



# Fish and Shellfish Program NEWSLETTER

July 2023  
EPA 823N23004

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

## Recent Advisory News



### Fish Consumption Advisory Issued for Bull Shoals and Norfolk

On January 19, 2023, the Arkansas Department of Health (ADH) issued a fish consumption advisory for walleye on Bull Shoals Lake (Marion, Baxter, and Boone counties) and Norfolk Lake (Baxter and Fulton counties). This advisory came after some walleye from both waterbodies, collected by the Arkansas Game and Fish Commission (AGFC) and tested by the Arkansas Division of Environmental Quality (ADEQ), were found to contain levels of mercury that have the potential to put human health at risk. The ADH held a meeting on February 7 at the Donald W. Reynolds Library in Mountain Home to answer public questions on this advisory. Personnel with AGFC and ADEQ were in attendance to answer questions related to their roles in the process.

Currently, over 20 waterbodies in Arkansas are under a fish consumption advisory due to mercury. Nationally, all 50 states have consumption advisories for at least one fish species due to mercury.

This advisory is a notice about the mercury levels present in some walleye and the possible health effects on those who regularly eat the fish from these lakes. This advisory does not affect swimmers, skiers, boaters, catch and release activities, or other recreational uses and does not limit the use of Bull Shoals Lake or Norfolk Lake as a drinking water source.

Occasional fish consumers are at little risk for adverse health effects. Those most at risk are pregnant women, small children, and people who frequently eat walleye from Bull Shoals or Norfolk lakes.

The fish consumption advisory is as follows:

**High-Risk Groups (pregnant women, breastfeeding women, women planning to be pregnant, and children under the age of seven years):**

Should not eat walleye (18 inches or longer) from these lakes.

**General Public (men, women, and children seven years and older):**

Recommend eating no more than two meals per month of walleye (18 inches or longer) from these lakes.

Eating fish with mercury will not make people sick right away, but as you eat more and more, it can build up in the body and over time, potentially cause adverse health effects.

The ADH issues fish consumption advisories when enough data indicate elevated levels of mercury.

Fish are an important, low-fat source of protein. Knowing and following the fish consumption advisories allows you to safely keep fish as an important part of your diet.

For more information about fish consumption advisories in Arkansas, visit [www.healthy.arkansas.gov](http://www.healthy.arkansas.gov) and type 'mercury' in the Smart Search box located on the right-hand side of the page. You may also visit [Fish Consumption Advisories](#).

For more information, contact Ashley Whitlow at [ashley.whitlow@arkansas.gov](mailto:ashley.whitlow@arkansas.gov) or [ADH.TS@arkansas.gov](mailto:ADH.TS@arkansas.gov).

Source: <https://www.healthy.arkansas.gov/news/detail/fish-consumption-advisory-issued-for-bull-shoals-and-norfork>



## **Maine CDC Issues Additional Advisories on Eating Freshwater Fish Due to Per- and Polyfluoroalkyl Substances (PFAS) contamination**

On April 27, 2023, the Maine Center for Disease Control and Prevention (Maine CDC) issued updated and additional freshwater fish consumption advisories, recommending limiting consumption of all fish or certain fish from six waterbodies in Maine. Two of the advisories are expansions of those [issued last year](#) for seven waterbodies, while four bodies of water are new additions. The number of advisories now totals 11. These updated advisories come after testing of fish in these locations found levels of PFAS above Maine CDC's [recommended levels for regular consumption](#).

Elevated levels of the PFAS called perfluorooctane sulfonic acid (PFOS) were detected in fish samples from Limestone Stream below the dam near Route 229 in Limestone, Kennebec River between Hinkley and Fairfield, Number One Pond on Mousam River in Sanford, Halfmoon Stream in Thorndike, Fifteenmile Stream in Albion, and China Lake.

The updated fish consumption advisories apply to game fish caught in these waterbodies:

Who	Guidelines	Consumption advisory
Albion	Fifteenmile Stream from the Yorktown Brook inlet at the Hussey Road to Route 137/202 in Albion.	Consume no more than 2 meals per month of brook trout.
China	All of China Lake.	Consume no more than 1 meal per month of any fish species.
Fairfield	Kennebec River from the Carrabassett Stream inlet just North of Route 23 to the Lockwood Dam in Waterville.	Consume no more than 9 meals per year of smallmouth bass.
<b>Limestone</b>	<b>All of Durepo Pond and Limestone Stream from Durepo to the Canadian Border.</b>	<b>Consume no more than 4 meals per year of brook trout and do not eat smallmouth bass.</b>
<b>Sanford</b>	<b>All of Number One Pond.</b>	<b>Consume no more than 1 meal per month of largemouth bass.</b>
Thorndike	Halfmoon Stream from the Shikles Road in Thorndike to the Berry Road in Unity near the confluence with Sandy Stream.	Consume no more than 2 meals per month of brook trout.

\*Bolded entries indicate extensions of advisories issued in 2022.

"This update and expansion of Maine's fish consumption advisories is based on the latest science about the health impacts of PFAS," said Nancy Beardsley, Acting Director of the Maine CDC. "These advisories are designed to support the health of Maine anglers, their families and friends, and everyone who enjoys eating freshwater fish from these bodies of water."

"There are over 360,000 anglers who are licensed to fish in Maine, and they enjoy fishing on over 32,000 miles of rivers and streams, and 6,000 lakes and ponds," said Judy Camuso, Commissioner of the Maine Department of Inland Fisheries and Wildlife (MDIFW). "These revised advisories for 11 waterbodies will help anglers make informed decisions when they choose to have a meal of freshwater fish."

Fishing in these specific waterbodies remains a safe activity, in accordance with the consumption advisories, along with other recreational activities such as swimming, wading, and boating. The Maine CDC recommends that anglers review all existing [fish consumption advisories](#) for Maine waters.

The Maine Department of Environmental Protection (DEP) collected and tested fish from these waterbodies for PFAS because they are located where historical PFAS contamination has been found in groundwater, surface water, and/or soils. The testing in 2023 included testing of new waterbodies and expanded testing of waterbodies already under consumption advisories.

Maine CDC continually consults with Maine's DEP and MDIFW to develop plans for additional sampling of fish as part of the State's ongoing investigation of PFAS.

PFAS are a group of man-made chemicals found in a variety of consumer products throughout the world. Based on a new [report](#) from the [National Academies of Sciences, Engineering, and Medicine](#), exposure to certain PFAS chemicals has been associated with changes in liver and kidney function, changes in cholesterol levels, decreased immune response to vaccines in children, complications during pregnancy, increased risk of kidney cancer and possibly testicular cancer.

The Mills Administration has taken an aggressive, nation-leading approach to addressing PFAS contamination in Maine. Under Governor Mills' leadership, Maine established a PFAS Task Force and has taken action to address PFAS contamination, including:

- securing \$30 million for PFAS remediation, which includes \$10 million to help farmers impacted by PFAS, \$15 million to provide safe drinking water, \$5 million for environmental testing, and \$5 million for managing PFAS-contaminated waste
- securing \$5 million to address PFAS through the Maine Jobs and Recovery Plan
- securing \$9.3 million to address PFAS through the supplemental budget
- securing \$60 million to create a PFAS Trust Fund
- establishing screening levels for PFAS in soil, wastewater, fish tissue and milk
- establishing drinking water standards for PFAS
- establishing containment and reporting requirements for firefighting foam containing PFAS
- installing more than 200 drinking water treatment systems
- establishing wastewater sludge testing requirements and eliminating land spreading of PFAS contaminated sludge
- expanding the statute of limitations for Maine citizens to file claims for PFAS contamination.

For more information about the fish consumption advisories and PFAS, please go to:

- [Maine CDC PFAS Fish Consumption Advisory FAQ \(PDF\)](#)
- [Maine CDC Scientific Brief: 2023 PFAS Fish Consumption Advisories \(PDF\)](#)

For more information, contact Breana Bennett at [breana.bennett@maine.gov](mailto:breana.bennett@maine.gov) or Tom Simones at [thomas.simones@maine.gov](mailto:thomas.simones@maine.gov).

Source: <https://www.maine.gov/dhhs/news/maine-cdc-issues-additional-advisories-eating-freshwater-fish-due-pfas-contamination-thu-04272023-1200>

## EPA News

### EPA Awards \$1.8 Million to the Delaware Estuary Program, Including Support for Mussel Hatchery at Philadelphia's Bartram's Gardens

On April 13, 2023, the U.S. Environmental Protection Agency (EPA) announced that the Delaware Estuary Program will receive \$1.8 million in restoration funds to support a comprehensive conservation and management plan for the program as part of President Biden's Bipartisan Infrastructure Law (BIL) funding to estuaries of national significance.

"This funding is a valuable investment in equity, clean water and resilience for the Delaware River's sensitive coastal shoreline," said **EPA Mid-Atlantic Regional Administrator Adam Ortiz**. "Thanks to the support of the President's BIL, we can accelerate efforts to preserve and improve the health of the estuary and enhance the popular riverside park — Bartram's Gardens in Philadelphia."

The Delaware Estuary Program is one of 28 estuaries under the National Estuaries Program (NEP) receiving this funding. The funding supports projects that address climate resilience, prioritize equity, and manage other key water quality and habitat challenges.

Part of the funding for the Delaware Estuary will support construction of a freshwater mussel hatchery that the Partnership for the Delaware Estuary is building at Bartram's Gardens. The partnership is in the beginning phases of raising funds needed to complete this project, and the BIL funding will help accelerate the timeline. The freshwater mussels from the hatchery will be used in a variety of clean water, habitat restoration, and educational projects across the estuary and beyond. Construction is proposed to begin in late 2023.

An estuary is a partially enclosed coastal water body where freshwater from rivers and streams mixes with salt water from the ocean. Estuaries, and their surrounding lands, are places of transition from land to sea. Estuaries are an irreplaceable natural resource that must be managed carefully for the mutual benefit of all who enjoy and depend on them.

Along with being home to thousands of species of birds, mammals, fish and other wildlife, estuaries have important commercial value and their resources provide economic benefits for tourism, fisheries, and recreational activities.

EPA's website has more information about the [National Estuary Program](#) and the [Bipartisan Infrastructure Law](#).

For more information, contact [r3press@epa.gov](mailto:r3press@epa.gov).

Source: <https://www.epa.gov/newsreleases/epa-awards-18-million-delaware-estuary-program-including-support-mussel-hatchery>

## Other News

### Swinomish Clam Garden to Bolster Littleneck Clam Populations

**Reviving a 3,500-year-old indigenous mariculture practice with funding from the National Oceanic and Atmospheric Administration (NOAA).**

#### First Modern Clam Garden

On November 30, 2022, NOAA Fisheries announced that the [Swinomish Indian Tribal Community](#) in Washington received NOAA funding to build the first modern clam garden in the United States. The Swinomish Tribe and other Coast Salish Indigenous peoples hold a rich history of practicing shellfish mariculture in Alaskan and Washington waters.



Building the first traditional clam garden on Swinomish land. (Photo courtesy of NWIFC)

For more than 3,500 years, native communities created clam gardens by constructing a rock wall in the intertidal zone, the land between high and low tides, and actively tending the beach. Over time their practices not only increased shellfish production, but also expanded clam habitat and increased species diversity, according to a [study of ancient clam gardens](#).

The project is funded through NOAA Fisheries' [Saltonstall-Kennedy Grants Program](#) and the [Northwest Climate Adaptation Science Center](#).

This new clam garden will revive ancient practices that further connect the Swinomish to their land and sea. “We have maintained our relationships with this territory since time immemorial — relationships with the land, the water, the sea, and everything that lives along with us. We are thankful to receive this funding that will enable us to continue to work with the land and the water as we restore our ancient practices,” said Steve Edwards, Chairman and member of the Swinomish Indian Tribal Community.

Due to influences such as colonialism and shoreline development that have displaced native communities, traditional clam gardens have fallen fallow. The Tribe's Fisheries Department and Community Environmental Health Program collaborated with [Washington Sea Grant](#) to work with Indigenous knowledge-holders in the community and clam garden researchers. They began identifying ecological and socio-cultural benefits in future garden sites. These include teaching traditional cultural practices and carrying on ceremonial subsistence harvesting practices to younger generations, as well as creating climate resilient food sources.

#### Climate Change Resilience

The numbers of littleneck clams began [declining in the 1990s](#) due to environmental impacts such as food availability, disease, and climate change. This spurred the Swinomish Community to bolster ecological resilience in their traditional harvest sites. Traditional clam gardening increases shellfish production and species diversity, including sea cucumbers, seaweed, and butter clams. This increases the resiliency of the ecosystem.



These gardens are also able to more effectively adapt to ocean acidification. Acidification causes clam shells to dissolve and affects their shell-building ability, feeding, metabolism, and respiration. Clam gardens increase the number of shell fragments in the area, boosting the minerals needed to create shells and combat acidification.

Aquaculture offers [mitigation and adaptation opportunities in the face of climate change](#). It uses less water and land resources and produces fewer greenhouse gas emissions. Indigenous aquaculture practices in particular use sustainable methods that benefit both the human and non-human community and can allow coastal communities to adapt and thrive.

### More Information

- [Swinomish Receives Funding to Build the First Modern-Day Clam Garden in the U.S.](#)
- [Swinomish Tribe builds U.S.'s first modern 'clam garden,' reviving ancient practice](#)
- [Reviving the Past to Protect the Future: Developing a Social-Ecological Clam Garden Site Selection Model](#)
- [Sea Gardens Across the Pacific](#)

For more information, contact NOAA Fisheries, Office of Aquaculture at [danielle.blacklock@noaa.gov](mailto:danielle.blacklock@noaa.gov) or [david.o'brien@noaa.gov](mailto:david.o'brien@noaa.gov).

Source: <https://www.fisheries.noaa.gov/feature-story/swinomish-clam-garden-bolster-littleneck-clam-populations>

## USDA Takes Steps to Support Food Sovereignty with the Menominee Indian Tribe of Wisconsin

On March 30, 2023, the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service (AMS) announced it signed a cooperative agreement with the Menominee Indian Tribe of Wisconsin under the Local Food Purchase Assistance Cooperative Agreement Program (LFPA). Through LFPA, the tribe seeks to purchase and distribute locally grown, produced, and processed food from underserved producers.

"USDA is excited to partner with the Menominee Indian Tribe of Wisconsin to promote economic opportunities for farmers and producers and to increase access to locally sourced, fresh, healthy, and nutritious food in underserved communities," said USDA Under Secretary for Marketing and Regulatory Programs Jenny Lester Moffitt. "The Local Food Purchase Cooperative Agreement Program will improve food and agricultural supply-chain resiliency and increase local food consumption around the country."

With the LFPA funds, the tribe will coordinate the procurement of indigenous foods for the Tribal Elder Food Box Program as well as additional purchases to distribute among other communities. The purchased foods will include indigenous and conventional foods from producers, such as white fish, bison, beef, wild rice, apples, and produce.

"The goals of the LFPA Cooperative Agreement align with the program goals of the Tribal Elder Food Box Program, meaning procurement and distribution of local, nutritious foods to our precious tribal elders while creating and

supporting indigenous producers who have not had access to steady markets like this before,” said Chairwoman of the Menominee Nation Gena Kakkak. “The LFPA funding certainly assists in maintaining and growing our Great Lakes Intertribal Foods Coalition, a coalition of tribal producers, all 11 tribal nations via designated distribution sites, and key food hub and distribution partners. While our coalition identified a shortfall within the LFPA formula used to allocate funding equitably, USDA/AMS stepped up to the plate with the second round of LFPA funding, issuing a tribal set-aside to ensure equity. As the Chairperson of Menominee Nation, we applaud your commitments to equitable funding for Tribal Nations. Menominee, our indigenous producers, and by extension Wisconsin’s tribal elders give our most sincere thanks and say *Maec-waewaenen* (Great Thanks) for the funding. We look forward with high expectations to the LFPA plus applications.”

USDA’s Local Food Purchase Assistance Cooperative Agreement Program provides up to \$900 million through non-competitive cooperative agreements to enable state, territory, and tribal governments to support local, regional and underserved producers, and maintain or improve food and agricultural supply chain resiliency through the purchase of food produced within the state or within 400 miles of delivery destination. Funding for the program comes from the American Rescue Plan and the Commodity Credit Corporation.

AMS looks forward to continuing to sign agreements under this innovative program that allows state and tribal governments to procure and distribute local and regional foods and beverages that are healthy, nutritious, and unique to their geographic area.

More information about the program is available on AMS’s [Local Food Purchase Assistance Cooperative Agreement Program](#) webpage or contact [PA@usda.gov](mailto:PA@usda.gov).

Source: <https://www.ams.usda.gov/press-release/usda-takes-steps-support-food-sovereignty-menominee-indian-tribe-wisconsin>

## Recently Awarded Research

### National Fish Habitat Partnership Projects to Engage Recreational Fishing Communities and Restore Habitat

**Nearly \$180,000 will support habitat restoration and angler engagement in Florida, Hawai‘i, and Alaska.**

On June 2, 2023, NOAA Fisheries announced the funding of four projects in 2023 to restore habitat through the coastal [National Fish Habitat Partnerships](#). These projects will actively engage local communities, including anglers, who make critical contributions to fish habitat conservation nationwide. The projects demonstrate NOAA’s commitment to restoring fish habitat and supporting access to sustainable saltwater recreational fishing, a popular pastime that boosts the U.S. economy.



Coral reefs in Maui, Hawaii. (Photo courtesy of NOAA Photo Library)



## Florida Keys Seagrass Restoration

### Sponsoring Partnership: Atlantic Coastal Fish Habitat Partnership

Over the next year, [Coastal Conservation Association Florida](#) and [Sea & Shoreline, LLC](#), will work with volunteers to restore damaged [seagrass](#) beds in John Pennekamp Coral Reef State Park. The park borders the [Florida Keys National Marine Sanctuary](#). From 1995 to 2015, the amount of damaged seagrass habitat in the sanctuary nearly doubled. This was mainly due to scarring from propellers and vessel groundings on seagrass beds. This project is sponsored by the [Atlantic Coastal Fish Habitat Partnership](#).

Local boat captains will bring young students to the project site to learn about the benefits of seagrass and the threats it faces. Sea & Shoreline staff will work with the student and captain volunteers to help recolonize seagrass through [sediment tube](#) installations. Trained biologists will monitor the site for 3 years post-restoration to assess seagrass recovery.

## Community-Based Coral Restoration in West Oahu, Hawai'i

### Sponsoring Partnership: Hawai'i Fish Habitat Partnership

[Kuleana Coral Restoration](#) will pilot a community-based coral restoration project at Pokai Bay in West O'ahu, Hawai'i. It will build upon the success of last year's NOAA-funded project through the [Hawai'i Fish Habitat Partnership](#). The bay is an important subsistence and recreational fishing area for the local community. Using input from community members to inform the project design, Kuleana Coral Restoration will work with local anglers and other community partners. They will restore degraded reefs and educate the public on reef restoration. These reefs are critical habitat for many target fish species and uphold the community's way of life in the bay.

Reef restoration will be focused on *Porites compressa*, also known as finger coral. Anglers will learn how to create finger coral fragment modules during interactive restoration demonstrations. These modules will then be outplanted back onto reefs.

## Restoring Stream Banks with Anglers near Anchorage, Alaska

### Sponsoring Partnerships: Kenai Peninsula Fish Habitat Partnership and Matanuska Susitna Basin Salmon Habitat Partnership

Next spring, [Trout Unlimited](#) will work with partners on two projects to stabilize stream banks on popular trout and salmon-fishing rivers near Anchorage, Alaska. They will focus on the lower Kenai River and Montana Creek (a tributary of the Susitna River). Local anglers, recreational fishing business staff, and tribal members will plant vegetation along nearly 600 feet of stream bank. This will improve rearing habitat for [pink](#), [chum](#), and [coho salmon](#), as well as trout, and Dolly Varden.

The restoration work and following outreach efforts will increase community awareness of the importance of caring for the rivers, on which local fisheries depend. This project is supported by [Kenai Peninsula Fish Habitat Partnership](#) and [Matanuska Susitna Basin Salmon Habitat Partnership](#).

## Restoration and Angler Outreach near Juneau, Alaska

### Sponsoring Partnership: Southeast Alaska Fish Habitat Partnership

[Trout Unlimited](#) (Tongass chapter) will work in close partnership with the [City and Borough of Juneau](#), local anglers, and local fishing businesses. They will restore eroded stream banks on Montana Creek (a tributary of the Mendenhall River), near Juneau, Alaska. The creek is a popular area for fishing and other forms of recreation. It has been experiencing high rates of erosion due to heavy use of [social trails](#) along its banks. This project will improve water quality conditions for important native trout and salmon species and enhance fishing opportunities in the watershed.

Partners will engage the local community by holding volunteer planting days to revegetate the stream banks. Additionally, they will launch a post-restoration outreach campaign aimed at preventing further erosion. This includes posting signage to encourage community and angler stewardship of the creek. This project is sponsored by the [Southeast Alaska Fish Habitat Partnership](#).

For more information on these projects, contact Office of Habitat Conservation at (301) 427-8600.



A pair of spawning pink salmon. (Photo courtesy of NOAA Fisheries)

Source: <https://www.fisheries.noaa.gov/feature-story/national-fish-habitat-partnership-projects-engage-recreational-fishing-communities-and>

## Tech and Tools

### Transforming Shellfish Farming with Smart Technology and Management Practices for Sustainable Production

On February 20, 2023, the National Institute of Food and Agriculture (NIFA) from the USDA indicated that shellfish aquaculture is perhaps the most sustainable form of aquaculture. Oysters filter water and provide habitat for many marine species. They contribute to national food security and provide numerous health benefits. Shellfish aquaculture is also an important economic driver for rural coastal areas, providing jobs and sustaining economic viability. However, domestic shellfish aquaculture is constrained by outdated technology and tools, preventing high-volume production. For example, on-bottom oyster farming methods have not substantially changed since the 19th century. Planting and harvesting methods are random and lack precision, leading to extremely low survival rate and production.

To address the sustainability issues of the current shellfish farming, University of Maryland scientists are developing smart precision farming practices with support from USDA's National Institute of Food and Agriculture that will lead to sustainable shellfish production and improve farmers' lives.

"The robotics and artificial intelligence technologies being developed would bring significant advances to shellfish farming industry, enhancing productivities and profitability," said Miao Yu, associate professor of mechanical engineering at the University of Maryland. "Although the oyster farmers don't fully understand the technology tools

that we are developing, to our surprise, we received tremendous support on our project. The farmers are very interested in accessing the environmental and crop inventory monitoring data and using precision farming practices to improve farm management.”

Currently, scientists are developing underwater robotics-based monitoring and smart-harvesting technologies to enable precision shellfish farming. In the long term, researchers will go from precision shellfish farming to digital, programmable aquaculture that would help address food insecurity and mitigate climate change, ultimately addressing the grand challenge of global ecosystem sustainability.

Preliminary economic studies show that modest increase of 10% oyster production will result in an annual increase in revenues of more than \$11 million for Maryland farmers and more than \$228 million nationwide.

“This production increase will lead to the removal of over 65 tons of nitrogen fertilizers from sea water,” Yu said. “More production will lead to expanded sales and increased consumption. Research suggested that 10% replacement of beef consumption with oysters would result in greenhouse gas emission reduction equivalent of having 10.8 million fewer cars on the road. Ultimately, this project will lead us to a more sustainable future.”

Additional information about this research was presented at a [NIFA education session](#) at Aquaculture America 2023 in New Orleans. NIFA national program leader Dr. Tim Sullivan, who provides leadership for programs in aquaculture, animal health and biotechnology, moderated a session highlighting the breadth and impact of NIFA-funded aquaculture research and outreach.

For more information, contact Lori Tyler Gula, Senior Public Affairs Specialist at [lori.gula@usda.gov](mailto:lori.gula@usda.gov).

Source: <https://www.nifa.usda.gov/about-nifa/blogs/transforming-shellfish-farming-smart-technology-management-practices-sustainable>

## Recent Publications

### Journal Articles

The list below provides a selection of research articles.

► [Peri-Urban Shore Recreational Fishing in New England and Climate Change](#)

Brink, T.T., and T. Dalton. 2023. Peri-Urban Shore Recreational Fishing in New England and Climate Change. *International Journal of Environmental Studies*:1-13.

► [Global Responses to the Covid-19 Pandemic by Recreational Anglers: Considerations for Developing More Resilient and Sustainable Fisheries](#)

Britton, J.R., A.C. Pinder, J. Alós, R. Arlinghaus, A.J. Danylchuk, W. Edwards, K.M.F. Freire, C. Gundelund, K. Hyder, I. Jarić, R. Lennox, W.-C. Lewin, A.J. Lynch, S.R. Midway, W.M. Potts, K.L. Ryan, C. Skov, H.V. Strehlow, S.R. Tracey, J.-i. Tsuboi, P.A. Venturelli, J.L. Weir, M.S. Weltersbach, and S.J. Cooke. 2023. Global Responses to the Covid-19 Pandemic by Recreational Anglers: Considerations for Developing More Resilient and Sustainable Fisheries. *Reviews in Fish Biology and Fisheries*.

► [Environmental and Health Impacts of Pfas: Sources, Distribution and Sustainable Management in North Carolina \(USA\)](#)

Ehsan, M.N., M. Riza, M.N. Pervaz, M.M.O. Khyum, Y. Liang, and V. Naddeo. 2023. Environmental and Health Impacts of Pfas: Sources, Distribution and Sustainable Management in North Carolina (USA). *Science of The Total Environment* 878:163123.

► [Nonlethal Detection of Pfas Bioaccumulation and Biomagnification within Fishes in an Urban- and Wastewater-Dominant Great Lakes Watershed](#)

George, S.E., T.R. Baker, and B.B. Baker. 2023. Nonlethal Detection of Pfas Bioaccumulation and Biomagnification within Fishes in an Urban- and Wastewater-Dominant Great Lakes Watershed. *Environmental Pollution* 321:121123.

► [Sensitivity of Fishery Resources to Climate Change in the Warm-Temperate Southwest Atlantic Ocean](#)

Gianelli, I., L. Orlando, L.G. Cardoso, A. Carranza, E. Celentano, P. Correa, A. de la Rosa, F. Doño, M. Haimovici, S. Horta, A.J. Jaureguizar, G. Jorge-Romero, D. Lercari, G. Martínez, I. Pereyra, S. Silveira, R. Vögler, and O. Defeo. 2023. Sensitivity of Fishery Resources to Climate Change in the Warm-Temperate Southwest Atlantic Ocean. *Regional Environmental Change* 23(2):49.

► [Small-Scale Fisheries Contribution to Food and Nutrition Security—a Case Study from Norway](#)

Kjellefjeld, M., G.A. Kuhnle, S.A. Iversen, M.W. Markhus, M.d.M. Mancha-Cisneros, G. Gorelli, and K. Nedreaas. 2022. Small-Scale Fisheries Contribution to Food and Nutrition Security—a Case Study from Norway. *npj Ocean Sustainability* 1(1):5.

► [A Machine Learning Model and Biometric Transformations to Facilitate European Oyster Monitoring](#)

Pineda-Metz, S.E.A., V. Merk, and B. Pogoda. A Machine Learning Model and Biometric Transformations to Facilitate European Oyster Monitoring. *Aquatic Conservation: Marine and Freshwater Ecosystems*.

► [Small Pelagic Fish Supply Abundant and Affordable Micronutrients to Low- and Middle-Income Countries](#)

Robinson, J.P.W., D.J. Mills, G.A. Asiedu, K. Byrd, M.d.M. Mancha Cisneros, P.J. Cohen, K.J. Fiorella, N.A.J. Graham, M.A. MacNeil, E. Maire, E.K. Mbaru, G. Nico, J.O. Omukoto, F. Simmance, and C.C. Hicks. 2022. Small Pelagic Fish Supply Abundant and Affordable Micronutrients to Low- and Middle-Income Countries. *Nature Food* 3(12):1075-1084.

► [Lake Erie Fish Safe to Eat yet Afflicted by Algal Hepatotoxins](#)

Shahmohammadloo, R.S., S.P. Bhavsar, X. Ortiz Almirall, S.A.C. Marklevitz, S.M. Rudman, and P.K. Sibley. 2023. Lake Erie Fish Safe to Eat yet Afflicted by Algal Hepatotoxins. *Science of The Total Environment* 861:160474.

► [Risk and Social Vulnerability Associated with Crustacean Shellfish Harvest in the Highly Urbanized San Diego Bay, USA](#)

Talley, T.S., C. Loflen, N. Venuti, D. Pedersen, R. Gossett, and M.D. Baker. 2023. Contaminant Risk and Social Vulnerability Associated with Crustacean Shellfish Harvest in the Highly Urbanized San Diego Bay, USA. *Environments* 10(6):91.

► [Small-Scale Octopus Fishery Operations Enable Environmentally and Socioeconomically Sustainable Sourcing of Nutrients under Climate Change](#)

Willer, D.F., D.C. Aldridge, C. Gough, and K. Kincaid. 2023. Small-Scale Octopus Fishery Operations Enable Environmentally and Socioeconomically Sustainable Sourcing of Nutrients under Climate Change. *Nature Food* 4(2):179-189.

## Upcoming Meetings and Conferences

### [American Fisheries Society 153<sup>rd</sup> Annual Meeting](#)

August 20–24, 2023  
Grand Rapids, MI

### [SETAC North America 44<sup>th</sup> Annual Meeting](#)

November 12–16, 2023  
Louisville, KY and Virtual

### [9<sup>th</sup> World Fisheries Congress](#)

March 3–9, 2024  
Seattle, WA

### 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](mailto: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>.