



# EPA's Assessment of Mercury in Fish from U.S. Rivers

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## Background

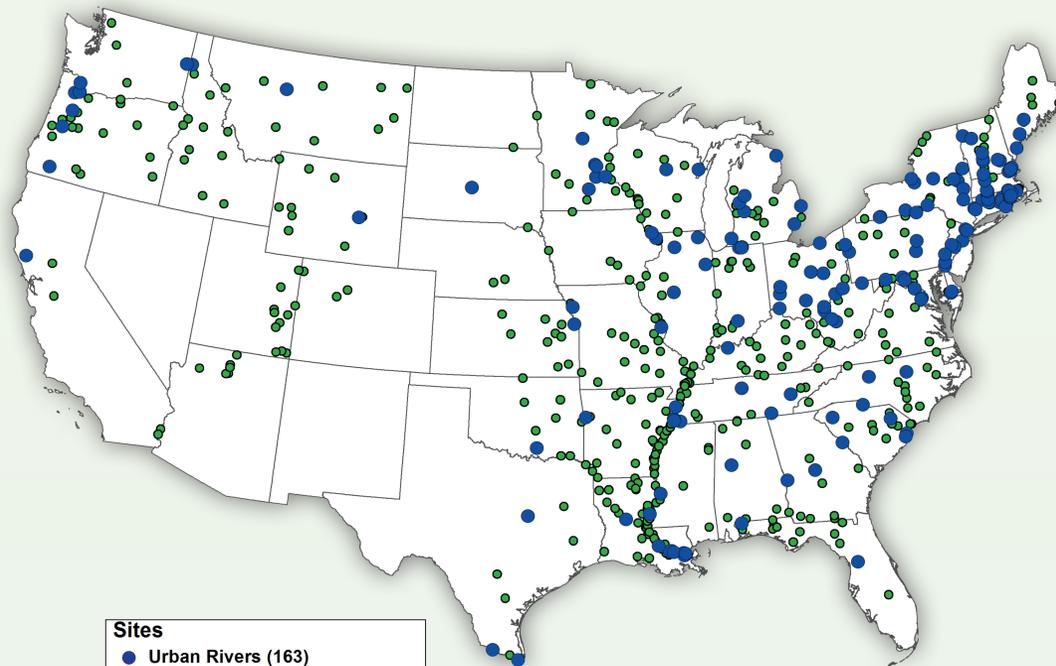
EPA's National Rivers and Streams Assessment (NRSA) is one of a series of probability-based surveys designed to assess the condition of U.S. waters. The Office of Water (OW) is responsible for planning and implementing the NRSA with support from the Office of Research and development (ORD). Fish tissue is a human health indicator included in the NRSA. The Office of Science and Technology (OST) within OW is leading the effort to study contamination in fish from U.S. rivers, including mercury and a number of other target chemicals.

## Why Is It Important to Monitor Mercury in Fish?

Mercury is a metal that is persistent, bioaccumulative, and toxic in the environment. It enters the atmosphere by the natural degassing of the earth's crust and by human activity, such as emissions from coal-fired power plants and medical waste incineration. When mercury is deposited in water, a large portion is converted from inorganic mercury to toxic methylmercury that bioaccumulates in fish muscle. Consuming fish with high levels of methylmercury can cause harmful human health effects, including impaired neurological development for children that impacts cognitive thinking, memory, attention, and language. Methylmercury poisoning in humans may also cause muscle weakness, lack of coordination, and impairment of speech, hearing, and walking. The majority of fish advisories issued in the U.S. involve mercury.



## NRSA Fish Sampling Locations (566)



**Sites**  
● Urban Rivers (163)  
● Non-urban Rivers (403)

## Total Mercury versus Methylmercury Analysis

Most mercury in adult fish tissue is in the form of methylmercury (which is toxic to humans). EPA's *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1, Third Edition* recommends monitoring for total mercury concentrations (rather than methylmercury) in screening-level fish contaminant studies.

## Study Design

- Assessment of mercury in fish from U.S. rivers included:
  - Sampling 566 randomly selected river sites (≥ 5th order based on 1:100,000-scale Strahler order) in the lower 48 states during 2008 and 2009.
  - Collecting one fish composite sample (i.e., 5 similarly sized adult fish of the same species that are consumed by humans) from each site.
  - Analyzing fish fillet samples for total mercury using a Direct Mercury Analyzer that achieved method detection limits ranging from about 0.5 – 1.5 ng/g or ppb.

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For more information visit: <http://water.epa.gov/scitech/swguidance/fishstudies/>

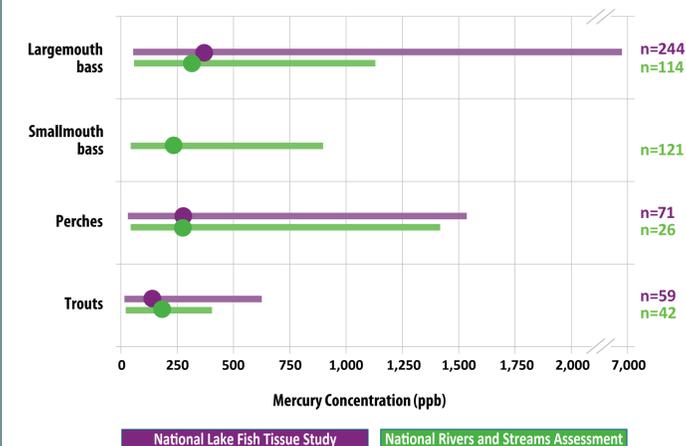
## Results

- 100% of the 565 fish samples analyzed for this national study contained quantifiable levels of mercury.
- Mercury concentrations measured in the fillet samples ranged from 24 ppb to 1419 ppb.
- The national mean mercury concentration for fillets in fish from U.S. rivers is 231 ppb compared to a mean mercury concentration of 250 ppb for fish fillet samples from only urban rivers.
- 25.6% of the 69,432 river miles included in this survey had fish samples whose mercury concentrations exceeded EPA's 300 ppb human health screening value (which represents a total of 17,775 river miles).
- Elevated mercury concentrations are more prevalent in fish from U.S. lakes than in fish from U.S. rivers.

## Mercury (Hg) Data

Hg Data Set	Number of Sites	Number of River Miles	Number of Detects	Median Concentration (ppb)	Mean Concentration (ppb)	Maximum Concentration (ppb)
National	565	69,432	565	190	231	1419
Urban	162	10,911	162	201	250	854
Non-urban	403	58,521	403	190	227	1419

## Concentration Ranges and National Statistical Estimates of Mean Mercury Concentrations for Fish from U.S. Lakes and Rivers



## NRSA Fish Tissue Assessments

- First statistically based national assessment of contaminants in fish from U.S. rivers

### Collaborators

**OW/Office of Science and Technology**

- Fish tissue indicator management
- SOPs for fish sample collection and preparation
- Quality review of analytical data
- Reporting of fish tissue indicator results

**OW/Office of Wetlands, Oceans, and Watersheds**

- NRSA leadership
- Sample collection management
- Final report development

**ORD/National Exposure Research Laboratory (Cincinnati, OH)**

- Fish tissue preparation for urban sites
- Mercury (and other target chemical) analysis

**ORD/National Health and Environmental Effects Research Laboratory (Corvallis, OR)**

- NRSA study design development
- Statistical analysis of mercury (and other target chemical) data

### Target Chemicals

**Metals**

- Total mercury
- Selenium
- Fillet sample analysis at 565 of the 566 river locations

**Organic Compounds**

- 21 polychlorinated biphenyls (PCBs)
- 8 polybrominated diphenyl ethers (PBDEs)
- 23 pesticides
- Fillet sample analysis at 566 river locations

**Contaminants of Emerging Concern**

- 13 perfluorinated compounds (PFCs)
- 20–30 pharmaceuticals
- 6 musks
- Fillet sample analysis at 163 urban river locations



## Future Mercury Milestones

**Ecological Assessment:** Whole fish samples were also collected at a subset of the NRSA sampling sites to generate mercury results for comparison with wildlife screening values to assess mercury risks to wildlife. These results will be published and presented separately.