

RESOURCE LIBRARY
ACTIVITY : 2 HRS

Create an Imaginary Marine Ecosystem

Students create a marine ecosystem that includes two fictitious organisms. They describe the adaptive, trophic, and symbiotic relationships between the biotic and abiotic components of the ecosystem.

GRADES

9 - 12+

SUBJECTS

Biology, Ecology, Earth Science, Oceanography, Geography, Physical Geography

CONTENTS

2 PDFs, 2 Images

OVERVIEW

Students create a marine ecosystem that includes two fictitious organisms. They describe the adaptive, trophic, and symbiotic relationships between the biotic and abiotic components of the ecosystem.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/marine-ecosystem-invention/>

DIRECTIONS

1. Review vocabulary.

Explain to students that they will work in small groups to create an imaginary marine ecosystem illustrating the various trophic levels, adaptations, symbiotic relationships, and niches of a community of marine organisms living in that ecosystem. Write the following vocabulary terms on the board and ask students to define them and give examples:

- abiotic and biotic factors
- food web
- adaptation, niche, habitat
- symbiosis: mutualism (both benefit); parasitism (one benefits/one harmed); commensalism (one benefits/one unharmed)
- trophic levels: producer (autotroph); primary/secondary/tertiary consumer (heterotroph); herbivore, carnivore, omnivore, decomposer, parasite, apex predator

2. Introduce the activity.

Divide students into small groups and distribute the two worksheets: Imaginary Marine Ecosystem Instructions & Organism Descriptions and Imaginary Marine Ecosystem Analysis. Also give each group markers and two pieces of butcher paper. Read aloud the directions. Clarify that students will create at least eight different organisms to inhabit their imaginary ecosystem. Six must be real marine organisms and live in the same real world ecosystem. The other two must be organisms that students invent. Use the worksheet to review what students should include for each organism, using the terrestrial example provided. Next, explain that students will create an imaginary ecosystem illustration. The illustration will include all eight organisms and the important abiotic components of the ecosystem, including water, sediment, rock, energy source, and other habitat features such as ocean floor features. Then, explain that students will create an imaginary ecosystem food web. Tell students to label each organism by name and trophic level and to use different colored arrows to represent each trophic level. Emphasize the importance of using arrows to show the proper flow of energy between organisms and trophic levels. If needed, refer to the two provided examples of rocky intertidal food web diagrams as examples. Finally, explain that students will answer the questions on the Imaginary Marine Ecosystem Analysis worksheet and present their ecosystems to the class.

3. Give small groups time to complete the activity.

Answer any questions students may have. In their small groups, give students 1 hour, 30 minutes to complete the project, which includes organism descriptions, an ecosystem drawing, a food web, and analysis questions. Remind them of the time periodically and make sure that they are making appropriate progress.

4. Have groups share their ecosystems and discuss them.

With approximately 20 minutes of class time remaining, ask groups to present and discuss

their imaginary marine ecosystems to the rest of the class. Allow other students to ask questions about each ecosystem and their imaginary organisms. To wrap up the activity and assess student comprehension, ask students to discuss question #11 from the Imaginary Marine Ecosystem Analysis worksheet. Ask: *How do ecological and symbiotic relationships shape your imaginary marine ecosystem? Why is it important to understand these relationships?* Display each group's work in the classroom and refer to them throughout the remainder of the unit.

Modification

As time allows, challenge students to create additional imaginary organisms for their ecosystems.

Tip

Have students mark their invented organisms with an asterisk to avoid misconceptions about the real versus imagined ones.

Modification

You may choose to modify the activity as needed based on time constraints, group sizes, and student background knowledge. For example, the organisms and ecosystems used can be based on those provided in Lesson 2: Marine Ecosystems and Biodiversity.

Informal Assessment

Check students' completed Imaginary Ecosystem Analysis worksheet for accuracy and comprehension.

Extending the Learning

Have students add humans to their imaginary ecosystems and discuss the roles and impacts humans might have within the ecosystem.

OBJECTIVES

Subjects & Disciplines

Biology

- Ecology

Earth Science

- Oceanography

Geography

- Physical Geography

Learning Objectives

Students will:

- describe the abiotic and biotic components of a marine ecosystem
- list several marine organisms and explain their trophic relationships using a food web
- describe the adaptations and niches of several marine organisms
- predict the effects abiotic changes or trophic imbalances might have upon an ecosystem as a whole

Teaching Approach

- Learning-for-use

Teaching Methods

- Brainstorming
- Cooperative learning
- Discussions
- Information organization

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Learning and Innovation Skills
 - Communication and Collaboration
 - Creativity and Innovation

- Life and Career Skills
 - Initiative and Self-Direction
- Critical Thinking Skills
 - Analyzing
 - Applying
 - Creating
 - Understanding
- Geographic Skills
 - Answering Geographic Questions

National Standards, Principles, and Practices

NATIONAL GEOGRAPHY STANDARDS

- Standard 14:

How human actions modify the physical environment

- Standard 8:

The characteristics and spatial distribution of ecosystems and biomes on Earth's surface

NATIONAL SCIENCE EDUCATION STANDARDS

- (9-12) Standard C-4:

Interdependence of organisms

- (9-12) Standard D-1:

Energy in the earth system

- (9-12) Standard F-4:

Environmental quality

OCEAN LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- Principle 5d:

Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (such as symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

- Principle 5e:

The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.

• **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 5i:**

Estuaries provide important and productive nursery areas for many marine and aquatic species.

Preparation

What You’ll Need

MATERIALS YOU PROVIDE

- Butcher paper
- Colored pencils
- Markers
- Pencils

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction
- Small-group instruction

BACKGROUND & VOCABULARY

Background Information

Marine ecosystems and the organisms and habitats that comprise them are highly diverse. They are made up of several interacting biotic and abiotic components that define the trophic characteristics, symbiotic relationships, adaptive strategies, and niche selection that exist within different ecosystems. Alterations of abiotic conditions or food webs caused by natural and anthropogenic factors can result in negative effects—including ecosystem imbalances—that can disrupt the entire marine ecosystem.

Prior Knowledge

["ecological principles related to food webs, adaptations, niche selection, symbioses", "interactions between biotic and abiotic ecosystem components"]

Recommended Prior Activities

- [Ecological Relationships](#)
- [Marine Ecology Video Scavenger Hunt](#)

Vocabulary

Term	Part of Speech	Definition
adaptation	<i>noun</i>	a modification of an organism or its parts that makes it more fit for existence. An adaptation is passed from generation to generation.
food chain	<i>noun</i>	group of organisms linked in order of the food they eat, from producers to consumers, and from prey, predators, scavengers, and decomposers.
food web	<i>noun</i>	all related food chains in an ecosystem. Also called a food cycle.
habitat	<i>noun</i>	environment where an organism lives throughout the year or for shorter periods of time.
marine ecosystem	<i>noun</i>	community of living and nonliving things in the ocean.
niche	<i>noun</i>	role and space of a species within an ecosystem.
trophic level	<i>noun</i>	one of three positions on the food chain: autotrophs (first), herbivores (second), and carnivores and omnivores (third).

For Further Exploration

Websites

- [National Geographic Education: National Teacher Leadership Academy \(NTLA\)](#)

FUNDER

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