On the Front Line: Response to Algae Blooms in South Florida

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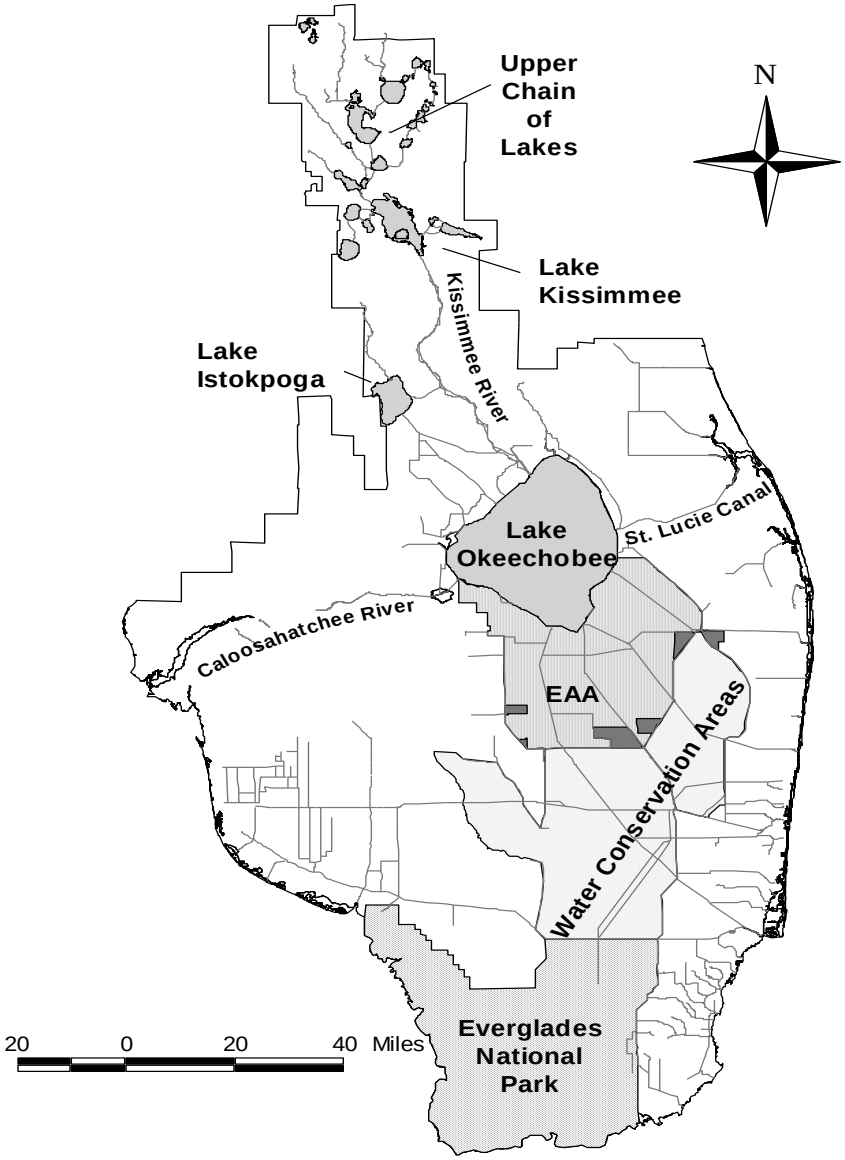


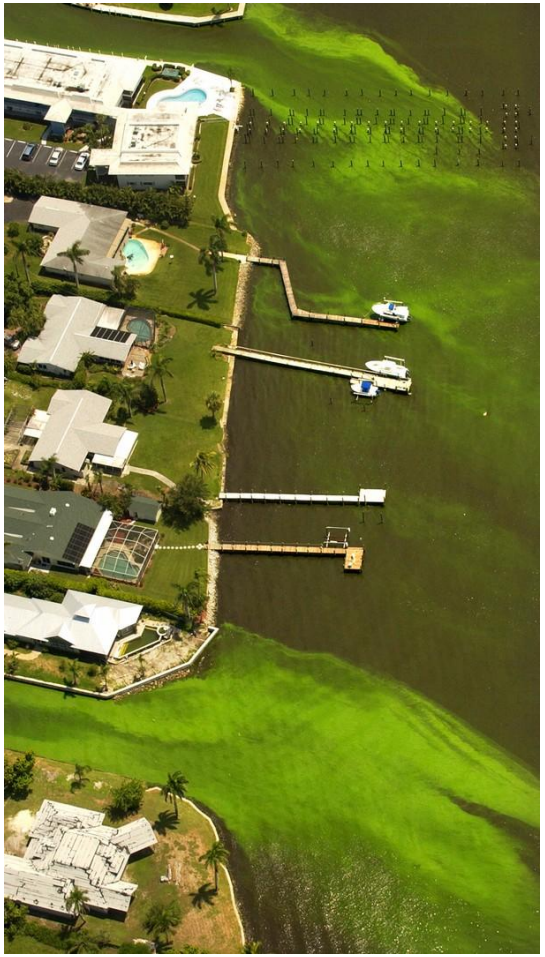
SFWMD Regional Monitoring

- 16 counties
- 46,439 kilometer^2
- 2,898 km of canals
- 22 major pump stations
- 2,220 water control structures
- ~1800 sampling locations

Recipe for Algal Blooms

- Prolonged periods of intense sunlight
- Nutrients
- Little or no movement of the water body
- Warm temperatures
- Low turbidity

Unprecedented Blooms in 2005

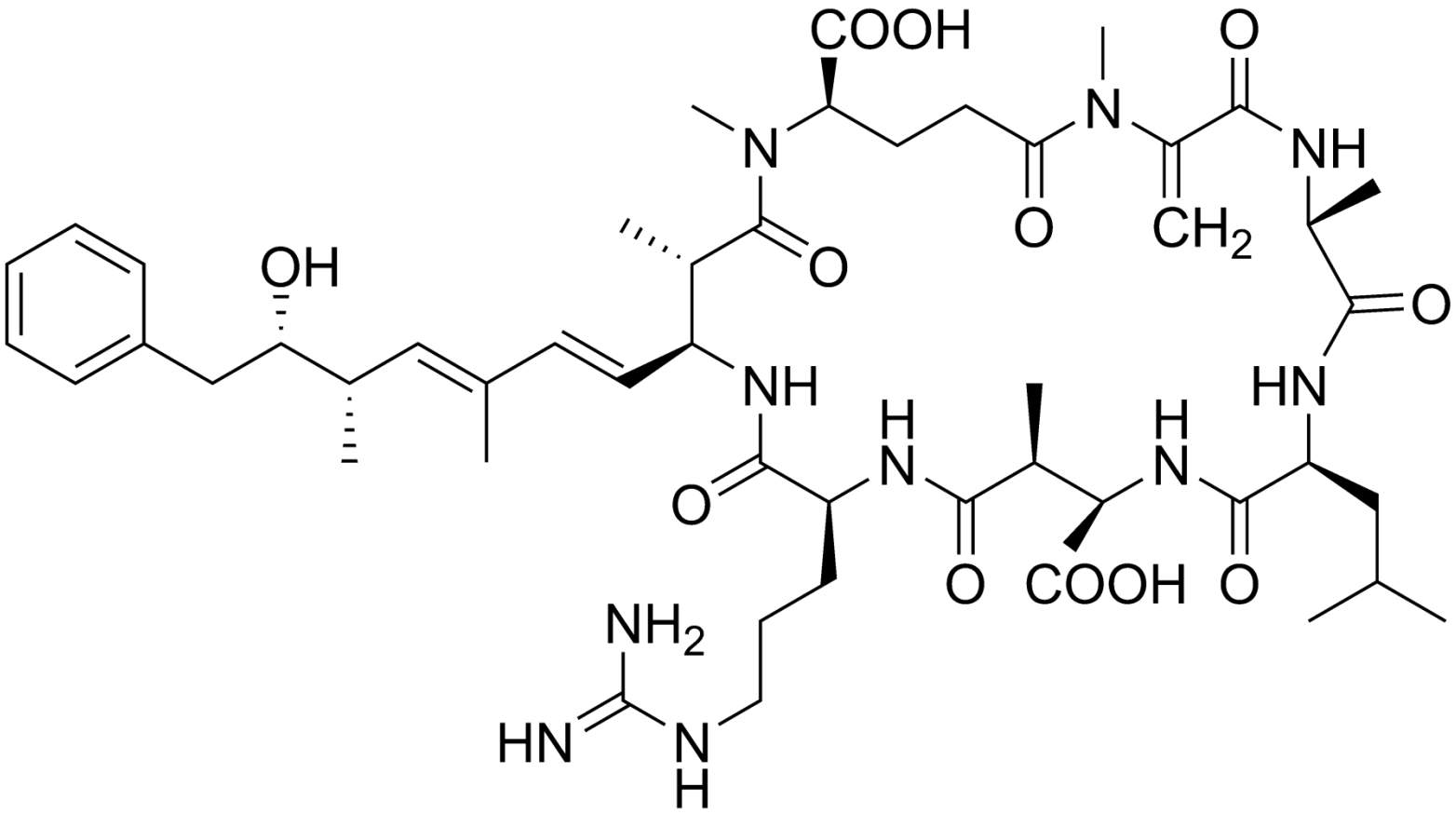


WARNING: ALGAE ALERT
STAY OUT OF WATER
NO DRINKING
BY HUMANS OR ANIMALS
NO EATING FISH
FOR MORE INFORMATION:
CALL (239) 274-2204
LEE COUNTY HEALTH DEPARTMENT

St. Lucie Scum!

Microcystis aeruginosa

Target Analyte - Microcystin LR



Methodology

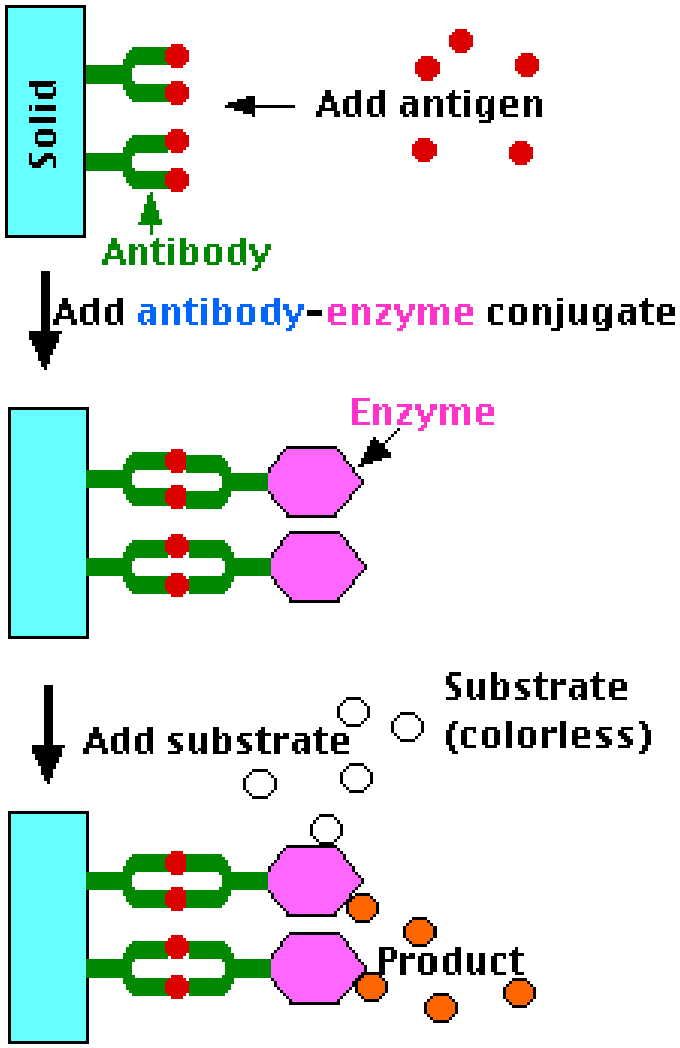
- Sample Preparation
- Method of Analysis
- Standards/Quality Control
- Reporting Results
- Sample Containers
- Holding Times
- Round-Robin Results
- Sample Collection

Sample Preparation

- Autoclave
- Tightly capped glass tubes
- Liquid cycle
- 30 minutes

Analytical Method

Competitive ELISA



Cross Reactivity

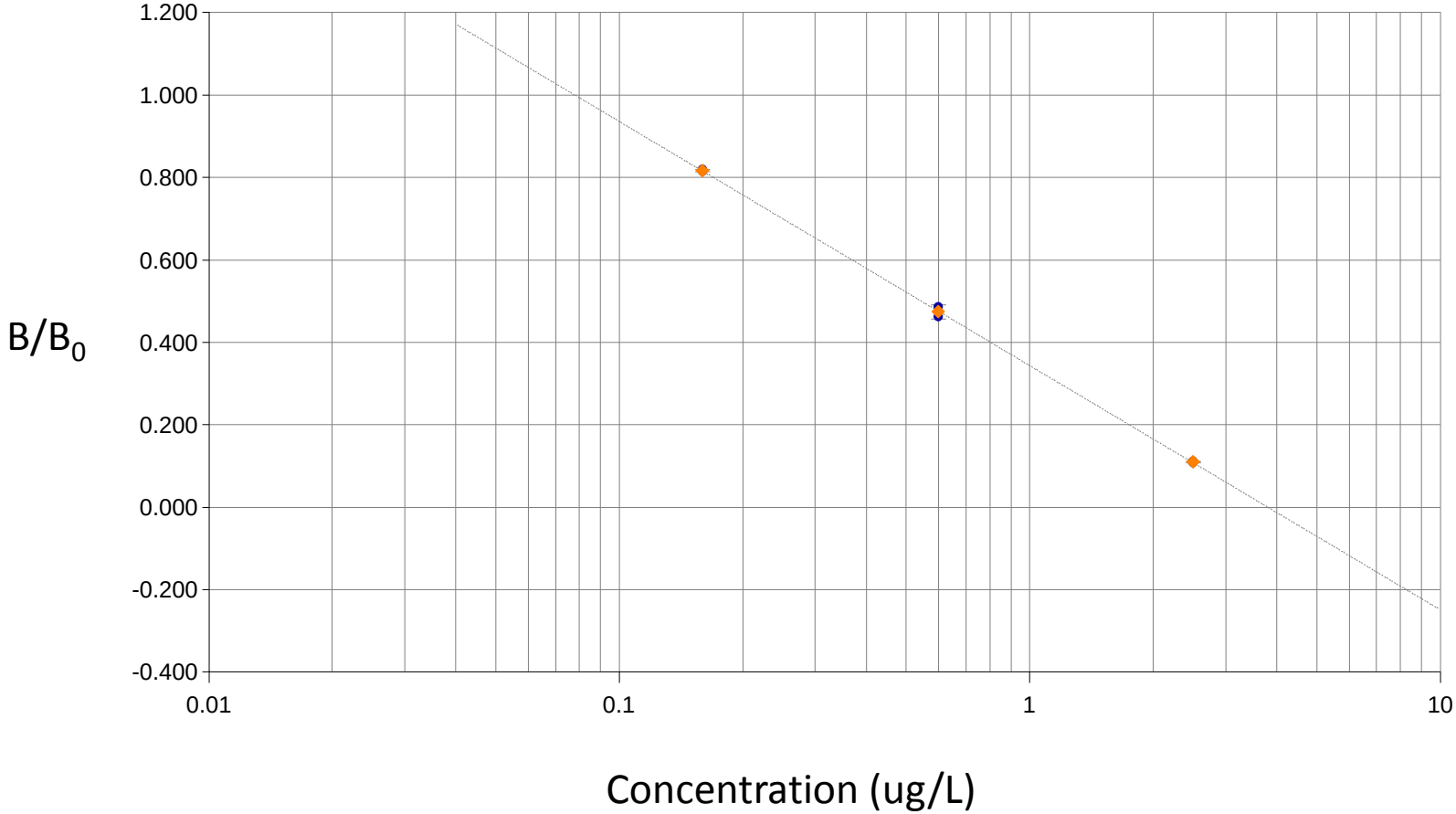
Compound	50% B_0*	LOD
Microcystin LR	0.50	0.15
Microcystin LA	0.81	0.24
Microcystin RR	0.92	0.27
Microcystin YR	1.42	0.44
Nodularin	0.73	0.21

* 50%B_0: the absorbance of microcystins at these concentrations is 50% of the absorbance of negative control.

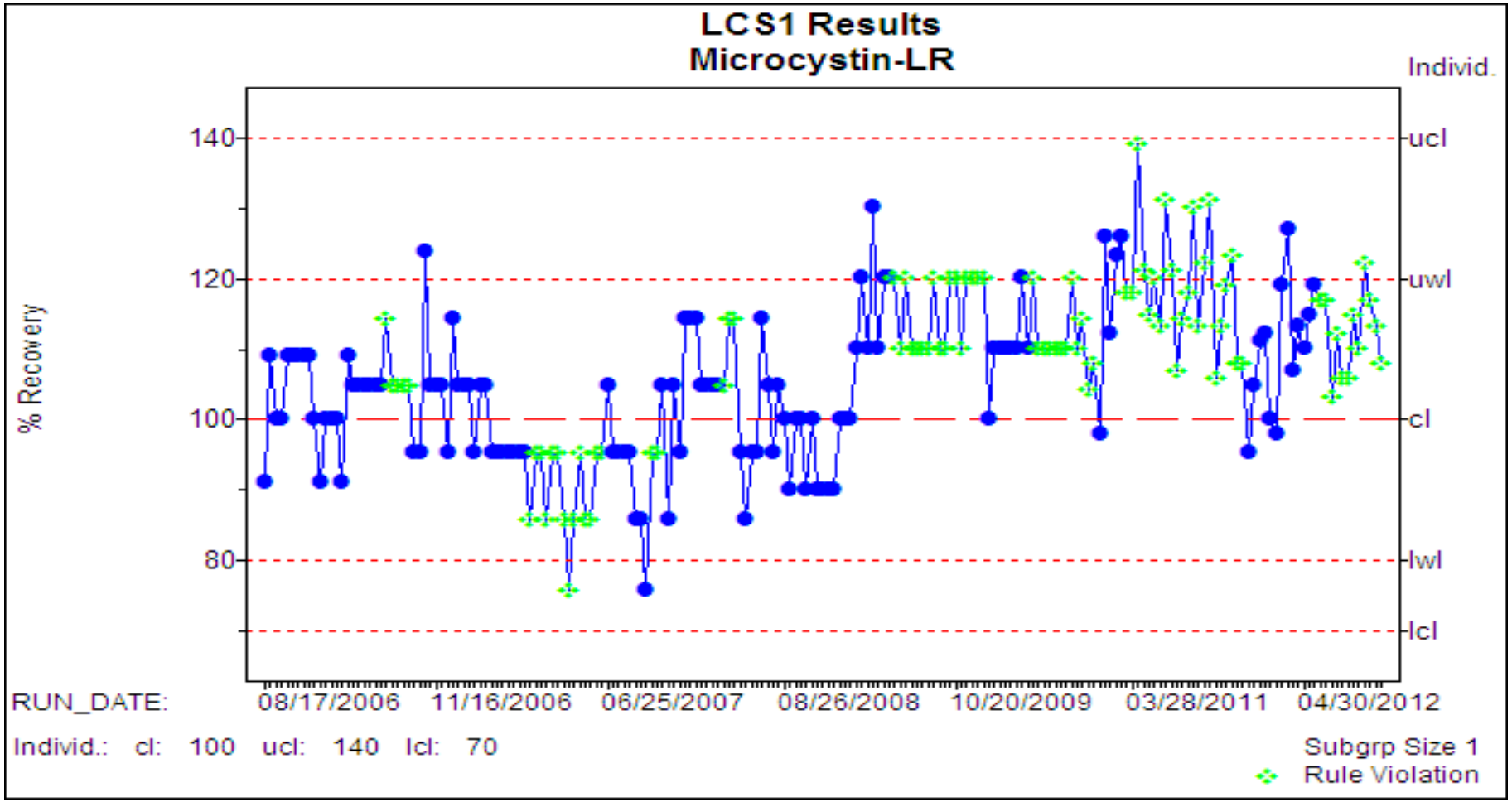
Typical Calibration Plot

(Biotec Synergy @ 450 nm)

25 uL Sample Volume, Average of 2 Wells

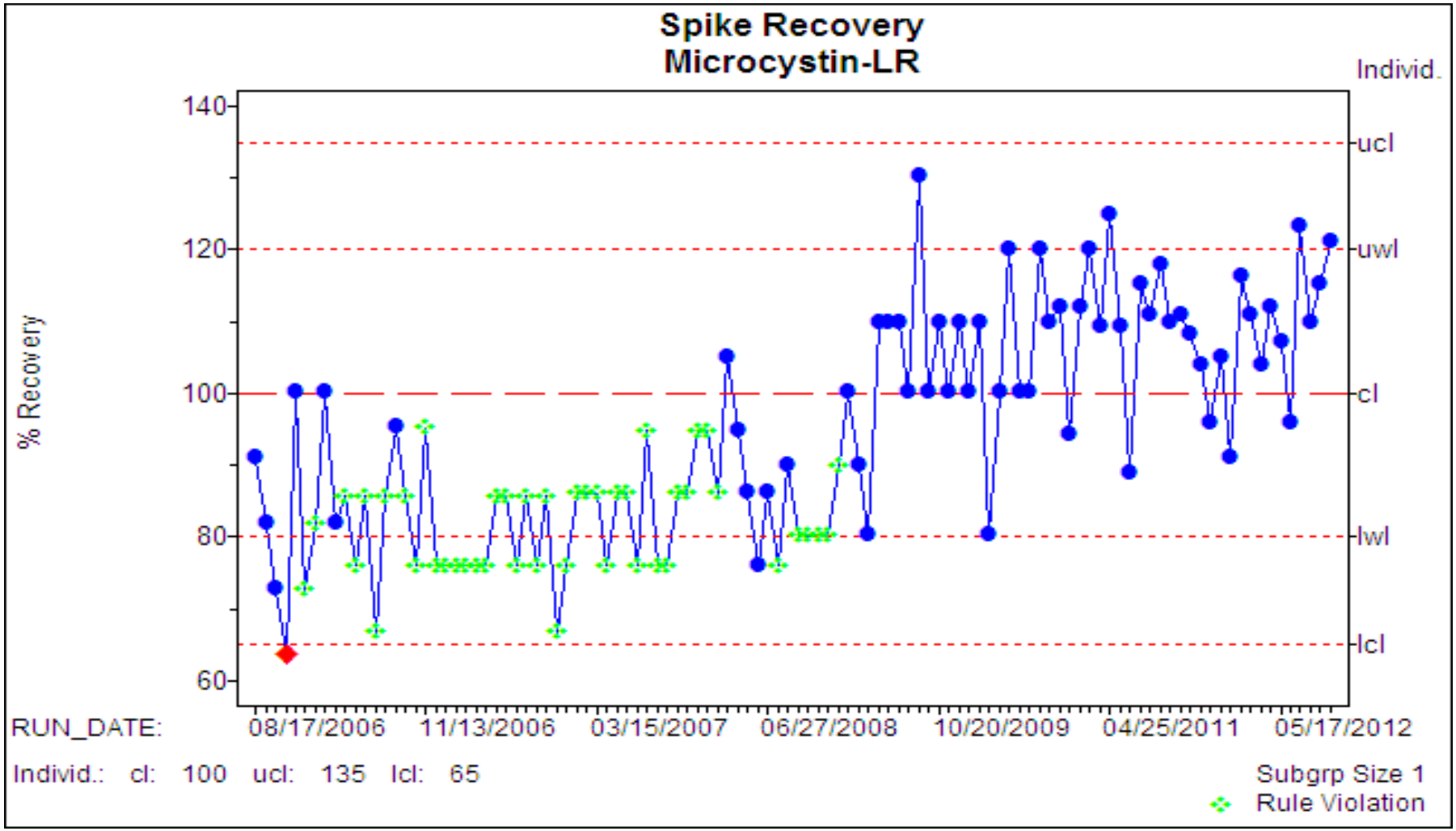


Quality Control Results



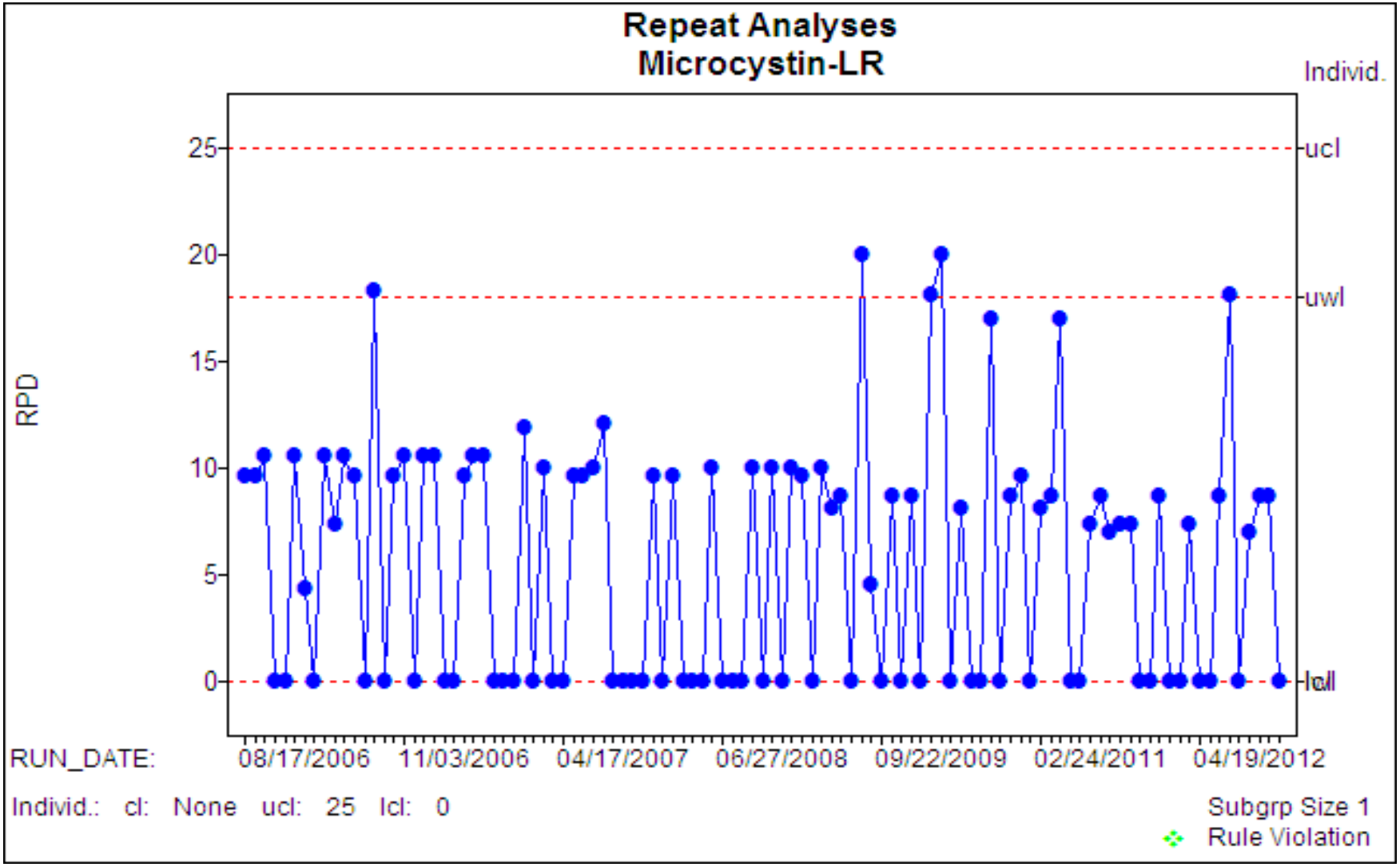
LCS1 Concentration 1.0 ug/L Microcystin LR

Matrix Spike Recoveries



Samples spiked with 1 ug/L Microcystin LR

Matrix Spike Duplicates



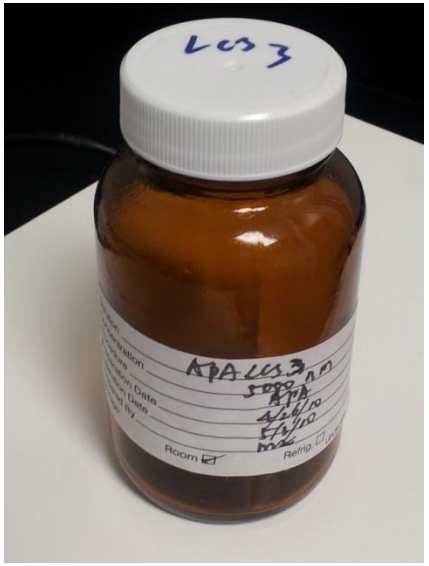
Reporting Results

- Reporting Units → ug/L as Microcystin LR
- Detection Limit = 0.2 ug/L*
- Estimated Uncertainty = +/- 19.2%**

*40 CFR Part 136

** Nested hierarchical methodology by Ingersoll

Sample Containers

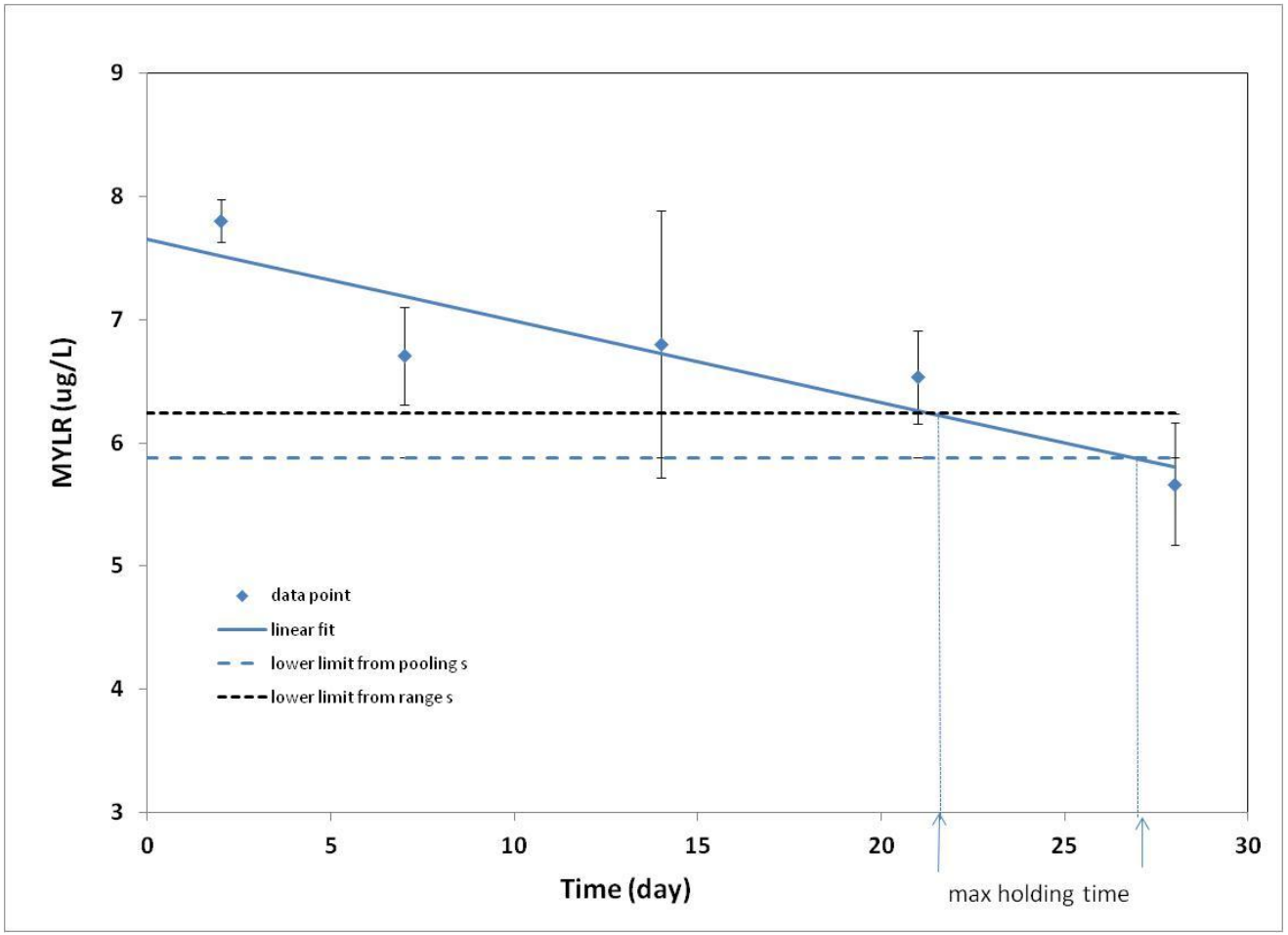


Microcystin LR adsorption in different type bottles (n=3)

SAMPLE	DAY 0*	DAY 1	DAY 3	DAY 7
GLASS_DI	1.8±0.03**	1.7±0.05	1.8±0.03	1.9±0.05
HDPE_DI	1.8±0.03	0.6±0.10	0.3±0.04	0.4±0.05
GLASS_NACL	1.8±0.08	1.8±0.09	1.6±0.06	1.8±0.13
HDPE_NACL	1.8±0.08	0.5±0.05	0.3±0.03	0.6±0.04

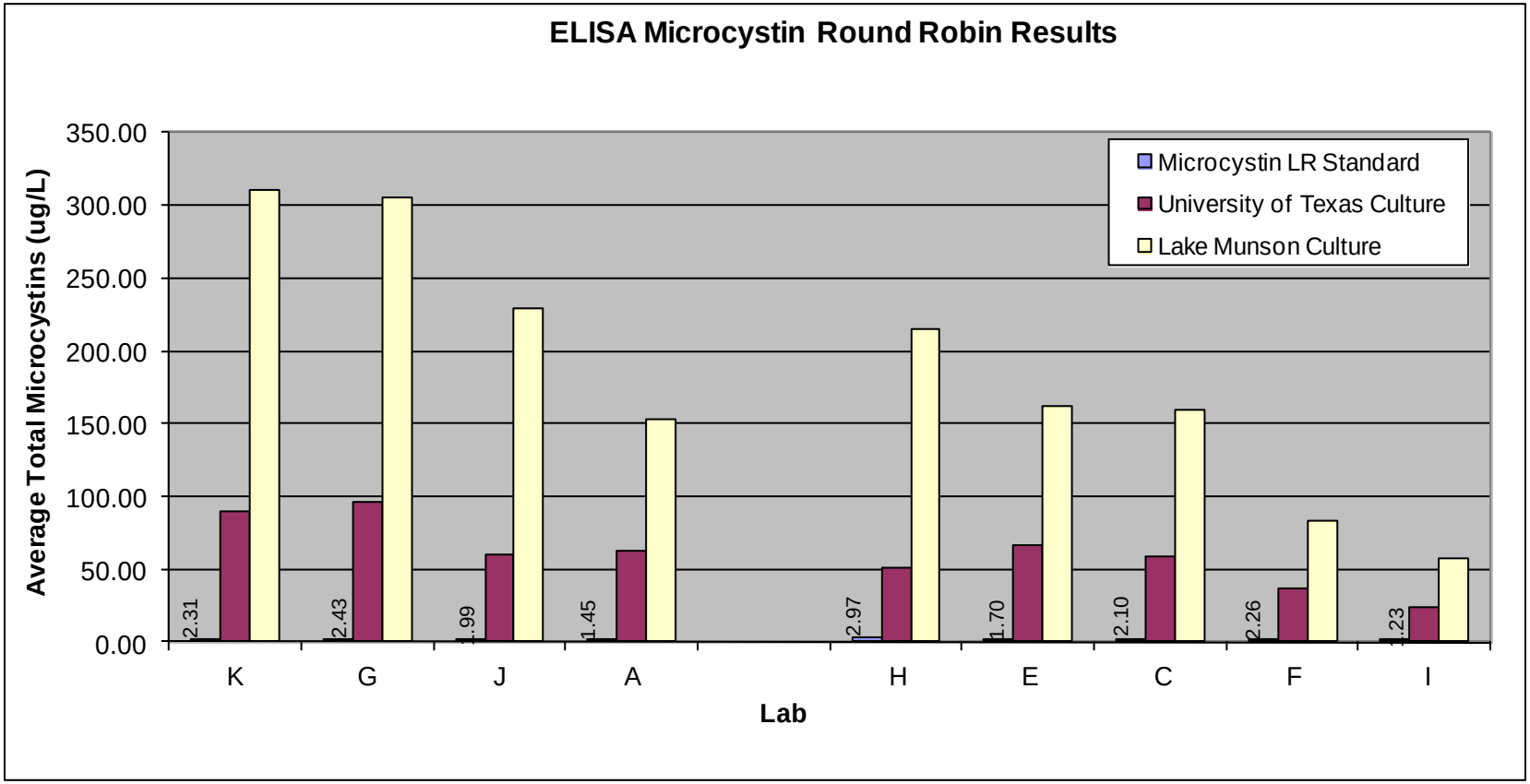
* Day 0 data are the initial microcystin LR concentrations from DI and NaCl microcystin LR samples before pouring them into the (glass and HDP) bottles.
** one standard deviation

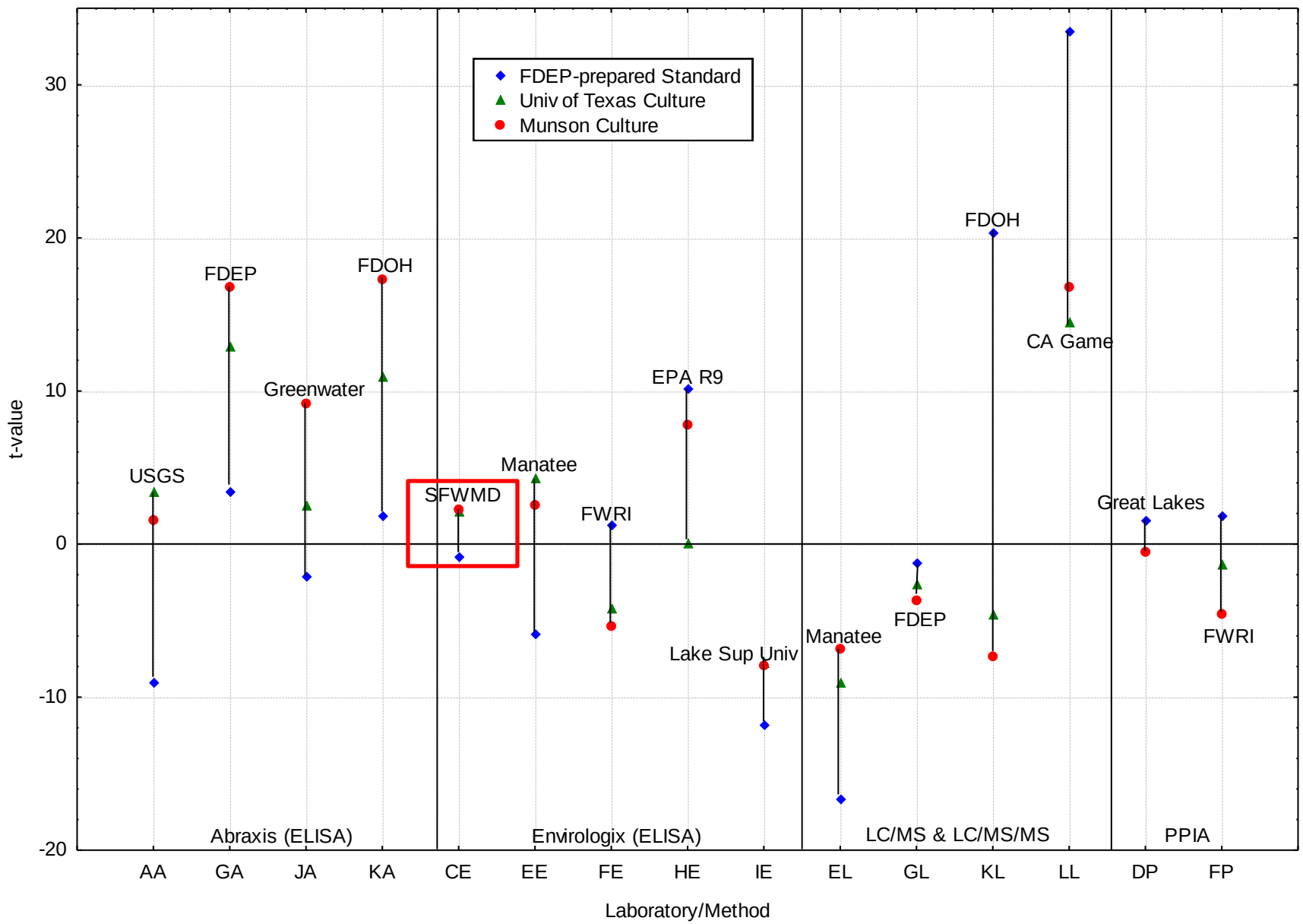
Holding Times



Samples stored at 4°C in glass containers

Round Robin Testing




FDEP-prepared Standard
Univ of Texas Culture
Munson Culture
t-value
30
20
10
0
-10
-20
USGS
FDEP
Greenwater
FDOH
SFWMD
Manatee
FWRI
EPA R9
Lake Sup Univ
Manatee
FDEP
FDOH
CA Game
Great Lakes
FWRI
Abraxis (ELISA)
Envirologix (ELISA)
LC/MS & LC/MS/MS
PPIA
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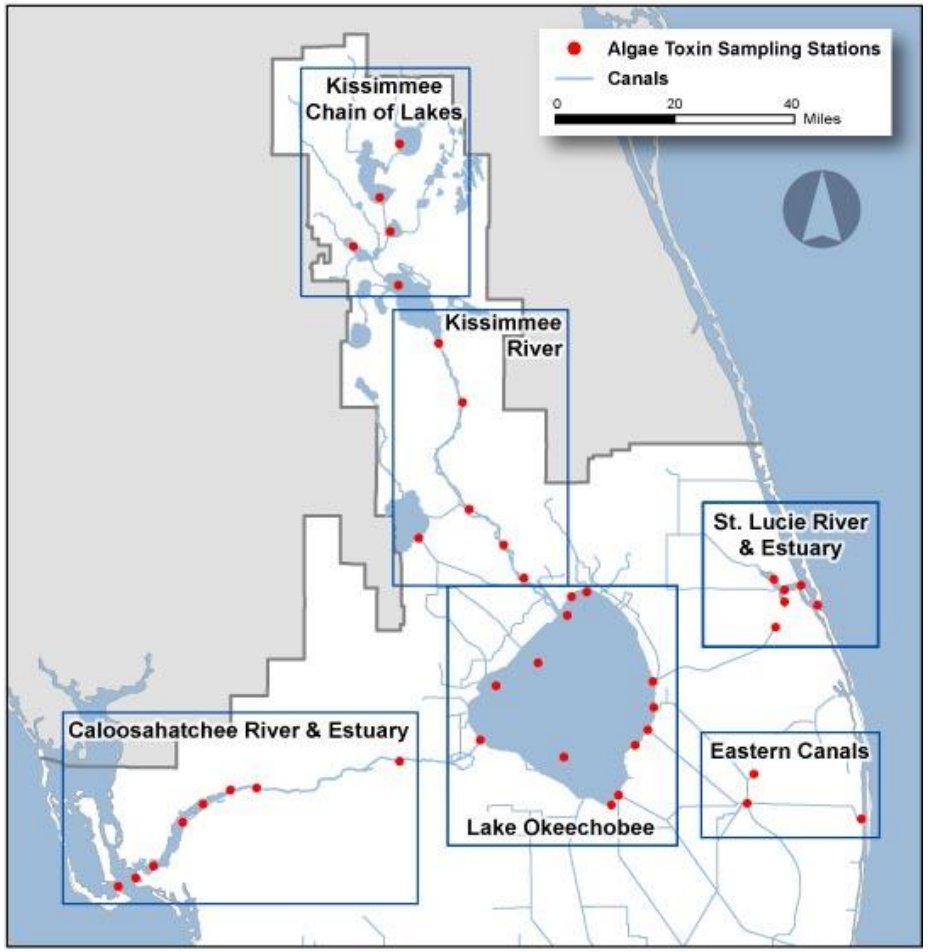
Laboratory/Method

Sample Collection

- Fixed Monitoring Locations
- Depth = Surface (0-10 cm)
- Collect Directly into Containers – Amber Glass
- Record location and extent of bloom

Sampling Stations



Maximum Observed Concentrations since 2005

- Caloosahatchee: 927 ug/L - 10/17/05
- Kissimmee: 83.5 ug/L – 10/12/05
- St. Lucie: 25.8 ug/L – 8/25/05
- Lake Okeechobee: 815 ug/L – 10/11/05

Blue-Green Algae Home - Microsoft Internet Explorer provided by SFWMD

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Blue-Green Algae

The facts on the floating phenomenon

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- FAQs

Blue-Green Algae

What is that neon green "*stuff*" we're seeing in lakes and waterways all over Florida? It's a variety of blue-green algae: a naturally occurring phenomenon that can be found around the world, not just in our backyard!

It grows when conditions are right: when nutrients such as phosphorus are in the water, and waters are warm and calm. That's why blue-green algae are most common in Florida in the summer, with its high temperatures and seemingly constant rainfall. When it's only present in small patches, you may not have noticed it.

Why So Much Now?

The hurricanes of 2004 churned up sediments in Lake Okeechobee that released a great deal of phosphorus into the water. Runoff of stormwater from our cities, farms and homes also adds nutrients to all of our waterways. And we're still in the middle of summer.

Blue-green algae growth can become seemingly explosive when lots of nutrients are present, providing a rich feast which can then cause "blooms" what may look like floating carpets of blue-green algae that turn the water green. Florida — along with Michigan, Oregon and Virginia — are currently experiencing massive algal blooms.

Some – not all – species of blue-green algae can produce toxins that can affect public health.Those blue-green algae that are known to produce toxins, do not always do so. Little is known about exactly what environmental conditions trigger toxin production.

The blooms in South Florida Water Management District waterways are caused by blue-green algae called Mycrocystis. These blue-green algae are not always toxic but can form toxic strains. The toxin – called microcystin – can be a threat to fish, pets, livestock, wild animals and humans if ingested or inhaled. However, information regarding toxins from blue-green algae and risks to humans, fish and wildlife is very limited.

September 12, 2005

Emergency Status

Current Situation: The District is now in **RECOVERY-EVALUATION PERIOD** for **HURRICANE Katrina**. more >

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Internet

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Task Force

- South Florida WMD
- St. Johns River WMD
- Department of Environmental Protection
- Florida Department of Health
- Center For Disease Control

Task Force Activities

- Coordinate monitoring programs
- Share technical information
- Coordinate public information
- Coordination with drinking water utilities

Conclusions

- ELISA is a reasonably good method for routine monitoring of microcystins but be prepared to make lots of dilutions
- ELISA results must be reported in terms of Microcystin LR “equivalents” as the assay is not specific to a single variant
- Not all blooms produce toxins
- Coordination with other agencies is essential when reporting toxin levels

Questions?

- Feel free to contact me, my email address is dstruve@sfwmd.gov
- I can also be reached at (561) 681-2500 x4521