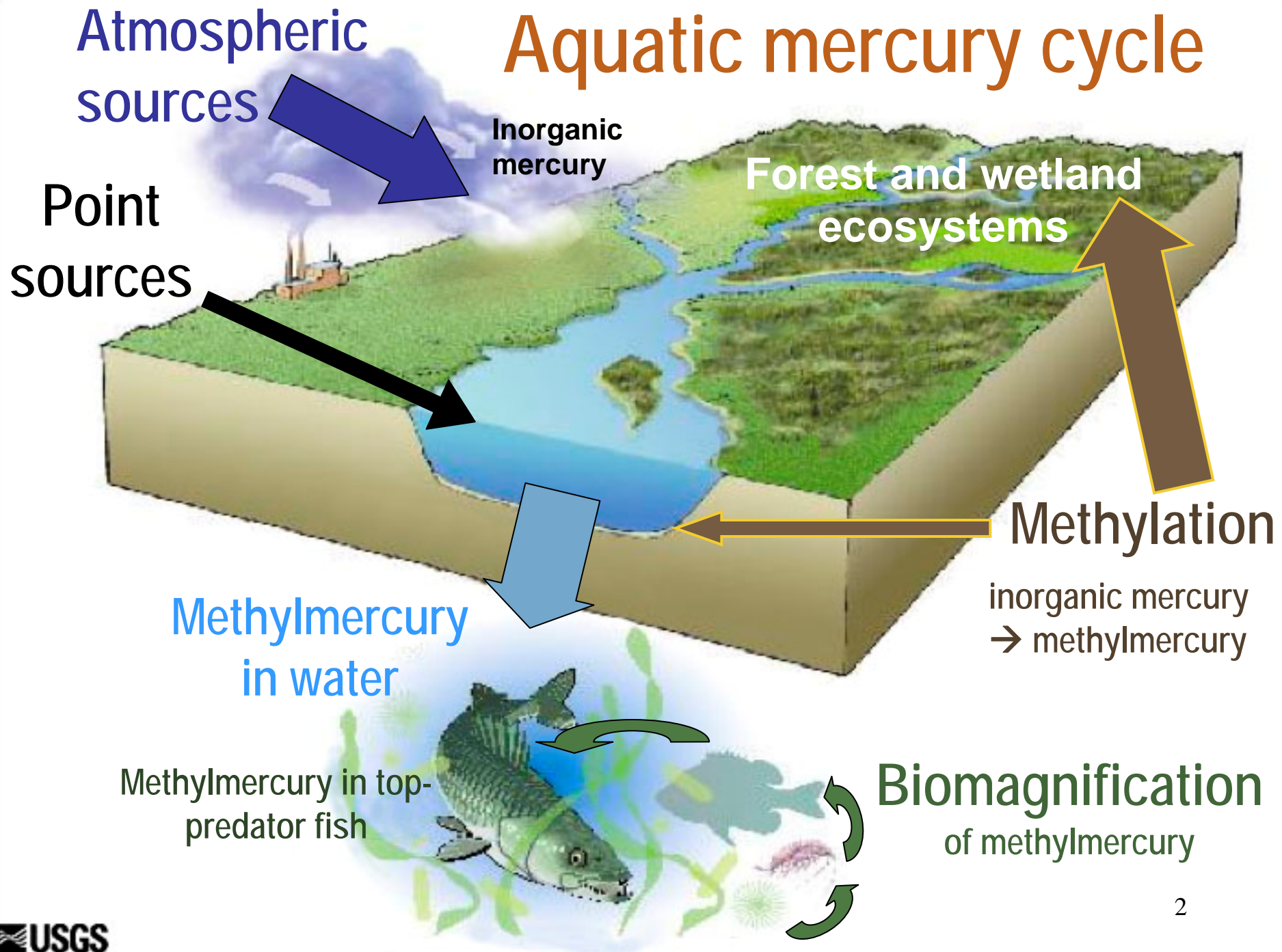


National Survey of Mercury in Fish, Bed Sediment, and Water from Streams

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Nancy Bauch, Mark Brigham, Patrick Moran,
and David Krabbenhoft

U.S. GEOLOGICAL SURVEY
Water Resources Discipline

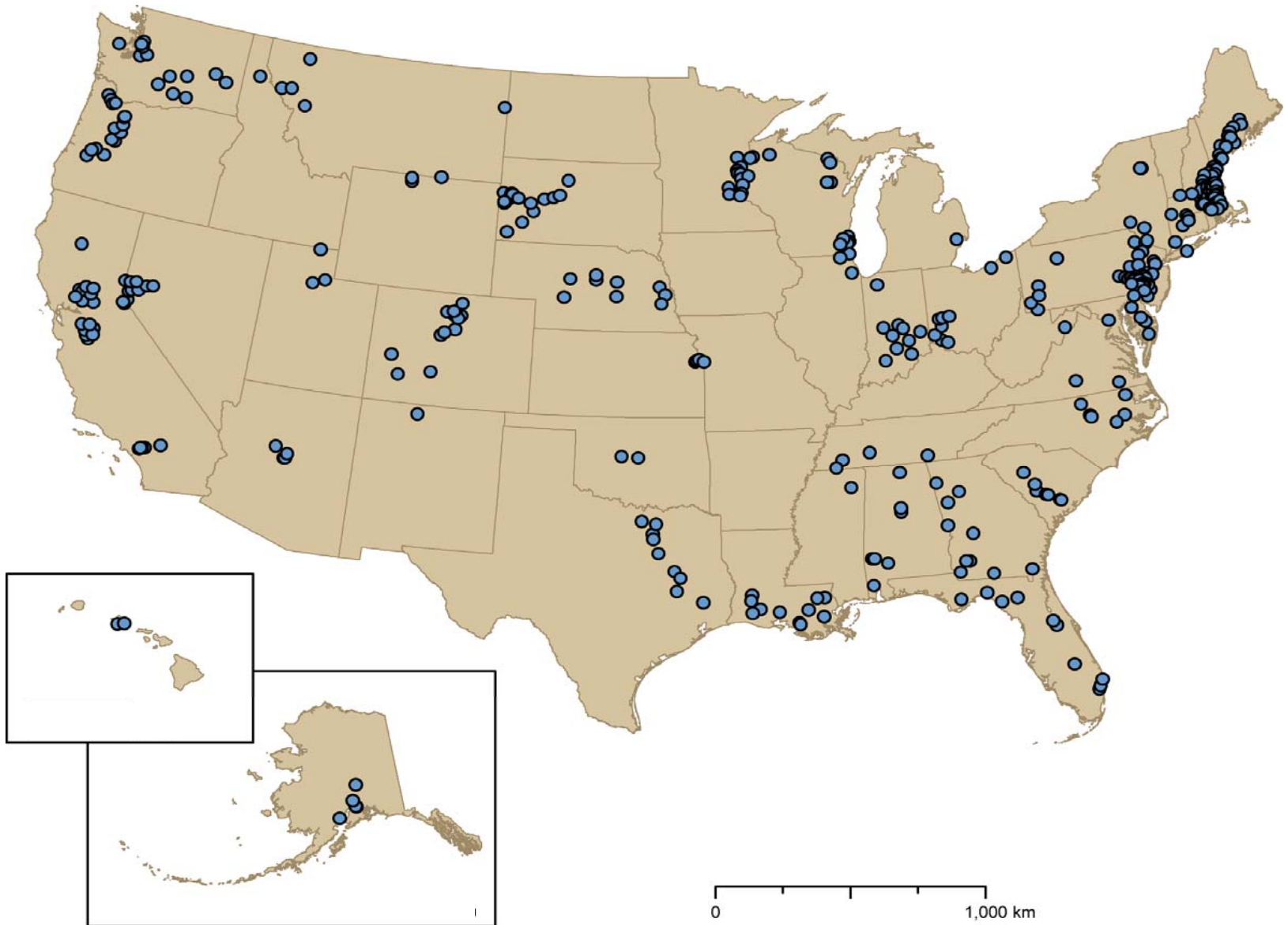
Aquatic mercury cycle



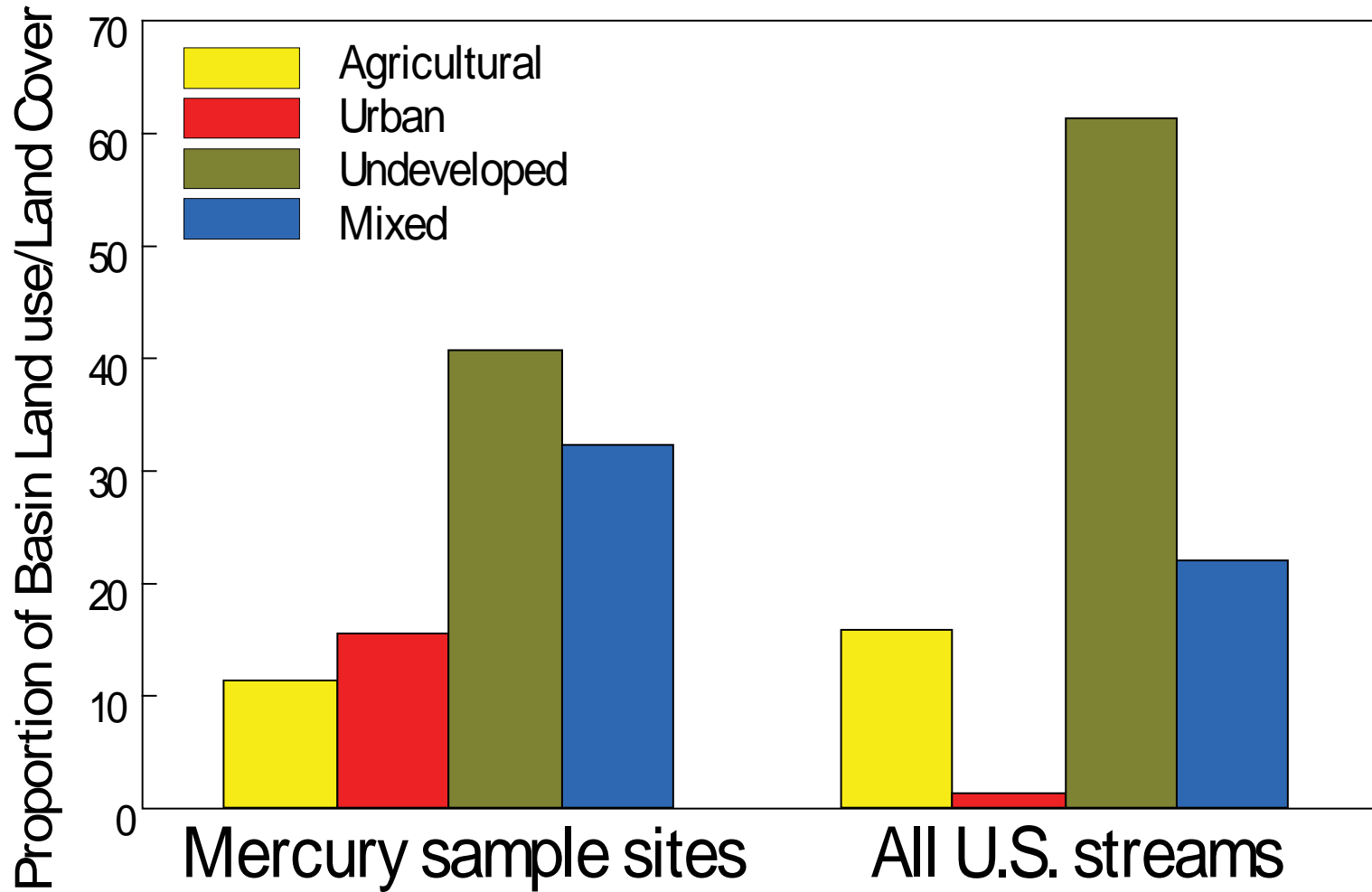
Study Objectives

- Describe the occurrence and distribution of mercury (Hg) in fish from streams in relation to regional and national gradients of Hg source strength and other factors thought to affect Hg bioaccumulation
- Evaluate total mercury (THg) and methylmercury (MeHg) in bed sediment and stream water in relation to these gradients and identify ecosystem characteristics that favor production and bioaccumulation of MeHg

Mercury Sampling Sites, 1998-2005



Targeted land use/cover settings



Sample Collection

■ General

- Each site sampled one time - seasonal low flow
- Atmospheric deposition of Hg (NADP-MDN)
- Land-use/Land-cover and other ancillary data using GIS

■ Top-predator fish

- Target: 3-year-old, largemouth bass
- Single-species composites
- THg in composited skin-off fillets ($\geq 95\%$ of Hg in fish is MeHg)
- Length, weight, age

Sample Collection - continued

■ Streambed sediment

- Single composite sample, bulk (unsieved) – surface, depositional
- MeHg and THg
- Acid volatile sulfide
- Loss on ignition (a measure of organic carbon)
- Particle size

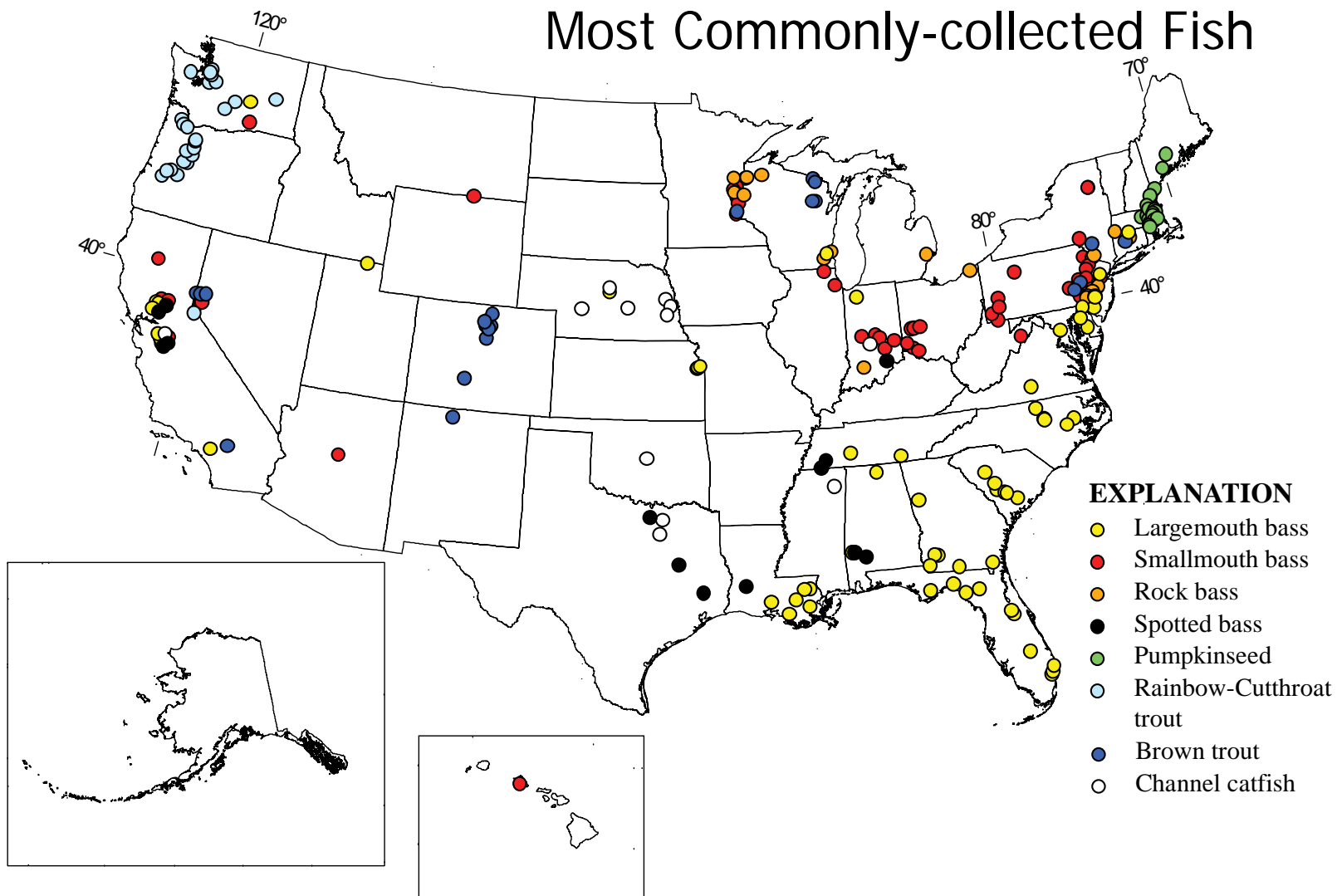
■ Surface-water

- Single grab sample – center of stream flow
- Unfiltered, filtered and particulate (unfiltered in 1998)
- MeHg, THg
- Dissolved organic carbon (DOC), sulfate, pH, temperature, flow

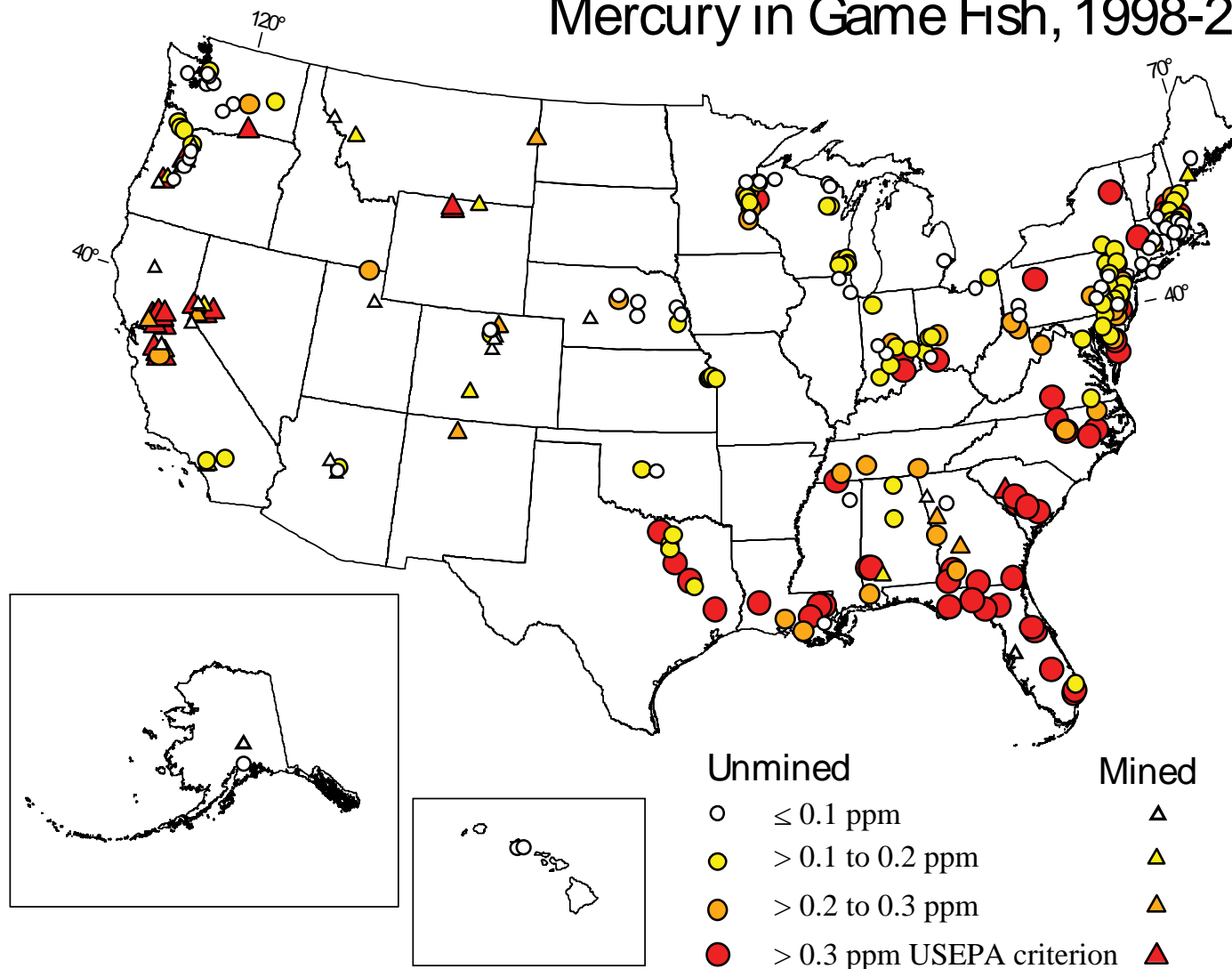
Results

- Spatial distribution of Hg bioaccumulation
- Comparison to benchmarks
- Comparison among fish, sediment, water
- Factors related to Hg bioaccumulation in fish

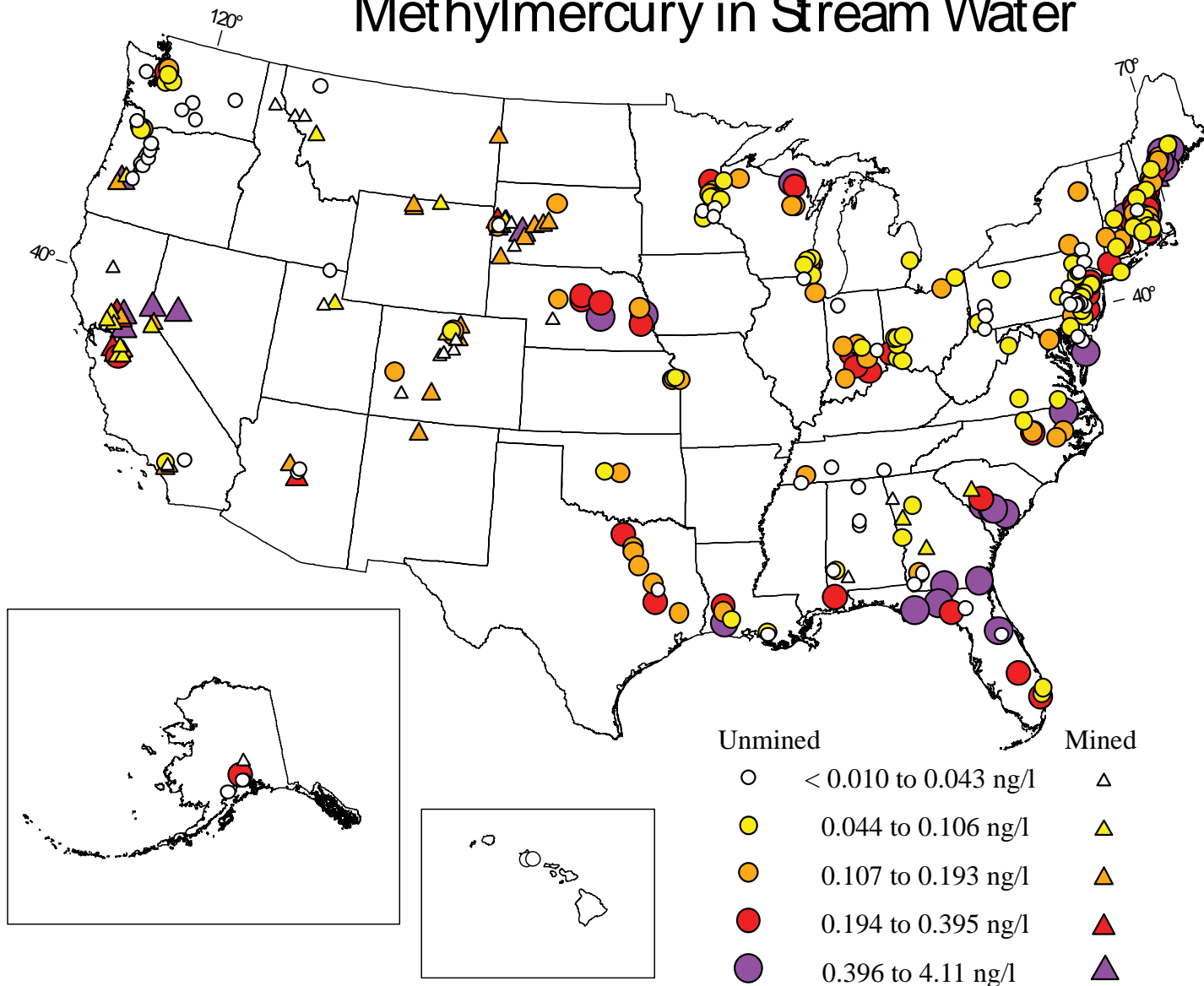
Most Commonly-collected Fish

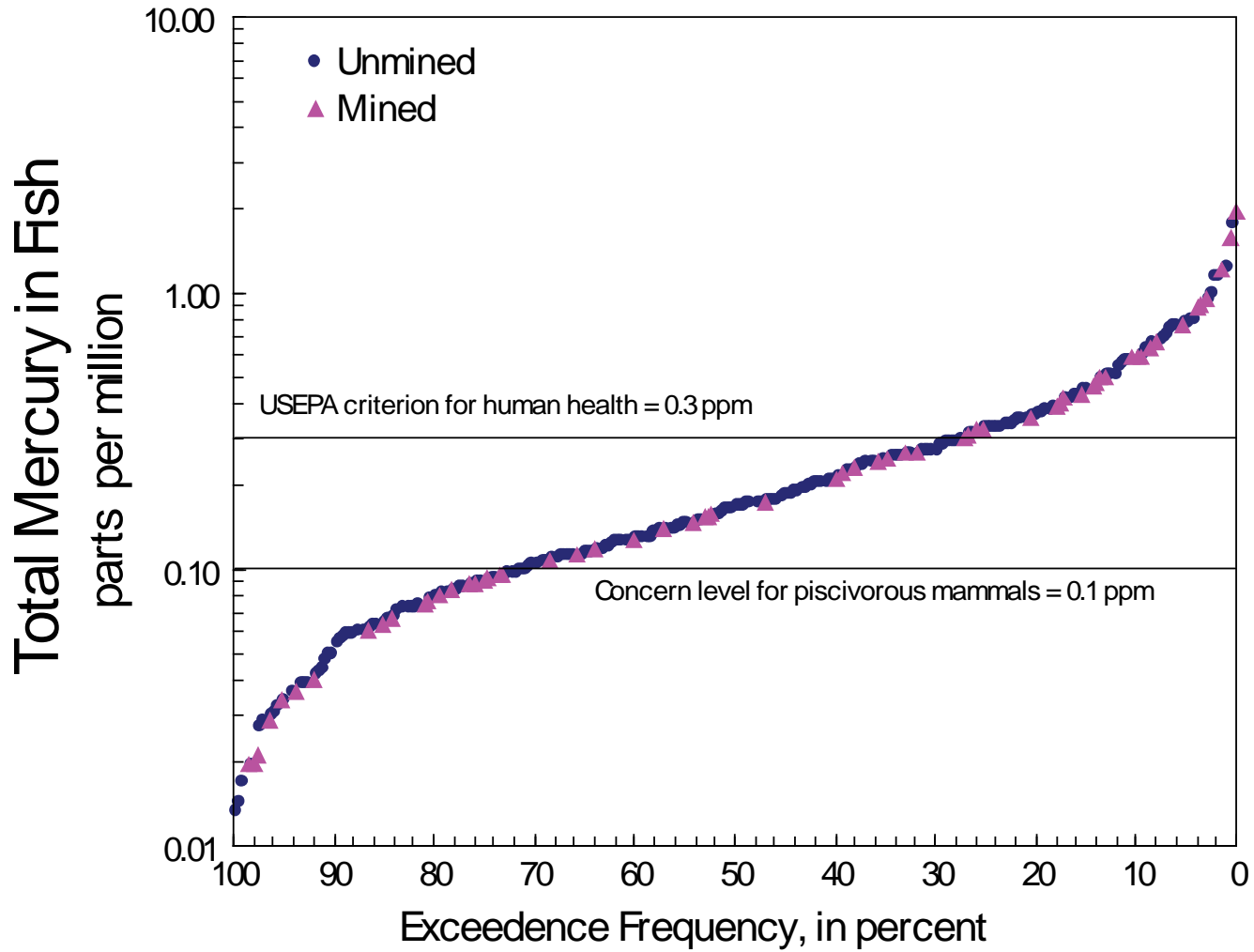


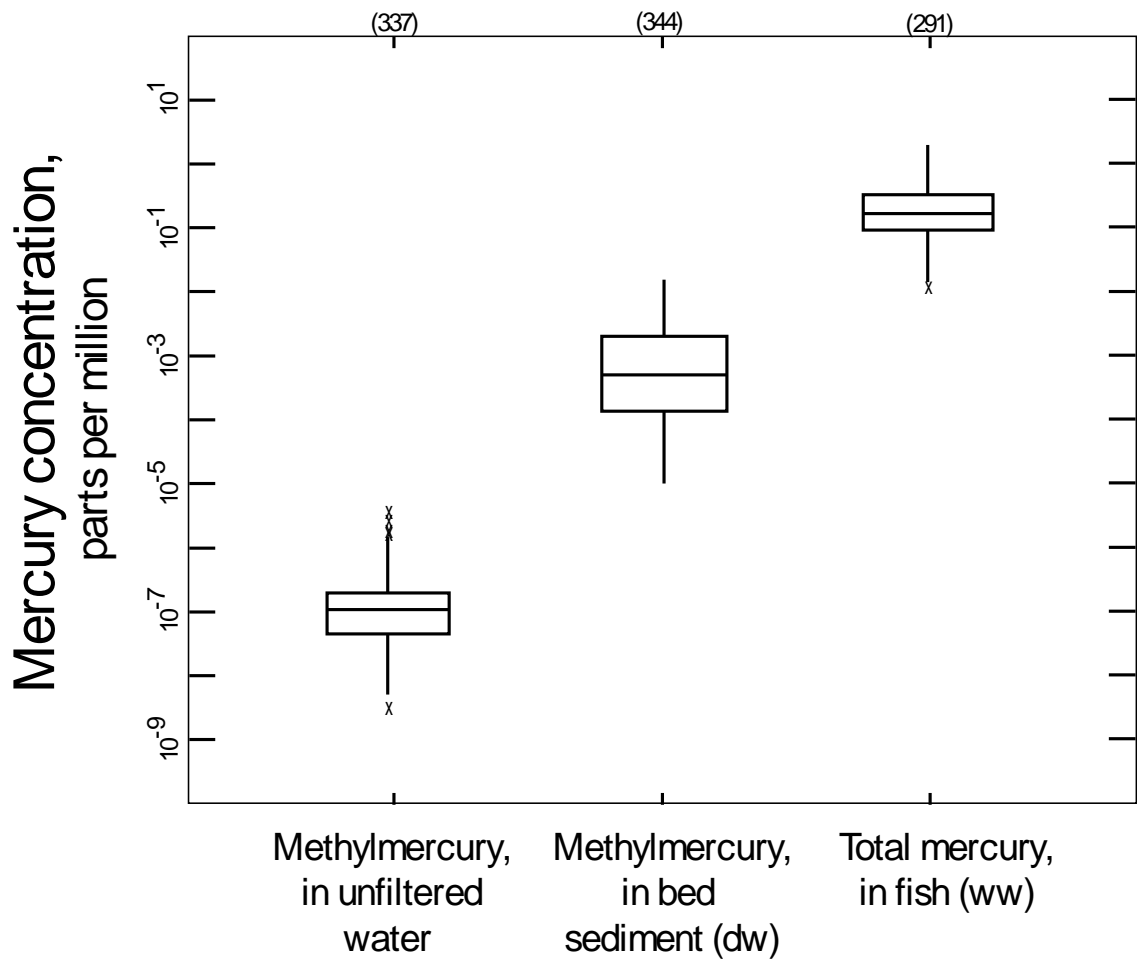
Mercury in Game Fish, 1998-2005



Methylmercury in Stream Water

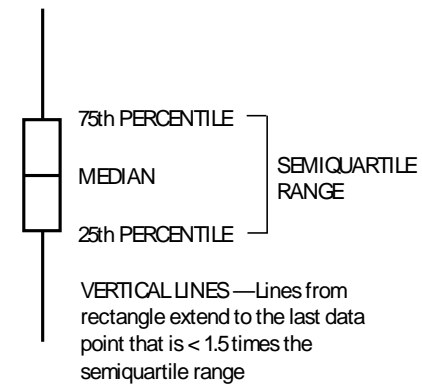




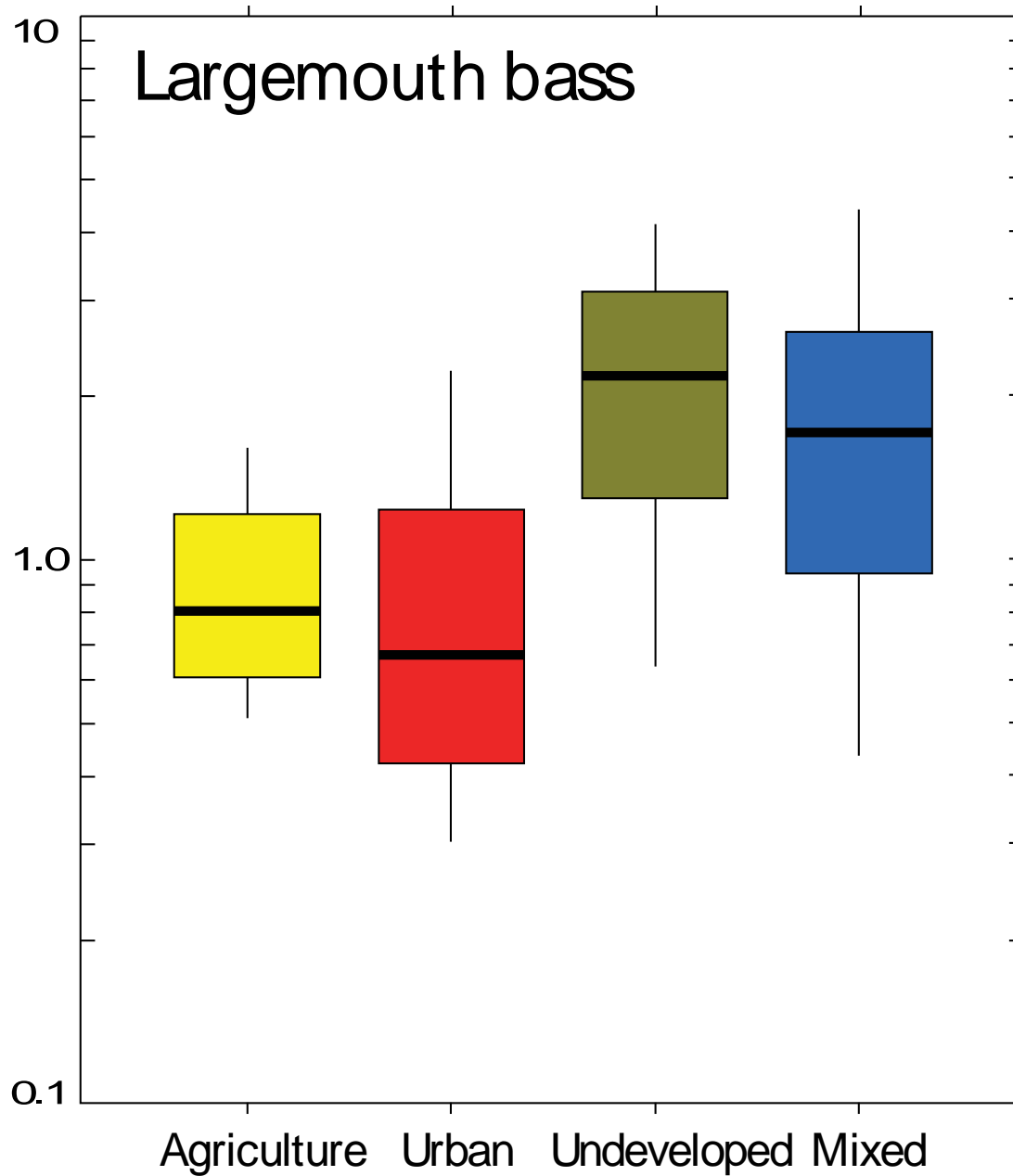


EXPLANATION

(337) Number of values



Total Mercury in Fish
parts per million, normalized by fish length

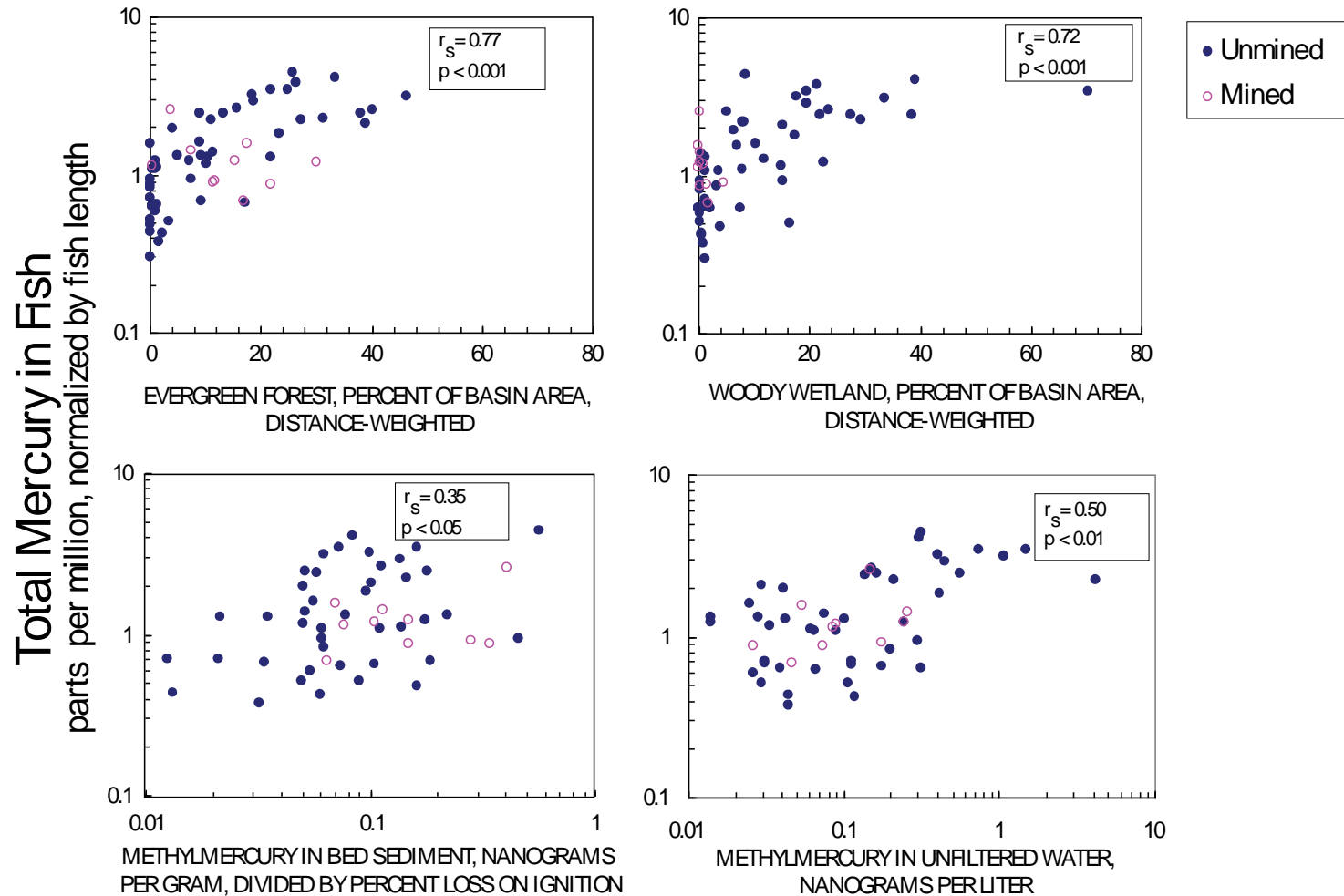


Higher length-normalized Hg concentrations in largemouth bass from unmined basins were primarily related to:

- Increasing amounts of evergreen forest and woody wetland
- Increasing MeHg in stream water
- Increasing MeHg in bed sediment when normalized by loss-on-ignition (a measure of organic carbon in sediment)
- Decreasing pH
- Dissolved sulfate in stream water



Largemouth Bass



Summary

- This comprehensive national-scale study of streams will allow managers to better anticipate mercury levels in fish, bed sediment, and water
- Fish from 27 percent of sampled sites exceeded the USEPA methylmercury criterion for the protection of people who consume average amounts of fish
- The highest fish mercury levels were from southeastern and eastern coastal streams draining largely undeveloped forested and wetland basins, as well as from western streams draining gold- or mercury-mined basins
- Mercury in fish is related to methylmercury in stream water, which is related to the amount of mercury input to a stream basin, organic carbon, and the susceptibility of the stream basin to form methylmercury
- Undeveloped basins, such as evergreen forests and wooded wetlands, are more susceptible than urban or agricultural basins to mercury inputs due to characteristics favoring formation and transport of methylmercury to streams

For more information:

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INTERPRETIVE REPORT:

<http://pubs.usgs.gov/sir/2009/5109> (Scudder and others, 2009)

DATA REPORT:

<http://pubs.usgs.gov/ds/307> (Bauch and others, 2009)

www.usgs.gov/mercury/



photo by Dennis Wentz