MARINE ECOSYSTEMS

Marine ecosystems are a part of the largest aquatic system on the planet, covering over 70% of the Earth's surface.
The habitats that make up this vast system range from the productive nearshore regions to the barren ocean floor. Some examples of important marine ecosystems are:

- **Oceans**
- **Estuaries and Salt marshes**
- **Coral Reefs**
- **Coasteal areas like Lagoons, Kelp and Seasgrass Beds and Intertidal systems (rocky, sandy, and muddy shores)**

Biota:

- Marine ecosystems are home to a host of different species ranging from tiny planktonic organisms that comprise the base of the marine food web (i.e., phytoplankton and zooplankton) to large marine mammals like the whales, manatees, and seals.
- In addition, many fish species reside in marine ecosystems including flounder, scup, sea bass, monkfish, squid, mackerel, butterfish, and spiny dogfish.

- Birds are also plentiful including shorebirds, gulls, wading birds, and terns.

- Some marine animals are also endangered including whales, turtles, etc. In summary, many animal species rely on marine ecosystems for both food and shelter from predators.

Environmental factors in the marine environment include:

- ❖temperature,
- ❖ salinity,
- ❖pressure,
- ❖nutrients,
- ❖dissolved gases,
- ❖currents,
- ❖light,
- ❖ suspended sediments,
- ❖ substrate (bottom material),
- ❖river inflow,
- ❖tides and waves.

Phytoplankton: More than 90% of marine plants are algae and most are unicellular and microscopic. Mainly-Diatoms and Dinoflagellates.

Zooplankton: include the copepods and foraminifera.

- Marine ecosystems contain several unique qualities that set them apart from other aquatic ecosystems, the key factor being the presence of dissolved compounds in seawater, particularly salts.

- This total gram weight of dissolved substances (salts) in one kg of seawater is referred to as salinity. In general 85% of the dissolved substances are Sodium (Na) and Chlorine (Cl) in seawater.

- On average seawater has a salinity of 35 parts per thousand grams (ppt) of water.

- These dissolved compounds give seawater its distinctive "salty" taste, affect species composition of particular marine habitats, and prevent oceans from freezing during the winter.

- Daily changes in factors such as weather, currents, and seasons as well as variations in climate and location will cause salinity levels to vary among different marine ecosystems.

- In areas such as estuaries , tidal marshes, and mangrove forests, tidal and freshwater influences from river and streams makes it necessary for marine organisms to adapt to a wide range of salinity levels.

- These organisms such as mussels, clams, and barnacles, are called euryhaline (salt tolerant) organisms.

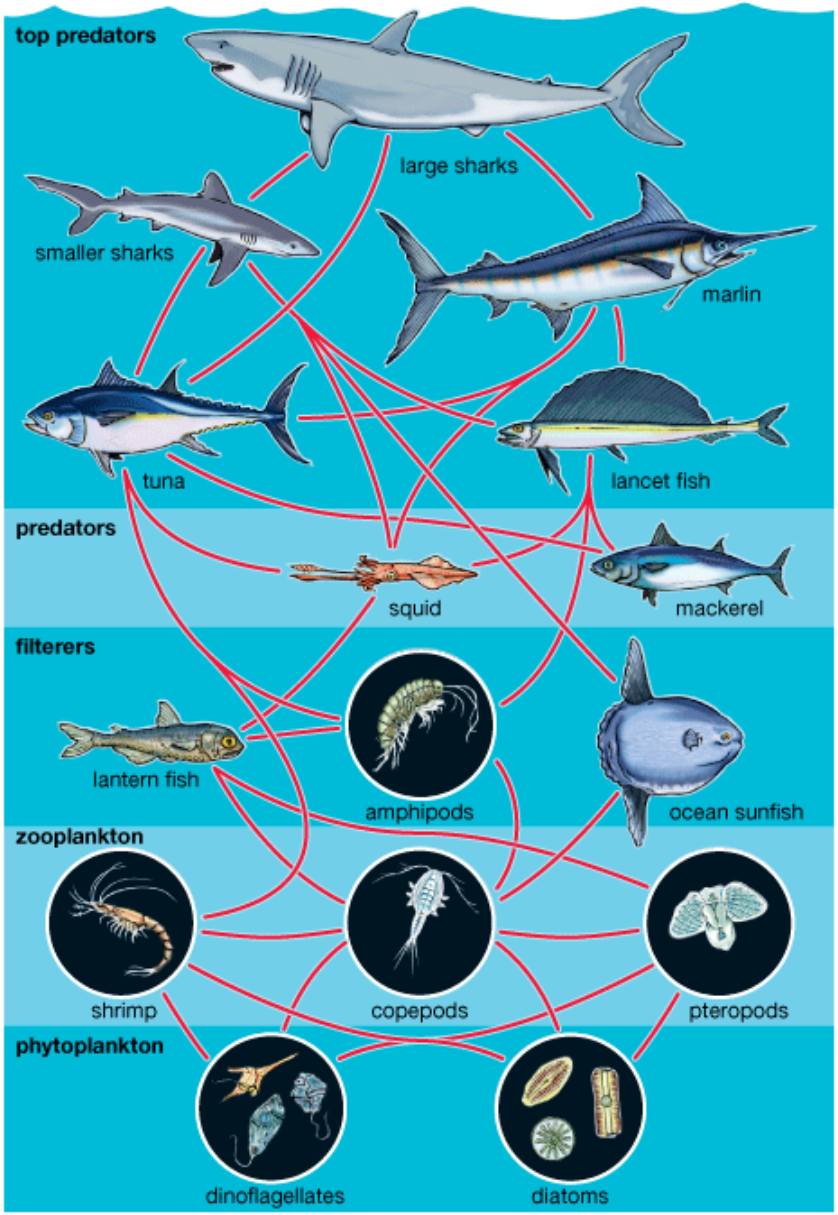
- Other organisms, in particular finfish, are unable to tolerate such changes in salinity. These organisms are considered to be (salt intolerant).

- These species require more constant levels of salinity, forcing them to either migrate to new areas when fluctuations in salinity levels occur or to seek out areas where salinity change is minimal (e.g., the deep ocean).

- Like other aquatic ecosystems, marine ecosystems require nutrients and light to produce food and energy.

- However, both nutrients and light are limiting factors in marine ecosystem productivity. Like many other aquatic plants, photosynthetic marine organisms (i.e., phytoplankton) rely upon sunlight and chlorophyll *a* to absorb visible light from the sun as well as nitrogen (N), phosphorus (P), and silicon (Si) to generate food and promote growth and reproduction.

- However, the amount of light penetrating the ocean surface tends to decrease with increasing water depth, therefore photosynthesis can only take place within a small band near the surface of the water (called the photic zone).



Marine producers are either seaweeds and/or phytoplankton and must be found where there is enough light for photosynthesis.

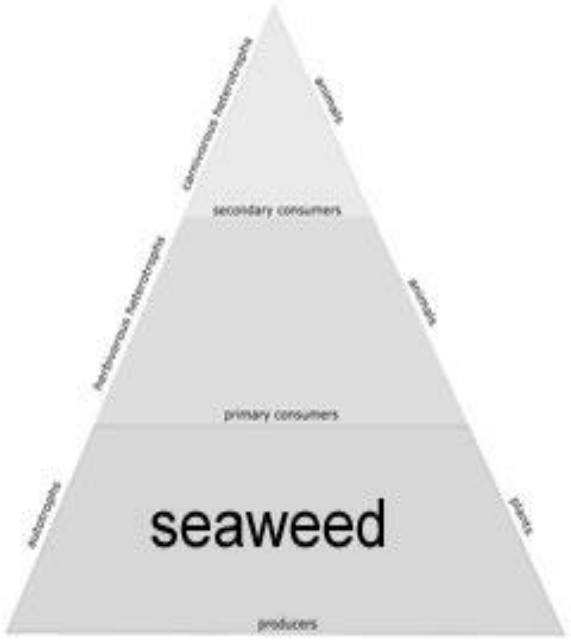
Therefore the marine producers are always in the upper layers of the ocean, the area we call the **photic zone**. Animals can be found everywhere, in both the photic and aphotic zones, because they are not limited by light.

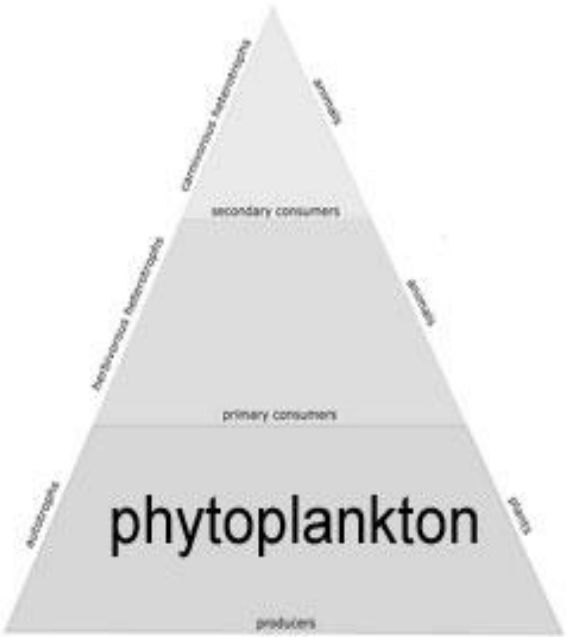
❖Most seaweeds grow only attached to the ocean bottom so their distribution is limited to the edges of continents and islands where the depth is within the photic zone. These seaweeds account for only a small portion of the producers in the ocean because they are so geographically limited.

❖Most of the ocean is open ocean, away from the edges of land and over deep water. It is here, near the surface, that the phytoplankton (plant plankton) dominates.

❖Phytoplankton is also found in the same coastal areas as the seaweeds. Both types of producers are important in marine ecosystems however the phytoplankton based ecosystems are more common.

❖The importance of the phytoplankton is one of the things that make marine ecosystems unique and different from land ecosystems because phytoplankton is generally microscopic.





Marine trophic pyramids are either seaweed based (coastal areas) or phytoplankton based (coastal areas and open ocean).

- In addition, nutrient availability often varies significantly from place to place. For example, in the open ocean, nutrient levels are often very poor causing primary production to be very low.

- In contrast, nearshore waters such as estuaries and marshes are often rich in nutrients, allowing primary production to be very high. In some instances, nearshore ecosystems have an excess of nutrients due to runoff and other terrestrial sources.

- Excess nutrients can cause an over-stimulation of primary production, depleting oxygen levels and causing eutrophic conditions to occur in coastal habitats.

Ocean Zones

The ocean can also be divided into zones based upon depth of light penetration;

A. The **photic zone** is the depth where light is sufficient for photosynthesis.
B. The **dysphotic zone** is where illumination is too weak for photosynthesis.
C. The **aphotic zone** receives no light from the surface because it is all absorbed by the water above.

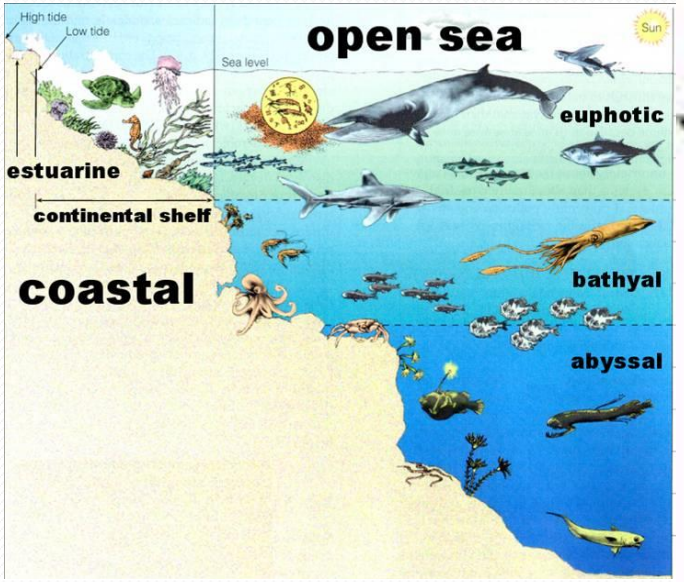
The Ocean also has separate zones, and each zone determines what can grow there and what animal life can live there. The farther down the Ocean zone's get, the less light there is that reaches that area.

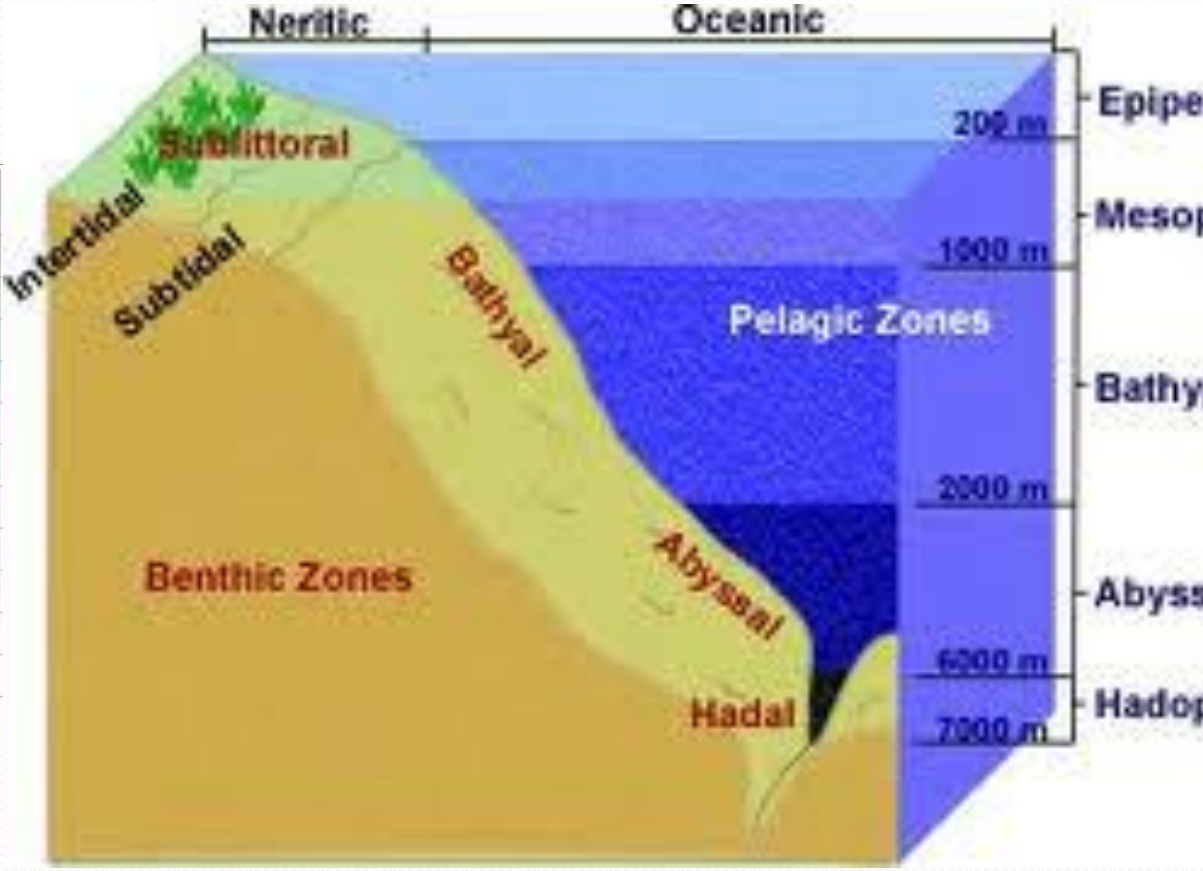
The oceanic zone is subdivided into the epipelagic, mesopelagic, and bathypelagic zones.

❖**The epipelagic (euphotic) zone receives enough sunlight to support photosynthesis.**

❖**The mesopelagic (dysphotic) zone, where only small amounts of light penetrate, lies below and**

❖**while 90% of the ocean lies in the bathypelagic (aphotic) zone into which no light penetrates.**


High tide
Low tide
Sea level
open sea
Sun
euphotic
estuarine
continental shelf
coastal
bathyal
abyssal


Neritic
Oceanic
Epipe
200 m
Subtittoral
Intertidal
Subtidal
Bathyal
1000 m
Pelagic Zones
Mesop
Bathy
2000 m
Benthic Zones
Abyssal
Abyss
6000 m
Hadal
Hadop
7000 m

1) Intertidal Zone

The intertidal zone is the shallowest portion of the ocean, often called the shore. As the waves move in and out, parts of the intertidal zone alternate between being covered and uncovered by water, and the biotic elements are in constant flux. There are two types of intertidal zones--those that are rocky and those that are sandy.

Flora	Algae Seaweed
Fauna	Oysters Worms Birds Barnacles Mussels

2)Pelagic Zone

The pelagic zone is the open ocean. It is divided into four sub-zones:
1. Neritic sub-zone- The neritic sub-zone is the shallowest portion of the open ocean. Sunlight is capable of penetrating completely through the neritic sub-zone. There is a high concentration of nutrients provided by abundant plankton.
2. Epipelagic sub-zone - Although it is deeper than the neritic sub-zone, it is well-lit. Photosynthesis is carried out by numerous types of phytoplankton, zooplankton, and seaweed, which also provide food for several types of fish, squid, and the sea mammals.

3) Benthic Zone

The benthic zone is the ocean floor in all except the very deepest sections of the ocean. This includes the **continental shelf**, which is the extension of the land mass into the ocean.

The ocean floor is littered with dead organisms, along with the bacteria and fungi that act as decomposers. There is limited light that filters down through this zone; as a result, not many plants can grow here. In fact, seaweeds are the only plants that grow from the ocean floor, and they are found growing only near the coasts. It just is too dark at the bottom of the deep ocean for plant life to survive. The sandy bottom of the ocean also contains sponges, sea anemones, and worms. Unusual fish exist in all except the deepest areas of the benthic zone

Flora	Seaweed
Fauna	Fungi Bacteria Fish Sponges Sea anemones Worms

4)Abyssal Zone

The abyssal zone is the deepest, darkest part of the ocean floor. This region consists of cracks, called **rifts**, in the ocean floor.

The only organisms in this region are the benthos, consisting primarily of fish and a few invertebrates.

However, there are some organisms, as discussed in earlier units, that exist only near the hydrothermal vents in the deepest parts of the ocean floor. These include the archea, the chemoautotrophic bacteria that flourish on the high concentrations of hydrogen sulfide

Flora	None
Fauna	Archea Fish Tube worms Clams

Importance of Marine ecosystems:

Marine ecosystems are very important in to the overall health of both marine and terrestrial environments. According to the World Resources Center, coastal habitats alone account for approximately 1/3 of all marine biological productivity, and estuarine ecosystems (i.e., salt marshes, seagrasses, mangrove forests) are among the most productive regions on the planet.

In addition, other marine ecosystems such as coral reefs, provide food and shelter to the highest levels of marine diversity in the world.

The diversity and productivity of marine ecosystems are also important to human survival and well-being. These habitats provide us with a rich source of food and income, and support species that serve as animal feed, fertilizers for crops, additives in foods (i.e., ice-cream) and cosmetics (i.e., creams and lotions).

Areas such as mangroves, reefs, and seagrass beds also provide protection to coastlines by reducing wave action, and helping to prevent erosion, while areas such as salt marshes and estuaries help in filtering runoff from the land.