

# State of the Science FACT SHEET



## Harmful Algal Blooms

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION • UNITED STATES DEPARTMENT OF COMMERCE

*HABs are mostly caused by single celled algae, a common and essential component in both marine and freshwater ecosystems and food webs. Algae blooms are considered harmful when they negatively affect human, animal, and ecosystem health and coastal resources by producing potent toxins or building up excessive, plantlike biomass. Sometimes referred to as “red tides,” HABs also can be brown, green, purple, or may have no color at all. Further, not all discolored water is harmful or is a HAB. HABs and their impacts have become more frequent and widespread across the US in recent years.*

### What are the Impacts of HABs?

*Acute human health impacts:* Effects of algal toxin exposure through eating or drinking contaminated water can range from neurological impairment, to gastrointestinal or respiratory distress, or eye irritation. In some cases, it even can result in severe or chronic illness or death.

*Acute animal health impacts:* Massive fish kills are perhaps the most commonly observed impact of HABs on wildlife; however, algal toxins also have been associated with the deaths of marine mammals, sea turtles, and birds. Freshwater HABs can cause the deaths of domestic animals and livestock, and even can sicken dogs swimming in a lake or pond.

*Economic impacts:* HAB events can cost millions of dollars. For example, in 2011, Lake Erie experienced its second largest bloom on record, which was estimated to have a \$71 million impact to the region. A 2016 NOAA Fisheries report showed that fishing communities in the Pacific Northwest experienced a \$97.5 million decrease in revenue in 2015, largely due to closures from a bloom. Coastal communities across Florida in 2017 and 2018 experienced millions of dollars in losses in tourism and restaurant revenue, due to health concerns related to airborne and ingestible HAB toxins.

### NOAA HAB Research and Response

NOAA’s goal is to provide tools to prevent, control, and mitigate the occurrence of HABs and their impacts.

*Research:* NOAA’s HAB activities include research on HAB and toxin detection; predictive models and forecasts; impacts on marine resources, human health, and coastal economies; and new strategies for prevention and control. NOAA also supports internal and external research programs.

*Monitoring:* NOAA is developing new technology and establishing partnerships between federal, state, tribal, and local managers and HAB researchers in order to improve HAB detection for resource monitoring programs and add HAB detection to ocean observing systems.

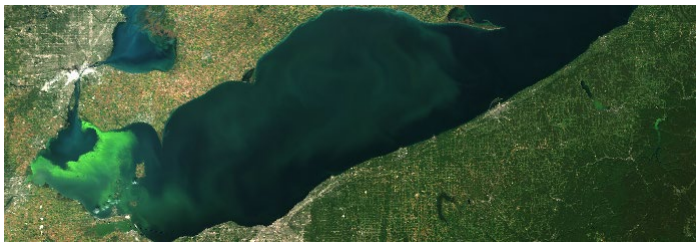
*Event Response:* NOAA provides assistance with toxin and cell identification, and funding for field investigations, during HAB and marine mammal mortality events. NOAA released approximately \$83,000 in event response funds between August and November 2018 in order to assess and research the ongoing HAB, toxin levels, means of how animals become sick, and potential treatment methods for animals sickened by the toxins.



Dead fish on beach near Sarasota, Florida, killed by brevetoxins from 2018 red tide. Credit: Texas A&M University.

## Harmful Algal Bloom Forecasting

NOAA and its partners use satellite remote sensing data, in situ observations, and numerical modeling to support a system for detecting, monitoring, and forecasting HABs across the US. HAB forecast bulletins are distributed directly to resource managers and the public. Operational forecasts are provided for the eastern and western regions of the Gulf of Mexico and Lake Erie, and are in development for the Gulf of Maine, California, Washington State, and the Chesapeake Bay. In 2018, NOAA researchers developed a new experimental red tide forecast that predicts risk of respiratory impacts on each beach of Florida's Pinellas County. In April 2018, the Pacific Northwest HAB forecast developed by NOAA and partners allowed the Washington Department of Fish and Wildlife (WDFW) to proceed with opening the state's recreational razor clam fishery. The WDFW estimates that there were 71,300 digger trips during the fishery's opening weekend, with an estimated revenue of \$6.4 million for the region.



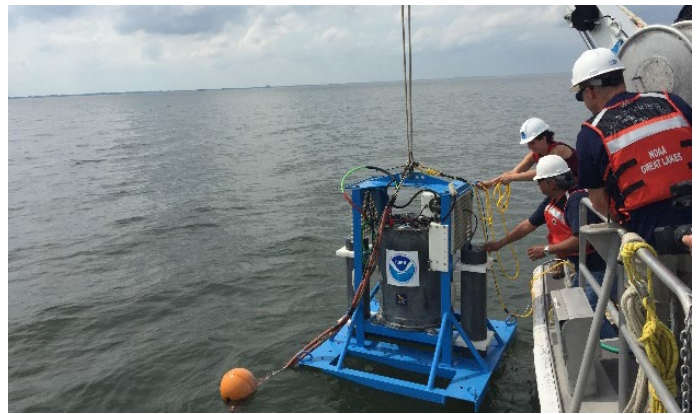
Satellite image of harmful algal bloom on Lake Erie in 2017.  
Credit: NOAA

### Algal Toxin Test Kit

NOAA researchers have partnered with private industry to develop test kits to detect toxins in shellfish. The rapid, simple, and inexpensive test allows frequent monitoring of shellfish to determine if they are safe to harvest and sell. Additionally, NOAA worked with Native American tribes in the Pacific Northwest, including the Sitka, to establish a lab that allows for quicker testing of samples for toxins, protecting human health.

### Understanding HAB Impacts on Wildlife

NOAA and collaborators are developing a new class of ocean sensors that remotely detect HAB species and toxins. These provide data for forecasting toxic blooms and mitigate HAB impacts on human health, marine resources, and coastal economies. The Environmental Sample Processor (ESP) is an in-water laboratory: it collects water samples and analyzes them for organisms of interest or their associated toxins, and transmits results to scientists and managers onshore.



The ESPniagara's first deployment from the 2017 HAB season in Lake Erie. Credit: NOAA

In 2018, NOAA researchers deployed two new ESPs in Lake Erie, which they anticipate to regularly be deployed in 2019. This will allow for additional surveillance across the Western Lake Erie Basin, leading to better advance warnings of possible impacts to human and economic health. The Imaging Flow Cytobot (IFCB) is an automated underwater microscope that uses a laser-based system to detect algae. It takes photos for species identification in real-time, enabling continuous monitoring of algal communities and alerts of rising levels of toxic algae.

### HAB and Hypoxia Research and Control Act

NOAA leads implementation of HABHRCA, through interagency coordination, assessments, research prioritization and planning, and intramural and competitive sponsored research with partners. The results are collaborative world-class research, monitoring, and technology/outreach, with an emphasis on application and working to help federal agencies most efficiently protect coastal communities.

### Additional Resources

- HABHRCA: <https://coastalscience.noaa.gov/research/stressor-impacts-mitigation/habhrca/>
- HAB research and response: <http://coastalscience.noaa.gov/research/habs>
- HABOFS, including Lake Erie HABs: [https://tidesandcurrents.noaa.gov/hab\\_info.html](https://tidesandcurrents.noaa.gov/hab_info.html)
- Northwest Fisheries Science Center HABs & Biotoxins: [http://www.nwfsc.noaa.gov/hab/habs\\_toxins/](http://www.nwfsc.noaa.gov/hab/habs_toxins/)
- Pinellas County Respiratory Forecast: <https://habscope.gcoos.org/forecasts>