

RESOURCE LIBRARY
ACTIVITY : 45 MINS

Save the Plankton, Breathe Freely

Students calculate how many of the breaths they take each day come from the phytoplankton, *Prochlorococcus*. Students use data collection and calculations to understand how the health of the ocean affects their lives.

GRADES

3 - 5

SUBJECTS

Arts and Music, Biology, Health, Earth Science, Oceanography, Experiential Learning, Geography, Physical Geography, Mathematics

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OVERVIEW

Students calculate how many of the breaths they take each day come from the phytoplankton, *Prochlorococcus*. Students use data collection and calculations to understand how the health of the ocean affects their lives.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/save-the-plankton-breathe-freely/>

DIRECTIONS

1. Discuss Earth's oxygen resources.

Ask: *Where does the oxygen we breathe come from?* Explain to students that rainforests are responsible for roughly one-third (28%) of the Earth's oxygen but a huge amount (from 50% to 85%) of the oxygen in the atmosphere is produced by marine plants. The remaining 2 percent of Earth's oxygen comes from other sources. The ocean produces oxygen through the plants

(phytoplankton, kelp, and algal plankton) that live in it. These plants produce oxygen as a byproduct of photosynthesis, a process which converts carbon dioxide and sunlight into sugars the organism can use for energy. One type of phytoplankton, *Prochlorococcus*, releases countless tons of oxygen into the atmosphere. It is so small that millions can fit in a drop of water. *Prochlorococcus* has achieved fame as perhaps the most abundant photosynthetic organism on the planet. Dr. Sylvia A. Earle, a National Geographic Explorer, has estimated that *Prochlorococcus* provides the oxygen for one in every five breaths we take.

2. Have students collect and analyze data.

Distribute a copy of the worksheet Breath Calculations to each student. Then divide students into small groups of three to measure and record the number of breaths taken in 30 seconds. Ask them to assign roles: timer, breather, and data recorder. After all groups have collected and recorded their data, have students independently calculate how many breaths they take in one minute, one hour, and one day. Finally, have students calculate the number of breaths that come from the phytoplankton, *Prochlorococcus*.

3. Discuss the importance of phytoplankton and ways humans can positively influence phytoplankton levels and overall ocean health.

Explain to students that phytoplankton form the base of the marine food web. The health of all organisms in the ocean is connected to the health of phytoplankton. Use the provided Carbon Cycle illustration and information in the Background & Vocabulary tab of this activity to build students' content knowledge about phytoplankton's role in oxygen production and the carbon cycle. Ask: *Why is it important that we protect our oceans and the plankton that live in them? What are some ways we can protect the ocean?* Explain to students that they can help protect plankton by decreasing pollution, using less energy, urging individuals and companies to stop destroying habitat on land and in the ocean, and encouraging others to stop overharvesting ocean wildlife. An important part of saving the ocean is working together and educating others about why it is important.

4. Have students create a t-shirt or bumper sticker.

Have students create a t-shirt or a bumper sticker to increase public awareness about the problem with their own ocean health outreach slogan; for example, Save the Phytoplankton—Breathe More Air!

Informal Assessment

Assess student comprehension by evaluating the accuracy of their calculations and their contributions to the class discussion.

Extending the Learning

Have students research and compare the volume of air used by a human in one day to the volume of air that algae output (about 330 billion tons per year). Have students blow one breath of air into a balloon. Place the balloon in a 2,000 milliliter beaker partially filled with water. Measure the displacement that occurs.

OBJECTIVES

Subjects & Disciplines

- Arts and Music
- **Biology**
 - Health
- **Earth Science**
 - Oceanography
- Experiential Learning
- **Geography**
 - Physical Geography
- Mathematics

Learning Objectives

Students will:

- describe the ratio between different sources of ocean oxygen production
- perform basic calculations based on raw data collection
- explain the importance of a healthy ocean
- identify ways humans can positively influence ocean health
- create a product to educate others through a mass media medium

Teaching Approach

- Learning-for-use

Teaching Methods

- Cooperative learning
- Discussions
- Experiential learning
- Hands-on learning

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Learning and Innovation Skills
 - Communication and Collaboration
 - Creativity and Innovation
- Critical Thinking Skills
 - Creating
 - Understanding

National Standards, Principles, and Practices

NCTM PRINCIPLES AND STANDARDS FOR SCHOOL MATHEMATICS

- Algebra (3-5) Standard 2:

Represent and analyze mathematical situations and structures using algebraic symbols

NATIONAL COUNCIL FOR SOCIAL STUDIES CURRICULUM STANDARDS

- Theme 3:

People, Places, and Environments

- Theme 9:

Global Connections

NATIONAL GEOGRAPHY STANDARDS

- Standard 14:

How human actions modify the physical environment

- **Standard 15:**

How physical systems affect human systems

- **Standard 16:**

The changes that occur in the meaning, use, distribution, and importance of resources

NATIONAL SCIENCE EDUCATION STANDARDS

- **(K-4) Standard C-3:**

Organisms and environments

- **(K-4) Standard F-4:**

Changes in environments

OCEAN LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- **Principle 4a:**

Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.

- **Principle 6g:**

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.

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Balloon
- Beaker
- Pencils
- Stopwatch
- Water

REQUIRED TECHNOLOGY

- Tech Setup: 1 computer per classroom, Projector

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction
- Small-group instruction

BACKGROUND & VOCABULARY

Background Information

Prochlorococcus and other ocean phytoplankton are responsible for 70 percent of Earth's oxygen production. However, some scientists believe that phytoplankton levels have declined by 40 percent since 1950 due to the warming of the ocean.

Ocean temperature impacts the number of phytoplankton in the ocean. Phytoplankton need sunlight and nutrients to grow. Since phytoplankton depend on photosynthesis, they have to live near the ocean surface. Nutrients come to the surface as a result of the global conveyor belt—an upwelling current that circulates cold water and nutrients from deeper waters to warmer surface waters. As the oceans warm, there is less circulation of warm and cold water by the global conveyor belt. As a result, less mixing and circulation is occurring between the ocean depths. As the ocean water gets warmer, there are less nutrients for the plankton to eat. This means less photosynthesizing, which decreases phytoplankton's carbon dioxide absorption and oxygen production.

Phytoplankton are extremely important to the Earth's carbon cycle; they help to process and store carbon. In addition to oxygen production, phytoplankton are responsible for most of the transfer of carbon dioxide from the atmosphere to the ocean. Carbon dioxide is consumed during photosynthesis and the carbon is incorporated and stored in the phytoplankton. This is similar to how trees store carbon in their leaves and wood. Worldwide, this plankton "biological carbon pump" transfers about 10 gigatonnes (1 gigatonne=1 billion tons) of carbon from the atmosphere to the deep ocean each year. Even small changes in the growth of phytoplankton may affect atmospheric carbon dioxide concentrations, which would cause further climate change and speed up the warming of surface temperatures.

Humans can protect plankton and help overall ocean health by decreasing pollution, overharvesting, and habitat destruction.

Prior Knowledge

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Recommended Prior Activities

- None

Vocabulary

| Term | Part of Speech | Definition |
|-----------------------|-----------------------|---|
| algae | <i>plural noun</i> | (singular: alga) diverse group of aquatic organisms, the largest of which are seaweeds. |
| atmosphere | <i>noun</i> | layers of gases surrounding a planet or other celestial body. |
| byproduct | <i>noun</i> | substance that is created by the production of another material. |
| carbon cycle | <i>noun</i> | series of processes in which carbon (C) atoms circulate through Earth's land, ocean, atmosphere, and interior. |
| carbon dioxide | <i>noun</i> | greenhouse gas produced by animals during respiration and used by plants during photosynthesis. Carbon dioxide is also the byproduct of burning fossil fuels. |
| displacement | <i>noun</i> | forced removal of something, often people or organisms, from their communities or original space. |
| food web | <i>noun</i> | all related food chains in an ecosystem. Also called a food cycle. |
| kelp | <i>noun</i> | type of seaweed. |
| marine | <i>adjective</i> | having to do with the ocean. |
| ocean | <i>noun</i> | large body of salt water that covers most of the Earth. |
| organism | <i>noun</i> | living or once-living thing. |
| oxygen | <i>noun</i> | chemical element with the symbol O, whose gas form is 21% of the Earth's atmosphere. |
| photosynthesis | <i>noun</i> | process by which plants turn water, sunlight, and carbon dioxide into water, oxygen, and simple sugars. |
| phytoplankton | <i>noun</i> | microscopic organism that lives in the ocean and can convert light energy to chemical energy through photosynthesis. |

| Term | Part of Speech | Definition |
|----------|------------------------------|---|
| plankton | <i>plural</i> <i>noun</i> | (singular: plankton) microscopic aquatic organisms. |

For Further Exploration

Websites

- [NOAA: What are phytoplankton?](#)

FUNDER

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