

Aquatic Ecosystems

Freshwater Ecosystems

The types of organisms in an aquatic ecosystem are mainly determined by the water's salinity. As a result, aquatic ecosystems are divided into freshwater and marine ecosystems.

Freshwater ecosystems include ponds, lakes, streams, rivers, and wetlands.

Wetlands are areas of land that are periodically under water or whose soil contains a great deal of moisture.



Characteristics of Aquatic Ecosystems

Factors such as temperature, sunlight, oxygen, and nutrients determine which organisms live in which area of the water.

Aquatic ecosystems contains several types of organisms that are grouped by their location and by their adaptation.

Three groups of aquatic organisms include plankton, nekton, and benthos.

Characteristics of Aquatic Ecosystems

Plankton are the mass of mostly microscopic organisms that float or drift freely in the water, and can be microscopic animals called zooplankton or microscopic plants called phytoplankton.

Nekton are all organisms that swim actively in open water, independent of currents.

Benthos are bottom-dwelling organisms of the sea or ocean and are often attached to hard surfaces.

Decomposers are also aquatic organisms.







Lakes and Ponds

Lakes, ponds, and wetlands can form naturally where groundwater reaches the Earth's surface.

Humans intentionally create artificial lakes by damming flowing rivers and streams to use them for power, irrigation, water storage, and recreation.

Lakes and ponds can be structured into horizontal and vertical zones. The types of organisms present depend on the amount of sunlight available.

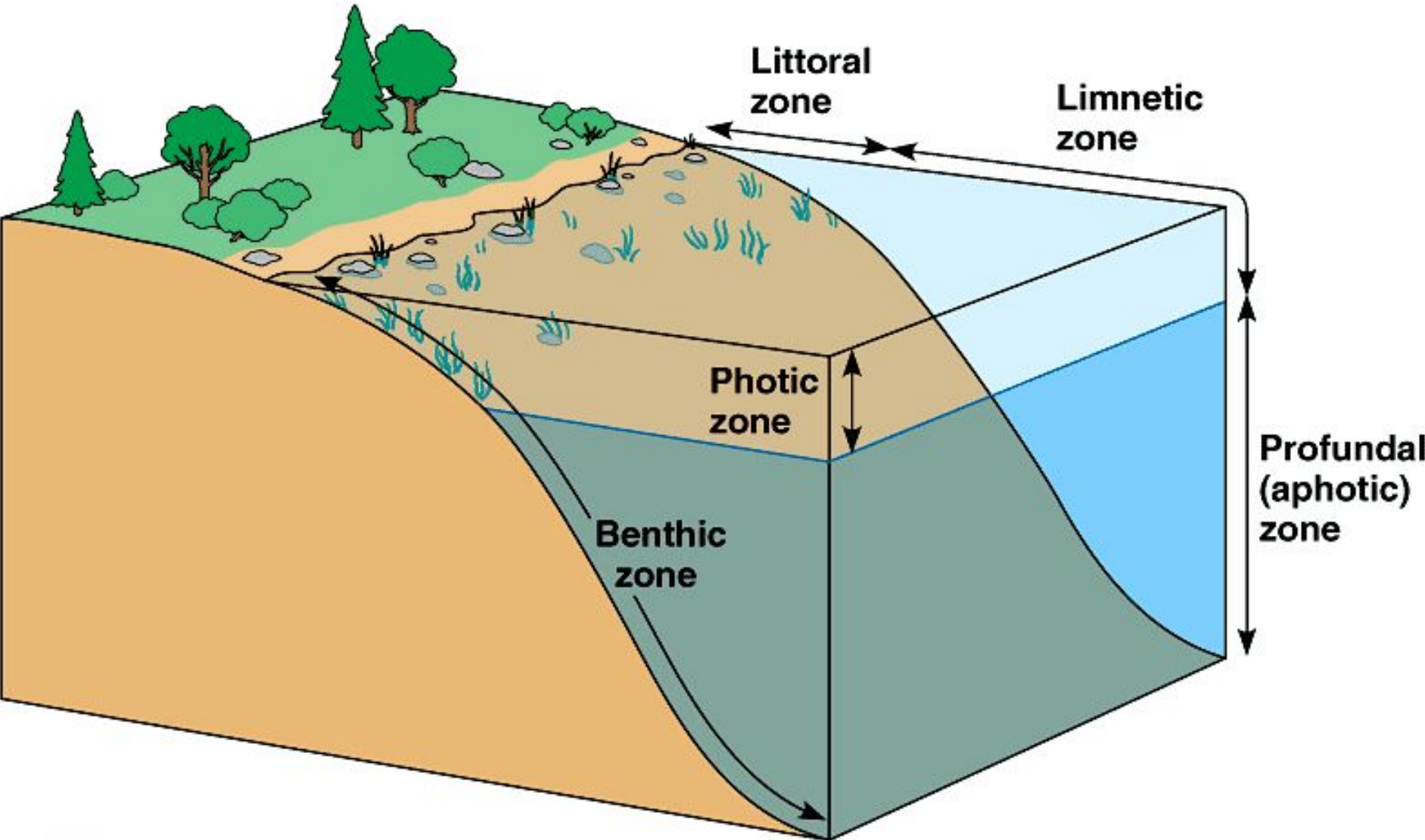


Life in a Lake

The **littoral zone** is a shallow zone in a freshwater habitat where light reaches the bottom and nurtures plants and aquatic life is diverse and abundant.

Some plants have rooted in the mud underwater with their upper leaves and stems above water. Other plants have floating leaves.

In open water, plants, algae, and some bacteria capture solar energy to make their own food during photosynthesis.



Life in a Lake

Some bodies of fresh water have areas so deep that there is too little light for photosynthesis.

Bacteria live in the deep areas of freshwater. Fish adapted to cooler, darker water also live there.

Eventually, dead and decaying organisms reach the benthic zone.

The **benthic zone** is the region near the bottom of a pond, lake or ocean which is inhabited by decomposers, insect larvae, and clams.

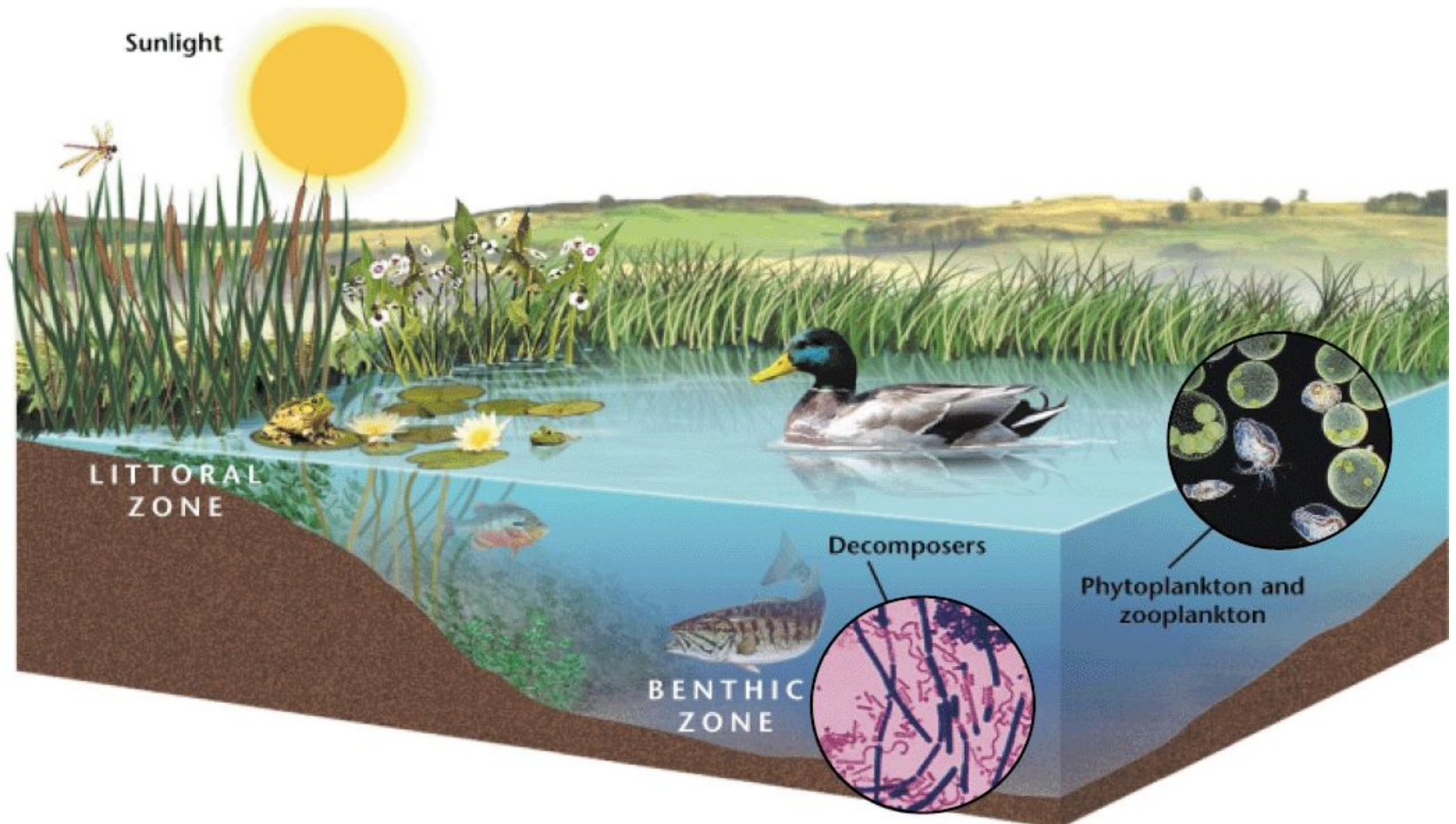
Life in a Lake

Animals that live in lakes and ponds have adaptations that help them obtain what they need to survive.

For example, water beetles use the hairs under their bodies to trap surface air so that they can breathe during their dives for food.

And, in regions where lakes partially freeze in the winter, amphibians burrow into the littoral mud to avoid freezing temperatures.

A Lake Ecosystem



How Nutrients Affect Lakes

Eutrophication is an increase in the amount of nutrients, such as nitrates, in an aquatic ecosystem.

As the amount of plants and algae grow, the number of bacteria feeding on the decaying organisms also grows.

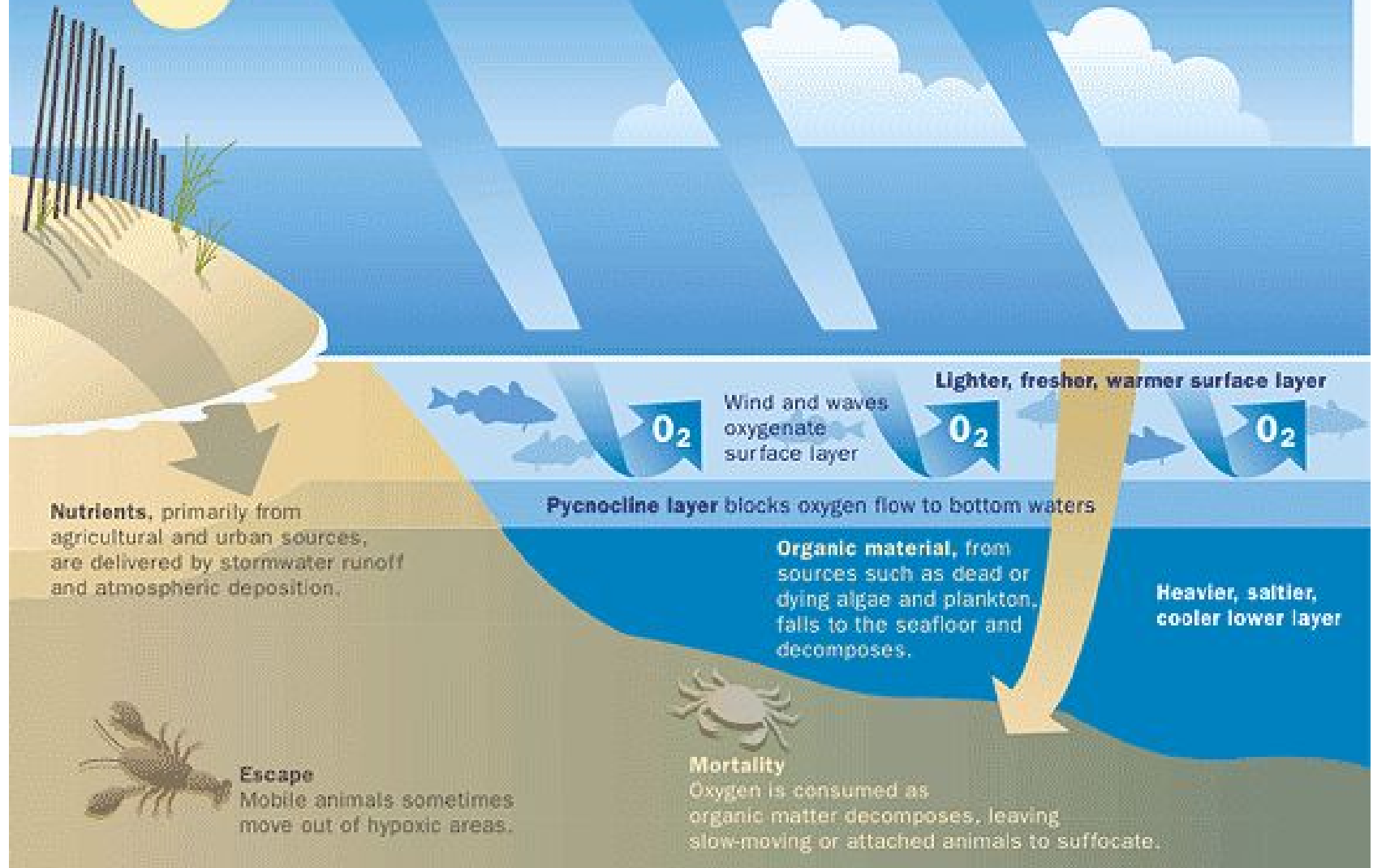
These bacteria use the oxygen dissolved in the lake's waters. Eventually the reduced amount of oxygen kills oxygen loving organisms.

How Nutrients Affect Lakes

A lake that has large amounts of plant growth due to nutrients is known as a eutrophic lake. Lakes naturally become eutrophic over a long period of time.

However, eutrophication can be accelerated by runoff, such as rain, that can carry sewage, fertilizers, or animal wastes from land into bodies of water.

The Eutrophication Process



Freshwater Wetlands

Freshwater wetlands are areas of land that are covered with fresh water for part of the year.

The two main types of freshwater wetlands are **marshes and swamps**. Marshes contain nonwoody plants, while swamps are dominated by woody plants.

Most freshwater wetlands are located in the **Southeastern United States**, with the largest in the Florida Everglades.

Freshwater Wetlands





Freshwater Wetlands

Wetlands perform several important environmental functions.

Wetlands act like **filters** or sponges that absorb and remove pollutants from the water. They also **control flooding** by absorbing extra water when rivers overflow.

These areas provide a home for native and migratory wildlife in addition to feeding and spawning for many freshwater game fish.

Environmental Functions of Wetlands

Environmental Functions of Wetlands

- trapping and filtering sediments, nutrients, and pollutants, which keep these materials from entering lakes, reservoirs, and oceans
- reducing the likelihood of a flood, protecting agriculture, roads, buildings, and human health and safety
- buffering shorelines against erosion
- providing spawning grounds and habitat for commercially important fish and shellfish
- providing habitat for rare, threatened, and endangered plants and animals
- providing recreational areas for activities such as fishing, bird-watching, hiking, canoeing, photography, and painting

Marshes

Freshwater marshes tend to occur on low, flat lands and have **little water movement**.

In shallow waters, plants root themselves in the rich bottom sediments while their leaves stick out about the surface of the water year round.

There are several kinds of marshes, each of which is characterized by its salinity. Brackish marshes have slightly salty water, while salt marshes contain saltier water.



Marshes

The benthic zones of marshes are nutrient rich and contain plants, numerous types of decomposers, and scavengers.

Water fowl, such as ducks, have flat beaks adapted for sifting through the water for fish and insects. While water birds, such as herons, have spearlike beaks they use to grasp small fish and probe for frogs in the mud.

Marshes also attract migratory birds from temperate and tropical habitats.

Swamps

Swamps occur on flat, poorly drained land, often near streams and are dominated by woody shrubs or **water loving trees**.

Freshwater swamps are the ideal habitat for amphibians because of the continuous moisture. Birds are also attracted to hollow trees near or over the water.

Reptiles are the predators of the swamp, eating almost any organism that crosses their path.



Human Impact on Wetlands

Wetlands were previously considered to be wastelands that provide breeding grounds for insects.

As a result, many have been drained, filled, and cleared for farms or residential and commercial development.

The importance of wetlands is now recognized, as the law and the federal government protect many wetlands while most states now prohibit the destruction of certain wetlands.

Rivers

At its headwaters, a river is usually cold and full of oxygen and runs swiftly through a shallow riverbed.

As a river flows down a mountain, it may broaden, become warmer, wider, slower, and decrease in oxygen.

A river changes with the land and the climate through which it flows.



Life in a River

In and near the headwater, mosses anchor themselves to rocks by using rootlike structures called *rhizoids*. Trout and minnows are adapted to the cold, oxygen rich water.

Farther downstream, plankton can float in the warmer, calmer waters. Plants here can set roots in the river's rich sediment, and the plant's leaves vary in shape according to the strength of the river's current. Fish such as catfish and carp also live in these calmer waters.

Rivers in Danger

Industries use river water in manufacturing processes and as receptacles for wastes. In addition, people have used rivers to dispose of their sewage and garbage.

These practices have polluted rivers with **toxins**, which have killed river organisms and made river fish inedible.

Today, runoff from the land puts pesticides and other poisons into rivers and coats riverbeds with toxic sediments.

Marine Ecosystems

Marine ecosystems are located mainly in coastal areas and in the open ocean.

Organisms that live in coastal areas adapt to changes in water level and salinity.

Organisms that live in the open ocean adapt to changes in temperature and the amount of sunlight and nutrients available.

Coastal Wetlands

Coastal land areas that are covered by salt water for all or part of the time are known as coastal wetlands.

Coastal wetlands provide habitat and nesting areas for many fish and wildlife.

They also absorb excess rain, which protects them from flooding, they filter out pollutants and sediments, and they provide recreational areas for boating, fishing, and hunting.

Estuaries

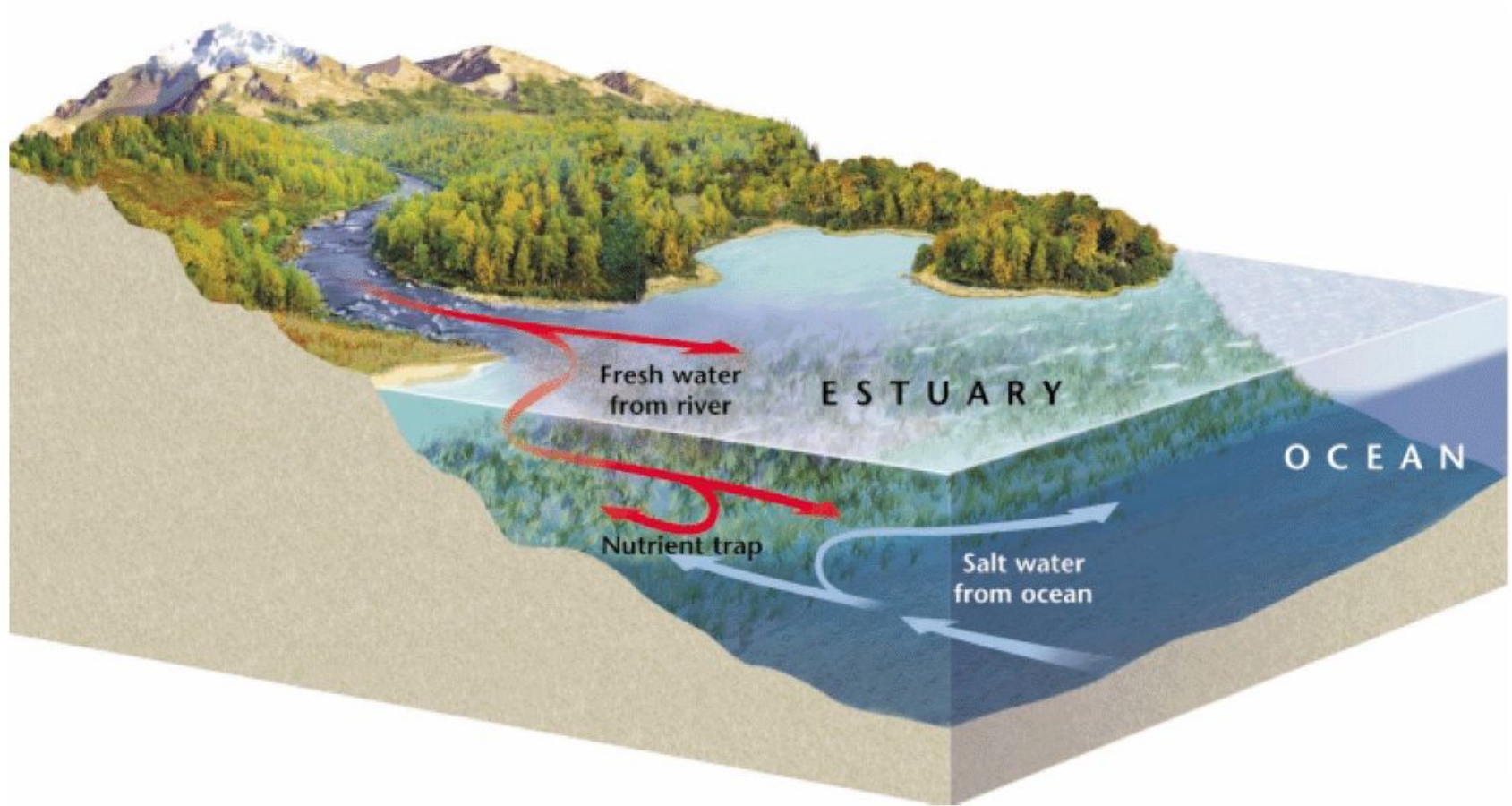
An **estuary** is an area where fresh water from rivers mixes with salt water from the ocean.

As the two bodies meet, currents form and cause mineral rich mud with many nutrients to fall to the bottom making it available to producers.

Estuaries are very productive because they constantly receive nutrients from the river and ocean while the surrounding land protects the estuaries from the harsh force of ocean waves.



Estuaries



Plants and Animals of Estuaries

Estuaries support many marine organisms because they receive plenty of light for photosynthesis and plenty of nutrients for plants and animals.

The light and nutrients support large populations of rooted plants as well as plankton. Plankton in turn provide food for fish, which can then be eaten by larger animals such as dolphins.

Oysters and clams live anchored to rocks and feed by filtering plankton from the water.

Plants and Animals of Estuaries

Organisms that live in estuaries are able to tolerate variations in salinity because the salt content of the water varies as fresh water and salt water mix when tides go in and out.

Estuaries also proved protected harbors, access to the ocean, and connection to rivers. As a result, many of the largest ports have been built on estuaries.

Six of the ten largest urban areas, including New York have been built on estuaries.



Threats to Estuaries

Estuaries that exist in populated areas were often used as places to **dump waste**. Estuaries filled with waste could then be used as building sites. The pollutants that damage estuaries include sewage, pesticides, fertilizers, and toxic chemicals. Most of these pollutants break down over time, but estuaries cannot cope with the amounts produced by dense human populations.

Salt Marshes

Salt marshes are maritime habitats characterized by grasses, sedges, and other plants that have adapted to continual, periodic flooding and are found primarily throughout the temperate and subarctic regions.

The salt marsh supports a community of clams, fish, aquatic birds, crabs, and shrimp.

Salt marshes, like other wetlands, also absorb pollutants to help protect inland areas.

Mangrove Swamps

Mangrove swamps are tropical or subtropical marine swamps that are characterized by the abundance of low to tall mangrove trees.

The swamps help protect the coastline from erosion and reduce the damage from storms. They also provide a home for about 2,000 animal species.

Mangrove swamps have been filled with waste and destroyed in many parts of the world.



Rocky and Sandy Shores

Rocky shores have many more plants and animals than sandy shores do because the rocks provide anchorage for seaweed that animals can live on.

Sandy shores dry out when the tide goes out, and many organisms that live between sand grains eat the plankton left stranded on the sand.

A **Barrier island** is a long ridge of sand or narrow island that lies parallel to the shore and helps protect the mainland.



Jane Thomas, IAN/UMCES

Coral Reefs

Coral reefs are limestone ridges found in tropical climates and composed of coral fragments that are deposited around organic remains.

Thousands of species of plants and animals live in the cracks and crevices of coral reefs, which makes **coral reefs among the most diverse ecosystems on Earth.**

Corals are predators that use stinging tentacles to capture small animals, such as zooplankton, that float or swim close to the reef.



Coral Reefs

Corals live only in clear, warm salt water where there is enough light for photosynthesis.



Disappearing Coral Reefs

Coral reefs are productive ecosystems, but they are also very fragile.

If the water surrounding a reef is too hot or too cold, or if fresh water drains into the water surrounding the coral, the coral may die.

If the water is too muddy, polluted, or too high in nutrients, the algae that live within the corals will either die or grow out control. If the algae grows out of control, it may kill the corals.

Disappearing Coral Reefs

Oil spills, sewage, pesticides, and silt runoff have also been linked to coral-reef destruction.

Overfishing can devastate fish populations, upsetting the balance of the reef's ecosystem.

A coral reef grows very slowly, and it may not be able to repair itself after chunks of coral are destroyed by careless divers, ships dropping anchor, fisheries, shipwrecks, and people breaking off pieces for decorative items or building materials.

Oceans

Because water absorbs light, sunlight that is usable by plants for photosynthesis penetrates only about 100 m into the ocean.

As a result, much of the ocean's life is concentrated in the shallow coastal waters where sunlight penetrates to the bottom and rivers wash nutrients from the land.

Seaweed and algae grow anchored to rocks, and phytoplankton drift on the surface. Invertebrates and fish then feed on these plants.



Plants and Animals of Oceans

In the open ocean, phytoplankton grow only in areas where there is enough light and nutrients, resulting in one of the least productive of all ecosystems.

The sea's smallest herbivores are zooplankton, including jellyfish and tiny shrimp, which live near the surface with the phytoplankton they eat.

Fish feed on the plankton as do marine mammals such as whales.

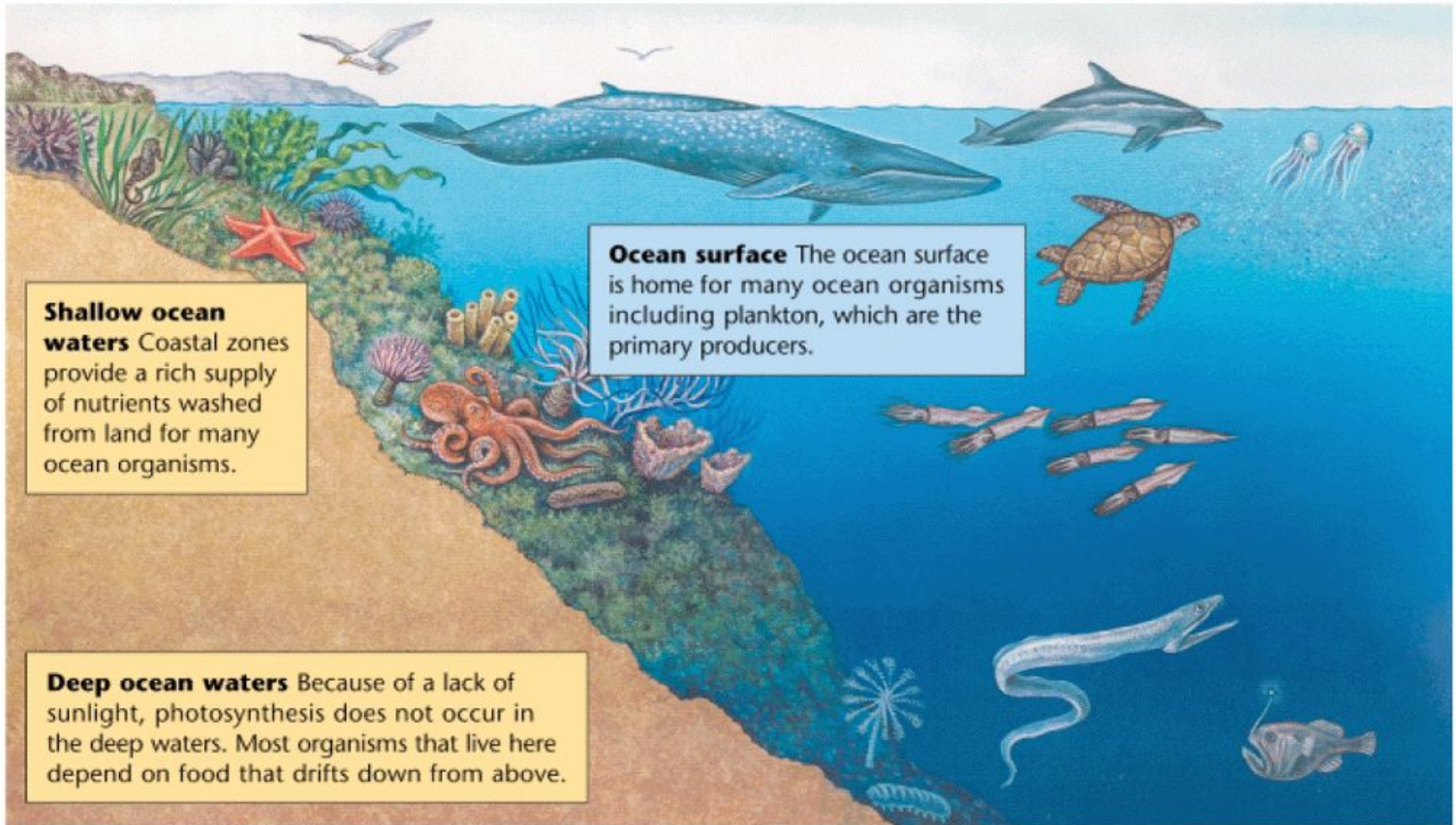
Plants and Animals of Oceans

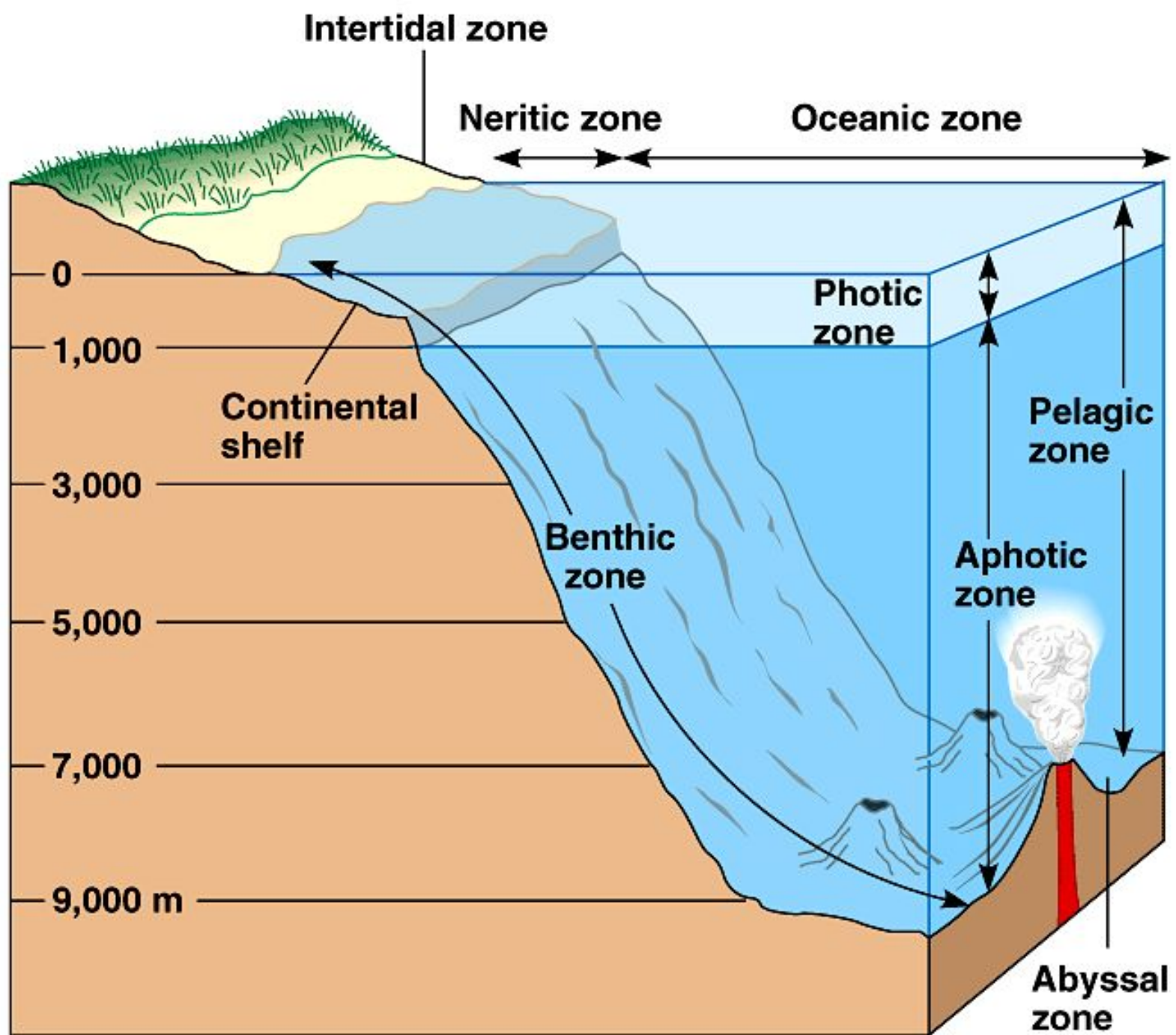
The depths of the ocean are very dark, so most food at the ocean floor consists of dead organisms that fall from the surface.

Decomposers, filter feeders, and the organisms that eat them live in the deep areas of the ocean.

Overall, the types of organisms that may be found in the layers of the ocean at various depths is dependent on available sunlight.

Plants and Animals of Oceans





Threats to the Oceans

The oceans are steadily becoming more polluted. **Runoff** from fertilized fields and industrial waste and sewage being discharged into rivers are major sources of ocean pollution.

Overfishing and certain fishing methods are also destroying some fish populations. Marine mammals can get caught and drown in the nets.

Although it is illegal, some ships discard fishing lines into the ocean where they can strangle and kill fish and seals.

Arctic and Antarctic Ecosystems

The Arctic Ocean is rich in nutrients from the surrounding landmasses and supports large populations of plankton, which feed a diversity of fish in the open water and under the ice.

These fish are food for ocean birds, whales. The arctic ecosystems at the North and South Poles depend on marine ecosystems because nearly all the food comes from the ocean.

and seals. Fish and seals then provide food for polar bears and people on land.

Arctic and Antarctic Ecosystems

The Antarctic is the only continent never colonized by humans. It is governed by an international commission and is used mainly for research.

Even during the summer, only a few plants grow at the edges of the continent.

So, as in the Arctic, plankton form the basis of the Antarctic food web, nourishing large numbers of fish, whales, and birds such as penguins.