CIMT
Center for Integrated Marine Technologies
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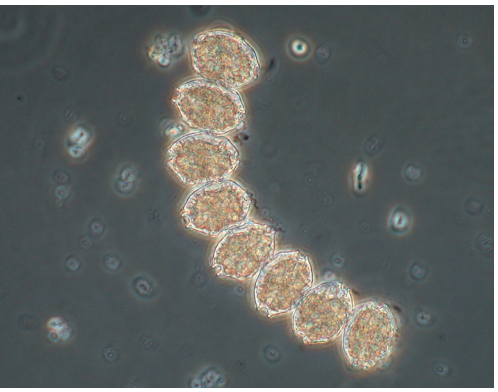
A research unit of the Central and Northern California Ocean Observing System (CeNCOOS)

Harmful Algal Blooms (HABs)

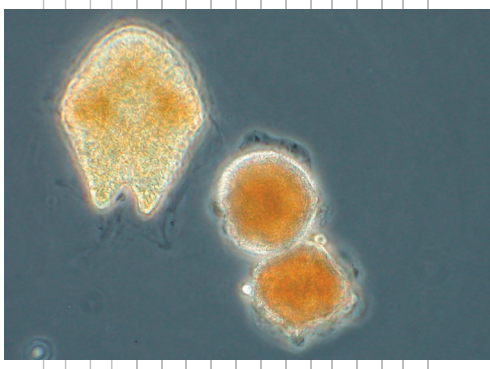
Algal Blooms occur when environmental conditions promote the rapid growth of large numbers of single celled marine algae, either microscopic or macroscopic phytoplankton. Harmful Algal Blooms (HABs) occur when some or all of the phytoplankton in a bloom exhibit a harmful trait. The vast majority of algal species are not harmful and indeed perform an essential role as the primary producers in many aquatic ecosystems. Thus, many algal blooms are not toxic; and in fact, contrary to common beliefs, discoloration of the water does not indicate whether a species is harmful. Many nontoxic species produce red tides or brown tides, while some HABs can occur without any discoloration of the water.



Alexandrium catenella. produces a suite of toxins responsible for paralytic shellfish poisoning symptoms.

There are a number of ways in which algal blooms can have a negative impact and thus be considered harmful. Some harmful species produce toxins, which can affect humans, fish, marine mammals, and seabirds. Some species cause large fish kills by clogging up or lacerating the fish's gills; these species generally are also detrimental to crustaceans. Still others negatively impact the system indirectly; by causing other aquatic plants and animals to suffocate (by using up all the oxygen), or by blocking all the sunlight and preventing aquatic plants from accessing it.

Harmful algal blooms are naturally occurring events, but they appear to be increasing in intensity and frequency. Blooms occur when environmental conditions change to be more favorable to phytoplankton growth. This often is due to an increase in limiting nutrients, but also could be due to changing temperatures or amounts of light, or turbulence in the water column. While some of the apparent increase in HABs may be due to better monitoring programs, there is growing evidence that humans are causing the blooms to occur more frequently, be larger and last longer. Humans could potentially be influencing blooms in a number of ways; examples include increasing nutrient availability via run-off, sewage, fertilizer, etc., climate change, or merely by assisting in the transport of new species into an area.



Akashiwo sp.

Harmful algal blooms occur along both coasts of the United States, some species are widespread, while others appear to have a more restricted range. There are six groups of harmful algae that have a strong presence on the West Coast of the United States. Some species of *Pseudo-nitzschia*, produce domoic acid, responsible for amnesic shellfish poisoning. *Alexandrium catenella* produces a suite of toxins responsible for paralytic shellfish poisoning symptoms. Diarrhetic shellfish poisoning is due to a milder suite of toxins which are produced by some species of *Dinophysis.* In the Northeast Pacific off the coast of Washington and up into Canada, *Heterosigma* is responsible for massive finfish mortalities, and it has also been observed in San Francisco Bay and Los Angeles waters. And then there's *Ciguatera* poisoning, which occurs in tropical waters and accumulates in the viscera and fatty tissues of reef fish. Finally, *Lingulodinium polyedrum* and *Gonyaulax spinifera* have been identified in California as yessotoxin producers, which may cause problems for marine mammals and humans.

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Why study HABs?

Harmful algal blooms impact human health, marine environments, and also can have a large economic impact. The majority of the economic losses are due to fisheries closures and loss of tourism. A recent EPA publication estimates that the impact of HABs on the US economy is over $40 million each year. By improving monitoring and prediction of HABs, growers are able to modify or adjust their business practices. The serious human health risks are due primarily to eating contaminated seafood, shellfish, finfish, and crustaceans. There are efficient monitoring programs in place that are protecting and preventing the majority of human exposure to these toxins. But the monitoring programs don't protect marine wildlife, and these HABs are responsible for the death of many species of marine mammals and seabirds. Thus, a rapid and effective method to monitor and detect the presence of HABs and their toxins is of high importance. Some harmful algal species don't produce toxins or pose a risk to human health, but they can still cause large fish and shellfish die-offs and disrupt the marine environment. These are often due to physical attributes, such as mucus or spines which clog or puncture, respectively, the gills of the animals feeding on them.

The impacts of HABs on the environment and the potential risk for human health are large and varied, and yet we know very little about what specifically causes blooms to occur, toxins to be produced, and how to predict when and where they will occur.

When a bloom occurs what should you do?

In general, harmful algal blooms along the West Coast pose no problems to swimmers or other recreational activities other than fishing. Always check for warning and closures before harvesting and eating shellfish. Exercise caution when eating fish caught during HABs, removing the viscera is strongly recommended. Discoloration of the water does not necessarily indicate a HAB (as many species that color the water are nontoxic), but again check for closures of shellfish beds.

For more HAB info please visit:

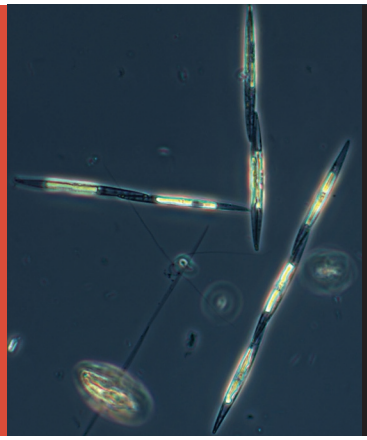
www.epa.gov/owow/estuaries/coastlines/summer98/harmfulalga.html

www.esa.org/HARRNESS/

www.nwfsc.noaa.gov/hab/habs_toxins/index.html

www.cop.noaa.gov/stressors/extremeevents/hab/

www.whoi.edu/redtide/



A RECENT EPA PUBLICATION ESTIMATES THE IMPACT OF HABS ON THE US ECONOMY IS OVER $40 MILLION EACH YEAR.

Current Research

In the mid-nineties a national plan was created to coordinate research on HABs. This became a multi-agency research agenda that funds and promotes collaborative research between many academic and governmental agencies into the large scale complex issue of Harmful Algal Blooms.

Research is continuing nationwide and locally, investigating the ecology, toxicology, and oceanographic influences relevant to HABs. More specifically, researchers are trying to understand what physical and environmental conditions these algal species respond to, what causes the blooms, what causes the toxin production, and how that toxin moves through the food web. Projects done locally at institutes around the Monterey Bay are maintaining long-term monitoring programs recording HABs, as well as investigating the ecology and physiology of the locally relevant harmful algal species. There are various ways in which harmful algal species are identified, some are time intensive, such as having an expert visually identify organisms under a microscope. Molecular probes that are species specific allow for a more rapid identification of species of interest.

Local researchers are also involved in another important area of research to protect the public health, which is the development of rapid detection techniques and monitoring systems. The predictions of blooms is another area that is under investigation. CIMT and other groups are working together to meet these goals for California.

For more information about CIMT & CENCOOS please visit:
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Far left: Pseudo-nitzschia sp., produces domoic acid, and is responsible for amnesic shellfish poisoning.

Cochlodinium

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