

Ocean Acidification Investigation

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Overview: Students will gain an understanding of how ocean acidification affects marine life by conducting an experiment to determine the effects of an acid environment on calcium carbonate shells by comparing the weights of shells before and after the experiment. Before beginning this experiment students should have an understanding of the pH scale.

Grade Level: 4-8

Focus Questions: (1) What is ocean acidification? (2) How will ocean acidification affect marine life? (3) How will ocean acidification affect humans? (4) What can **you** do to prevent ocean acidification?

Oregon Content Standards:

- 5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.
- 5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.

Ocean Literacy: Essential Principles and Fundamental Concepts

6 The ocean and humans are inextricably interconnected.

e Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

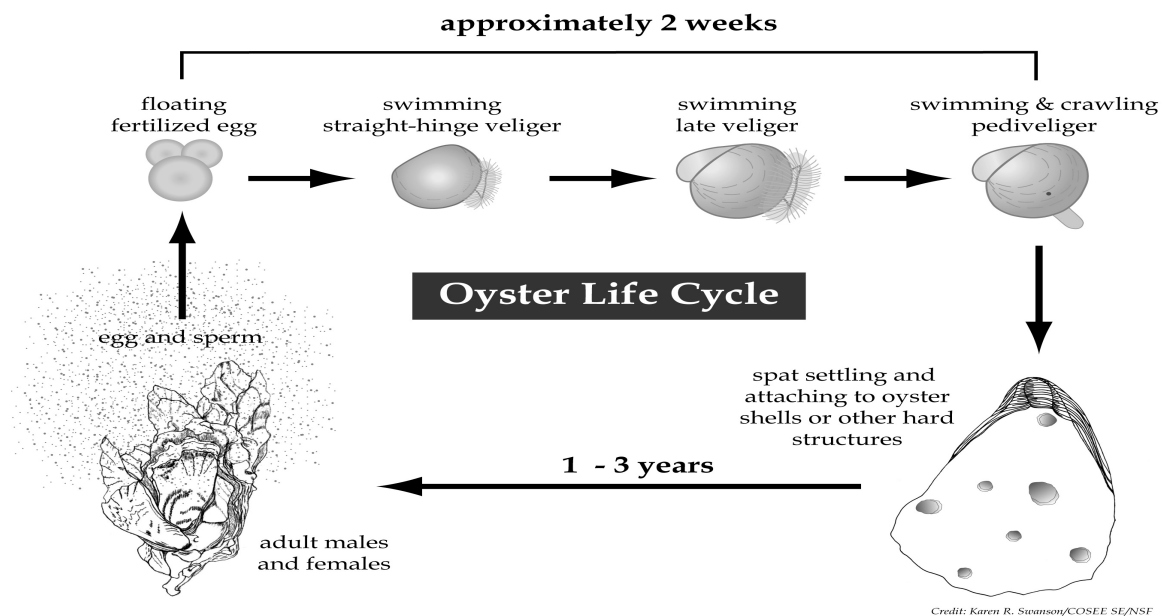
g Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Engagement: Students will watch a video that explains ocean acidification produced by kids for kids, "[CO2, the Other Problem](http://www.youtube.com/watch?v=kvUsSMa0nQU)" (<http://www.youtube.com/watch?v=kvUsSMa0nQU>).

Or another video for use with older students is, *Acid Test*, narrated by Sigourney Weaver <http://www.youtube.com/watch?v=5cqCvcX7buo> : approximately 21 minutes.

I used both videos in my fifth grade classroom. After viewing the video(s), ask students to partner up and identify the main ideas of the videos and share them with the class.

Exploration: Take students to an oyster farm to learn how oysters are grown. Collect oyster shells from the oyster farm. In their science journals have students sketch an oyster shell and note size, weight, texture, and colors. Be sure they make observations of both the inside and outside of the shell. Have students draw the life cycle of oysters:



Obtain samples of oyster larvae and view them under a microscope (optional).

Explanation:

Have students look back at their notes on the video(s). Partner students and have them define ocean acidification and identify marine organisms that are affected by ocean acidification. Guide students to develop simple food chains/webs consisting of marine organisms that can be hurt by ocean acidification.

Afterwards, ask volunteers to share their definitions and chains/webs. Ask students to share their drawings of the oyster life cycle and identify where in the development of the oyster ocean acidification is going to cause the greatest damage to its development.

Elaboration:

Conduct the following ocean acidification investigation. You may wish to guide students to form a question and hypothesis before beginning the investigation.

1. Fill each jar with one of the following solutions:

1 cup of vinegar

1 cup of tap water

1 cup of sea water

$\frac{1}{2}$ cup of vinegar and $\frac{1}{2}$ cup sea water, mixed

2. Clean shells of any grit and dirt. Dry the shells well and weigh each one, taking the time to record observations about the shell on the data sheet. Note its size, color, shape, texture and weight.

If you are unable to locate an accurate scale to weigh each shell, you can still conduct this experiment by making observations about what you see before, during and after the experiment.

3. Place each shell in a jar containing a different liquid and be sure to record which shell went into which jar.

4. Leave the jars for one-two weeks, continuing to make observations on the data sheet about changes you see in this time (such as fading color and changes in shape and texture). Time scales may vary depending on your class requirements.

5. Take the shells out of the solution at the end of the investigation and dry them thoroughly. Re-weigh each shell and record any changes. Do not leave them exposed to the air for extended periods before re-weighing them. Record your observations, again on the data sheet, and compare with the original information. Note any changes in size, color, shape, texture and weight.

Have the students create a graph displaying the weights of the oyster shells before and after soaking in the solutions.

You can also access the data sheet template at www.redmap.org.au.

Ocean Acidification Data Sheet

Name of scientist _____

Grade of scientist _____

Date of experiment _____

Tap water

Date _____

Shell weight

Before _____

Date _____

Shell weight after _____

Observations

Sea water Observations

Date _____

Shell weight

Before _____

Date _____

Shell weight after _____

Sea water and vinegar Observations

Date _____

Shell weight

Before _____

Date _____

Shell weight after _____

Vinegar Observations

Date _____

Shell weight

Before _____

Date _____

Shell weight after _____

Conclusions _____

Evaluation: Students can make posters of their findings and share them with the class. Also, have students answer the focus questions in their science journals and share their responses with the class.

Materials:

4 clean glass jars
4 shells
1 cup vinegar
1 cup tap water
1 cup of sea water
½ cup of vinegar and ½ cup sea water, mixed
electronic scales
oyster shells
oyster larvae (optional)
science journals
graph paper (optional)

Audio Visual Materials: Computer with internet access to view *CO2, the Other Problem* video and/or *Acid Test*.

Vocabulary: plankton, phytoplankton, zooplankton, carbon dioxide, acidic, emissions, and calcium carbonate shells, food chain, food web, pH

Teacher Preparation:

Answers to focus questions:

- *Ocean acidification is the process caused by increasing man-made carbon dioxide emissions, by which the oceans are becoming more acidic. Rising carbon dioxide emissions, mostly from the burning of fossil fuels for energy, has led to a 30 percent rise in ocean acidity since the Industrial Revolution.*
- *Ocean acidification leads to a reduction in the amount of carbonate ions in the water. Many marine organisms need carbonate ions for the calcium carbonate needed to form skeletons and produce shells. Species under the most threat include corals, crabs, lobsters, clams and oysters.*
- *Declines in fish and shellfish will impact an important source of protein for millions of people. Fish provides protein for more than 2.9 billion people. Fishermen who make their living from the sea will be negatively affected. 47.5 million fishermen make their income from the sea.*
- *What can be done to prevent ocean acidification? Reduce carbon dioxide emissions produced by the burning of fossil fuels used for transportation (cars, busses, airplanes, trains etc.) and energy (coal, oil and gas power plants).*

If your class is unable to visit a local oyster farm, gather oyster shells and break them into workable sizes that fit into the glass jars used in the investigation.