

**RESOURCE LIBRARY**  
ACTIVITY : 50 MINS

## Marine Food Chains and Biodiversity

Students use marine organism cards and trophic level classifications to identify and describe food chains in several marine ecosystems.

**GRADES**

9 - 12+

**SUBJECTS**

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

**CONTENTS**

3 Videos, 1 Link, 3 PDFs

## OVERVIEW

Students use marine organism cards and trophic level classifications to identify and describe food chains in several marine ecosystems.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/marine-food-chains-and-biodiversity/>

## DIRECTIONS

### 1. Define the role of marine microbes.

Explain to students that, in a single drop of salt water, thousands of microbes (tiny organisms), including bacteria and phytoplankton (tiny floating plants), are interacting to form the base of the food web for the entire ocean. The oxygen and biomass they produce also sustains terrestrial life. Tell students that phytoplankton (algae) take in sunlight, nutrients, carbon dioxide, and water to produce oxygen and food for other organisms. Ask: *What is this process called?* (photosynthesis) Explain that other microbes, like many bacteria, play a role at the other end of the food chain by breaking down dead plant and animal material and

changing it into a form that can be re-used as nutrients by phytoplankton and other organisms. Ask: *What is this process called?* (decomposition)

## 2. Watch the National Geographic video “Tiny New Sea Species Discovered.”

Show students the National Geographic video (2 minutes, 30 seconds) “Tiny New Sea Species Discovered.” Ask:

- *What is the goal of the Census of Marine Life?* (for scientists to try to uncover as much as possible about diversity, distribution, and abundance of life in the ocean within ten years)
- *What have scientists learned about the importance of microbes in the ocean?* (Microbes play a key role in the way nutrients move through the ocean.)
- *What do all microbes in the global ocean collectively weigh?* (the equivalent of 240 billion African elephants, or about 90 percent of all the ocean’s biomass)

Summarize that microbes, including phytoplankton and bacteria, are the beginning and end, respectively, of ocean food chains and are therefore essential components of marine ecosystems.

## 3. Introduce trophic level vocabulary.

Ask: *What is a food chain?* Ask students to list the organisms in a terrestrial or aquatic food chain that they are familiar with. Explain to students that the trophic level of an organism is the position it occupies on the food chain. An organism’s trophic level is measured by the number of steps it is away from a primary producer/autotroph (photosynthesizer). Write the trophic levels and definitions listed below on the board, leaving off the examples provided. Have students try to identify the trophic level for each of the organisms on their list. Invite volunteers to share their answers with the class. Discuss the correct answers. Next ask students to brainstorm ocean examples of each trophic level and write their correct responses on the board. Eventually, add all of the examples listed below.

- **primary producer/autotrophs**—organisms, like plants, that produce food. Examples: phytoplankton, algae
- **primary consumer/heterotroph**—an animal that eats primary producers. Examples: mussels, oysters, krill, copepods, shrimp
- **secondary consumer/heterotroph**—an animal that eats primary consumers. Examples: blue claw crab, lobster, seastar, humpback whale, silverside

- **tertiary consumer/heterotroph**—an animal that eats secondary consumers. Examples: shark, dolphin
- **apex predator/heterotroph**—an animal at the top of the food chain with no predators. Examples: shark, dolphin
- **decomposer/detritivores**—organisms that break down dead plant and animal material and wastes and release it again as energy and nutrients in the ecosystem. Examples: bacteria, fungi, worms, crabs

#### 4. Have students watch the National Geographic video “Krill.”

Explain to students they are going to watch a video that highlights a marine food chain. Tell students that while they are watching the film, they are going to write examples of organisms from each trophic level. When the film is over, they will identify each organism’s trophic level using the information from the board. Show students the National Geographic video (2 minutes) “Krill.” After the video is over, allow students a couple of minutes to properly identify the trophic levels of each of the organisms shown in the film. Ask:

- *What is the ultimate source of energy in this ecosystem?* (the sun; photosynthesis)
- *What is the primary producer in the video?* (phytoplankton and other algae)
- *What is the primary consumer in the video? Is it an herbivore or carnivore?* (krill; herbivore)
- *What secondary and tertiary consumers are shown in the video? Are they herbivores or carnivores?* (anchovies, sardines, birds, salmon, tuna, humpback and blue whales; carnivores)

#### 5. Have students create food chains.

Remind students that food chains connect organisms through energy transfer among producers, consumers, and decomposers. These energy levels are called trophic levels. A significant amount of energy is lost between trophic levels. Divide students into five groups. Assign each group one of the following marine ecosystems:

- Coral Reef
- Kelp Forest
- Open Ocean
- Rocky Shore
- Sandy Shore

Have groups identify the geographic locations of their marine ecosystems on their World Physical Tabletop Maps, included in the Physical World MapMaker Kit. Then give each group its assigned Marine Ecosystem Cards Handout, and each student a Feeding Frenzy worksheet.

Have students cut out the ecosystem cards, discuss the activity as a group, and then individually complete the Feeding Frenzy worksheet.

#### **6. Have a whole-class discussion about the marine ecosystems and food chains.**

Invite small groups to share their completed Feeding Frenzy worksheets with the whole class. Review each of the five food chains, as well as the ecosystems in which each food chain is likely to be found. Ask:

- *Looking across the different food chains, which of the organisms can make their own food through photosynthesis?*
- *Compare the food chains to terrestrial food chains you may know. How are the marine food chains the same? How are they different?*
- *How might humans be a part of the food chains?*

## Modification

In Step 1, use a local food chain example to cement student comprehension.

## Modification

In Step 5, instead of small group work and discussions, you may choose to turn the Feeding Frenzy activity into a game format with rules and points.

## Informal Assessment

Use the provided Feeding Frenzy Answer Key to assess students' comprehension.

## Extending the Learning

Have students use their food chain cards to create food webs. Discuss the role each organism plays in the food web.

## OBJECTIVES

## Subjects & Disciplines

### **Biology**

- Ecology

## Earth Science

- Oceanography

## Geography

- Physical Geography

# Learning Objectives

Students will:

- summarize the role of photosynthesis and decomposition within food chains
- distinguish between different trophic levels and describe examples of food chains in major marine ecosystems
- order organisms in a food chain by trophic levels

# Teaching Approach

- Learning-for-use

# Teaching Methods

- Brainstorming
- Cooperative learning
- Discussions
- Hands-on learning
- Multimedia instruction

# Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Communication and Collaboration
- Critical Thinking Skills
  - Analyzing

- Understanding
- Geographic Skills
  - Acquiring Geographic Information
  - Answering Geographic Questions

# 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 D-1:

Energy in the earth system

## OCEAN LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- Principle 5a:

Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

- Principle 5b:

Most life in the ocean exists as microbes. Microbes are the most important primary producers in the ocean. Not only are they the most abundant life form in the ocean, they have extremely fast growth rates and life cycles.

- 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.

## Preparation

## What You'll Need

## **MATERIALS YOU PROVIDE**

- Glue
- Pencils
- Scissors

## **REQUIRED TECHNOLOGY**

- Internet Access: Required
- Tech Setup: 1 computer per classroom, Projector, Speakers
- Plug-Ins: Flash

## **PHYSICAL SPACE**

- Classroom

## **GROUPING**

- Large-group instruction
- Small-group instruction

## **OTHER NOTES**

Before starting the activity, download and queue up the two videos.

## **BACKGROUND & VOCABULARY**

### **Background Information**

Marine microbes include tiny photosynthetic phytoplankton (algae) and bacteria that form the base of marine food chains, becoming food for primary and secondary consumers like zooplankton, small fish, and filter feeders. Tertiary consumers and apex predators, including big fish, marine mammals, and humans, form the top trophic levels. Decomposers, including bacteria, complete the food chain by breaking down organic material and releasing it as nutrients and energy. Marine biodiversity and trophic relationships define a variety of marine food chains and interconnect them in complex oceanic food webs.

### **Prior Knowledge**

# Recommended Prior Activities

- [Mapping Marine Ecosystems](#)
- [Marine Food Webs](#)

## Vocabulary

Term	Part of Speech	Definition
apex predator	noun	species at the top of the food chain, with no predators of its own. Also called an alpha predator or top predator.
autotroph	noun	organism that can produce its own food and nutrients from chemicals in the atmosphere, usually through photosynthesis or chemosynthesis.
coral reef	noun	rocky ocean feature made up of millions of coral skeletons.
decomposer	noun	organism that breaks down dead organic material; also sometimes referred to as detritivores
decomposition	noun	separation of a chemical compound into elements or simpler compounds.
detritivore	noun	organism that consumes dead plant material.
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.
food web	noun	all related food chains in an ecosystem. Also called a food cycle.
heterotroph	noun	organism that cannot make its own nutrients and must rely on other organisms for food.
hydrothermal vent	noun	opening on the seafloor that emits hot, mineral-rich solutions.
kelp forest	noun	underwater habitat filled with tall seaweeds known as kelp.
marine ecosystem	noun	community of living and nonliving things in the ocean.
microbe	noun	tiny organism, usually a bacterium.
open ocean	noun	area of the ocean that does not border land.
photosynthesis	noun	process by which plants turn water, sunlight, and carbon dioxide into water, oxygen, and simple sugars.

Term	Part of Speech	Definition
phytoplankton	<i>noun</i>	microscopic organism that lives in the ocean and can convert light energy to chemical energy through photosynthesis.
trophic level	<i>noun</i>	one of three positions on the food chain: autotrophs (first), herbivores (second), and carnivores and omnivores (third).

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## For Further Exploration

### Websites

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

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