

Mercury isotopic signatures are transmitted from aquatic to terrestrial ecosystems

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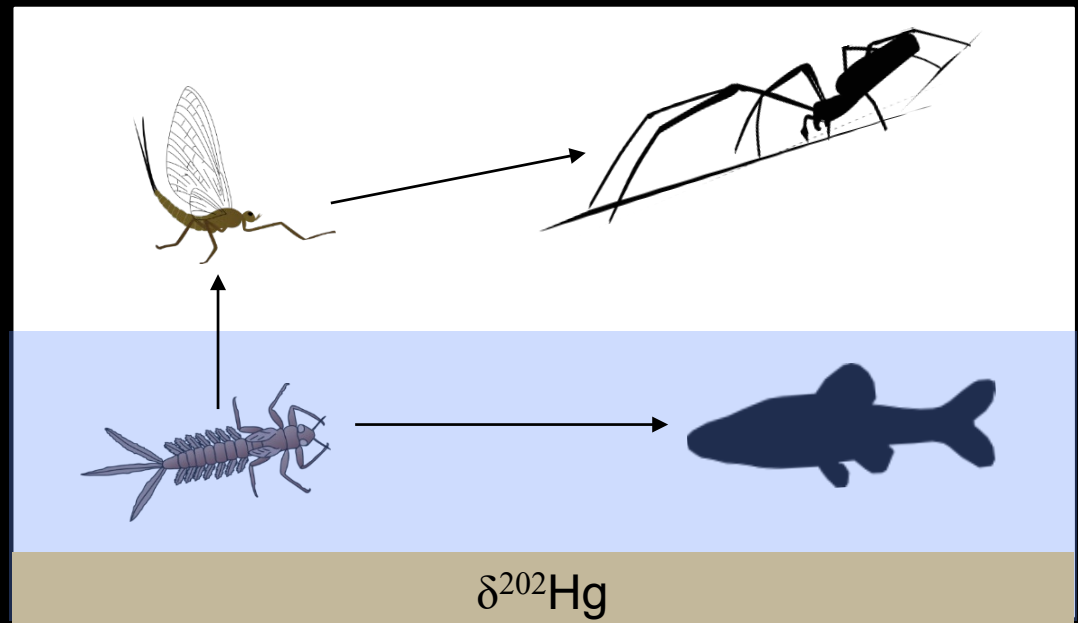
¹ U.S. Geological Survey

² U.S. Environmental Protection Agency

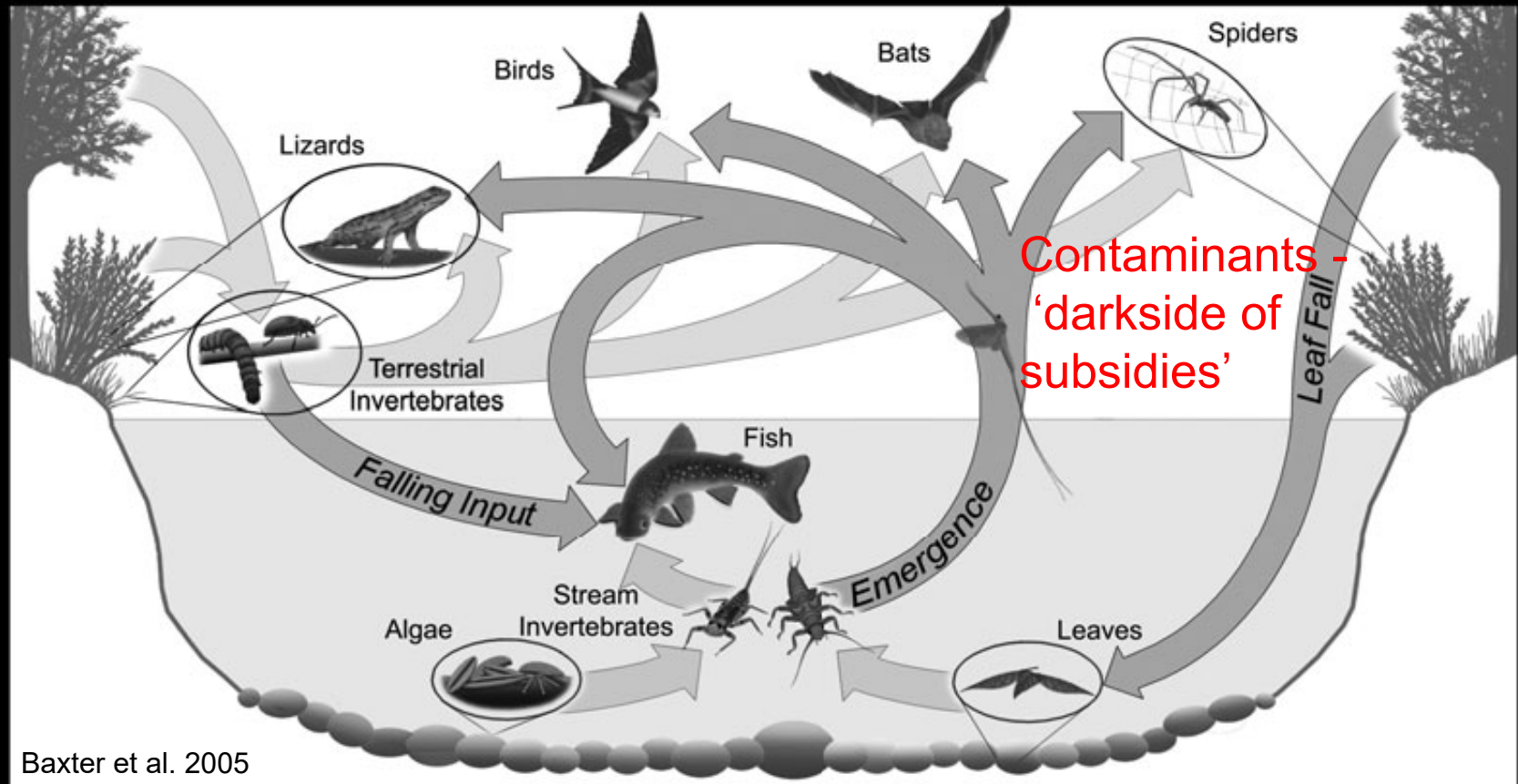
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Land-Water Interactions



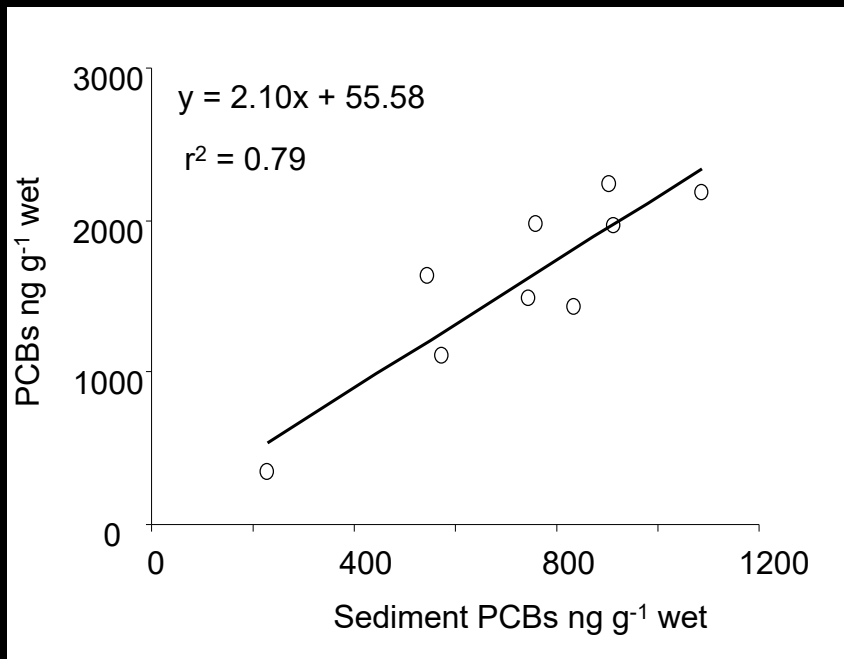
Aquatic systems are bug factories. They package solutes, organic matter, and nutrients from the watershed into insect bodies, which feed many animals on land. “Ecological Subsidies”

Spiders are sentinels of aquatic contamination

Tetragnathidae. Long-jawed spiders

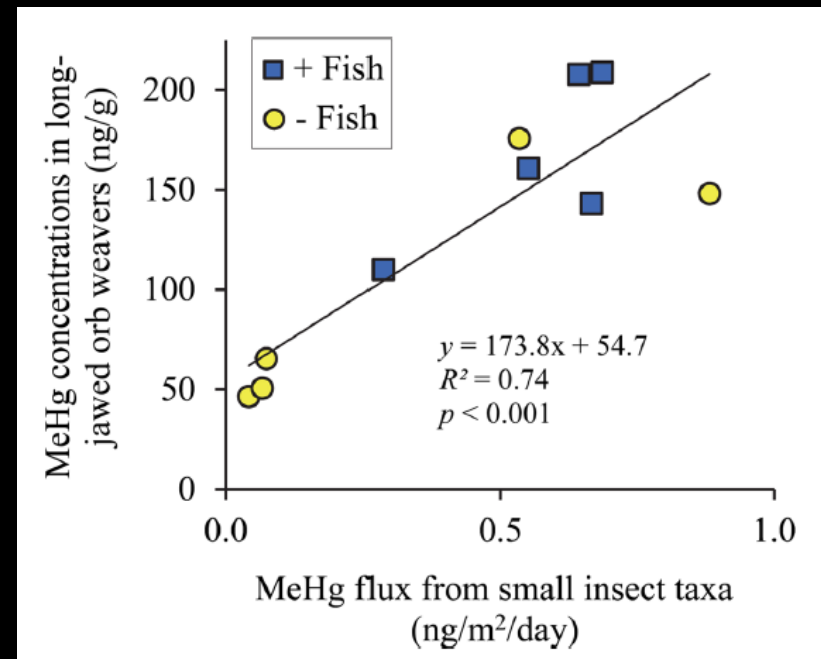


PCBs



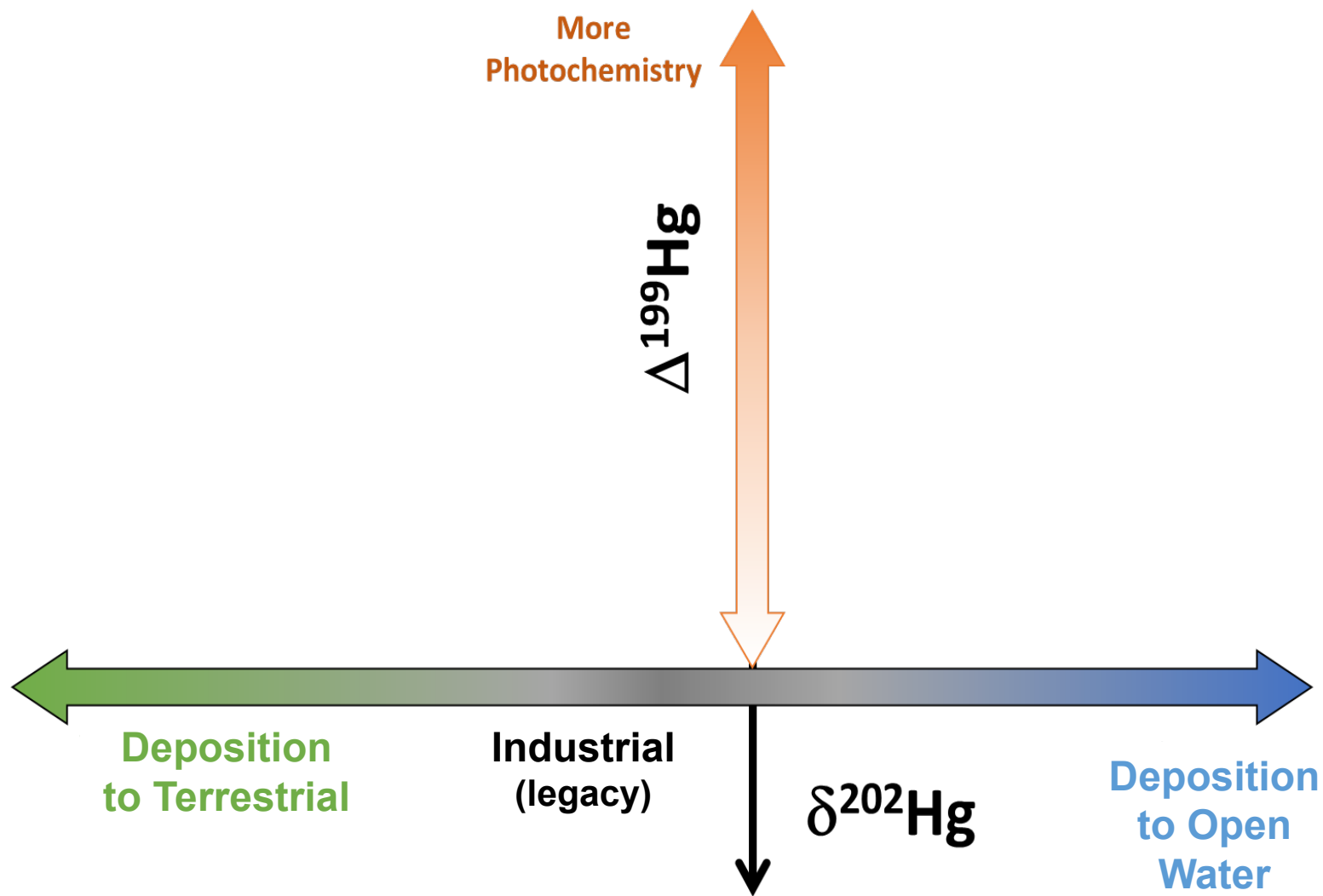
Walters et al. 2010. ES&T

Hg



Tweedy et al. 2013. ES&T

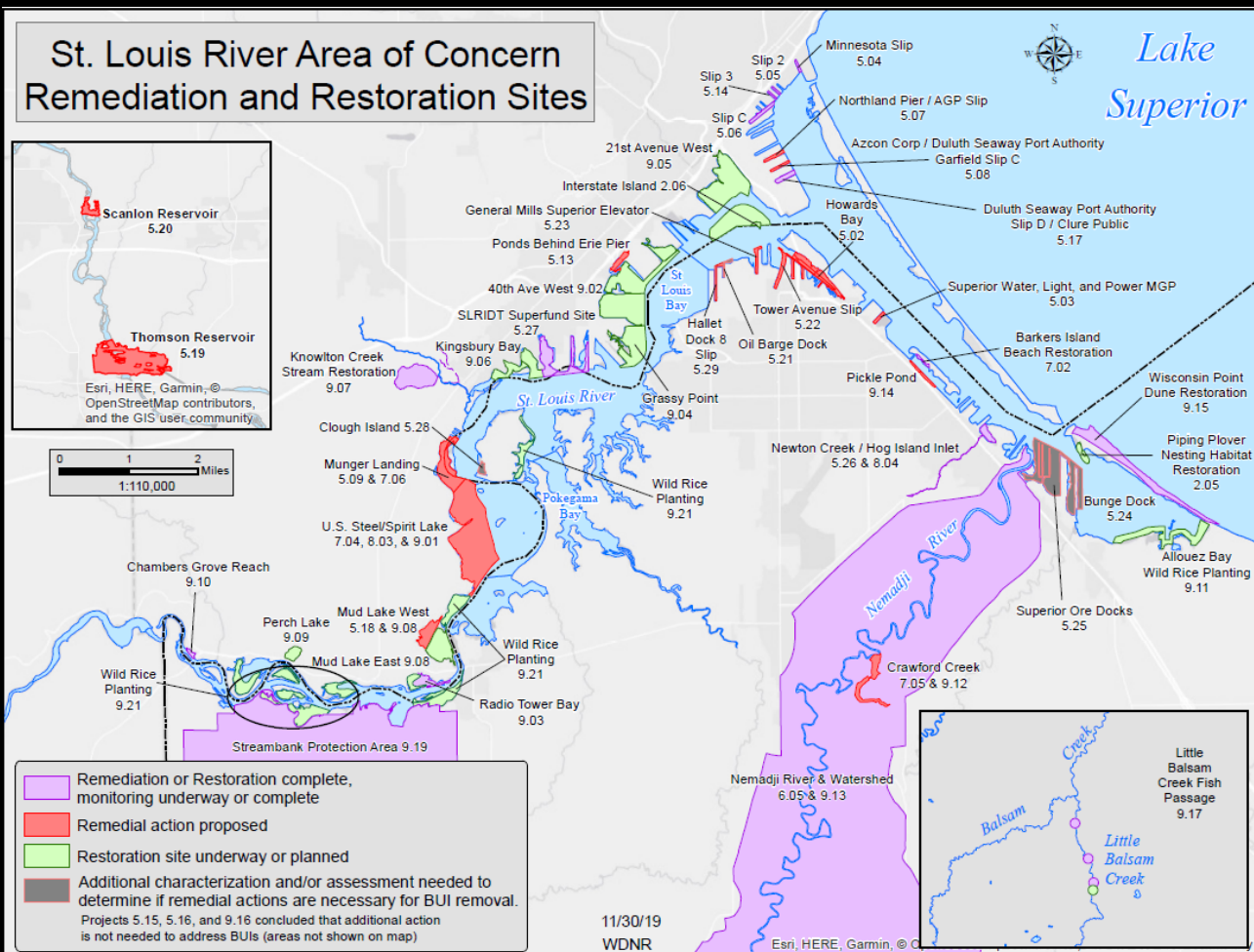
Source Attribution with Hg Isotopes



Research Questions

- Are sediment Hg isotopic signatures conserved in aquatic and riparian food webs?
- Do Hg isotopes fractionate as they move through these food webs?
- Can riparian spiders be used to infer sources of Hg in neighboring aquatic ecosystems?

The St Louis River, MN Area of Concern



- Areas of concern (AOCs):
Regions within the Great Lakes impaired due to local human activities
- 39 miles of the lower St. Louis River estuary (SLRE) and 2 upstream reservoirs are designated in the AOC
- Historic contamination from point sources, superfund sites, landfill and wastewater discharge
- Hosts mercury (Hg), PCBs, dioxin, and PAHs

Map: Minnesota Pollution Control

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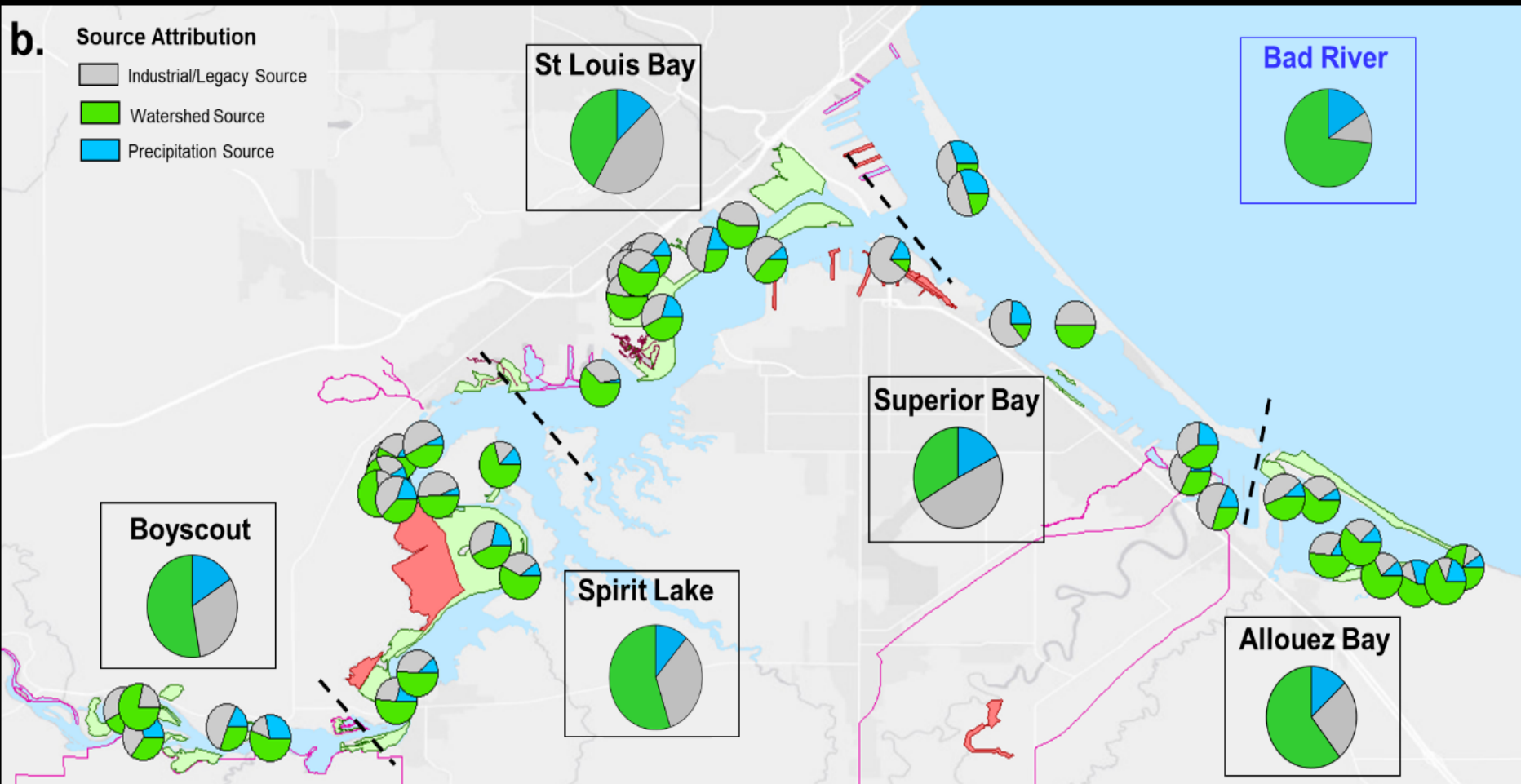
Saint Louis River & Reservoir HD Sites



Bad River HD Sites



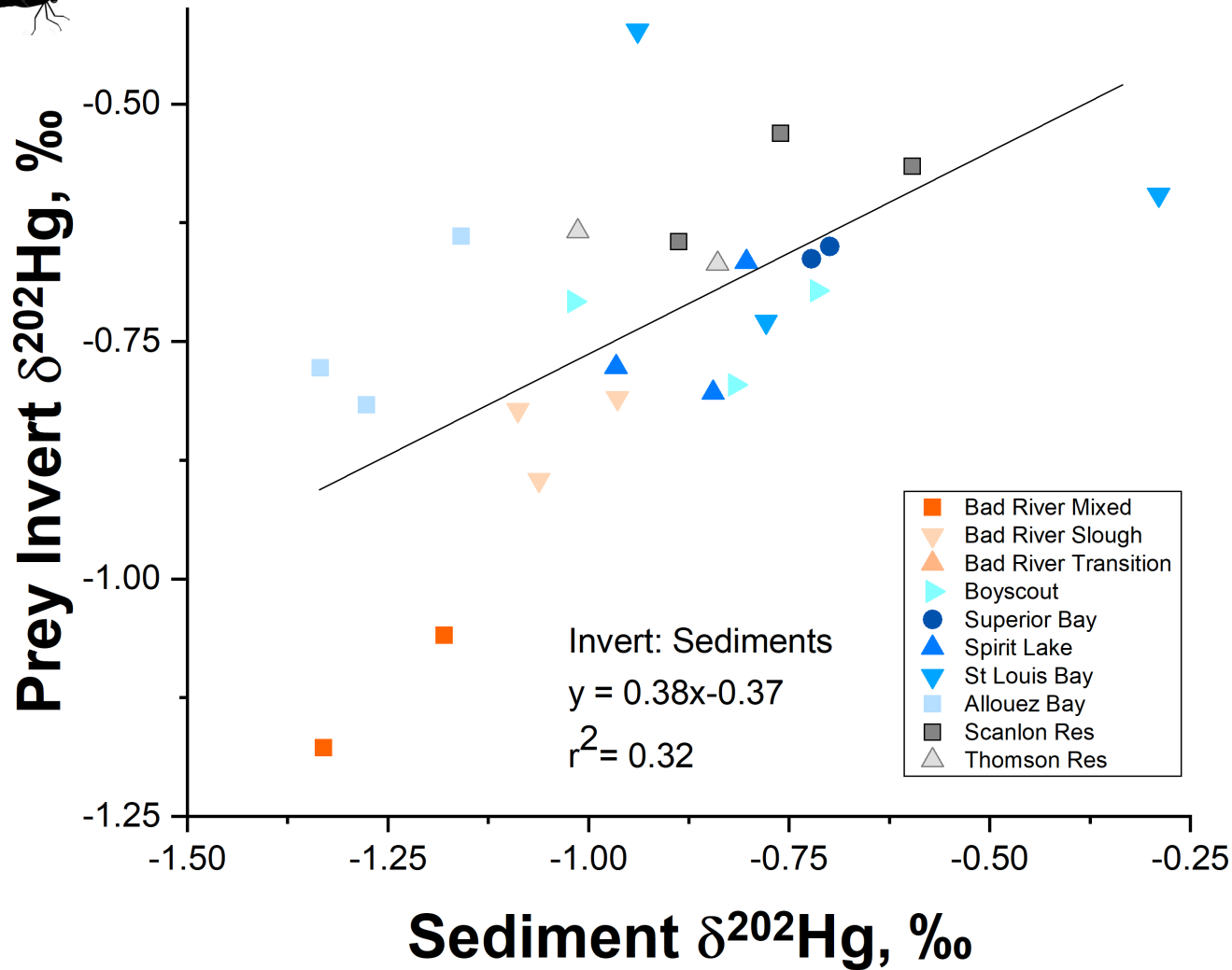
Hg sources to aquatic sediments



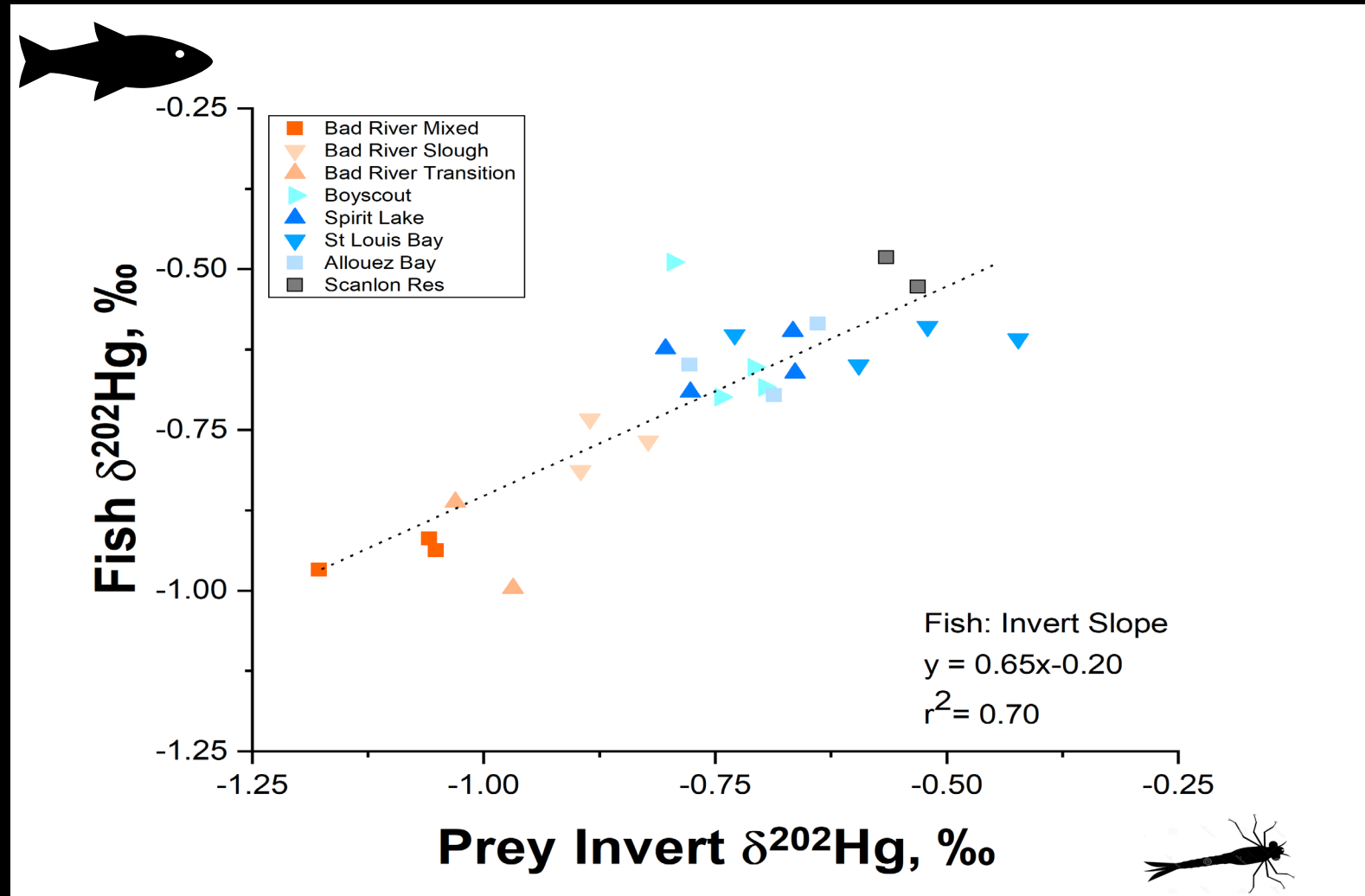
Janssen et al. In Review

Janssen SciCon2 #1.09.02

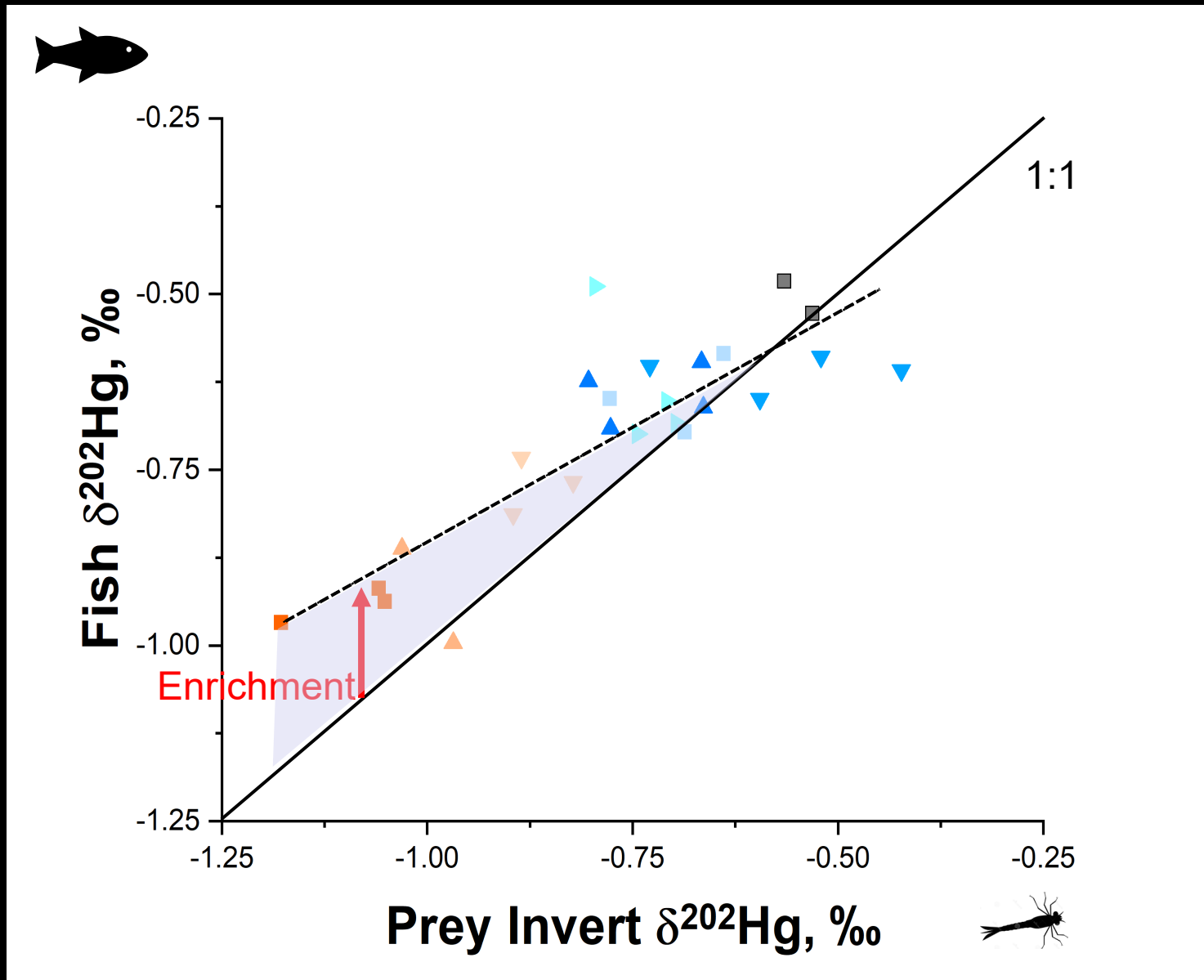
Sediment $\delta^{202}\text{Hg}$ signatures are conserved in aquatic invertebrates



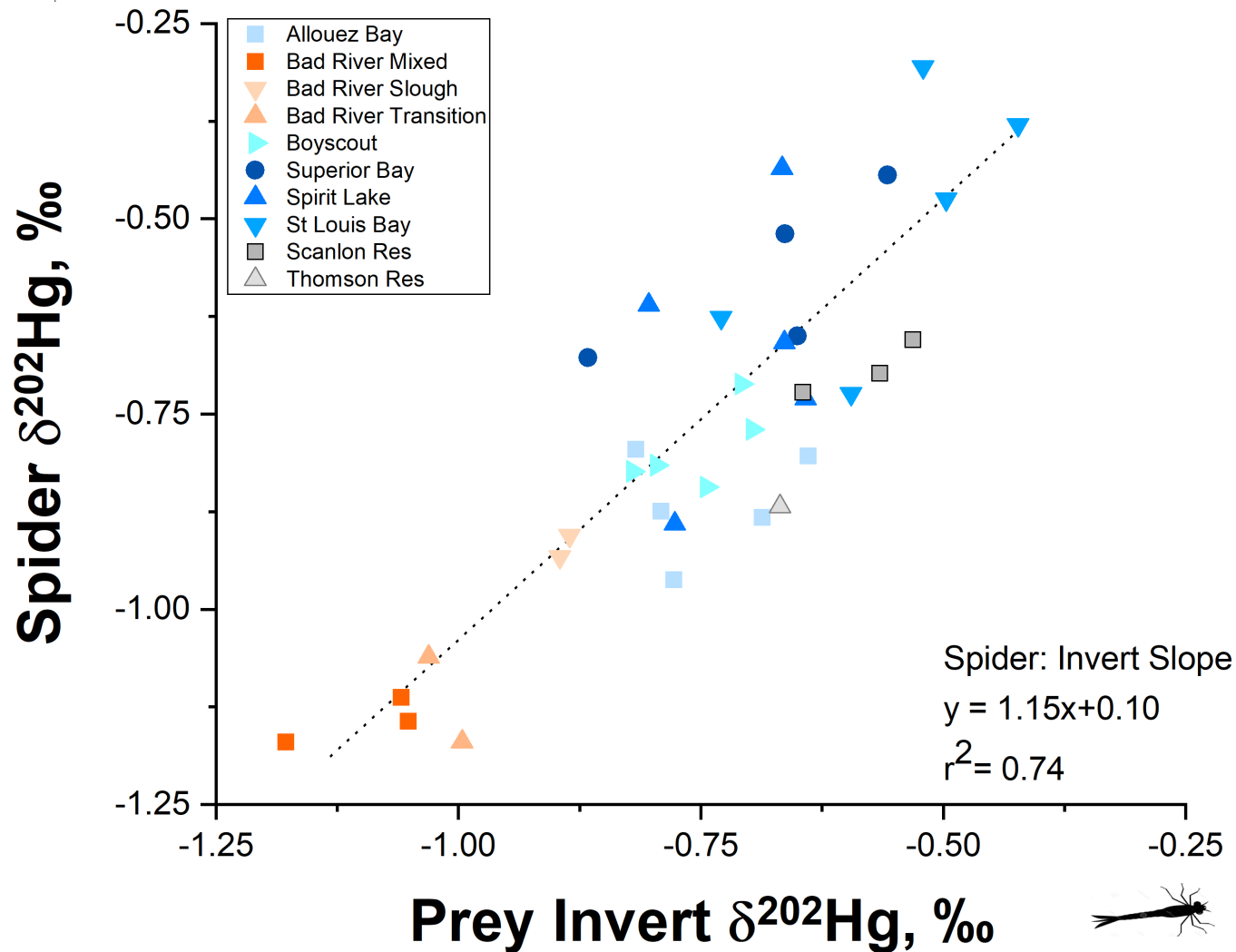
Aquatic insect and fish $\delta^{202}\text{Hg}$ are highly correlated



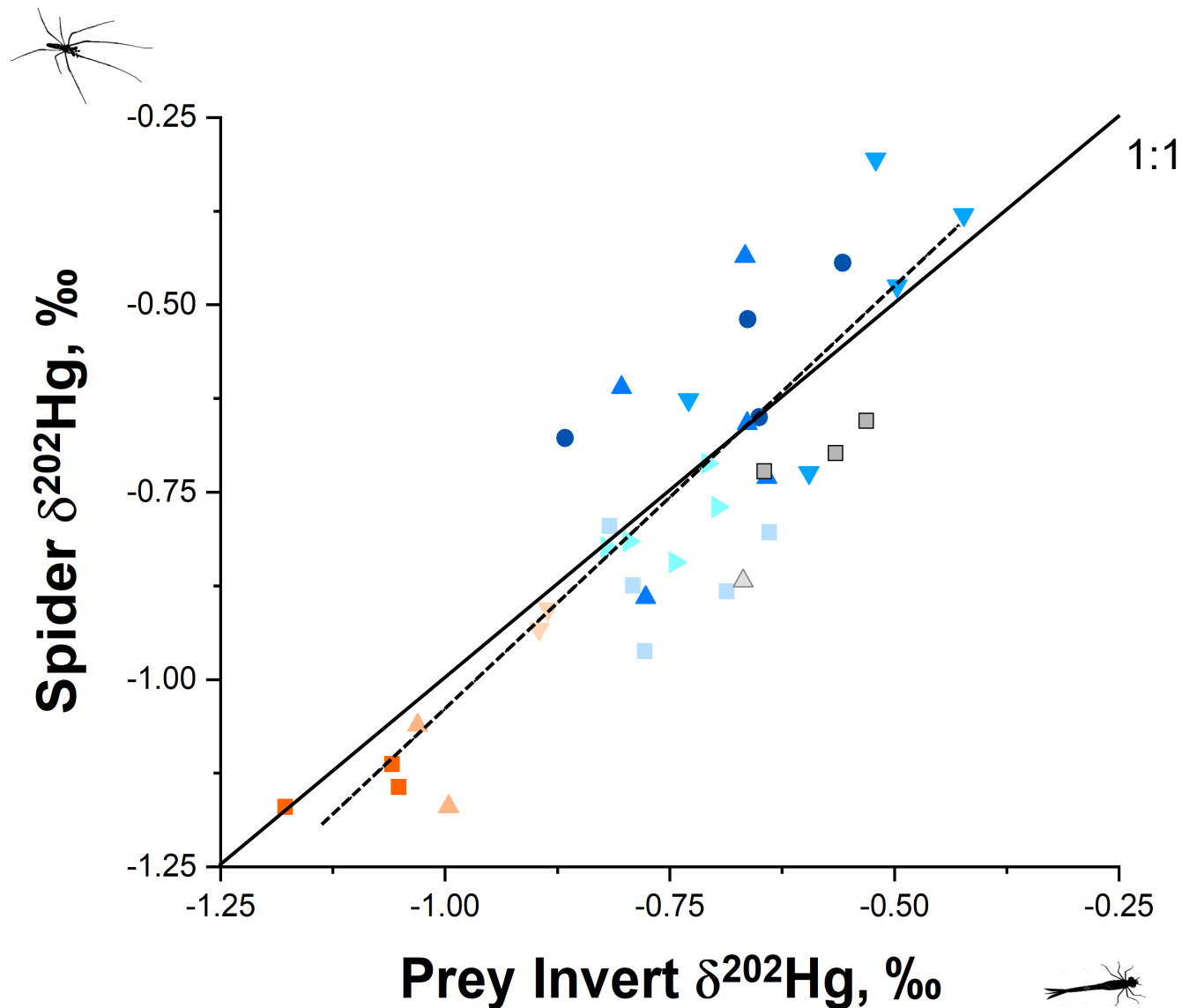
Some evidence for trophic fractionation of $\delta^{202}\text{Hg}$



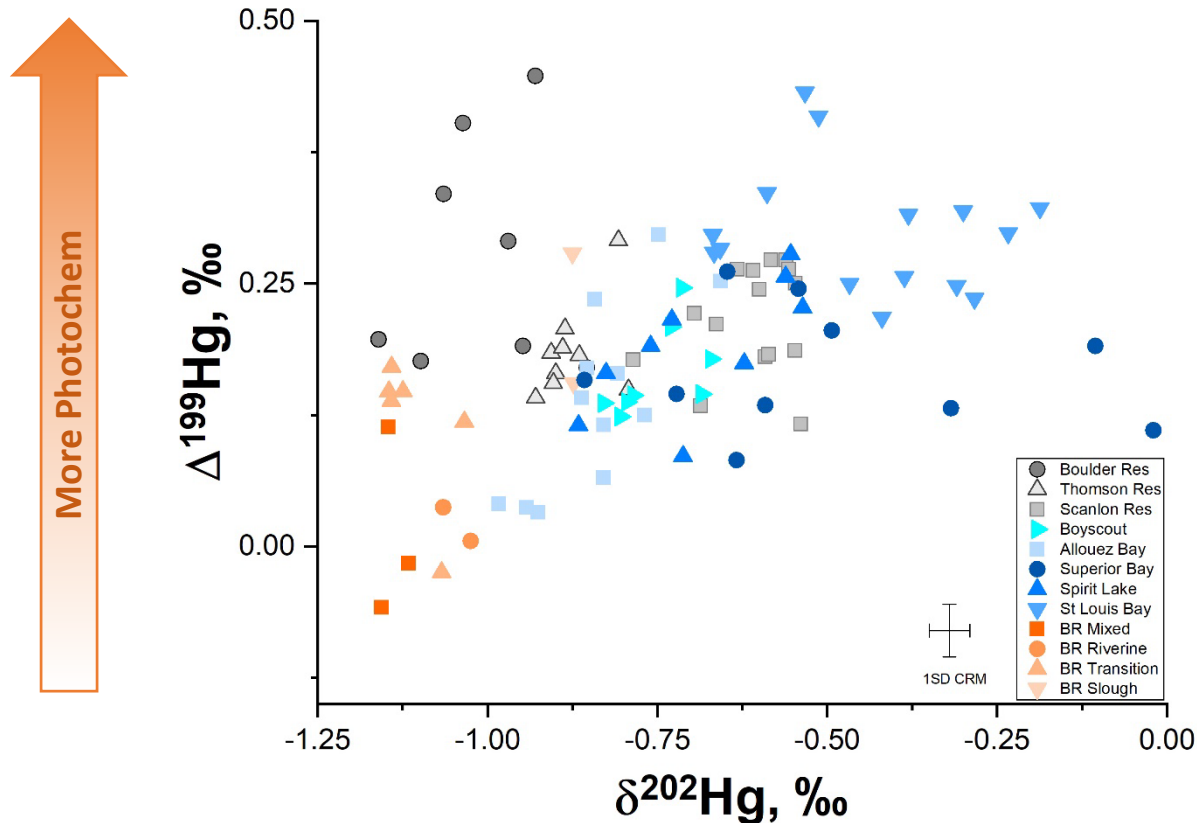
Aquatic insect and spider $\delta^{202}\text{Hg}$ are highly correlated



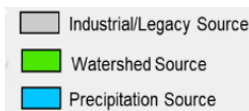
No evidence for fractionation of $\delta^{202}\text{Hg}$



Spider Hg isotopes indicate Hg sources in aquatic systems



Sediment sources



Conclusions

