Algae in Eagle Harbor (2005)



Potentially Toxicogenic Algae in Doctor's Lake (2005)



Cylindrospermopsin Concentration Levels at Recreational Water Sites in the St. Johns River (2005)



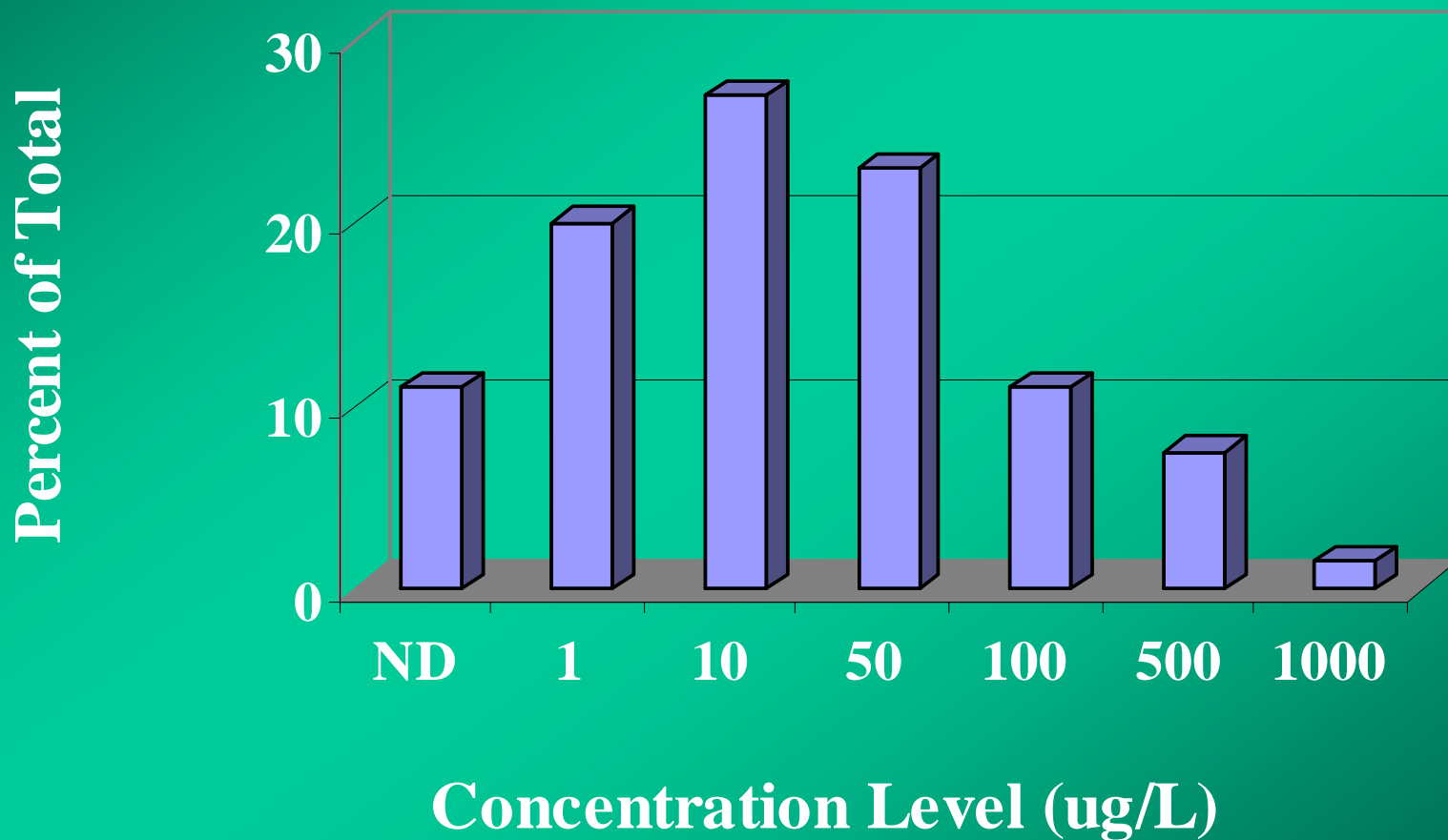
St. Johns River *Microcystis* Bloom- 2005



photos courtesy of Dr. Gerry Pinto, Jacksonville University Manatee Research Center

St. Johns River- Microcystins

St. Johns River Water Management District



World Health Organization Suggested Monitoring Levels for Recreational Waters

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Public Health Advisories

- Duval County Health Department

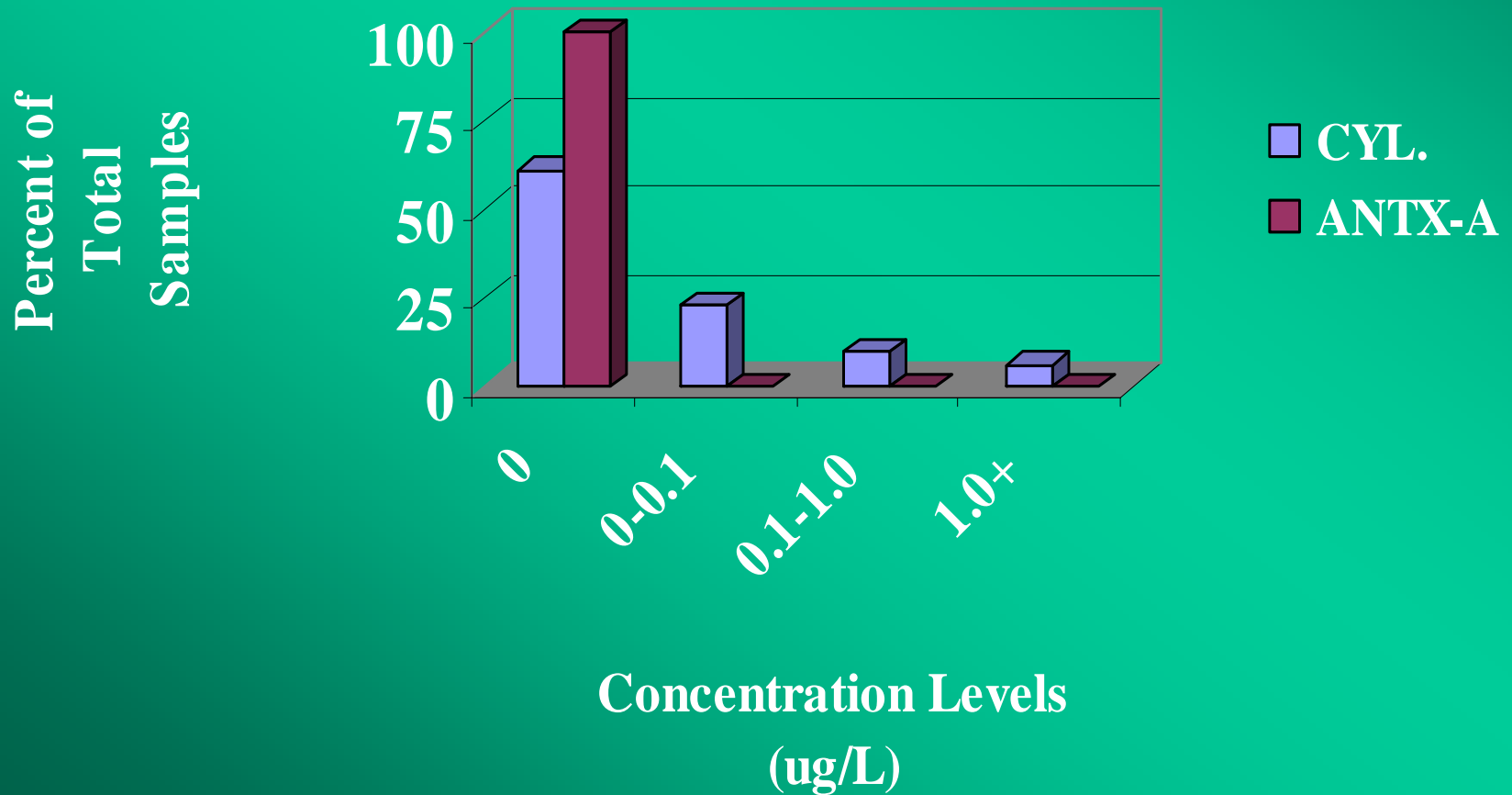
Health Alert/Avoid Scum Formations

- St. Johns River Water Management District

Weekly Press Releases/Bloom Tracking

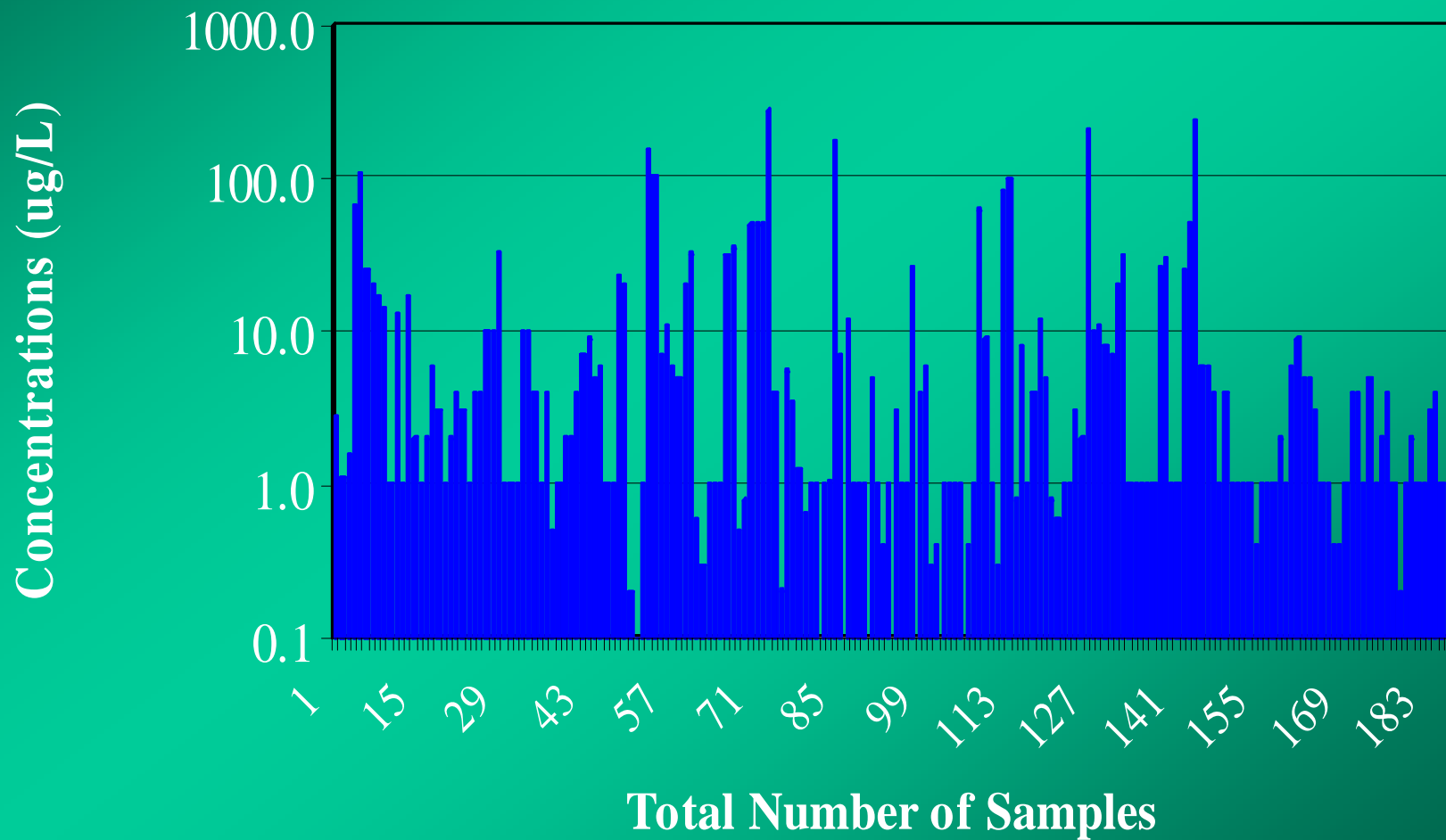
St. Johns River - 2005

Cylindrospermopsin and Anatoxin-a



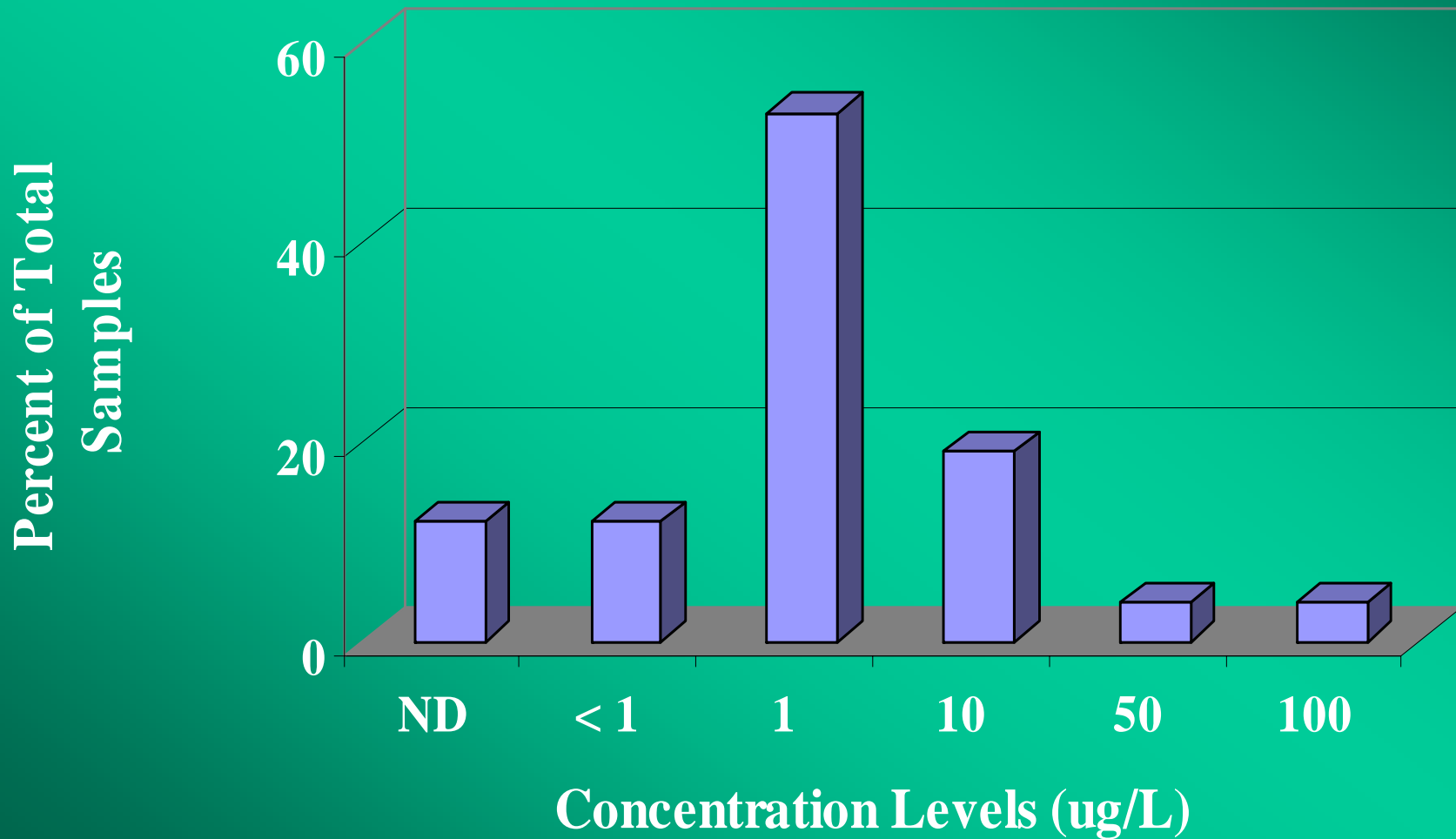
South Florida Microcystins

South Florida Water Management District-2005



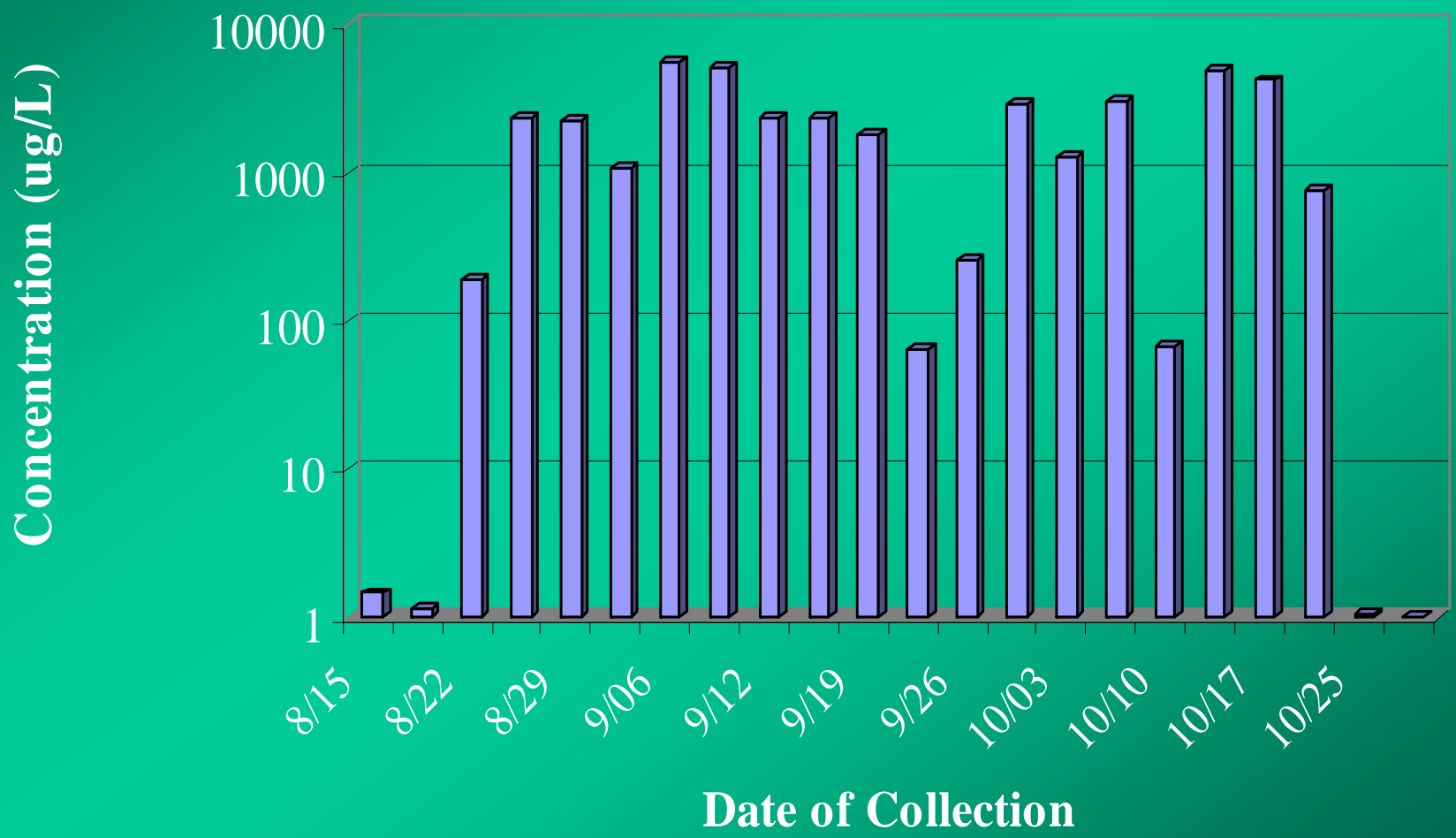
South Florida Microcystins

South Florida Water Management District-2005



Southwest Florida Water Body

August - October, 2005



Port Angeles Peninsula Daily News, WA 2006-06-07

Lab Tests Confirm Deadly Algae in Anderson Lake; State Park Remains Closed Indefinitely

by EVAN CAEL

CHIMACUM -- Laboratory tests of blue-green algae from Anderson Lake showed Tuesday that high concentrations of toxicity did exist in the state park lake that Jefferson County health officials shut down Saturday.

The algae poisoned three pet dogs which drank from the lake, resulting in the deaths of two.

St. Augustine Record Wednesday, June 14, 2006

WORSE ALGAL BLOOM LIKLEY THIS YEAR

By RICHARD PRIOR

And it's back with a vengeance.

An aerial photograph taken in front of expensive homes in Mandarin shows broad waves of blue-green algae swirling around docks in front of the property.

The photo shows few clear spots in the river. A swimmer or boater couldn't get to them without plowing through the green ooze.

That was last August's algal "bloom." It's already worse this time around.

"There's more algae in the St. Johns River now than there was last year," environmental scientist John Hendrickson said. "You don't see all of it because it's spread out through the whole water column. If you go out there and fill a clear water bottle, it's going to be notably green."

Microcystis is part of the group of blue-green algae responsible for most freshwater blooms worldwide. Microcystis can float to the top of the water column to get light and sink low to get nutrients.

Jackson County Floridan,
Thursday, August 24, 2006

Muck on the Mill Pond

By DEBORAH BUCKHALTER



Butch Odom sees nothing but muck when he looks out across Merritt's Mill Pond from his dock on the water. He can't get a boat out for the eel grass, duckweed and algae blocking the way. Swimming is out of the question, and fish are scarce or too hard to reach. The aquatic plants have formed a carpet of green on the surface of the water. As a child, decades ago, Odom says, the water was so clear he could see bottom. His frustration about the current state of the pond reached a boiling point this week, and on Tuesday he demanded action of the Jackson County Board of Commissioners. He convinced them to draft a letter to the state, asking that something be done. Commissioners agreed to send a letter to the very top of the governor's office. County Administrator Ted Lakey said the letter was still being prepared as of Thursday, with more research needed before it could be completed. He said the county will likely be asking that the governor dispatch the proper state agency to look into the matter, rather than asking for a specific action to be taken.

High Springs Herald, September 7, 2006

River in Danger – Algae Killing Ichetucknee Springs

By Christa Jenkins-Desrets
Herald Writer



Photo By Emily Jourdan

An egret flies over the Ichetucknee River, a river that experts say is slowly dying because of algae that is coating the surface of the water and the underwater plant life, killing it.

FORT WHITE - The cool, clear water of the Ichetucknee River gently flows around tubers enjoying one of their final floats this season.

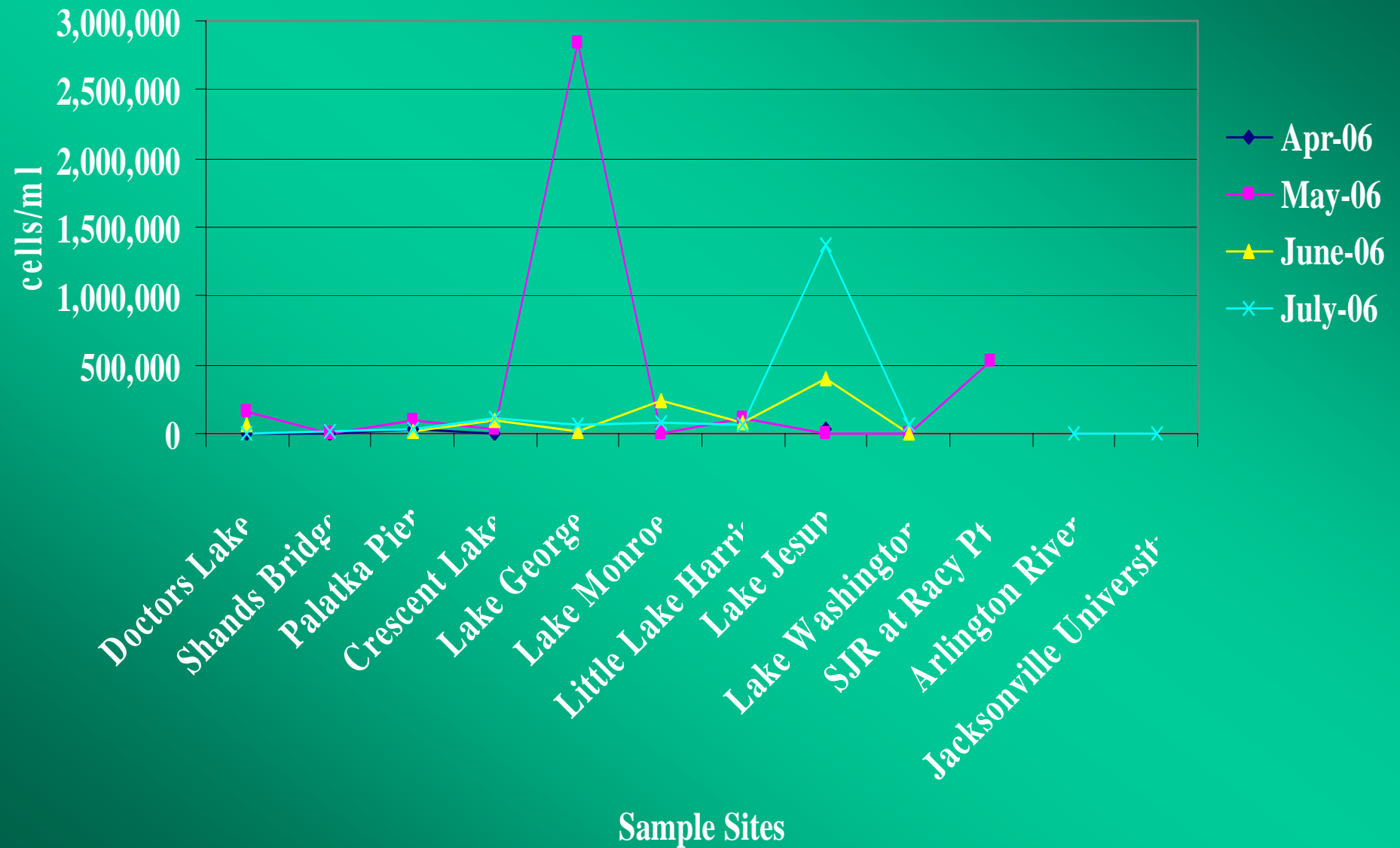
To those who visit the river as a retreat into nature's beauty, the water is pristine, one of the few bodies left untouched by the complications of civilization.

But to many experts, changes to the river are coming at an alarming rate.

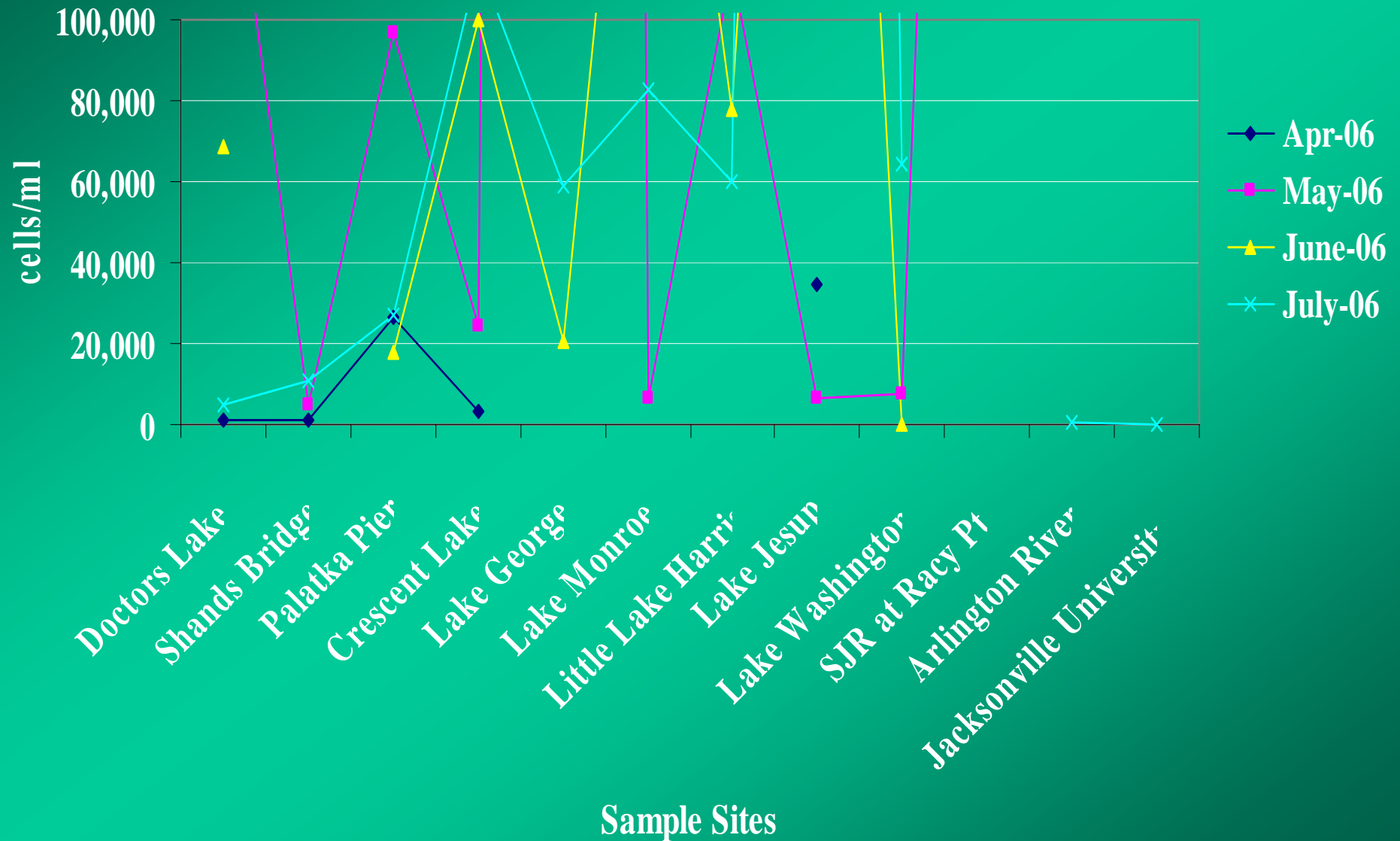
Slow though the changes may be to the visitors' eyes, experts say, the changes in plant and animal life have intensified over the past several years.

That intensification may even affect visitors to the springs. Some people have had severe allergies from something in the river, causing reactions as minor as itchiness to as serious as cardiac arrest.

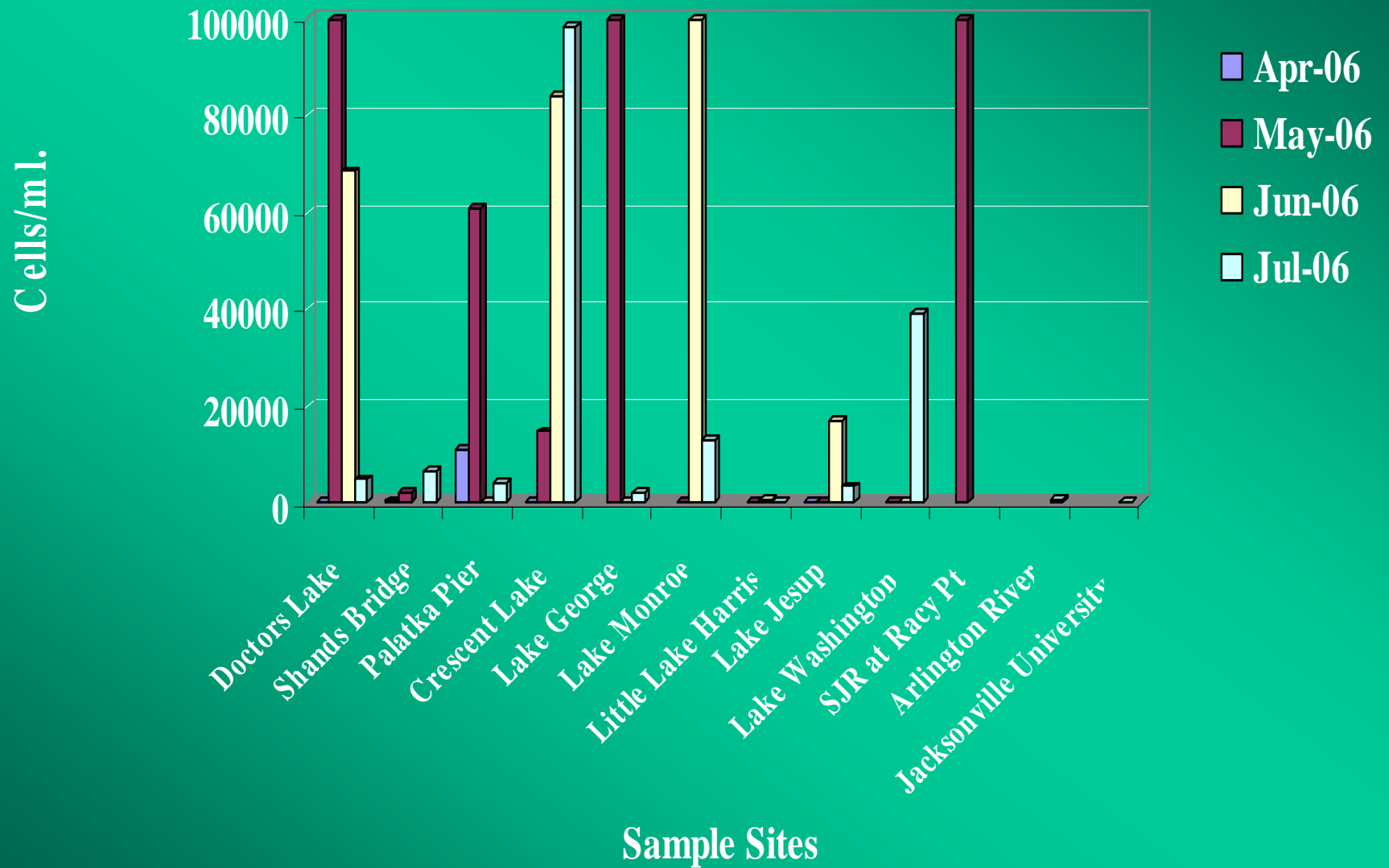
Potentially Toxigenic Algal Concentrations - 2006



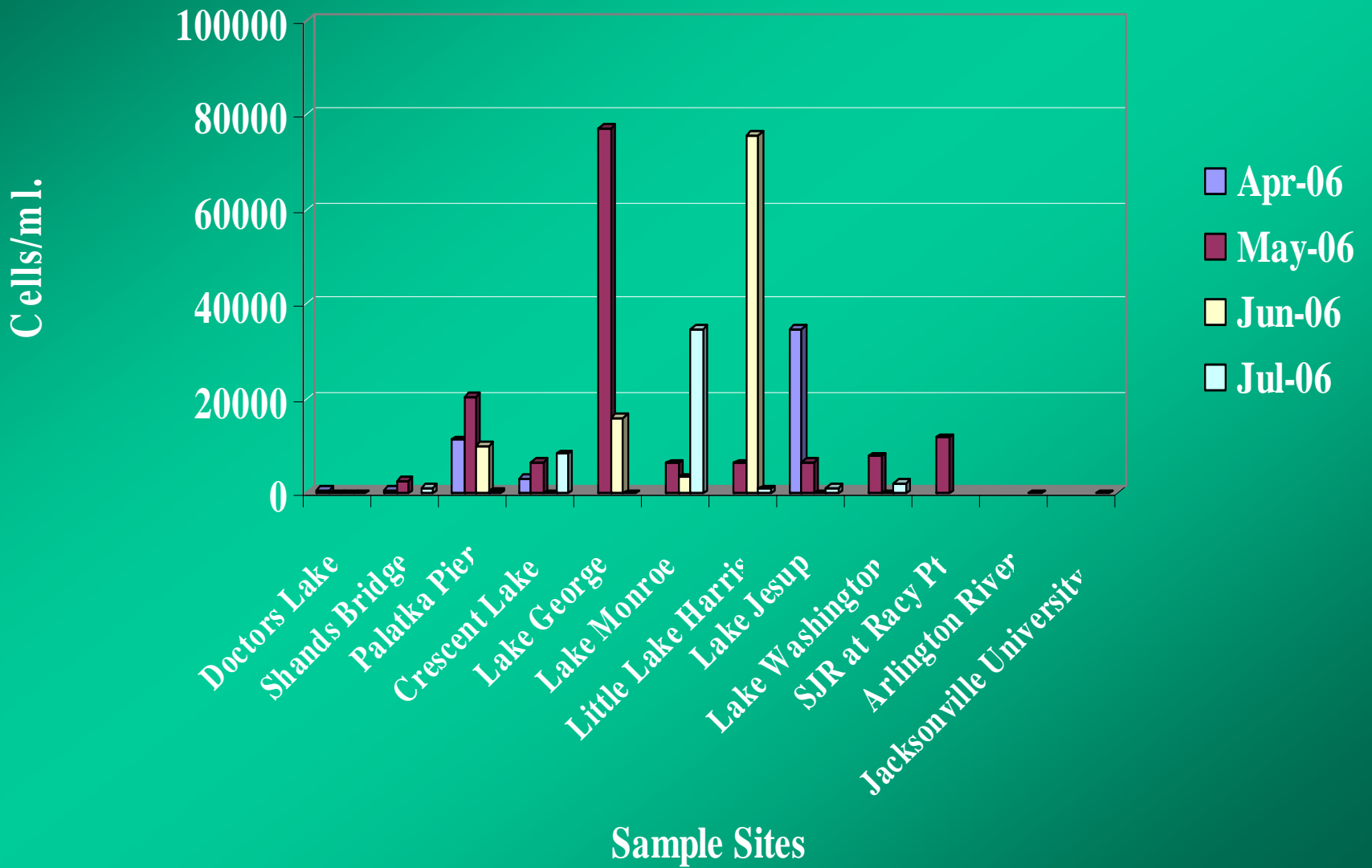
Potentially Toxigenic Algal Concentrations - 2006



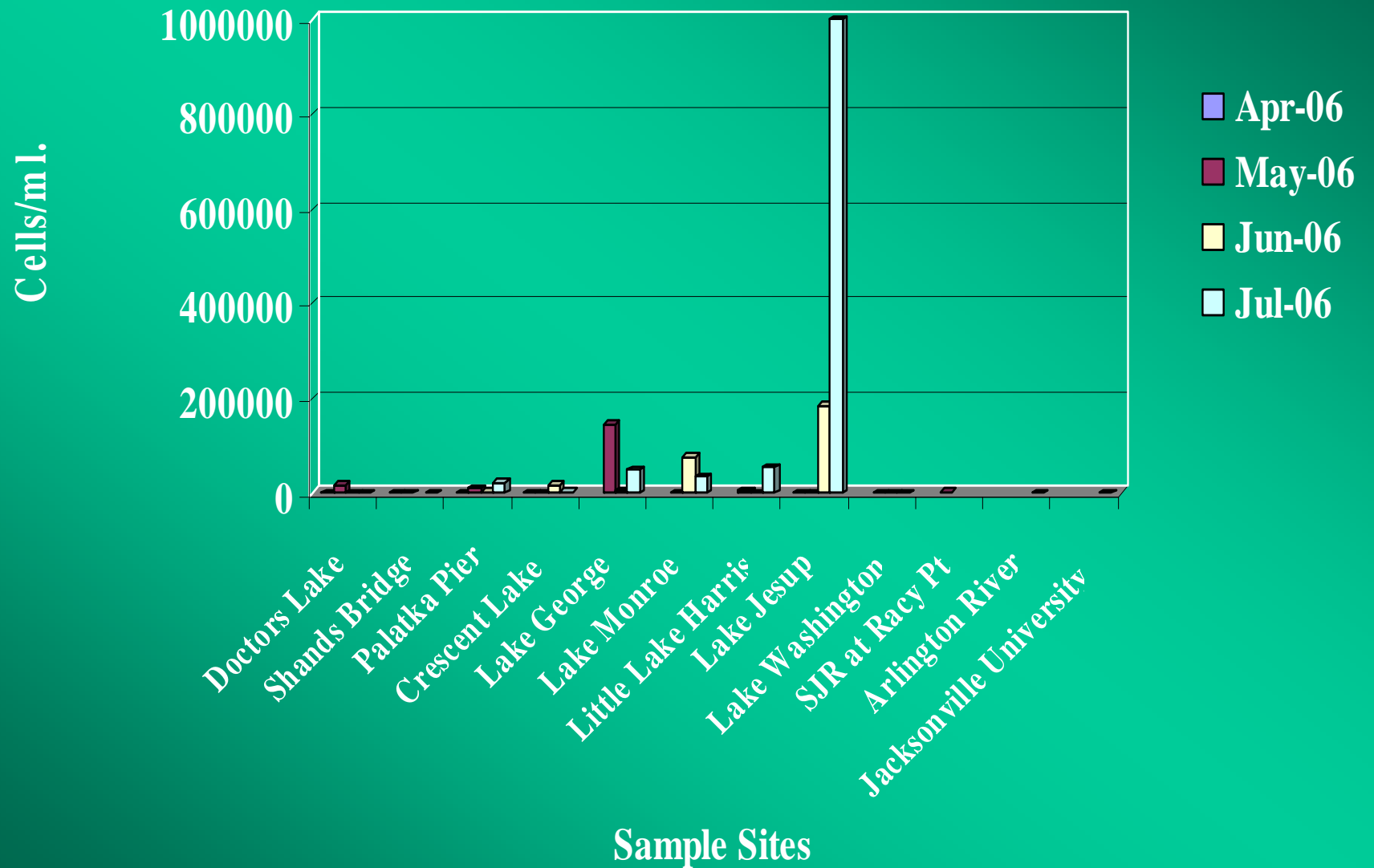
Population Abundance of *Anabaena* spp.



Population Abundance of *Microcystis* spp.



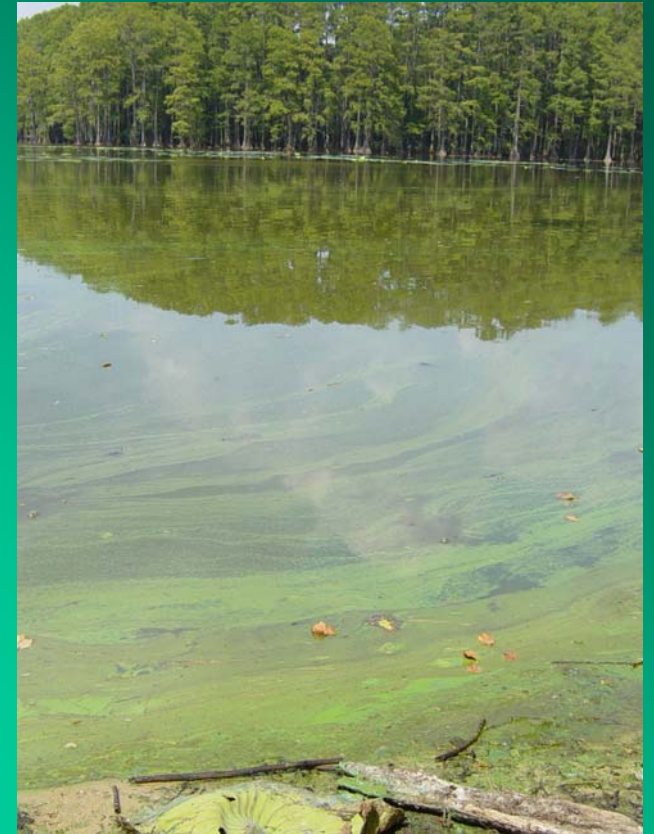
Population Abundance of *C. raciborskii*



Cyanotoxin Data for Recreational Water Sites

- Microcystins: ND – 2.3 ug/L
20/34 (59%) ND
- Cylindrospermopsin: ND – 0.6 ug/L
26/32 (81%) ND
- Anatoxin-a: not reported

Lake Munson



FDOH and Other Cyanotoxin Data

- Lake Wauberg (3 months)
Microcystins: 5-8 ug/L
Anatoxin-a: 0.1-1.0 ug/L
- Lake Munson (2 months)
Microcystins: 20-46 ug/L
Anatoxin-a: ND
- Florida Springs/ *Plectonema wollei*
Lyngbyatoxins/Aplysiatoxins/Saxitoxins

Center for Disease Control

Florida Department of Health

Bear Lake/Muskegon, Michigan

GWL-FDOH/Mote Marine Lab./Lovelace

Recreational Exposure Epidemiological Study

August of 2006

Modest bloom of *Microcystis* spp.

In general, 2-5 ug/L: Surface accumulation
approx. 40 ug/L

Aerosols of microcystin detected
(Lovelace)

Human Health Effects?

Conclusions/Hypotheses

- Algal species dynamics are important
- Weather patterns are significant
- Lake specific differences/Interannual differences
- Toxins can co-occur
 - Microcystins are primary concern
 - Cylindrospermopsin/Anatoxins/Saxitoxins?
- Microcystins are aerosolized
- Monitoring is vital/Public Information

GreenWater Laboratories/ CyanoLab

www.greenwaterlab.com

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