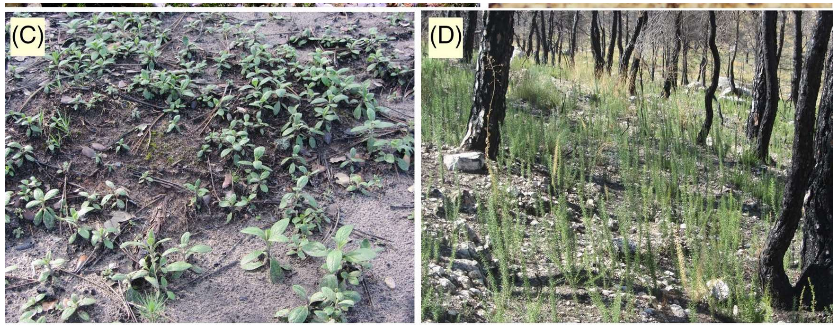
Zoogeography

Lesson 11

Dormancy	That seed state when germination will not proceed even though external conditions may be favourable. Where this is controlled internally through retarded embryo maturity or metabolic inactivity it is referred to as primary (innate or inherent) dormancy. Dormancy may also be imposed environmentally through the lack of suitable hydrothermal conditions when it is referred to as imposed (secondary) dormancy.



Pausas & Lamont (2022)

Heat-stimulated germination	Heat *per se* does not stimulate germination but breaks dormancy that allows germination to proceed later, i.e. once suitable hydrothermal conditions are met.

Smoke-stimulated germination	In physiologically dormant seeds, specific smoke chemicals break dormancy and allow germination to proceed. These chemicals may be absorbed by dry seeds but, once the wet season begins, they are more likely to be absorbed dissolved in the soil solution during imbibition so that germination proceeds without further delay.

Tundra

sub-zero temperatures and short growing seasons

Adaptations: How do animals survive in the tundra biome

Surviving in the cold

•Animals living in the tundra regions have **thick fur and extra layers of fat** to keep them insulated.
•The **bodies** of most animals are **large with short limbs and tails** helping them to retain heat within their body, as much as possible.
•**Birds** of the tundra usually have **two layers of thick feathers** to stay warm.
•Animals like bears, arctic squirrels, and marmots **hibernate** through the winter season.
•Smaller animals like lemmings and stoats dig holes, known as **burrow**s and spend the cold season in there.
•Many animals, especially birds, **migrate** away from the Tundra during the winter season, and come back during the brief summers.

Locomoting on the snow

•Most ground-dwelling species have a characteristic **fur lining on their feet** to prevent them from getting too cold when walking long distances.

Camouflaging to the surroundings

•Many animals of this region are **white in colour** so they can blend in with the white snow, and use it as an effective camouflage. This adaptation is useful for both predator and prey. Arctic foxes **lose their white fur in the summer to maintain the masquerade through that season**.



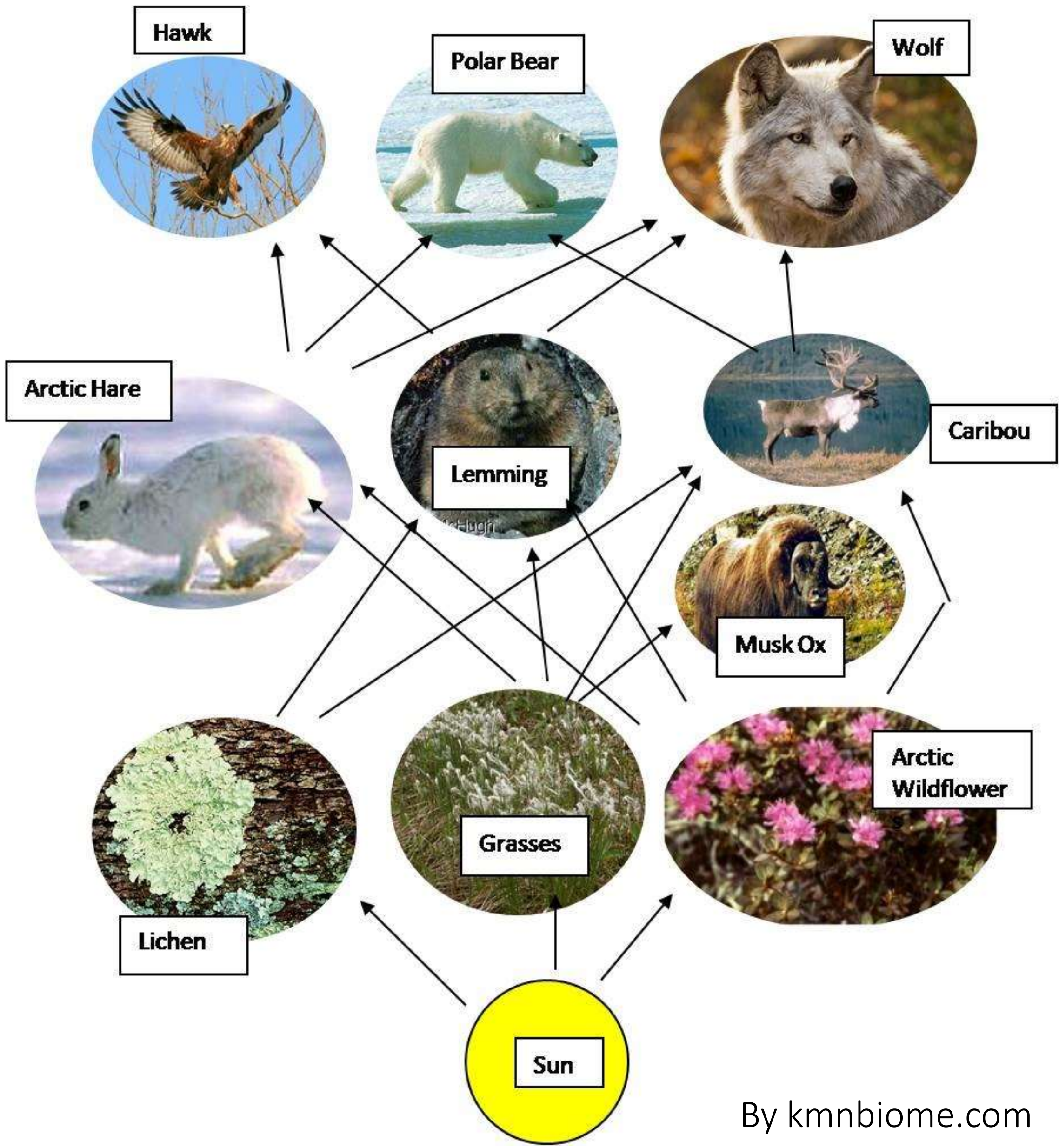


•Penguins have a **unique coloration** because of their regular forays in the water. For something that looks up towards the surface of the water, the penguin will blend in with the skies above, and for predatory birds looking into the water from above, it blends in with the black background of the sea floor.

Optimizing food resources

•The **competition** for food is naturally **extremely high**, especially during the winter months.

•So, many tundra animals have been seen to **grow at a slower rate** to optimize whatever little food they get during the summer.



By kmnbiome.com

Conservation status: Are there any endangered animals in the tundra?

Because of the **difficulty of access to humans**, and the sheer **inhospitable environment** that it poses to humankind, most of the animals of the tundra ecosystem are relatively safe.

Although the populations of some animals, like polar bears, Eskimo curlews, and the Arctic subspecies of the peregrine falcon, have been on a downward spiral for the past few decades because of the **improvements in technology** and man's ability to finally catch up and deal with the harsh conditions of the tundra.

Did You Know?

•The word **tundra** comes from the Finnish term *'tunturia'*, which means '**treeless plains**.'

•The snow-covering of the ground is thick enough to actually provide ample insulation for burrowing animals.

•Even during the summer season, **the temperatures do not exceed 10°C (50°F)**, and the daytime hours can last for up to 24 hours in the Polar Regions.

•The dominant animals in the tundra food chain, including the Arctic fox, polar bear, and Arctic wolf, **obtain water from the body of their prey**.

•One **example of a symbiotic relationship in the tundra** would be where a fox follows a caribou in search of food so the latter can dig holes in the ground to get lichens for itself, exposing some subnivean animals in the process that the fox can feed on.

•**Polar bears rarely drink water**; they chemically break down fat within their body to make water instead. The fat sources are replenished by feasting on the fatty parts of their prey, particularly the blubbers of seals. Most other parts of the seal's body are left for scavengers.

https://www.youtube.com/watch?v=cTQ3Ko9ZKg8

doi: 10.1146/annurev-marine-010213-135103

Ice

Sea ice covers some 3-7% of the total surface of our planet depending on the season of the year.

Apart from being one of the most important climatic variables and key indicator of climate change, sea ice also provides an extreme and changeable habitat for diverse sympagic organisms, which play an important role in the ecosystems of the polar seas

The incorporation of micro-organisms from the water column into the sea ice occurs mainly during the ice formation. Ice crystals floating on water surface act as filter collecting particles such as micro-algae, heterotrophic protists and bacteria.

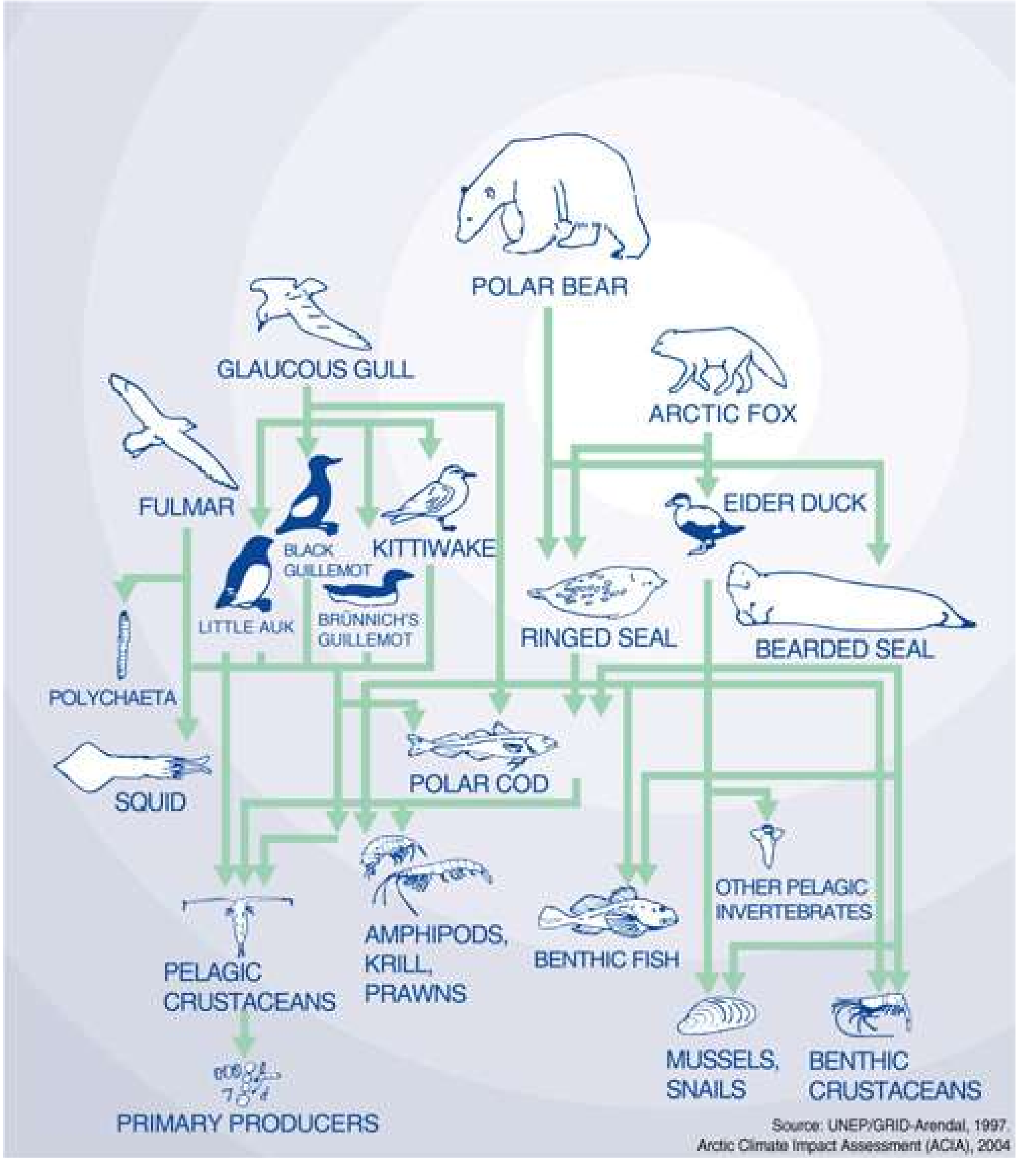
Metazoans can use sea ice either as temporary breeding, nursery and feeding ground or refuge area (allochthonous) or as a permanent habitat during the entire life cycle (autochthonous)

Arctic food chain

Many birds and mammals are strongly associated with ice which serves as a platform for resting, feeding and reproduction and provides a refuge from predators.

Ice algae contribute considerably to the total primary production in the Arctic (25%) and in the Antarctic (20%) and play an important role in sustaining the secondary production that supports marine mammals and birds.

Killer whales are the apex predators hunting for an diverse array of species including penguins, seals and other cetaceans



The liquid brine fraction of the ice matrix is home to a diverse array of organisms, ranging from tiny archaea to larger fish and invertebrates.

Thriving ice algal communities, generally dominated by diatoms, live at the ice/water interface and in recently flooded surface and interior layers, especially during spring, when temperatures begin to rise.

Although protists dominate the sea ice biomass, heterotrophic bacteria are also abundant.

The sea ice ecosystem provides food for a host of animals, with crustaceans being the most conspicuous. Uneaten organic matter from the ice sinks through the water column and feeds benthic ecosystems. As sea ice extent declines, ice algae likely contribute a shrinking fraction of the total amount of organic matter produced in polar waters.

Threats

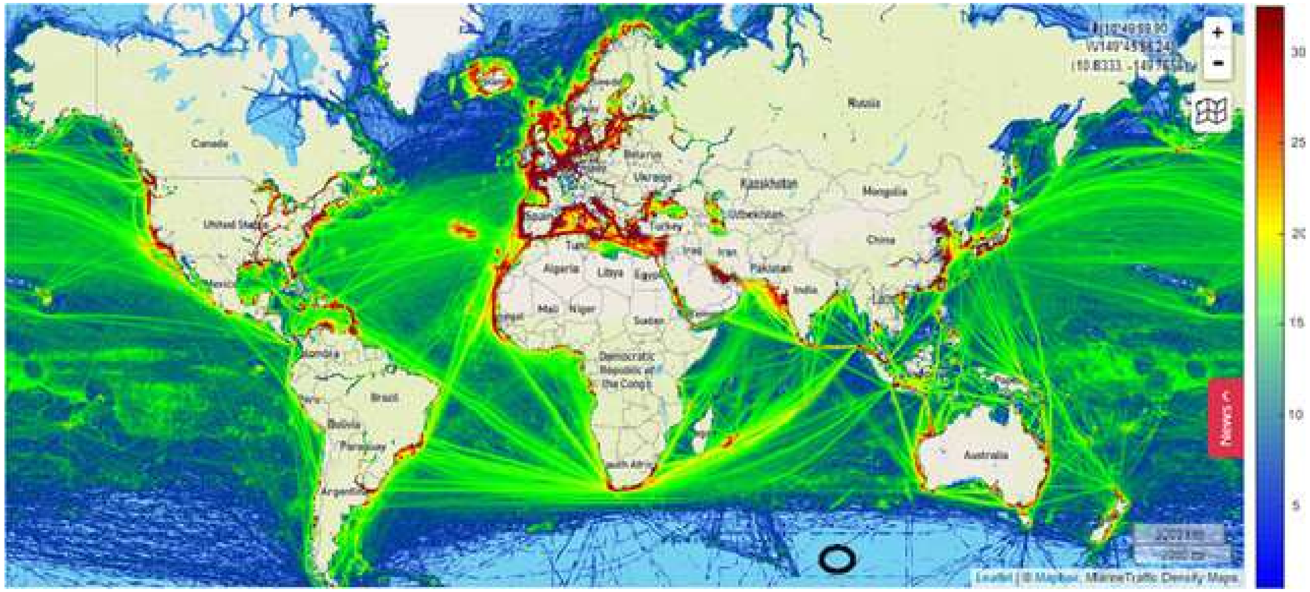
Polar regions have experienced significant **warming** in recent decades.

Climate-inducted changes have been most pronounced across the Arctic Basin and along the Antarctic Peninsula, with significant **decreases in the extent, thickness and seasonal duration of sea ice**.

These changes have severe ecological consequences for the sea ice biota. The **habitat loss** and **changes in productivity, species composition** and **community structure** of the under-ice community have a negative impact on higher trophic levels. Warming can also affect the sea ice ecosystem through changes in hydrography which include **introduction of species from lower latitudes**. The decline of the sea-ice extent will improve the accessibility of the high latitude areas. That may led to increase of anthropogenic pressure on polar ecosystems (ship traffic, exploration, industrial activities and fisheries)

2015 worldwide maritime traffic density map

(Di Simone et al. 2017)



https://www.youtube.com/watch?v=R2DU85qLfJQ

Freshwater

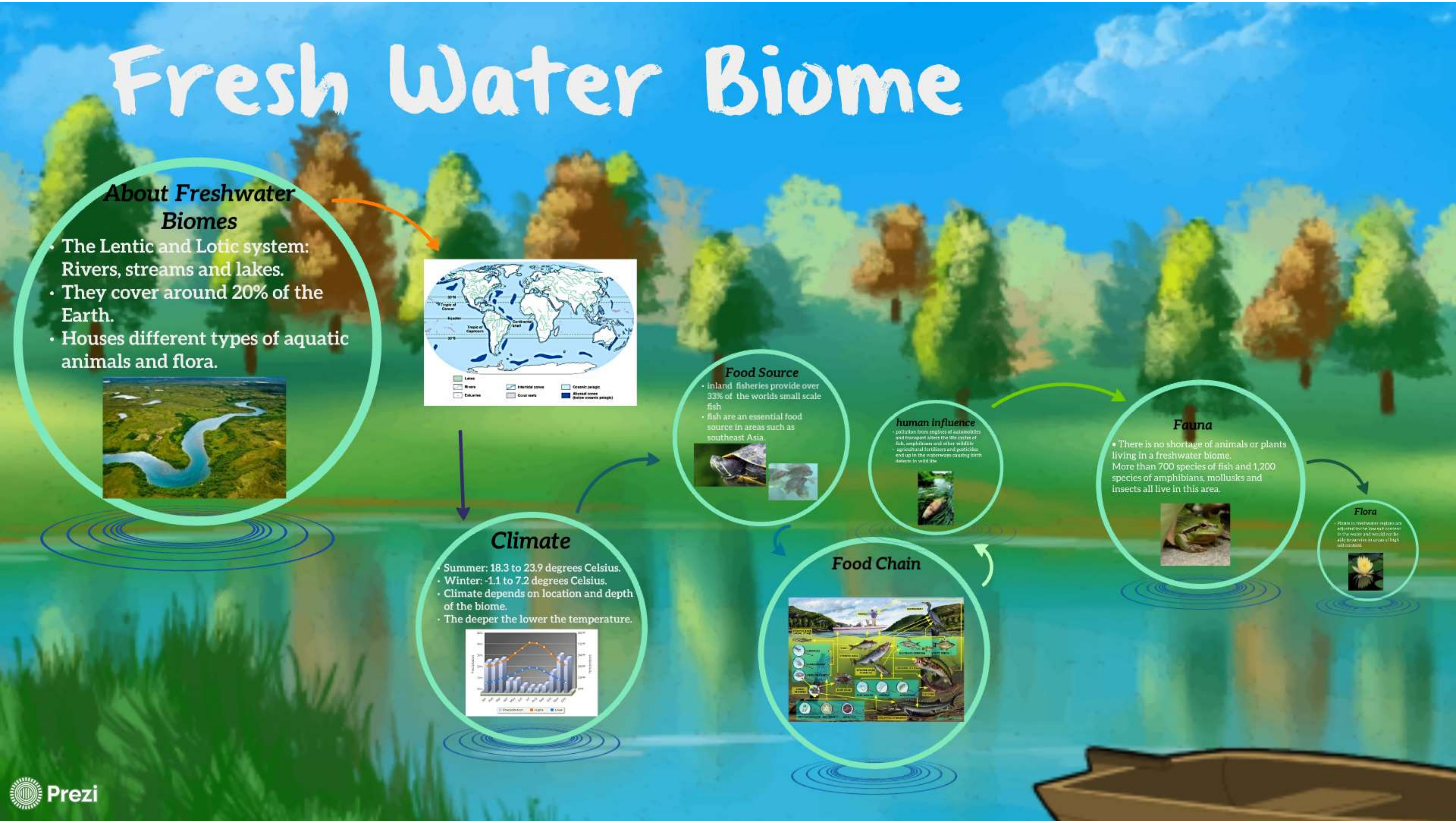
- all continental aquatic environments. As the name indicates, freshwater is characterized by low concentrations of salt (containing less than 0.05% of dissolved salts) as opposed to seawater.

- Freshwater only accounts for about 2.5–2.75% of all water on Earth.

- However, 1.75–2% of freshwater is frozen in polar ice caps and glaciers as ice, and 0.5–0.75% exists as groundwater

This leaves about 0.01% of freshwater on the surface where fish can live.

- nearly three-quarters of freshwater is concentrated in the Great Lakes region of Africa, the Great Lakes in North America and the Baikal Lake in Siberia


Fresh Water Biome
About Freshwater Biomes
• The Lentic and Lotic system: Rivers, streams and lakes.
• They cover around 20% of the Earth.
• Houses different types of aquatic animals and flora.
Lakes
Rivers
Estuaries
Intertidal zones
Coral reefs
Oceanic pelagic
Abyssal zones (below oceanic pelagic)
Tropic of Cancer
Equator
Tropic of Capricorn
Continental shelf
Climate
• Summer: 18.3 to 23.9 degrees Celsius.
• Winter: -1.1 to 7.2 degrees Celsius.
• Climate depends on location and depth of the biome.
• The deeper the lower the temperature.
Food Source
• inland fisheries provide over 33% of the worlds small scale fish
• fish are an essential food source in areas such as southeast Asia.
human influence
• pollution from engines of automobiles and transport alters the life cycles of fish, amphibians and other wildlife
• agricultural fertilizers and pesticides end up in the waterways causing birth defects in wild life
Food Chain
Fauna
• There is no shortage of animals or plants living in a freshwater biome.
More than 700 species of fish and 1,200 species of amphibians, mollusks and insects all live in this area.
Flora
• Plants in freshwater regions are adjusted to the low salt content in the water and would not be able to survive in areas of high salt content.
Prezi

There are three zones in lakes and ponds:

Argyroneta aquatica

The **littoral zone** (the topmost and warmest is home to snails, clams, insects, crustaceans, fishes and amphibians and the eggs and larvae of dragonflies and midges). These resources provide food for turtles, snakes and ducks.

The **limnetic zone** is close to the surface and consequently receives a good deal of light. This zone contains a variety of freshwater fish.

The **profundal zone** is very dense and cold, with little light penetrating this region. Only heterotrophs (animals that eat dead organisms) are found in this region

Threats

- The **creation of dams** and water-diversion systems blocks migration routes for fish and disrupts habitats.

- **Water withdrawal** for human use shrinks and degrades habitats.

- Runoff from agricultural and urban areas hurts **water quality**.

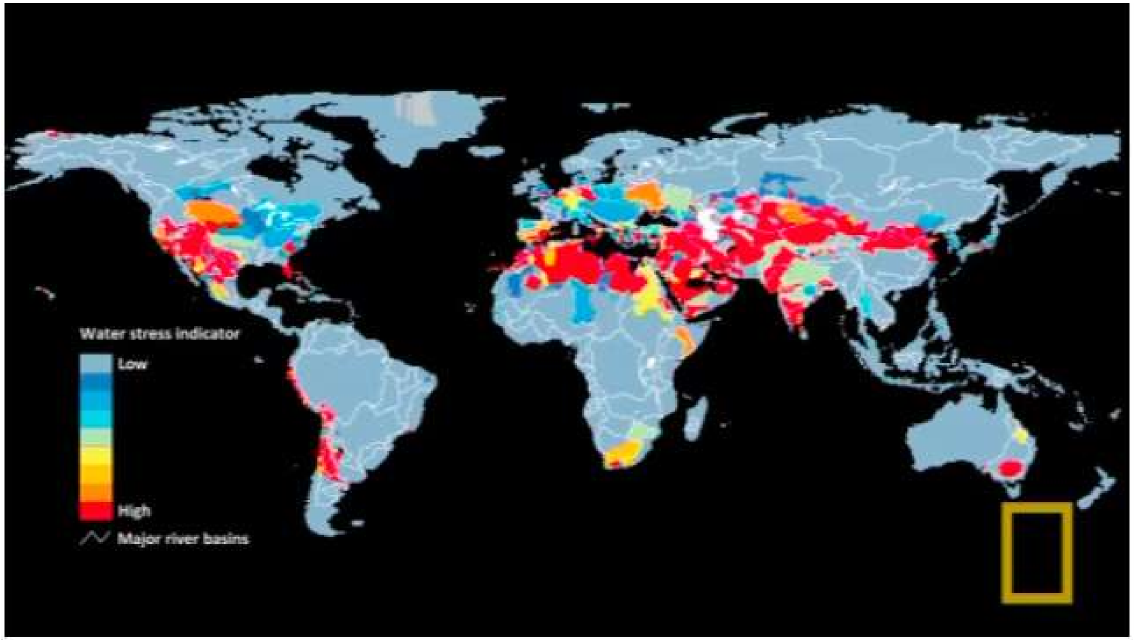
- **Draining of wetlands** for development depletes habitats.

- **Overexploitation and pollution** threaten **groundwater** supplies.

- Invasion of **exotic species** can harm native animals and plants.

- **Global warming** may lead to devastating floods and droughts.

https://www.nationalgeographic.com/environment/article/freshwater-threats



NG LIVE!: SANDRA POSTEL: TROUBLED WATERS

2400 L

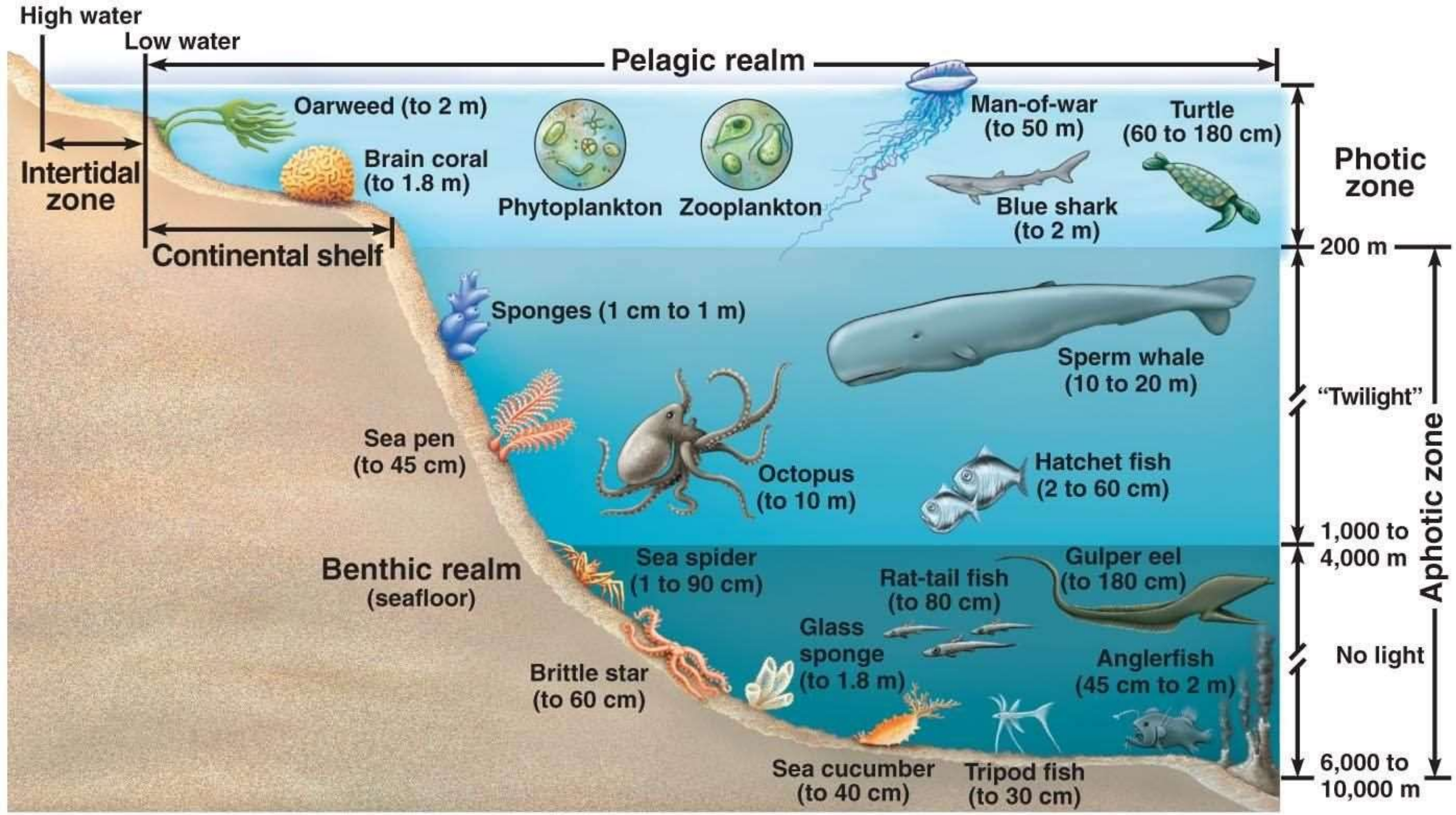
129 L

Marine ecosystems

https://www.youtube.com/watch?v=9FqwhW0B3tY

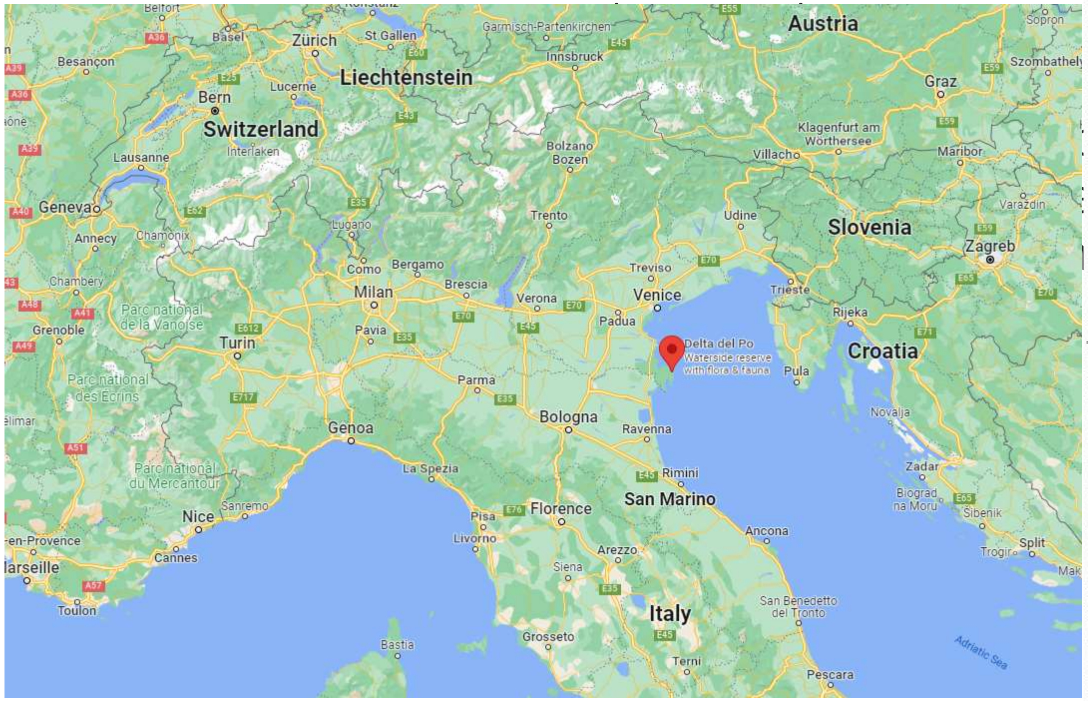
Several broad categories, although there is some disagreement, are:

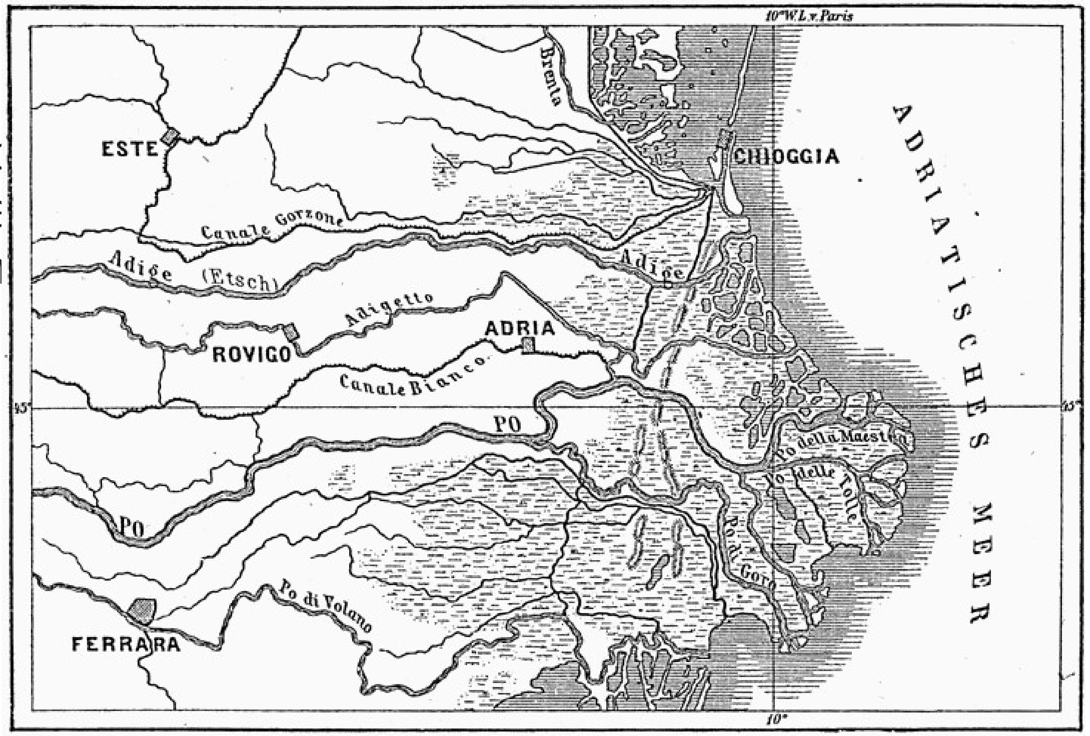
1- estuaries,
2- salt marshes,
3- mangrove forests,
4- coral reefs,
5- the open ocean, and
6- the deep-sea ocean



Estuary

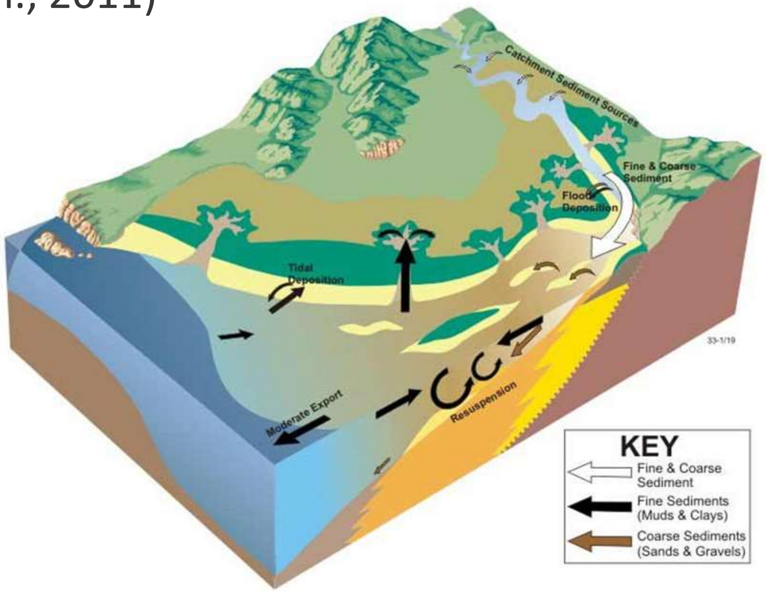
semi-enclosed body of water which has an open connection with the sea and in which sea water is measurably diluted with fresh water derived from land drainage (e.g. rivers) (Pritchard, 1967)



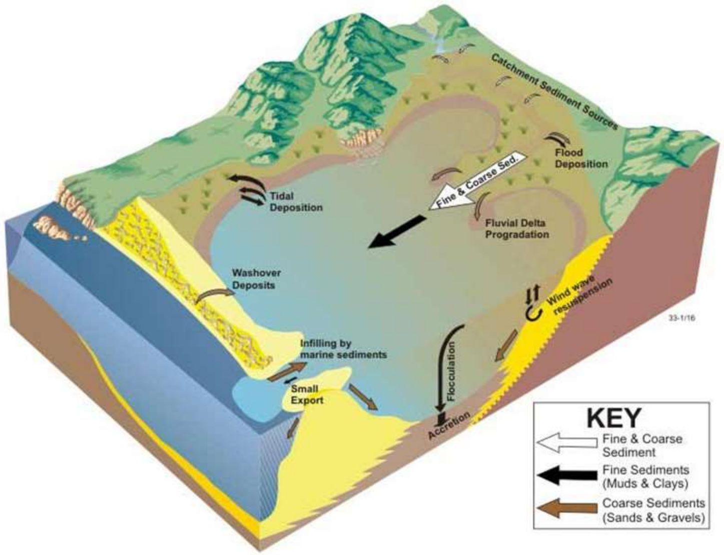


Classification of estuarine ecosyste

- Based on geomorphology (e.g. coastal plain estuaries, fjords and lagoons)
- Based on water circulation patterns (e.g. salt wedge and different stages of mixing) (Bowden, 1967)
- Others are relative to the importance of waves and tides, or the large-scale morphology (see Dürr et al., 2011)



tide dominated sediment transport



wave dominated sediment transport

System description

Estuaries are very dynamic and transitory systems, influenced by what happens at their landward as well as their seaward end.

Being a transitional area, estuaries are rich in gradients of processes and environmental factors:

- between the **hydromorphological dynamics** of the river and of the sea
- between **fresh river water and saline water**
- between **river sediment and marine sediment.**

Ecology

Besides food, the estuarine environment also provides breeding-, resting-, nursery grounds. In fact, migratory birds rest and feed in estuarine habitats, which makes estuaries important stop-overs along bird migration routes.

Estuaries also provide **billions of larvae of zooplankton** to coastal waters.

Multiple **commercially important sea fish and crustaceans** use estuaries as **nurseries** during their juvenile stage. Thus, estuarine habitats are critical to the survival of many marine species.

Estuarine communities have a relatively **low species diversity** compared to those in fresh or fully saline conditions. This is due to the presence of high-amplitude and partly unpredictable stresses, such as salinity conditions, osmotic stress, hydrodynamic stress, which select a limited set of adapted species.

The biota responsible for changes in the geomorphology and biogeochemistry of soft substrates are termed '**ecosystem engineers**' (Jones *et al.*, 1997).

They can be divided into **two main functional groups**, namely **'biostabilizers'**, causing increased sediment stability and a reduced erosion potential, and '**biodestabilizers**', doing the opposite (Paterson & Black, 1999; Reise, 2002; Widdows & Brinsley, 2002; Bouma *et al.*, 2008; Montserrat *et al.*, 2008).

Stabilizing key species of tidal flats are for example microphytobenthos, sea grasses and mussel beds. Benthic macrofauna may have both stabilizing and destabilizing effects.