



2022 National Lakes Assessment Human Health Fish Tissue Study

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Background

Obtaining statistically representative data on contaminants in fish is a priority area of interest for EPA. In the early 2000s, EPA's Office of Science and Technology (OST), within the Office of Water (OW), conducted the first national probability-based study of chemical contamination in fish from U.S. lakes, ponds, and reservoirs (hereafter referred to as lakes), known as the *National Lake Fish Tissue Study*. Mercury and PCBs were detected in all fish samples collected from 500 sampling locations in the lower 48 states, and it was estimated that 49% of U.S. lakes, at the time, contained fish with mercury levels that exceeded the human health screening level of 300 parts per billion (i.e., EPA's fish tissue-based water quality criterion for methylmercury).

Twenty years later, the 2022 National Lakes Assessment (NLA), one of EPA's National Aquatic Resource Surveys (NARS), has provided an opportunity to conduct a contemporary national-scale assessment of chemical contaminants in fish from U.S. lakes. The NLA is a probability-based national survey that includes collection and analysis of physical, chemical, and biological indicator data to allow a statistically valid characterization of the condition of the Nation's lakes. OST is collaborating with the Office of Wetlands, Oceans, and Watersheds and with the Office of Research and Development to complete the 2022 National Lakes Assessment Human Health Fish Tissue Study, which will compare current chemical concentrations of certain chemicals in lake fish to results from the *National Lake Fish Tissue Study*, and will evaluate lake fish fillet contaminant changes over time.



Study Design

- The NLA Human Health Fish Tissue Study involves:
- Attempting to collect whole fish samples from 636 randomly selected lakes in the coterminous U.S.
 - Obtaining one fish composite sample from each lake (optimally, five similarly sized adult fish of the same species that are commonly consumed by humans)
 - Shipping whole fish samples to sample repository freezers in Baltimore, Maryland for interim storage
 - Transferring the frozen whole fish samples to the sample preparation laboratory in Owings Mills, MD
 - Preparing fillet tissue samples by scaling and filleting each fish in the composite sample, homogenizing the fillets from all the fish in the sample, and dividing homogenates into aliquots for chemical analyses
 - Analyzing the fillet samples for mercury, 40 per- and polyfluoroalkyl substances (PFAS), and 209 polychlorinated biphenyl (PCB) congeners

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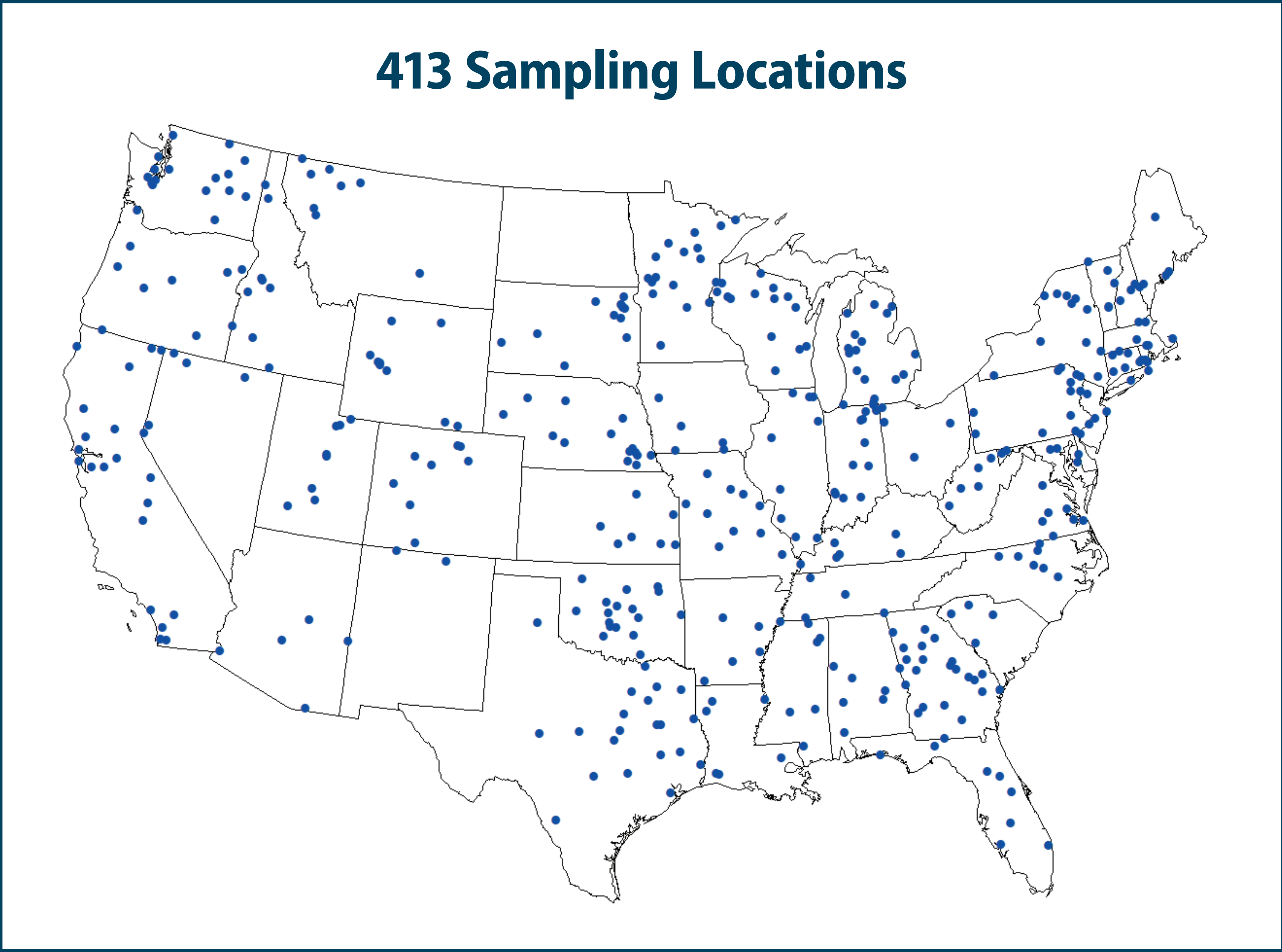
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For more information on EPA fish tissue contaminant studies visit: <https://www.epa.gov/fish-tech/studies-fish-tissue-contamination>



National Lakes Assessment Human Health Fish Tissue Study

- Second statistically based assessment of contaminants in fish from inland lakes of the conterminous United States, mirroring EPA's National Lake Fish Tissue Study of 2000–2003 to assess change over time
- Fish successfully collected from 413 of the 636 randomly selected sampling locations.

Sample Collection

- The target population consisted of all lakes and reservoirs in the lower 48 states with a surface area >1 hectare and that contain 1,000 square meters of open, unvegetated space and a permanent population of predator fish species.
- A total of 636 randomly selected lakes were targeted for fish sampling.
- Sampling procedures for collection of whole fish samples are detailed in EPA's *National Lakes Assessment 2022 Quality Assurance Project Plan* and *National Lakes Assessment 2022 Field Operations Manual*.
- Procedures included a list of 12 primary target predator fish species and 10 secondary predator fish species (all commonly consumed by humans).
- Most fish samples were collected by hook and line or electrofishing.
- A total 1,512 fish were collected, which yielded 413 valid whole fish composite samples from the 636 sites targeted for fish sampling.
- A total of 21 species were collected, and the majority of samples (66%) were Largemouth Bass.

Sample Preparation

- Whole fish samples were stored in freezers at ≤ -20° Celsius (C).
- The sample preparation laboratory is scaling and filleting each fish, homogenizing the fillet tissue, and preparing the required number of fish fillet tissue aliquots for analysis.
- Sample preparation quality control procedures include analysis of lipids in ground fillet tissue samples for homogeneity testing and analysis of mercury, PCBs, and PFAS in equipment rinsates to test the adequacy of equipment cleaning.
- The filleting process involves removing the fillet (with skin on and "belly flap" or ventral muscle attached) from both sides of each fish, combining fillets from all fish in the composite sample, and homogenizing them together using an electric meat grinder.
- Sample preparation procedures are detailed in EPA's *Quality Assurance Project Plan for 2022 National Lake Assessment (NLA) Fish Tissue Study Sample Preparation*.

Analysis

- Fillet tissue homogenates will be prepared and analyzed for mercury using *Appendix to Method 1631, Total Mercury in Tissue, Sludge, Sediment, and Soil by Acid Digestion and BrCl Oxidation* Revision B and Revision E, respectively.
- Fillet homogenates will also be analyzed for 40 PFAS and 209 PCB congeners (Analytical method requirements for PFAS and PCB analyses will be described in the *Quality Assurance Project Plan for Analysis of the 2022 National Lake Assessment Fish Fillet Samples for Mercury, Per- and Polyfluoroalkyl Substances, and Polychlorinated Biphenyls*).
- Statistical analysis will include an estimation of the number and proportion of lakes in the sampled population, and an estimation of the cumulative distribution and percentile concentrations of the target chemicals in fillets.
- The percentage of the sampled population of U.S. lakes containing fish with fillet concentrations that exceed screening levels for human health protection will be estimated by overlaying these screening levels on cumulative distribution plots for the target chemicals.

Target Chemicals

Metals		
Target Analyte	CAS Number	
Mercury (total)	7439-97-6	
Per- and Polyfluoroalkyl Substances (PFAS)		
Target Analyte	Abbreviation	CAS Number
Perfluoroalkyl carboxylic acids		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTriDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluoroalkyl sulfonic acids		
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Fluorotelomer sulfonic acids		
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4
Perfluorooctane sulfonamides		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols		
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
Per- and Polyfluoroether carboxylic acids		
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
4,8-Dioxo-3H-perfluorononanoic acid	ADONA	919005-14-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Nonafluoro-3,6-dioxahexanoic acid	NFDHA	151772-58-6
Ether sulfonic acids		
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
11-Chloroicosadecafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUDS	763051-92-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
Fluorotelomer carboxylic acids		
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4
Polychlorinated Biphenyls (PCBs)		
Target Analyte		
Full congener analysis providing results for 209 congeners		

Anticipated Study Milestones

