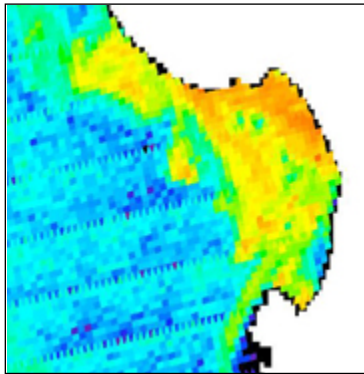


## Time Traveling in Monterey Bay



Satellite Image of a Monterey Bay Algal Bloom

The physical conditions of Monterey Bay make it a “hot spot” for algal blooms. Monterey Bay has a shallow continental shelf and provides shelter from open ocean conditions, providing an ideal HAB environment because there is less disturbance. Also, the deep Monterey Submarine Canyon that splits the Bay provides nutrients to sustain phytoplankton growth in the form of a “turbid plume” (see diagram below).

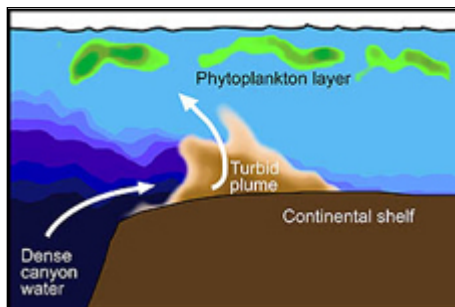


Diagram of turbid plume effect

**In 1991**, the U.S. experienced its first recognized toxic algal bloom involving *Pseudo-nitzschia* and domoic acid in Monterey Bay. This outbreak resulted in the unusual deaths of many pelicans and cormorants that ate sardines and anchovies contaminated with high levels of domoic acid.

**After the 1997-98 El Niño** Another large [\*Pseudo-nitzschia\*](#) bloom was detected in Monterey Bay . Over 400 sea lion carcasses washed up on shore, appearing to have suffered neurological damage that later was connected to eating infected anchovies. Since then a series of environmental changes and regime shifts have occurred in the area.

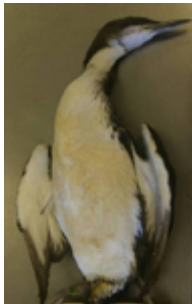
**After the 2003 El Niño**, researchers noticed a strange shift in phytoplankton species. Diatoms, which are usually the more dominant phytoplankton species in upwelling systems, became less abundant. Even though diatoms grow faster and out-compete other phytoplankton species, the dinoflagellates proved to be better swimmers and were able to obtain more nutrients at lower depths.

**In the fall of 2004**, dinoflagellates [\*Cochlodinium\*](#) and [\*Akashiwo sanguinea\*](#), became the dominant phytoplankton species in Monterey Bay. In comparison to previous years, *Cochlodinium* was not regularly seen in the area.

**In 2006** another harmful bloom was reported, and since then this has become a regular occurrence in the fall. Unfortunately, with dinoflagellates blooms becoming more frequent and intense, California's fishing industries and coastal economy has suffered.

**In September 2007**, there was a harmful red tide event caused by *Cochlodinium* that killed a lot of abalone, costing the Monterey Abalone Company almost \$60,000 worth of abalone ([view the CeNCOOS success story pdf](#)).

**In December 2007**, there was a huge die-off of seabirds in Monterey Bay that was connected with a red tide caused by *Akashiwo sanguinea*. The combination of large waves and huge bloom created a slimy foam that caused the birds' feathers to stick together. As a result, the birds died from hypothermia because their feathers were not able to keep them warm enough in the ocean ([view CeNCOOS report](#)). This is a good example of a "harmful" red tide that did not produce a toxin.



One of the seabirds killed during this HAB

Listen to NOAA Ocean Service Podcast on this HAB event:  
[Making Waves Episode 19: New Study Links Sea Foam to Unexplained Seabird Deaths and Strandings \(March 6, 2009\)](#) (10mins)

Although some blooms are tied to an excess source of nutrients coming from runoff and fertilizers, in the case of the *Cochlodinium* blooms, humans are not always to blame. Rather dinoflagellates do not need a constant source of agricultural runoff because they can use their flagella to move to warmer surface waters to carry out photosynthesis during the day, and then move back down to cooler, nutrient-rich waters at night.

Since these outbreaks, HABs have been reported on a regular basis, increasing not only in distribution and intensity, but also frequency and duration. Historically speaking, most harmful blooms in Monterey Bay were first identified because of a sudden die-off of seabirds and marine mammals. As a result, the California Department of Public Health is running a statewide program to carefully monitor blooms and toxin levels.

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Additional links:

For a recap and overview of phytoplankton, HABs, and its role in the food chain, view [John Ryan's \(MBARI\) presentation](#)

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Now that you've learned everything there is to know about HABs, you can apply your new knowledge at our [Become a HAB Expert](#) page