NOAA Teacher at Sea Program Lesson Plan

Activity Title: Preserving Biodiversity: Comparing the *Atlantic Surfclam* with the *Zebra mussel*

Subject: This lesson addresses the biological basis of animal diversity and the human behaviors that influence the numbers and health of particular animal populations.

Grade Level: Written for AP Environmental Science (grades 9-12)

Average learning time: 2-week lesson involving direct instruction (teacher presented), independent learning (through text reading) and culminating in student-produced evaluation using this lesson model.

Lesson Summary (Overview/summary): Students will research current population data available from the NOAA website to analyze the population sizes and health of the *Atlantic Surfclam* and the *Zebra mussel*.

Overall concept/The Big Idea: Biodiversity is generally used to describe the depth and breadth of living species. The health of an ecosystem is often defined by the biodiversity it supports; the water, food supply, air supply and space needed by the native inhabitants. Biodiversity can be affected not only by natural events (floods, wildfires, disease) but also by human behavior (pollution, removal of resources). In this activity you will be researching the ecosystems that support two organisms that are related, yet have completely different needs and growth patterns.

Specific Concepts: Concepts covered in this lesson are:

1. Knowing the general physical characteristics of the *Mollusca* phylum.
2. Knowing the difference between a native species and a non-native invasive species
3. Recognition of the role of human activity in the change in animal habitat
4. How biodiversity can be measured and evaluated

Focus Questions:

1. What is the scientific name of each organism and what phylum is it found in?
2. What are the general physical characteristics of members of this phylum?

3. Where are these animals naturally found? (be specific)
4. How long do they live?
5. What differences are there physically between male and female animals?
6. What are the primary predators?
7. What is their primary source of nutrition?
8. What adaptation does each one have that allows its survival? Are there any other places (habitats) where you think they could survive?
9. What is an invasive species? Explain why this term may apply to one or both of these species.

Objectives/Learning Goals:

1. Students will demonstrate how two organisms related structurally can survive in unique habitats by describing the common physiological features of both clam species.
2. Given recent data on population sizes, students will be able to conclude if populations are increasing in numbers (depth) as well as in size (breadth).
3. In analyzing current distribution maps, students will correctly be able to identify areas of population increase and population decrease.
4. Students will demonstrate their knowledge of organism habitat by correctly identifying areas where species are likely to be found in significant population sizes.

Background Information: Students need to have prior knowledge of the following:

1. Geography of water sources that support mussel populations.
2. Basic knowledge of mussel structure, including how they eat and adaptions for survival.
3. Research skills on a computer that permit them to evaluate data as reliable (i.e. they need to know how to identify a valid source of information).

Areas where students need support include a refresher lesson on types of mollusks and where they are generally found; how mussels gain nutrition, and how they are classified. New areas of knowledge include how NOAA research is conducted (a teacher presentation of data collection is helpful) and the concept of a non-native invasive species is needed prior to beginning the assignment. Students frequently assume non-native species are a negative part of a habitat. Students also need to be reminded that mollusks live in fresh as well as salt water.

Common misconceptions: Students will frequently assume the *Atlantic surfclam* and the *zebra mussel* are found in the same type of environment. Prior to having students work independently on this assignment, lead a discussion on the two different species and their habitats. Students will easily find information about the surfclam but will have to do some online searching for data on the zebra mussel.

Material: Students need computers with Internet access.

Technical Requirements: Internet with ability to download large quantities of data; a printer is desirable but not necessary.

Teacher preparation: Teacher should collect the same information prior to student research (approximately 2 hours worth of research time); teacher-prepared PowerPoint or other visual instruction is helpful to show students what they will be looking for (samples of pictures of both species, maps, and sample data from the internet).

Keywords: invasive species, mollusk, habitat, biodiversity

Pre-assessment Strategy/Anticipatory set: N/A

Lesson Procedure:

1. Prior to this assignment complete the following:
    a. Teacher-directed instruction in the form of lecture/PowerPoint a lesson on mollusk structure and classification
    b. Teacher-directed instruction in the form of lecture/PowerPoint on animal diversity and human behaviors that affect biodiversity
    c. Student independent work that includes reading/analysis of biodiversity, NOAA research (including recent projects involving both the *surfclam* and the *zebra mussel*)
    d. Written quiz on student understanding of mollusk structure, vocabulary terms (invasive species, mollusk, habitat, biodiversity, human behaviors that affect animal distribution)

2. Preparing students for this assignment:
    a. Present the goals of the assignment – review visually what kind of work students will be collecting
    b. Discuss the desired outcome – what will students produce
    c. Review with students how to research the required topics – demonstrate visually how to locate the information on the internet

3. As students are working independently on this assignment:
    a. Monitor the sites students are using for data collection
    b. Have students report at the end of each class session what they have learned so far
    c. Require students to submit "report cards" of their progress at the end of each class period (a report card can be a one-paragraph summary of their progress including what they have finished, what still needs to be done, and any problems they have encountered).
    d. Begin each class period by reviewing areas students are struggling with – for example, if a number of them are having trouble finding current data on the *Atlantic surfclam* demonstrate to the class as a whole how to find the information

4. Student product – allow 3 hours of class time for research and 1-2 hours for student analysis. A typed report should be finished within 6 (class) hours of giving the assignment.

Assessment and Evaluation:
Students will be assessed on their formal written report using the following guideline:

1. Part 1 (30 points) – Basic scientific knowledge: Students demonstrate through their writing their understanding of the classification system that included the *surfclam* and the *zebra mussel*. They identify the physiological structures common to both species and an understanding of their basic reproduction, nutrition, and habitat requirements.
2. Part 2 (30 points) - Habitats: Students demonstrate through their writing an understanding of habitat requirements and habitat loss through human activities. They distinguish the difference between native and non-native species and the consequences of a non-native invasive species.
3. Part 3 (30 points): Research analysis: Students demonstrate they are able to interpret and understand data from a variety of sources showing the changes in populations of the *Atlantic surfclam* and *zebra mussel*; student reference data from the NOAA website specific to these two species.
4. Part 4 (10 points): Use of academic language, appropriate organization of topics, citations of sources in correct format, all graphs/charts/diagrams appropriately identified and labeled.

5. Optional Activity (10 points); Students may give a 5- minute presentation of their findings to any of the other life science classes (7th grade Life Science, 9th grade Biology, or AP Biology).

Standards:

National Science Education Standard(s) Addressed:

1. **Content Standard A**: **As a result of activities in grades 9–12, all students should develop**: Abilities necessary to do scientific inquiry and understandings about scientific inquiry.
2. **Content Standard C**: **As a result of their activities in grades 9-12, all students should develop understanding of** the interdependence of organisms, the matter, energy, and organization in living systems, and the behavior of organisms.

Ocean Literacy Principles Addressed:

1. **Principle 5:** The ocean supports a great diversity of life and ecosystems.
2. **Principle 6:** The ocean and humans are inextricably interconnected.

State Science Standards(s) Addressed:

1. **Life Science Standard 6:** Stability in an ecosystem is a balance between competing effects.
2. **Investigation and Experimentation Standard 1:** Scientific progress is made by asking meaningful questions and conducting careful investigations.

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