

Aquatic Ecology

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OUTLINE

1. Factors Affecting Life in Aquatic Ecosystems

2. Saltwater Ecosystems

- the ocean & its zones
- estuaries & coastal wetlands
- barrier islands
- coral reefs

3. Freshwater Ecosystems

- lakes
- rivers & streams
- wetlands

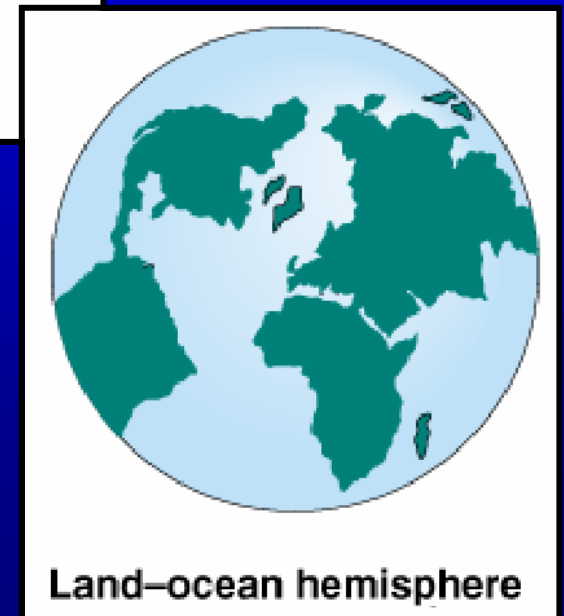
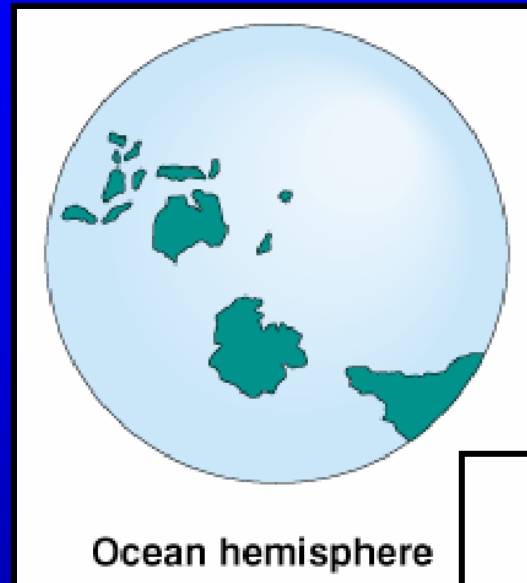
1. Factors Affecting Life in Aquatic Ecosystems

- **temperature**
decreases with depth because of decreasing energy input from sun; affects dissolved gases, rates of chemical reactions, & where organisms can live;
- **light (solar radiation)**
decreases with depth because of absorption by water, suspended materials, & phytoplankton; essential for photosynthesis;
- **dissolved oxygen**
varies with temperature, producers, & consumers; essential for respiration of organisms;
- **nutrient availability**
most limiting macronutrients are phosphorus (P) & nitrogen (N); limiting micronutrients include iron (Fe); essential for growth of phytoplankton.

2. Saltwater Ecosystems

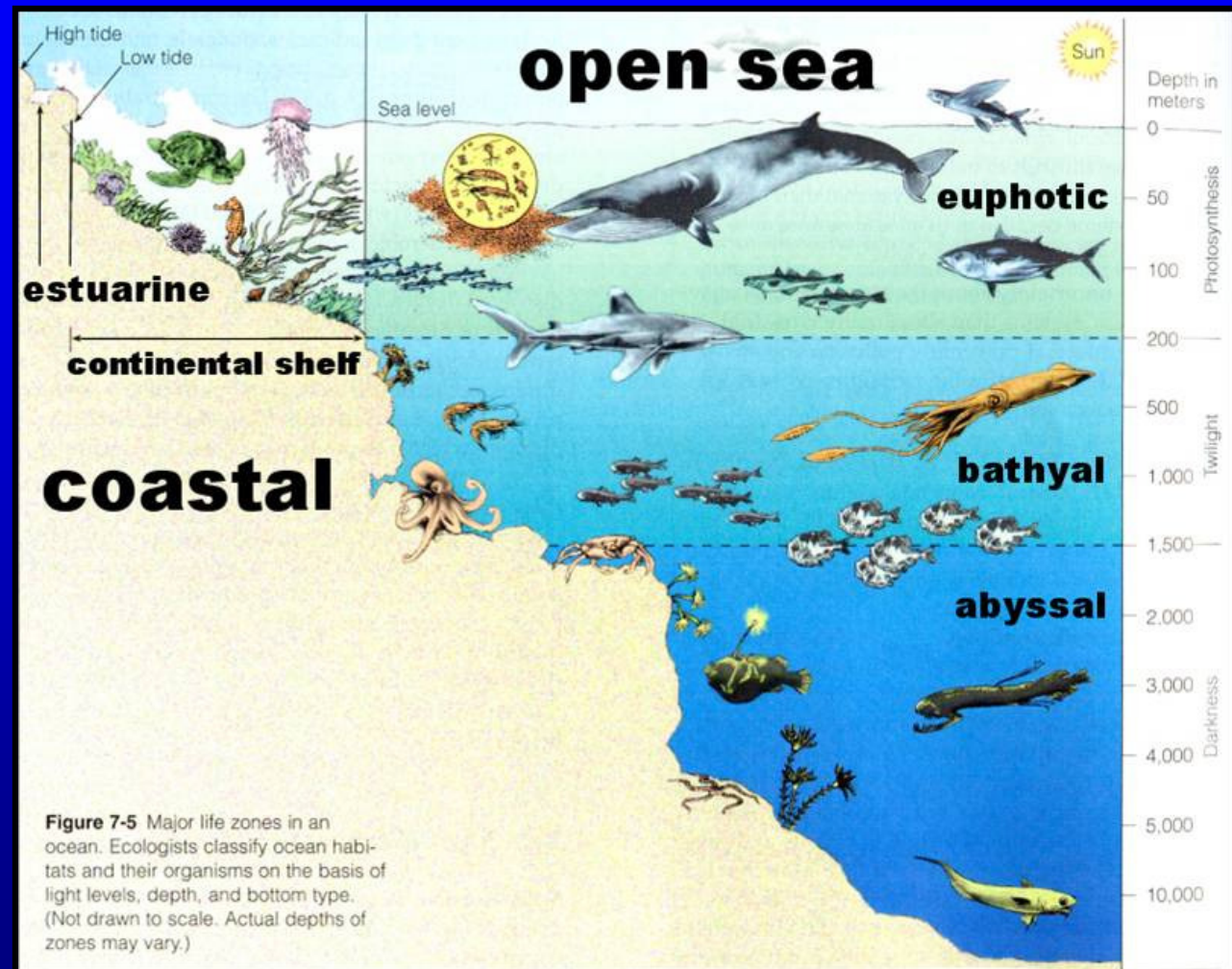
Oceans

- cover 71% of the earth's surface
- ocean currents distribute solar heat
- reservoir for carbon dioxide (CO₂)
- regulates temperature of the troposphere
- habitat for plants & animals, including critical food sources for humans
- communal dumping ground



Life zones of the Ocean

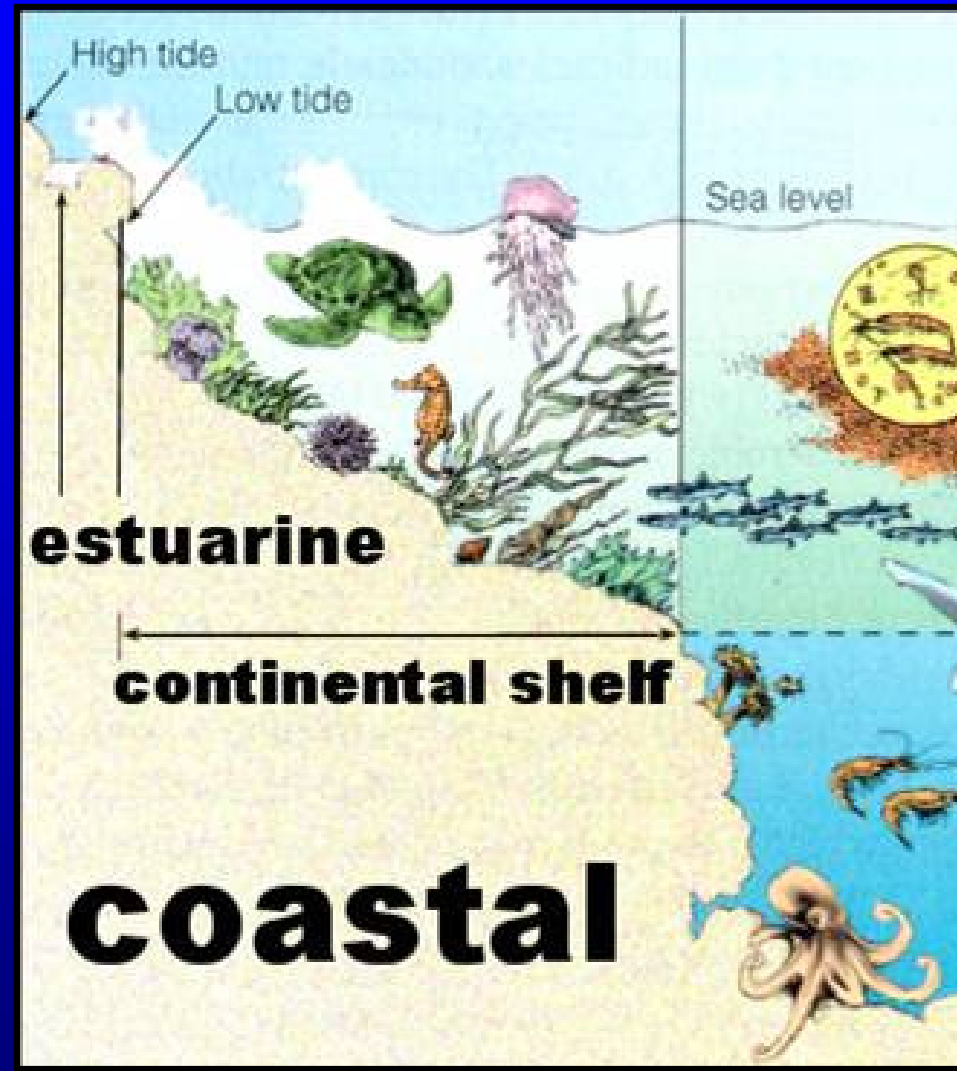
- zones defined by amount of solar radiation penetrating the water
- zones (in order of declining solar radiation): euphotic zone, bathyal zone, abyssal zone



<http://library.thinkquest.org/04oct/01590/intro/ocean.jpg>

Coastal Zone of the Ocean

- extends from high-tide mark to edge of continental shelf
- entirely within the euphotic zone & includes estuaries, wetlands, barrier islands, & coral reefs
- nutrient-rich & the site of most commercial fisheries
- high primary productivity: sunlight + nutrients from land & ocean currents



Estuaries & Coastal Wetlands

Estuary: where seawater mixes with freshwater from land, generally at the mouth of a river

Coastal wetland: areas of coastal land covered all or part of the year with salt water



www.anra.gov.au/topics/coasts/estuary/index.html

Estuaries & Coastal Wetlands

Importance

- nutrient rich
- high primary productivity
- nurseries for fish & other aquatic animals
- waterfowl & shorebird breeding areas
- filter water pollutants



Estuaries & Coastal Wetlands

Human Impacts

- world has lost over half of its estuaries & coastal wetlands
- percentage lost in the U.S. even higher most lost to coastal development
- causes of degradation urban runoff, sewage treatment plant effluent, sediment & chemical runoff from agricultural lands



Barrier Islands

Barrier Islands: long, thin, low offshore islands of sand that run parallel to the shore.

Importance

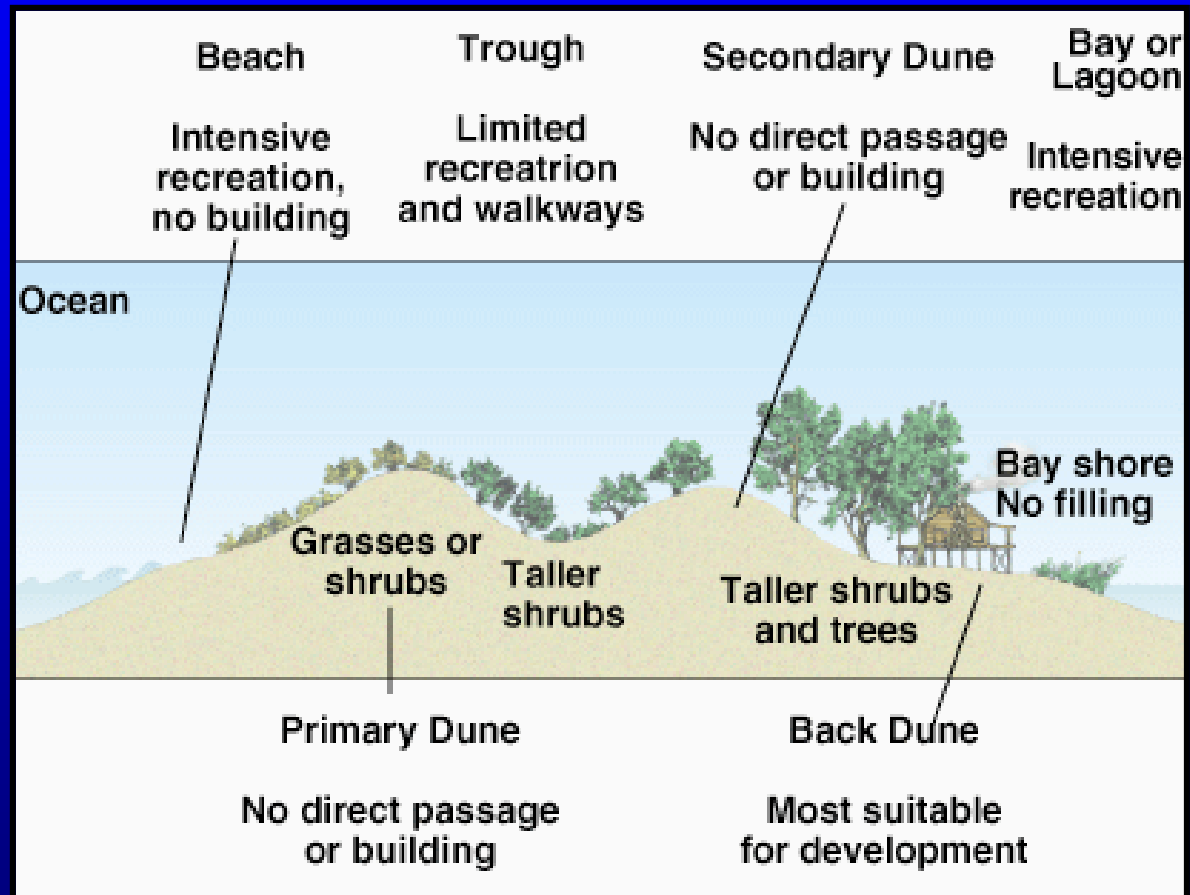
- protect mainland from offshore storms
- shelter inland bays, estuaries, & wetlands
- popular recreational & residential areas



Barrier Islands

Human Impacts

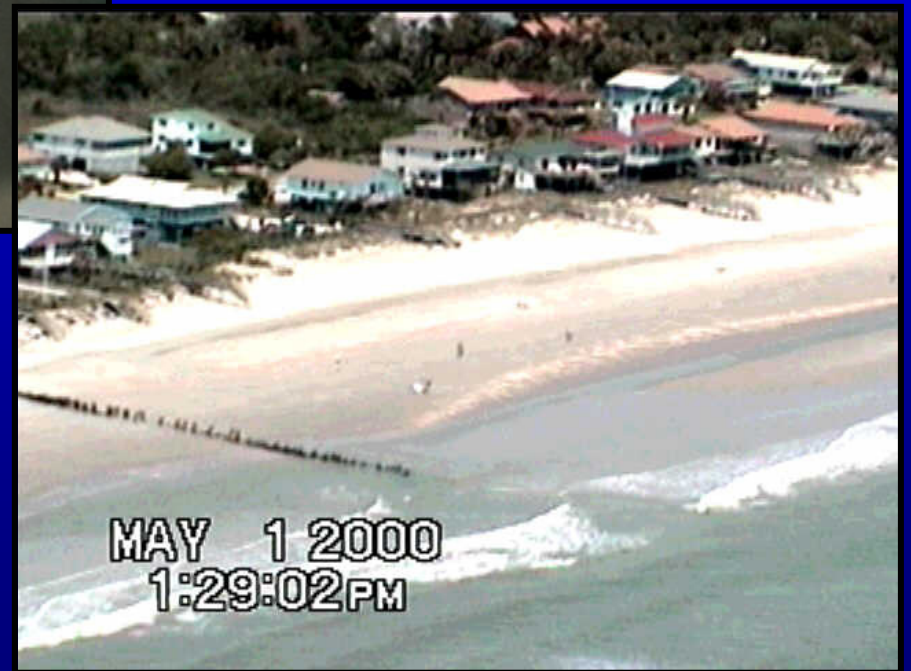
- Development of barrier islands
 - destroys dunes & dune vegetation
 - causes beach erosion
 - destroys or disturbs wildlife habitat (e.g., some endangered birds nest on barrier islands)



Protecting Beaches

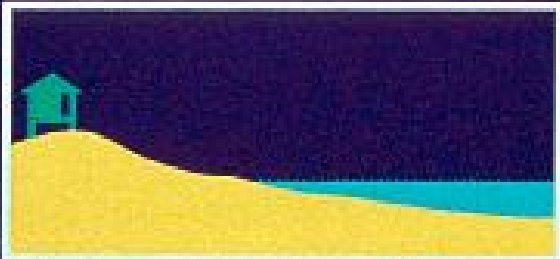
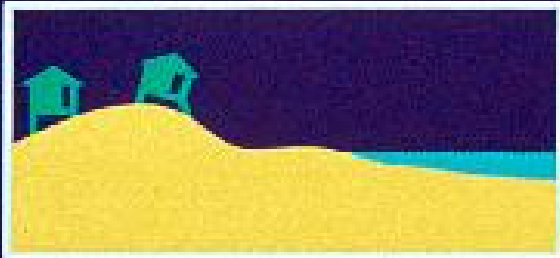


Jetties & Groins



Seawalls

Natural Beach Retreat



Beach Retreat With a Seawall





The beach at South Carolina's Myrtle Beach retreated during Hurricane Hugo in 1989 and reestablished itself in front of the houses on the right. The beach could not retreat due to the seawall on the left and as a result, there is no beach there at high tide.

Seawalls



North Myrtle Beach, South Carolina

Beach Replenishment

From the town of Ocean City Website: "Ocean City's Beach Replenishment Project is an on going effort. Twice a year the Army Corps of Engineers survey our beach to determine the need for any additional sand. In general, the dredging is on a four year cycle. The last project was completed in 2002. This year (2006) we will be pumping approximately 830,000 cubic yards of sand."



Ocean City, Maryland

<http://www.octhebeach.com/images-things/beach-replenishment-b.jpg>

Replanting Dune Vegetation & Controlling Development

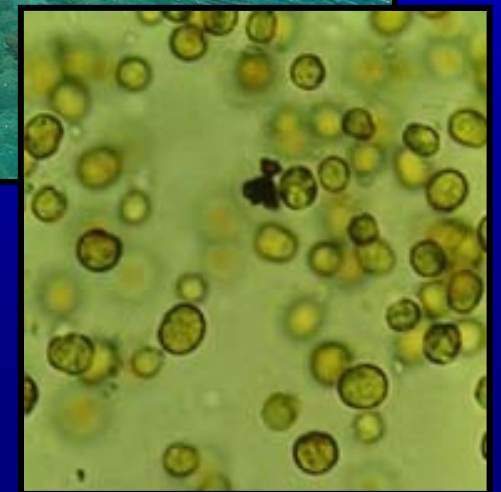


<http://www.dkimages.com/discover/previews/754/414234.JPG>

Coral Reefs

- reefs formed by mutualism between polyps & algae
- reefs built as colonies of polyps secrete limestone hard deposits remain when the polyps die
- reefs located in coastal zones of tropical oceans

<http://dogoodclub.org/wp-content/uploads/2008/06/fringing-coral-reef-near-eilat-israel.jpg>



Coral Reefs

Importance

- high biodiversity like “tropical rain forests of the ocean”
- protect coastlines from storms & high waves
- nurseries for many fish species
- disappearing



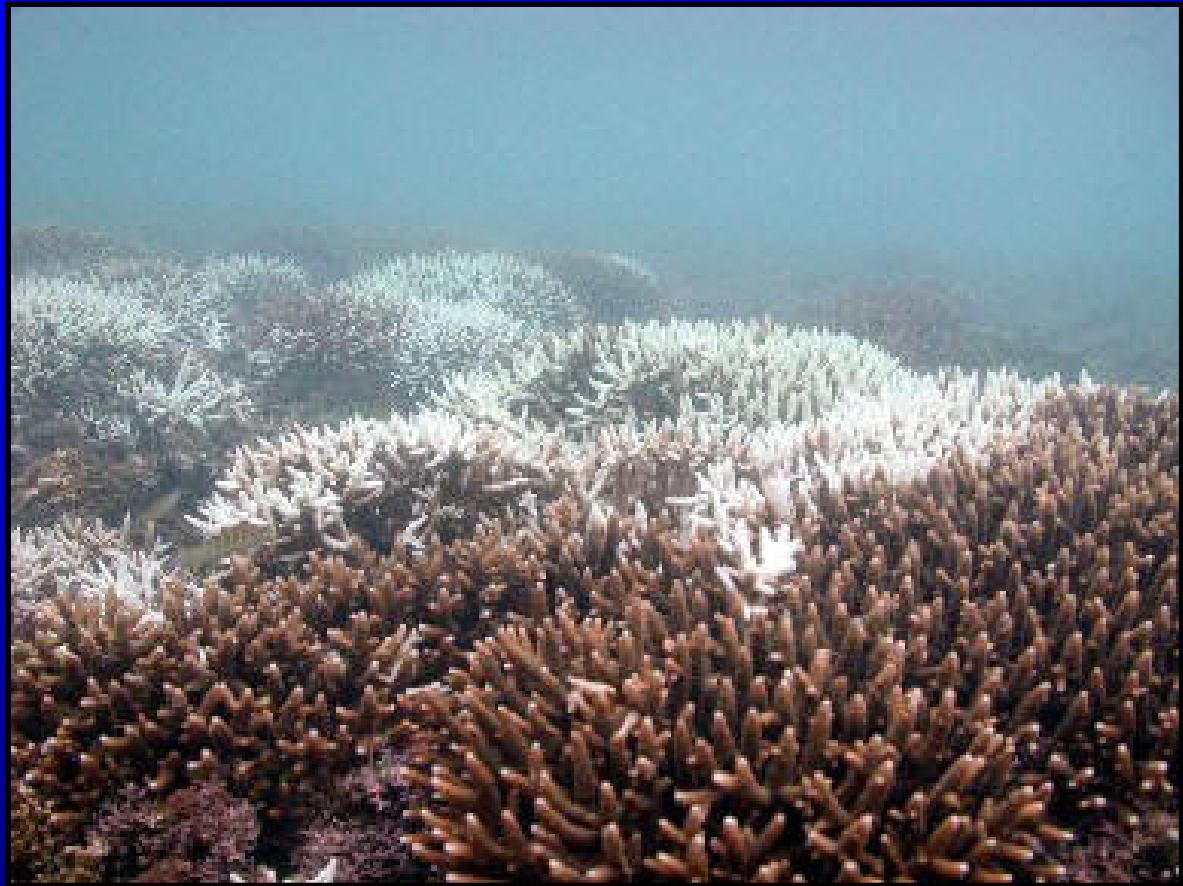
Coral Reefs

Vulnerability

- slow growing
- easily disturbed
- thrive only in clear water

Human Impacts

- sediment runoff & effluent
- increased UV radiation
- fishing with cyanide & dynamite



<http://www.lizasreef.com/HOPE%20FOR%20THE%20OCEANS/Images%20HFTO/Coral%20Bleaching.jpg>

3. Freshwater Ecosystems

Lakes

standing (lentic) body of freshwater formed when rain, runoff, or groundwater fills depressions in the landscape



LAKE ZONES



<http://library.thinkquest.org/04oct/01590/intro/lake.jpg>

Littoral zone: shallow area near the shore, to the depth at which rooted plants stop growing.

Limnetic zone: open, sunlit, surface layer away from the shore. Depth is the limit of light penetration.

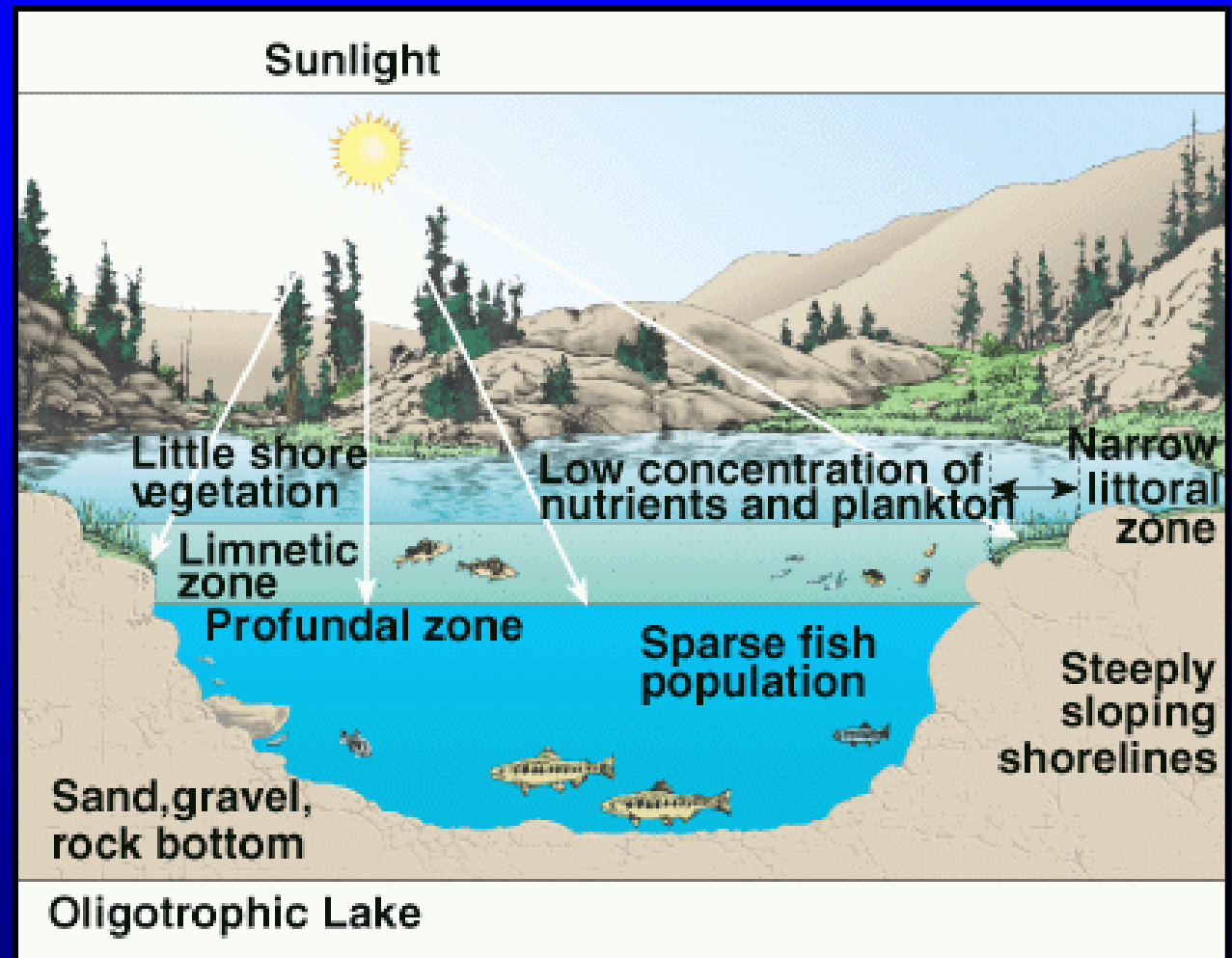
Profundal zone: deep, open water where there is no light penetration.

Benthic zone: the bottom of a lake; inhabited by insect larvae, decomposers, & clams.

Types of Lakes

- **Oligotrophic**

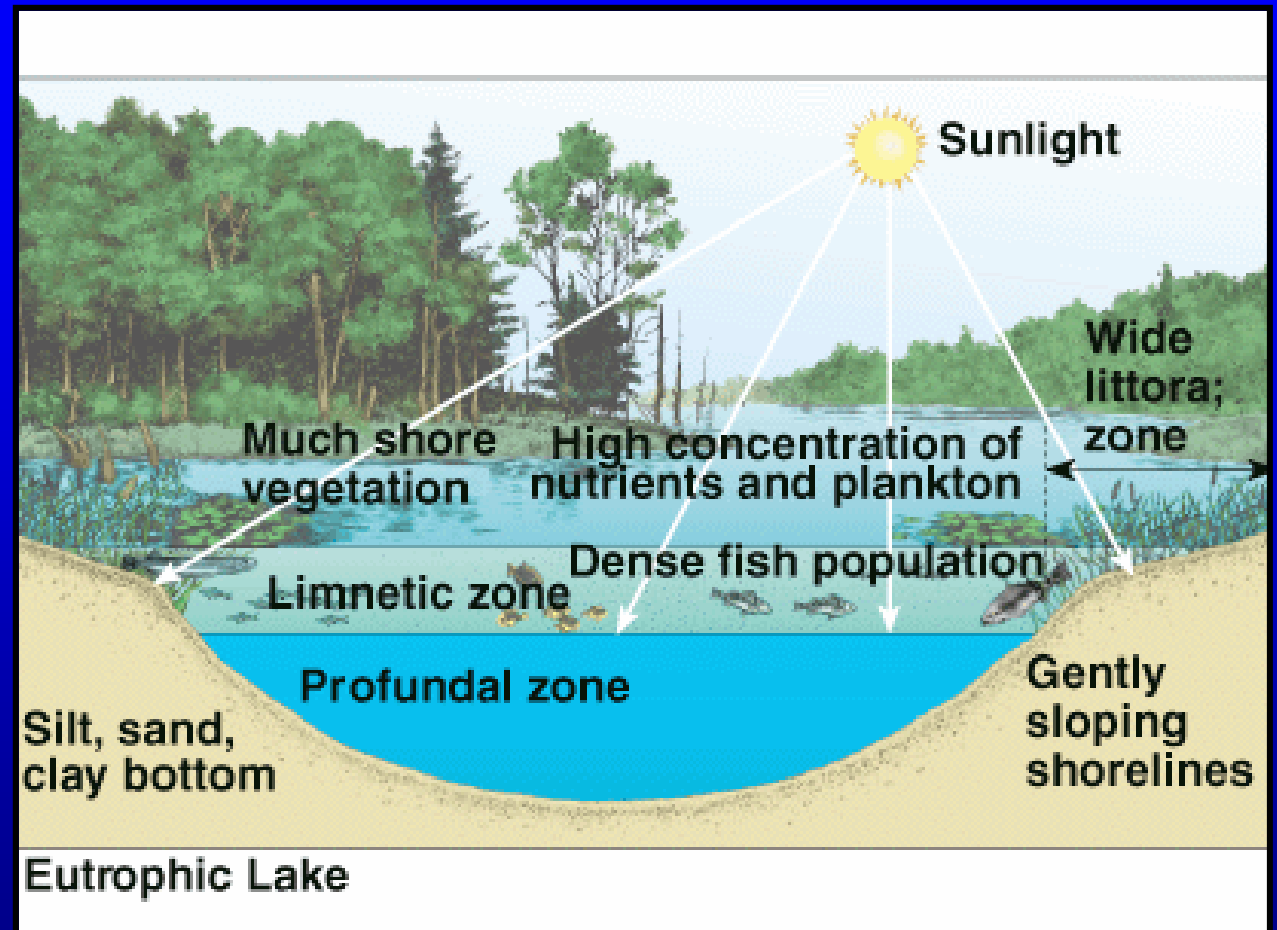
- low nutrient supply
- low primary productivity
- clear water, few plants & fish



Types of Lakes

- **Eutrophic**

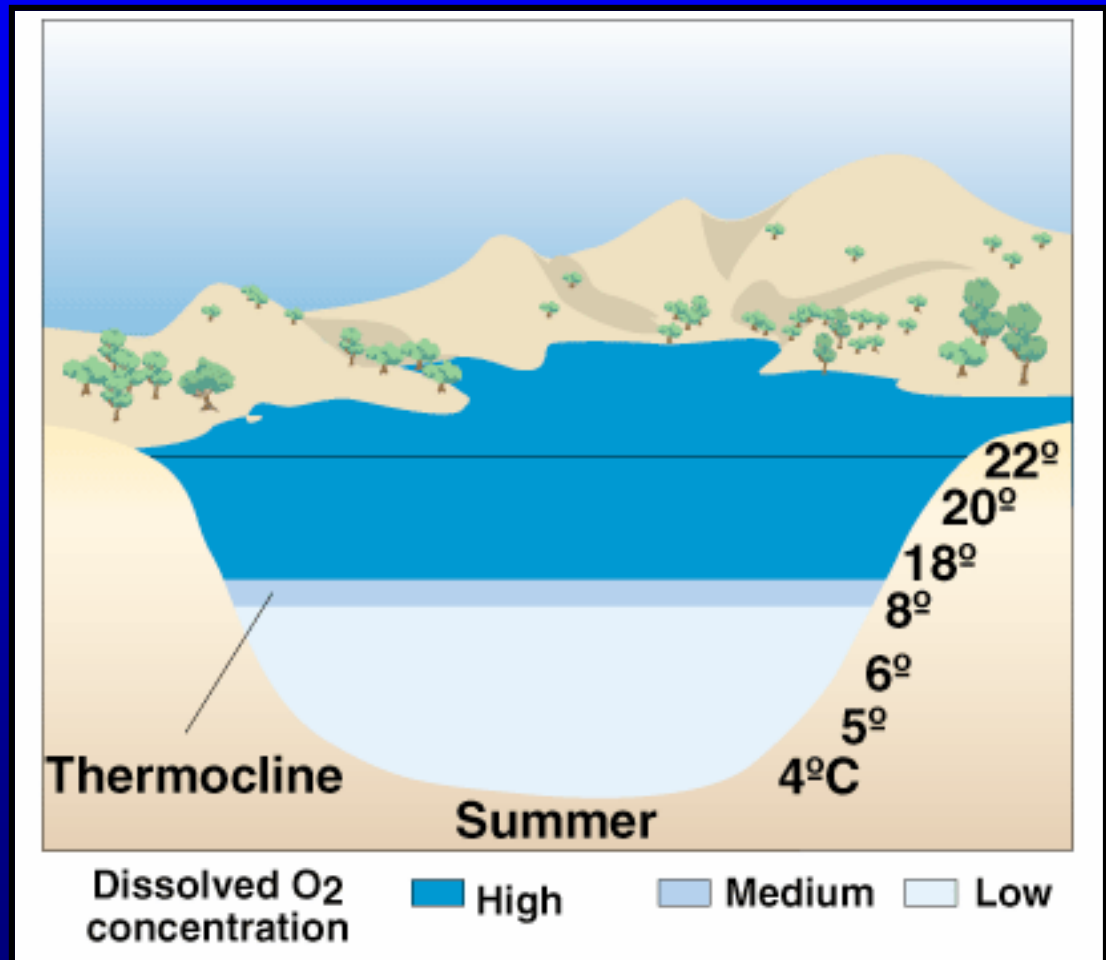
- excess supply of nutrients
- high primary productivity
- murky water, large phytoplankton population



LAKES

Thermal stratification: during summer (temperate lakes)

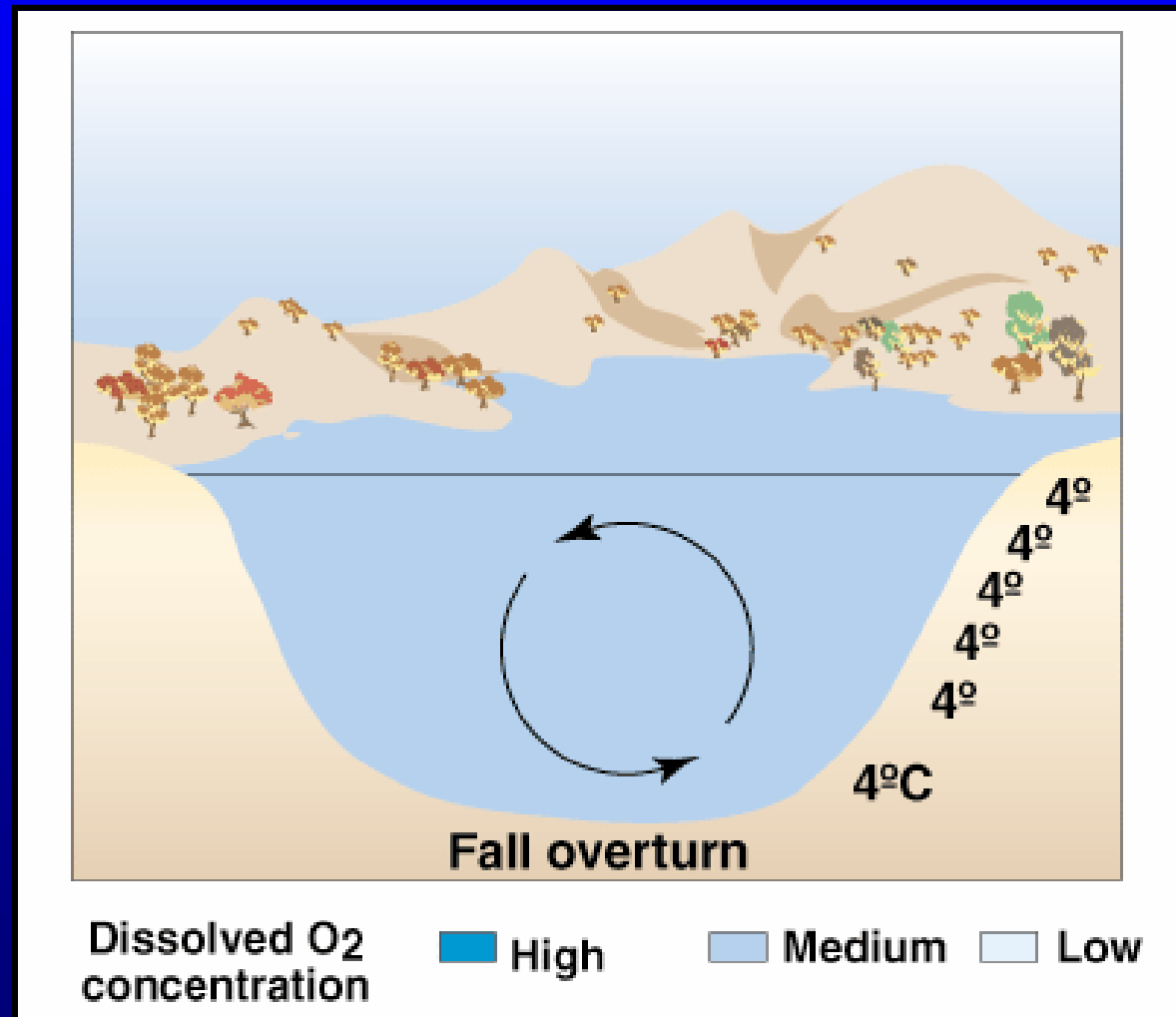
- **epilimnion:**
warm, upper layer of water
- **thermocline:**
zone of lake where temperature changes rapidly with depth
- **hypolimnion:**
colder, denser lower layer of water can be depleted of oxygen in eutrophic lakes



LAKES

Overtourn: spring & fall (temperate zone lakes)

- upper layer of water sinks & winds mix layers
- redistributes oxygen & temperature evenly
- redistributes nutrients from the lower layers



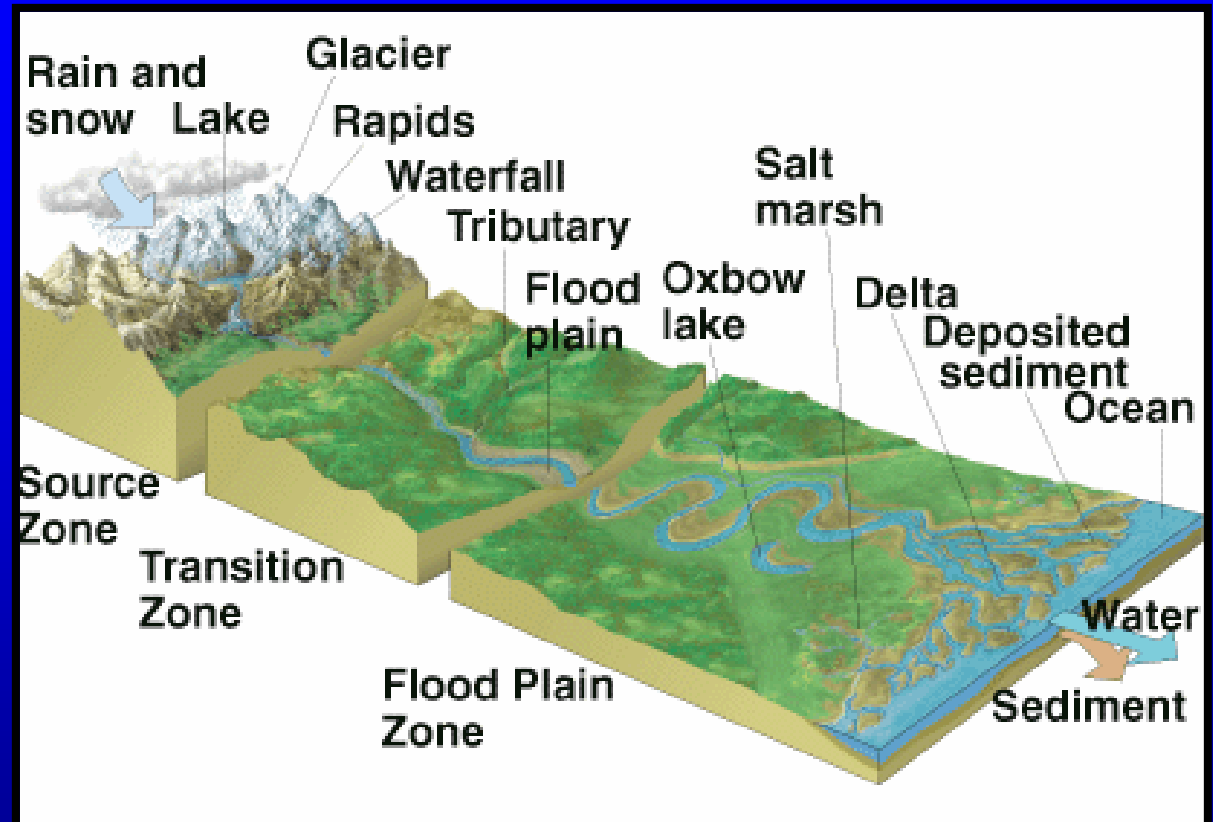
Streams & Rivers

watershed: the land area that delivers water, sediment, & dissolved substances to a water body.



Stream Zones

- source zone: cold, clear, fast-running streams in upper watershed
- transition zone: middle part of watershed, where streams widens & join, flow slows, water temperature increases
- flood plain zone: many streams join to form a broad, slow-moving, meandering river in lower watershed



Each zone has unique characteristics that support different assemblages of plants & animals

Streams & Rivers

Human Impacts

- pollution
- sediments
- channelization
- dams
- introduction of exotic species,
- removal of vegetation from banks
- change of flow (more floods, lower base flow)



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