“Ballast treatment compliance: Searching for science in ballast water discharge standards”

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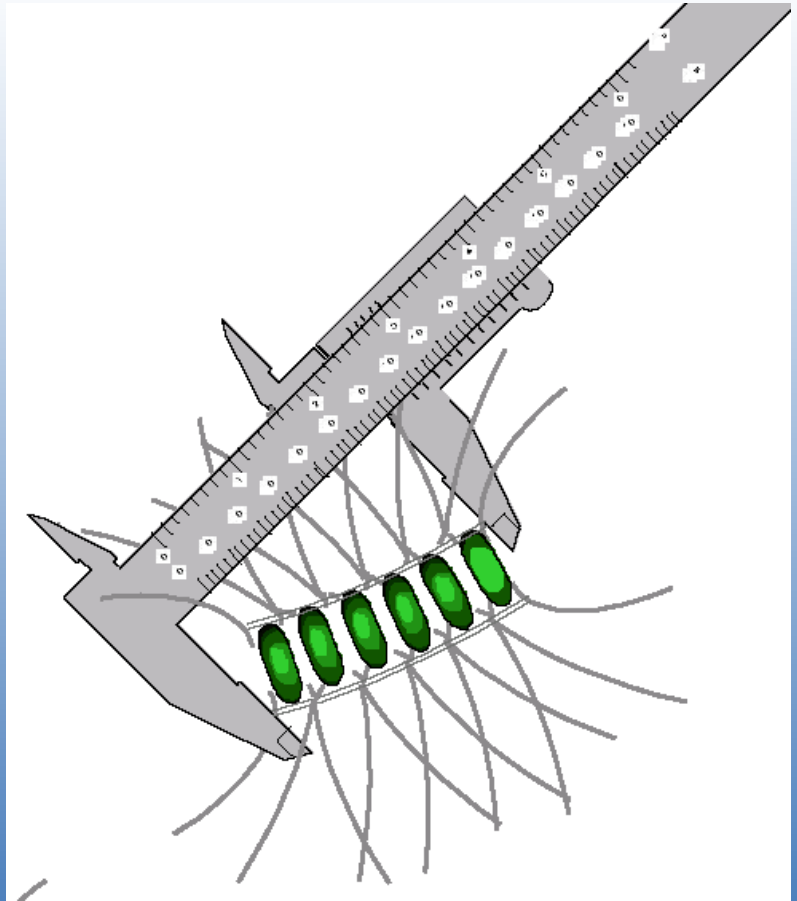



LATE SHOW
with David Letterman


LATE SHOW
TOP TEN
NUMBERS FROM ONE TO TEN
1. TWO
2. SEVEN
3. THREE
4. FOUR
5. ONE
6. EIGHT
7. FIVE
8. SIX
9. NINE
10. TEN

1. IMO and USCG BWDSs are not evaluated statistically in Type Approval Tests.
2. A 'fraction-of-a-micron' edge exists near 50 um, where BWDSs go into an instant 1 million-fold increase in stringency; 10/mL to 10/m^3.
3. BWDSs for E. coli are too high, the vast majority of tested water 'passes' with no need for treatment.
4. BWDSs for Enterococcus are too high, the vast majority of tested water 'passes' with no need for treatment.
5. BWDSs for Vibrio Cholerae provide no efficacy information since none have been detected.
6. The BWDSs for ≥ 50um size class is too low: contamination from 'dead volumes'
7. USCG BWDSs for the 10-50 um protist group is analyzed by a 'required' method that is plagued by false-positives (FDA/CMFDA).
8. BWDSs for the 10-50 um group vastly underestimate the true number of planktonic protists (by at least 10x) because most protists are <10 um.
9. Challenge concentration for IMO shipbased HPC bacteria is too high; 10,000 CFU/mL.
10. No one on earth knows the 'true' number of live organisms for any size class within BWDS; there is NO STANDARD for analytical reference.

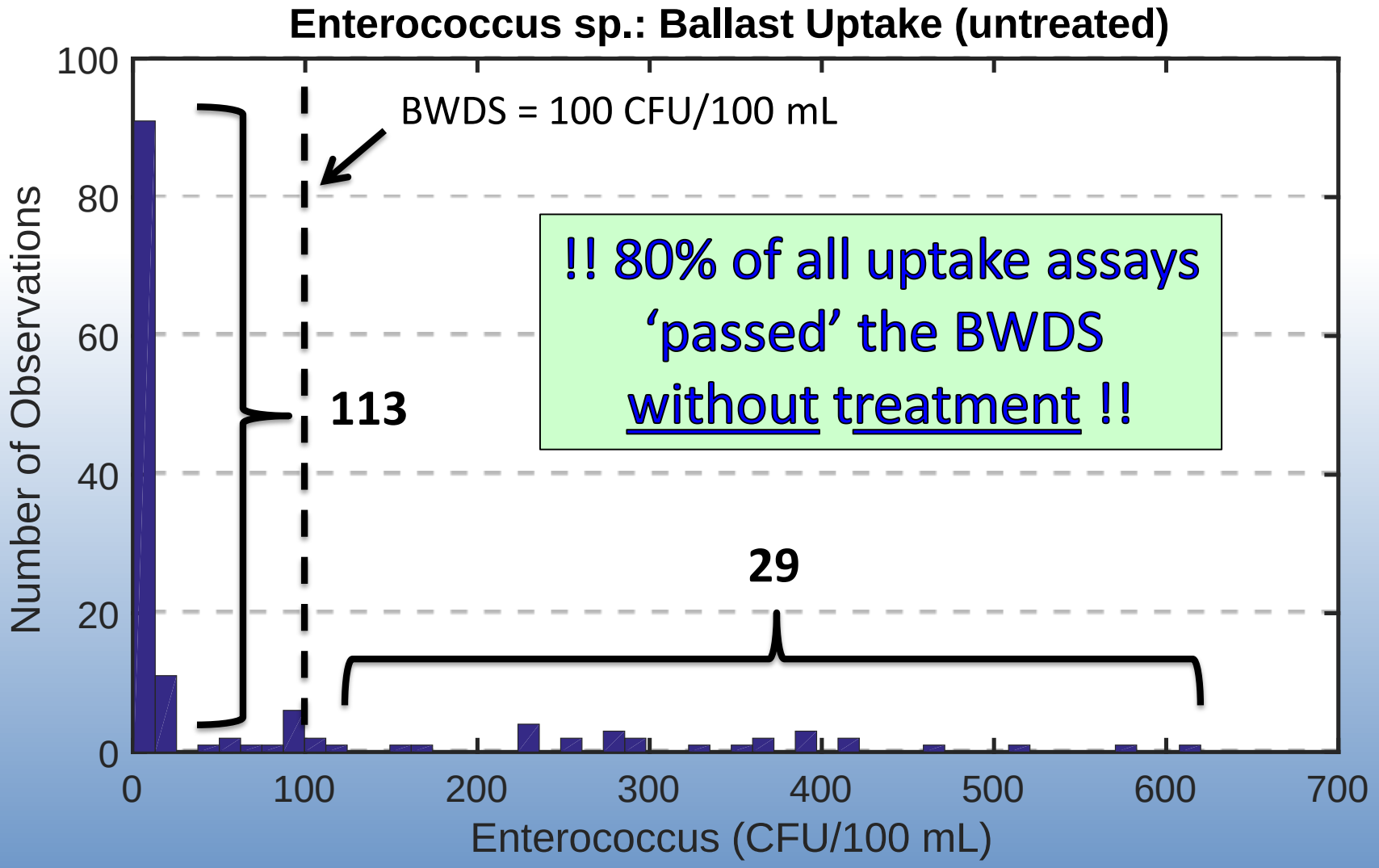
Does the absolute value of Ballast Water Discharge Standards (BWDS) matter ??

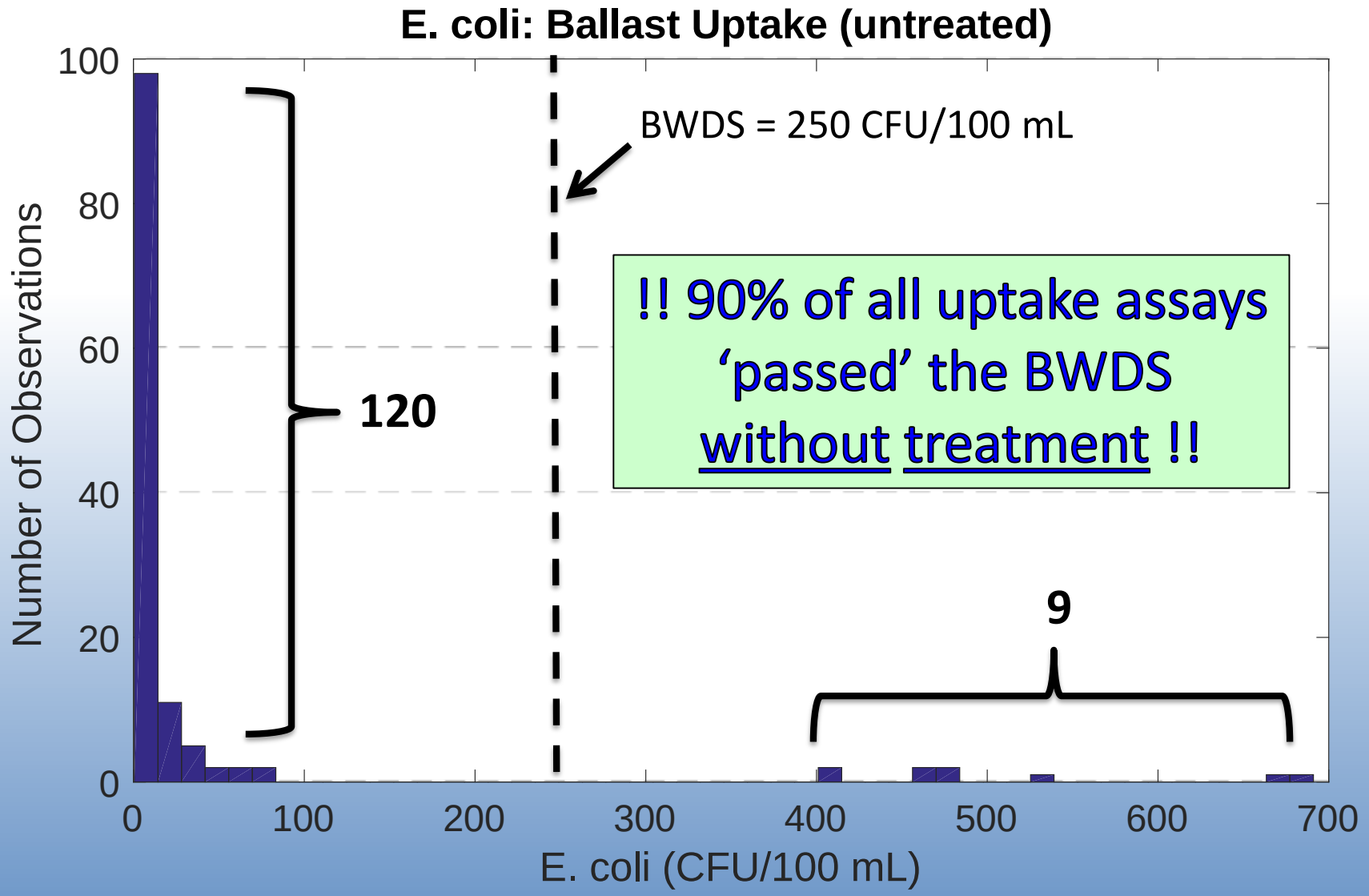
Function of Ballast Water Discharge Standards:

1. Protect the environment
2. Provide targets for treatment efficacy
3. The backbone of quantitative regulation

The six biological ballast water discharge standards:

1. Live organisms ≥ 50 µm in minimum dimension (10 #/m^3)
2. Live organisms ≥ 10 µm, but < 50 µm, in minimum dimension (10 #/mL)
3. Live *Enterococcus* sp. (< 100 CFU/100 mL)
4. Live *E. coli* (< 250 CFU/100 mL)
5. Live *V. cholerae*, Serotype O1 (< 1 CFU/100 mL)
6. *Live V. cholerae*, Serotype O139 (< 1 CFU/100 mL)


Enterococcus sp.: Ballast Uptake (untreated)
BWDS = 100 CFU/100 mL
!! 80% of all uptake assays 'passed' the BWDS without treatment !!
113
29
Number of Observations
Enterococcus (CFU/100 mL)
0
20
40
60
80
100
0
100
200
300
400
500
600
700


E. coli: Ballast Uptake (untreated)
BWDS = 250 CFU/100 mL
!! 90% of all uptake assays 'passed' the BWDS without treatment !!
120
9
Number of Observations
E. coli (CFU/100 mL)
0
20
40
60
80
100
0
100
200
300
400
500
600
700

Results for *V. cholerae* serotype O1 and V. cholerae serotype O139:

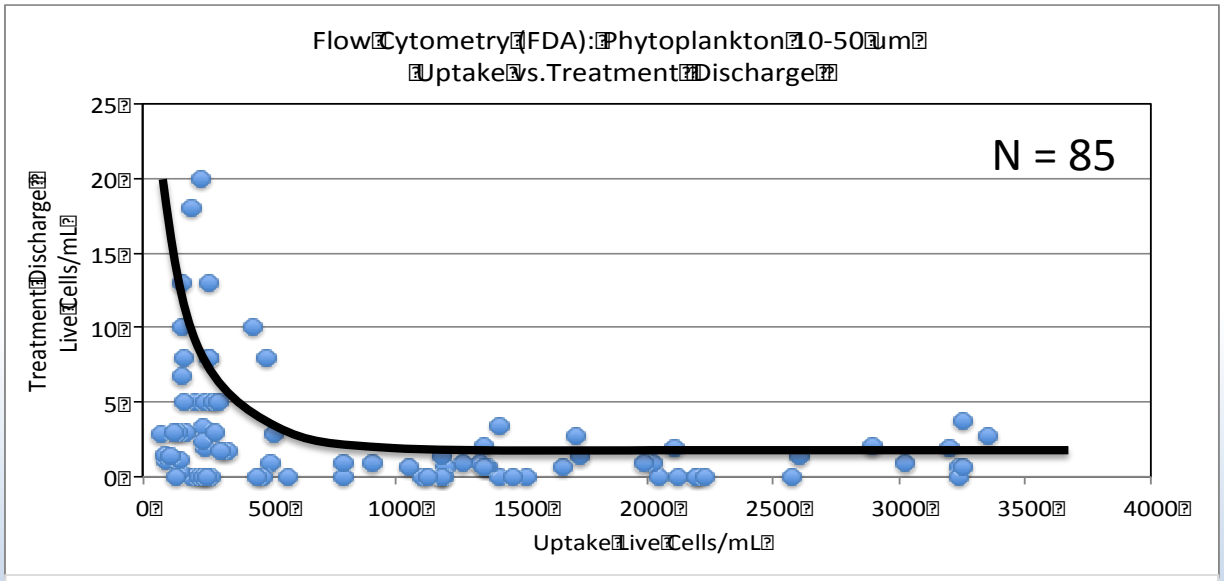
No graphs are necessary!

After an estimated 2,000 test assays, we have never detected Cholera in untreated uptake water, nor in treated discharge ballast water.

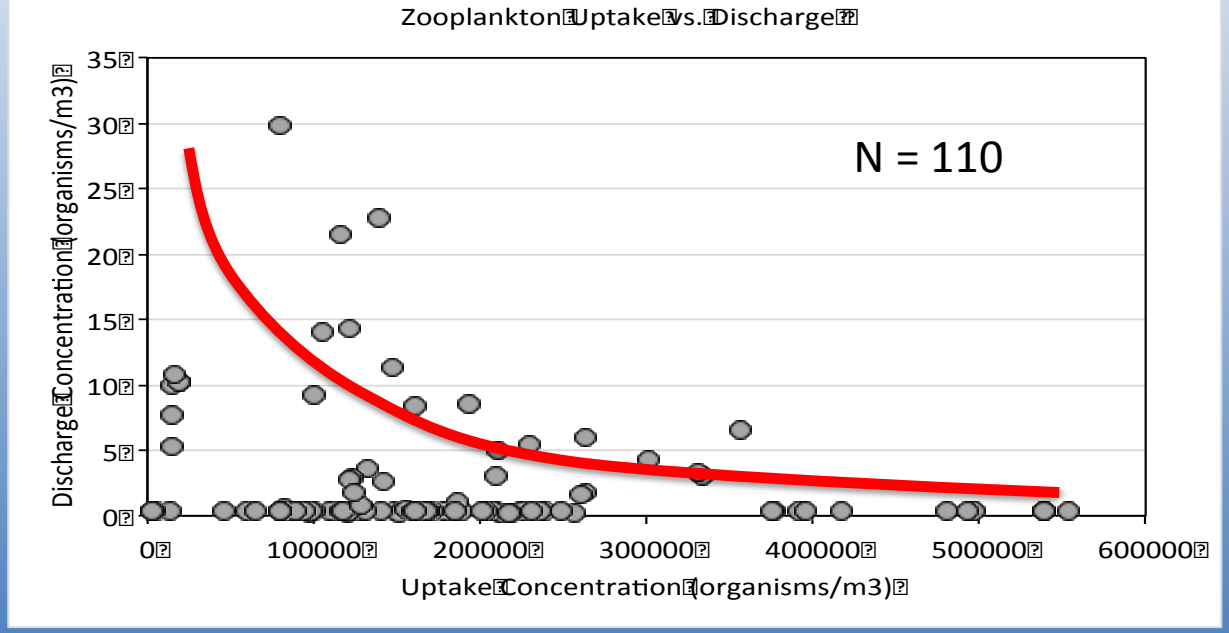
Compliance with BWDS was always met.

CHALLENGE: Higher uptake concentrations yield a more 'Challenging' test

?? A Misconception ??

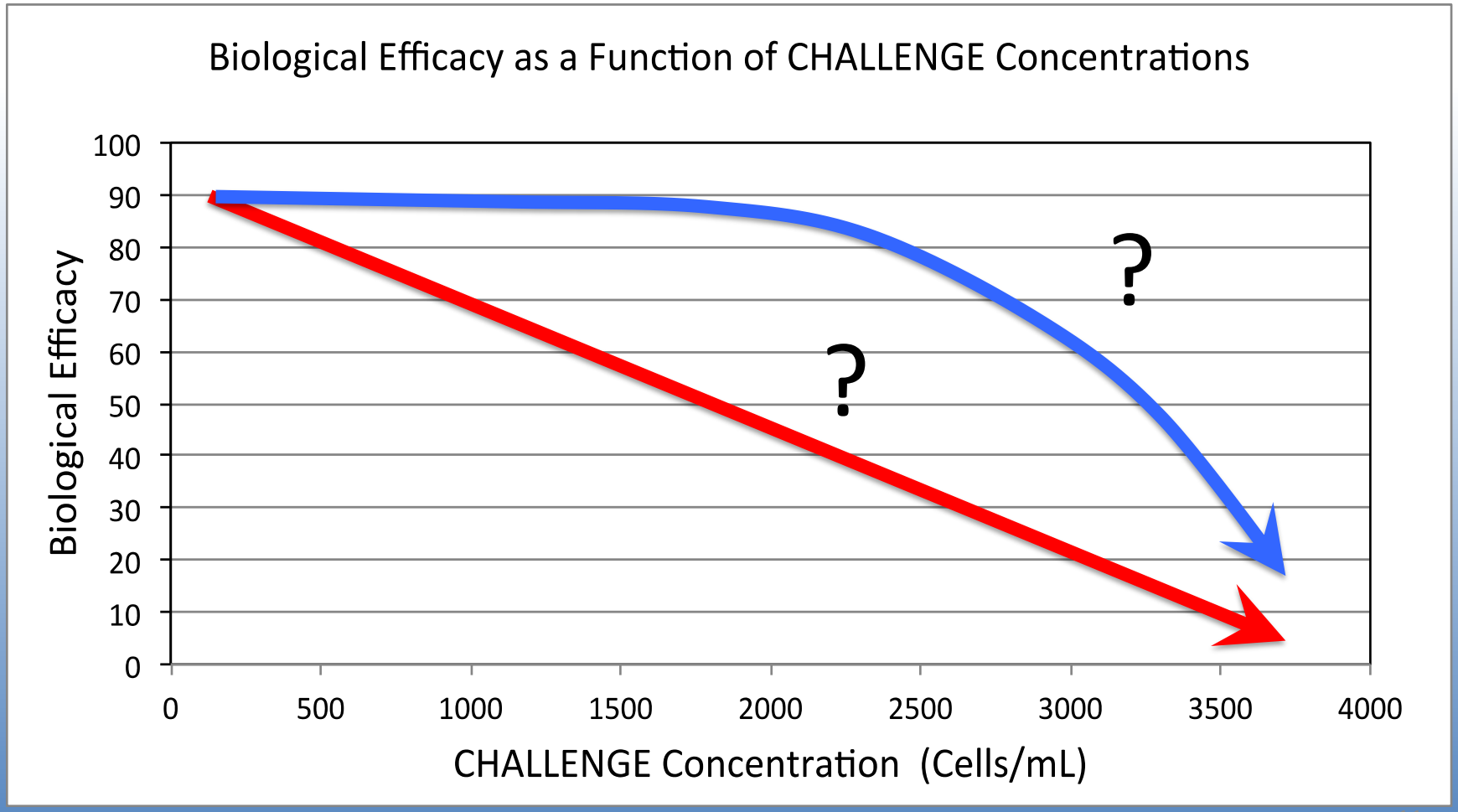


10-50 um
Live Phytoplankton (FDA)



>50 um
Live Zooplankton

“CHALLENGE” in Ballast Water Treatment Testing: Conceptions and Misconceptions



Treatment Efficacy for a Ballast Tank:

<u>What goes in vs. What goes out</u>

If Discharge is reduced to 1% of Uptake:

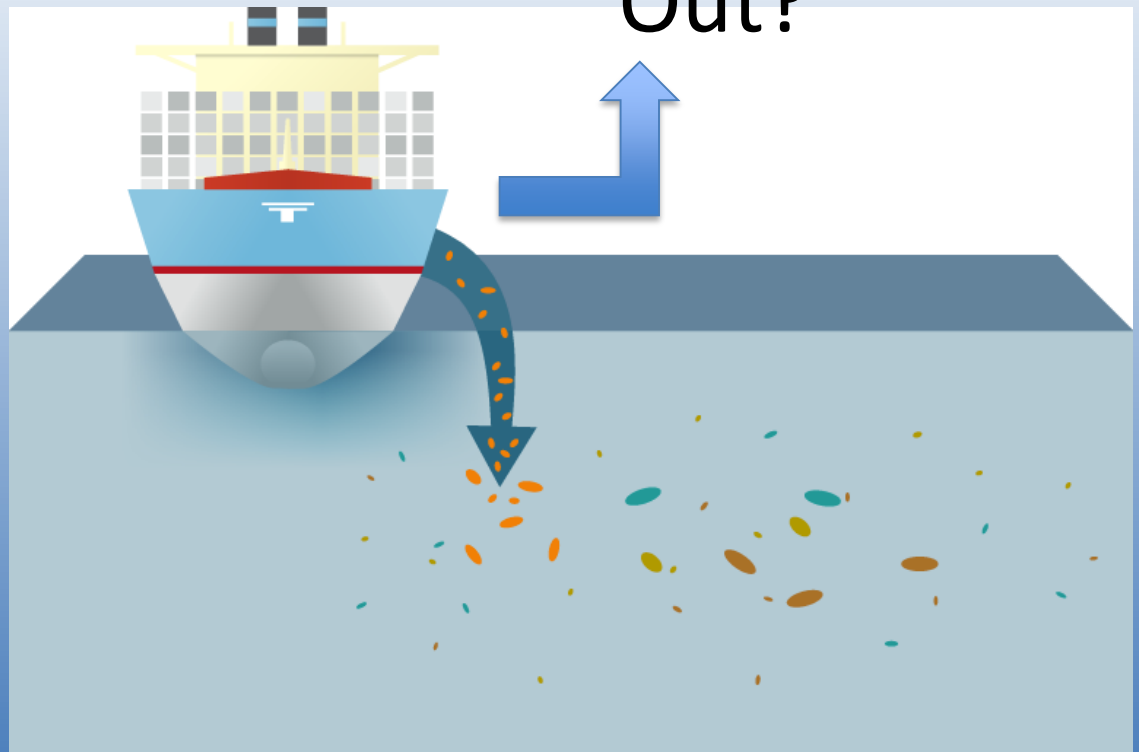
=100x reduction

=2 log reduction

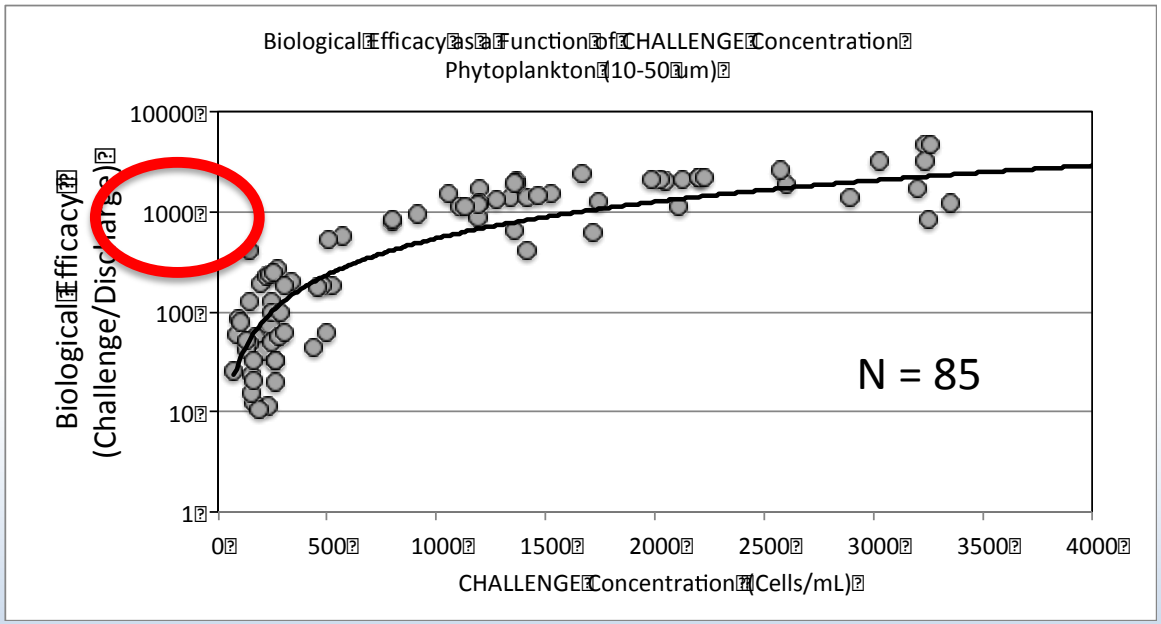
= 99% reduction

In

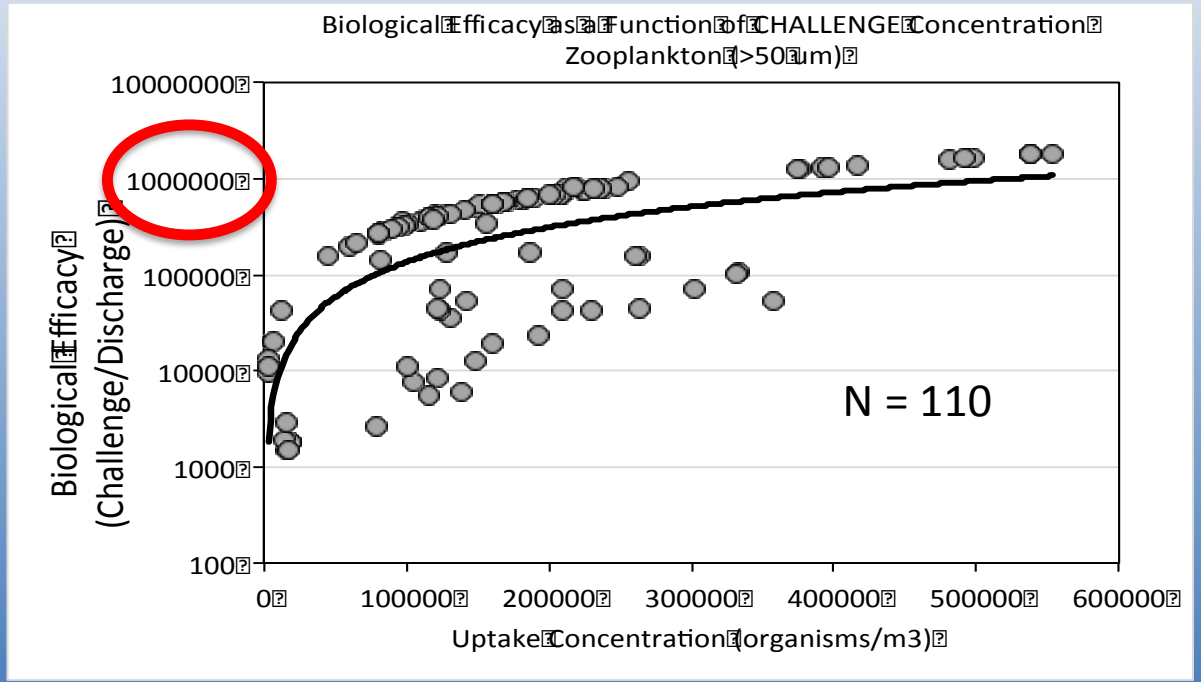
Out?



Biological efficacy does not obey the CHALLENGE Concept in Ballast Water Testing



10-50 um
Live Phytoplankton (FDA)



>50 um
Live Zooplankton

Conclusions:

1. BWDS for larger organisms ($x \geq 50$ µm and $10\ \mu m \leq x < 50\ \mu m$) produce quantitative analyses of fundamental importance to the scientific evaluation of ballast treatment efficacy, including the remarkable one million-fold reduction in zooplankton under routine conditions.
2. BWDS for pathogenic bacteria provide little, if any, useful quantitative information for treatment efficacy, environmental protection, or Type Approval determination.

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