

Protecting Human Health, Marine Resources, and Local Economies from Harmful Algal Blooms

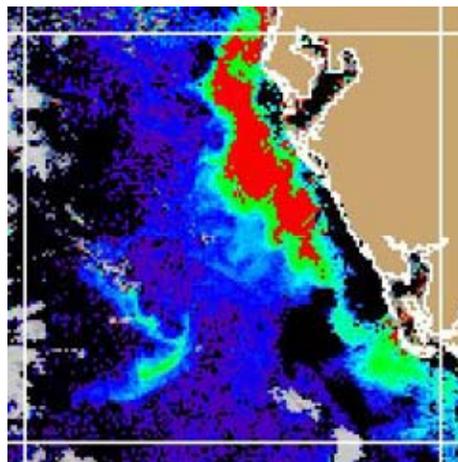
Harmful Algal Blooms Threaten Marine and Human Health

Virtually every coastal state has experienced harmful algal blooms (HABs). These blooms occur when a toxic algal species multiplies to the point of producing toxin levels that can lead to human and marine animal health affects. The HABs increase in concentration to the point that they discolor the ocean surface. The estimated average economic impact of HABs is \$49 million annually; areas dependant on tourism can be especially hard hit by HAB impacts. Thus, coastal managers need advance warning of HAB events to determine whether to close beach areas and shellfish beds in order to protect human health, marine resources, and local economies.

In the Gulf of Mexico, blooms of the toxic algae *Karenia brevis*, known as 'red tides,' have become almost yearly occurrences. Powerful toxins from the algae cause shellfish closures, fish kills, and marine mammal deaths. When released into the air, toxins from the algae can cause cold-like symptoms in humans and more significant impacts to asthmatics. About 50% of unusual marine mortality events are thought to be caused by HABs.

The Need for Early Notification of HAB Events

Early notification of the formation and likely movement of these toxic blooms provides local and state coastal managers with lead time to take necessary management actions such as closing shellfishing and beach areas to protect human health and fisheries. To address this issue, the National Oceanic and Atmospheric Administration (NOAA) integrated coastal and ocean observations from NOAA buoys, satellites, and field data to develop a HABs Forecasting System. This system puts essential, but otherwise unavailable, information into a useful form that is delivered to local and state coastal managers in the Gulf of Mexico.



Satellite imagery indicating HAB movement along the Southern Gulf Coast of Florida.

Integrating Satellite Imagery, Wind, and Ocean Data

NOAA's National Centers for Coastal Ocean Science (NCCOS) and its NOAA partners develop approaches to use satellite imagery of ocean color, along with wind data and oceanographic data from state managers and researchers, to predict the occurrence, direction, and potential landfall of these algal blooms. NCCOS scientists also develop methods to analyze this information and training materials for operational forecasters.

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A "red tide" harmful algal bloom along the Florida coastline. Source: *Charlotte Sun Herald*.

Partnering to Ensure NOAA System Meets Local and State Needs

Development and implementation of the system was accomplished through teamwork of NOAA scientists with those in user communities, multi-jurisdictional organizations, and tourism and convention bureaus. NOAA developed numerous partnerships to receive and incorporate user feedback and respond to local, state, and national requirements. Bulletin subscribers from North Carolina, Texas, Alabama, Mississippi, and Florida helped to develop the Forecasting System and are now reaping the benefits from it by receiving early notification of potential HAB events. For example, the Florida Fish and Wildlife Conservation Commission uses the HAB bulletins to improve decision-making on where and when to sample water quality, as well as to make more informed decisions on whether to close shellfish beds and public beaches. Closing these resources unnecessarily could have significant adverse impacts, just as failing to close them when justified could increase risks to both public health and economies.

From Research to an Operational System

After years of researching and testing the system, NOAA transferred its HAB Forecasting System into an operational product. The system produces bulletins on a twice weekly basis during events.

The bulletins and data are distributed electronically to resource and public health managers through a web-based interface to ensure a more timely and user-friendly manner. The experience gained through the development and operation of this system for the Gulf of Mexico region is enabling the development of a HAB Forecasting System for the Pacific Coast, Gulf of Maine, and eventually, one that is national in scope. This will also help advance NOAA's development of an ecological component for a global environmental observing system.

In the Pacific Northwest, a toxin called domoic acid is produced by types of algae called *Pseudonitschia*. This toxin affects shellfish, especially razor clams, an important fishery that contributes at least \$4 million annually to Oregon's local economies, and can cause human health impacts from ingesting contaminated clams. Through a NOAA-inspired monitoring network developed for the management of HABs, Washington State can now take preventative action to minimize the impacts of such blooms. By developing a series of models to forecast the location of the blooms, tracking their movement, and predicting their impact to living marine resources, state managers now have longer lead times to adjust harvest season openings before the shellfish ingest the toxin.

Over 200 Bulletins Distributed to Help Protect Humans and Economies

Through the approximately 200 HAB bulletins that have been published to date in both the demonstration and operational phases, Gulf Coast managers now have more information and options to better manage shellfishing and beach areas, thereby protecting human health, marine species, and local economies. This results in less "downtime" for local fisheries and helps to assure that both residents and tourists have limited exposure to HAB-related toxins.



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