

Major Aquatic Ecosystems

Aquatic ecosystems are divided into two broad categories. Freshwater ecosystems have salt concentrations that are typically below 1 %. Ocean, or marine, ecosystems have salt concentrations averaging about 3 %. While the difference in salt concentration may appear small, it has a dramatic influence on the chemical and physical properties of the water. Anyone who has gone swimming in the ocean knows how much more buoyant they are in salt water when compared with fresh water.



Figure 1 The water in rivers and streams is constantly moving.

oligotrophic a body of water that is low in nutrients

eutrophic a body of water that is rich in nutrients

Freshwater Ecosystems

Freshwater ecosystems consist of moving bodies of water, such as rivers, and nearly stationary bodies of water, such as lakes. Rivers and streams are unique among ecosystems as they are continuously flushed with a fresh supply of water from upstream. Organisms must either swim continuously against the current or attach themselves to the bottom or some other fixed object (Figure 1).

Lakes and ponds are classified based on their nutrient levels.

Oligotrophic bodies of water are low in nutrients (Figure 2). Even with abundant light, photosynthetic organisms have difficulty obtaining enough nutrients to grow. **Eutrophic** bodies of water are high in nutrients. Photosynthetic aquatic plants and algae grow more rapidly and support a large biomass of consumers. Eutrophic bodies of water are often clouded with suspended microscopic plankton.



(a)



(b)

Figure 2 (a) Oligotrophic lakes are often clear and deep and favoured for swimming and boating. (b) Eutrophic ecosystems have more insects, are murky, have less open water, and may be too shallow for boating.

Wetlands such as bogs and marshes are large areas of shallow water or saturated soils. They are nutrient rich and support large populations of fish, amphibians, insects, and birds. Wetlands act as huge sponges and play a critical role in filtering water in the water cycle.

Watersheds

Watersheds are an important characteristic of freshwater ecosystems. A **watershed** is the area of land through which all water drains into a single river or lake. This geographical relationship is important because water always flows downhill. If a pollutant enters a watershed, the areas downstream could become polluted as well. When you manage a water system, you must manage the whole watershed.

watershed the land area drained by a particular river; also called a drainage basin

Conservation Authorities protect Ontario's watersheds. To learn more about working for a Conservation Authority,



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Figure 3 shows the movement of water in a watershed. As you can see, pollutants in the watershed can flow down to other parts of the water system.

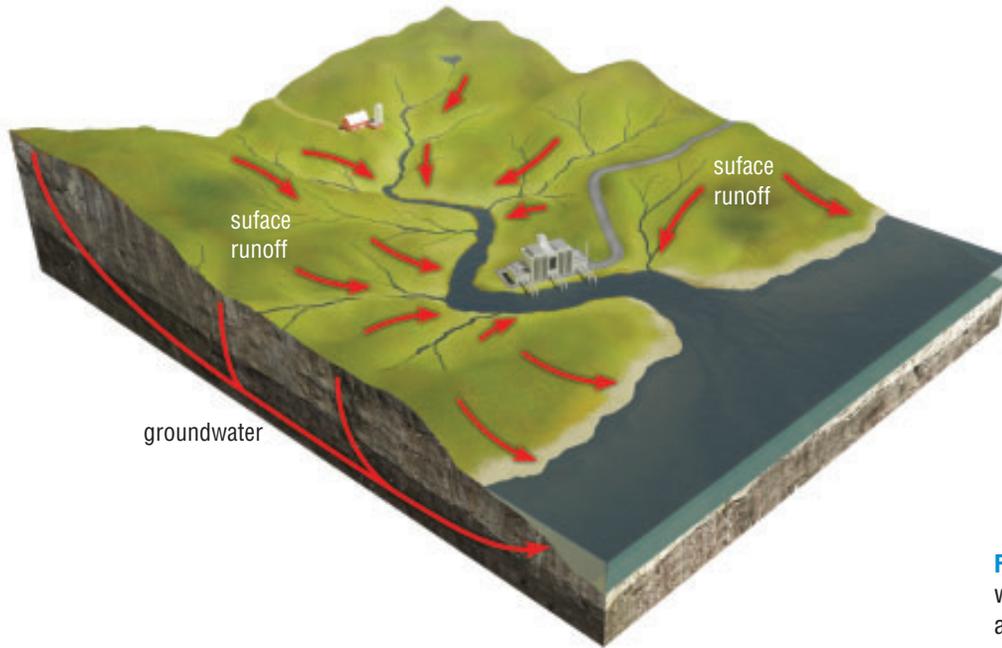


Figure 3 In a watershed, all surface water and groundwater flow downhill and collect into the same river or lake.

Marine Ecosystems

More than 70 % of Earth's surface is covered in oceans. Marine ecosystems are an important part of biogeochemical cycles. Most of the water that evaporates into the air and falls as rain and snow comes from oceans. Marine algae play a critical role in the production of oxygen and the absorption of carbon dioxide gas from the atmosphere.

Much of the ocean supports very little life. The open ocean is nutrient poor and unable to support many photosynthesizing organisms. The deep ocean is a lightless environment, so photosynthesis is impossible. In contrast, the shallow waters near shore are nutrient rich and support abundant life.

Coral reefs develop in warm shallow oceans and support a huge variety of organisms. They are home to commercially valuable species and support a large tourist industry. Coral reefs are extremely sensitive to changes in water temperature, acidity, and pollution.

Estuaries are partially enclosed bodies of water where fresh and salt water mix. They are high in nutrients and often support valuable shellfish, such as clams and scallops. The Gulf of St. Lawrence is the world's largest estuary (Figure 4). Historically, the Gulf supported an important fishery for Aboriginal people. Today, the Gulf supports commercial fishing and is a major shipping route for entry into the Great Lakes basin.

Mangroves are unusual communities that occur along tropical and semitropical sandy shorelines. They contain specialized tree species adapted to live at and beyond the water's edge (Figure 5). The prop roots of the mangroves grow out into the water. This reduces coastline erosion and creates a habitat for several marine organisms. Shoreline developments have destroyed much of the mangrove habitat. This has increased storm damage to shorelines. Replanting efforts in some regions are underway to re-establish this valuable ecosystem.



Figure 4 Pilot whales in the Gulf of St. Lawrence feed primarily on squid and small fishes.



Figure 5 Mangroves protect coastlines from erosion and are refuges for immature individuals of many species.

READING TIP

Connections and Responses

Make a two-column chart labelled “Connections” and “Responses.” Use the first column to make text-to-self, text-to-text, and text-to-world connections. In the second column, explain how the connections helped you to better understand the text by visualizing, making predictions, inferences, or judgments, forming opinions, drawing and supporting conclusions, or evaluating it.

The Intertidal Zone

Ocean coastlines are ecosystems that are part-time terrestrial and part-time aquatic. They are home to the unusual communities that occupy the intertidal zone—the area between the low-tide and high-tide lines. Many coastlines exhibit a significant change in water levels approximately four times a day, with two periods of high tide interceded by two periods of low tide. The highest tides in the world occur in the Bay of Fundy, with differences of up to 17 m between low and high tide. Among the most common species that inhabit this unusual environment are seaweeds, barnacles, sea stars, and urchins (Figure 6).



Figure 6 Species that inhabit the intertidal zone like these sea stars and sea anemones must be able to withstand extremely variable conditions, including hot and freezing temperatures and harsh wave action.

Imagine the conditions faced by organisms in the intertidal zone on the coast of Nova Scotia. During the summer they alternate between a life under water and above water where they are exposed to high temperatures, full sun, and strong drying winds. During the winter they alternate between icy ocean water and exposure to bitterly cold air, snow, and ice. Throughout the year, these species must also be able to withstand the daily pounding of wave action. It is not surprising that many intertidal species have protective body coatings and very tough tissues.

IN SUMMARY

- Aquatic ecosystems can be freshwater (for example, lakes and streams) or marine (for example, coral reefs and estuaries).
- The most productive aquatic ecosystems occur in relatively shallow, warm, and nutrient-rich waters.
- The abiotic conditions of intertidal zones continuously alternate between those of a terrestrial and those of an aquatic ecosystem.
- Species living in the intertidal zone are able to survive highly variable abiotic conditions.

✓ CHECK YOUR LEARNING

1. Why do the open oceans not support rich ecosystems and large numbers of fish? **K/U**
2. What are the most important abiotic features of aquatic ecosystems? **K/U**
3. Would you rather swim in an oligotrophic lake or a eutrophic lake? Explain why. **K/U C**
4. What unique challenges might a scientist face when trying to understand coral reefs? **A**
5. Describe the abiotic conditions of the intertidal zone and how they change. **K/U**
6. Explain why species living in the intertidal zone have to be unusually tough. **K/U**
7. The intertidal zone may be sandy, muddy, or rocky. How do you think these conditions might influence what species can live there? **T/I**