



Imagine a Kelp Forest

Students will explore the kelp forest ecosystem by conducting research and by writing imaginary narratives through an activity that integrates science and language arts.

SUBJECT

Science
English/Language Arts

TIME

Three to four class periods

OBJECTIVES

Students will be able to

- describe characteristics of a kelp forest ecosystem.
- explain the interactions between habitats and species.
- give examples of producers, consumers and scavengers in a kelp forest.
- draw and label the parts of a kelp plant.
- identify human uses of kelp.

MATERIALS

- "Secrets of the Kelp Forest" video (2 minutes 53 seconds); available to stream or download at www.pbs.org/oceanadventures/video/kelpforest
- Notebook paper
- A class set of 11-1/2"x17" paper
- Colored pencils or markers
- Poster paper (one for each student)
- Internet or library access
- Ecosystem Data Table Student Handout (two copies for each student)

BACKGROUND

Beautiful and biologically complex kelp plants grow underwater and create underwater kelp forests in the rocky coastline areas of the world's oceans. They are a vital part of the kelp forest ecosystem, which provides food and shelter for diverse ocean species and is also a source of economic stability and recreation for fisherman and divers everywhere.

Giant kelp (*Macrocystis pyrifera*) is a type of brown algae that can grow at depths of greater than 100 feet (30 meters). Anchored to the rocky ocean bottom with structures called holdfasts, kelp grows toward the sunlit surface of the water, held upright by gas-filled bladders at the base of the leaf-like blades. What looks like the stem of the kelp plant is called a stipe. As the blades reach the surface of the water, they spread out and float, creating a canopy. Because of this structure, kelp forest ecosystems provide multiple living spaces for the organisms that inhabit them. Ocean organisms can live up in the canopy, among the stipes, on the blades and in the holdfasts. The constant source of abundant food in this ecosystem enables these organisms to have their own niche in the food web, providing producers, consumers and decomposers with plenty of opportunity to feed.

All organisms that live in the kelp forest need to be able to find food, reproduce, avoid being eaten and adjust to the changing physical environment. Today, one of the main concerns for kelp forests is maintaining a balanced ecosystem. Threats to the kelp forest ecosystem include sewage dumping, the overharvesting of kelp plants and overfishing. Studying kelp forest organisms will help students understand the role of biotic and abiotic factors that affect the kelp forest community, from sea otters to sea urchins, from abalone to crabs.

STANDARDS**National Science
Education Standards
Grades 5-8**

www.nap.edu/readingroom/books/nsea/6d.html#ls

Life Science -**Content Standard C:**

Regulation and behavior
Populations and ecosystems
Diversity and adaptations of organisms

**Ocean Literacy: Essential
Principles and Fundamental
Concepts**

<http://coexploration.org/oceanliteracy/>

Essential Principle #5:

The ocean supports a great diversity of life and ecosystems.

PROCEDURE**Days 1–2**

1. Begin by exploring with your class the concept of an ecosystem (an area where living things interact with each other and their physical environment). Make a list of different ecosystems with your students. Talk about the biotic (living) and abiotic (nonliving—inert materials such as soil, water, minerals and gases) factors that affect some of these ecosystems.
2. Next, create a list of all the different marine ecosystems that your students can think of (e.g., coral reef, deep sea, rocky intertidal zone, sandy beach, mangrove, estuary, salt marsh). Make a list of the biotic and abiotic factors that specifically affect marine ecosystems.
3. Next, break students into groups of two to four to brainstorm how characteristics of a marine ecosystem impact an animal's physical and behavioral adaptations. Distribute the Ecosystem Data Table handout. The table has four columns, titled Biotic Factors, Abiotic Factors, Physical Adaptations and Behavioral Adaptations. Students will list biotic and abiotic factors and then describe possible physical and behavioral adaptations for each.
4. As a class, share what each group discussed. End your discussion on how the characteristics of a marine ecosystem ultimately impact an animal's survival.
5. Hand out another copy of the Ecosystem Data Table. Tell your students that they are going to watch a video of a kelp forest ecosystem twice. The first time will be without sound and the second time will be with sound. Tell the students that during each viewing they are to fill in their data table about the kelp forest ecosystem.
6. View the short video "Secrets of the Kelp Forest" on the **Ocean Adventures** Web site (www.pbs.org/oceanadventures/video/kelpforest) without sound. Tell students to use their observation skills to collect as much data for their table as possible. After watching the video, ask students what questions they now have. Also ask them what information they still want to know and will be listening for when they view the video with sound.

7. View the video with sound. Afterward, ask the students what information they were able to obtain that they didn't get without the sound. Discuss any questions that they still have.
8. Have the students share the information they collected on their data tables with the rest of the class.
9. Tell the students that it is now their job to do some research on the kelp forest ecosystem. Hand out an 11-½"x17" sheet of paper and have them fold it so that there are four equal sections on the front and back, creating eight sections. They should title each section with one of the following topics:
 - a. Draw and label the kelp plant and all of its parts.
 - b. Describe a kelp forest.
 - c. List biotic and abiotic factors affecting a kelp forest.
 - d. List organisms that live in a kelp forest.
 - e. Name human activities that can harm a kelp forest ecosystem.
 - f. Give examples of producers, consumers (herbivores and carnivores) and scavengers in a kelp forest.
 - g. Choose two of the following kelp forest inhabitants and draw and describe their characteristics: sea cucumber, sea otter, red abalone, fish-eating anemone, bat star, brown turban snail, and decorator crab.
 - h. List human uses of the kelp plant historically to present day.The students will complete each of the eight sections by conducting Internet research or using the library to collect information.

Days 3–4

1. The students will now use what they have learned about the kelp forest ecosystem to create an imaginary narrative that demonstrates what they know. Tell your students that each of them is a scientist who has discovered a new species of animal found in giant kelp forests around the world.
2. First, have the students do a "free write," answering questions like: What sex is the animal? How does it reproduce? What does it eat? How does it eat? What kinds of adaptations does it have that enables it to live in the kelp forest ecosystem? Where does it live within the ecosystem? What are its predators? How can it damage and/or help maintain the kelp forest ecosystem?
3. Have students share out their ideas and add to their own lists.
4. On another sheet of paper students can begin drawing their imaginary animal.

5. Ask students to write a story about their "new discovery."
They should write the story as if they were scientists and as if they discovered the new species in the kelp forest while scuba diving. They should include the following:
 - how they came across the species and what they were doing at that moment
 - how they felt when finding the new species
 - what they named the species
 - what happened when they saw it and what it was doing
 - what it looks like
 - its physical and behavioral adaptations
 - the way it affects the kelp forest ecosystem, both positively and negatively
 - how it is affected by the abiotic and biotic factorsBe sure to pay careful attention to how the students include factual information about the kelp forest ecosystem and how their new species successfully lives in this habitat.

6. Compile all imaginary narratives and pictures into one class anthology to share with the language arts department or other colleagues and students at your school.

Optional

- Have students present their imaginary narratives to small groups of students or to the whole class.
- In addition to the drawing and the narrative, you may choose to have them do a multimedia-based presentation or iMovie depicting their story. Be sure to let students utilize the KQED download library of pictures. <http://www.pbs.org/kqed/oceanadventures/educators/library/>

Assessment

- Have students draw and label a kelp forest ecosystem, including organisms and their roles.
- Give a quiz with a picture of the kelp plant and have students label its parts.
- Ask students to make a list of everyday items that contain kelp.

Extensions

- Choose another ecosystem or habitat and have students conduct research and write another creative narrative for a different imaginary animal.
- Have students research the issues affecting the kelp forest ecosystems around the world and how human activities are damaging ocean ecosystems. Students can create educational presentations about these issues and present them to the class or post them around school as a way of educating the school community.
- Take a virtual field trip to the Monterey Bay Aquarium to view life in a kelp forest. View the kelp forest Web cam at http://www.mbayaq.org/efc/efc_kelp/kelp_cam.asp and the kelp forest underwater Web cam at http://www.mbayaq.org/efc/efc_kelp/kelp_underwatercam.asp

Lesson Resources

Students can use the following Web sites for their Internet searches:

- The National Marine Sanctuaries' Web site on kelp forest ecosystems
<http://sanctuaries.noaa.gov/about/ecosystems/welcome.html>
- Kelp Forest Activities, Videos and Resources, from the Monterey Bay Aquarium's Web site
http://www.mbayaq.org/efc/efc_kelp/kelp_resources.asp
- "Kelp Forest," an article from the Olympic Coast National Marine Sanctuary
<http://olympiccoast.noaa.gov/living/habitats/kelpforest/welcome.html>
- "Temperate Oceans," by the Missouri Botanical Society
<http://www.mbgnet.net/salt/oceans/forest.htm>
- "Plant Glossary," from the National Park Service
<http://www.webs.uidaho.edu/nsan/aliens/alienglossary.htm>

Additional Resources

Additional educator resources for ***Jean-Michel Cousteau: Ocean Adventures*** can be found at pbs.org/oceanadventures.

Also try:

- Cathedral of the Sea, a lesson plan from the PBS series Secrets of the Ocean Realm
<http://www.pbs.org/oceanrealm/intheschool/school1.html>

About the Author

Elsie Ovrahim is a middle school science teacher in Oakland and an independent contractor for KQED Education Network. KQED Education Network uses the power of KQED Public Broadcasting to inspire learning by providing projects for youth and curriculum materials and professional development for teachers, child-care providers and families.

CREDITS

Jean-Michel Cousteau: Ocean Adventures is produced by KQED Public Broadcasting and Ocean Futures Society.

The corporate sponsor is The Dow Chemical Company.

Additional major support comes from the Richard and Rhoda Goldman Foundation, KQED Campaign for the Future, and the Corporation for Public Broadcasting.

Ecosystem Data Table

BIOTIC FACTORS	ABIOTIC FACTORS	PHYSICAL ADAPTATIONS	BEHAVIORAL ADAPTATIONS