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For the second year in a row, smaller Chesapeake Bay dead zone forecast for the summer

Hypoxia shows up earlier due to a warm spring, but decreased river flow means less pollution entering the Bay

Annapolis, MD – Researchers from the Chesapeake Bay Program, the University of Maryland Center for Environmental Science, University of Michigan and U.S. Geological Survey announced today that they are forecasting, for the second year in a row, a smaller than average "dead zone" due to reduced river flows entering the Chesapeake Bay, as well as less nutrient and sediment pollution thanks to the management actions taken across the watershed to improve water quality.

Hypoxic and anoxic regions, which are areas of low and no oxygen, respectively, are caused by excess nutrient pollution flowing into the Bay. Compared to the last 35 years, this year's Chesapeake Bay hypoxic volume, or "dead zone", is predicted to be 14% lower than average, while the volume of water with no oxygen is predicted to be 18% lower than average. In 2020, the Virginia Institute of Marine Science reported the dead zone to be smaller than 80% of those monitored since 1985.

The levels of pollution reaching the Chesapeake Bay each year varies due to the amount of spring rainfall that impacts river flows. Additionally, the many efforts of Chesapeake Bay Program partners—Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, West Virginia, academic institutions, local governments, federal agencies and non-governmental organizations—are making a difference in gradually reducing the amount of nutrient and sediment pollutants that are entering the Bay.

Though different types of nutrients contribute to the annual dead zone, the amount of nitrogen that enters the Bay from January-May is a key driver in how hypoxic conditions can vary from year-to-year. In spring 2021, river flows entering the Bay were 13% below average, but still fell within the normal range. Nine river input monitoring stations located on major Bay tributaries showed that the Chesapeake received 19% less nitrogen pollution when compared to the long-term average. Overall, nitrogen loads entering the Bay included an estimated 98 million pounds recorded at the nine river input monitoring stations, as well as an additional 6.6 million pounds from treated wastewater discharge and non-point sources (e.g., agricultural, stormwater and urban runoff) located downstream of these stations.

A Bay-wide assessment of the 2021 dead zone will be available this fall.

Facts

Throughout the year, researchers measure oxygen and nutrient levels as part of the Chesapeake Bay Monitoring Program, a Bay-wide cooperative effort involving watershed jurisdictions, several federal agencies, 10 academic institutions and over 30 scientists. Among these institutions, the Maryland Department of Natural Resources and Virginia Department of Environmental Quality conduct 8-10 cruises between May – October, depending on weather conditions, to track summer hypoxia in the Bay. Results from each monitoring cruise can be accessed through the Eyes on the Bay website for the Maryland portion of the Bay

and the VECOS website for the Virginia portion. The U.S. Geological Survey monitors river flow, nutrients and sediment entering the Bay at the nine river input monitoring stations.

A model developed by the University of Michigan has been used since 2007 to forecast the volume of summer hypoxia for the mainstem of the Chesapeake based on the amount of nitrogen pollution flowing into the Bay from the Susquehanna River from the previous January-May. This year's forecast is based on a revised and updated model that accounts for nitrogen entering the Bay from the nine river monitoring stations and the wastewater treatment plants that are located downstream of them. A companion model from the University of Maryland Center for Environmental Science forecasts summer volumes of oxygen-free water.

Each of these models and forecasts are supported by the most up-to-date river flow and nutrient inputs from the U.S. Geological Survey. Scientists at the Virginia Institute of Marine Science, in collaboration with Anchor QEA, produce daily real-time estimates of hypoxia volume that showed levels beginning earlier in 2021 when compared to 2020, due to warmer temperatures in May. However, these levels are still less than what has been observed in recent years.

Funding for the models has come from the National Oceanic and Atmospheric Administration and data used by the models are provided by the U.S. Geological Survey, Maryland Department of Natural Resources, Virginia Department of Environmental Quality and Chesapeake Bay Program. The hypoxia forecast model, enhanced in 2020, allows for projections for an average July, average summer and the total annual hypoxic volume, and is based on the monitoring of nitrogen pollution and river flow at the nine river input monitoring stations along the Appomattox, Choptank, James, Mattaponi, Pamunkey, Patuxent, Potomac, Rappahannock and Susquehanna rivers. Together, the U.S. Geological Survey, in partnership with Maryland and Virginia, monitor nitrogen loads, and other important pollutants, flowing into the Bay from 78% of the watershed. In the area not monitored by these stations, additional loads reported from wastewater treatment plants are also included in the model.

Issues

The dead zone is an area of little to no oxygen that forms when excess nutrients, including both nitrogen and phosphorus, enter the water through polluted runoff and feed naturally-occurring algae. This drives the growth of algae blooms, which eventually die and decompose, removing oxygen from the surrounding waters faster than it can be replenished. This creates low-oxygen—or hypoxic—conditions. Plant and animal life are often unable to survive in this environment, which is why the area is sometimes referred to as a "dead zone".

Pollution reducing practices used in backyards, cities and on farms can reduce the flow of nutrients into waterways. Management actions taken to decrease loads from point sources (e.g., wastewater treatment plants) may immediately show detectable pollution changes, but regarding the implementation of best management practices for non-point sources, there is often a lag in measuring their impact on improving water quality and the health of the Bay.

Weather conditions also play a role in the size and duration of the annual dead zone. Heavy rainfall can lead to strong river flows entering the Bay, which carries along increased amounts of nutrient and sediment pollution. Above average spring freshwater flows to the Bay, along with hot temperatures and weak winds in the summer, provide the ideal conditions for the dead zone to grow larger and last longer.

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Quotes

"This year's forecast suggests a smaller dead zone than is typical because the river flows that carry nutrients to the Bay were slightly lower than normal. But the amount of nutrients carried to the Bay by a given amount of flow has lessened over time due to effective nutrient management in the watershed. This is an example of a positive trajectory for the Bay."

- Dr. Jeremy Testa, Associate Professor, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science

"These annual forecasts are a fine example of the collaboration that brings together high-quality monitoring data and cutting-edge science to support Chesapeake Bay restoration efforts."

- Joel Blomquist, Hydrologist, United States Geological Survey

"Less hypoxia is important as it means better habitat for our iconic Bay species, such as crabs, oysters and striped bass. The Maryland Department of Natural Resources will be working with our fellow Chesapeake Bay Program partners to monitor and report on the 2021 hypoxia."

- Tom Parham, Director, Tidewater Ecosystem Assessment, Department of Natural Resources, State of Maryland