United States Environmental Protection Agency
Office of Water
Washington, DC 20460
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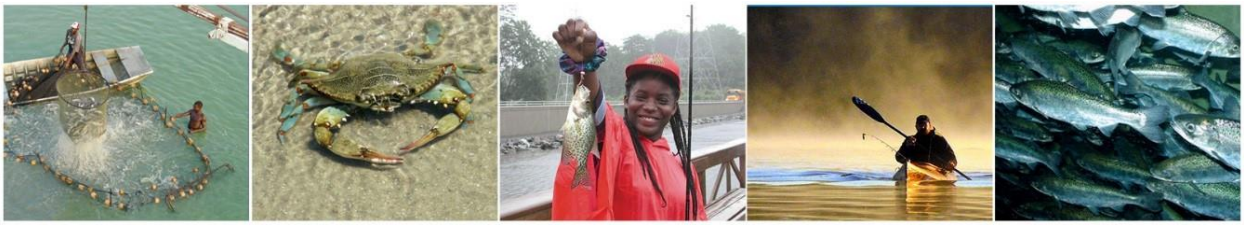
June 2023

Proceedings of the 2023 National Forum on Contaminants in Fish



Virtual – February 28th, March 2nd, 7th, and 9th

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ACKNOWLEDGMENTS

The U.S. Environmental Protection Agency would like to thank the steering committee for their support in developing the 2023 National Forum on Contaminants in Fish. The steering committee included the following individuals:

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INTRODUCTION

On February 28th, March 2nd, 7th, and 9th, 2023, representatives of states, U.S. territories, tribes, federal agencies, and other interested organizations and individuals virtually attended the 2023 National Forum on Contaminants in Fish. The U.S. Environmental Protection Agency (EPA) sponsored the Forum.

The 2023 Forum was the thirteenth National Fish Forum. The first Forum was convened in 1990, and Forums have been held every few years. The location of the Forum has rotated around the country and has included Alexandria, Virginia (1994, 1995, 1997, 1999, 2014); Chicago, Illinois (2001); Burlington, Vermont (2002); San Diego, California (2004); Baltimore, Maryland (2005); Portland, Maine (2007); and Portland, Oregon (2009).

Early Forums were attended by representatives from states and tribes, and academics, but as public interest in fish consumption advisories increased, additional groups became involved. Attendees of the 2023 Forum included state, tribal, and federal governments/agencies, local governments, environmental advocacy groups, utilities, academia, consultants, and non-governmental organizations, among others. In addition, representatives from several other agencies, including the U.S. Food and Drug Administration (FDA), the U.S. Geological Survey (USGS), as well as representatives from other countries, usually participate in the Forum. The agenda for each Forum is developed by a steering committee, generally composed of representatives of state, tribal, and federal agencies.

The agenda was developed to provide a variety of perspectives and approaches to assessing and communicating public health risks associated with consumption of contaminated fish. The Forums present the latest science and public health policies.

Topics for the 2023 National Forum on Contaminants in Fish included:

- Fish Consumption Advisories
- PFAS Toxicity Assessments
- Beyond PFOS: What's in the fish? Why does it matter?
- PFAS in Commercial Fish
- PFAS Monitoring Studies
- Risk Communication for PFAS
- PFAS: It’s Not Just in Finfish
- PFAS Research: Developmental, Reproductive and Neural Effects
- Fish Consumption and Equity
- Risk Communication
- Fish Data Tools
- Climate Change
- Contaminants in Fish

This document contains the proceedings of the Forum, including the agenda, abstracts of presentations and biosketches of presenters and moderators.

For additional information, please contact:

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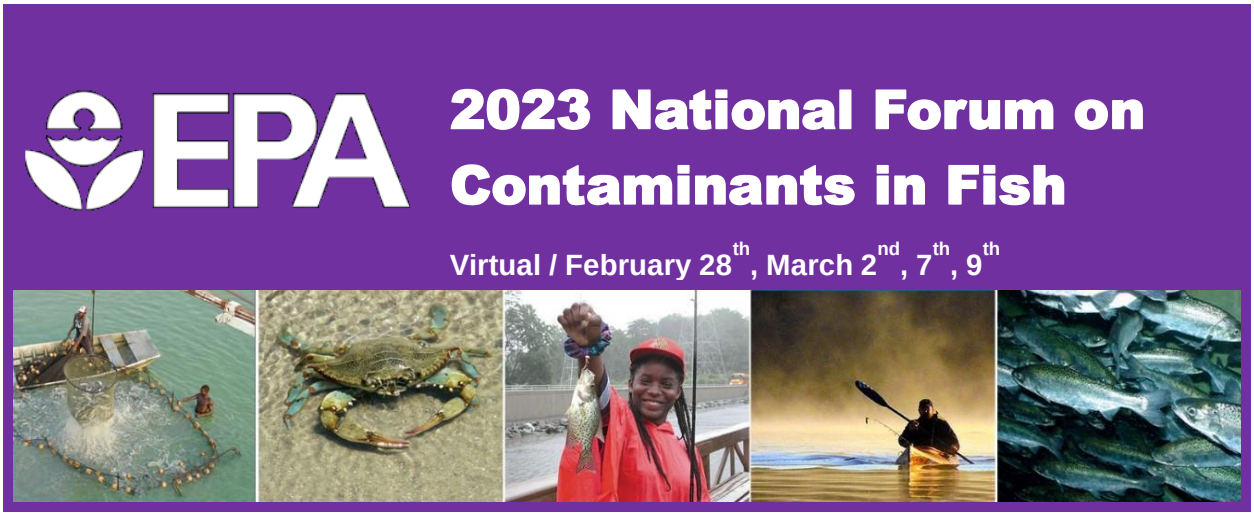

SECTION I: AGENDA

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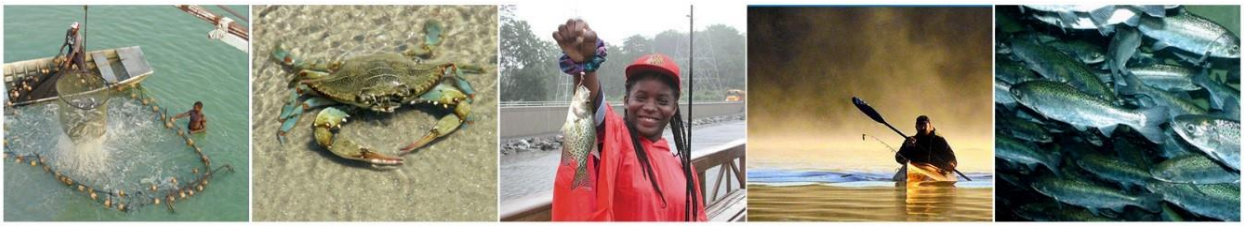


AGENDA ***(All times are Eastern Time)***

Week 1

TUESDAY, FEBRUARY 28	PRESENTER NAME(S)	ABSTRACT TITLE
12:00 – 1:15 PM	Welcome | **John Healey**, Master of Ceremonies (U.S. EPA)	
	Opening Remarks & Introductions | **Deborah Nagle** (U.S. EPA)	
	Keynote Speaker | **Elsie Sunderland** (Harvard University)	
1:15 – 1:30 PM Break		
Session 1: Fish Consumption Advisories Moderator: **Marc A. Nascarella** (Massachusetts Dept. of Public Health)		
1:30 – 2:10 PM	**David Farrer** (Oregon Health Authority)	*Oregon Fish Consumption Advisories for Migratory Species*
	Samuel Cohen (Duke University Superfund Research Center)	*Collecting Data to Inform Fish Consumption Advisories in North Carolina When You are Outside of State Government*
	Matt Chumchal (Texas Christian University)	*Effect of Land Cover on Ecoregion-Scale Spatial Patterns of Mercury Contamination of Largemouth Bass in the Southeastern United States*
	Sarah Janssen (U.S. Geological Survey)	*Exploring Spatiotemporal Patterns in Fish Mercury Bioaccumulation with Mercury Isotopes*
	Wesley Smith (California Office of Environmental Health Assessment)	**POSTER**: *2021 Southern California Oil Spill Seafood Safety Assessment*
2:10 – 2:30 PM	Discussion and Questions	
Session 2: PFAS Toxicity Assessments Moderator: **Sandra Goodrow** (New Jersey Dept. of Environmental Protection)		
2:30 – 3:45 PM	**Brittany Jacobs** (U.S. EPA)	*EPA's PFOS Health Effects Assessment: Current Status*
	Wendy Heiger-Bernays (Boston University)	*Influence of Chemical Mixtures on Risk-Based Screening Levels for Fish Consumption Advisories*
	Gloria Post (New Jersey Dept. of Environmental Protection)	*Development of Reference Dose and Fish Consumption Triggers for Perfluoroundecanoic Acid*

		(PFUnDA) for Use in New Jersey Fish Consumption Advisories
3:45 – 4:00 PM	Discussion and Questions	
3:45 – 4:00 PM Break		
Session 3: Beyond PFOS: What's in the fish? Why does it matter? Moderators: **Meghan Williams** & **Sean Strom** (Wisconsin Dept. of Natural Resources)		
4:00 – 4:45 PM	**Heidi Pickard** (Harvard University)	*Per- and Polyfluoroalkyl Substance and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories*
	John Wathen (U.S. EPA)	*Patterns of Occurrence of Poly and Perfluoroalkyl Substances (PFAS) Compounds in Fresh Water Fish from Major U.S. Rivers*
	Anna Robuck (U.S. EPA)	*Occurrence and Bioaccumulation of Novel Poly and Perfluoroalkyl Substances (PFAS) in the Delaware River Estuary, USA*
4:45 – 5:00 PM	Discussion and Questions	
Session 4: Presentation		
5:00 – 5:30 PM	**Adrian Hanley** (U.S. EPA)	*U.S. EPA Draft Method 1633 for Per- and Polyfluorinated Alkyl Substances (PFAS) Validation and Path Forward*
Day 1 Adjourns		

THURSDAY, MARCH 2	**PRESENTER NAME(S)**	**ABSTRACT TITLE**
12:00 – 12:15 PM	Day 2 Welcome | **John Healey**, Master of Ceremonies (U.S. EPA)	
Session 1: PFAS in Commercial Fish Moderator: **Jesse Becker** (New York State Dept. of Environmental Conservation)		
12:15 – 12:45 PM	**Susan Genualdi** (U.S. FDA)	*FDA Survey of Poly and Perfluoroalkyl Substances (PFAS) in Highly Consumed U.S. Seafood Products*
	Betsy Ruffle (AECOM)	*Potential Human Exposure to Perfluoroalkyl Substances (PFAS) from Consumption of U.S. Market Basket Fish and Shellfish*
	Mariam Oladosu (University of Illinois Chicago)	*Per- and Polyfluoroalkyl Substances (PFAS) in Seafood Consumed by Asians in Chicago, IL*
12:45 – 1:00 PM	Discussion and Questions	
Session 2: PFAS Monitoring Studies, Part 1 Moderator: **Angela Preimesberger** (Minnesota Pollution Control Agency)		

1:00 – 1:45 PM	**John Healey** (U.S. EPA)	*Probability-based National Assessments of Contaminants in Fish from Great Lakes and U.S. Rivers*
	Anna Boatman (University of North Carolina, Chapel Hill)	*Per- and Polyfluoroalkyl Substances (PFAS) in Sunfish from North Carolina's Haw River and Jordan Lake*
	Frannie Nilsen (North Carolina Dept. of Environmental Quality)	*PFAS Examined in 14 Fish Species in the Cape Fear River, North Carolina*
	Tom Danielson (Maine Dept. of Environmental Protection)	*Accumulation of perfluorooctane sulfonic acid (PFOS) in Stocked Brook Trout in Fairfield, Maine*
	David Cravens (Kentucky Division of Water)	**POSTER**: *Initial Fish Tissue Results for Per- and Polyfluoroalkyl Substances in Kentucky Waterbodies*
	Cloelle Danforth (Environmental Defense Fund)	**POSTER**: *Drivers for Building Gulf Coast Resilience: Findings from Fish Sampling in Galveston Bay*
1:45 – 2:00 PM	Discussion and Questions	

2:00 - 2:15 PM Break

Session 3: PFAS Monitoring Studies, Part 2
Moderator: **Wayne Richter** (New York State Dept. of Environmental Conservation)

	Breana Bennett (Maine Center for Disease Control and Prevention)	*Surface Water and Fish Impacted by Historic Land Application of Biosolids and Resulting Fish Consumption Advisories in Fairfield, Maine*
	Wayne Richter (New York State Dept. of Environmental Conservation)	*Fish Contaminant Monitoring in New York's Great Lakes Waters*
	Jennifer Sun (Harvard University)	*A food web bioaccumulation model for the accumulation of per- and polyfluoroalkyl substances (PFAS) in fish: how important is renal elimination?*
2:15 – 3:15 PM	**Meghan Cerpa** (University of Illinois Chicago)	*Perfluoroalkyl Substances (PFAS) and Fish Consumption in the Great Lakes Fish Consumer Study (GLFCS)*
	David Andrews (Environmental Working Group)	**POSTER**: *Locally Caught Freshwater Fish Across the United States are Likely a Significant Source of Perfluoroalkyl Substances (PFAS) Exposure*
	Samantha Fontenelle (U.S.EPA)	**POSTER**: *Temporal and Demographic Patterns of PFAS Exposure and the Relationship with Seafood Consumption in the U.S. General Population using 1999-2012 NHANES Data*
3:00 – 3:15 PM	Discussion and Questions	

Session 4: Risk Communication for PFAS
Moderator: **Roxanne Karimi** (Stony Brook University)

	Gillian Miller (Ecology Center)	*Holistic Assessment of Perfluoroalkyl Substances (PFAS) in Fish Filets and Organs using a Community-Science Approach*
3:15 – 4:00 PM	**Rachel Gladstone** (Massachusetts Dept. of Public Health)	*Conducting Perfluoroalkyl Substances (PFAS) Surveillance of Freshwater Fish from Select Locations in Massachusetts*
	Ken Edwardson (New Hampshire Dept. of Environmental Services)	*New Hampshire Department of Environmental Services (NHDES) Fish Tissue Study Results: What does it mean and what might it mean?*
3:45 – 4:00 PM	Discussion and Questions	

4:00 – 4:15 PM Break

Session 5: PFAS: It's Not Just in Finfish
Moderator: **Amy LaLiberte** (Maryland Dept. of the Environment)

	Kayla Boyd (Auburn University)	*Perfluoroalkyl Substances (PFAS) Bioaccumulation, Depuration, and Energetic Cost in the Eastern Oyster, Crassostrea virginica*
	Jonathan Petali (New Hampshire Dept. of Environmental Services)	*Seafood as a Source of Per- and Polyfluoroalkyl Substance Exposure Among Residents of New Hampshire*
	Shannon Jones (University of Delaware)	**POSTER**: *Bioaccumulation of Per-and Polyfluoroalkyl Substances (PFAS) in Delaware Bay Fish and Shellfish*
4:15 – 5:00 PM	**Christine Gardiner** (Dartmouth College)	**POSTER**: *All Perfluoroalkyl Substances (PFAS) and No Pearls: Preliminary Findings of Per- and Polyfluoroalkyl Acids in Great Bay Bivalves*
	Nathan Giffard (New Hampshire Dept. of Environmental Services)	**POSTER**: *Challenges and Opportunities for Evaluating Perfluoroalkyl Substances (PFAS) in Bivalve Shellfish*
	Melanie Hedgespeth (U.S. EPA)	**POSTER**: *Ecological Characteristics Impact Perfluoroalkyl Substances (PFAS) Concentrations in a U.S. North Atlantic Food Web*
4:45 – 5:00 PM	Discussion and Questions	

Session 6: PFAS Research: Developmental, Reproductive and Neural Effects
Moderator: **Jonathon Petali** (New Hampshire Dept. of Environmental Services)

	Ahmed Abdelmoneim (Louisiana State University)	*Effects of Developmental Exposure to Poly and Perfluoroalkyl Substances (PFAS) on the Behavioral Response to Acute Stressors*
5:00 – 5:30 PM	**Jessica Plavicki** (Brown University)	*Effects of Poly and Perfluoroalkyl Substances (PFAS) Exposure on Microglial Function and Neural Network Development*
5:20 – 5:30 PM	Discussion and Questions	

Day 2 and Week 1 Adjournment

Week 2

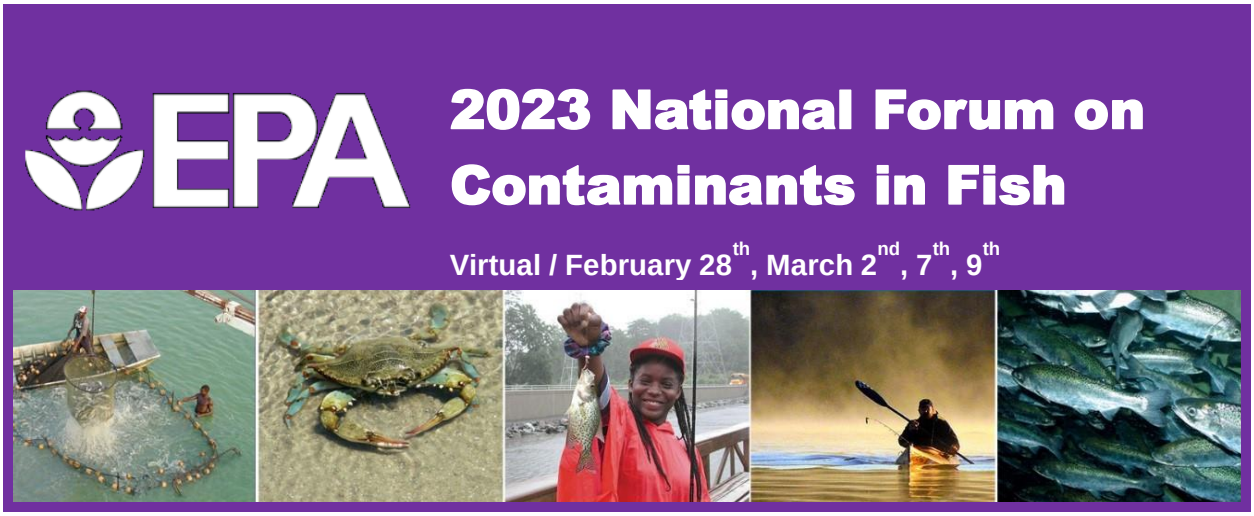
TUESDAY, MARCH 7	PRESENTER(S) NAME	TITLE
12:00 – 12:15 PM	Day 3 Welcome | **John Healey**, Master of Ceremonies (U.S. EPA)	
Session 1: Fish Consumption and Equity Moderator: **Dianne Barton** (Columbia River Inter-Tribal Fish Commission)		
	Trey Sherard (Anacostia Riverkeeper)	*Anacostia River: Urban Subsistence Fishing in Two Jurisdictions' Fish Consumption Advisories*
	Dianne Barton (National Tribal Toxics Council)	*Protection of Tribal Fish Consumers under the Toxic Substances Control Act (TSCA)*
	Meghan Williams (Wisconsin Dept. of Natural Resources)	*The Great Lakes Fish Consumption Collaborative*
12:15 –1:30 PM	**Shanna Alexander** (U.S. EPA, Region 4) & **Marian Olsen** (U.S. EPA, Region 2)	*Development of Site-Specific Fish Consumption Rates for Anglers at Superfund Sites*
	Amina Wilkins (U.S. EPA)	*Subsistence Seafood and Aquatic Biota Consumption Systematic Review and Project Update for the 2023 Fish Forum*
	Sarah Nelson (Appalachian Mountain Club)	**POSTER**: *The Dragonfly Mercury Project in the Merrimack River Watershed: Participatory Science to Inform Risk in Environmental Justice Communities*
1:10 – 1:45 PM	Discussion and Questions	
1:30 – 1:45 PM Break		
Session 2: Risk Communication, Part 1 Moderator: **Page Hingst** (Santee Sioux Nation of Nebraska)		
	Beth Appert (Multnomah County Health Dept.)	*Know Your River, Know Your Food – A Fish Consumption Advisory Program*
	Ruben Chi Bertoni (King County and Seattle – Dept. of Public Health)	*Engagement, Equitable Voice, and Empowerment: Building a Health Promotion Program to Advance Environmental Justice in the Duwamish River Superfund Site*
1:45 – 3:00 PM	**Summer Shaw** (Wisconsin Division of Health Services)	*A Focus Group Study of Fish Consumption Behaviors Among Asian Women in Milwaukee*
	Chiara Klein (Duke University Superfund Research Center)	*An Online Manual to Increase Access to and Application of Best Practices for Communicating Fish Consumption Advisories in North Carolina*
	Matthew Dellinger (Medical College of Wisconsin)	*Gigiigooinaan (Our Fish): A New Advisory to Promote Anishinaabe Health and Wellness*
2:35 – 3:00 PM	Discussion and Questions	
3:00 – 3:15 PM Break		

Session 3: Risk Communication, Part 2 Moderator: **Audrey Van Genechten** (New York State Dept. of Health)		
3:15 – 4:10 PM	**Bruce Lauber** (Cornell University)	*Preferences for Seafood Consumption Advice in Pregnant Women*
	Sarah Rothenberg (Oregon State University)	*Risk Assessment and Effectiveness of Fish Consumption Advisories Among Female Anglers in Oregon, USA*
	Mary Ellen Turyk (University of Illinois Chicago)	*The Efficacy of a Text Messaging Intervention Trial to Conserve Healthy Fish Consumption and Reduce Mercury Contaminants in Reproductive Age Chicago Asian Women*
	Kellie Casavale (U.S. FDA)	*FDA Update: New Studies to Inform Advice About Eating Fish*
	Audrey Van Genechten (New York State Dept. of Health)	*Working with New York State Burmese and Karen Speaking Anglers to Create Culturally Appropriate Fish Advisory Materials*
4:10 – 4:30 PM	Discussion and Questions	
Session 4: Trainings		
4:30 – 5:30 PM	**Tai Lung** (U.S. EPA) & **Matthew Lee** (U.S. EPA)	*Environmental Justice (EJ) Screen*
	Nicholas Spalt (U.S. EPA)	*Office of Enforcement and Compliance Assurance Per- and Poly-fluoroalkyl Substances (PFAS) Analytic Tools*
Day 3 Adjournment		

THURSDAY, MARCH 9	**PRESENTER(S) NAME**	**TITLE**
12:00 – 12:15 PM	Day 4 Welcome | **John Healey**, Master of Ceremonies (U.S. EPA)	
Session 1: Fish Data Tools Moderator: **Brandon Reid** (Michigan Dept. of Health and Human Services)		
12:15 – 1:30 PM	**Ryan Lepak** (U.S. EPA)	*Advancing our Understanding of Contaminant Sources and Burden to Predator Fishes of the Great Lakes Over Vast Time Domains*
	Joel Hoffman (U.S. EPA)	*Incorporating Habitat Use and Life History to Predict Polychlorinated Biphenyl (PCB) Residues in Fish*
	Adam Griggs (U.S. EPA)	*Submitting Fish Contaminant Data to the Water Quality Exchange (WQX)*
	Adam Griggs (U.S. EPA)	*How to Find, Access, and Deploy Fish Contaminant Data Using the Water Quality Portal*

	John Healey (U.S. EPA)	**POSTER**: *An Evaluation of Mercury and Selenium Fish Tissue Monitoring Alternatives: Fish Biopsy Plug Samples Versus Homogenized Whole Fillets*
	John Healey (U.S. EPA)	**POSTER**: *EPA's 2022 National Assessment of Contaminants in Fish from U.S. Lakes*
	Enid Partika (Michigan Technological University)	**POSTER**: *Filling the Data Gap on Responses of Fish Polychlorinated Biphenyl (PCB) Content to Remedial Actions in Torch Lake, Michigan*
1:05 – 1:30 PM	Discussion and Questions	
Session 2: Climate Change Moderator: **Wendy Heiger-Bernays** (Boston University)		
	Stephen Jane (Cornell University)	*Will Climate Warming Enhance Mercury Bioaccumulation in Lake Fishes by Inducing Deep-Water Anoxia?*
1:30 – 2:00 PM	**Astrid Schnetzer** (North Carolina State University	*Food Web Transfer of Cyanobacterial Toxins in the Chowan River and the Western Albemarle Sound, North Carolina*
	Roxanne Karimi (Stony Brook University)	**POSTER**: *Winter Mercury Patterns in Lake Champlain and Future Environmental Health Risks*
1:50 – 2:00 PM	Discussion and Questions	
2:00 – 2:15 PM Break		
Session 3: Contaminants in Fish, Part 1 Moderator: **Elsie Sunderland** (Harvard University)		
	John Logan (Massachusetts Division of Marine Fisheries)	*Mercury Bioaccumulation in Estuarine Food Webs with Different Nitrogen Loads*
	Mike Cyterski (U.S. EPA)	*Spatiotemporal Effects of Interacting Water Quality Constituents on Mercury Concentrations in Everglades' Mosquitofish*
2:15 – 3:05 PM	**Sally Thurston** (University of Rochester) & **Susan Korrick** (Harvard T.H. Chan School of Public Health)	*A Novel Approach to Assessing the Joint Effects of Mercury and Fish Consumption on Neurodevelopment in the New Bedford Cohort Study*
	Tyler Orgon (Red Lake Band of Chippewa Indians)	*Spatial and Temporal Variability of Mercury in Upper and Lower Red Lake Walleye*
	Noel Urban (Michigan Technological University)	*Experimental Evaluation of Additive Interactions in the Toxicity of Methylmercury and Polychlorinated Biphenyls (PCBs) to Zebrafish*
3:05 – 3:30 PM	Discussion and Questions	
3:30 PM – 4:00 PM Break		
Session 4: Contaminants in Fish, Part 2 Moderator: **Vivien Taylor** (Dartmouth College)		

	James Gawel (University of Washington Tacoma)	*Human Health Risk from Fish Consumption in Arsenic Contaminated Lakes in Western Washington*
	Lauren Salvato (Upper Mississippi River Basin Association)	*Fish Consumption Use Assessments for the Upper Mississippi River*
4:00 – 5:00 PM	**Vivien Taylor** (Dartmouth College)	*Geographic and Ecological Drivers of Harmful and Beneficial Compounds in Gulf of Maine Fish*
	Christoff Furin (State of Alaska Dept. of Environmental Conservation)	**POSTER**: *Selenium in Alaska's Fish*
4:30 – 5:00 PM	Discussion and Questions	
Closing Remarks		
5:00 – 5:30 PM	Closing Remarks & Thank You **| Matthew Tejada** (U.S. EPA)	
Day 4 and 2023 National Fish Forum Adjournment		



SECTION II: BIOSKETCHES & ABSTRACTS

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SECTION II: Biosketches & Abstracts

Day 1: Tuesday, February 28th

Session 1: Fish Consumption Advisories
Session 2: PFAS Toxicity Assessments
Session 3: Beyond PFOS: What's in the fish? Why does it matter?
Session 4: Presentation

Day 2: Thursday, March 2nd

Session 1: PFAS in Commercial Fish
Session 2: PFAS Monitoring Studies, Part 1
Session 3: PFAS Monitoring Studies, Part 2
Session 4: Risk Communication for PFAS
Session 5: PFAS: It's Not Just in Finfish
Session 6: PFAS Research: Developmental, Reproductive and Neural Effects

Day 3: Tuesday, March 7th

Session 1: Fish Consumption and Equity
Session 2: Risk Communication, Part 1
Session 3: Risk Communication, Part 2
Session 4: Trainings

Day 4: Thursday, March 9th

Session 1: Fish Data Tools
Session 2: Climate Change
Session 3: Contaminants in Fish, Part 1
Session 4: Contaminants in Fish, Part 2

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DAY 1 SESSION 1: FISH CONSUMPTION ADVISORIES

Moderator:
Marc A. Nascarella (Massachusetts Department of Public Health)

Biosketch
Dr. Marc A. Nascarella is the State Toxicologist and Senior Environmental Health Science Advisor to state agency leadership on strategies to manage the risk of exposure to environmental hazards. Dr. Nascarella serves in the DPH Bureau of Environmental Health (BEH) where he is responsible for the oversight and direction of DPH/BEH programs that monitor, evaluate, and respond to the public health risks of environmental exposure to microbial, chemical, radiation, and climate-related human health hazards. He serves as a Principal Investigator on federal funding from U.S. EPA, CDC, and ATSDR as well as the Department lead on cross-agency and cross-secretariat collaborations on statewide climate and environmental justice initiatives. As the State Toxicologist, Dr. Nascarella is responsible for oversight, direction, and professional development of state employees and contractors performing toxicology and environmental hazard related public health assessments and coordinating the appropriate response with federal, state, and local officials.

Presentations
Oregon Fish Consumption Advisories for Migratory Species
David Farrer (Oregon Health Authority)

Collecting Data to Inform Fish Consumption Advisories in North Carolina When You are Outside of State Government
Samuel Cohen (Duke University Superfund Research Center)

Effect of Land Cover on Ecoregion-Scale Spatial Patterns of Mercury Contamination of Largemouth Bass in the Southeastern United States
Matt Chumchal (Texas Christian University)

Exploring Spatiotemporal Patterns in Fish Mercury Bioaccumulation with Mercury Isotopes
Sarah Janssen (U.S. Geological Survey)

POSTER: 2021 Southern California Oil Spill Seafood Safety Assessment
Wesley Smith (California Office of Environmental Health Assessment)

Oregon Fish Consumption Advisories for Migratory Species

David Farrer (Oregon Health Authority)

Biosketch

David Farrer has been a Public Health Toxicologist with the Oregon Health Authority's Public Health Division for 15 years. For most of that time he has supported Oregon's Fish Consumption Advisory Program in addition to his regular work activities. David has a Masters and PhD in toxicology from the University of Rochester's School of Medicine and Dentistry and completed a postdoctoral fellowship in toxicology at Oregon State University. David's other work duties include human health risk assessment and risk communication related to chemical contaminant issues in air, water, land, and food.

Abstract

The Oregon Health Authority (OHA) typically issues fish consumption advisories for resident fish species because 1) partner agencies more often sampling resident fish as part of clean-up site remedial investigations and 2) resident fish are more likely affected by local contamination. However, OHA recently issued advisories for some migratory, or anadromous, species based on available data. One advisory is for Pacific Lamprey (Entosphenus tridentatus) and two are for white sturgeon (Acipenser transmontanus). Evaluating anadromous fish tissue data for consumption advisories is different from most advisories because the assumed source of contaminants is not likely local and because the areas covered by the resulting fish consumption advisories may be vast. The fish tissue contaminant levels are likely independent of where the fish were caught or where they spawned. For example, lamprey collected from disparate locations in the Columbia River system had remarkably similar contaminant levels resulting in a single advisory covering hundreds of miles of the Columbia River and its Oregon tributaries. In contrast, OHA found significant differences in contaminant levels in white sturgeon collected from the Lower Willamette vs. Lower Columbia River. This was surprising because the Willamette River is a tributary to the Columbia River, and there are no physical barriers preventing free passage of sturgeon between these water bodies. OHA's experience highlights the importance of evaluating contaminant data from groupings of samples of migratory species carefully and not assuming that samples collected in one area represent an entire population.

Collecting Data to Inform Fish Consumption Advisories in North Carolina When You are Outside of State Government

Samuel Cohen (Duke University Superfund Research Center)

Biosketch

Sam Cohen is an environmental science and policy professional with varied experience analyzing and communicating complex environmental and environmental health topics. He is interested in working at the intersection of science and policy, and in helping empower communities to address environmental and environmental health concerns through harnessing sound and approachable science. Since 2018, he has worked for the Duke University Superfund Research Center, helping to apply and translate interdisciplinary environmental health and exposure science research beyond academia. In this role, he has also worked extensively in partnership with groups in North Carolina seeking to better understand and address chemical exposure risks in their communities. He has previously worked with U.S. EPA's Office of Research and Development on environmental health research communication efforts. He received his Masters of Environmental Management from the Yale School of the Environment in 2016.

Abstract

The lower Cape Fear River of North Carolina is a highly polluted waterway with fish consumption advisories for mercury, other metals, and PCBs. In 2019-2020, the Duke Superfund Research Center's Community Engagement Core and collaborators collected and tested fish tissue samples from popular fishing locations within the lower Cape Fear River basin to expand knowledge on fish contamination in the region. Unfortunately, resource limitations at the N.C. Department of Environmental Quality, which oversees fish tissue sample collection in the state, and elsewhere in state government has meant that prior to our own sampling work, no fish contaminant data for the region had been gathered in nearly a decade. As a result of our sampling and testing, six new advisories were issued in October 2021.

While our team was able to collect and test fish samples in a way that satisfied the requirements for consumption advisories in the state, it was not a straightforward process. No guide existed for organizations or local health departments who might also want to assess the health risks of fish caught from local water bodies throughout the state. Our team created a manual to help other groups do similar work.

Fish consumption advisories can be a valuable tool to encourage safe habits for those eating wild-caught fish. States should fund fish collection and testing, but they should also support outside groups to do this work. Clear guidance from state governments can help encourage additional outside sampling, especially if a state's resources are limited.

Effect of Land Cover on Ecoregion-Scale Spatial Patterns of Mercury Contamination of Largemouth Bass in the Southeastern United States

Matt Chumchal (Texas Christian University)

Biosketch

Dr. Matt Chumchal is a professor of biology at Texas Christian University. He is an ecologist interested in the interactions between ecological and human systems. His research is primarily focused on mercury contamination in the environment. Recent areas of interest include the trophic transfer of mercury in food webs, factors that lead to spatial variation in the mercury contamination of organisms at a variety of scales, insect-mediated mercury flux from aquatic to terrestrial ecosystems and the use of riparian spiders as sentinels of aquatic pollution. He has used both experimental and field survey approaches to study mercury contamination in wetlands, small ponds, lakes, rivers, estuaries and the Gulf of Mexico.

Abstract

Consumption of methylmercury (MeHg)-contaminated fish is the primary source of MeHg in humans and poses a hazard to human health. Because of widespread atmospheric deposition of inorganic mercury (IHg), all water bodies in the United States have been contaminated with Hg. In aquatic ecosystems, IHg is converted to MeHg, which biomagnifies, reaching high concentrations in piscivorous fish. It is not possible for governmental agencies to monitor fish from every waterbody to determine if concentrations of MeHg in fish are hazardous to human health. To help government agencies focus their monitoring efforts, it is critical that we develop the ability to predict regions where waterbodies are most likely to contain fish with hazardous concentrations of MeHg. The objective of the present study was to examine the relationship between MeHg contamination of largemouth bass (Micropterus salmoides), a popular piscivorous gamefish, and land cover in 24 ecoregions across 15 states in the southeastern United States. In our study, we demonstrate for the first time that 72% of the variance in average concentrations of MeHg in largemouth bass between ecoregions of the southeastern United States can be explained by the percentage coverage by evergreen forests, emergent herbaceous wetlands, and pasture/hay. Land cover determines the sensitivity of freshwater systems to atmospheric IHg deposition, and the present study suggests that at the ecoregion scale, MeHg bioaccumulation in piscivorous gamefish, and ultimately the health hazard that these MeHg-contaminated fish pose to humans, can be in part predicted by land-cover type.

Exploring Spatiotemporal Patterns in Fish Mercury Bioaccumulation with Mercury Isotopes

Sarah Janssen (U.S. Geological Survey)

Biosketch

Sarah Janssen is a research chemist at the U.S. Geological Survey in Madison, WI and the team lead for the Mercury Research Lab. She has her PhD in environmental chemistry from Rutgers University, where she focused on developing methods for the measurement of mercury stable isotopes in natural matrices. Sarah joined the USGS in 2016 and since then has been using the mercury isotope technique to investigate mercury bioaccumulation and cycling. Her research predominantly focuses on contaminated site assessment as well as investigations of mercury cycling in critical ecosystems, such as the Florida Everglades and the Great Lakes.

Abstract

Mercury (Hg) accumulation in fish tissue can be influenced by a myriad of factors including the source type and extent of anthropogenic Hg contamination, interactions with other aquatic constituents (e.g., organic carbon and sulfur), Hg cycling differences due to habitat type, and food web structure. Owing to these complexities, simply measuring fish Hg burden is insufficient to understand and potentially inform strategies to manage fish Hg burdens. Hg stable isotopes ratios have shown promise in deciphering Hg sources and reactionary processes during bioaccumulation, which inform Hg burdens in fish. Here, we discuss two advantages that the application of Hg stable isotopes provides for informing management actions aimed at (1) removing fish consumption advisories in contaminated zones and (2) understanding change in Hg bioaccumulation in response to shifts in Hg emissions and food web dynamics in the Great Lakes. The first application deals with distinguishing between legacy and contemporary Hg sources to fish within a Great Lakes Area of Concern (St. Louis River) and determining if legacy Hg clean-up will impact fish consumption limits. The second application is an examination of a nearly 40-year biological monitoring archive, which can provide insight on how changes in Hg sources and food web shifts have altered Hg bioaccumulation within the Great Lakes. We demonstrate the utility of Hg stable isotopes to both directly address remedy effectiveness and identify factors contributing to long-term change in fish Hg burden.

POSTER: 2021 Southern California Oil Spill Seafood Safety Assessment

Wesley Smith (California Office of Environmental Health Assessment)

Biosketch

Dr. Smith is a Staff Toxicologist in the Fish, Ecotoxicology and Water Section at the Office of Environmental Health Hazard Assessment (OEHHA), California Environmental Protection Agency. Dr. Smith received a Ph.D. in pharmacology and toxicology from the University of Montana with an emphasis in neurotoxicology. He received additional training in environmental toxicology at the University of Washington. Dr. Smith joined OEHHA in 2012 working on Public Health Goals (PHGs) for drinking water and transitioned to developing fish consumption advisories shortly thereafter. Currently, he is responsible for seafood safety following oil spills, including the recent Huntington Beach Oil Spill. When not responding to spills, Dr. Smith works on a diverse range of topics, including microplastics and PFAS chemicals.

Abstract

On October 3, 2021, a fisheries closure was declared as a result of a coastal crude oil spill that occurred off Newport Beach in Southern California. The closure area was expanded on October 5, and then again on October 7, based on aerial observations, satellite imagery, and trajectory models showing the spread of the spill. The final fisheries closure area spanned 45 miles along the coast, from Anaheim Bay to San Onofre Nuclear Power Plant, and extended 23 miles offshore at the widest extent, covering 650 square miles. California statute requires expedited testing of seafood if fisheries remain closed for 48 hours following notification of an oil spill. The California Office of Environmental Health Hazard Assessment (OEHHA) must then assess whether the seafood in the area is safe for human consumption. As part of the process, OEHHA and the California Department of Fish and Wildlife's Office of Spill Prevention and Response (OSPR) developed a sampling plan to collect species based on four factors: 1) potential to bioaccumulate polycyclic aromatic hydrocarbons (PAHs), 2) commercial, recreational, or subsistence importance, 3) habitat, and 4) likelihood of exposure to oil. A total of 417 mussels and 431 non-mussel invertebrates and finfish, representing more than 20 species, were collected during the sampling effort. OEHHA had developed a level of concern (LOC) as part of a protocol for assessing the risk from consuming seafood following an oil spill. Because no samples exceeded the established LOC, the fisheries closure was lifted on November 30, 2021.

DAY 1 SESSION 2: PFAS TOXICITY ASSESSMENTS

Moderator:
Sandra Goodrow (New Jersey Dept. of Environmental Protection)

Biosketch
Dr. Sandra Goodrow is a Research Scientist in the New Jersey Department of Environmental Protection's (NJDEP) Division of Science and Research. Dr. Goodrow is a physical and chemical environmental modeler, evaluating the sources, fate, transport, and transformation of emerging compounds including per- and polyfluoroalkyl substances (PFAS). Dr. Goodrow has been involved in multiple research efforts that identify occurrences and track down sources of PFAS and other emerging compounds in fish tissue, surface water, and sediments from around the State of New Jersey and provides technical expertise for the Contaminants in Fish Tissue program. She has coordinated efforts with US EPA Office of Research and Development on multi-media analysis leading to the detection of a novel PFAS present in the New Jersey environment. She also serves as the co-Team lead for the Interstate Technology Regulatory Council's (ITRC) PFAS Team.

Presentations
EPA's PFOS Health Effects Assessment: Current Status
Brittany Jacobs (U.S. EPA)

Influence of Chemical Mixtures on Risk-Based Screening Levels for Fish Consumption Advisories
Wendy Heiger-Bernays (Boston University)

Development of Reference Dose and Fish Consumption Triggers for Perfluoroundecanoic Acid (PFUnDA) for Use in New Jersey Fish Consumption Advisories
Gloria Post (New Jersey Dept. of Environmental Protection)

EPA's PFOS Health Effects Assessment: Current Status

Brittany Jacobs (U.S. EPA)

Biosketch

Brittany Jacobs is a Biologist and Team Lead in the Health and Ecological Criteria Division in the Office of Science and Technology, Office of Water at the U.S. EPA. She joined EPA as a Presidential Management Fellow in August 2016 after completing her Ph.D. in Cell and Molecular Biology from the University of Wisconsin-Madison. Brittany has worked on projects supporting Safe Drinking Water Act actions and Clean Water Act actions, most notably the GenX chemicals toxicity assessment finalized in 2021 and the updated toxicity assessments for PFOA and PFOS sent for external peer review in 2021. She is currently working to derive maximum contaminant level goals for PFOA and PFOS, which supports the National Primary Drinking Water Regulation for PFOA and PFOS.

Influence of Chemical Mixtures on Risk-Based Screening Levels for Fish Consumption

Wendy Heiger-Bernays (Boston University)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

Development of Reference Dose and Fish Consumption Triggers for Perfluoroundecanoic Acid (PFUnDA) for Use in New Jersey Fish Consumption Advisories

Gloria Post (New Jersey Dept. of Environmental Protection)

Biosketch

Gloria B. Post, Ph.D., D.A.B.T., has been a toxicologist with in the NJDEP Division of Science and Research for more than 37 years. She is the chair of the Risk Subcommittee of the NJ Interagency Toxics and Biota Committee; this Subcommittee develops fish consumption triggers used in NJ fish consumption advisories. She is a member of the NJ Drinking Water Quality Institute, an advisory body that recommends drinking water standards to NJDEP. She currently serves on the chartered (main) USEPA Science Advisory Board and its Chemical Assessment Advisory Committee, PFAS Review Panel, and Hexavalent Chromium Review Panel. She is also major contributor to the Human Health section of the Interstate Technology & Regulatory Council (ITRC) PFAS Technical and Regulatory Document. Dr. Post holds an A.B. with honors in Biochemical Sciences from Princeton University and a Ph.D. in Pharmacology from Thomas Jefferson University, with post-doctoral research at Duke University.

Abstract

Perfluoroundecanoic acid (PFUnDA), the 11-carbon perfluoroalkyl carboxylate, is highly bioaccumulative in fish and was frequently detected in a statewide screening study of per- and polyfluoroalkyl substances (PFAS) in fish conducted by NJDEP. A Reference Dose (RfD) and fish consumption triggers were developed for use in fish consumption advisories. Like other PFAS, PFUnDA causes hepatic, developmental, and male reproductive toxicity in laboratory animals; it also caused pancreatic effects in a mouse strain that is susceptible to diabetes. Carcinogenicity has not been evaluated. The Point of Departure for the RfD was a BMDL10 of 0.19 mg/kg/day for increased relative liver weight in male rats in a 42-day study. A dosimetric adjustment factor of 146, based on the ratio of estimated half-lives in humans (12 years) and male rats (30 days) was applied to account for much slower excretion in humans than rats. A total uncertainty factor (UF) of 1000 was applied, including: intraspecies UF of 10, interspecies UF of 3, subchronic-to-chronic UF of 10, and UF for potentially more sensitive endpoints of 3. Consumption triggers for unlimited daily, weekly, monthly, once every 3 months, yearly, and "do not eat" were developed assuming 70 kg body weight and 227 g meal size; triggers for infrequent (less than monthly) consumption were not recommended for the high-risk population (e.g., women of childbearing age; young children). Consideration of these PFUnDA consumption triggers has minimal impact on current site- and species-specific fish consumption advisories in New Jersey which also consider PFOS, PFNA, PFOA, and non-PFAS contaminants.

DAY 1 SESSION 3: BEYOND PFOS: WHAT'S IN THE FISH? WHY DOES IT MATTER?

Moderator:
Meghan Williams & Sean Strom (Wisconsin Dept. of Natural Resources)

Biosketch
Meghan Williams has been a toxicologist at the Wisconsin Department of Natural Resources since 2012 and has been in her current role as a water quality toxicologist since 2018. She is responsible for developing water quality criteria for the protection of human health and aquatic life, revising existing water quality standards, and providing technical expertise on the potential health effects of pollutants in surface waters for the Water Quality Bureau. Meghan has also served on the board of the Midwest chapter of the Society for Environmental Toxicology and Chemistry since 2019. She has a BA in zoology from Ohio Wesleyan University and a Master's in aquatic toxicology from Bowling Green State University.

Sean earned a B.S. Environmental Science and Biology from University of Wisconsin - Green Bay and a Master's in Environmental Toxicology from Colorado State University. Sean has been with the WI DNR for over 20 years, serving as a Toxicologist in both the Wildlife Management and Fisheries Management programs. He has studied both legacy and emerging contaminants in a wide variety of species including fish, bald eagles, water birds, songbirds, waterfowl, furbearers, and small mammals.

Presentations
Per- and Polyfluoroalkyl Substance and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories
Heidi Pickard (Harvard University)

Patterns of Occurrence of Poly and Perfluoroalkyl Substances (PFAS) Compounds in Fresh Water Fish from Major U.S. Rivers
John Wathen (U.S. EPA)

Occurrence and Bioaccumulation of Novel Poly and Perfluoroalkyl Substances (PFAS) in the Delaware River Estuary, USA
Anna Robuck (U.S. EPA)

Per- and Polyfluoroalkyl Substance and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories

Heidi Pickard (Harvard University)

Biosketch

Heidi Pickard is a fourth year PhD candidate in the department of Engineering Sciences at Harvard University, working with Dr. Elsie Sunderland's lab focused on biogeochemistry of global contaminants. Heidi grew up in Atlantic Canada and holds a Bachelor's degree in Analytical Chemistry from Mount Allison University in New Brunswick, and a Master's degree in Chemistry from Memorial University in Newfoundland. Her Master's research focused on the long-range transport mechanisms of PFAS. Her current PhD research focuses on using a toolbox of analytical methods to explore the full extent of PFAS contamination in the environment and investigate important pathways of exposure to humans. Her overarching research goal is to better understand if PFAS precursors that persist in the aquatic and terrestrial environment accumulate in biota across different field settings.

Abstract

Per- and polyfluoroalkyl substances (PFAS) are a diverse class of fluorinated anthropogenic chemicals that include perfluoroalkyl acids (PFAA). Many consumer products and environmental samples contain abundant PFAA precursors that can degrade into terminal PFAA associated with adverse health effects. Several of the PFAA can bioaccumulate in food webs and fish consumption is an important dietary exposure source. However, little is known about bioaccumulation of PFAA precursors. In this work we identified and quantified PFAS in recreational fish species collected from surface waters across New Hampshire, United States using a toolbox of analytical methods. Targeted analysis of paired water and fish muscle tissue samples using liquid chromatography tandem mass spectrometry (LC-MS/MS) suggests that many precursors below detection in water have a higher bioaccumulation potential than their terminal PFAA. Perfluorobutane sulfonamide (FBSA), a short chain precursor produced by the electrochemical fluorination manufacturing process was detected in all fish samples analyzed for this compound. The total oxidizable precursor assay (TOP) interpreted using Bayesian inference, which groups PFAS precursor classes by their perfluorinated carbon chain-lengths and manufacturing origins, revealed fish muscle tissue contained additional, short-chain precursors in higher concentration samples. Suspect screening analysis using a quadrupole time-of-flight tandem mass spectrometer (QTOF MS/MS) revealed these were perfluoroalkyl sulfonamide precursors with three and five perfluorinated carbons. Fish consumption advisories are primarily being developed for perfluorooctane sulfonate (PFOS), but this work reinforces the need for risk evaluations to consider additional bioaccumulative PFAS, including perfluoroalkyl sulfonamide precursors.

Patterns of Occurrence of Poly and Perfluoroalkyl Substances (PFAS) Compounds in Fresh Water Fish from Major U.S. Rivers

John Wathen (U.S. EPA)

Biosketch

John Wathen serves as senior science advisor for fish and beach programs in the Standards and Health Protection Division of the Office of Science and Technology (OST) in EPA's Office of Water. After farming in Southern Indiana for 12 years, Mr. Wathen received his B.A. in Geology from Northeastern University and an M.S. in Earth Sciences from the University of New Hampshire. He worked as a consulting hydrogeologist for 15 years, primarily in northern New England, served as Southern Maine Regional Director of the Maine Department of Environmental Protection 2000-2005, when he joined U.S. EPA. He provides technical support to the BEACH Act monitoring and advisory program, National Fish Advisory Program, and OW's fish tissue contaminant studies, focusing on human health implications. Mr. Wathen is a Maine Certified Geologist and a Professional Geologist in Kentucky.

Moderator

One of the most prominent and problematic qualities of Perfluoro-Alkyl Substances (PFAS) is the number and diversity of identified compounds. The occurrence of PFAS in fish, however, is limited by its decreasing solubility with increasing chain length and is generally limited to the longer chain (C-7 to C-14) compounds. PFOS was detected in 346/349 fish fillet samples from major U.S. rivers studied by the U.S. EPA in the 2013-2014 National Rivers and Streams Assessment. Other PFAS compounds, (PFUnA, PFDA, and PFDoA), were also consistently detected in a highly repeatable pattern. 148/322 samples were found to include PFOS, PFUnA, PFDA, and PFDoA with or without other PFAS. Other identified groups of compounds included these compounds with 1) PFNA (93 samples), 2) PFOSA (45 samples), or 3) both PFNA and PFOSA (36 samples). This project uses adopted nomenclature for these common groupings of PFAS in fish tissue to facilitate an assessment of health risks associated with exposure to fishers and their families from consuming fish containing these compounds in combination. Such an assessment has been impeded by a lack of information on their toxicological characteristics relative to human consumption.

Occurrence and Bioaccumulation of Novel Poly and Perfluoroalkyl Substances (PFAS) in the Delaware River Estuary, USA

Anna Robuck (U.S. EPA)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 1 SESSION 4: PRESENTATION

Presentations

U.S. EPA Draft Method 1633 for Per- and Polyfluorinated Alkyl Substances (PFAS) Validation and Path Forward

Adrian Hanley (U.S. EPA)

U.S. EPA Draft Method 1633 for Per- and Polyfluorinated Alkyl Substances (PFAS) Validation and Path Forward

Adrian Hanley (U.S. EPA)

Biosketch

Adrian Hanley is a senior chemist for the USEPA Office of Water and is the team leader for the Clean Water Act Laboratory Methods Program. He leads multiple method validation projects and supports regulatory updates to 40 CFR Part 136. He has served as a chemist, project manager, QA/QC officer, and field team leader for a wide variety of government and privately funded environmental projects. He has an M.S. in analytical chemistry from the University of Wisconsin – Madison.

Abstract

EPA Office of Water is providing a summary of method validation efforts to date on Draft EPA Method 1633 for PFAS analytes, and future anticipated validation efforts. This presentation is focusing on marine and fish tissue validation work.

DAY 2 SESSION 1: PFAS IN COMMERCIAL FISH

Moderator:
Jesse Becker (New York State Dept. of Environmental Conservation)

Biosketch
Dr. Jesse Becker is the Quality Assurance Officer for the Division of Fish and Wildlife at the New York State Department of Environmental Conservation (NYSDEC). Becker works primarily in the fish and wildlife contaminants monitoring program for New York State. Becker is an ecosystem ecologist with a B.S. degree in Environmental Biology and Management from the University of California at Davis, and a M.S. and Ph.D. in Aquatic Resources from Texas State University – San Marcos. Becker's professional interests are related to how legacy and emerging pollutants move and bioaccumulate in aquatic systems. Becker began his career studying mercury pollution in Clear Lake, CA, and worked his way across the country studying reservoirs and river systems in Texas and Indiana before landing at NYSDEC.

Presentations
FDA Survey of Poly and Perfluoroalkyl Substances (PFAS) in Highly Consumed U.S. Seafood Products
Susan Genualdi (U.S. FDA)

Potential Human Exposure to Perfluoroalkyl Substances (PFAS) from Consumption of U.S. Market Basket Fish and Shellfish
Betsy Ruffle (AECOM)

Per- and Polyfluoroalkyl Substances (PFAS) in Seafood Consumed by Asians in Chicago, IL
Mariam Oladosu (University of Illinois Chicago)

FDA Survey of Poly and Perfluoroalkyl Substances (PFAS) in Highly Consumed U.S. Seafood Products

Susan Genualdi (U.S. FDA)

Biosketch

Susan Genualdi is currently a Research Chemist in the Center for Food Safety and Applied Nutrition at the Food and Drug Administration. Her research focuses on developing methods for the analysis of direct and indirect food additives in food and food packaging. For the last 5 years, she has focused primarily on the method development and analysis of PFAS in foods. Prior to her work at the FDA, she received her PhD in Analytical Chemistry at Oregon State University and was a postdoctoral fellow at Environment Canada.

Abstract

To understand the occurrence of per- and polyfluoroalkyl substances (PFAS) in the general food supply, the FDA has been analyzing foods collected under the Total Diet Study (TDS) since 2019. Of the 532 TDS samples tested for PFAS to date, there were ten samples with detectable levels of certain PFAS, eight of which were seafood. In 2022, the FDA conducted a targeted seafood survey, testing 81 samples of clams, cod, crab, pollock, salmon, shrimp, tuna, and tilapia, most of which were imported to the United States. Compared to FDA's previous testing of foods obtained from the TDS, this testing of seafood showed that a greater percentage of samples had detectable levels of PFAS, there were more types of PFAS detected, and the levels detected in multiple samples were higher. Notably, FDA determined that the estimated exposure to perfluorooctanoic acid (PFOA) from the canned clams from China is likely a health concern. Based on these findings, the agency is planning additional seafood testing for PFAS. As the science evolves and as FDA researchers and food safety experts advance our understanding of PFAS in foods, the FDA will refine our regulatory approach to PFAS in foods accordingly.

During this session, FDA will provide an update on its analytical method development for PFAS in seafood, findings to date, and planned next steps. FDA also hopes to engage with other scientists working on PFAS in seafood, to exchange data and information that may further inform seafood safety.

Potential Human Exposure to Perfluoroalkyl Substances (PFAS) from Consumption of U.S. Market Basket Fish and Shellfish

Betsy Ruffle (AECOM)

Biosketch

Betsy Ruffle is a Senior Scientist with AECOM where she serves as a Technical Leader in the Risk Assessment and Contaminated Sediments practice areas. She has over 30 years of experience evaluating environmental health risks, with a focus on fish consumption and exposure to bioaccumulative contaminants including PFAS, PCBs, dioxin, and mercury. She has presented and published on a range of topics related to risk assessment, human exposure modeling, fish consumption, and water quality criteria derivation. Ms. Ruffle has an undergraduate degree in Biology from Vassar College and a Masters degree in Environmental Health from Tufts University. She is located in AECOM's Chelmsford, Massachusetts office.

Abstract

Dietary exposure is estimated to contribute approximately 60-80 percent of total exposure to per- and polyfluoroalkyl substances (PFAS), particularly long-chain PFAS (Vestergren and Cousins 2009; Vestergren et al. 2012; Trudel et al. 2008). A number of European studies have shown fish consumption to be a significant route of exposure especially for high-end consumers (Domingo and Nadal 2017; Barbarossa et al. 2016). However, data on PFAS levels in U.S. commercial fish and shellfish are limited. An empirical study was conducted to characterize PFAS levels in U.S. market basket finfish and shellfish. A mix of popular marine and freshwater species was purchased at commercial fish markets and supermarkets from four regions of the U.S. (Northeast, Southeast, Midwest, and West). Fresh (raw) fish of local origin was the primary target, supplemented with exported fish and shellfish of popular species. Each sample consisted of approximately one half-pound to represent a typical fish meal size. Samples were analyzed for 26 PFAS using an isotope dilution method that achieved detection limits of less than 1 ng/g. The 26 compounds analyzed include the most widespread and commonly reported long-chain PFAS (e.g., PFOS, PFOA), short-chain (e.g., PFBS, PFBA), and precursors of interest (e.g., FOSA, FTSAs) that have been reported in abiotic and tissue media. Reported concentrations are close to method quantitation limits and lower than or similar to levels reported in other studies. Study results provide perspective on national exposures to PFAS from consumption of U.S. market basket fish.

Per- and Polyfluoroalkyl Substances (PFAS) in Seafood Consumed by Asians in Chicago, IL

Mariam Oladosu (University of Illinois Chicago)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 2 SESSION 2: PFAS MONITORING STUDIES, PART 1

Moderator:
Angela Preimesberger (Minnesota Pollution Control Agency)

Biosketch
Angela Preimesberger (she/her) recently joined the Minnesota Department of Health as a Research Scientist in the Fish Consumption Guidance Program. Angela has 20 years of experience as a scientist with the State of Minnesota working on human health risk assessments and rulemaking for toxic pollutants in fish and waters. Angela has also reviewed a significant amount of fish and water PFAS monitoring datasets to develop and evaluate bioaccumulation factors with colleagues in Minnesota and Wisconsin. Angela enjoys learning through collaboration and is thrilled to be invited to moderate the PFAS Monitoring Studies (part 1) Session.

Presentations
Probability-based National Assessments of Contaminants in Fish from Great Lakes and U.S. Rivers
John Healey (U.S. EPA)

Per- and Polyfluoroalkyl Substances (PFAS) in Sunfish from North Carolina's Haw River and Jordan Lake
Anna Boatman (University of North Carolina, Chapel Hill)

PFAS Examined in 14 Fish Species in the Cape Fear River, North Carolina
Frannie Nilsen (North Carolina Dept. of Environmental Quality)

Accumulation of perfluorooctane sulfonic acid (PFOS) in Stocked Brook Trout in Fairfield, Maine
Tom Danielson (Maine Dept. of Environmental Protection)

POSTER: Initial Fish Tissue Results for Per- and Polyfluoroalkyl Substances in Kentucky Waterbodies
David Cravens (Kentucky Division of Water)

POSTER: Drivers for Building Gulf Coast Resilience: Findings from Fish Sampling in Galveston Bay
Cloelle Danforth (Environmental Defense Fund)

Probability-based National Assessments of Contaminants in Fish from Great Lakes and U.S. Rivers

John Healey (U.S. EPA)

Biosketch

John Healey (he/him) leads the national fish tissue monitoring program at the U.S. Environmental Protection Agency's Office of Science and Technology. The fish tissue monitoring program collects fish composite samples from the Great Lakes, and from rivers and lakes throughout the 48 contiguous United States, for analysis of per- and polyfluoroalkyl substances (PFAS), mercury and polychlorinated biphenyls (PCBs). These national probabilistic surveys are conducted in collaboration with EPA's National Aquatic Resource Surveys, and the results provide a national baseline assessment for these contaminants.

Abstract

The U.S. EPA developed an unequal probability survey design to allow a characterization of mercury, PCB, and PFAS contamination in fish from U.S. rivers on a national scale. During 2018-2019, fish fillet samples were collected from 290 sites selected randomly from the target population of rivers (≥5th order in size) in the conterminous U.S. This nationally representative sample allowed extrapolation to a sampled population of 66,142 river km. The goal was to develop estimates of the national distribution of total mercury, all 209 PCB congeners, and 33 PFAS (including perfluorooctane sulfonate or PFOS) in river fish. All fillet tissue samples contained detectable levels of mercury and PCBs. PFAS were detected in 95.2% of the fillet samples. Fish tissue screening levels (SLs) applied to national contaminant probability distributions allowed an estimation of the percentage of the sampled population of river km that contained fish with fillet concentrations above a level protective of human health. Fish tissue SL exceedances for an average level of fish consumption were 26.0% for mercury (applying EPA's 300 ng/g fish tissue-based water quality criterion), 17.3% for PCBs (using a derived 49 ng/g noncancer SL), 45.1% for PCBs (using a derived 12 ng/g cancer SL), 0.7% for PFOS (using a derived 46 ng/g noncancer SL). Fish tissue SL exceedances for high-frequency fish consumers (e.g., subsistence fishers) were 46.2% for PCBs (using a derived 11 ng/g noncancer SL), 73.8% for PCBs (above a 2.8 ng/g cancer SL), and 18.3% for PFOS (using a derived 11 ng/g noncancer SL).

Per- and Polyfluoroalkyl Substances (PFAS) in Sunfish from North Carolina's Haw River and Jordan Lake

Anna Boatman (University of North Carolina, Chapel Hill)

Biosketch

Anna Boatman (she/her) is a third-year analytical chemistry PhD student in Dr. Erin Baker's group at the University of North Carolina in Chapel Hill. Anna's research is focused on detecting and studying environmental contaminants that impact ecological and human health. Her research specifically centers on evaluating PFAS in different tissues and biofluids. Currently, she is using mass spectrometry and other advanced separation techniques to study PFAS in fish fillets and alligator plasma.

Abstract

Per- and polyfluoroalkyl substances (PFAS) are emerging contaminants gaining global attention due to their persistence, bioaccumulation, and toxicity. Use and disposal of PFAS-containing products, such as nonstick pans and firefighting foams, leads to human exposure and accumulation in drinking water. Jordan Lake, the primary drinking water source for 700,000 nearby North Carolina residents, was an ideal location to study how fish living in this water source accumulate PFAS. It is fed by the Haw River, which has known PFAS contamination. To explore human dietary exposure and investigate fish utility to monitor for PFAS, we characterized fillets from 38 individual sunfish (genus Lepomis) caught at five different locations in this watershed. PFAS were extracted from the fillets and analyzed with nontargeted measurements on a platform combining liquid chromatography, ion mobility spectrometry, and mass spectrometry (LC-IMS-MS). Data analysis was performed using the open-source software Skyline and our in-house library containing over 100 PFAS. A total of 22 different PFAS were detected in the fillets. Notably, several legacy PFAS that have been phased out of production were detected in every sunfish sample, including PFDA, PFUdA, PFDoA, PFTrDA, and linear and branched PFOS and PFDS isomers. Furthermore, the fish upstream in the Haw River had more PFAS species and higher PFAS concentrations than the fish from Jordan Lake. Comparisons of PFAS levels in fish versus water also suggested different PFAS accumulation in these two matrices. Thus, we concluded that effective PFAS monitoring should include sampling of both fish and water.

PFAS Examined in 14 Fish Species in the Cape Fear River, North Carolina

Frannie Nilsen (North Carolina Dept. of Environmental Quality)

Biosketch

Frannie Nilsen is the lead Environmental Toxicologist at the North Carolina Department of Environmental Quality with experience in a wide range of environmental disciplines and a passion for environmental stewardship. Frannie started her career in toxicology with NOAA's marine mammal response program across the Hawaiian Islands. Her Master's Degree involved researching the effects of plastic pollution on endangered seabirds in the North Pacific Ocean. Her doctoral work took her to South Carolina where she investigated the sublethal effects of mercury exposure on alligators at the National Institute of Standard and Technology Hollings Marine Lab and the Medicinal University of South Carolina. When she came to North Carolina, she joined the EPA to combine environmental exposures and genetic predisposition to determine children's health outcomes. Today she uses all these experiences to communicate environmental issues to policy makers and protect North Carolina.

Abstract

PFAS are persistent contaminants that have unknown impacts in many environments. In North Carolina (NC), there is a point source of PFAS contamination into the Cape Fear River, which runs over 300-kilometers (km) and serves as a drinking water source for NC residents. In effort to examine the extent of the PFAS contamination and better understand bioaccumulation of PFAS, a fish and water collection project was conducted by the NC Department of Environmental Quality (NCDEQ) from June – August 2022. Over 250 fish across 14 species were collected from the Cape Fear River, starting below the point source and ending at the Atlantic Ocean. The fish species were identified by the North Carolina Wildlife Resource Commission (NCWRC) and the Division of Marine Fisheries (NCDEQ DMF) through public surveys as the species that are most frequently recreationally caught and consumed in the Cape Fear Region.

The fish were analyzed alongside water samples collected in situ for 56 different PFAS to support bioaccumulation factor (BAF) calculations across trophic levels in NC. The BAFs will be used in tandem with reference doses (RfDs) to support NCDEQ standards development to protect public health and NC's water resources. Similarly, concentrations of PFAS in collected fish tissue will be analyzed by the NC Department of Health and Human Services (NCDHHS) for the development PFAS-specific fish consumption advisories. Altogether, the data collected in this study will inform current activities in NCDHHS and NCDEQ and will provide a comprehensive data set to inform additional PFAS fish studies beyond NC.

Accumulation of perfluorooctane sulfonic acid (PFOS) in Stocked Brook Trout in Fairfield, Maine

Tom Danielson (Maine Dept. of Environmental Protection)

Biosketch

Tom Danielson (he/his) leads the Aquatic Toxicology Unit of the Maine Department of Environmental Protection (DEP). Tom is an aquatic biologist working with toxicology, nutrient criteria, and biological assessments of rivers, streams, and wetlands. The Aquatic Toxicology Unit collects fish, water, and sediment samples for analysis of a variety of contaminants, such as PFAS, mercury, PCBs, dioxins, and DDT. We analyze data and work with Maine CDC and Maine IF&W to help set fish consumption advisories when necessary.

Abstract

The Maine Department of Environmental Protection, Maine Department of Inland Fisheries & Wildlife, and Maine Center for Disease Control and Prevention conducted an experiment to determine if stocked brook trout (Salvelinus fontinalis) accumulate perfluorooctane sulfonate (PFOS) in the wild. Fingerling and yearling trout were stocked in two adjacent ponds in Fairfield, Maine. Hatchery fish had <1 ng/g PFOS in muscle tissue. Fingerlings and yearlings were collected from both ponds 4 and 10 weeks after stocking. Skinless and skin-on fillets were analyzed for PFOS. In addition, fingerling trout were collected from the larger pond 1 and 2 weeks after stocking, and skinless fillets were analyzed for PFOS. Water samples were collected from the ponds at each sampling event. PFOS concentrations for water samples were 550 – 600 ng/L in the large pond and 2,000 – 2,500 ng/L in the small pond. Yearling trout collected from the large pond in weeks 4 and 10 had PFOS concentrations of 44 and 40 ng/g in skinless fillets and 48 and 67 ng/g in skin-on fillets. Skinless fillets from fingerling trout in the large pond had PFOS concentrations of 39, 41, 67, and 81 ng/g in weeks 1, 2, 4, and 10. Skin-on fillets from fingerling trout in the large pond had PFOS concentrations of 68 and 82 ng/g in weeks 4 and 10. Fingerling trout collected from the small pond in weeks 4 and 10 had PFOS concentrations of 97 and 192 ng/g in skinless fillets and 153 and 276 ng/g in skin-on fillets.

POSTER: Initial Fish Tissue Results for Per- and Polyfluoroalkyl Substances in Kentucky Waterbodies

David Cravens (Kentucky Division of Water)

Biosketch

David Cravens (he/him) is the project coordinator for the fish tissue monitoring program at Kentucky Division of Water. David has over 10 years of experience in stream monitoring activities and working with game and non-game fish species along with freshwater mussels throughout Kentucky.

Abstract

In the ongoing effort to better understand the occurrence of per- and polyfluoroalkyl substances (PFAS) in Kentucky, the Kentucky Department for Environmental Protection (DEP) recently incorporated PFAS into its fish contaminant monitoring program. The pilot project initiated in November 2021 included a site on Gunpowder Creek in Boone County, South Elkhorn Creek in Woodford County, and West Hickman Creek in Jessamine County. These streams were known to contain PFAS based on surface water sampling in 2020. In early 2022, an additional site was added on Gunpowder Creek to include stocked trout, and four additional streams were sampled: Otter Creek in Meade County, a tributary of North Elkhorn Creek in Fayette County, and Northern Ditch and Southern Ditch (also known as Pond Creek) in Jefferson County. Around the same time, testing was completed on samples collected from an earlier project involving 13 lakes across the state. Target fish species for both projects included those that are typically consumed, such as bass and bluegill. PFAS were detected in all 98 samples from the two projects. Perfluorooctane sulfonic acid (PFOS) occurred at the highest concentrations of any PFAS. Results for PFOS ranged between 0.31 and 50 parts per billion (ppb) in fish tissue. Fifteen other PFAS were detected in at least one sample at concentrations of 18 ppb or less. The average concentration of PFOS in fish from the stream study was 13 ppb; the average for fish from the lake study was 5 ppb. Additional statewide PFAS sampling is ongoing.

POSTER: Drivers for Building Gulf Coast Resilience: Findings from Fish Sampling in Galveston Bay

Cloelle Danforth (Environmental Defense Fund)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 2 SESSION 3: PFAS MONITORING STUDIES, PART 2

Moderator:
Wayne Richter (New York State Dept. of Environmental Conservation)

Biosketch
I am a research scientist in the Division of Fish and Wildlife in the New York State Department of Environmental Conservation (DEC). I have managed the Department's fish contaminant monitoring program since 2010. This program annually analyzes close to 1,500 fish for contaminants including PCBs, mercury, organochlorine pesticides, and per- and polyfluoroalkyl substances. The program provides data to the Department of Health for use in fish consumption advisories, and enables us to track the status of environmental contaminants. I am an active participant with Great Lakes Consortium for Fish Consumption Advisories. I previously worked for the NYS Department of Health where I researched the prevalence of disinfection byproducts in public water supplies. I earlier managed enterprise GIS development for DEC's Fish and Wildlife and worked as a wetlands biologist for DEC and for the Dade County, Florida, Department of Environmental Resources Management.

Presentations
Surface Water and Fish Impacted by Historic Land Application of Biosolids and Resulting Fish Consumption Advisories in Fairfield, Maine
Breana Bennett (Maine Center for Disease Control and Prevention)

Fish Contaminant Monitoring in New York's Great Lakes Waters
Wayne Richter (New York State Dept. of Environmental Conservation)

A food web bioaccumulation model for the accumulation of per- and polyfluoroalkyl substances (PFAS) in fish: how important is renal elimination?
Jennifer Sun (Harvard University)

Perfluoroalkyl Substances (PFAS) and Fish Consumption in the Great Lakes Fish Consumer Study (GLFCS)
Meghan Cerpa (University of Illinois Chicago)

POSTER: Locally Caught Freshwater Fish Across the United States are Likely a Significant Source of Perfluoroalkyl Substances (PFAS) Exposure
David Andrews (Environmental Working Group)

POSTER: Temporal and Demographic Patterns of PFAS Exposure and the Relationship with Seafood Consumption in the U.S. General Population using 1999-2012 NHANES Data
Samantha Fontenelle (U.S.EPA)

Surface Water and Fish Impacted by Historic Land Application of Biosolids and Resulting Fish Consumption Advisories in Fairfield, Maine

Breana Bennett (Maine Center for Disease Control and Prevention)

Biosketch

Breana is a toxicologist with the Maine Center for Disease Control and Prevention. She has a bachelor's degree in biochemistry from the University of Maine and master's degrees in environmental toxicology and public administration from the University of Washington. She is the lead toxicologist for fish and wildlife consumption advisories for the state of Maine.

Abstract

An investigation into the presence of PFAS in the Fairfield area of Maine began after PFOS was detected at greater than 20,000 ppt in milk samples collected at a local dairy farm. Testing of soils from farm fields with a history of land application of biosolids identified field average PFOS levels ranging from low 10s ppb to greater than 1000 ppb on a dry weight basis. The headwaters of Fish Brook runs near and adjacent to farm fields that have elevated PFOS levels in the soil. Surface water samples from Fish Brook collected where the stream runs adjacent to fields as well as downstream of the farm fields had PFOS levels measured at 128 - 394 ppt. Brook trout in the headwaters were found to have tissue levels ranging from 151 – 162 ppb. Sampling of brook trout, largemouth bass, and yellow perch in downstream waters of Fish Brook were found to have tissue levels ranging from 182– 742 ppb. Fish Brook is a tributary for Messalonskee Stream and elevated of PFOS in tissue were found for northern pike and smallmouth bass from these waters (12 – 57 ppb). This presentation will discuss the data on soils, surface waters, fish tissue, and the subsequent development of site-specific fish consumption advisories.

Fish Contaminant Monitoring in New York's Great Lakes Waters

Wayne Richter (New York State Dept. of Environmental Conservation)

Biosketch

I am a research scientist in the Division of Fish and Wildlife in the New York State Department of Environmental Conservation (DEC). I have managed the Department's fish contaminant monitoring program since 2010. This program annually analyzes close to 1,500 fish for contaminants including PCBs, mercury, organochlorine pesticides, and per- and polyfluoroalkyl substances. The program provides data to the Department of Health for use in fish consumption advisories, and enables us to track the status of environmental contaminants. I am an active participant with Great Lakes Consortium for Fish Consumption Advisories. I previously worked for the NYS Department of Health where I researched the prevalence of disinfection byproducts in public water supplies. I earlier managed enterprise GIS development for DEC's Fish and Wildlife and worked as a wetlands biologist for DEC and for the Dade County, Florida, Department of Environmental Resources Management.

Abstract

Beginning with mercury, the New York State Department of Environmental Conservation has been monitoring contaminants in the fish of the state's Great Lakes waters (Lake Erie, the Niagara River, Lake Ontario, the St. Lawrence River, and key tributaries) since 1970. Most analyses are of fillets used for fish consumption advisory development by the NYS Department of Health. We also study young-of-year fish, primarily to indicate local, short-term conditions, but also relevant to consumption advisories for immigrant communities. Here, we present a selection of our findings from recent years within the context of historical patterns. Mercury, after declining from 1970 to around 1990 has been relatively stable for several decades. PCBs, mirex, and dioxins and furans each contribute to Lake Ontario's fish consumption advisories. All have decreased over time, leading to relaxation of advisories. However, data from these legacy contaminants, as well as results from PFAS and polychlorinated naphthalenes, show continued contamination and downstream influence from the industrial corridor along the Niagara River.

A food web bioaccumulation model for the accumulation of per- and polyfluoroalkyl substances (PFAS) in fish: how important is renal elimination?

Jennifer Sun (Harvard University)

Biosketch

Jennifer Sun is a PhD candidate in Dr. Elsie Sunderland's Biogeochemistry of Global Contaminants group at Harvard University. Jennifer graduated from Cornell University with a B.S. in the Science of Natural and Environmental Systems, with a research focus in aquatic ecology. She has previously worked in water quality monitoring and management in California, in both the private and non-profit sectors. As an analyst at the San Francisco Estuary Institute, she managed multi-sector regional monitoring studies for legacy and emerging contaminants in fish and surface waters as part of the San Francisco Bay Regional Water Quality Management Program. Her current research focuses on modeling the environmental fate, transport, and exposures of PFAS in aquatic ecosystems and the atmosphere.

Abstract

Per- and polyfluoroalkyl substances (PFAS) are a large class of highly fluorinated anthropogenic chemicals, some of which bioaccumulate in aquatic food webs and can pose risks for seafood consumers. Large variability in the bioaccumulation of PFAS in aquatic food webs can present a challenge for the prediction of potential PFAS exposure risks from seafood consumption in new ecosystems. However, existing bioaccumulation models for persistent organic pollutants (POPs) perform poorly for ionizable PFAS. Here we adapt a well-established food web bioaccumulation model for neutral POPs to predict the bioaccumulation behavior of six perfluoroalkyl acids (PFAAs). The new model includes sorption to blood plasma proteins and phospholipids, empirically parameterized membrane transport, and renal elimination for PFAAs. Improved performance relative to prior models without these updates is shown by comparing simulations to field and lab measurements. PFAS with eight or more perfluorinated carbons (i.e., PFOS, PFDA, PFUn) are often the most abundant in aquatic food webs. The new model reproduces their observed bioaccumulation potential within a factor of two for >80% of fish species, indicating its readiness to support development of fish consumption advisories for these compounds. Results suggest bioaccumulation of PFAS with eight or more perfluorinated compounds is primarily driven by phospholipid partitioning, while albumin protein binding and protein transporter-mediated renal elimination is more important for many shorter-chained PFAAs. Implications for aquatic food web monitoring will be presented. Additional data on protein-binding and membrane transport mechanisms for PFAS are needed to better understand the biological behavior of shorter-chain PFAAs and their alternatives.

Perfluoroalkyl Substances (PFAS) and Fish Consumption in the Great Lakes Fish Consumer Study (GLFCS)

Meghan Cerpa (University of Illinois Chicago)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

POSTER: Locally Caught Freshwater Fish Across the United States are Likely a Significant Source of Perfluoroalkyl Substances (PFAS) Exposure

David Andrews (Environmental Working Group)

Biosketch

David Andrews specializes in the public health implications of chemicals detected in drinking water, consumer products and cosmetics. For the past fifteen years, he has been working to educate consumers, move markets toward safer chemistries and protect health. Andrews is a senior scientist at the Environmental Working Group, which has been studying PFAS chemicals since 2001. Andrews has published numerous public reports and interactive maps on PFAS contamination and is frequently interviewed by the news media. He has been a co-author on 7 peer-reviewed publications regarding PFAS occurrence and health risks. Andrews holds a patent on quantum interference devices. He received his Ph.D. in chemistry from Northwestern University and BA from Wesleyan University.

Abstract

Identifying and reducing exposure to per- and polyfluoroalkyl substances, or PFAS, is an urgent public health priority due to health harms associated with exposure. There remains significant uncertainty with respect to the role and importance of different exposure routes, including consumption of contaminated food, drinking water, dust and inhalation. Here we calculate the potential contribution of PFAS from consumption of locally caught freshwater fish to blood serum levels in the United States. The basis for our analysis is over 500 composite samples of fish filet collected across the United States from 2013-2015 under the U.S. EPA's monitoring programs, the National Rivers and Streams Assessment and the Great Lakes Human Health Fish Filet Tissue Study. The PFAS levels in sampled freshwater fish were compared with recent FDA seafood sampling and the impacts on serum levels are calculated. The median levels of PFAS in freshwater fish across the United States were 278 times higher than levels in commercially relevant fish tested by the U.S. Food and Drug Administration in 2019-2022. Our analysis finds that a single serving of freshwater fish per year with the median level of PFAS as detected in the U.S. EPA monitoring programs would have a significant impact on levels in blood serum. This finding is significant when considered alongside EPA's 2022 updated interim health advisories for PFOA and PFOS. Additional communication and public guidance on freshwater fish consumption is urgently need.

POSTER: Temporal and Demographic Patterns of PFAS Exposure and the Relationship with Seafood Consumption in the U.S. General Population using 1999-2012 NHANES Data

Samantha Fontenelle (U.S.EPA)

Biosketch

Commander Samantha Fontenelle is a Commissioned Officer with the U.S. Public Health Service and an Environmental Protection Specialist in the U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology. Her current duties include supporting the EPA's Fish and Beach programs and is the Technical Lead for EPA's Sanitary Survey App for Marine and Freshwaters. Prior to joining the Office of Science and Technology, she worked in Office of Groundwater and Drinking Water supporting the development of the Water Laboratory Alliance. Prior to joining EPA, Commander Fontenelle worked in the private sector as a contractor to the U.S. Department of Energy. Commander Fontenelle has a Masters of Public Health from Johns Hopkins University and a Masters of Arts in Environmental Studies from the University of Illinois at Springfield.

Abstract

This study investigates patterns of exposure to perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA) in the general U.S. population aged 12 and older, with a focus on how seafood consumption plays in exposure and how it's changed over time. Using Centers for Disease Control & Prevention's (CDC) National Health and Nutrition Examination Survey (NHANES) data (1999-2000 and 2003-2012), we estimated long-term seafood intake with regression calibration and applied survival analysis to evaluate relationships between PFAS concentrations human blood serum and seafood consumption, year of data collection, demographic factors.

Serum PFOS and PFOA concentrations in humans decreased ($p<0.0001$) while serum PFNA concentrations increased over time ($p<0.0001$). Seafood intake is positively associated with all three contaminants studied, and significantly associated with PFOS and PFNA ($p<0.0001$). The positive relationship between seafood intake and serum PFOS increased across the study time-period ($p=0.01$). Males have higher serum PFAS concentrations than females ($p<0.0001$ for PFOS and PFOA, $p=0.0005$ for PFNA). Serum PFOS and PFNA concentrations increased with increasing income ($p<0.0001$). Differences exist in serum PFAS concentration by race/ethnicity ($p<0.0001$) that vary with individual PFAS.

Serum PFOS and PFOA concentrations decreased across the study period. PFOS concentrations decreased more rapidly than PFOA concentrations. The more rapid decline in serum PFOS is likely due to non-seafood-related exposure sources due to cessation of U.S. PFOS production. Serum PFNA concentrations increased over time. Seafood consumption continues to be an important exposure route for PFOS and PFNA, but less important for PFOA based on the NHANES data evaluated.

DAY 2 SESSION 4: RISK COMMUNICATION FOR PFAS

Moderator:
Roxanne Karimi (Stony Brook University)

Biosketch Omitted at Moderator's Request

Presentations
Holistic Assessment of Perfluoroalkyl Substances (PFAS) in Fish Filets and Organs using a Community-Science Approach
Gillian Miller (Ecology Center)

Conducting Perfluoroalkyl Substances (PFAS) Surveillance of Freshwater Fish from Select Locations in Massachusetts
Rachel Gladstone (Massachusetts Dept. of Public Health)

New Hampshire Department of Environmental Services (NHDES) Fish Tissue Study Results: What does it mean and what might it mean?
Ken Edwardson (New Hampshire Dept. of Environmental Services)

Holistic Assessment of Perfluoroalkyl Substances (PFAS) in Fish Filets and Organs using a Community-Science Approach

Gillian Miller (Ecology Center)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

Conducting Perfluoroalkyl Substances (PFAS) Surveillance of Freshwater Fish from Select Locations in Massachusetts

Rachel Gladstone (Massachusetts Dept. of Public Health)

Biosketch

Rachel Gladstone works as an Environmental Analyst for the Massachusetts Department of Public Health (MDPH) in the Bureau of Environmental Health (BEH). With considerable experience in environmental chemistry and data analytics, she is passionate about addressing public health concerns by researching environmental contaminants and quantifying their impacts. Her background features research in PFAS, disinfection by-products, PCBs, microplastics, and heavy metals. With the Environmental Toxicology Program at MDPH, Ms. Gladstone is responsible for evaluating health impacts associated with chemical contaminants in a variety of media including air, water, soil, fish, and consumer products. Prior to her position at MDPH, Rachel worked as an ORISE Environmental Chemistry Researcher for EPA, where she studied the transformation of PFAS in metabolic and environmental systems. Rachel graduated from the University of Vermont, where she majored in environmental science and minored in chemistry and statistics.

Abstract

The Massachusetts Department of Public Health has conducted several years of surveillance of 40 PFAS analytes in fish tissue harvested from more than 200 freshwater fish locations across the state. This presentation will provide an overview of our technical approach to sampling, laboratory analysis, and interpretation, as well as the perspectives on how local, state, federal, and tribal stakeholders were engaged through the various stages of the process. We will describe how an initial pilot study evolved into a plan to prioritize state parks and environmental justice communities across the state. The presentation will include a description of sampling results and the development of consumption advice, fact sheets, and supporting information. We will also discuss how current PFAS advice at waterbodies compares to advice that has been issued for legacy contaminants such as PCBs and mercury.

New Hampshire Department of Environmental Services (NHDES) Fish Tissue Study Results: What does it mean and what might it mean?

Ken Edwardson (New Hampshire Dept. of Environmental Services)

Biosketch

Ken Edwardson is a senior scientist at New Hampshire's Department of Environmental Services overseeing the water quality standards and assessment programs. Ken has spent the last 20 years at NHDES developing methods and processes to interrogate water quality data to guide sound water quality decisions for New Hampshire waters. Before coming to NHDES, Ken spent a half dozen years performing tracer studies in support nutrient isotope work in Arctic rivers then dabbled in teaching. He has a BS and MS in water resource management from the University of New Hampshire.

Abstract

In 2020 the New Hampshire Department of Environmental Services funded a study water, sediment and fish tissue PFAS concentrations in 14 lakes focusing on the most developed portion of the state. That study led to the addition of several fish consumption advisories for PFOS. A common follow-on question was what the 2020 dataset might mean for the rest of the state. In subsequent analysis we evaluated the co-occurring water quality and land use land cover characteristics to estimate what portion of New Hampshire lakes might have elevated fish tissue concentrations. The subsequent analysis will be beneficial in targeting additional sampling.

DAY 2 SESSION 5: PFAS: IT'S NOT JUST IN THE FINFISH

Moderator:
Amy LaLiberte (Maryland Dept. of the Environment)

Biosketch
Amy Laliberte works in the Public Health section of the Water and Science Administration at the Maryland Department of the Environment. Her work focuses on Shellfish Certification and the Fish Consumption Advisory Programs. Amy holds two associates degrees in Environmental Science and Public Health from Anne Arundel Community College, a bachelor's degree in Environmental Science and Biology from Towson University, a master's degree in Environmental Biology from Hood College, and a certificate in Advanced Geospatial Applications from the Community College of Baltimore County. Since the COVID pandemic, much of her work has been in the study of PFAS and its impacts on shellfish and fish consumption. In addition to working for the State of Maryland, Amy teaches Biology and Environmental Science at Anne Arundel Community College and prefers to focus on student's with alternate learning needs.

Presentations
Perfluoroalkyl Substances (PFAS) Bioaccumulation, Depuration, and Energetic Cost in the Eastern Oyster, Crassostrea virginica
Kayla Boyd (Auburn University)

Seafood as a Source of Per- and Polyfluoroalkyl Substance Exposure Among Residents of New Hampshire
Jonathan Petali (New Hampshire Dept. of Environmental Services)

POSTER: Bioaccumulation of Per-and Polyfluoroalkyl Substances (PFAS) in Delaware Bay Fish and Shellfish
Shannon Jones (University of Delaware)

POSTER: All Perfluoroalkyl Substances (PFAS) and No Pearls: Preliminary Findings of Per- and Polyfluoroalkyl Acids in Great Bay Bivalves
Christine Gardiner (Dartmouth College)

POSTER: Challenges and Opportunities for Evaluating Perfluoroalkyl Substances (PFAS) in Bivalve Shellfish
Nathan Giffard (New Hampshire Dept. of Environmental Services)

POSTER: Ecological Characteristics Impact Perfluoroalkyl Substances (PFAS) Concentrations in a U.S. North Atlantic Food Web
Melanie Hedgespeth (U.S. EPA)

Perfluoroalkyl Substances (PFAS) Bioaccumulation, Depuration, and Energetic Cost in the Eastern Oyster, Crassostrea virginica

Kayla Boyd (Auburn University)

Biosketch

Kayla Boyd is a PhD student at Auburn University in the Crustacean and Molluscan Ecology Lab headed by Dr. Jim Stoeckel. She earned her Bachelor of Science in Applied Science: Biochemistry and Molecular Biology with a minor in Computer Science at the University of Wisconsin – Stout. Her research focuses on thermal tolerance physiology of aquatic invertebrates including freshwater mussels, crayfish, and oysters. Kayla is stationed at the Auburn University Shellfish Laboratory on Dauphin Island, Alabama, studying oyster physiology, specifically the interactions between environmental conditions and oyster energetics and how this relates to oyster mortality events in the Gulf of Mexico.

Abstract

Per- and poly- fluorinated chemicals (PFAS) are a class of man-made chemicals that are widespread and persistent in the environment, including Mobile Bay, AL. They have a high potential to bioaccumulate in many aquatic organisms. Oysters are chronically exposed to PFAS through filtering activities, which calls into question the health of wild and farmed populations. Depuration of contaminants has been shown to be efficient but energetically expensive in some bivalves, with previous studies primarily focusing on single compounds rather than mixtures. In this study we investigate whether oysters can efficiently depurate an ecologically relevant mixture of PFAS compounds and whether depuration is energetically expensive with potential negative effects on organismal health. Eastern oysters (Crassostrea virginica) were exposed to a mixture of PFAS (PFPeA, PFHxA, PFBS, PFOA, and PFOS) at an ecologically relevant cumulative concentration (<2 ug/L) to estimate bioaccumulation during exposure and depuration after being transferred to clean water. Optical respirometry was used to assess energetic costs associated with exposure and subsequent depuration. Results show that at ecologically relevant concentrations, PFAS did bioaccumulate at low levels, but compounds were depurated below detection limits within 24 hours of being placed in clean water. We found no evidence for increased energetic costs related to exposure and/or depuration. It is unlikely that the mixtures of dominant PFAS compounds recently detected in and near Mobile Bay are negatively affecting the energetic health of oysters. Oysters appear to have the capacity to quickly and efficiently depurate ecologically relevant mixtures of PFAS when transferred to clean water.

Seafood as a Source of Per- and Polyfluoroalkyl Substance Exposure Among Residents of New Hampshire

Jonathan Petali (New Hampshire Dept. of Environmental Services)

Biosketch

Jonathan Petali, PhD, DABT, is the toxicologist for the New Hampshire Department of Environmental Services. For nearly 5 years he has supported NH's efforts to address per- and polyfluoroalkyl substances (PFAS). Dr. Petali aided the development of NH's drinking water standards for PFAS, conducts risk assessment for human and ecological health, and provides technical support for a growing number of PFAS-related site investigations in NH. Additionally, he supports the risk communication with stakeholders impacted by PFAS and the evolving scientific and regulatory landscape. Jon holds a PhD in Environmental Toxicology from the University of Nebraska Medical Center's College of Public Health, and a BS in Biological Sciences from Wright State University. Following his doctoral training, he was a postdoctoral associate with the University of Nebraska-Lincoln's Department of Civil and Environmental Engineering, where he studied the fate and transport of emerging contaminants in Midwestern waterways.

Abstract

Per- and polyfluoroalkyl substances (PFAS) are persistent, fluorinated chemicals used in a wide variety of industrial and commercial applications with known adverse health effects. PFAS in seafood is believed to be an underappreciated dietary source of exposure. We conducted a population-based survey of New Hampshire (NH) residents (n=1,829) to determine frequency of seafood consumption and typical portion size among adults and children aged 2-11 years old residing within surveyed households. Among adult respondents, 93% reported seafood consumption within the last year, 94% in the prior month, and 77% had within the previous week. Overall, shrimp, haddock, salmon, and canned tuna were the most frequently consumed types of seafood. Approximately a quarter of the respondents (28%) resided in a household in which at least one member had a NH fishing license within the prior five calendar years. The majority of respondents (68%) indicated that their fish consumption habits were not influenced by the COVID-19 pandemic. PFAS concentrations in fish tissues were generally low, but several PFAS were detected in >70% of the fish sampled | (perfluorooctanesulfonic acid (PFOS), perfluorotetradecanoic acid, perfluoroundecanoic acid (PFuDA), perfluorotridecanoic acid, perfluorohexadecanoic acid, perfluorodecanoic acid, perfluorododecanoic acid, perfluorononanoic acid. Across species sampled the highest average concentrations of PFAS were observed for PFuDA (mean=0.27 ng/g; standard deviation=0.19) and PFOS (mean=0.24 ng/g; standard deviation=0.37). Estimated daily intake of PFAS from fish were calculated using the combined survey and lab data and the findings will inform future risk assessment activities.

POSTER: Bioaccumulation of Per-and Polyfluoroalkyl Substances (PFAS) in Delaware Bay Fish and Shellfish

Shannon Jones (University of Delaware)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

POSTER: All Perfluoroalkyl Substances (PFAS) and No Pearls: Preliminary Findings of Per- and Polyfluoroalkyl Acids in Great Bay Bivalves

Christine Gardiner (Dartmouth College)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

POSTER: Challenges and Opportunities for Evaluating Perfluoroalkyl Substances (PFAS) in Bivalve Shellfish

Nathan Giffard (New Hampshire Dept. of Environmental Services)

Biosketch

As a lab technician and manager of the Chen Lab at Dartmouth College, I have worked on various epidemiology, ecotoxicology, and fresh water and estuarine ecology projects —all of which relate to the sources, bioaccumulation, and fate of per- and polyfluoroalkyl substances (PFAS) in the environment. Our research is focused on the states of New Hampshire and Vermont, with particular interest in the Great Bay Estuary located in Great Bay, NH. At these sites, which are typically impacted by current and/or historical PFAS sources, our lab measures PFAS in lower trophic level species, and the bioaccumulation of these compounds through the food web. As I continue my work and education, I hope to further explore the intersection between ecology and public health and to better understand the impacts that PFAS have on human health in the United States. Recent publications include Giffard et. al., 2022; and Bangma et. al., 2022.

Abstract

Per- and polyfluoroalkyl substances (PFAS) are a diverse class of persistent, fluorinated surfactants used widely in industrial and commercial applications with known adverse health effects. Consumption of shellfish is a suspected source of PFAS exposure in the general population. This presentation provides 1) findings from a literature review that synthesizes the current understanding of PFAS occurrence in shellfish and 2) relates these finding to preliminary data from shellfish sampled in New Hampshire. In the broader literature, concentrations of PFAS reported in shellfish (non-detect up to 125.9 ng/g for PFOS, the most prevalent PFAS) vary by geographic location, shellfish species, habitat, and across PFAS compounds, and studies informing estimates of bioaccumulation of PFAS in shellfish are extremely limited at this time. Within New Hampshire's coastal waters, lower concentrations of PFAS (non-detect to 2.4 ng/g for the most prevalent PFAS, PFOS) were detected in a variety of bivalve mollusks. Tissues were sampled and extracted by Dartmouth College then at Clarkson University using LC-MS/MS for 27 PFAS compounds. PFAS concentrations and profiles varied between bivalve species and in relation to their distances from PFAS sources. Differences in analytical methods and sampling designs have led to risk communication challenges with the public and commercial growers who have increasing concerns for the impacts of PFAS. This presentation identifies several important opportunities for researchers to standardize PFAS sampling techniques, analytical methodologies and facilitate data collection to inform basic research as well as human health risk assessments.

POSTER: Ecological Characteristics Impact Perfluoroalkyl Substances (PFAS) Concentrations in a U.S. North Atlantic Food Web

Melanie Hedgespeth (U.S. EPA)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 2 SESSION 6: PFAS RESEARCH: DEVELOPMENTAL, REPRODUCTIVE AND NEURAL EFFECTS

Moderator:
Jonathon Petali (New Hampshire Dept. of Environmental Services)

Biosketch
Jonathan Petali, PhD, DABT, is the toxicologist for the New Hampshire Department of Environmental Services. For nearly 5 years he has supported NH's efforts to address per- and polyfluoroalkyl substances (PFAS). Dr. Petali aided the development of NH's drinking water standards for PFAS, conducts risk assessment for human and ecological health, and provides technical support for a growing number of PFAS-related site investigations in NH. Additionally, he supports the risk communication with stakeholders impacted by PFAS and the evolving scientific and regulatory landscape. Jon holds a PhD in Environmental Toxicology from the University of Nebraska Medical Center's College of Public Health, and a BS in Biological Sciences from Wright State University. Following his doctoral training, he was a postdoctoral associate with the University of Nebraska-Lincoln's Department of Civil and Environmental Engineering, where he studied the fate and transport of emerging contaminants in Midwestern waterways.

Presentations
Effects of Developmental Exposure to Poly and Perfluoroalkyl Substances (PFAS) on the Behavioral Response to Acute Stressors
Ahmed Abdelmoneim (Louisiana State University)

Effects of Poly and Perfluoroalkyl Substances (PFAS) Exposure on Microglial Function and Neural Network Development
Jessica Plavicki (Brown University)

Effects of Developmental Exposure to Poly and Perfluoroalkyl Substances (PFAS) on the Behavioral Response to Acute Stressors

Ahmed Abdelmoneim (Louisiana State University)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

Effects of Poly and Perfluoroalkyl Substances (PFAS) Exposure on Microglial Function and Neural Network Development

Jessica Plavicki (Brown University)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 3 SESSION 1: FISH CONSUMPTION AND EQUITY

Moderator:
Dianne Barton (Columbia River Inter-Tribal Fish Commission)

Biosketch
Dianne is the Water Quality Coordinator at the Columbia River Inter-Tribal Fish Commission where she provides technical expertise related to water quality, environmental toxics, and regulatory processes. Dianne serves as the Chairman of the National Tribal Toxics Council (NTTC) which is an EPA tribal partnership group for the Office of Pollution Prevention and Toxics. Key issues for the NTTC include advocacy for programs to minimize the disproportionate exposure of tribal members to toxic chemicals, increasing tribal capacity to monitor natural resources for toxic chemicals, and enhancing tribal consultation on chemical risk management and pollution prevention policies. Dianne holds a Ph.D. in Geochemistry from the University of Arizona and is a member of the Bad River Band of Lake Superior Chippewa.

Presentations
Anacostia River: Urban Subsistence Fishing in Two Jurisdictions' Fish Consumption Advisories
Trey Sherard (Anacostia Riverkeeper)

Protection of Tribal Fish Consumers under the Toxic Substances Control Act (TSCA)
Dianne Barton (National Tribal Toxics Council)

The Great Lakes Fish Consumption Collaborative
Meghan Williams (Wisconsin Dept. of Natural Resources)

Development of Site-Specific Fish Consumption Rates for Anglers at Superfund Sites
Shanna Alexander (U.S. EPA, Region 4) & Marian Olsen (U.S. EPA, Region 2)

Subsistence Seafood and Aquatic Biota Consumption Systematic Review and Project Update for the 2023 Fish Forum
Amina Wilkins (U.S. EPA)

POSTER: The Dragonfly Mercury Project in the Merrimack River Watershed: Participatory Science to Inform Risk in Environmental Justice Communities
Sarah Nelson (Appalachian Mountain Club)

Anacostia River: Urban Subsistence Fishing in Two Jurisdictions' Fish Consumption Advisories

Trey Sherard (Anacostia Riverkeeper)

Biosketch

Trey Sherard, Anacostia Riverkeeper, grew up in coastal North Carolina, and is beginning his twelfth year with Anacostia Riverkeeper. Recognized by River Network as a 2022 River Hero, he is DC Vice-Chair of the Anacostia Watershed Community Advisory Committee after serving as Chair for three years and continues to serve on the Mayor's Leadership Council for a Cleaner Anacostia River. He is an experienced community organizer who has increased engagement and volunteer activity in Anacostia River communities through a variety of partnerships. He helped build Anacostia Riverkeeper's water quality monitoring program, currently coordinate's ARK's Clean Waterways cleanups and Friday Night Fishing, manages eight Bandalong litter traps in DC and MD, runs ARK’s green infrastructure program, and gives many of the Anacostia River Explorer boat tours. B.S. Biology Duke University, USCG 100-ton Captain on Inland Waters

Abstract

Anacostia Riverkeeper has worked closely with the District Department of Energy and Environment and, to a lesser degree with Maryland Department of Environment, to improve the degree to which both agencies' fish consumption advisories in the Anacostia River watershed actually protect the most vulnerable populations - subsistence anglers who are frequently people of color. This talk will discuss our perspective as an NGO partner and watchdog on the work of the agencies, as well as our own direct experience educating the communities around the river about the danger of consuming fish containing PCBs and other organic toxins. We will review the a recent ethnographic study of the subsistence anglers in this watershed, as well as advisories currently and recently imposed in the District of Columbia and Maryland portions of the watershed. We will then dig into their strengths and their weaknesses when it comes to actually protecting the health of local anglers, in particular subsistence anglers. We will touch on the District's Anacostia River Sediment Project and the assumptions currently inherent to the toxics remediation goals thereof, and we will look at other potential frameworks used in the United States that might better protect the subsistence angling communities here.

Protection of Tribal Fish Consumers under the Toxic Substances Control Act (TSCA)

Dianne Barton (National Tribal Toxics Council)

Biosketch

Dianne is the Water Quality Coordinator at the Columbia River Inter-Tribal Fish Commission where she provides technical expertise related to water quality, environmental toxics, and regulatory processes. Dianne serves as the Chairman of the National Tribal Toxics Council (NTTC) which is an EPA tribal partnership group for the Office of Pollution Prevention and Toxics. Key issues for the NTTC include advocacy for programs to minimize the disproportionate exposure of tribal members to toxic chemicals, increasing tribal capacity to monitor natural resources for toxic chemicals, and enhancing tribal consultation on chemical risk management and pollution prevention policies. Dianne holds a Ph.D. in Geochemistry from the University of Arizona and is a member of the Bad River Band of Lake Superior Chippewa.

Abstract

The Toxic Substances Control Act (TSCA) is unique in its across-media requirement to "look comprehensively" at the hazards of a chemical "in total" in controlling it's use in products, and to consider 'potentially exposed or susceptible subpopulations' in doing so. But TSCA risk evaluations often fail to fully capture risk to tribes when toxic substances contaminate fish resources.

In the 2019 HBCD risk evaluation, fish consumption is listed as the exposure route expected to be "the largest contributor to overall dose, given the persistent and bioaccumulative properties of HBCD". Indeed, EPA employed for the first time a conservative tribal population fish consumption rate to determine acute exposure for "subsistence fishers," but used a central-tendency rate for chronic exposure -- thereby failing to understand that tribal lifeways are lifelong. A revised evaluation addressed aggregate exposure for subsistence fishers but not those living near releases, and not for infant fish ingestion, thus underestimating tribal infant risk.

Underestimation of tribal risk from a chemical because of nonrepresentative exposure may be compounded from insufficient chemical specific fish data. Tribes not only consume more fish, they consume fish and other aquatic species that are not commercially available and less likely to be studied. Without relevant fish data to inform TSCA risk evaluations, tribal scenarios may be missed and/or result in underestimated risk. Fish data being produced now is out of step with the TSCA priority chemical timeline. The issue needs urgent attention by federal agencies that drive fish monitoring studies.

The Great Lakes Fish Consumption Collaborative

Meghan Williams (Wisconsin Dept. of Natural Resources)

Biosketch

Meghan Williams has been a toxicologist at the Wisconsin Department of Natural Resources since 2012 and has been in her current role as a water quality toxicologist since 2018. She is responsible for developing water quality criteria for the protection of human health and aquatic life, revising existing water quality standards, and providing technical expertise on the potential health effects of pollutants in surface waters for the Water Quality Bureau. Meghan has also served on the board of the Midwest chapter of the Society for Environmental Toxicology and Chemistry since 2019. She has a BA in zoology from Ohio Wesleyan University and a Master's in aquatic toxicology from Bowling Green State University.

Abstract

Fish consumption rates are an integral component in the calculation of water quality standards and the assessment of public health risks. However, most of the default consumption rates used to develop standards rely on data that are several decades old and reflect average consumption among non-subsistence populations. In recognition of these deficiencies, the United States Environmental Protection Agency's (USEPA) 2015 updates to recommended human health water quality criteria included an increased default fish consumption rate (although this value was still based on average consumption) and noted that higher values could be used when suitable. With this in mind, personnel from the Minnesota Pollution Control Agency, the Wisconsin Department of Natural Resources, and the USEPA have established the Great Lakes Fish Consumption Collaborative. Along with colleagues from other state and tribal agencies, our goals are 1) to gain an improved understanding of the fish consumption patterns of high-consuming or vulnerable populations in the upper Midwest and 2) to implement changes, as appropriate, to protect these populations from exposure to fish contaminants. This presentation will discuss the Collaborative's work thus far including summarizing data gaps that have been identified, providing a review of our anticipated products, and offering opportunities for input and collaboration.

Development of Site-Specific Fish Consumption Rates for Anglers at Superfund Sites

Shanna Alexander (U.S. EPA, Region 4) & Marian Olsen (U.S. EPA, Region 2)

Biosketch

Shanna Alexander is a senior toxicologist with the United States Environmental Protection Agency (Region 4) in Atlanta, Georgia. Shanna specializes in conducting human health and ecological risk assessments. She has almost 20 years of experience spanning both the private and regulatory sectors focusing on health-protective, risk-based solutions to environmental challenges. She currently serves as the co-chair of EPA's Fish Consumption Workgroup and have co-authored numerous risk-based guidance documents and training modules with the Interstate Technology and Regulatory Council (ITRC). Shanna earned her Bachelor of Science in Molecular Biology and Chemistry from the University of Nebraska and Master of Science in Toxicology from Louisiana State University in Baton Rouge, Louisiana. Shanna has been awarded a certification from the American Board of Toxicology.

Abstract

The EPA Regions formed a Subsistence and Recreational Fish Consumption Workgroup to discuss approaches for the development of fish, shellfish (e.g., crabs, shrimp, mussels, oysters, etc.) and other aquatic and exotic species (e.g., turtles, sea urchins, etc.) identified at waterbodies affected by contaminant releases from Superfund sites. This presentation will summarize resources for establishing site-specific consumption rates for various Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) individuals under the Superfund Program. It is anticipated that the presentation will highlight information in the EPA's Exposure Factors Handbook, studies of consumption rates for Tribal Nations and subsistence anglers including rates for adults and children where data is available. The presentation will highlight examples of approaches that have been used at Superfund sites for high-end consumers and the general population.

Subsistence Seafood and Aquatic Biota Consumption Systematic Review and Project Update for the 2023 Fish Forum

Amina Wilkins (U.S. EPA)

Biosketch

Amina Wilkins is a senior scientist at the USEPA, Office of Research and Development (ORD), Center for Public Health and Environmental Assessment (CPHEA). With previous experience as an exposure scientist, she is skilled in developing methods, models and guidance documents to facilitate the estimation of human exposure to chemicals in the environment including guidance to help assessors identify highly exposed population groups, creation of geographical information system (GIS) risk-based computer exposure models, development of exposure factors and a fate and transport model, provision of data to quantify chemical exposures from human milk and fish consumption, and data to support environmental justice (EJ) analyses. Her recent work focuses on advancing the systematic review of literature and developing automated data extraction methods pertaining to exposure sciences and chemical risk assessments. She served as a past Society for Risk Analysis (SRA) Council Member and the past inaugural chair of the SRA Justice, Equity and Risk Specialty Group (JERSG). Amina completed her graduate studies in Public Health at the George Washington University in Washington D.C. and prior to that received a Bachelor of Science degree in Environmental Sciences.

Abstract

As a measure to improve upon previous methods for evaluating chemicals under the Toxic Substances Control Act (TSCA), the United States Environmental Protection Agency (USEPA), Office of Chemical Safety and Pollution Prevention (OCSPP) initiated collaboration with the National Tribal Toxics Council (NTTC) and the National EPA Tribal Science Council (TSC) to develop exposure scenarios to better understand and capture unique tribal exposures to chemicals in the environment. In developing these scenarios, EPA tribal partnership groups expressed that EPA and other risk assessors may not be utilizing the latest information available to estimate subsistence consumption rates for aquatic foods such as fish, seafood, plants, and mammals. Thus, ORD staff proposed that the partnership conduct a systematic literature review utilizing ORD-developed workflows to survey literature sources for the latest information on subsistence fish consumption. A workgroup was formed consisting of staff from ORD, OSCPP, R10, and tribal members from the Tribal Pesticide Program Council (TPPC), NTTC and TSC.

The consumption data resulting from this workgroup's systematic review is envisioned to support development of health assessments and standards such as:

1. State and tribal water quality standards
2. Assessment of human health risks from CERCLA/RCRA sites that involve exposure to contaminants via consumption of fish with site related contaminant body burden
3. Evaluation of the fish consumption associated risks of chemicals in commerce, particularly for high fish consuming populations (TSCA).

This systematic review identifies studies from major database and gray literature sources containing consumption rate data for aquatic biota such as fish, seafood, plants, and mammals, consumed by subsistence and tribal populations. Specifically, this presentation overviews the systematic review methods used to collect and screen over 11,878 references, evidence mapping results (i.e., the number of included and excluded references), and discusses the status and future application of the data extracted from relevant references.

Results from this systematic review will better inform and increase the accuracy of health risk assessments by providing data for subsistence populations thereby decreasing reliance on use of default consumption rate values, which tend to underestimate and be less protective of subsistence populations. Thus, data from this effort will increase protection of subsistence populations. When standards are in place to protect subsistence populations, the health of the general population is also protected.

POSTER: The Dragonfly Mercury Project in the Merrimack River Watershed: Participatory Science to Inform Risk in Environmental Justice Communities

Sarah Nelson (Appalachian Mountain Club)

Biosketch

Sarah Nelson is the Director of Research at the Appalachian Mountain Club. Prior to AMC, she was at the University of Maine for 21 years, as Associate Research Professor in the School of Forest Resources and Director of the Program in Ecology and Environmental Sciences. Her research focuses on understanding the effects of atmospheric pollution and climate change on forests, foodwebs, and freshwaters in remote and protected ecosystems. Current research includes geochemistry in lakes, climate change with a focus on changing winters, and mercury contamination, using approaches including long-term monitoring, biosentinels, and citizen/community science. One of her signature programs is the Dragonfly Mercury Project (DMP), which engages citizen scientists in collection of dragonfly larvae for mercury analysis in national parks, allowing for national-scale assessment of this contaminant. She now works with teachers and community partners in the Merrimack River Watershed who are assessing mercury in Lowell and Lawrence, MA.

Abstract

Mercury is a toxic pollutant that bio-accumulates and biomagnifies in food webs – including dragonflies, fish, and people – impairing immune and endocrine systems, reproduction, and the central nervous system function. In the Dragonfly Mercury Project (DMP), community scientists nationwide are working with national parks and public land managers to monitor mercury concentrations in dragonfly larvae, a useful mercury biosentinel that is linked with fish mercury concentrations and indicates relative mercury risk in freshwaters. The project includes remote and relatively 'pristine' national parks and wildlife refuges, typically led by public lands staff. In urban watersheds with legacies of industrialization and pollution, such as the Merrimack River in Massachusetts, partner schools and community organizations in the environmental justice communities of Lowell and Lawrence find connections to natural spaces and learn how past and current mercury sources affect close-to-home water resources. In 2021 and 2022, dragonfly larvae were collected from 12 waterbodies; results to date indicate moderate to high risk to food webs and people. Over 200 students and 11 partner community groups in the Merrimack watershed are practicing real-world science skills and will use the data to explain to their community, family, and decision-makers how mercury could be an environmental health issue where they live. The data are contributed to the DMP's national-scale dataset (over 18,000 observations) of biotic mercury, putting local results in a national context. This presentation will focus on the collaboration and outcomes of scientists, partners, teachers, community members, and students in the first two seasons of the Merrimack DMP.

DAY 3 SESSION 2: RISK COMMUNICATION, PART 1

Moderator:
Page Hingst (Santee Sioux Nation of Nebraska)

Biosketch
Page Hingst is the 128(a) Tribal Response Program Manager for the Santee Sioux Nation of Nebraska. She has worked in her capacity for 7 years and for the Santee for 5 years. Page is responsible for brownfields, UST's, solid and hazardous waste, and emergency response. She is a member of the Tribal Waste and Response Steering Committee, Tribal Science Council Vice Co-Chair, National Tribal Brownfields Workgroup, and co-lead of the Tribal PFAS Workgroup. She has a Bachelor of Science degree from Wayne State College in Biology and Psychology. Page enjoys camping, fishing, and spending time with family.

Presentations
Know Your River, Know Your Food – A Fish Consumption Advisory Program
Beth Appert (Multnomah County Health Dept.)

Engagement, Equitable Voice, and Empowerment: Building a Health Promotion Program to Advance Environmental Justice in the Duwamish River Superfund Site
Ruben Chi Bertoni (King County and Seattle – Dept. of Public Health)

A Focus Group Study of Fish Consumption Behaviors Among Asian Women in Milwaukee
Summer Shaw (Wisconsin Division of Health Services)

An Online Manual to Increase Access to and Application of Best Practices for Communicating Fish Consumption Advisories in North Carolina
Chiara Klein (Duke University Superfund Research Center)

Gigiigooinaan (Our Fish): A New Advisory to Promote Anishinaabe Health and Wellness
Matthew Dellinger (Medical College of Wisconsin)

Know Your River, Know Your Food – A Fish Consumption Advisory Program

Beth Appert (Multnomah County Health Dept.)

Biosketch

Beth possesses a combination of lived, learned and professional experience as it relates to community based and culturally specific public health engagement. She holds a master's degree of public health, with a focus on global health. Her work includes 3 years on a community-based HIV and AIDS project in Mozambique and 12 years in local public health, most recently as a Program Specialist Senior with Multnomah County Health Department (MCHD). During her time with MCHD, she's worked across several areas from teaching adolescent sexuality education to COVID-19 outbreak investigation, to her current role engaging with community members about the Lower Willamette River Fish Advisory. Born in Burundi and raised in Portland, Oregon, she has a love and passion for collaborating with the local multicultural community.

Abstract

Problem: Little evidence exists showing signage is effective at communicating the risk of eating contaminated seafood despite its repeated use at the Portland Harbor Superfund Site (PHSS). Best practice is to consult with the target audience, once they're defined, to help shape and evaluate the message.

Aim: No comprehensive fishers study was conducted at the PHSS to determine the target audience. To fill this knowledge gap, Multnomah County's Fish Consumption Outreach & Engagement program sought to define and engage this population in risk communication.

Approach: The program relied heavily on prior surveys and documents to identify the target audience. Once identified, a Human-Centered Design approach was used to develop workshops to engage these communities in the design of the program and outreach materials.

Ten workshops were held over 11 months with 178 community members. Workshops were held in the Slavic, Vietnamese, Native American, Latinex, African Immigrant, Pacific Islander, Black communities and among community members. Risk communication concepts were developed in each workshop with a vote to determine the "best" concept.

Results: Workshop participants identified targeted concept materials including games, multicultural fish festivals, "If Fish Could Talk" radio show, Community Health Worker training, etc.

Implications: To be effective, fish advisory risk communication must demonstrate a clear connection to the risk of eating certain seafood in a format and cultural context familiar to those fishing and/or eating them.

Next steps are to develop an evaluation plan to determine if specific activities are effectively educating and transferring this information to the community and impacting behavior change.

Engagement, Equitable Voice, and Empowerment: Building a Health Promotion Program to Advance Environmental Justice in the Duwamish River Superfund Site

Ruben Chi Bertoni (King County and Seattle – Dept. of Public Health)

Biosketch

Ruben Chi Bertoni has working in multicultural outreach and engagement for over 8 years. In the past year, he has joined the Fun2catchtoxic2eat Program under Public Health King County-Seattle. His passion lies in environmental justice and helping communities all have access to a healthy environment.

Abstract

The Lower Duwamish Waterway Group's Fishers Study (2014-2016) identified that the majority of fishers and consumers of contaminated residential seafood from the Duwamish River Superfund Site (DRSS) were immigrant and refugee populations who have Limited English Proficiency, with the top three groups from Vietnamese, Khmer, and Latino communities. To educate our community about the health risks and benefits of consuming seafood from the Duwamish River, we--as representatives from these diverse groups are working together to educate our communities on the risks of eating contaminated residential seafood and the benefits of consuming salmon and the alternatives of consuming safe seafood elsewhere.

Under an innovative community health program established by Public Health-Seattle & King County (PHSKC) in partnership with the Environmental Protection Agency (EPA), the Fun to Catch, Toxic to Eat Program builds community capacity to provide input on decisions related to the DRSS that affect our communities. We build capacity by bringing our communities together, training community members to become Community Health Advocates (CHA), leveraging community expertise, and empowering the CHAs to work towards a solution to protect health. Our work allows us to talk and problem solve with decision makers on breaking down the barriers to ensuring communities' lived experiences are considered through government processes—giving our community a voice so that we can work together to help create a change for future generations.

As a result, we have been able to work with PHSKC to create a community health promotion program plan for the EPA that combines the co-creation of culturally appropriate educational materials and the mobilization of trained community health workers to reach the most vulnerable members of the community exposed to residential seafood toxics, targeting pregnant and nursing moms, parents, and caregivers of young children. Our teams' confidence has increased in raising awareness in the community, and we have empowered participants in our Program to make changes to protect their health. We prioritize building bridges between agencies and our community. This allows an opportunity for the agencies to connect and share more information with communities and allow community to directly voice their concerns.

This is the first federal regulatory program to use this community engagement model and we receive inquiries from agencies in other regions on how this project works and for us to share our model practices with others. The successes of this Program are a result of collaborative

partnerships across various government agencies and community organizations, and truly meaningful involvement of community members representative of the people it aims to serve. Through community-driven strategic development and iterative process improvements, we can gain direct feedback from those receiving our health messages and better understand the challenges and motivators they experience in taking up the behavior change we're promoting to adapt our approaches. We cannot expect our communities to change their health behaviors alone without the partnership and commitment from agencies and government to involve and empower communities in their processes and work with us to strive for health equity and environmental justice.

A Focus Group Study of Fish Consumption Behaviors Among Asian Women in Milwaukee

Summer Shaw (Wisconsin Division of Health Services)

Biosketch

Summer Shaw is an epidemiologist with the Wisconsin Division of Health Services. She has a Masters of Public Health in epidemiology from University of Illinois at Chicago School of Public health and is a graduate of the Council of State and Territorial Epidemiologists Applied Epidemiology Fellowship.

Abstract

Although consumption of locally caught fish provides numerous health benefits, it is a major route of exposure to methylmercury and other persistent environmental contaminants such as per- and polyfluoroalkyl substances (PFAS). Previous studies by the Wisconsin Department of Health Services (WDHS) found that Asian women of childbearing age (WCBA) in the Milwaukee area have high levels of contaminant exposure through fish consumption but limited awareness of public health fish advisories. To understand the impact of culture on health behaviors, WDHS conducted a series of focus groups among 19 Chinese, Hmong, and Karen community members. Focus group transcripts were thematically analyzed and coded using Dedoose© (SCRC, Manhattan Beach, CA) based on the integrated behavior model. All participants were aware of risks associated with eating fish, yet few knew ways to mitigate risk and maximize benefits. Participants expressed interest in dissemination of health messages through trusted sources and in educational materials that included relevant fish species. They recommended focusing not only at the individual level, but on families as well. Participants' confidence in self-efficacy was most likely to predict agreeing to follow health messaging. Providing culturally appropriate materials that Asian women can use to educate themselves along with friends and family may increase self-efficacy and uptake of fish advisories. Developing partnerships with local community health organizations was strongly recommended. Future studies will evaluate the effectiveness of self-affirmation messaging among Asian WCBA and assess changes in fish consumption based on message content.

An Online Manual to Increase Access to and Application of Best Practices for Communicating Fish Consumption Advisories in North Carolina

Chiara Klein (Duke University Superfund Research Center)

Biosketch

Chiara Klein is currently the Program Coordinator for the Community Engagement Core of the Duke University Superfund Research Center. She has a diverse background in education, environmental policy and advocacy, and community engagement. Her skills and interests are in supporting and empowering communities to be on the forefront of creating healthier environments, from both an ecological and an environmental health standpoint. Chiara has been in her current role since the summer of 2021, stepping in as a recent graduate from Duke University's Master of Environmental Management program, where her concentration was Ecosystem Science and Conservation. She also earned a certificate in Community-Based Environmental Management. Her previous roles include science educator at the Museum of Life and Science, Community Engagement + Outreach intern with the Dogwood Alliance, environmental policy advocate with the Franciscan Action Network, and environmental educator with the Sound to Sea program

Abstract

As in many states, fish consumption advisories (FCAs) in North Carolina are communicated primarily through physical signage that due to where they are located and their complex language and graphics, are difficult to access and interpret by the most vulnerable populations, such as those who are food insecure, low-income, or non-English-speaking. Local health departments, who are responsible for communicating advisories, often lack both the resources and capacity to do so well, and face trade-offs with competing priorities. Non-profit organizations and state agencies that have access to relevant populations and may have interest in filling communication gaps also have little guidance on how best to communicate FCAs. In response, we developed an online manual to provide easy access to best practices for communicating advisories. Based on current models for understanding the psychology of the complex process of changing behavior related to a new health threat, including the theory of planned behavior and the health belief model, the manual provides guidance on best practices for: (a) bringing a health threat to the attention of those affected, and (b) providing guidance on what they can do to address the threat. Developing the manual on the ArcGIS StoryMaps platform provides easy access and navigation by users and allows us to describe but also actively demonstrate best practices through the embedding of graphics, active hyperlinks and videos. While this manual was designed for users in North Carolina, it is open for adaptation and use by organizations in other states.

Gigiigooinaan (Our Fish): A New Advisory to Promote Anishinaabe Health and Wellness

Matthew Dellinger (Medical College of Wisconsin)

Biosketch

I am an Associate Professor in the Institute for Health and Equity at the Medical College of Wisconsin. Since 2004, I have dedicated myself to environmental and biomedical science collaborations with the Great Lakes Native American tribes. This has led to hard-earned and productive working relationships with tribal organizations in the region. My primary expertise is in adapting stakeholder engagement as part of Human Health Risk Assessment projects in partnership with Native American tribes. This requires extensive work in community engaged research methods. I also have over 18 years' experience promoting Native American youth education programs through digital media combined with academic research and cultural perspectives. In my collaborations with tribal organizations, we have strived to conduct health research that addresses concerns in the Bemidji (Great Lakes) Region.

Abstract

Fish consumption comprises an important part of what the Anishinaabe (Great Lakes Native Americans) call "minobimaadiziiwin" which translates roughly to "living in a good way". Our team of academic and Anishinaabe scientists co-developed a fish consumption advisory for the Anishinaabe using software that can be accessed via mobile phones and/or the internet.

The software, Gigiigoo'inaan ("our fish") is designed to improve environmental health literacy using culturally congruent messaging and aesthetics. We tested the following hypotheses: 1) the Gigiigoo'inaan would encourage consumption of fish high in Polyunsaturated Omega-3 fatty acids (PFUA-3) whilst minimizing contaminant intake (methylmercury (MeHg) and Polychorinated Biphenyls (PCBs)); and 2) intervention participants will be more likely than controls to achieve a favorable n-3 PUFA/MeHg consumption ratios. We conducted a randomized controlled trial with prospective self-reported fish consumption using automated email surveys. One-month pre and one month post, control and intervention outcome variables were calculated per participant as µg/kg/day of MeHg, µg/kg/day of PCB, g of fish, and mg/day of EPA+DHA. These were modeled using an analysis of covariance (ANCOVA) with a-priori covariates: age, sex, and tribal affiliation.

Most participants in both trial arms reported eating relatively elevated amounts of fish yet remained within advisory guidelines for contaminants. EPA+DHA:MeHg ratios were also favorable in most participants. Advisory limits for contaminants were exceeded by relatively few participants in the study. Since most participants did not exceed advisory limits, Gigiigoo'inaan was not demonstrated to alter those behaviors given the current statistical power. We did observe, through a secondary analysis, that providing more affirmative responses to a cultural questionnaire assessing minobimaadiziiwin was correlated with increased confidence and fish consumption (i.e., Environmental Health Literacy).

DAY 3 SESSION 3: RISK COMMUNICATION, PART 2

Moderator:
Audrey Van Genechten (New York State Dept. of Health)

Biosketch
Audrey Van Genechten has worked as a Public Health Specialist with the New York State Department of Health since 2010. Her work as Program Manager for the Hudson River Fish Advisory Project and coordinating fish advisory outreach across NYS focuses on helping fishermen of all backgrounds understand the NYSDOH advice about eating local fish. Audrey's extensive experience with face-to-face outreach to anglers makes her particularly interested in creating actionable advisories and understanding barriers to advisory compliance. Audrey is involved in the graphic design, creation, and testing of new and existing advisory materials. Education: Audrey received a Bachelor of Science from University of Vermont with concentrations in Plant & Soil Science, Chemistry, and International Development. While at UVM she did soil research in the mountains of Vermont. While abroad in Honduras and Cuba, she worked with farmers to bring back traditional crop rotations and implement organic methods to build soil fertility.

Presentations
Preferences for Seafood Consumption Advice in Pregnant Women
Bruce Lauber (Cornell University)

Risk Assessment and Effectiveness of Fish Consumption Advisories Among Female Anglers in Oregon, USA
Sarah Rothenberg (Oregon State University)

The Efficacy of a Text Messaging Intervention Trial to Conserve Healthy Fish Consumption and Reduce Mercury Contaminants in Reproductive Age Chicago Asian Women
Mary Ellen Turyk (University of Illinois Chicago)

FDA Update: New Studies to Inform Advice About Eating Fish
Kellie Casavale (U.S. FDA)

Working with New York State Burmese and Karen Speaking Anglers to Create Culturally Appropriate Fish Advisory Materials
Audrey Van Genechten (New York State Dept. of Health)

Preferences for Seafood Consumption Advice in Pregnant Women

Bruce Lauber (Cornell University)

Biosketch

Bruce Lauber is Director of the Center for Conservation Social Sciences (CCSS) and a Senior Research Associate in the Department of Natural Resources and the Environment at Cornell University. The CCSS conducts research on the social dimensions of natural resource and environmental management. Its work is used by a wide array of decision makers and natural resource practitioners. Lauber has published nearly a dozen papers on fish consumption and fish consumption advisories, most of which focus on the Great Lakes region.

Abstract

Many women of childbearing age do not consume enough seafood to derive optimal health benefits for themselves and their children. In a set of three focus groups, we varied three characteristics of fish consumption advice to assess how pregnant or recently pregnant women could be encouraged to consume seafood. First, we found focus group participants preferred gain-framed statements emphasizing benefits of eating fish vs. loss-framed statements emphasizing costs of not eating enough fish. Second, we compared how women respond to a recommendation to eat seafood vs. a recommendation to eat lower mercury seafood because some pregnant women avoid seafood because of concern about mercury, but found no consistent preference for either approach. Lastly, we examined preferences for systems of categorizing seafood into different consumption categories, varying the number of categories and the number of species listed under each category. Shorter, dichotomous lists of species to eat or avoid were preferred by some participants because they were clear and easy to use. Many women, however, preferred lists with mores species listed and consumption categories (e.g., eat once a week) because of their comprehensiveness. We will describe how our findings could be used to design advice to encourage greater fish consumption.

Risk Assessment and Effectiveness of Fish Consumption Advisories Among Female Anglers in Oregon, USA

Sarah Rothenberg (Oregon State University)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

The Efficacy of a Text Messaging Intervention Trial to Conserve Healthy Fish Consumption and Reduce Mercury Contaminants in Reproductive Age Chicago Asian Women

Mary Ellen Turyk (University of Illinois Chicago)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

FDA Update: New Studies to Inform Advice About Eating Fish

Kellie Casavale (U.S. FDA)

Biosketch

Kellie Casavale is the Senior Science Advisor for Nutrition in the Office of Analytics and Outreach in CFSAN, FDA. She supports cross-Center and cross-Departmental collaborations, particularly those related to the Dietary Guidelines for Americans (DGAs), Closer to Zero, and maternal and child populations. She has led in the Dietary Guidelines process through roles at USDA/CNPP, HHS/ODPHP, and now FDA. She supported the development of the first Dietary Patterns for children under 2 years with 2020 Dietary Guidelines Advisory Committee. Other leadership roles include the U.S. Federal Data Consortium on Pregnancy and Birth to 24 Months, the Human Milk Composition Initiative in the U.S. and Canada, and maternal and child health projects in CDC's National Health and Nutrition Examination Surveys (NHANES). She contributes leadership for Closer to Zero and the FDA/EPA Fish Advice, elucidating the ways nutrition can reduce the adverse developmental effects of potential exposures to environmental chemical contaminants from food.

Abstract

In April 2021, the U.S. Food and Drug Administration (FDA) released the Closer to Zero action plan to drive down levels of arsenic, lead, cadmium, and mercury in foods consumed by babies and young children. Seafood can be a source of all four elements, but most notably, is the primary source of methylmercury in U.S. diets. FDA and the Environmental Protection Agency (EPA) jointly issue "Advice about Eating Fish" (Advice) to limit exposure to methylmercury from fish to children and during pregnancy and breastfeeding. The most current Advice, released in October 2021, incorporates the recommendations of the Dietary Guidelines for Americans to eat seafood for its potential health benefits and, in particular, because of seafood's unique nutrient content that supports child brain, immune system, and spinal cord development. FDA is taking additional steps to develop a more holistic view of seafood's role in the diet. FDA has commissioned an independent study by the National Academies of Sciences, Engineering, and Medicine, in partnership with the National Oceanic and Atmospheric Administration, U.S. Department of Agriculture, and EPA. The study will incorporate systematic reviews of both the nutritional and toxicological effects of seafood composition to inform conclusions on how seafood consumption impacts child growth and development. FDA also is updating analytical methods for mercury analysis to support a sampling and analysis plan for new FDA data on seafood composition. In addition, work is planned in the areas of health equity and environmental justice, consumer research, and development of educational materials and tools related to dietary recommendations for fish.

Working with New York State Burmese and Karen Speaking Anglers to Create Culturally Appropriate Fish Advisory Materials

Audrey Van Genechten (New York State Dept. of Health)

Biosketch

Audrey Van Genechten has worked as a Public Health Specialist with the New York State Department of Health since 2010. Her work as Program Manager for the Hudson River Fish Advisory Project and coordinating fish advisory outreach across NYS focuses on helping fishermen of all backgrounds understand the NYSDOH advice about eating local fish. Audrey's extensive experience with face-to-face outreach to anglers makes her particularly interested in creating actionable advisories and understanding barriers to advisory compliance. Audrey is involved in the graphic design, creation, and testing of new and existing advisory materials. Education: Audrey received a Bachelor of Science from University of Vermont with concentrations in Plant & Soil Science, Chemistry, and International Development. While at UVM she did soil research in the mountains of Vermont. While abroad in Honduras and Cuba, she worked with farmers to bring back traditional crop rotations and implement organic methods to build soil fertility.

Abstract

As part of work funded by a 2021 EPA GLRI grant, NYS DOH sought to create a culturally appropriate fish advisory guides for newcomer anglers of the Burmese diaspora. From previous outreach work with Burmese and Karen anglers, NYS DOH wanted feedback from the community about which information was most important to them to make materials that were understandable, actionable, and that took into account cultural considerations such as preference for eating whole fish (vs. just eating fillets).

DOH worked with community liaisons to create and translate guides and held focus groups with Burmese and Karen speakers in Albany and Syracuse, NY to test key concepts, usability, and receive feedback from anglers and family members.

The presentation will discuss cultural consideration learned, recruitment efforts, final products, and discuss future efforts for NYS DOH to undertake suggested by focus group participants.

DAY 3 SESSION 4: TRAININGS

Trainings

Environmental Justice (EJ) Screen
Tai Lung (U.S. EPA)

Office of Enforcement and Compliance Assurance Per- and Poly-fluoroalkyl Substances (PFAS) Analytic Tools
Nicholas Spalt (U.S. EPA)

Environmental Justice (EJ) Screen

Tai Lung (U.S. EPA)

Biosketch

Mr. Lung has worked on tools, mapping, and policy in EPA's Office of Environmental Justice and External Civil Rights since 2012. His work focuses on the development of tools and policies that address low income and minority populations overburdened by disproportionately high environmental pollution. Tai leads EPA's efforts on EJScreen, a mapping and screening tool that combines environmental and demographic data to highlight areas with potential environmental justice concerns. He worked on environmental justice and partnerships issues in EPA's Office of Land and Emergency Management from 2008 to 2012. Prior to joining EPA, Tai served as an Environmental Education Extension Agent in Senegal with the Peace Corps. Mr. Lung has a bachelor's degree in environmental geography from West Virginia University and a master's degree in public management from the University of Maryland.

Office of Enforcement and Compliance Assurance Per- and Poly-fluoroalkyl Substances (PFAS) Analytic Tools

Nicholas Spalt (U.S. EPA)

Biosketch

Nicholas Spalt is a Program Analyst in EPA's Office of Compliance where he focuses on data integration and transparency. Nicholas works on EPA's Enforcement and Compliance History Online Website (also known as ECHO) and various data products within it. He's been with the Agency for four years coming from service in the U.S. Peace Corps and a transition from Academia with a focus in hydrogeology. He is an avid spearfisherman and makes annual trips to Philippines with his wife to make Kinilaw – akin to a Filipino version of sushi – with her family.

Abstract

In January 2023, EPA's Enforcement and Compliance History Online (ECHO) website added a new search interface - the PFAS Analytic Tools. PFAS, which is short for perfluoroalkyl and polyfluoroalkyl substances, are a category of chemicals of high concern to communities. The PFAS Analytic Tools bring together available national datasets containing PFAS records into a searchable, map-themed webpage that allows user to filter, zoom in and download information such as PFAS chemical production, releases/effluent discharges, and occurrence in the environment (including fish tissue). The application may be used by investigators, both regulatory and academic, to identify or prioritize locations for PFAS testing or other actions.

DAY 4 SESSION 1: FISH DATA TOOLS

Moderator:
Brandon Reid (Michigan Dept. of Health and Human Services)

Biosketch
Brandon Reid is a toxicologist with the Michigan Department of Health and Human Services (MDHHS) Division of Environmental Health (DEH). His work at MDHHS involves conducting public health assessments for sites of environmental contamination. Brandon also manages MDHHS's Eat Safe Fish (ESF) program, which sets fish consumption advisories and guidelines for waterbodies in Michigan. In addition to analyzing data and setting consumption guidelines, Brandon's work as the ESF program manager involves overseeing health education and community outreach efforts to raise awareness and education regarding safe fish consumption, as well as coordinating several grants that fund projects that further the ESF program mission. Previously, Brandon worked at a scientific consulting firm where he specialized in conducting chemical hazard evaluations and risk assessments. Brandon has a Master of Public Health from the University of Michigan School of Public Health.

Presentations
Advancing our Understanding of Contaminant Sources and Burden to Predator Fishes of the Great Lakes Over Vast Time Domains
Ryan Lepak (U.S. EPA)

Incorporating Habitat Use and Life History to Predict Polychlorinated Biphenyl (PCB) Residues in Fish
Joel Hoffman (U.S. EPA)

Submitting Fish Contaminant Data to the Water Quality Exchange (WQX)
Adam Griggs (U.S. EPA)

How to Find, Access, and Deploy Fish Contaminant Data Using the Water Quality Portal
Adam Griggs (U.S. EPA)

POSTER: An Evaluation of Mercury and Selenium Fish Tissue Monitoring Alternatives: Fish Biopsy Plug Samples Versus Homogenized Whole Fillets
John Healey (U.S. EPA)

POSTER: EPA's 2022 National Assessment of Contaminants in Fish from U.S. Lakes
John Healey (U.S. EPA)

POSTER: Filling the Data Gap on Responses of Fish Polychlorinated Biphenyl (PCB) Content to Remedial Actions in Torch Lake, Michigan
Enid Partika (Michigan Technological University)

Advancing our Understanding of Contaminant Sources and Burden to Predator Fishes of the Great Lakes Over Vast Time Domains

Ryan Lepak (U.S. EPA)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

Incorporating Habitat Use and Life History to Predict Polychlorinated Biphenyl (PCB) Residues in Fish

Joel Hoffman (U.S. EPA)

Biosketch

Joel Hoffman is a Supervisory Biologist at the US EPA Office of Research and Development. He is located at the Great Lakes Toxicology and Ecology Division in Duluth, Minnesota where he conducts research and manages the Ecosystem Services Branch. Joel conducts research that supports the development of a workable practice of sustainable, ecosystem-system based management of coastal (Great Lakes, estuaries) ecosystems. His expertise includes assessing coastal ecosystem services; using ecological tracers to study water quality, characterize aquatic food webs and fish movements, and model contaminant bioaccumulation; and developing ecosystem condition and biodiversity assessments. Current contaminants of research interest include PCBs, dioxins, mercury, and PFOA/PFAS.

Abstract

The heterogenous distribution of contaminated sediments in urban environments presents multiple challenges for characterizing risk, measuring exposure, and establishing fish consumption advisories. Owing to this heterogenous distribution, contaminant residues in fish tissue can vary widely, presumably due to variable exposure that arises from, at least in part, within- and among-species differences in habitat use and life history. Therefore, to understand the potential impact of remediation and restoration on fish tissue concentrations, we developed a habitat-specific, geospatial Biota-Sediment Accumulation Factor (BSAF) model for PCBs. The model predicts fish PCBs residues at a scale of 0.1 km2 (i.e., potentially remedy-scale) by incorporating both home range and habitat use. First, we compared multiple fishes to select an appropriate model species that has a small feeding area based on carbon and nitrogen stable isotope ratios and habitat-specific relationships for PCBs. Subsequently, we developed the BSAF model for small (75-150 mm total length) yellow perch (Perca flavescens), a widely-distributed freshwater species and popular game fish. Third, we conducted a field validation of the model in an urban river—wetland complex and found the model had a high degree of accuracy for predicting fish tissue residues. We conclude this approach has strong potential to be used for PCBs “hot spot” screening and confirmation, estimating remediation project footprints, and to estimate potential remediation impact to improve the quality of a fishery.

Submitting Fish Contaminant Data to the Water Quality Exchange (WQX)

Adam Griggs (U.S. EPA)

Biosketch

Adam is an Ecologist (M.S.) in the US EPA's Office of Water, Office of Wetlands, Oceans and Watershed's Water Data Integration Branch. Adam has over nineteen years of experience in aquatic monitoring and assessment, data science, community science, and program management. Adam is the current project lead for the Water Quality Portal and leads Outreach and Training for the Water Quality eXchange (WQX). He is working to build resources for scientists and communities to better collect, access, and interpret data collected from their waters.

Abstract

This workshop will be a how-to for submitting fish contaminant (tissue) data to the Water Quality Exchange (WQX). The Water Quality Exchange (WQX) is EPA's open data standard for submitting and exchanging water quality data and information. Data submitted through WQX is made available through the Water Quality Portal (WQP). The EPA WQX Team has developed a new draft Fish Tissue WQXWeb Template to simplify the process of submitting fish contaminant (tissue) data through WQXWeb. WQXWeb is EPA's online web application that assists users in formatting their water quality datasets to the WQX standard. The new fish tissue WQXWeb Template is limited to the fields needed for a successful WQX fish tissue data submission, comes pre-packaged with up-to-date allowable values, contaminants (Characteristics), and species names, and contains instructions for data submission through WQXWeb. In the workshop, we'll cover how to register for WQX, access and populate the new web templates, and submit data through WQXWeb.

How to Find, Access, and Deploy Fish Contaminant Data Using the Water Quality Portal

Adam Griggs (U.S. EPA)

Biosketch

Adam is an Ecologist (M.S.) in the US EPA's Office of Water, Office of Wetlands, Oceans and Watershed's Water Data Integration Branch. Adam has over nineteen years of experience in aquatic monitoring and assessment, data science, community science, and program management. Adam is the current project lead for the Water Quality Portal and leads Outreach and Training for the Water Quality eXchange (WQX). He is working to build resources for scientists and communities to better collect, access, and interpret data collected from their waters.

Abstract

This workshop will be a how-to for finding, downloading, and using fish contaminant (tissue) data from the Water Quality Portal (WQP). The Water Quality Portal (WQP) is a cooperative service sponsored by the United States Geological Survey (USGS), the Environmental Protection Agency (EPA), and the National Water Quality Monitoring Council (NWQMC). The WQP integrates data submitted through the Water Quality Exchange (WQX), sample data from USGS National Water Information System (NWIS), and the USDA ARS Sustaining The Earth's Watersheds - Agricultural Research Database System (STEWARDS). The WQP hosts data of many water data types, so this workshop will demonstrate how to retrieve fish contaminant data successfully and will cover the new WQP data profiles being delivered to the WQP in 2023. This workshop will explain the differences between the data profiles available through the WQP, cover joining the profiles to access metadata, and demonstrate how to use the WQP web services to import data directly into your preferred data analysis or visualization platform.

POSTER: An Evaluation of Mercury and Selenium Fish Tissue Monitoring Alternatives: Fish Biopsy Plug Samples Versus Homogenized Whole Fillets

John Healey (U.S. EPA)

Biosketch

John Healey (he/him) leads the national fish tissue monitoring program at the U.S. Environmental Protection Agency's Office of Science and Technology. The fish tissue monitoring program collects fish composite samples from the Great Lakes, and from rivers and lakes throughout the 48 contiguous United States, for analysis of per- and polyfluoroalkyl substances (PFAS), mercury and polychlorinated biphenyls (PCBs). These national probabilistic surveys are conducted in collaboration with EPA's National Aquatic Resource Surveys, and the results provide a national baseline assessment for these contaminants.

Abstract

Monitoring contaminant bioaccumulation in fish is necessary to ensure human health protection and to communicate risks associated with fish consumption. Biopsy punch (or fish fillet plug) sampling has recently been applied in some fish monitoring programs as a more cost-effective alternative to obtain data than the routine approach of homogenizing and analyzing entire fillets. However, the degree to which fish fillet plug results are representative of homogenized fillet results is largely unknown. EPA's Office of Science and Technology conducted a study to address the fundamental question of whether fish fillet plug analysis can serve as a reliable alternative for analyzing whole fillet tissue to monitor mercury and selenium concentrations in fish. Six target species of fish commonly consumed by humans were collected from three Great Lakes and three eastern U.S. rivers. For mercury analysis, a total of ten specimens of each of the six species were used to prepare fish tissue samples, including five replicate field-extracted fillet plug samples and five replicate samples of homogenized whole fillet tissue (prepared in the laboratory) to produce 600 samples for mercury analysis. For selenium analysis, five specimens of each of the six species were collected to prepare fish tissue samples, including four replicates each of field-extracted fillet plugs and lab-prepared homogenized whole fillet samples yielded 240 samples for selenium analysis, with another 120 plugs used to determine percent solids. EPA used Analysis of Variance (ANOVA) to test the comparability of mercury and selenium results from field-extracted fillet plugs and homogenized whole fillets.

POSTER: EPA's 2022 National Assessment of Contaminants in Fish from U.S. Lakes

John Healey (U.S. EPA)

Biosketch

John Healey (he/him) leads the national fish tissue monitoring program at the U.S. Environmental Protection Agency's Office of Science and Technology. The fish tissue monitoring program collects fish composite samples from the Great Lakes, and from rivers and lakes throughout the 48 contiguous United States, for analysis of per- and polyfluoroalkyl substances (PFAS), mercury and polychlorinated biphenyls (PCBs). These national probabilistic surveys are conducted in collaboration with EPA's National Aquatic Resource Surveys, and the results provide a national baseline assessment for these contaminants.

Abstract

EPA is conducting a probability-based study of fish contamination in U.S. lakes and reservoirs (collectively referred to as lakes) as part of the Agency's 2022 National Lakes Assessment (NLA). This study provides the first opportunity for EPA to assess PFAS contamination in lake fish on a national scale and to reassess mercury and PCB contamination in lake fish since the last assessment 20 years ago. In 2022, field teams collected one fish composite sample per lake from a statistically representative subset of approximately 400 lakes with surface areas ranging from one to about 5,000 hectares. Routine composite samples consisted of five similarly sized adult fish of the same predator species that are commonly consumed by humans. EPA will analyze fillet tissue composite samples for mercury, 40 PFAS, and 209 PCB congeners using EPA Method 1631E, Draft Method 1633, and Method 1668C, respectively. EPA will compare mercury and PCB results from the 2022 NLA Fish Tissue Study to predator species fillet results from the National Lake Fish Tissue Study (conducted in 2000-2003) and evaluate if average fillet composite concentrations for these contaminants have changed in the 20-year interval between the two studies.

POSTER: Filling the Data Gap on Responses of Fish Polychlorinated Biphenyl (PCB) Content to Remedial Actions in Torch Lake, Michigan

Enid Partika (Michigan Technological University)

Biosketch

Enid Partika is a current Ph.D. Candidate in Environmental Engineering at Michigan Technological University. Before her time at Michigan Tech, she received her MS in Analytical Chemistry and her BS in Environmental Systems and Environmental Chemistry. As a doctoral candidate at Michigan Tech, Enid is working with Judith Perlinger and Noel Urban to develop a Quality assurance project plan for organic toxics analyses of Great Lakes fish tissue in collaboration with the Keweenaw Bay Indian Community using Gas Chromatography and Tandem Mass Spectrometry. Her research currently focuses on streamlining trace environmental analytical methods, investigating the spatial variability of organic contaminants in fish throughout the Lake Superior watershed, and developing new approaches to defining planetary boundaries for novel chemical pollutants.

Abstract

The Torch Lake Area of Concern (AOC) in the Upper Peninsula of Michigan has been a hotspot of a mixture of chemical contaminants including mercury and PCBs but was recently delisted as a Superfund site. However, most of the early remediation performed at the Torch Lake AOC was not aimed at mitigating polychlorinated biphenyl (PCB) contamination, and accordingly, PCB concentrations in walleye changed little between 1988 and 2013. Between 2017 and the present, a number of remedial actions were undertaken to reduce PCB inputs to the lake. To evaluate the efficacy of this remediation, fish tissue samples collected annually from 2018 to 2020 were analyzed via Accelerated Solvent Extraction, Gel Permeation Chromatography, Florisil column chromatography cleanup, and analysis by Agilent 8890 GC-7010B Tandem Mass Spectrometer for PCBs, dichlorodiphenyltrichloroethane (DDT), Chlordane, and lipid concentrations in Torch Lake walleye. Changes in DDT and Chlordane concentrations enable quantification of the PCB changes that are due to remediation rather than global and local transport and accumulation. This presentation will utilize novel separation methods and tandem mass spectrometry to discover how human exposure to fish contaminants has changed as a result of both remediation and fish community dynamics.

DAY 4 SESSION 2: CLIMATE CHANGE

Moderator:
Wendy Heiger-Bernays (Boston University)

Biosketch Omitted at Moderator's Request

Presentations
Will Climate Warming Enhance Mercury Bioaccumulation in Lake Fishes by Inducing Deep-Water Anoxia?
Stephen Jane (Cornell University)

Food Web Transfer of Cyanobacterial Toxins in the Chowan River and the Western Albemarle Sound, North Carolina
Astrid Schnetzer (North Carolina State University

POSTER: Winter Mercury Patterns in Lake Champlain and Future Environmental Health Risks
Roxanne Karimi (Stony Brook University)

Will Climate Warming Enhance Mercury Bioaccumulation in Lake Fishes by Inducing Deep-Water Anoxia?

Stephen Jane (Cornell University)

Biosketch

Stephen Jane is an Atkinson Postdoctoral Fellow at Cornell University. Dr. Jane received his PhD from Rensselaer Polytechnic Institute in 2020. He has broad experience in aquatic research ranging from environmental DNA behavior in small mountain streams to hurricane impacts to coastal-marine fauna. His current work focuses on the impact of warming surface waters on these systems with an emphasis on lake ecosystems. Dr. Jane's work explores the effects warming has on the physical and chemical aspects of these systems, often employing computational and data intensive approaches. Recent work includes a human health component as it examines the potential for warming-induced deoxygenation of lakes to enhance the bioaccumulation of toxic mercury in fishes sought by anglers.

Abstract

Warming of surface waters is decreasing deep-water dissolved oxygen (DO) concentrations in lakes. Anoxia enables MeHg production by microbes, hence warming induced oxygen deficits could translate into increased accumulation of toxic Hg in fishes. We monitored fifteen lakes of varying conditions through one summer season using high frequency DO and temperature sensors. At the end of the summer stratified period, we collected brook trout from each lake and analyzed tissue Hg concentrations. Lakes varied widely in their degree of oxygen depletion. Some lakes exhibited no anoxia while others became anoxic in over half of the water column for almost the entire period. Brook trout Hg concentrations were similarly variable, with most lakes having low concentrations but a few consistently exceeding the 0.3 ug/g threshold for consumption advisories. Lakes without bottom anoxia always exhibited relatively low Hg in trout, but some highly anoxic lakes also showed low fish Hg. Our findings suggest that anoxia is necessary but not sufficient to favor high Hg biomagnification, but that other factors also influence fish Hg. Quantifying the factors that interact with water-column anoxia will be important for understanding how further warming will affect Hg contamination of fisheries.

Food Web Transfer of Cyanobacterial Toxins in the Chowan River and the Western Albemarle Sound, North Carolina

Astrid Schnetzer (North Carolina State University

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

POSTER: Winter Mercury Patterns in Lake Champlain and Future Environmental Health Risks

Roxanne Karimi (Stony Brook University)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 4 SESSION 3: CONTAMINENTS IN FISH, PART 1

Moderator:
Elsie Sunderland (Harvard University)

Biosketch
Elsie Sunderland is the Fred Kavli Professor of Environmental Chemistry and Professor of Earth and Planetary Sciences at Harvard University. Professor Sunderland's research aims to better understand how chemicals released by human activity interact with natural ecosystems and affect living systems. A main innovation of her group's work is to quantitatively analyze the entire exposure pathway for aquatic pollutants to identify key processes that have a large influence on their accumulation in biota. Prior to joining the faculty at Harvard, she spent five years working to inform environmental policy decisions with best-available science at the headquarters for the U.S. Environmental Protection Agency (U.S. EPA) in various offices. Her work at the U.S. EPA included regulatory impact assessments for Hazardous Air Pollutants and developing guidance on best use of environmental models to inform regulatory decisions. Prof. Sunderland received her B.Sc. from McGill University and Ph.D. from Simon Fraser University in Canada.

Presentations
Mercury Bioaccumulation in Estuarine Food Webs with Different Nitrogen Loads
John Logan (Massachusetts Division of Marine Fisheries)

Spatiotemporal Effects of Interacting Water Quality Constituents on Mercury Concentrations in Everglades' Mosquitofish
Mike Cyterski (U.S. EPA)

A Novel Approach to Assessing the Joint Effects of Mercury and Fish Consumption on Neurodevelopment in the New Bedford Cohort Study
Sally Thurston (University of Rochester) & Susan Korrick (Harvard T.H. Chan School of Public Health)

Spatial and Temporal Variability of Mercury in Upper and Lower Red Lake Walleye
Tyler Orgon (Red Lake Band of Chippewa Indians)

Experimental Evaluation of Additive Interactions in the Toxicity of Methylmercury and Polychlorinated Biphenyls (PCBs) to Zebrafish
Noel Urban (Michigan Technological University)

Mercury Bioaccumulation in Estuarine Food Webs with Different Nitrogen Loads

John Logan (Massachusetts Division of Marine Fisheries)

Biosketch

I have worked as a fisheries biologist with the Massachusetts Division of Marine Fisheries (MA DMF) in New Bedford, MA since 2010. This position includes a mix of policy and applied research aimed at protecting fish habitat from anthropogenic impacts in Massachusetts state waters. My contaminants-related work in this position has included studying the relationship between mercury transfer and nitrogen loading in Cape Cod, MA estuaries as well as PCB transfer related to macroalgal blooms in the New Bedford Harbor, MA Superfund Site. Before joining MA DMF, I completed my Ph.D. at the University of New Hampshire using chemical tracers to study movement and foraging patterns of Atlantic bluefin tuna.

Abstract

Eutrophication is a threat to estuaries worldwide that can adversely affect biota by facilitating algal blooms and hypoxia. Mercury (Hg) bioaccumulation in estuarine and coastal food webs is also a concern, particularly for higher trophic level fish and invertebrate species that are consumed by humans. Recent work has shown elevated Hg concentrations in groundwater entering estuaries in Cape Cod, Massachusetts, possibly due to mobilization mediated by eutrophication. To assess the extent of mercury transfer from groundwater to aquatic food webs and test the proposed relationship with eutrophication, we sampled representative estuarine biota from three sites within four neighboring estuaries on Cape Cod (Falmouth, MA) with different nitrogen loads. We sampled representative consumers (quahogs (Mercenaria mercenaria), mud snails (Ilyanassa obsoleta), mummichogs (Fundulus heteroclitus), striped killifish (F. majalis), Atlantic silversides (Menidia menidia), and grass shrimp (Palaemonetes pugio)) in these systems. We measured total mercury concentrations as well as carbon (δ13C) and nitrogen (δ15N) stable isotope ratios in these sentinel species to relate observed mercury concentrations to trophic position and energy pathways in these systems. Using δ15N as a proxy for wastewater nitrogen inputs, we further assessed the relationship between eutrophication and mercury bioavailability by measuring both δ15N and total Hg in quahog shells from these four estuaries. Comparison between Hg and stable isotope values will help define the mechanism of Hg entry to coastal waters and guide management associated with coastal urbanization, municipal wastewater, land-use planning, and sustainable fisheries.

Spatiotemporal Effects of Interacting Water Quality Constituents on Mercury Concentrations in Everglades' Mosquitofish

Mike Cyterski (U.S. EPA)

Biosketch

Michael Cyterski is a research ecologist and data scientist with the USEPA Office of Research and Development in Athens, GA. He was born in Erie, PA, and received a bachelor's degree in biology from Harvard University. He garnered two degrees (Masters in Statistics, PhD in Fisheries) from Virginia Tech. He joined the EPA in 1999 as a post-doc, and an ongoing research focus has been on software (Virtual Beach) that facilitates development of empirical models to predict concentrations of fecal indicator bacteria (FIB) at recreational beaches. He has also used multivariate, machine-learning statistical methods to predict fish assemblages in US streams, and he served on a multi-disciplinary team to quantify impacts of the Gold King Mine spill on the Animas River system in Colorado. He also serves as a statistical consultant for experimental design and data analyses for researchers at ORD Athens and the nearby Region 4 laboratory.

Abstract

We discuss a multiyear study of the Everglades detailing how various environmental variables can alter mercury concentrations in the food web. About 1000 random locations throughout the marsh have been sampled for the USEPA REMAP program since 1995. REMAP sampling includes an abundant prey fish (eastern mosquitofish, Gambusia holbrooki) as an indicator of mercury bioaccumulation. We used Generalized Boosted Models to estimate how much of the mercury concentration in mosquitofish could be explained by water quality constituents or indicators of ecological health. The resulting model accounts for 60% of the variation in mosquitofish mercury, a robust outcome for a large, disturbed ecosystem such as the Everglades. Of the eight most influential covariates, two were methyl mercury in periphyton and water, two can be indicators of trophic state (alkaline phosphatase and chlorophyll-a), one can be a marker of stormwater transport (conductivity), and two can be enablers of mercury methylation (sulfate in soil and water). Water with low phosphorus, but with sulfur and carbon above background, moved into the less disturbed parts of the Everglades via modifications to the existing water management system, could increase mercury bioaccumulation in those parts of the marsh.

A Novel Approach to Assessing the Joint Effects of Mercury and Fish Consumption on Neurodevelopment in the New Bedford Cohort Study

Sally Thurston (University of Rochester) & Susan Korrick (Harvard T.H. Chan School of Public Health)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

Spatial and Temporal Variability of Mercury in Upper and Lower Red Lake Walleye

Tyler Orgon (Red Lake Band of Chippewa Indians)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

Experimental Evaluation of Additive Interactions in the Toxicity of Methylmercury and Polychlorinated Biphenyls (PCBs) to Zebrafish

Noel Urban (Michigan Technological University)

Biosketch Omitted at Presenter's Request

Abstract Omitted at Presenter's Request

DAY 4 SESSION 4: CONTAMINENTS IN FISH, PART 2

Moderator:
Vivien Taylor (Dartmouth College)

Biosketch
Dr. Vivien Taylor is a Research Scientist in the Department of Earth Sciences at Dartmouth College. Dr. Taylor's research is in the field of environmental chemistry, with a focus on understanding the biogeochemical processes that dictate contaminant fate and transport, bioavailability, and exposure, under the broad context of environmental change. Her current projects examine mercury cycling and bioaccumulation in Lake Champlain and the Gulf of Maine and include outreach and engagement efforts with community and government stakeholders in these regions.

Presentations
Human Health Risk from Fish Consumption in Arsenic Contaminated Lakes in Western Washington
James Gawel (University of Washington Tacoma)

Fish Consumption Use Assessments for the Upper Mississippi River
Lauren Salvato (Upper Mississippi River Basin Association)

Geographic and Ecological Drivers of Harmful and Beneficial Compounds in Gulf of Maine Fish
Vivien Taylor (Dartmouth College)

POSTER: Selenium in Alaska's Fish
Christoff Furin (State of Alaska Dept. of Environmental Conservation)

Human Health Risk from Fish Consumption in Arsenic Contaminated Lakes in Western Washington

James Gawel (University of Washington Tacoma)

Biosketch

Jim Gawel is Associate Professor of Environmental Chemistry and Engineering at UW Tacoma, where he has been teaching and doing research with undergraduates for 23 years. He got his B.S. in Civil Engineering from Brown University, worked as a water engineer in the Peace Corps in Kenya, and then earned a Ph.D. from MIT in Environmental Engineering. His scholarship is diverse but can be summarized as investigating chemical fate and transport in terrestrial and aquatic environments, and its implications for biota (including humans). Dr. Gawel has shaped his scholarship around UW Tacoma's urban serving and community engaged mission, reaching a broader audience through applied research, student and community involvement, and disseminating results through alternative venues that have a greater impact on the citizens and policy makers not likely to read academic journals.

Abstract

Arsenic (As) contamination of lakes in the US has occurred as a result of mining, smelting, and its use as an aquatic herbicide and terrestrial pesticide. This carcinogen has accumulated in Puget Sound lakes and can be mobilized from lake sediments during the summer, although in deeper lakes there is a spatial separation between dissolved As and oxygen-requiring organisms, reducing the potential for biotic uptake. Our team of collaborators has now elucidated the mechanisms by which As in the sediments of shallow, urban lakes is remobilized into oxygenated surface waters, resulting in significant bioaccumulation of As in aquatic species. We measured the concentration of As in nine fish species from five regional lakes with varying As concentrations and maximum depth. Three fish species (largemouth bass, yellow perch, and bluegill) in the most contaminated (200 ppm As) shallow lake exceeded the 10-6 cancer risk level at the 90th percentile consumption level used for sport anglers, as did three species (brown bullhead, common carp, and rock bass) in another shallow lake with intermediate levels of As in sediments (50 ppm As). All of these fish species in these two lakes also exceeded the 10-5 risk level for the 99th percentile consumption rate used for subsistence fishers. Our results show there is a species-specific aspect to As health risk. For example, the cancer risk from largemouth bass is twice that of bluegill, with the difference possibly due to some combination of differences in feeding behavior and physiological retention/transformation of As.

Fish Consumption Use Assessments for the Upper Mississippi River

Lauren Salvato (Upper Mississippi River Basin Association)

Biosketch

Lauren Salvato has been the Water Quality Policy and Program's Director for the Upper Mississippi River Basin Association since 2017. The Association is a five-state interstate organization formed by the Governors of Illinois, Iowa, Minnesota, Missouri, and Wisconsin to coordinate the states' river-related programs and policies and work with federal agencies that have river responsibilities. Lauren has degrees from the University of New Mexico and Indiana University in environmental science, water resources, and public policy.

Lauren lives two blocks from the Minnesota River and volunteers as a Board member for the Lower Minnesota River Watershed District. In her spare time, Lauren likes to spend time outdoors, travel, and cook with her husband and young son.

Abstract

The five states of the Upper Mississippi River Basin (UMRB) – Minnesota, Missouri, Iowa, Illinois, and Wisconsin - developed a monitoring plan in 2013 to collect data on the shared borders of the large river floodplain. The plan's design includes monitoring of the four designated uses: fish consumption, recreation, aquatic life, and drinking water. In 2020 to 2021, Illinois, Iowa, and Missouri state agencies piloted the plan by monitoring the Upper Mississippi River from Lock and Dam 17 (L&D) near New Boston, Illinois to L&D 21, near Quincy, Illinois. The Upper Mississippi River Basin Association (UMRBA), the interstate water quality entity for the UMRB states, will share results from the pilot project including challenges and successes. In addition, UMRBA staff will share its plan to operationalize the monitoring plan and communicate the results of the pilot project to river users.

Geographic and Ecological Drivers of Harmful and Beneficial Compounds in Gulf of Maine Fish

Vivien Taylor (Dartmouth College)

Biosketch

Dr. Vivien Taylor is a Research Scientist in the Department of Earth Sciences at Dartmouth College. Dr. Taylor's research is in the field of environmental chemistry, with a focus on understanding the biogeochemical processes that dictate contaminant fate and transport, bioavailability, and exposure, under the broad context of environmental change. Her current projects examine mercury cycling and bioaccumulation in Lake Champlain and the Gulf of Maine, and include outreach and engagement efforts with community and government stakeholders in these regions.

Abstract

Marine fish are an important source of nutrients including lean protein and omega 3 polyunsaturated fatty acids but can also be a route of exposure to harmful compounds such as methylmercury. Broad consumption guidelines seek to minimize potential risk from contaminant exposure while maximizing the nutritional benefits of fish, but more information is needed on the ecological and locational drivers of these risks and benefits of fish within a population. This study assessed total Hg, Se, and lipids in muscle tissue from six species of fish (Atlantic cod, Atlantic herring, red hake, silver hake, little skates and spiny dogfish) caught in the Gulf of Maine, along with methylmercury, and fatty acid profiles on a subset of the same fish. Length and catch location had a significant effect on concentrations within and across species tissue concentrations, particularly for Hg, lipids, and fatty acids. These relationships are likely driven by plankton community compositions as well as Hg inputs to the Gulf of Maine. These findings inform the assessment of the risks and benefits of consuming demersal fish species and should be considered in the development of fish consumption advice.

POSTER: Selenium in Alaska's Fish

Christoff Furin (State of Alaska Dept. of Environmental Conservation)

Biosketch

Dr. Christoff Furin is the Research Analyst for the State of Alaska Fish Monitoring Program which is responsible for monitoring environmental contaminants in fish and shellfish caught in Alaska. He manages the sampling operations and database management for the program. Dr. Furin earned a Ph.D. from the University of Alaska Fairbanks studying the developmental effects of perchlorate, an endocrine disruptor, on fish. He has a background in environmental contaminants, marine biology, resource management and commercial fishing.

Abstract

Selenium is an essential micronutrient, a component of physiologically important enzymes and proteins needed for construction of DNA, function of the thyroid, reproduction, and protection against oxidative cell damage, is abundant in marine fish and shellfish. Seafood is also a source of environmental contaminants such as methylmercury, which is a health hazard, particularly to developing fetuses and children. Ongoing research suggests that selenium and methylmercury have an antagonistic relationship in which selenium binds to methylmercury, effectively removing it, but at the same time irreversibly removing selenium for use in selenoenzymes. The State of Alaska Fish Monitoring Program has been analyzing Alaska's fish for total mercury and selenium since 2002. The data for some species is presented here and its potential for incorporating this benefit into fish consumption recommendations is discussed.