chapter 3

Communities, Biomes, and Ecosystems

section 3 Aquatic Ecosystems

MAIN Idea

Aquatic ecosystems are grouped by abiotic factors.

What You'll Learn

- how depth and water flow affect freshwater ecosystems
- how to identify transitional aquatic ecosystems
- the zones of marine ecosystems

Before You Read

On the lines below, list some characteristics of a body of water near you. How deep is it? Is the water salty? Is it calm or fast flowing? Then read the section to learn the characteristics of different water ecosystems.

Study Coach

Make Flash Cards Think of a quiz question for each paragraph. Write the question on one side of the flash card. Write the answer on the other side. Use the flash cards to quiz yourself until you know all the answers.

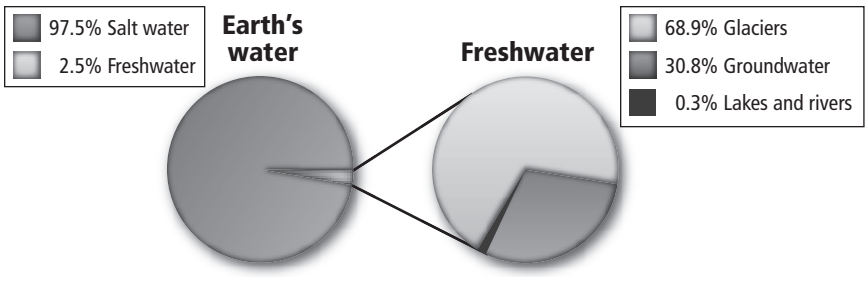
Read to Learn

The Water on Earth

Most of Earth is covered with water. Aquatic ecosystems include freshwater, transitional, and marine ecosystems.

Freshwater Ecosystems

Ponds, lakes, streams, rivers, and wetlands are freshwater ecosystems. The graph on the left below shows that only about 2.5 percent of Earth's water is freshwater. The graph on the right shows that 68.9 percent of the freshwater is contained in glaciers, 30.8 percent is groundwater, and 0.3 percent is found in lakes, ponds, rivers, streams, and wetlands. Almost all freshwater species live in the 0.3 percent.



Picture This

1. **Calculate** the percentage of freshwater that is not ice. Show your work.

What affects water flow in rivers and streams?

The water in rivers and streams flows in one direction. As illustrated in the figure below, the water flow begins at a source called a headwater. The water flows to the mouth, where it empties into a larger body of water. Rivers and streams also might start from underground springs or from melting snow.

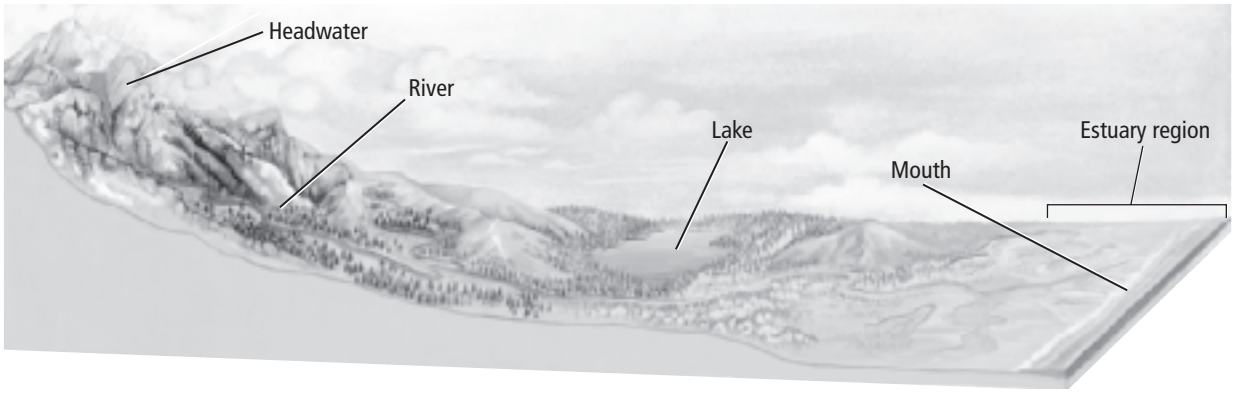
The slope of the land determines direction and speed of the water flow. Water flows quickly down a steep slope. Fast-flowing water picks up a lot of sediment. **Sediment** is material left by water, wind, or glaciers. As the slope levels, the fast-flowing water slows. This causes the sediment to be deposited in the form of sand, silt, and clay.

Rivers and streams change during their journey from source to mouth. Wind stirs up the water's surface and adds oxygen to the water. Water erodes the land, changing the path of the river or stream.

Currents of fast-moving rivers and streams prevent organic materials and sediments from building up. As a result, fewer species live in rapid waters. Organisms living in rivers and streams must be able to withstand the water current. Plants take root in streambeds where rocks and sand bars slow the water flow. In slow-moving water, insect eggs and larvae are the main food source for many fish. Calm water also provides a home for crabs, tadpoles, and frogs.

Picture This

2. Label the area of the river where most sediment will be deposited. On the lines below, explain why.



How does altitude affect life in lakes and ponds?

Some lakes and ponds last only a couple of weeks every year. Other lakes might exist for thousands of years. Nutrient-poor lakes, called oligotrophic (uh lih goh TROH fihk) lakes, are found high in the mountains. Few plant and animal species live in these lakes. Many plant and animal species live in nutrient-rich lakes, called eutrophic (yoo TROH fihk) lakes, at lower elevations.

Reading Check

3. Identify the limiting factor in oligotrophic lakes.

What distinguishes zones in lakes and ponds?

Lakes and ponds are divided into three zones that are determined by depth and distance from the shoreline. The area closest to shore is the **littoral** (LIH tuh rul) **zone**. Species in this zone includes algae, rooted and floating plants, snails, clams, insects, fishes, and amphibians. Some insect species lay eggs in the littoral zone and the larvae develop there.

The **limnetic** (lihm NEH tihk) **zone** is the open water area. It is well lit and full of plankton. **Plankton** are free-floating photosynthetic autotrophs that live in freshwater or marine ecosystems. Many species of freshwater fish live in the limnetic zone because food is plentiful there.

The deepest area of a lake is the **profundal** (pruh FUN dul) **zone**. It is much colder and has less oxygen than the other two zones. Less light reaches the profundal zone, which limits the species that are able to live there.

Think it Over

4. Explain why you would expect to find few plankton in the profundal zone.

Transitional Aquatic Ecosystems

Transitional aquatic ecosystems are a combination of two or more different environments. Transitional aquatic ecosystems can be areas where land and water mingle. They can also be areas where salt water and freshwater mix. Examples of transitional aquatic ecosystems are wetlands and estuaries.

What kinds of life thrive in wetlands?

Wetlands are areas of land that are saturated with water and support aquatic plants. Examples include marshes, swamps, and bogs. Bogs are wet and spongy areas of decomposing vegetation. Wetlands support a diversity of species. Pond lilies, cattails, amphibians, reptiles, birds, and mammals live in wetlands.

How do estuaries differ from wetlands?

An **estuary** (ES chuh wer ee) is an ecosystem that forms where a freshwater river or stream merges with the ocean. The mixing of waters with different salt concentrations creates a unique ecosystem. Algae, seaweed, and marsh grasses thrive in estuaries. Animals such as worms, oysters, and crabs feed on tiny organic matter called detritus (dih TRY tus). Many species of fishes, shrimp, ducks, and geese use estuaries as nurseries for their young.

Salt marshes are transitional ecosystems similar to estuaries. Salt-tolerant grasses live along the shoreline. Animals such as shrimp and shellfish live in salt marshes.

Think it Over

5. Contrast How do estuaries differ from wetlands?

Marine Ecosystems

Marine ecosystems have a major impact on the planet. For example, marine algae consume large amounts of carbon dioxide from the atmosphere. In the process, they supply much of the oxygen in the atmosphere. Also, water that evaporates from the oceans eventually provides most of Earth's precipitation—rain and snow. Oceans are separated into zones, as shown in the figure below.

How do the tides affect the intertidal zone?

The **intertidal** (ihn tur TY dul) **zone** is a narrow band where the ocean meets land. As tides and waves move in, the intertidal zone is submerged. As tides and waves move out, the intertidal zone is exposed. Only a few species of algae and mollusks live where the highest tides reach. A diversity of species, including algae and small animals such as snails, crabs, sea stars, and fishes, live in areas that are submerged during high tide. The bottom of the intertidal zone is exposed only during the lowest tides. Many species of invertebrates, fishes, and seaweed live here. On sandy coasts, waves constantly shift the sand. The constant shifting makes it hard for algae and plants to grow on sandy beaches. Animals that live on beaches include worms, clams, predatory crustaceans, crabs, and shorebirds.

Reading Check

6. Describe two important ways that marine ecosystems impact the planet.

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Picture This

7. Identify the zone in the figure that the tide does not submerge.

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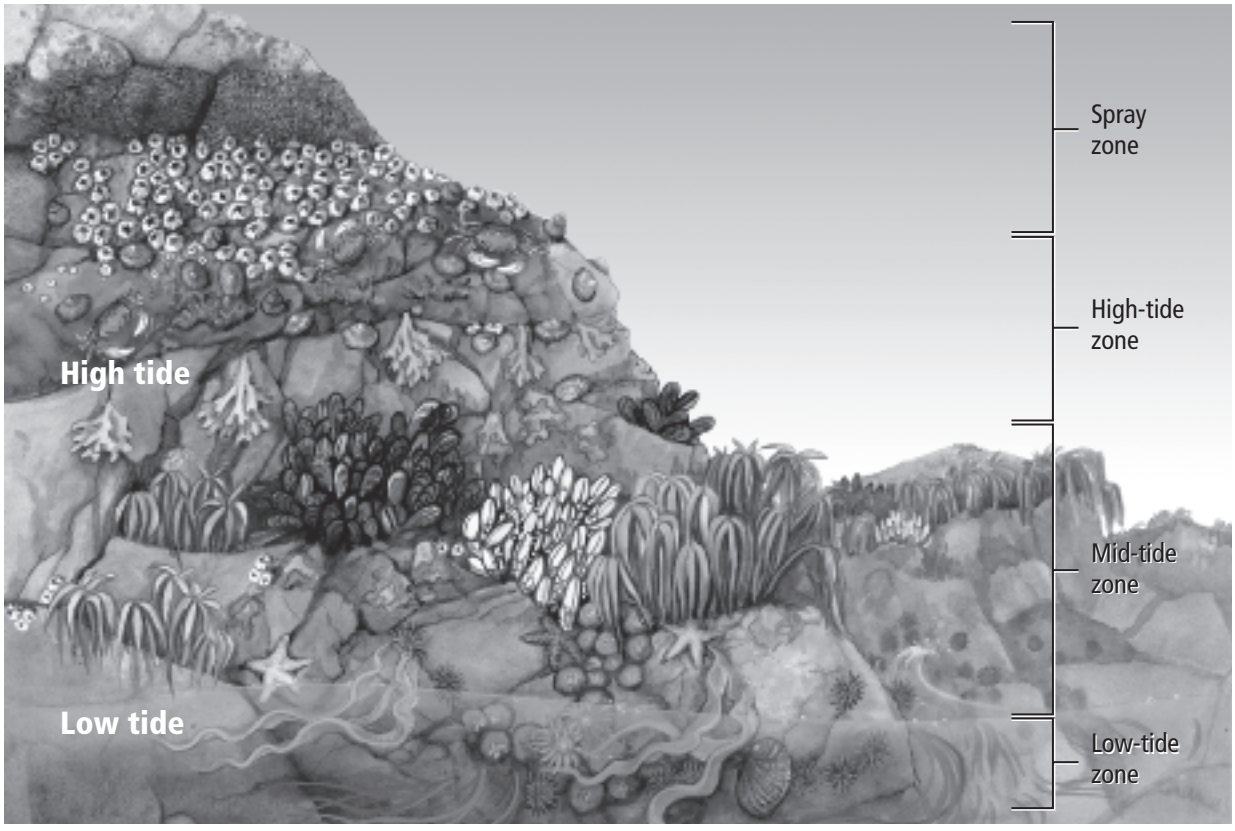

How do layers of the pelagic zone differ?

The open ocean is divided into the pelagic (puh LAY jihk) zone, abyssal (uh BIH sul) zone, and benthic zone. The **photic zone** is the area in the pelagic zone from the surface of the water down to about 200 m. The photic zone is shallow enough for sunlight to penetrate. As depth increases, light decreases. The photic zone supports seaweed, plankton, fishes, turtles, jellyfish, whales, and dolphins.

Below the photic zone lies the **aphotic zone** where sunlight cannot penetrate. This region of the pelagic zone remains in constant darkness. Organisms that depend on sunlight for energy cannot live in the aphotic zone. The water in the aphotic zone is generally cold.

Where are the benthic and abyssal zones?

The **benthic zone** is the area along the ocean floor. It consists of sand, silt, and dead organisms. In shallow areas, sunlight can penetrate to the ocean floor. As depth increases, less sunlight can penetrate and temperatures decrease. As a result, species diversity also decreases as depth increases. Many species of bacteria, fungi, sponges, sea anemones, and fishes live in shallower parts of the benthic zone.

Reading Check

8. Name two limiting factors as depth increases in the benthic zone.

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The **abyssal zone** is the deepest region of the ocean. The water is very cold. Most organisms depend on pieces of food that drift down from the zones above. Hydrothermal vents on the seafloor release hot water, hydrogen sulfide, and other minerals. Communities of bacteria live around these vents. These bacteria can use the sulfide molecules for energy.

What organisms do coral reefs support?

A coral reef is an ecosystem that exists in warm, shallow marine waters. The hard, stony structure of the reef is formed by secretions of tiny animals—coral polyps. Most coral polyps have a symbiotic relationship with algae. The algae provide corals with food. In turn, the corals provide algae with protection and access to light. Corals also feed by extending tentacles to catch plankton. Sea slugs, octopuses, sea urchins, sea stars, and fishes are part of the great diversity of the coral reef.

Reading Check

9. Define What is a coral? (Circle your answer.)

a. a plant
b. an animal
c. a colorful shell

Like all ecosystems, a coral reef is sensitive to changes in the environment. A natural event such as a tsunami as well as human activity such as land development can damage or kill a coral reef. Ecologists monitor coral reef environments to help protect them from harm.