EPA United States Environmental Protection Agency

Fish and Shellfish Program NEWSLETTER

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In This Issue

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

This edition of the Fish and Shellfish Program Newsletter generally focuses on harmful algal blooms (HABs).

Recent Advisory News

Texas Issues Revised Fish Consumption Advisory for Ellison Creek Reservoir

On September 29, 2016, the Texas Department of State Health Services (DSHS) issued a revised fish consumption advisory for Ellison Creek Reservoir, also known as Lone Star Lake, due to unsafe levels of dioxins and polychlorinated biphenyls (PCBs).

DSHS tested tissue samples from fish as part of a re-evaluation of the lake. Concentrations of dioxins and PCBs in channel catfish, common carp, flathead catfish, hybrid striped bass, largemouth bass, spotted gar, sunfish, and white bass continue to exceed DSHS guidelines for protection of human health.

DSHS recommends people limit or avoid consumption of the following species of fish because eating contaminated fish can be a health hazard.

Contaminants of Concern	Species	Women of Childbearing Age and Children Under 12[1]	Women Past Childbearing Age and Males 12 and Older[2]
Dioxins and PCBs	Channel catfish	DO NOT EAT	1 meal/month
	Common carp	DO NOT EAT	DO NOT EAT
	Flathead catfish	DO NOT EAT	1 meal/month
	Hybrid striped bass	DO NOT EAT	DO NOT EAT
	Largemouth bass	1 meal/month	2 meals/month
	Spotted gar	DO NOT EAT	1 meal/month
	Sunfish species (Bluegill, Green, Redbreast)	DO NOT EAT	1 meal/month
	White bass	DO NOT EAT	2 meals/month

[1] A meal is four ounces of fish.
[2] A meal is eight ounces of fish.

DSHS removed the consumption advisory for bowfin and crappie from Ellison Creek Reservoir because testing indicated that concentrations of dioxins and PCBs have decreased to acceptable levels and no longer pose a significant health risk.

Sources: https://www.dshs.texas.gov/news/releases/2016/DSHS-Issues-Revised-Fish-Consumption-Advisory-for-Ellison-Creek-Reservoir.aspx; www.dshs.state.tx.us/seafood.

Indiana Alerts for Blue Green Algae Blooms Related to Consumption of Fish

Updated in September 2016, the following alerts have been issued in Indiana for blue green algae blooms. No more samples will be collected until next sampling season, which starts in May 2017.

Lake Name	Status as of 9/2/16)
Brookville Lake (Quakertown and Mounds SRA)	Advisory
Cecil M. Harden Lake (Raccoon SRA)	Advisory
Ferdinand Lake at Ferdinand State Forest	Advisory
Hardy Lake	Advisory
Mississinewa Lake	Advisory

Lake Name	Status as of 9/2/16)
Monroe Lake (Paynetown and Farifax SRA)	Advisory
Potato Creek State Park	Advisory
Salamonie Lake	Advisory
Whitewater Memorial	Advisory

Some blue-green algal toxins can accumulate in the tissues of fish. Recent studies in Ohio have determined that the flesh of fish is safe to consume. The World Health Organization advises that if you eat fish taken from water where a blue-green algae bloom is present, eat them in moderation and avoid eating the guts, where accumulation of toxins may be greatest. Do not cut into organs when filleting, and rinse the fillets with clean water to remove any liquids from the guts or organs before freezing or cooking.

During an advisory in Indiana, swimming and boating are permitted. The state recommends avoiding contact with algae and swallowing water while swimming. Additional recommendations include taking a bath or shower with warm soapy water after coming in contact with lake water, not using lake water for cooking or bathing, and not allowing pets to swim or drink water where algae are present. Advisories signs are posted with a yellow diamond on the warning sign.

Source: http://www.in.gov/dnr/parklake/8473.htm.

EPA News

EPA CyanoHABs Webpage and Monthly Newletter

In order to educate and inform the public about HABs, EPA releases a monthly newsletter specifically focusing on cyanobacteria harmful algal blooms (cyanoHABs). The monthly newsletter focuses primarily on freshwater HABs and provides information on beach closures, health advisories with respect to HABs, current news, recently published journal articles, as well as upcoming conferences, workshops, webinars, and useful resources. For more information visit EPA's cyanoHABs website at www.epa.gov/cyanohabs or email Dr. D'Anglada at Danglada.Lesley@epa.gov. The 2016 CyanoHABs Newsletters can be accessed at https://www.epa.gov/nutrient-policy-data/cyanohabs-newsletters-2016.

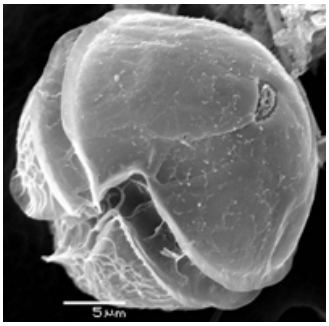
Other News

Gulf of Maine Red Tide Monitoring Season Begins for NOAA and Partners

On May 19, 2016, the National Oceanic and Atmospheric Agency (NOAA) posted that HAB monitoring was underway in the Gulf of Maine, with near real-time early warning of potential toxic blooms being provided by three Environmental Sample Processors (ESPs). The ESPs operate like laboratories in a can, sampling cells and toxins produced by *Alexandrium fundyense*, the red tide alga. Data from the ESPs are used by monitoring programs in Maine, New Hampshire, and Massachusetts and by the region's shellfish industry. Shellfish harvest is regulated to prevent paralytic shellfish poisoning (PSP), a serious illness in humans who eat shellfish contaminated with the toxins produced by *Alexandrium fundyense*.

"ESPjake" is in Harpswell Sound, Maine, co-located with a Maine Department of Marine Resources (ME DMR) mussel monitoring program site to determine the relationship between cell concentration and mussel toxicity. "ESPdon" is deployed offshore near ME DMR shellfish sampling sites in Casco Bay, and "ESPdennis" is near the Wells National Estuarine Research Reserve, upstream from Ogunquit, Maine.

All three ESPs are monitoring and providing early warning for *Alexandrium fundyense* and *Pseudo-nitzschia*. "ESPjake" and "ESPdon" are also equipped with saxitoxin sensors. ESP data are sent directly to shellfish monitoring programs, and reported on the Woods Hole Oceanographic Institution website and Northeast PSP website.



An *Alexandrium* cell image from a scanning electron microscope. *(Image courtesy of NOAA)*

This is the third year that NOAA has supported the HAB early warning network in the Gulf of Maine. The ESP and toxin sensor technology was first tested in the Gulf of Maine in 2011, supported by EPA and NOAA Integrated Ocean Observing System. Similar systems are being deployed to improve HAB early warning off the coast of Washington State and in Lake Erie. This is part of a NOAA ecological forecasting initiative that aims to deliver accurate, relevant, timely, and reliable ecological forecasts directly to coastal resource managers.

For more information, contact Marc.Suddleson@noaa.gov.

Source: https://coastalscience.noaa.gov/news/habs/nccos-regional-partners-begin-gulf-maine-red-tide-season-monitoring/.

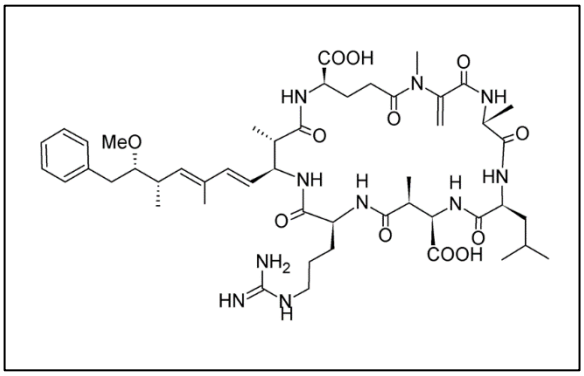
Toxins from Freshwater Algae Found in San Francisco Bay Shellfish

Scientists have detected high levels of a toxin produced by freshwater algae in mussels from San Francisco Bay. Although shellfish harvested from California's coastal waters are monitored for toxins produced by marine algae, they are not routinely tested for this freshwater toxin, called microcystin. The toxin, which causes liver damage, is produced by a type of cyanobacteria (also known as blue-green algae) that thrives in warm, nutrient-rich waters. It

has been found in many lakes and rivers in California, including the Sacramento and San Joaquin Rivers, which flow into the San Francisco Bay Delta, and in several Bay Area lakes.

Raphael Kudela, the Lynn Professor of Ocean Health at University of California, Santa Cruz, said his lab investigated the potential for microcystin to contaminate shellfish after detecting low levels of the toxin in water samples from San Francisco Bay. The researchers tested mussels collected from five sites in the Bay. They also did experiments with both mussels and oysters in tanks to determine how quickly the shellfish take up the toxin and how long it takes to clear it from their tissues. The results are published in the journal *Harmful Algae*. "We found that this freshwater toxin accumulates in shellfish, both mussels and oysters, and that in San Francisco Bay, the toxin levels in some mussels exceed the recommended guidelines for consumption by quite a bit," Kudela said.

The researchers also detected low levels of the toxin in commercial oysters from Tomales Bay, although the levels were well below the guidelines for microcystin levels in fish. First author Corinne Gibble said the findings suggest tests for microcystin should be added to existing shellfish monitoring programs. "There is monitoring of shellfish for marine-derived toxins, but because this is a freshwater toxin no one has been looking for it. Now it seems microcystin is something we should be monitoring as well," Gibble said.



The chemical structure of microcystin-LR (*Image by DrJohn1100 - Own work, CC BY-SA 4.0*)

A state quarantine on harvesting of mussels for human consumption is usually in effect from May through October to prevent poisonings from marine toxins. Kudela said his lab has been working closely with state agencies, and they are continuing to conduct tests to determine the extent of the microcystin problem and the best way to address it. "The agencies have been very responsive," he said. "There is potential for this toxin to affect humans, but most of our samples are still below the recommended limits for human consumption, so people shouldn't panic and think they can't eat shellfish."

A greater concern, he said, is the potential impact on marine mammals such as sea otters, which eat large amounts of shellfish. In 2010, Kudela and scientists with the California Department of Fish and Wildlife reported that microcystin poisoning had killed several sea otters in Monterey Bay. Kudela said he suspects the toxins detected in San Francisco Bay are coming from multiple sources, including the rivers that flow into the Delta as well as local sources. The drought appears to have exacerbated the problem throughout California, he said. "The rains help by flushing things out. Warm, dry conditions favor these blooms, so we've been seeing more of them lately than we would without the drought," Kudela said.

Source: http://news.ucsc.edu/2016/10/microcystin-toxin.html.

Recently Awarded Research

Work Begins to Assess Emerging Algal Toxin Threat in Washington State Waters

In early June 2016, NOAA and Washington State partners began a four-month long effort to monitor shellfish and water every week at six locations around Puget Sound and on the Pacific coast. The team plans to measure concentrations of marine algae and their associated lipophilic (fat soluble) toxins, which can accumulate in shellfish and cause human illnesses when consumed.

Lipophilic shellfish toxins comprise an extensive suite of compounds, including those associated with the human illnesses known as diarrhetic shellfish poisoning (DSP) and azasparacid shellfish poisoning (AZP). Though research has documented several algal species associated with DSP in Washington waters, distribution and toxicity data is limited. While little is known about the distribution of algal species that produce AZP toxins in the U.S., they have been found in Puget Sound water and shellfish.

The research team will map the distribution of toxic algae that produce DSP and AZP toxins and establish and validate a tiered HAB early warning system using capabilities of the SoundToxins and the Olympic Region Harmful Algal Bloom programs. Ultimately, the research will establish globally accepted protocols for quantifying a suite of lipophilic toxins to enhance state agency biotoxin monitoring programs.

For more information, contact Marc.Suddleson@noaa.gov.

Source: https://coastalscience.noaa.gov/news/ecosystem-management/assessing-emerging-algal-toxin-threat-washington-state-waters/.

Recent Publications

Journal Articles

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

Fish

- Cyanobacteria and cyanotoxins in fishponds and their effects on fish tissue
  Drobac, D., N. Tokodi, J. Lujić, Z. Marinović, G. Subakov-Simić, T. Dulić, T.Važića, S. Nybom, J. Meriluoto, G.A. Codd, and Z. Svirčev. 2016. Cyanobacteria and cyanotoxins in fishponds and their effects on fish tissue. *Harmful Algae* 55:66–76.

- Occurrence of microcystins in water, bloom, sediment and fish from a public water supply
  Gurbuz, F., O.Y. Uzunmehmetoğlu, Ö. Diler, J.S. Metcalf, and G.A. Codd. 2016. Occurrence of microcystins in water, bloom, sediment and fish from a public water supply. *Science of the Total Environment* 562:860–868.

- Dynamics of algae growth and nutrients in experimental enclosures culturing bighead carp and common carp: Phosphorus dynamics
  Huang, S., M. Wu, C. Zang, S. Du, J. Domagalski, M. Gajewska, F. Gao, C. Lin, Y. Guo, B. Liu, S. Wang, Y. Luo, A. Szymkiewicz, and R. Szymkiewicz. 2016. Dynamics of algae growth and nutrients in experimental enclosures culturing bighead carp and common carp: Phosphorus dynamics. *International Journal of Sediment Research* 31(2):173–180.

- Gender-specific toxicological effects of chronic exposure to pure microcystin-LR or complex *Microcystis aeruginosa* extracts on adult Medaka fish
  Le Manach, S., N. Khenfech, H. Huet, Q. Qiao, C. Duval, A. Marie, G. Bolbach, G. Clodic, C. Djediat, C. Bernard, M. Edery, and B. Marie. 2016. Gender-specific toxicological effects of chronic exposure to pure microcystin-LR or complex *Microcystis aeruginosa* extracts on adult Medaka fish. *Environmental Science & Technology* 50(15):8324–8334.

- Histopathological and biochemical effects of cyanobacterial cells containing microcystin-LR on Tilapia fish
  Preeti, T., G. Hariharan, and G.R. Rajarajeswari. 2016. Histopathological and biochemical effects of cyanobacterial cells containing microcystin-LR on Tilapia fish. *Water and Environment Journal* 30(1–2):135–142.

- Microcystin-LR induced developmental toxicity and apoptosis in zebrafish (*Danio rerio*) larvae by activation of ER stress response
  Qi, M., Y. Dang, Q. Xu, L. Yu, C. Liu, Y. Yuan, and J. Wang. 2016. Microcystin-LR induced developmental toxicity and apoptosis in zebrafish (*Danio rerio*) larvae by activation of ER stress response. *Chemosphere* 157:166–173.

- Pro- and anti-inflammatory cytokine expression in carp blood and head kidney leukocytes exposed to cyanotoxin stress – An in vitro study
  Rymuszka, A., and Ł. Adaszek. 2012. Pro- and anti-inflammatory cytokine expression in carp blood and head kidney leukocytes exposed to cyanotoxin stress – An in vitro study. *Fish & Shellfish Immunology* 33(2):382–388.

- Zebrafish Oatp-mediated transport of microcystin congeners
  Steiner, K., L. Zimmermann, B. Hagenbuch, and D. Dietrich. 2016. Zebrafish Oatp-mediated transport of microcystin congeners. *Archives of Toxicology* 90(5):1129–1139.

- Massive fish mortality and *Cylindrospermopsis raciborskii* bloom in Aleksandrovac Lake
  Svirčev, Z., V. Obradović, G.A. Codd, P. Marjanović, L. Spoof, D. Drobac, N. Tokodi, A. Petkovi, T. Nenin, J. Simeunović, T. Važić, and J. Meriluoto. 2016. Massive fish mortality and *Cylindrospermopsis raciborskii* bloom in Aleksandrovac Lake. *Ecotoxicology* 25(7):1353–1363.

- Cyanobacteria are controlled by omnivorous filter-feeding fish (Nile tilapia) in a tropical eutrophic reservoir
  Torres, G.S., L.H.S. Silva, L.M. Rangel. J.L. Attayde, and V.L.M. Huszar. 2016. Cyanobacteria are controlled by omnivorous filter-feeding fish (Nile tilapia) in a tropical eutrophic reservoir. *Hydrobiologia* 765(1):115–129.

- Silver carp exhibited an enhanced ability of biomanipulation to control cyanobacteria bloom compared to bighead carp in hypereutrophic Lake Taihu mesocosms
  Yi, C., L. Guo, L. Ni, and C. Luo. 2016. Silver carp exhibited an enhanced ability of biomanipulation to control cyanobacteria bloom compared to bighead carp in hypereutrophic Lake Taihu mesocosms. *Ecological Engineering* 89:7–13.

Shellfish

- First detection of benthic cyanobacteria in Lake Baikal producing paralytic shellfish toxins
  Belykh, O.I., I.V. Tikhonova, A.V. Kuzmin, E.G. Sorokovikova, G.A. Fedorova, I.V. Khanaev, T.A. Sherbakova, and O.A. Timoshkin. 2016. First detection of benthic cyanobacteria in Lake Baikal producing paralytic shellfish toxins. *Toxicon* 121:36–40.

- Characterization of paralytic shellfish toxins from *Lyngbya wollei* dominated mats collected from two Florida springs
  Foss, A.J., E. Philips, M. Yilmaz, and A. Chapman. 2012. Characterization of paralytic shellfish toxins from *Lyngbya wollei* dominated mats collected from two Florida springs. *Harmful Algae* 16:98–107.

- Bloom of *Dinophysis* spp. dominated by D. *sacculus* and its related diarrhetic shellfish poisoning (DSP) outbreak in Alfacs Bay (Catalonia, NW Mediterranean Sea): Identification of DSP toxins in phytoplankton, shellfish and passive samplers
  García-Altares, M., A. Casanova, M. Fernández-Tejedor, J. Diogène, and P. de la Iglesia. 2016. Bloom of *Dinophysis* spp. dominated by D. *sacculus* and its related diarrhetic shellfish poisoning (DSP) outbreak in Alfacs Bay (Catalonia, NW Mediterranean Sea): Identification of DSP toxins in phytoplankton, shellfish and passive samplers. *Regional Studies in Marine Science* 6:19–28.

- Evidence of freshwater algal toxins in marine shellfish: Implications for human and aquatic health
  Gibble, C.M., Peacock, M.B. and Kudela, R.M., 2016. Evidence of freshwater algal toxins in marine shellfish: Implications for human and aquatic health. *Harmful Algae* 59:59–66.

- Two decades of *Pseudo-nitzschia* spp. blooms and king scallop (*Pecten maximus*) contamination by domoic acid along the French Atlantic and English Channel coasts: Seasonal dynamics, spatial heterogeneity and interannual variability
  Husson, B., T. Hernández-Fariñas, R. Le Gendre, M. Schapira, and A. Chapelle. 2016. Two decades of *Pseudo-nitzschia* spp. blooms and king scallop (*Pecten maximus*) contamination by domoic acid along the French Atlantic and English Channel coasts: Seasonal dynamics, spatial heterogeneity and interannual variability. *Harmful Algae* 51:26–39.

- Environmental roles and biological activity of domoic acid: A review
  Zabaglo, K., E. Chrapusta, B. Bober, A. Kaminski, M. Adamski, and J. Bialczyk. 2016. Environmental roles and biological activity of domoic acid: A review. *Algal Research* 13:94–101.

Other

- Applied simulations and integrated modelling for the understanding of toxic and harmful algal blooms (ASIMUTH): Integrated HAB forecast systems for Europe's Atlantic Arc
  Maguire, J., C. Cusack, M. Ruiz-Villarreal, J. Silke, D. McElligott, and K. Davidson. 2016. Applied simulations and integrated modelling for the understanding of toxic and harmful algal blooms (ASIMUTH): Integrated HAB forecast systems for Europe's Atlantic Arc. *Harmful Algae* 53:160–166.

Upcoming Meetings and Conferences

67th Annual Northwest Fish Culture Concepts: A Workshop for Fish Culturists
December 6–8, 2016
Centralia, Washington

109th Annual Meeting of the National Shellfisheries Association
March 26–30, 2017
Knoxville, Tennessee

Seafood Safety: New Findings & Innovation Challenges Conference
January 25–26, 2017
Brussels, Belgium

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.