

Aquatic Plant Invasion

Time: 2 class period

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 the relationship between light and dissolved oxygen and be able to predict what will happen when a plant does not receive enough light.

Students will know what happens to an aquatic ecosystem when a floating macrophyte is introduced as an invasive species, and be able to design an experiment to test their hypothesis.

Lesson Outline:

1. Students discuss the impacts of living without light
2. Students learn about the impacts of light on plants using a demonstration or overnight observation
3. Students view photos of water chestnut
4. Students create an experiment to test the impact of a floating plant on dissolved oxygen
5. Over a one-week or two-week period, students take measurements of the water
6. Students report and discuss conclusions

Materials: jars or 2-liter bottles with the tops cut off (at least 2 jars per group), aged tap water, fertilizer (phosphate-based dish detergent works well), algae culture, Elodea, aluminum foil, plastic wrap, thermometers, styrofoam

Day 1: This can be done as a demonstration or as a cooperative activity. To prepare the experiment, set up several jars of aged tap water with sprigs of Elodea and place them in the dark overnight. This causes the levels of DO to drop due to respiration, and allows a better measurement of the change during the experiment. For a cooperative activity, each

group needs two jars with Elodea. You should also provide jars of boiled sealed water (with no DO) that the students can test before and after to prove that the light is not affecting the water alone.

Day 2: Once students have tested their water after leaving the jars in different light conditions, they should be presented with the water chestnut problem. Once they have read the background information, they will be given several choices for how to mimic the effects of water chestnut: using a cover on the water, such as styrofoam or aluminum foil; adding algal cultures to create a floating plant ‘mat’; or using floating plants such as duckweed (teacher’s discretion). Allow one-two weeks for the creation and completion of the experiments.

Engage: Students should be encouraged to think about what life would be like if they had to live in a closet, or, if some imaginary large umbrella covered the sky and blocked out all the sunlight. Ask students if they know of any organisms that can survive without sunlight (they might think about animals that live along the deep ocean vents). Discuss the kinds of adaptations these animals need to survive in such hostile conditions. Explain to students that today they will try and find out what happens to plants in different levels of light.

Explore:

Day 1: Students will be given the jars with the elodea and the control jars. They should decide how to set up their experiment. Some students may want to cover their jars with a dark cloth, while others may want to place the jar in a closet or cupboard. Either way, make sure that temperature is not a confounding variable. Students should test the DO levels before they start their experiment. Leave the jars overnight and allow the students enough time to test the water again the next day. The jars have to be kept in very low artificial light if they are left overnight, because they might produce too much oxygen and saturate the system.

Day 2: After students test their jars, they should be shown the next set of materials: algal culture, floating plants, various types of covers for the jars, fertilizer. Each group can decide what concentration of fertilizer to use in their ‘pond’, but they should keep one jar as a control. The second jar will become inoculated with algal culture and the pre-determined amount of fertilizer. Jars should be placed in warm, well-lit place. This experiment should be allowed to run for two weeks. Replace water lost to evaporation with aged tap water. Students should continuously make observations on their ponds.

Extend: Ask students to think about what their results might mean for aquatic animals living in a situation with low light. Ask the students to think about what kinds of conditions cause low light levels for submerged plants. This would be a good time to show the water chestnut photos and discuss the implications.

Evaluate: Students should complete their lab report and be prepared to give a presentation to the class.

Comments:

Initial exploration modified with permission from: "A light snack" 1997. Living in Water, National Aquarium in Baltimore, Kendall Hunt Publishing, Iowa.