

# Considerations and Challenges in Setting Fish Consumption Advisories for PFAS

PFAS External Advisory Group Meeting

Wisconsin Department of Natural Resources

February 21, 2025

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Environmental Solutions

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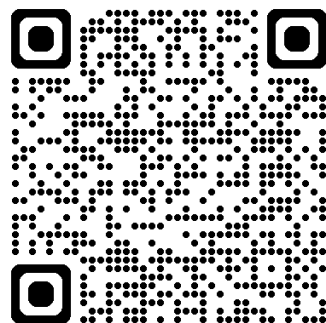
- DOE U.S. National Laboratory operations management
- NSF National Ecological Observatory Network (NEON)
- NSF Arctic Research Science and Logistics Support

# Presentation Acknowledgements

This presentation summarizes a review article with contributions from academia, government and the private sector.

This would not be thorough without these diverse perspectives.

For a copy of this review article, use this QR Code:



Integrated Environmental Assessment and Management — Volume 00, Number 00—pp. 1–20

Received: 5 October 2023 | Revised: 18 April 2024 | Accepted: 23 April 2024

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## Critical Review

### Considerations and challenges in support of science and communication of fish consumption advisories for per- and polyfluoroalkyl substances

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# What are we discussing today?

## PFAS in fish and risk assessment.

- Posterchild issue understand PFAS in food.
- Presentation content is from a well-received peer reviewed work.
- We will consider risk assessment, management and communication.

## Considerations for other foods.

- Lessons from fish and seafood studies have insights for other food: agricultural products, wild game, and more.
- Sampling and analytical challenges are similar.
- Helpful for identify research and regulatory needs.

## Hurdles for effective investigations.

- PFAS work isn't easy, you all know that.
- I will share our "We should have..." moments.
- Think about changing your *No* moments to *No, but* ideas.

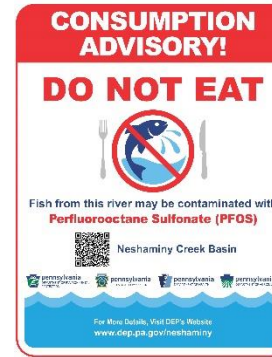
## Strategies to answer your questions.

- Which expertise and teams do you need for investigations?
- How can you leverage existing resources?
- How to promote collaboration between stakeholders?

# What are Fish Consumption Advisories (FCAs)?

- **Non-enforceable guidance** for consumption of recreationally-caught fish.
  - May be applied to “seafood” like shellfish or reptiles.
- Most U.S. public health agencies follow [U.S. EPA Guidance \(2000\)](#) for setting FCAs.
- FCAs exist for individual chemicals and certain groups of chemicals.
  - Mercury, Arsenic, Lead, DDT
  - Polyaromatic hydrocarbons (PAHs), Polychlorinated biphenyls (PCBs), Dioxins

**Broader Than FCAs:** Some agencies also issue similar advisories for shellfish, waterfowl, deer and other game or natural/foraged products.



FOR IMMEDIATE RELEASE: 2023-01-18  
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[dhsmedia@dhs.wisconsin.gov](mailto:dhsmedia@dhs.wisconsin.gov)

## NEW PFAS FISH CONSUMPTION ADVISORY ISSUED FOR LAKE WAUSAU AND STEVENS POINT FLOWAGE

ELEVATED LEVELS OF PFAS FOUND IN SEVERAL FISH SPECIES

Pennsylvania Department of Environmental Protection (2024): [Neshaminy Creek Fish Advisory \(pa.gov\)](#)

New Hampshire Department of Environmental Services (2024): [Fish Consumption | NH Department of Environmental Services](#)

Wisconsin Department of Natural Resources (2023): [New PFAS Fish Consumption Advisory Issued For Lake Wausau And Stevens Point Flowage | Wisconsin DNR](#)

### Fish Consumption

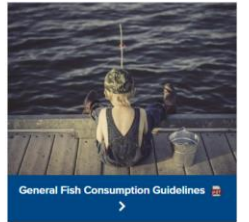
Providing guidance on safer options for eating fish caught in New Hampshire.

Fish and shellfish are an important part of a healthy diet. They are a good source of low-fat protein and contain nutrients like omega-3 fatty acids, a key nutrient for brain development.

There are potential health risks in consuming fish and shellfish with elevated levels of contaminants. These contaminants include chemicals like mercury, polychlorinated biphenyls (PCBs), per and polyfluoroalkyl substances (PFAS) and more. To help recreational fishers and shellfish harvesters reduce their risks, the State of New Hampshire has statewide and waterbody-specific fish consumption advisories that provide recommendations for safer portions of certain species:

- [New Hampshire Fish Consumption Guidelines](#)
- [Recomendações sobre consumo de pescado em New Hampshire](#) (Portuguese)
- [Directives en matière de consommation de poisson dans le New Hampshire](#) (French)
- [Directrices de consumo de pescados en New Hampshire](#) (Spanish)
- [न्यू ह्याम्पशायरमा माका उपभोगसम्बन्धी निर्देशिका](#) (Nepali)
- [新罕布什尔州鱼类食用指南](#) (Chinese)

Mercury in Fish	PFAS in Fish	Safer Consumption
	NHDES continues to monitor mercury levels in fish tissues. In 2018, NHDES published a report analyzing the mercury content in 26 freshwater fish species from over 200 New Hampshire waterbodies from 1992-2016. The report evaluates human health risks, trends over time, and geographic patterns of mercury in fish tissue. For more information, read the <a href="#">Mercury in Fish Tissue Full Report</a> .	NHDES also provides a <a href="#">summary of the report</a> .



Related Content

# WI DNR Fish Consumption Advisories for PFAS

## NEW PFAS FISH CONSUMPTION ADVISORY ISSUED FOR LAKE WAUSAU AND STEVENS POINT FLOWAGE

*ELEVATED LEVELS OF PFAS FOUND IN SEVERAL FISH SPECIES*

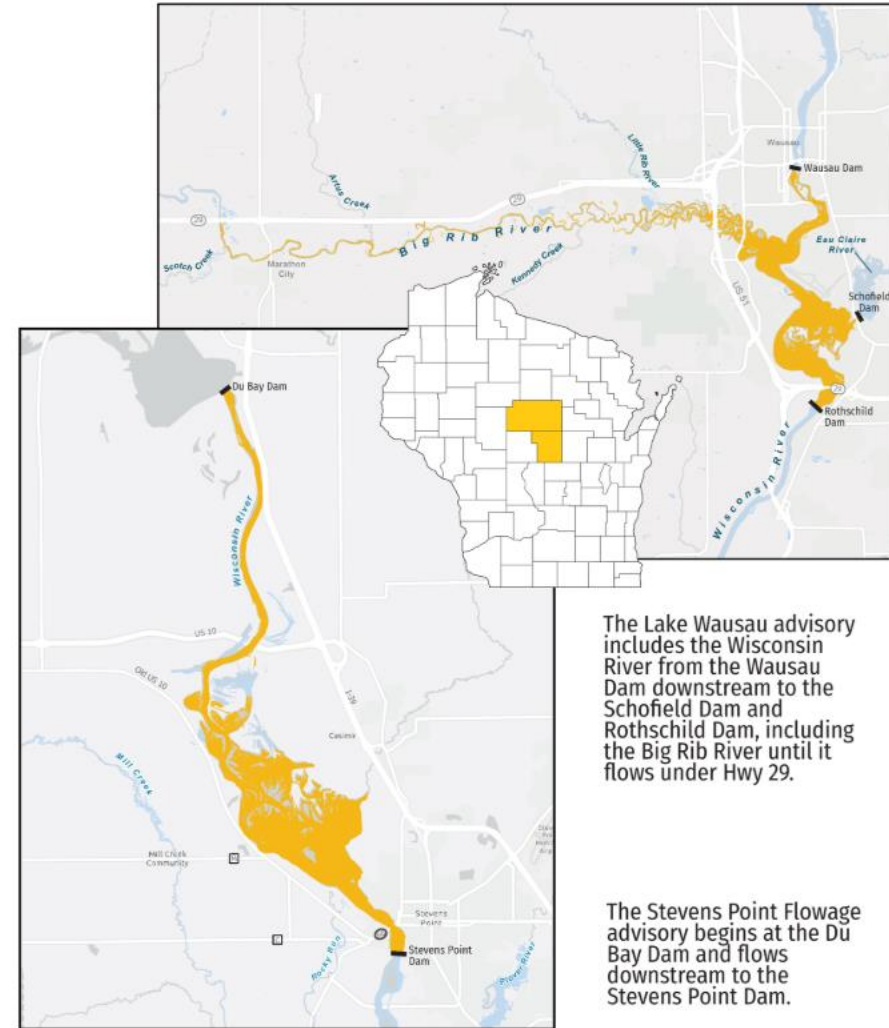
**MADISON, Wis.** – The Wisconsin Department of Natural Resources (DNR) and the Department of Health Services (DHS) today announced a new PFAS-based consumption advisory for several fish species in Lake Wausau in Marathon County and the Stevens Point Flowage in Portage County (both of which are segments of the Wisconsin River) based on fish sampling.

Elevated levels of PFOS (perfluorooctane sulfonate), a type of PFAS (per- and polyfluoroalkyl substances), were found in several fish species sampled from both Lake Wausau and the Stevens Point Flowage.

As a result, the DNR and DHS recommend the following consumption guidelines for anyone harvesting fish from those waterbodies:

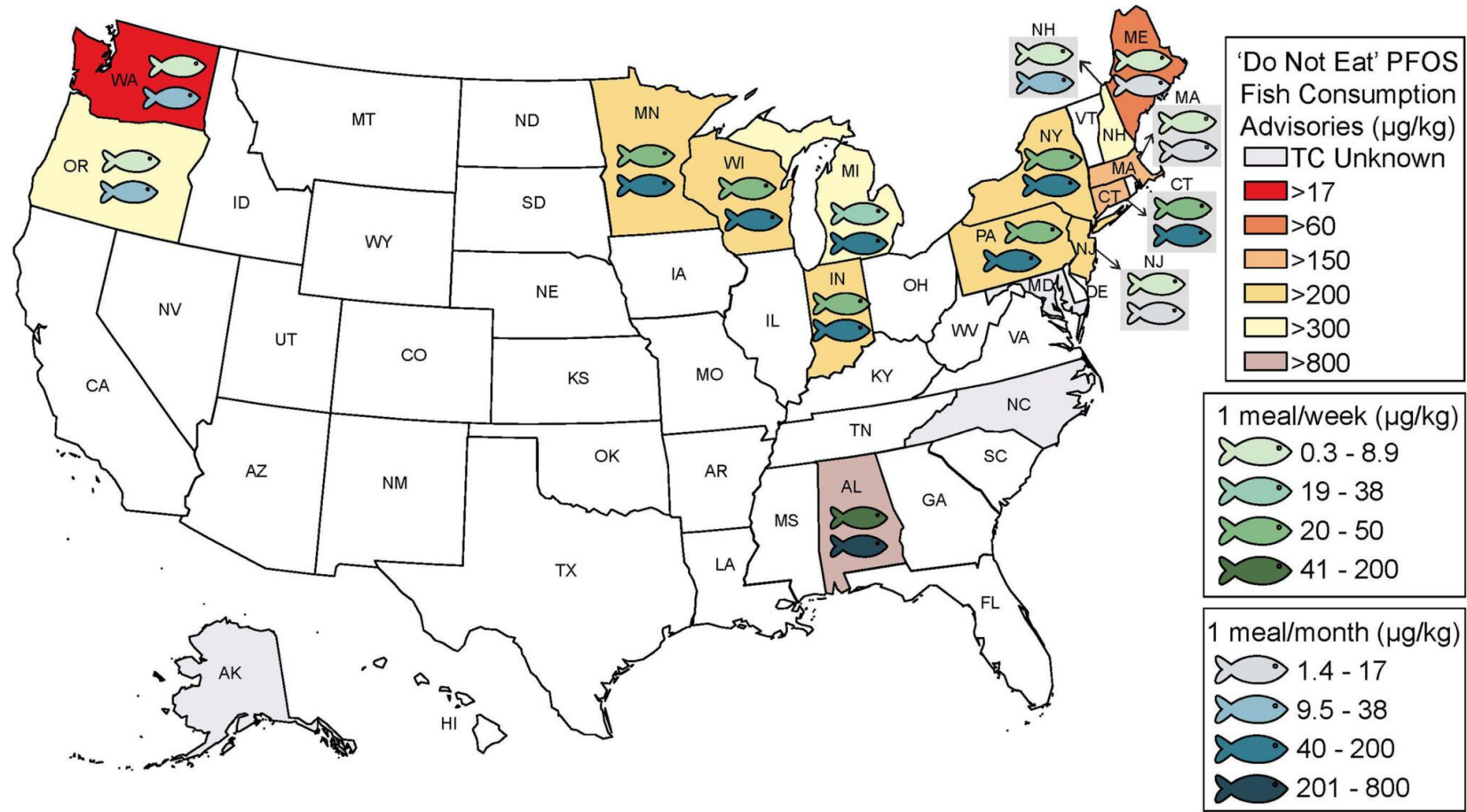
**Lake Wausau (Marathon County):** Advisory is from the Wausau Dam downstream to the Schofield Dam and Rothschild Dam, including the Big Rib River until it flows under Hwy 29.

SPECIES	PREVIOUS ADVISORY	NEW ADVISORY
Black Crappie	General/Statewide*	1 meal/week
Bluegill	General/Statewide*	1 meal/week
Rock Bass	General/Statewide*	1 meal/week
Yellow Perch	General/Statewide*	1 meal/week
Common Carp	1 meal/month (PCBs)	1 meal/month (PCBs) (No Change)
Redhorse	1 meal/month (PCBs)	1 meal/month (PCBs) (No Change)



Wisconsin Department of Natural Resources (2023): [New PFAS Fish Consumption Advisory Issued For Lake Wausau And Stevens Point Flowage | Wisconsin DNR](#)

# PFAS FCAs Across the U.S. are Evolving



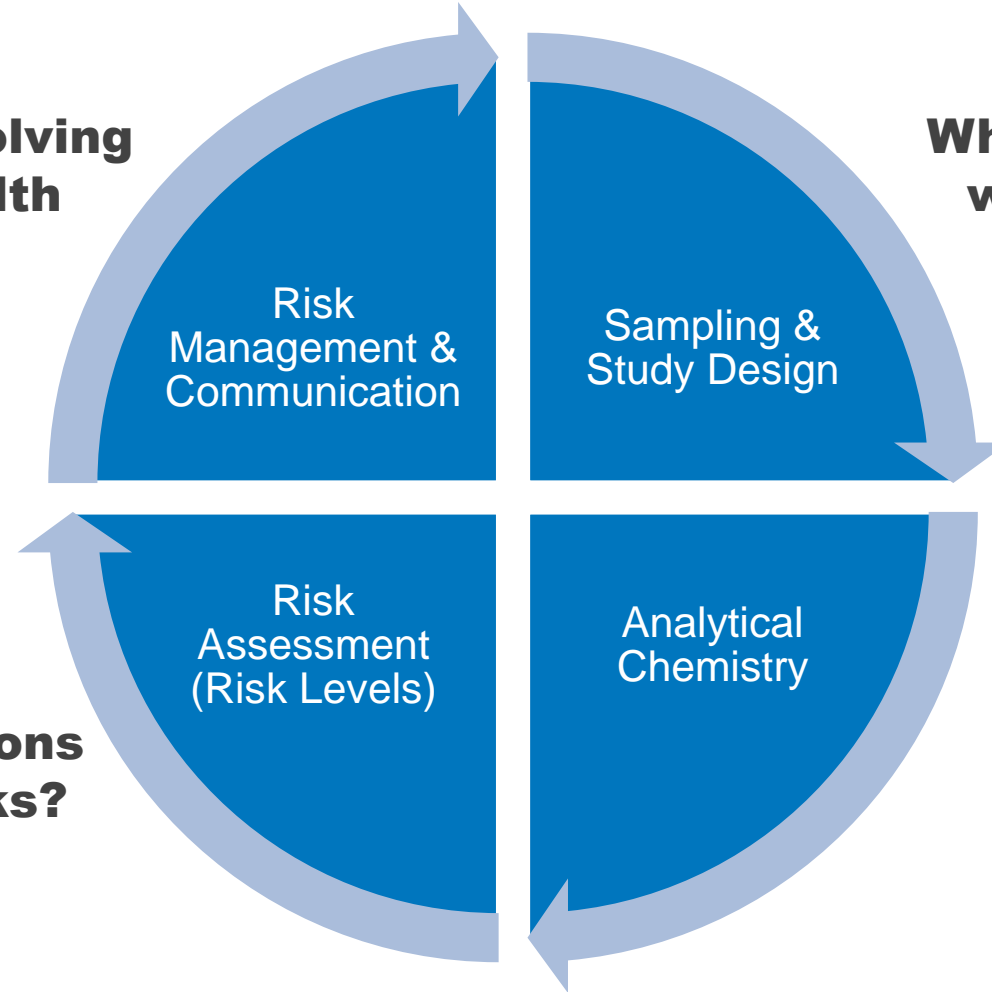
- Map was current in 2023.
- States are (re)considering their PFAS FCAs.
- New USEPA information about toxicity affects these considerations.
  - Namely PFOS and PFHxS
- Useful resources for tracking these changes:
  - [USEPA Fish & Shellfish Advisories](#)
  - [Environmental Council of States \(ECOS\) PFAS Page](#)

Source: Petali et al. (2024). [Considerations and challenges in support of science and communication of fish consumption advisories for per- and polyfluoroalkyl substances - Integrated Environmental Assessment and Management](#)

# Overview of the Challenges for PFAS FCAs or Advisories for of Foods

**How do we address evolving science and public health protection?**

**Where, when and what should we sample to maximize data collection?**



**What PFAS concentrations present meaningful risks?**

**Are we measuring enough PFAS and at low enough concentrations?**



# Numeric Basis of Fish Consumption Advisories

$$\frac{\text{Toxicity Factor} \times \text{Body Weight (kg)}}{\text{Meal Size (g/day)}} \times \text{Other Factors} = \text{Trigger Concentration (ng/g)}$$

## Toxicity Factors

- **Reference Dose (RfD)** for non cancer effects
  - mg/kg/day or ng/kg/day
  - Relatively low for PFOA, PFOS and PFHxS
- **Oral slope factor (OSF)** for carcinogen risks
  - mg/kg/day<sup>-1</sup>
- Often chemical specific and do not account for mixtures.
- These numbers vary by orders of magnitude.

## Exposure Assumptions

- Assumed **body weight** for children, adults and subpopulations.
- **Meal sizes and consumption rates.**
  - Varies by sex, age, region of the country and cultural practices.
- What portion of the fish/animal/plant is being consumed?
  - Fillet versus whole fish

## Other Factors

- What are the other sources of exposure?
- What's the **bioavailability** of PFAS from food?
- Does cooking affect PFAS concentrations?
- Are there precursors, PFAS mixtures, or likely co-contaminants?

## Example FCA for PFOS (ng/g or ppb)

Adult - 80 kg

Meal size - 8 oz. or 227 g

EPA RfD –

1×10<sup>-7</sup> mg/kg/day

or 0.1 ng/kg/day

**1 Meal Per Week Limit at 0.25 ng/g PFOS**

# Example of Characterizing Local Exposures: Consumer Survey in New Hampshire

## How much fish, game or forage food are people actually consuming?


- Federal and state agencies default to historical estimates of how much we eat.
  - [Exposure Factors Handbook | US EPA](#)
- Local surveys of consumer behaviors are preferred to this general estimates.
- In NH, an academic-state partnership measured consumption patterns.
  - NH residents consume more seafood than previously estimated.
  - Risk of common seafood items was more accurately assessed.




[Home](#) > [Exposure and Health](#) > [Article](#)

## Patterns of Seafood Consumption Among New Hampshire Residents Suggest Potential Exposure to Per- and Polyfluoroalkyl Substances

Original Paper | Published: 12 April 2024

Volume 16, pages 1501–1517, (2024) [Cite this article](#)

[Kathryn A. Crawford](#), [Lisa G. Gallagher](#), [Nathan G. Giffard](#), [Christine L. Gardiner](#), [Tracy Keirns](#), [Sujan Fernando](#), [Thomas M. Holsen](#), [Jonathan M. Petali](#), [Celia Y. Chen](#) & [Megan E. Romano](#) 

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### Abstract

Fish and shellfish (“seafood”) consumption has health benefits yet is a source of exposure to bioaccumulative environmental contaminants, such as per- and polyfluoroalkyl substances (PFAS), that may cause adverse health impacts. We conducted a population-based survey of 1829 New Hampshire (NH) residents in June 2021 to determine consumption frequency, portion size, types and sources of seafood among adults and children (2–11 years old). We purchased the most commonly consumed species from a seafood market in Portsmouth, NH and quantified 26 PFAS compounds. For PFAS with available health guidance values we calculated hazard quotients to assess exposure risk from seafood consumption. Among adults, 95% reported consuming seafood within the last year and shrimp, haddock, salmon, and canned tuna were most frequently consumed.

**Source:** Crawford, et al. (2024) Patterns of Seafood Consumption Among New Hampshire Residents Suggest Potential Exposure to Per- and Polyfluoroalkyl Substances. *Expo Health* 16, 1501–1517. <https://doi.org/10.1007/s12403-024-00640-w>

# Sampling & Study Design: Where and When to Sample?



Photo: Dartmouth staff sampling in Merrimack NH (Petali, 2023)

## BIOLOGICAL FACTORS

### Species-specific diet and feeding strategies

- Who eats these species and which parts of the animal?
- What do these species eat?

### Species-specific differences in uptake, elimination, metabolism, and reproductive status

- What is the magnitude of bioaccumulation for PFAS?
- How does physiology and life history change bioaccumulation?

### Species-specific native range or migration patterns

- Are measured PFAS only a problem here, or move with the animal?
- How fast does depuration or accumulation occur?
- Where else could these be consumed?

## ENVIRONMENTAL FACTORS

### Seasonality

- Does temperature, weather or other factors affect PFAS bioavailability to organisms?
- Do seasonal changes influence physiology and bioaccumulation?

### Precipitation events

- How do storms, runoff and other hydrological events affect uptake?

### Waterbody and habitat characteristics

- Is this a relevant waterbody for human exposure?
- Are other contaminants of concern here?

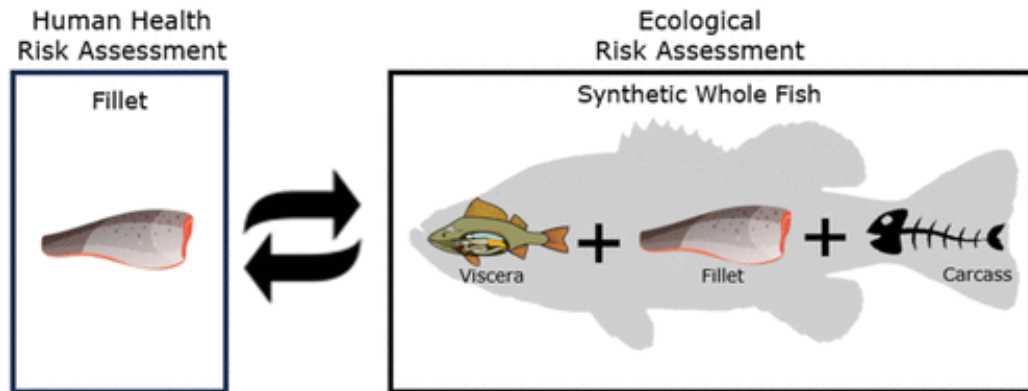
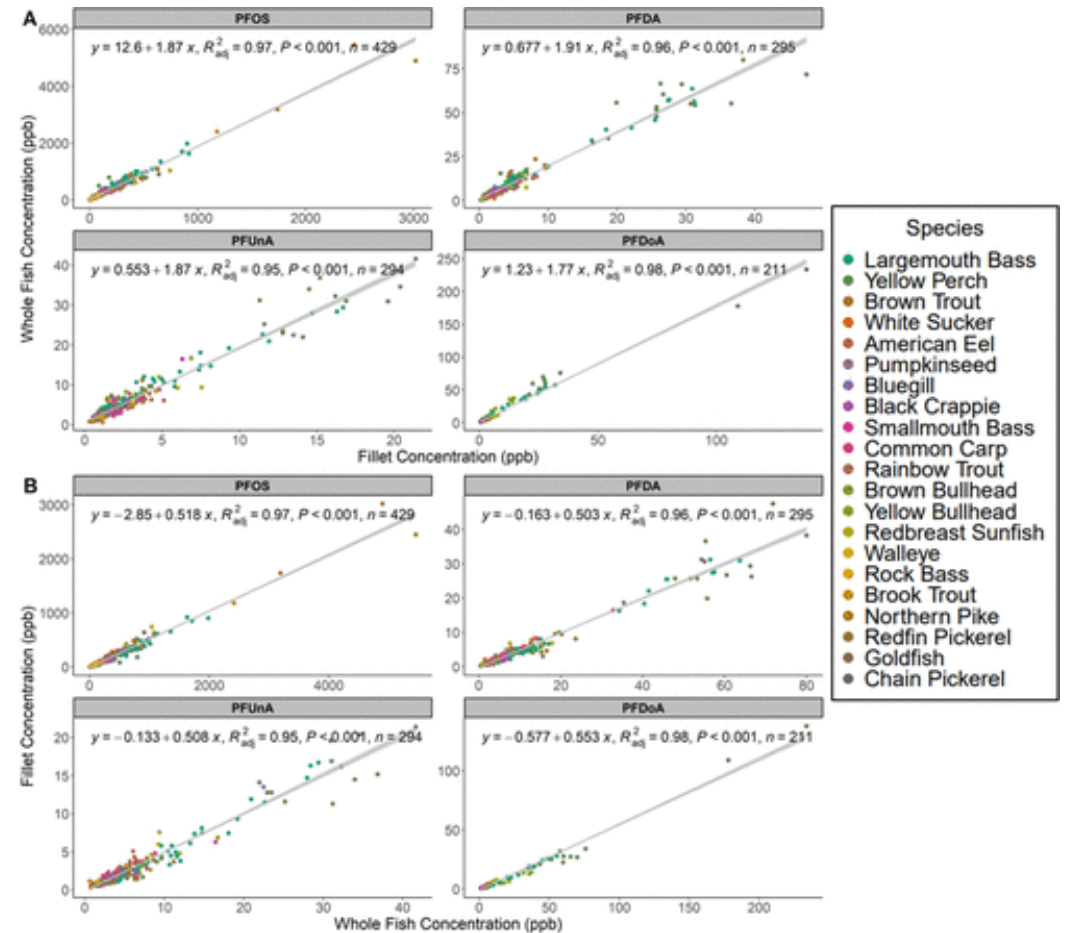
### Human influences

- What local sources of PFAS are there?
- How would this change expected PFAS and analytical methods you use?

# Example of Leveraging Existing Sampling: New York State's Fish Tissue Analyses

- Leveraging monitoring data that informs both ecological and human health risk assessments.
- Understanding PFAS burdens between whole body versus fillets in fish.
  - Informs ecological and human health risk assessments.
  - Informative for assessing risks to special populations that may use more ingredients.

Source: Levanduski et al. (2024). [Two for the Price of One: Deriving Per- and Polyfluoroalkyl Substances \(PFAS\) Fillet and Whole-Body Conversion Equations in Fish](#) | Environmental Science & Technology Letters (acs.org)



# Measuring PFAS in Fish Tissues

- Like other environmental media, your **analytical methods matter**.
- How will you use the analytical data?
  - *Do you have unique sources of PFAS at your sites?*
  - *Can these be “fingerprinted” to tease apart sources?*
  - *Not all PFAS have toxicological information.*
  - *How will you assess and communicate these results?*

**2024 U.S. EPA Analyte Recommendations:** [EPA Releases New Science-Based Recommendations to Help More States, Tribes, and Territories Reduce Exposure to PFAS in Fish | US EPA](#)

Analytical method	Method description	Analytical instrumentation	Used for FCA derivation (yes/no)
Target analysis	Finite list of compounds	LC-MS/MS	Yes
Nontarget analysis (NTA)	Scans for unknown PFAS compounds	HRMS with quadrupole time-of-flight (Q-TOF) or Orbitrap analyzers	No
Total oxidizable precursor (TOP) assay	Target analytes and oxidizable precursors	LC-MS/MS	Yes
Total or extractable organic fluorine	Quantifies the total or extractable organic fluorine in a sample	Combustion ion chromatography (CIC); proton-induced gamma-ray emission (PIGE)	No

# Analytical Challenges for Measuring PFAS in Fish, Game and/or Plant Tissues

ISSUE	DESCRIPTION	POTENTIAL SOLUTIONS
<b>Precursors</b>	Contributes to underestimating exposure to target consumers.	<ul style="list-style-type: none"> <li>• Use non-targeted or TOP methods</li> <li>• Collect data to characterize uncertainty</li> <li>• Re-evaluate risks as science evolves</li> </ul>
<b>Matrix interference</b>	Contributes to over- or underestimating exposure to target consumers	<ul style="list-style-type: none"> <li>• Review your analytical results</li> <li>• Meet with your chemists</li> <li>• Review literature for similar results</li> </ul>
<b>Analytical level limitations</b>	Can we measure the levels that determine risk or potential actions?	<ul style="list-style-type: none"> <li>• Prioritize sample analysis around current available capabilities.</li> <li>• Archive samples for future analysis</li> </ul>
<b>Availability of standards</b>	Which PFAS can we reliably identify?	<ul style="list-style-type: none"> <li>• Use non-targeted or TOP methods</li> <li>• Archive samples for future analysis</li> </ul>
<b>Method acceptance &amp; validation</b>	Most FCAs are based on data from the targeted approach, relying on validated methods and reproducible results.	<ul style="list-style-type: none"> <li>• Review study objectives</li> <li>• Meet with policy makers or regulators before analyses</li> </ul>

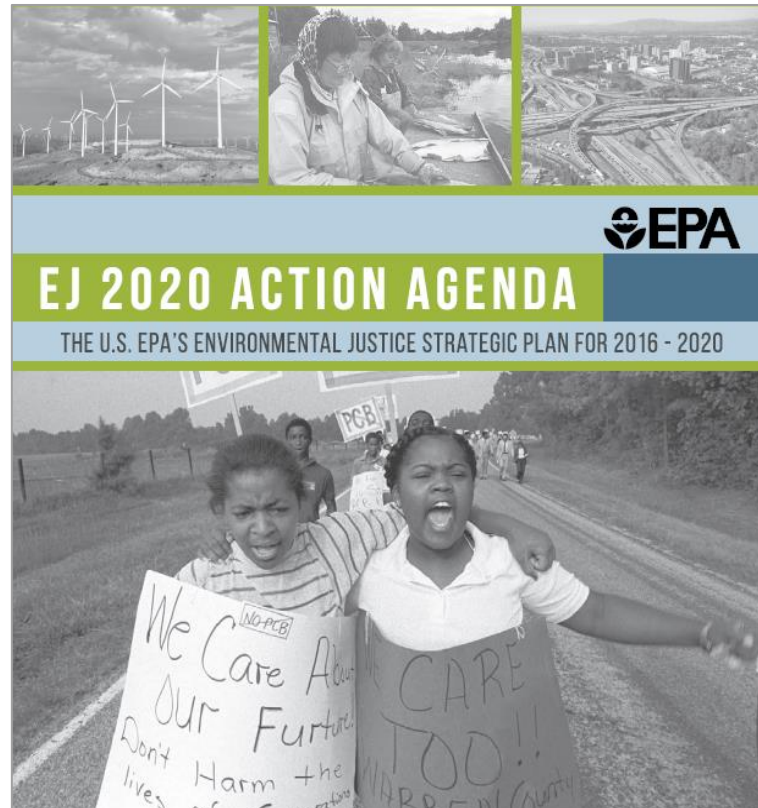
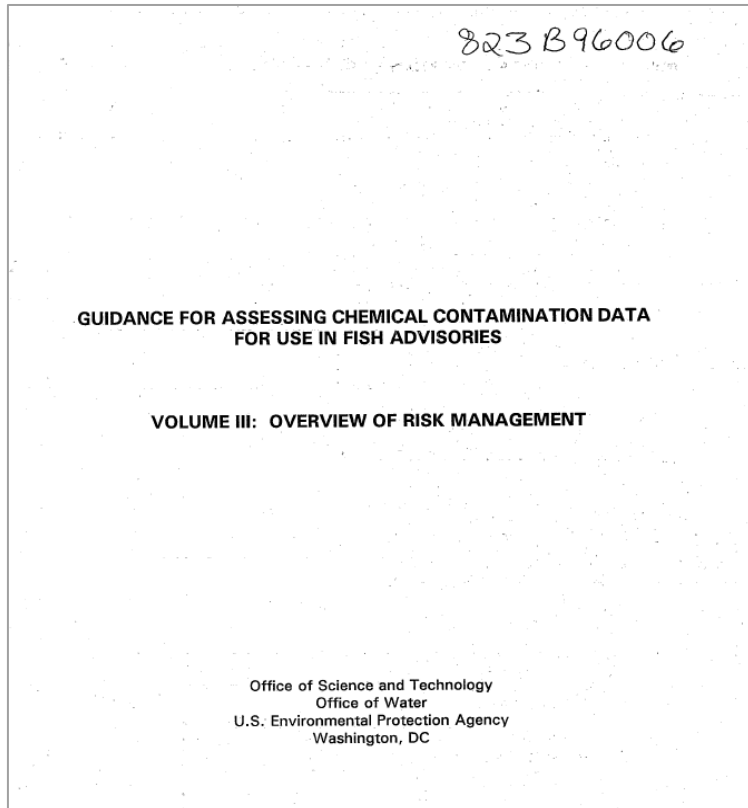
# You have sampled, analyzed the data and developed FCAs. Now what?

- Are your local agencies staffed and resourced for outreach?
- How do your local agencies communicate advisories?
  - *Do your communities even trust public health agencies?*
- How to engage with special populations?
  - *Subsistence fishers?*
  - *Language barriers?*
  - *Signs, social media, websites?*
- What **resources** are available to limit or redirect harvesting and consumption?
- How do “you” as individuals, regulators and policy makers address **risks versus benefits**?



Photo Credit: “Loon Eggs Tell Story of forever chemicals in Squam Lake.” Valley News (2023)

# Environmental Justice, Cumulative Impacts, and “Good Customer Service”



Rapidly shifting landscape for risk management policies and practices.



# Example of Basic Customer Service from New Hampshire's State Agency

- Start with a conversation, not assumptions.
- Check your agencies available resources for translation services.
  - Is there funding for basic translation?
- Use available information to identify potential at risk groups.
  - Census Bureau Data
  - US EPA EJ Screen is no longer available.
  - Conduct community surveys/interviews to assess needs.



## Language Access Services

Providing translations for NHDES website content.

NHDES ensures that individuals with Limited English Proficiency (LEP) have meaningful access to all NHDES programs. Policy guidance published by the U.S. Environmental Protection Agency (EPA) defines LEP as "individuals who do not speak English as their primary language and who have a limited ability to read, write, speak, or understand English."

### Webpage translation

All NHDES webpages can be automatically translated by clicking on the "Change Site Language" option at the top of the page and then selecting a language from the dropdown menu.

If you need a translation of a standalone document, please submit a [Translation Request Form](#).

- > Español (Spanish)
- > Português (Portugues)
- > Français (French)
- > 简体中文 (Simplified Chinese)
- > 繁體中文 (Traditional Chinese)
- > नेपाली (Nepali)

### Maintaining demographic data

The New Hampshire Department of Environmental Services (NHDES) ensures that no person shall be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination, under any program or activity receiving financial assistance from NHDES on the basis of race, color, or national origin. In addition, NHDES does not discriminate based on age, sex, marital status, religion, gender identity or gender expression, income, disability, sexual orientation, citizenship status, status as a veteran or any other legally protected status.

In order to ensure compliance with [40 C.F.R. § 785.602](#), which requires the applicant/recipient of federal funds to maintain demographic data on the race, color, national origin, sex, age, or handicap of the population it serves, NHDES adheres to the following procedure:

- At the beginning of each state fiscal year, a refreshed link to the [New Hampshire U.S. Census Bureau Profile](#) will be provided on the NHDES website in a prominent location on its [Civil Rights and Nondiscrimination webpage](#).
- Data in the following categories is provided on the linked U.S. Census Bureau page:
  - Populations and People.
  - Income and Poverty.
  - Education.
  - Employment.
  - Housing.
  - Health.
  - Business and Economy.
  - Families and Living Arrangements.
  - Race and Ethnicity.

# Summary

**PFAS advisories are challenging but not impossible.**

**Similar challenges as other chemicals (e.g., PCBs, mercury, dioxins).**

**Unique challenges exist for PFAS.**



**The science is evolving, expanding our PFAS toolbox.**

**Collaboration is crucial to address PFAS in natural resources.**

**Effective Risk Communication = Effective Risk Management**

# Addressing PFAS Requires Diverse Teams

Battelle is addressing the problem from several angles.



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# Thank you for your time.

## Contact Information

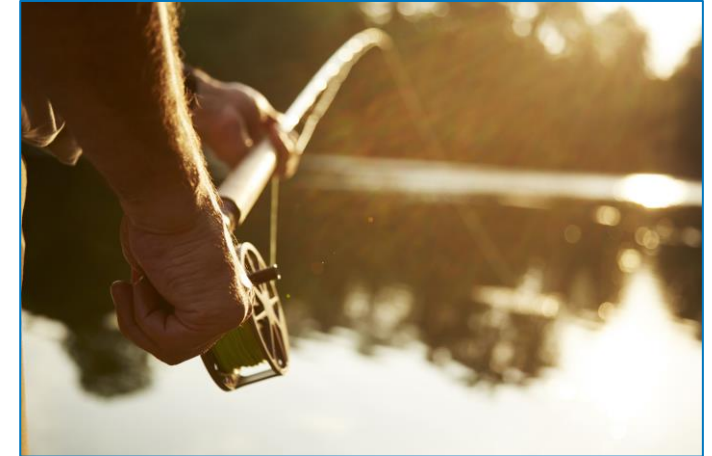
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Additional Resources:

- [Support for Fish and Shellfish Advisory Programs | US EPA](#)
- [US FDA Announcements on PFAS | FDA](#)
- [2023 National Fish Forum | US EPA](#)
- [Interstate Technology & Regulatory Council's \(ITRC\) PFAS Technical and Regulatory Guidance Document](#)
- [PFAS and Emerging Chemicals | Battelle Market](#)



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