



“One day by the bank of the river he noticed a pile of empty shells of the fresh-water Mussel, or Clam. The shells were common enough, but why all together and marked in the same way?”

Around the pile on the mud were curious tracks and marks.... he saw a round, brown animal hunched on the bank eating a clam. It dived into the water on his approach, but it reappeared swimming farther on. Then, when it dived again, Yan saw by its long thin tail that it was a Muskrat...”

Ernest Thompson Seton, Two Little Savages, 1903

The mercury uptake and bioaccumulation by resident muskrats of the South River, VA



JMU Graduate Student: Tiffany Tumer
Thesis Advisor: Dr. Tom Benzing

Muskrat Ecology



- Semi-aquatic mammal
- Inhabits large variety of aquatic environments
- Distributed across most of North America
- Very prolific species
- Lifespan of 3-4 years



Muskrat Ecology

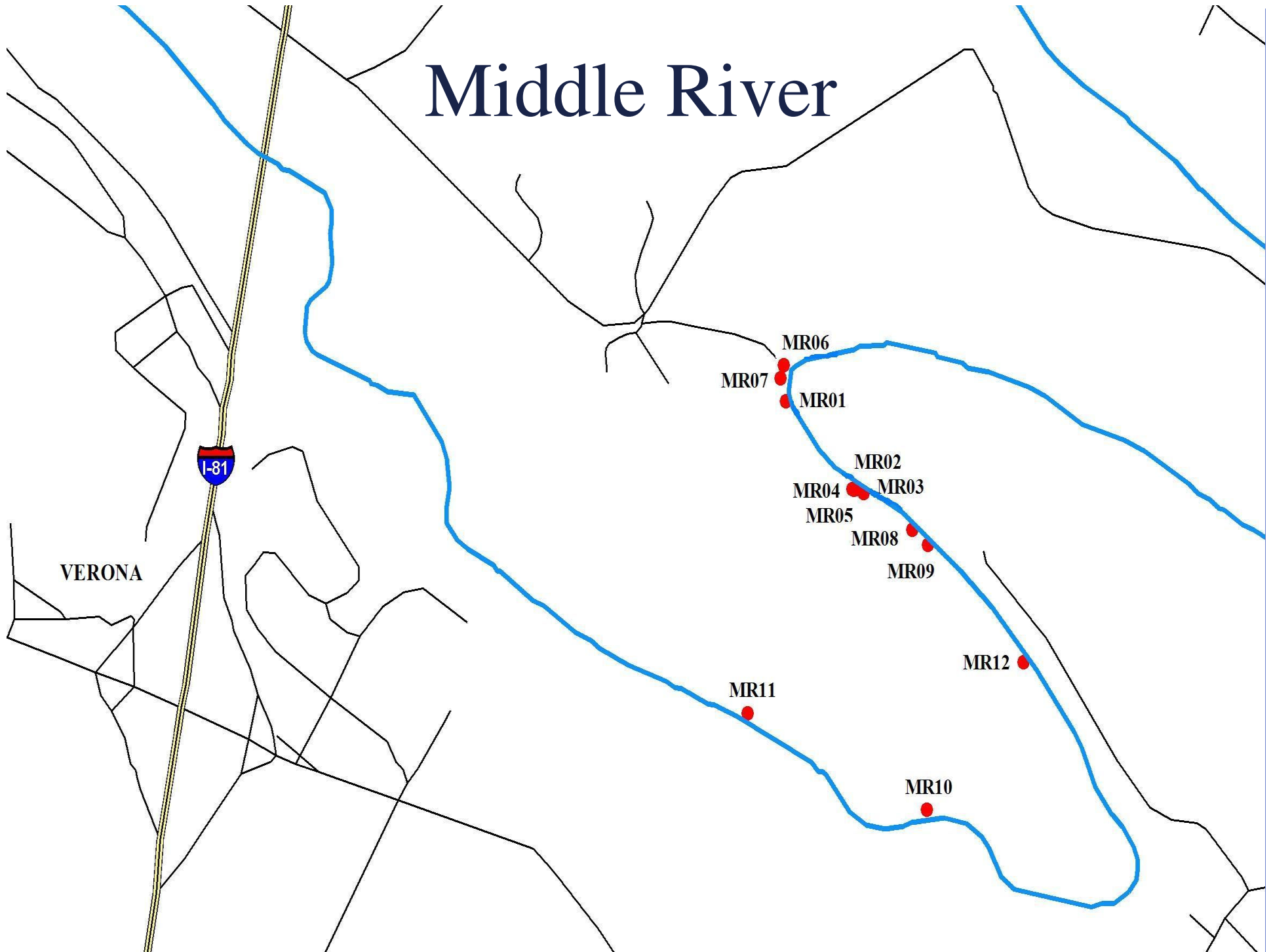


- Significant portion of diet in riverine muskrats is clams
- Muskrat predation has inhibited recovery of endangered mussel in Clinch River
- *Corbicula* mollusk of choice

Control Site: Middle River (Verona, VA)

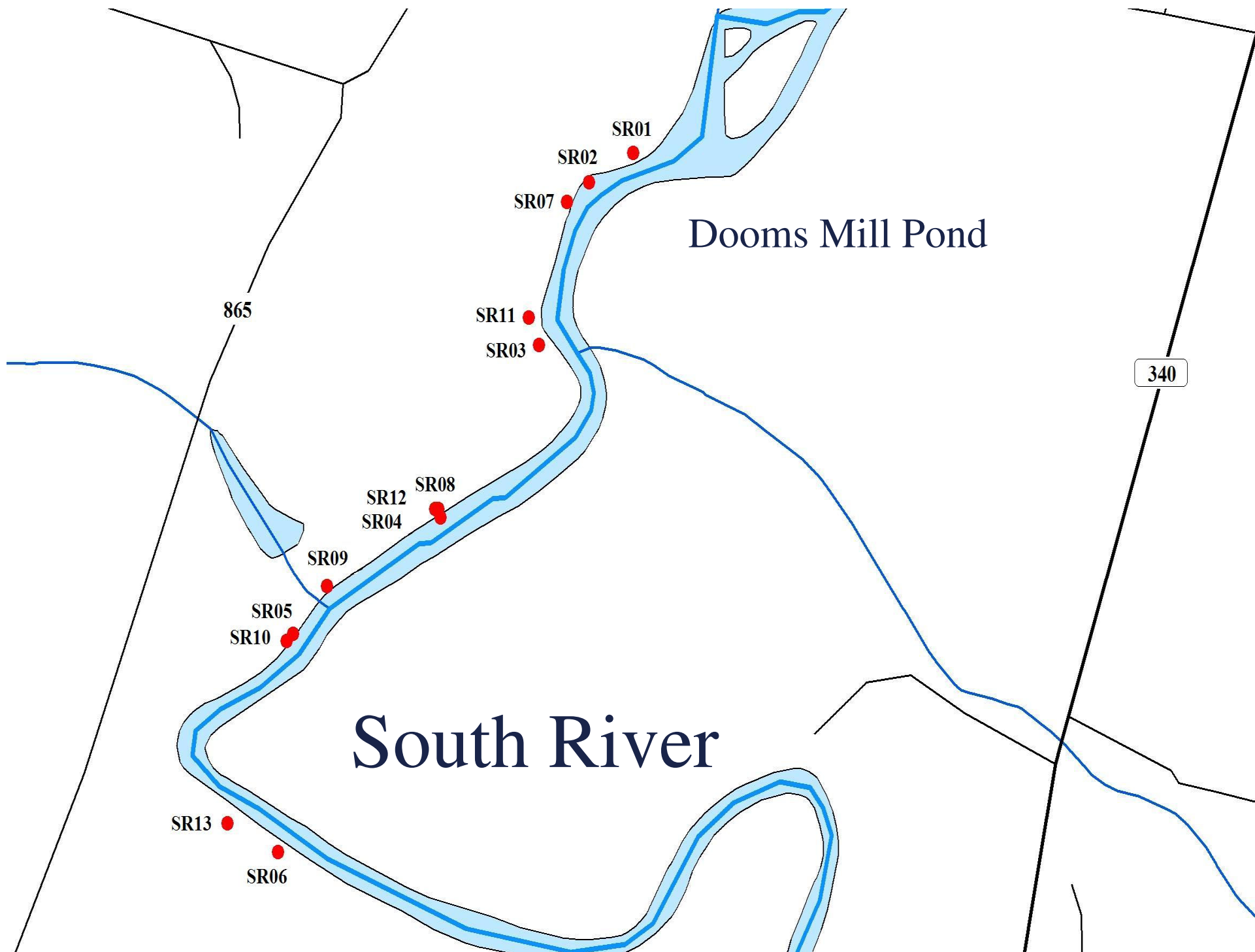


Middle River



Study Site: South River (Dooms, VA)

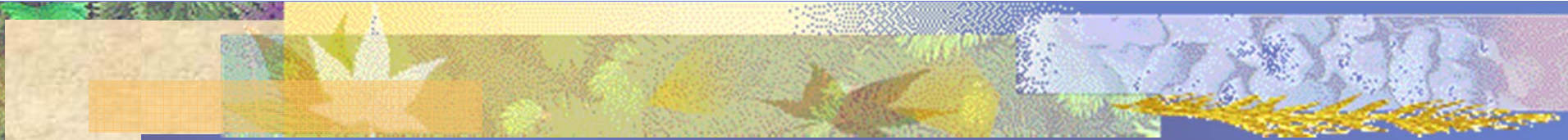






Results: Animals Collected

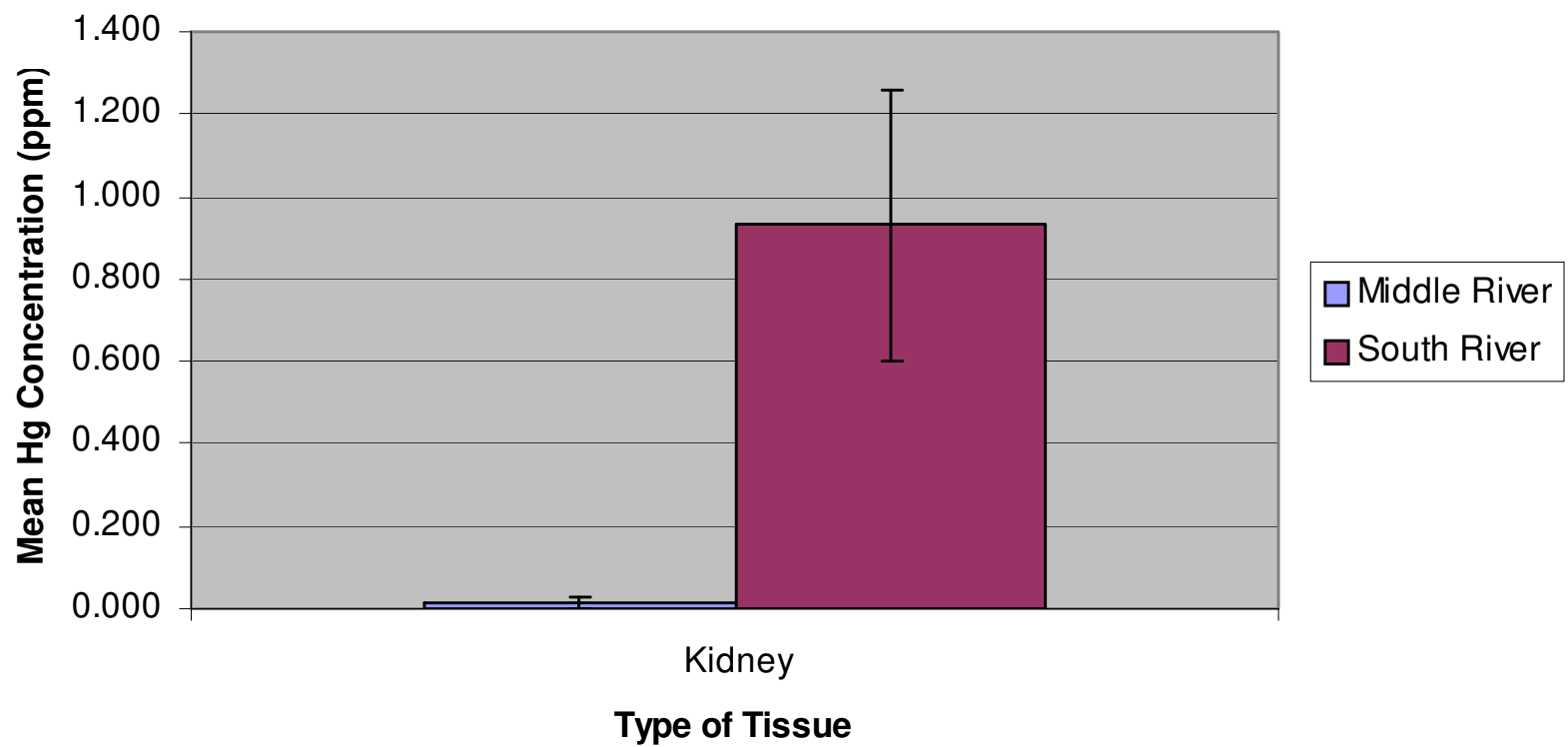
	Middle River	South River
N	12	13
Collection Dates	December 7 – 14, 2005	January 6 – 8, 2006
Average age (months)	7.7	9.6
Sex	1 male, 11 females	10 males, 3 females



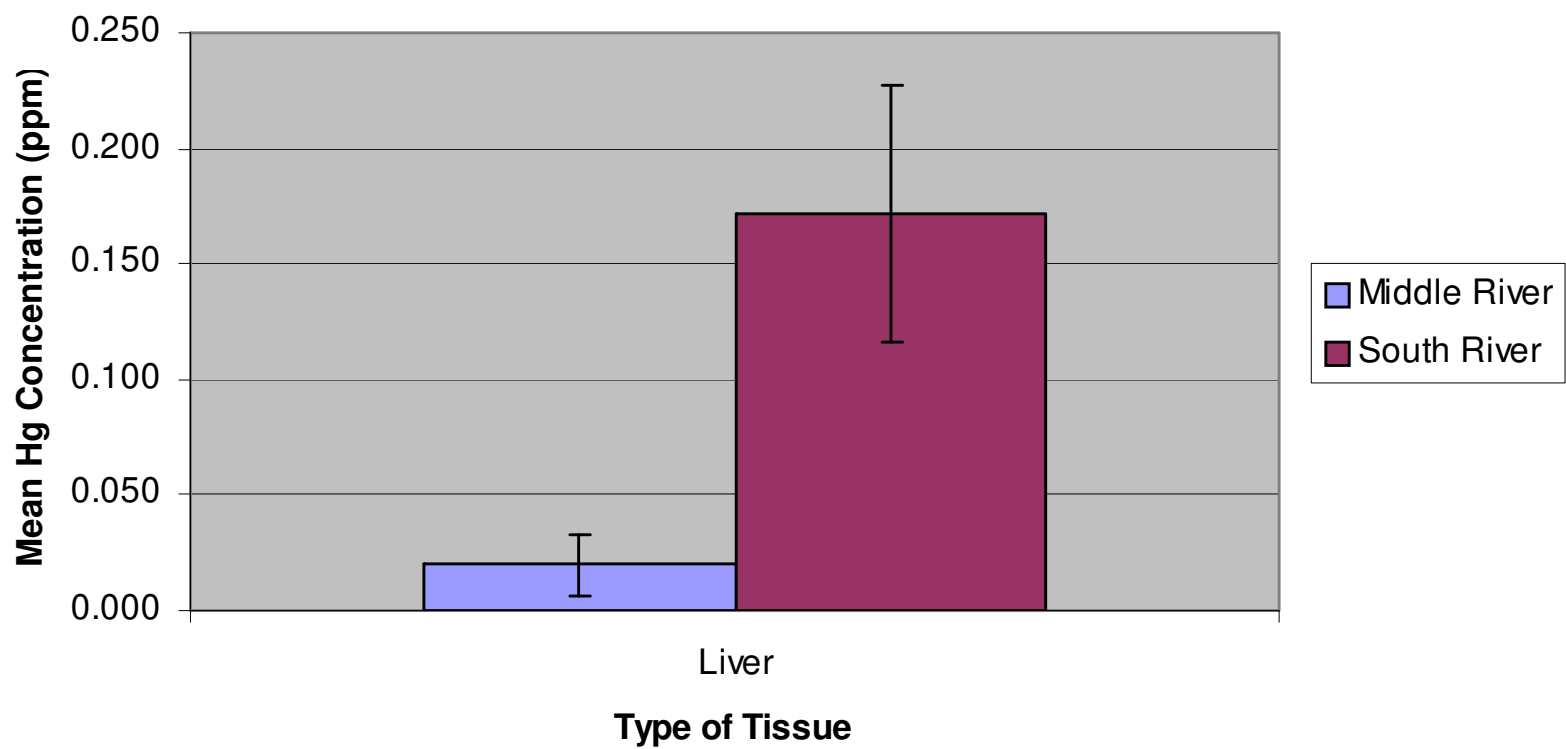
Tissue Analysis

- Tissue type
 - Kidney
 - Liver
 - Muscle (*Biceps femoris*)
- Future analysis
 - Brain
 - Hair
 - Claw
 - Tail
- Procedures
 - Acid tissue digestion
 - Cold Vapor Atomic Absorption Spectrometry (CVAAS)

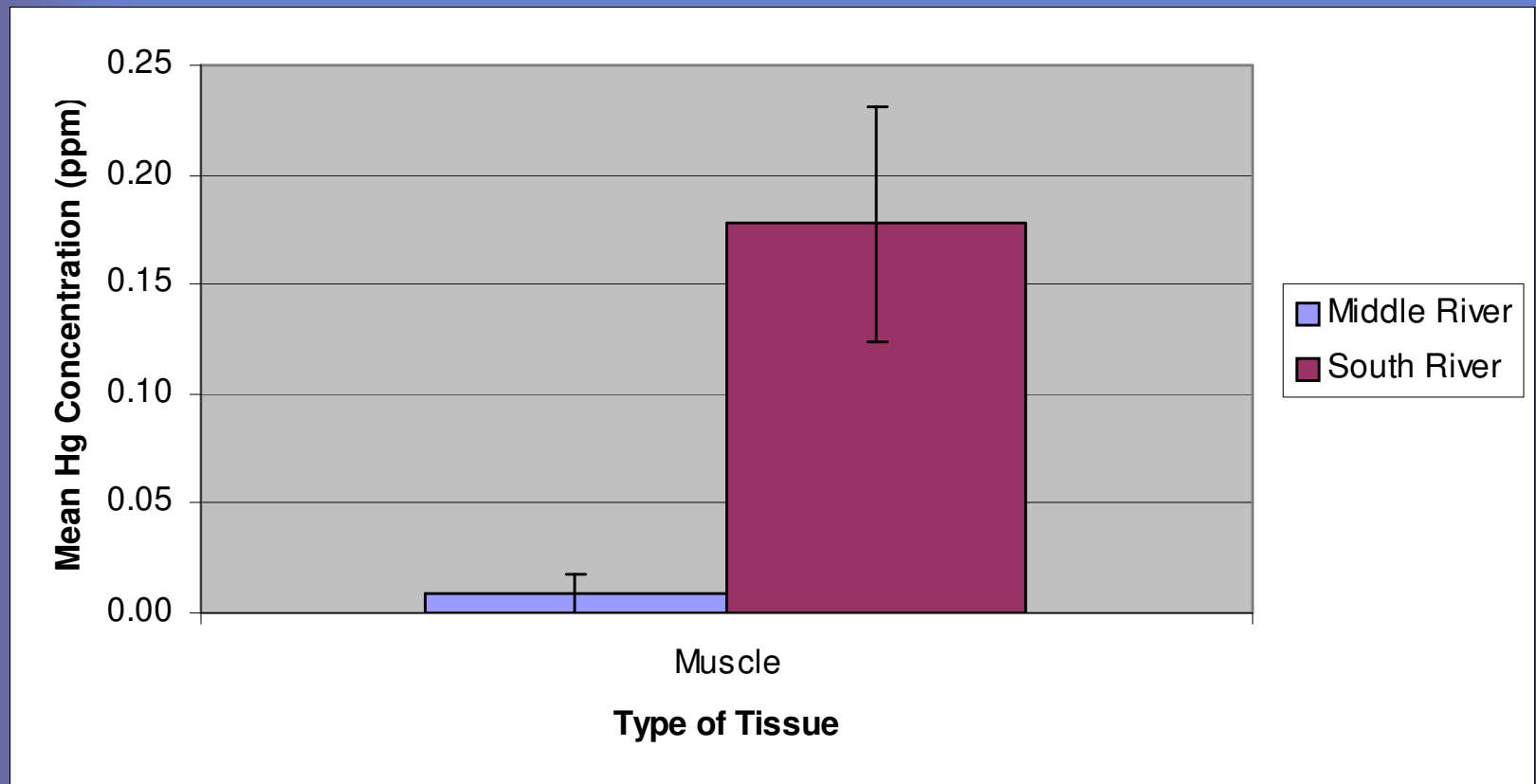
Results: Kidney



Results: Liver



Results: Muscle





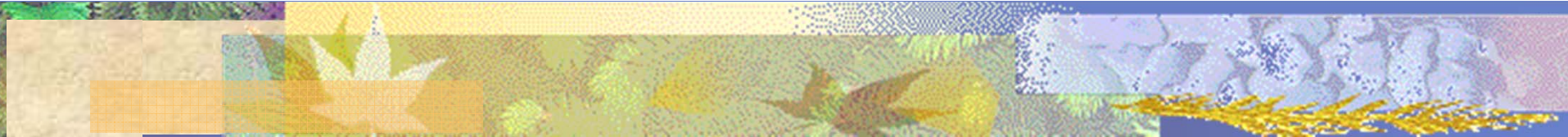
Other Findings

- Standard body measurements are similar between MR and SR muskrats
- SR muskrats had livers (9 of 13) infected with multiple cestode cysts
- SR muskrats had stomach contents that included clam tissue (9% by weight)



Conclusions

- Significant differences exist in total Hg between MR and SR muskrats (kidney, liver, and muscle)
- Poor correlations between Hg in tissues and:
 - Animal age
 - Animal sex
 - Body weight
 - Total body length
- Slight correlation between Hg in liver, kidney and muskrat preference for clams
- Kidneys contained significantly higher total Hg than liver or muscle samples



Thanks To....

- Michael Hensley
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- Jason Hallacher
- Carney Tumer
- Mike Fees
- Hunter Joseph
- Whit Wall

Questions?



Discussion, cont...

- Hg concentrations measured in South River muskrat tissues, specifically the kidney, far exceeds any levels found in previous studies

Study	Tissue Type	N	Mean Hg Concentration (ppm)
Halbrook et al.	Kidney	30	0.019
Halbrook et al.	Kidney	20	0.017
Halbrook et al.	Kidney	26	0.011*
Everett & Anthony	Liver	14	0.029
Everett & Anthony	Liver	18	0.039
Everett & Anthony	Liver	20	0.053
Everett & Anthony	Liver	11	0.070
Sheffy and St. Amant	Liver	14	< 0.02
Sheffy and St. Amant	Kidney	14	< 0.02
Sheffy and St. Amant	Muscle	14	< 0.02

