



Fish and Shellfish Program NEWSLETTER

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

This edition of the Fish and Shellfish Program Newsletter generally focuses on shellfish.

Recent Advisory News



Domoic Acid in Razor Clams in Washington

A new study shows razor clams containing low levels of domoic acid may cause memory problems for those who eat large amounts year-round. The Washington Department of Health recommends you eat no more than 15 razor clams each month for 12 consecutive months. This interim advisory applies to everyone, especially women who are or might become pregnant, nursing mothers, children, the elderly, and people with compromised renal function.

This interim advisory is based on research from the CoASTAL study (“Community Advancing the Study of Tribal Nations Across the Lifespan”). The study was completed by the Universities of Maryland, Hawaii, and Florida; the National Oceanic and Atmospheric Administration (NOAA); and three tribes in Washington State (Quileute, Makah, and Quinault Nations). The study’s goal was to determine whether exposure to low levels of domoic acid over long periods of time could affect people’s health. This is the first study to evaluate long-term exposure to low levels of domoic acid from eating razor clams.

After consulting with tribal leaders, tribal advisory committee members, and medical advisors, the researchers recommended tribal members from the Quileute, Makah, and Quinault Nations eat no more than 15 razor clams each month for 12 consecutive months. The Department of Health is recommending everyone follow this advice.

Domoic acid is a naturally occurring toxin produced by microscopic marine algae. Fish, shellfish, and crabs may eat this algae. At high levels, eating seafood with domoic acid can cause Amnesic Shellfish Poisoning (ASP). Symptoms can include nausea, vomiting, diarrhea, and abdominal cramps within 24 hours of eating contaminated seafood. In more severe cases, neurological symptoms may develop within 48 hours, including headache, dizziness, confusion, disorientation, loss of short-term memory, motor weakness, seizures, trouble breathing, irregular heartbeat, coma, and possibly death. There is no known way to stop the harmful effects from high levels of domoic acid. The Department of Health routinely monitors shellfish for domoic acid. If levels reach or exceed 20 parts per million, the Department closes harvesting areas to protect human health. The new CoASTAL study shows razor clams containing low levels of domoic acid may cause memory problems for those who eat large amounts year-round, prompting this interim advisory.

Since the focus of the CoASTAL study was on tribal members, more research is needed to understand the potential exposure and health risks for others. For additional resources, see [Amnesic Shellfish Poisoning](#); [Acid in Razor Clams Handout \(PDF\)](#); [Prevent Shellfish-Related Illnesses](#).

Source:

<http://www.doh.wa.gov/CommunityandEnvironment/Shellfish/BiotoxinsIllnessPrevention/Biotoxins/DomoicAcidinRazorClams>.



Division of Marine Fisheries Issues Shellfish Harvest Closure in Buzzards Bay (Massachusetts) and Mount Hope Bay (Massachusetts and Rhode Island)

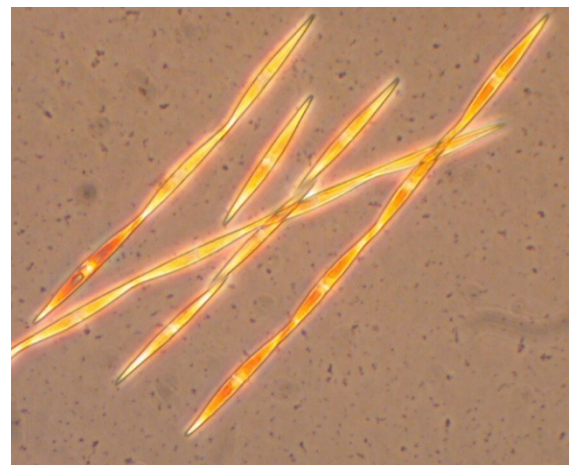
On October 7, 2016, the Massachusetts Division of Marine Fisheries (DMF) banned the harvesting of shellfish in Buzzards Bay, the Massachusetts portion of Mount Hope Bay, and Lackeys Bay due to a substantial bloom of a potentially toxic kind of phytoplankton termed *Pseudo-nitzschia*. Buzzards Bay and Lackeys Bay were closed to shellfish harvesting effective at sunrise on Saturday, October 8, 2016, and Mount Hope Bay was closed to shellfish harvesting effective immediately. As a result of the closure, digging, harvesting, collecting, and/or attempting to dig, harvest, or collect shellfish, and the possession of shellfish, were prohibited in Bourne, Dartmouth, Fairhaven, Falmouth, Gosnold, Marion, Mattapoissett, New Bedford, Swansea, and Westport.

Phytoplankton samples collected by DMF on October 6, 2016 indicated extremely high concentrations of *Pseudo-nitzschia* throughout Buzzards Bay. Though the necessary testing was not yet conducted in Mount Hope Bay, a precautionary closure was issued because a *Pseudo-nitzschia* bloom was present, and testing results by Rhode Island Department of Environmental Management in nearby Narragansett Bay and the Rhode Island side of Mount Hope Bay indicated that the phytoplankton *Pseudo-nitzschia spp* were producing toxins.

Pseudo-nitzschia can produce domoic acid, a biotoxin that concentrates in filter feeding shellfish. Shellfish containing high concentrations of domoic acid can cause Amnesiac Shellfish Poisoning (ASP) with symptoms that include vomiting, cramps, diarrhea, and incapacitating headaches followed by confusion, disorientation, permanent loss of short-term memory, and in severe cases, seizures, and coma.

DMF staff continued testing the waters of Vineyard Sound, Nantucket Sound, and Cape Cod Bay for the presence of *Pseudo-nitzschia spp*. Additional testing of phytoplankton and shellfish for domoic acid concentrations was carried out within areas of the coast where significant *Pseudo-nitzschia* blooms were detected.

Based on the results of further testing, DMF rescinded the shellfish harvest closure on October 31, 2016 after the phytoplankton bloom had dissipated and shellfish were known to be free of toxic levels of domoic acid. In



A microscopic image of *Pseudo-nitzschia*. (Image courtesy of NOAA)

Massachusetts, the closure did not affect the harvest of whelks nor bay scallops, or sea scallops for purposes of extracting and selling or consuming the adductor muscle.

Sources: <http://www.mass.gov/eea/pr-2016/shellfish-harvest-closure-in-buzzards-bay-and-mount-hope.html>;
<http://www.mass.gov/eea/docs/dfg/dmf/marinefisheriesnotices/asp-opening-notice-103116.pdf>;
<http://www.mass.gov/eea/pr-2016/dmf-reopens-waters-south-of-cape-cod-to-shellfishing.html>.

Recreational Shellfish Advisories and Consumption Guidelines along the Oregon Coast

The following tables provide recreational shellfish advisories and consumption guidelines for the Oregon Coast.

Zone	Affected Species	Contaminant	Location	Meals per Month	Resources
				Consumption Guidelines *Meal Sizes by Age	
Oregon Coast	Softshell clams (<i>Mya arenaria</i>) Gaper clams (<i>Tresus capax</i>)	Inorganic Arsenic	North Coast (Mouth of Columbia to Neskowin)	Siphon skin intact: 1 Siphon skin removed: 11	<ul style="list-style-type: none"> • Press Release • Questions and Answers (pdf) • Video: How to remove siphon skin from softshell clams • Oregon clam identification chart
			Central Coast (Cascade Head to mouth of Umpqua River)	Siphon skin intact: 2 Siphon skin removed: 26	
			South Coast (Mouth of Umpqua River to California Border)	Siphon skin intact: 4 Siphon skin removed: 33	

Softshell and Gaper Clams Meal Sizes for Different Age Groups		
Age Group	Meal Size by Clam Weight (Excluding Shells)	Meal Size by Clam Volume (Excluding Shells)
Adult (17 years and older)	8 ounces	1 cup
12-16 years old	6 ounces	3/4 cup
7-11 years old	4 ounces	1/2 cup
4-6 years old	3 ounces	1/3 cup
2-3 years old	2 ounces	1/4 cup

Source:

<http://public.health.oregon.gov/HealthyEnvironments/Recreation/FishConsumption/Pages/fishadvisories.aspx#shellfish>.

Interstate Shellfish Sanitation Conference News Addressing Public Health Issues for Ingestion of Molluscan Shellfish

The Interstate Shellfish Sanitation Conference (ISSC) is a public health organization that fosters and promotes shellfish sanitation through the cooperation of state and federal control agencies, the shellfish industry, and the academic community. According to Ken Moore, Executive Director of the ISSC, the three most significant issues facing public health based on ingestion of raw or cooked molluscan shellfish are (1) *Vibrio* bacteria, (2) norovirus, and (3) harmful algal blooms (HABs).

Issues associated with two naturally-occurring species of bacteria, *Vibrio vulnificus* and *Vibrio parahaemolyticus*, receive the most resources from states and the Food and Drug Administration (FDA). The ISSC has time-to-temperature strategies for *V. vulnificus* and *V. parahaemolyticus*. The time from harvest to refrigeration is determined using risk-based calculators that were developed from risk assessments. The time and temperature controls are very similar yet have differences because the risk of illness is different for the two species of vibrios. Since *Vibrio* infections occur naturally rather than through contamination, the only step available for hazard control is cooking. The control strategies in place have been reducing illnesses, especially in recent years. Mr. Moore hopes this trend will continue, but noted that since the strategies depend upon water and air temperature, its efficacy relies upon the climate.

ISSC is also working with NOAA and FDA to develop a program that would provide industry with *Vibrio* risk predictions based on air and water temperature forecasts. Separately, states are testing the accuracy of existing models and their ability to forecast *Vibrio* risk.

Norovirus is the second-most prevalent source of illness in the United States associated with shellfish consumption. The ISSC is confident in its controls for known point source discharges that can contaminate shellfish with norovirus. However, norovirus outbreaks in the last few years have originated from events outside of the usual controls, such as boat overflow discharge. With FDA oversight, adjustments have been made to state shellfish sanitation programs to ensure freshwater rivers and upstream discharges are addressed.

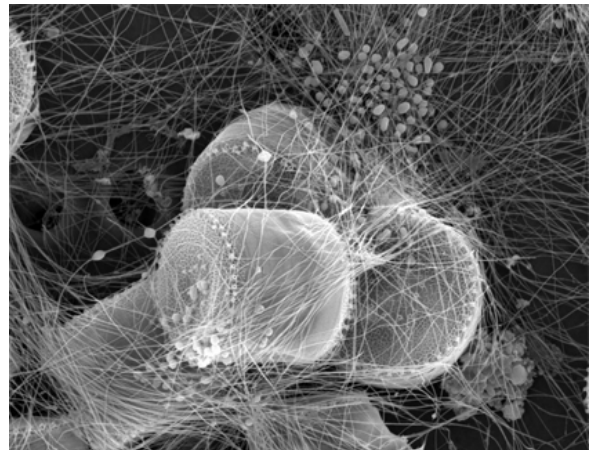
Finally, HABs are the third-most pressing public health issue for the ingestion of shellfish. Not all shellfish-producing states experience HABs, and those that do have effective monitoring programs that determine when to close harvesting grounds. The ISSC is investigating new cost-effective and timely methods to make closure decisions. Historically, the biotoxins of concern were Paralytic Shellfish Poisoning (PSP) and Neurotoxic Shellfish Poisoning. Now ISSC is reviewing and approving methods that have been developed to focus on additional biotoxins.

Regulations currently in place effectively curb threats from *Vibrio*, norovirus, and HABs as they pertain to shellfish harvesting and ingestion. The best way for states and tribes to help address these three problems is simply to adhere to the minimum requirements of the National Shellfish Sanitation Program (NSSP). For more information about the NSSP, visit <http://www.fda.gov/Food/GuidanceRegulation/FederalStateFoodPrograms/ucm2006754.htm>. For more information about the ISSC, visit [http://issc.org/about/default.aspx?section=Conference Administration](http://issc.org/about/default.aspx?section=Conference+Administration).

Other News

Contagious Cancers Spreading among Several Shellfish Species

Direct transmission of cancer among some marine animals may be more common than once thought, suggests a new study published in *Nature* by researchers at Columbia University Medical Center. The study, led by Stephen



Vibrio parahaemolyticus adhering to chitin expressed by the diatom *Thalassiosira weissfloggi*. (Image courtesy of NOAA)

Goff, PhD, revealed that in several species of bivalves, including mussels, cockles, and clams, cancer cells from contagious cells spread from animal to animal through the sea water. The cancer, known as disseminated neoplasia, is a leukemia-like disease that affects bivalves in many parts of the world. Direct transmission of cancer cells is quite rare. Until recently, the phenomenon had only been observed in two species of mammals. Last year, the research team found a third example in the soft shell clam (*Mya arenaria*) after initially suspecting that the culprit behind the cancer cluster was a virus.

The team then wondered if cancers in other mollusks are also caused by contagious cells. To find out, the DNA of cancers and normal tissue from mussels (*Mytilus trossulus*), cockles (*Cerastoderma edule*), and golden carpet shell clams (*Polititapes aureus*) collected from the coasts of Canada and Spain were examined. In each species, the researchers discovered that the cancers were caused by independent clones of cancer cells that were genetically distinct from their hosts. They also found that in one species, the carpet shell clam, the infectious cancer cells came from a related but distinct species. The researchers concluded that this cancer was due to a case of cross-species transmission. “Now that we have observed the spread of cancer among several marine species, our future research will investigate the mutations that are responsible for these cancer cell transmissions,” said Dr. Goff.

Study citation: Metzger, M.J., A. Villalba, M.J. Carballal, D. Iglesias, J. Sherry, C. Reinisch, A.F. Muttray, S.A. Baldwin, and S.P. Goff. 2016. Widespread transmission of independent cancer lineages within multiple bivalve species. *Nature* 534:705–709.

Source: <http://www.thefishsite.com/fishnews/27821/contagious-cancers-spreading-among-several-shellfish-species/>.

National Centers for Coastal Ocean Science (NCCOS) Helps New England Respond to Unprecedented HAB

On November 2, 2016, NOAA posted that for the first time in New England’s coastal waters, shellfish exceeded the regulatory limit for domoic acid—a potent neurotoxin produced by the diatom *Pseudo-nitzschia*. Domoic acid accumulates in shellfish that feed on *Pseudo-nitzschia*, and can lead to [ASP](#) in people who consume tainted shellfish.

The [NCCOS Harmful Algal Bloom Event Response Program](#) awarded funds to the Woods Hole Oceanographic Institution and the Bigelow Laboratory for Ocean Sciences to rapidly map the spatial extent, species composition, and toxicity of the *Pseudo-nitzschia* bloom in the coastal and nearshore waters of the Gulf of Maine, and to determine the oceanographic conditions contributing to the bloom’s toxicity and distribution. Maine state managers are using these data to inform shellfish harvest closures and mitigate the impact of the unfolding bloom.

Blooms of *Pseudo-nitzschia* have also been observed in Massachusetts and Rhode Island. Weekly coordination calls between state agencies, researchers, and NOAA are also helping Massachusetts and Rhode Island respond to this ongoing regional bloom.

[Earlier NCCOS and partner harmful algal bloom research](#) in the region has documented the presence of *Pseudo-nitzschia* species capable of producing toxins and alerted shellfish managers to this potential threat. Those efforts

focused on providing agencies with better detection technology and monitoring methods and have provided some capacity that has aided the rapid response to the current bloom. For more information, contact Quay Dortch (Quay.Dortch@noaa.gov) or Marc Suddleson (Marc.Suddleson@noaa.gov).

Source: <https://coastalscience.noaa.gov/news/habs/nccos-helps-new-england-respond-unprecedented-harmful-algal-bloom/>.

Risk of Shellfish Toxicity Predicted by Temperature and Salinity

A new [study](#) shows that water temperature and salinity can indicate the likely occurrence of toxic *Alexandrium* blooms (a type of harmful algae) in the Pacific Northwest. As shellfish become contaminated with the toxins produced by these HABs, researchers and shellfish managers can use these findings to predict shellfish toxicity, which causes illness or even death when contaminated shellfish are consumed by humans.

In the Salish Sea region of the Pacific Northwest (the Puget Sound, Strait of Juan de Fuca, Strait of Georgia), *Alexandrium* blooms are common. By measuring the growth rates of two *Alexandrium* isolates at a range of temperatures (T) and salinities (S), researchers found optimal T and S ranges, or windows, for where and when *Alexandrium* will grow. Based on the findings, in the Salish Sea, the optimal conditions for *Alexandrium* growth and risk of shellfish toxicity occur between April and November, though this window only indicates the potential of a HAB to form rather than a guaranteed bloom.

In addition to their usefulness under current conditions, the identified T and S windows can serve as indicators of the potential for *Alexandrium* blooms under future climate change scenarios.

This study is part of the NCCOS Ecology and Oceanography of HABs (ECOHAB) project [Modeling Favorable Habitat Areas for *Alexandrium catenella* in Puget Sound and Evaluating the Effects of Climate Change](#). Additional support for the study was provided by the National Science Foundation and the National Institute of Environmental Health Sciences. For more information, contact Quay Dortch (Quay.Dortch@noaa.gov).

Source: <https://coastalscience.noaa.gov/news/climate/risk-shellfish-toxicity-predicted-temperature-salinity/>.

Recently Awarded Research

Pathogens, Nitrogen, and Changing Climate: Impacts on Narragansett Bay Shellfish

The eastern oyster (*Crassostrea virginica*) and blue mussel (*Mytilus edulis*) are commercially, culturally, and ecologically significant shellfish in New England. In response to stakeholder interest on the potential effects of environmental change on shellfish populations, Dr. Moseman-Valtierra will lead research investigating how two key drivers of coastal ecosystems—



Eastern oyster (*Crassostrea virginica*). (Image by [Andrew C - Own Work, CC BY 2.0](#))

nitrogen and warming—impact the health and function of *C. virginica* and *M. edulis*. Shellfish perform significant nitrogen cycling functions but are potentially overlooked as major sources (or sinks) of nitrous oxide due to microbial associates in their guts and on their shells.

This project will examine potential relationships among nitrogen loading, nitrous oxide emissions, and shellfish disease to help sustain local aquaculture and evaluate their effectiveness at nitrogen remediation, as well as minimize potential feedback from managed and natural shellfish populations on global climate. Field experiments at Point Judith Pond will directly involve Rhode Island shellfishermen and will incorporate a high quality, time series of environmental data made available via the University of Rhode Island Watershed watch laboratory and the Rhode Island Salt Ponds Coalition.

Results may reveal the potential usefulness of shellfish in nutrient control, as well as help identify pathogens of greatest threat to two major bivalve species and at what thresholds of nitrogen and/or warming shellfish populations may be severely impacted by disease.

Source: <http://seagrant.gso.uri.edu/research/research-2016-2018/>.



Blue mussel (*Mytilus edulis*). (Image by [Andreas Trepte](#) - Own work, [CC BY-SA 2.5](#))

Where is *Vibrio* Now and Where is it Going? Protecting the Health of Oysters and Consumers

As filter feeders, eastern oysters can accumulate nutrients and pathogens present in the water column. And while most are harmless some pathogens are not, such as *Vibrio parahaemolyticus*, a bacteria that can cause gastrointestinal illness for consumers of raw oysters, and in rare cases, death for those with compromised immune systems.

Rhode Island aquaculture has not yet suffered from closures due to human infections and the industry has taken important preventative handling steps, but as sea temperatures increase, it is likely that the accumulation of *Vibrio parahaemolyticus* will increase in aquacultured oysters. The research team will investigate current levels of *Vibrio parahaemolyticus* and pathogenic genes in aquacultured animals under different culture conditions commonly used in Rhode Island, as well as whether certain diseases increase the likelihood of *Vibrio parahaemolyticus* accumulation in tissues, which could support the use of different types of oysters that are disease resistant for aquaculture. Results will provide guidance for depuration or probiotic treatment methods currently being discussed in order to protect consumers and maintain healthy seafood in the state.

Source: <http://seagrant.gso.uri.edu/research/research-2016-2018/>.

Rapid, Quantitative, Molecular Diagnostics for Virulent *Vibrio* Pathogens in Water and Shellfish

This project focuses on translating ecological research that has been previously conducted on a set of bacterial pathogens, vibrios, found in estuaries and coastal systems. *Vibrio cholerae* is a well-known freshwater pathogen that is of concern in developing countries. Two lesser known but important human pathogens in the United States are from the same bacterial group: *Vibrio vulnificus* and *Vibrio parahaemolyticus*. These are bacteria that are naturally found in estuarine systems, but they can also present a risk to human health when consumed in raw shellfish, or in rare cases, contacted in beach waters. This project will translate knowledge gained through prior ecological research into technology that allows for the design of user-friendly, rapid, molecular testing kits. The existing ways to test for *Vibrio* species in water and shellfish samples are decades old, and they require 24–96 hours for results. Even new molecular approaches for testing of pathogenic forms of *V. vulnificus* and *V. parahaemolyticus* are compromised by a lack of specificity and/or a need for an enrichment step to improve sensitivity, making them require almost a day for completion. This project will promote generation of new, rapid molecular diagnostics for virulent forms of *V. vulnificus* and *V. parahaemolyticus* using a new approach for determining useful targets for the kits. It is envisioned that these kits could be used to (1) certify that shellfish is safe for raw consumption, (2) protect the health of at risk populations for water contact, and (3) determine the patterns associated with dangerous forms of the bacteria for improved warning systems. The funded project will result in the design of commercially available molecular testing kits that will be easy to use, and will provide results in 2–3 hours. These features will allow for accurate public notification and protection of public health.

This project addresses a specific knowledge gap in the transition from research to commercial application. *Vibrio* sp. are complex bacterial organisms that are naturally found in estuarine and coastal waters, but only a small subset of them are capable of causing disease. The combination of knowledge facilitates known virulent (pathogenic) *Vibrio* samples to be analyzed for specific sets of “DNA motifs” that are related to the capability of the bacteria to cause disease. From a repetitive process of analyzing known virulent and avirulent cells, the project team can identify the DNA motifs, or signatures, that can be used to design a DNA test kit. Subsequently, through support from this project the molecular test kits will be developed, optimized, validated, and commercialized.

The researchers believe this project will directly impact the advancement of marine metagenomics due to the fact that the project team is utilizing a holistic approach to target complex organisms. The project is novel in that the approach moves away from the “single gene target” qualitative polymerase chain reaction (qPCR) design approach, permitting the generation of diagnostic kits that are rapid and cost-effective that shellfish harvesting and water quality managers can use to manage precious resources and protect public health.

Please report errors in award information by writing to awardsearch@nsf.gov.

Source: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1602023.

Recent Publications

Journal Articles

The list below provides a selection of research articles focusing on shellfish.

Mollusks

- ▶ [One-century decline of mollusk diversity as consequence of accumulative anthropogenic disturbance in a tropical estuary \(Cuban Archipelago\)](#)
Armenteros, M., M. Díaz-Asencio, R. Fernández-Garcés, C.A. Hernández, Y. Helguera-Pedraza, Y. Bolaños-Alvarez, C. Agraz-Hernández, and J.A. Sanchez-Cabeza. 2016 (online). One-century decline of mollusk diversity as consequence of accumulative anthropogenic disturbance in a tropical estuary (Cuban Archipelago). *Marine Pollution Bulletin* (in press).
- ▶ [Pharmaceutically active compounds and endocrine disrupting chemicals in water, sediments and mollusks in mangrove ecosystems from Singapore](#)
Bayen, S., E.S. Estrada, G. Juhel, L.W. Kit, and B.C. Kelly. 2016. Pharmaceutically active compounds and endocrine disrupting chemicals in water, sediments and mollusks in mangrove ecosystems from Singapore. *Marine Pollution Bulletin* 109(2):716–722.
- ▶ [Living oysters and their shells as sites of nitrification and denitrification](#)
Caffrey, J.M., J.T. Hollibaugh, and B. Mortazavi. 2016. Living oysters and their shells as sites of nitrification and denitrification. *Marine Pollution Bulletin* 112(1–2):86–90.
- ▶ [First study on oyster-shell-based phosphorous removal in saltwater – A proxy to effluent bioremediation of marine aquaculture](#)
Martins, M.C., E.B.H. Santos, and C.R. Marques. 2016. First study on oyster-shell-based phosphorous removal in saltwater – A proxy to effluent bioremediation of marine aquaculture. *Science of the Total Environment* 574:605–615.
- ▶ [Assessment of PCB and chlorinated pesticide accumulation in mussels at Kaštela Bay \(Eastern Adriatic\)](#)
Milun, V., D. Grgas, and T.L. Dragičević. 2016. Assessment of PCB and chlorinated pesticide accumulation in mussels at Kaštela Bay (Eastern Adriatic). *Science of the Total Environment* 562:115–127.
- ▶ [Haematopoiesis in molluscs: A review of haemocyte development and function in gastropods, cephalopods and bivalves](#)
Pila, E.A., J.T. Sullivan, X.Z. Wu, J. Fang, S.P. Rudko, M.A. Gordy, and P.C. Hanington. 2016. Haematopoiesis in molluscs: A review of haemocyte development and function in gastropods, cephalopods and bivalves. *Developmental & Comparative Immunology* 58:119–128.
- ▶ [Is there a direct relationship between stress biomarkers in oysters and the amount of metals in the sediments where they inhabit?](#)
Rodríguez-Iruretagoiena, A., A. Rementería, B. Zaldibar, S. Fdez-Ortiz de Vallejuelo, A. Gredilla, G. Arana, and A. de Diego. 2016. Is there a direct relationship between stress biomarkers in oysters and the amount of metals in the sediments where they inhabit? *Marine Pollution Bulletin* 111(1–2):95–105.
- ▶ [Modeling and prediction of oyster norovirus outbreaks along Gulf of Mexico coast](#)
Wang, J., and Z. Deng. 2016. Modeling and prediction of oyster norovirus outbreaks along Gulf of Mexico coast. *Environmental Health Perspectives* 124(5):627–633.
- ▶ [Impact on bird fauna of a non-native oyster expanding into blue mussel beds in the Dutch Wadden Sea](#)
Waser, A.M., S. Deuzeman, A.K. wa Kangeri, E. van Winden, J. Postma, P. de Boer, J. van der Meer, and B.J. Ens. 2016. Impact on bird fauna of a non-native oyster expanding into blue mussel beds in the Dutch Wadden Sea. *Biological Conservation* 202:39–49.
- ▶ [What has happened to the benthic mollusks of the Yellow Sea in the near half century? Comparison on molluscan biodiversity between 1959 and 2007](#)
Zhang, J., S. Zhang, S. Zhang, Y. Du, and F. Xu. 2016. What has happened to the benthic mollusks of the Yellow Sea in the near half century? Comparison on molluscan biodiversity between 1959 and 2007. *Continental Shelf Research* 113:21–29.

Crustaceans

- ▶ [On the diet of the invasive crab *Charybdis longicollis* Leene, 1938 \(Brachyura: Portunidae\) in the eastern Mediterranean Sea](#)
Stasolla, G., G. Innocenti, and B.S. Galil. 2016. On the diet of the invasive crab *Charybdis longicollis* Leene, 1938 (Brachyura: Portunidae) in the eastern Mediterranean Sea. *Israel Journal of Ecology & Evolution* 61(3-4):130-134.
- ▶ [Occurrence of plastic debris in the stomach of the invasive crab *Eriocheir sinensis*](#)
Wójcik-Fudalewska, D., M. Normant-Saremba, and P. Anastácio. 2016 (online). Occurrence of plastic debris in the stomach of the invasive crab *Eriocheir sinensis*. *Marine Pollution Bulletin* (in press).

Multiple Species / Other

- ▶ [Assessment of trace element contamination and bioaccumulation in algae \(*Ulva lactuca*\), mussels \(*Perna perna*\), shrimp \(*Penaeus kerathurus*\), and fish \(*Mugil cephalus*, *Saratherondon melanotheron*\) along the Senegalese coast](#)
Diop, M., M. Howsam, C. Diop, J.F. Goossens, A. Diouf, and R. Amara. 2016. Assessment of trace element contamination and bioaccumulation in algae (*Ulva lactuca*), mussels (*Perna perna*), shrimp (*Penaeus kerathurus*), and fish (*Mugil cephalus*, *Saratherondon melanotheron*) along the Senegalese coast. *Marine Pollution Bulletin* 103(1-2):339-343.
- ▶ [The distribution, contamination and risk assessment of heavy metals in sediment and shellfish from the Red Sea coast, Egypt](#)
El Nemr, A., G.F. El-Said, S. Ragab, A. Khaled, and A. El-Sikaily. 2016. The distribution, contamination and risk assessment of heavy metals in sediment and shellfish from the Red Sea coast, Egypt. *Chemosphere* 165:369-380.
- ▶ [Investigation on the differences of accumulating *Escherichia coli* in three types of shellfish species, involving in the environmental factors](#)
Jin, L., T. Li, H. Liu, and J. Zhu. 2016. Investigation on the differences of accumulating *Escherichia coli* in three types of shellfish species, involving environmental factors. *Marine Pollution Bulletin* 109(1):81-86.

Upcoming Meetings and Conferences

[Seafood Safety: New Findings & Innovation Challenges Conference](#)

January 25-26, 2017
Brussels, Belgium

[109th Annual Meeting of the National Shellfisheries Association](#)

March 26-30, 2017
Knoxville, Tennessee

[11th International Conference on Molluscan Shellfish Safety](#)

May 14-18, 2017
Galway, Ireland

[The 77th Midwest Fish & Wildlife Conference](#)

February 5-8, 2017
Lincoln, Nebraska

[10th Biennial Symposium of the Freshwater Mollusk Conservation Society](#)

March 26-30, 2017
Cleveland, Ohio

[13th International Conference on Mercury as a Global Pollutant](#)

July 16-21, 2017
Providence, Rhode Island

Additional Information

This monthly 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>.