Aquatic Ecosystems

Life Science Georgia Standards of Excellence

S7L4d. Ask questions to gather and synthesize information from multiple sources to differentiate between Earth's major terrestrial biomes (i.e., tropical rain forest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e. freshwater, estuaries, and marine).

Freshwater and Marine 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**.

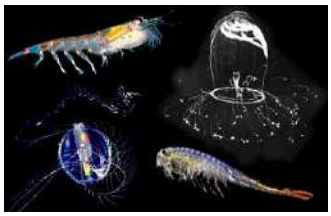
Wetlands are areas of land that are periodically under **water** or whose **soil** contains a great deal of **moisture**.

Characteristics of Aquatic Ecosystems

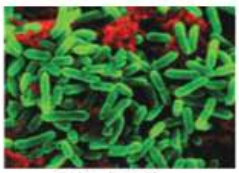
Factors such as **temperature**, **sunlight**, **oxygen**, and **nutrients** determine which organisms live in which area of the water.
Aquatic ecosystems contains several types of organisms that are grouped by their **location** and by their **adaptation**
Three groups of aquatic organisms include **plankton**, **nekton**, and **benthos**.



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**



Phytoplankton

Benthos

Decomposers

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 are **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**.

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.

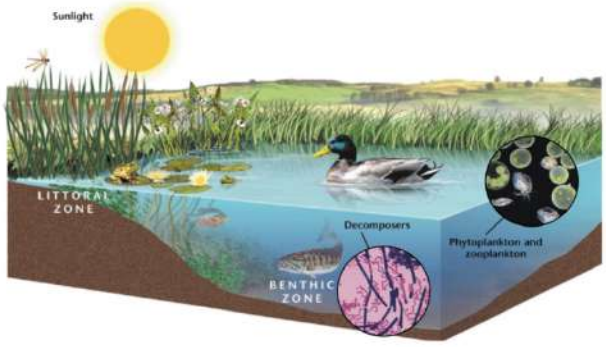
Eventually, **dead** and decaying organisms reach the **benthic** zone.

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

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

For example, water beetles use 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.



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.

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.

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

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.

Wetlands

Watch the video and answer the following questions:

1) **Where can wetlands be found?**
2) **What are the types of plants that can be found in wetlands?**
3) **Why are wetlands important?**

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 above 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 spear like beaks they use to grasp small fish and probe for frogs in the mud.
Marshes also attract migratory birds from temperate and tropical habitats.

Marshes

What is the difference between a swamp and a marsh?
List some of the dominate plant and animal life as you watch the video.

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.

What resources might the "Okefenokee Swamp" and other swamps offer? Explain your answer.

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 be 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 root-like structures called **rhizoids**.

Trout and minnow 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.


Catfish


Carp


River Plankton

Rivers in Danger

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

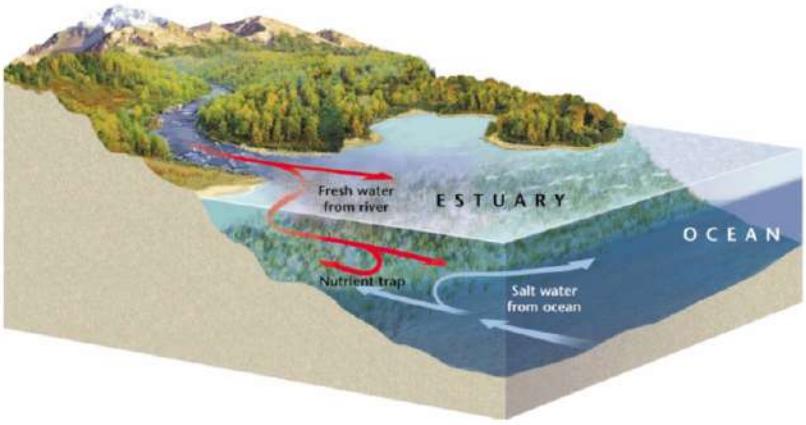
They also **absorb excess rain**, which protects them from flooding, they **filter out pollutants** and sediments, and they **provide recreational areas** areas for boating and fishing, and hunting.

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 the ocean.



What is an Estuary?

Before the clip: Why might an estuary be so important?

What did you find out during the video that you can add? What are some benefits of estuaries? Explain your answer.

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 lived **anchored** to rocks and feed by filtering plankton from the water.

Oysters

Phytoplankton found in estuaries

Plants and Animals of Estuaries

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

Estuaries also provided **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 place 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.


Clam


Sea Trout


Salt Marsh Crabs

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.

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.

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 of control. If the algae grows out of control, it may kill the corals.

Watch the Video and Answer the Following Questions

1) What organisms make up coral?
2) Give at least three reasons Coral Reefs are beneficial.
3) List at least three threats to Coral Reefs.

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.

Coral Reefs

Describe the life in this ecosystem.

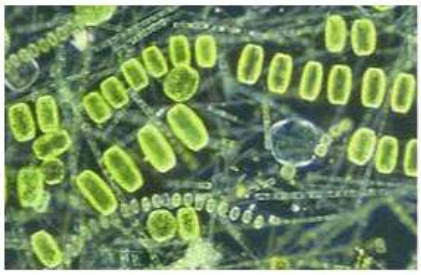
Oceans

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.

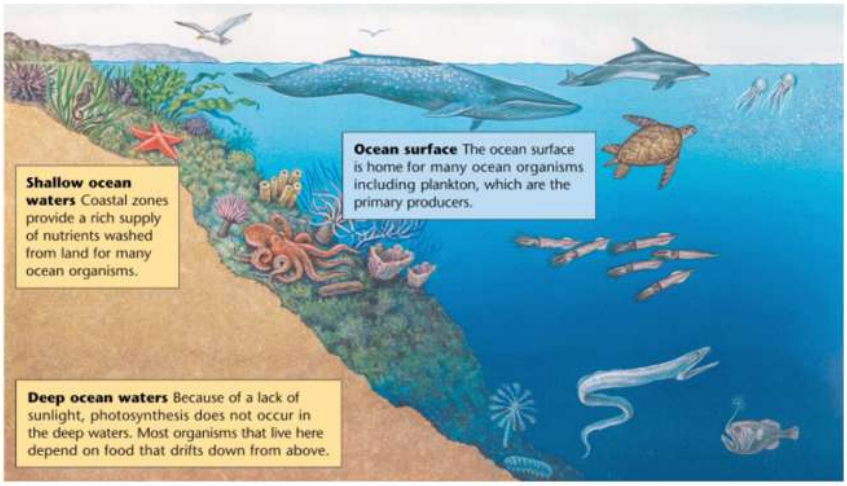
The sea's smallest herbivores are **zooplankton**, including jellyfish and tiny shrimp, which live near the surface with the phytoplankton they eat.

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

The depths of the ocean are very dark, so most food at the ocean floor 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**.



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.

Oceans

What might you be able to do to save our oceans?