Harmful Algal Bloom Impacts on Aquaculture

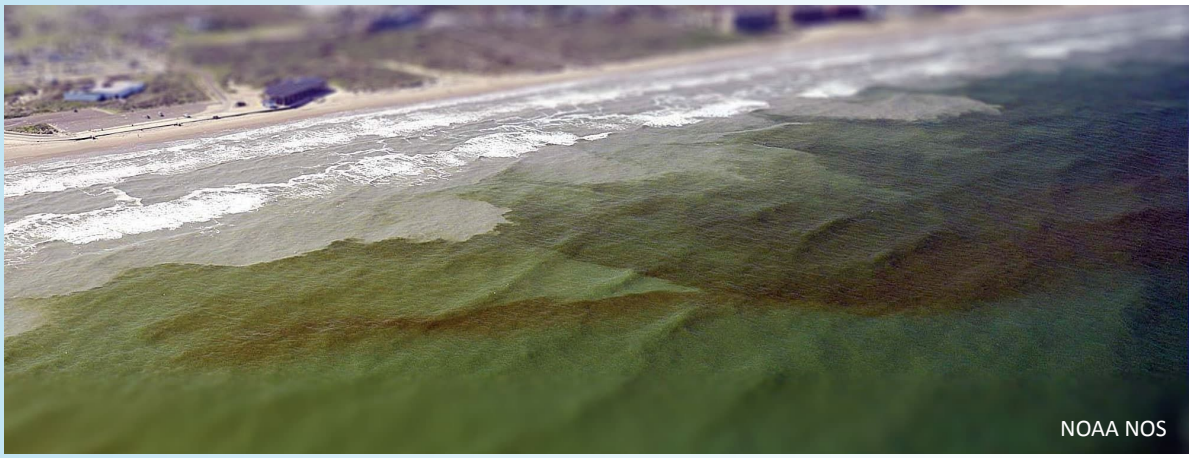
NOAA FISHERIES

Office of Aquaculture

Harmful algal blooms (HABs) emit powerful toxins which can endanger the health of humans, animals, and ecosystems.

HABs can have negative economic impacts on marine aquaculture and the livelihoods of workers. Many factors that contribute to HAB growth and toxicity are inherently linked to a changing global climate.

NOAA is working closely with other agencies and citizen scientists to address HABs.



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WHAT ARE HARMFUL ALGAL BLOOMS (HABs)?

In the United States and globally, coastal regions are subject to diverse and frequent Harmful Algal Bloom (HAB) events. HABs occur when certain kinds of algae grow excessively in water bodies. HABs can threaten human, animal, and ecosystem health[1] by producing potent toxins or reaching high biomass levels that can lead to depletion of dissolved oxygen or clogging of gills. Toxins produced by HABs can kill fish or shellfish directly. HAB events can be extensive and complex with an increasing number of species and toxins of concern; they are impacting a growing range of resources, including wild and farmed fish and shellfish.[2]

HABs AND AQUACULTURE

The U.S. marine aquaculture industry produced $430M of seafood in 2018,[3] and primarily grows salmon, oysters, clams, mussels, and aquatic plants. HAB events often result in harvest closures and over the past few decades have led to economic losses in the tens of millions of dollars in commercial fisheries and aquaculture across the U.S.[2,4] The longer closures last, the more revenue is lost, and it becomes increasingly difficult to recover. Ripple effects beyond direct revenue loss include an inability to reliably fill delivery contracts or to keep up with supply during periods of peak demand. HAB events can also delay harvest to a point where shellfish grow larger than their optimal market size. Delayed harvest also prevents the use of space and gear for growing new cohorts. This can result in social impacts, including job loss for working families.[5]

DRIVERS AND HABs

Many factors contribute to HABs; how different HAB species respond to environmental pressures is a subject of intense study. Many algal species flourish when wind and water currents are favorable. Some HABs are linked to an excess of nutrients that originate from sources such as lawns and farmlands that flow downriver to the sea. Some HABs have also been reported in the aftermath of phenomena such as unusually high water, temperatures such as marine heatwaves, and extreme weather events, such as hurricanes and floods.[2,6] Climate change and HABs can be linked through increasing sea surface temperatures which may broaden the seasonal bloom window of opportunity for algae growth, alter their optimal habitat and distributions, and/or change ocean acidity promoting toxicity of certain HAB species.

WHY FARM SEAFOOD?

Today, the United States **imports between 70-80% of the seafood we eat** by value–more than any other country. Global and domestic demand for seafood continues to grow. Even as we maintain and rebuild our wild harvest fisheries, we cannot meet increasing domestic demand for seafood through wild-caught fisheries alone.

Marine aquaculture provides a domestic source of economically and environmentally sustainable seafood that complements and supports our wild fisheries production.

2021

fisheries.noaa.gov/aquaculture

coastalscience.noaa.gov/project/harmful-algal-bloom-hab-forecasting/

EFFECTS ON HUMAN AND ANIMAL HEALTH

The toxins that are produced by certain types of algae are what make a particular algal bloom harmful.[1,6,7] These toxins and their potential health effects in humans and animals vary depending on the mode and length of exposure, and the type of toxin. Modes of toxin exposure might include human consumption of fish or shellfish containing toxins, through contact with the skin, or inhalation while swimming. Eating seafood contaminated with HAB toxins causes several different types of illness, including ciguatera fish poisoning, neurotoxic shellfish poisoning, and paralytic shellfish poisoning. Each type of human illness caused by HABs causes different symptoms, but HAB poisoning symptoms can include nausea, vomiting, diarrhea, shortness of breath, irregular heartbeat, numbness of mouth and lips, and weakness.

Some HABs can impact shellfish health directly by causing physical damage to shellfish gills through mucus or foam production, or by reducing the oxygen content of the water.[8] Others can produce toxins that are not harmful to humans, but can kill shellfish. In the Pacific Northwest, NOAA-sponsored research has determined that HAB-produced Yessotoxins can cause mass mortality of shellfish, and contribute to annual shellfish losses, commonly known as “summer mortalities.” HAB monitoring programs, such as the SoundToxins partnership managed by Washington Sea Grant, provide an early warning of these shellfish killers.[9] This partnership mitigates the devastating effects of shellfish-killing HABs on shellfish populations, and allows growers to make farm-based management decisions such as early harvest, movement of shellstock to safe areas, or enhanced filtration at aquaculture facilities, thereby protecting shellfish from mortality.

NOAA’S ROLE IN SEAFOOD SAFETY

NOAA works with the U.S. Food and Drug Administration (FDA) to ensure the safety of seafood products we eat. NOAA’s Seafood Inspection Program (SIP) offers a variety of professional inspection services to the seafood industry (e.g., processing plants, fishing vessels, and retailers) to encourage and help the industry improve the quality, safety, and marketability of safe seafood and fishery products for the benefit of consumers.[10] NOAA SIP helps the seafood industry ensure compliance with all applicable food regulations, including those that relate to HAB biotoxins.

NOAA’s HAB program, led by the National Centers for Coastal Ocean Science (NCCOS), aims to understand, detect, predict, control, mitigate, and respond to HABs.[11] NCCOS supports research to understand bloom drivers and the fate and effects of HAB toxins. NCCOS develops and pilots sensors and analytical methods that detect and accurately measure cells and toxins and enhances regional HAB response capacity. NOAA and partner organizations deliver near real-time products that help mitigate HAB impacts on coastal resources and the seafood industry.[12] NCCOS also runs the National Phytoplankton Monitoring Network (PMN) which, together with partnerships like SoundToxins, serve the aquaculture industry by warning growers about HAB species of concern.[13] These efforts could be helpful in the near future to inform aquaculture businesses for mitigation purposes. NCCOS and partners are also advancing technologies that aim to control or eliminate HABs through environmentally sustainable means.[14]

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