

Lakes: Small seas

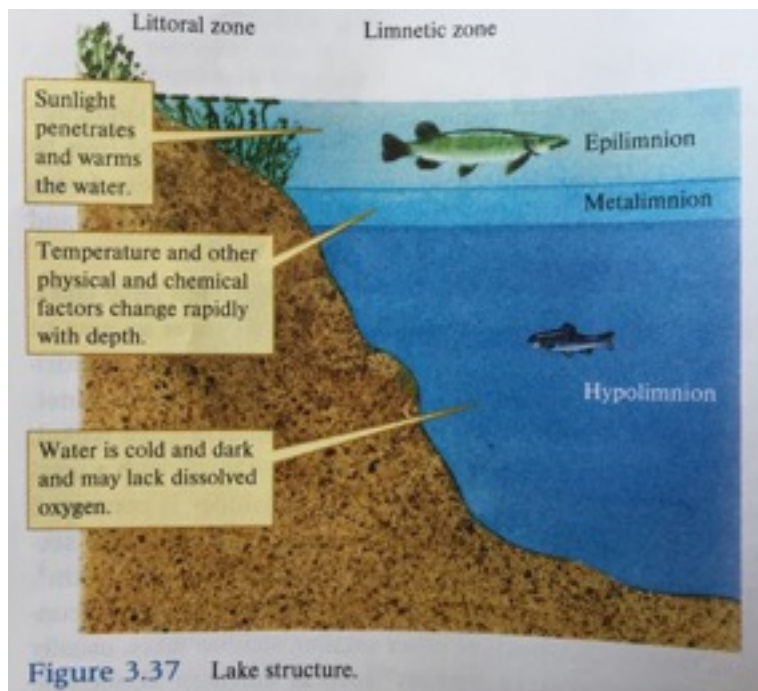
- Lakes = small seas
- Difference: smaller size of lakes and relative isolation

Geography

- Lakes= topographic depressions in landscapes that collect water
- Lakes are found in regions worked over geological forces (earth crust, vulcanism, glacial activity)

Structure

- It parallels with that of the ocean, just on a much smaller scale
- Littoral zone: shallowest waters along the lakeshore
- Limnetic zone: beyond littoral zone in open lake
- Epilimnion: encompasses the surface layer of lakes
- Metalimnion/ thermocline: temperature changes substantially with depth
- Hypolimnion: cold, dark waters



Physical conditions

- Light
 - Lake colours: deep blue, yellow, brown, red, green
 - Influenced by many factors, especially lake chemistry and biological activity

- Temperature
 - Lakes become thermally stratified as they heat
 - Warm season: warmer at the surface than below the thermocline
 - temperate lakes are stratified during summer, stratification breaks down in fall
 - lowland tropical lakes are stratified year-round
- Water movements
 - Wind-driven mixing of water column as the most important water movement
 - Temperate zone lakes limit wind-driven mixing to surface waters above the thermocline
 - Winter: Ice as a surface that prevents mixing
 - Spring/ fall: vertical mixing of water columns maintains uniform temperature
 - Consequences for chemical conditions

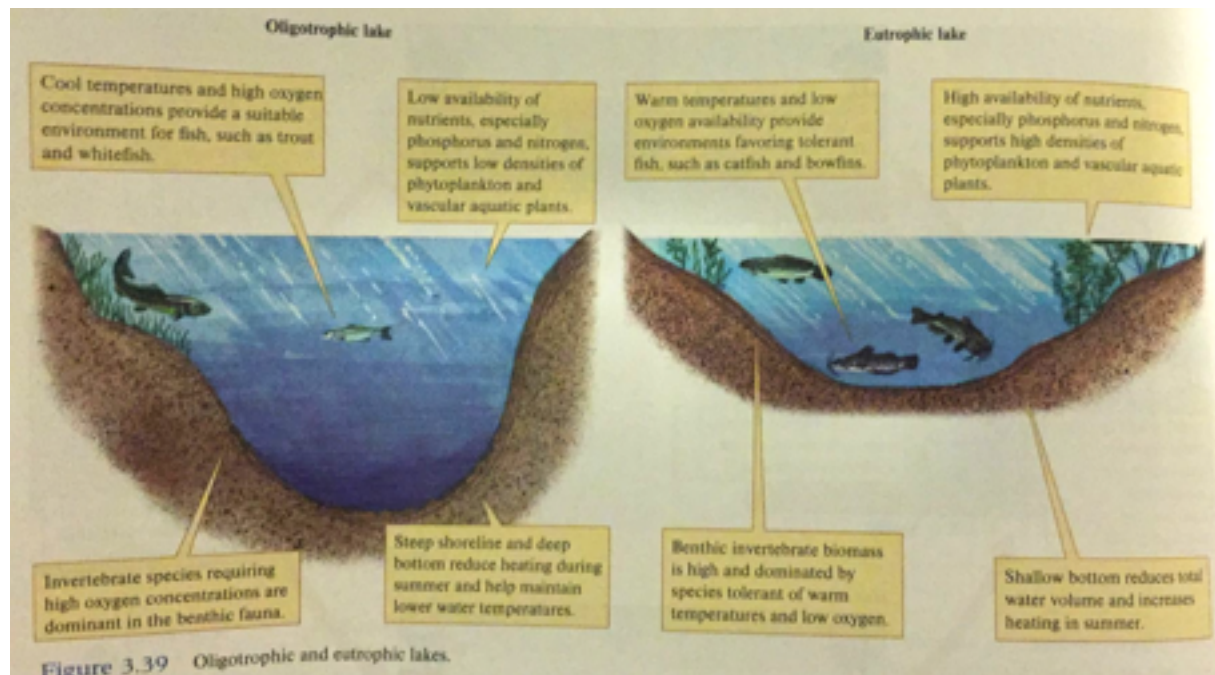
Chemical conditions

- Salinity
 - Salinity of lakes much more variable than that of the open ocean
 - Salinity of desert lakes may change due to variations in precipitation, runoff, evaporation, fluctuations in lake volume
- Oxygen
 - Oligotrophic: well-mixed lakes of low biological production → well oxygenated
 - Eutrophic: lakes of high biological production → depleted of oxygen
 - Human activities can accelerate the process of eutrophication
 - Oxygen depletion likely during periods of thermal stratification (when decomposing organic matters below the thermocline → consuming oxygen)
 - Eutrophic lakes: depletion of oxygen at night due to the absence of photosynthesis
 - Tropical lakes: water often permanently depleted of dissolved oxygen

Biology

- oxygen availability: can determine where fish and other organisms occur in a lake in both space and time

- oligotrophic and eutrophic lakes: differ in temperature, oxygen and nutrients availability, support different biological communities (differ greatly in their environmental requirements)



Human Influences

- populations have had usually negative influences on the ecology of lakes
- cases of amazing resilience and recovery-resilience
- lakes offer ready access to water for domestic and industrial uses: many human population centers have grown up around them
- ecological impact of these populations has been the dumping of quantities of nutrients and toxic wastes
 - Cuyahoga River (Cleveland): was so fouled with oil (in 1960s) that it would catch fire
 - Lake Erie: was transformed from a healthy lake to an algal soup, only the most tolerant fish species could live
 - with greater controls on waste disposal the process of degradation began to reverse itself
- Humans introduced nutrients, fish, invertebrates, plants and algae into the Great lakes

