KEY CONCEPT

5.2 Conditions differ away from shore.

Sunshine State STANDARDS

SC.G.1.3.4: The student knows that the interactions of organisms with each other and with the non-living parts of their environments result in the flow of energy and the cycling of matter throughout the system.

SC.G.2.3.2: The student knows that all biotic and abiotic factors are interrelated and that if one factor is changed or removed, it impacts the availability of other resources within the system.

SC.G.2.3.4: The student understands that humans are a part of an ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems.

BEFORE, you learned

- Coasts support plants and animals
- Estuaries and intertidal zones are coastal environments

NOW, you will learn

- About ocean environments away from the coast
- How ocean environments change with depth
- How hydrothermal vents support life in the ocean

EXPLORE Air Bladders

How can air make things float?

PROCEDURE

1. Fill the container halfway with soda water.
2. Add raisins to the container, one by one.
3. Observe for 5 minutes. Record your observations.

MATERIALS

- clear container
- soda water
- 5 raisins

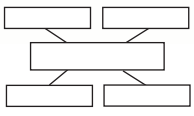
WHAT DO YOU THINK?

- How did the air bubbles control the movement of the raisins?
- Many ocean fish have an air-filled organ called an air bladder. The fish can control the amount of air in the bladder. How might the amount of air in the bladder change as a fish dives from the ocean surface to the bottom and then returns to the surface?

VOCABULARY

coral reef p. 162
kelp forest p. 164
phytoplankton p. 166
hydrothermal vent p. 168

MAIN IDEA WEB
Remember to start a main idea web in your notebook for the blue heading.



Ocean environments change with depth and distance from shore.

Your journey through ocean environments continues as you leave the intertidal zone and move farther out into the ocean. First, you will visit the habitats found in the waters near shore. Next you will move out into the open ocean.

Near shore—in the waters over the continental shelf—sunlight reaches most of the way to the ocean bottom. Nutrients wash in from land. Temperature and salinity are nearly constant from the surface to the bottom. These conditions support many kinds of living things.

CHECK YOUR READING What are some characteristics of the environment near shore?

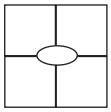
The waters near shore support diverse life forms.

More kinds of ocean life live in the waters near shore than in any other ocean environment. Microscopic organisms including bacteria, protists, plants, and animals live there. They share the waters near shore with plants as tall as ten-story buildings and animals larger than elephants. Each organism is part of a delicate and complex food web. You become part of this food web when you eat a fish from the waters near shore. In fact, most of the world's fish are caught in this ocean environment.

Two important habitats near shore are the kelp forest and the coral reef. Kelp forests are found in cooler waters, and coral reefs are found in tropical warm waters.

Coral Reefs

VOCABULARY
A four square diagram would be a good choice for taking notes about the term *coral reef.*



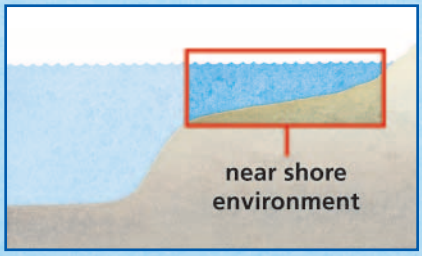
In warm, tropical regions of the globe, the waters near shore support coral reefs. **Coral reefs** are built-up limestone deposits formed by large colonies of ant-sized organisms called corals. Corals produce a hard limestone covering that remains after the corals die. New generations of corals grow on top of older limestone coverings. Although individual corals are small, coral reefs can be huge. Australia's Great Barrier Reef is about 2000 kilometers (1250 mi) long—as long as the distance from Chicago, Illinois, to San Antonio, Texas.

Corals rely on a special relationship with a kind of algae for almost all of their food needs. Tiny algae live inside individual corals. Like plants, the algae use sunlight to produce food through photosynthesis. The food algae produces provides the coral with most of its nutrition. In return, the coral provides some nutrients to the algae. Because the algae need sunlight to survive, coral reefs exist only in the ocean environment near shore, where sunlight reaches all the way to the ocean floor.

Coral reefs, which contain over 25 percent of all of the species of ocean life, help protect shorelines from wave and storm damage.

Coral Reefs

The nutrient-rich, sunlit waters near shore support a greater variety of life than any other part of the ocean.



The **anemone** can paralyze most fish with its stinging tentacles.

The **anemone fish** (also called the clown fish) is covered by mucus that protects it from the anemone. The anemone shelters the fish from predators. The anemone benefits by eating bits of food that the fish drops.

The **parrotfish** uses its hard teeth to chew on coral. It eats the algae that live in and on the coral. The hard coral skeletons get ground into sand as they pass through the parrotfish's digestive system.

The **moray eel** spends days hidden in cracks or holes in the reef. At night the eel comes out to hunt.

The **nudibranch** is related to snails but has no shell. It contains bad-tasting or poisonous chemicals that discourage fish from eating it.

The **giant clam** can grow to be over 1 meter (3 ft) long. It feeds by filtering tiny organisms from the water. Like corals, the giant clam gets some of its nutrients from algae that live within its own tissues.

READING VISUALS Which organisms in the diagram appear to be using nooks in the reef for shelter?

RESOURCE CENTER
CLASSZONE.COM
Explore coral reefs.

The huge amount and variety of life found at coral reefs compares with that found in rain forests. In fact, coral reefs contain over 25 percent of all the species of ocean life. Some reef inhabitants use nooks and crannies in the reef for shelter. Other inhabitants eat corals or feed on seaweed that grows on the corals. Clown fish, sea anemones, (uh-NEHM-uh-neez), sea urchins, starfish, giant clams, and parrotfish are some of the many colorful reef inhabitants.

Coral reefs are now endangered habitats. Pollution that drains off land or that is dumped directly into the water harms coral reefs. Some fishing practices also harm corals and other life at reefs.

CHECK YOUR READING Why are coral reefs endangered?

Kelp Forests

In cold waters, a seaweed called kelp attaches itself to the ocean floor and grows as tall as 40 meters (130 ft)—about the length of an airline jet. Air-filled bulbs on the seaweed's stalks help it to float up toward the surface and remain upright underwater. Large communities of this seaweed form **kelp forests.** Like plants, kelps use sunlight to produce food. Because kelps need sunlight and grow in the ocean, kelp forests

Kelp forests, such as this one in California, provide food and shelter for many living things.

A sea otter off the coast of California wraps itself in kelp.

are found only in the waters near shore, where sunlight reaches to the ocean floor. Thick kelp forests provide habitats for many organisms. Worms, starfish, lobsters, crabs, abalones, and octopuses are some of the animals that live among the crowded stands of kelp. Fish find shelter and food there. Sea otters dining on sea urchins anchor themselves to the thick mats that the kelps form on the surface.

CHECK YOUR READING Why are kelp forests found only in waters near shore?

INVESTIGATE Floating

How do plankton float?

DESIGN YOUR OWN

Plankton are microscopic organisms that drift in the ocean, where they are moved about by wind, waves, and currents. They must stay near the sunlit surface in order to live. Because plankton have no muscles, they cannot swim to stay afloat. In this lab, you will construct different-shaped clay models to determine how shape helps plankton stay near the ocean surface.

SKILL FOCUS
Modeling

MATERIALS
- clear container
- water
- modeling clay
- watch with a second hand

TIME
30 minutes

PROCEDURE

1. Fill the clear container with tap water.
2. Use the clay to make several different shapes that you think will stay afloat.
3. One by one, place your clay models on the surface of the water. Time how long each piece takes to reach the bottom. Record your observations.

WHAT DO YOU THINK?

- What were the characteristics of the clay shape that sank the slowest?
- What factors affected how fast your clay shape sunk?

CHALLENGE Some kinds of floating organisms release oil droplets or air bubbles to help them stay afloat. How could oil or air help them float?

Environments in the open ocean change with depth.

FLORIDA Content Review

Remember what you learned about ecosystems in grade 6. Each section of the ocean is its own ecosystem; notice how interrelated the animals and plants are.

Out in the open ocean, conditions are different from these found in the waters near shore. Sunlight reaches through only the very top part of the open ocean. Nutrients sink down to the dark depths. There are no rocks, reefs, or big plants to provide shelter from predators. The open ocean covers a huge area but contains fewer living things than the waters near shore. Life is more spread out in the open ocean.

Surface Zone

The surface zone of the open ocean is the sunlit top 200 meters (650 ft). Microscopic floating organisms called **phytoplankton** (FY-toh-PLANGK-tuhn) live at or near the sunlit surface. Like plants, phytoplankton convert sunlight and carbon dioxide into food and oxygen. In fact, phytoplankton convert about as much carbon dioxide into oxygen as all land plants combined. Phytoplankton are an important source of the oxygen that you are breathing right now. Tiny floating animals called zooplankton eat phytoplankton. Zooplankton and phytoplankton then become food for fish, squids, and ocean mammals, such as whales.

READING TiP

Word parts can help you remember the meaning of *phytoplankton* and *zooplankton*. The prefix *phyto-* means "plant" and the prefix *zoo-* means "animal."

Inhabitants of the surface zone must keep from sinking. To stay afloat, phytoplankton bodies have big surface areas and may use air bubbles or oil droplets to stay near the ocean surface. Many fish have an air-filled organ called an air bladder that helps the fish change depth. Changing the amount of air in the bladder allows these fish to move up and down in the water. When the bladder fills with air, the fish floats up toward the surface. Releasing air from the bladder allows the fish to dive down into deeper water.

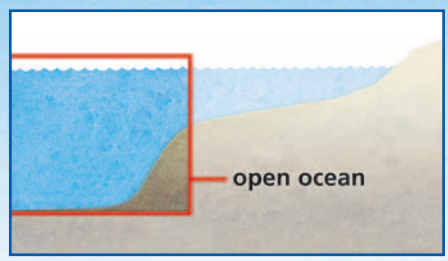
Deep Zone

The dark and cold deep zone of the open ocean lies under the surface zone. Because sunlight does not reach the deep zone, no plants can live there. Without plants for food, many deep-sea animals must either eat each other or rely on food drifting down from above.

The anglerfish in the photograph on page 167 has many of the common features of deep-sea animals. Its huge mouth and sharp teeth are typical of predators—animals that hunt and eat other animals. Many deep-sea animals glow in the dark, as fireflies do. A glowing extension sticks out from the head of the anglerfish and acts as bait to attract prey. Animals of the deepest waters often have small eyes—and some have no eyes at all. Among the animals found in the deep zone are lantern fish, squids, octopuses, and shrimp.

Life in the Open Ocean

The open ocean consists of a sunlit surface zone and a dark deep zone.



dolphin

The **surface zone** is the top 200 meters of the ocean.

Many kinds of phytoplankton and zooplankton live in the surface zone.

zooplankton

jellyfish

The **deep zone** is the part of the ocean beneath the surface zone all the way to the ocean floor.

phytoplankton

No sunlight reaches below this line.

Sperm whales need to breathe air at the surface but may dive down hundreds of meters to hunt giant squid.

lantern fish

hatchet fish

mid-water shrimp

This extension glows in the dark and attracts prey.

The gulper eel's huge jaws can open wide enough to swallow animals as large as itself.

The anglerfish is a predator that lives in the deep zone.

Scientists estimate there are about 20 billion rattail fish in the ocean—over three times the number of people on Earth.

giant squid

The **deep zone** continues to the ocean floor.

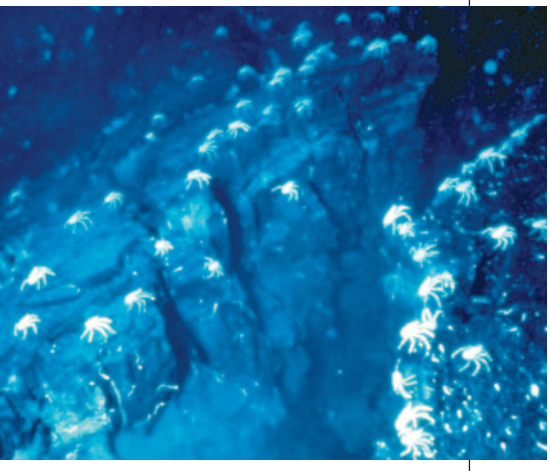
Open ocean inhabitants shown here are not drawn to scale.

READING VISUALS Which are bigger, phytoplankton or zooplankton? How can you tell?

New discoveries about ocean life continue.

VISUALIZATION
CLASSZONE.COM
Examine the life found at hydrothermal vents.

While investigating deep-sea sediments in 1977, scientists got quite a surprise. On the deep-ocean floor they found thriving communities of crabs, fish, mussels, shrimp, giant clams, and tubeworms. These animals live near openings in Earth's crust called **hydrothermal vents**. Cold ocean water that seeps into cracks in the ocean floor gets heated deep underground by hot magma. The heated water then rises up and gushes out into the ocean, forming hydrothermal vents.



Hydrothermal vents support many kinds of life, including clams, crabs, fish, tubeworms, and bacteria.

Before the discovery of animal communities near vents, most scientists thought life was impossible on the dark ocean floor. On land, life depends on plants, which use sunlight to produce food. Without sunlight, how could these deep sea animals live?

Scientists found that animals at hydrothermal vents depend on a special type of bacteria. Instead of making food from sunlight and carbon dioxide, like plants, these bacteria make food from chemicals released by the vents. The bacteria thus form the base of the food chain at the vents. Some of the animals living there eat the bacteria. Other animals, such as tubeworms, have the bacteria living within their bodies. Tubeworms do not eat and have no digestive system—they absorb all their food directly from the bacteria.

Because of its crushing pressure, darkness, and huge size, the deep ocean remains mostly unexplored. The discovery of animal communities at hydrothermal vents is a reminder that life may be possible even in seemingly impossible places. In fact, more recent explorations have even found life deep within the sediments of the ocean floor.

CHECK YOUR READING Why were scientists surprised to find life at hydrothermal vents?

5.2 Review

KEY CONCEPTS

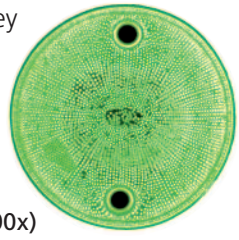
1. What are two environments in the waters near shore? Describe the characteristics of each.
2. How does the surface zone of the open ocean differ from the deep zone?
3. How do hydrothermal vents support life on the deep-ocean floor?

CRITICAL THINKING

4. **Predict** How might a change in the amount of phytoplankton in the ocean affect the world's atmosphere?
5. **Evaluate** Suppose you are seeking a site for a submarine station where scientists could live for months at a time. Which ocean environment would you choose, and why?

CHALLENGE

6. **Apply** Diatoms are tiny ocean organisms that convert carbon dioxide to oxygen. Describe the depth at which diatoms live and where they fit into the ocean food chain.



(magnified 200x)