LONG-TERM AND LARGE-SCALE TRENDS IN MERCURY BIOACCUMULATION SUWANNEE RIVER BASIN, FLORIDA

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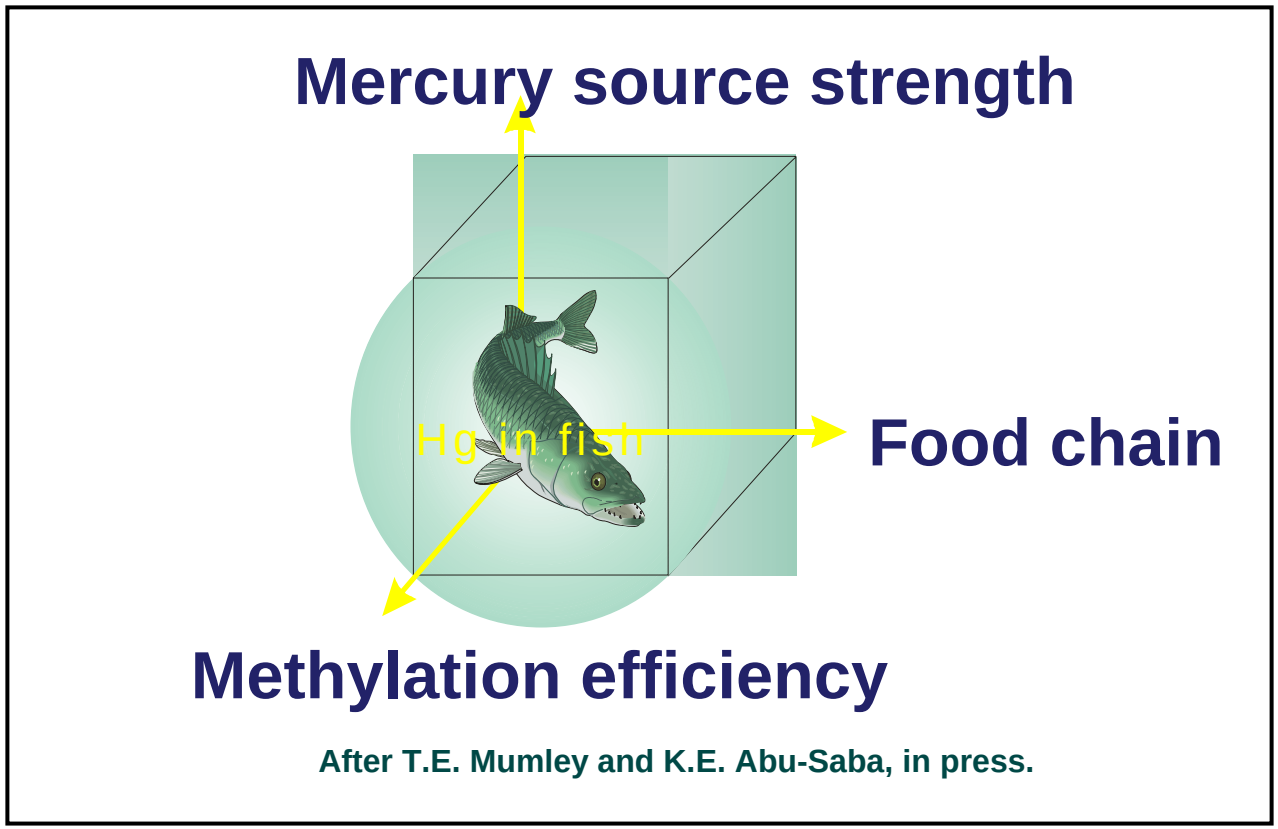
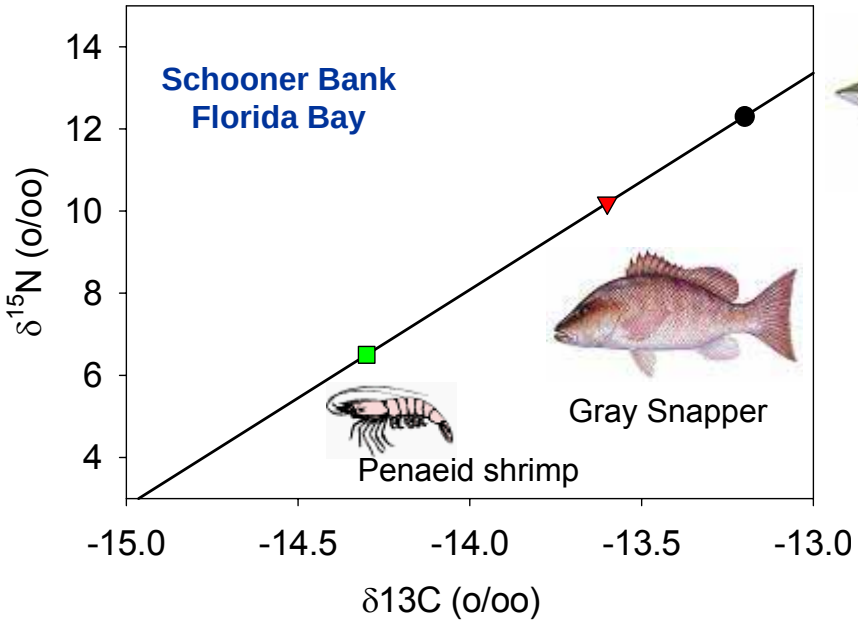
Bioacumulation of Mercury in Stream Ecosystems



Primary Study Objective

To investigate the effects of source strength, cycling, and food web interactions on the bioaccumulation of mercury in stream ecosystems

Stable isotopes help establish estuarine/marine trophic relationships

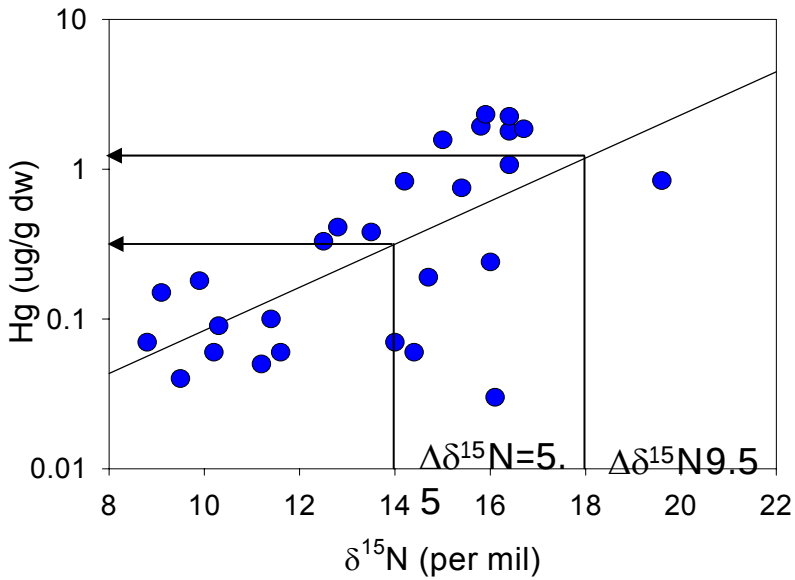


Blacktip Shark

Food web complexity

↑trophic level ≈ ↑δ^{15}N ≈ ↑Hg burden

Relationship between Hg and ^{15}N in a marine food web



Atwell, L. et al. 1998. Can. J. Fish. Aquat. Sci. 55:1114-1121

Adapted by Robin Stewart, USGS, Menlo Park

Questions

- **Stable isotopes useful in establishing trophic relationships in riverine systems?**
  - **surface water run-off**
  - **tributaries**
  - **sharp gradients in water chemistry and productivity**

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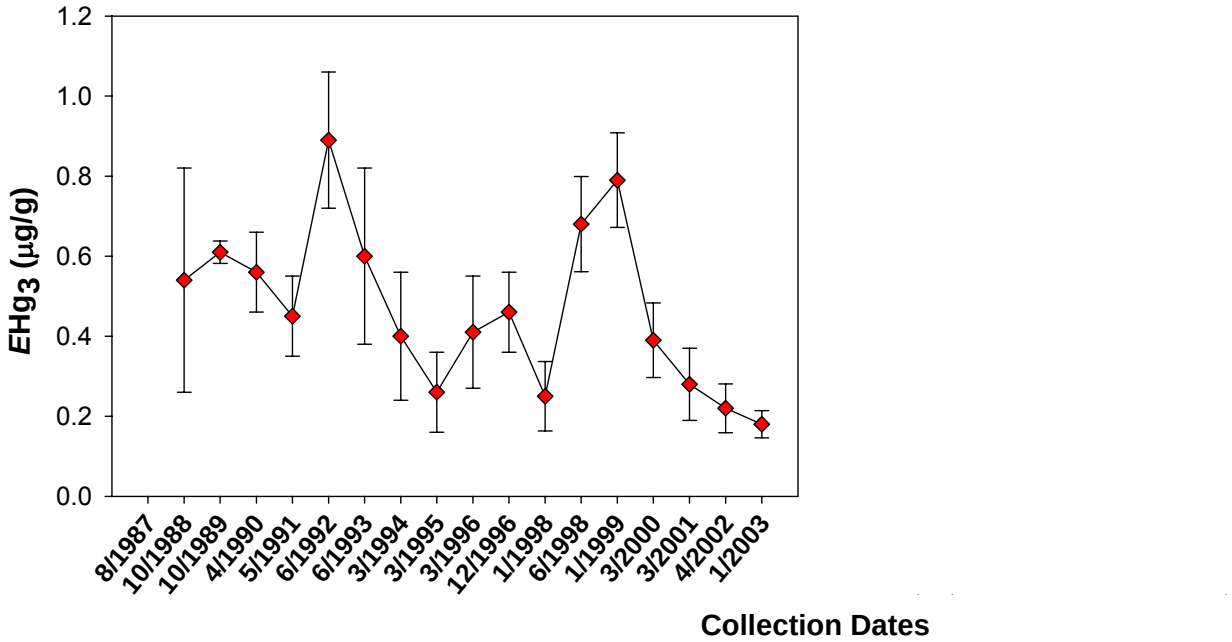
  - **i.e. variability within a river reach vs. entire basin?**

Long-term Monitoring of Mercury Body Burden for Largemouth Bass Fowlers Bluff, Suwannee River



Drivers for fluctuations? (no apparent change in atm. dep.)

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  - **surface water run-off**
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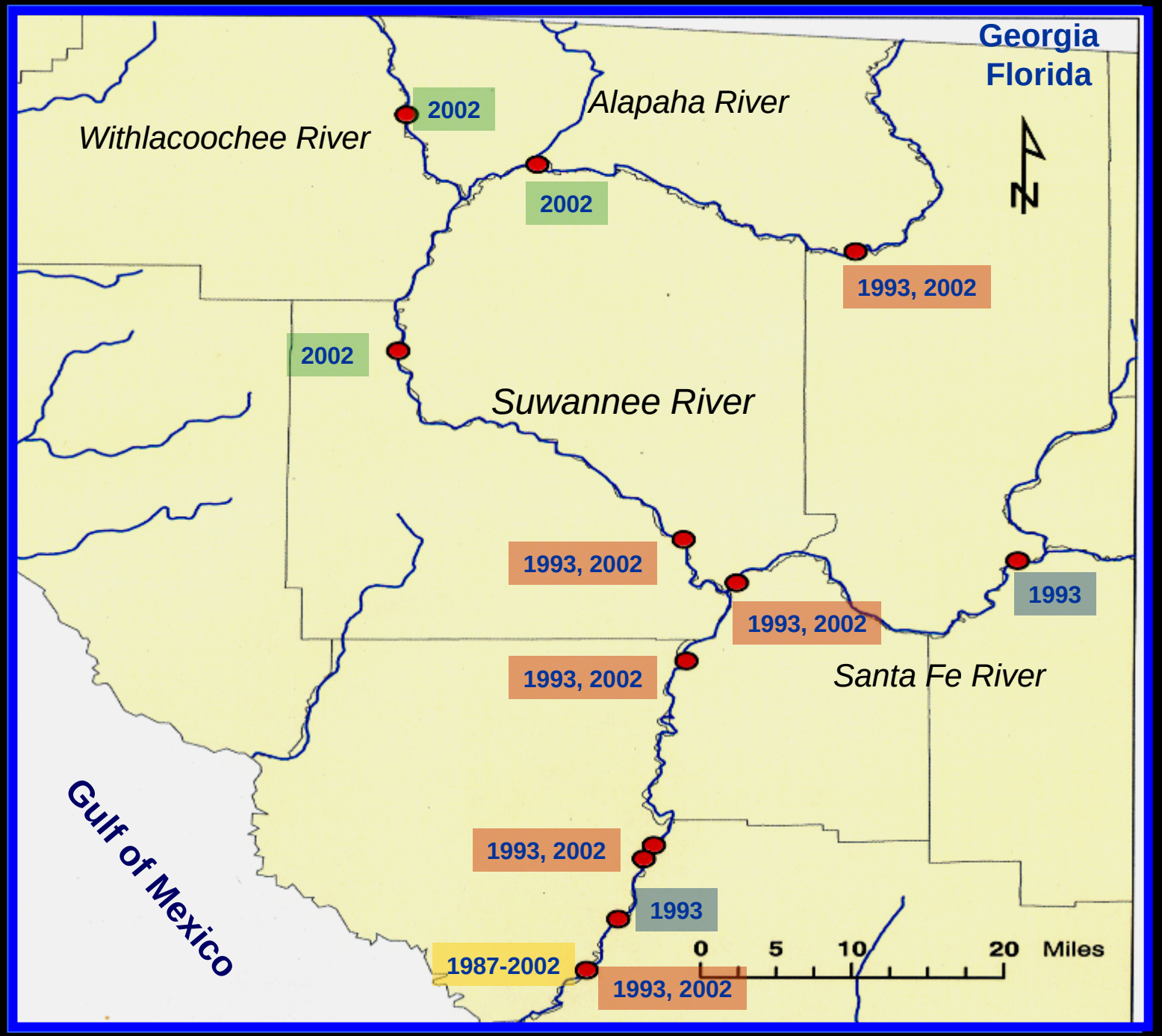
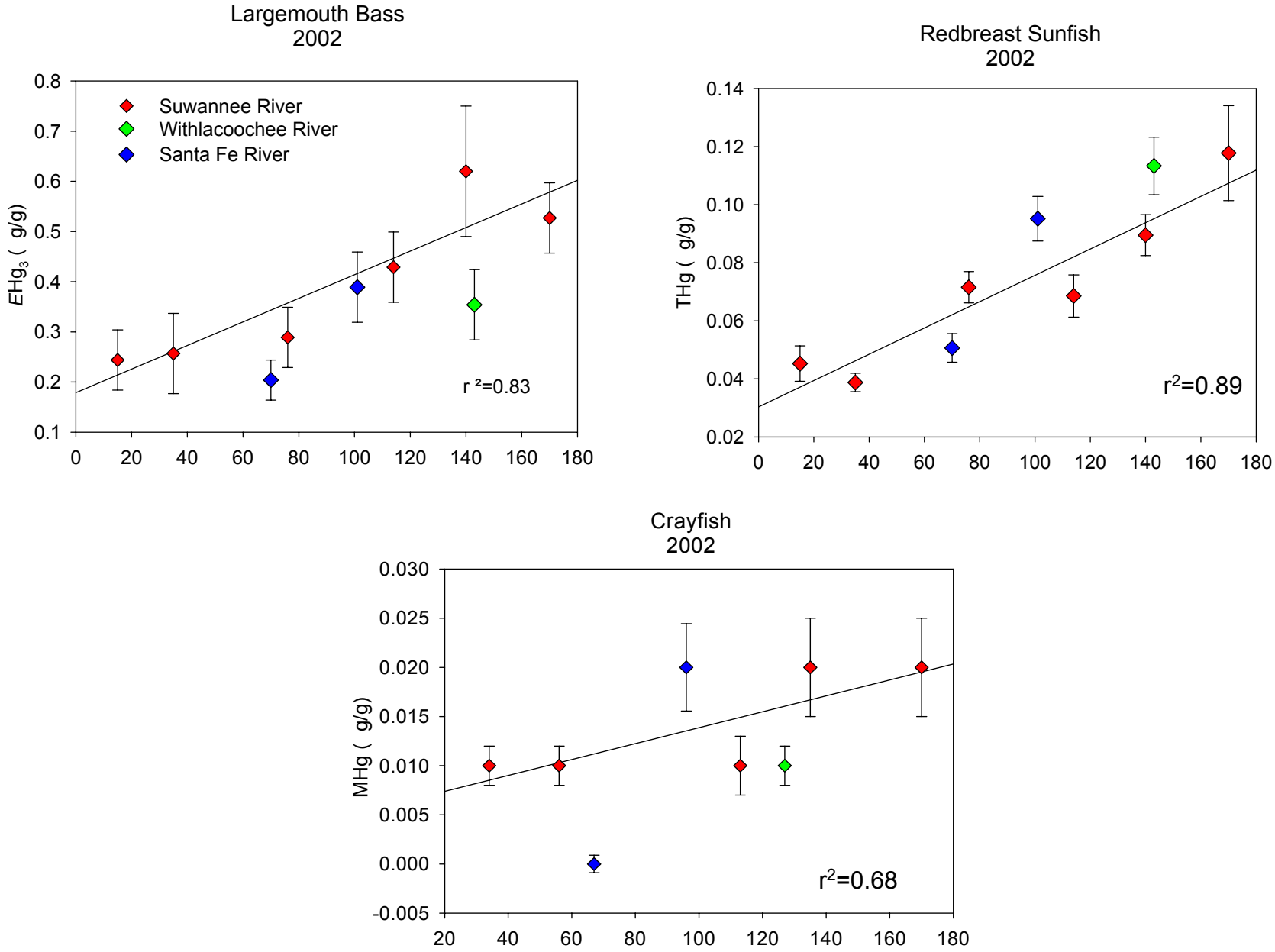
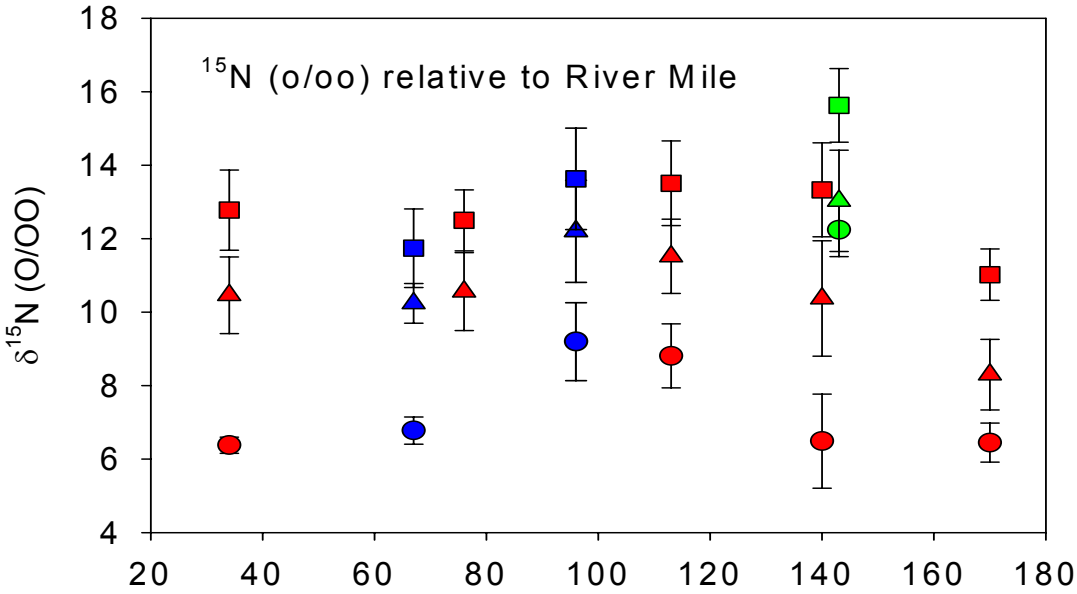
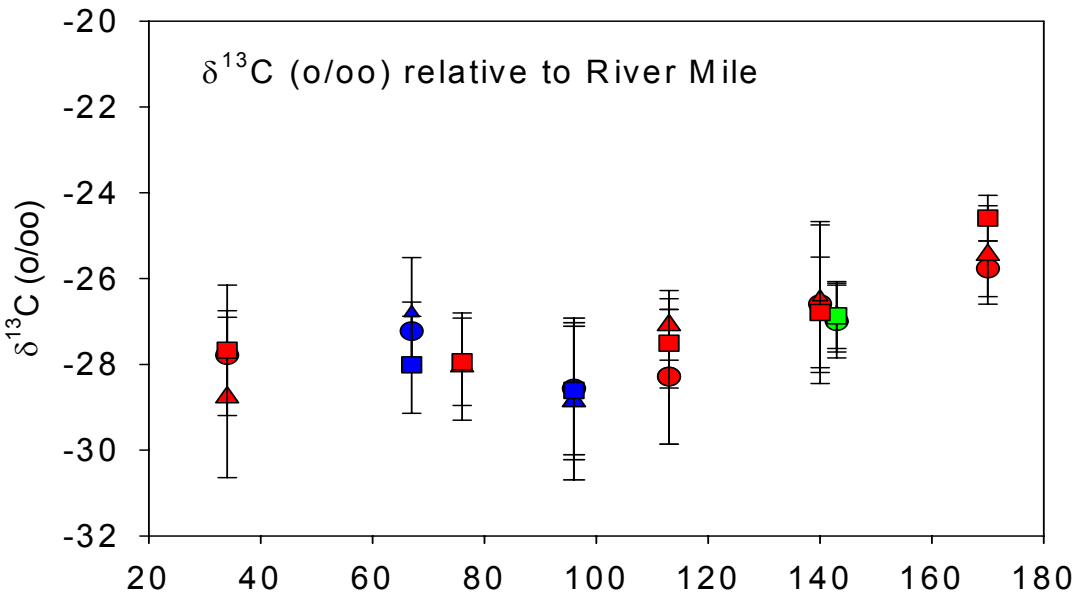
  - **sharp gradients in water chemistry and productivity**
- **Influence of local biogeochemical processes on bioaccumulation of contaminants (sp. Mercury) in riverine systems?**
  - **i.e. variability within a river reach vs. entire basin?**
- **What drives temporal trend in mercury body burden of fish in Suwannee River basin?**


Georgia
Florida
Withlacoochee River
Alapaha River
Suwannee River
Santa Fe River
Gulf of Mexico
2002
2002
1993, 2002
2002
1993, 2002
1993
1993, 2002
1993, 2002
1993, 2002
1993
1987-2002
1993, 2002
0 5 10 20 Miles

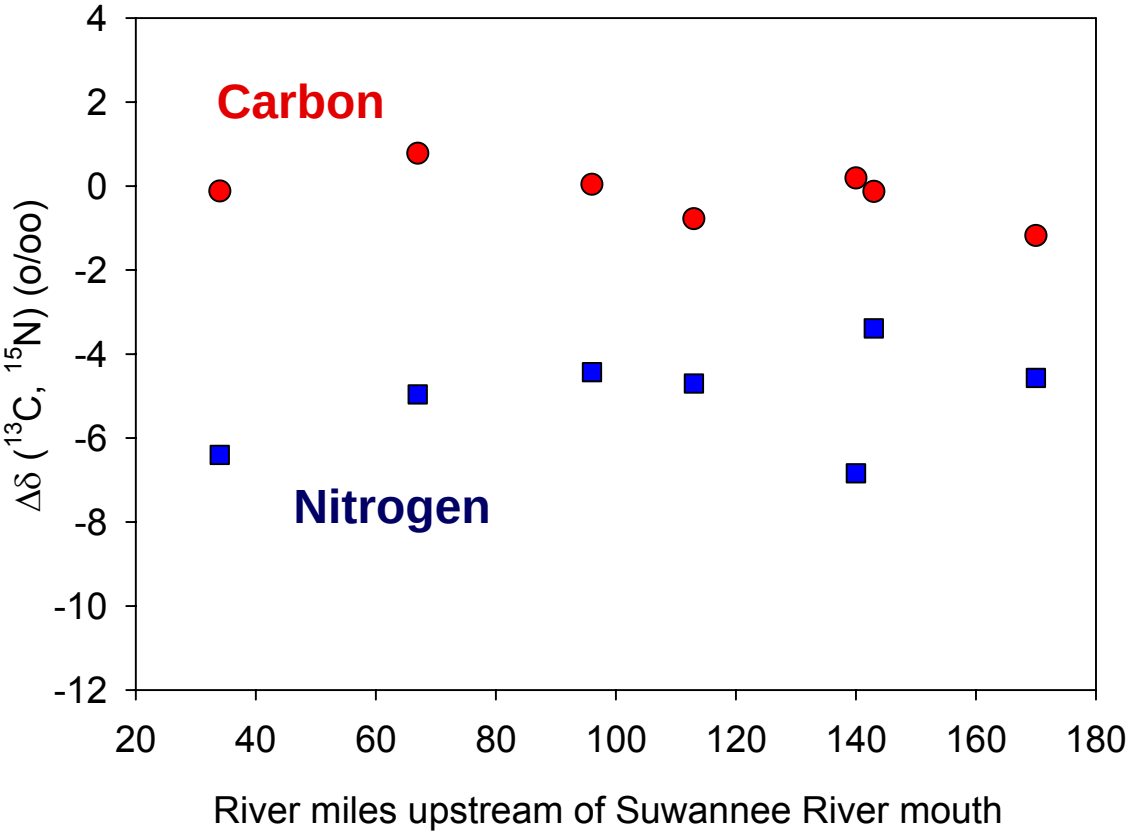

Largemouth Bass
2002
Suwannee River
Withlacoochee River
Santa Fe River
EHg3 (g/g)
r ²=0.83
Redbreast Sunfish
2002
THg (g/g)
r2=0.89
Crayfish
2002
MHg (g/g)
r2=0.68
River mile upstream from mouth of Suwannee River

Role of Trophic Complexity?

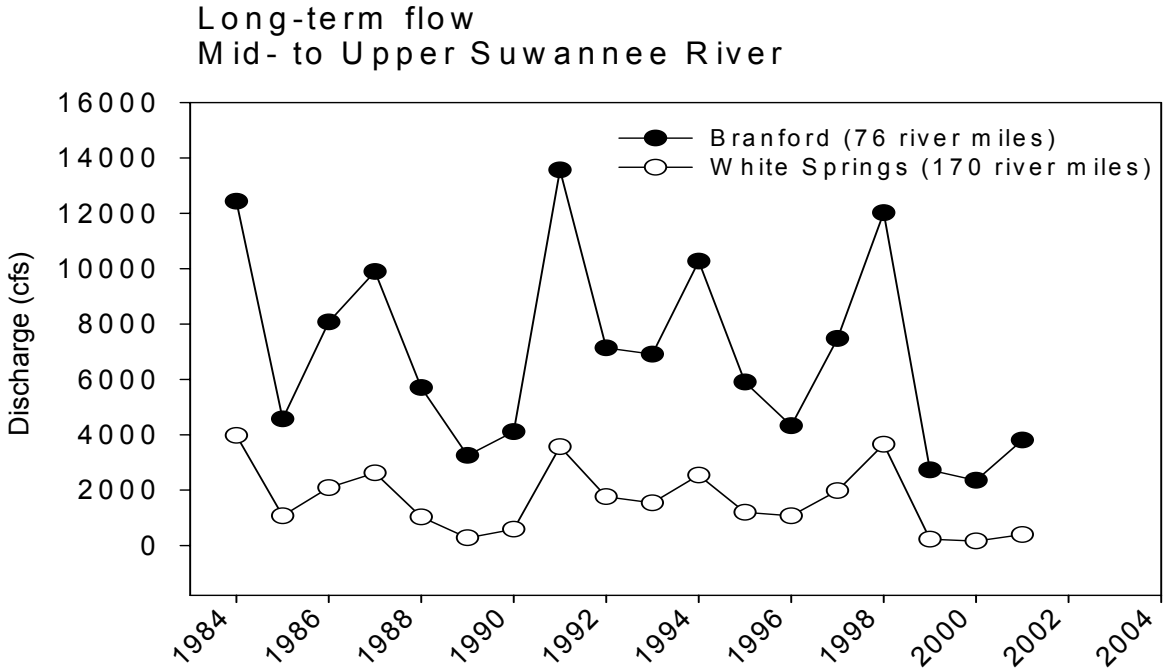


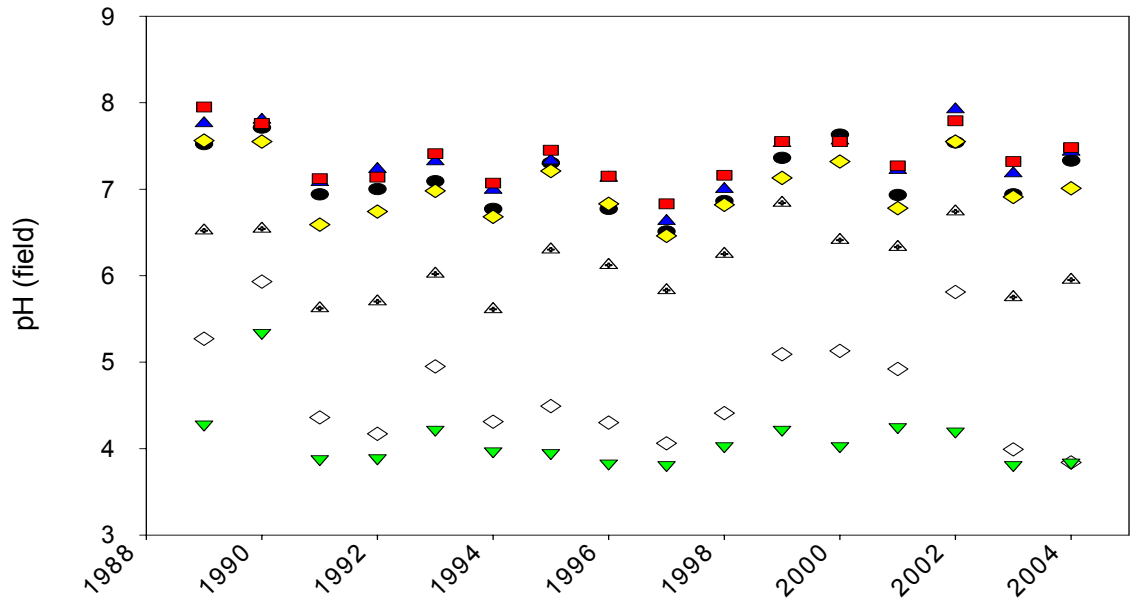


Difference in stable isotopic signature (C, N)
between crayfish and largemouth bass along river course



$\Delta\delta^{15}$N only slight decrease with distance upstream
Mean $\Delta\delta^{15}$N = 5.04 (±1.19)‰





Transport/transformation? (pH, DOC vary in both space and time)

Conclusions

- THg body burden in all three consumers has experienced decrease since 1987, however values have peaked repeatedly
- THg increases with increasing distance upstream for crayfish, redbreast sunfish and largemouth bass
- Stable isotopes indicate that local biogeochemical processes and mercury transport/transformation are likely more important than trophic level shifts in mercury bioaccumulation


What's next?

Future Research:

- importance of water level
  - natural variability
    - seasonal wetting/drying river margins
  - extreme events
    - extended drought
    - flooding
- forcing factors
  - pH
  - DOC
  - additional Hg loading
- moving further downstream
  - continue decrease?
  - estuary as mixing zone?
    - pH, quality of DOC, SO_4^-
- resource management
  - temporal trends/advisories

Lookin' for bugs in all the wrong places…

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