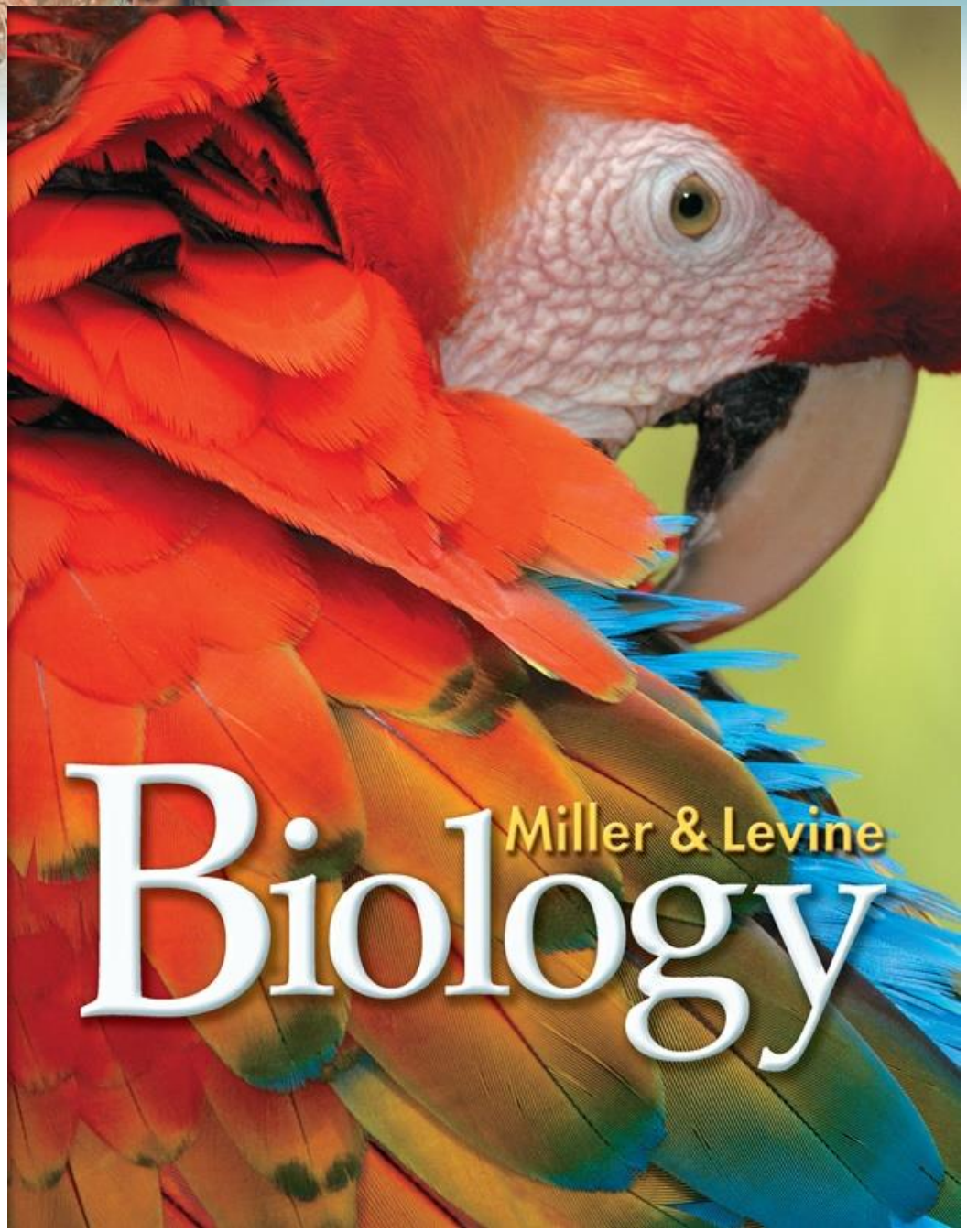


Lesson Overview

4.5 Aquatic Ecosystems

Conditions Underwater

- What factors affect life in aquatic ecosystems?

- Aquatic organisms are affected primarily by the water's depth, temperature, flow, and amount of dissolved nutrients.

Water Depth

Water depth strongly influences aquatic life because sunlight penetrates only a relatively short distance through water.

The sunlit region near the surface in which photosynthesis can occur is known as the **photic zone.**

The photic zone may be as deep as 200 meters in tropical seas, but just a few meters deep or less in rivers and swamps.

Water Depth

Photosynthetic algae, called phytoplankton, live in the photic zone.

Zooplankton—tiny free-floating animals—eat phytoplankton. This is the first step in many aquatic food webs.

Below the photic zone is the dark **aphotic zone**, where photosynthesis cannot occur.

Water Depth

Many aquatic organisms live on, or in, rocks and sediments on the bottoms of lakes, streams, and oceans.

These organisms are called the **benthos**, and their habitat is the benthic zone.

When the water is shallow enough for the benthic zone to be within the photic zone, algae and rooted aquatic plants can grow.

When the benthic zone is below the photic zone, chemosynthetic autotrophs are the only primary producers.

Temperature and Currents

Aquatic habitats are warmer near the equator and colder near the poles.

Temperature in aquatic habitats also often varies with depth. The deepest parts of lakes and oceans are often colder than surface waters.

Currents in lakes and oceans can dramatically affect water temperature because they can carry water that is significantly warmer or cooler than would be typical for any given latitude, depth, or distance from shore.

Nutrient Availability

Organisms need certain substances to live, such as oxygen, nitrogen, potassium, and phosphorus.

The type and availability of these dissolved substances vary within and between bodies of water, greatly affecting the types of organisms that can survive there.

Freshwater Ecosystems

- What are the major categories of freshwater ecosystems?

- Freshwater ecosystems can be divided into three main categories: rivers and streams, lakes and ponds, and freshwater wetlands.

Rivers and Streams

Rivers, streams, creeks, and brooks often originate from underground water sources in mountains or hills.

Near a source, water has plenty of dissolved oxygen but little plant life.

Downstream, sediments build up and plants establish themselves. Farther downstream, water may meander slowly through flat areas.

Animals in many rivers and streams depend on terrestrial plants and animals that live along their banks for food.

Lakes and Ponds

The food webs in lakes and ponds often are based on a combination of plankton and attached algae and plants.

Plankton is a general term that includes both phytoplankton and zooplankton.

Water flows in and out of lakes and ponds and circulates between the surface and the benthos, distributing heat, oxygen, and nutrients.

Freshwater Wetlands

A **wetland** is an ecosystem in which water either covers the soil or is present at or near the surface for at least part of the year.

Water may flow through freshwater wetlands or stay in place.

Wetlands are often nutrient-rich, highly productive, and serve as breeding grounds for many organisms.

Freshwater wetlands purify water by filtering pollutants and help to prevent flooding by absorbing large amounts of water and slowly releasing it.

Three main types of freshwater wetlands are freshwater bogs, freshwater marshes, and freshwater swamps.

Saltwater wetlands are called estuaries.

Estuaries

An **estuary** is a special kind of wetland, formed where a river meets the sea.

Estuaries contain a mixture of fresh water and salt water, and are affected by the rise and fall of ocean tides.

Many are shallow, which means that enough sunlight reaches the benthos to power photosynthesis.

Estuaries serve as spawning and nursery grounds for many ecologically and commercially important fish and shellfish species including bluefish, striped bass, shrimp, and crabs.

Estuaries

Salt marshes are temperate estuaries that have salt-tolerant grasses above the low-tide line and seagrasses below water.

One of the largest salt marshes in America surrounds the Chesapeake Bay in Maryland.

Estuaries

Mangrove swamps are tropical estuaries that have several species of salt-tolerant trees, collectively called mangroves.

The largest mangrove area in America is in Florida's Everglades National Park.

Marine Ecosystems

Ecologists typically divide the ocean into zones based on depth and distance from shore.

Starting with the shallowest and closest to land, marine ecosystems include the intertidal zone, the coastal ocean, and the open ocean.

Intertidal Zone

Organisms in the intertidal zone are submerged in seawater at high tide and exposed to air and sunlight at low tide.

These organisms are subjected to regular and extreme changes in temperature and are often battered by waves and currents.

A typical rocky intertidal community exists in temperate regions where exposed rocks line the shore.

There, barnacles and seaweed permanently attach themselves to the rocks.

Coastal Ocean

The coastal ocean extends from the low-tide mark to the outer edge of the continental shelf—the relatively shallow border that surrounds the continents.

Water in the coastal ocean is brightly lit, and is often supplied with nutrients by freshwater runoff from land. As a result, coastal oceans tend to be highly productive.

Kelp forests and coral reefs are two important coastal communities.

Open Ocean

The open ocean begins at the edge of the continental shelf and extends outward.

More than 90 percent of the world's ocean area is considered open ocean.

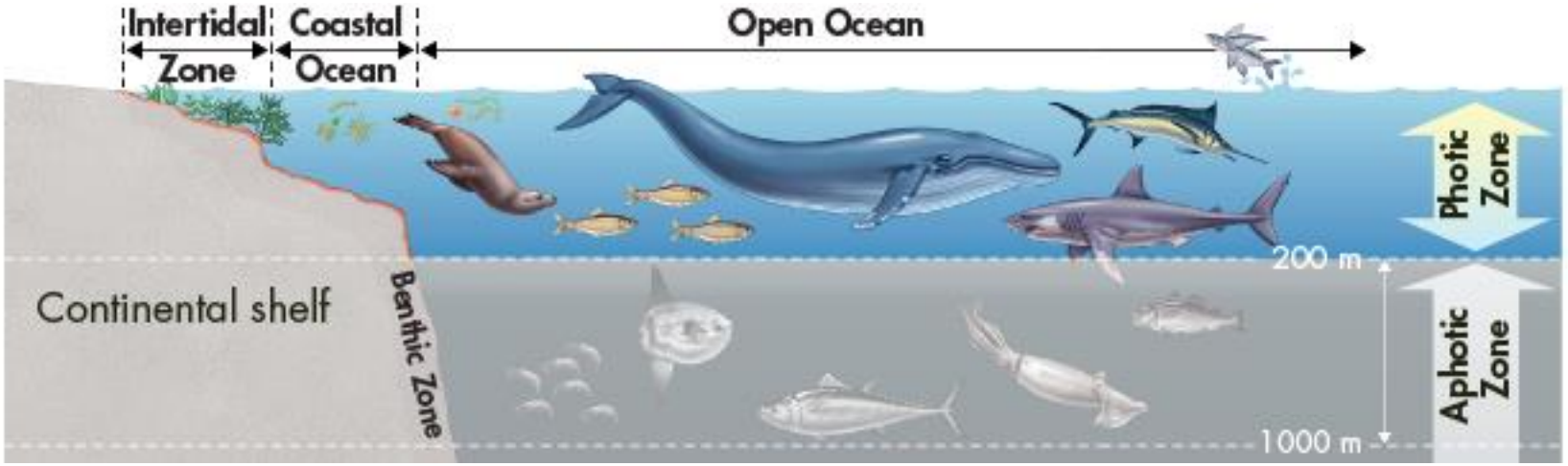
Depth ranges from 500 m along continental slopes to more than 10,000 m in ocean trenches.

The open ocean is divided into two zones based on light penetration—the photic and aphotic.

The Open Ocean Photic Zone

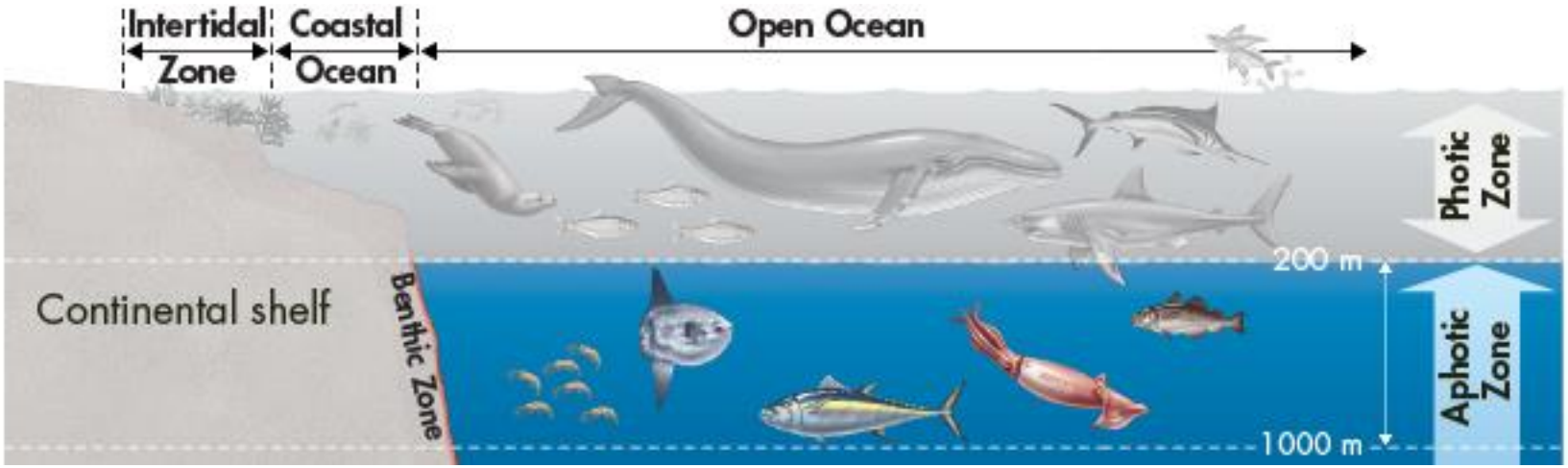
The open ocean typically has low nutrient levels and supports only the smallest species of phytoplankton.

Still, because of its enormous area, most photosynthesis on Earth occurs in the sunlit top 100 meters of the open ocean.



The Open Ocean Aphotic Zone

The permanently dark aphotic zone includes the deepest parts of the ocean.



The Open Ocean Aphotic Zone

Food webs in the aphotic zone are based either on organisms that fall from the photic zone above, or on chemosynthetic organisms.

Deep ocean organisms, like hatchet fish, are exposed to high pressure, frigid temperatures, and total darkness.

Benthic environments in the deep sea were once thought to be nearly devoid of life but are now known to have islands of high productivity.

Deep-sea vents, where superheated water boils out of cracks on the ocean floor, support chemosynthetic primary producers.