Proofing the Bay's summer DEAD ZONE predictions

Predicting future conditions based on our understanding of natural processes can be difficult. Yet, Chesapeake Bay researchers from institutions including: University of Maryland (Center for Environmental Science-UMCES, Chesapeake Biological Laboratory, Horn Point Laboratory), University of Michigan, The Johns Hopkins University and Old Dominion University have developed mathmatical models to estimate the summer volume of Bay water with low oxygen. Late winter-early spring data on key measures, such as freshwater flow to the Bay, nitrogen loads, amount of algae and wind blowing across the Bay are fairly successful for predicting the seasonal size of "dead zones" in the Bay where oxygen levels are too low to support aquatic life like fish, crabs, oysters and clams.

In collaboration with EcoCheck, a partnership program between the National Oceanic and Atmospheric Administration (NOAA) - Chesapeake Bay Program Office and the Integration and Application Network at UMCES, the following summer dissolved oxygen predictions for the Chesapeake Bay were released in June 2011 (*http://www.eco-check.org/forecast/chesapeake/2011/*):

- Hypoxia conditions *(0.2 to 2 parts per million of dissolved oxygen)* are predicted to be **poor to very poor in July** and **very poor throughout the summer (June to September**)
- Anoxia conditions *(0 to 0.2 parts per million of dissolved oxygen)* will be **moderate to poor in early summer** and **poor to very poor conditions in late summer**.

On the heels of these predictions, news reports of low oxygen in Bay tributaries by local Riverkeepers and headlines like, "*Scientists predict large Bay 'dead zone' this summer"* and "*Chesapeake Bay dead zone could be the largest ever"*, what is the status of the "dead zones" in the Maryland portion of the Chesapeake Bay this summer?

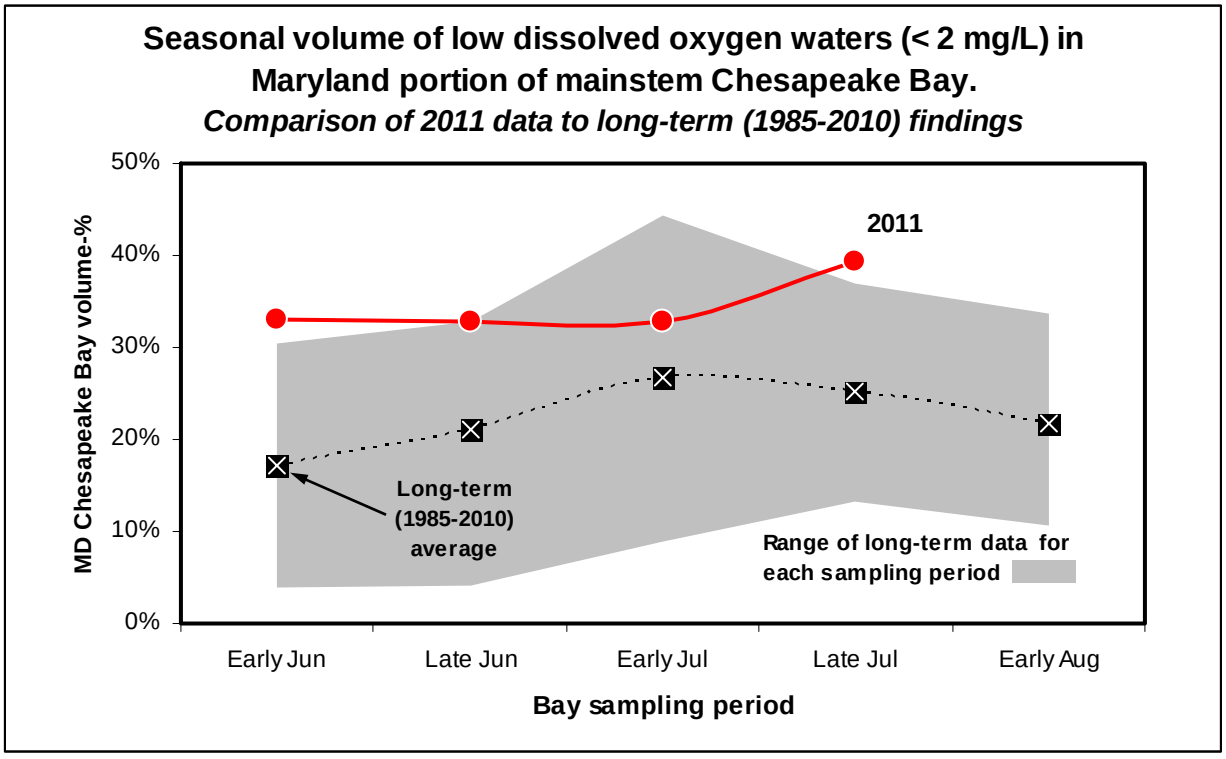
Maryland Department of Natural Resources has a long-term and extensive water monitoring program in Chesapeake Bay and its tidal rivers. During the summer, Bay water quality is usually monitored every two weeks. Long-term results show that, on average, the volume of water in the Maryland portion of the Bay with oxygen levels below 2 parts per million (ppm) - increases during summer to a peak in late July (**Table 1**). The focus on the mainstem Bay addresses seasonally low oxygen conditions found only in deep waters below the upper-mixed layer of the Bay.

Table 1. Long-term water monitoring period and average volume of low dissolved oxygen (0 to 2.0 ppm) in Maryland's 21.4 km^3 portion of Chesapeake Bay

Summer period	Average volume of Maryland Bay with low dissolved oxygen levels (1985 - 2010)	Volume of Maryland Bay with low dissolved oxygen levels: 2011
Early June	17.1 %	33.0 % - record high volume
Late June	21.2 %	32.7 %
Early July	26.6 %	32.8 %
Late July	25.2 %	39.4% - record high volume
Early August	21.6 %	*To be determined…*

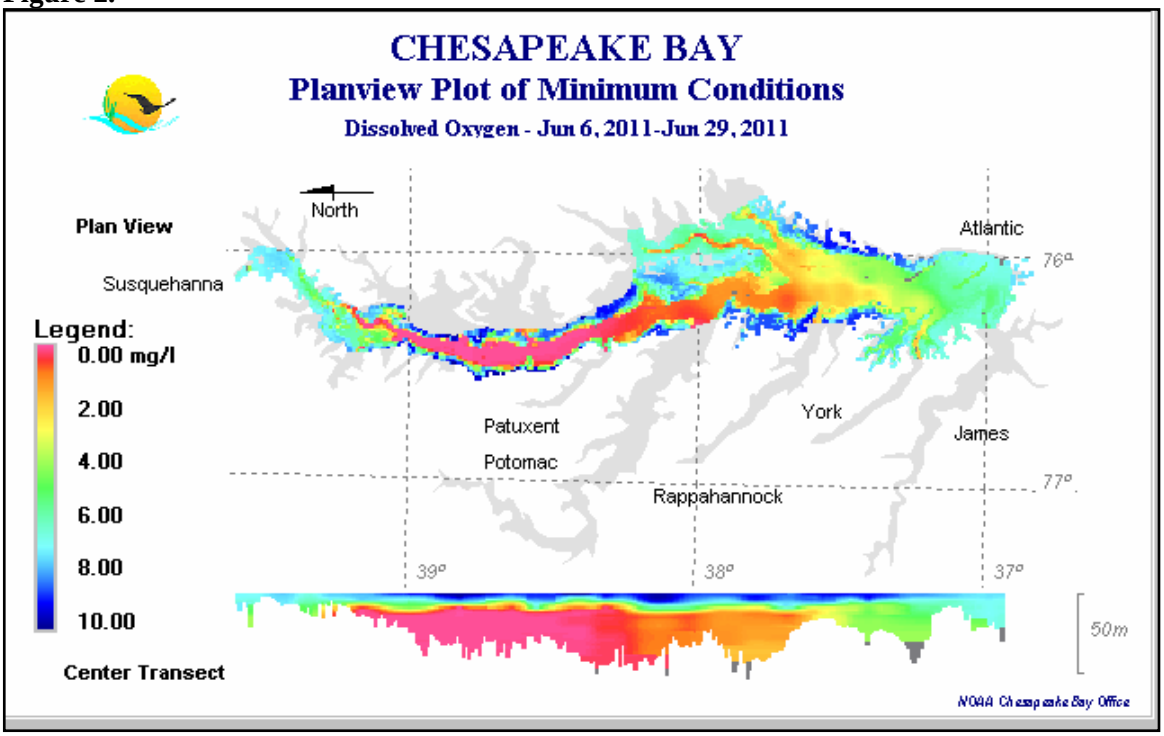
From samples collected in June and July, the volume of the Maryland mainstem Bay with low dissolved oxygen conditions has been **well above** the long-term (1985-2010) average. The volume of low dissolved oxygen in the Maryland mainstem Bay in early June was the highest recorded (33%) in that summer period since monitoring began in 1985 (Figure 1). Over the next few weeks, this volume declined slightly, increasing areas where fish, crabs and shellfish can survive. Data collected in late July showed an expansion in these low oxygen waters, again setting a record high volume (39.4 %) for this summer period - further reducing habitat available for Bay species (Table 1; Figure 1). This year's worse-than-average low dissolved oxygen conditions are being driven by high spring flows of freshwater and nitrogen into the Bay. The US Geological Survey reported that freshwater flows in 2011 from the Susquehanna River by late spring had already equaled the total amount delivered to the Bay in an average year. These high flows add additional nutrients, fueling algal blooms that die and sink into deeper waters where they decompose and use up available oxygen. When oxygen levels get too low, some animals simply leave the area but oxygen levels can get low enough to also cause fish kills. Oysters and clams that have settled on the bottom, cannot move and die.

Figure 1.



Since early June, between about 30 and 40 percent of the volume of the Maryland portion of the mainstem Chesapeake Bay had oxygen levels so low that fish, crabs and oysters could not survive. The following figure of the Bay from NOAA's Chesapeake Bay Program Office shows the distribution of oxygen levels in the Bay in June 2011 - both in terms of the distribution across the Bay's bottom waters and as a vertical profile with depth. Colors ranging from orange to red indicate low oxygen (Figure 2).

Figure 2.



***Source**: A. Gorka, Chesapeake Bay Program, Annapolis, MD*

Long-term data show that, as summer progresses, the low oxygen-volume of the Bay should decline. This occurs primarily from changes in weather patterns - perhaps high winds from a passing tropical storm - that begin to force oxygen from upper layers of the Bay into deeper, poorly-oxygenated waters. Only time will tell, of course, but DNR will continue to monitor the oxygen conditions and provide periodic updates. The implementation of the Baywide TMDL in December 2010, committing Maryland and the other Bay watershed States to accelerate their nutrient and sediment reduction strategies, should reduce the size and duration of the Bay's 'dead zone' even in years with above average spring flows.

In addition, responsible Marylanders know that reducing polluted runoff is the key to a healthier Chesapeake Bay. Here is how you can do your part now and make a difference:

- Limit your use of lawn fertilizers
- Maintain your septic system
- Drive less
- Plant a tree

<u>For more information:</u>

- Real-time Maryland Tidal Water Quality Conditions: *www.eyesonthebay.net*
- Restoring the Chesapeake Bay: Maryland's Actions & Progress: *www.baystat.maryland.gov/*
- What You Can Do to Help the Bay: *www.baystat.maryland.gov/what_you_can_do.html*