An Assessment of PFAS in Great Lakes Fish

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Purpose of this Presentation

- Introduce the fillet tissue monitoring program in the context of Office of Water programs to address PFAS.
- Summarize occurrence results of PFAS in the Great Lakes.
- Discuss how states and Tribes could calculate screening levels for fish advisories and compare to the EPA national study results.

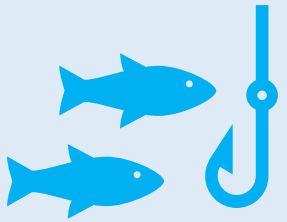
The EPA's PFAS Strategic Roadmap

Toxicity assessments

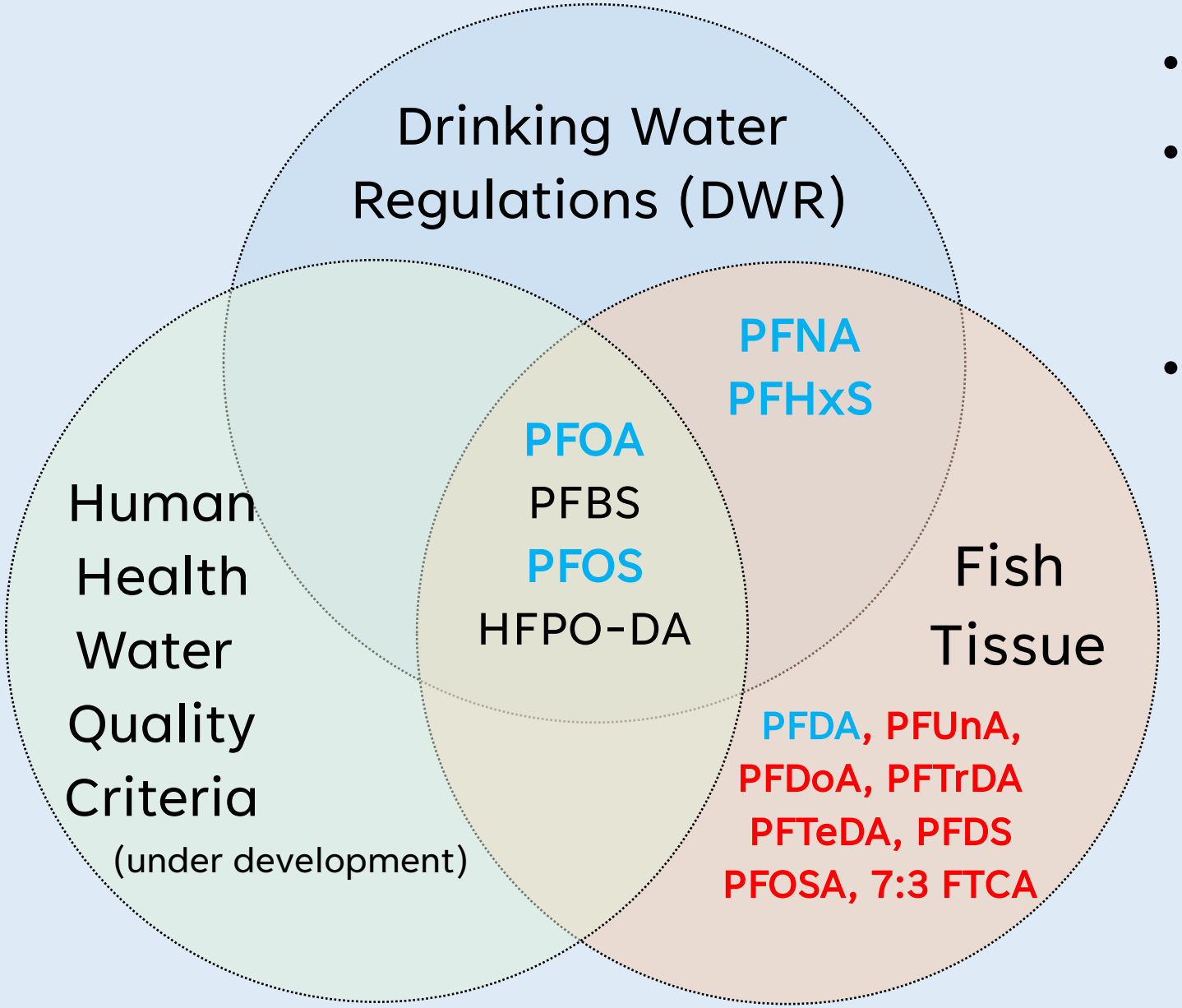
Recommended ambient water quality criteria

National Primary Drinking Water Regulations

Fish Tissue Monitoring & Fish Advisory Program

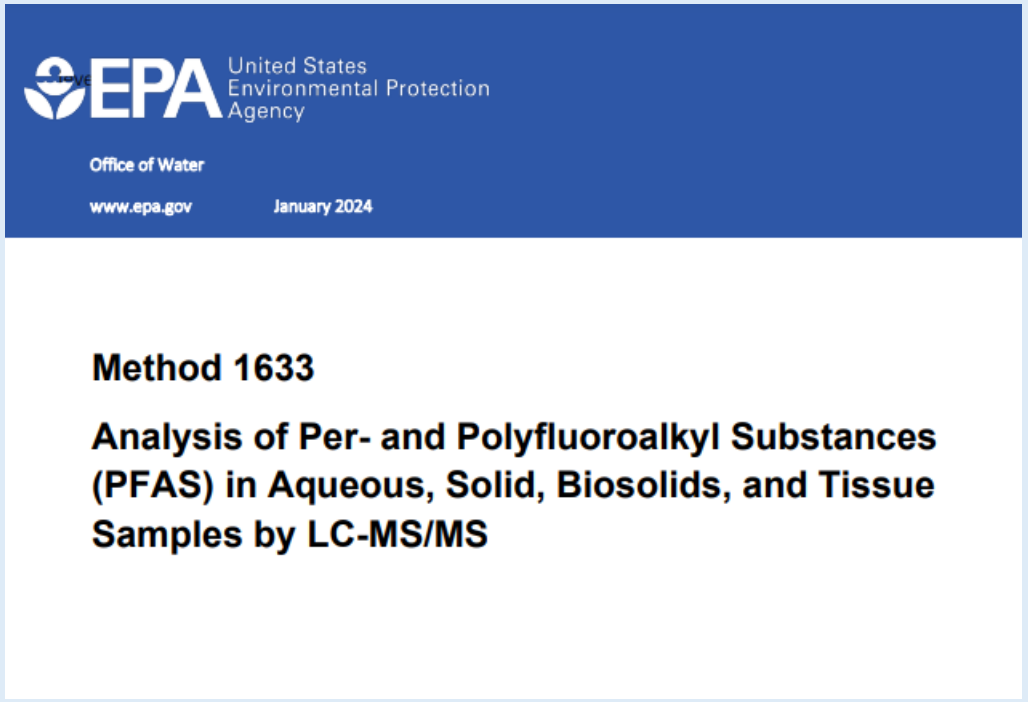


Increased Attention on PFAS



- 6 PFAS addressed in DWR (SDWA)
- 4 PFAS currently being drafted as recommended human health criteria (CWA)
- 40 PFAS monitored in fish tissue; 12 of these PFAS are commonly detected:
  - 5 commonly detected PFAS with final toxicity values (**blue**)
  - 7 commonly detected PFAS with unknown or draft toxicity values (**red**)

Method 1633 for Analysis of 40 PFAS in Tissue



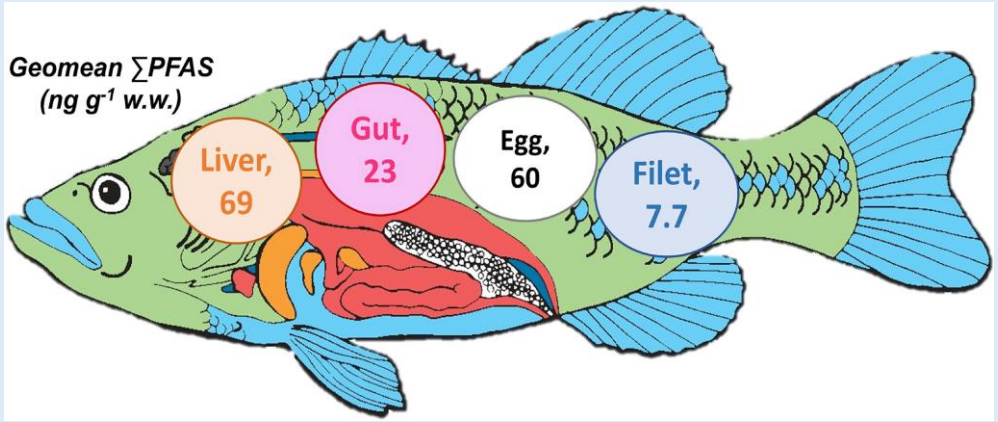
- 12/40 PFAS commonly detected in Great Lakes fish (highlighted)
- 5/12 commonly detected PFAS have known toxicity assessments (blue text)

PFBA	PFBS	PFOSA	NFDHA
PFPeA	PFPeS	NMeFOSA	9CL-PF3ONS
PFHxA	PFHxS	NEtFOSA	
PFHpA	PFHpS	NMeFOSAA	11CL-PF3OUdS
PFOA	PFOS	NEtFOSAA	
PFNA	PFNA	NMeFOSA	PFEESA
PFDA	PFDS	NEtFOSE	3:3FTCA
PFUnA	PFDoS	HFPO-DA	5:3FTCA
PFDoA	4:2 FTS	ADONA	7:3FTCA
PFTrDA	6:2 FTS	PFMPA	
PFTeDA	8:2 FTS	PFMBA	

Various Monitoring Objectives:

- Whole body or fillet?
- Probabilistic or targeted survey?
- Importance of longitudinal data?

Partitioning in Fish



Source: Capozzi et al. 2023. From watersheds to dinner plates: Evaluating PFAS exposure through fish consumption in Southeast Michigan

Effects on Human Health

Source: EPA/OW/OST Fillet Tissue Monitoring Program (for human health protection)

Published Survey Design

Environ Monit Assess (2009) 150:91–100
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Survey design for lakes and reservoirs in the United States to assess contaminants in fish tissue

Anthony R. Olsen · Blaine D. Snyder · Leanne L. Stahl · Jennifer L. Pitt

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Abstract The National Lake Fish Tissue Study (NLFTS) was the first survey of fish contamination in lakes and reservoirs in the 48 conterminous states based on a probability survey design. This study included the largest set (268) of persistent, bioaccumulative, and toxic (PBT) chemicals ever studied in predator and bottom-dwelling fish species. The U.S. Environmental Protection Agency (USEPA) implemented the study in cooperation with states, tribal nations, and other federal agencies, with field collection occurring at 500 lakes and reservoirs over a four-year period (2000–2003). The sampled lakes and reservoirs were selected using a spatially balanced unequal probability survey design from 270,761 lake objects in USEPA's River Reach File Version 3 (RF3). The survey design selected 900 lake objects, with a reserve sample of 900, equally distributed across six lake area categories. A total of 1,001 lake objects were evaluated to identify 500 lake objects that met the study's definition of a lake and could be accessed for sampling. Based on the 1,001 evaluated lakes, it was estimated that a target population of 147,343 (±7% with 95% confidence) lakes and reservoirs met the NLFTS definition of a lake. Of the estimated 147,343 target lakes, 47% were estimated not to be sampleable either due to landowner access denial (35%) or due to physical barriers (12%). It was estimated that a sampled population of 78,664 (±12% with 95% confidence) lakes met the NLFTS lake definition, had either predator or bottom-dwelling fish present, and could be sampled.

Keywords Fish tissue · Contaminants · Lakes · Reservoirs · Probability survey design · PBTs

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Introduction

In 1998, the U.S. Environmental Protection Agency's (EPA's) Office of Science and Technology (OST) within the Office of Water (OW) held a workshop to initiate a national study of contamination in fish tissue for lakes and reservoirs in the 48 conterminous states. Workshop

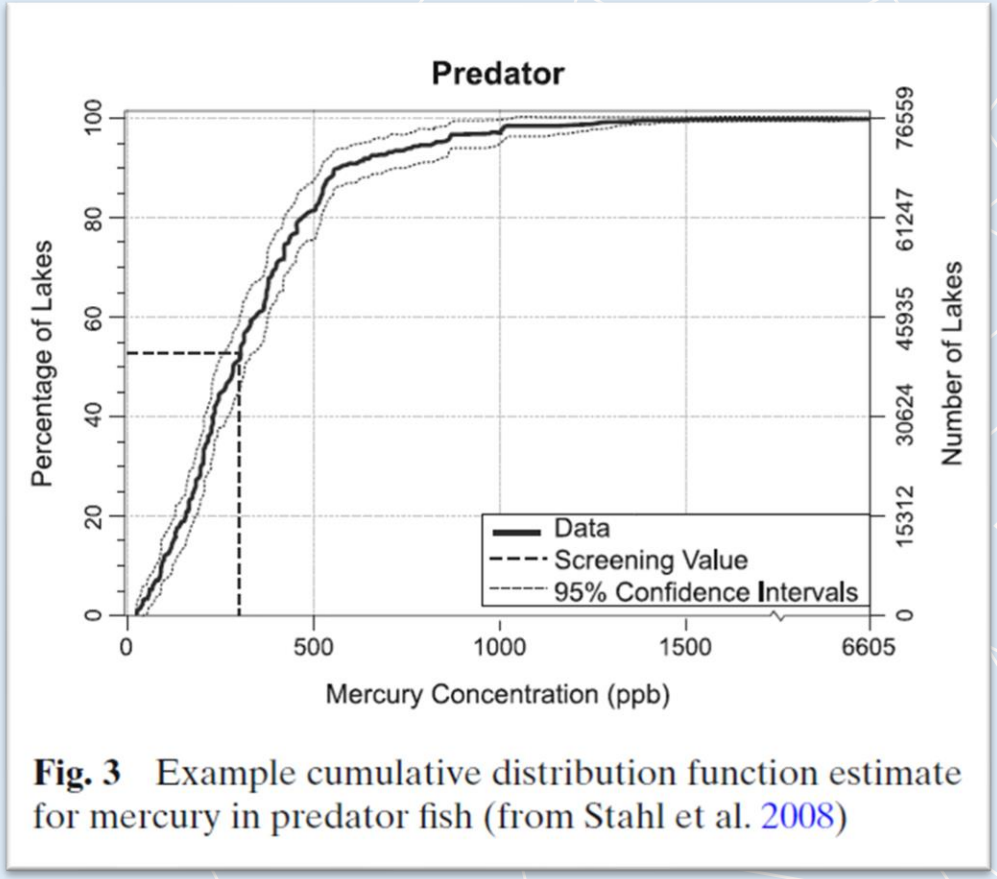
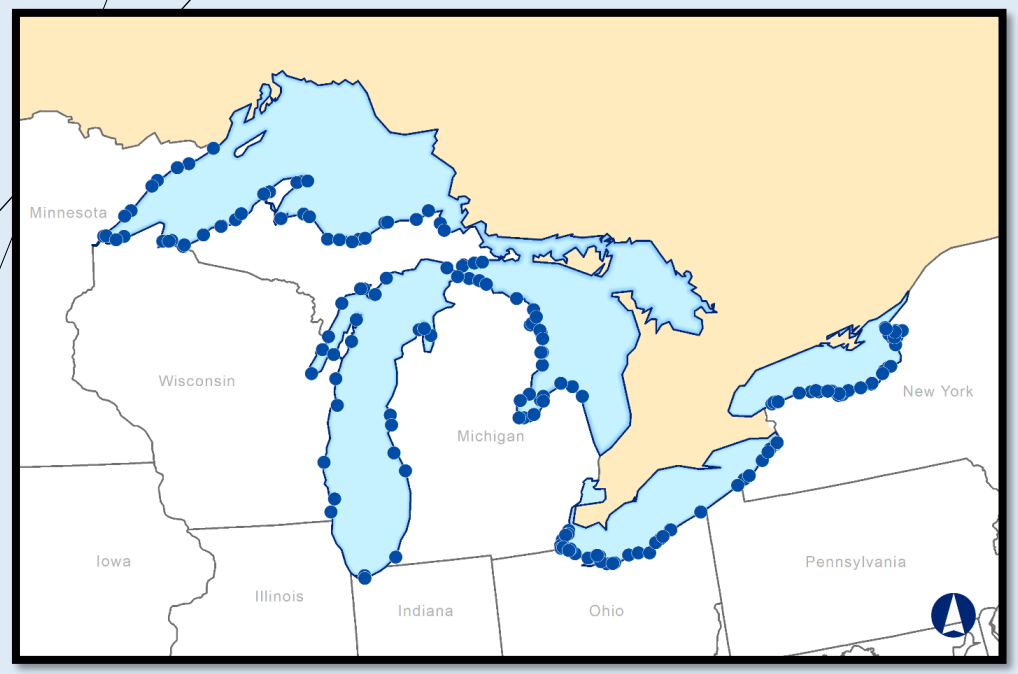


Fig. 3 Example cumulative distribution function estimate for mercury in predator fish (from Stahl et al. 2008)

Olsen, A.R., Snyder, B.D., Stahl, L.L. *et al.* Survey design for lakes and reservoirs in the United States to assess contaminants in fish tissue. *Environ Monit Assess* **150**, 91–100 (2009). https://doi.org/10.1007/s10661-008-0685-8

Monitoring Levels of Pollutants in Fish Tissue

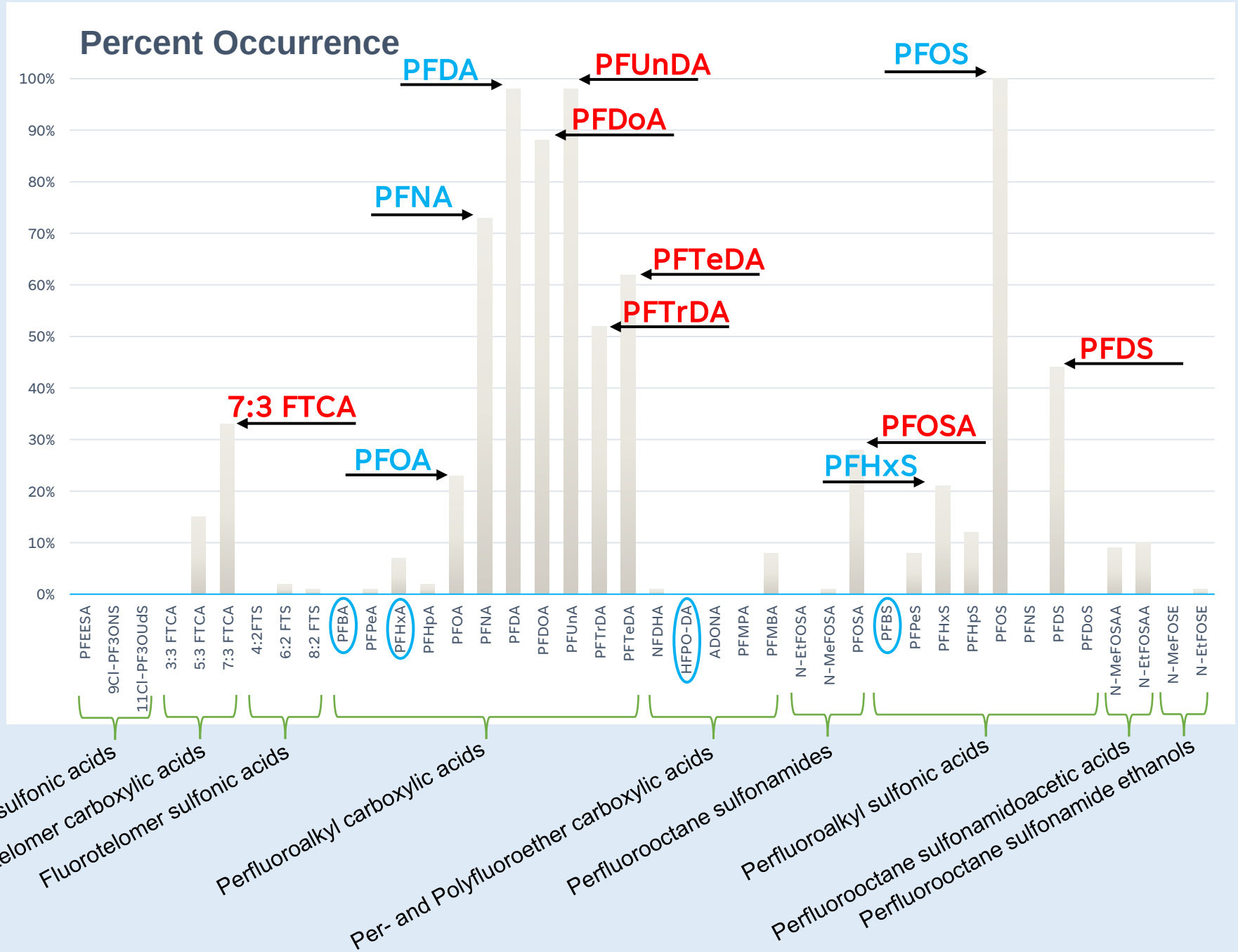


Map of 2020 sample locations

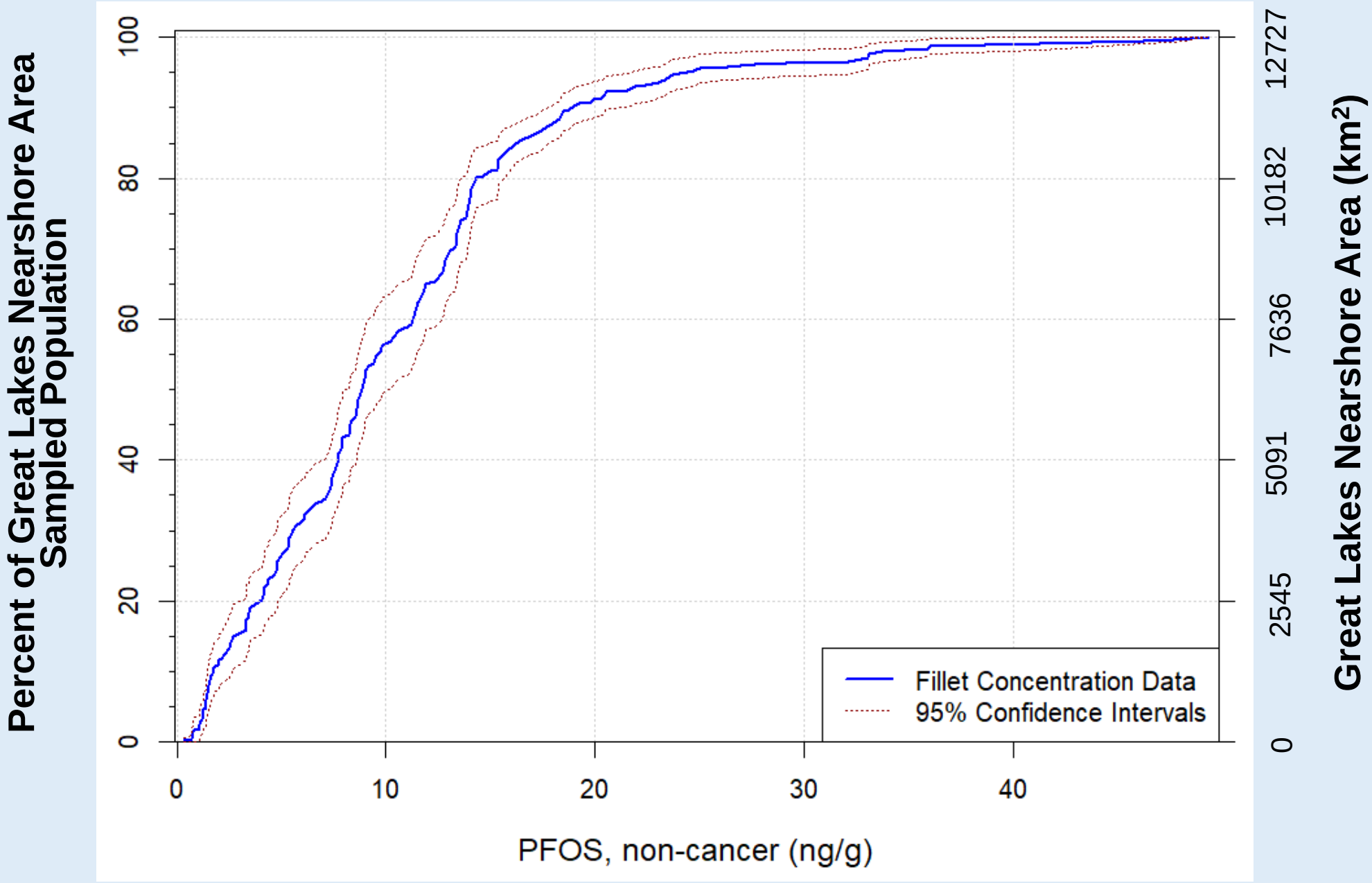
- 165 samples
- Composite samples of predator fish species commonly consumed by humans
  - Up to 5 fish of same species
  - Minimum length of 190 mm (~8 in)
  - 75% rule
- Skin-on fillet tissue analyzed
- Common species include Lake Trout, Smallmouth Bass, Freshwater Drum, and Walleye

Summary Data: 2020 Great Lakes Fish Tissue Study

Chemical	Number of Detections (n=165)	Frequency of Occurrence	Minimum (ng/g)	Tissue Concentrations by Percentile (ng/g)				Maximum (ng/g)
				25th	50th	75th	90th	
PFOA	38	23%	0.09	< MDL	< MDL	0.10	0.34	1.41
PFNA	120	73%	0.17	0.17	0.37	0.95	2.00	12.0
PFDA	162	98%	0.13	0.39	0.81	1.27	1.85	5.52
PFUnA	161	98%	0.19	0.44	0.85	1.59	2.50	8.91
PFDoA	146	89%	0.14	0.22	0.41	0.66	1.01	2.47
PFTrDA	85	52%	0.50	< MDL	0.53	1.05	1.80	5.17
PFTeDA	102	62%	0.18	< MDL	0.22	0.36	0.47	0.96
PFHxS	34	21%	0.08	< MDL	< MDL	0.05	0.12	0.28
PFOS	165	100%	0.37	4.82	8.85	13.8	18.9	49.3
PFDS	73	44%	0.10	< MDL	< MDL	0.14	0.32	2.50
PFOSA	46	28%	0.09	< MDL	< MDL	0.19	0.52	2.50
7:3 FTCA	54	33%	0.88	< MDL	< MDL	1.06	3.86	20.0


Percent Occurrence
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PFDA
PFUnDA
PFOS
PFDoA
PFNA
PFTeDA
PFTrDA
PFDS
7:3 FTCA
PFOSA
PFOA
PFHxS
PFEESA
9Cl-PF3ONS
11Cl-PF3OUdS
3:3 FTCA
5:3 FTCA
7:3 FTCA
4:2FTS
6:2 FTS
8:2 FTS
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFDOA
PFUnA
PFTrDA
PFTeDA
NFDHA
HFPO-DA
ADONA
PFMPA
PFMBA
N-EtFOSA
N-MeFOSA
PFOSA
PFBS
PFPeS
PFHxS
PFHpS
PFOS
PFNS
PFDS
PFDoS
N-MeFOSAA
N-EtFOSAA
N-MeFOSE
N-EtFOSE
Ether sulfonic acids
Fluorotelomer carboxylic acids
Fluorotelomer sulfonic acids
Perfluoroalkyl carboxylic acids
Per- and Polyfluoroether carboxylic acids
Perfluorooctane sulfonamides
Perfluoroalkyl sulfonic acids
Perfluorooctane sulfonamidoacetic acids
Perfluorooctane sulfonamide ethanols

2020 Great Lakes Fish Tissue Study (PFOS)



Conclusions and Potential Future Work

- Much of the Great Lakes nearshore area contains fish with detectable levels of multiple PFAS.
- People who eat freshwater fish caught in local waters should consult their Tribe, state or territory for information on local fish advisories.
- The EPA offers guidance to states, Tribes and territories on contaminants in fish and developing fish consumption advisories.
- Reduced consumption of fish from the Great Lakes can reduce exposure to contaminants (consider alternate sources of fish).
- More work is needed to assess the toxicity of other PFAS in fish.
- More work is needed to consider whether benefits of eating locally caught fish can reduce risks.

For further information, please contact me:

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or go to:

https://www.epa.gov/choose-fish-and-shellfish-wisely/studies-fish-tissue-contamination