UNDERWATER SUFFOCATION

Grades 7-10

Background

Eutrophication is a process where a body of water like an estuary receives an input of excess nutrients, especially nitrogen and phosphorus in forms that are easily taken up by plant life. Phytoplankton are microscopic plants that thrive in coastal waters. The flow of excess nutrients common results in an increase in phytoplankton. If the increase is on a grand scale, it is usually referred to as a bloom event.

There are many problems associated with these blooms. Most importantly is how the amount of oxygen in the water is affected. As the phytoplankton are fertilized by the flow of nutrients into the water, initially increased photosynthetic activity results in an increase in oxygen. However as the phytoplankton die, they sink in the water column. Bacteria starts the process of decaying this organic material. As a result, large amounts of oxygen are removed from the water. All the organisms that require oxygen for respiration are then affected. During this time when oxygen levels decline, certain thresholds will be passed that will cause a die off of organisms sensitive to the declining oxygen content.

Secondly, these blooms reduce water clarity. A reduction in clarity can have a negative effect on macroscopic plant forms lower in the water column by reducing the amount of light reaching them. This reduces their ability to photosynthesize and they may even die, creating more decaying material.

Objective

The objective is to observe how the addition of nutrients to water will affect oxygen content. Following the activity students will be able to explain the affect of the addition of nitrogen and phosphorus to an estuary.

Materials

Five jars (per group)
Grease pencils (or masking tape and pencils)
Marine sand and seaweed (or pond mud and plants)
Fresh Seawater (or pond water)
Nitrogen fertilizer (in a soluble form)
Phosphorus fertilizer (in a soluble form)
Dissolved oxygen kits (appropriate for student age level)

Procedure

Brainstorm with students about how they could use materials provided to investigate the effect of fertilizers on plankton growth and oxygen in the water. Guide them to label five jars A through E. Review what makes a fair test and guide them into saving one sample for a control. Seaweed, marine sand (or pond mud and plants), and sea water (or pond water) should be added to each jar.

Working in teams students should design a table on which they can record their observations and measurements of dissolved oxygen. Make sure they take a measure of the dissolved oxygen in the control samples of sea or pond water and record their data on their table. Students should determine the quantities of fertilizers they will be adding to each sample and note that on their tables. Following the quantities listed on the data tables they will add nitrogen and phosphorus to the jars. (Teachers may want students to determine the mass of the quantities shown in the table ahead of time and use mass units to reinforce lab skills.)

Place the jars in a sunny location or under grow lights. Over the period of a couple of weeks, students will make and record observations. Once each week, they should take a measurement of the dissolved oxygen in each jar and record it on their table.

Follow Up

Students should record quantitative and qualitative observations throughout the time of the activity. After several weeks the results

can be discussed. What are sources of these nutrients in Narragansett Bay or estuaries in your own area? Should anything be done about controlling these sources? This activity can be concluded with a simple lab report or be incorporated into a larger project report about pollution.

This would be a good point to talk about sewage treatment plants and what they don't take out of the sewage (nitrogen and phosphorus).