



LESSON 5: BIVALVES & OCEAN ACIDIFICATION

SUMMARY

Bivalves (mussels, scallops, clams, oysters) are a type of sea mollusk that has a compressed body enclosed in a hinged shell. Bivalves effect nutrient cycling as filter feeders by keeping the water clean. Some bivalves can filter up to 25 gallons of water a day. As the concentration of carbon dioxide in the atmosphere increases, bivalves are at risk as the ocean becomes more acidic.

Next Generation Science Standard

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.



BACKGROUND INFORMATION

Living in the greater Miami community, we are fortunate to live in a robust coastal community! Miami-Dade County is internationally recognized for its beaches. Along the coast are sensitive ecosystems including coral reefs, the Biscayne Bay, Everglade marshes, and coastal wetlands. These natural resources support fisheries, recreation, and tourism while also reducing erosion and flooding. Observing the local fauna and flora is a way to visualize our impact and influence on these ecosystems.

OBJECTIVES

Students will:

- Understand what bivalves are & their importance to the ocean ecosystem.
- Understand what ocean acidification is and how it affects bivalves.
- Construct an argument about the potential impact of ocean acidification on the ocean ecosystem.



LESSON PLAN BIVALVES & OCEAN ACIDIFICATION

TIME

45 minutes

MATERIALS

- White vinegar
- Sea shells
- Paper towel
- Glass beakers
- Water
- Heavy books

ENGAGE

Ask students if they know what a bivalve is. Explain to students that a bivalve is a marine animal that has two hinged shells that enclose a soft body. Examples include mussels, oysters, clams, and scallops. Ask students why these animals are important to the marine environment and human beings.

EXPLORE

Lay out non-soaked shells. Have students observe and identify the different species mentioned during the initial part of the activity. Allow students to handle the shells and ask them why the development of shells is advantageous to animals. Explain to students that shellfish are invertebrates and make their protective covering by combining calcium and carbonate, two substances found in seawater. The product is calcium carbonate, the same material chalk is made of.

Divide students into small groups with both a beaker of non-soaked shells and an experimental group of vinegar-soaked shells of similar species. Give each group paper towels and have them label them Control and Acid Washed. Ask students to lay the shells on the proper towels according to the treatment.

Ask students to make predictions about which group of shells will withstand a greater amount of pressure. Have students record the mass of their textbooks before placing them on top of their shells. Have students determine how much mass is required to break the shells soaked in the acid solution.

EXPLAIN

Initiate a discussion and ask students to share the results of their experiments. Have them refer to their original predictions - do the results support or refute their prediction? Did the non-soaked shells break? Explain to students that the calcium carbonate is broken down when carbon dioxide in the water undergoes a series of chemical reactions ultimately forming carbonic acid, which decreases the pH of the seawater. This leads to the calcium carbonate shells to become brittle and dissolve easily.

EXTEND

Calcium carbonate is also the main ingredient in chalk. For a dramatic demonstration, put seltzer water into a glass beaker with a piece of chalk. The bubbles in the seltzer (carbon dioxide) will eat away at the chalk, causing it to dissolve within minutes.

After watching this happen, explain to students that the same substance, carbon dioxide, is produced by burning fossil fuels and is entering the oceans, causing acidification.

EVALUATE

Ask students to brainstorm possible implications of ocean acidification on shell-forming organisms, and problems that could come from the weaker shells. Discuss how a shell protects an organism from dangers such as predation. Have students think about the challenge of surviving with a weakened shell. What does this mean for shellfish populations?