

Mercury Accumulation in Freshwater Mussels in Pool 12 of the Mississippi River



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Abstract

Mercury (Hg) is a neurotoxin that is widespread amounts in fish and shellfish in the rivers and streams of the United States. Although natural Hg sources exist, the primary sources for most systems are industrial, often via wastewater treatment plants. A heavy metal itself, Hg differs from most other common heavy metals in that a higher proportion of Hg is transported in dissolved forms rather than attached to sediments. With source and speciation differences in mind this study investigated if the content of mercury in mussels differed among pool locations (upstream vs. downstream) and among individual mussel species. In addition, we examined if the accumulation of Hg was similar to the accumulation of other heavy metals. Mussels were collected by pollywogging along transects at nine sites in Pool 12. At each site four individuals from three common species, Plain Pocketbook (*Lampsilis cardium*), Wabash Pigtoe (*Fusconaia flava*), and Threeridge (*Amblema plicata*), were selected and their digestive glands were removed. The glands were frozen, homogenized, subsampled, acid digested, and analyzed for total Hg. The null hypothesis tested was that there would be no difference among freshwater mussel samples taken throughout Pool 12 with respect to Hg concentrations in terms of mussel location or mussel species. Implications regarding the distribution of Hg and freshwater mussel Hg concentrations in Pool 12 will be discussed.

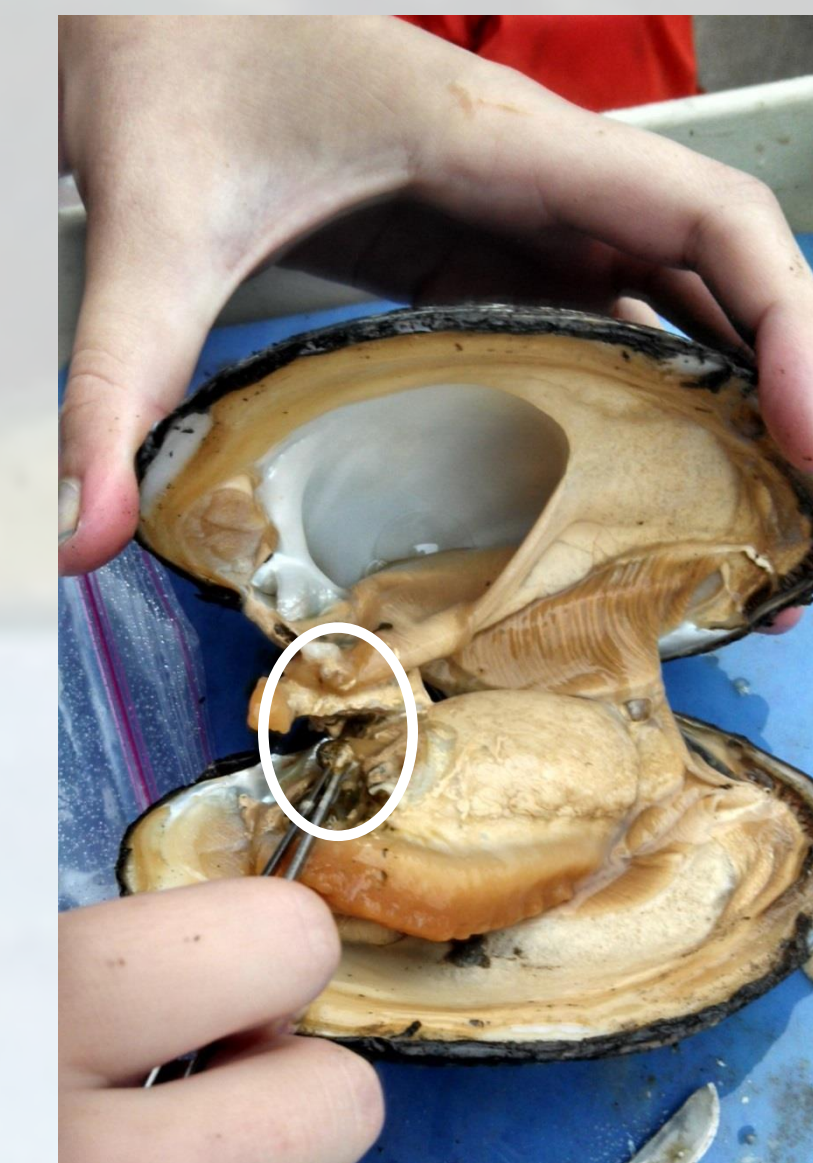


Methods*

- Collected 12 samples from each of the 9 sites within Pool 12 of the upper Mississippi River (Figure 1)
 - Samples collected from Plain Pocketbook, Threeridge, and Wabash Pigtoe
 - Digestive glands were removed and frozen
 - Samples were separated into approximately 1 gram portions (if total sample sizes were less than 1 gram, only half the sample was removed)
 - Digested with 1:1 HNO₃, concentrated HNO₃, H₂O, 30% H₂O₂, HCl; brought to volume
 - Total Hg was measured using a Milestone DMA-80 auto analyzer
- *Method procedures followed are as listed in EPA Method 3050 B

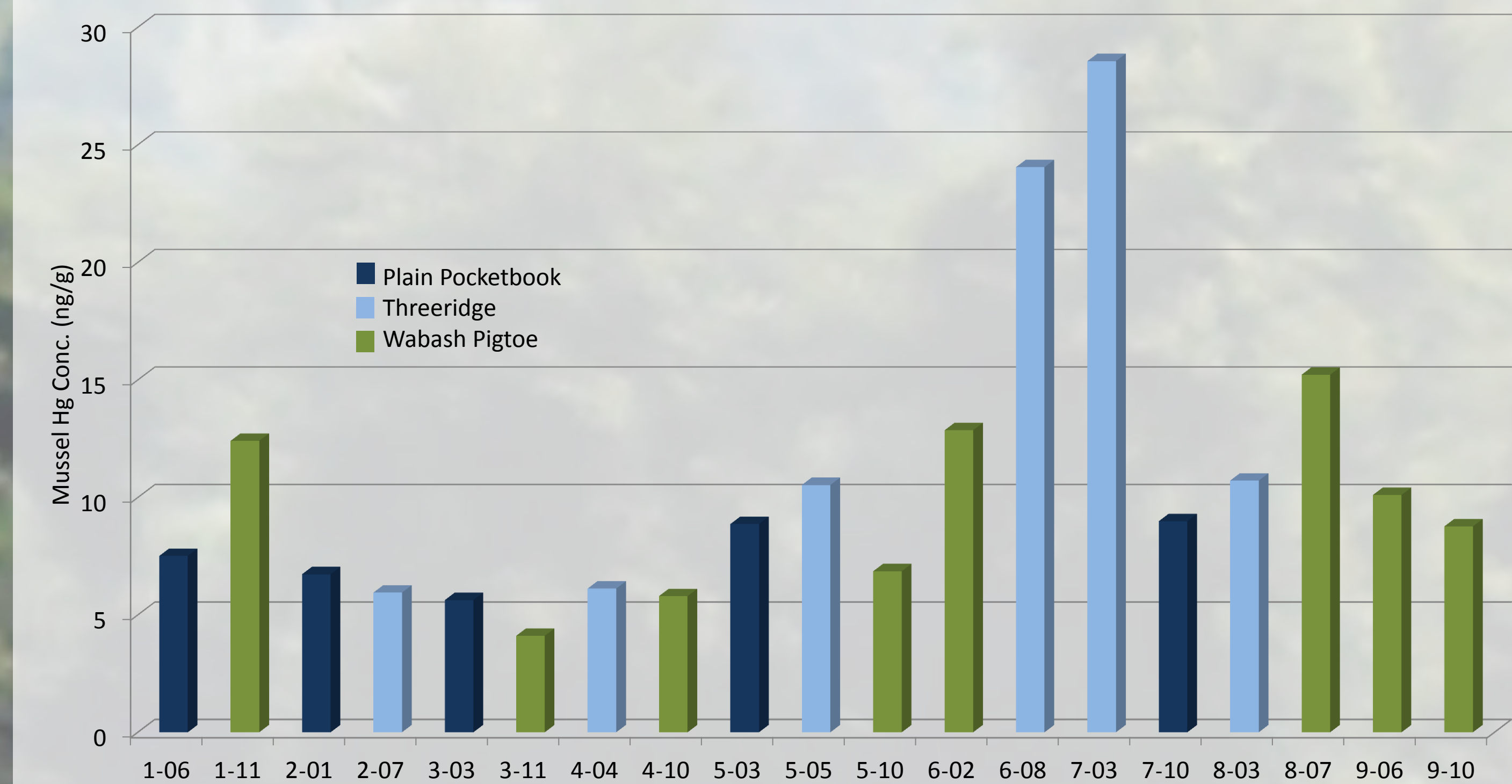


(Below) The removal of the digestive gland from a Threeridge



Results, continued

Figure 4. Concentration of Total Hg in Mussel Sample



Background

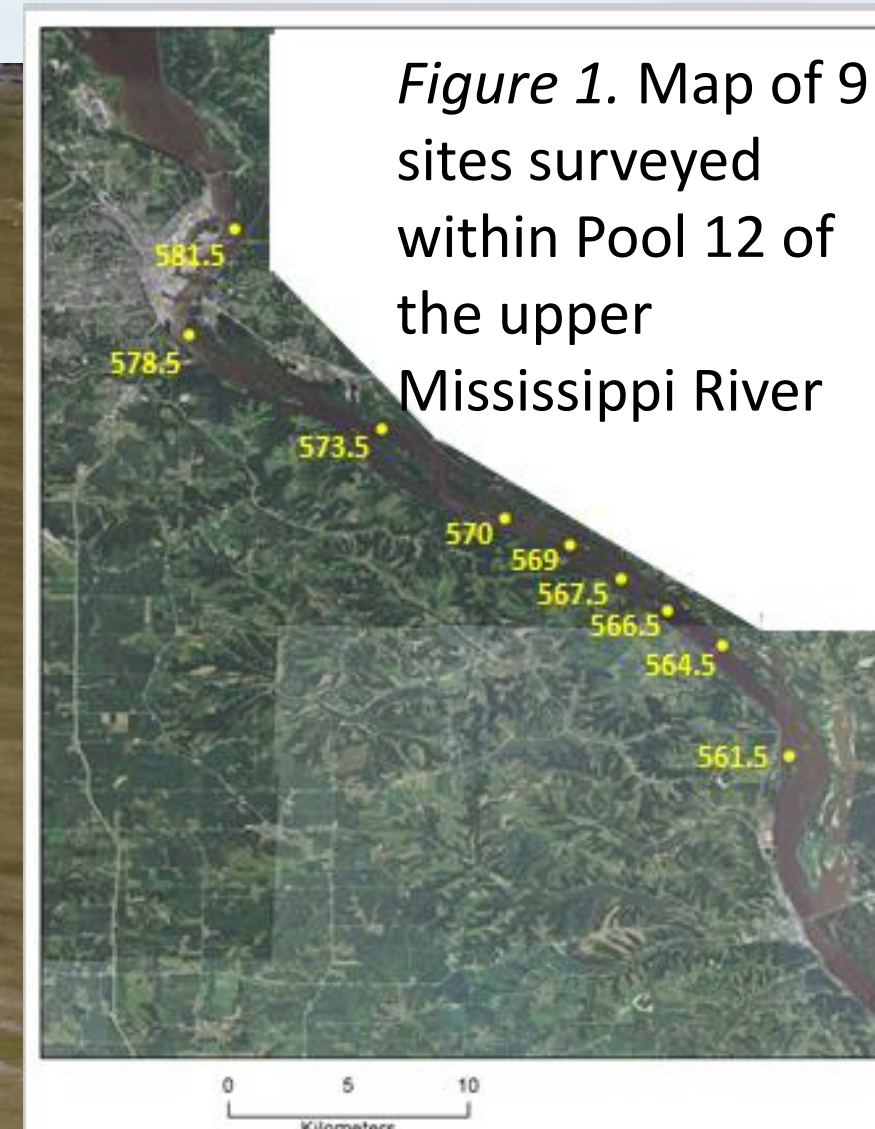
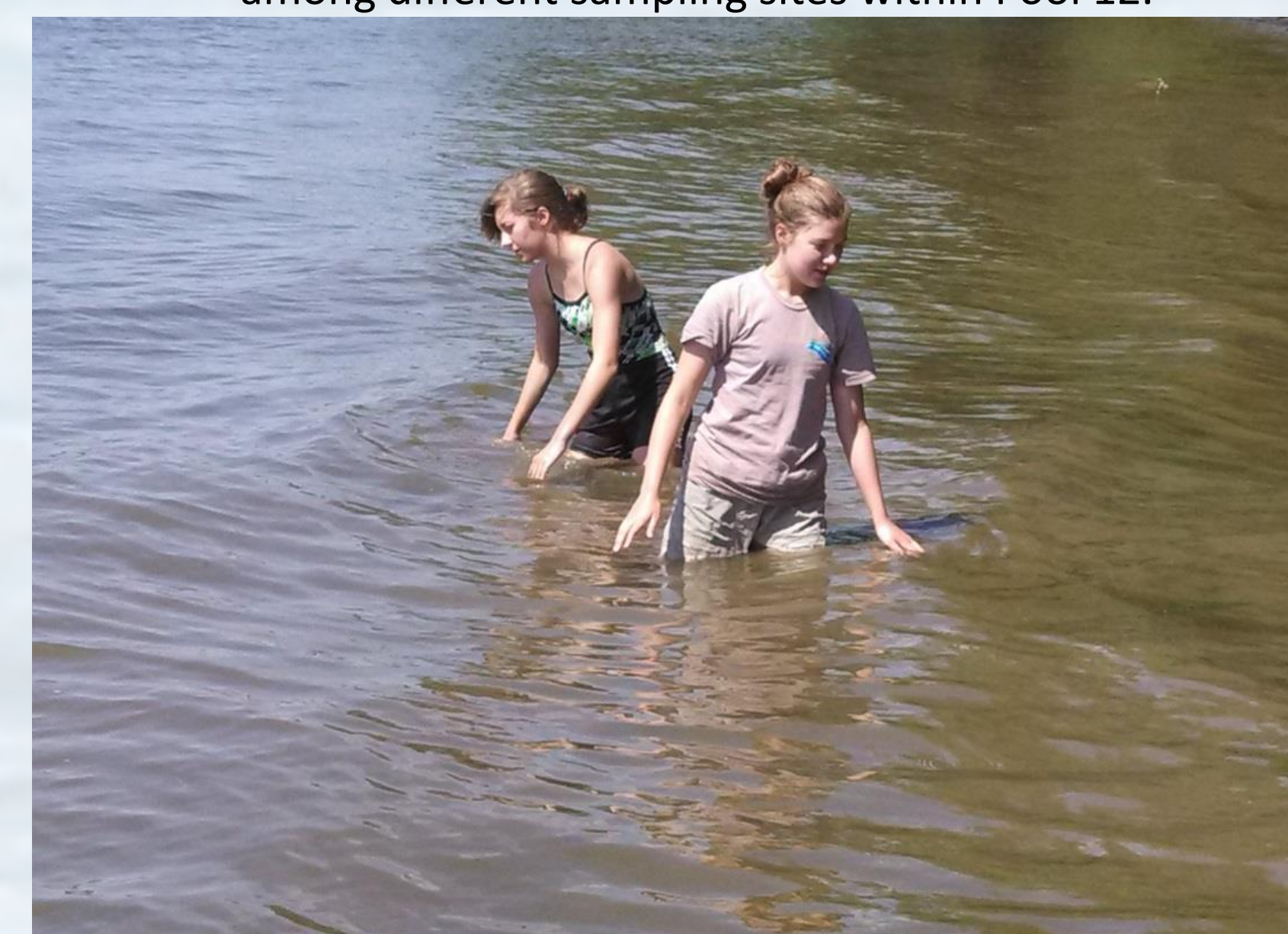
- Mussels, particularly Plain Pocketbooks, are consumed by people. If there are significant levels of Hg in these mussels, it can potentially be dangerous.
- Mussels are eaten by river otters, mink, fish, and other predators. If these mussels contain significant levels of Hg, the predator will be affected greatly due to bio-magnification.
- Intake of Hg by mussels has been shown to decrease reproductive rates.
- The consumption of mercury by children and fetuses may harm neurological development. Intake of methyl mercury set by the Food and Agriculture Organization (FAO) is at 1.6 µg per kg body weight per week.
- Freshwater mussels are good water quality indicators because they are filter feeders. Digestive glands have been proven to be an area of concentration for Hg and other heavy metals.

Objective and Hypotheses

- Evaluate occurrence and amount of Hg uptake by river mussels in Pool 12 of the upper Mississippi River

$H_0 1$: There is no difference in occurrence and amount of Hg uptake among freshwater mussel species throughout Pool 12.

$H_0 2$: There is no difference in occurrence and amount of Hg uptake in freshwater mussels among different sampling sites within Pool 12.



Results



Figure 2. Average Concentrations of Total Hg by Species

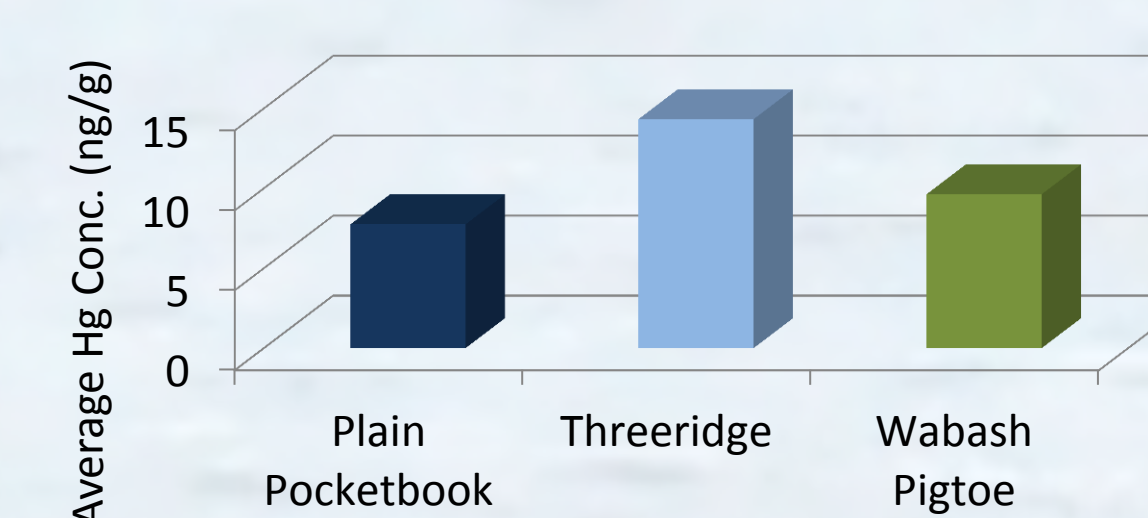
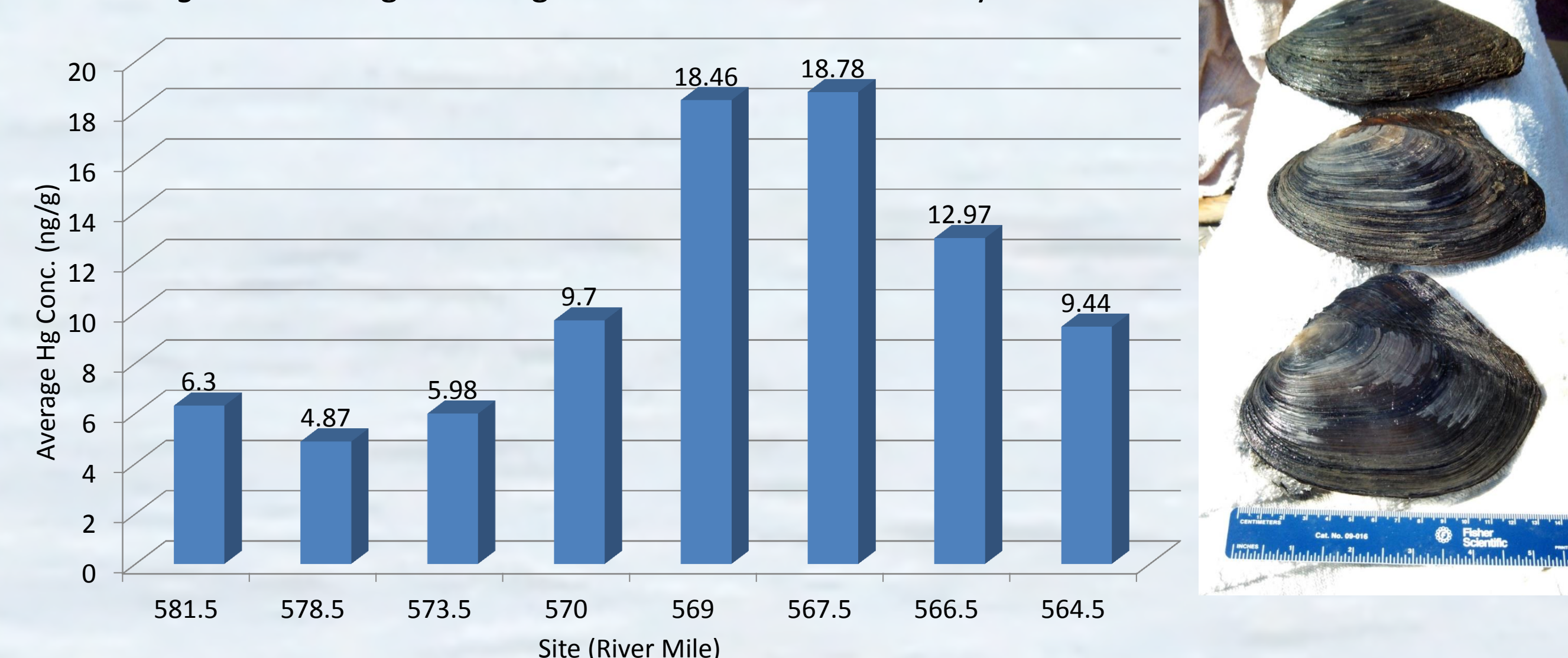


Figure 3. Average Total Hg Concentration in Mussels by Site



Conclusion and Discussion

- Although not statistically significant, our data suggests differences exist between species and mercury uptake, as well as site and mercury uptake.
- We reject $H_0 1$; on average Plain Pocketbooks contained the least concentration of Hg while Threeridges contained the most (Figure 2).
- We reject $H_0 2$; significant spikes in Hg concentration were seen at sites 569 and 567.5 (Figure 3).
- The Hg levels detected in our mussel samples are not high enough to pose a health risk to humans who may consume river mussels from Pool 12.
- More work is needed to assess the potential for bio-magnification of Hg in mussel consumers such as mink and river otter.
- Future research could include comparison between mercury concentration and age of mussels and comparison between mercury concentration of individuals and mercury content of water.



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