

Name \_\_\_\_\_

Date \_\_\_\_\_

## Decomposition

**Background:** Decomposition is taking place all the time, and is a critical part of any ecosystem. Without decomposers, nutrients would not cycle back into the environment and we would be left with mountains of detritus. Aquatic ecosystems are no different; decomposition is constantly occurring, and the existence of bacteria and other organisms impacts the water in different ways. In this lab, you will discover how decomposition affects dissolved oxygen by adding decaying leaf litter to a water sample.

**Hypothesis:** \_\_\_\_\_

\_\_\_\_\_

**Procedure:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Results

Create a data table to keep track of your results.

## Discussion Questions:

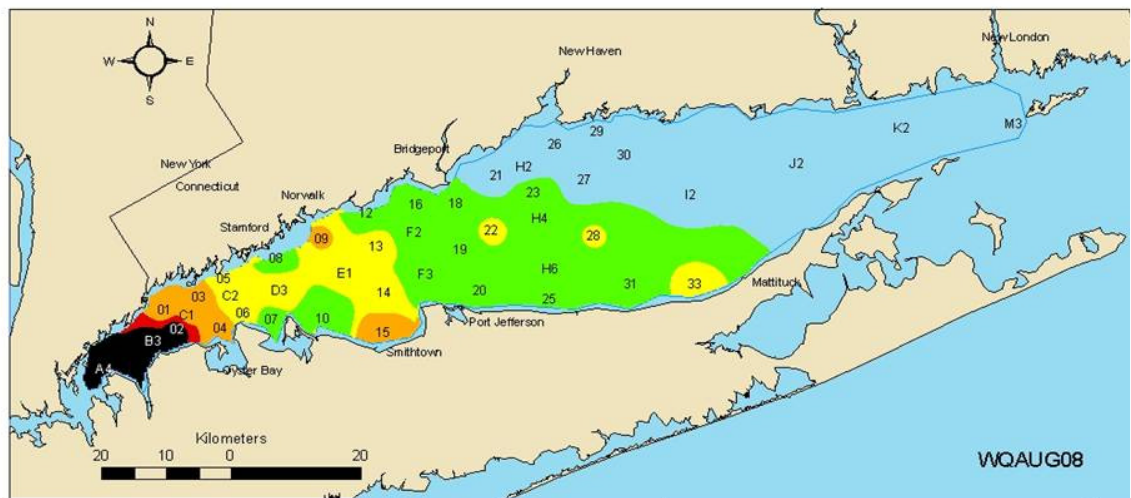
1. Was your hypothesis supported or rejected? Why?
2. How do your results compare with the class results?
3. Based on this experiment, what happens to dissolved oxygen levels in an aquatic ecosystem during decomposition? How does your experiment compare with a natural setting? How would the results be different if you completed this experiment in a stream? In a pond?
4. Imagine you are driving home one night and saw the pond on the right, covered in green algae. What do you think will happen to the dissolved oxygen levels in the pond over time? Why?
5. How is the process of eutrophication connected to decomposition? Why are people concerned about elevated levels of nitrogen and phosphorous that enter into aquatic ecosystems?
6. If a large amount of sewage was accidentally released into the Hudson River, what would you expect would happen to the dissolved oxygen levels in the area near the spill? Why?



7. Every summer, the Long Island Sound suffers from extremely low dissolved oxygen levels, which has prompted local officials to begin a monitoring program that monitors DO levels throughout the year at up to 48 stations every other week. Use the map below to answer the questions that follow.

Dissolved Oxygen in Long Island Sound Bottom Waters

8/5/08 - 8/8/08



The 2008 August Water Quality Survey was conducted 5-8 August. Forty-four stations were sampled using the R/V Patricia Lynn. Bottom water dissolved oxygen concentrations fell below 4.8 mg/L at 32 stations with 19 of those stations falling below 3.5 mg/L and nine stations falling below 3.0 mg/L. The lowest concentration was observed at Station A4 (0.61 mg/L). The area of bottom water affected by hypoxia (DO <3.5 mg/L) is 225.2 square miles (583.3 sq. km). The area with DO concentrations less than 3.0 mg/L is 91.1 square miles (235.9 sq km). The average area affected by hypoxia from 1999-2007 was 215.4 sq mi (557.8 sq km). Secchi disk transparency depths, which reflect water clarity, during this survey ranged from 1.4 meters to 4.7 meters. Plankton tows are not conducted during the surveys. However, jellyfish were still observed in high densities, especially in the central and eastern basins. Abundance in the western basin and the narrows seemed to be lower.

Dissolved Oxygen	Severity of Impact
0.0 - 0.99	Severe
1.0 - 1.99	Moderately severe
2.0 - 2.99	Moderate
3.0 - 3.49	Marginal
3.5 - 4.79	Interim management goal
4.8+	Excellent - Supportive of marine life

- Where was dissolved oxygen the lowest (the darker the color, the lower the DO levels)?
- Where is the water that enters the LI Sound coming from?
- Do you think the problem is worse in the summer or the winter? Why?
- Read the following excerpt from the Long Island Sound Study website, [www.longislandsoundstudy.net](http://www.longislandsoundstudy.net).

Excessive discharges of nitrogen, a nutrient, are the primary cause of hypoxia. Nitrogen fuels the growth of planktonic algae. The algae die, settle to the bottom of the Sound and decay, using up oxygen in the process.

Natural stratification of the Sound's waters occurs during the summer when warmer, fresher water "floats" on the top of cooler, saltier water that is more dense. This natural stratification forms a density difference between the two layers called a pycnocline. This prevents mixing of surface and bottom waters.

Oxygen from the atmosphere and photosynthesis keep the surface layer well oxygenated, but the oxygen cannot pass through the pycnocline into the bottom layer very easily. Decaying algae and other organic material in the sediment and animal respiration in the bottom layer use up oxygen

faster than it is replenished. Hypoxia develops and usually persists as long as the stratification lasts (usually one to two months in late summer).

The most oxygen that can be dissolved in Long Island Sound at summer water temperatures is about 7.5 mg/l. This is known as the saturation level.

In pre-Colonial days, natural, healthy biological activity brought dissolved oxygen levels below saturation due to the natural loadings of organic material and nitrogen, but oxygen levels probably were not below 5 mg/l.

Under today's nutrient and organic material loading conditions, minimum dissolved oxygen levels average approximately 1.5 mg/l. These levels are associated with severe hypoxia and have been documented in the field.

By substantially reducing nitrogen loadings to the Sound from sources within its drainage basin, the minimum dissolved oxygen levels in the bottom waters during late summer can be increased to an average of about 3.5 mg/l, thereby significantly reducing the probability and frequency of severe hypoxia and reducing the area affected by hypoxia.

Based on this information, what is the cause of the low dissolved oxygen levels?  
What could be done to eliminate the problem?