Animals & Dissolved Oxygen

Time: 2 class periods
National Benchmarks: Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.
National Science Content Standards: *Science as Inquiry: A*; *Life Science: C*: Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges
New York State Standards: 1, 2, 4, 5, 6, 7

Objective: Students will know that aquatic organisms need oxygen to survive and will be able to understand how decreasing dissolved oxygen levels affect aquatic animals through an experiment.

Lesson Outline:

1. Students discuss what animals need to survive in water
2. Students observe animal behavior in low-oxygen waters
3. Students discuss implications of low-oxygen as related to thermal pollution at Indian Point Nuclear Power Plant

Materials: Feeder goldfish or other aquatic animals, aged tap water, tap water that has been boiled and cooled, large jars of water or individual jars for groups to do observations, straws of different sizes

Engage: Ask for four volunteers (do not choose students who have asthma or other breathing problems). Give two volunteers a large straw each, and the other two volunteers a smaller straw. The volunteers should hold their noses and breathe only through the straws. Allow the class to observe the reactions (caution the students doing the test to stop if they feel faint or dizzy). Ask: why was it harder for the students with the smaller straws to breathe? What does this mean for us? Can you think of times when people have run out of oxygen and died? They may have heard stories of immigrants who were illegally transported, trapped in truck trailers or other containers. Ask: What do you think would happen to an aquatic animal if it ran out of oxygen?
Explore: If you are completing this as an observation, use two jars of aged tap water (at room temperature) and two jars of sealed, boiled water (at room temperature). Ask: How can we tell if the fish are breathing? Allow students to observe the fish before you begin the experiment. If you have a large class, you may need to set up several observation stations or use a video projector. You can also do this as an experiment where each group does the experiment. Ask students to brainstorm possible responses beforehand.

Use two types of water: aged tap water (to remove the chemicals) and tap water that has been boiled and then cooled (to remove both the chemicals and the DO). Fill

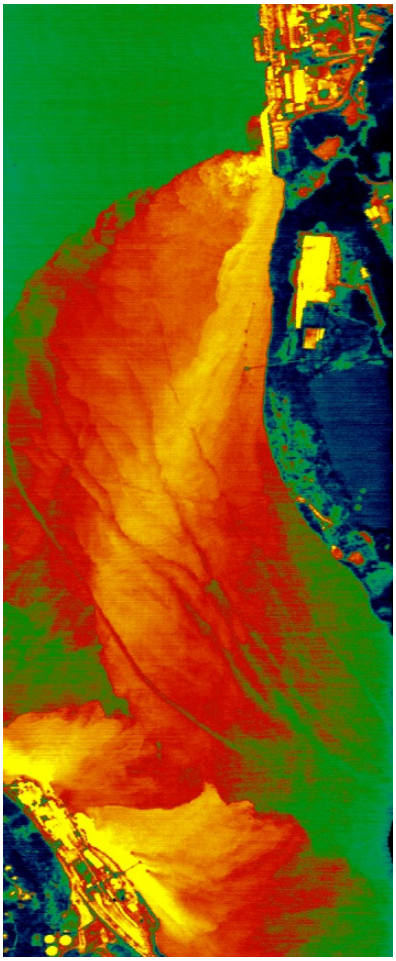
each jar with one type of water before class. Add a feeder goldfish (available in pet stores) to each jar-decide beforehand if this is a step you will do or allow the students to do. As soon as the goldfish are in the water, the students should observe the fishes' behavior and write down what they see. One option is to write down the number of gill closings per thirty second intervals, or how many times the fish comes to the surface looking for oxygen. Carefully monitor the students' observations to make sure that the goldfish are not overly stressed. You don't want casualties! Once students have completed the observations, discuss what happened to the fish when they were in the high DO and low DO.

Explain: Like plants, animals need oxygen to survive, and low dissolved oxygen causes the animals to become stressed and perhaps die. Refer students to the reading on Dissolved Oxygen for specific limits.

Extend: Students can research different types of animals that would live in different DO levels. This information can be used when completing the macroinvertebrate surveys. You can also extend this into a full lab by measuring the DO concentrations of the jars of water. Alternatively, you could use *Daphnia magna* for the experiment and observe the heart rate of the organisms using a digital projection of the animal.

Evaluate: Students will complete a write-up of their observations on animals and dissolved oxygen. Show students the picture of the Indian Point power plant thermal discharge image. Explain the colors on the picture. Students should receive copies of this picture if possible, or have access to it online. Explain that they will have to use this image to answer questions on their lab report.

Comments:



Thermal pollution in the Hudson River is visible through an infrared image (photo taken in 1988). The plume on the lower left is from a power plant (Lovett coal) that has since been decommissioned. The plume on the upper right is from Indian Point Nuclear Power Plant. Source: http://www.ger.com/indpt.jpg

Modified with permission from: "When the oxygen goes…" 1997. Living in Water, National Aquarium in Baltimore, Kendall Hunt Publishing, Iowa.