

# Algal Toxins in Minnesota

*Brief Overview for NWQMC call May 14, 2015*

***Steve Heiskary, Research Scientist  
Environmental Analysis & Outcomes Division***



**Minnesota Pollution  
Control Agency**

# Outline



- History with Algal Toxins
- Response to dog deaths & HAB concerns
  - “targeted” sampling;
    - case study examples
- Randomized studies: NLA 2007 & 2012;
- Comparison of results
- Summary

# Minnesota History With Algal Toxins

- Late 1800's - First accounts of algal toxicity in MN;
- 1990's - Increasing concern and reports world wide;
- 2004 -Three dog deaths (Fish and Benton Lakes) prompted more attention on this issue in MN.
- 2005 -MPCA joined MDNR, MDH and the Minnesota Veterinary Medicine Association (MVMA) to form the Minnesota Blue-green Algal Toxicity Workgroup
- 2006 study conducted to examine Microcystin (MC) in 12 eutrophic lakes in two south central MN counties
- 2007 Five suspected dog deaths
  - NLA: MN sampled MC in 50 lakes: mid-lake & nearshore;
  - MC monitored in 35 targeted southern MN lakes
- 2009 – Published comprehensive article on work-to date
- 2012 – NLA: MN sampled MC in 150 lakes
- 2014 – 3 dog deaths in “non-bloom” waters
- 2014 - Published paper on all MC data;

# Case Study #1. Lake Benton, September 2004

## “Targeted” sampling

1. Sept. 24-25 - Two dog deaths over weekend;
2. Sept. 27<sup>th</sup> -MPCA regional office notified about a dog death;
3. Sept 28<sup>th</sup> Marshall MPCA staff responded.
4. Residence where the dog died the water was “clear” and DO normal.  
Elsewhere evidence of blooms & fish kill
5. Microcystin at 100 ppb; Saxitoxin ~0.2 ppb



## Case Study #2. Little Rock Lake, Benton County: July 2007

- Response to numerous WQ & odor complaints;
- July 25, 2007 sampling & observations by MPCA;
- Strong wind from S piled algae N & W shores.
- Samples at four sites from Little Rock Creek inflow, county park beach, west shore & outlet.
- Benton Co. closed beach;



# Little Rock Lake, July 2007 ("targeted" samples)

Chl-a: 120-130 ppb

MC: 20 to >80,000 ppb

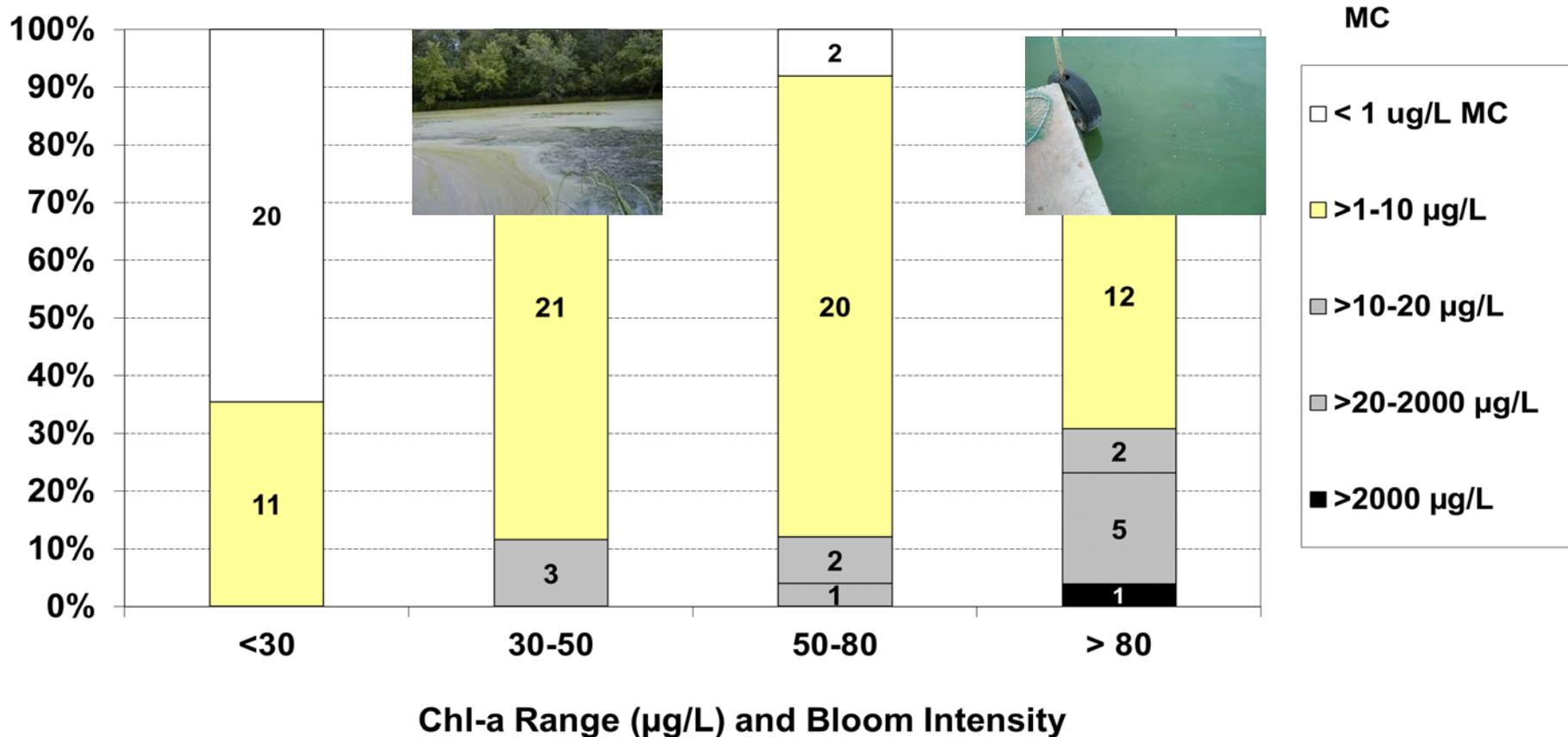
Saxitoxin 0.03-0.04 ppt (ng/L)



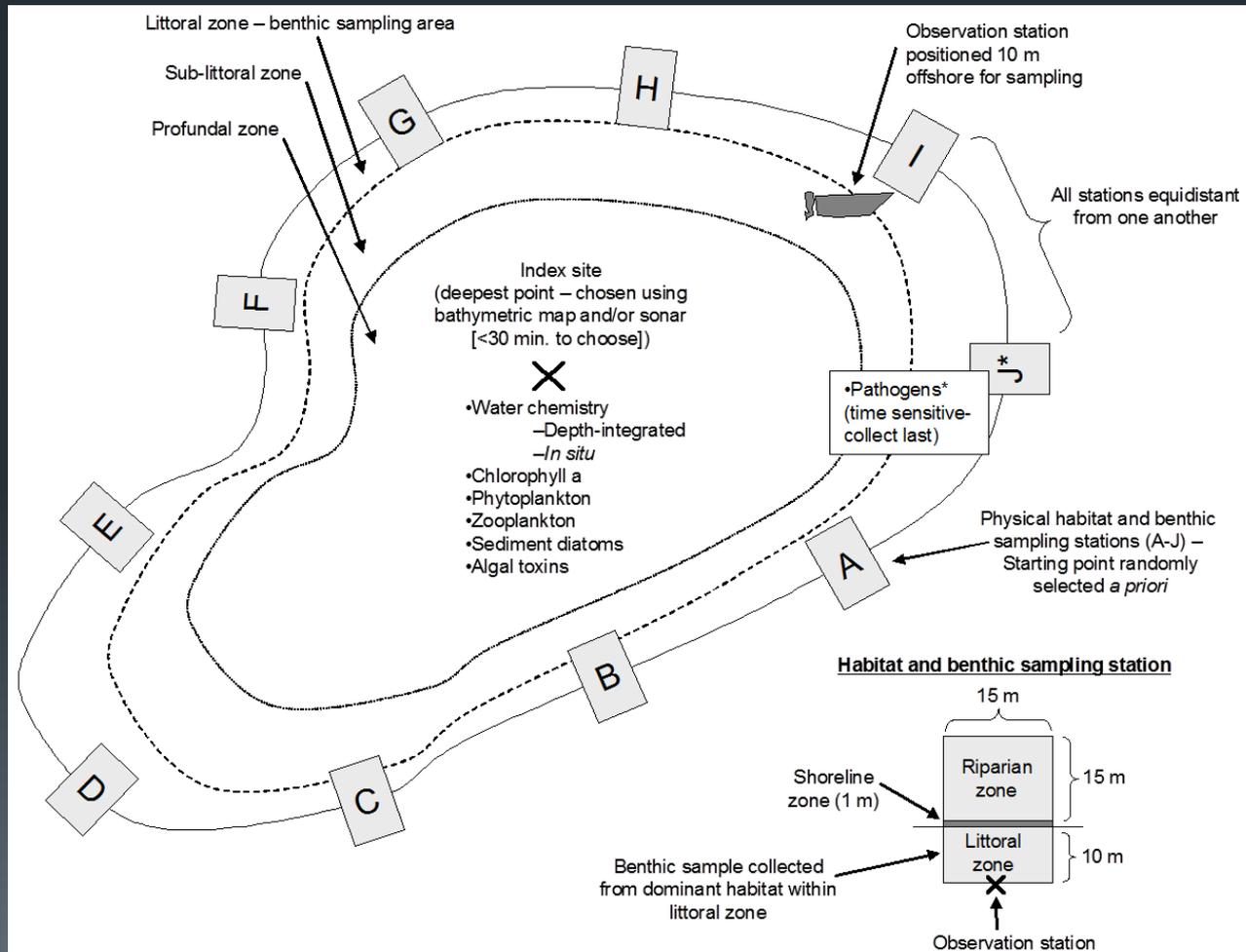
Targeted #2. 2006 study of 12 lakes with monthly sampling: mid-lake each visit & 1 nearshore in bloom or downwind;

***Risk of “high to very high” MC increased as bloom intensity increased.***

### a. Chl-a and MC Relationship



# NLA randomized collections: Randomly selected lakes & standardized sites: 1 mid-lake & 1 nearshore (e.g. J site): *not biased by wind or bloom conditions (essentially random)*

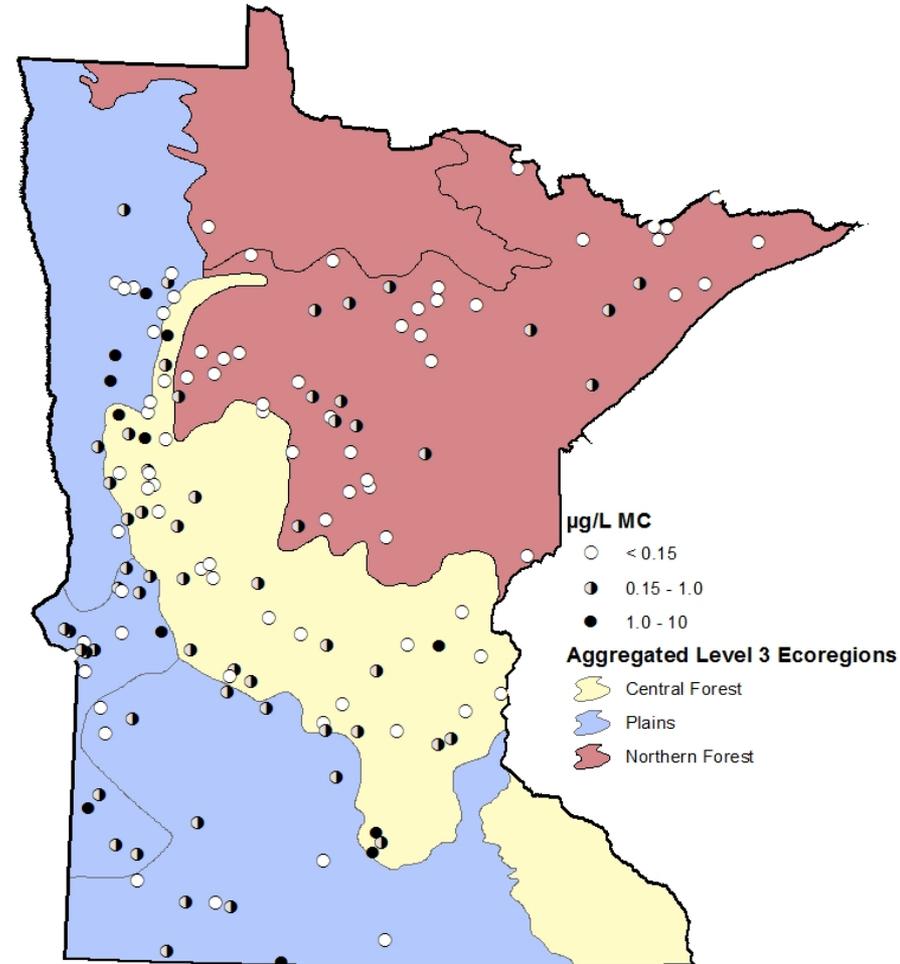


# 2012 National Lakes Assessment: Randomized sampling

- Mid-lake samples;
- Analyzed at MDH
- 50-lakes per ecoregion:

MC detect    Max.

- North    29%    0.6 ppb
- Central 54%    2.2 ppb
- South    60%    8.2 ppb

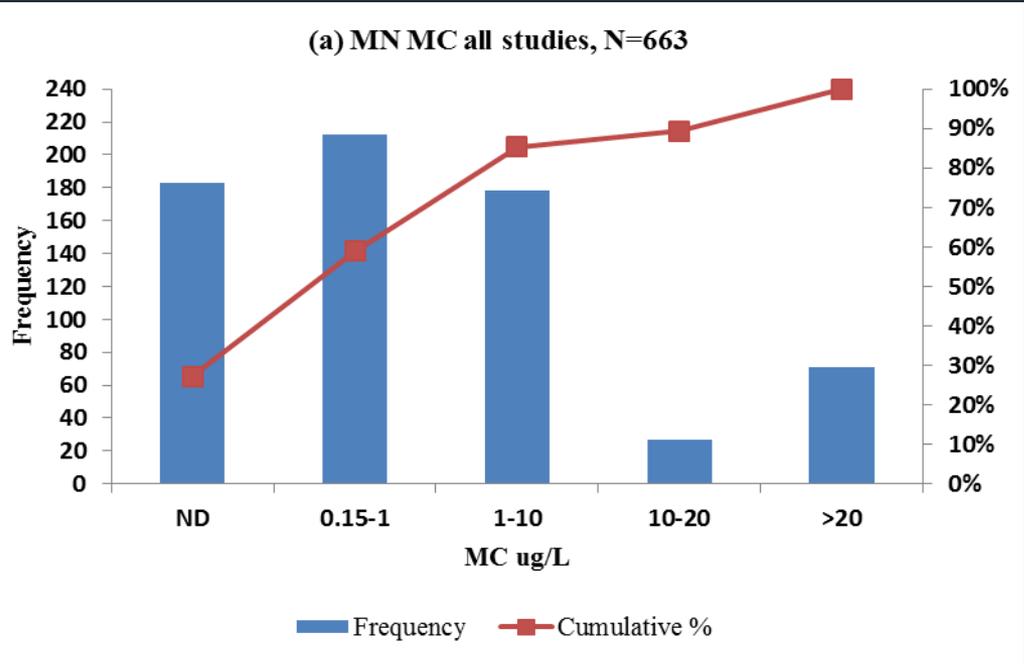


	2007 NLA Pelagic	2007 NLA shore	2012 NLA Pelagic	2012 NLA shore
# of Samples	51	51	50	50
% Nondetects	40%	45%	62%	54%
Minimum	<0.15	<0.15	<0.15	<0.15
% > 1 $\mu\text{g/L}$	27%	29%	12%	4%
Maximum	5.3	44	8.2	6.9

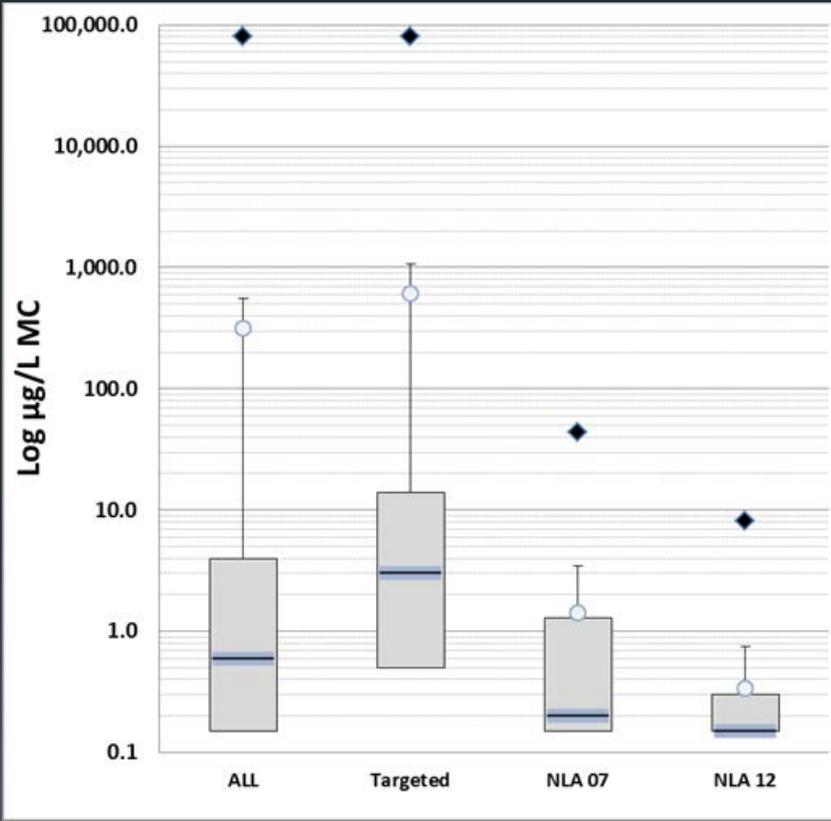
# Summary of Microcystin Concentrations in Minnesota Lakes

Heiskary, Lindon & Anderson. 2014. Lake and Reserv. Manage. 30:268-272.

- 1. Frequency distribution for all MC data (N=663);
- 2. Box plot comparisons of all data, targeted, and random sample collection



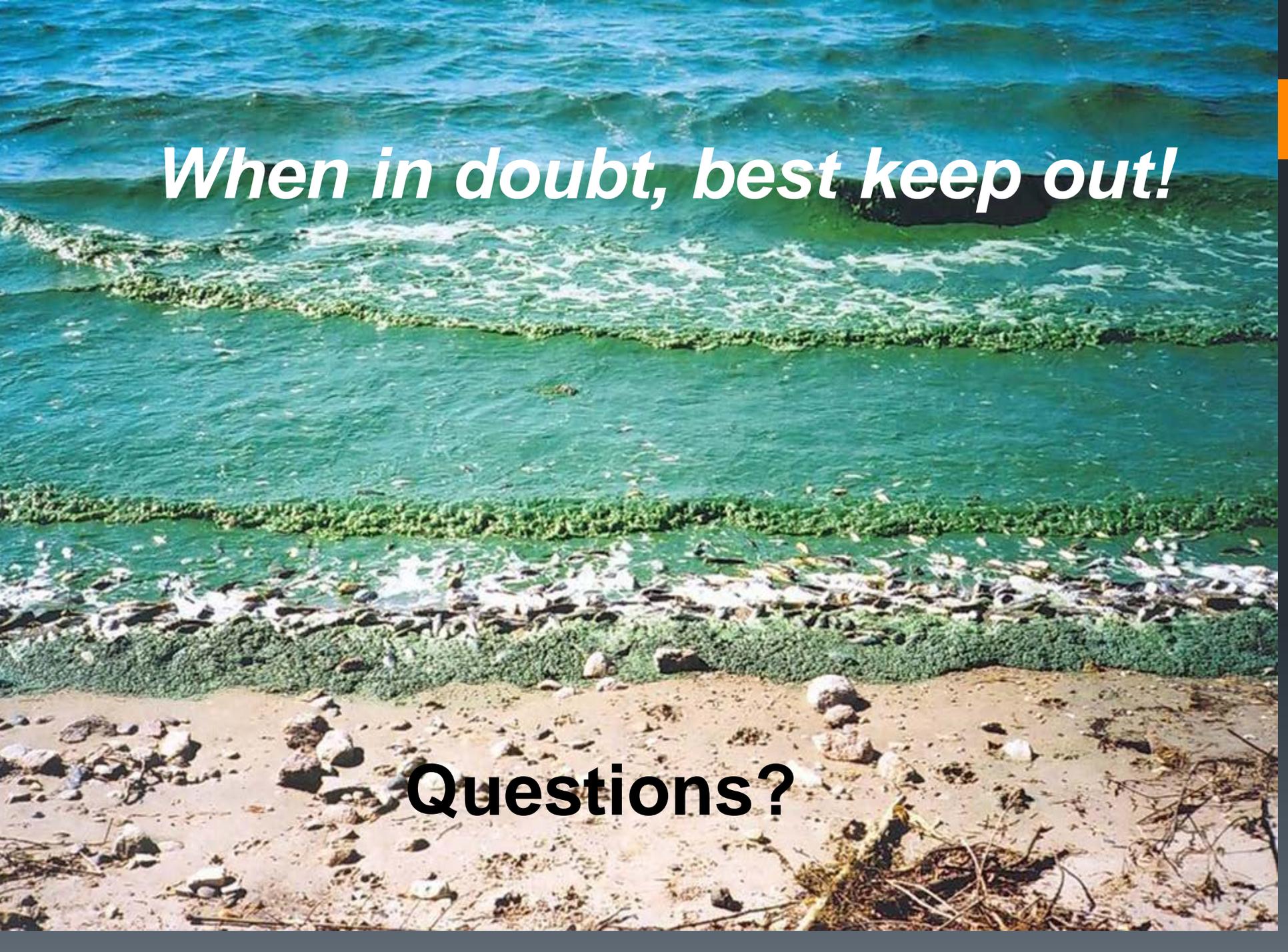
All MC data (N=663)



Comparison of all, targeted, and random MC

# Summary

- Severe blue-green blooms most frequently in lakes with high nutrients, warm water, low wind and abundant sunlight;
- MN has extensive MC data based on both targeted and randomized sampling efforts (c2004-2012);
- Important to consider how sampling is conducted and focus of effort when interpreting the data
- NLA – pelagic sampling may be adequate for purposes of survey;
- MPCA does not have a routine MC sampling program;
- MPCA collaborates with MDH, MN Veterinary Medicine Association & MDNR to address HAB issue and develop appropriate awareness;
- MPCA is developing MC recreational risk-based thresholds & aquatic life thresholds;



***When in doubt, best keep out!***

**Questions?**