

South River Aquatic Environment



South River Aquatic Environment
2010 Expert Panel Meeting
October 5, 2010

Expert Panel Question

- What critical gaps remain in our understanding of the South River aquatic environment that specifically impact remedial options selection and implementation?

Presentations

- Quantification of Conceptual Model for Methylmercury Supply to Smallmouth Bass (Reed Harris)
- Phase II 2010 Ecological Study (Greg Murphy)
- Trophic Analysis and Modeling - Aquatic Component (Mike Newman)

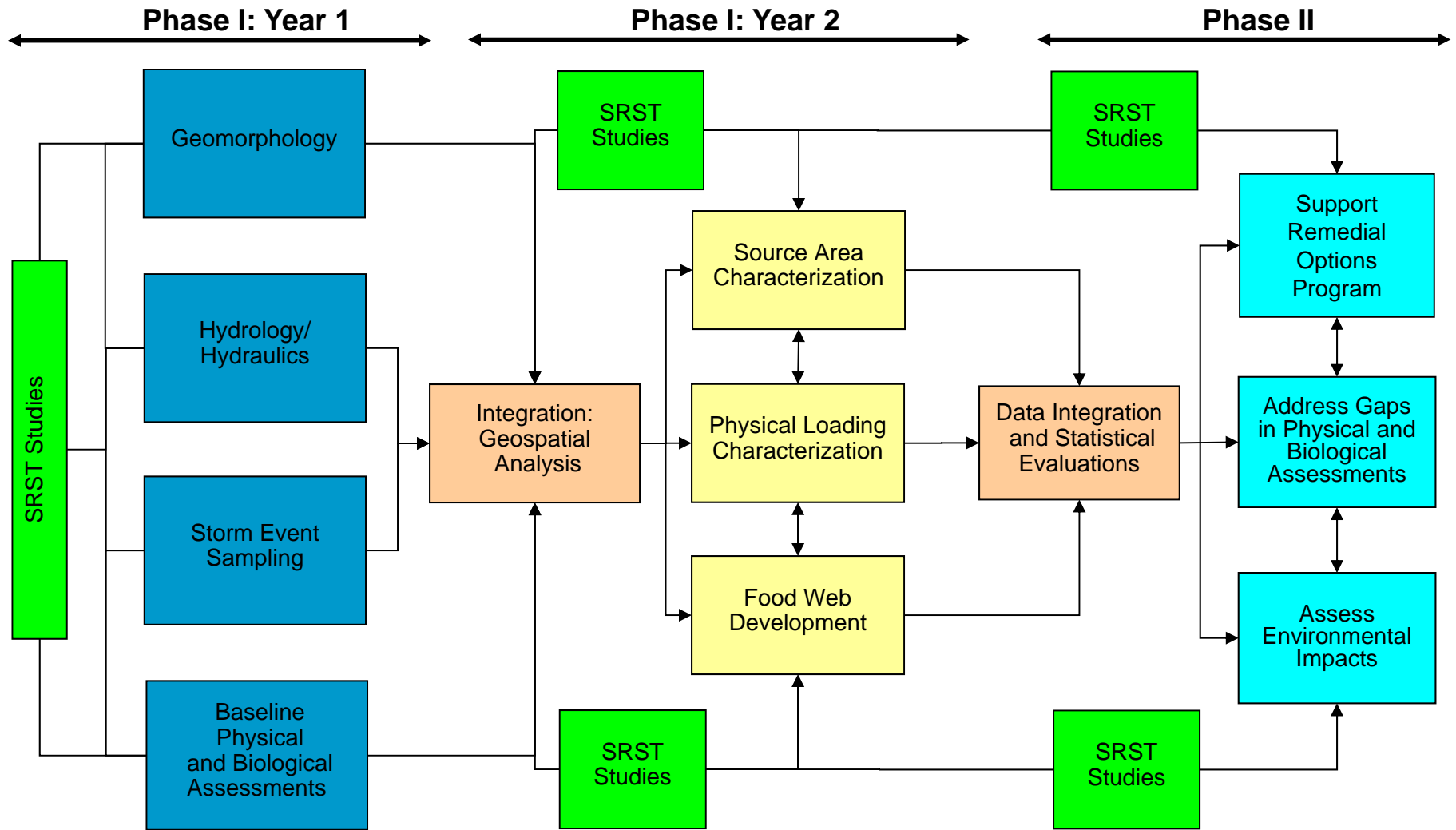
Quantification of Conceptual Model for Methylmercury Supply to Smallmouth Bass

Reed Harris

Phase II 2010 Ecological Study

Greg Murphy

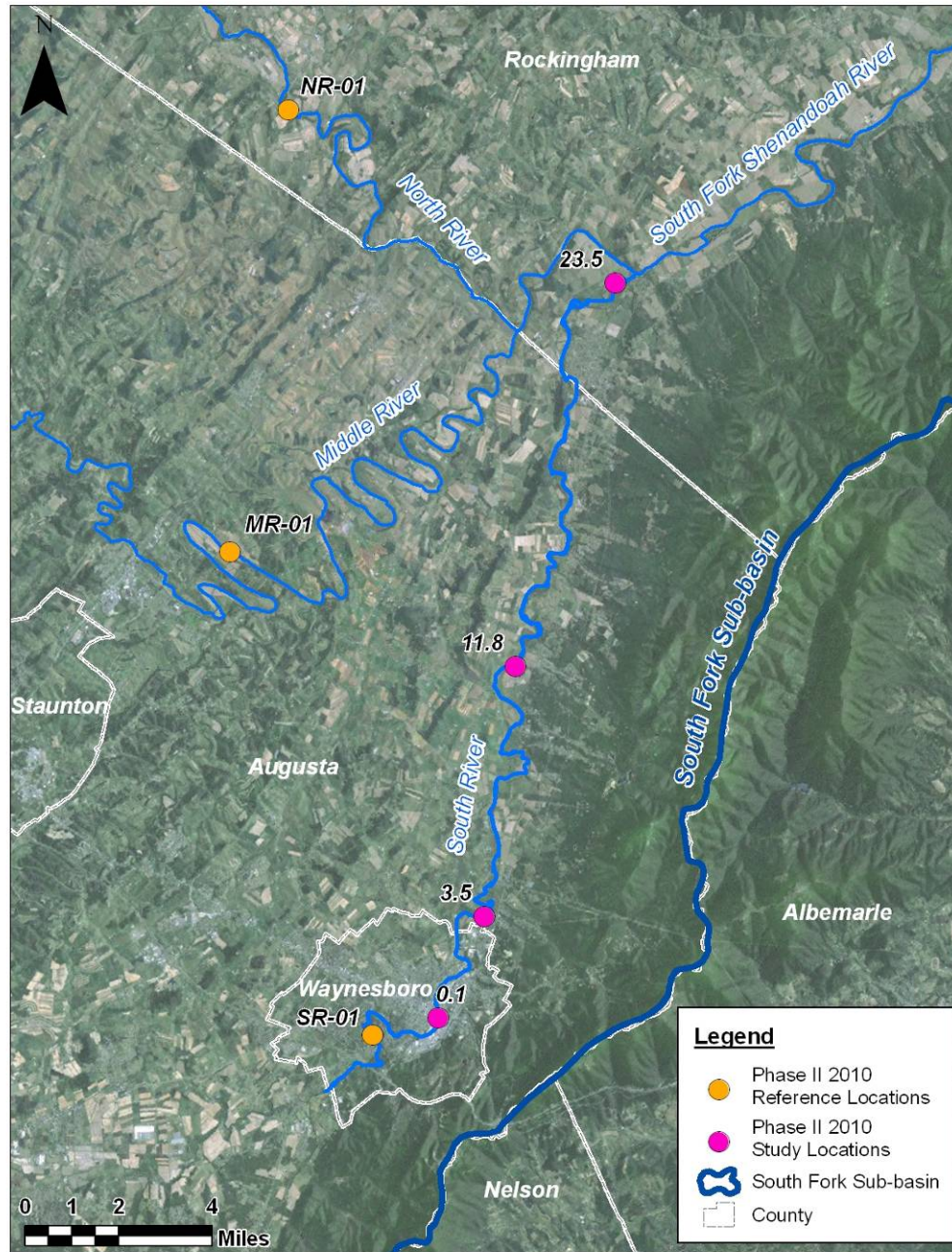
Overview: Ecological Study



Phase II 2010 Study Objectives

1. Support Remedial Options Program
2. Monitor surface water and tissue
3. Evaluate the movement and disposition of mercury in the aquatic environment
4. Assess potential impacts to benthic macroinvertebrate communities

Phase II 2010 Study Locations



Movement of Mercury in the Aquatic Environment

2010 Studies

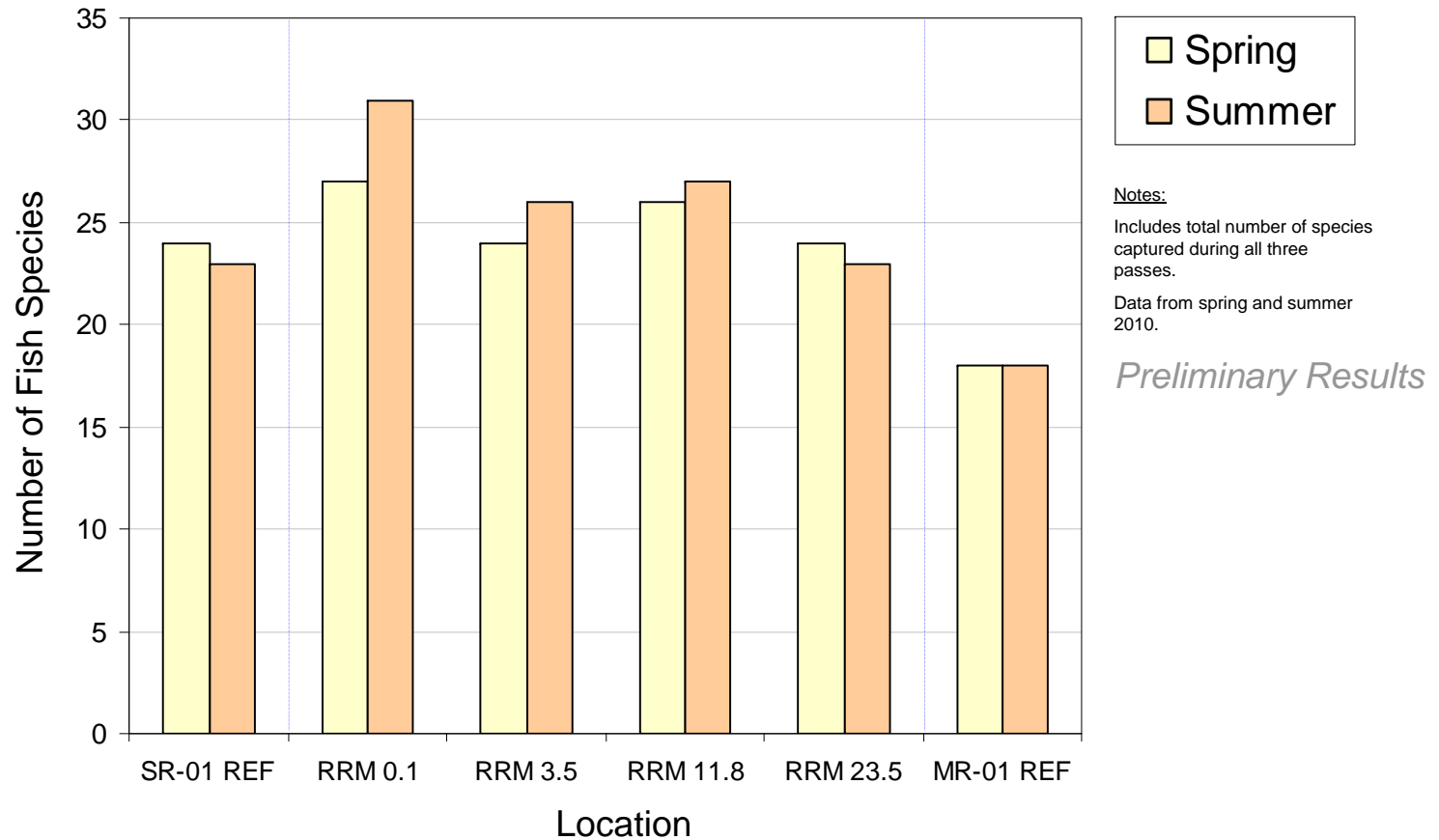
- Fish population / community, tissue, and stomach content analyses
- Mercury uptake (*in situ*) by aquatic invertebrates
- Basal resource utilization by aquatic consumers (URS / VIMS)
- Bioaccumulation modeling

Fish Population / Community Assessments

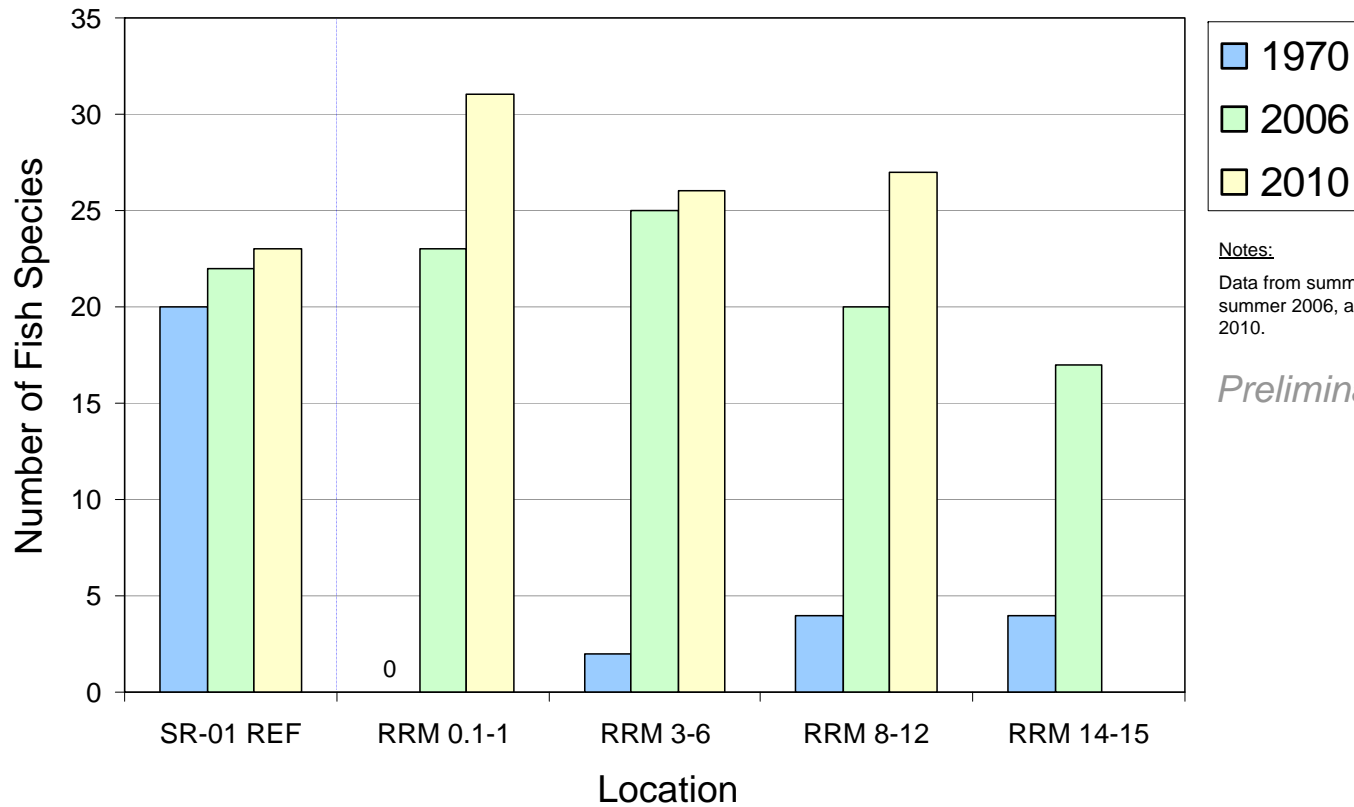
- Spring and summer 2010
- Locations RRM 0.1, 3.5, 11.8, 23.5, SR-01, and MR-01
- 3-pass depletion by electrofishers
- Identified, counted, and weighed all fish; measured subset



Total of 40 Fish Species Collected in South River



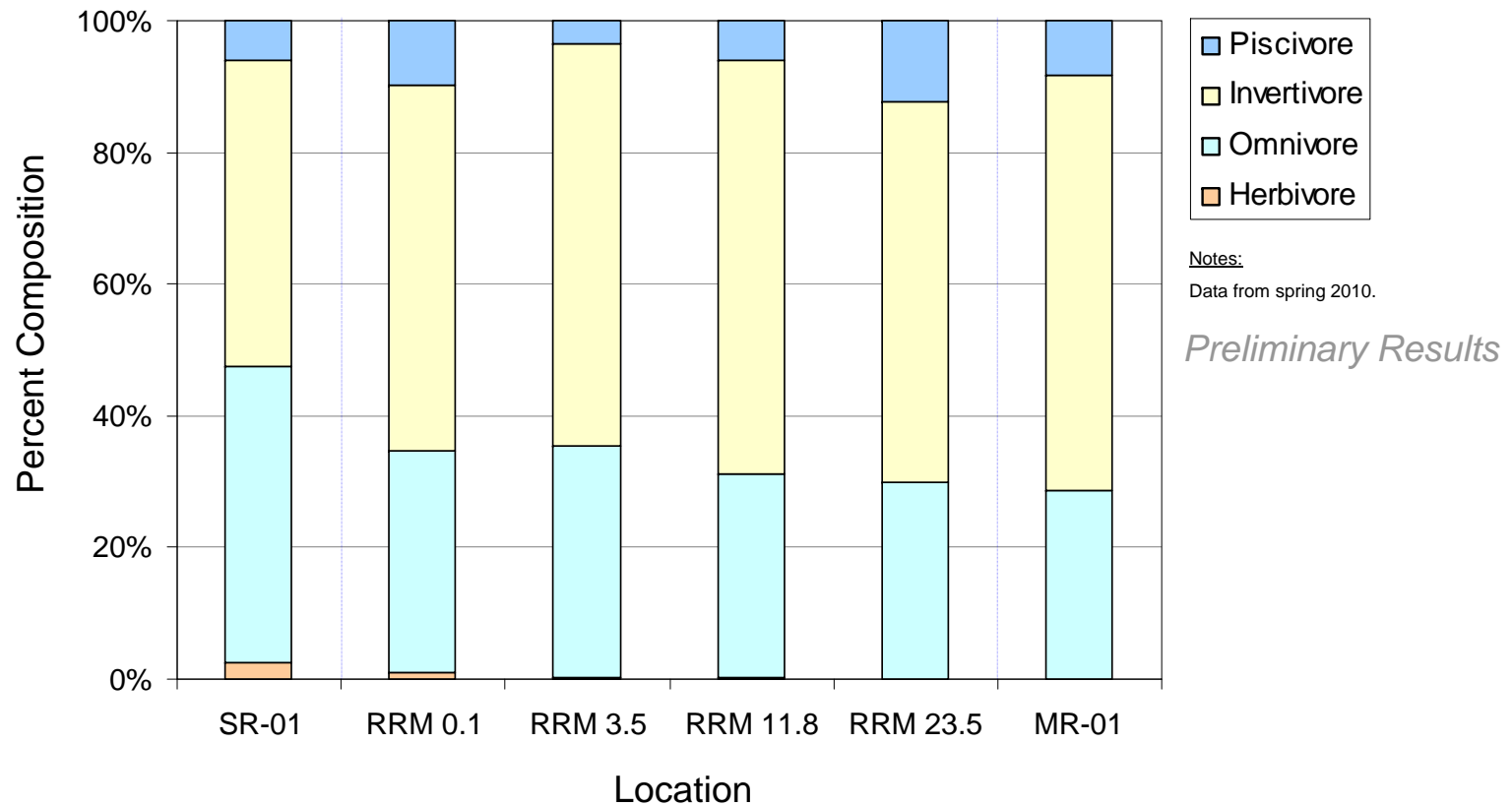
Fish Community Increased in Diversity Since 1970



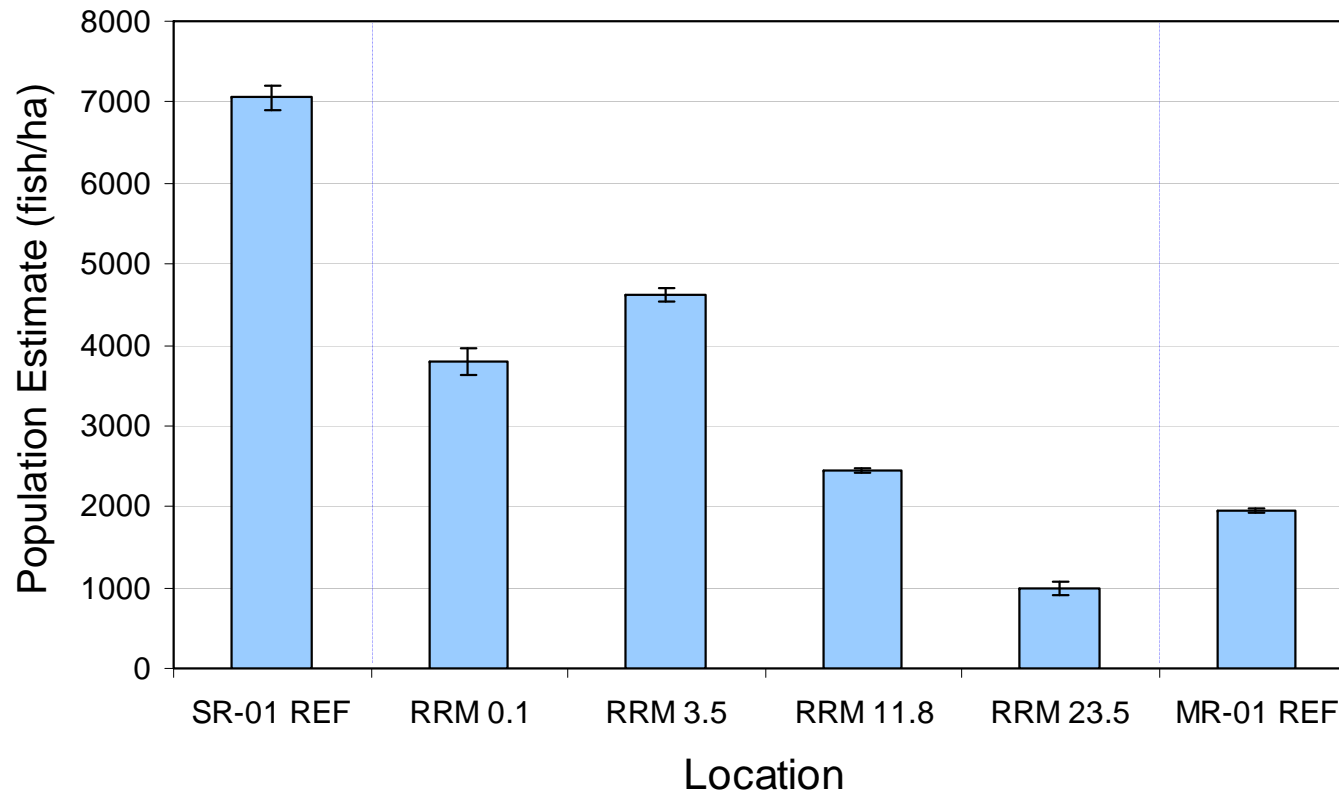
Notes:
Data from summer 1970,
summer 2006, and summer
2010.

Preliminary Results

Invertivorous Fishes Important in Fish Community



Population Estimates for All Fish Species Combined (Spring)



Notes:

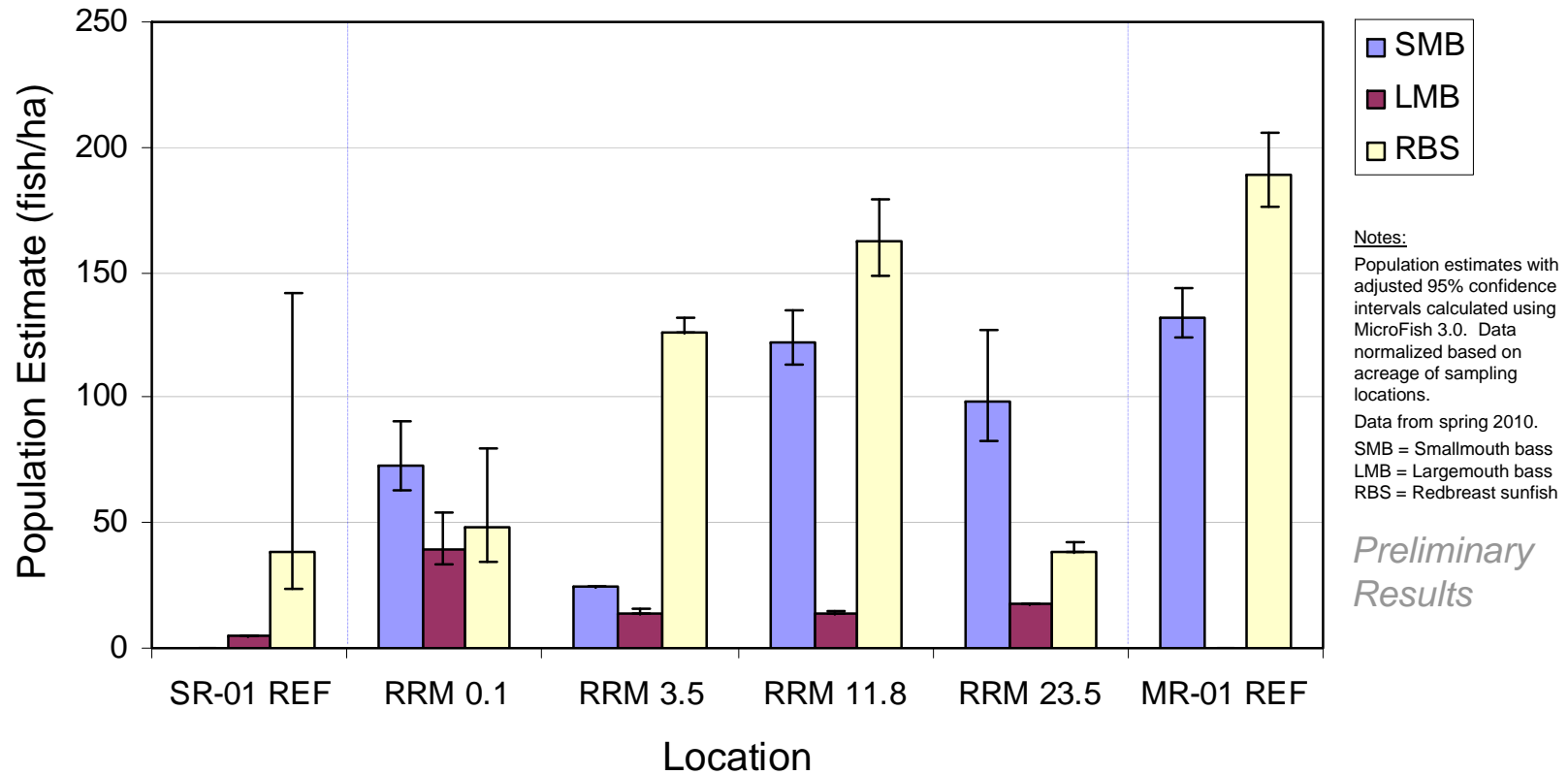
Population estimates with adjusted 95% confidence intervals calculated using MicroFish 3.0. Data normalized based on acreage of sampling locations.

All fish species combined.

Data from spring 2010.

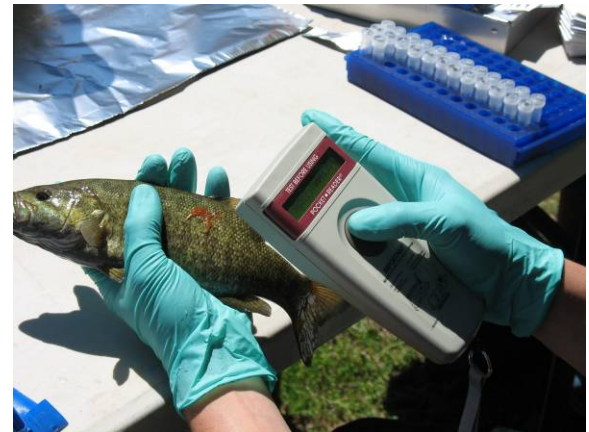
Preliminary Results

Population Estimates for Selected Fish Species (Spring)

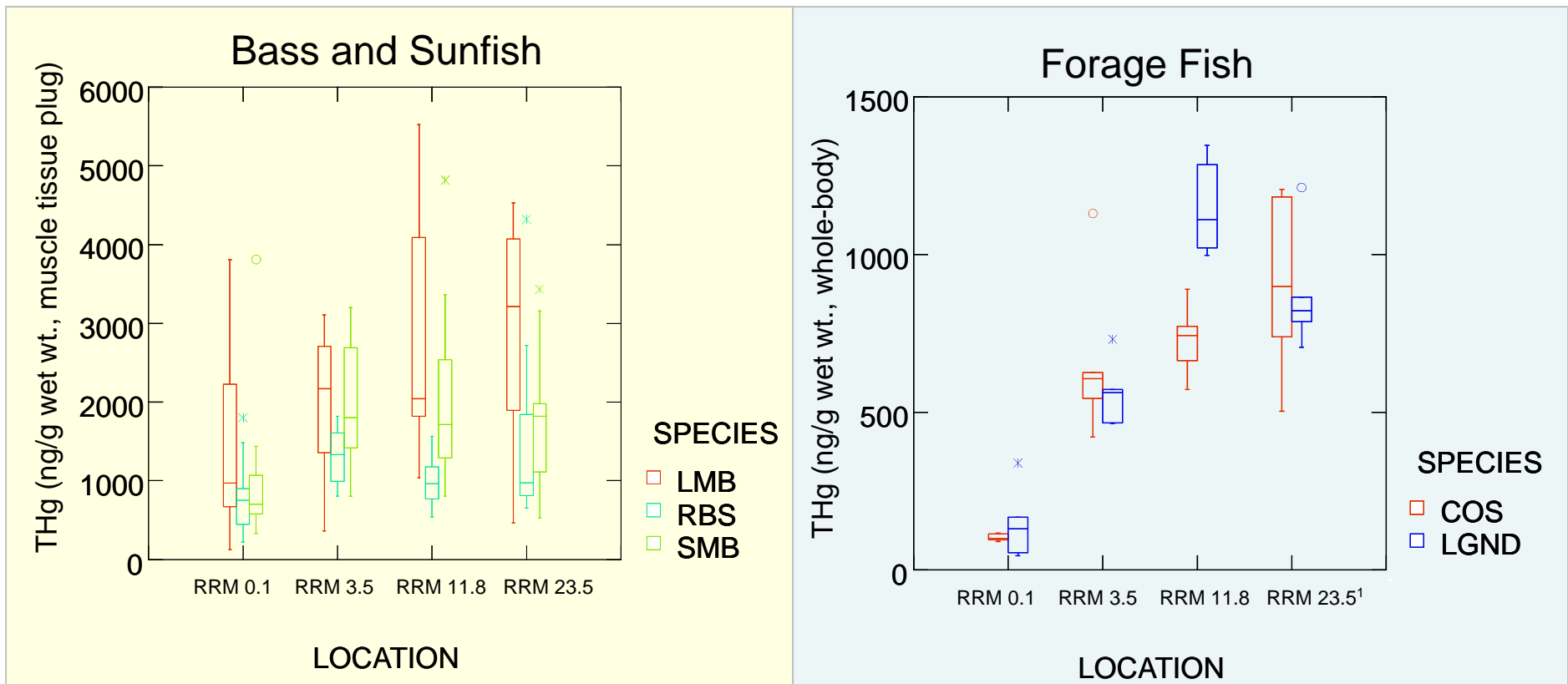


Fish Tissue Analyses

- Spring and summer 2010
- Locations RRM 0.1, 3.5, 11.8, 23.5
- Dorsal muscle plug from multiple size classes of bass and sunfish
- Whole-body forage fish
- Bass tagged for unique ID during future re-sampling (25 recaps)



Fish Tissue Results (Spring)



Notes:

SMB = Smallmouth bass, LMB = Largemouth bass, RBS = Redbreast sunfish, COS = Common shiner, LGND = Longnose dace
 Data from spring 2010.

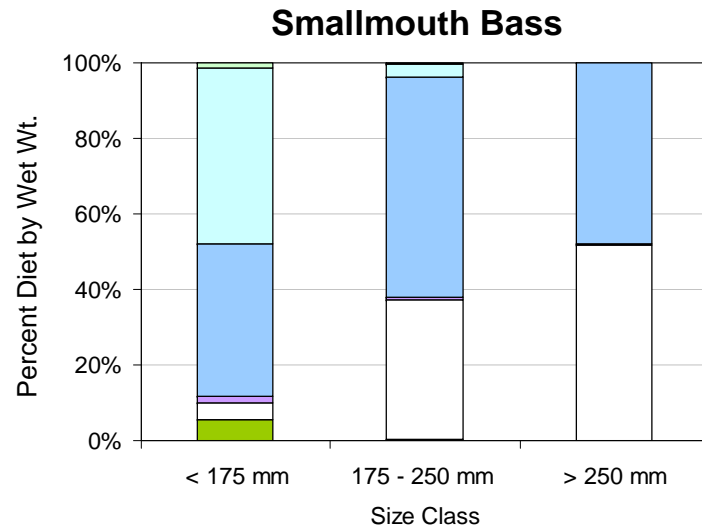
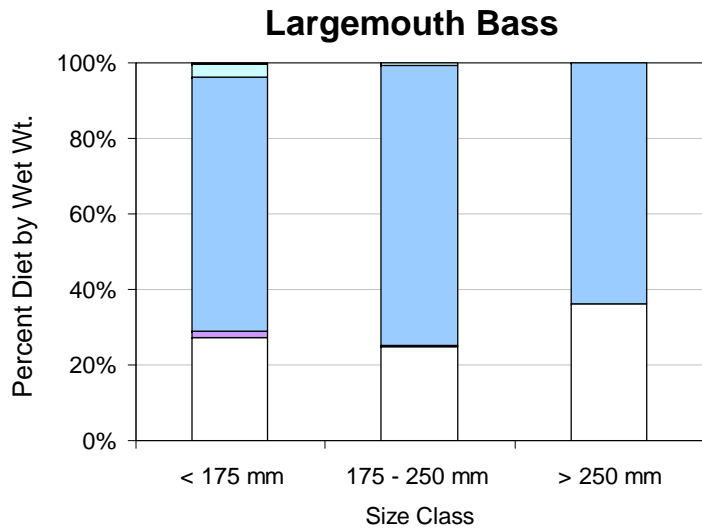
Preliminary Results

Fish Stomach Content Analyses

- Spring, summer, and fall 2010
- Locations RRM 0.1, 3.5, 11.8, 23.5
- Pulsed gastric lavage on multiple size classes of bass and sunfish; anterior intestine of forage fish
- ID to lowest taxonomic level; calculate % diet composition by wet weight



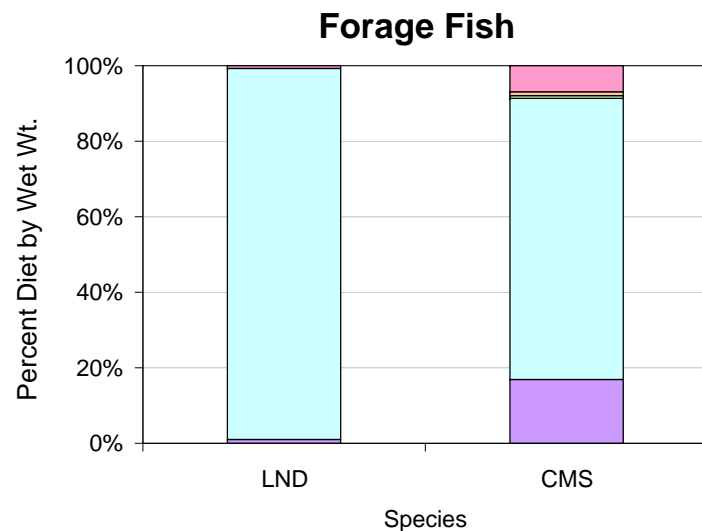
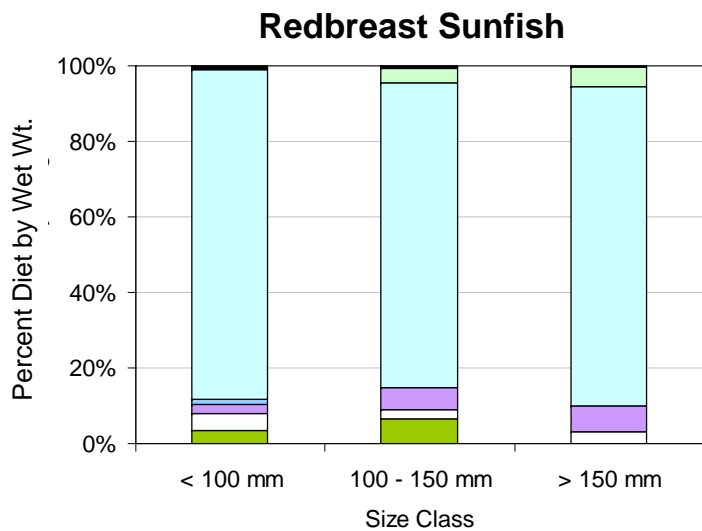
Fish Stomach Content Results (Spring)



- Vegetation
- Mollusca
- Miscellaneous
- Insecta (Terrestrial)
- Insecta (Aquatic)
- Fish
- Detritus
- Crustacea
- Annelida

Notes:
Data from spring 2010.

Preliminary Results

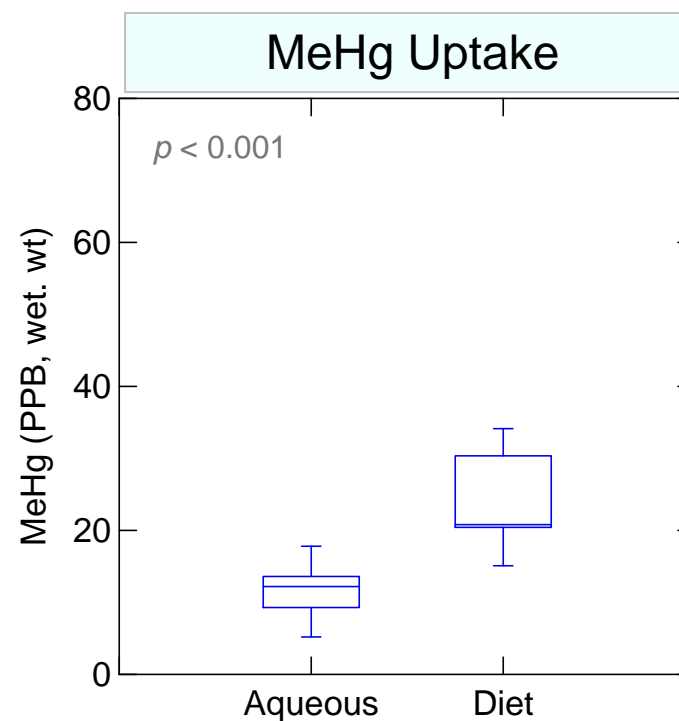
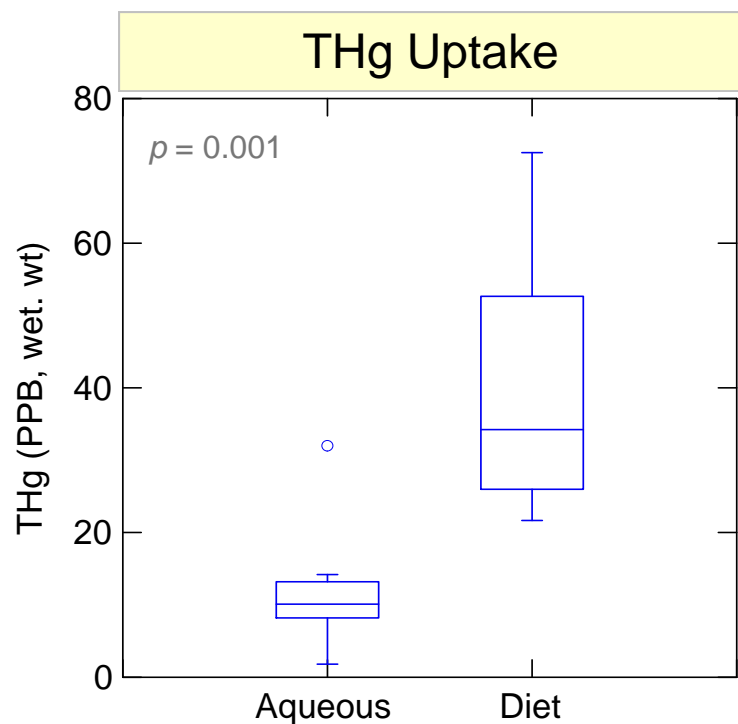


Mercury Uptake by Aquatic Invertebrates

- Spring and summer 2010 at RRM 3.5, 11.8, and 23.5
- Transplanted reference mayfly larvae and crayfish
- Aqueous and dietary treatments
- 7-day uptake period
- Collected day-0 and day-7 periphyton, seston, surface water, detritus/sediment, and resident biota; analyzed for THg and MeHg



Crayfish Had Greater Mercury Uptake by Diet (Spring)

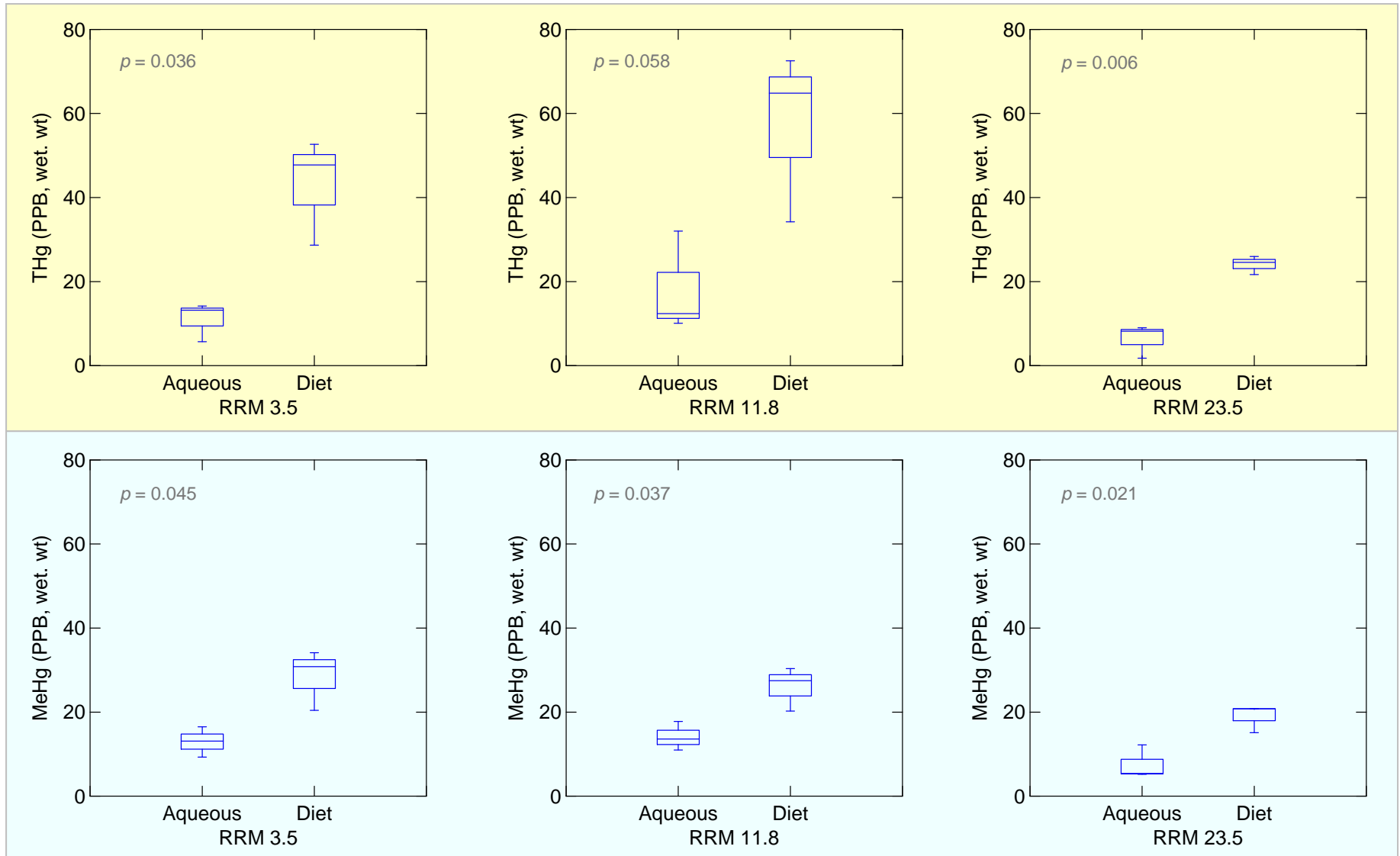


Notes:

Data from spring 2010.

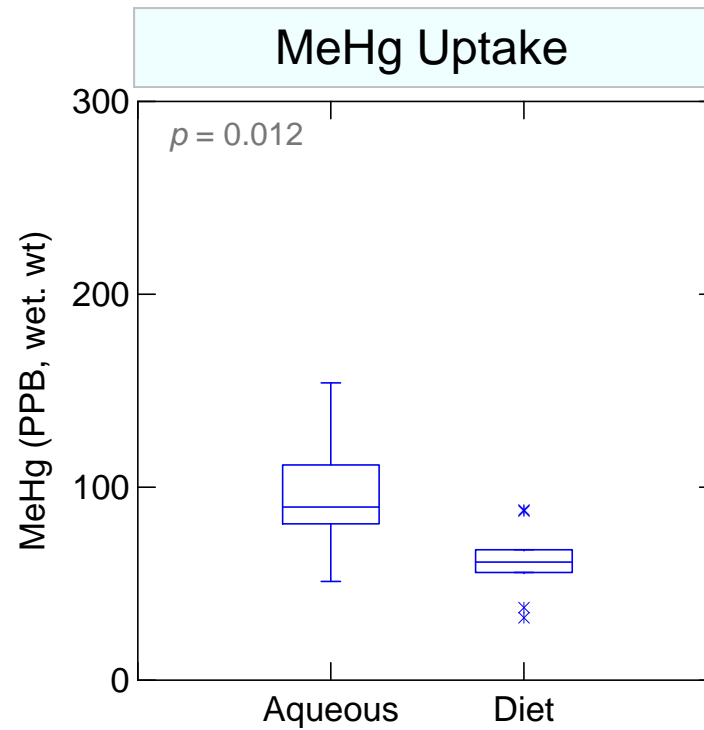
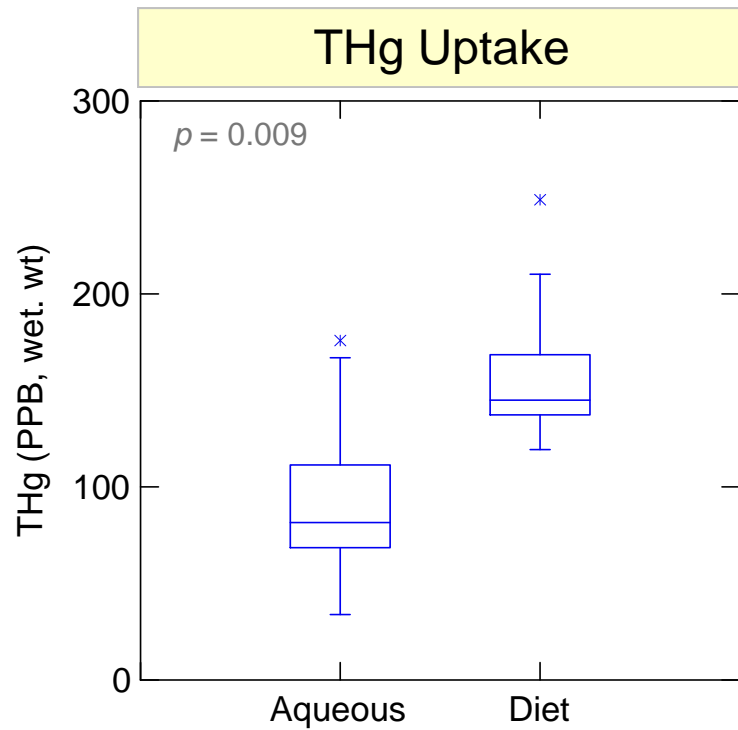
Preliminary Results

Crayfish cont'd



Preliminary Results

Mayfly Had Greater MeHg Uptake by Water (Spring)



Notes:

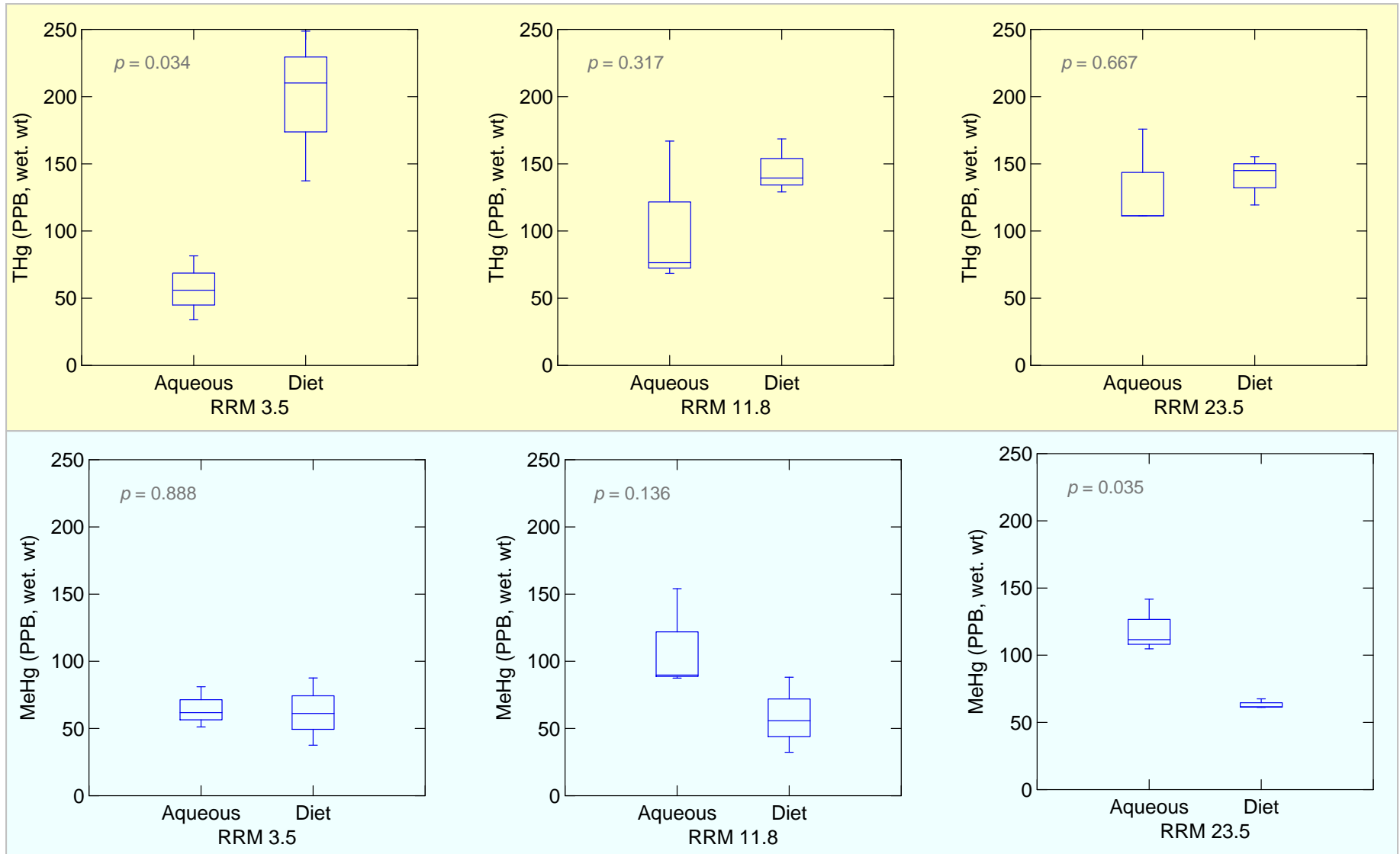
Data from spring 2010.

Preliminary Results

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Mayfly cont'd



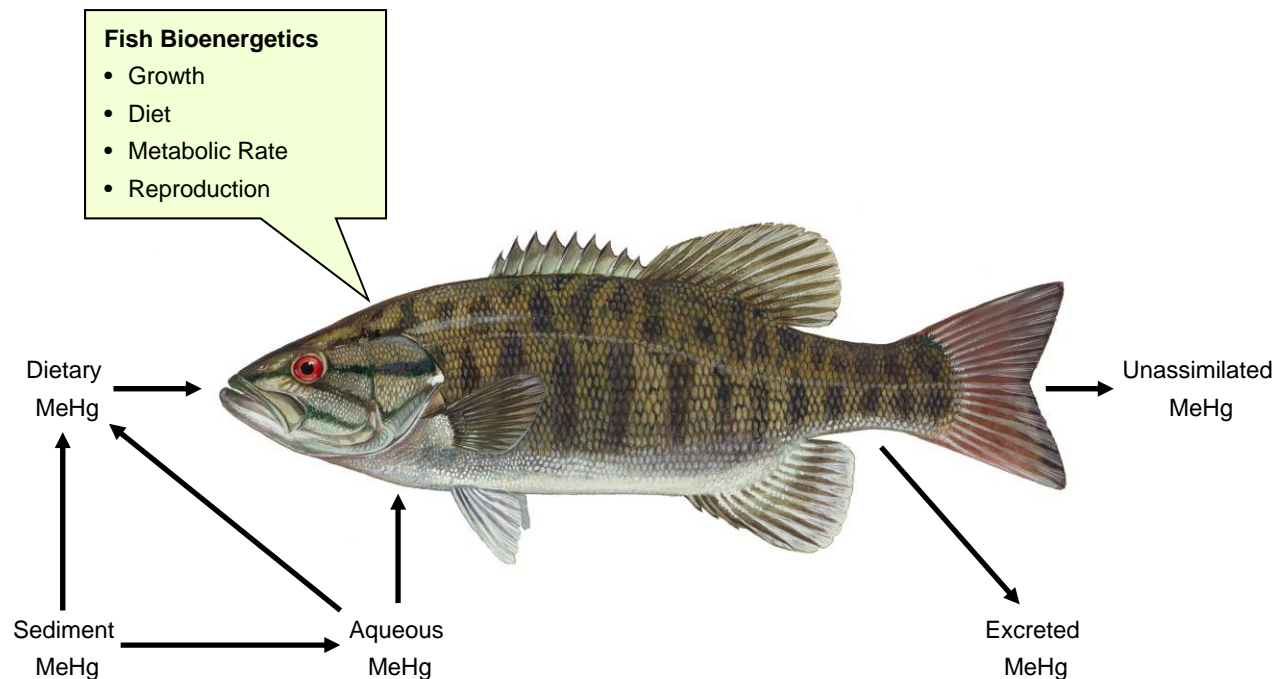
Preliminary Results

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Bioaccumulation Modeling

- Integrate aquatic communities, fish food habits, and MeHg in physical media
- Simulate MeHg bioaccumulation dynamics in resident fish communities
- Assess modeled results as they relate to remedial options program



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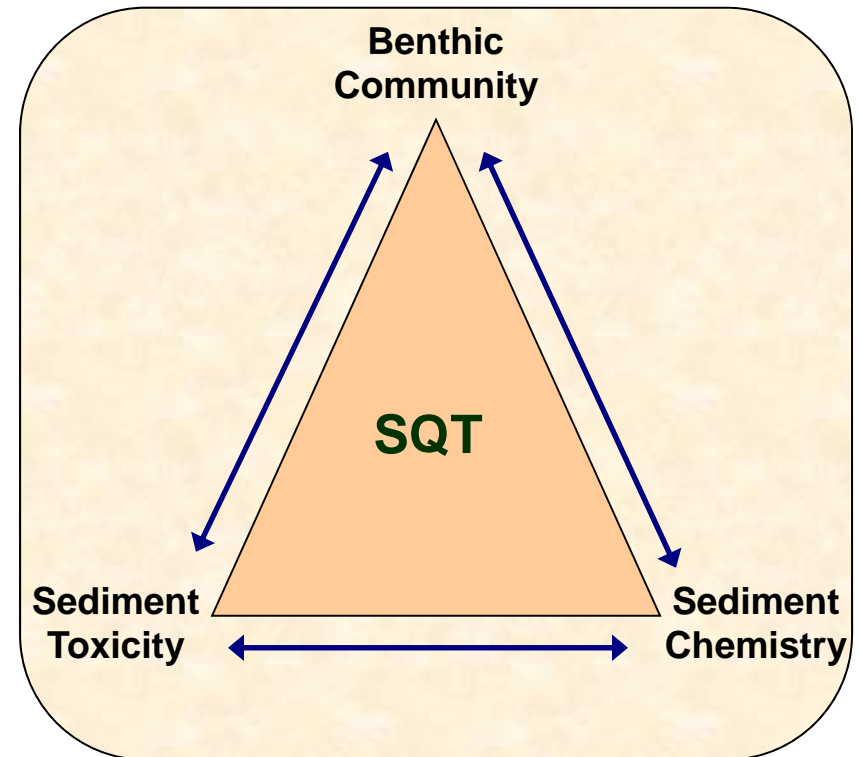
Assessing Benthic Macroinvertebrate Communities

2010 Studies

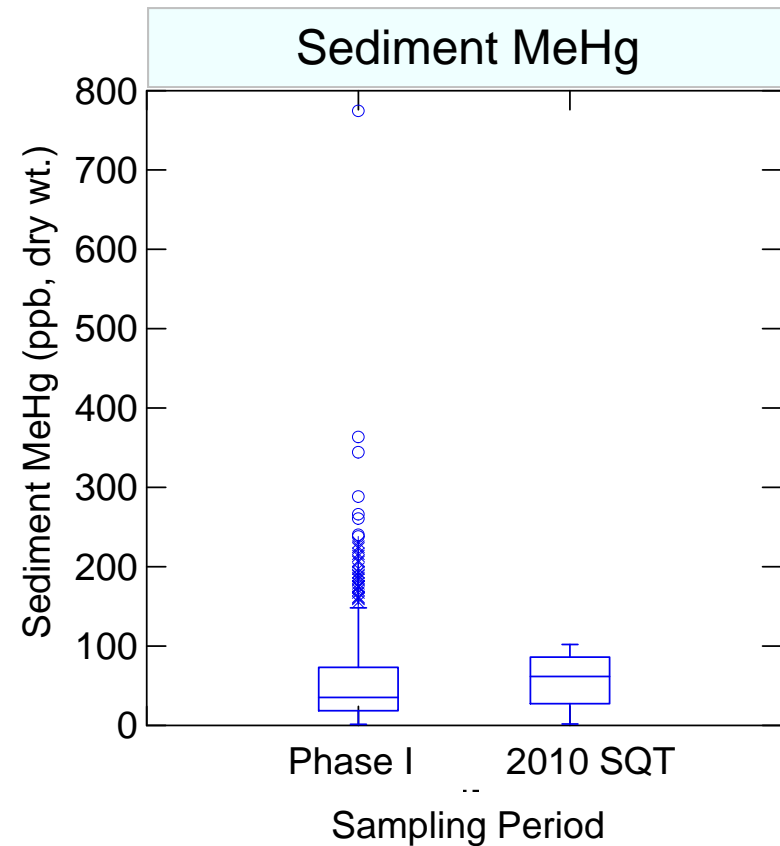
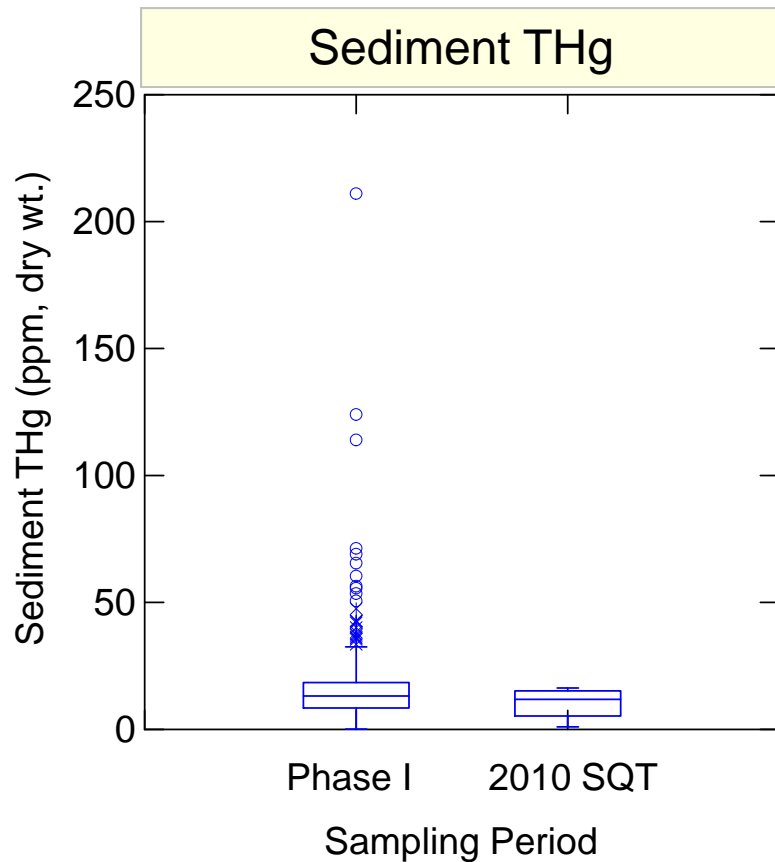
1. Sediment Quality Triad
2. Field-based (*in situ*) microcosm study

Sediment Quality Triad Includes Three Lines of Evidence

1. Sediment chemistry
 - Metals, pesticides, herbicides, PAHs, and PCBs
2. Sediment toxicity
 - *Hyalella azteca* and *Chironomus dilutus*
3. Benthic macroinvertebrate community structure

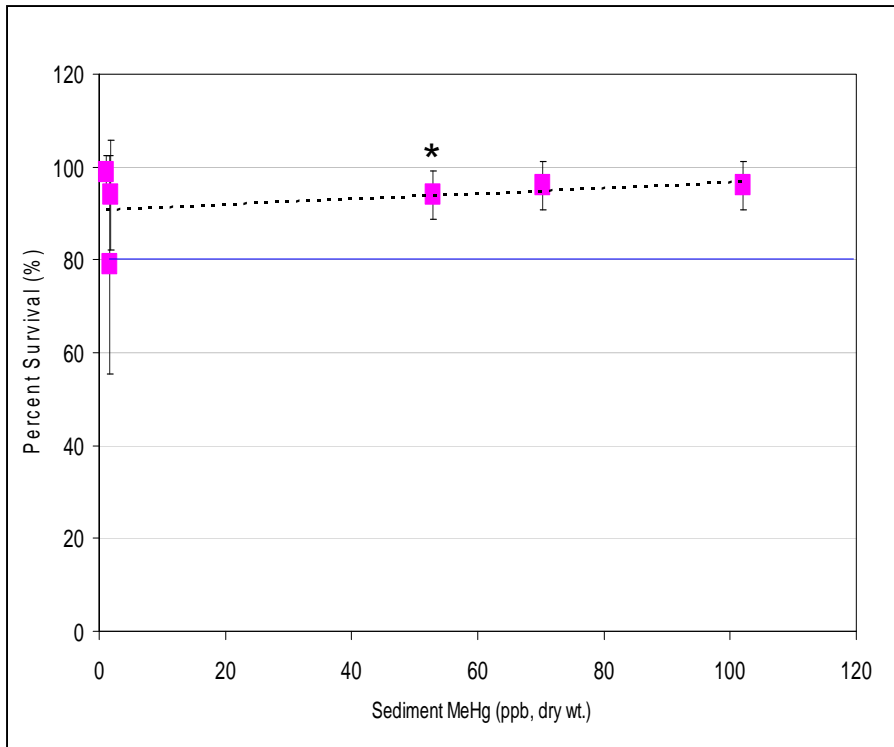


Sediment Toxicity Assessed with Representative Sediments

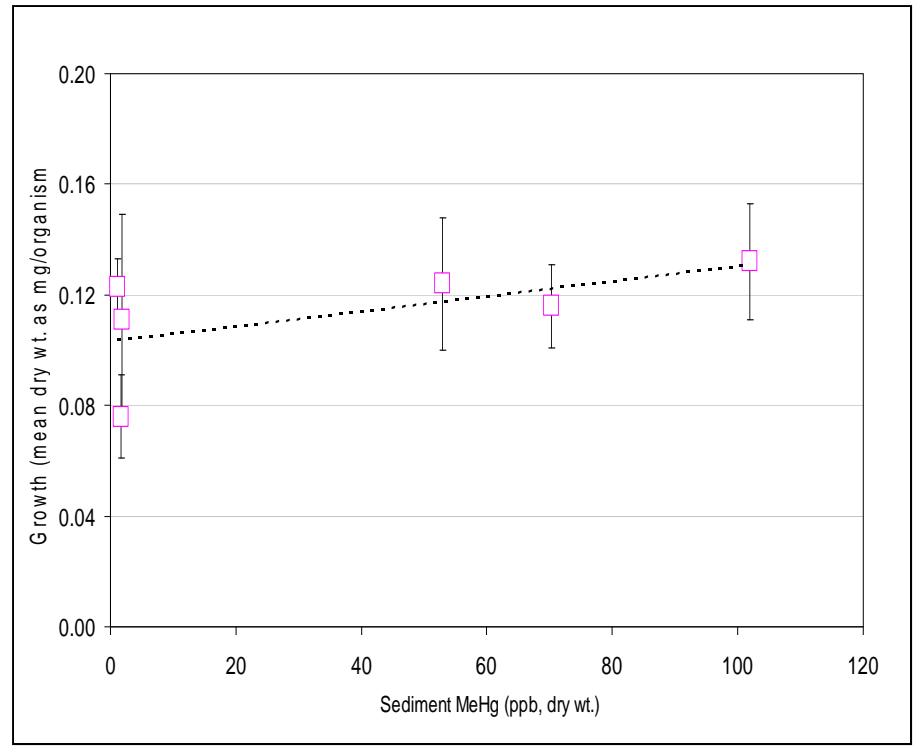


Survival and Growth of *H. azteca*

Survival



Growth



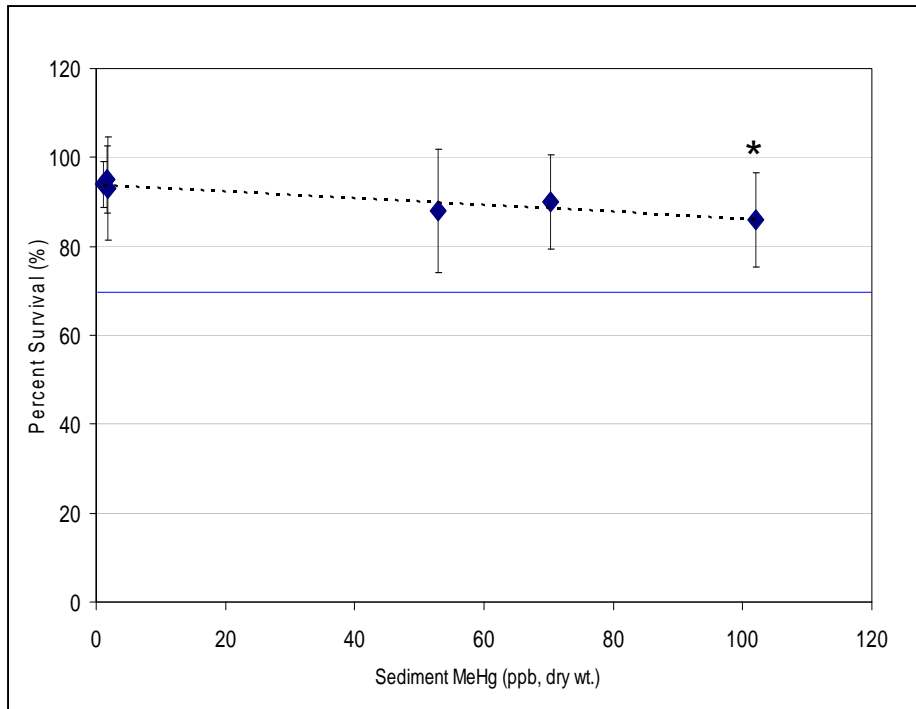
USEPA Method 100.1

*Statistically different from one or more reference locations

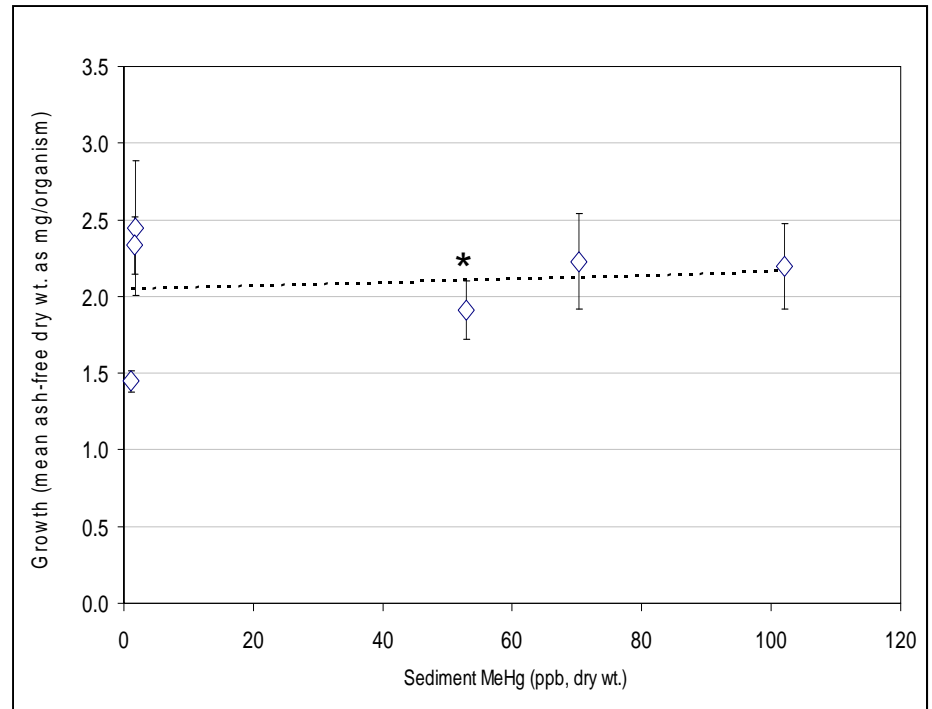
Preliminary Results

Survival and Growth of *C. dilutus*

Survival



Growth

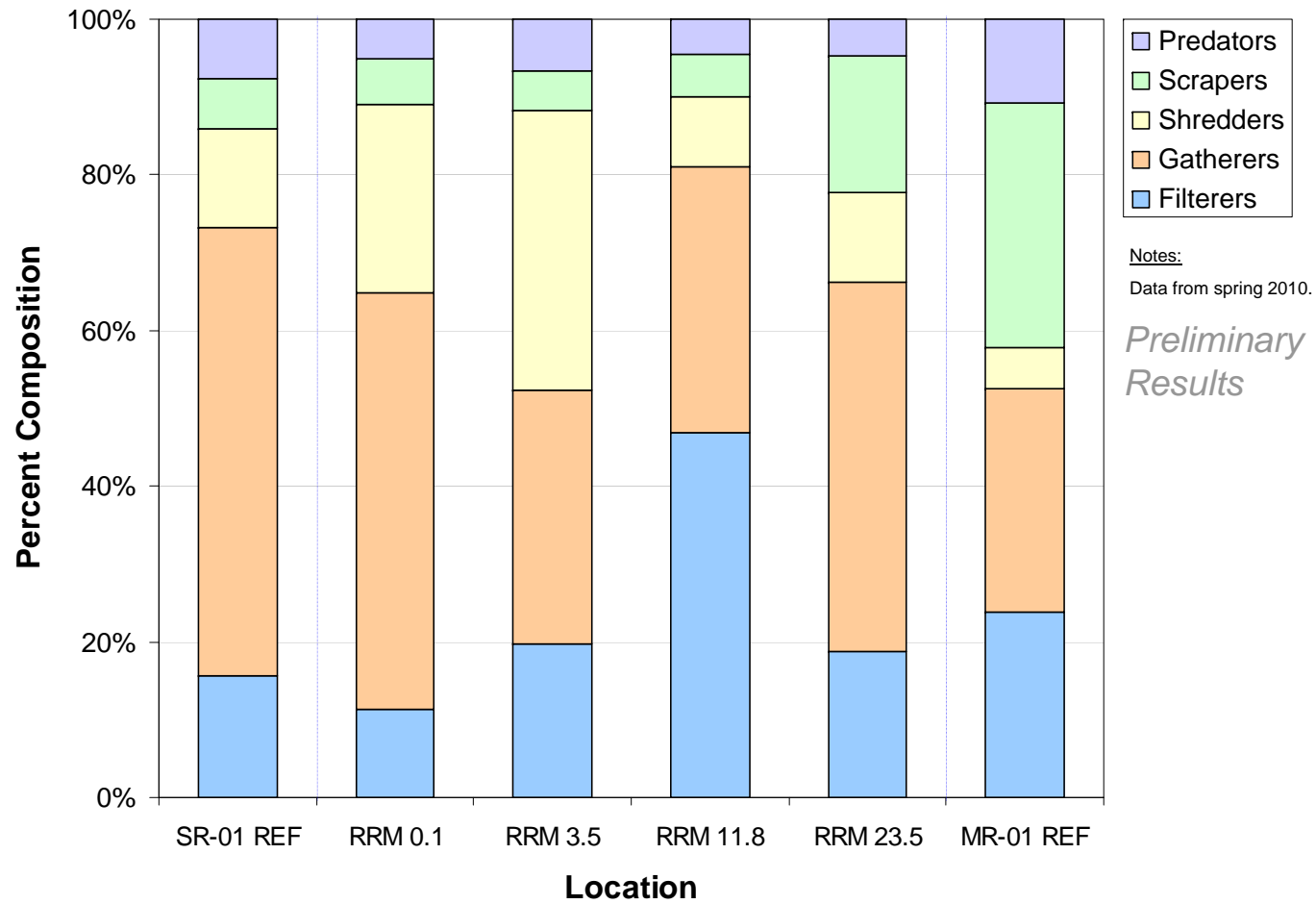


USEPA Method 100.1

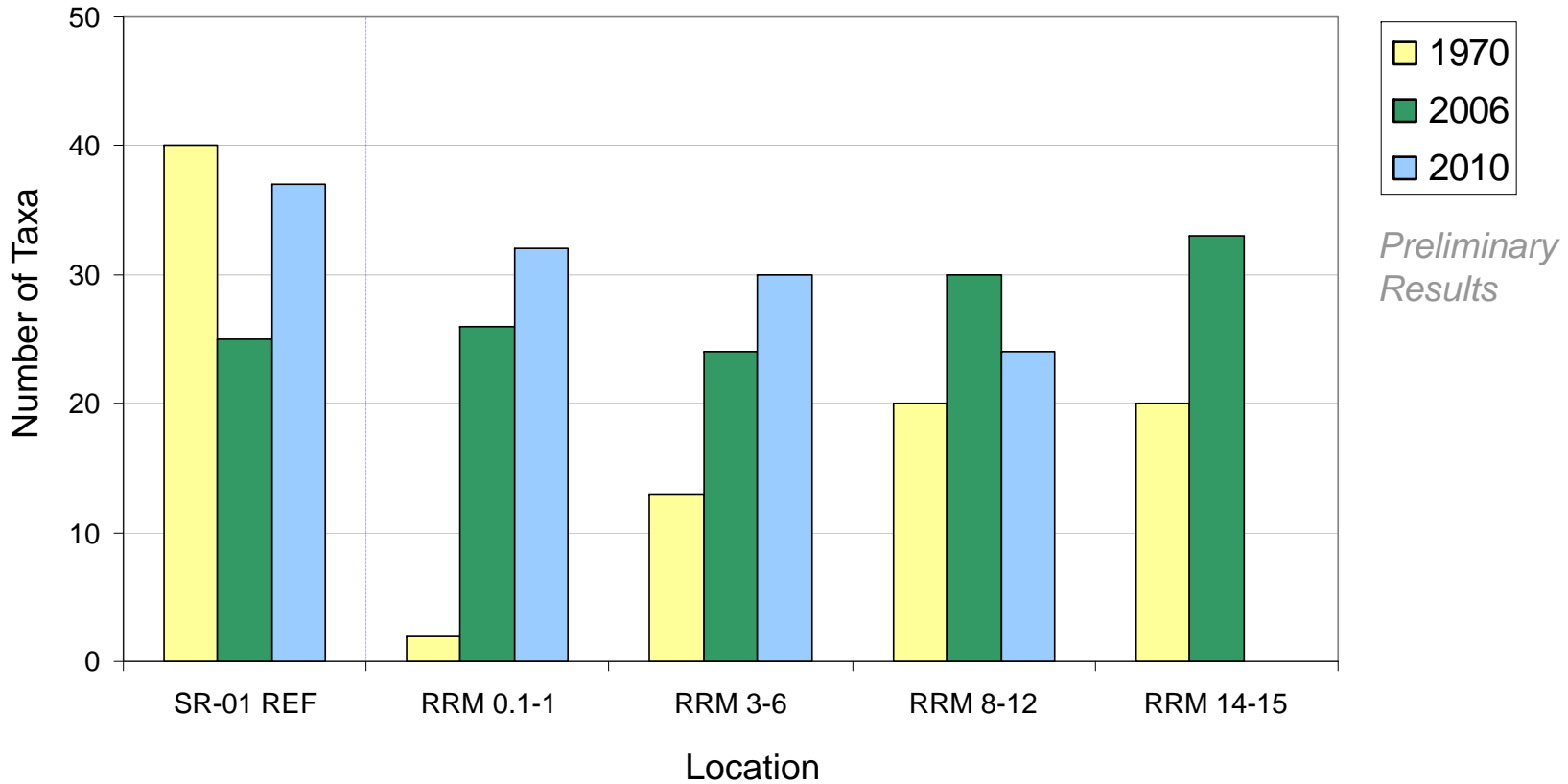
*Statistically different from one or more reference locations

Preliminary Results

Benthic Community Composition



Benthic Community Increased in Taxa Richness Since 1970



Field-based (*In Situ*) Microcosm Study

- Summer 2010
- Deployed 4 chambers with colonized substrate trays
- 7-day exposure period
- 500-organism sub-count and ID; Head capsule widths of *Baetis* and *Cheumatopsyche*
- Taxonomic results anticipated in December 2010



Next Steps

- Field sampling (surface water, fish stomach contents, forage fish tissue, and isotopes) in October / November
- Data evaluations
- Bioaccumulation modeling
- NRDC consultation in December

Trophic Analysis and Modeling - Aquatic Component

Mike Newman