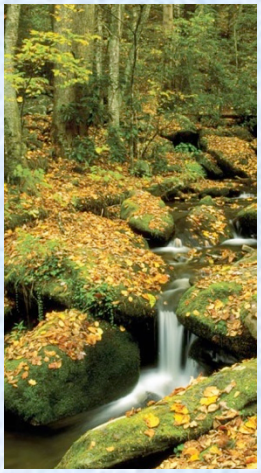
Aquatic Biomes

Life zones in water



2 main types

Marine

Ocean

Freshwater

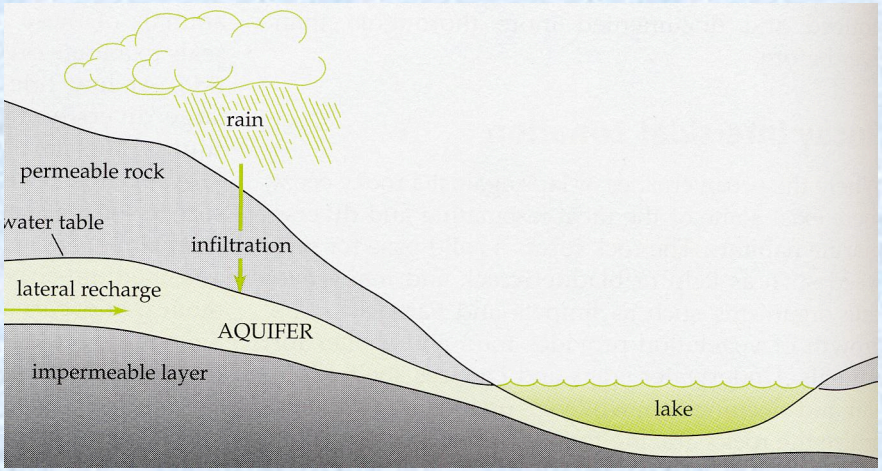
Lakes, Rivers, Wetlands

Water on Earth

Oceans: 97.4%

Freshwater: 2.6%

- **80% Ice**
- **19.6% Groundwater**
- **0.4% Surface water**
  - lakes & rivers



Groundwater is stored in Aquifers

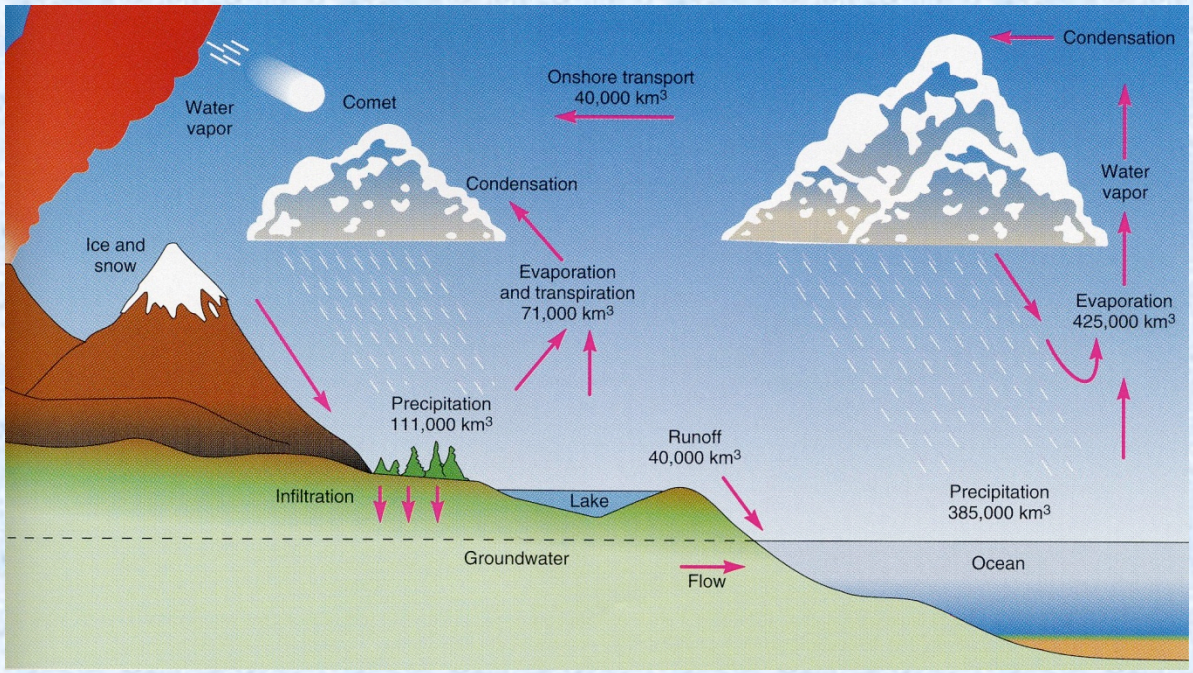
Aquifer = porous rock that holds underground water

- slow, continuous horizontal flow
- water table is "top" of aquifer

Water Cycle

Continuous movement of water between hydrosphere, atmosphere & land

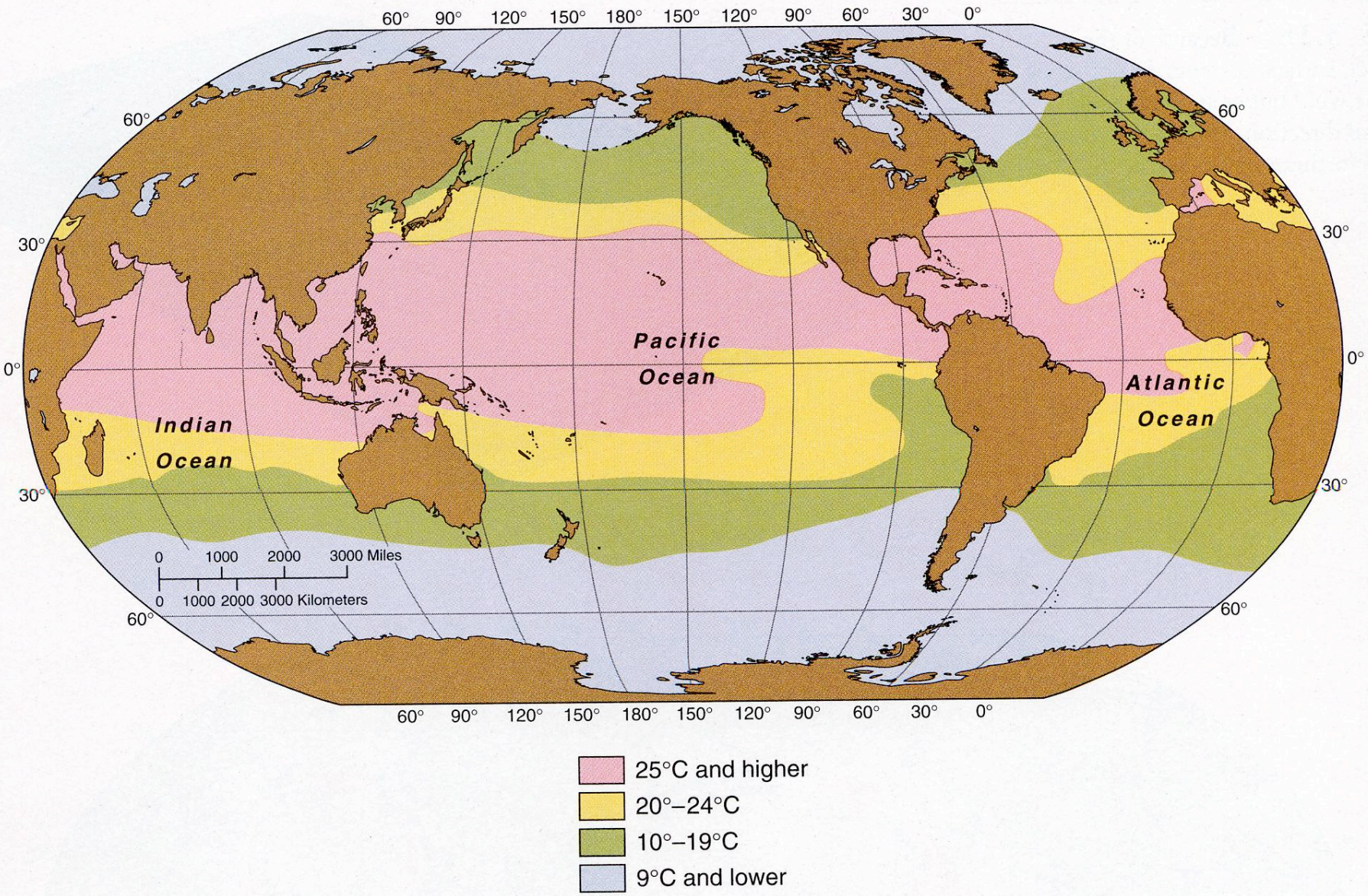
Solar energy drives ***evaporation*** & cooling leads to ***precipitation***



Water is a gas, a liquid or a solid *depending on temperature*

Water is the universal solvent

Ocean Surface Temperatures vary by latitude

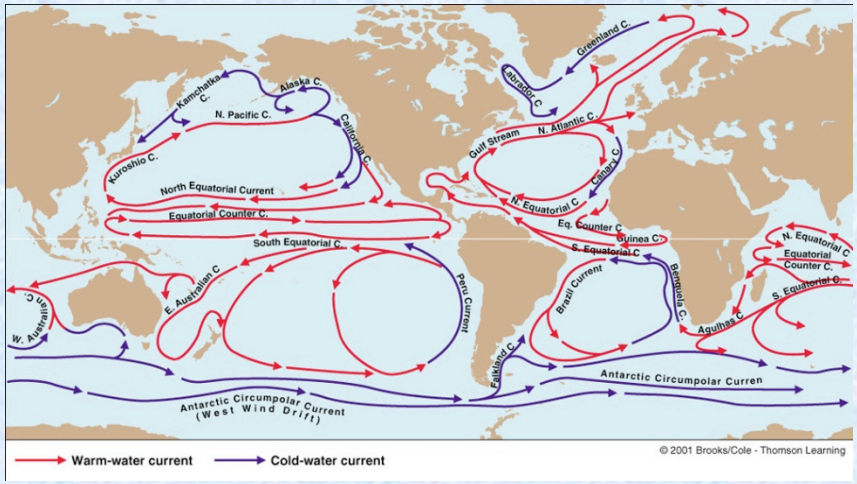


Circulation of ocean water

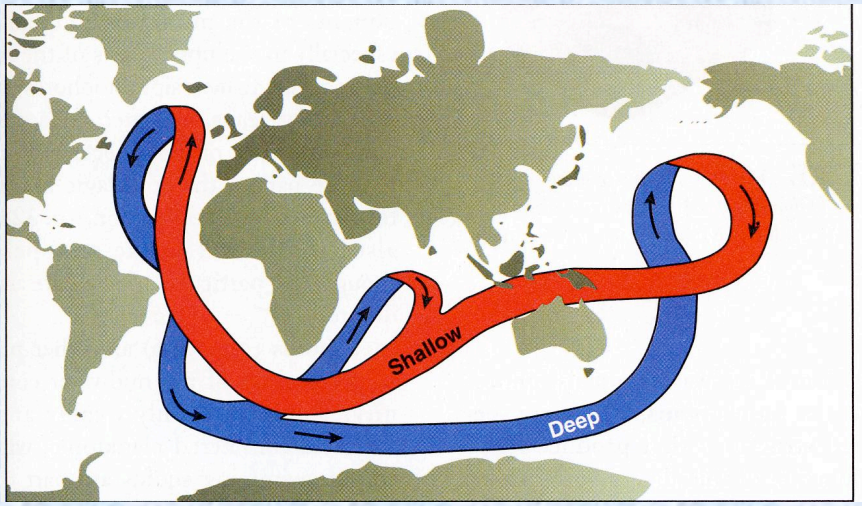
Current = horizontal movement of water

2 types of currents

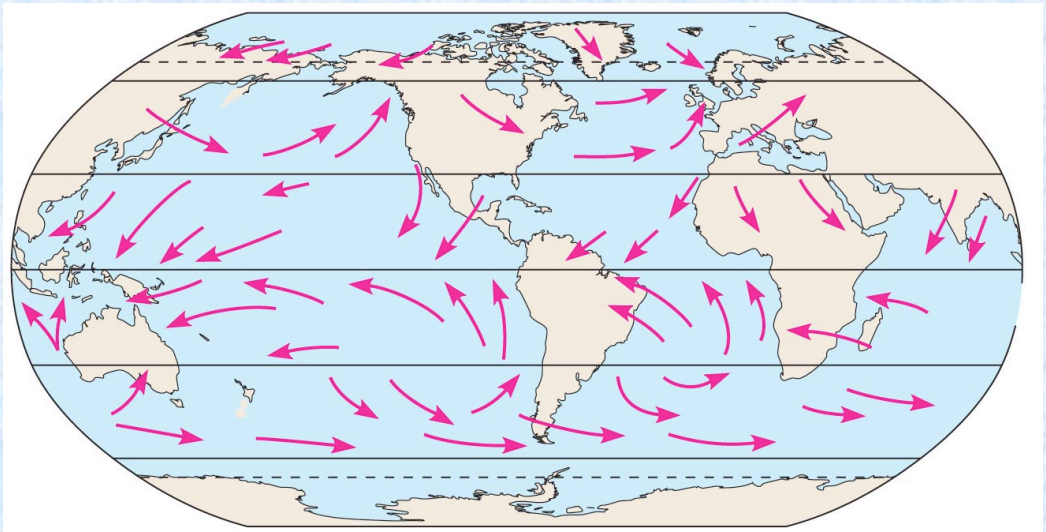
Surface currents



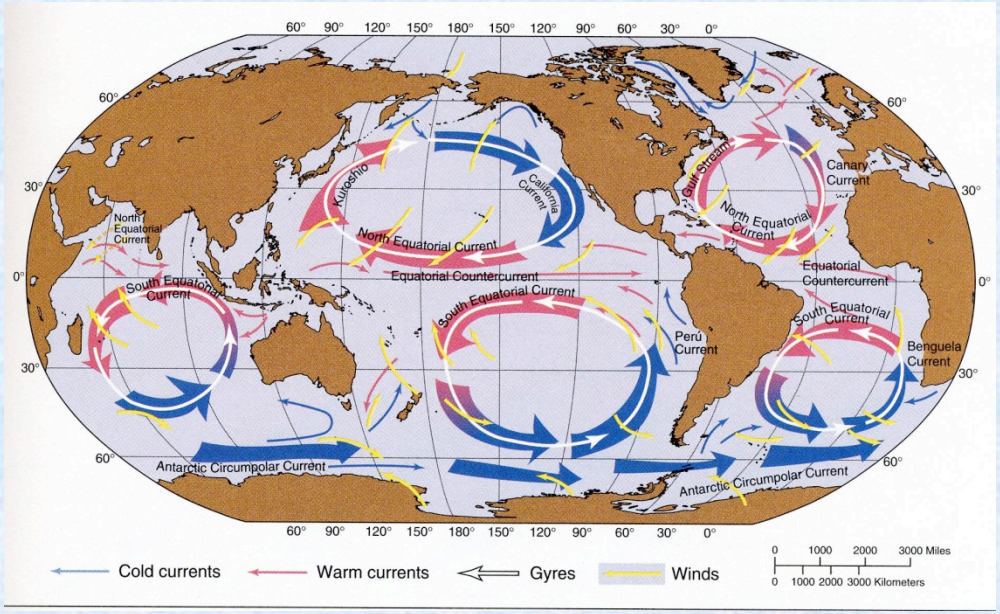
Deep water currents



Surface Winds



Surface Ocean Currents



Surface winds create surface currents in the ocean

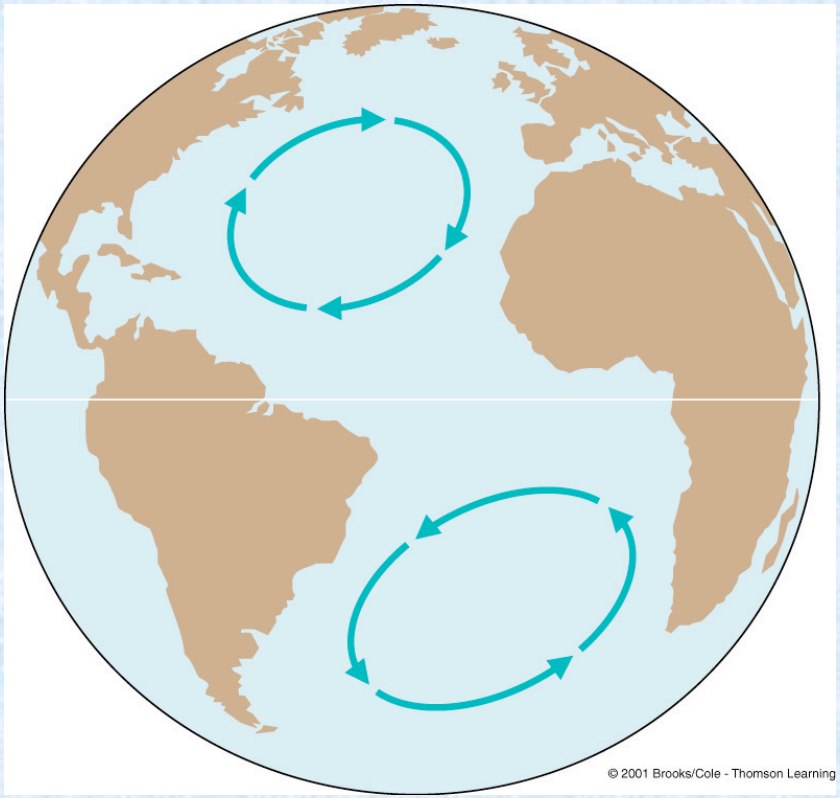
Gyre

A circular surface current in an ocean basin

Ocean basins have a gyre in each hemisphere

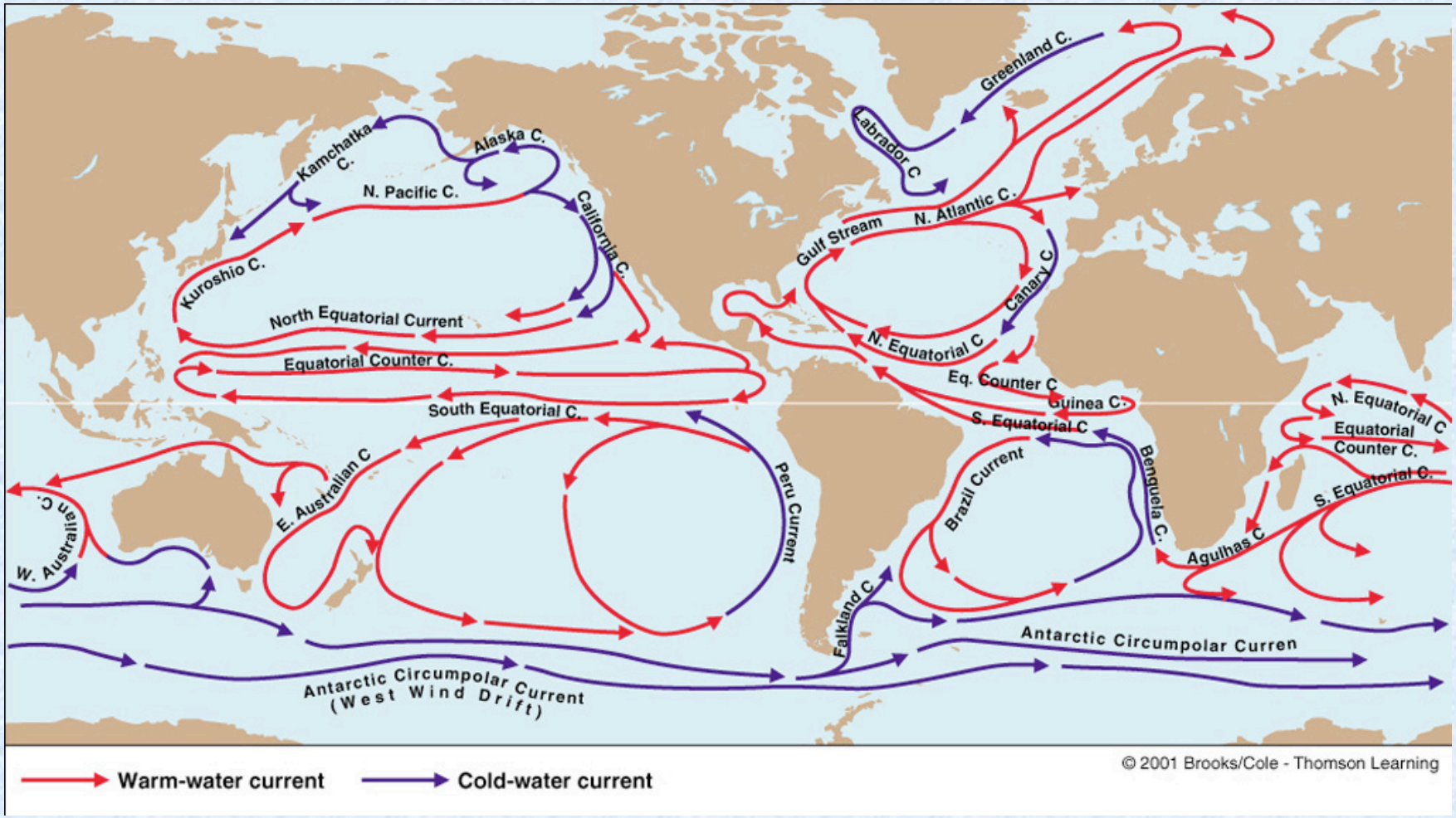
Gyre rotation

- **Clockwise in N. hemisphere**
- **Counterclockwise in S. hemisphere**



Surface current temperatures in Gyres

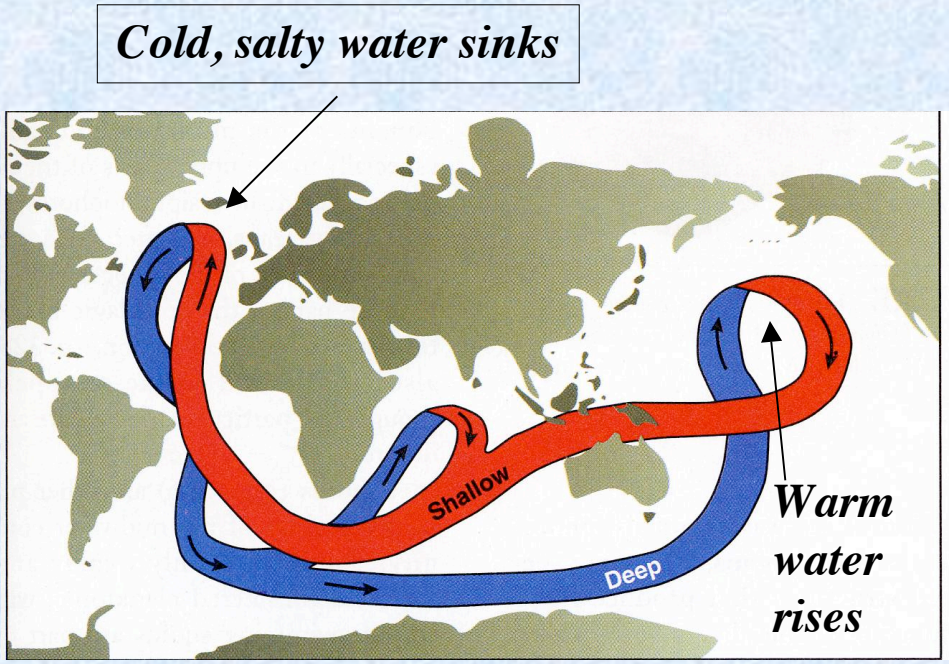
Warm on Eastern side of continents
Cold on Western sides



Thermohaline Circulation

The great ocean "conveyor belt"

Differences in density of seawater causes flow of deep water



Redistributes heat in ocean by circulating deep water

Abiotic Influences in Aquatic Ecosystems

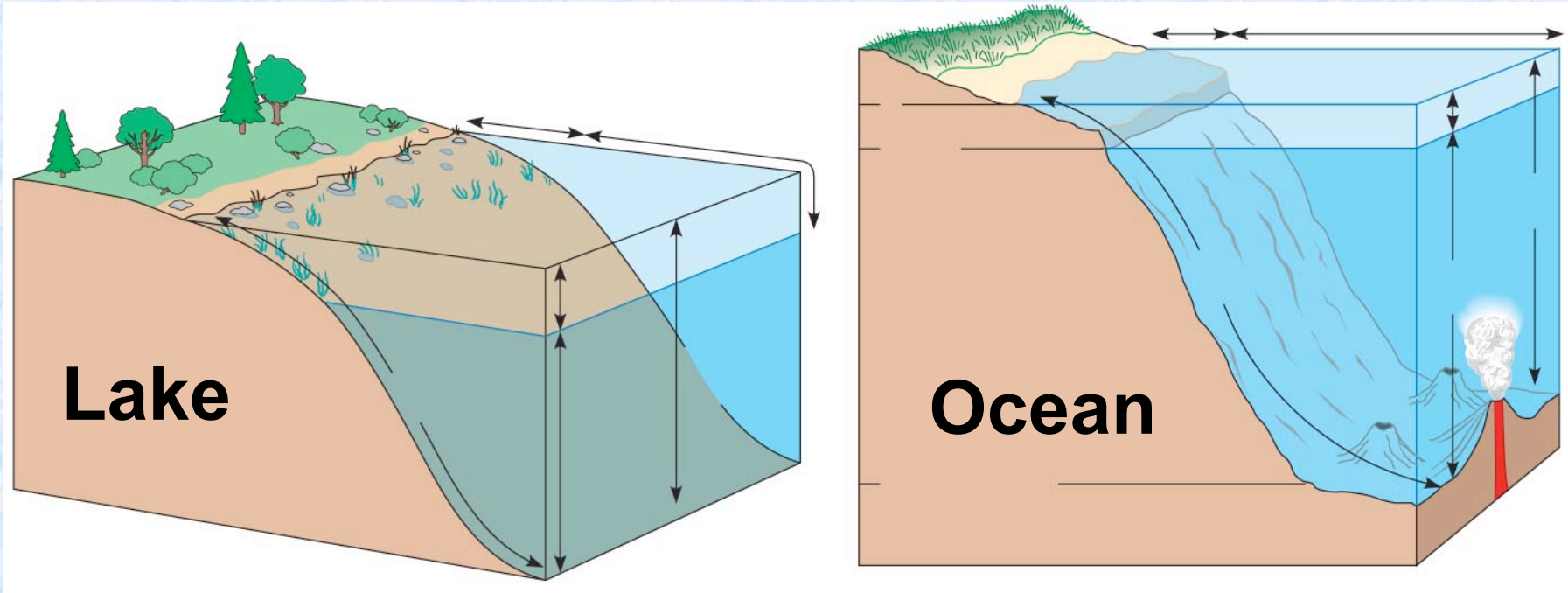
4 main factors

- **Salinity**
  - *ave. 3% salts in ocean (more variable in shallow water)*
  - *< 0.1% in freshwater*
- **Oxygen**
  - high in shallow water; low in deep water
- **Light (depth & water clarity)**
  - high in shallow water; none in deep
- **Nutrient availability - Nitrogen & Phosphorous**
  - low in shallow water; high in deep
  - source of nutrients is land, but they sink in water

Abiotic factors are stratified in water

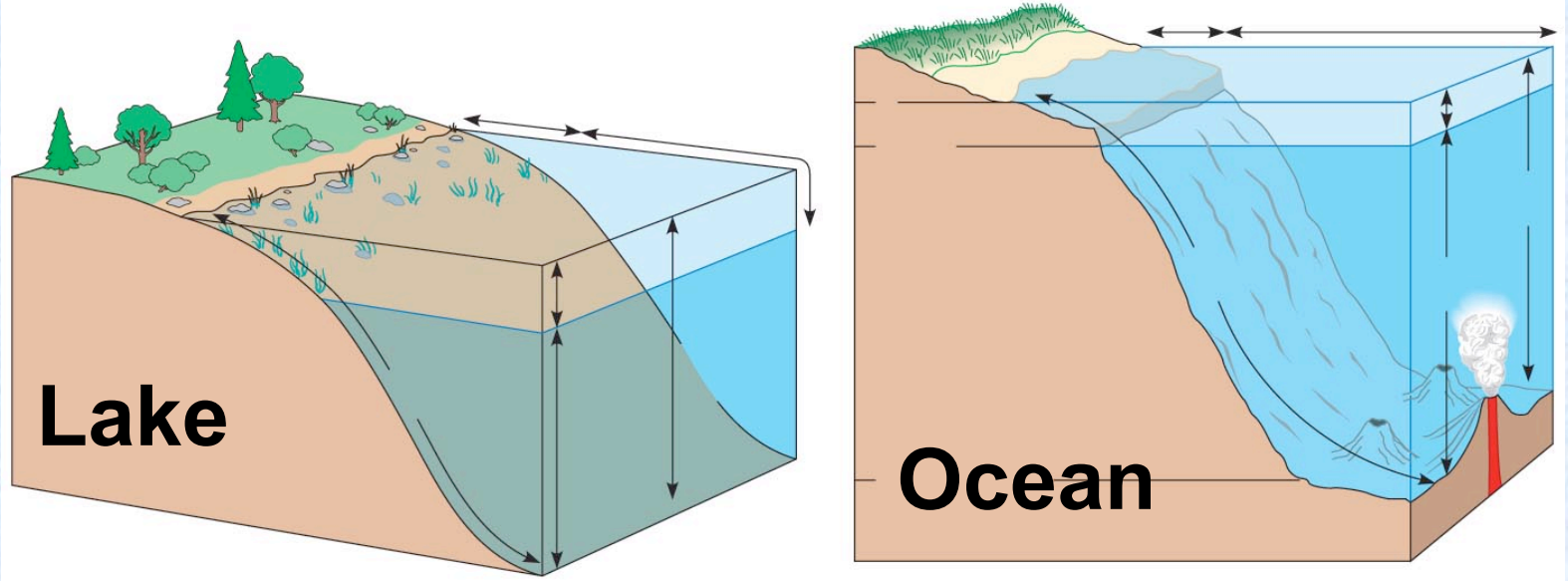
- decrease with depth

- Light
- Temperature
- Oxygen



<u>Factors affecting species distributions</u>:

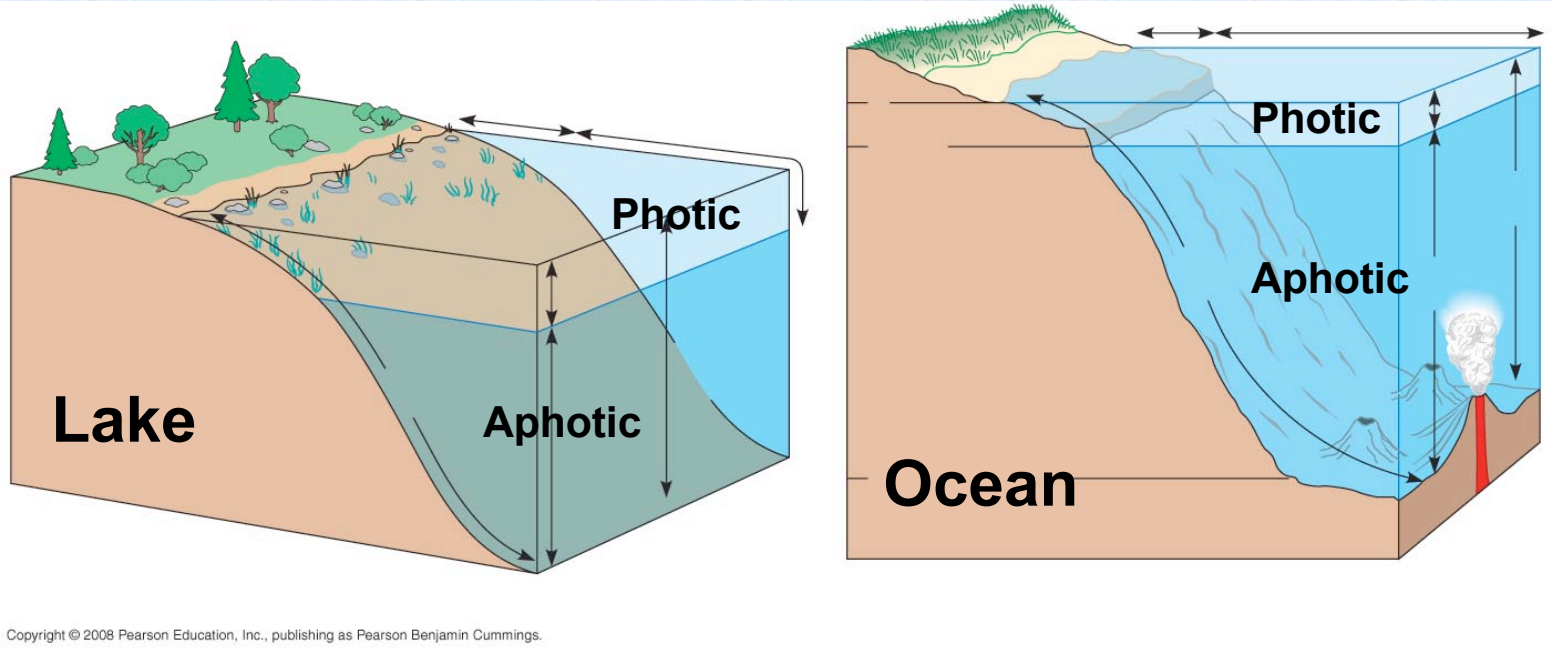
- ***Distance from shore***
- ***Depth***
- ***Light penetration***
- ***Location (open water or bottom)***



Zonation by Light

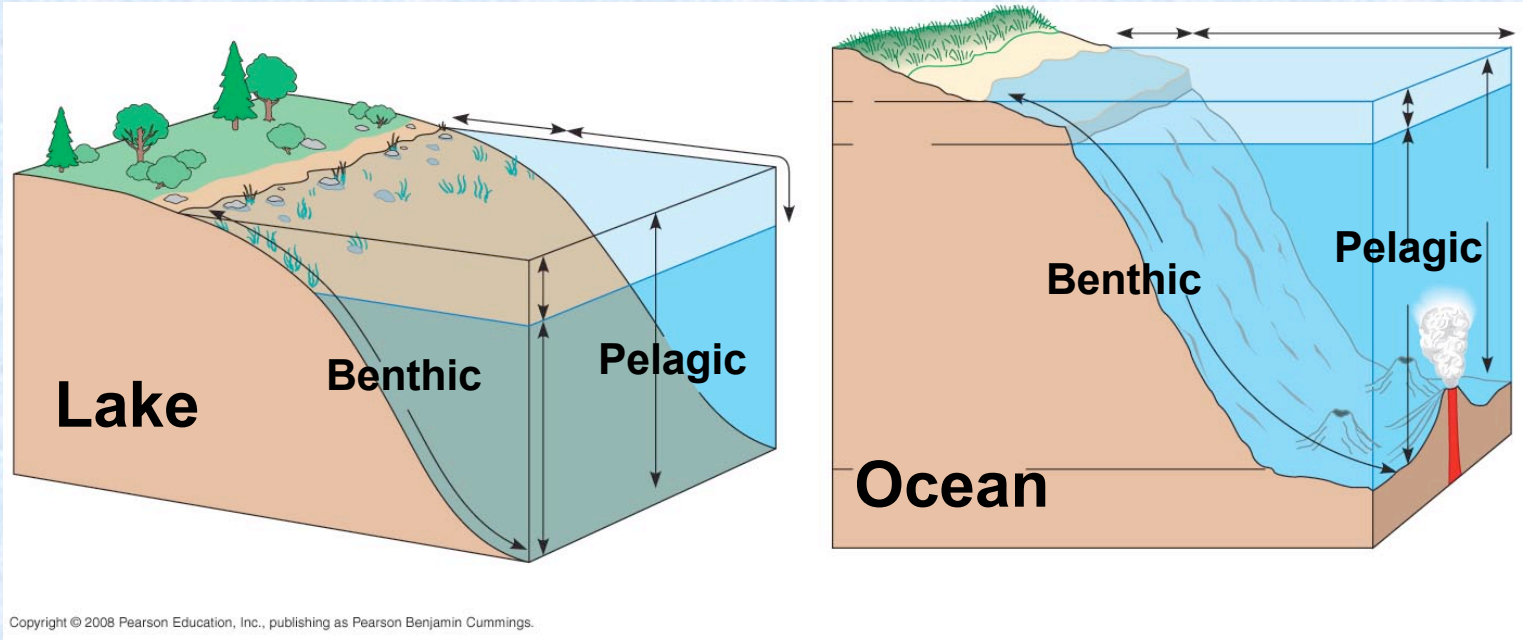
Water absorbs light

- ***Photic zone*** **= upper sunlit waters**
- ***Aphotic zone*** **= no light**

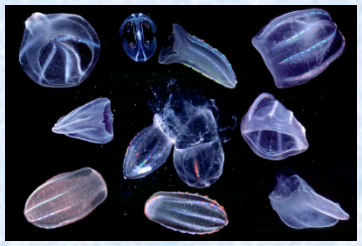


2 main aquatic environments

- *Pelagic zone* = water column
- *Benthic zone* = bottom



Aquatic lifestyles



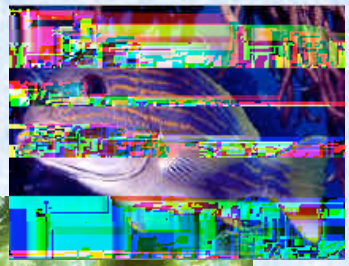
Plankton - pelagic drifters

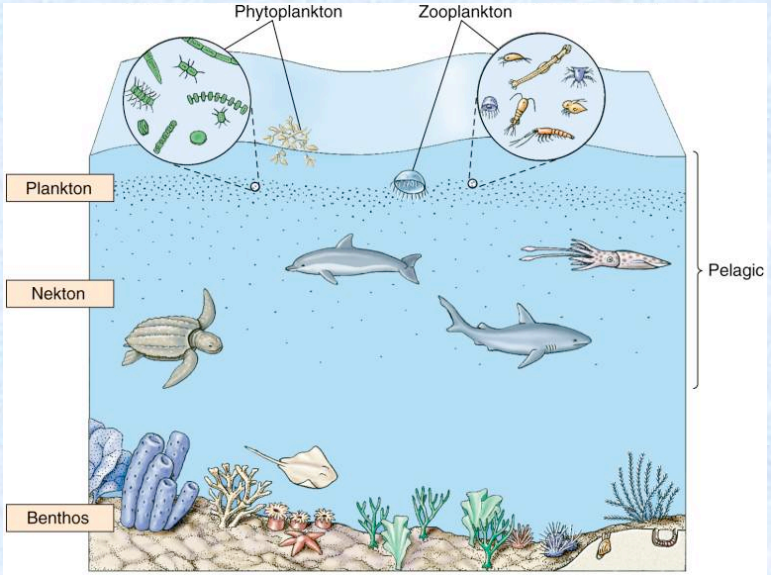
- lives in sunlit surface water
- floats in currents
  - Phytoplankton - producers
  - Zooplankton - consumers

Nekton - pelagic swimmers

Benthos - lives on bottom

- sessile or attached





Freshwater Ecosystems

Standing water: Lakes & Ponds

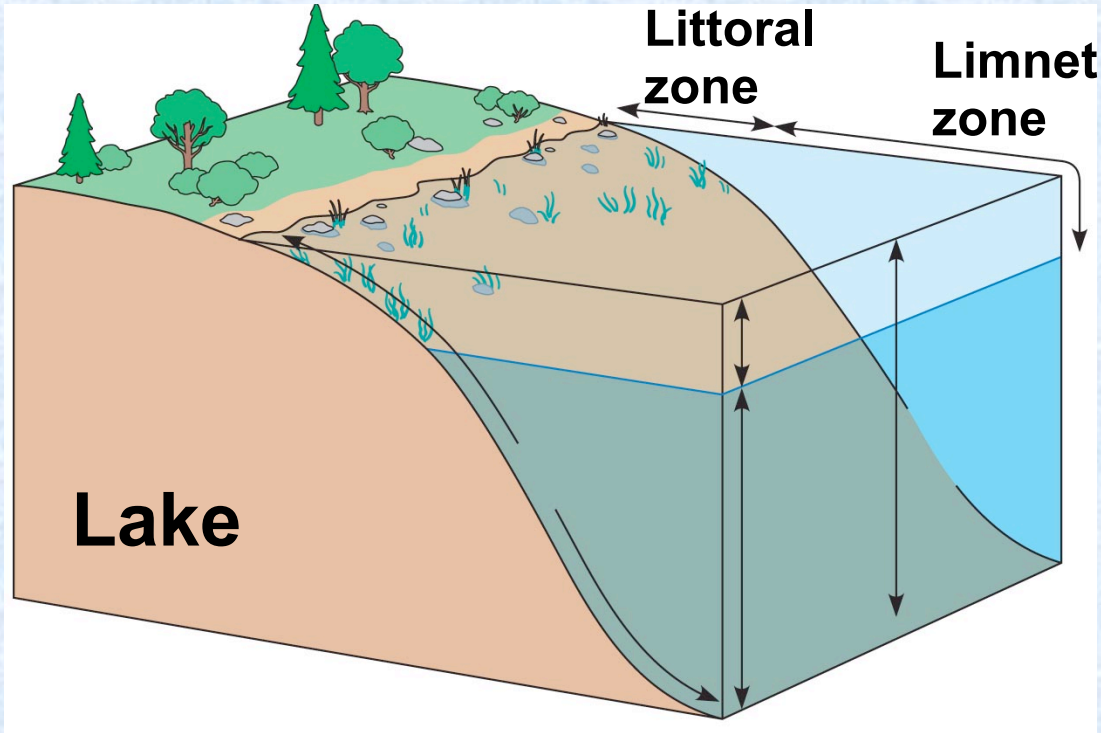
Flowing water: Rivers & Streams

Wetlands: Marshes, Swamps, Vernal pools

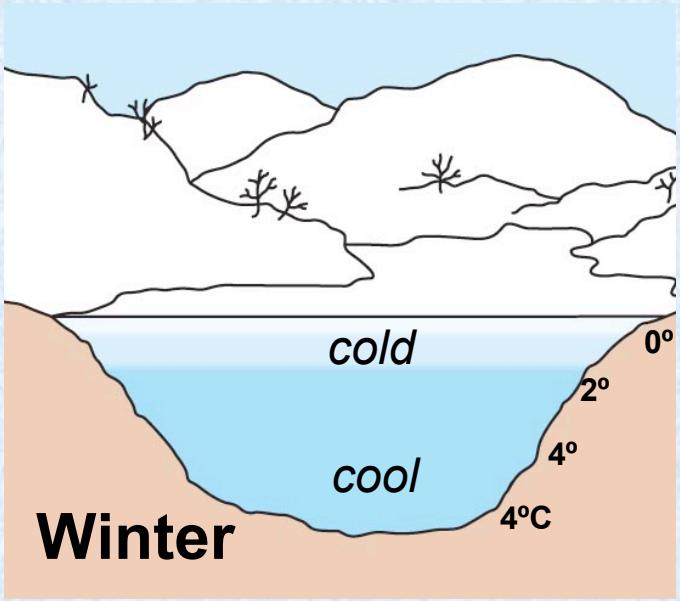
Lake zones by depth & distance from edge

- *Littoral zone* - shallow water along lake edge with rooted plants

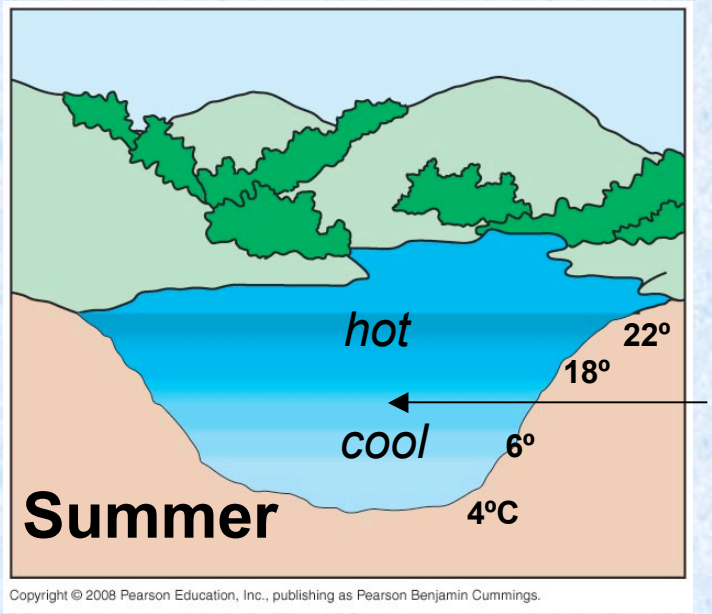
- *Limnetic zone* - deeper water away from shore
  - phytoplankton, no plants



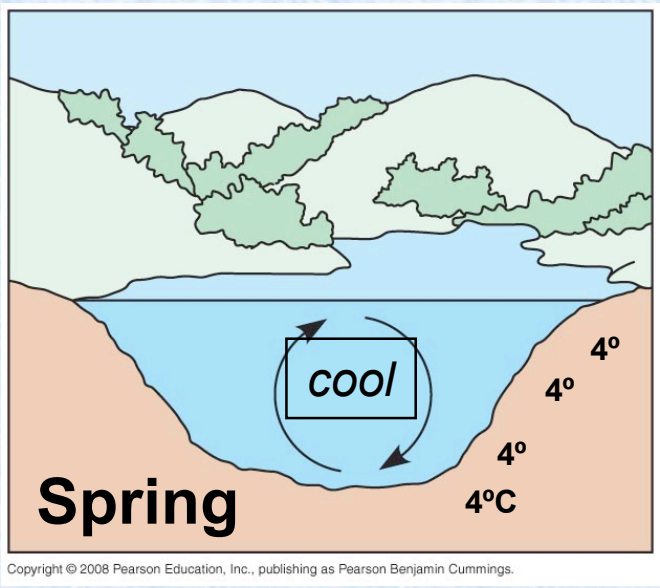
Thermal stratification in a lake



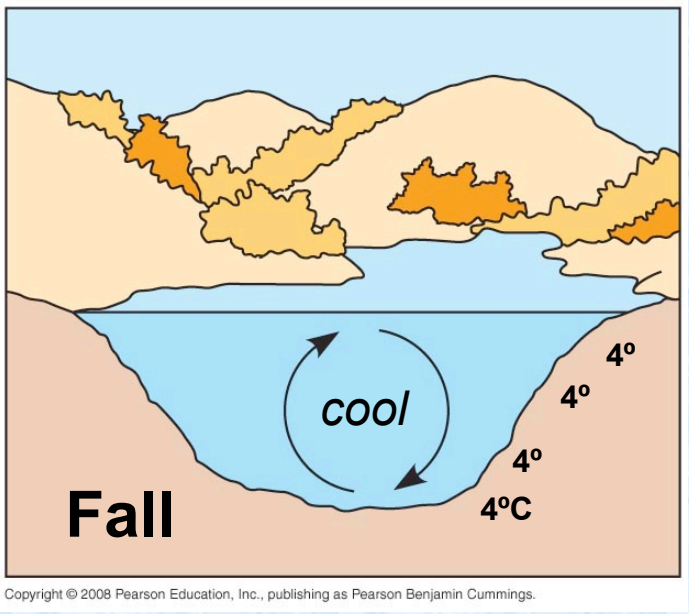
No mixing = stratification



Thermocline

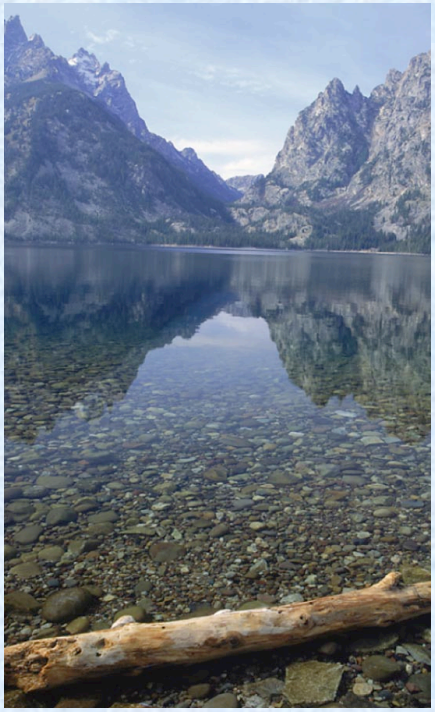


Turnover = Mixing



Lakes differ in nutrient loads

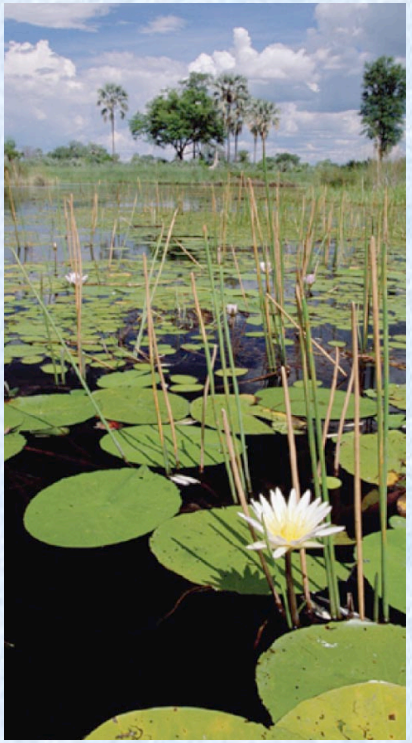
Oligotrophic lakes



Blue, clear water
- few plankton

- **Nutrient poor**
- **Oxygen rich**

Eutrophic lakes



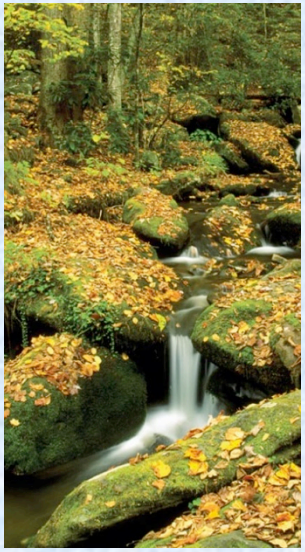
Green, cloudy water
- lots of plankton

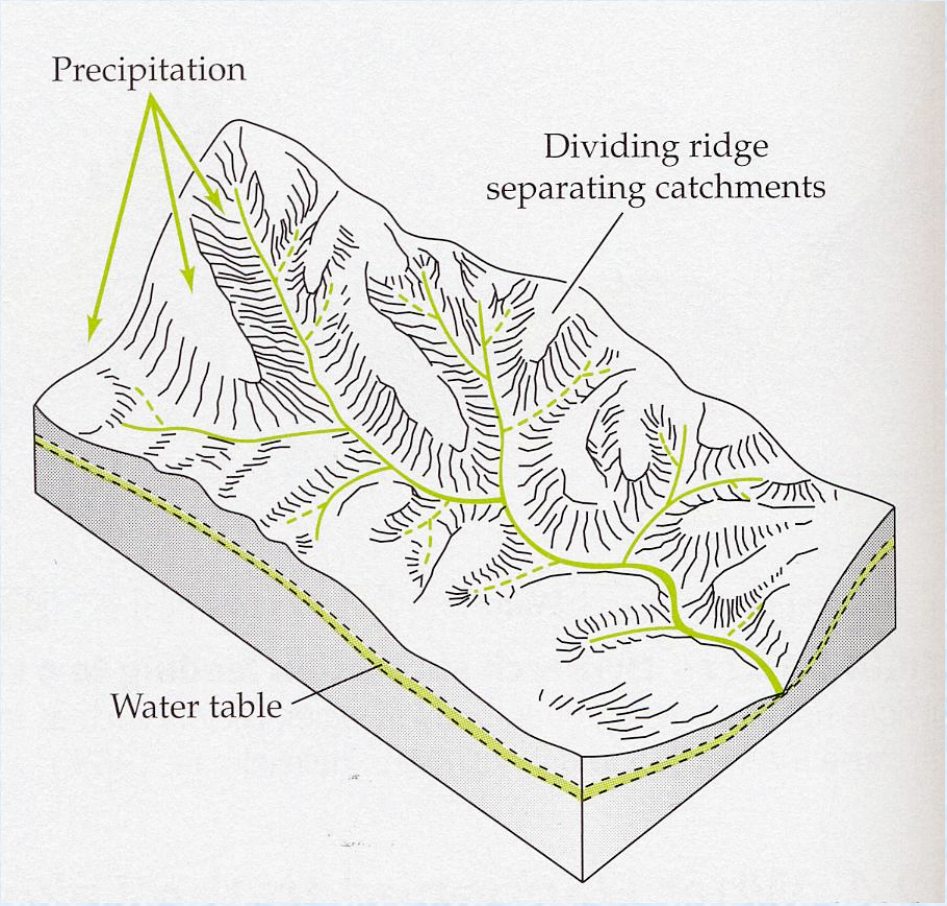
- **Nutrient rich**
- **Oxygen poor**

Rivers - Flowing waters

<u>Watershed</u> - a large drainage basin that feeds a river

Precipitation
Runoff
forms
Streams





Streams
converge to form
Rivers

Current, depth & temperature vary with location in the watershed

Rivers

Upstream: Headwaters

Swift, shallow, cold, oxygen rich

Downstream

Slow, deep, warm, oxygen poor

Wetlands

Ecotones between terrestrial & aquatic ecosystems

Ecotones = transitional areas between different ecosystems

Wetlands defined by:

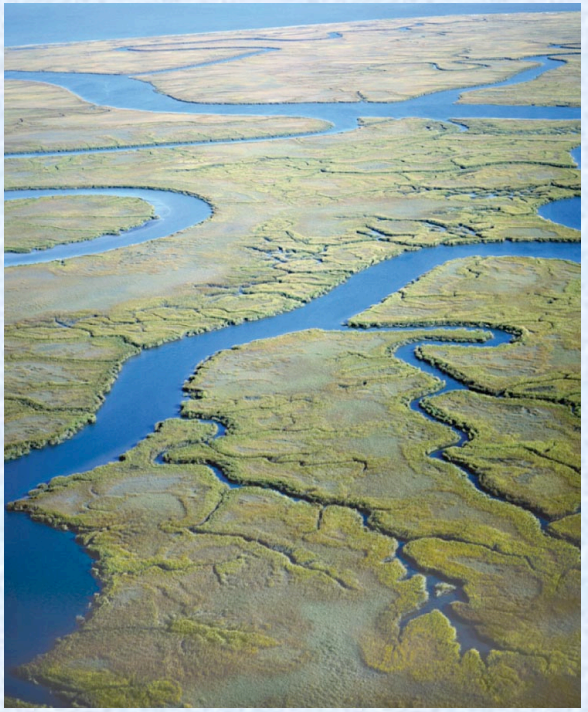
- Standing water < 2 m depth
- Saturated soil
  - water at or near the surface
  - may or may not be flooded all year
- Terrestrial plants adapted to flooding

Mangrove Swamp

Marshland

Estuaries

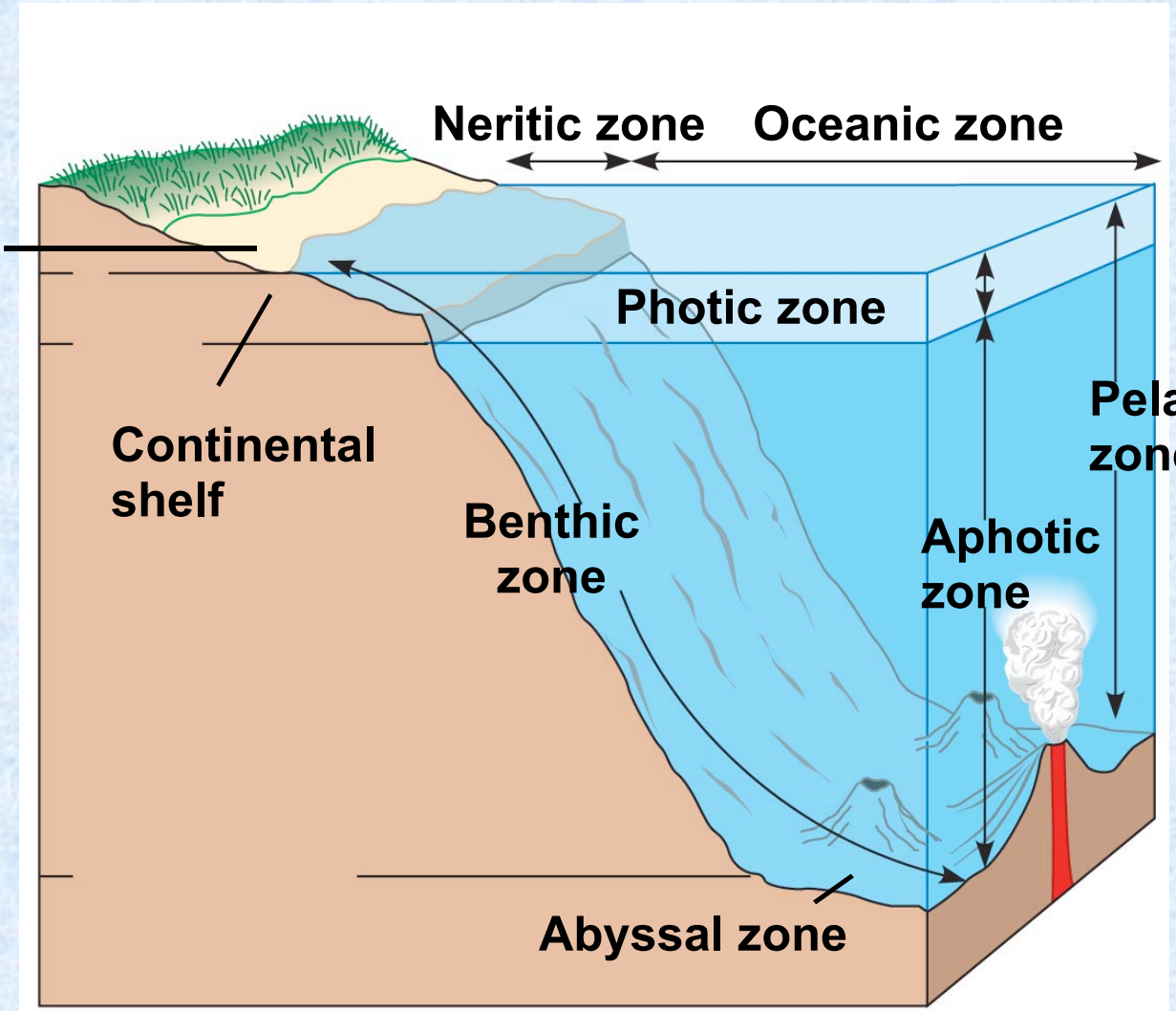
- An estuary is a marine ecosystem that forms where a river meets the sea
- Brackish water (less salty than ocean)
- Salinity varies with the tides & variations in river flow
- Nutrient rich & highly productive
- Open water & wetlands



Marine Ecosystems

Benthic zone
- Intertidal
- Subtidal
- Abyssal

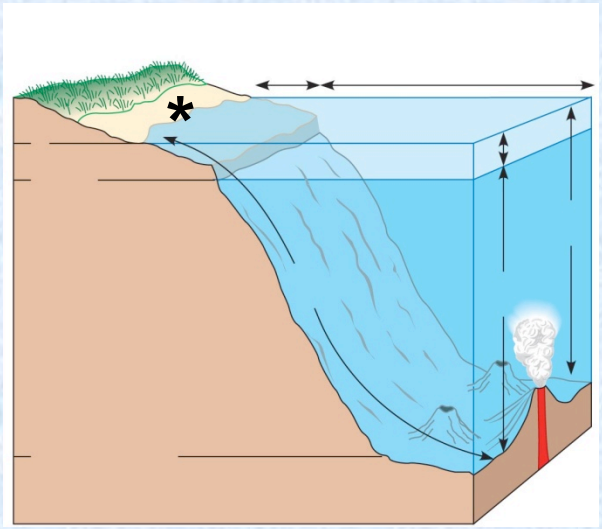
Pelagic zone
- Neritic
- Oceanic

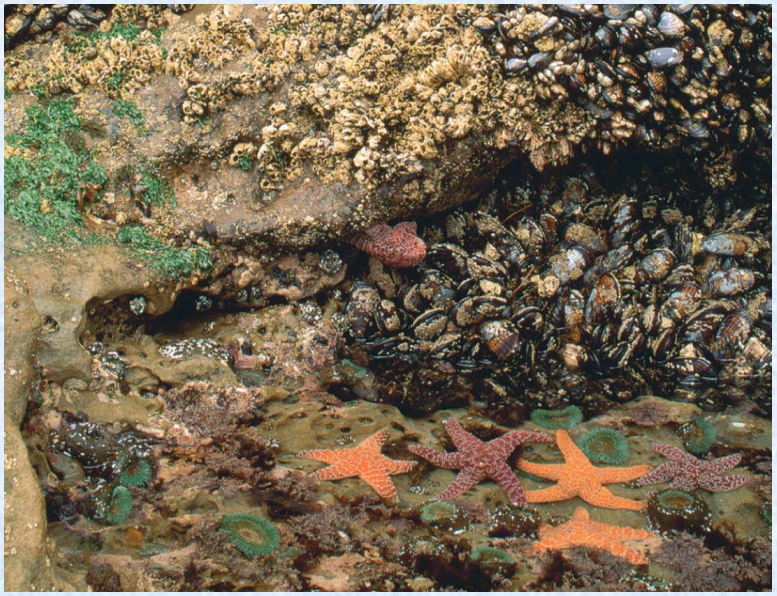


Benthic Zone

Intertidal region

- Benthic habitats at ocean edge
- Tidal influences
- Sandy or rocky bottoms
- Producers - Seaweeds on rocks

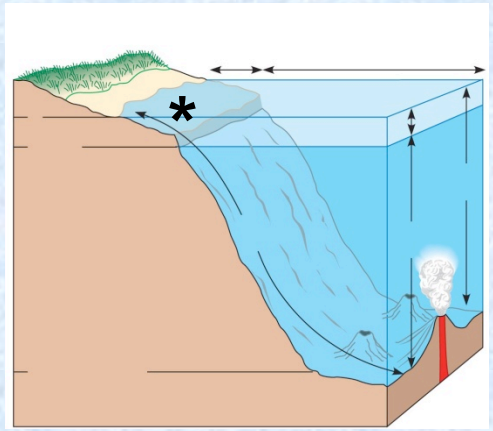


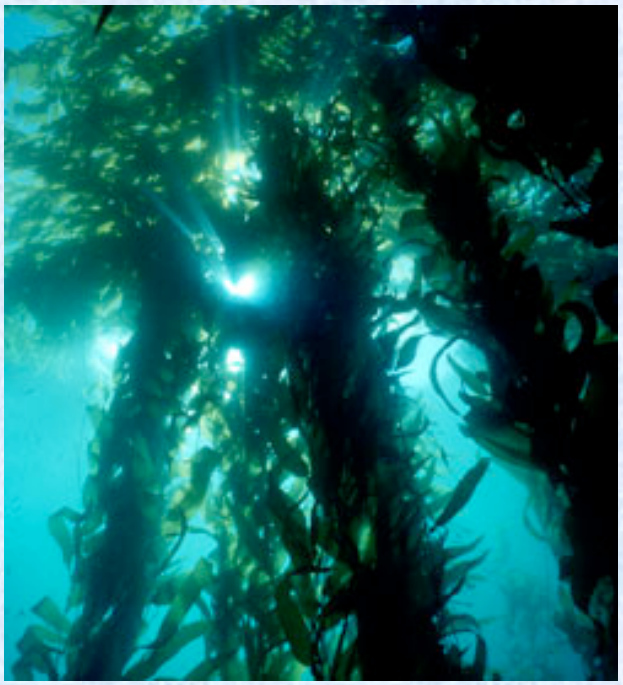


Benthic Zone

Subtidal region

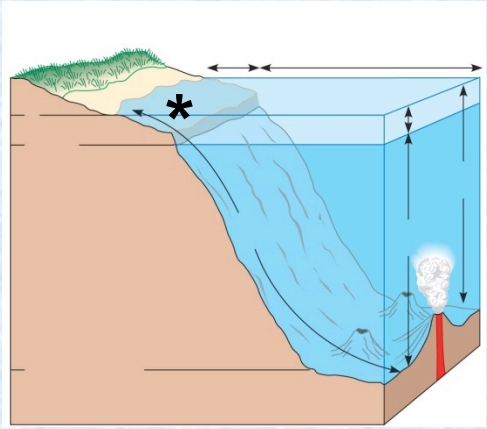
- Benthic habitats *below* low tide level
- Sandy or rocky bottoms on continental shelf
- Photic zone
- In Warm water - Coral Reefs
- In Cold waters - Kelp Forests
  - Temperate & Arctic zones
  - Nutrient rich water (green)
  - Kelp create habitat





Coral Reefs

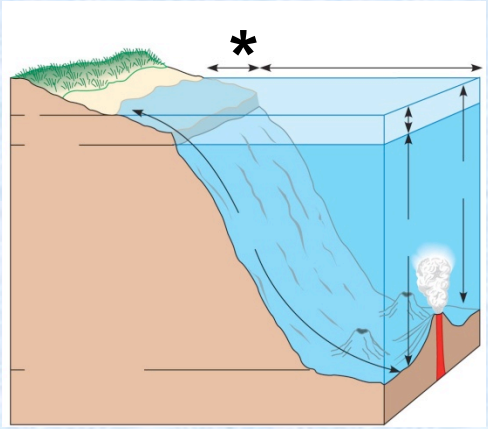
- Subtidal, benthic habitats
- Warm tropical & subtropical water
- Photic zone
- Clear, nutrient poor water
- Corals form habitat



Pelagic zone - Open water habitats

Neritic region * - above continental shelf

- Shallow water
- Nutrient rich
- Photic zone
- Producers:
  - Phytoplankton



Pelagic zone - Open water habitats

Oceanic ** - away from continental shelf

- Photic & aphotic zones
- Nutrient poor
- Producers:
  - Phytoplankton