United States Environmental Protection Agency

Fish and Shellfish Program NEWSLETTER

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https://www.epa.gov/fish-tech

Recent Advisory News

Maryland Department of the Environment (MDE) Issues New Fish Consumption Advisory and Guidelines

Recommended meal limits issued based on testing results as part of Maryland's comprehensive response to per- and polyfluoroalkyl substance (PFAS) risks; testing shows blue crabs and oysters do not appear to be affected, vast majority of fish may still be eaten in moderation

On December 8, 2023, MDE issued a new fish consumption advisory for certain locations based on levels of a chemical compound in a class known as PFAS for 15 fish species found in Maryland waterways.

"Fish is an important part of a healthy diet, but it is important to share what we've learned to help people — including subsistence anglers in underserved communities — make informed decisions about what they and their families eat," said MDE Secretary Serena McIlwain. "Maryland is committed to informing the public, following the science, and providing data as part of our comprehensive response to PFAS as an emerging national concern."

Though the vast majority of fish from Maryland waters may be eaten in moderation, the advisory provides updated guidelines for recommended consumption for certain recreationally-caught fish species in Maryland's fresh, estuarine, and marine waters.

PFAS refers to a group of more than 4,000 human-made chemicals that have been used since the 1940s in a range of products, including stain- and water-resistant fabrics and carpeting, cleaning products, paints, cookware, food packaging and fire-fighting foams. The uses have led to PFAS entering the environment, where they have been measured in soil, surface water, groundwater and seafood. Most people have been exposed to PFAS because of its use in so many common consumer goods.

Fish consumption advisories provide recommended limits on how often certain fish may be eaten to help minimize health risks. Consumption guidelines offer recommendations on the number of meals per month by species for the general population, women of childbearing age, and children. If a person were to eat more than the recommended meals

every month for 30 years, then they have an increased risk of 1 in 10,000 of having a health outcome due to that level of consumption.

Of the species with a new PFAS-based advisory, large and smallmouth bass (13 advisories), sunfish including bluegill (12 advisories), and white perch (11 advisories) had the highest numbers of advisories based on location and accounting for more conservative recommendations for women of childbearing age and children. None of the results from this round of PFAS sampling led to an advisory for all populations to completely avoid any fish from any Maryland waterway. Testing revealed no PFAS levels of concern or need to recommend meal limits for blue crabs or oysters.

A previous round of testing and resulting advisories for meal limits based on PFAS were issued in 2021 for three species of fish caught in Piscataway Creek in Prince George's County.

Maryland has monitored levels of other chemicals, including PCBs and methylmercury, in fish in the state for decades. Findings from such monitoring are the basis for the Department's fish consumption advisories. Surveillance will continue as needed.

More information:

- Fish consumption advisories
- Guidance for Fish Consumption: Monitoring PFAS Levels in Maryland (video)
- PFAS in Maryland: Monitoring and Mitigation is a Priority for Maryland (story map)
- Maryland and PFAS

For more information, contact MDE at mde.webmaster@maryland.gov.

Source: https://news.maryland.gov/mde/2023/12/08/maryland-department-of-the-environment-issues-new-fish-consumption-advisory-and-guidelines/

Illinois Department of Public Health (IDPH) Releases Updated Illinois Sport Fish Consumption Advisories

New methylmercury advisories issued for three lakes; polychlorinated biphenyl (PCB) advisories removed for seven lakes and rivers

On May 3, 2023, IDPH announced updated consumption advisories for sport fish caught in Illinois waters. These changes are the result of continued sampling by the Illinois Fish Contaminant Monitoring Program. IDPH maintains an interactive **Fish Advisory Map** that includes consumption advisories for more than 100 publicly accessible bodies of water across the state.

In 2023, IDPH added Lake Chaminwood, Lake McMaster, and Ramsey Lake to the list of waters with site-specific methylmercury advisories and issued more restrictive methylmercury advisories for certain species in Anna State Pond, Lake Nellie, Wabash River, and Arrowhead, Gillespie, Kinkaid, and Pinckneyville City Lakes.

In line with the statewide trend of declining PCB levels, no new PCB advisories were issued. PCB advisories were relaxed for certain species in the Fox Chain O'Lakes, the Illinois River, and Waukegan North Harbor. PCB advisories were removed for certain species in the Fox Chain O'Lakes, Frank Holten State Lakes, Powerton Lake, and the Illinois, Mackinaw, Mississippi, and Wabash Rivers. Most notably, all PCB advisories were removed for channel catfish throughout the Mississippi River.

In addition to the 2023 site-specific updates, a statewide methylmercury advisory remains in place for all Illinois waters. The statewide advisory cautions sensitive populations (those who are nursing, pregnant, or may become pregnant, and children less than 15 years of age) to eat no more than one meal per week of predatory fish. Predatory fish include all species of black bass, gar, salmon, and trout, as well as striped bass, white bass, walleye, sauger, flathead catfish, muskellunge, northern pike, and associated hybrids.

While there is no known immediate health hazard from eating contaminated fish from any Illinois water body, there are concerns about effects of long-term, low-level exposure to PCBs and methylmercury in fish. More information is at the IDPH **Fish Advisories** website.

For more information, contact IDPH Fish Advisories program at (217)-782-5830 or DPH.Tox@illinois.gov.

Source: https://dph.illinois.gov/resource-center/news/2023/may/idph-releases-updated-illinois-sport-fish-consumption-advisories.html

Illinois Discontinues Statewide Testing of Freshwater Fish for Organochlorine Pesticides

Low levels of pesticides in state fish population demonstrate effectiveness of environmental regulations

On September 18, 2023, IDPH, in conjunction with the Illinois Environmental Protection Agency and the Illinois Department of Agriculture, announced the discontinuation of statewide testing for organochlorine pesticides, such as dichlorodiphenyltrichloroethane (DDT), in fish from Illinois lakes and rivers.

Organochlorine pesticides, including DDT and other similar chemicals, have been banned for decades, but the state had tested for them since 1974 because they are "environmentally persistent" and can build up in the tissue of fish and other animals. But the levels of these pesticides found through that testing has diminished to near zero over the past nearly 50 years, allowing the state to discontinue testing for those chemicals.

Testing for other contaminants in fish, including methylmercury and PCBs, will not be affected by these changes.

"The progress made in improving the safety of fish found in Illinois waterways is an incredible victory for public health and a testament to the success of sensible health and safety regulations," said IDPH Director Dr. Sameer Vohra. "Banning dangerous pesticides like DDT has made our water cleaner, our food safer, and our state healthier."

"The work done through the Illinois Fish Contaminant Monitoring Program not only provides important information to residents regarding fish consumption, but it also shows the significant progress being made to reduce pollutants in Illinois waters," said Illinois EPA Director John J. Kim. "Data clearly shows that these organochlorine pesticides are no longer prevalent in our waters or the fish that live in those waters, which is a testament to the achievements made through the Clean Water Act."

"This exemplifies the strength of our agriculture community," said Dr. Michael Woods, Division Manager of Natural Resources at the Department of Agriculture. "Illinois farmers are always seeking advancement in producing the highest yields using the best practices. To render any contaminant testing obsolete while Illinois farmers continue to produce at historic levels is a success story for the entire state."

Organochlorine pesticides like DDT were in widespread use across America dating back to the 1940s. Concerns about the impact of DDT on wildlife (particularly the bald eagle) and on people led to its ban for agricultural use in the U.S. in 1972; bans on other organochlorine pesticides followed in the 1980s. However, concerns remained about levels of the chemicals in the state's fish population.

In the early 1970s, the state implemented the Illinois Fish Contaminant Monitoring Program, a protocol of testing fish from the state's lakes, rivers, and streams. Lake Michigan is sampled annually, with samples drawn from rivers and large streams every five years, along with periodic testing of other public lakes. The testing measures whether fish samples contain pesticides, metals, or other dangerous chemicals at a level that would render them unsafe to eat.

In its early days, testing from state waterways indicated concerning levels of DDT, chlordane, and dieldrin in bottom feeding fish such as carp and catfish. Levels of chlordane were detected at rates making the fish unsafe to eat until the mid-1970s; DDT was found at unsafe levels until the early 1980s. Dieldrin, another organochlorine pesticide, was detected in levels deemed to be unsafe to eat as recently as the early 1990s. Since then, however, the pesticides are no longer found in unsafe amounts in Illinois. With those chemicals no longer in use, continuation of the testing program for those pesticides is no longer necessary, saving both time and money.

Fish consumption advisories are issued annually by IDPH when certain chemicals are found in fish at levels that make it advisable to limit consumption of those fish. Advisories and associated resources can be found at the IDPH **Fish Advisories** website.

For more information, contact Brian Koch at brian.koch@illinois.gov.

Source: https://www.illinois.gov/news/press-release.27034.html

EPA News

EPA Proposes Revising Certain Water Quality Standards (WQS) for Florida's Waters

On December 1, 2023, the EPA announced a proposed rule to establish new and revised federal WQS for the state of Florida based on the latest scientific knowledge about protecting human health.

"EPA continues to take strong action to ensure that our nation's waters are safe for all," said **EPA Administrator Michael S. Regan**. "This proposed rule, if finalized, would update water quality standards for Florida's water bodies to reflect the current science and continue to protect the health of Floridians."

Under the Clean Water Act, state governments, or EPA, when necessary, set limits (called "human health criteria") for pollutants in water bodies that pose risks to human health through the consumption of drinking water or locally caught fish and shellfish. EPA is proposing new or revised criteria for a total of 73 priority toxic pollutants.

On December 1, 2022, EPA issued an Administrator's Determination that Florida's current standards — last updated in 1992 — do not reflect the latest science or the current habits of Floridians. Since 1992, national and regional data have become available that indicate greater levels of fish consumption, particularly among residents of coastal states like Florida. In addition, Florida does not have human health criteria for 37 pollutants that are likely to be in its waters. New data have become available since 1992 on the specific toxic pollutants that are likely to be present in Florida's waters, and how those pollutants may impact Florida's designated uses. EPA's proposed rule accounts for more recent evidence on fish consumption rates and, as a result, proposes criteria that are more protective of Floridians that consume fish caught in the state.

In addition, EPA's rule proposes criteria to protect subsistence fishers in and around Everglades National Park and Big Cypress National Preserve where Tribes hold reserved rights to fish for subsistence.

The Agency will accept comments on this proposal until February 6, 2024. EPA will also hold two online public hearings on this proposal. Learn more about the proposed rule and public hearings.

Background

WQS define the water quality goals for a water body and provide a regulatory basis for many actions under the Clean Water Act, including developing water quality-based effluent limits in National Pollution Discharge Elimination System permits for point-sources; performing Clean Water Act section 401 certifications of federal licenses and permits; and reporting on water quality conditions and designated uses attainment.

For more information, contact EPA Region 4 Press Office at region4press@epa.gov or (404)-562-8400.

Source: https://www.epa.gov/newsreleases/epa-proposes-revising-certain-water-quality-standards-floridas-waters

National Rivers and Streams Assessment (NRSA): The Third Collaborative Survey

On December 19, 2023, EPA published the NRSA report, which includes NRSA's key findings. EPA and its state and tribal partners conducted the survey in 2018–2019.

NRSA is an EPA, state, and tribal partnership to assess the condition of rivers and streams across the United States. *NRSA: The Third Collaborative Survey* presents the results of the 2018–2019 survey of perennial rivers and streams in the conterminous United States. The first survey took place in 2008–2009, with the second in 2013–2014. A pilot study of streams (the Wadeable Streams Assessment) was conducted between 2000 and 2004.

The NRSA is designed to answer the following questions about rivers and streams across the United States:

- What percentage of rivers and streams support healthy ecological communities and recreation?
- What are the most common problems?
- Are conditions improving or getting worse?
- Are investments in water quality focused appropriately?

Penns Creek, Centre County, Pennsylvania. *(Photo courtesy of EPA)*

Key Findings on 2018–2019 Condition

Following standard practices (described in the Assessment Benchmarks, Criteria, and Screening Levels section), EPA analysts classified results for most indicators as good, fair, or poor. For a few indicators, the results instead show whether chemicals were detected or whether values exceeded a benchmark, criterion, or screening level.

Field crew members measuring physical stream characteristics. *(Photo courtesy of EPA)*

- Healthy habitat occurred in over half of our river and stream miles.
- Less than one-third of our river and stream miles (28%) had healthy biological communities, based on an analysis of benthic macroinvertebrate communities.
- Just over one-third (35%) of river and stream miles had healthy fish communities.
- Nutrients (phosphorus and nitrogen) were the most widespread stressors.
- Reducing nutrient pollution could improve biological condition.
- Bacteria exceeded EPA's recreational benchmark in 20% of river and stream miles.

- Algal toxins were present, but at very low levels, with minimal recreational human health concerns.
- Contaminants were present in all fish tissue, but risk varied by contaminant and fish consumption levels. In samples composed of fillet tissue from multiple fish, concentrations exceeded screening levels as follows (as a percentage of the 41,099 river miles comprising the sampled population):
    - Mercury: 26%.
    - Total PCBs: 45% for general fish consumers, 74% for high-frequency fish consumers.
    - Perfluorooctane sulfonic acid (PFOS) was detected in 91% of the 290 fish fillet composite samples analyzed for NRSA 2018–2019. EPA is not currently comparing PFOS concentrations in fish to screening levels because the toxicity assessment used to calculate screening levels is a draft. When the assessment is final, EPA intends to update the PFOS information provided in this report to include screening level exceedances.

Field crew members count and identify fish (such as this sunfish) caught at the site. Most are then released. *(Photo courtesy of EPA)*

Key Findings on Changes from 2013–2014 to 2018–2019

- For the benthic macroinvertebrate community indicator, little changed between surveys nationally.
- For fish community, there were statistically significant changes in condition.
- Significant changes occurred for some physical habitat measures.
- Two human health indicators showed improvement.
- For most water chemistry parameters (except phosphorus), there was little change between surveys at the national level.

For fish tissue contaminant analysis, field crew members attempt to catch fish on a list of targeted species, such as this brook trout. *(Photo courtesy of Julia Woods)*

NRSA Dashboard

EPA has developed an interactive dashboard to accompany this report. It contains full regional results and allows comparisons between different subpopulations of rivers and streams (e.g., EPA regions and river basins).

For more information, contact Sarah Lehmann at lehmann.sarah@epa.gov, Richard Mitchell at mitchell.richard@epa.gov, or John Healey at healey.john@epa.gov.

Source: https://riverstreamassessment.epa.gov/webreport/

Other News

Smallmouth Bass Mercury Levels Linked to Habitat Types Along the Snake River

On December 5, 2023, the U.S. Geological Survey (USGS) reported mercury concentrations are twice as high in smallmouth bass found in reservoirs than those in the free-flowing sections of the Snake River in Idaho and Oregon. These findings are according to a joint USGS and Idaho Power Company study that looked at 1,815 specimens of this popular recreational fishing species from a variety of habitats in 31 sites along 530 miles of the Snake River.

"Impoundments, or dams, are one of the most common man-made changes to river systems," said James Willacker, USGS ecologist and lead author of the study titled "Reservoir Stratification Modulates the Influence of Impoundments on Fish Mercury Concentrations along an Arid Land River". "The reservoirs resulting from these dams along the Snake River can affect mercury cycling. We wanted to find out the degree to which fish mercury levels differed across reservoirs and their upstream and downstream environments, and how that translated into potential exposure and health risk to fish, wildlife, and humans."

Smallmouth bass are good indicators of methylmercury exposure to humans and wildlife because they are a common, popular sport fish and eat a variety of food during their lifetime. *(Photo courtesy of Forest and Rangeland Ecosystem Science Center [FRESC])*

The Snake River, the largest tributary of the Columbia River and a massive river system in its own right, includes 22 federal and private dams built between 1901 and 1982. These dams, and the reservoirs they create, provide hydropower, flood control, agricultural irrigation, recreation, and municipal water supplies. However, they can also influence the hydrology, biogeochemistry, and ecology of the Snake River.

Reservoir waters can stratify — or become layered. In systems like the Snake River, stratification is primarily driven by temperature, and this has implications for oxygen levels. As surface water warms, it stops mixing with colder, bottom water. Algae growing in surface waters, fueled by nutrient inputs from surrounding lands, eventually settle in deeper water and decompose, which uses up available oxygen and creates anoxic conditions. These anoxic conditions in reservoirs often create ideal conditions for the creation of methylmercury.

Methylmercury is naturally formed by microbes living under certain conditions in water, sediments, and soils. Methylmercury is easily incorporated into, but not easily removed from, living tissue and therefore accumulates in animals' bodies, reaching higher levels in animals at the top of the food web. Mercury is therefore not only a potential risk to the smallmouth bass, but also in species with similar feeding habits or that may consume smallmouth bass — including humans. Mercury contamination is not unique to the Snake River. In fact, a bass consumption advisory is in place for the entire state of Idaho.

To understand the role of reservoir stratification on fish mercury concentrations, scientists compared concentrations in several Snake River habitats, including stratifying and non-stratifying reservoirs, and different sections of free-flowing water along the river. The study also looked at methylmercury exposure risk to smallmouth bass in each habitat and potential risk to other fish, wildlife, and humans.

Researchers found that mercury concentrations in smallmouth bass were higher in reservoirs than in the free-flowing river. Twice as many harvestable bass from reservoir-influenced habitats had levels of mercury higher than EPA suggested level for protecting humans compared to harvestable bass in free-flowing areas. The scientists also found that bass mercury concentrations were influenced by reservoir stratification, with the highest concentrations seen in, and downstream of stratifying reservoirs.

The Snake River reservoirs, formed by these dams, vary in their construction and management resulting in a range of impacts on the hydrology, biogeochemistry, and ecology of the Snake River. *(Photo courtesy of FRESC)*

Smallmouth bass fisheries are one of the many culturally and economically important fisheries along the Snake River system. Research on the smallmouth bass may give insight into the potential for mercury exposure in other species who share these habitats. The area has also provided critical spawning and rearing habitat for numerous other fish species of cultural significance since time immemorial, many of which are of conservation concern. These species include bull trout, chinook salmon, pacific lamprey, sockeye salmon, steelhead, and white sturgeon.

“The results underscore the influence of reservoirs and their biogeochemical conditions as potential drivers of mercury exposure risk,” said co-author Collin Eagles-Smith, USGS Supervisory Research Ecologist. “Resource managers can take these factors into account as they evaluate current advisories in a manner that balances harvest opportunities with consumption risk.”

The study “Reservoir Stratification Modulates the Influence of Impoundments on Fish Mercury Concentrations along an Arid Land River,” was published on December 5, 2023 in *Environmental Science and Technology*.

For more information, contact Communications and Publishing at plaustsen@usgs.gov or (630)-847-8522.

Source: https://www.usgs.gov/news/state-news-release/smallmouth-bass-mercury-levels-linked-habitat-types-along-snake-river

Recently Awarded Research

New Illinois-Indiana Sea Grant (IISG) Funding will Support Research to Address PFAS Knowledge Gaps

On December 12, 2023, IISG announced $400,000 in funding for four new research projects focused on social and policy issues related to PFAS in the Great Lakes region. PFAS are known as "forever chemicals" because they don't break down in the environment.

PFAS are used in a range of products, including nonstick cookware, water- or stain-resistant clothing or carpeting, cosmetics and even toilet paper. As a result, scientists are finding PFAS in waterbodies just about everywhere they look.

These substances have been associated with negative health effects, including a weakened immune system, kidney disease, and cancer.

"Many federal, state and tribal organizations are now monitoring and detecting PFAS and related compounds in drinking water and fish," said Tomas Höök, IISG director. "However, it may be unclear how organizations can communicate to the public about risks related to PFAS, and the public may struggle to determine what actions to take to reduce risk."

Four new research projects have been recommended for funding to fill in these information gaps:

Through a listening session and surveys, Susan Buchanan, a medical doctor and an environmental health scientist at the University of Illinois Chicago and her team will engage with recreational anglers in two communities of color in Chicago, Illinois and Benton Harbor, Michigan to assess their knowledge about PFAS and related issues and their fish consumption levels. The researchers will work closely with on-the-ground local partners in both locations.

At the University of Wisconsin-Madison, Lyn van Swol, a communication scientist, will test the effectiveness of messaging to the public, with a special emphasis on Latino populations in the state. Her team will gather data on people's internet searches related to PFAS information. Then they will test specific messages with municipal water users, and finally, test what messaging engages audiences on social media.

Ruohao Zhang, an agricultural economist at Pennsylvania State University will lead an effort to develop an online risk assessment tool to help residents of Michigan, New York and Pennsylvania get a better understanding of their exposure to PFAS related to their location and personal choices. The team will also assess the effectiveness of local regulations and advisories on public awareness and decisions related to PFAS levels.

Finally, to help inform state regulators and lay the groundwork for regional consensus regarding PFAS policies, Catherine Janasie, a senior research counsel at the National Sea Grant Law Center, will lead an effort to compile a list of all PFAS-related state laws and regulations in the Great Lakes and Lake Champlain regions. The team will then engage in comparative analysis of these policies and create case studies to further explore policy challenges.

"Researchers are continuously learning more and more about the prevalence of PFAS in the environment and their effects on humans, thereby complicating policy setting and communication about risks," added Höök. "We hope these projects will collectively contribute to improved communication and consideration of policies related to PFAS in the Great Lakes region."

IISG is working in cooperation with Great Lakes Sea Grant programs and with funding from the National Sea Grant Office to support these projects. Each team has been awarded up to $100,000 with an additional $10,000 directed to Sea Grant partners to develop and engage in related extension work.

IISG's efforts to identify and fund these projects began with guidance from an advisory committee as a plan was developed to define social and economic knowledge gaps related to PFAS. Then, more than 70 representatives from at least 45 federal and state agencies, tribal nations, academic institutions and consulting firms joined in the scoping process. The results have been compiled in the PFAS Scoping Report.

For more information, contact IISG at sgweb@noaa.gov.

Source: https://seagrant.noaa.gov/new-illinois-indiana-sea-grant-funding-will-support-research-ti-address-pfas-knowledge-gaps/

Tech and Tools

Aquatic Disease and Pathogen Repository (AquaDePTH)

AquaDePTH will be a public-facing national repository to support biosurveillance of aquatic animal diseases and pathogens. By collating historically published data, plus new aquatic pathogen and disease information, stakeholders will be able monitor fish kill and aquatic pathogen trends spatially and temporally in freshwater and marine environments. The USGS has been engaging with partners from a variety of agencies in the development of this new repository.

Fish swim along the gravel bed bottom of the North Fork of the Flathead River. *(Photo courtesy of EESC)*

Infectious disease significantly impacts commercially and ecologically relevant aquatic animal populations in the United States. Federal, state, tribal, academic, and private entities expend considerable resources to survey for aquatic pathogens but, there is no infrastructure to facilitate sharing or tracking of aquatic pathogen surveillance data at a regional or national scale. The effort for AquaDePTH is led by three USGS centers, including the Wetland and Aquatic Research Center in Gainesville Florida, the Western Fisheries Research Center in Seattle Washington, and the Eastern Ecological Science Center (EESC) in Kearneysville West Virginia. With the spread of aquatic pathogens/disease and invasive species being key priorities

within aquatic ecosystems, AquaDePTH will expand on the success of the USGS Nonindigenous Aquatic Species (NAS) database, a long running, nationwide repository that provides managers and researchers tools to track the spread of aquatic invasive species with the use of helpful layers that demonstrate watersheds and aquatic connectivity. The new AquaDePTH Database will expand the NAS framework to curate spatially referenced biogeographic accounts of priority freshwater and marine animal diseases and pathogens to support national USGS biosurveillance efforts. Datasets will be provided by USGS research efforts, and from partnerships with federal, state, tribal, and academic institutions. AquaDePTH sets out to curate existing and new aquatic pathogen data within a single sharable source and to ensure interoperability with other existing pathogen databases. Stakeholder engagement is occurring through workgroup participation during the design of the database, as well as webinars and presentations to the aquatic animal health community. The goal of AquaDePTH is to curate aquatic pathogen occurrence/prevalence and aquatic disease data along with user-collected information on host and environmental co-factors that may influence disease. This data will facilitate efforts to track and model aquatic diseases over space and time, particularly to better understand disease trends in the face of aquatic ecosystem stressors including climate change and habitat degradation. The new AquaDePTH Database will distribute information to stakeholders and the general public through an online portal, providing custom data queries and downloads, distribution maps, and a data dashboard for generating data summaries.

Project funding provided by U.S. Fish and Wildlife Service in support of the American Rescue Act Plan of 2021.

For more information, contact Wesley Daniel at wdaniel@usgs.gov or Jan Lovy at jlovy@usgs.gov.

Source: https://www.usgs.gov/centers/eesc/science/aquadepth-aquatic-disease-and-pathogen-repository

Recent Publications

Journal Articles

The list below provides a selection of research articles.

- **Per- and Polyfluoroalkyl Substances (PFAS) Measured in Seafood from a Cross-Section of Retail Stores in the United States.**
  Bedi, M., Y. Sapozhnikova, R.B. Taylor, and C. Ng. 2023. Per- and Polyfluoroalkyl Substances (PFAS) Measured in Seafood from a Cross-Section of Retail Stores in the United States. *Journal of Hazardous Materials* 459:132062.

- **Barriers and Drivers to Increasing Sustainable Bivalve Seafood Consumption in a Mass Market Economy.**
  Gawel, J.P.F., D.C. Aldridge, and D.F. Willer. 2023. Barriers and Drivers to Increasing Sustainable Bivalve Seafood Consumption in a Mass Market Economy. *Food Frontiers* 4(3):1257-1269.

- **The Influence of Sustainability on Identities and Seafood Consumption: Implications for Food Systems Education for Generation Z.**
  Gibson, K.E., C.E. Sanders, A.R. Byrd, K.W. Lamm, and A.J. Lamm. 2023. The Influence of Sustainability on Identities and Seafood Consumption: Implications for Food Systems Education for Generation Z. *Foods* 12(10):1933.

- **Spatiotemporal and Multispecies Comparisons between a Citizen Science Platform and Recall Surveys in Recreational Fisheries.**
  Gundelund, C., P. Venturelli, B.W. Hartill, K. Hyder, H.J. Olesen, and C. Skov. 2023. Spatiotemporal and Multispecies Comparisons between a Citizen Science Platform and Recall Surveys in Recreational Fisheries. *Marine Policy* 155:105780.

- Compliance in Recreational Fisheries: Case Study of Two Blue Swimmer Crab Fisheries.
  Lindley, J., and L. Quinn. 2023. Compliance in Recreational Fisheries: Case Study of Two Blue Swimmer Crab Fisheries. *PLOS ONE* 18(1):e0279600.

- One Health Assessment of Persistent Organic Chemicals and PFAS for Consumption of Restored Anadromous Fish.
  Melnyk, L.J., J.M. Lazorchak, D.H. Kusnierz, G.D. Perlman, J. Lin, R. Venkatapathy, D. Sundaravadivelu, J. Thorn, J. Durant, K. Pugh, and M.A. Stover. 2023. One Health Assessment of Persistent Organic Chemicals and PFAS for Consumption of Restored Anadromous Fish. *Journal of Exposure Science and Environmental Epidemiology*.

- Inorganic Arsenic Concentration in Fish Governed by Trophic Level and Size, Not Water Concentration: Implications for Human Health Water Quality Criteria.
  Morrison, E.B., J. Pappani, A. Prouty, H.M. McChesney, and P.D. Anderson. 2023. Inorganic Arsenic Concentration in Fish Governed by Trophic Level and Size, Not Water Concentration: Implications for Human Health Water Quality Criteria. *Environmental Toxicology and Chemistry* 42(7):1542-1552.

- Metal pollution in freshwater fish: A key indicator of contamination and carcinogenic risk to public health.
  Panda, B.P., Y.K. Mohanta, S.P. Parida, A. Pradhan, T.K. Mohanta, K. Patowary, W.A.W. Mahari, S.S. Lam, A.A. Ghfar, G. Guerriero, M. Verma, and H. Sarma. Metal pollution in freshwater fish: A key indicator of contamination and carcinogenic risk to public health. *Environmental Pollution* 330: 121796.

- Toxicity of Wildland Fire Retardants to Rainbow Trout in Short Exposures.
  Puglis, H.J., and M. Iacchetta. Toxicity of Wildland Fire Retardants to Rainbow Trout in Short Exposures. *Environmental Toxicology and Chemistry* 43(2):398-404.

- Reservoir Stratification Modulates the Influence of Impoundments on Fish Mercury Concentrations Along an Arid Land River System.
  Willacker, J.J., C.A. Eagles-Smith, J.A. Chandler, J. Naymik, R. Myers, and D.P. Krabbenhoft. 2023. Reservoir Stratification Modulates the Influence of Impoundments on Fish Mercury Concentrations Along an Arid Land River System. *Environmental Science and Technology* 57(50):21313-21326.

Upcoming Meetings and Conferences

9th World Fisheries Congress
March 3–9, 2024
Seattle, WA

47th Larval Fish Conference
May 12–16, 2024
Huron, Ohio

154th American Fisheries Society Annual Meeting
September 15–19, 2024
Honolulu, Hawaii

Responsible Seafood Summit
October 21–24, 2024
St. Andrew's, Scotland

Additional Information

This bimonthly newsletter highlights current information about fish and shellfish.

For more information about specific advisories within the state, territory, or tribe, contact the appropriate state agency listed on EPA's National Listing of Fish Advisories website at https://fishadvisoryonline.epa.gov/Contacts.aspx.

For more information about this newsletter, contact Sharon Frey (Frey.Sharon@epa.gov, 202-566-1480).

Additional information about advisories and fish and shellfish consumption can be found at https://www.epa.gov/fish-tech.