A scanning electron micrograph (SEM) showing a detailed view of a diatom frustule. The central feature is a large, elongated, teardrop-shaped structure with a highly porous, lattice-like surface composed of numerous small, rectangular pores. This structure is surrounded by other smaller, more irregularly shaped diatom components, some showing similar porous structures and others appearing as fragmented silica shells. The overall texture is intricate and three-dimensional.

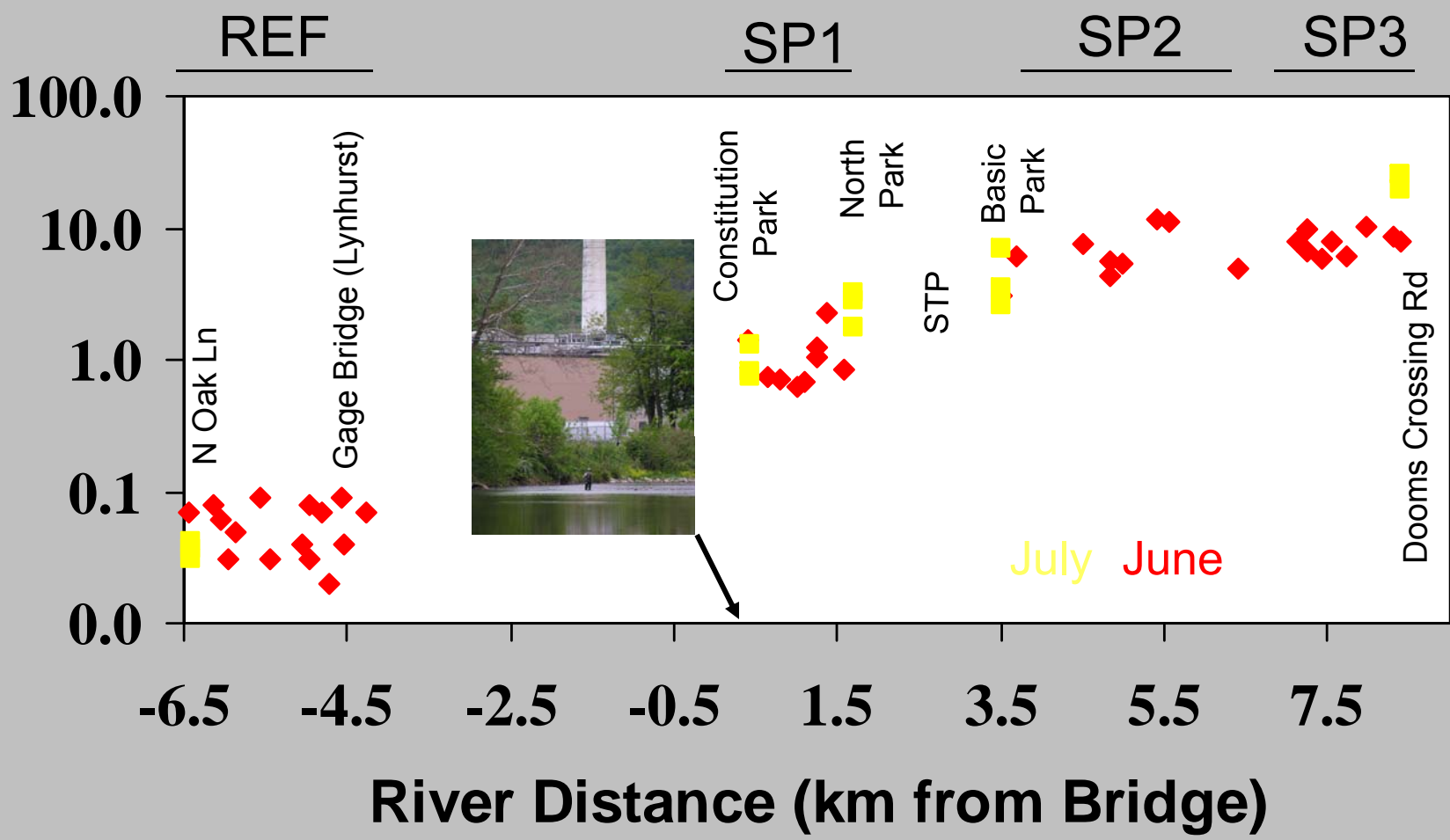
Periphyton Surveys and Trophic Transfer Modeling

Prof. Mike Newman
Kyle R. Tom

In collaboration with the W&M avian and URS Eco Study Teams

Mercury Spatial Distribution

Total Hg (ug/g dry wt)





Periphyton Update

- * Extended sampling downriver in trophic modeling efforts
- * We analyzed additional metals to further understand metal transport/accumulation. Student-Newman-Kuels Test

WHAT INSIGHTS EMERGE FROM THIS ANALYSIS?

Several metals in addition to Hg increased at Waynesboro

(☒ ^{15}N increased at STP and then decreased, ☒ ^{13}C did not change spatially)

Distinct patterns so “depositional regime” is not sole driver of $[\text{Hg}]_{\text{site}}$

Hg is the only element still increasing after Dooks Crossing

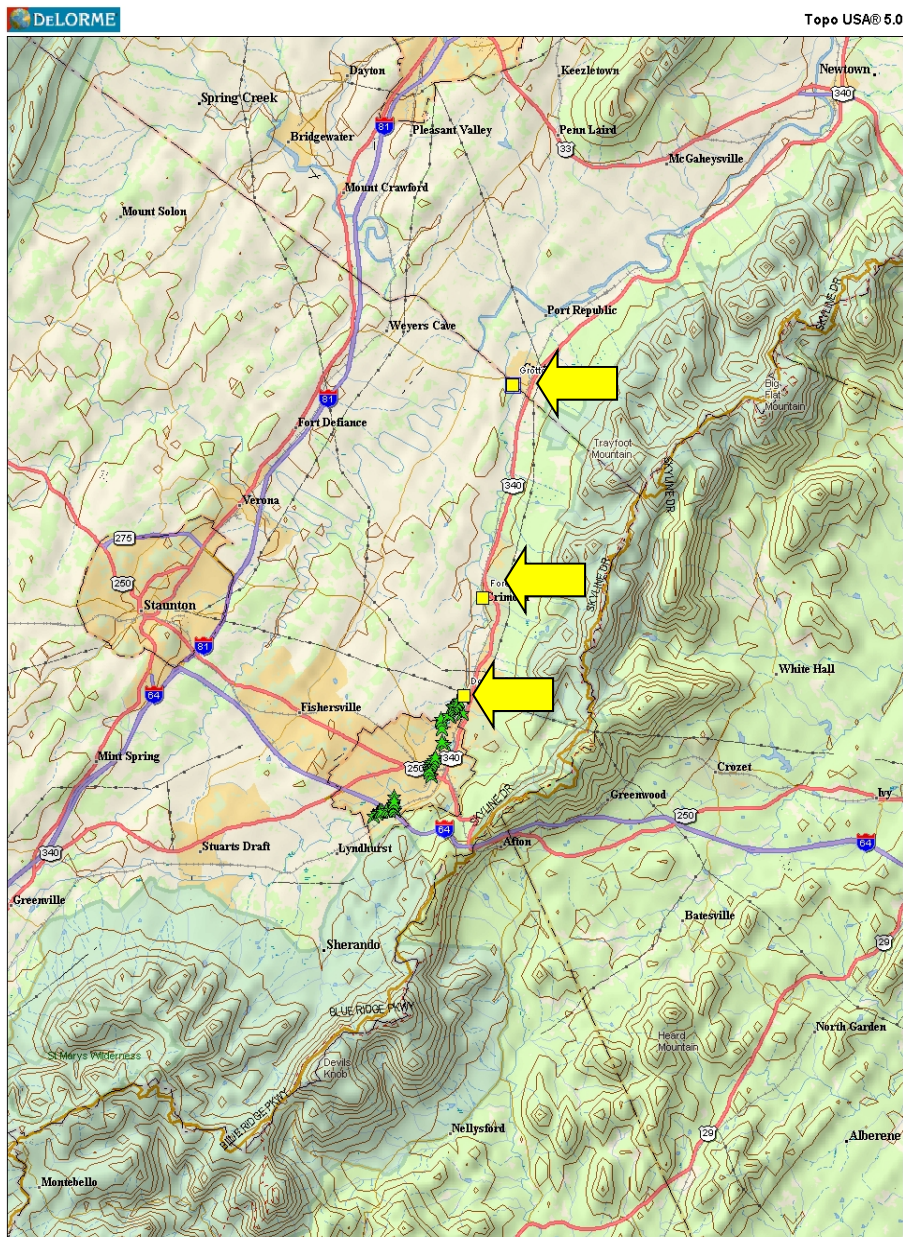
Why? Are several plausible, nonexclusive hypotheses -

1. Relative magnitude of sources dictates metal spatial distributions?
2. Spatial qualities (floodplain) of sources create differences in spatial distributions?
3. Trophic domination of Hg dynamics relative to those of the other metals?

Like nutrients, Hg exhibits elemental “spiraling” that fosters retention?

Knowing which is/are “true” informs future predictions/remediation





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Current Sampling For Trophic Modeling

Central theme is to coordinate sampling with avian and URS Eco Study (invertebrates & fish) teams for tissue analyses. VIMS team also took samples to fill gaps.

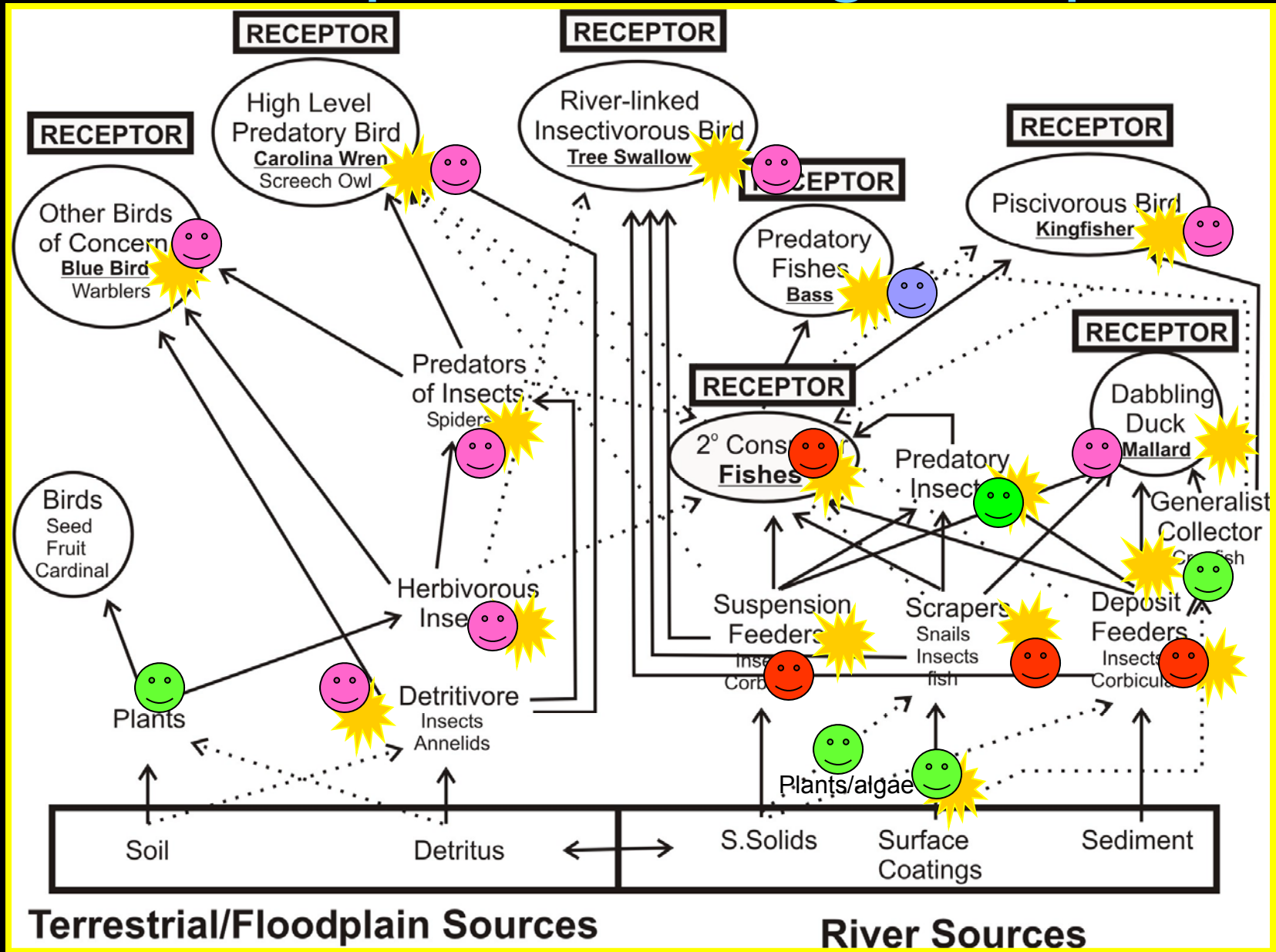
Sites were sampled at

- *Dooms Crossing Rd (Rt 611)
- *Crimora (Augusta Forestry Center)
- *Grottoes (Town Park)

Also took advantage of past fish sampling (larger fish):

- *1BSTH020.44
Dooms near Rt 611 bridge
- *1BSTH014.49
Crimora at Augusta Forestry Center
- *1BSTH004.21
Grottoes near Grand Caverns bridge

2006 Trophic Modeling Samples



Promising Preliminary Results

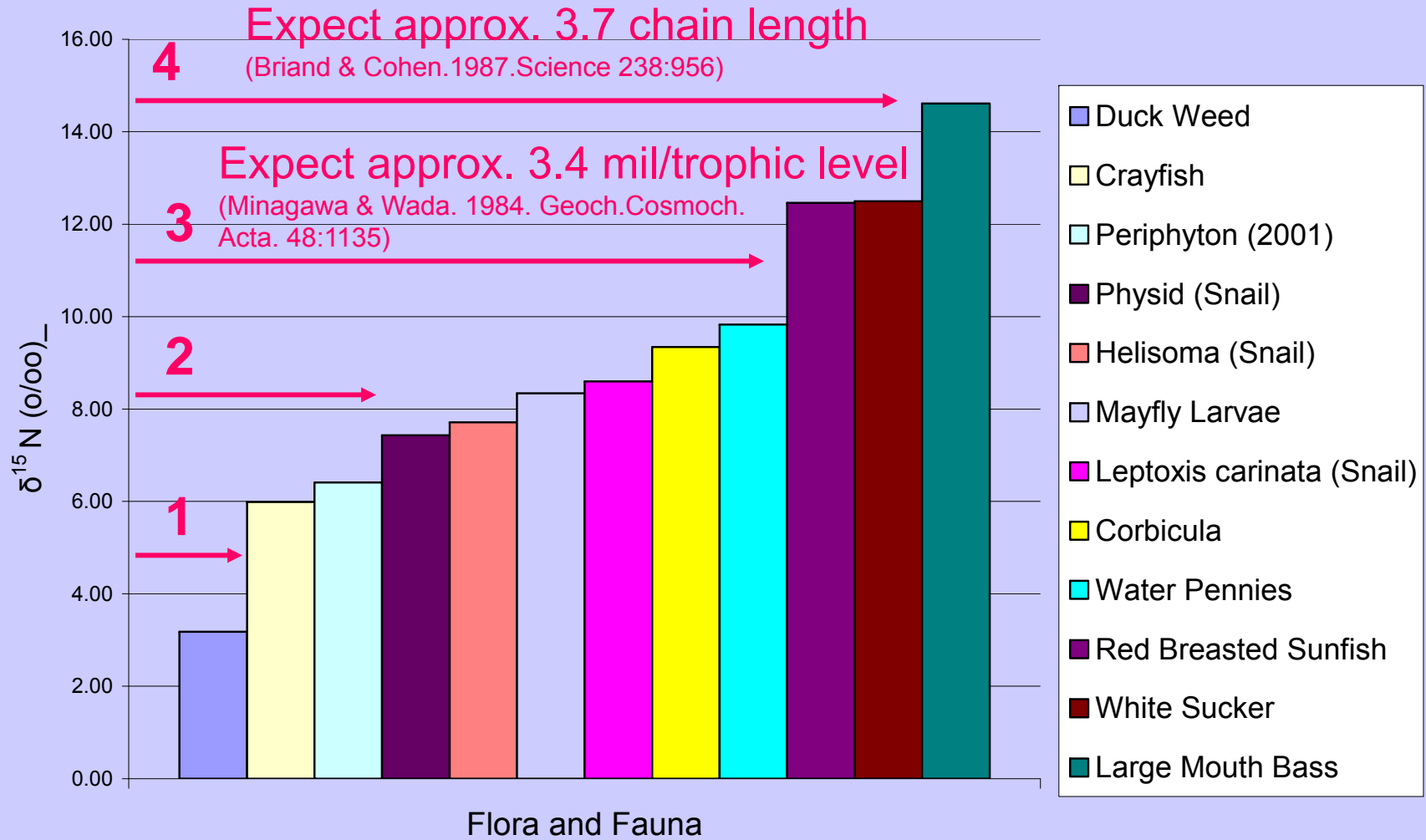


Promising Preliminary Results

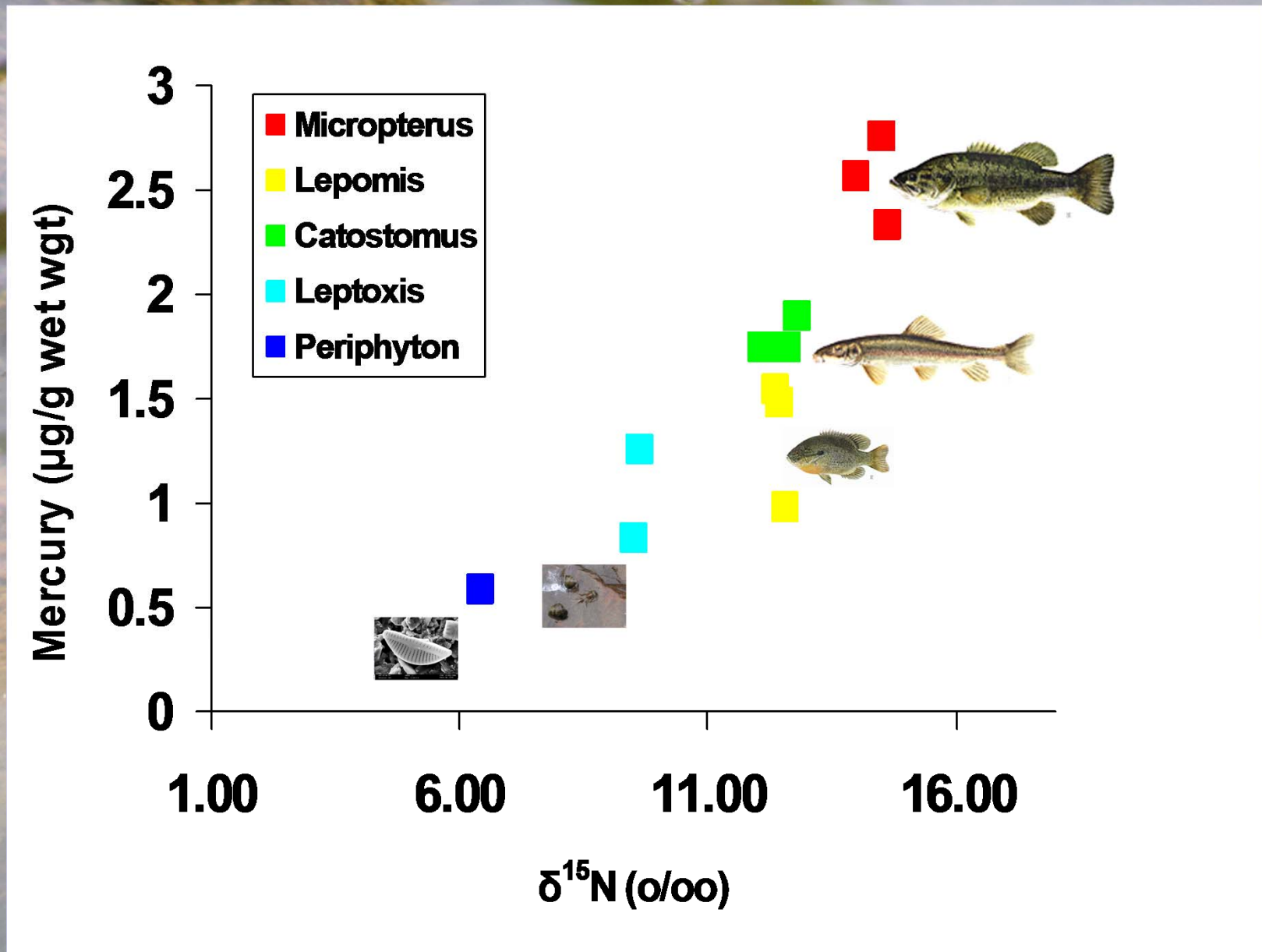


Patterns Slowly Surfacing

Dooms Crossing Rd (Rt 611)



Patterns Slowly Surfacing



Trophic Modeling

Statistical Fitting of Data to Biomagnification Models:

A separate model will be generated for each site and slopes compared to assess whether a more general model can be generated that includes all sites. Data pairs (total mercury concentration vs $\delta^{15}\text{N}$) will be fit to the model,

$$[\text{Hg}]_i = a + b(\delta^{15} N_i)$$

or, if plots of mercury concentration vs $\delta^{15}\text{N}$ suggest an exponential relationship,,

$$[\text{Hg}]_i = e^{a+b\delta^{15} N_i}$$

Proposed for 2007/2008

Locations

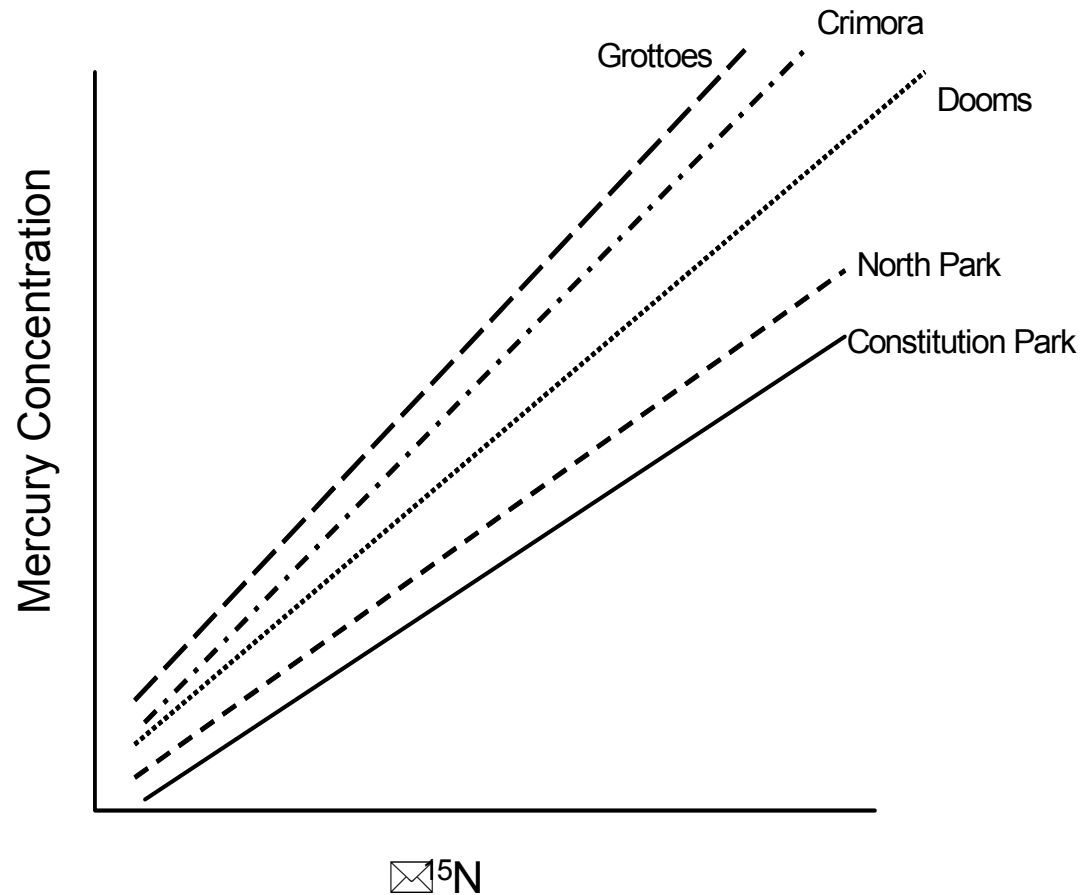
Constitution Park
North Park
Dooms Crossing
Crimora (AFC)
Grottoes (Town Park)

Sampling

Triplicates of each
All whole body
Split every composite
for Hg and N isotopes

Model Cross-validation

- 2 to Build/1 to Test
- Also PRESS



QUESTIONS?

