Chesapeake Bay Program
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BACKGROUNDER

The Dead Zone

Background

When an excess of nutrients, such as nitrogen and phosphorus, flow into the water, they can fuel the growth of dense algae blooms. When these algae blooms die off, their decomposition removes oxygen from the water faster than it can be replaced. This situation creates hypoxic, or low-oxygen conditions, that can impair or suffocate marine life, which is why it is referred to as a dead zone.

The severity of a dead zone depends on wind speed and direction, temperature and rainfall, meaning that extreme weather events, such as hurricanes, tropical storms and heavy snowfall can impact its size, distribution and duration.

The Chesapeake Bay dead zone

Signs of hypoxia were first observed in the mainstem of the Bay over 80 years ago, marking the Chesapeake as one of the first water bodies in the world to have a recognized dead zone. It is typically the most pronounced in the deep waters of the Bay during the warm summer months. Experts noted that between 1985 and 2010, the amount of time that the dead zone lasted began to decline (about one month less), suggesting that management activities to reduce pollution were working.

Experts are seeing a larger than average dead zone in the Bay this summer. Due to the extreme rainfall in 2018 and a wet spring in 2019, freshwater flows increased, bringing higher amounts of nutrients and sediment than normal into the Bay. In comparison to last year, the hot weather and calm winds the Bay region have experienced so far this summer provide favorable conditions for an above-average dead zone.

An algae bloom on Beaverdam Creek in Salisbury, Md., on Sept. 25, 2010. (Photo by Margaret Enloe/Chesapeake Bay Program)

Extreme rainfall

Rainfall impacts the severity of the Bay's dead zone, and the summer of 2018 brought some of the wettest months on record for the region. The heavier-than-normal rainfall brought an influx of fresh water into the Bay, along with increased amounts of debris and pollution.

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Above average freshwater flows to the Bay occurred from July through December 2018. The Susquehanna River is the largest tributary of the Chesapeake Bay and typically contributes about half of the fresh water entering the Bay. The highest flows on record since 1937 were reached in both July and August 2018 for the

Susquehanna, peaking at 375,000 cubic feet per second (Note: Average flows during this time are close to 10,000 cubic feet per second.) and causing the operators of the Conowingo Dam to open floodgates more than usual. The James and Potomac rivers, other tributaries of the Bay, also recorded higher-than-average flows during some weeks last summer.

Calm winds

Wind conditions in the region affect the degree to which the surface and deeper waters of the Bay mix: necessary for bringing oxygen to the depths of the Bay. The calm and hot weather this summer have not provided favorable conditions to allow mixing between well-oxygenated surface waters and low-oxygen deep waters of the Bay.

Hot air temperatures

Hot air temperatures lead to warmer than average water temperatures, which hold less oxygen than cooler waters. When you combine hot, calm weather conditions with a nutrient-rich Bay that already is showing a large dead zone, oxygen reduces even further in surface waters. Since most aquatic life can't escape to cooler waters with better oxygen conditions, many species of fish and shellfish are unable to find suitable habitats.

Impacts on Bay species

Blue crabs: Blue crabs can tolerate fresh water but will seek out other areas of the Bay where conditions are more favorable. Despite a population increase of nearly 60% over the past year, crabs have sought out the saltier waters of the southern Bay this summer. This shift in the seasonal distribution of the crab population to far more southern areas of the Bay impact those who depend on blue crab fisheries for their livelihoods.

Finfish: A decrease in salinity levels also impacts fish populations. Salt-loving fish move further south, while freshwater fish begin to appear in areas they normally don't frequent. A rising concern is the expansion of non-native, freshwater species, such as blue catfish or snakeheads, and their impact on the Bay and watershed ecosystems. Over the last 30 years, these species in particular have gone from not being present or having a limited distribution, to becoming established species that have expanded their range throughout the tidal waters of the Bay, and even in some cases, into nontidal waters.

Oysters: Record freshwater flows dilute Bay waters, making it less salty than normal in many regions. Oysters require salty water and are unable to move to more favorable habitats if their conditions change. Extra pollution and sediment coming from the increased flows can also smother oyster reefs and suffocate oysters.

Underwater grasses: Heavy rains can cause stream banks to erode, and increase flooding, which can bring large amounts of nutrients, sediment and other debris flowing into the Chesapeake Bay. Strong currents, as a result of high flow conditions, can rip up underwater grasses. Extended periods of cloudy waters can lead to increased deposits of sediment on the grasses and smother them, as well as block access to sunlight. This combination of conditions causes increased stress to the grasses, impacting their ability to survive, grow and reproduce. Changes in the distribution of salty and fresh waters also impact which grass species will grow in an area.