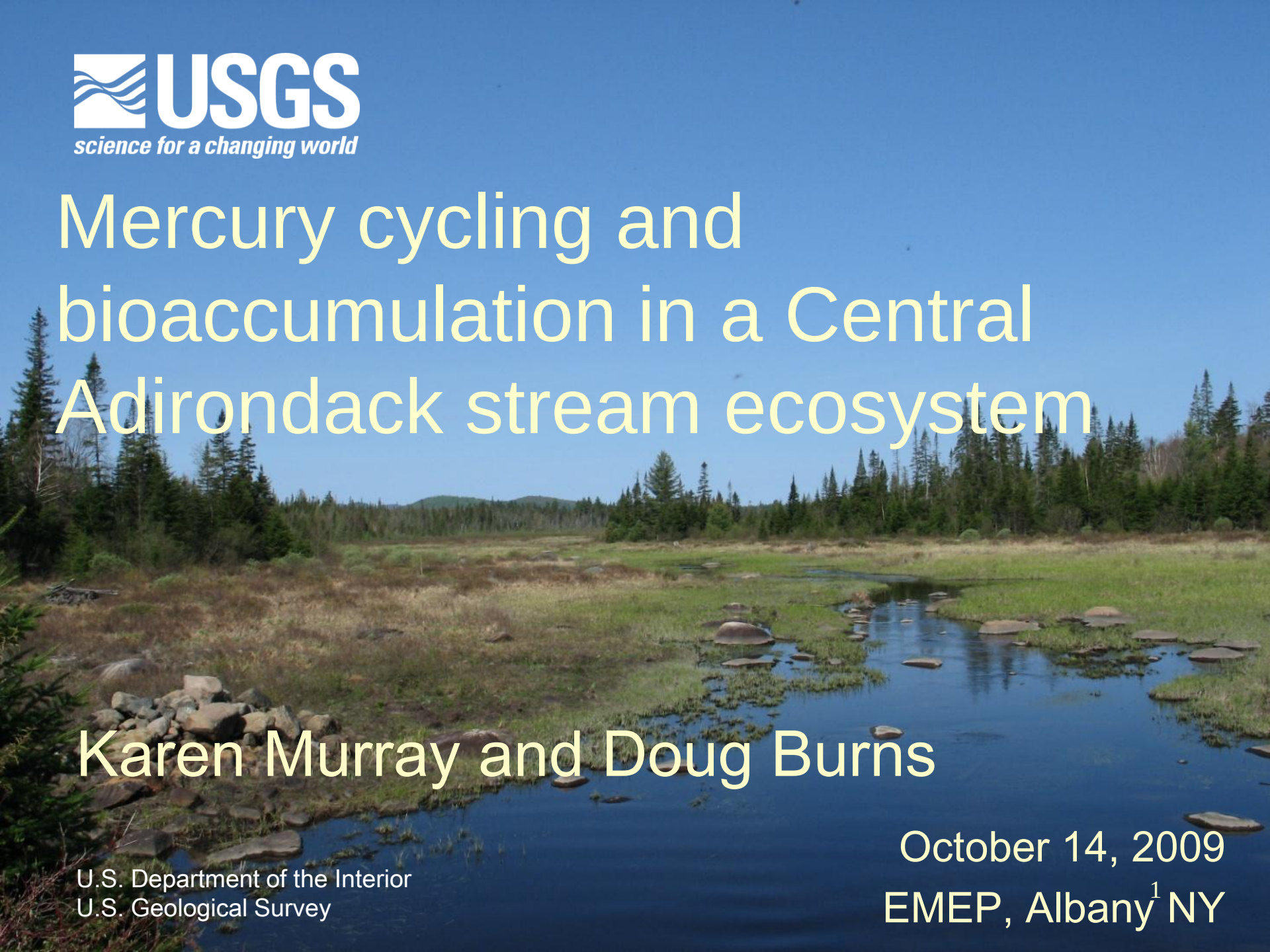

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Mercury cycling and bioaccumulation in a Central Adirondack stream ecosystem

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U.S. Geological Survey

October 14, 2009
EMEP, Albany NY

Presentation outline

- Background - Mercury cycle in aquatic ecosystems
- Mercury in streams across the US (NAWQA mercury studies)
- Intensive research on a Central Adirondack stream

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Acknowledgments

Mark Brigham , USGS, MN Water Science Center

Lia Chasar, USGS, FL Water Science Center

Barb Scudder, USGS, WI Water Science Center

Adirondack Ecological Center (Huntington Wildlife Forest)

Nature Conservancy, Finch-Paper Co, RMK Timberland

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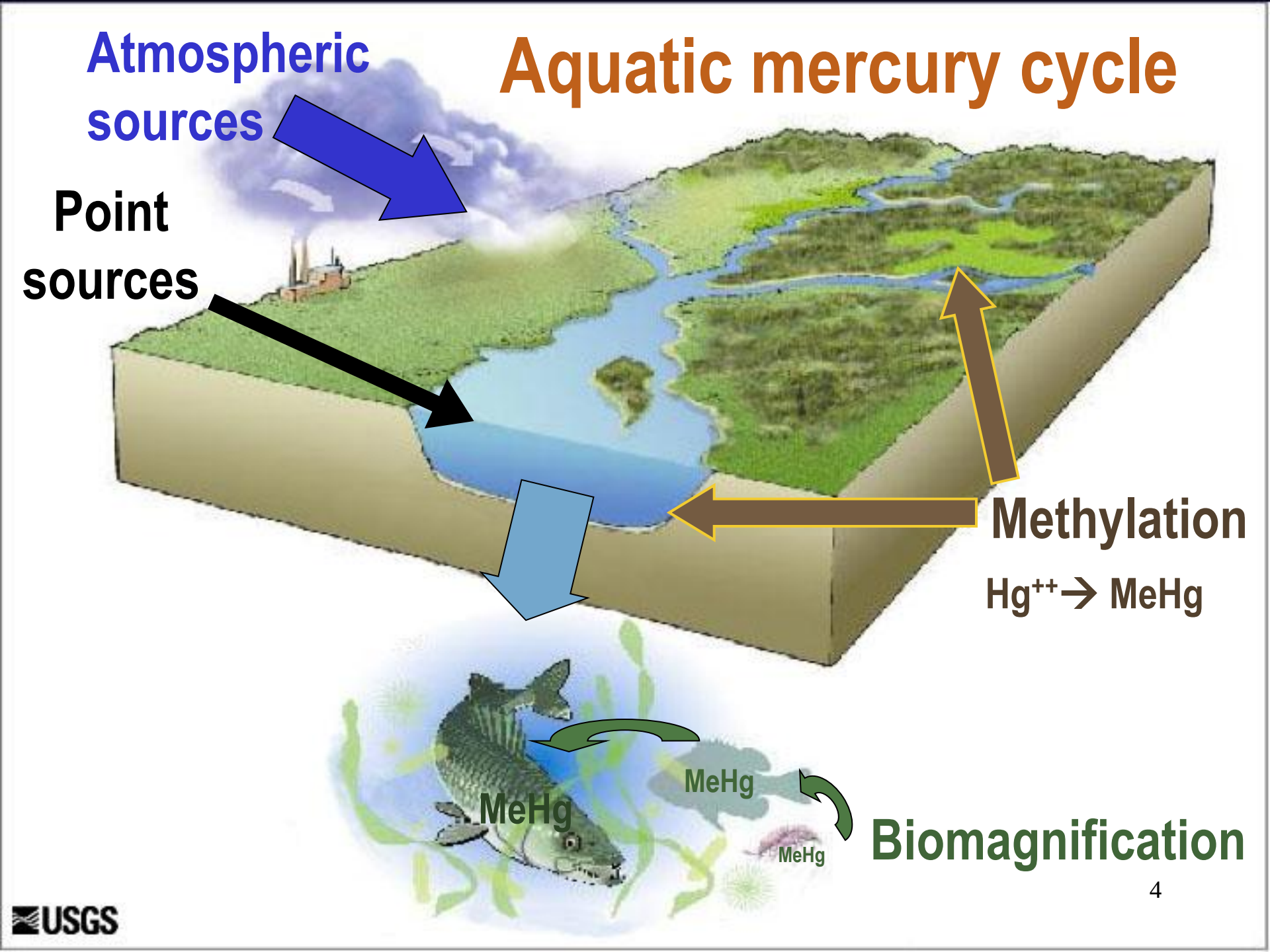
Aquatic mercury cycle



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Key questions

- How does mercury move from source to fish & other organisms?
- How does mercury vary geographically among stream fish?
- What controls mercury concentrations in stream biota?

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National stream study Scudder et al. 2009

- Game fish, water, sediment
- 291 streams across the US
- Variety of landscapes
- 1998-2005
- Methylmercury & Total mercury in water & bed sediment
- Total mercury in game fish

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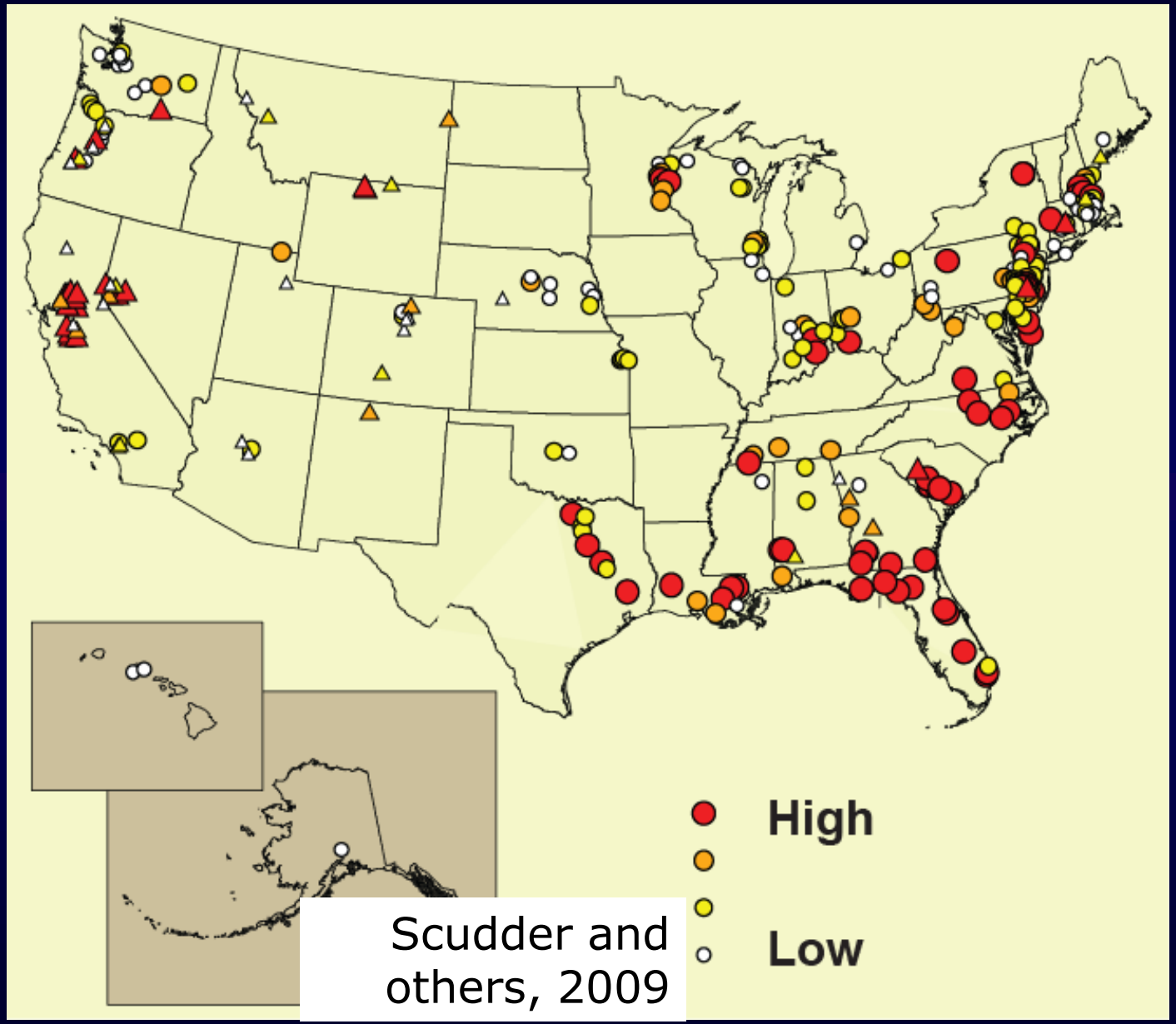
Mercury in Game Fish



Scudder and others, 2009

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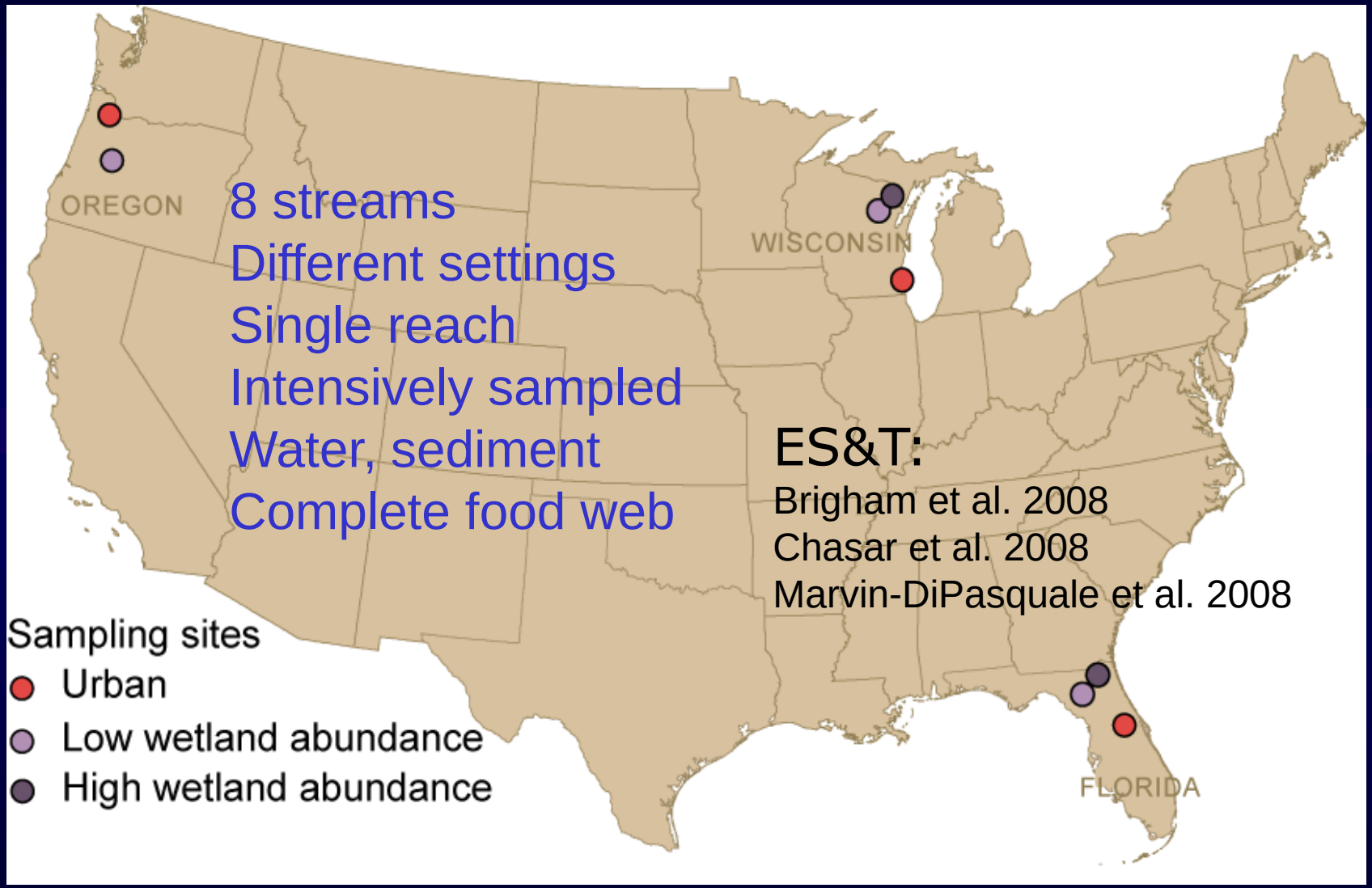
How does mercury move from source to fish?



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Key findings

- Runoff of methylmercury produced in watershed (wetlands)
  - Water quality (DOC, pH)
- Source versus methylation
  - Modest source with high methylation
  - Large source with low methylation
- Biomagnification
  - Similar among ecosystems
  - Methylmercury in the water determines methylmercury in fish

ES&T: Brigham et al. 2008, Chasar et al. 2008, Marvin-DiPasquale et al. 2008

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Intensive watershed studies 2007-2009

- Where is meHg produced in the watershed?
- How / when is it transported to the stream?
- What controls its bioaccumulation?

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Intensive watershed studies 2007-2009

- Forested catchments; atmospheric deposition primary source
- Multiple sites sampled throughout small catchments
- Fishing Brook (Hudson R basin, NY)
- McTier Creek (Edisto R basin, SC)

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Fishing Brook study area

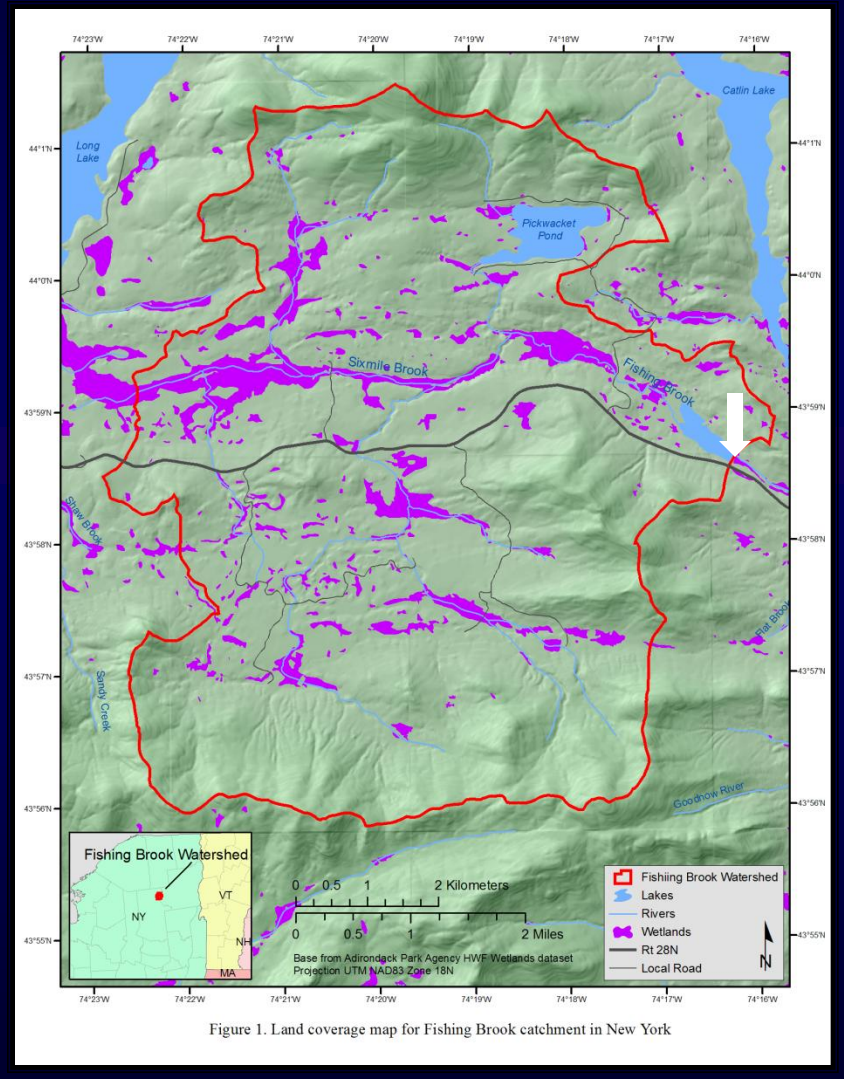

Figure 1. Land coverage map for Fishing Brook catchment in New York

- Central Adirondacks
- Upper Hudson R. basin
- Near MDN site at HWF
- 26mi^2 area
- 89% forest
- 8% wetland
- <3% open water

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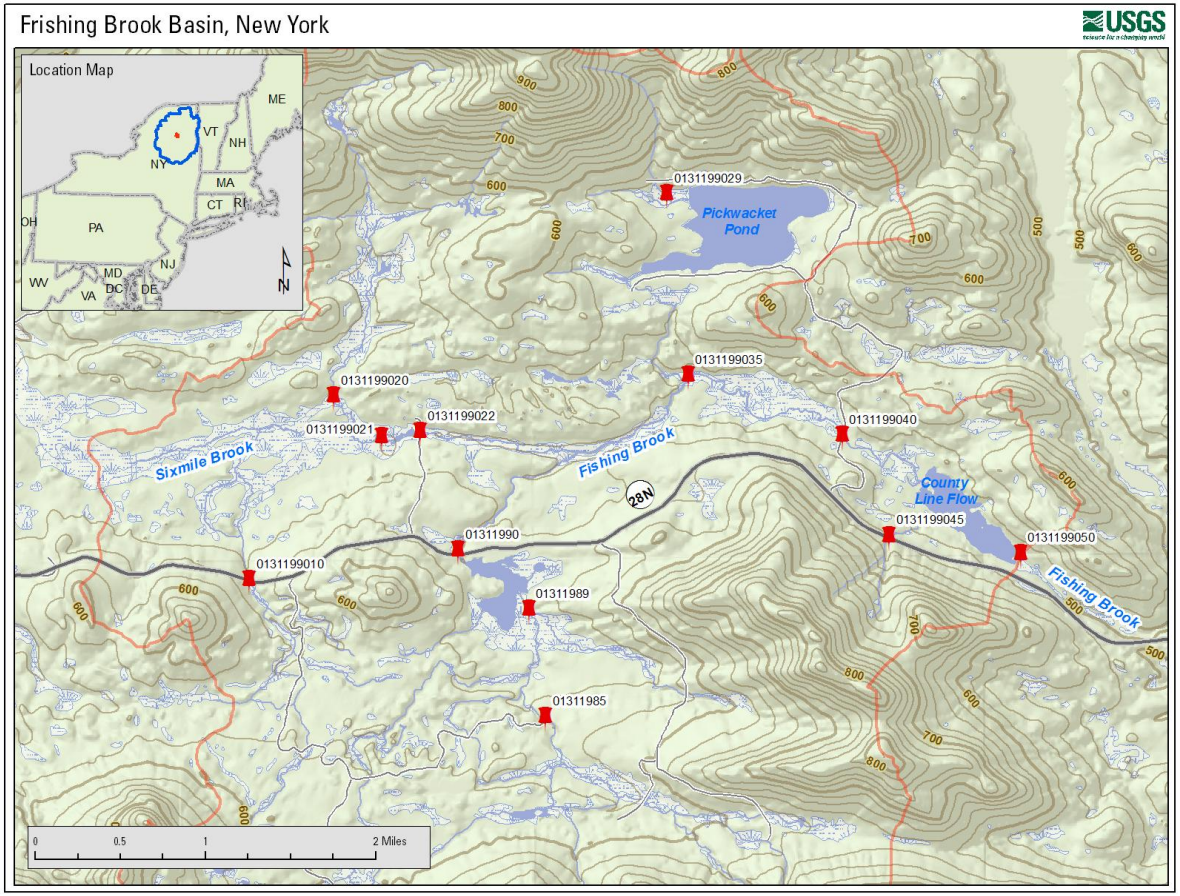
Fishing Brook sites



12 sites overall

Range of characteristics

Bio collected @ 9 sites

Gage at outlet

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Approach

- Sample seasonally 2007-09
- Sample biota from 9 sites
- Collect invertebrates & fish representing multiple feeding groups
- Analyze for MeHg, THg, $d^{13}C$, $d^{15}N$
- Analyze water for MeHg, THg, DOC, sulfate, pH, & more

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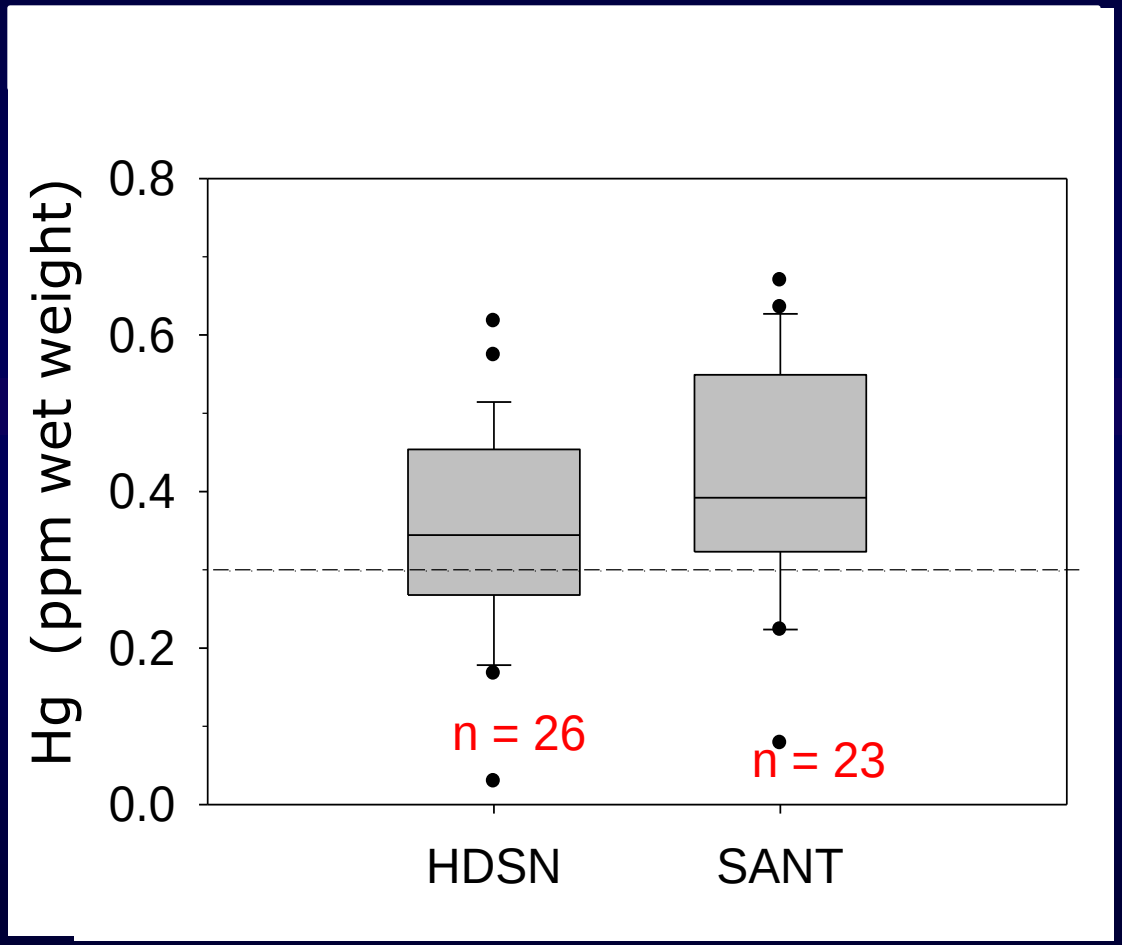
Hg in top predator fish



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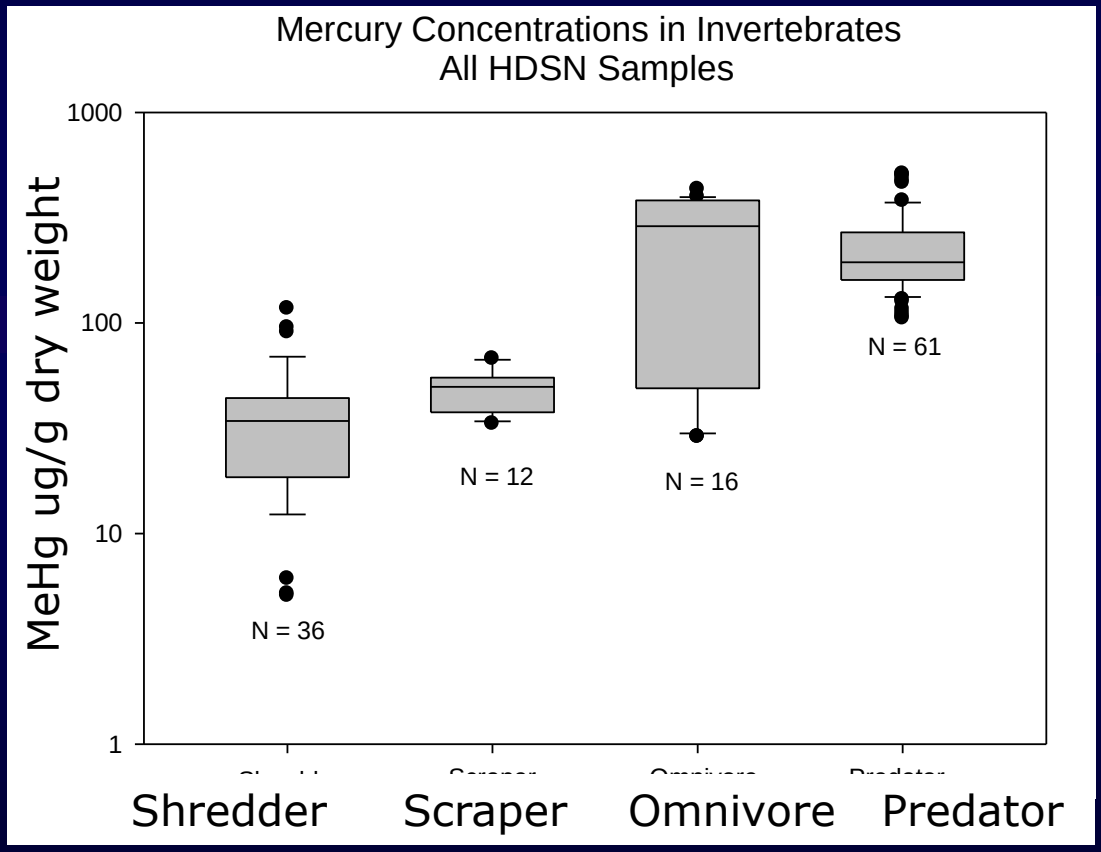
Includes Hudson R & Edisto R samples

Methylmercury in invertebrates – all sites



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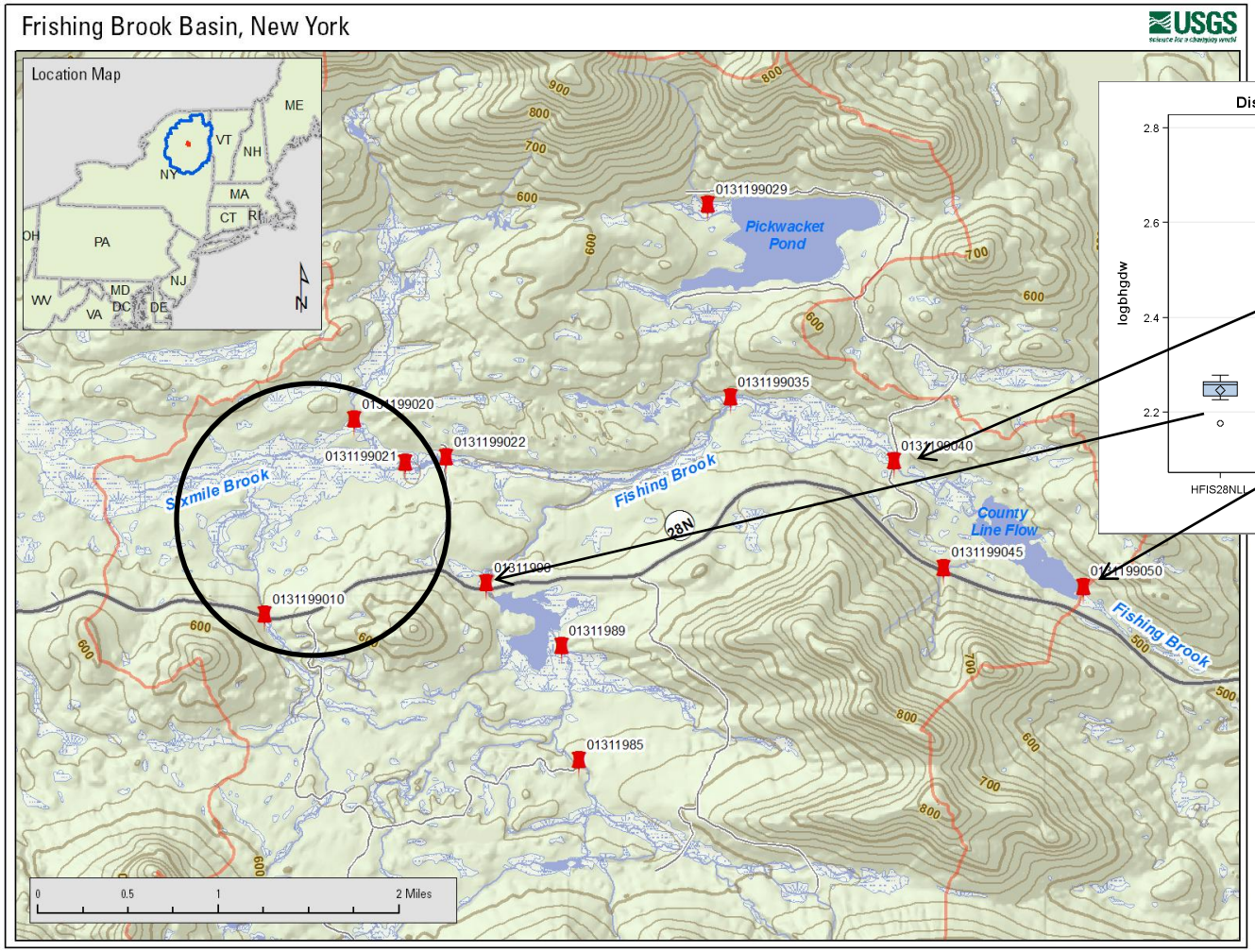
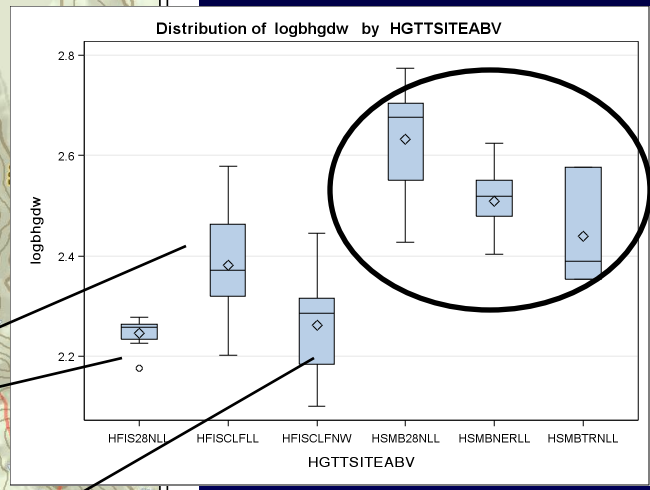
MeHg Spatial patterns

Creek chub





Darner dragonflies

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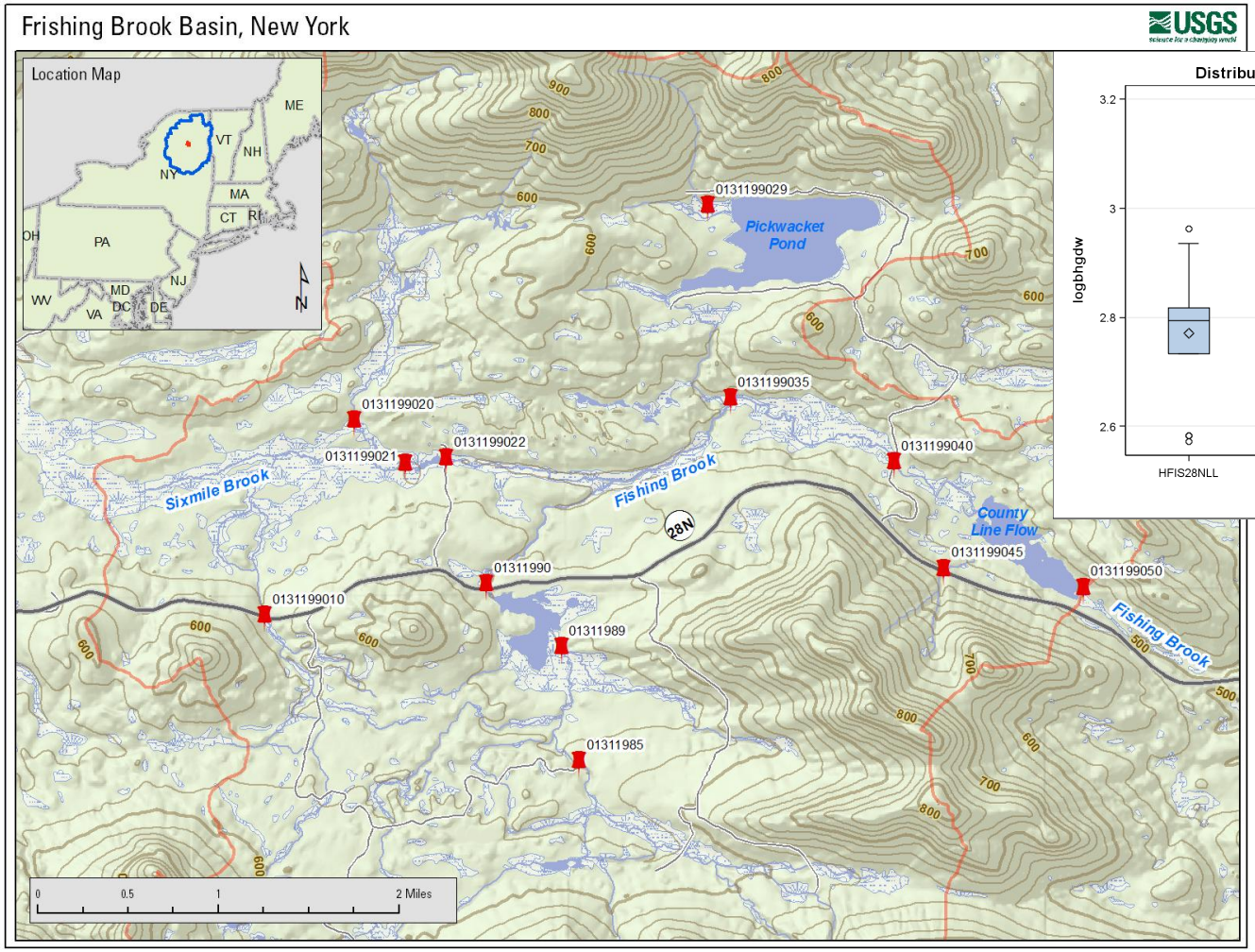
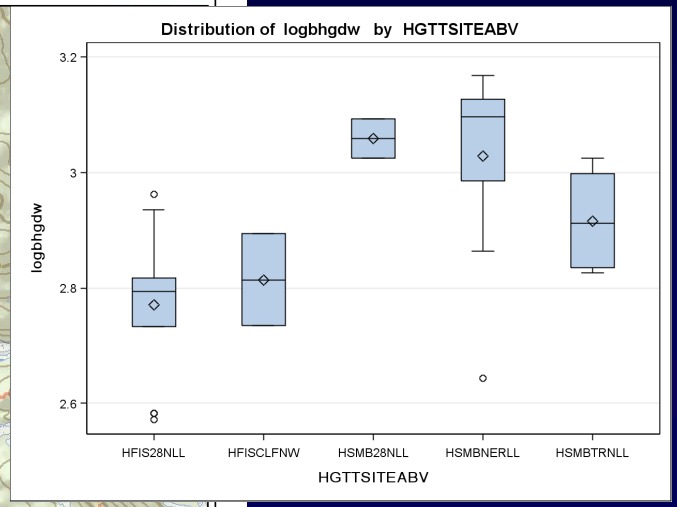
Spatial patterns in fish

Creek chub





blacknose dace

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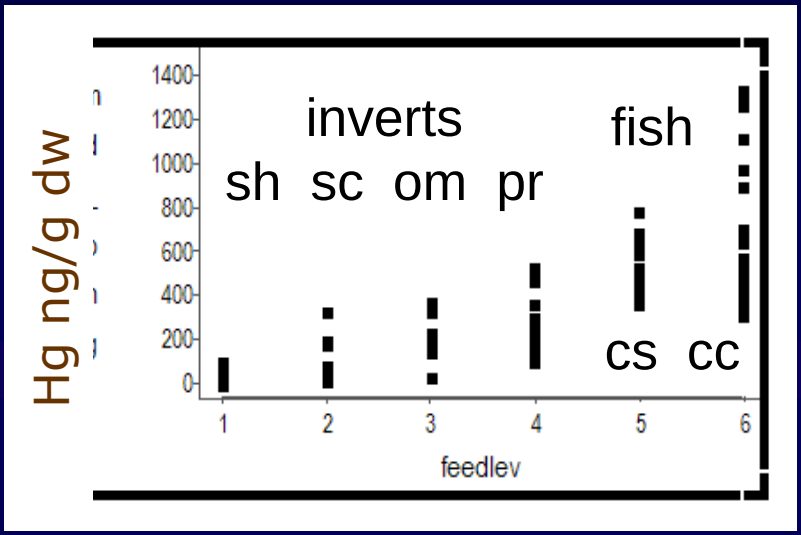
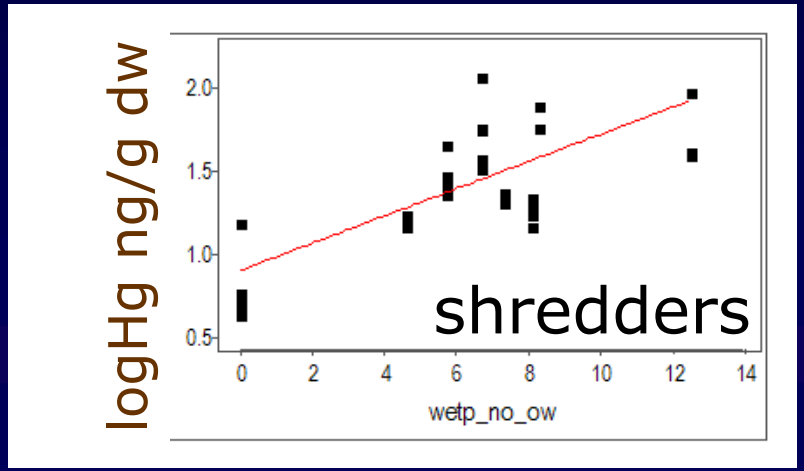
Factors influencing Hg in stream biota



Feeding level

R^2 0.60 $p<0.0001$



% wetland

R^2 0.60 $p < 0.0001$

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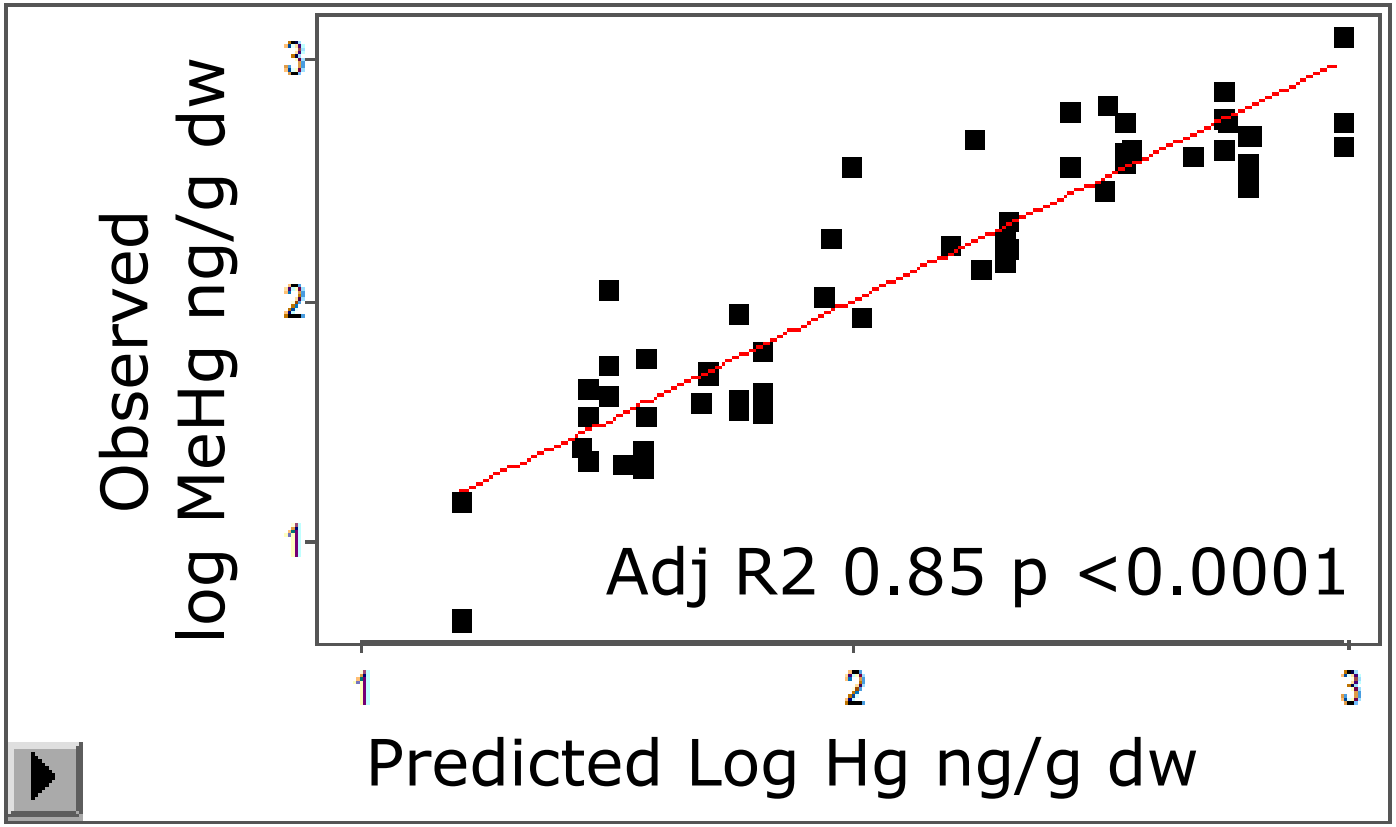
Mercury in Fishing Brook biota as a function of feeding level & % wetland



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Summary & Conclusions

- Streams vary widely in mercury in biota across a relatively small (<30 mi^2) area
- Mercury in biota of Central Adirondack streams are strongly linked to riparian wetlands
- Recovery is expected to be highly variable
- There is a need for monitoring of multiple media & multiple organisms in variety of settings

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Further information

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