

Northeast PSP: Background

Spring 2005 brought the worst "bloom" of the toxic alga *Alexandrium fundyense* since a massive outbreak occurred in 1972 in the New England region. These outbreaks are commonly called red tide, but scientists prefer the term "harmful algal bloom" (or HAB). The term red tide includes many blooms which discolor the water but cause no harm, and ignores blooms of highly toxic cells that cause problems at low (and essentially invisible) cell concentrations.

Millions of microscopic plants (phytoplankton) thrive in nearly every drop of coastal seawater. In the presence of sunlight and sufficient nutrients to grow, these plants photosynthesize and multiply, creating a "bloom." While most of the thousands of species of algae are harmless, this species is one of a few dozen that create potent toxins.

The swimming, photosynthetic cells of *A. fundyense* are responsible for blooms in the northeast US. A closely related species called *Alexandrium tamarense* also occurs in these waters but *A. fundyense* is more abundant and thus its name is used to simplify discussions.

The motile cells of *A. fundyense* originate from the germination of dormant cysts that accumulate in bottom sediments and allow the species to survive cold winter temperatures and unfavorable growing conditions. The cysts can also be resuspended by tides and storms.

The toxins produced by *A. fundyense* accumulate in filter-feeding shellfish such as clams, mussels and oysters making them unsafe for people and animals to eat. There is no risk to people who consume the flesh of fish, lobsters, and shrimp or who swim in the ocean. If eaten in sufficient quantity, these contaminated shellfish can result in illness or even death from a poisoning syndrome called paralytic shellfish poisoning, or PSP.

Scientists at Woods Hole Oceanographic Institution have been studying red tides for decades. Data collected are shared with state and local officials who are responsible for public health decisions [regarding closures of shellfish beds](#). WHOI researchers are working closely with federal officials as well, and have received event response funding for sampling cruises from NOAA's National Center for Coastal Ocean Science, Center for Sponsored Coastal Ocean Research. Other projects are underway through Woods Hole's Center for Oceans and Human Health and through Don Anderson's and Dennis McGillicuddy's laboratories at WHOI.

Alexandrium is naturally distributed throughout New England waters, and past research by Woods Hole Oceanographic Institution (WHOI) scientists has shown that these cells travel to the south in coastal currents derived from rivers and other water moving west in the Gulf of Maine. The algae typically develop into large-scale blooms only in waters off Maine and Canada, with intensities varying from year to year. Natural current and wind patterns usually keep the cells from flowing into nearshore waters of southern New England in most years.

Red Tides or Harmful Algal Blooms

Harmful algae are microscopic, single-celled plants that live in the sea. Most species of algae or phytoplankton are not harmful and serve as the energy producers at the base of the food web, without which higher life on this planet would not exist.

Occasionally, the algae grow very fast or "bloom" and accumulate into dense, visible patches near the surface of the water. "Red Tide" is a common name for such a phenomenon where certain phytoplankton species contain reddish pigments and "bloom" such that the water appears to be colored red. The term "red tide" is thus a misnomer because they are not associated with tides; they are usually not harmful; and those species that are harmful may never reach the densities required to discolor the water. Unfortunately, a small number of species produce potent neurotoxins that can be transferred through the [food web](#) where they affect and even kill the higher forms of life such as zooplankton, shellfish, [fish](#), [birds](#), [marine mammals](#), and even [humans](#) that feed either directly or indirectly on them.

Scientists now prefer the term, HAB, to refer to bloom phenomenon that contain toxins or that cause negative impacts.



[Enlarge Image](#)

Reports of harmful algal blooms in U.S. waters and around the world have drastically increased in the past three decades. Researchers attribute the increase partly to excessive nutrient pollution of the water and partly to better detection of HABs by coastal monitoring programs.



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Reports of harmful algal blooms in U.S. waters and around the world have drastically increased in the past three decades. Researchers attribute the increase partly to excessive nutrient pollution of the water and partly to better detection of HABs by coastal monitoring programs. (Illustration by Don Anderson and Jayne Doucette, WHOI)



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Cells of *alexandrium*. (Photo by Don Anderson, Woods Hole Oceanographic Institution)

Harmful Algal	Geographic Area	Organisms Affected
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Species		
<i>Alexandrium</i> spp.	Northern Atlantic and Pacific Coast of North America	<p>Mussels, surfclams, softshell clams, sea scallops, butterclams, ocean quahogs, oysters, gastropods, lobsters, crabs</p> <p>Herring, salmon, menhaden, sandlance, mackerel and possibly other fish species.</p> <p>Whales, sea lions⁺, sea otters⁺, sea birds.</p> <p>Squid, zooplankton, and other benthic invertebrates</p>



[Enlarge Image](#)

Dennis McGillicuddy, one of the principal investigators of the red tide research project, talks with colleague Bruce Keafer (back to camera) prior to another sampling cruise aboard *Tioga*. (Photo by Tom Kleindinst, Woods Hole Oceanographic Institution)

Paralytic Shellfish Poisoning (PSP)

causative organisms: *Alexandrium* spp., *Gymnodinium catenatum*, *Pyrodinium bahamense*

toxins produced: Saxitoxins

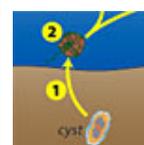
PSP is a life threatening syndrome. Symptoms are purely neurological and their onset is rapid. Duration of effects is a few days in non-lethal cases. Symptoms include tingling, numbness, and burning of the perioral region, ataxia, giddiness, drowsiness, fever, rash, and staggering. The most severe cases result in respiratory arrest within 24 hours of consumption of the toxic shellfish. If the patient is not breathing or if a pulse is not detected, artificial respiration and CPR may be needed as first aid. There is no antidote, supportive therapy is the rule and survivors recover fully. PSP is prevented by large-scale proactive monitoring programs (assessing toxin levels in mussels, oysters, scallops, clams) and rapid closures to harvest of suspect or demonstrated toxic areas.

[Additional information on PSP](#)

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Related Multimedia



Life Cycle of a Harmful Alga: *Alexandrium*

Certain species of toxic algae—in this case, *Alexandrium*—have evolved a cyst stage in their life cycle that promotes wide dispersal

through the coastal ocean and long-term survival through difficult environmental circumstances.

Illustration by Jack Cook, WHOI Graphic Services

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