Alaska
Harmful Algal Bloom Network

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Algal Blooms in Alaska and Why Some Are Harmful

The benefits of phytoplankton

Harmful algal blooms are caused by phytoplankton – microscopic, plant-like organisms that are present in all the world's oceans and major bodies of water. Like plants, most phytoplankton get their energy from sunlight, consume carbon dioxide, and produce oxygen. They are estimated to produce more than half of the world's oxygen and form the basis of the marine food chain. When phytoplankton are exposed to the right conditions they can "bloom," or multiply extremely rapidly.

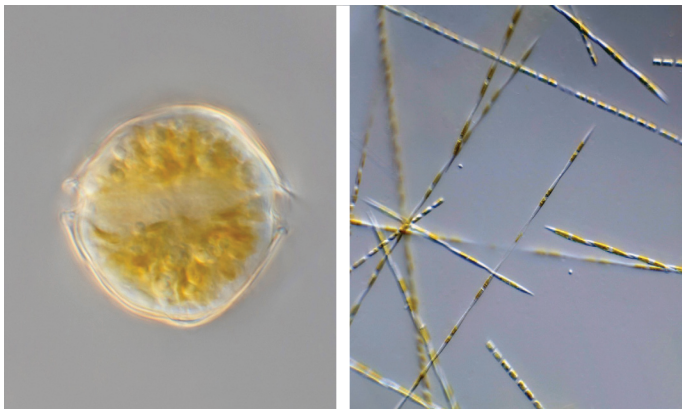
Some phytoplankton species can cause harm

In general, more phytoplankton means more food and oxygen for everything else in the ocean, but occasionally plankton blooms are hazardous to human or marine life. These are known as "Harmful Algal Blooms" or HABs. HABs are typically defined by their impacts to humans, their property, or the marine animals or resources that we care about. Harmful blooms come in a variety of different forms. Some produce toxins that directly poison humans, marine mammals, or fish. Others have sharp spines that mechanically damage fish gills. HABs occur around the world and in all months of the year, but in Alaska blooms are most common from late spring through fall.

HABs in Alaska

Alaska's most well-known and destructive HABs are caused by two phytoplankton genera that can produce lethal toxins. *Alexandrium* is a genus of dinoflagellate that produces paralytic shellfish toxins (PSTs) – a family of dozens of compounds that includes saxitoxin. Paralytic shellfish poisoning (PSP) has killed or sickened people and marine animals from Southeast Alaska to the Aleutians and new blooms are detected every year, including in the northern Bering, Chukchi, and Beaufort seas.

Pseudo-nitzschia is a genus of diatom that can produce the toxin domoic acid. Domoic acid causes amnesic shellfish poisoning in humans and has been documented to cause severe neurological damage and death to marine mammals. There have been very few documented human cases of amnesic shellfish poisoning in Alaska, although domoic acid has been found in the tissue of marine mammals harvested all over the state. *Pseudo-nitzschia* blooms have rapidly become a severe threat in other West Coast states and may increase in severity as Alaska waters warm.



Photos by K. Holtermann.

The most concerning HAB species in Alaska are dinoflagellates in the genus *Alexandrium* (left) and diatoms in the genus *Pseudo-nitzschia* (right).

Threats to food safety and security

Algal toxins can accumulate in food items consumed by humans (such as shellfish) and cause illness or even death. Symptoms of PSP include tingling around the mouth and in the extremities, dizziness, numbness, paralysis, and eventually respiratory arrest. There is no anti-toxin. In the worst cases, breathing needs to be supported at a medical facility until the toxin is eliminated from the body.

In addition, algal toxins have been found throughout the food web from invertebrates to marine mammals. Research is still ongoing as to the extent of the impact on wild animal populations, but if individual survival is lowered during toxic bloom events, food security from these marine resources could be threatened.

What is being done to mitigate the threat of HABs in Alaska? What is still needed?

Photo by Bethany Goodrich.

Harvesters wash shellfish samples to remove sediment before delivering them to the Sitka Tribe of Alaska Environmental Research Lab for algal toxin testing.

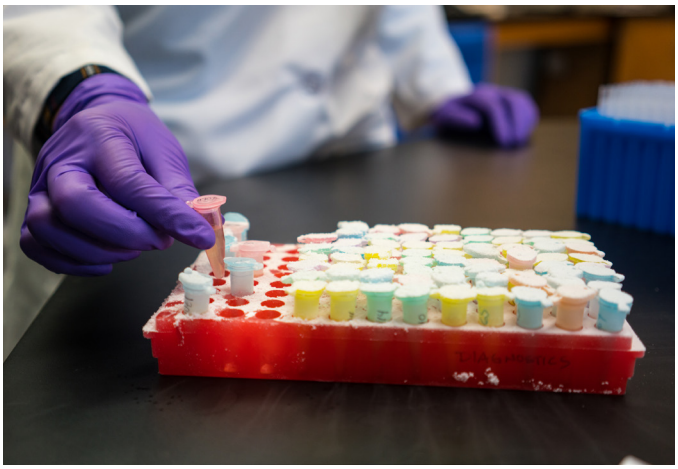


Photo by Bethany Goodrich.

Shellfish samples are being prepared for algal toxin testing. These samples will be tested using a simpler method that provides a partial toxin profile for research purposes.

The Alaska Harmful Algal Bloom Network

The Alaska HAB Network (AHAB) was formed in 2017 to provide statewide coordination of HAB monitoring, research, outreach, and response in Alaska. AHAB brings together a diverse group of researchers, managers, and ocean users that address human and wildlife health risks from HABs.

Phytoplankton monitoring

In order to better understand bloom dynamics of the harmful phytoplankton species, monitors and researchers are collecting water samples and determining their presence. By collecting this information along with water parameters (temperature, salinity, etc…) over months and years, researchers will be able to better understand what conditions are necessary for HABs to form. Monitoring phytoplankton may also provide an indication of whether toxins are likely to be present; however, this alone is not sufficient to determine the safety of food items.

Algal toxin testing

Toxin testing in Alaska requires complex lab techniques. Only certain techniques (such as the mouse bioassay) are FDA-approved to determine whether food is safe for human consumption. All commercial shellfish in Alaska are tested with this method before being sold, but there is no equivalent statewide monitoring program for recreational and subsistence harvests. Non-food safety toxin testing methods can be useful for research purposes and are being used to determine in which organs the toxins accumulate, and how toxins move through the food web.

Exploring new and innovative approaches

To help find new and better ways to understand HABs and algal toxins in Alaska, innovative methods are being tested to detect and quantify HAB species (such as Image FlowCytoBots and hyperspectral cameras), and to make toxin testing easier and faster (such as qPCR and field tests).

Remaining needs

The length and remotness of Alaska's coastlines means that monitoring for HABs and their toxins needs to expand geographically. Sampling and testing of subsistence food items needs to be increased, and the turnaround time should be shortened so results can be provided to ocean users quickly. This requires long-term funding and capacity throughout Alaska.

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