Bottle Habitat

Region: Great Lakes

Grade Level(s): 5-8

Time Required: One 50 minute class period, then 5 minutes each day for the next 4 weeks

Focus Question:

- What is needed for a healthy aquatic ecosystem, and what will happen when the balance is disrupted due to climate change?

Learning Objectives:

- The students will be able to identify quantitative and qualitative changes in aquatic ecosystems.
- The students will be able to describe the effects of climate change on aquatic ecosystems.

Materials:

- 4 two-liter plastic soda bottles for each group
- A water source
- A light source (sunlight or a halogen lamp)
- Black paper
- Guppies
- Elodea
- Duckweed
- Water snails
- Sand
- Scissors
- Graph paper

Procedures/Instructional Strategies:

1. Students will, in groups of four, construct 2 aquatic habitats using 2 two-liter soda bottles.

2. Cut the top off one bottle at the shoulder (where it tapers) and discard. The bottom of the bottle is the base. Cut the top off another bottle and score the base with holes. This is the cover. Do the same to the other soda bottles so that there are 2 aquatic habitats. Label one habitat as “Bottle 1”, and the other as “Bottle 2”.

3. Fill the bottom of each bottle with sand, two inches deep.

4. Add water slowly to each bottle to minimize sand displacement. In each bottle, root three ten-centimeter elodea stalks firmly into the sand, and sprinkle a small amount of duckweed onto the water’s surface.

5. Allow the aquaria to stand overnight to let the sand settle and to allow chlorine to dissipate from the water (if tap water is used).

6. Add two guppies and two snails to Bottle 1 only.

7. Place Bottle 1 in an area with sunlight. Place Bottle 2 in an area with sunlight (or near a halogen lamp) on top of a piece of black paper to simulate climate change.

8. Students will create charts to record temperature and qualitative data from physical and visual observations.

9. Over a four-week period, have the students record daily observations in journals. Suggest certain things for them to be watching for, such as plant growth or population changes. Ask for quantitative measurements (population numbers, amount of plant/animal growth, number of days, temperature) as well as qualitative measurements (color, shape, type of movement).

10. During the research period, have the students research pond ecology and the organisms involved in the project.

11. At the end of the observation period, have the students graph the information they have obtained through observation. At this time, they should write hypotheses to explain some of the things that they observed.

12. Pose questions to the students to consider, such as: “What would happen to your plant population if you added more snails?” or “What environmental factors do you think influenced the growth of your fish/snails/plants?” or “What do you think would happen if the fish population doubled? Quadrupled?” or “What impact does temperature have on the quality of an environment?” or “Why did we not add snails or fish to the Bottle 2 ecosystem?” (Cruelty…)

13. Outcome/Assessment: Are the aquaria appropriately stocked? Have they been well-maintained? Are observations recorded at regular intervals? Are graphs drawn correctly? Are hypotheses based on facts?

National Science Education Standards:

Populations and Ecosystems

- Developing abilities necessary to do scientific inquiry.
- Developing understandings about scientific inquiry.
- A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.

- Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers--they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

- For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.

- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Additional Resources:

- Bottle Biology (http://www.fastplants.org/activities.manuals.php#Bottle)

References:

1. Bottle Habitat – An Educator's Reference Desk Lesson Plan (http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Ecology/ECL0014.html)

2. Bottle Biology. Bottle Biology Project. 1993. Department of Plant Pathology, College of Agriculture and Life Sciences, University of Wisconsin-Madison. Published by Kendall-Hunt Publishing Company.