



Harmful Algal Blooms

The Issue

Algae are the most abundant photosynthetic organisms in marine ecosystems and are essential components of marine food webs. Harmful algal bloom or “HAB” species are a small subset of algal species that negatively impact humans or the environment. Some harmful algae produce potent toxins that pose health hazards for humans or animals. Harmful algae can also cause deterioration of water quality through the buildup of high biomass, which degrades aesthetic, ecological, and recreational values.

It is widely believed that the frequency and geographic distribution of marine HABs have been increasing worldwide. All U.S. coastal states have experienced HABs over the last decade, and new species have emerged in some locations that were not previously known to have problems (for a map of HAB-related events in the US, visit:

<http://www.whoi.edu/redtide/page.do?pid=14898>). While HABs occur naturally, human actions that disturb ecosystems—e.g., through increased nutrient loadings, overfishing, invasive species introductions, and water flow modifications—have been linked to the increased occurrence of some HAB species.

In recent years, HABs have decimated the scallop fishery in Long Island’s estuaries and have led to seasonal closures of various shellfisheries along the Atlantic, Gulf of Mexico, and Pacific Coasts. HABs have caused significant respiratory and other illnesses in coastal residents and vacationers. They are also thought to have contributed to deaths of manatees in Florida, sea lions in California, and other marine mammals, including dolphins in the Northern Gulf of Mexico. A 2006 study showed that the economic impacts from a subset of HAB events in U.S. marine waters averaged to be about \$82 million/year (2005 dollars). However, just one major HAB event can cost local coastal economies tens of millions of dollars, indicating that the Nationwide economic impact of HABs is likely much larger (for more on the economic impacts of HABs, visit http://www.cop.noaa.gov/stressors/extremeevents/hab/current/HAB_Econ.html).

Program Description

The Harmful Algal Bloom and Hypoxia Research and Control Act ([HABHRCA](#)) authorized funding for existing and new competitive research programs on HABs housed in NOAA, including the interagency Ecology and Oceanography of HABs ([ECO HAB](#)) Program, the Monitoring and Event Response for HABs ([MER HAB](#)) Program, and the Prevention, Control, and Mitigation of HABs ([PCM HAB](#)) Program. These programs involve Federal, state, and academic partners and support peer-reviewed interdisciplinary research to address the issues of HABs in an ecosystem context. [HAB Event Response](#) is another CSCOR program designed to provide immediate assistance, either as funding or expertise, as HAB events occur.

The challenges for managing HABs differ among regions of the country, so CSCOR applies a regional approach to its research. Requests for proposals for CSCOR’s competitive HAB programs are rotated on a regional basis, providing every U.S. coastal region an opportunity to apply to one of three HAB programs each year.



A nontoxic bloom of the harmful dinoflagellate *Lingulodinium polyedrum* along the coast of La Jolla, San Diego County. Photo: Kai Schumann

ECOHAB is a multi-agency partnership between NOAA's Center for Sponsored Coastal Ocean Research (CSCOR-lead), NOAA Office of Protected Resources, NOAA Sea Grant, the National Science Foundation, U.S. Environmental Protection Agency, National Aeronautics and Space Administration, and the Office of Naval Research. ECOHAB seeks to understand HABs and HAB toxins in relation to the surrounding environment with the intent of developing new information and tools, predictive models, and prevention strategies to aid managers in coastal environments. ECOHAB also develops models of trophic transfer of toxins, knowledge of biosynthesis and metabolism of toxins, and assessment of impacts of toxins on higher trophic levels. Research results are intended to guide management of coastal resources and reduce HAB development, impacts, and future threats. Results also feed into other HAB programs for development of tools to improve HAB management and response.

MERHAB enhances water and shellfish monitoring programs with new technologies and strategies allowing for proactive detection of coastal HAB events. It also promotes sustainable partnerships between Federal agencies and state, academic, tribal, and local entities that enhance delivery of services and/or development of new technologies to mitigate HAB impacts. MERHAB projects are mitigating bloom impacts on valuable coastal resources, benefiting efforts to safeguard HAB-impacted endangered marine life, and enabling risk analysis and communication critical to prevent human illness and death from HAB toxins.

PCM HAB is a new research program based on HAB community input and is one component of a larger strategy outlined in the *[HAB Research, Development, Demonstration, and Technology Transfer \(RDDTT\) National Workshop Report](#)* and in the HABHRCA report, *[Harmful Algal Bloom Management and Response: Assessment and Plan](#)*. PCM HAB will transition promising prevention, control, and mitigation technologies and strategies to end-users. PCM HAB will also assess the social and economic costs of HAB events and the costs and benefits of PCM strategies, which will aid managers in devising a cost-effective management strategy.

HAB Event Response provides immediate assistance for managing events and for advancing the understanding of HABs as they occur. The program aims to provide access to the best technology and expertise available, provide modest financial support for investigating a unique event, and ensure proper scientific documentation to add to the HAB knowledge base.

Accomplishments

In the decade following the passage of the original HABHRCA legislation, CSCOR HAB Programs have made significant advances that have improved HAB management. More accurate and efficient tools for detecting cells and toxins, early warning of toxic blooms, better predictions of when and where the blooms will move, possible methods for HAB control, and partnerships developed that allow for more effective response are just a few examples of how CSCOR-supported HAB research has benefited society. Accomplishments also include scientific discoveries that improve management approaches, dissemination of knowledge (e.g., through workshops, public outreach) that facilitates coordination, and contributions to core infrastructure needs that support research and management.

For more information:

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