

Interpreting the Sediment Triad: Harmonizing Instead of Weighting the Evidence

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Weight of Evidence Analyses

State of the Art for Sediments

Multiple lines of Evidence, none alone
considered definitive

Weight results objectively

Makes use of available information

Minimizes arbitrariness, increases
consensus

WOE



Weighted Evidence Analyses

Current State of Practice for Sediments?

Lines of evidence weighted subjectively

Ostensibly for technical reasons

Really, just policies/preferences

Wastes available information

Increases arbitrariness, decreases consensus

WOEisme



Real World Example

Small (ca. 4 acres) isolated tidal mudflat

Legacy contamination

High [Hg], [PCB], [PAHs], [CBs]

But also very high Organic Carbon, AVS

Eco risks to other guilds dismissed

Focus on direct toxicity to benthos



Best-Science Chemical Screening

ESB non-polar narcotics (PAHs, CBs, PCBs)

9 of 10 sites with ESB < 1.5

For Hg⁺⁺, used AVS/SEM method for Me⁺⁺

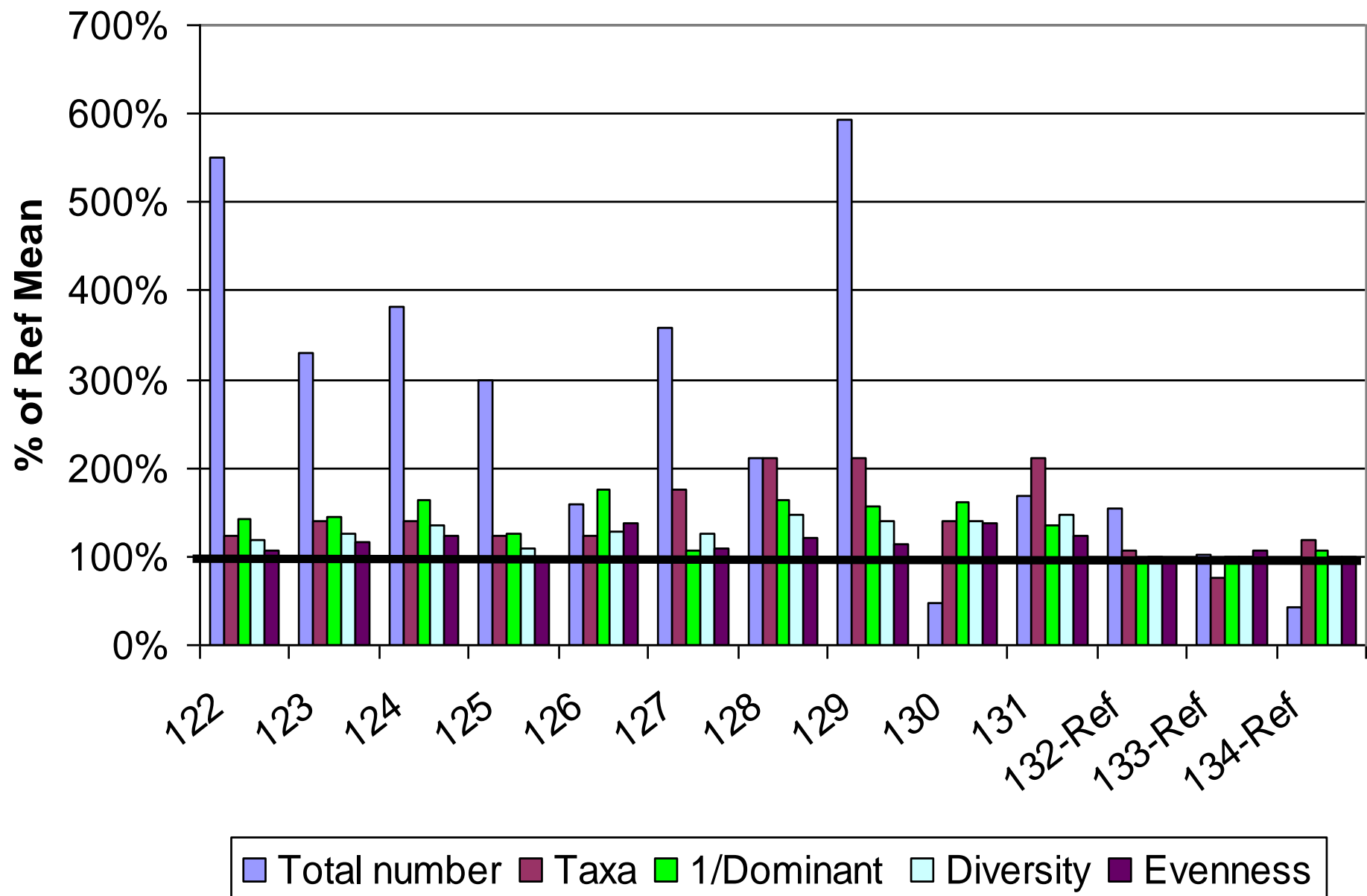
Ample AVS alone wout carbon to bind
Hg⁺⁺

Prediction No toxicity in 9 of 10 sites

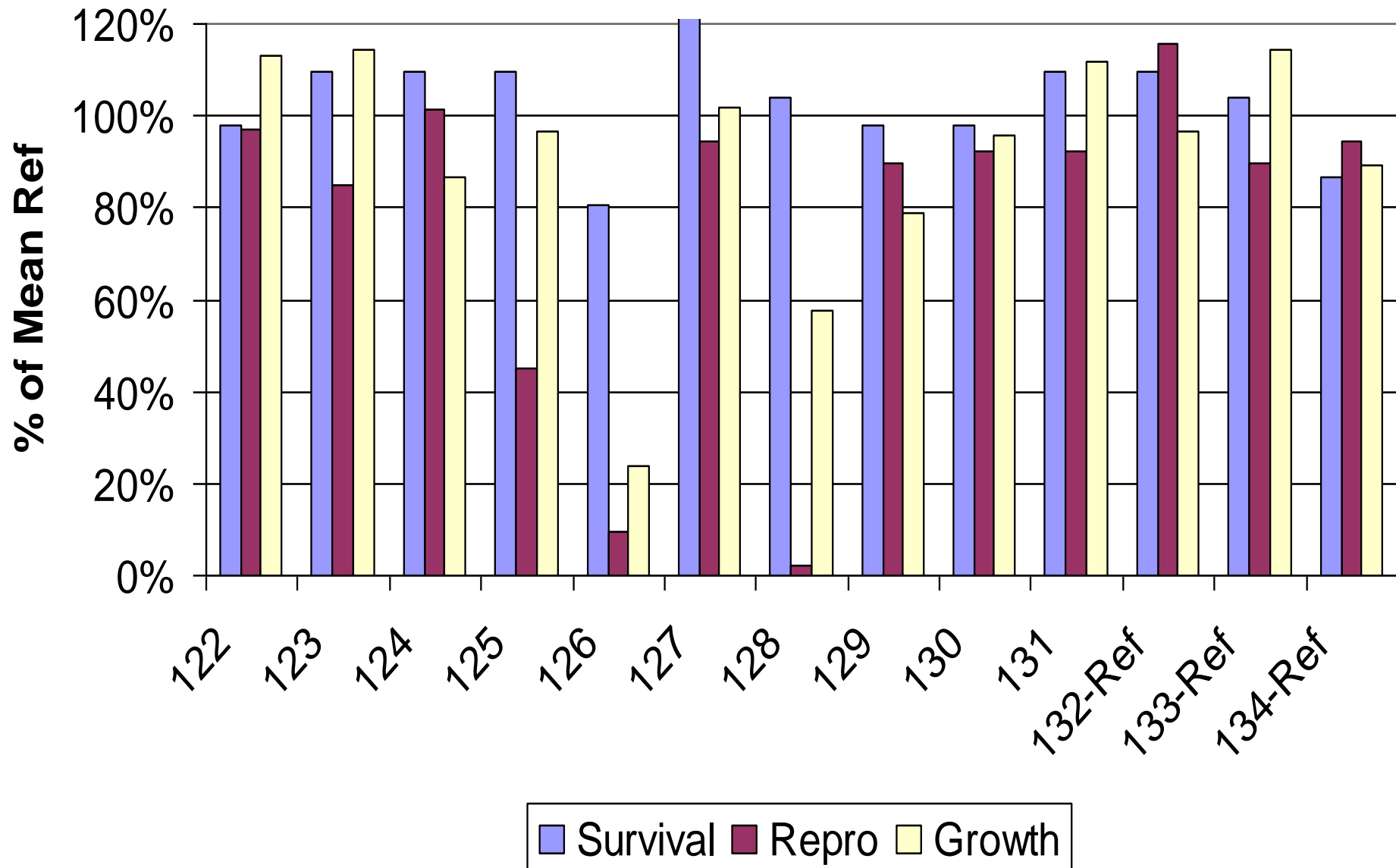
Moderate to no toxicity at one location



Results of Biological Survey



Bioassay Results



Known Bioassay Biases

Disruption of sediment microstructure

Minimal dilution

$\frac{1}{2}$ dilution 3X/week

Less than optimal? food or no food

Toxicity less when fed algae

Potentially limited genetic potential



Leptocheirus plumulosus

Common to East Coast US

Lives in U-shaped mucus-lined burrow

Found at the top of the sediments

Measured irrigation rates several times/hr

Probably filter-feeder and deposit feeder

Pulse species – rapid population increases co-incident with phyto blooms

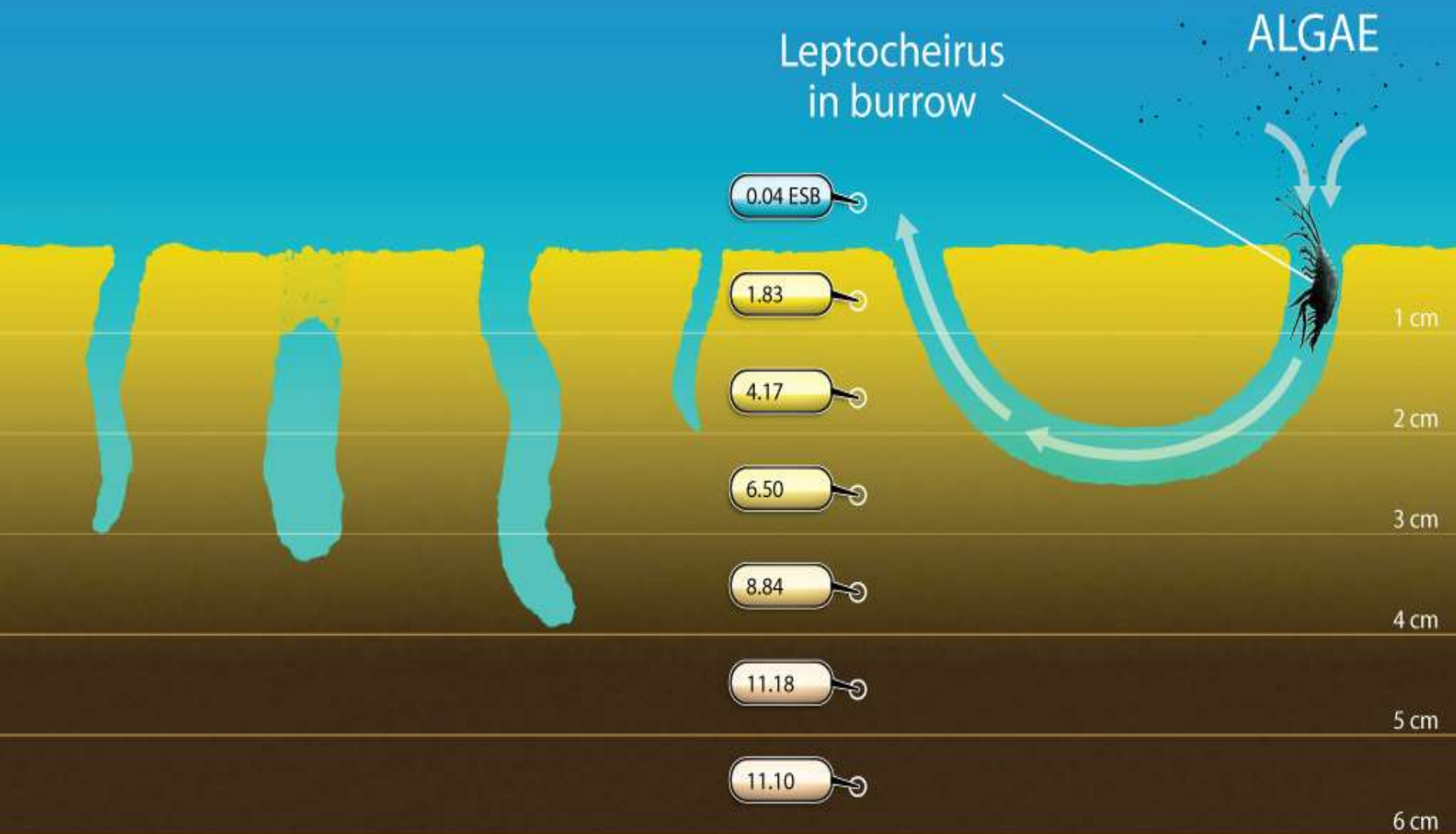
Broods young in pouch, young probably dispersal stage

In terms of exposure to chemicals, may be more like zooplankton than infaunal benth

Among more sensitive species to narcotics



Natural Conditions



Lab Bioassay

3.20 ESB

Leptocheirus
in burrow

TETRAMIN

6.50

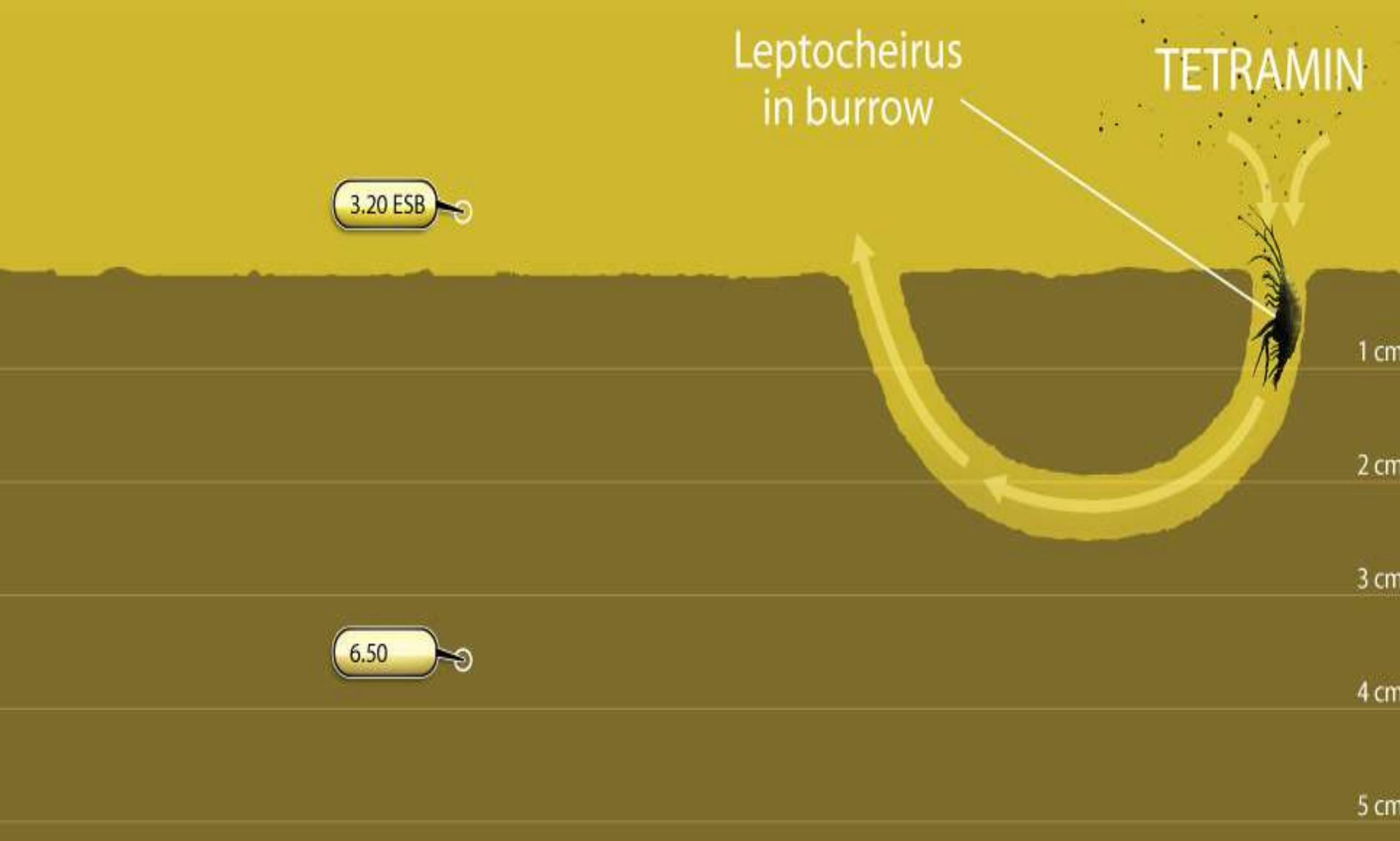
1 cm

2 cm

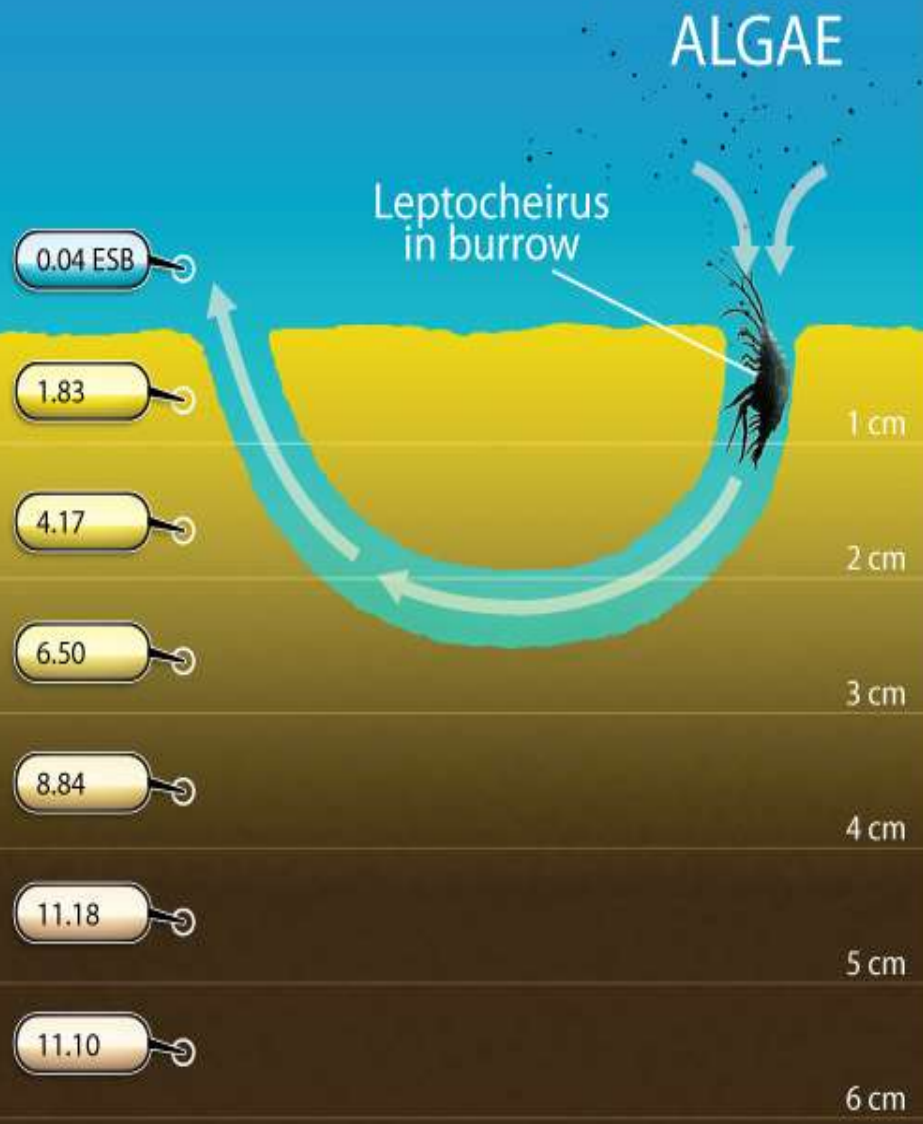
3 cm

4 cm

5 cm



Natural Conditions



Lab Bioassay



Harmonized Lines of Evidence

Sediment Chemistry

No effects predicted at 90% of areas

Null to moderate effects predicted at 10% of area

Therefore no effect on community

Sediment Bioassays

With biases and most sensitive species

No tox. at 50%, low tox at 30%, mod tox at rest

Estimated bias 3 to 10 or more

Wout bias, no effects likely at 9 or 10 of 10 sites

No effects on community

Biological Survey

No effects on community



Common Sense Ending

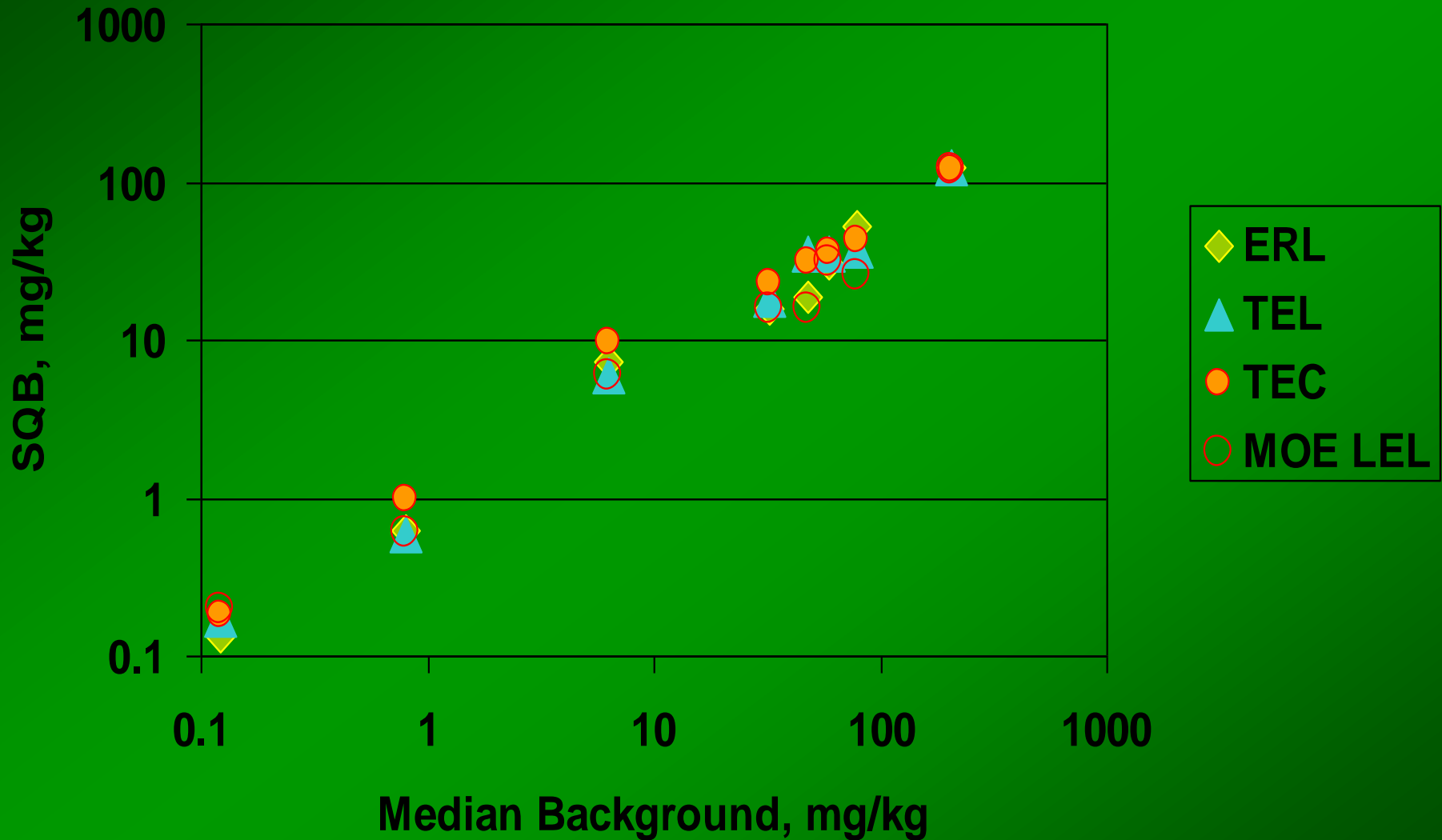
Get it in writing

Know your ecosystem

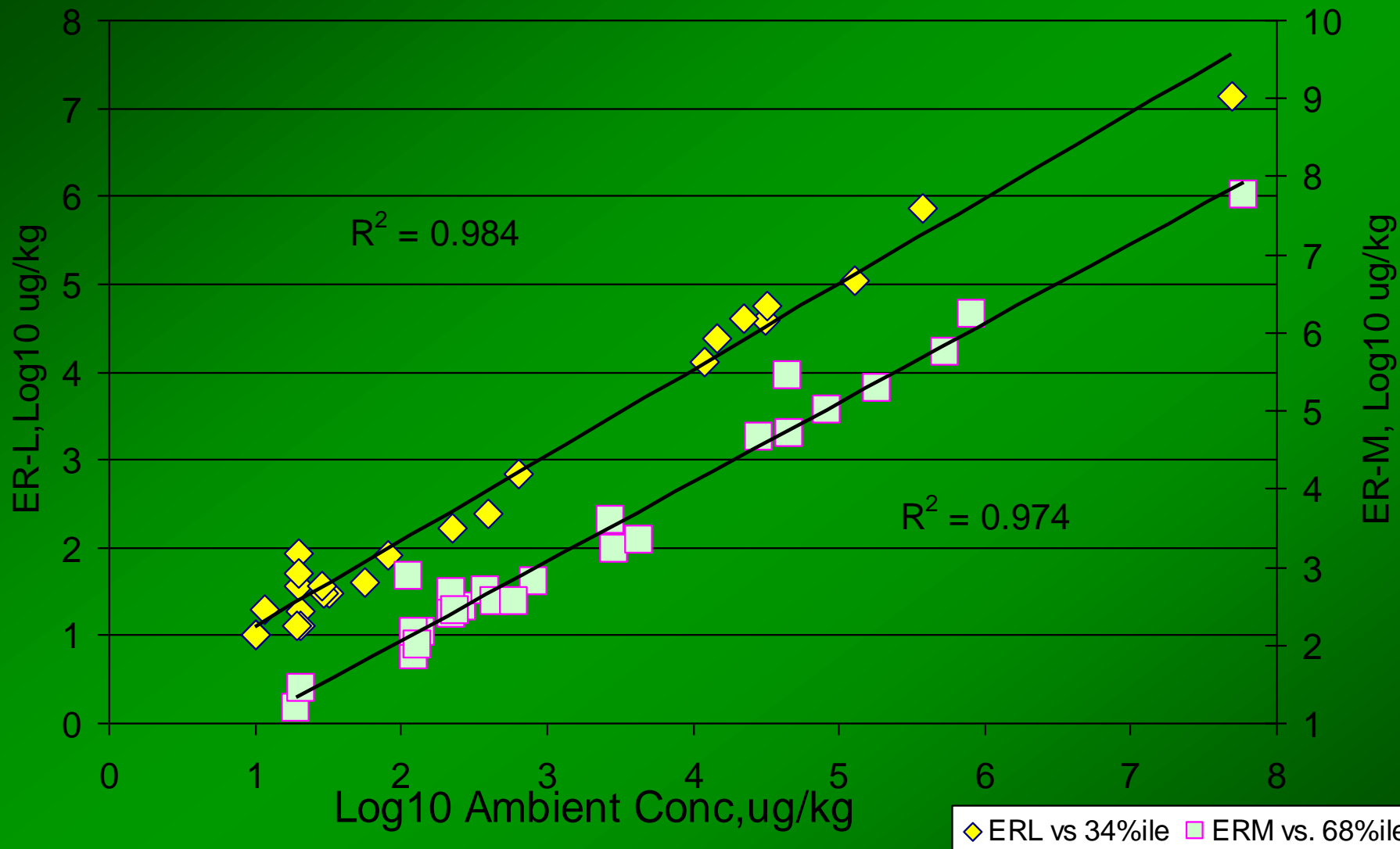
Be willing to manipulate methods



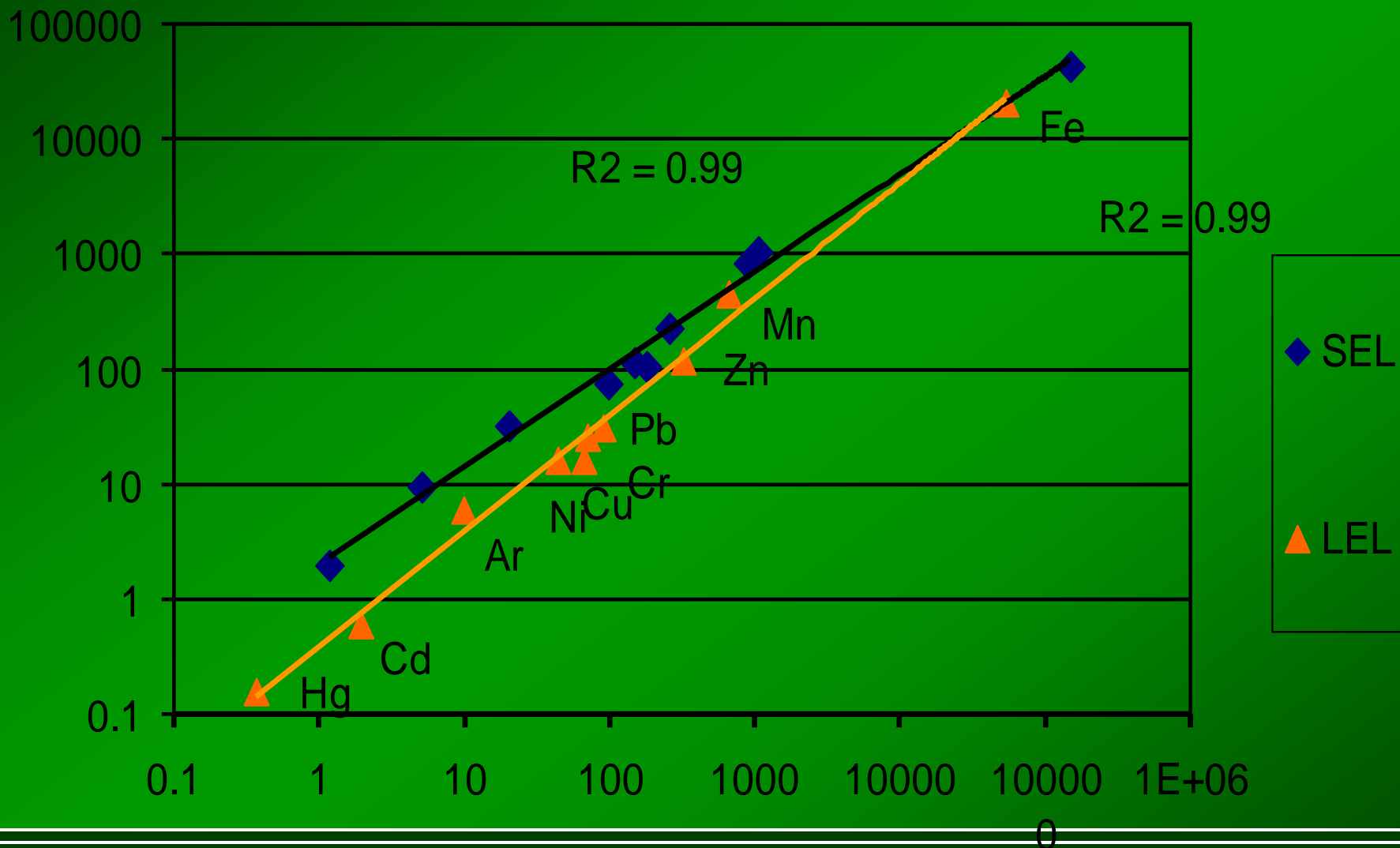
LT-SQG for Metals vs. Median Urban Conc. In Sediments from US



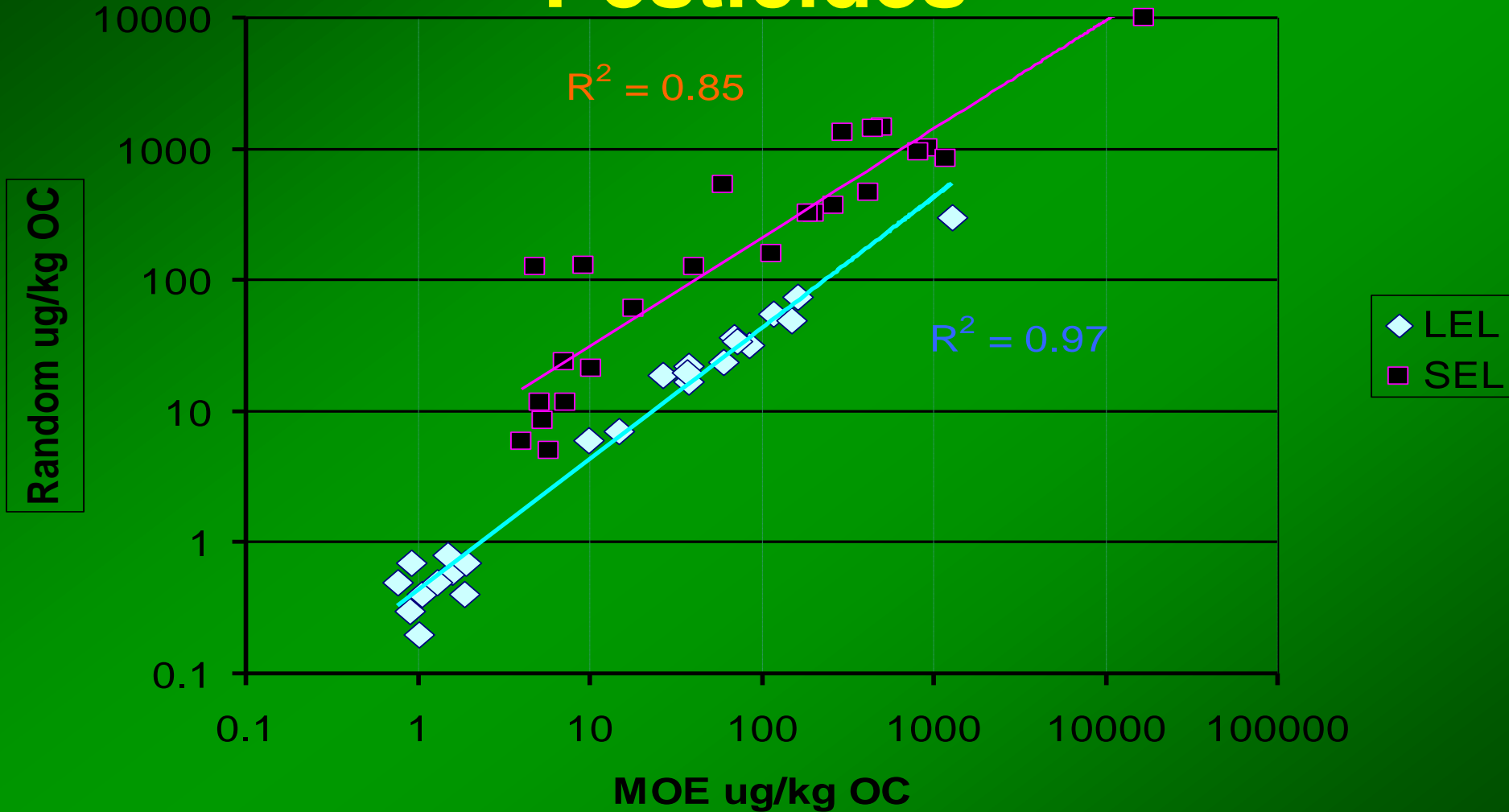
ER-L and ER-M Values for PAH, metals, PCB vs. "Ambient" Conc.



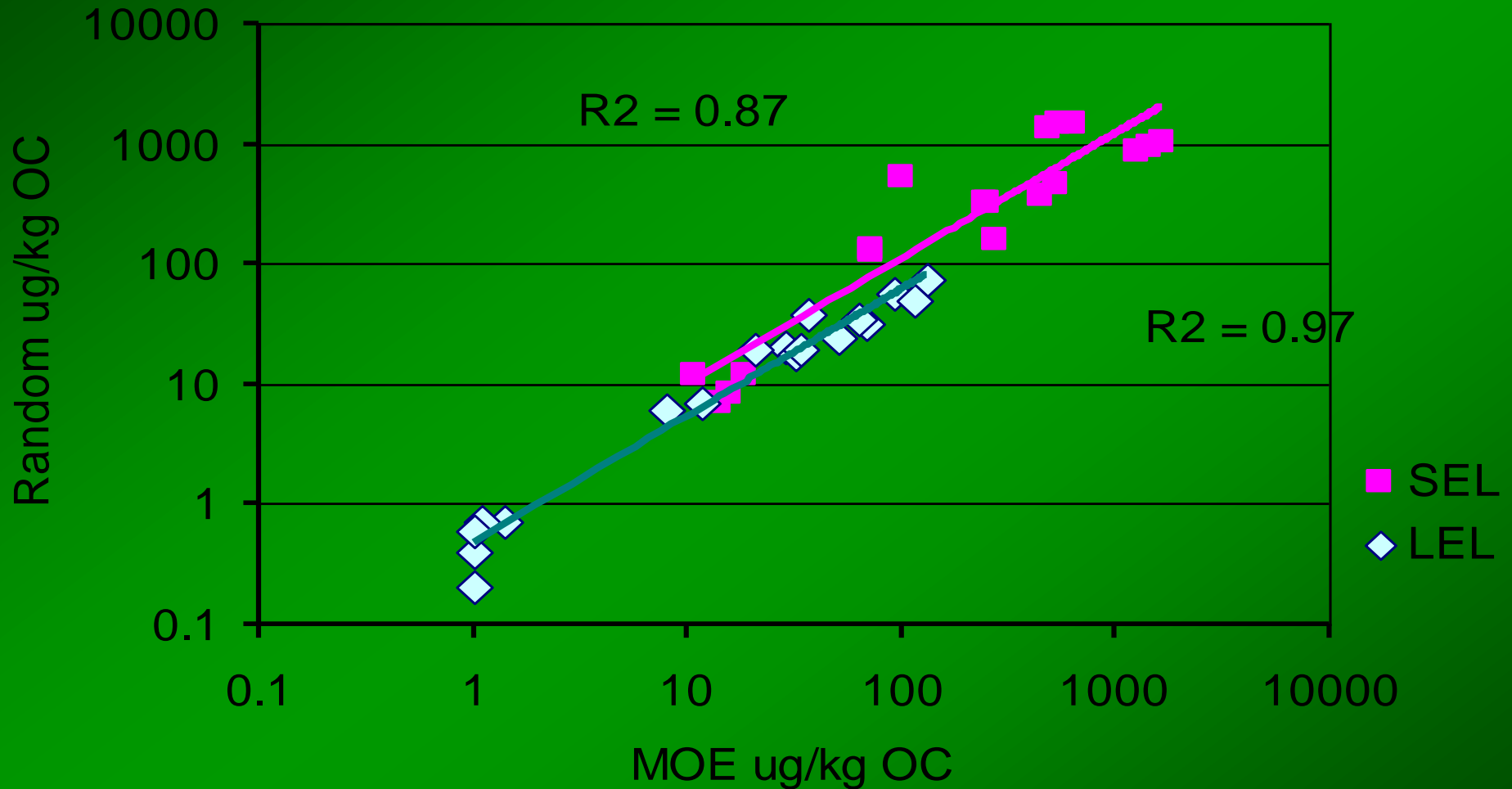
Random (Analytical) SELs and LELs vs. MOE Values for Metals (mg/kg)



vs. MOE Values for PAH, PCB, Pesticides



Random (by iteration) SELs and LELs vs. MOE Values for PAH, PCB, Pesticides



Conclusions of Analysis

Values statistically similar to LELs and SELs can be generated with constrained random sampling of the chem. conc.

This sampling does not include “effects” at all

Magnitude of SEL and LEL function of

1. Bias (choice of chemical to estimate SEL/LEL)
2. Randomness (constrained random sampling)
3. Distribution of chemicals in the database

Therefore, critical assumption that SELs and LELs are “effects-based”, toxicological values is mirage, delusion, fantasy, myth, blather, poppycock, drivel, nonsense, hoax, balderdash, BS, inanity,

