Coastal Studies Institute
East Carolina University Outer Banks Campus

Nutrient Overload!

Storm water outfall.

ABSTRACT

The estuarine waters of North Carolina are home to many commercially and recreationally important fish and invertebrate species. These organisms are part of a complex and interconnected food web. When this system is thrown off balance due to an influx of nutrients, the consequences can be dire.

Grade Level: 8-12

Duration: One 30-minute class period, 6-8 weeks for observation and discussion

Standards: ESS.EES.2.4, ESS.EES.5.1, ESS.EES.5.2, LS.Bio.5.2, ESS.8.3.1, ESS.8.3.2

Key Words: eutrophication, nutrient loading, estuarine ecology, storm water

OBJECTIVE

This experiment provides an opportunity for students to see the harmful side effects that storm water runoff and other nutrient loading processes have on our estuaries. This activity can serve as a demonstration or a team experiment.

SUPPLIES

- 2 large gallon glass jars
- Vegetation (algae works best, straw or grass, only a small amount is required)
- Plant fertilizer

VIDEO RESOURCES

Eutrophication: https://www.youtube.com/watch?v=6LAT1gLMPu4
Nitrogen cycle: https://www.youtube.com/watch?v=372K0jyO0hQ

Estuarine Ecology: https://www.youtube.com/watch?v=h01JBiZt6rg

BACKGROUND

An overabundance of nutrients introduced into estuarine systems can result from several sources including leaky septic tanks, fertilizer from farms and golf courses, and storm water runoff. Bacteria breaks down these nutrients into nitrates and phosphates, which are absorbed by plants to help them grow. Under normal circumstance subaquatic vegetation, marsh grasses, and other plants can efficiently cycle the nitrogen out of the system. When a nutrient overload occurs, single-celled algae proliferate, consuming the nutrients. This process, called eutrophication, negatively impacts other organisms in the ecosystem. Subaquatic vegetation is unable to photosynthesize because the algae bloom blocks the sunlight and when the algae consume all the nutrients, they die off as quickly as they appeared. Bacteria feed on the decomposing algae which strips the water of dissolved oxygen. This lack of oxygen leads to large scale die-offs of organisms that depend on oxygen to live. This experiment offers an observable reaction to an increase of nutrients and provides an opportunity for discussion about the nitrogen cycle, food webs, and human effects on our environment.

PROCEDURE

1. In preparation, fill each of the 2 one-gallon jars with tap water and leave uncovered for a weekend. This "ages" the tap water and de-chlorinates the samples.
2. Place a mat of dead or dying vegetation or algae in each jar.
3. Designate one jar as the experimental jar and one as the control. Add a teaspoon of fertilizer to the experimental jar and nothing to the control jar.
4. Position both jars in an area of equal sunlight.
5. Keep a photographic and tabulated record. If able, take samples from each jar and examine them under a microscope. Protozoans and algae can be observed under a low power microscope.

DISCUSSION

1. What are your observations of each jar?

2. What brough about these differences?

3. Considering the results of this experiment, how do humans affect our environments in this way?

4. What are some ways that you can be a part of the solution rather than the problem?

5. How do changes in the ecosystem affect food webs? How do these changes affect humans?