

OCEAN ABIOTIC FACTORS

How do abiotic factors and physical processes impact life in the ocean?

OVERVIEW

Students define and provide examples of abiotic and biotic factors of different ecosystems. Then they investigate the importance of abiotic factors and physical processes within ocean ecosystems.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/ocean-abiotic-factors/>

DIRECTIONS

1. Build background on the abiotic and biotic components of ecosystems.

State that the root of the word *ecology* is the Greek word *oikos*, meaning "house." *Ecosystem* literally means a "system of houses." Ecology is the study of nature's houses and the organisms living in them. Ask: ***Does anyone know the scientific term for the "living" components of an ecosystem?*** Elicit from students that a *biotic factor* is any living component of the environment and ask for examples, such as plants, animals, fungi, algae, and bacteria. Ask: ***Does anyone know the scientific term for the "non-living" components of an ecosystem?*** Elicit from students that an *abiotic factor* is any non-living component of the environment and ask for examples, such as sunlight, temperature, moisture, wind or water currents, soil type, and nutrient availability. Display the illustration of ocean abiotic factors. Tell students that the interaction of multiple biotic and abiotic, or physical, factors determines which species can survive in a particular ecosystem.

2. Have students define abiotic factors and physical processes that impact ocean ecosystems.

Explain to students that, in this activity, they will learn more about abiotic factors and physical processes that impact ocean ecosystems. Arrange students in small groups and give each group two or three index cards and a copy of the Ocean Abiotic Factors handout. Read aloud the directions. Explain that students will use the handout to create concept map vocabulary cards and learn the terms. Assign two or three terms to each group. On one side of each card, have students use a pencil to divide the card into three sections. For each section, have them record the following information:

- a definition of the term in their own words
- a symbol or drawing to represent the term
- one example of how the term affects organisms living in the ocean

After they finish, collect the cards and post them on the board. As a class, go over each card and match it to its corresponding term/definition. Address students' questions.

3. Have students investigate the abiotic factors and physical processes of different ocean ecosystems.

Tell students that they will next learn about three different ocean ecosystems (rocky shore, coral reef, and open ocean) and identify abiotic factors that affect the organisms living in them. Distribute a copy of Ocean Ecosystem Descriptions to each small group. You can also distribute copies of Ocean Ecosystem Illustrations, or you can project the Ecosystem Illustration gallery instead. Assign each group one of the three ecosystems. Have groups read their assigned ecosystem's brief description and look at its matching illustration to learn what

abiotic factors or physical processes impact organisms in the ecosystem. Ask groups to label all of the abiotic factors they see in the illustration. Next, ask groups to list other abiotic factors that are not seen in the illustration. Then provide each group with a copy of the Ocean Abiotic Factors Chart. Have students decide which abiotic factors are impacting the organisms in each of the ecosystems and place check marks next to those factors. Then have students write one or more examples of how that factor is impacting organisms in the ecosystem. Facilitate as needed, giving students about 15 minutes for their small-group work. Finally, as a class, facilitate a discussion in which students share what they learned about each ecosystem. As examples of abiotic-biotic interactions are given, ask volunteers to fill in the Ocean Abiotic Factors Chart projected on the board.

4. Have students discuss how humans can impact the abiotic factors and processes of ocean ecosystems.

Emphasize that humans should be listed as a biotic factor and that they can impact the abiotic factors and processes of ocean ecosystems. In their small groups, have students identify and discuss different ways humans are impacting the abiotic factors in their assigned ecosystem. After a few minutes of small-group discussions, bring the class together for further discussion. Ask: ***What are ways in which humans can impact the abiotic factors in these ocean ecosystems?*** Elicit and discuss student responses. For example, over half of the American population lives within 50 miles of the coast (NOAA, 2008). Ask: ***How could this impact coastal ecosystems?*** Elicit from students that this could destroy coastal habitat, increase pollution, strain water resources, and increase non-native species. Encourage students to list impacts due to the Gulf oil spill, ocean warming, and land-based runoff from nutrients/fertilizers, soil, and pollution. Explain that all biotic and abiotic factors are important because they are all interacting to maintain the health and balance of an ecosystem.

Informal Assessment

Lead a discussion in which students compare and contrast the abiotic factors and physical processes impacting the three different marine ecosystems. Ask students to analyze and discuss which marine ecosystem is the most inhospitable in terms of its abiotic characteristics.

Extending the Learning

Use the National Geographic [MapMaker Interactive](#) and the temperature, chlorophyll, and surface currents layers to demonstrate how one ocean biotic factor, like chlorophyll concentration, is affected by two abiotic factors, like sea surface temperature and currents.

OBJECTIVES

Subjects & Disciplines

Geography

- [Physical Geography](#)

Science

- Earth science
- [Oceanography](#)

Learning Objectives

Students will:

- list abiotic factors of ocean ecosystems
- identify and describe abiotic factors and physical processes that impact ocean ecosystems
- list ways humans interact with and impact ocean ecosystems

Teaching Approach

- Learning-for-use

Teaching Methods

- Cooperative learning
- Discussions
- Hands-on learning
- Information organization

Skills Summary

This activity targets the following skills:

- 21st Century Themes
 - Global Awareness
- Critical Thinking Skills
 - Analyzing
 - Understanding
- Geographic Skills
 - Acquiring Geographic Information
 - Analyzing Geographic Information

National Standards, Principles, and Practices

NATIONAL GEOGRAPHY STANDARDS

- **Standard 1:**

How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

NATIONAL SCIENCE EDUCATION STANDARDS

- **(9-12) Standard B-4:**

Motions and forces

- **(9-12) Standard C-4:**

Interdependence of organisms

- **(9-12) Standard C-6:**

Behavior of organisms

OCEAN LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- **Principle 1c:**

Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth's rotation (Coriolis effect), the Sun, and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation.

- **Principle 5f:**

Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is "patchy". Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.

- **Principle 6f:**

Coastal regions are susceptible to natural hazards (such as tsunamis, hurricanes, cyclones, sea level change, and storm surges).

PREPARATION

What You'll Need

MATERIALS YOU PROVIDE

- Colored markers
- Index cards
- Pencils
- Transparent tape

REQUIRED TECHNOLOGY

- Tech Setup: 1 computer per classroom, Projector

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction

RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- [Ocean Abiotic Factors](#)
- [Ocean Ecosystem Descriptions](#)
- [Ocean Ecosystem Illustrations](#)
- [Ocean Abiotic Factors Chart](#)

RESOURCES PROVIDED: IMAGES

- Abiotic Factors in a Coral Reef
- Ecosystems Illustration Gallery

BACKGROUND & VOCABULARY

Background Information

Marine ecosystems are comprised of the living organisms that have adapted to the abiotic factors and physical processes that characterize each ecosystem. Biotic factors include plants, animals, fungi, algae, and bacteria. Abiotic factors include sunlight, temperature, moisture, wind or water currents, soil type, and nutrient availability. Ocean ecosystems are impacted by abiotic factors in ways that may be different from terrestrial ecosystems. Humans are biotic components of marine ecosystems and have a significant impact on the maintenance of healthy, well-balanced ocean ecosystems.

Prior Knowledge

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Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
abiotic	<i>adjective</i>	lacking or absent of life.
biotic factor	<i>noun</i>	effect or impact of an organism on its environment.
current	<i>noun</i>	steady, predictable flow of fluid within a larger body of that fluid.
ecosystem	<i>noun</i>	community and interactions of living and nonliving things in an area.
nutrient	<i>noun</i>	substance an organism needs for energy, growth, and life.
oxygen	<i>noun</i>	chemical element with the symbol O, whose gas form is 21% of the Earth's atmosphere.

Term	Part of Speech	Definition
salinity	<i>noun</i>	saltiness.
substrate	<i>noun</i>	base of hard material on which a non-moving organism grows. Also called substratum.
temperature	<i>noun</i>	degree of hotness or coldness measured by a thermometer with a numerical scale.
tide	<i>noun</i>	rise and fall of the ocean's waters, caused by the gravitational pull of the moon and sun.
wave	<i>noun</i>	moving swell on the surface of water.

For Further Exploration

Websites

- [NASA Ocean Motion: Wind Driven Surface Currents](#)
- [U.S. Environmental Protection Agency: Oceans, Coasts, Estuaries, and Beaches](#)
- [NOAA: The Global Conveyor Belt](#)
- [NASA: Amateur Scientist's Guide](#)
- [Reef Education Network: Oceans—A Whole New World](#)
- [NOAA: Surface Ocean Currents](#)
- [National Geographic Education: National Teacher Leadership Academy \(NTLA\)](#)

FUNDER



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