Ocean Habitats

Reading Preview

Key Concepts

- Into what zones do scientists divide the ocean?
- How are marine organisms classified?

Key Terms

- intertidal zone
- neritic zone
- open-ocean zone
- plankton
- nekton
- benthos
- food web

Target Reading Skill

Using Prior Knowledge Your prior knowledge is what you already know before you read about a topic. Before you read, write what you know about conditions that might determine where ocean organisms live. Use a graphic organizer like the one below. As you read, continue to write in what you learn.

What You Know
1. Many organisms need sunlight. 2.

What You Learned
1. 2.

Lab zone Discover Activity

How Complex Are Ocean Feeding Relationships?

1. Form a circle of five students. Each student will represent one of the following marine organisms: algae, shrimp, fish, sea otter, and whale. Each student should write the name of his or her organism on a card.
2. Discuss the possible feeding relationships among the five organisms. What might your organism eat? What might eat the organism you represent?
3. Use pieces of string to connect your card to the cards of all the organisms that may have feeding relationships with your organism.

Think It Over

Inferring Based on your results in Step 3, are the feeding relationships among ocean organisms simple or complex? Explain your answer.

At first glance, an ocean may seem lifeless. As you walk along the beach, your feet sink in the soft, wet sand. You may notice some dark, tangled seaweed that has washed up on the shore. A few sea gulls screech and swoop overhead. Otherwise, all is calm. You stop to gaze out at the horizon. The ocean stretches as far as the eye can see. Waves crash against the shore. But you see no sign of life in the water.

Look closer. Right beneath your feet you can see evidence of living things. Tiny, round holes are signs of burrowing clams. These clams dig down into the sand. This burrowing enables the clams to hide from predators and avoid being washed away by the tide. If you wade into the water, you may be able to spot a sand crab feeding in the surf. And far out to sea, a school of dolphins swims by. Their bodies form graceful arcs as they dive in and out of the water. An ocean may seem lifeless, but many different organisms inhabit this vast, watery environment.

A sea gull ▶

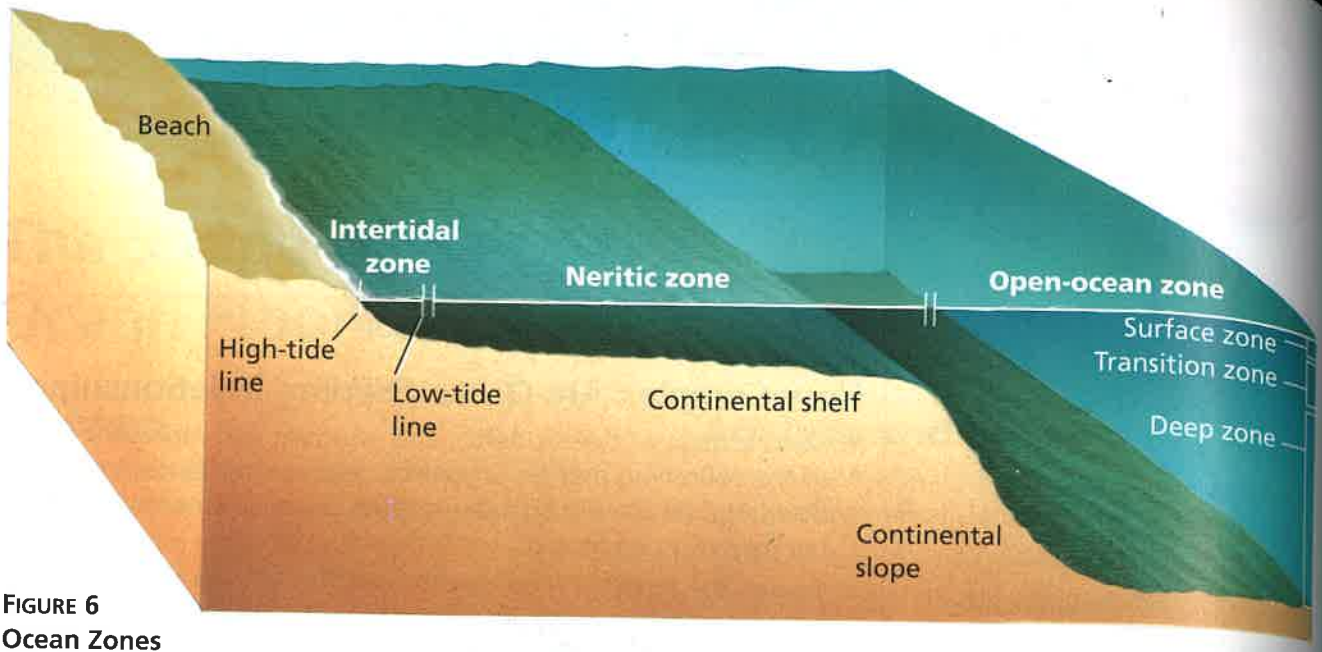


FIGURE 6
Ocean Zones
The three ocean zones are the intertidal zone, the neritic zone, and the open-ocean zone.
Classifying *Into what three zones is the open-ocean zone divided?*

Ocean Zones and Conditions

You can think of the ocean as a huge community that includes living and nonliving things. In some ways, the ocean community resembles a human city or town. Typically, cities and towns are divided into several zones. Some zones consist mostly of houses and apartment buildings. Other zones have stores and shops or factories and office buildings.

Ocean Zones The ocean, too, can be divided into zones, as shown in Figure 6. Your walk on the sandy beach, for example, took place in the intertidal zone. **Ocean zones include the intertidal zone, the neritic zone, and the open-ocean zone.** At the highest high-tide line on land, the **intertidal zone** begins. From there, the zone stretches out to the point on the continental shelf exposed by the lowest low tide. The **neritic zone** extends from the low-tide line out to the edge of the continental shelf. Beyond the edge of the continental shelf lies the **open-ocean zone.** This zone includes the deepest, darkest part of the ocean. You will learn more about these ocean zones in Section 3 and Section 4.

Physical Conditions Each ocean zone has its characteristic physical conditions. These conditions help determine which organisms can live in that zone. For example, light does not penetrate very far beneath the ocean's surface. Organisms that need light for photosynthesis must live near the surface of the ocean. In contrast, in the deep ocean, pressure is high. Organisms that live deep in the ocean must be able to withstand this force.

Reading Checkpoint **Which ocean zone is farthest from shore?**

Lab zone Try This Activity

Feeling the Pressure

1. Use a pen to poke two similar holes in an empty milk carton. One hole should be about one third of the way from the bottom. The other hole should be about two thirds of the way from the bottom.
2. Cover the holes with tape. Then fill the carton with water.
3. Hold the carton over a sink. Remove the tape. Note any differences in the flow of water from the two holes.

Making Models What physical condition in the ocean does this activity model? In which ocean zone is this condition most significant?

Life in the Ocean

On land, most organisms live on or near the surface. The ocean, on the other hand, is inhabited by organisms at every depth. **Scientists classify marine organisms according to where they live and how they move.** Figure 7 shows the three categories of ocean organisms—plankton, nekton, and benthos.

Plankton **Plankton** are tiny algae and animals that float in the water and are carried by waves and currents. Algae plankton include geometrically shaped diatoms. Animal plankton include some tiny young fish and microscopic crustaceans, such as copepods.

Nekton **Nekton** are free-swimming animals that can move throughout the water column. Squid, most fishes, and marine mammals such as whales and seals are nekton.

Benthos **Benthos** are organisms that inhabit the ocean floor. Some benthos, like crabs, sea stars, octopus, and lobsters, move from place to place. Others, like sponges and sea anemones, stay in one location.

Reading Checkpoint **Are sharks plankton, nekton, or benthos? Why?**

FIGURE 7
Marine Organisms
Marine organisms can be classified as plankton, nekton, or benthos.

Go Online
active art

For: Ocean Food Web activity
Visit: PHSchool.com
Web Code: cfp-3042

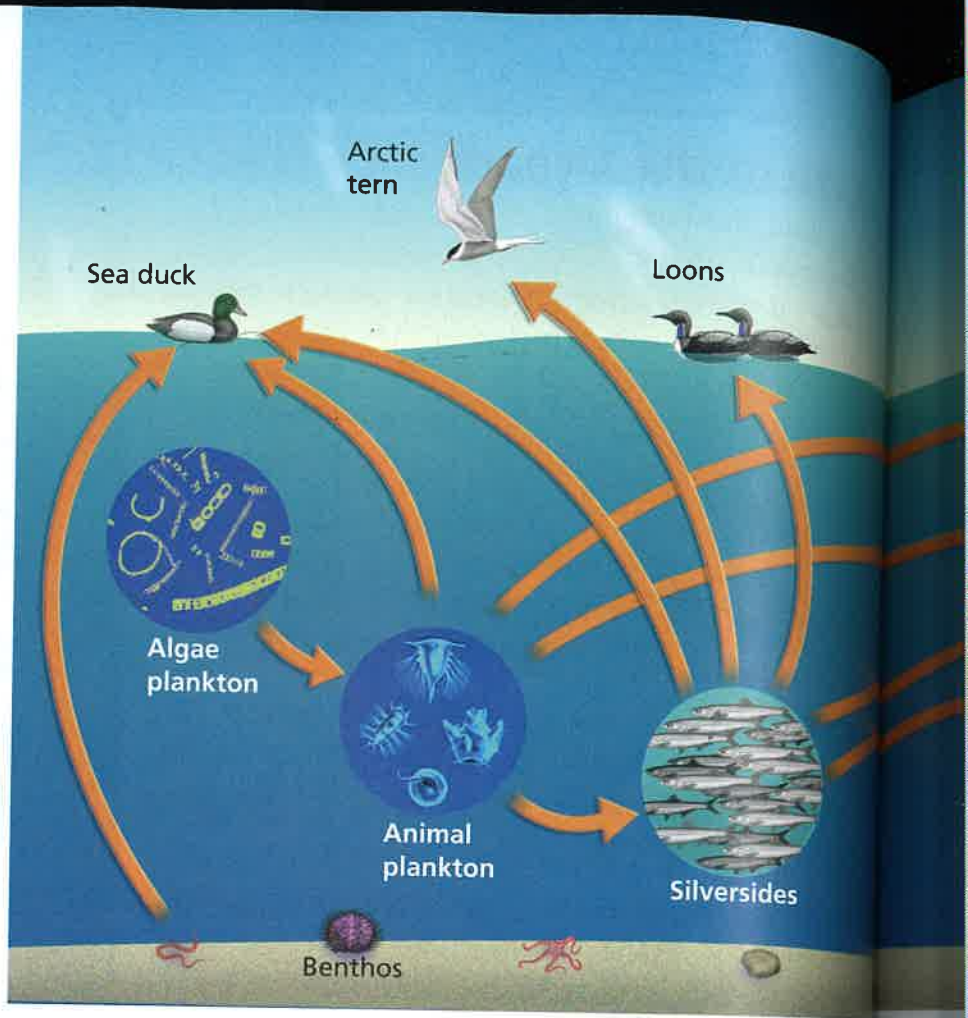
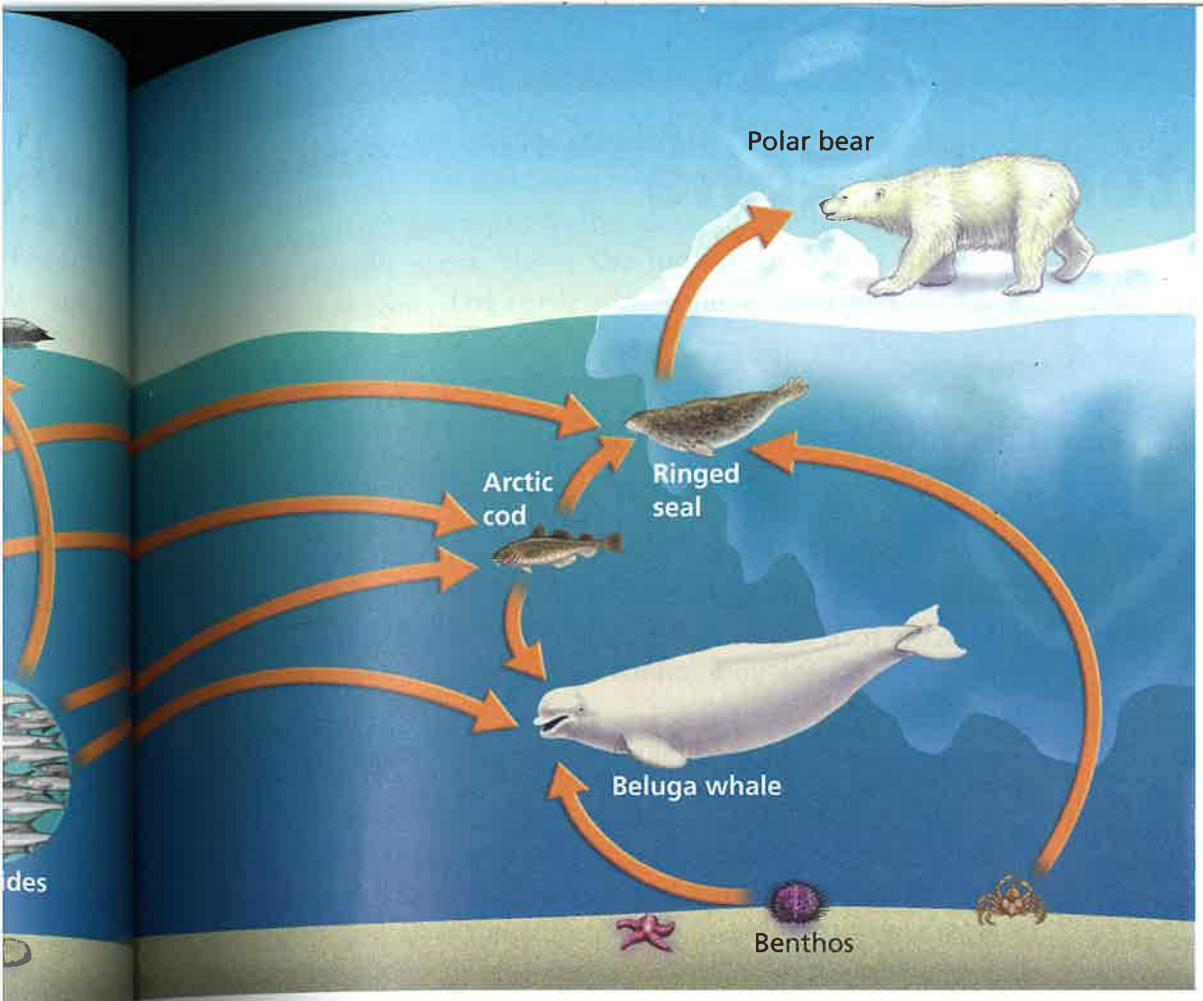


FIGURE 8
An Ocean Food Web
This ocean food web includes typical organisms found in the Arctic Ocean. The arrows indicate what each organism eats.
Interpreting Diagrams *Which organisms feed directly on the Arctic cod? Which organisms depend indirectly on the cod?*

Relationships Among Organisms Plankton, nekton, and benthos are all found in most marine habitats. Many plankton and benthos are algae. Like plants, algae use sunlight to produce their own food through photosynthesis. Photosynthetic plankton are called producers. Other plankton and benthos, as well as all nekton, eat either algae or other organisms. They are called consumers. Finally, some organisms, including many benthos, break down wastes and the remains of other organisms. They are called decomposers.

Ocean Food Webs All of the feeding relationships that exist in a habitat make up a **food web.** A typical ocean food web is shown in Figure 8. Each organism in this Arctic food web depends either directly or indirectly on the algae plankton. Throughout the ocean, plankton are a source of food for other organisms of all sizes. If you think of sharks as sharp-toothed, meat-eating hunters, you might be surprised to learn that the biggest sharks of all feed directly on tiny plankton! Many whales, including Earth's largest animal—the blue whale—also feed only on plankton.

Reading Checkpoint **Which organisms in an ocean food web are the producers?**



Section 2 Assessment

Target Reading Skill Using Prior Knowledge Review your graphic organizer and revise it based on what you just learned in the section.

Reviewing Key Concepts

1. a. Identifying Identify the three ocean zones.
   b. Sequencing Put the ocean zones in order, beginning with the zone in which the water is least deep and ending with the zone that is deepest.
   c. Inferring Which zone probably has the greatest variety of living things? How is this variety related to the water's depth?
2. a. Reviewing What characteristics do scientists use to classify ocean organisms?
   b. Describing Identify the three categories of ocean organisms and describe their characteristics.
   c. Classifying Sea cucumbers are small animals that crawl along the ocean floor. To which category of ocean organisms do they belong? Explain.

Writing in Science

Cause and Effect Paragraph Write a brief paragraph describing how the ocean food web in Figure 8 might be affected by a decrease in the Arctic cod population. Which populations might increase as a result and why? Which populations might decrease and why? To help plan your writing, you might use a cause-and-effect graphic organizer.

Section 3

Intertidal Zone

Reading Preview

Key Concepts

- What conditions must organisms in the rocky intertidal zone tolerate?
- What are the major types of coastal wetlands?

Key Term

- estuary

Target Reading Skill

Outlining As you read, make an outline about the intertidal zone. Use the red headings for the main topics and the blue headings for the subtopics.

Intertidal Zone
I. Rocky shores
A. Along the rocks
B.
II. Where river meets ocean

Lab zone **Discover Activity**

Can Your Animal Hold On?

1. Your teacher will give you a ping-pong ball, a rock, and some other materials. The ping-pong ball represents an ocean animal. Design a way for the animal to cling to the rock.
2. Attach the ping-pong ball to the rock.
3. Place the rock in a sink or deep pan. Run water over the rock. Observe how well your animal stays in place on the rock.

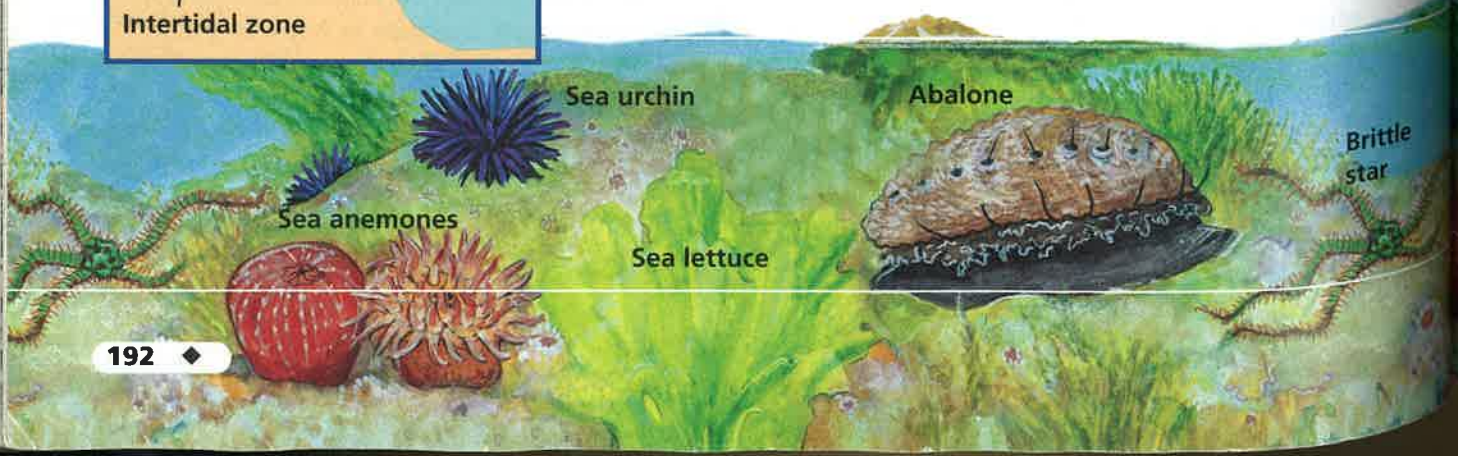
Think It Over

Inferring How might the ability to "hold on" be important to an animal that lives on the shore?

Imagine that your home has no walls or roof. Twice a day, a huge storm passes through, bringing a drenching downpour and winds so strong you can hardly keep your balance. At other times, the sun beats down, heating you and leaving you dry. This is what life is like for organisms that live on rocky shores, where the land meets the sea.

Rocky Shores

A rocky shore is one type of habitat found in the intertidal zone. You read about sandy shores, another type, in Section 2. **Organisms that live in the rocky intertidal zone must be able to tolerate the pounding of the waves and changes in both salinity and temperature. They must also withstand periods of being underwater and periods of being exposed to the air.** They must avoid drying out, hide from predators, and find food in this harsh setting. Luckily, they are well suited to these tasks.



Along the Rocks Rocky shores are found along much of both coasts of the United States. Figure 9 shows some of the colorful organisms that typically live along the California coast.

The highest rocks, above the highest high-tide line, make up the spray zone. The spray zone is never completely covered with water, but it gets wet as the waves break against the rocks. A stripe of black algae indicates the highest high-tide line.

The rocks below this level are covered with barnacles. Barnacles can close up their hard shells. This action traps a drop of water inside to carry the barnacles through the dry period until the next high tide. The rocks are also home to flat animals called limpets. Limpets have a large, muscular foot that allows them to hold tightly to the rocks. They release drops of mucus around the edges of their shells. The mucus forms a tight seal.

In Tide Pools When the tide goes out, some water remains in depressions among the rocks called tide pools. As the water in a tide pool is warmed by the sun, the water begins to evaporate. The remaining water becomes saltier. If it rains, however, the salinity quickly decreases. Organisms in the tide pool must be able to withstand these changes in temperature and salinity. Tide-pool organisms must also withstand the force of the waves when the tide comes in again.

Sea stars cling to the rocks with rows of tiny suction cups. Spiny sea urchins crawl slowly along the bottom of the tide pool. If the bottom is sandy, a sea urchin can use its spines to dig a hole. The sea urchin buries itself in the hole during heavy surf.

Under shady rock ledges, sponges and sea anemones wait for the incoming tide to bring a fresh supply of plankton and other food particles. Most sea anemones look delicate. However, some sea anemones can survive out of water for more than two weeks. When out of the water, the anemone pulls its tentacles inside and folds up into a round blob.

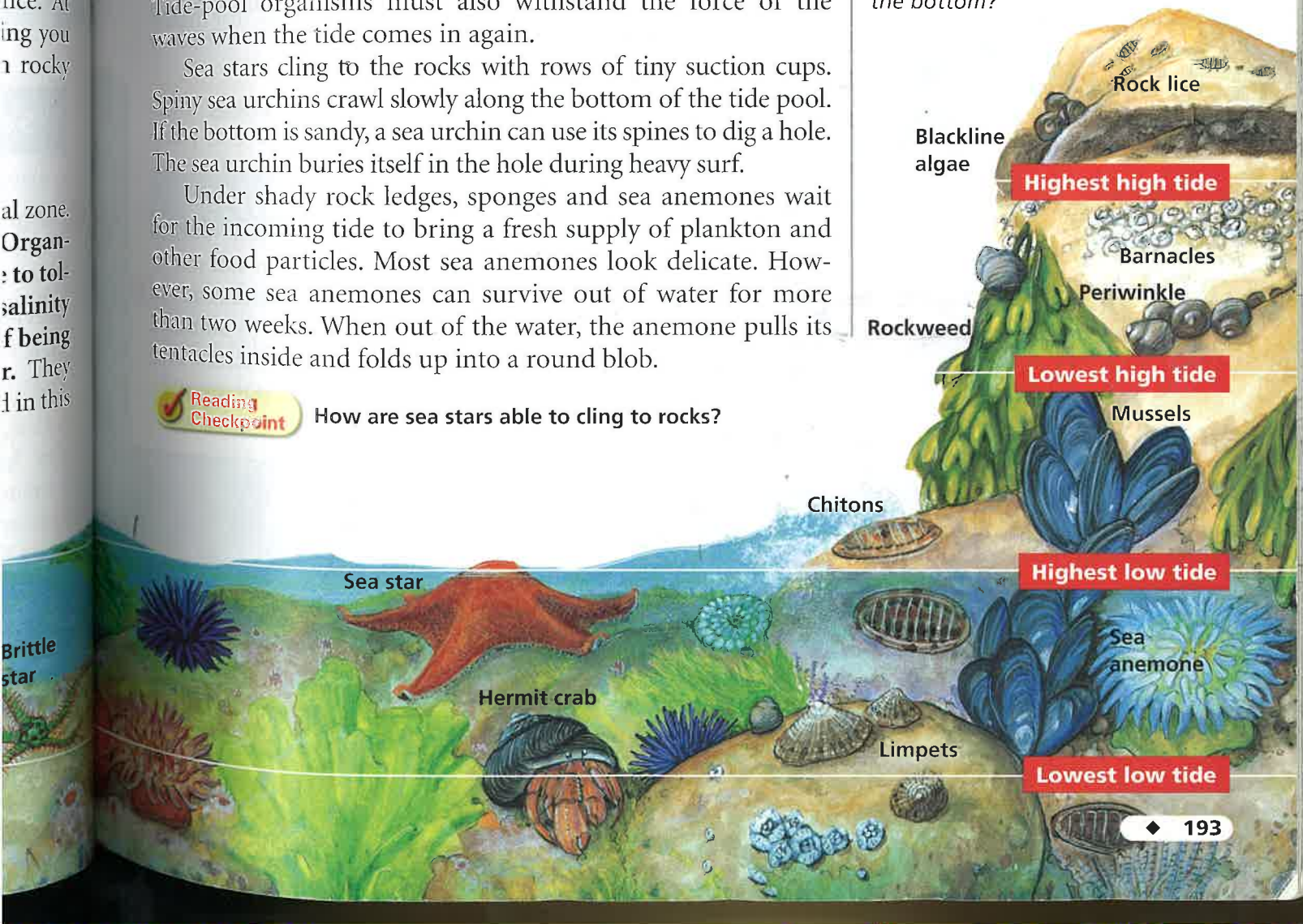
Reading Checkpoint How are sea stars able to cling to rocks?

FIGURE 9

A Rocky Shore

The constantly changing water level along a rocky shore in the intertidal zone creates different habitats.

Comparing and Contrasting *How are conditions different for organisms near the top of the rocks compared to organisms at the bottom?*



Go Online
PHSchool.com

For: More on the intertidal zone
Visit: PHSchool.com
Web Code: cfd-3043

Where River Meets Ocean

Other important environments along the ocean's edge are estuaries. **Estuaries** are coastal inlets or bays where fresh water from rivers mixes with the salty ocean water. Water that is partly salty and partly fresh is brackish.

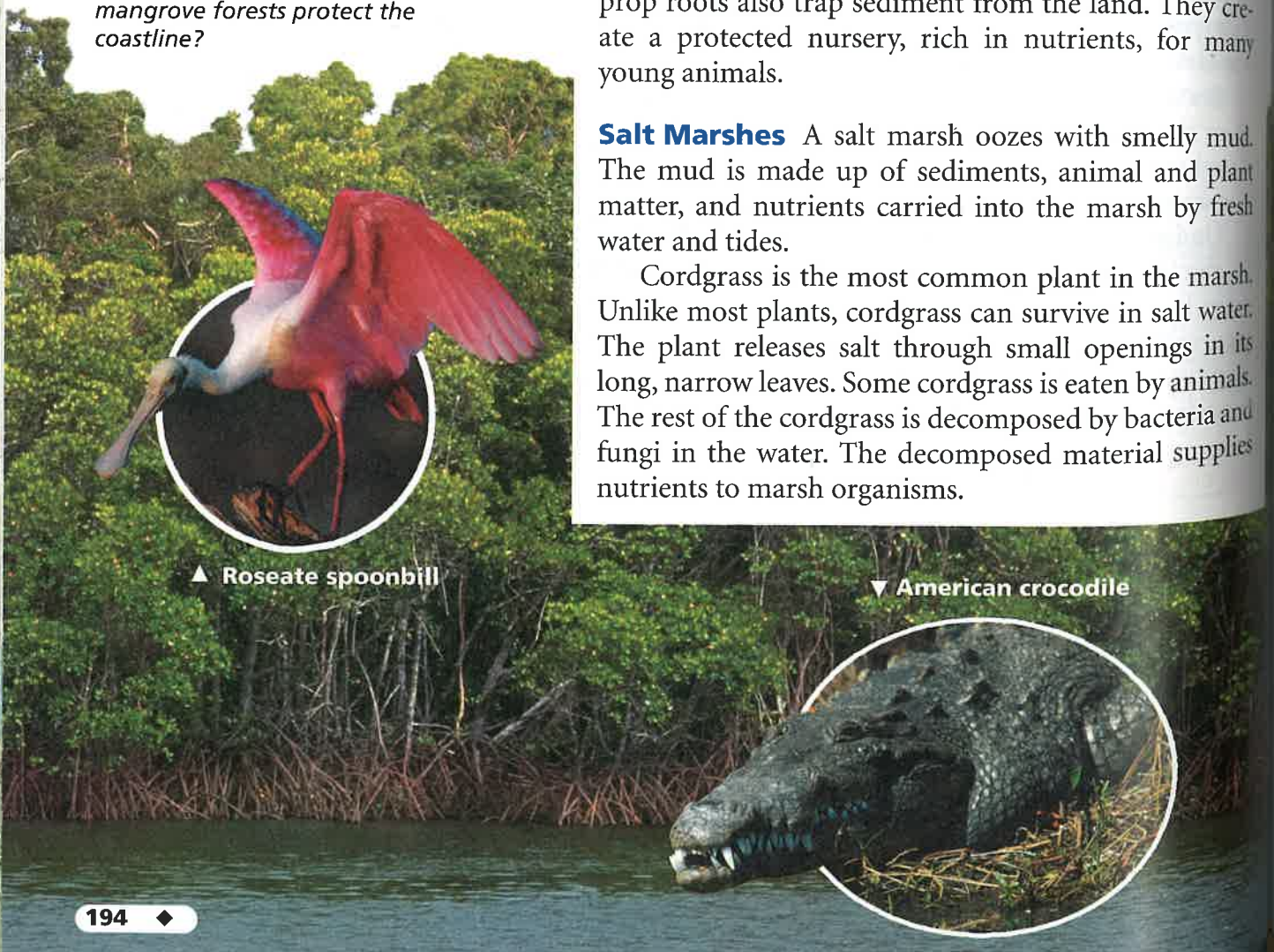
Coastal wetlands are found in and around estuaries. **Along the coasts of the United States, most wetlands are either mangrove forests or salt marshes.** Mangrove forests are found in southern Florida and along the coast of the Gulf of Mexico. Salt marshes are especially abundant along the east coast from Massachusetts to Florida.

Mangrove Forests Mangroves are short, gnarled trees that grow well in brackish water. These trees fringe the coastline of southern Florida. The mangroves' prop roots, shown in Figure 10, anchor the trees to the land. Mangroves can withstand all but the strongest hurricane winds. The mangroves break the action of winds and waves, protecting the coastline during storms. The prop roots also trap sediment from the land. They create a protected nursery, rich in nutrients, for many young animals.

Salt Marshes A salt marsh oozes with smelly mud. The mud is made up of sediments, animal and plant matter, and nutrients carried into the marsh by fresh water and tides.

Cordgrass is the most common plant in the marsh. Unlike most plants, cordgrass can survive in salt water. The plant releases salt through small openings in its long, narrow leaves. Some cordgrass is eaten by animals. The rest of the cordgrass is decomposed by bacteria and fungi in the water. The decomposed material supplies nutrients to marsh organisms.

FIGURE 10
A Mangrove Forest
Arching prop roots anchor these mangrove trees firmly in the soft, sandy soil.
Relating Cause and Effect *How do mangrove forests protect the coastline?*



Tidal channels run through the cordgrass. Waves break up as they enter the channels, so that organisms in the marsh are protected from the surf. Within the marsh, fish, crabs, shrimp, and oysters hatch and feed before entering the harsher ocean environment offshore. As the tide retreats, mud flats are exposed. Many crabs search for food in the rich mud. Herons, stilts, and egrets stalk across the mud to prey on the crabs and other benthos exposed by the low tide.

Protecting Estuaries The rivers that flow into estuaries can carry harmful substances. Pollutants such as pesticides, sewage, and industrial waste may end up in an estuary. Organisms that live in the estuary are affected by these pollutants.

For example, the Chesapeake Bay is a huge estuary located on the mid-Atlantic coast. It has been a rich source of oysters, clams, and blue crabs. However, pollutants from inland sources accumulated in the bay for years. Pollution, along with overfishing, greatly reduced the numbers of blue crabs in the Chesapeake Bay. When people realized the threat to the estuary, they took action. Laws were passed to regulate the water quality of rivers that empty into the Chesapeake Bay. Cleanup efforts have reduced much of the pollution in the bay. Today, pollution is less of a problem in the Chesapeake Bay than it once was.

Reading Checkpoint **What has been done to help reduce pollution in the Chesapeake Bay?**

FIGURE 11
Food From an Estuary
A crabber in the Chesapeake Bay pulls up the last trap of the day. As the health of the estuary improves, the blue crab population is increasing again.

Section 3 Assessment

Target Reading Skill **Outlining** Use the information in your outline about the intertidal zone to help you answer the questions below.

Reviewing Key Concepts

1. a. **Describing** What are conditions like in the rocky intertidal zone?
   b. **Explaining** Explain what a sea anemone does when it is not covered by water.
   c. **Applying Concepts** How does this behavior help the sea anemone survive in the intertidal zone?
2. a. **Identifying** Identify two types of coastal wetlands.
   b. **Comparing and Contrasting** List two ways that these environments are alike and two ways they are different.
   c. **Making Judgments** A builder has proposed filling in a salt marsh to create a seaside resort. What positive and negative impacts might this action have on wildlife and local residents? Would you support the proposal? Explain.

Writing in Science

Fact Sheet Suppose you work for a national or state park that contains salt marshes. Your job is to take people on guided tours of a salt marsh. Before the tour, you distribute a fact sheet that points out the sights that visitors can expect to see. Write a fact sheet on salt marshes to distribute to park visitors. If you want, you can illustrate your fact sheet.

Section 4

Neritic Zone and Open Ocean

Reading Preview

Key Concepts

- What are the conditions in the neritic zone?
- What environments support coral reefs and kelp forests?
- What are the conditions in the open ocean?

Key Terms

- atoll
- bioluminescence
- hydrothermal vent

Target Reading Skill

Relating Cause and Effect As you read, identify the conditions that affect life in the neritic zone. Write the information in a graphic organizer like the one below.

Causes	Effect
	The neritic zone has a wide variety of organisms.

Lab zone Discover Activity

How Deep Can You See?

1. With a permanent marker, divide a white plastic lid into four quarters. Shade in two quarters as shown.
2. Use a pair of scissors to carefully poke a small hole in the center of the lid.
3. Tie a piece of string to a paper clip. Place the clip underneath the lid and thread the string up through the hole.
4. Tape the string tightly to a meterstick so that the lid presses against the bottom of the meterstick.
5. Fill a large, deep bucket with tap water. While stirring the water, add one teaspoon of flour to represent the dissolved substances in seawater. The water should be slightly cloudy.
6. Lower the lid into the water so that it is 5 cm below the surface. Note whether the lid is still visible in the water.
7. Lower the lid 10 cm below the surface, then 15 cm, and so on until the lid is no longer visible.

Think It Over

Observing At what depth could you no longer see the lid? Based on your results, how do you think visibility changes with depth in the ocean?

Floating mats of algae on the ocean surface mark the location of a kelp forest. Bright-orange sheephead fish dart about. Young sea lions chase each other around the kelp stalks. A sea otter dives down to the rocky ocean bottom. When it rises, the otter is clutching a sea urchin between its paws. On the surface again, the otter rolls onto its back among the kelp. The otter skillfully uses its paws to scoop out the meat from the soft parts of the sea urchin.

▼ Sea otter in a kelp forest

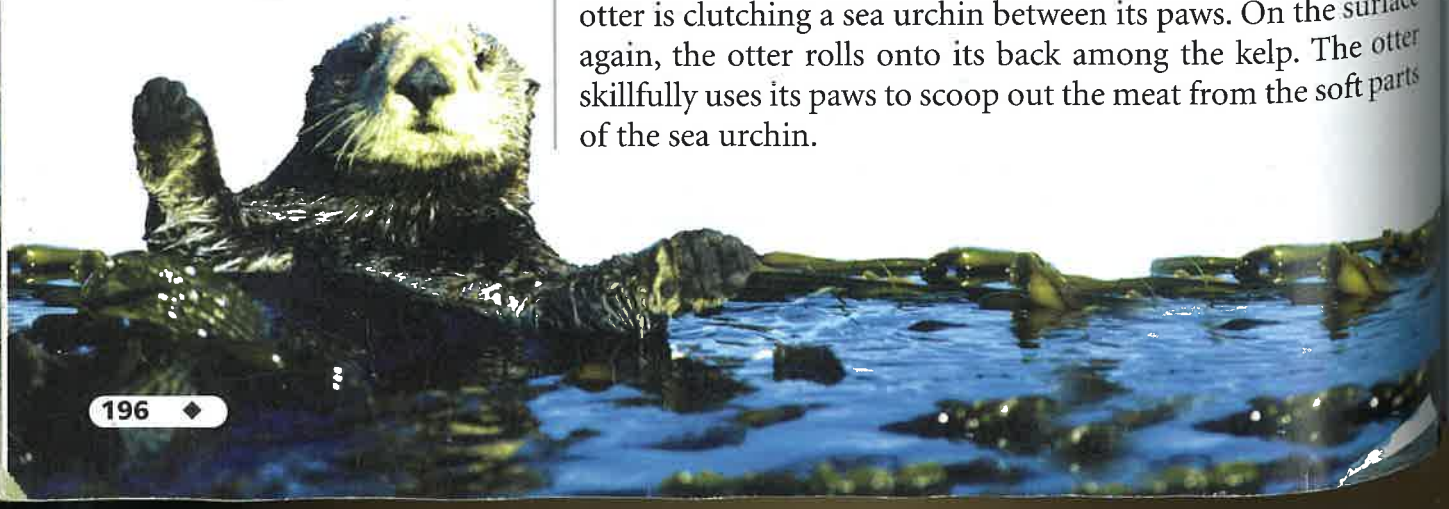
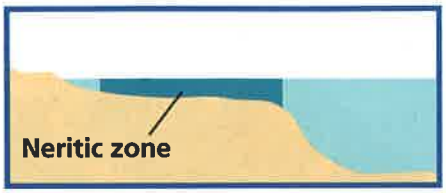


FIGURE 12
Organisms in the Neritic Zone
Because it is so rich in nutrients, the neritic zone supports a huge variety of organisms. These include sea lions (left) and herring (below). **Inferring** *Why is the neritic zone so rich in nutrients?*



Conditions in the Neritic Zone

A kelp forest is one type of habitat found in the neritic zone. Remember that the neritic zone extends from the low-tide line out to the edge of the continental shelf. A huge variety of organisms are found in the neritic zone, more than in any other ocean zone. Most of the world's major fishing grounds are found in this zone.

Why is the neritic zone home to so many living things? The answer has to do with its location over the continental shelf. **The shallow water over the continental shelf receives sunlight and a steady supply of nutrients washed from the land into the ocean. The light and nutrients enable large plantlike algae to grow.** These algae serve as a food source and shelter for other organisms.

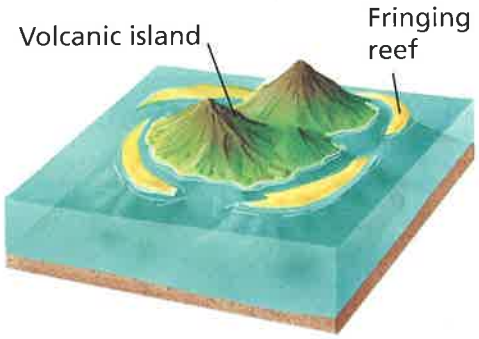
In many parts of the neritic zone, upwelling currents bring additional nutrients from the bottom to the surface. These nutrients support large numbers of plankton, which form the base of ocean food webs. Schools of fish such as sardines and herrings feed on the plankton. Major fisheries in upwelling areas include Monterey Canyon off the California coast, Newfoundland's Grand Banks, and Georges Bank off the New England coast.

Reading Checkpoint **What are two ways that nutrients may be supplied to the neritic zone?**

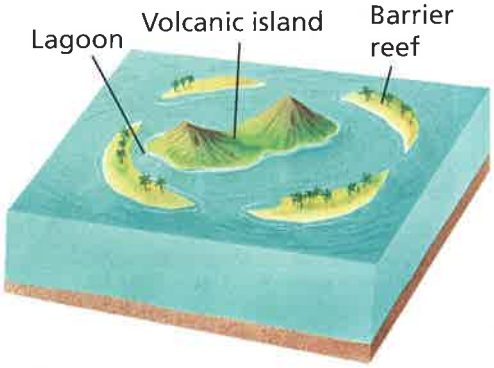
FIGURE 13

How an Atoll Forms

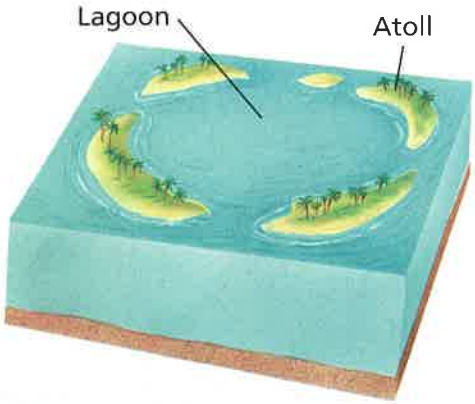
An atoll develops in stages, beginning with a fringing reef that surrounds a volcanic island.
Relating Cause and Effect *For an atoll to form, what must happen to the volcanic island?*



1 A fringing reef closely surrounds an island.



2 As the island sinks, a lagoon forms inside the barrier reef.



3 Finally, the island sinks, leaving a ring–shaped atoll.

Coral Reefs

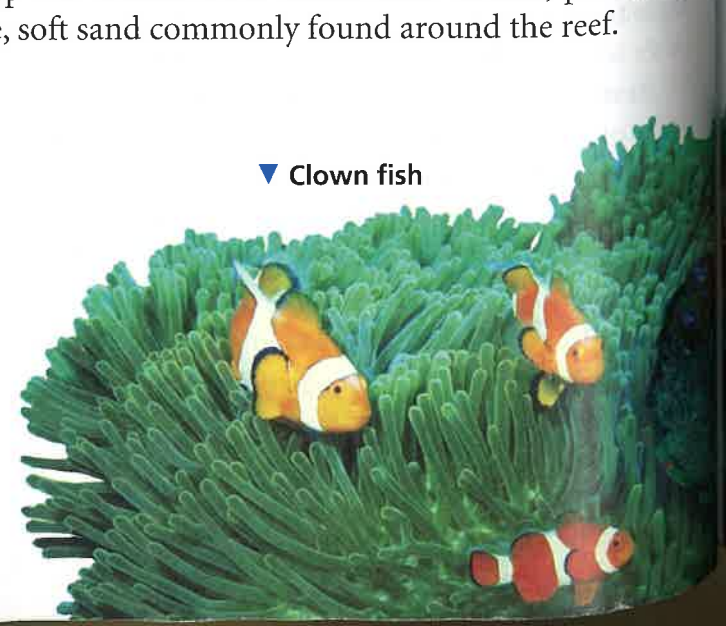
A coral reef is another type of diverse habitat found in the neritic zone. Although a coral reef may look as if it is made of rock, it is actually made of living things. Coral reefs are created by colonies of tiny coral animals, each of which is not much larger than a pencil eraser. Each coral animal produces a hard structure that surrounds its soft body. After the coral dies, the empty structure remains. New coral animals attach and grow on top of it. Over many years, a reef is built.

Environment of Coral Reefs Microscopic algae live in the bodies of the coral animals and provide food for the corals. The algae need warm temperatures and sunlight. **Therefore, coral reefs can form only in shallow, tropical ocean waters.** The reefs grow above continental shelves or around volcanic islands, where the water is shallow.

Ring-Shaped Reefs In areas where the seafloor is sinking, a reef may develop over time into an atoll. An **atoll** is a ring-shaped reef surrounding a shallow lagoon. Figure 13 shows the development of an atoll. It begins as a fringing reef that closely surrounds the edges of the island. As the sea floor sinks, the island sinks with it, and the reef continues to grow upward. Water separates the top of the barrier reef from the island. The island continues to sink until it is entirely underwater, forming the atoll.

Life Around a Reef Coral can form a variety of shapes. These shapes are suggested by the names of coral species—elkhorn, brain, plate, star. Many animals live in and around a coral reef. Coral-reef animals include octopuses, spiny lobsters, shrimp, and fishes in all colors and sizes. Parrotfish scrape coral off the reef to eat. The parrotfish grind up the broken coral inside their bodies, producing the fine, soft sand commonly found around the reef.

▼ Clown fish



Coral Reefs and Humans Coral reefs are like natural aquarium exhibits, displaying a colorful diversity of life that people can enjoy and study. Reefs also protect coastlines during violent storms. The reefs break up the surf, preventing waves from severely eroding the land. However, human activities can harm the fragile reefs. Boat anchors dragging across a reef can damage it. Divers can accidentally break off pieces of the reef. Even brushing against a reef can harm coral animals. Because coral grows only a few millimeters a year, a reef cannot quickly recover.

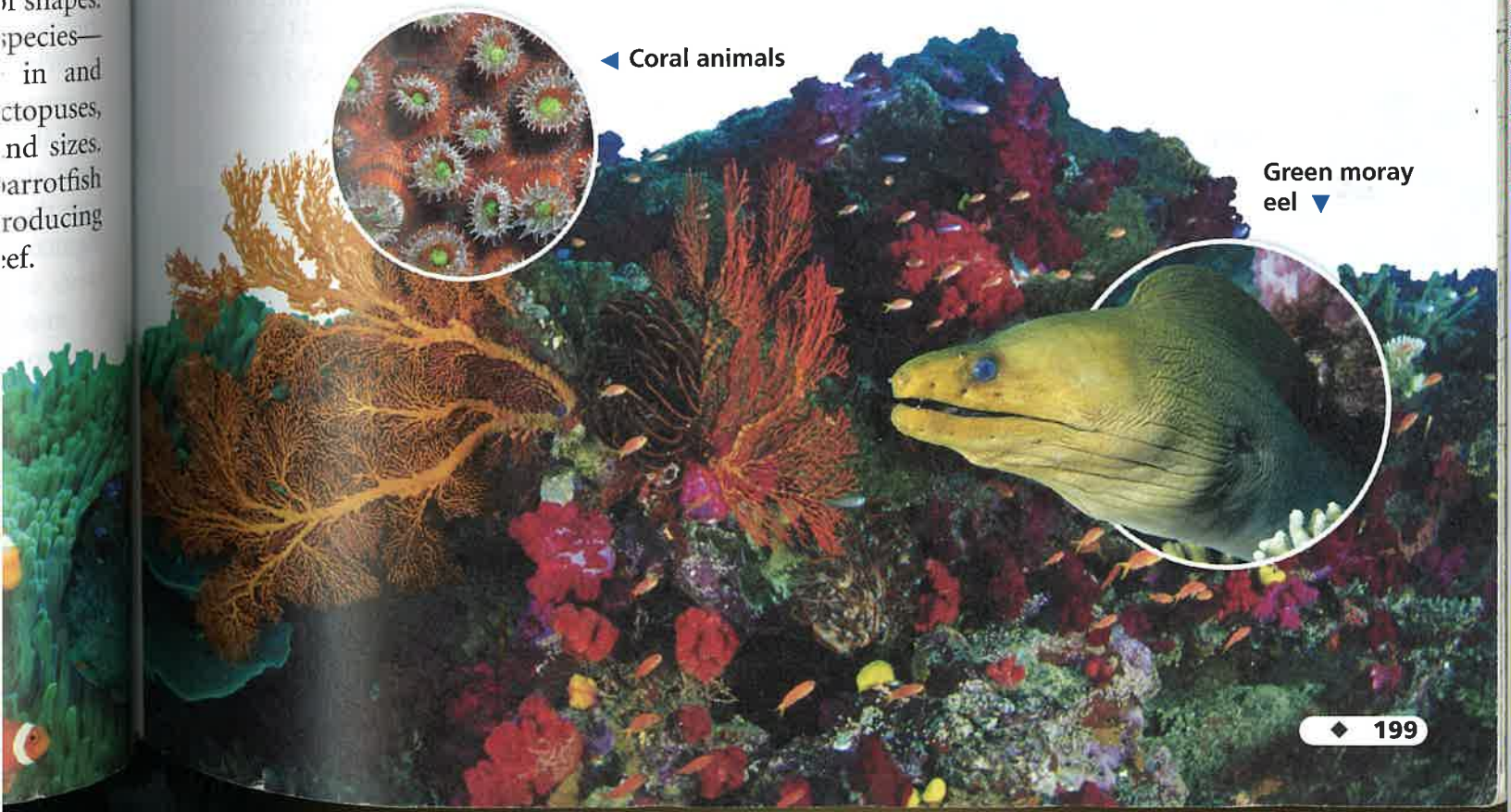
Changes in water temperature and clearness also affect algae, and therefore, endanger coral reefs. For example, if the water becomes too warm, the corals release the algae that live inside them. Cloudy water endangers the algae by reducing the amount of light that reaches them. If sediments produced by storms or human activities bury a reef, the algae in the living coral cannot survive. Without the algae, the coral animals die.

Today many people understand the importance of coral reefs and try to protect them. Many reef areas have been set aside as marine sanctuaries. In a marine sanctuary, the amount of diving and other activity near the reef is limited. Scientists are also studying the effects of temperature change and pollution on the reefs in order to preserve them.

Reading Checkpoint **How can human activities impact a coral reef?**

Go Online
NSTA SCILINKS™
For: Links on coral reefs
Visit: www.SciLinks.org
Web Code: scn-0844

FIGURE 14
Life Around a Coral Reef
Many animals, algae, and other organisms live in the diverse habitats of a coral reef.



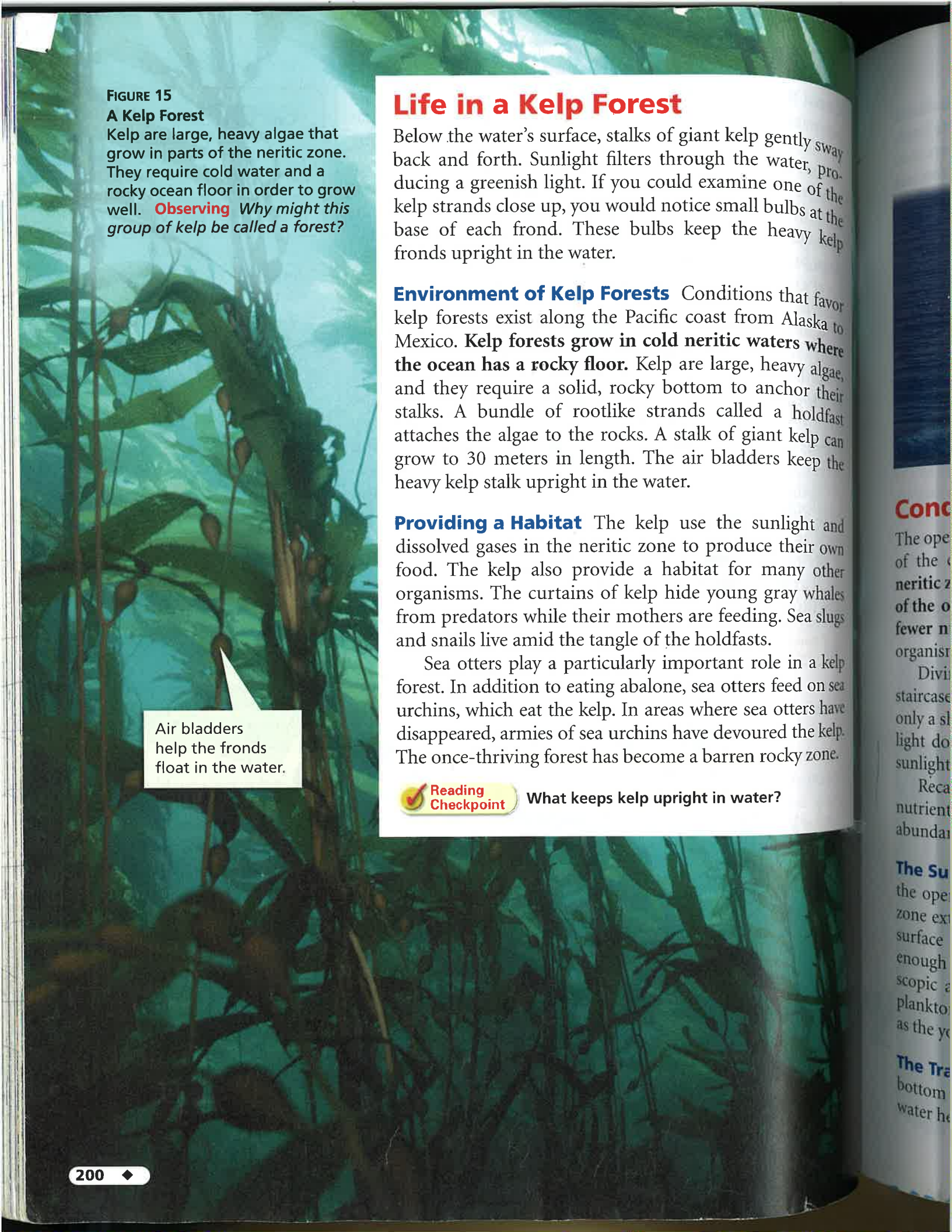


FIGURE 15
A Kelp Forest
Kelp are large, heavy algae that grow in parts of the neritic zone. They require cold water and a rocky ocean floor in order to grow well. **Observing** *Why might this group of kelp be called a forest?*

Life in a Kelp Forest

Below the water's surface, stalks of giant kelp gently sway back and forth. Sunlight filters through the water, producing a greenish light. If you could examine one of the kelp strands close up, you would notice small bulbs at the base of each frond. These bulbs keep the heavy kelp fronds upright in the water.

Environment of Kelp Forests Conditions that favor kelp forests exist along the Pacific coast from Alaska to Mexico. **Kelp forests grow in cold neritic waters where the ocean has a rocky floor.** Kelp are large, heavy algae, and they require a solid, rocky bottom to anchor their stalks. A bundle of rootlike strands called a holdfast attaches the algae to the rocks. A stalk of giant kelp can grow to 30 meters in length. The air bladders keep the heavy kelp stalk upright in the water.

Providing a Habitat The kelp use the sunlight and dissolved gases in the neritic zone to produce their own food. The kelp also provide a habitat for many other organisms. The curtains of kelp hide young gray whales from predators while their mothers are feeding. Sea slugs and snails live amid the tangle of the holdfasts.

Sea otters play a particularly important role in a kelp forest. In addition to eating abalone, sea otters feed on sea urchins, which eat the kelp. In areas where sea otters have disappeared, armies of sea urchins have devoured the kelp. The once-thriving forest has become a barren rocky zone.

Reading Checkpoint **What keeps kelp upright in water?**

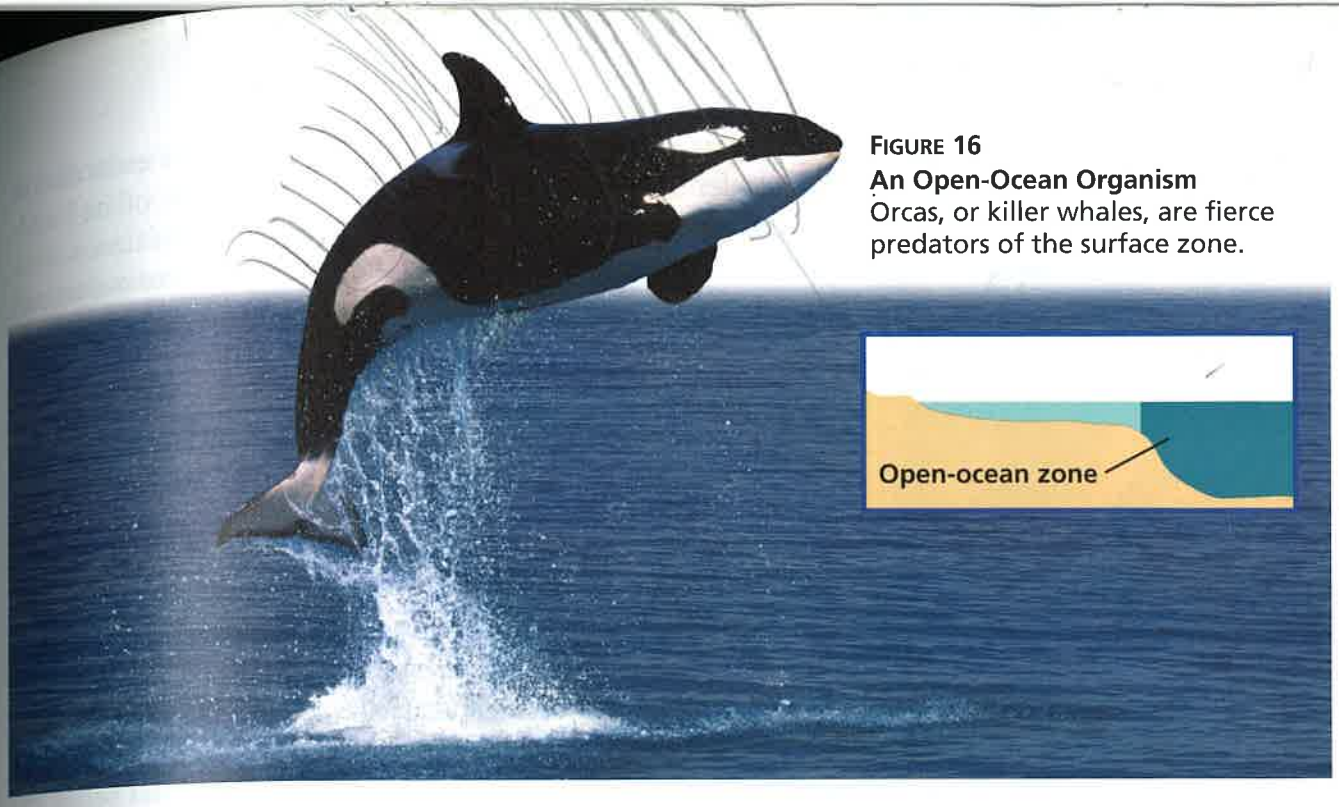


FIGURE 16
An Open-Ocean Organism
Orcas, or killer whales, are fierce predators of the surface zone.

Conditions in the Open Ocean

The open ocean begins where the neritic zone ends, at the edge of the continental shelf. **The open ocean differs from the neritic zone in two important ways. First, only a small part of the open ocean receives sunlight. Second, the water has fewer nutrients.** As a result, the open ocean supports fewer organisms.

Diving into the open ocean is like walking down a long staircase that has a light only at the top. Sunlight penetrates only a short distance into the water. If the water is cloudy, sunlight does not reach as far. In clear tropical waters, however, sunlight may reach as deep as a few hundred meters.

Recall that the neritic zone receives a constant supply of nutrients from shore. In contrast, dissolved nutrients are less abundant in the open ocean.

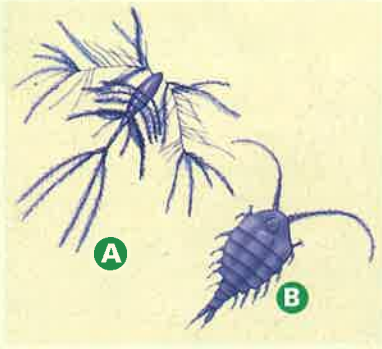
The Surface Zone You have read that the water column in the open ocean can be divided into three zones. The surface zone extends as far as sunlight reaches below the surface. The surface zone is the only part of the open ocean that receives enough sunlight to support the growth of algae. These microscopic algae are the base of open-ocean food webs. Animal plankton that feed on the algae include shrimplike krill, as well as the young of crabs, mollusks, and fishes.

The Transition Zone The transition zone extends from the bottom of the surface zone to a depth of about 1 kilometer. The water here is darker and colder than in the surface zone.

Lab zone Skills Activity

Inferring

To keep from sinking, many plankton rely on the friction between their bodies and the surrounding water. More friction is needed to stay afloat in warm water than in denser cold water. One of the copepods below is found in tropical ocean waters, while the other is found near the poles. Which do you think is which? Explain your reasoning. (*Hint:* More streamlined shapes create less friction with their surroundings.)



The Deep Zone In the deep zone, the water is even darker and colder than in the transition zone. Because of its harsh conditions, the deep ocean is often compared to a desert. Few organisms live in the deep zone, compared to other ocean and land environments. But unlike a desert, which bakes under the bright sun, the deep ocean is cold, dark, and wet.

Finding food in the darkness is a challenge. Many deep-sea fishes produce their own light. The production of light by living things is called **bioluminescence.** Chemical reactions in the cells of organisms produce bioluminescence.

In some cases, light is produced by bioluminescent bacteria that live on the bodies of fishes. In other cases, the chemical reactions take place in the bodies of the fishes, as they do in fireflies on land. For example, tiny light-producing structures are scattered over the surfaces of some fishes. Other fishes, such as the anglerfish, have light-producing organs. The anglerfish has a light organ on its head. The anglerfish lurks in the shadows below the pool of light created by its light organ. Shrimp and fishes that are attracted to the light become prey of the anglerfish.

The food supply in most of the deep ocean is much more limited than in shallower water. Therefore, animals in this zone must be good hunters to survive. The gaping mouths of many deep-sea fishes are filled with fanglike teeth. Rows of sharp teeth stick out at angles, ensuring that any animal it bites cannot escape.

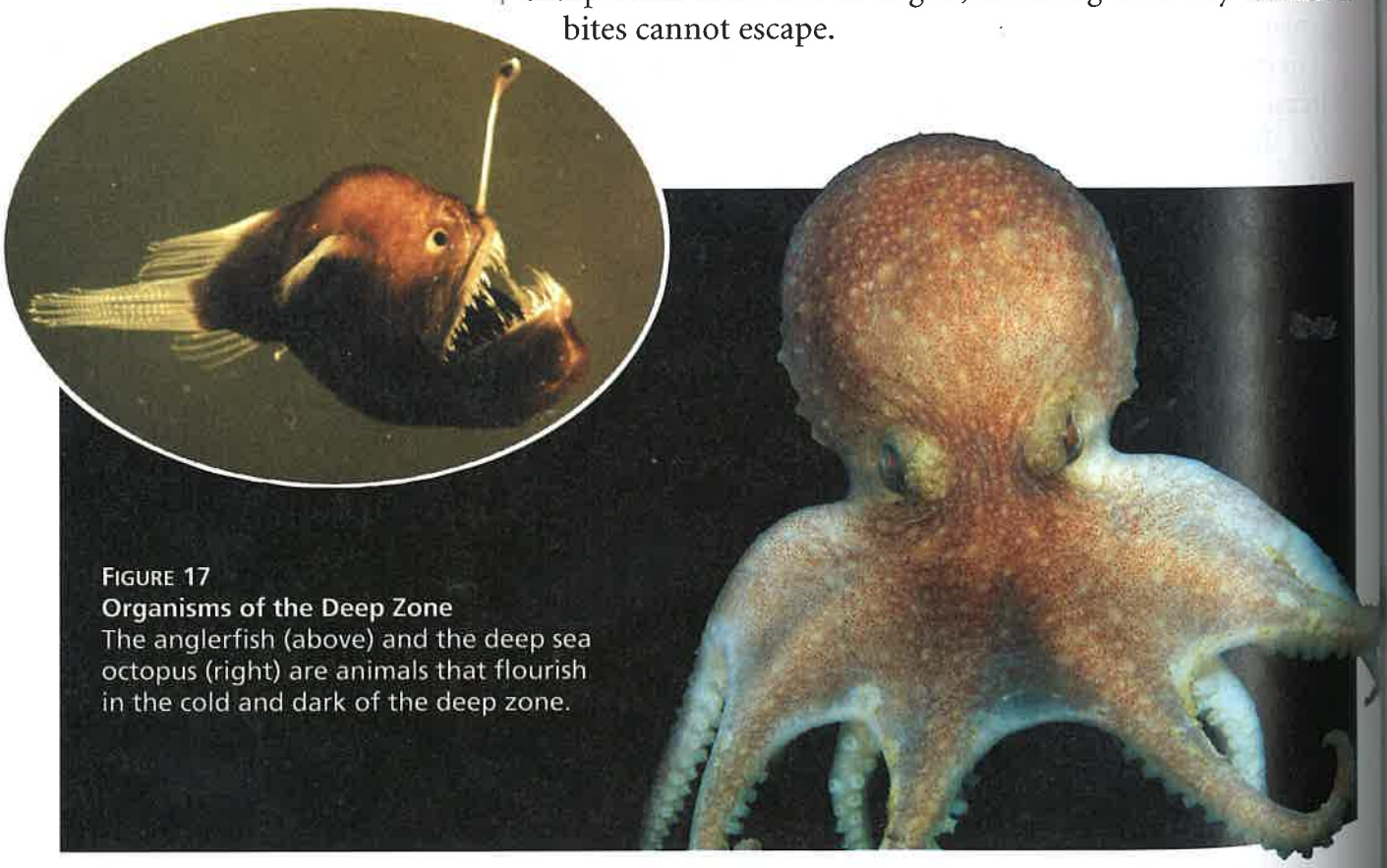


FIGURE 17
Organisms of the Deep Zone
The anglerfish (above) and the deep sea octopus (right) are animals that flourish in the cold and dark of the deep zone.

Hydrothermal Vents In the deep zone, food is very scarce. As a result, organisms there tend to be small and slow-moving. However, there is one kind of deep-zone environment—a hydrothermal vent—that supports organisms of an unusual number, variety, and size. At a **hydrothermal vent,** hot water rises out of cracks in the ocean floor. This rising water has been heated by hot rock magma beneath the ocean floor. These vents are located along ocean ridges, where the plates are moving apart and new ocean floor is forming.

A hydrothermal vent is far from sunlight. What could organisms around a hydrothermal vent find to eat? The heated water coming from a vent carries gases and minerals from Earth's interior. Bacteria feed directly on these chemical nutrients. Like the algae in the surface zone that use sunlight to produce food, these bacteria use chemical nutrients to produce food.

These bacteria form the base of the food web at a hydrothermal vent. Other organisms, such as giant clams, feed on the bacteria. The giant red-tipped tube worms are supplied with food by bacteria living within their tissues. Meanwhile, the crabs feed on the remains of the other inhabitants of their unusual habitat.

FIGURE 18
A Hydrothermal Vent
Giant tube worms and crabs cluster around a hydrothermal vent on the ocean floor.

Reading Checkpoint **What is a hydrothermal vent?**

Section 4 Assessment

Target Reading Skill **Relating Cause and Effect** Refer to your graphic organizer about conditions in the neritic zone to help you answer Question 1 below.

Reviewing Key Concepts

1. a. **Describing** Describe the physical conditions in the neritic zone.
   b. **Relating Cause and Effect** Explain how neritic-zone conditions support the growth of plankton.
   c. **Making Generalizations** Why are food webs in the neritic zone especially complex? (*Hint:* What is the role of plankton in food webs?)
2. a. **Describing** Describe life near a coral reef and life in a kelp forest.
   b. **Comparing and Contrasting** Compare and contrast the physical conditions that support coral reefs and kelp forests.
3. a. **Reviewing** How do conditions in the open ocean and the neritic zone differ?
   b. **Summarizing** Summarize the conditions that exist around hydrothermal vents.
   c. **Applying Concepts** Are the organisms around a hydrothermal vent typical of deep-zone organisms? Explain.

Writing in Science

Editorial You are a scientist studying a coral reef located near a tropical island. A forest on the island has been cut down. As a result, soil erosion is increasing. Write an editorial for the local newspaper explaining how this could affect the coral reef.