

Short and long-term monitoring plans

Very robust “front loaded” sampling designs
Focus on detecting statistical changes

Must be prepared to make changes in sampling design as technology improves (e.g., YOY bass; non-lethal biopsy plugs; seasonality in bass Hg)

How do we decide when we can modify our long-term sampling program or remove a parameter?
What criteria?

Scaling Issues: Lab → Microcosm → Field

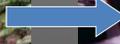
Lab experiments with amphipods → stream mesocosms → bank stabilization & floodplains

“Microcosm experiments have limited relevance in community and ecosystem ecology”

“Irresponsible for academic ecologists to produce larval microcosmologists”

Carpenter, 1996

- Do the statistical advantages of small-scale experiments offset the problems of scale?
- What information is lost when we move from natural ecosystems to model systems?
- How do we to identify scale-dependent processes?



Relative Risk Models

- Innovative to link human and ecological risk, but this presents some challenges
- How do we prioritize protection of specific ecological services versus human health?
- How best to engage stakeholders in this discussion?

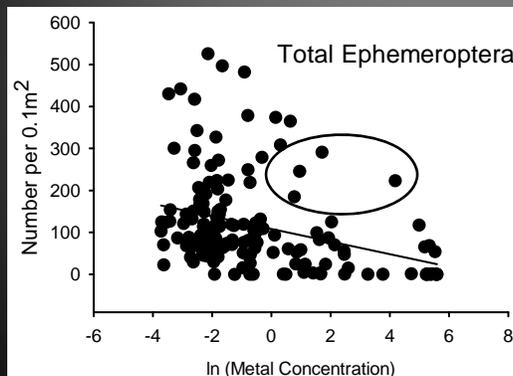
How do we decide when restoration is working?

- Statistically significant downward trends in Hg?
- Given the huge variation, very difficult to predict significant reductions in some variables
- Overall, statistical models predict only a modest reduction in sediment Hg after restoration
- Empirical data from pilot studies more encouraging than predictive models

Power, P-values & Physics Envy

“What is considered noise to a physicist should be music to the ears of ecologists”

(Simberloff 1980)



We should embrace
& exploit this variation

Development of statistical models

- Stepwise multiple regression versus model selection approaches (Bayesian, AIC)
- Some journals are rejecting papers that simply use stepwise regression
- New model selection approaches are broadly accepted by the scientific community
- Also getting attention in the lay media

*“Statistics may not sound like the most heroic of pursuits. But if not for statisticians, a Long Island fisherman might have died in the Atlantic Ocean after falling off his boat early one morning last summer. **The man owes his life to a once obscure field known as Bayesian statistics** — a set of mathematical rules for using new data to continuously update beliefs or existing knowledge.”*



New York Times
Sept. 29. 2014

How much emphasis should we place on identifying statistically significant relationships (e.g., $p < 0.05$)?

Should we consider these alternative approaches?

Can the Phase I interim measures be used in a short term monitoring context to inform decisions regarding effectiveness of restoration treatments?

Can we treat bank as a separate study units?

Design some larger-scale field experiments to quantify multiple restoration treatments

Bank stabilization

Bank stabilization with biochar

Capping