



**Harmful Algae Bloom Response  
Fall 2013 Review Meeting  
October 15, 2013**

# HAB Data 2010-2013

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10/06/2013

**Photo: NCDO Staff**



**Our Mission – to Protect and Improve the Health and Environment of all Kansans**

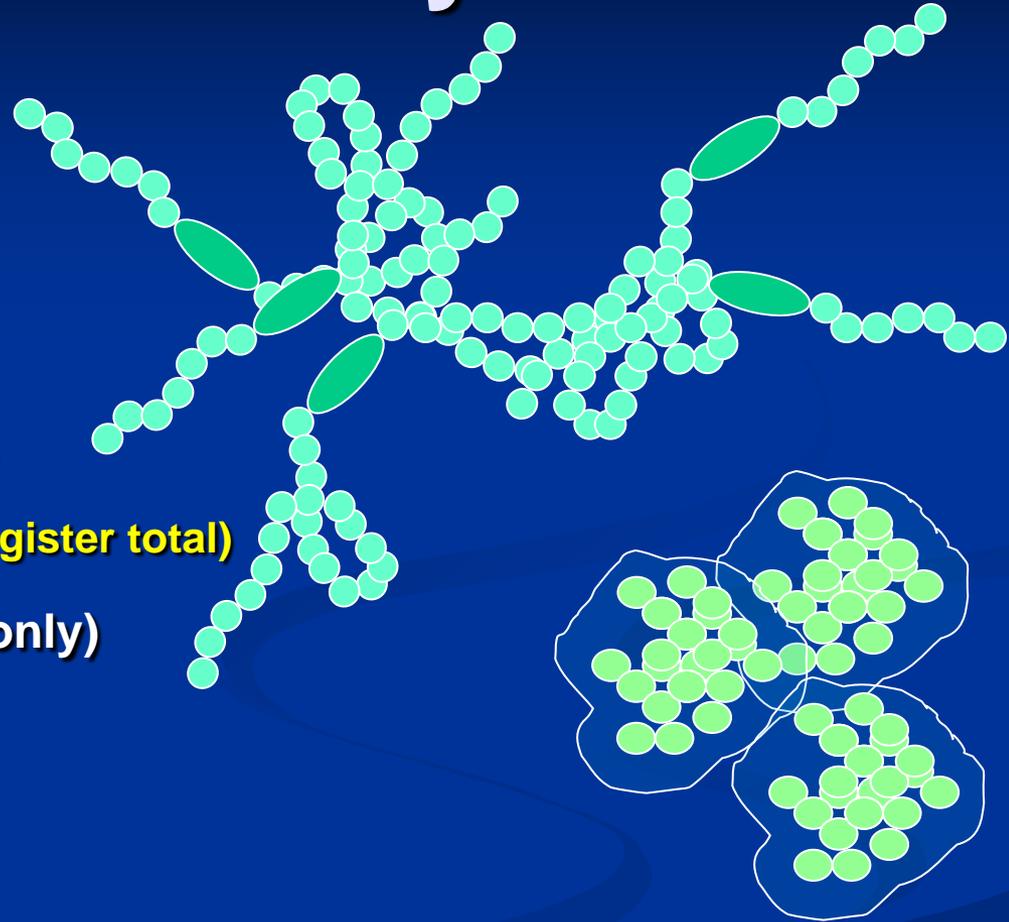
# HAB Work Since July 2010

## ■ Lakes (HAB only)

- 2010 = 9
- 2011 = 39
- 2012 = 40
- 2013 = 24 (as of 10-15-13)
- 67 total (~21% of Water Register total)

## ■ Algae Samples (HAB only)

- 2010 = 132
- 2011 = 248
- 2012 = 206
- 2013 = 101 (as of 10-15-13)
- 687 total

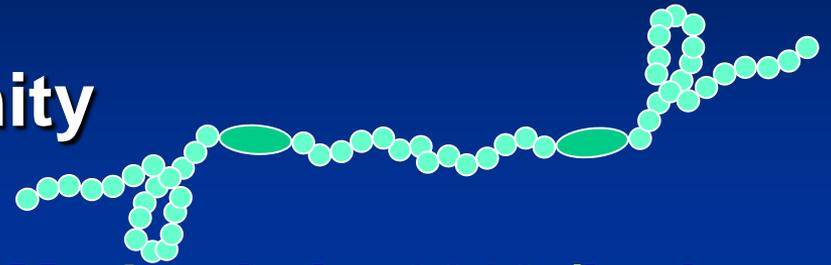


# Some Program High-Points

## ■ Biggest Algae Community

- 414,000,000 cells/mL

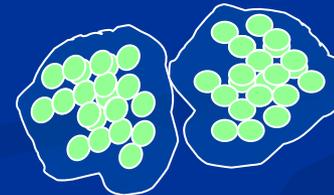
- Anabaena community at Marion Lake 2012 (had 1,200 ug/L microcystin level)



## ■ Highest Microcystin Value

- 9,500 ug/L

- Microcystis community at Centralia Lake 2012 (24,000,000 cells/mL)



## ■ Favorite Complaint

- The Rio Grande River in 2012



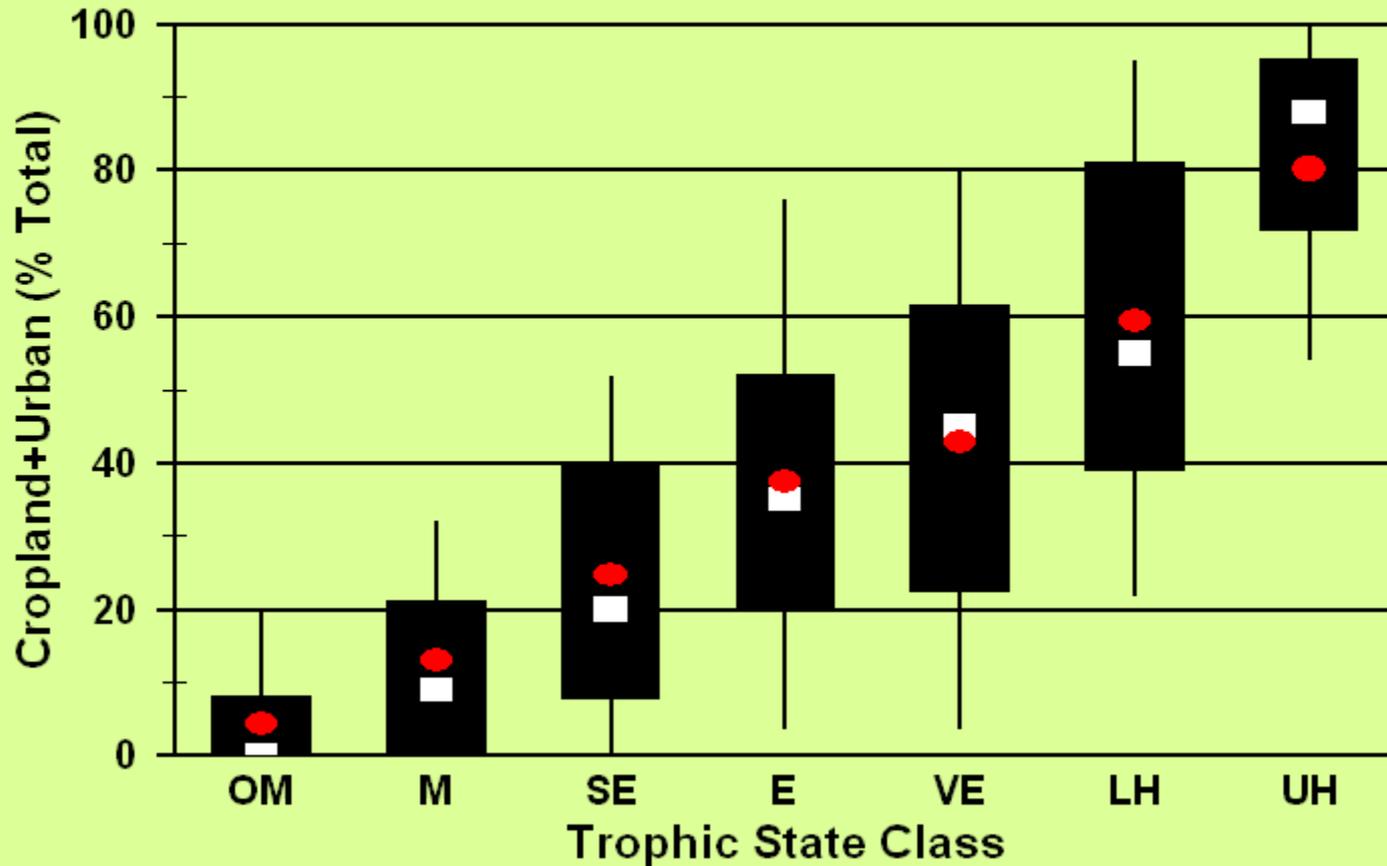
Mort says.....  
“Day of the dead?”  
“My favorite holiday!”



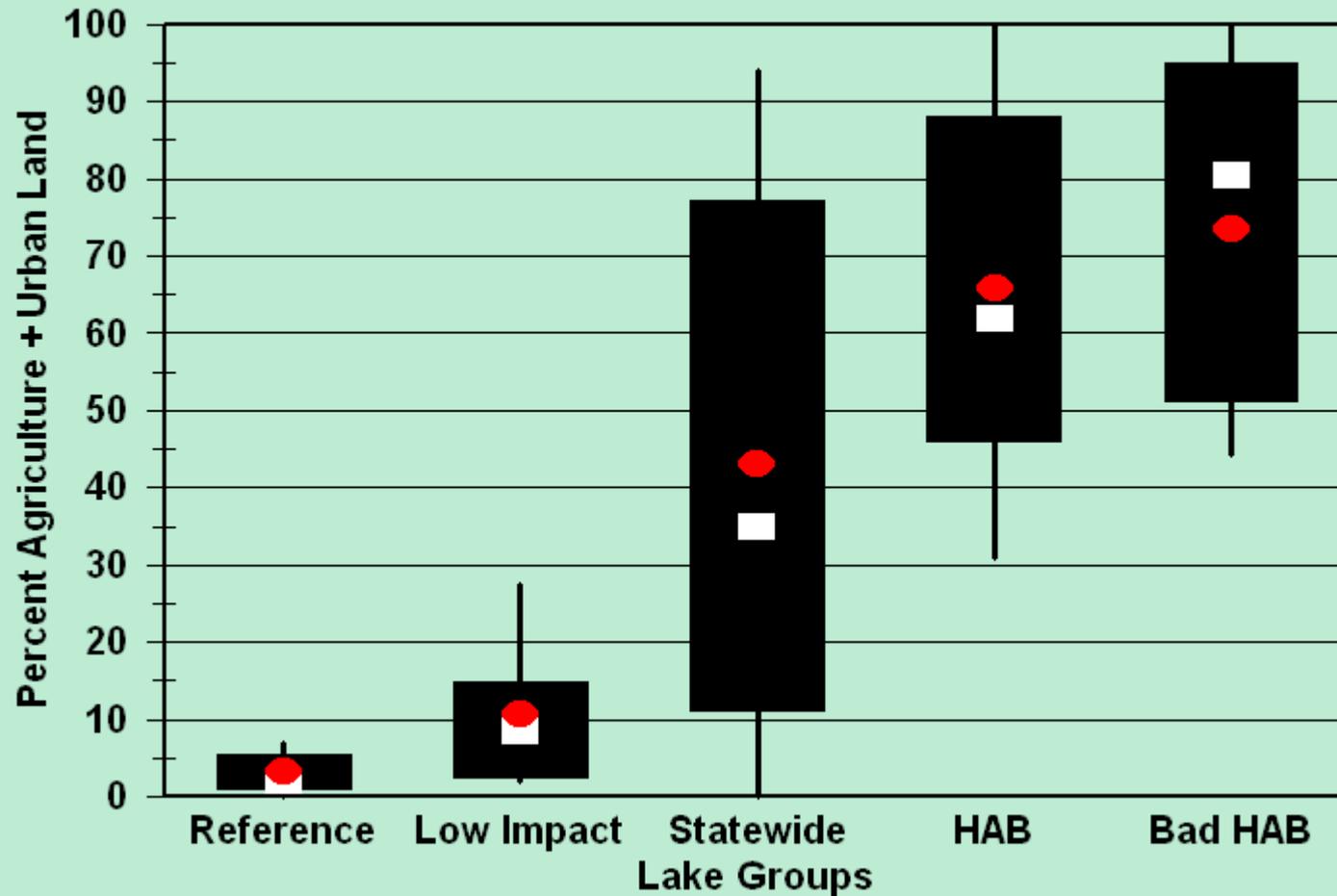
# Watersheds are Key to Prevent Eutrophication and HABs



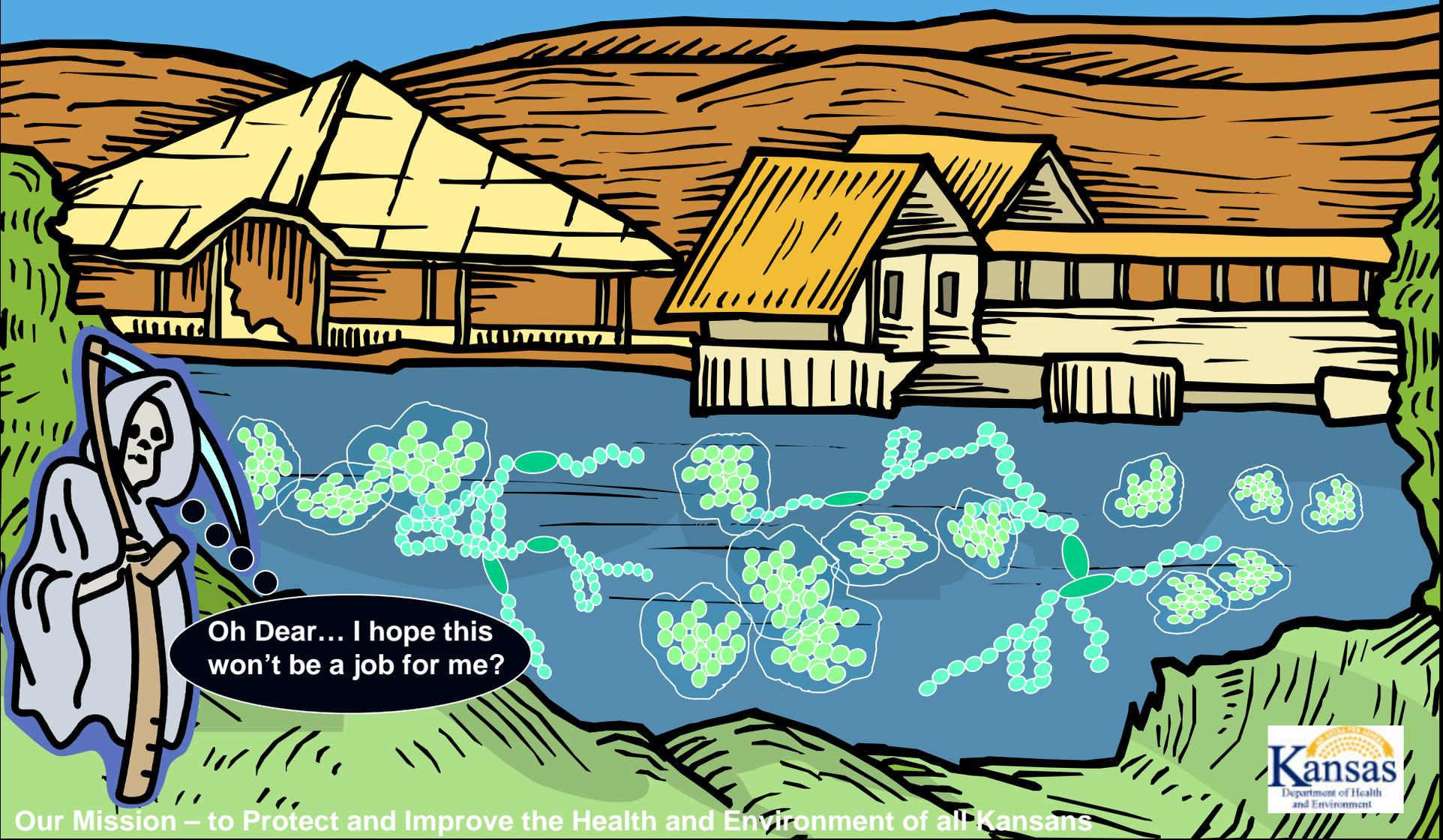
# Trophic State Classes versus Watershed Development 1994-2012



# Watershed Condition vs. HAB Risk



# What Four Years of Paired BGA and ELISA Data Show



# Basic Statistics 2010-2013

- Almost 700 bloom related samples
  - **Blue-Green Cell Counts (cells/mL)**
    - Mean = 1,215,000 cells/mL
    - Median = 34,000 cells/mL
    - Interquartile Range = 5,000 to 215,000 cells/mL
    - Maximum = 414,000,000 cells/mL
  - **ELISA microcystins (ug/L)**
    - Mean = 44.6 ug/L
    - Median = 0.5 ug/L
    - Interquartile Range = zero (non-detect) to 3.0 ug/L
    - Maximum = 9,500 ug/L



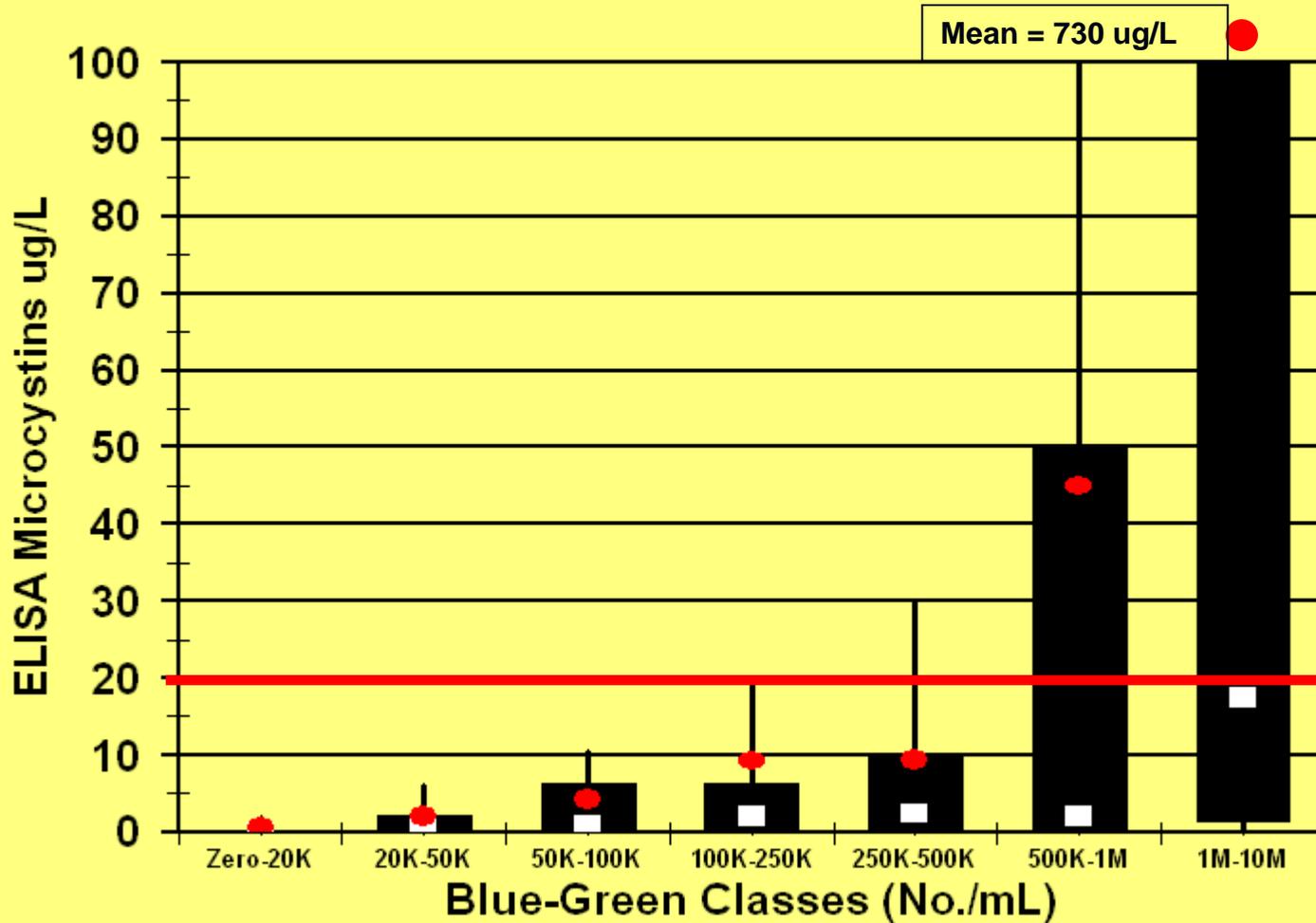
# Basic Statistics 2010-2013

## ■ Almost 700 bloom related samples

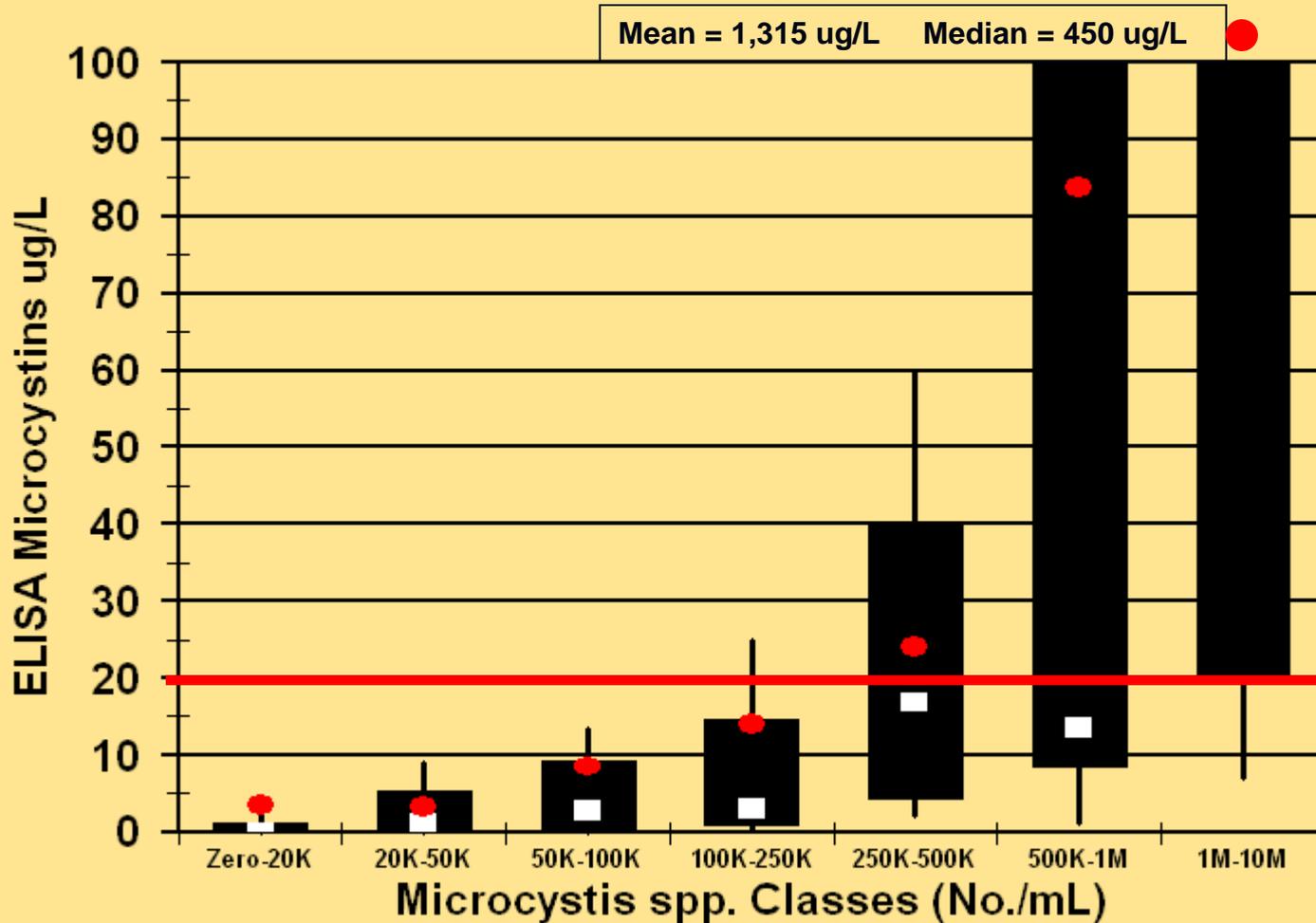
### ■ **Community Type (% samples)**

■ Microcystis =	39.9%
■ Anabaena =	14.1%
■ Aphanizomenon =	14.8%
■ Planktothrix =	7.0%
■ Cyndrospermopsis =	3.1%
■ Woronichinia =	1.3%
■ Other BGA =	5.5%
■ Non-BGA =	14.2%

# Total Blue-Greens vs. ELISA

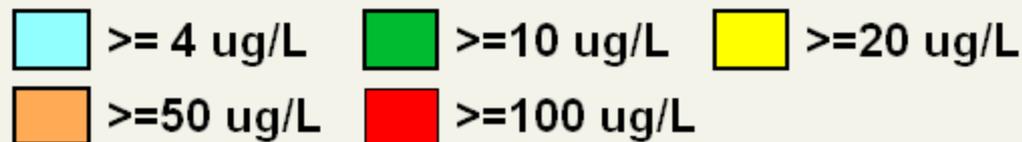
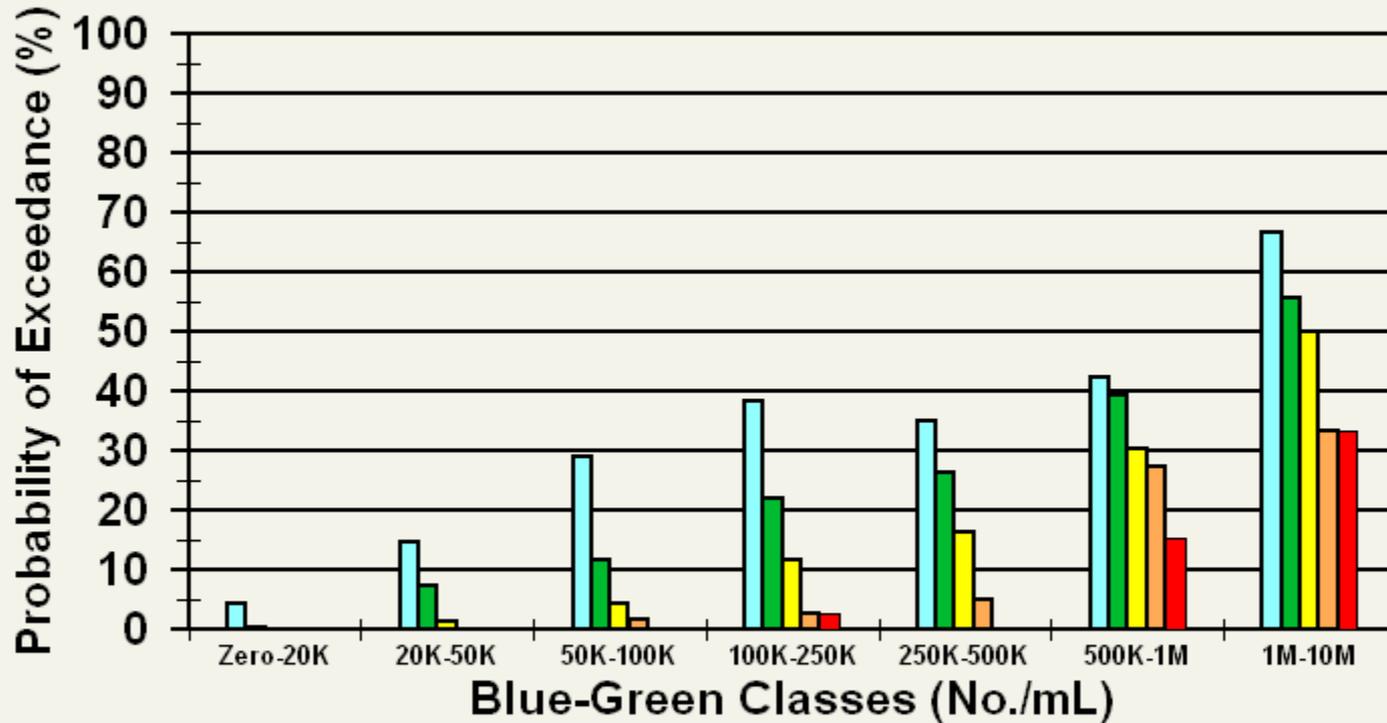


# Total Microcystis spp. vs. ELISA



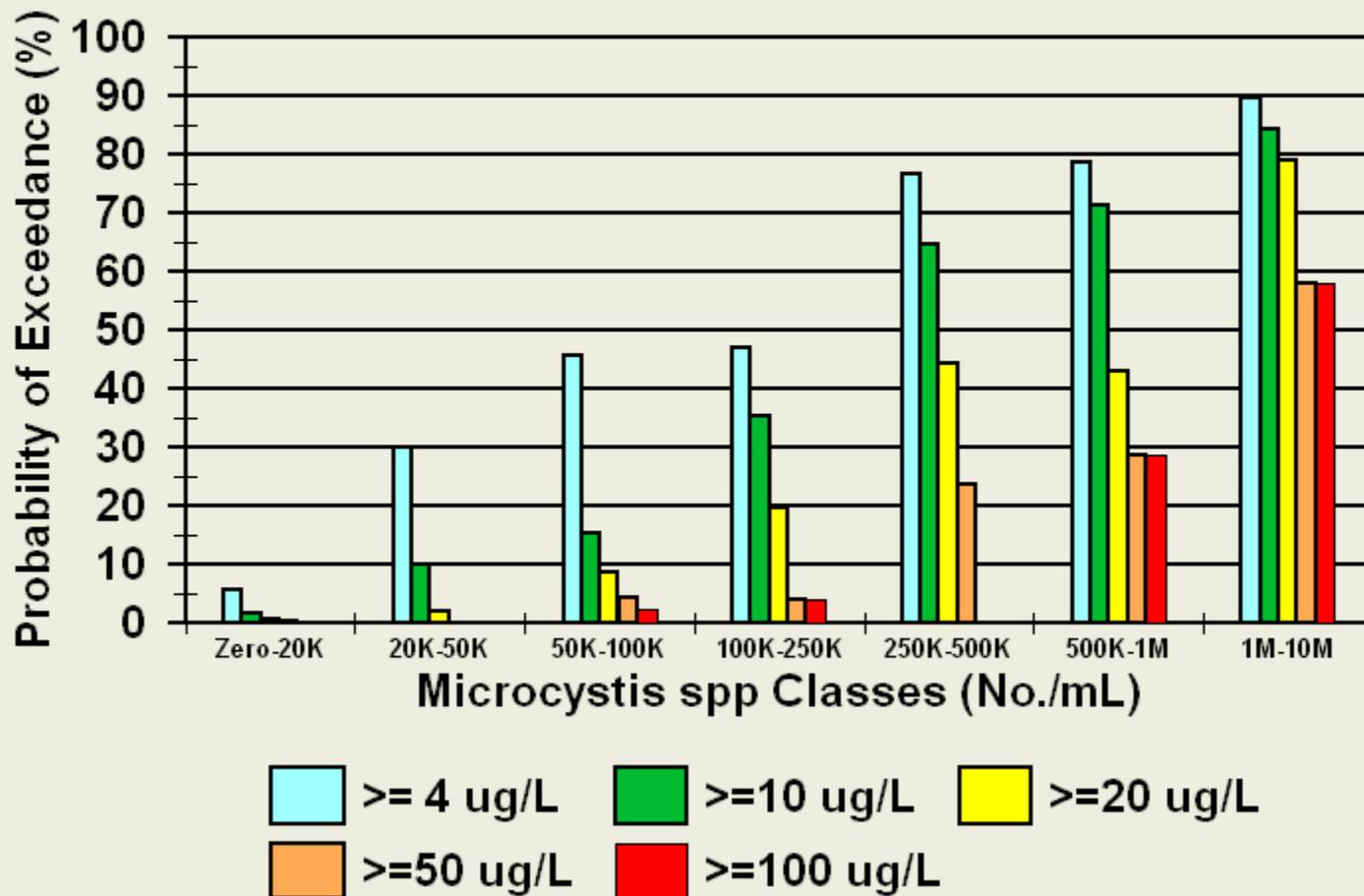
# Total Blue-Greens vs. Microcystins

## Probability of Exceeding MC levels

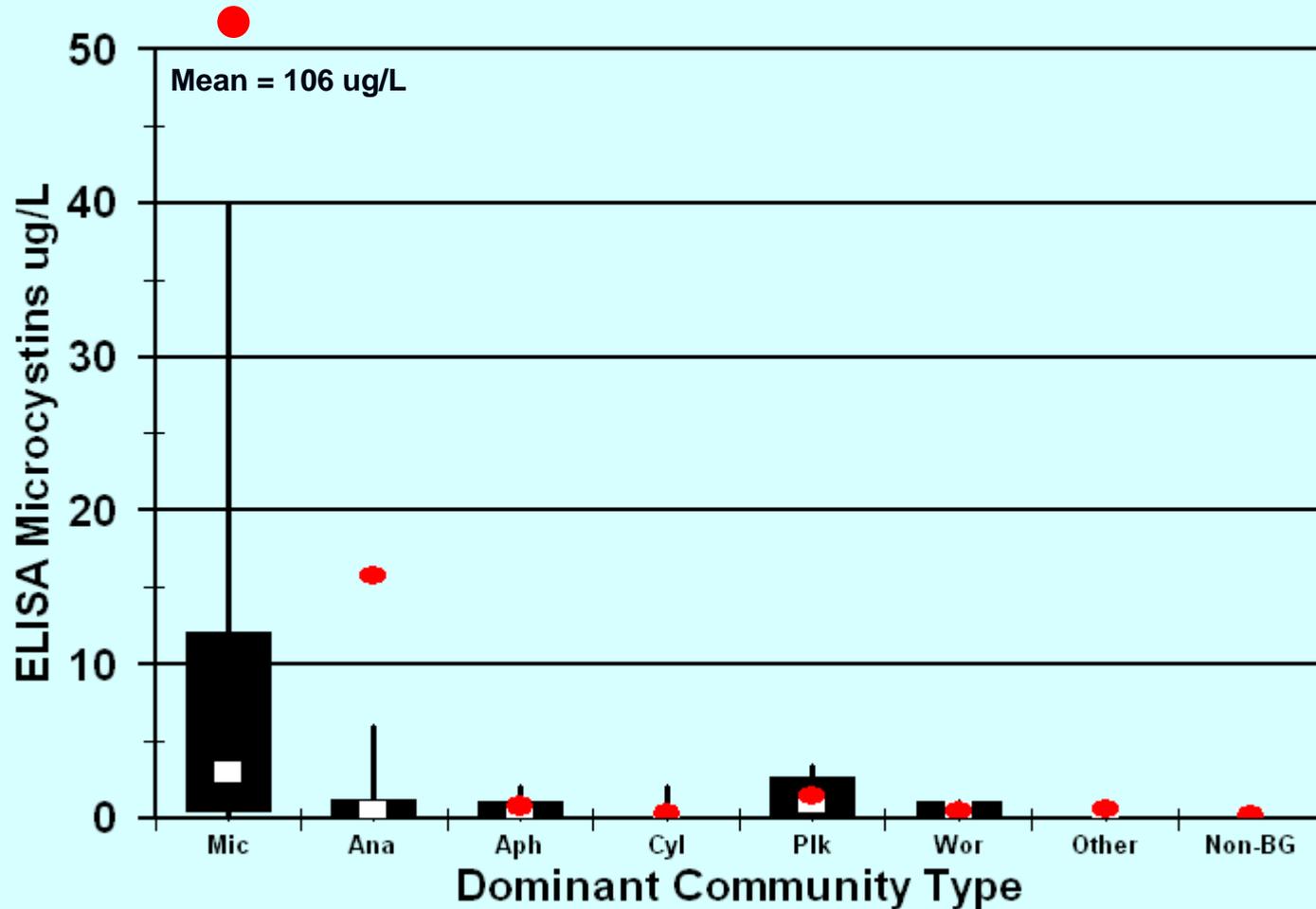


# Total Microcystis spp vs. Microcystins

## Probability of Exceeding MC levels



# Blue-Greens Community vs. ELISA



# Conclusions – The Data

- **Data clearly shows BGA/Toxin link**
  - **But regressions remain weak**
    - Total BGA/ELISA:  $R^2 = 0.21$ ,  $p < 0.001$
    - Microcystis/ELISA:  $R^2 = 0.31$ ,  $p < 0.001$
- **Microcystis blooms are the biggest microcystin toxicity threat**
  - **And microcystins represent the toxin with the primary public health threat**
    - USGS 2010 regional survey and other literature
  - **But toxin yields are still well below what the WHO data indicates we should see versus cell counts**
    - 100,000 BG cells/mL = 2.4 – 4.6 ug/L microcystin
    - 100,000 Microcystis cells/mL = 4.9 – 7.0 ug/L

# Concerns - Other Toxins

- Microcystins are the main threat
  - **Regional surveys (USGS 2010) show microcystins to be the dominant type**
    - For concentrations and frequency of detection
    - Mean of detects = 600 ug/L, present in >95% of lakes
- Anatoxin-a and saxitoxins might be expected to be present in only about 25% of blooms (USGS 2010)
  - **Anatoxin-a: mean of detects = 1.6 ug/L, present in 30% of lakes**
  - **Saxitoxins: mean of detects = <1 ug/L, present in 17%**
- Cylindrospermopsin even less frequent
  - **Mean of detects = <1 ug/L, present in 9%**
- Although 2<sup>nd</sup> in concern, proposed thresholds for anatoxin-a tend to be high compared to microcystins
  - **6 vs. 80 ug/L and 20 vs. 300 ug/L, microcystin vs. anatoxin-a for recreation (Ohio 2012)**
- With either toxin... main area of concern is with accumulation of shoreline masses and crusts

# Conclusions - Causes

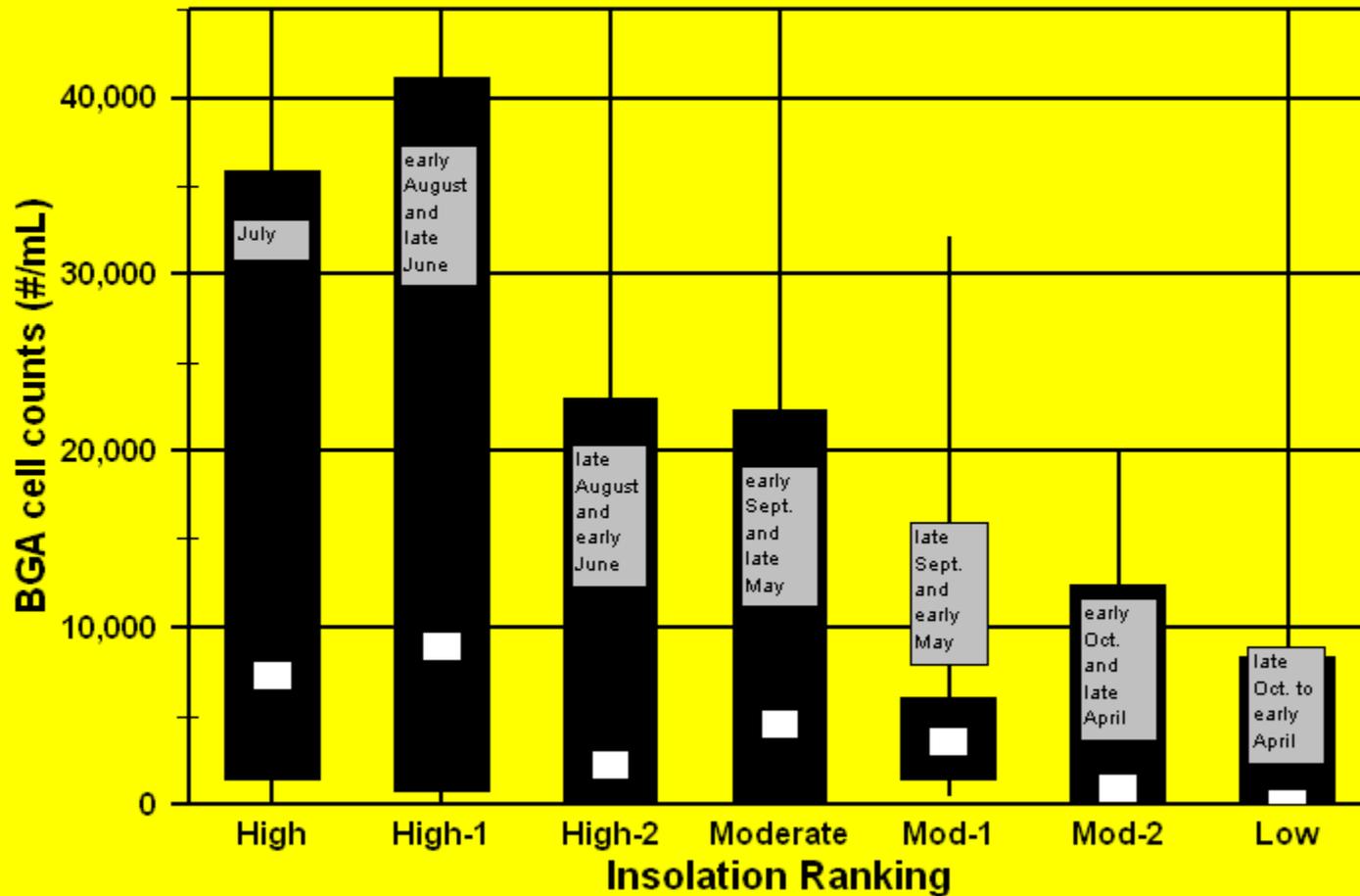
- What are the main causes... really?
- Literature often lists
  - **Nutrients**
  - **Summer temperatures**
  - **Stable water column**
- We know nutrients (phosphorus) and watershed land use are strongly linked to Chl-a, Algae, HABs
- Temperature and water column stability are NOT causes, at best acting as accelerants



# Temperature & Mixing

- **Water temperature vs. blue-green biomass**
  - **Correlation:  $R = 0.108$ ,  $p = 0.002$**
  - **Variation in temperature can only explain ~1% of variation in blue-green algal biomass**
- **Stratification/mixing potential vs. blue-green biomass**
  - **Correlation:  $R = -0.12$ ,  $p = 0.07$**
  - **Variation in mixing potential can only explain ~1% of variation in blue-green algal biomass**
  - **AND It's an INVERSE relationship!**
  - **Aeration and lake mixing might actually INCREASE BGA bloom potential**
    - **Works for aerated sewage lagoons**
- **So what is it about summer and BGA?**

# Insolation vs Blue-Green Algae



# Conclusions – Prevention/Control

- **How do we prevent HABs?**
  - **Best option = Keep excess nutrients out**
  - **Next best = Remove excess nutrients**
    - Floating wetlands
    - Package waste treatment systems?
    - Dredging? (not really)
  - **Worst = Symptomatic treatments and “snake oil”**
    - Herbicides, aeration, swans, & bacterial additives
- **We know the cause**
  - **Hint..... Eutrophication and nutrient loading**
- **We just need the will to act on and remove the “cause,” not the “symptom”**
  - **Brad gets it, Janet gets it.... but does Rocky?**



**Tony Clyde, Tulsa ACOE, could not make it due to the shutdown. This song from “Oklahoma” is for him.**

**There’s a bright blue-green haze on the meadow.  
There’s a bright blue-green scum on the lake shore.**



**The algae’s as high,  
As an elephant’s eye,**

**And it just keeps on blooming, right up to the sky.**

**Oh, what a blue-green morning.**

**Oh, what a blue-green day.**

**I’ve got this wonderful feeling.....**



**This algae’s not going away!**

**Photo: Scott Lang**



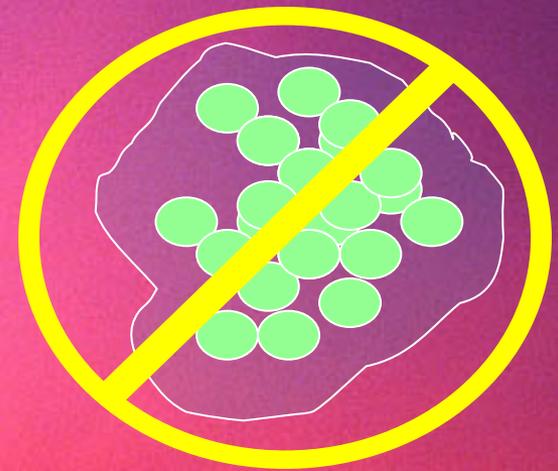
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Working on the blue-greens,  
going down, down, down...

Working on the blue-greens, Oop, I'm gonna  
step down.

Working...counting...working...counting...

Lord, I'm so tired.....

How much longer can this go on?



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