



# Chapter 7:

# Aquatic Life Zones

AP Environmental Science

# Types of aquatic life zones

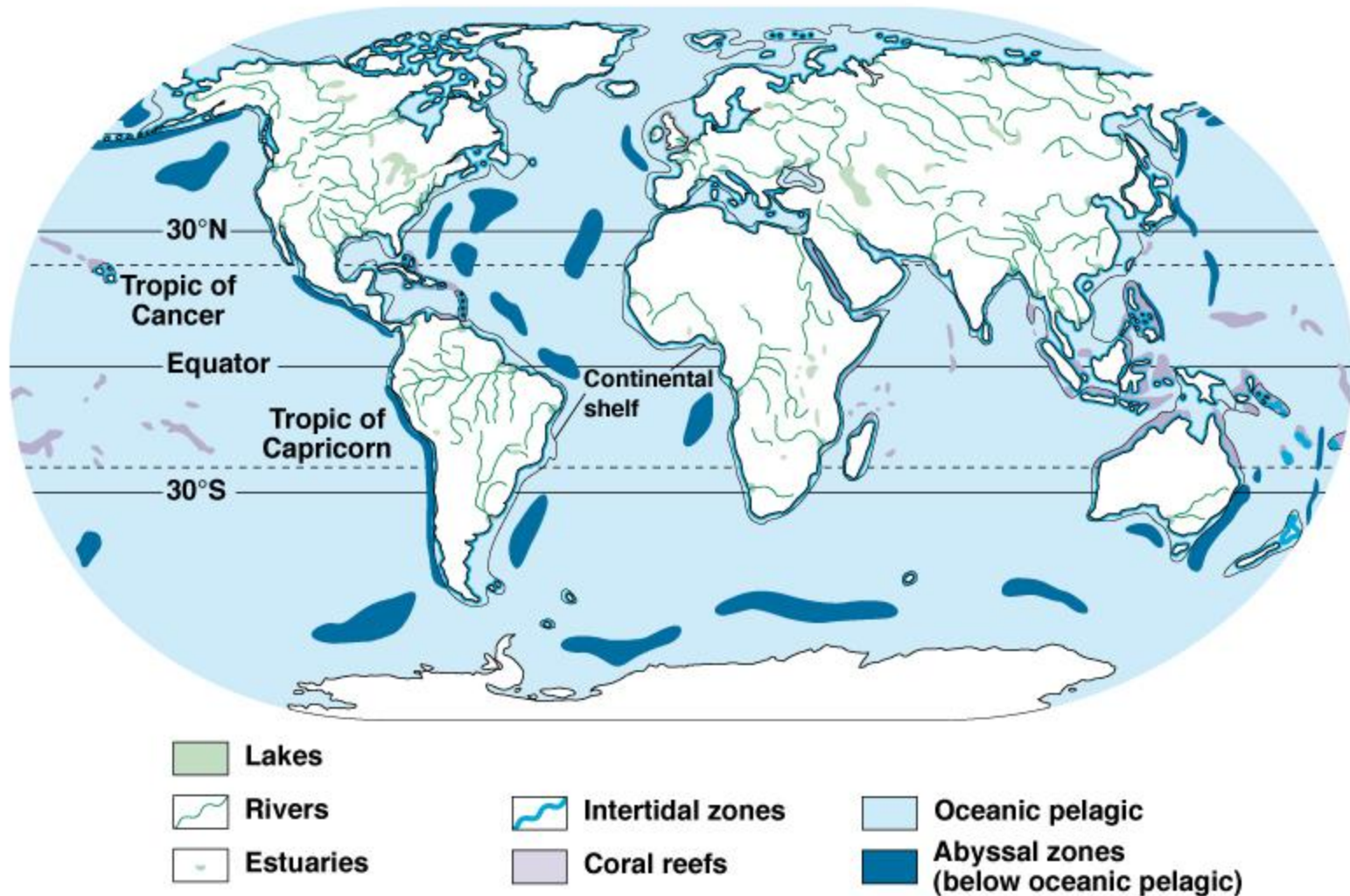
- MARINE

- Estuaries
- coral reefs
- mangrove swamps
- neritic zone
- pelagic zone

- FRESHWATER

- lakes and ponds
- streams and rivers
- wetlands

# Distribution of aquatic life zones



# Kinds of organisms

- Plankton (weakly swimming, free-floating)
  - phytoplankton = prokaryote/eukaryote producers
  - nanoplankton = recently discovered tiny producers
  - zooplankton = primary and secondary consumers
- Nekton (strongly swimming consumers)
- Benthos (bottom-dwellers)
- Decomposers

# Physical and chemical characteristics

- Water provides fluid medium which supports and disperses organisms.
- Water moderates temperature fluctuations.
- Water filters out UV radiation.
- Water dilutes and disperses most potentially toxic pollutants and metabolic wastes.

# Species and habitat diversity

- Third dimension (depth) of water supports a variety of different species.
- Communities of aquatic life zones have less pronounced physical boundaries than land biomes and tend to shift in space and time.
- Endemism, the restriction of species to one place, is much less common than on land.

# Trophic structure and food webs

- Most producers are microscopic plankton.
- Most herbivores are much smaller than land herbivores.
- Food chains and food webs of aquatic life zones tend to be more complex and have more trophic levels than do land biomes.

# Monitoring and protection

- Many aquatic species are r-selected causing dramatic fluctuations in population sizes; makes identifying human impacts difficult.
- Difficult to monitor and study aquatic life zones because they are large and hidden.
- Greater uncertainty about aquatic life zones means prevention of environmental degradation is most important strategy.



# Importance of oceans

- Moderating earth's temperature variations.
- Providing reservoir for supplying water to the global hydrologic cycle.
- Acting as reservoir for removing carbon dioxide from the atmosphere.
- Providing habitat for 250,000 marine species.
- Dispersing and diluting human produced wastes and pollution.

# Estuaries and coastal wetlands

- Partially enclosed area of coastal water where seawater mixes with freshwater from rivers, streams, and runoff from land.
- Temperature and salinity levels vary widely.
- Constant water movement stirs up nutrients resulting in high primary productivity.

# Ecological services of estuaries and coastal wetlands.

- Provide breeding habitat for many marine invertebrate and fish species, waterfowl, and other wildlife.
- Dilute, filter, settle out sediments, excess nutrients, and pollutants.
- Serve as popular recreational areas.
- Buffer nearby land areas from floods, ocean current and tidal erosion, and hurricanes.

# Human impacts on estuaries and coastal wetlands

- Dredging for navigation
- Filling in for coastal development
- Point and non-point source pollution
- Dams and water diversion projects
- Conversion for aquaculture and rice cultivation
- Industrial logging --> sediment pollution

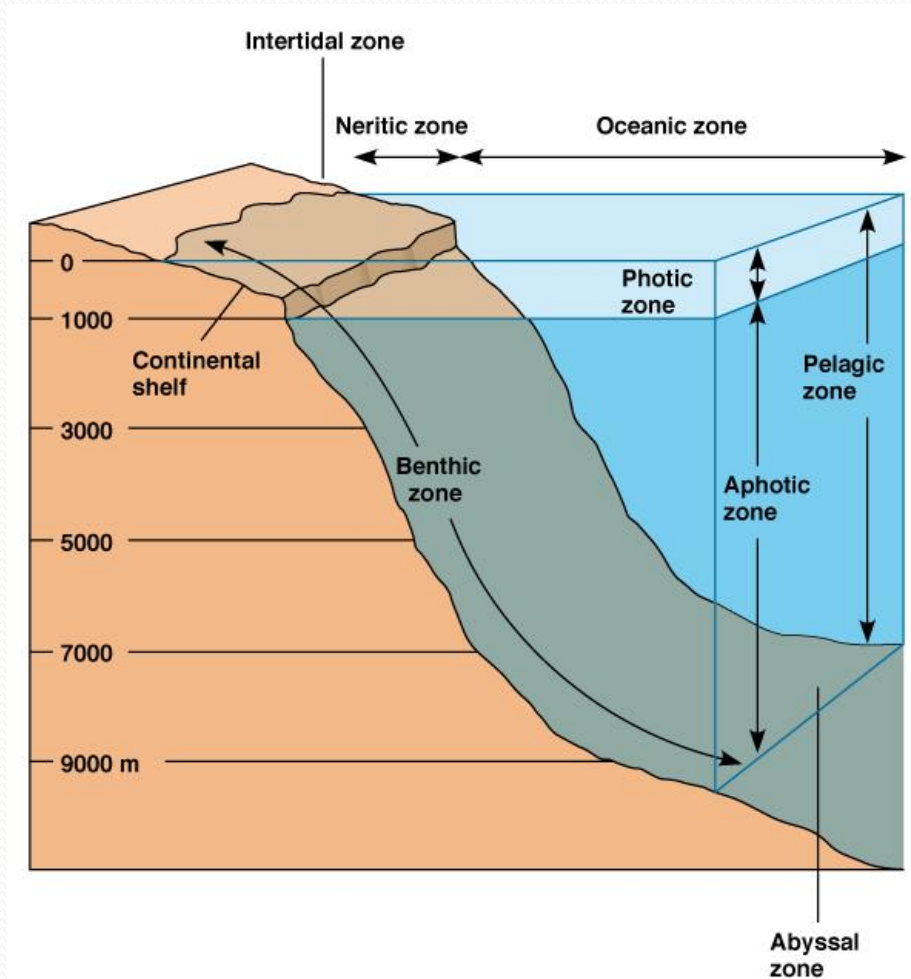
# Barrier islands, rocky shores, and sandy shores

- Intertidal zone requires special adaptations for attachment or burrowing and protection against crushing waves and dehydration.
- Biodiversity threatened by (1.) violent storms, (2.) pollution, (3.) overharvesting of fish, shellfish, and seaweed, and (4.) coastal development--especially on sand dunes.

# Coral reefs

- Occur only in warm shallow ocean water.
- High species diversity; ecologically complex.
- Slow growing and easily disrupted by:
  - Mangrove destruction; sediment pollution.
  - Fertilizer runoff-->eutrophication and disease.
  - Increased exposure to UV radiation
  - Bleaching caused by increased ocean temperatures.
  - Physical damage from human activity.

# Zonation of ocean



# Open sea life zones

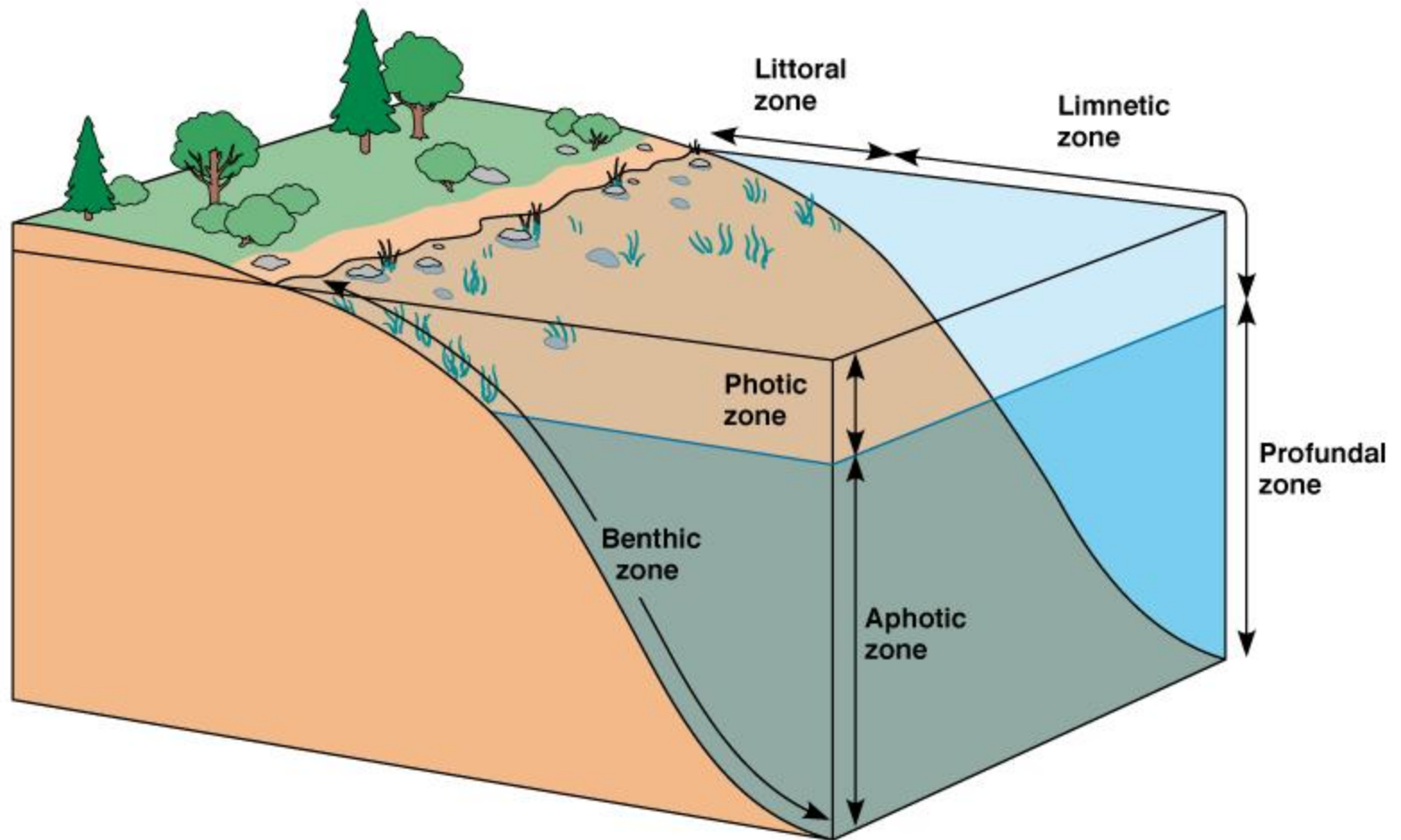
- Euphotic zone has high light levels, but low in mineral nutrients (except around upwellings), and high dissolved oxygen. Large predators.
- Bathyal zone has no producers; zooplankton and smaller fish migrate to surface at night.
- Abyssal zone is very cold and has low dissolved oxygen.



# Zones of lakes and ponds

- Littoral zone is shallow sunlit waters from shore to where rooted plants stop growing; has high biological diversity.
- Limnetic zone is open sunlit waters where most primary productivity occurs.
- Profundal zone is deeper dark cool waters.
- Benthic zone is the bottom zone where settling organic matter collects.

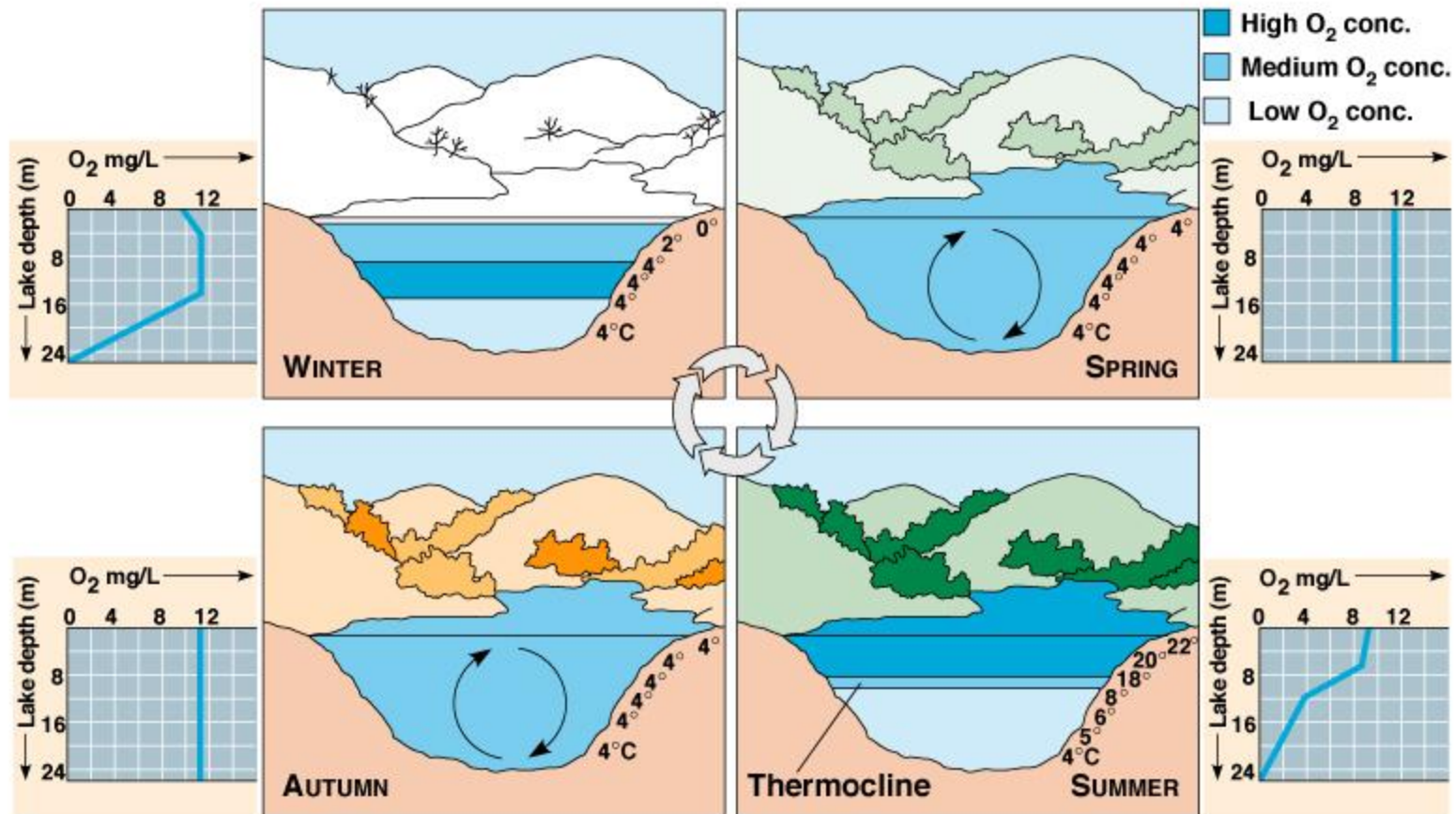
# Zonation in a lake



# Lakes and plant nutrients

- Oligotrophic lakes are young lakes with low mineral nutrients and low net primary productivity. Water clear.
- Mesotrophic lakes are middle aged lakes with some mineral nutrients and moderate net primary productivity.
- Eutrophic lakes are older lakes with high levels of mineral nutrients and high net primary productivity. Water turbid.

# Lake stratification and turnover



# Freshwater streams and rivers

- Drain surface water runoff from particular areas of land called watersheds or drainage basins.
- Strongly affected by human activities on bordering land ecosystems.
- Conditions change from source to mouth of the stream (river continuum concept).

# River continuum concept

	Source zone	Transition zone	Floodplain zone
Abiotic factors	Steep, shallow, cold, rocky, rapid and turbulent, high dissolved oxygen, cold temperature	Gentle gradient, wider, deeper, cool, more light exposure, moderate dissolved oxygen	Flat, slow, warm, turbid, sediment covered bottom, less dissolved oxygen
Biotic factors	Organisms adapted for clinging to rocks; lots of coarse particulate organic matter	Supports more phytoplankton and filter feeding organisms	High productivity at surface and shore. Burrowing organisms common in bottom sediments.

# Wetlands

- Areas of land containing soils submerged under or saturated by water for a long enough period each year to affect the plant life able to grow there.
- Include marshes with emergent herbaceous plants, swamps with woody plants, flood plains, bogs with stagnant water, and wet arctic tundra.

# Ecological and economic roles of wetlands

- Provide habitat for fish and wildlife including many threatened and endangered species.
- Improve water quality by filtering, diluting, and degrading toxic wastes and pollution.
- Reduce flooding and erosion by absorbing storm water and releasing it slowly.
- Recharge ground water.



# Human impact on wetlands

- Over half of original US wetlands have been drained and converted to other uses:
  - 80% of converted wetlands used for agriculture
  - 20% of converted wetlands used for mining, forestry, oil and gas extraction, highways, and urban development
- Other countries have suffered similar losses.