Blooming but Not Beautiful: Addressing Harmful Algal Blooms in Southeast New England

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On September 14, 2021, the Southeast New England Program hosted our most recent webinar titled "Blooming but Not Beautiful: Addressing Harmful Algal Blooms (HABs) in Southeast New England." During this webinar, our panelists Don Anderson and Di Jin of the Woods Hole Oceanographic Institution (WHOI), Corey Conville of the U.S. EPA New England Regional Lab, and Shasten Sherwell of USEPA SNEP provided an overview of the challenges of estuarine and freshwater HABs in the SNEP region. This article is a summary and continuation of that discussion. For more information, please reference our website at www.epa.gov/snep/snep-webinars.

What is a HAB? Algal blooms are typically natural processes that can vary in severity depending on the species involved and the physical nature of the water. In terms of the latter, waters with high nutrient content can result in larger and more frequent blooms; however, what makes a bloom harmful comes down to the type of phytoplankton present in that water body and whether it is releasing a harmful toxin. In freshwater, HABs are caused by photosynthetic bacteria, whereas marine HABs can be caused by multiple types of algae with varying effects. These species can vary in type and location – not only throughout the northeastern U.S., but even within the water body itself. It's entirely feasible for a given water body to have multiple algal blooms present with none or some being harmful, which adds to the complexity of identifying, testing, and addressing HABs when they occur.

Absent regular water quality testing, the health outcomes of exposure to HABs can also vary. As presented by Don Anderson, health effects of HABs exposure depend on the type of HAB. Because symptoms take time to present themselves or in some cases are subtle or non-life threatening, exposure to less severe HABs can result in symptoms consistent with more general illness (or even inebriation), and so might not be reported at all. Though the impacts are still difficult to track, the cyclical nature of some HABs allow them to be studied more closely.

Based on existing data, Anderson discussed how HABs events occur annually in the New England region, with blooms typically starting in northeastern Maine and Canada before travelling down the coast into Massachusetts Bay, and occasionally to the islands of Marthas Vineyard and Nantucket. There are also more localized blooms that originate within small salt ponds or kettle holes (such as on Cape Cod), or in restricted bays or embayments, as in Connecticut and Long Island. As the impacts of climate change worsen, warming waters can provide a more hospitable climate for blooms to become larger, longer, and the impacts more severe.

The Impacts of HABs. In addition to health impacts, chronic HABs can impact local economies. As Di Jin of WHOI discussed in his presentation, HABs can affect coastal economies by severely hindering commercial fisheries, aquaculture, tourism, and other industries on which they depend. An example impact would be lost sales revenues and income from clam or oyster harvests. In studying 2005 data, Jin found that after a large HAB event in Maine resulted in a sharp reduction of local shellfish landings, there was an increase of shellfish imports in New England to fill that supply gap. This change in supply initially resulted in an increase in price due to scarcity, but the wholesale price of shellfish from Maine then declined in New York as buyers had found other suppliers and new relationships were built during the event. Longer and more severe HABs can have a more significant impact. In another study, Jin reported that if an event results in the closure of only 25% of relevant softshell clam production area within coastal towns in Maine, the related economic damages would result in $60,000/day, or $1.73 million/month. These costs increase with higher percentage impacts, with 75% of relevant area resulting in $190,000/day or $5.2 million/month.

Economic analyses are integral to measuring and communicating both the socioeconomic and environmental damages, and mitigation benefits of HABs; but the types of analyses that can be done for HABs nationally are severely limited by available data. Obtaining more widespread economic data in addition to developing better models to predict HABs would be instrumental in better calculating and predicting the costs of inaction for future blooms to motivate further action.

How to Identify HABs? Both EPA and WHOI utilize a suite of tools to collect and analyze the presence of HABs. Currently, these tests require a laboratory setting to identify the type of HAB present, however USEPA has been training local community groups, tribes, non-profits, businesses, and municipal staff interested in establishing monitoring programs to collect water samples at frequent intervals that are then analyzed by EPA laboratory staff. For freshwater HABs or HCBs (harmful cyanobacteria blooms), while it takes a laboratory to determine the dominant species and toxicity level of a bloom, an easy way for anyone to identify whether the bloom could potentially be harmful is to employ the jar test (shown in the image right). This is a quick way to know if you have a cyano bloom. Waterbodies should still be monitored and tested since there are some cyanobacteria that are not present on the surface of the water and are instead dispersed in the water column or on the pond floor.

The Jar Test: *If you collect water and let it sit for at least 30 mins, if it settles (left) it is most likely green algae. If it floats and stays on the surface (right) it is most likely cyanobacteria. Photo courtesy of Shasten Sherwell.*

Once a bloom is identified, citizens can report the bloom to their local officials with the bloomWatch application (available on iPhone or Android) by uploading a photo and location through the mobile app. From there, public officials can determine whether to close access to the water body for recreation while the bloom is present, and water quality samples can be taken and analyzed at a local lab. Citizen scientists can also do some of this analysis themselves. EPA offers regular trainings to citizen science groups who can then use Cyanoscope water quality monitoring kits provided by EPA. Groups are trained in how to use the kit to take and prepare water samples, prepare microscope slides, and upload images via iNaturalist for analysis by a regional group of community scientists who can help identify the presence or absence of a HAB in the sample.

How is EPA Responding? The challenges that HABs pose to the region vary by type and cause – though much of the necessary response centers on similar tenets. As Corey Conville of the EPA New England Regional Laboratory described, the primary goals of EPA include increased monitoring capabilities through improved technologies, public education and outreach, and limiting polluting sources. As such, EPA has created the Cyanobacteria Monitoring Collaborative, composed of state, federal and university partners who collaborate with citizen scientists, water professionals and the public to monitor cyanobacteria in water bodies. The New England Regional laboratory also has a dedicated team of

scientists that operate the EPA mobile lab for site visits and various trainings on monitoring techniques using EPA-supplied water quality monitoring equipment. To limit pollutant sources, the nonpoint source and SNEP teams at EPA are working diligently to collaborate with state and local partners to identify and lessen nutrient pollution from a multitude of sources throughout the region such as spearheading the development of a low-cost nitrogen sensor for septic systems; with SNEP working specifically to move nitrogen-treating septic systems (I/A septic) closer to general use authorization, and to fund the development of novel, innovative approaches to nitrogen capturing technologies.

The Future of HABs Monitoring. HABs monitoring relies heavily on the commitment and diligence of regulatory agencies and community groups who can augment regular monitoring once trained by professional staff. Outside of the lab, there is no easy way to confirm the presence or absence of HABs; and while some sensors exist that can make this distinction, the high price point of these instruments makes widespread implementation impossible. For freshwater systems, until more regular data are collected, local boards of health often err on the side of caution by closing a beach for several weeks once a HAB is confirmed. The development of more routine and cost-effective monitoring strategies might lessen this closure time by being able to detect when the HAB has abated. Therefore, there is strong incentive for EPA, SNEP, and regional programs to develop more sensitive, automated, and cost-effective monitoring strategies. Until such strategies are developed, citizen scientists, using the training and equipment support they receive through EPA and others, are integral to ensuring that the region's waters are monitored regularly and are safe for all.

For more information on this topic, please reference the webinar at www.epa.gov/snep/snep-webinars. Other useful web resources include the Harmful Algae website maintained by WHOI and the EPA HAB web page.