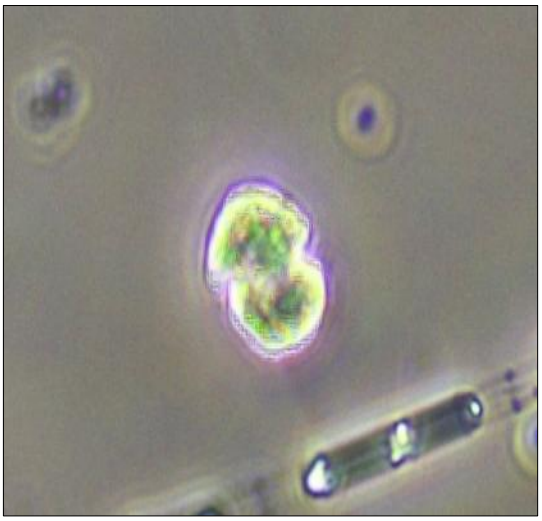
Maryland
Department of
the Environment

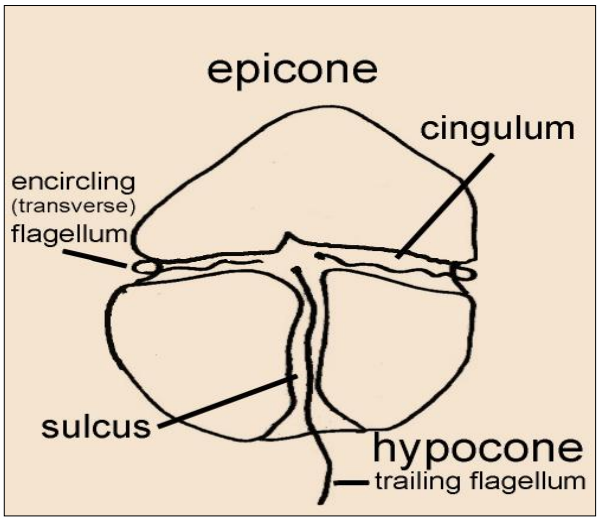
Karlodinium veneficum and fish kills

What You Need to Know

Karlodinium veneficum **is a single-celled organism common to the Chesapeake Bay and its tributaries. It is capable of forming intense blooms. Although no known human health effects are associated with the organism, it can produce strains of toxins capable of causing fish kills. Fish kills in 2015 in Middle River and in 2016 in the Gunpowder and Bird rivers were found to have been caused in large part by toxins produced by *Karlodinium veneficum*.**



Karlodinium veneficum cell from 2016 Gunpowder River fish kill (12-18 microns)



Dinoflagellate anatomy

Karlodinium veneficum 101

Karlodinium veneficum, or K. veneficum, is a chlorophyll-containing dinoflagellate species of phytoplankton or algae. It feeds and grows by using light, nutrients and inorganic carbon for nutrition through photosynthesis. At times it also eats food (often other algae) for nutrition. The "Karlotoxin" it produces appears to be used to prey on food and for self-defense. While no water temperature range for its survival are known to have been firmly established, some research indicates it can survive in temperatures as low as about 43 degrees.

K. veneficum blooms

K. veneficum has been in the Chesapeake Bay for many years, frequently present in relatively low cell counts. However, like all types of phytoplankton, *K. veneficum* can generate population explosions, or blooms, under ideal conditions of light, temperature, salinity and other factors. These blooms can cause water to become discolored a reddish-brown and form what are sometimes called mahogany tides. During a mahogany tide, the organism cells can die and decompose and, in turn, severely reduce the amount of oxygen available to aquatic life.

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Karlotoxin

K. veneficum was previously thought to be non-toxic, but in 2002 researchers at the University of Maryland isolated the potent toxins released by the algae. Experiments at the university showed the effects on organisms exposed to different levels of the toxin. At sufficient levels, Karlotoxin can damage fish gills and cause the fish to die.

K. veneficum and fish kill investigations

The Maryland Department of the Environment uses diagnostic tools such as phytoplankton identification, water quality analysis, fish pathology and University of Maryland toxin analysis to diagnose fish kills caused by Karlotoxin. As of February 2017, Karlotoxin was associated with 38 incidents in Maryland, killing an estimated 479,028 fish. Gill damage caused by Karlotoxin exposure, exacerbated by stress to freshwater-acclimated fish from an increase in water salinity levels was found to be the cause of a November 2015 incident in Middle River that killed an estimated 201,789 fish. Similar conditions were found to have caused a December 2016 incident in the Gunpowder and Bird rivers that killed an estimated 20,553 fish.

More information

Maryland Department of the Environment fish kill webpage

http://bit.ly/mdefishkills

Report on December 2016 fish kill investigation

http://bit.ly/mde2016fishkillreport

Report on November 2015 fish kill investigation

http://bit.ly/mde2015fishkillreport

Anyone with information on fish kills or with other concerns on environmental matters involving the Chesapeake Bay or its tributaries should call the Bay environmental hotline at 877-224-7229.

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