NATIONAL GEOGRAPHIC

RESOURCE LIBRARY
ACTIVITY : 1 HR

Marine Food Webs

Students investigate marine food webs and trophic levels, research one marine organism, and fit their organisms together in a class-created food web showing a balanced marine ecosystem.

GRADES

9 - 12+

SUBJECTS

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

CONTENTS

9 Images, 3 PDFs, 6 Links

OVERVIEW

Students investigate marine food webs and trophic levels, research one marine organism, and fit their organisms together in a class-created food web showing a balanced marine ecosystem.

For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/marine-food-webs/

DIRECTIONS

1. Build background about marine trophic pyramids and food webs.

Review with students that food chains show only one path of food and energy through an ecosystem. In most ecosystems, organisms can get food and energy from more than one source, and may have more than one predator. Healthy, well-balanced ecosystems are made up of multiple, interacting food chains, called food webs. Ask volunteers to come to the front

of the room and draw a pyramid and a web. Explain that the shapes of a pyramid and a web are two different ways of representing predator-prey relationships and the energy flow in an ecosystem. Food chains are often represented as food pyramids so that the different trophic levels and the amount of energy and biomass they contain can be compared. In the Marine Pyramids gallery, display the Marine Food Pyramid. Ask: *Based on this food pyramid, do you think there are more top predators (gray reef sharks, bluefin tuna) than producers (phytoplankton, seagrass, algae)? Why or why not?* Then display the Marine Ecological Pyramid and ask the same question. Lead students to observe the differences between the two graphics. The ecological pyramid should help them to see that while the traditional food pyramid displays the trophic levels and specific organisms, it does not accurately display the proportion of energy loss and biomass required between trophic levels. Finally, display the What We Eat Makes A Difference graphic and explain that on average, only 10 percent of energy and biomass in one trophic level is passed to the next higher level.

2. Have students analyze a marine food web example.

Display the Coral Reef Food Web gallery. Scroll through the illustrations and have students read the captions. Ask: *How are food webs similar to or different from food pyramids? Why do food webs have arrows between organisms and not just straight lines?* (Arrows represent the flow of energy and biomass between trophic levels.) Be sure to point out the role of decomposers and provide examples. Although decomposers are included in food webs, they are absent in food pyramids.

3. Have students research marine organisms.

Tell students that they will build their own marine food web for two interrelated ecosystems: mangroves and coral reefs. Have students work in pairs or individually. Assign each pair an organism, and have them use the mangrove and coral reef ecosystem illustrations in the Marine Ecosystems gallery for reference. Distribute a copy of the Marine Organism Notetaking worksheet. Have student pairs use the school computer lab and/or provided Internet

resources to research their organism and complete the worksheet. After checking the worksheets for completion and accuracy, give each student pair an index card to illustrate its organism and record the following information:

- common name of organism
- list of predators, if applicable
- list of prey, if applicable

If time is limited, let students print images of their organisms rather than drawing them.

4. Have students create a whole-class food web display.

After all students have completed their worksheets and made their organism index cards, ask students to present their organisms one trophic level at a time, gradually building the whole-class food web display. After all the cards are correctly placed on the display, have students connect interdependent species (predator-prey relationships) using string or thread. If possible, turn the string or thread into arrows and remind students that they represent the flow of energy and biomass from one organism (trophic level) to another. Prompt students to recognize trophic relationships between the mangrove and coral reef ecosystems.

5. Have a whole-class discussion about the food web display.

Allow plenty of time for discussion. Analyze the food web display as you discuss the interconnectedness of species within and between the mangrove and coral reef ecosystems. Ask:

- *What two ecosystems are represented in this interconnected food web?*
- *Which species are only predators? Which are only prey? Which are both?*
- *What would happen to the food web if one species were to become endangered or extinct? Which species would be affected? Which ecosystem would be affected?*
- *Why is phytoplankton so important to marine food webs?*
- *What happens to the amount of energy/biomass that is transferred from one trophic level to the next?*
- *What roles do humans play in marine food webs?*
- *How can human actions upset the balance of an ocean ecosystem?*

Informal Assessment

Students' ecosystems can be evaluated on the placement of each organism into the proper trophic level and on the labeling of how energy moves through the ecosystem. During the class discussion the teacher should prompt students to talk about the amount of energy that is lost between trophic levels using their organisms as examples. The key point of this activity is how much energy is retained and lost between each level of the food web.

Extending the Learning

As homework or an independent project, have students research a different marine ecosystem and construct a food web or food pyramid to represent that ecosystem.

OBJECTIVES

Subjects & Disciplines

Biology

- Ecology

Earth Science

- Oceanography

Geography

- Physical Geography

Learning Objectives

Students will:

- create a food web display to illustrate the trophic relationships between marine organisms
- identify common organisms living in a marine ecosystem
- research ecological facts about marine organisms
- prepare illustrated cards depicting marine organisms and their predator-prey relationships

Teaching Approach

- Learning-for-use

Teaching Methods

- Brainstorming
- Cooperative learning
- Discussions
- Information organization
- Research

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Communication and Collaboration
- Critical Thinking Skills
  - Analyzing
  - Creating
  - Understanding
- Geographic Skills
  - Acquiring Geographic Information
  - Analyzing Geographic Information
  - Organizing Geographic Information

National Standards, Principles, and Practices

NATIONAL GEOGRAPHY STANDARDS

• **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 C-5:**

Matter, energy, and organization in living systems

• **(9-12) Standard C-6:**

Behavior of organisms

• **(9-12) Standard D-1:**

Energy in the earth system

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 6b:**

From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Colored pencils
- Colored thread
- Index cards
- Large bulletin board
- Pencils
- Push pins

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per classroom, Projector

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction

BACKGROUND & VOCABULARY

Background Information

Every living thing in the ocean depends on energy. When an ecosystem is in balance, all organisms have sufficient energy and food to survive. When an imbalance occurs, every organism in the food web suffers. Food pyramids and food webs are used to represent these relationships and show how energy and food (biomass) is transferred and lost between trophic levels.

Prior Knowledge

["food webs and trophic levels"]

Recommended Prior Activities

- Mapping Marine Ecosystems
- Marine Food Chains and Biodiversity

Vocabulary

Term	Part of Speech	Definition
biomass	*noun*	living organisms, and the energy contained within them.
common name	*noun*	non-scientific name of a species, or what the organism is usually called.
decomposer	*noun*	organism that breaks down dead organic material; also sometimes referred to as detritivores
ecosystem	*noun*	community and interactions of living and nonliving things in an area.
food chain	*noun*	group of organisms linked in order of the food they eat, from producers to consumers, and from prey, predators, scavengers, and decomposers.

Term	Part of Speech	Definition
food pyramid	*noun*	diagram of a healthy diet that shows the number of servings of each food group a person should eat every day.
food web	*noun*	all related food chains in an ecosystem. Also called a food cycle.
habitat	*noun*	environment where an organism lives throughout the year or for shorter periods of time.
predator	*noun*	animal that hunts other animals for food.
prey	*noun*	animal that is hunted and eaten by other animals.
producer	*noun*	organism on the food chain that can produce its own energy and nutrients. Also called an autotroph.
scientific name	*noun*	the name, usually in Latin, of an organism's genus and species.
trophic level	*noun*	one of three positions on the food chain: autotrophs (first), herbivores (second), and carnivores and omnivores (third).

For Further Exploration

Websites

- Texas A&M University: Department of Oceanography—Marine Fisheries Food Webs
- National Geographic Education: National Teacher Leadership Academy (NTLA)

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