Bioaccumulation of Mercury in Fish

Mercury Workshop:
Global Emissions and U.S. Exposures

Christopher D. Knightes, Ph.D.

U.S. EPA Office of Research and Development
National Exposure Research Laboratory
Ecosystems Research Division
Athens, Georgia

Where we are and where we want to be

- Current understanding of fish bioaccumulation of Hg has focused on freshwater systems
- What do we know and what is available to us given freshwater studies?
- What do we need to know to move into marine systems?

This presentation has been reviewed and approved in accordance with the U.S. Environmental Protection Agency's peer and administrative review policies.

Bioaccumulation and Biomagnification

- *Bioaccumulation*: total uptake of a contaminant by an organism via ingestion of contaminated food as well as transport across gill
- *Biomagnification*: increased concentrations in tissue with increased trophic level

Bioaccumulation for organic contaminants

- Organic contaminants (PAHs, PCBs, Dioxins) partition to the fatty tissue of fish, resulting in bioaccumulation.

$$BAF = \frac{Conc\ in\ Fish\left[\frac{ug}{kg}\right]}{Conc\ in\ water\left[\frac{ug}{L}\right]}$$

Chemical	BAF [L/kg]
DDT	84,500
Aroclor 1254	46,000
Benzo[a]pyrene	10,000
Atrazine	11

Biomagnification for mercury

- Mercury associates with muscle tissue.
  - biomagnifies up the food chain
  - function of the food web structure
  - placement in the food web
  - fish species, age, length, weight

$$BAF = \frac{Conc\ in\ Fish\left[\frac{ug}{kg}\right]}{Conc\ in\ water\left[\frac{ug}{L}\right]}$$

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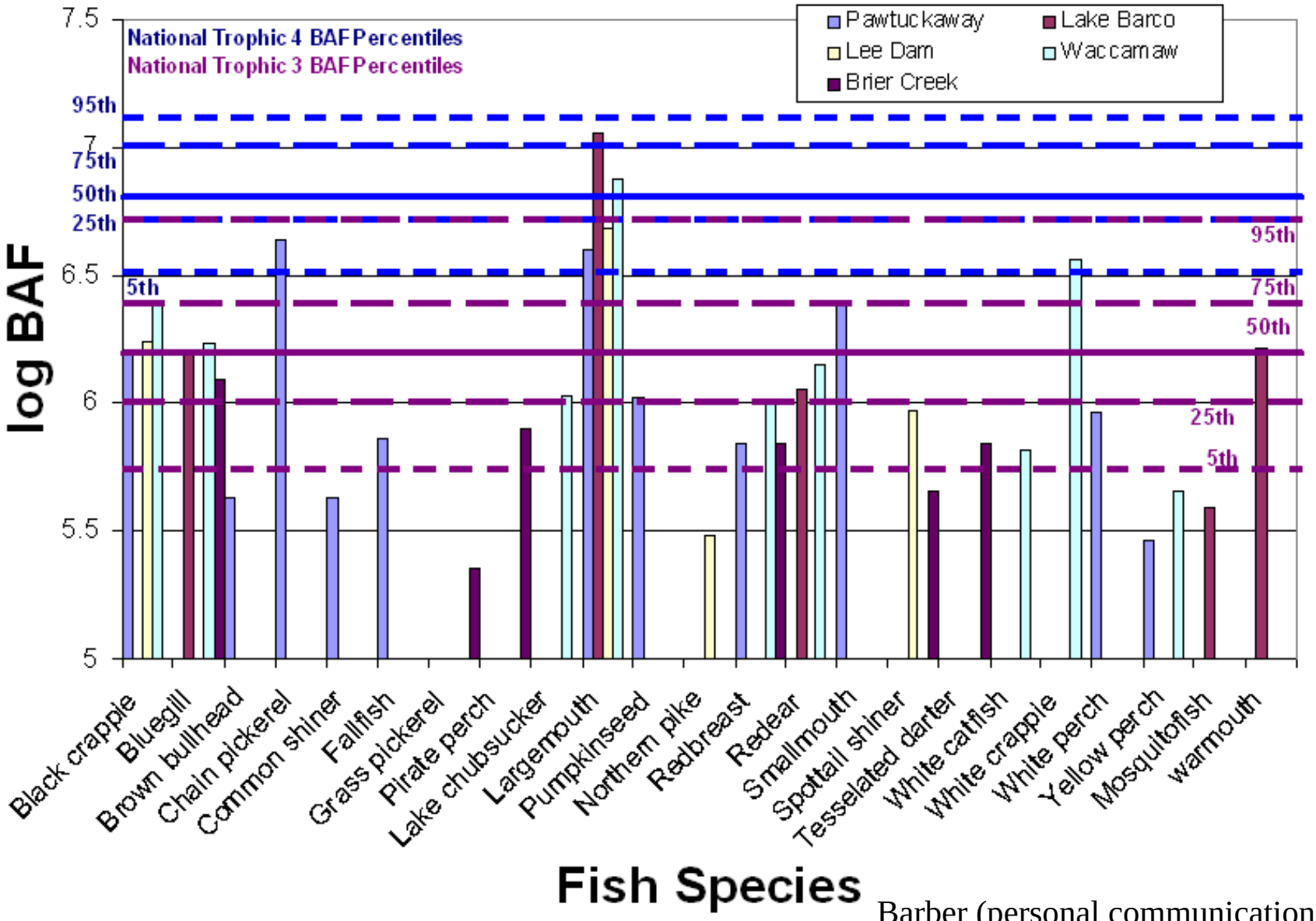
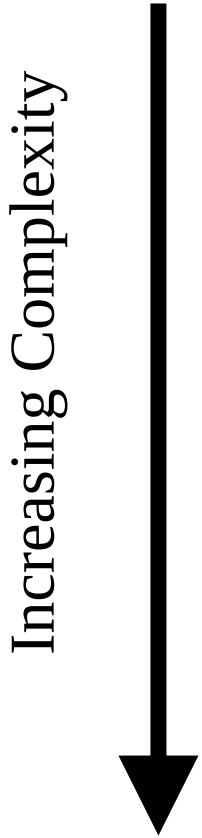
Representative Variability of BAFs



Barber (personal communication)

Different Models for Predicting Fish Tissue from MeHg Concentrations



BAF

Food Web Structure

Population and Food Web Dynamics

Translating Fresh Water to Marine Systems

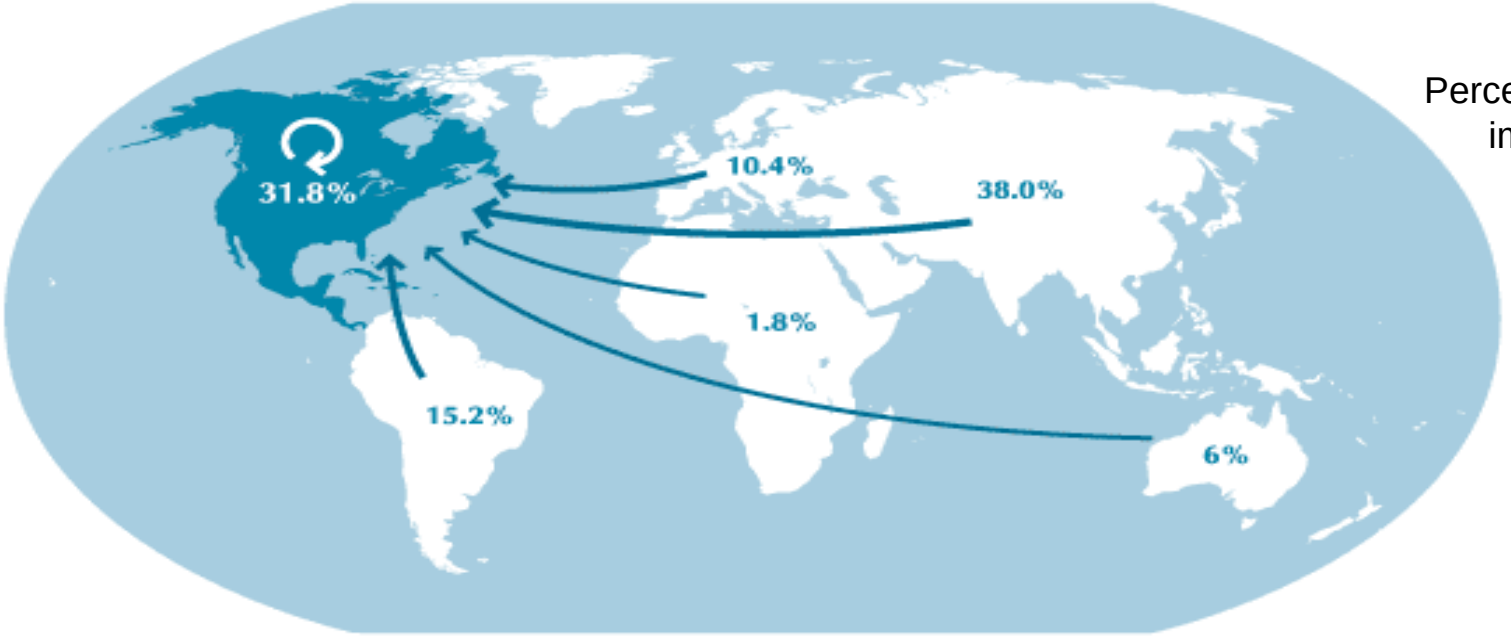
- Translate developed models and knowledge to marine systems
- Capture differences in food web structure in marine systems
- Where MeHg exposure occurs
  - Issues of migration and movement
    - Spawning migrations
    - Spatial feeding patterns
      - Open ocean to estuary/coastal
      - Off Reef / On Reef
  - Sediment versus Aqueous MeHg

Translating Fresh Water to Marine Systems

- Freshwater systems assume all Hg is MeHg, is this applicable to marine systems?
- How do we capture the different processes and exposure risks of Hg(II) vs MeHg?
- Linking commercial fisheries to exposed communities

Where Do Fish Come From?

North America import flows



Percent of total imports

Notes: Average import flows for 1998-2000. Source: FAO State of World Fisheries and Aquaculture, 2002

- Commercial marine fish consumption is a major dietary source of Hg exposure in the U.S.

Sunderland (personal communication)