Harmful Algal Blooms
What They Mean to Alaskans and How We Can Adapt

What are HABs?
Marine algae range from single-celled phytoplankton to giant kelp. The tiniest and simplest are extremely abundant in the ocean and serve as the base of the entire marine food chain. Optimal combinations of temperature, nutrients, and light cause algal blooms—dramatic events that are key to supporting populations of useful and commercially important fish, birds, and mammals.

However, some marine algae produce toxic substances that, when bio-accumulated (concentrated in tissues) in filter-feeding bivalves like clams, oysters, and mussels, can poison wildlife and humans. Algal blooms that produce vast quantities of harmful algae are called harmful algal blooms or HABs. HABs have killed 15 people in Alaska in the last 80 years, sickened hundreds, and imposed serious financial consequences on the seafood industry. In recent years conditions that trigger HABs are occurring more frequently.

Three species of dinoflagellates in the genus *Alexandrium* cause paralytic shellfish poisoning (PSP), a sometimes fatal ailment in humans resulting from eating tainted bivalves. Reported PSP incidents increased in the late 1970s when an extended cold oceanographic period ended, though it’s difficult to know whether the increase resulted from more *Alexandrium* blooms or from more reporting due to heightened awareness. PSP is a hazard associated with eating personal use and subsistence-harvested clams and mussels from the coast of Alaska outside the Arctic. PSP also has been identified in the viscera (internal organs) of five species of commercially valuable crabs in Alaska.

Farmed oysters and scallops and commercially harvested clams are tested for PSP and are safe to consume.

Several diatoms of the genus *Pseudo-nitzschia* produce a neurotoxin known as domoic acid, or amnesiac shellfish poisoning. Until recently domoic acid was unknown in Alaska waters and so far it has not killed anyone, but an illness apparently resulting from consumption of Kachemak Bay shellfish in 2006 sounded an alarm. The toxin has been identified in several kinds of shellfish, and in blood samples from marine mammals. Domoic acid is of particular concern to the crab industry because it accumulates in the “crab butter” (hepatopancreas) of crabs. It is common in the lower states of the Pacific Coast where water temperatures typically are warmer.

A third form of HAB is now plaguing freshwater and brackish systems, causing illness, inconvenience, and economic loss to residents far from the ocean. Blue-green algae live in lakes and rivers, and can produce a cyanotoxin harmful to people and wildlife. Research suggests that exposure to high levels of cyanotoxin can cause a fatal neurological condition called Lou Gehrig’s disease. When blue-green algae bloom, huge filamentous masses of organisms make the waters murky and clog village water system filters. The blooms can suffocate subsistence fish and cause illness in people.

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Why do HABs matter?
HABs affect Alaskans in two ways: they threaten health, and they impose significant financial costs. PSP occurs in potentially fatal concentrations on many parts of the coast each year, and only the sparse populations and limited personal use bivalve harvests have prevented more fatalities.

The existence of PSP imposes significant testing and monitoring costs on the commercial shellfish industry, and restricts species, areas, and times of harvest. A potential Bering Sea surf clam industry never developed due in part to PSP concerns. Shellfish growers have to site their farms to avoid areas where blooms are more likely, and in some cases have to relocate grow-out gear to avoid contamination. Recreational and personal-use harvesting is limited, which decreases tourism opportunities.

Concerns about PSP and domoic acid in southeast Alaska are causing the crab industry to change to lower-value or higher-cost product forms, such as sectioned rather than whole live crabs, which lowers industry profitability. The Kodiak and Aleutian Islands fisheries already are required to section crabs.

Some village water systems now require several intake filter changes per day during the summer, at considerable cost, due to clogging by algal blooms. Some villages have had to relocate water system intakes or change sources of village water altogether. Blue-green algae have lived in Alaska's inland waterways for millennia, but increasing temperatures, reduced ice cover, and a longer growing season are contributing to larger, more frequent, and more harmful blooms.

Why is this happening?
Harmful algal blooms have occurred in Alaska waters as far back as recorded history goes. A recent increase in frequency could be due to:
- Higher water temperatures, a result of increasing atmospheric temperatures.
- Introduction and transport of toxins in carrier species. For example, the highest concentrations of domoic acid have been found in anchovies, which migrate into Alaska waters in warm years.

A warming global climate raises ocean temperatures, changes the speed and trajectories of ocean currents, changes water chemistry, and increases water salinity and temperature stability, all of which promote algal blooms.

How can Alaskans adapt to the threat of harmful algal blooms?
- Read the available literature and become familiar with the HAB threat.
- Avoid eating clams and mussels from Alaska waters that are not commercially grown or harvested. Section crabs and discard the viscera, including the crab butter.
- Support the creation of in-state capacity for HAB monitoring, research, and outreach. Participate in a local monitoring program.

For more information or assistance
Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program
http://www.marineadvisory.org/climate
Alaska Center for Climate Assessment and Policy (ACCAP)
http://ine.uaf.edu/accap/alaska_arctic.html
Alaska Department of Environmental Conservation
http://www.dec.alaska.gov/eh/fss/seafood/shellfish_home.html
Centers for Disease Control and Prevention
www.cdc.gov/nceh/hsb/hab/default.htm
NOAA National Ocean Service
http://oceanservice.noaa.gov/hazards/hab/
Paralytic Shellfish Poisoning: The Alaska Problem
http://seagrant.uaf.edu/features/PSP/PSP.pdf

This Alaska Sea Grant Marine Advisory Program (MAP) project is supported by the Alaska Center for Climate Assessment and Policy (ACCAP). MAP is a statewide outreach and technical assistance program that helps Alaskans sustain economic development, traditional cultural uses, and conservation of marine and coastal resources. ACCAP’s mission is to assess the socioeconomic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate.