

## Fish Tissue Contamination in the Mid-continental Great Rivers of the United States

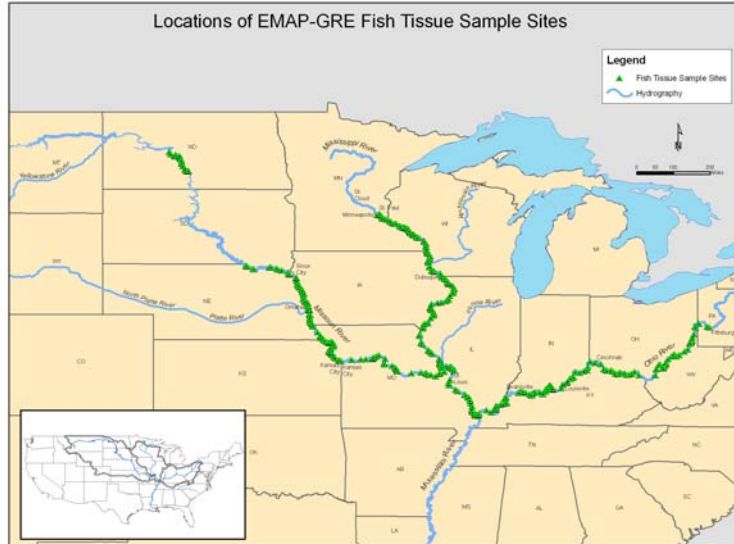
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### Environmental Monitoring and Assessment Program - Great River Ecosystems

- Broad scale assessment of Upper Mississippi, Missouri, and Ohio rivers.
- Probability-based design for each river.
- Sample collection conducted 2004-2006, with focus on reference sites in 2006.
- Data on a large variety of indicators collected, including fish, macroinvertebrates, algae, macrophytes, water chemistry, physical habitat, sediment, and fish tissue.



### Fish Tissue Contaminants

- At each site, small fish collected to assess risk to piscivorous wildlife, large fish to assess human health risk.
- Prioritized target species list and prioritized size ranges within species.
- Whole fish homogenized for analysis, often multiple similarly-sized fish of a single species from a site combined for sample.
- Legacy organics (20 PCB congeners, DDT, chlordane, dieldrin), Hg, and the contaminant of emerging concern PBDEs (6 congeners) analyzed using Dionex ASE-200 accelerated solvent extractor.
- Percent lipids and percent moisture also evaluated for each sample.

### Statistical Analysis

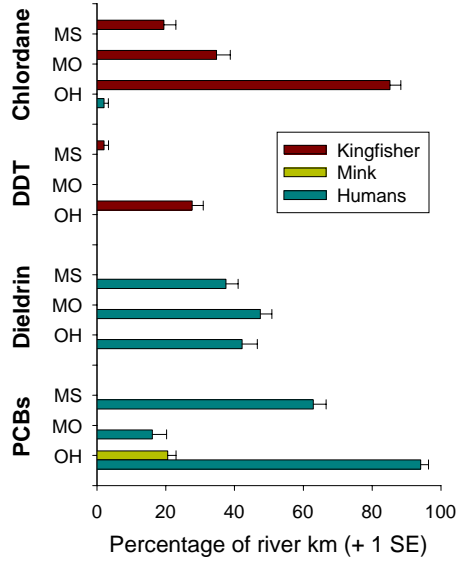
- Wildlife risk values (WV) obtained from Lazorchak et al. (2003) for mink and kingfisher.
- Human health screening values (SV) obtained using *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, 3rd edition* (EPA-823-B-00-007) for setting cancer risk SVs.
- Small fish used with WV, large fish with SV.
- Estimated extent in each river above criteria for PCBs, DDT, chlordane, and dieldrin, using *psurvey* package for R software (available at <http://www.epa.gov/nheerl/arm/>)
- Assessed extent of PBDE detection and composition by congeners.

### Human Screening Values and Wildlife Risk Values

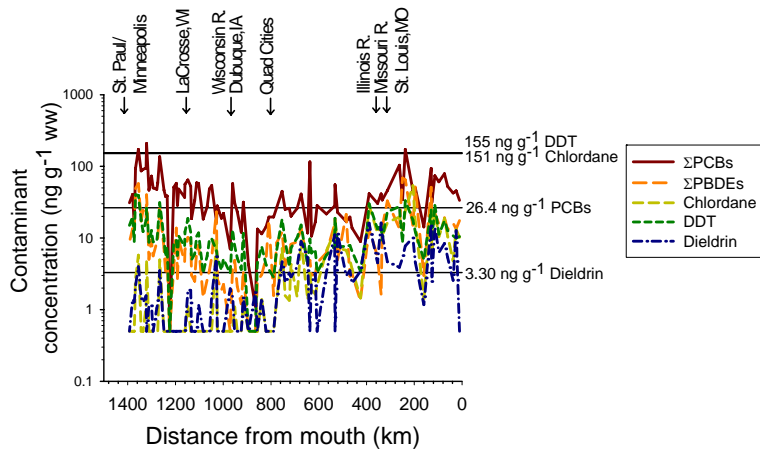
Chemical (ng g <sup>-1</sup> ww)	SV <sup>a</sup>	Mink WV <sup>b</sup>	Kingfisher WV <sup>b</sup>
Chlordane (sum of all forms)	151	830	4.5
DDT (sum of all derivatives)	155	360	20
Dieldrin	3.3	20	360
PCBs	26.4	130	440

<sup>a</sup>From USEPA *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, 3rd edition*; EPA-823-B-00-007; <sup>b</sup>From Lazorchak et al., 2003, *Environ. Toxicol. Chem.*, 22:545-553

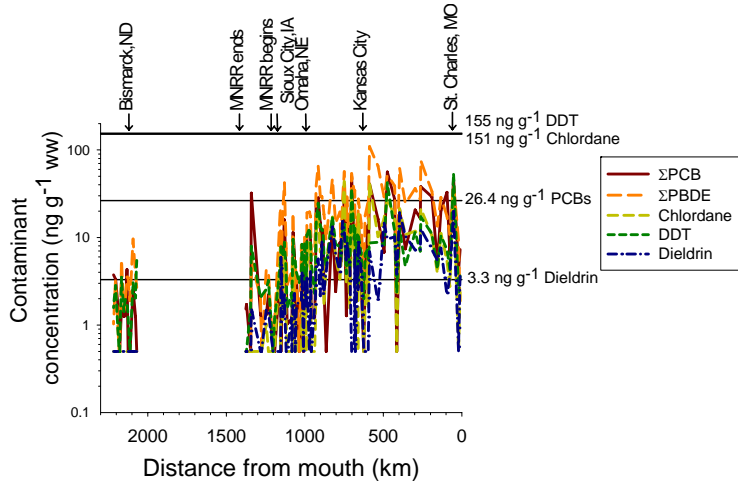
### Extent of river exceeding human and wildlife risk values



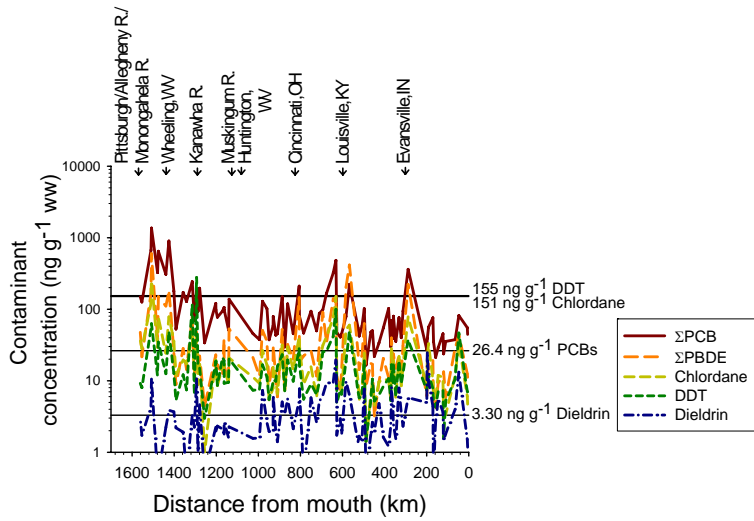
### Upper Mississippi River: Large fish



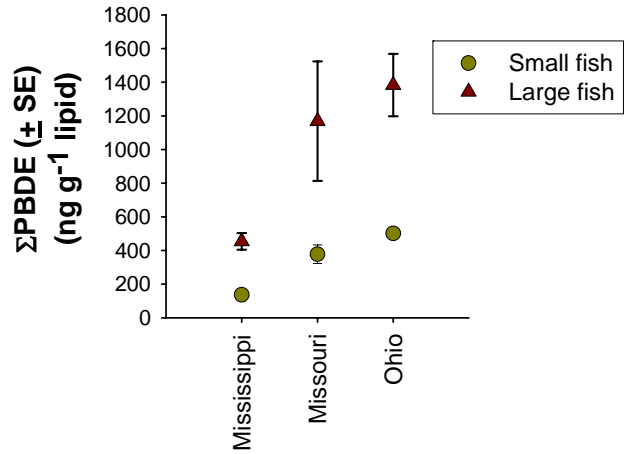
### Missouri River: Large fish



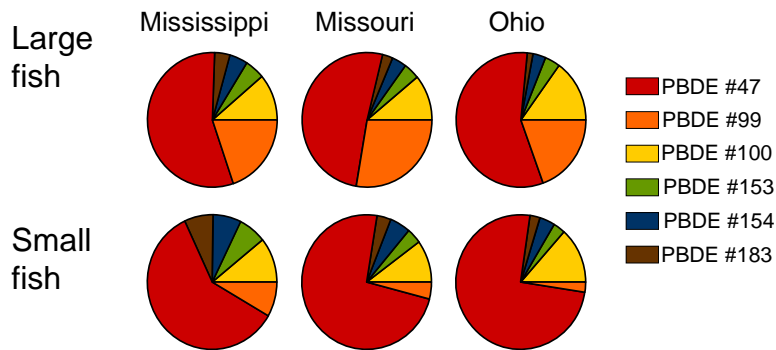
### Ohio River: Large fish



### Total PBDE concentrations



### PBDE congeners



### Summary of findings

- Legacy Organics:
  - PCBs and Dieldrin present greatest risk to humans.
  - Chlordane and DDT are of greatest risk to wildlife (kingfisher), most widespread in the Ohio River.
  - The Ohio River had the greatest levels of contaminants in fish tissue overall, particularly for Chlordane, DDT, and PCBs.
  - Contamination widespread, but linked loosely to urban areas.

### Summary of findings (cont'd)

- PBDEs:
  - Larger fish exhibited higher concentrations of total PBDEs
  - Concentrations higher and more variable in Missouri and Ohio rivers.
  - The most common congener overall was #47.
  - Second most common congener was #99 in large fish, #100 in small fish.
  - Concentrations linked closely with PCBs, possibly indicating atmospheric deposition of contaminants.