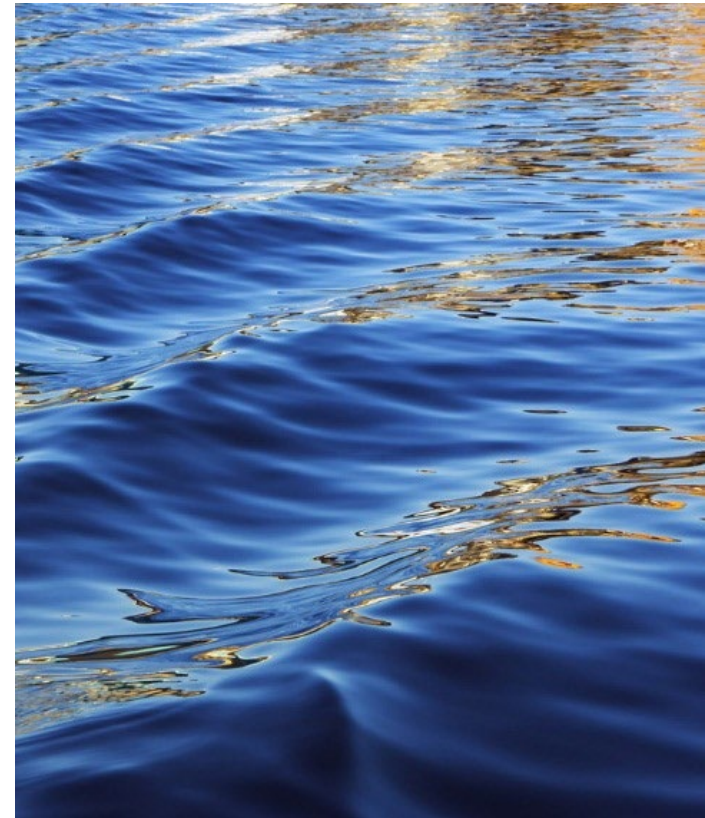




Challenges & Research Opportunities for PFAS Risk Assessment in Seafood & Aquatic Resources: A New Hampshire Perspective

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Northeast Conference The Science of PFAS
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Seafood & The Northeast

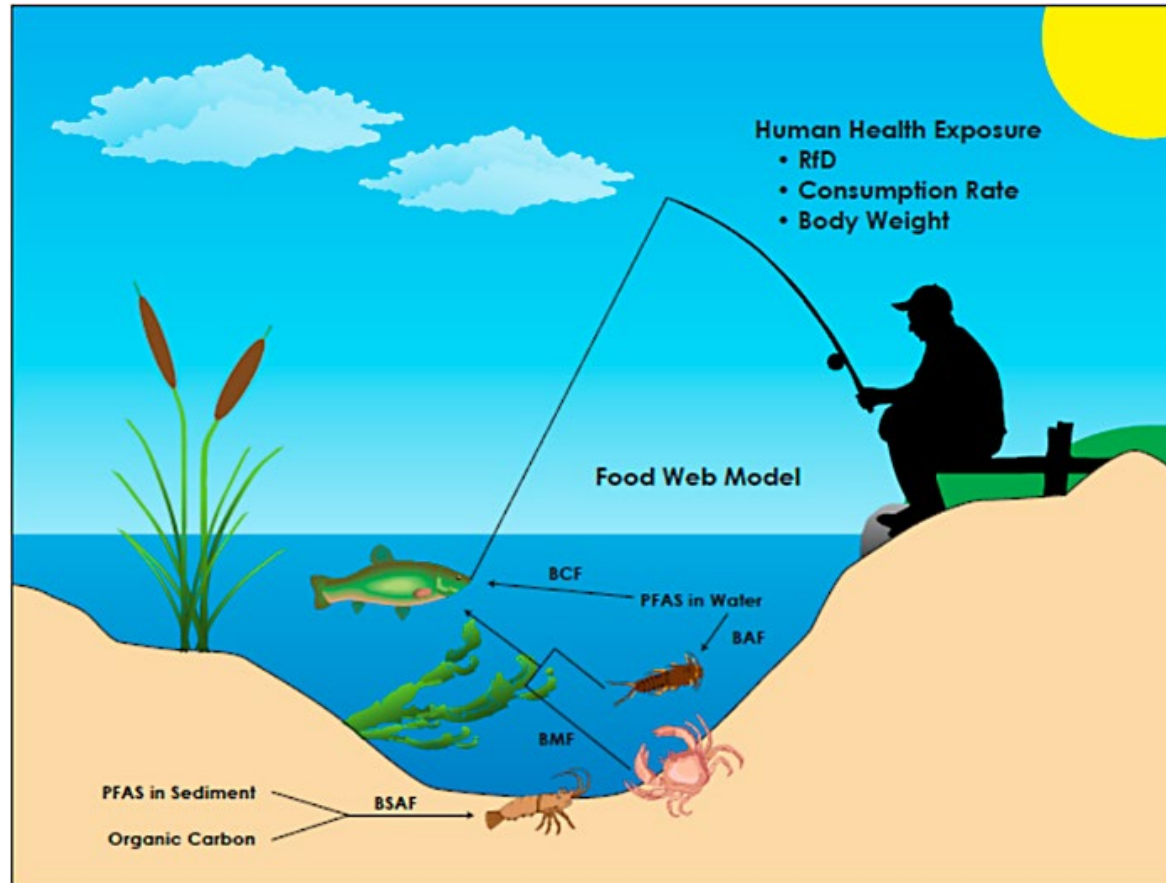


Diagram Source: Interstate Technology & Regulatory Council's PFAS Technical & Regulatory Guidance Document (Figure 17-1; <https://pfas-1.itrcweb.org/>)



Image Source: Petali, JM (2021)

Fish Consumption Advisories & Seafood

- **Fish/Shellfish Consumption Advisories (FCAs)** are recommended consumption limits of fish/shellfish.
- Expressed as a meal size (4-8 ounces) and in terms of frequency (e.g., daily, weekly, monthly).
- Often waterbody-specific and applied to certain species based on available data.
- FCAs are not synonymous with Water Quality Criteria.

$$\frac{\text{RfD} \times \text{BW}}{\text{MS}} = \text{DTC}$$

RfD – Reference Dose (ng/kg/day)

BW – Body Weight (kg)

MS – Meal Size (g/day)

DTC – trigger concentration for daily consumption (ng/g)

1 ng/g = 1 part-per-billion (ppb)

Risk Assessment for Fish Consumption Advisories

- Fish Consumption Advisories are developed using EPA methodology.
- Often generated for Children, Women of Child-Bearing Age and Other Adults.
- Interstate Technology & Regulatory Council (2022), <https://pfas-1.itrcweb.org/>

$$\frac{3.0 \text{ ng/kg/day} \times 80 \text{ kg}}{227 \text{ g/day}} = 1.1 \text{ ng/g}$$

RfD	3 ng/kg/day*
BW	80 kg (default adult)
MS	227 g/day (or 8-ounce fillet)
DTC	1.1 ng/g or 1.1 ppb

Alternatively, 7.4 ppb would trigger a once-per-week fish consumption advisory.

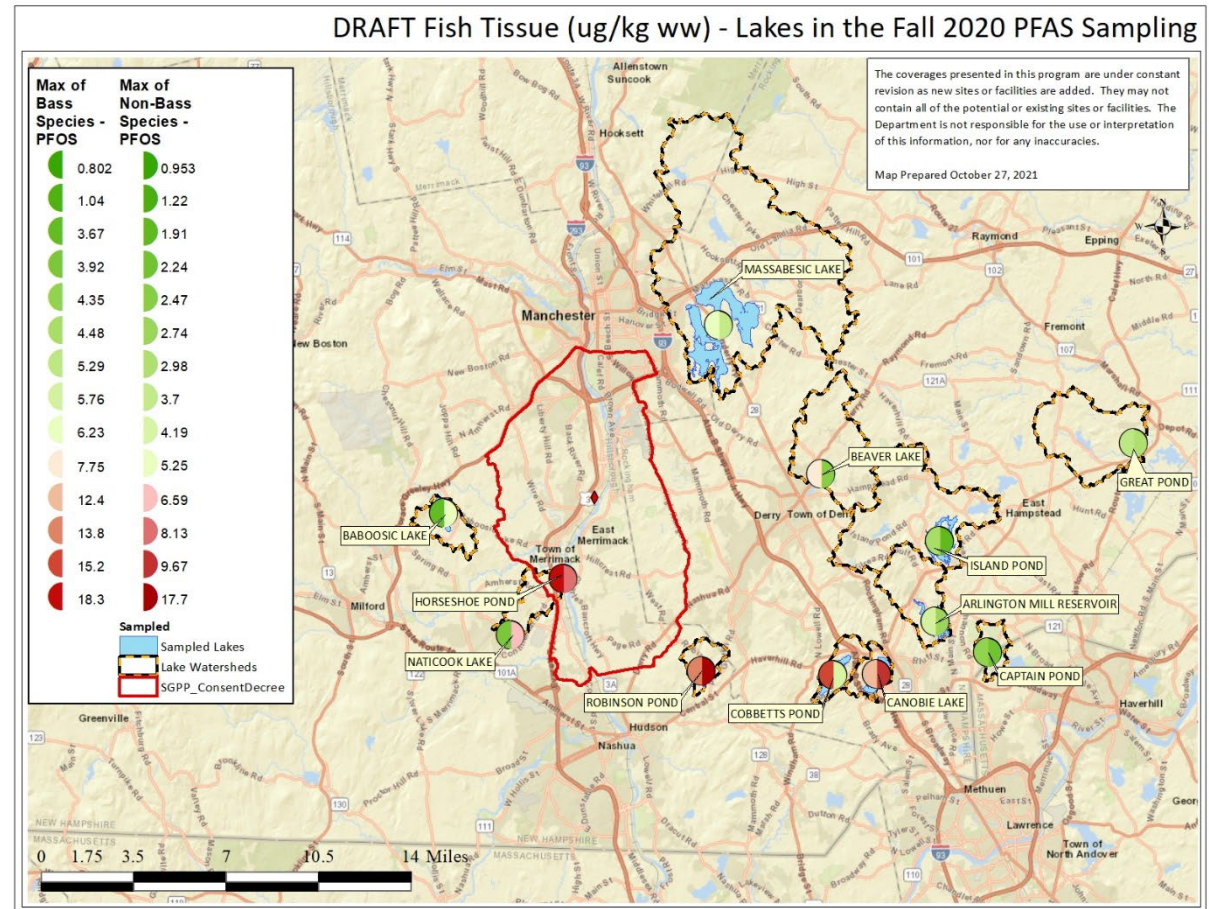
Example Fish Consumption Advisory Development: PFOS

- Several states use an RfD of ~2-3 ng/kg/d for perfluorooctane sulfonic acid (PFOS).
 - Examples: NH, IL, MN, NJ
- PFOS is commonly detected in fish tissue at varying concentrations.

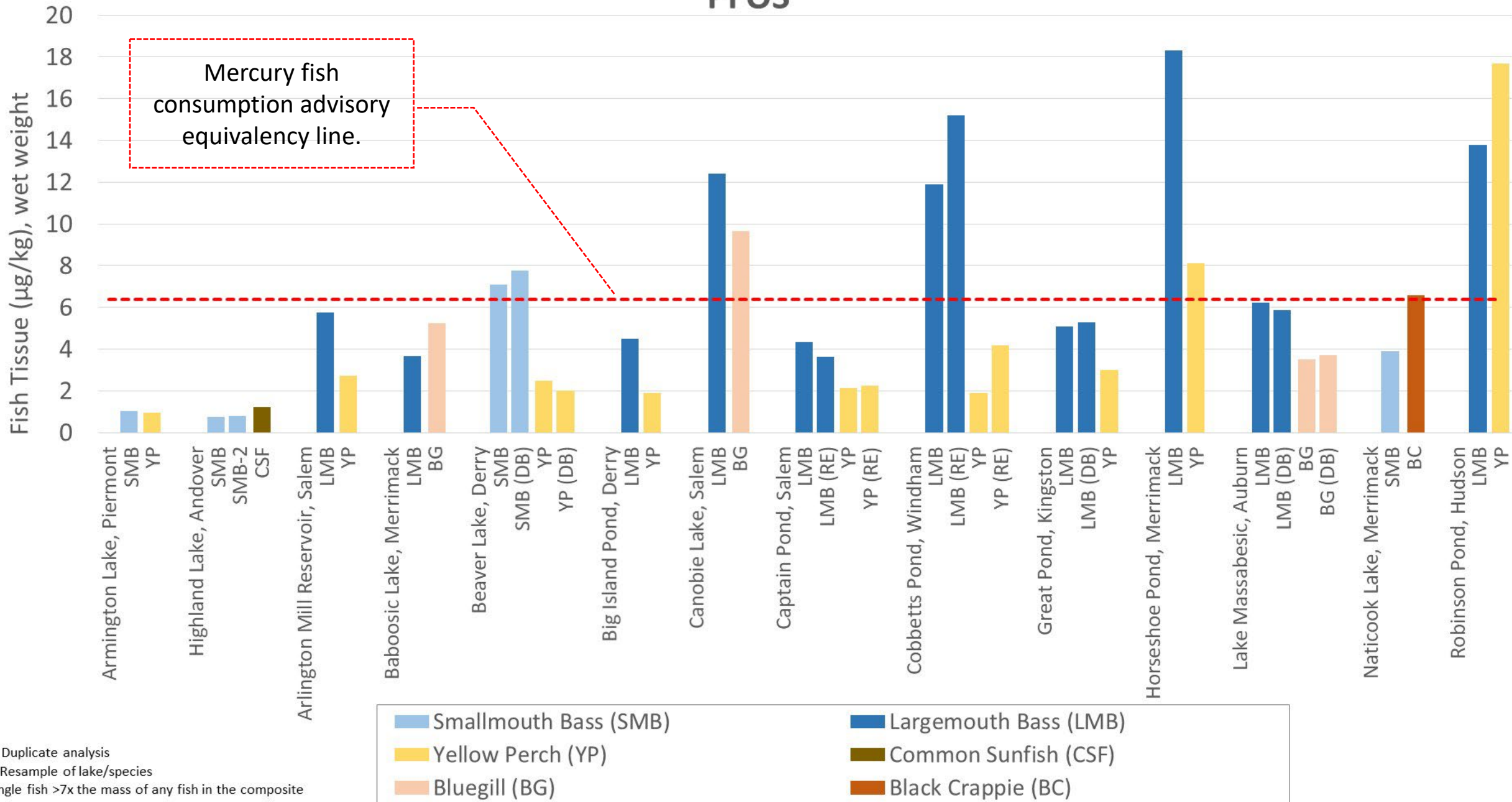
Freshwater Fish & Resources

Overview & Finfish

- Sample sizes and composite sampling of fish tissue.
- Sampling is biased to South Central NH, not representative of the state.
- Risk of total PFAS is unknown.
- Other contaminants.
- Relative risks and benefits of fish consumption.



PFOS



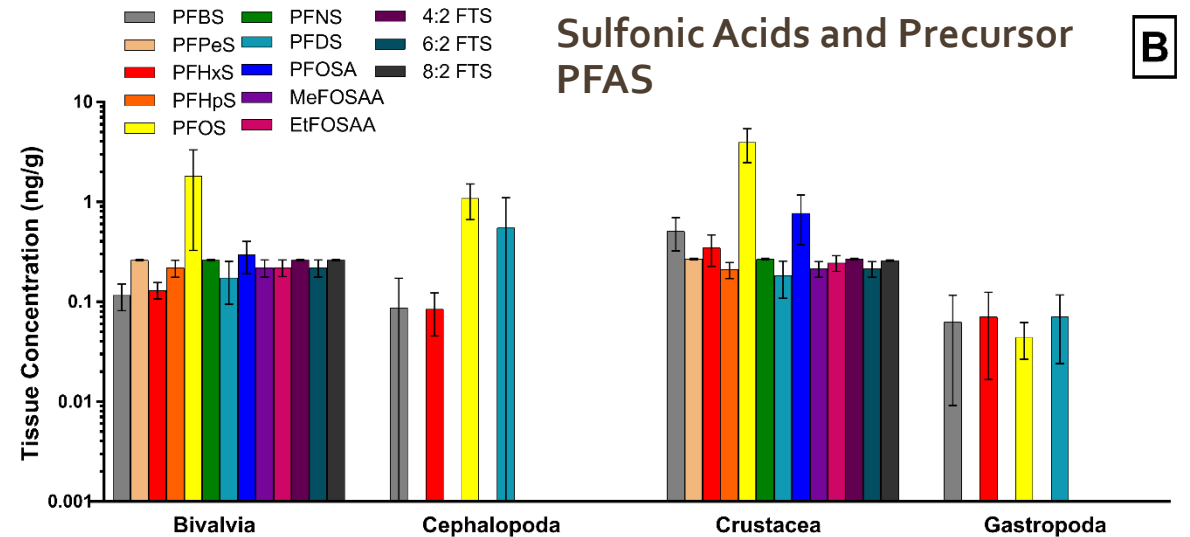
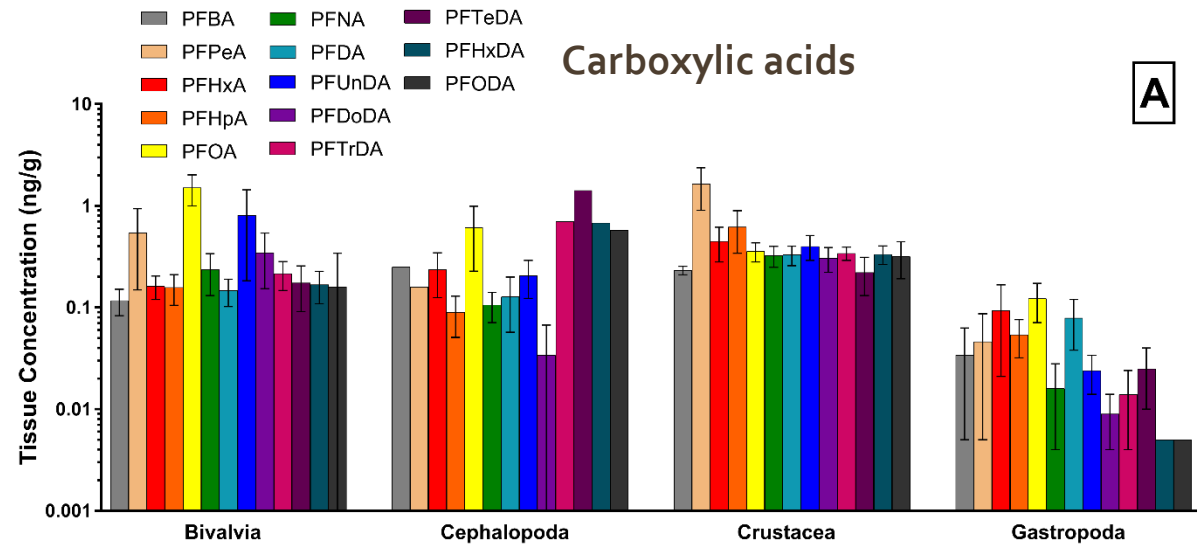
Recommended Fish Consumption Advisories in NH

Lake	Species	Population Segment	Recommended Maximum Consumption Rate (meals/month)
NH Statewide Mercury Advisory	Most Species	Typical Adult	4 meals/month
		Women CBA & Children	1 meal/month
Derry, Beaver Lake	Bass Species	Typical Adult	3 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Salem, Canobie Lake	All Species	Typical Adult	3 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Windham, Cobbetts Pond	Bass Species	Typical Adult	2 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Merrimack, Horseshoe Pond	All Species	Typical Adult	1 meal/month
		Women CBA Children	1 meal/month (same as Hg) DO NOT EAT
Hudson, Robinson Pond	All Species	Typical Adult	2 meals/month
		Women CBA Children	1 meal/month (same as Hg) DO NOT EAT

Marine Seafood

Shellfish & PFAS

- Marine seafood is diverse, and PFAS occurrence reflect that.
- PFAS have been detected in marine finfish, especially PFOS.
- Shellfish are complicated due to difference in taxa and limited research.



See "Shellshocked: A Comprehensive Review of PFAS in Shellfish" Giffard et al. Poster Hall.

$$\frac{\text{RfD} \times \text{BW}}{\text{MS}} = \text{DTC}$$

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Risk Assessment for Fish Consumption Advisories

- Commonly applied method throughout the U.S.
- Dependent on fish tissue data collected from the field.
- Relies on risk assessment assumptions.

Analytical Challenges & Opportunities

Can we measure it and is it really there?

- The list of PFAS analytes is growing, along with replacement products in the global market.
- Methods Differ: Drinking water \neq Fish Tissue \neq Shellfish Tissue
 - Detection limits and “interferent” problems
- Lack of lab capacity and/or capability in several regions.

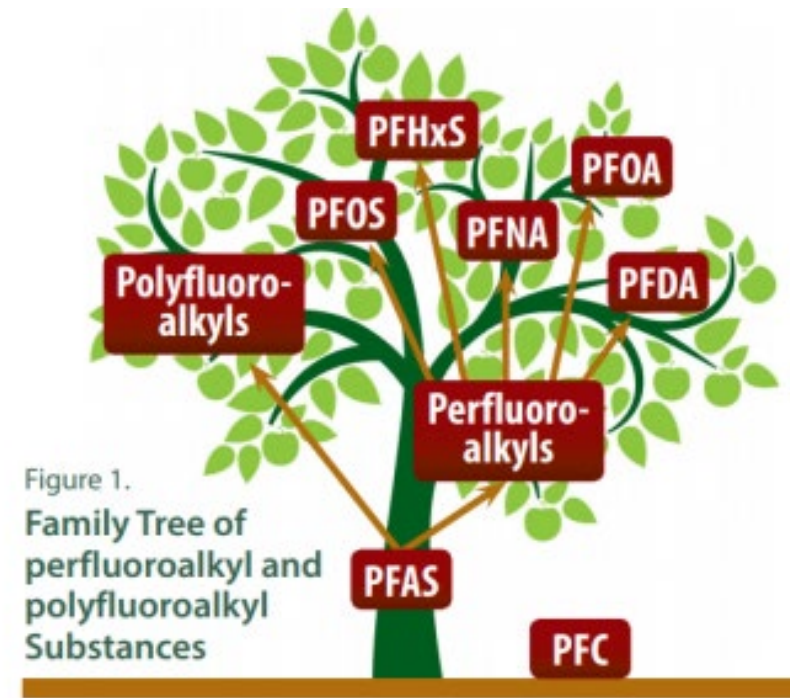


Figure 1.
Family Tree of
perfluoroalkyl and
polyfluoroalkyl
Substances

Image Source: ATSDR (2019)

Exposure Assumption Challenges & Opportunities

Who are we protecting with FCAs?

- Current methods rely on EPA default assumptions.
 - 80 kg body weight
 - 8 oz. meal size
 - X grams/day fish consumption rates
- Need to learn about our communities and their goals.
 - Survey local communities to understand fish consumption patterns.
- Special need to consider vulnerable populations, especially those with cultural ties to fish consumption.

Estimated Fish Consumption Rates for the U.S.
Population and Selected Subpopulations
(NHANES 2003-2010)

Final Report

April 2014
EPA-820-R-14-002



DARTMOUTH



UNH SURVEY
CENTER

“We don’t talk about... risk versus benefits?”



Image Source: Buzzfeed.com (2022): <https://www.buzzfeed.com/amhtml/andriamoore/lin-manuel-miranda-encanto-oscar-song>

An evolving issue.

- This approach does not quantitatively weigh risk versus benefit of fish consumption.
- What is the impact to health?
- Are there cultural impacts for vulnerable groups?

$$\frac{RfD \times BW}{MS} = DTC$$

In Summary

Fish consumption advisories are:

- *Public health tools for reducing exposure* to harmful contaminants.
- *Expected to evolve with changes in knowledge about PFAS* occurrence and toxicity.
- **Limited by data availability**, both about chemical toxicity, occurrence and knowledge about communities.



Acknowledgements

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- And the New Hampshire Communities and Advocacy Groups



Image Source: Petali, JM (2021)

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