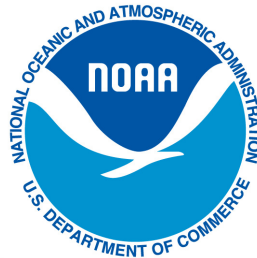




KIDS ENVIRONMENTAL LESSON PLANS

This lesson developed by:



Marine Osteoporosis

Overview:

In this lesson students will explore the effects of acidic oceans on certain marine organisms, in the ocean food web, and to humans. Students will conduct a science experiment using the scientific method to see the effects of increased acidity on certain species. They will also investigate the causes for increased ocean acidity and discuss ways to minimize the impact as an individual and as a society.



Marine Osteoporosis (cont.)

Ocean Literacy Principles:

1. The Earth has one big ocean with many features
5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected
7. The ocean is largely unexplored

Key Concepts:

- What is ocean acidification?
- What are the effects of acidity on certain marine organisms?

Materials:

- Small dishes
- 1-liter bottles or containers with lids
- Tap water
- Carbonated Water
- Vinegar
- pH strips (buy at a pet or pool store)
- shells, piece of dead coral, urchin test (skeleton) and chicken bones

Duration:

Two 45-minute periods

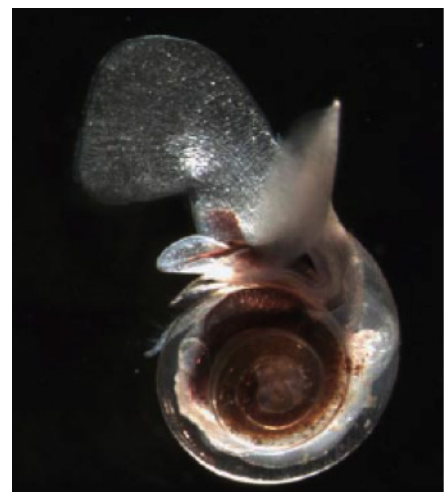
Physical Activity:

Moderate

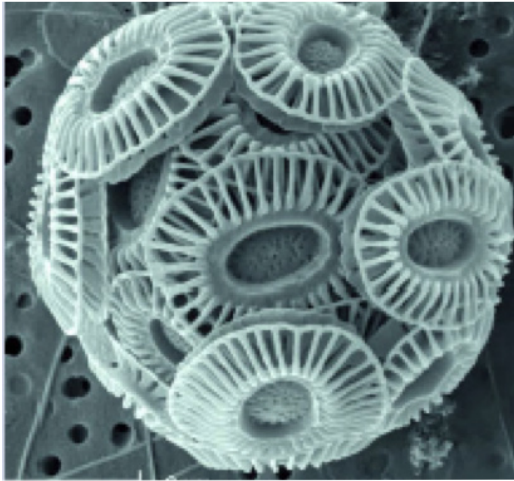
Background:

The process of ocean acidification (the decreasing pH of the ocean water) affects the organisms living within those waters. Many organisms use various forms of calcium carbonate to form their shells and skeleton. The increasing acidity of the water affects these organisms. As CO_2 is absorbed into the water the resulting chemical process reduces the amount of available carbonate ions used to by organisms to create their shells and skeleton. In addition to reducing the available carbonate ions the decreased pH makes the ocean water more corrosive.

Some of the organisms most immediately affected by ocean acidification include: sea urchins, abalone, corals, and some species of plankton (such as pteropods (see right) and coccolithophores). If the ocean water continues to grow more acidic these organisms will be unable to form their shells and grow. The loss of these organisms will greatly impact the marine food web. Plankton is at the base of the marine food web.



Marine Osteoporosis (cont.)



Plankton are organisms that cannot swim against the current. Some plankton are algae and some are animals. Phytoplankton (algae-plankton) include coccolithophores (see left) and zooplankton (animal plankton) include pteropods. Planktonic feeders include bivalves (mussels, clams, scallops, and oysters), sand crabs, and anchovies. Baleen whales, such as blue whales, are also planktonic feeders.

As the base of the marine food web plankton are incredibly important. If oceans become inhospitable to plankton the removal of that portion of the marine food web could result in disaster to many other marine species. The increasing acidity of the ocean also has an effect on habitat. Coral reefs provide habitat for a large and diverse number of organisms. Many species of fish and invertebrates inhabit coral reef. If the coral can no longer successfully grow at optimum rates they will not be able to maintain the reef. Without the reefs the biodiversity of the ocean will decrease.

Ocean acidification may also affect important fisheries. Sea urchins, crabs, lobsters, and shrimp all use calcium carbonate to create their shells and skeletons. These are very important fisheries worldwide. A loss in species population would not only affect the marine food web, but would also affect the availability of food for humans as well as a means of livelihood for many people worldwide.

Activity:

Experiment 1:

*To vary the experiment educators may instruct students to test different items in the liquids. For example, one group tests shells while another group tests urchin tests.

1. Fill one dish with tap water and the other dish with vinegar
2. Hypothesize what the pH of each liquid substance will be and justify your answer
3. Measure and record the pH of both liquids
4. Hypothesize what will happen when the item is immersed in each liquid.
5. Record initial observation of the items to be immersed in the liquids.
6. Record observations at 30 minute intervals.
7. Draw conclusions from your observations.

Experiment 2:

1. Place small chicken bones or small pieces of shell into 2 1-liter bottles (1 containing tap water and the other containing carbonated water).
2. Hypothesize what will happen in the two containers.
3. Record observations each day.
4. After items have started to react to the carbonated water have students review their hypothesis.



Marine Osteoporosis (cont.)

Discussion:

1. Discuss the students' results from both experiments.
2. What happened to the shells, dead coral, urchin tests or chicken bones in the more acidic liquid?
3. Why did this happen?
4. Discuss the impacts of ocean acidification on the marine environment.

Additional Resources:

Acid Test Video: <http://www.nrdc.org/oceans/acidification/aboutthefilm.asp>