



Fish and Shellfish Program NEWSLETTER

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

Recent Advisory News



Fishing in California Rivers, Streams, and Creeks? Follow the New Statewide Advisory for Safe Eating Guidelines

On September 21, 2022, the California Environmental Protection Agency’s Office of Environmental Health Hazard Assessment (OEHHA) issued a new statewide fish advisory that offers [safe-eating advice for fish caught in California rivers, streams and creeks without site-specific advice](#). With the issuance of the advisory, OEHHA now offers fish consumption advice covering every water body in California.

The new advisory is based on the levels of mercury and polychlorinated biphenyls (PCBs) found in fish collected from more than 700 sites, including popular rivers frequented by anglers all over California. These include the Los Angeles, Santa Ana, and Kern rivers in Southern California; the Merced River in Central California; the Owens, Truckee, and East Walker rivers in Eastern California; and the Klamath, Smith, McCloud, and Eel rivers in Northern California.

This is the first time that safe-eating guidelines have been provided for these rivers. The advisory is intended to be a guide for eating fish caught in these rivers, along with other rivers, streams and creeks that are not covered by a specific advisory.

OEHHA has previously issued general advisories for [coastal areas, lakes and reservoirs](#), and [fish that migrate](#) between inland water bodies and the Pacific Ocean.

“Today’s advisory represents an important milestone. It completes our suite of statewide advisories, ensuring people fishing anywhere in California can consult safe-eating guidance,” said OEHHA Director Dr. Lauren Zeise.

“Many fish are excellent sources of protein and have nutrients that may reduce the risk of heart disease. However, like fish all over the world, California fish also have detectable levels of contaminants,” Dr. Zeise said. “By following the guidelines in our latest advisory, people who enjoy fishing along California’s rivers, creeks and streams can safely eat fish low in chemical contaminants and enjoy the well-known health benefits of fish consumption.”

When consuming fish from California rivers, streams, and creeks without site-specific advice, the guidelines are as follows:

- Women ages 18 – 49 and children ages 1 – 17 should not eat black bass species, catfish species, common carp, goldfish, Sacramento pikeminnow, or Sacramento sucker. They may safely eat a maximum of two total servings per week of red shiner; **or** one total serving per week of brown trout, bullhead species, rainbow trout, or sunfish species.
- Women ages 50 and older and men ages 18 and older may safely eat a maximum of five total servings per week of red shiner; **or** three total servings per week of bullhead species or rainbow trout; **or** two total servings per week of brown trout or sunfish species; **or** one total serving per week of black bass species, catfish species, common carp, goldfish, Sacramento pikeminnow, or Sacramento sucker.

One serving is an eight-ounce fish fillet, measured prior to cooking, which is roughly the size and thickness of your hand. Children should eat smaller servings. For small fish species, such as red shiner, several individual fish may make up a single serving.

In addition to statewide advisories, OEHHA continually develops fish advisories for specific water bodies across the state. OEHHA currently offers [more than 100 site-specific advisories](#) for lakes, reservoirs, rivers, bays, and coastal areas across California. Locations are prioritized based on high contaminant levels or to alert people where it is safe to fish for consumption.

Mercury is released into the environment from mining and burning coal, as well as from volcanoes and forest fires. It accumulates in fish in the form of methylmercury, which can damage the brain and nervous system, especially in developing children and fetuses. Because of this, OEHHA provides a separate set of recommendations specifically for children up to age 17 and women of childbearing age (18 – 49 years).

PCBs are a group of industrial chemicals. At high levels of exposure, they can cause health problems, including cancer. Although they were banned in the United States in the late 1970s, PCBs persist in the environment from spills, leaks, or improper disposal. PCBs accumulate in the skin, fat, and some internal organs of fish. To reduce exposure from PCB-contaminated fish, OEHHA recommends eating only the skinless fillet (meat) portion of the fish.

OEHHA's fish advisory recommendations are based on the levels of contaminants, such as mercury, that persist in the environment and accumulate in fish. They are independent of any advisories to limit fish intake due to freshwater or estuarine harmful algal blooms (HABs). Before fishing, check the [California HABs Portal](#) to see if there are recommended HAB advisories and always practice [healthy water habits](#).

Eating fish in amounts slightly greater than the advisory's recommendations is not likely to cause health problems if it is done occasionally, such as eating fish caught during an annual vacation.

A [poster](#) with the safe-eating advice for fish caught in California rivers, streams and creeks without site-specific advice is available on OEHHA's website in English and additional languages.

OEHHA's mission is to protect and enhance the health of Californians and the environment through scientific evaluations that inform, support, and guide regulatory and other actions in the state.

For more information, contact Amy Gilson at Amy.Gilson@oehha.ca.gov.

Source: <https://oehha.ca.gov/fish/press-release/press-release-fish/fishing-california-rivers-streams-and-creeks-follow-new>



Tennessee Department of Environment and Conservation Issues Precautionary Fish Consumption Advisory on Center Hill Reservoir

On June 20, 2022, the Tennessee Department of Environment and Conservation (TDEC) announced a precautionary fish consumption advisory due to mercury on Center Hill Reservoir in Dekalb and Putnam counties.

In 2021, TDEC and the Tennessee Wildlife Resources Agency (TWRA) collected fish tissue data on Center Hill Reservoir where fish were analyzed for mercury. Based on the fish tissue results, a precautionary fish consumption advisory was issued for black bass species (largemouth, spotted, and smallmouth bass) in the reservoir.

TDEC advises that pregnant women, nursing mothers, and children avoid eating the fish species included in the advisory and that all others limit consumption to one meal per month. Other recreational activities such as boating, kayaking, swimming, wading, and catch and release fishing carry no risk.

“We provide these advisories so the community can make informed decisions about whether or not to consume the fish they catch,” said TDEC Deputy Commissioner Greg Young. “Unlike ‘do not consume’ advisories that warn the general population to avoid eating fish from a particular body of water altogether, precautionary fish consumption advisories are specifically directed to sensitive populations such as children, pregnant women, nursing mothers and those who may eat fish frequently from the same body of water.”

These studies documented that in black bass species mercury levels were above the trigger of 0.3 milligrams (mg) per kilogram (kg) (parts per million [ppm]).

TDEC considers the source of mercury in Center Hill Reservoir to be atmospheric deposition.

TDEC will post warning signs at primary public access points and will work with the TWRA and United States Army Corps of Engineers to communicate this information to the public.

About Fish Consumption Advisories

The Tennessee Water Quality Control Act identifies the commissioner of the Department of Environment and Conservation as having the authority and responsibility to issue advisories for either water contact hazards like pathogens or excessive health risks due to the accumulation of contaminants in fish or shellfish. Tennessee's

General Water Quality Criteria provide additional guidance regarding the conditions under which advisories may be warranted.

There are two types of fish consumption advisories issued by TDEC based on the levels of contaminants present in fish tissue. "Do not consume" fishing advisories are issued when levels of contaminants in fish tissue would represent a threat to the general population. "Precautionary" advisories are issued when contaminant levels are lower but would still pose a risk to sensitive subpopulations such as children, pregnant women, nursing mothers and those who eat fish frequently from the same body of water.

Where new advisories have been issued, TDEC will immediately begin the process of putting up signs at primary public access points. TDEC works in partnership with the TWRA to communicate information about fishing advisories.

For a complete listing of Tennessee's current fishing advisories plus additional information about the advisory issuance process, visit: https://www.tn.gov/content/dam/tn/environment/water/watershed-planning/wr_wq_fish-advisories.pdf.

An EPA website has additional information about mercury at: <http://www.epa.gov/fish-tech/epa-fda-advisory-mercury-fish-and-shellfish>.

For more information, contact Debbie Arnwine at Debbie.Arnwine@tn.gov.

Source: <https://www.tn.gov/environment/news/2022/6/20/tdec-issues-precautionary-fish-consumption-advisory-on-center-hill-reservoir.html>

EPA News

EPA Reestablishes Federal Water Pollution Standards for Washington

On November 15, 2022, the U.S. Environmental Protection Agency (EPA) announced a final rule to reestablish federal water quality standards for the State of Washington. The agency's final rule follows the science to help protect the health of Washingtonians and Tribal members who eat fish and shellfish caught in the state.

"Under the Clean Water Act, EPA has taken significant action to ensure our precious waters are safe for all to enjoy," said **EPA Administrator Michael S. Regan**. "This final rule utilizes the latest scientific knowledge and brings us one step closer to delivering safe swimmable, fishable bodies of water that the people of Washington deserve."

"For many of us in Washington, and for the Tribal communities with whom we share geography, eating fish from Puget Sound and our streams and rivers is part of our daily lives," said **Washington Governor Jay Inslee**.

"These fish must be safe for our families to eat. By reinstating the rule repealed by the prior administration, EPA honors our shared commitment to protect and preserve clean water now and for generations to come."

"EPA's rule reestablishes standards that truly protect people who depend on locally caught fish as a staple in their diets," said **Laura Watson, director of the Washington Department of Ecology**. "I am grateful that EPA restored rules that recognize and reflect the importance of fish for Tribes as well as many other communities in our state."

"The Makah Tribe appreciates that EPA has made good on its commitment to restore water quality standards in Washington," said **Patrick DePoe, vice chair of the Makah Tribal Council**. "This is an important step toward protecting water quality, ensuring health of our treaty resources, and supporting the exercise of our Treaty rights to harvest fish and marine mammals. We have relied on marine and freshwater resources for thousands of years and we need those resources to be clean and safe in order to survive and thrive as a people. We hope that we can work with the United States and the State of Washington to build on this effort for continued improvement of water quality, and expect our federal and state partners to move forward based on sound science and fulfillment of their trust obligation to Tribes."

Under the Clean Water Act, states, 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 locally caught fish and shellfish. With this rule, EPA finalized limits for 72 different pollutants in Washington waters based on the comparatively large amount of fish and shellfish consumed by people in the state. These stricter limits will better protect Tribal fish consumers as well as all Washingtonians.

The agency's final rule supports EPA's commitment to protect water resources that support public health, economic development, cultural activities, and subsistence practices.

Over the objections of state and Tribal leaders, the previous administration rolled back protective water quality standards established by EPA in 2016. As a result of that rollback, water quality standards being implemented in Washington were inadequate to protect human health. The final rule announced on November 15, 2022, follows through on EPA's June 2021 and March 2022 commitments to restore protective, science-based human health criteria in the state. [View the final rule.](#)

Learn more about protecting Tribal reserved rights in water quality standards in the Office of Water's action plan, [*Strengthening The Nation-To-Nation Relationship with Tribes to Secure a Sustainable Water Future.*](#)

For more information, contact Erica Fleisig at fleisig.eric@epa.gov.

Source: <https://www.epa.gov/newsreleases/epa-reestablishes-federal-water-pollution-standards-washington>

Contaminants in Fish from U.S. Rivers: Probability-Based National Assessments – Recent EPA Publication

EPA recently published an article titled, “Contaminants in fish from U.S. rivers: Probability-based national assessments,” which characterizes mercury, PCB and per- and polyfluoroalkyl substances (PFAS) contamination in river fish. By comparing results of the 2013-14 and 2018-19 National Rivers and Streams Assessments with screening levels for assessing human health risks, EPA estimated the percent of sampled river miles with fillet contaminant concentrations above a level protective of human health. Access the article here:

<https://doi.org/10.1016/j.scitotenv.2022.160557>

For more information, contact John Healey at healey.john@epa.gov

Other News

Connecting Southeast Alaska’s Algal Blooms to Shellfish Health

The Central Council of Tlingit and Haida Indian Tribes of Alaska (CCTHITA) are working alongside Alaska Climate Adaptation Science Center (CASC) to better predict harmful algal blooms that affect locally harvested shellfish.

On October 4, 2022, the U.S. Geological Survey (USGS) on behalf of Alaska CASC reported that many rural communities in Southeast Alaska rely on shellfish as a source of subsistence and recreation. However, harmful algal blooms that occur in this region can lead to an accumulation of paralytic shellfish toxins in shellfish, like clams, at a level that are dangerous for human consumption. With rising sea temperatures from a warming climate prolonging the timing of when these algal blooms occur, Alaska CASC supported researchers are working with collaborators from the CCTHITA to identify and model trends in algal blooms.

Temperature, wind speed and salinity data, combined with Traditional Ecological Knowledge from Tlingit elders, who use the timing of spawning herring as an indicator for the return of algal blooms, help identify when shellfish may be most toxic and harmful to eat. With records on the timing of herring spawns dating back to the 1980s, resource managers could use this data as a proxy for the timing of historical algal blooms to better predict when and where shellfish resources may be affected.

For more information, visit the [CASC webpage](#) or [read the original news story by the Alaska CASC](#).

Source: <https://www.usgs.gov/programs/climate-adaptation-science-centers/news/connecting-alaskas-algal-blooms-shellfish-health>

Domoic Acid Monitoring in Razor Clams 2015–2021

Information about domoic acid levels in razor clams from Humboldt and Del Norte counties, focusing on samples collected 2015–2021.

Razor Clam Monitoring

On October 6, 2022, the California Department of Public Health (CDPH) released a summary of the razor clam domoic acid data and health advisories, focusing on the 2015 to 2021 period. CDPH coordinates with the Office of Environmental Health Hazard Assessment (OEHHA) and the California Department of Fish and Wildlife (CDFW) to protect the public from biotoxins in bivalve shellfish and other seafood. Razor clams are filter feeders which can accumulate naturally occurring toxins as they feed on [phytoplankton](#) that produce the toxins.

One of the naturally occurring marine biotoxins that CDPH monitors is domoic acid. Domoic acid, which is produced by microscopic algae of the genus *Pseudo-nitzschia*, is a nerve toxin which can cause amnesic shellfish poisoning. Mild symptoms include vomiting, diarrhea, abdominal cramps, headache, and dizziness. Severe symptoms include excessive bronchial secretions, difficulty breathing, confusion, disorientation, cardiovascular instability, seizures, permanent loss of short-term memory, coma, and death. Cooking does not destroy the toxin.

The CDPH Marine Biotoxin Monitoring Program has been frequently testing Pacific razor clams (*Siliqua patula*) for domoic acid in Del Norte and Humboldt counties since 2016. In California, the largest populations of razor clams are in these two counties, providing recreational clamming opportunities.

Figure 1 summarizes the razor clam domoic acid data and health advisories from 2015 to mid-2022. Annual detections of domoic acid in razor clams began in 2015 for Humboldt County and in 2016 for Del Norte County. CDPH increased razor clam sampling in response to the toxin detection, with assistance from volunteers and sampling partners, and issued health advisories to warn the public. Domoic acid levels greater than or equal to 20 ppm are a public health risk to consumers as established by the federal [Food and Drug Administration \(FDA\)](#). Prior to 2015, razor clam sampling was less frequent, and domoic acid detections above the alert level occurred in 1992, 2004, and 2006 for Humboldt and in 2004 for Del Norte.

Razor clams are unusual in that they hold onto the toxin domoic acid in the meat and viscera much longer than other bivalve shellfish filter feeders, like mussels, oysters, and other clam species. The sample results show that the razor clams from Del Norte and Humboldt counties contained domoic acid levels above the 20 parts per million (ppm) federal alert level for about one year after each domoic acid event. The concentrations slowly

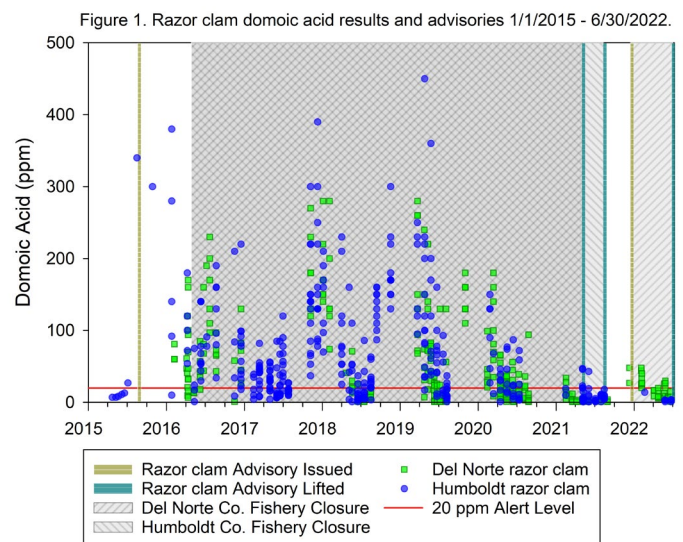


Figure 1. Razor clam domoic acid results and advisories 1/1/2015–6/30/2022. Full-size image available in the [original article](#) (Photo courtesy of CDPH Marine Biotoxin Monitoring Program)

decreased over time; then annual domoic acid events in 2016 – 2020, between the months of June–November, caused the results to increase again.

The data presented demonstrates that consistent monitoring of domoic acid levels in razor clams is needed to ensure the safety of recreational razor clamming due to the unique way these clams retain high concentrations for long periods of time. CDPH remains committed to monitoring biotoxin levels in this fishery to ensure public safety of domoic acid in razor clams in both Del Norte and Humboldt Counties.

Health Advisories & Closures

CDPH Health Advisories

The current Health Advisories issued by CDPH for bivalve shellfish are displayed in an [interactive map](#). CDPH also posted the recent [Shellfish Advisories online](#).

When domoic acid concentrations in bivalve shellfish meet or exceed the federal level, CDPH issues a health advisory for the County or counties with elevated results to warn recreational harvesters. Typically, when an advisory is issued, it is issued for all species of recreationally harvested bivalve shellfish (clams, mussels, and scallops). Advisories can also be issued for a specific species of shellfish, like razor clams, if the risk of poisoning is only related to that species.

Razor Clam Fishery Closures

CDFW and/or the Fish and Game Commission (FGC) have the ability to close the razor clam fishery to protect recreational harvesters from domoic acid.

Timeline of razor clam CDPH Health Advisories and CDFW/FGC fishery closures issued from 2015 to June 30, 2022 (Figure 1):

- August 26, 2015: CDPH Warns Consumers Not to Eat Bivalve Shellfish Caught in Humboldt or Del Norte Counties.
- December 9, 2015: CDPH Updates Warning about Shellfish from Humboldt and Del Norte Counties. Health Advisory lifted for other species of shellfish, advisory remains for razor clams.
- April 25, 2016: FGC [closed the recreational razor clam fisheries in Humboldt and Del Norte counties](#) in response to continued unsafe levels of domoic acid in razor clams posing a public health risk to consumers.
- April 29, 2021: [CDFW reopened the razor clam fishery for Del Norte County](#). These actions were taken after two consecutive rounds of samples that met the reopening criteria.
- May 3, 2021*: [CDPH Lifts warning about razor clams from Del Norte County](#).
- August 9, 2021: [CDFW reopened the razor clam fishery for Humboldt County](#). These actions were taken after two consecutive rounds of samples that met the reopening criteria.
- August 11, 2021*: [CDPH lifts warning about razor clams from Humboldt County](#).

- December 16, 2021: [CDPH warns consumers not to eat sport-harvested razor clams from Del Norte County.](#)
- December 16, 2021: [CDFW closed the razor clam fishery in Del Norte County due to domoic acid.](#)
- June 24, 2022: [CDFW reopened the razor clam fishery for Del Norte County.](#) These actions were taken after two consecutive rounds of samples that met the reopening criteria.
- June 27, 2022*: [CDPH lifts warning about razor clams from Del Norte County.](#)

*Note there are a few days between fishery reopening and CDPH advisory liftings due to posting timing only.

Reopening Criteria

CDPH and CDFW receive guidance from OEHHA to determine sampling strategy and reopening criteria.

The criteria for reopening the fishery or lifting the CDPH health advisory for razor clams is two sets of samples collected at least one week apart that test below the 20 ppm alert level for domoic acid.

Starting in 2016, samplers were directed to collect at least six razor clams per sampling date. Most of the analyses were conducted on individual clam meats. Occasionally, small clams were pooled (combined) together to meet minimum sample weight requirements and for processing purposes.

After the razor clam fisheries reopened in April 2021 for Del Norte County and August 2021 for Humboldt County, CDPH transitioned to a new sampling strategy with guidance from OEHHA. The samplers are instructed to collect 12 individual razor clams per sampling date. These clam meats are analyzed by pooling four individuals together for three separate samples. The new sampling strategy was put into place because the pooled samples more accurately represent a meal-sized portion. The pooled sample result also makes it less likely that one individual clam would trigger an advisory.

Sampling and Testing

The [map](#) shows primary sample sites for both razor clams (blue dots), mussels (orange diamonds), and phytoplankton (black dots) in Del Norte and Humboldt counties. It should be noted that mussels and razor clams are collected from different locations and habitats, which may result in differences in exposure to the domoic acid producing phytoplankton *Pseudo-nitzschia*. The occurrence of *Pseudo-nitzschia* may vary along the coastline depending on ocean currents and water column characteristics.

Razor Clams

In California, the largest populations of razor clams are in Del Norte and Humboldt counties. Razor clams can only be accessed at low tides when the portion of the beach where the clams live is exposed. The whole in-shell clams are dug out of the sand, frozen, and shipped to the CDPH laboratory in Richmond, California where



Razor clams from Clam Beach. (Photo courtesy of CDPH)

they are processed and analyzed. At the laboratory, the clams are shucked and dissected to separate meat from viscera. The meat or viscera is ground up and analyzed by high performance liquid chromatography an analytical chemistry method.

Primary sample sites are Crescent Beach in Del Norte County and Clam Beach in Humboldt County, with Moonstone Beach in Humboldt County infrequently sampled. CDPH will continue testing razor clams from both counties.

Razor clam samples are collected for testing by partners from CDFW, Tolowa Dee-Ni' Nation, and citizen volunteers.

Mussels

Mussels are the main bivalve shellfish species sampled for routine biotoxin monitoring statewide. Mussels are found in the rocky intertidal zone and can be accessed at low tide. Mussels are collected and typically shucked, frozen, and shipped to CDPH. A sample consists of 12 – 30 shucked whole mussels pooled together and ground up. All mussel samples are tested for paralytic shellfish poison (PSP) toxins. Select mussel samples are tested for domoic acid based on risk assessment from phytoplankton data, during domoic acid events, and for commercial or other monitoring needs.

Primary mussel sampling sites in Del Norte County are Wilson Creek and Hunter Rock, and less frequently sampled sites include Pyramid Point, Point St. George, and Crescent City locations. Primary sample sites in Humboldt County are inside Humboldt Bay and at Trinidad Head, and less frequently sampled sites include Baker Beach, Moonstone Beach, Luffenholtz Beach, Shelter Cove, Stone Lagoon, and other Trinidad locations.

Del Norte County mussel sample collectors include the Yurok Tribe, Tolowa Dee-Ni' Nation, CDFW, and volunteers. Humboldt County collectors include Pacific Shellfish Humboldt, Humboldt County Environmental Health, Yurok Tribe, Humboldt State University Marine Lab, CDFW, and volunteers.

Phytoplankton

Phytoplankton samples are collected using a 2 µm mesh net to concentrate seawater. Sample bottles are mailed to CDPH where the types of phytoplankton are identified using light microscopy. CDPH estimates the relative abundance of phytoplankton (like *Pseudo-nitzschia*) as the percent observed out of 100% of both living and non-living matter.

Primary phytoplankton sample sites are Wilson Creek and Hunter Rock in Del Norte County and Trinidad Pier and Indian Island Channel in Humboldt County.

Collectors include Pacific Shellfish Humboldt, Yurok Tribe, Tolowa Dee-Ni' Nation, Humboldt State University Marine Lab, and volunteers.

Results 2015 – 2021

A data summary for January 2015 to December 2021 and a table of recent domoic acid results in razor clams are [posted online](#).

Domoic Acid in Razor Clams and Mussels

Figures 2 and 3 display the domoic acid sample results in razor clams and mussels for each year from 2015 to 2021 collected in Del Norte and Humboldt counties.

Most of data points are for concentrations of domoic acid in individual clam meats without viscera. A small portion of data are pooled samples of two or more clam meats, and a small portion are individual or pooled whole clams (meat and viscera). Samples are represented by transparent blue dots which appear darker where there are overlapping data points. Pooled mussel samples are represented by orange triangles. The red line represents the 20 ppm alert level. Samples which tested below the detection limit of 2.5 ppm are plotted at 1 ppm. Domoic acid is plotted on a non-linear logarithmic scale, to show the lower range of the values.

Due to the timing of ocean conditions and sampler availability, there are data gaps and changes in sampling frequency.

Mussel Samples

Mussels do not retain domoic acid for very long and detection in mussels can indicate when a domoic acid event occurred in the region. Note that mussel samples were collected infrequently in Del Norte County.

For Del Norte County, domoic acid was detected in pooled mussel samples every year from 2015 – 2019 and in 2021. For Humboldt County, domoic acid was detected in pooled mussel samples every year from 2015 – 2020. Detection of domoic acid in mussels occurred between the months of June to November. When mussel samples exceeded the alert level for domoic acid, they returned to levels below the detection limit (2.5 ppm) within two to seven weeks.

Razor Clam Samples

From 2015 – 2021, for every instance of domoic acid detection in pooled mussel samples, there was an even higher concentration in razor clams that slowly declined over the following months such that another domoic acid event would cause the razor clams to re-accumulate the toxin before reaching safe levels. The domoic acid levels in all

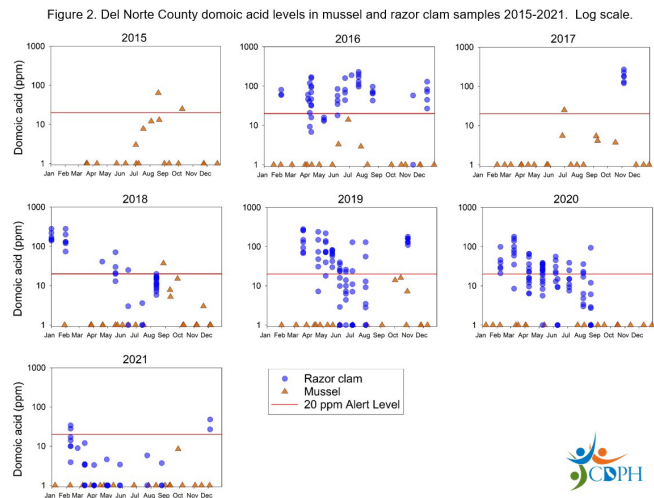


Figure 2. Del Norte County domoic acid levels in mussel and razor clam samples 2015–2021. Log scale. Full-size image available in the [original article](#) (Photo courtesy of CDPH)

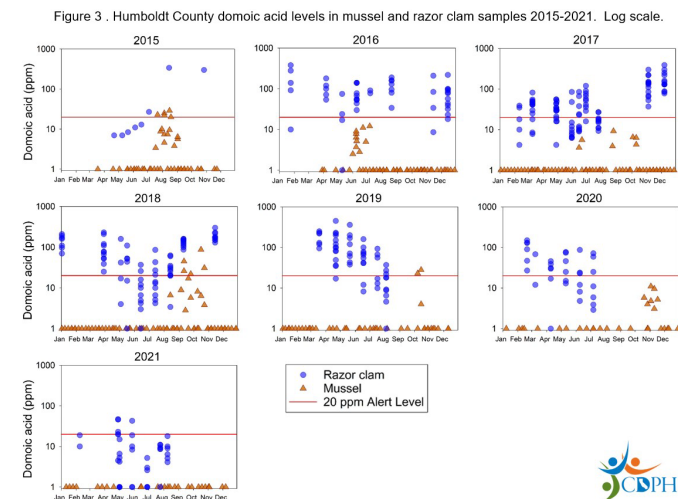


Figure 3. Humboldt County domoic acid levels in mussel and razor clam samples 2015–2021. Log scale. Full-size image available in the [original article](#) (Photo courtesy of CDPH)

razor clam samples didn't fall below the alert level until early 2021 for Del Norte County and mid-2021 for Humboldt County.

For both counties, Figures 2 and 3 show samples above the alert level occurred every year, when samples were tested. There was variability in razor clam meat domoic acid concentrations among individuals collected on the same date from 2016 to 2020. Humboldt County razor clams accumulated higher levels of domoic acid than razor clams from Del Norte County with a maximum domoic acid concentration in individual meat of 450 ppm which occurred in April 2019 at Clam Beach. In Del Norte County the highest concentration of 280 ppm occurred in January 2018 and March 2019, at Crescent Beach.

For Del Norte County, in 2016, 84% of razor clam samples were at or above the 20 ppm alert level, including individual and pooled samples (n=50). In 2020, this number had fallen to 52% (n=83), and from January to April 2021, only 7% of samples were at or above 20 ppm (n=28). Two sets of samples collected in March and April 2021 had all individuals below the alert level and allowed for re-opening.

For Humboldt County, in 2016, 90% of razor clam samples were at or above the 20 ppm alert level, including individual and pooled samples (n=49). By 2020 this number had fallen to 64% (n=33), and from January to April 2021, 31% were at or above 20 ppm (n=16). Samples were collected more consistently over time in Humboldt County and Figure 3 shows more clearly the differences in razor clam and mussel domoic acid concentrations. Two sets of samples collected in June and July 2021 had all individuals below the alert level and allowed for re-opening.

Comparison With *Pseudo-nitzschia* Phytoplankton Data

Figures 4 and 5 show the razor clam maximum domoic acid result per sample date and mussel domoic acid results with the percent composition of *Pseudo-nitzschia*, the diatom which can produce domoic acid. The dataset spans from 1996 – 2021. Note that shellfish data are sporadic prior to 2015.

The razor clam maximum domoic acid sample results per date are represented as blue circles and the pooled mussel domoic acid sample results are represented by orange triangles. The red line represents the 20 ppm domoic acid alert level. Samples which tested below the detection limit of 2.5 ppm are plotted at 1 ppm. Domoic acid is plotted on a non-linear logarithmic scale, to show the lower range of the values.

Figure 4. Del Norte County domoic acid levels and *Pseudo-nitzschia* observations. Log scale.

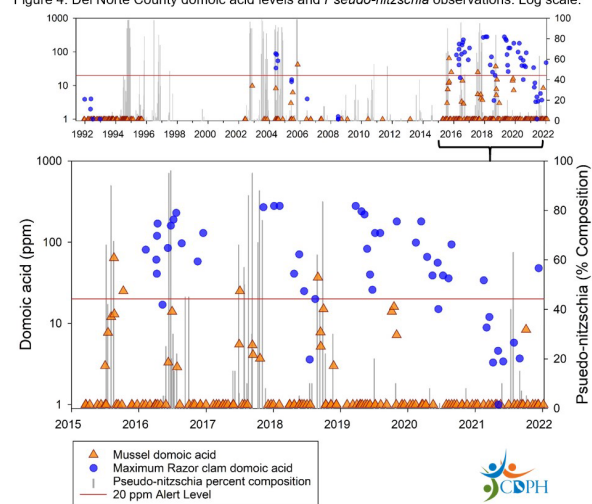


Figure 4. Del Norte County domoic acid levels and *Pseudo-nitzschia* observations. Full-size image available in the [original article](#) (Photo courtesy of CDPH)

Bivalve shellfish such as mussels and clams can accumulate domoic acid from filter feeding on *Pseudo-nitzschia* cells. Note: *Pseudo-nitzschia* cells do not always produce the biotoxin domoic acid, so the monitoring of shellfish is necessary to confirm a toxic event. CDPH considers detection of elevated abundance or blooms of *Pseudo-nitzschia* cells in the water column to be a high risk for domoic acid production. Percent composition is an estimate of *Pseudo-nitzschia* relative abundance, the percent observed out of 100% of both living and non-living matter in a concentrated water sample determined via light microscopy. The grey lines show the percent composition of *Pseudo-nitzschia* observed in a sample. A spike in the percent composition represents a period of elevated relative abundance of *Pseudo-nitzschia* cells in the water column.

The spikes in mussel domoic acid indicate which *Pseudo-nitzschia* blooms contain toxigenic species and are an indicator of the magnitude and length of time of a domoic acid event. The figures show the rapid response of mussels for both accumulating and purging the toxin during and after a domoic acid event. The razor clams also appeared to uptake domoic acid rapidly, but in contrast, took much longer to cleanse. Consequently, the razor clams maintained elevated domoic acid concentrations due to repeated exposure to toxigenic *Pseudo-nitzschia* activity.

The historical data, starting in 1991, show episodic domoic acid occurrences in shellfish samples. Prior to 2015, domoic acid was detected over the alert level in shellfish in 1991, 2002, 2004, 2005, and 2006. When razor clams were sampled, they generally contained higher levels of domoic acid than the mussels. There may be some domoic acid events that were missed due to gaps in the data set. This shows a need for constant monitoring of both plankton and shellfish.

Resources and Additional Information

- [CDPH Marine Biotoxin Monitoring Program](#)
- [Domoic Acid Frequently Asked Questions](#)
- [CDFW: Health Advisories and Closures for California Finfish, Shellfish and Crustaceans](#)
- [Food and Drug Administration: Fish and Fishery Products Hazards and Controls Guidance](#)
- [OEHHA Harmful Algal Blooms \(HABs\)](#)

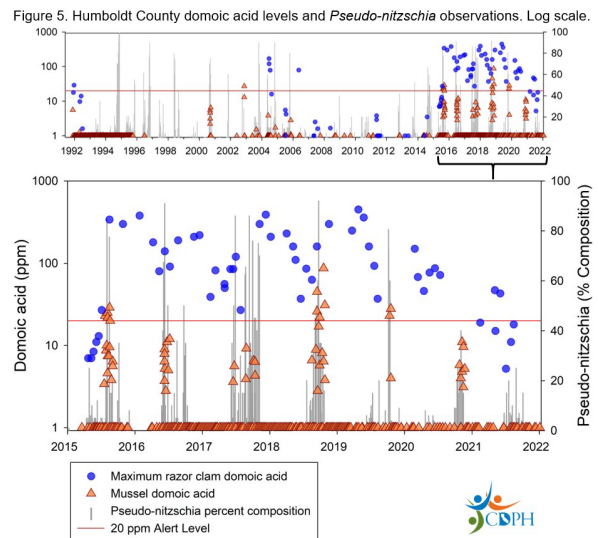


Figure 5. Humboldt County domoic acid levels and *Pseudo-nitzschia* observations. Full-size image available in the [original article](#) (Photo courtesy of CDPH)

Check Current Shellfish Advisories

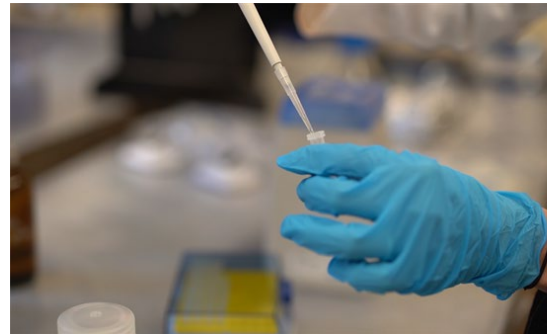
Before harvesting or consuming recreationally harvested shellfish please check the [Recreational Bivalve Shellfish Advisory Map](#) or call the Biotxin Information Line at 1-800-553-4133.

For more information, including about volunteer opportunities sampling shellfish or phytoplankton, contact CDPH or Marine Biotxin Monitoring Program at redtide@cdph.ca.gov.

Source: <https://storymaps.arcgis.com/stories/0180e416a7484ba1850a36ca37f09bb2>

Sea Grant Advances Investigation of Contaminants of Emerging Concern

On December 1, 2022, the National Oceanic and Atmospheric Administration (NOAA) noted that contaminants of emerging concern, like pharmaceuticals, cleaning products and microfibers, pose risks to the nation's drinking waters and aquatic life, but they are often excluded from monitoring programs and published water quality standards. [Two new projects](#) recently funded by Sea Grant aim to enhance research and monitoring efforts for this class of chemicals and materials while strengthening strategies to reduce their presence in aquatic environments.



A researcher investigates PFAS in Wisconsin's waters from a lab. (Photo courtesy of NOAA Sea Grant)

In the Great Lakes, Illinois-Indiana Sea Grant will lead the development of a regional research competition on the impact of PFAS, to better understand the risk, exposure, and remediation of these environmental contaminants. PFAS compounds can persist in the environment and drinking water as “forever chemicals”, and they negatively impact human and animal health. The regional research competition will address challenges such as how to effectively communicate risk of PFAS exposure in vulnerable communities, identify behaviors that limit risk of PFAS exposure or negative impacts or quantify economic impacts of suggested PFAS remediation practices. A key component of funded research will be to collaborate with at least one Great Lakes region Sea Grant partner to support outreach activities that engage underserved communities and state or tribal agencies, sharing research results across the Great Lakes region and beyond.

In the Southeast U.S., the South Carolina Sea Grant Consortium will lead an investigation of the drivers of aquatic contaminants of emerging concern in South Carolina, Georgia and Florida and inform the development of potential mitigation solutions. The program will execute a competitive research program supported by a gap and network analysis, an advisory committee of community experts, and a blended research model of academic faculty, students, state agency representatives, community leaders and extension specialists to carry out research and outreach activities. Topics to be addressed related to contaminants of emerging concern could include prevalence, transport and interactive effects, climate change impacts and human health effects from seafood consumption. In the final

year of the project, [Sea Grant's Community Engaged Interns](#) will participate in the development and implementation of outreach activities for pertinent stakeholders.

Both projects will receive a combined total of approximately \$900,000 in federal funding over three years and require at least 50 percent in non-federal matching funds.

Sea Grant's work in contaminants of emerging concern is supported in part by congressional direction and appropriations from fiscal years 2021 and 2022. [Funding from 2021](#), supported a nationwide scoping campaign to identify how the National Sea Grant College Program's expertise in contaminants of emerging concern can be most effectively leveraged. [Connecticut Sea Grant](#) published the resulting national framework in May 2022. The program is also in the process of executing an Atlantic coast regional research competition on contaminants of emerging concern with 2021 funds.

To learn more about Sea Grant's work in Healthy Coastal Ecosystems [visit this page](#).

For more information, contact Sea Grant at sgweb@noaa.gov.

Source: <https://seagrant.noaa.gov/News/Article/ArtMID/1660/ArticleID/2916/Sea-Grant-advances-investigation-of-contaminants-of-emerging-concern>

Recently Awarded Research

Westchester County Parks Conservation Division Receives Grant from the State for the Hudson River Fish Advisory Outreach Project

On July 28, 2022, the Westchester County Parks Conservation division received a grant from New York State for the Hudson River Fish Advisory Outreach Project. The division was awarded \$15,000 per year through December 31, 2023.

The Hudson River Fish Advisory Outreach Project's mission is to educate the public about fishing, fish consumption, and its accompanying advisories and regulations, by appointing ambassadors to provide information at Westchester County parks, beginning with Croton Point Park in Croton-on-Hudson in 2022, followed by Oscawana Park in Croton-on-Hudson and George's Island in Montrose in 2023.

Westchester County Executive George Latimer said, "Fishing is a common pastime in Westchester County, and it is important that those who actively fish are educated and prepared. I am confident the Westchester County Parks Conservation Division and its ambassadors will provide the community with all necessary information."

Commissioner of the Westchester County Department of Parks, Recreation and Conservation, Kathy O'Connor said, "I'm thrilled that the Conservation Division has been awarded such an important grant and are providing residents with a fun and interactive way to learn more about fishing in our parks."

In addition to Croton Point Park, ambassadors can be found across the county at various events this summer including local farmers markets and County events like Heritage Cultural Festivals alongside an interactive educational stand-in display that allows visitors to learn about the mission in a fun way through various handouts, which are available in English and Spanish, as well as photo opportunities. The display is also located at Croton Point Park, and visitors are encouraged to share photos on social media using #PRCFishingAmbassadors.

Additional information can be found on the New York State Department of Health [website](#).

Source: <https://parks.westchestergov.com/press-releases/3118-westchester-county-parks-conservation-division-receives-grant-from-the-state-for-the-hudson-river-fish-advisory-outreach-project>

Tech and Tools

App Provides Culturally Tailored Fish Consumption Guidelines to Anishinaabe

A phone app for reducing exposure to harmful contaminants from fish consumption was developed for the Anishinaabe (Ojibwe and associated Great Lakes Tribes). It is called Gigiigoo'inaan, which means “our fish” in the Ojibwe language. Phone apps and online environmental health literacy resources can be effective ways to reach community members with important health information.

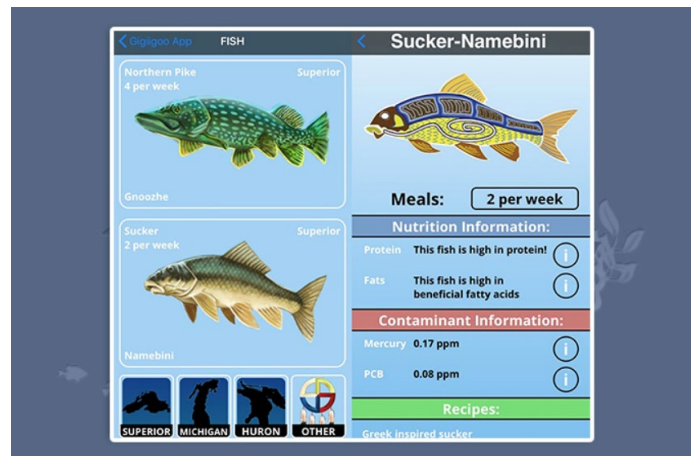
The culturally relevant app was designed and developed by researchers at the Medical College of Wisconsin who worked with the Chippewa Ottawa Resource Authority (CORA), the Great Lakes Inter-Tribal Council, and the Inter-Tribal Council of Michigan. The research team also tested whether the app was successful at increasing environmental health literacy about fish consumption. This work is described in a [September 2022 paper](#).

“Fishing and fish consumption are important parts of minobimaadiziwin — or ‘living in a good way,’” stated Amy Poupart, program director for the Great Lakes Native American Research Center for Health. “Restrictive fish consumption advisories are disruptive to our traditions and lifeways. However, there is ongoing work in the community to reduce environmental contaminants, and environmental health literacy interventions, such as ours, complement these efforts.”

Tailoring Recommendations to the Anishinaabe Community

Community members informed the app’s features and content. For example, Gigiigoo'inaan includes Ojibwe names for fish and incorporates traditional artwork. Previous papers describe the app’s [development and design](#), [focus group results](#) that informed development, and [methods to determine recommended fish consumption](#).

The app is intended to increase environmental health literacy by including information on recommended consumption amounts of different types of fish. The recommendations are based on CORA's sampling data for contaminants found in various types of fish. The app also allows for personalization by the user, such as body weight and sex, which allows the user to calculate the maximum fish consumption that is within regulatory limits of contaminants set by government agencies. Additionally, the app shows whether a fish provides healthy fatty acids and how many times the fish may be consumed per week based on the risk of contaminant exposure.



A screenshot of the Gigiigoo'inaan app shows an example of the nutrition recommendations and contaminant information for a fish, as well as the corresponding images and artwork. (Photo courtesy of Matthew Dellinger)

“Our team developed this app over several years, incorporating community engaged, culturally appropriate data that truly makes this app unique to the Anishinaabe,” stated Matthew Dellinger, Ph.D., lead investigator of the National Institute of Environmental Health Science (NIEHS)-funded study and co-investigator at the [Great Lakes Native American Research Center for Health](#). “An important part of environmental health literacy is access to information, so the app format, which can be accessed on a smartphone or online on another device, is easily accessible to most people. But providing information tailored to the community is also critical. The Gigiigoo'inaan app meets this goal.”

Fish Consumption App Tested in the Community

The Inter-Tribal Council of Michigan recruited Tribal members to participate in the study through inter-Tribal consortia agreements. The researchers used an experimental study design in which 130 participants had access to Gigiigoo'inaan after researchers determined typical fish consumption before using the app. An additional 136 participants in a control group did not use the app. All participants received compensation for their participation.

The study took place over eight weeks during the Great Lakes winter ice fishing season, when residents typically consume a lot of fish. Throughout this time, researchers sent weekly surveys to participants prompting them to self-report the amount of each type of fish they consumed. Using CORA's sampling data on contaminant levels in fish, researchers estimated contaminant consumption based on the self-reported data. Researchers also estimated omega-3 fatty acid consumption.

Interestingly, researchers did not find statistically significant differences between the contaminants consumed by participants using the app and those who did not use the app. Few participants in both the control and app arms of the study exceeded regulatory limits, but encouragingly, the researchers found that most participants were consuming recommended intakes of omega-3 fatty acids, indicating that minobimaadiziiwin and traditional fishing practices promote healthy eating habits. Additionally, app users found Gigiigoo'inaan to be engaging, useful, and culturally appropriate.

“While we did not see large differences in contaminant exposure or fish consumption between the app users and those that did not use the app, we don’t find these results discouraging,” reflected Dellinger. “Quite the opposite. These results show that Anishinaabe community engagement efforts may be encouraging healthy fish consumption behaviors by getting the word out about fish advisories while promoting minobimaadiziwin, which in turn encourages more fishing and hunting. The main effect we found was a self-reported increase in confidence that fish could be safely consumed by favoring lower contaminant species and limiting others.”

Dellinger provided the example of walleye, a fish species important to the community. Previous advice has flagged large walleye as dangerously high in contaminants, but Gigiigoo’inaan provides a personalized recommendation that increases confidence in safe consumption of that fish without exceeding advisory limits.

In the future, the researchers will look to expand their understanding of how cultural concepts of health and wellness interact with environmental health literacy to promote healthy, exposure-reducing, behaviors. The study is currently in its final phase to assess long-term app use and sustained improvement in environmental health literacy.

For more information, contact Matthew Dellinger at mdellinger@mcw.edu.

Source: <https://www.niehs.nih.gov/research/supported/translational/peph/newsletter/2022/11/index.cfm>

Recent Publications

Journal Articles

The list below provides a selection of research articles.

- ▶ [The Impact of Mercury Contamination on Human Health in the Arctic: A State of the Science Review](#)
Basu, N., Abass, K., Dietz, R., Krümmel, E., Rautio, A., and P. Weihe. 2022. The Impact of Mercury Contamination on Human Health in the Arctic: A State of the Science Review. *Science of The Total Environment*, Volume 831, 154793.
- ▶ [Preferences for Seafood Consumption Advice in Pregnant American Women](#)
Connelly, N., Lauber, T., and B. Knuth. 2022. Preferences for Seafood Consumption Advice in Pregnant American Women. *Environmental Research*, 214, 114058.
- ▶ [Environmental Health Literacy for Anishinaabe \(Great Lakes Native American\) Fish Consumers: A Randomized Control Trial](#)
Dellinger, M., Pingatore, N., Chelius, T., Visotcky, A., Sparapani, R., and M. Ripley. 2022. Environmental Health Literacy for Anishinaabe (Great Lakes Native American) Fish Consumers: A Randomized Control Trial. *Environmental Research*, 212, 113335.
- ▶ [Mercury in Kansas Fish: Levels, Patterns, and Risk-Based Safe Consumption Limits for Mercury Sensitive Populations](#)
Goodrich, C., Jacobs, B., and B. Miller. 2022. Mercury in Kansas Fish: Levels, Patterns, and Risk-Based Safe Consumption Limits for Mercury Sensitive Populations. *Transactions of the Kansas Academy of Science*, 125(3-4), 165-190
- ▶ [Affordability Influences Nutritional Quality of Seafood Consumption Among Income and Race/Ethnicity Groups in the United States](#)
Love, D., Thorne-Lyman, A., Conrad, Z., Gephart, J., Asche, F., Godo-Solo, D., and M. Bloem. 2022. Affordability Influences Nutritional Quality of Seafood Consumption Among Income and Race/Ethnicity Groups in the United States. *The American Journal of Clinical Nutrition*, 116(2), 415-425.

▶ [PFAS and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories](#)

Pickard, H., Ruyle, B., Thackray, C., Chovancova, A., Dassuncao, C., Becanova, J., and E. Sunderland. 2022. PFAS and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories. *Environmental Science & Technology*, 56(22), 15573-15583.

▶ [Assessing Per-and Polyfluoroalkyl Substances \(PFAS\) in Sediments and Fishes in a Large, Urbanized Estuary and the Potential Human Health Implications](#)

Pulster, E., Rullo, K., Gilbert, S., Ash, T., Goetting, B., Campbell, K., and S. Murawski. 2022. Assessing Per-and Polyfluoroalkyl Substances (PFAS) in Sediments and Fishes in a Large, Urbanized Estuary and the Potential Human Health Implications. *Frontiers in Marine Science*, 2314.

▶ [Restored Oyster Reefs Match Multiple Functions of Natural Reefs Within a Decade](#)

Smith, R., Lusk, B., and M. Castorani. 2022. Restored Oyster Reefs Match Multiple Functions of Natural Reefs Within a Decade. *Conservation Letters*, e12883.

▶ [Meta-Analysis of Ecosystem Services Associated with Oyster Restoration](#)

Smith, R., Cheng, S., and M. Castorani. 2022. Meta-Analysis of Ecosystem Services Associated with Oyster Restoration. *Conservation Biology*, 00, e13966.

▶ [Contaminants in Fish from U.S. Rivers: Probability-Based National Assessments](#)

Stahl, L.L., Snyder, B.D., McCarty, H.B., Kincaid, T.M., Olsen, A.R., Cohen, T.R., Healey, J.C. 2023. Contaminants in Fish from U.S. Rivers: Probability-Based National Assessments. *Science of the Total Environment*, 160557.

Upcoming Meetings and Conferences

[115th Annual Meeting of the National Shellfisheries Association](#)

March 26–30, 2023
Baltimore, MD

[13th National Monitoring Conference](#)

April 24–28, 2023
Virginia Beach, VA

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>.