



## **Cabrillo Marine Aquarium**

Virginia Reid Moore Marine Research Library

Library Pathfinder: Harmful Algal Blooms (HABs)

Harmful algal blooms (HAB) are a major environmental problem in all 50 states. Often known as red tides, harmful algal blooms may have severe impacts on human health, aquatic life and our economy.

Harmful algal blooms are population explosions of algae in water. HABs require plenty of sunlight, slow moving water and nutrients such as phosphorous and nitrogen. Nutrient pollution is a result of human industrial waste and agricultural runoff into the ocean and often provides excess nutrients for the harmful algae. HABs occur when water conditions foster explosive growth of a toxic algal species.

Harmful algal blooms can produce extremely dangerous toxins. These toxins bioaccumulate in the food web and can reach dangerous concentrations in the top predators. High levels of these toxins can sicken or kill people and/or animals. Domoic acid is a type of neurotoxin produced by HABs. Studies have shown how domoic acid can cause illness, seizures and death in humans and marine mammals, specifically in the California sea lion. Other HABs can raise the cost of the treatment of drinking water and put a strain on industries that depend on clean water.

Scientists predict that climate change will have many effects on freshwater and marine environments. These effects, along with nutrient pollution, might cause harmful algal blooms to occur more often, in more bodies of water and to be more intense. Several climate change factors may contribute to the growth of algal blooms. **Warmer temperatures** prevent water from mixing, allowing algae to grow faster. **Increases in salinity**, caused by droughts, can allow marine algae to invade freshwater ecosystems and kill freshwater fish. **Higher levels of carbon dioxide** can increase the growth of blue-green algae (a type of cyanobacteria HAB). **Changes in rainfall patterns** from droughts to intense storms can increase the nutrient pollution of water, which feeds the HABs. Climate change may also alter the timing and intensity of **coastal upwelling** along the west coast of the United States, bringing excess nutrients from the ocean floor which might lead to more algal blooms.

Using water and energy efficiently, using phosphate-free cleaning supplies, driving fuel efficient vehicles, washing your car on the lawn (to avoid runoff), fertilizing and watering gardens minimally, properly disposing of pet waste and planting native gardens are just a few of the many ways we can help reduce the nutrient pollution which nourishes harmful algae blooms.

## **BOOKS**

### **Books for Adults**

Ecology of Harmful Algae: 189 (Ecological Studies) E. Granéli (Author, Editor), Jefferson T. Turner (Author, Editor) B0017ZNVAI

Toxic Algae: How to Treat and Prevent Harmful Algal Blooms in Ponds, Lakes, Rivers and Reservoirs Paperback – December 22, 2014. 978-1505640052

### **Journal Articles**

Anthropogenic nutrients and harmful algae in coastal waters. Keith Davidson et al. *Journal of Environmental Management*, 146: 206-216 (2014)

Form of epilepsy in sea lions similar to that in humans. Stanford University Medical Center. *Science Daily*, 18 March 2014. [www.sciencedaily.com/releases/2014/03/140318113725.htm](http://www.sciencedaily.com/releases/2014/03/140318113725.htm)

Hippocampal neuropathology of domoic acid-induced epilepsy in California sea lions (*Zalophus californianus*). Paul S. Buckmaster, et al. *Journal of Comparative Neurology*, 2014 May 1: 552(7): 1961-1706

Ocean Climate Change, Phytoplankton Community Responses and Harmful Algal Blooms: A Formidable Predictive Challenge. Hallegraeff, Gustaaf. *Journal of Phycology*, April 2010: 46(2): 220-235.

Pathology of Domoic Acid Toxicity in California Sea Lions (*Zalophus californianus*). P. A. Silvagni et al., *Veterinary Pathology*, 42: 184-191 (2005)

### **Featured Websites**

EPA / HABs, Climate Change  
<http://www2.epa.gov/nutrientpollution/harmful-algal-blooms>

Climate Change  
<http://www2.epa.gov/nutrientpollution/climate-change-and-harmful-algal-blooms>

Harmful Algal Blooms Program  
<http://hab.ioc-unesco.org/>

Marine Mammal Center / Domoic Acid  
<http://www.marinemammalcenter.org/science/top-research-projects/domoic-acid-toxicity.html>

Marine Mammal Center / Domoic Acid  
<http://www.marinemammalcenter.org/about-us/News-Room/2014-news-archives/domoic-acid-toxicity.html>

Predicting HABs  
<http://oceantoday.noaa.gov/predictinghabs/>