



Crystal Ball for Critters (Learning Experience #1) Lesson Plan



Overview

Students will work in teams as they play the role of biologists from the West Virginia Department of Natural Resources. They will research what is known about the hellbender (*Cryptobranchus alleganensis*) as a **bioindicator species** of the effects of climate change and present their findings to their classmates.

Essential Question: *What can a bioindicator species, such as the hellbender, tell us about the effects of climate change on its habitat?*

Objectives

The students will:

- use research to discover the importance of a bioindicator species, its life cycle, habitat and niche in the ecosystem.
- design and complete an experiment to find the effects of temperature on dissolved oxygen levels in a local stream.
- suggest how climate change could affect the hellbender population in West Virginia.
- use technology to create and deliver a presentation to the class.
- work productively as a part of a project team.
- use a variety of resources to investigate the background information necessary for this project.
- keep accurate, complete records in a journal.

Materials for Learning Experience #1

- One packet per group containing one copy each of the following materials:
 - *Happy Hellbender: Habitat Requirements* (Student Sheet #1)
 - *Hellbender Hot or Cold Tub?* (Student Sheet #2)
 - *What's Next for Hellbenders?* (Student Sheet #3)





- Materials for dissolved oxygen lab, per group:
 - Water sample from a nearby stream, 500 mL, or tap water
 - Refrigerator access
 - Ice cubes of water sample
 - Hot plate access
 - Thermometer or temperature data probe
 - Dissolved oxygen data probe or dissolved oxygen test materials
 - Four 200mL (or larger) beakers
 - Large container for waste water
- Internet and computer access in the classroom or library, including power point capability if possible.
- Notebooks or small binders or folders to be used as journals, one (1) for each student
- Chart paper and markers for the class

Target Student Grade Level: 8-12

Subject Areas

Environmental science, ecology, biology, geography, history, language arts

Timeline

Teacher preparation: 45 minutes

Student Learning Experience: 90 minutes

Setting: Classroom lab; library or computer lab

Skills

Research in print materials and on web sites; organize information; problem solve as part of a team; communicate to team and classmates; design and carry out an experiment

Vocabulary

Adaptation; bioindicator; climate change; cutaneous; dissolved oxygen





Advanced Preparation Required

Prior to the lesson copy and organize the student sheets listed, creating one packet per project team. Acquire chart paper and markers or access to technology such as a SMART Board. You will need to obtain water samples from a local waterway **no more than 24 hours prior to implementing the lesson** for *Hellbender Hot or Cold Tub?* (Student Sheet #2); refrigerate half of the water collected. Obtain the equipment and materials necessary for students to test the water sample for dissolved oxygen (DO).

Procedure

1. Introduce the learning experience by telling students that they are going to learn about a rare species known as a hellbender. Students should set up a page in their science journal (leaving room to make their observations) with the following headings:
 - a. name of species
 - b. physical description of species
 - c. habitat description
 - d. importance of species
 - e. other observations
2. Have the class view the following “West Virginia Wildlife” segment which provides an introduction to the hellbender and was filmed by a West Virginia TV station (the program can be found at <http://www.wvdnr.gov/Hunting/wildlifetv-aug04.shtm>). Students may need to view the video more than once in order to complete an introductory description of the hellbender and its habitat. If your classroom technology will allow, pause the video and ask your students questions such as:
 - a. *How would you describe the habitat where the hellbender lives?*
 - b. *What are some of the ways that the hellbender is adapted to living in its habitat (physical and behavioral adaptations)?*
 - c. *Do you think that you would find this animal living in the same stream if the water became warm or polluted?*
3. Ask students to write a reflection in their journals about their introduction to a hellbender. Tell them that it is called a “bioindicator species” by some scientists. What do they think that means?
4. Assign students to project teams consisting of three to four members. Each team member should have a task: researcher (may have two of these), recorder, and communicator. Grouping students with a variety of abilities will promote peer teaching and differentiation of instruction. Have a brief discussion about using and citing reliable resources.





5. Post the essential questions for the scenario and Learning Experience #1 on a piece of chart paper or a SMART Board and have students copy them into their science journals. Students should discuss the questions with their teams and provide preliminary answers, leaving space for more complete answers at the end of the Learning Experience and the scenario. Remind the students to keep these questions in mind as they as they are completing the Learning Experience.
6. Inform students that each team represents a group of wildlife biologists working for the West Virginia Division of Natural Resources and their challenge is to discover as much as possible about the hellbender. Each team will make the decision about whether or not the hellbender should be considered a bioindicator species for clean waterways and predict what effects climate change will have on the hellbender's continued presence in West Virginia streams. Each team will make a presentation about its findings at the end of the scenario.
7. Distribute a copy of the packets to each team. Students will begin their research by completing *Happy Hellbender: Habitat Requirements* (Student Sheet #1). Teams should refer to the notes they made when they watched the video then find more information by researching in print materials and the web sites that you have listed for them on chart paper or on the board.
8. Teams should share their answers in Student Sheet #1 during a class discussion. Students will suggest reasons why a mountain stream in West Virginia may become unsuitable for hosting a population of hellbenders.
9. Student teams will learn about the importance of water temperature for the hellbender and other cutaneous breathers as they complete *Hellbender Hot or Cold Tub* (Student Sheet #2). A separate page is posted with information for the teacher. Stock a table with the materials listed, plus others that you or your students request. Following the team's completion of the experiment in Student Sheet #2, each group will share their results with the rest of the class. Teams will report on their experimental design, their data and conclusions. As a result of the experiment, the students should discover that cold water holds more dissolved oxygen than warm water.
10. Instruct the class to compare the respiratory system of an adult hellbender to that of a human and write a brief answer to the following question on their lab paper: *How does an adult of each species take in oxygen?* Students may need to review the introductory video or do some additional research in order to answer this question.
11. Students should complete the questions contained in *What's Next for Hellbenders?* (Student Sheet #3). Students may need a reminder about the information in the opening video about the hellbender's restricted territory.
12. Instruct students to write a reflection in their journals about how they think climate change will affect the extinction rates of species in the next 100 years. Remind the students to consider all organisms, not just animals. Students will share their ideas with their classmates.