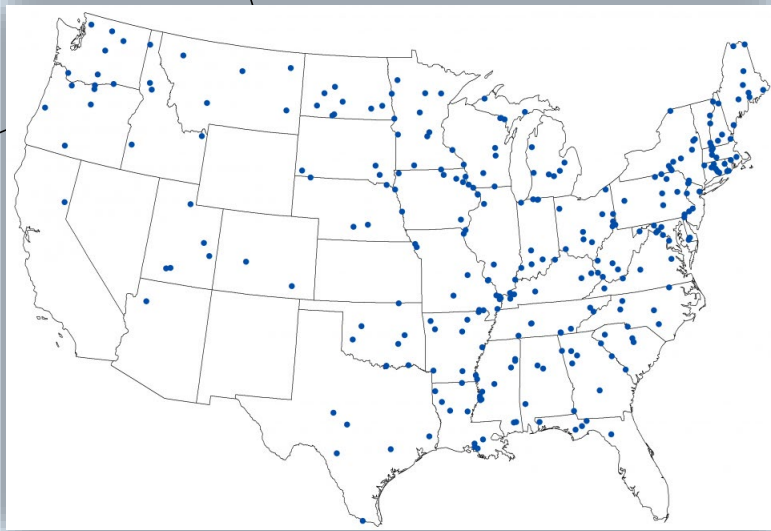


SUMMARY OF PFAS RESULTS FROM U.S. RIVERS AND LAKES

JOHN HEALEY – US EPA/OW/OST

U.S. Rivers
2018-2019



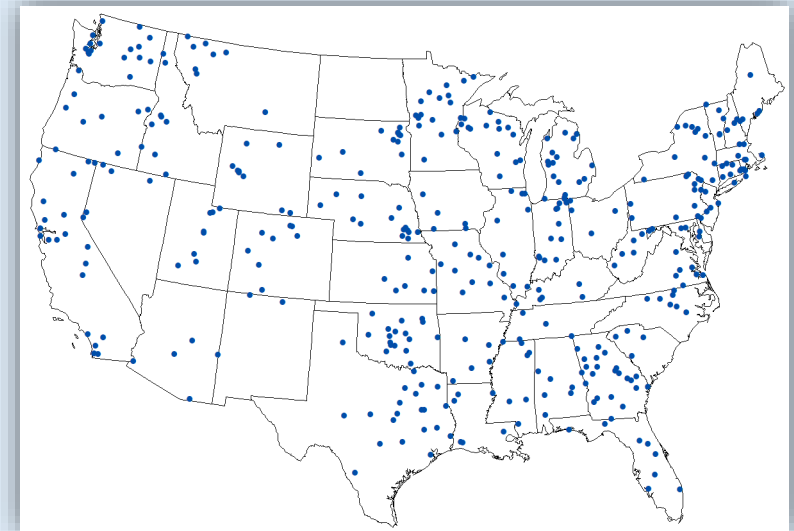
n = 290 river sites

Great Lakes
2020



n = 165 nearshore area sites

U.S. Lakes
2022



n = 413 lake sites



DISCLAIMER STATEMENT

This presentation has been reviewed and approved by USEPA's Office of Science and Technology within the Office of Water. Approval does not signify that the contents reflect the views of the Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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 U.S. freshwater fish from rivers and lakes.
- Comparison of local data to the EPA national study results.

The EPA's PFAS Strategic Roadmap

Toxicity
assessments



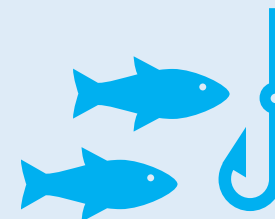
Recommended
ambient water
quality criteria



National Primary
Drinking Water
Regulations



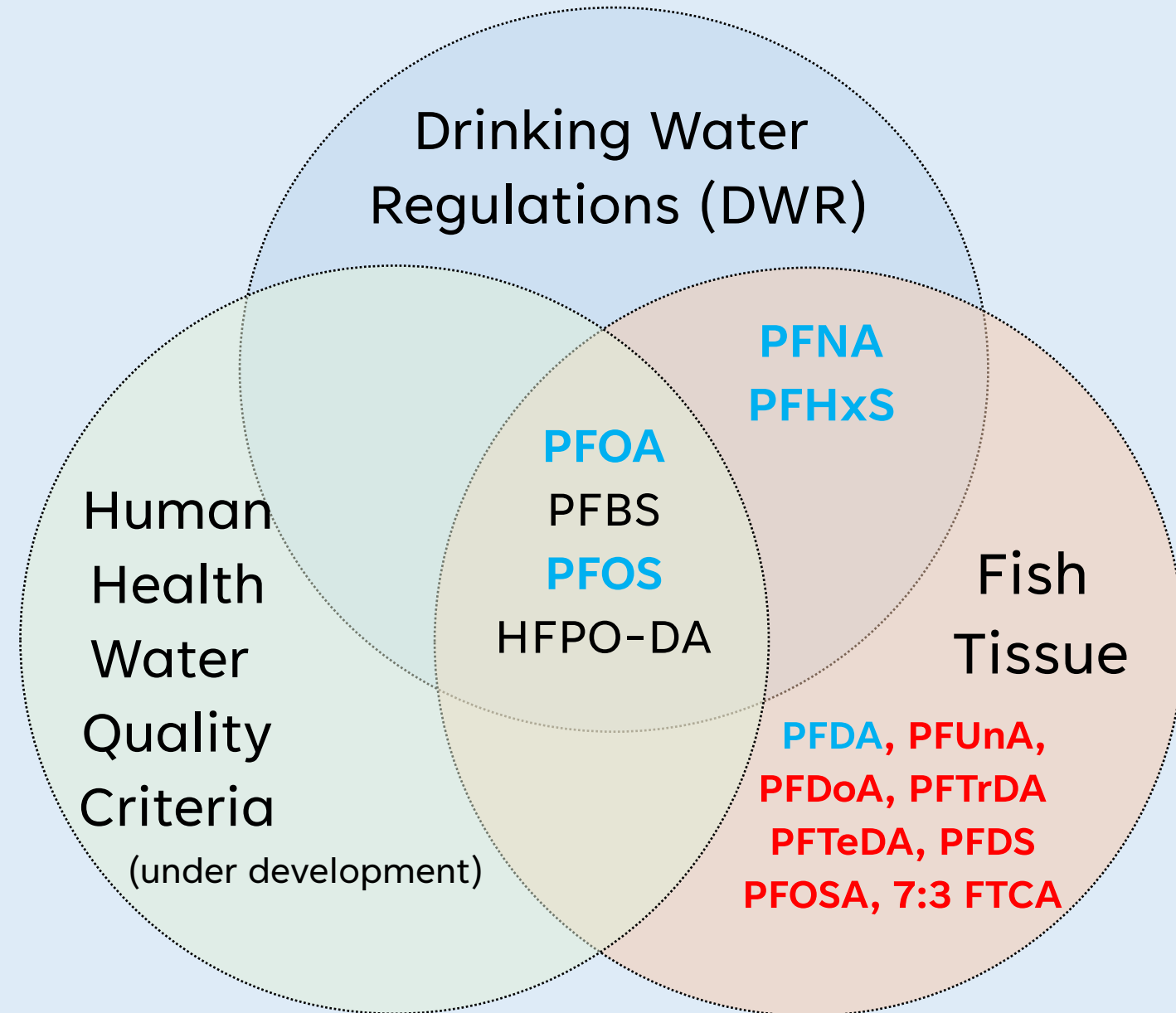
Fish Tissue
Monitoring & Fish
Advisory Program



PFAS Toxicity Assessments

Chemical	Oral RfD, mg/kg/day	Cancer SF, (mg/kg/day) ⁻¹	Source
PFBA	1×10^{-3}		ORD/IRIS final value, 2022
PFHxA	5×10^{-4}		ORD/IRIS final value, 2023
PFOA	3×10^{-8}	29,300	OW/OST final value, 2024
PFNA	3×10^{-6}		OW EPA NPDWR final value, 2024; (IRIS draft value is 7×10^{-9})
PFDA	2×10^{-9}		ORD/IRIS final value, 2024
PFBS	3×10^{-4}		ORD/CPHEA final value, 2021
PFHxS	2×10^{-6}		OW EPA NDPWR final value, 2024; (IRIS draft value is 4×10^{-10})
PFOS	1×10^{-7}	39.5	OW/OST final value, 2024
HFPO-DA	3×10^{-6}		OW/OST final value, 2021

EPA's 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



Office of Water
www.epa.gov January 2024

Method 1633

Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS

- 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
PFTTrDA	6:2 FTS	PFMPA	
PFTeDA	8:2 FTS	PFMBA	

OBJECTIVES OF OST'S FISH TISSUE STUDIES

- Develop national estimates of persistent bioaccumulative toxic chemical (PBT) concentrations in fish fillet tissue
- Estimate the percentage of waters in the conterminous U.S. with fish fillet tissue concentrations above human health protection screening levels
- Provide national baseline information for assessing changes in PBTs over time

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

Received: 29 January 2008 / Accepted: 14 February 2008 / Published online: 4 December 2008
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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 ob-

jects 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 ($\pm 7\%$ 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 ($\pm 12\%$ 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

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

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Published Survey Design

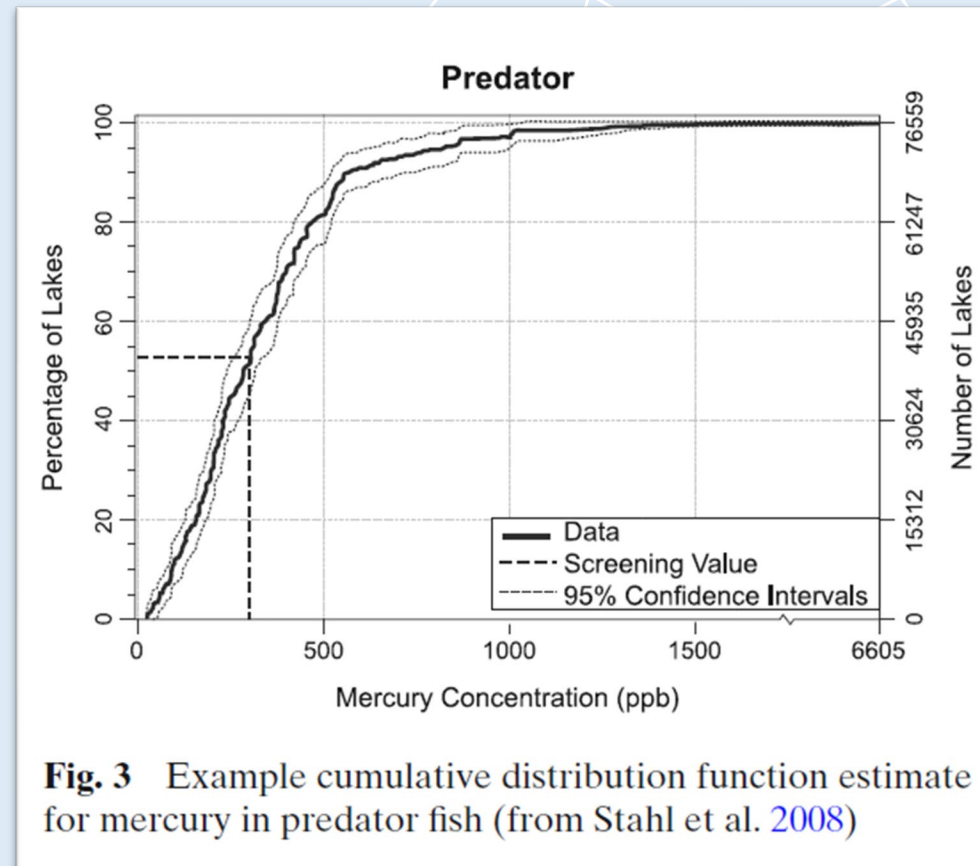


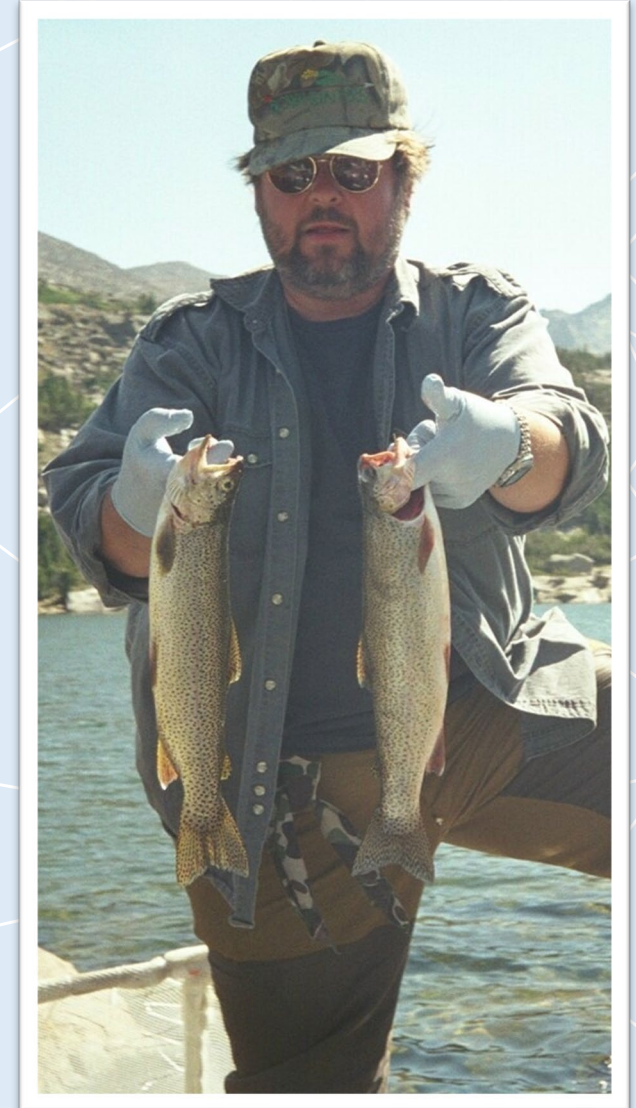
Fig. 3 Example cumulative distribution function estimate for mercury in predator fish (from Stahl et al. 2008)

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>

How Are Fish Collected?

- Field crews collect fish by electrofishing, hook and line, and netting methods.
 - A composite consists of up to 5 similarly sized adult fish of the same species (75% rule applies).
- EPA supplies a target species list to field crews based on these criteria:
 - Abundant
 - Commonly consumed by people
 - Large enough to provide sufficient tissue for chemical analyses (adult specimens preferred)
- Fish are handled and shipped from each site using consistent methods derived from NLFTS and incorporated in an approved QA plan.



How Are the Fillet Samples Prepared?

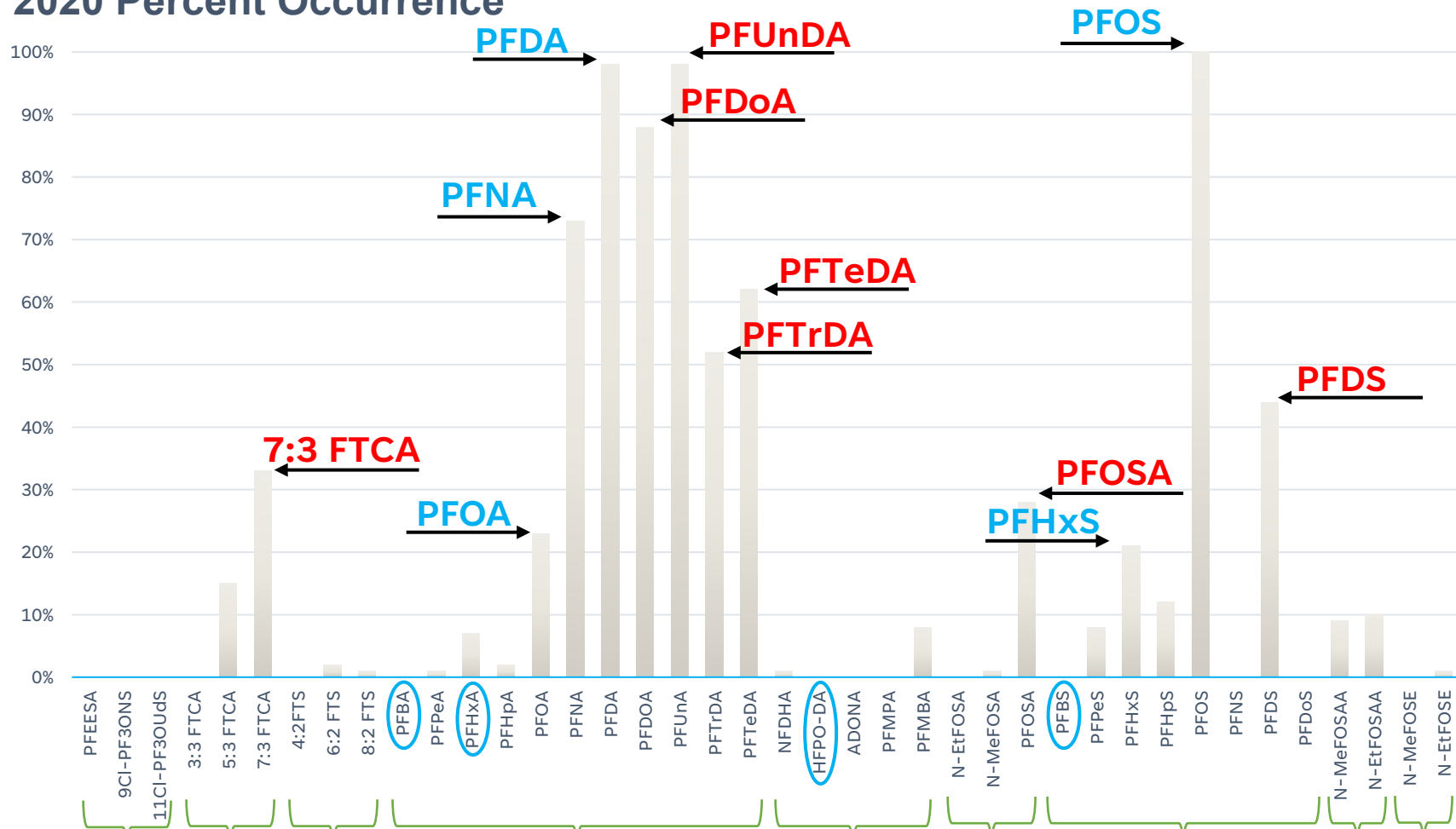
- Scale and remove fillets from each fish in the composite sample.
- Homogenize fillets for each composite sample using a tissue grinder.
- Divide ground fillet tissue into separate aliquots for each type of chemical analysis (method specifies required tissue volume).
- Complete quality control steps to:
 - Confirm homogeneity based on lipid testing.
 - Verify that equipment cleaning procedures are preventing cross-contamination by analyzing rinsate samples.



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)
				25 th	50 th	75 th	90 th	
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
PFTTrDA	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

2020 Percent Occurrence



Ether sulfonic acids

Fluorotelomer carboxylic acids

Fluorotelomer sulfonic acids

Perfluoroalkyl carboxylic acids

Per- and Polyfluoroether carboxylic acids

Perfluorooctane sulfonamides

Perfluoroalkyl sulfonic acids

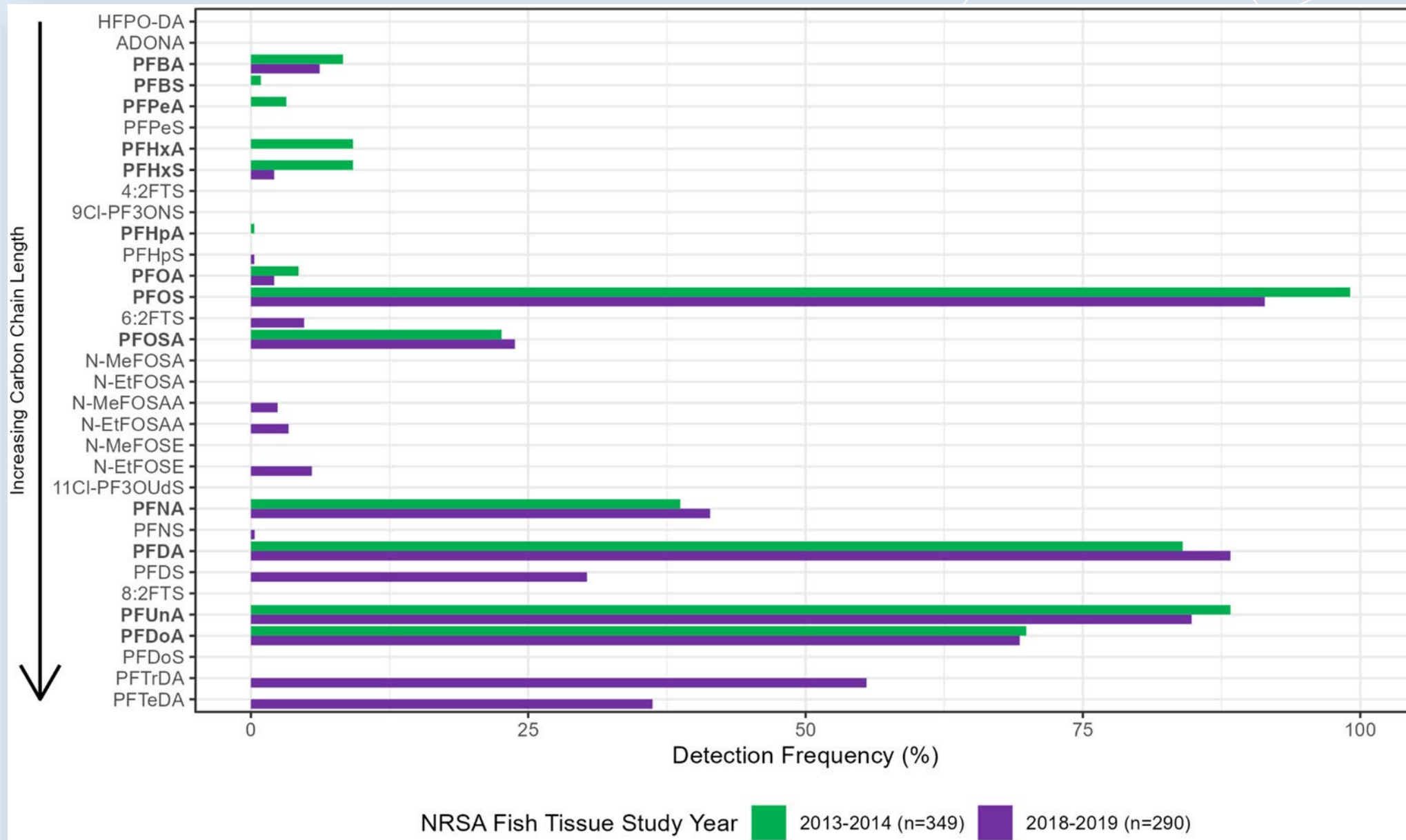
Perfluorooctane sulfonamidoacetic acids

Perfluorooctane sulfonamide ethanols

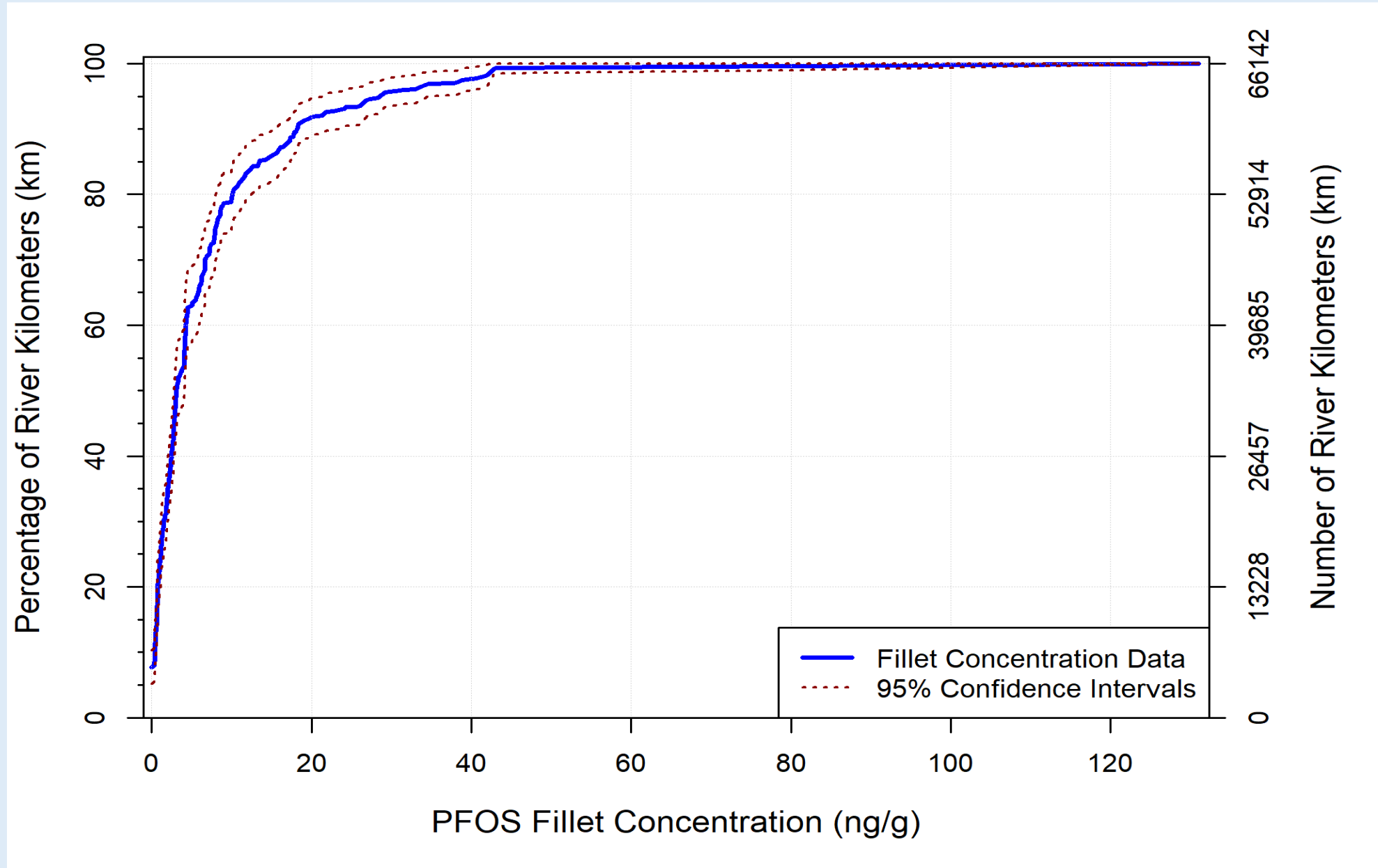
Summary Data: 2018-19 NRSA Fish Tissue Study

Chemical	Number of Detections (n=290)	Frequency of Occurrence	Minimum (ng/g)	Tissue Concentrations by Percentile (ng/g)				Maximum (ng/g)
				25 th	50 th	75 th	90 th	
<i>PFOA</i>	6	2%	0.161	< MDL	< MDL	< MDL	< MDL	0.354
PFNA	120	41%	0.122	< MDL	< MDL	0.176	0.273	1.44
PFDA	256	88%	0.115	0.200	0.332	0.655	1.23	29.8
PFUnA	246	85%	0.143	0.237	0.516	0.939	1.52	105
PFDoA	201	69%	0.155	< MDL	0.277	0.533	1.30	140
PFTTrDA	161	56%	0.386	< MDL	0.42	0.84	1.52	140
PFTeDA	105	36%	0.310	< MDL	< MDL	0.39	0.85	62.8
<i>PFHxS</i>	6	2%	0.162	< MDL	< MDL	< MDL	< MDL	0.611
PFOS	265	91%	0.353	1.15	3.07	7.97	18.2	131
PFDS	88	30%	0.201	< MDL	< MDL	0.14	0.32	4.97
PFOSA	69	24%	0.149	< MDL	< MDL	< MDL	0.25	2.87

PFAS Detection Frequencies in Fish Fillet Samples



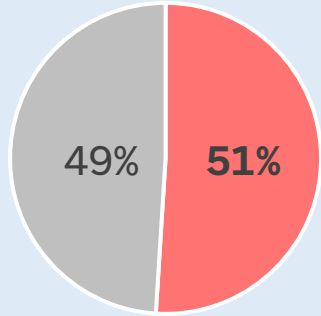
2018-19 Rivers Fish Tissue Study (PFOS)



NATIONAL LAKES ASSESSMENT 2022

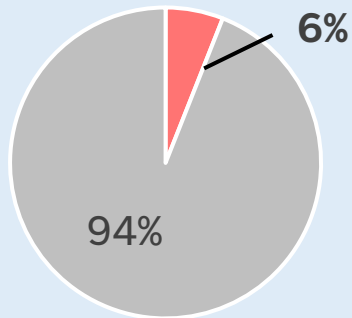
FISH FILLET TISSUE CONTAMINATION

Mercury



Fillet mercury concentrations exceeded the EPA's 300 ppb water quality criterion in **51%** of lakes

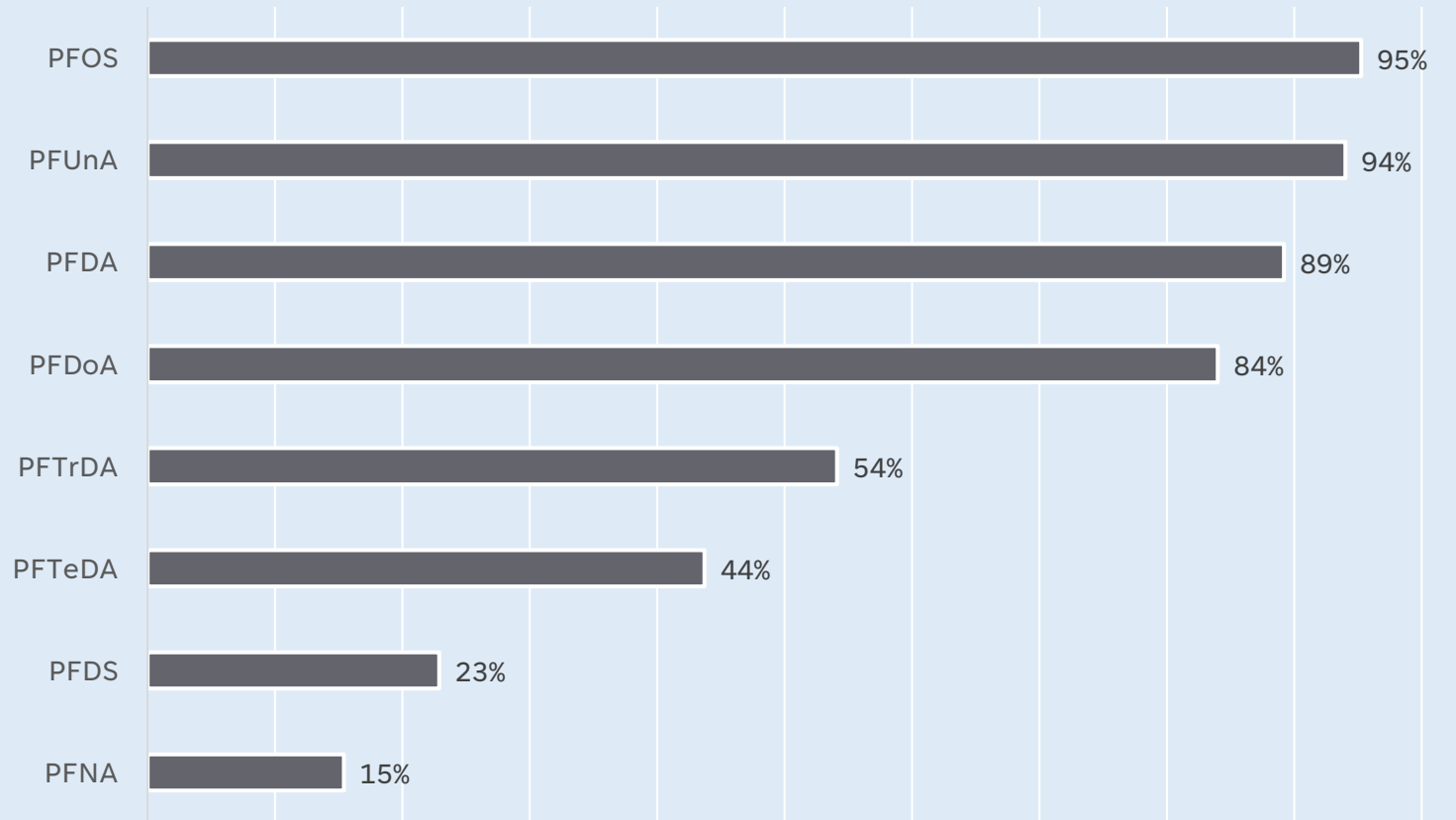
Total Polychlorinated Biphenyls (PCBs)



Fillet PCB concentrations exceeded the EPA's 12 ppb cancer screening level in **6%** of lakes

Per- and Polyfluoroalkyl Substances (PFAS)

Eight PFAS were detected in fish fillet tissue from at least 15% of lakes



Note: Fillet tissue results are reported only for the sampled population of lakes (n=58,747 lakes)

<https://www.epa.gov/national-aquatic-resource-surveys/nla>



Conclusions and Potential Future Work

- Much of the sampled waterbodies contain 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 locally caught fish 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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Office of Science and Technology

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or go to:

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