

Eutrophication

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Eutrophication

- An aquatic environment with a limited availability of phosphorus and nitrogen is described as “oligotrophic” while one with high availability of these elements is called “eutrophic”; a lake with intermediate availability is called “mesotrophic”.
- “Eutrophication is an enrichment of water by nutrient salts that causes structural changes to the ecosystem such as: increased production of algae and aquatic plants, depletion of fish species, general deterioration of water quality and other effects that reduce and preclude use”.
- This is one of the first definitions given to the eutrophic process by the OECD (Organization for Economic Cooperation and Development) in the 70s.
- All water bodies are subject to a natural and slow eutrophication process, which in recent decades has undergone a very rapid progression due to the presence of man and his activities (so called cultural eutrophication).
- The cultural/ anthropogenic eutrophication process consists of a continuous increase in the contribution of nutrients, mainly nitrogen and phosphorus (organic load) until it exceeds the capacity of the water body (i.e. the capacity of a lake, river or sea to purify itself), triggering structural changes in the waters.

Factors of eutrophication

- **Use of fertilisers:** Agricultural practices and the use of fertilisers in the soil contribute to the accumulation of nutrients. When these nutrients reach high concentration levels and the ground is no longer able to assimilate them, they are carried by rain into rivers and groundwater that flow into lakes or seas.
- **Discharge of waste water into water bodies:** Waste water discharged directly into water bodies such as rivers, lakes and seas results in quantity of nutrients which stimulates the disproportionate growth of algae.
- **Reduction of self purification capacity:** Over the years, lakes accumulate large quantities of solid material transported by the water (sediments). The accumulation of sediments starts to fill the basin and, increasing the interactions between water and sediment, the resuspension of nutrients present at the bottom of the basin is facilitated. This phenomenon could in fact lead to a further deterioration of water quality, accentuating the processes connected with eutrophication

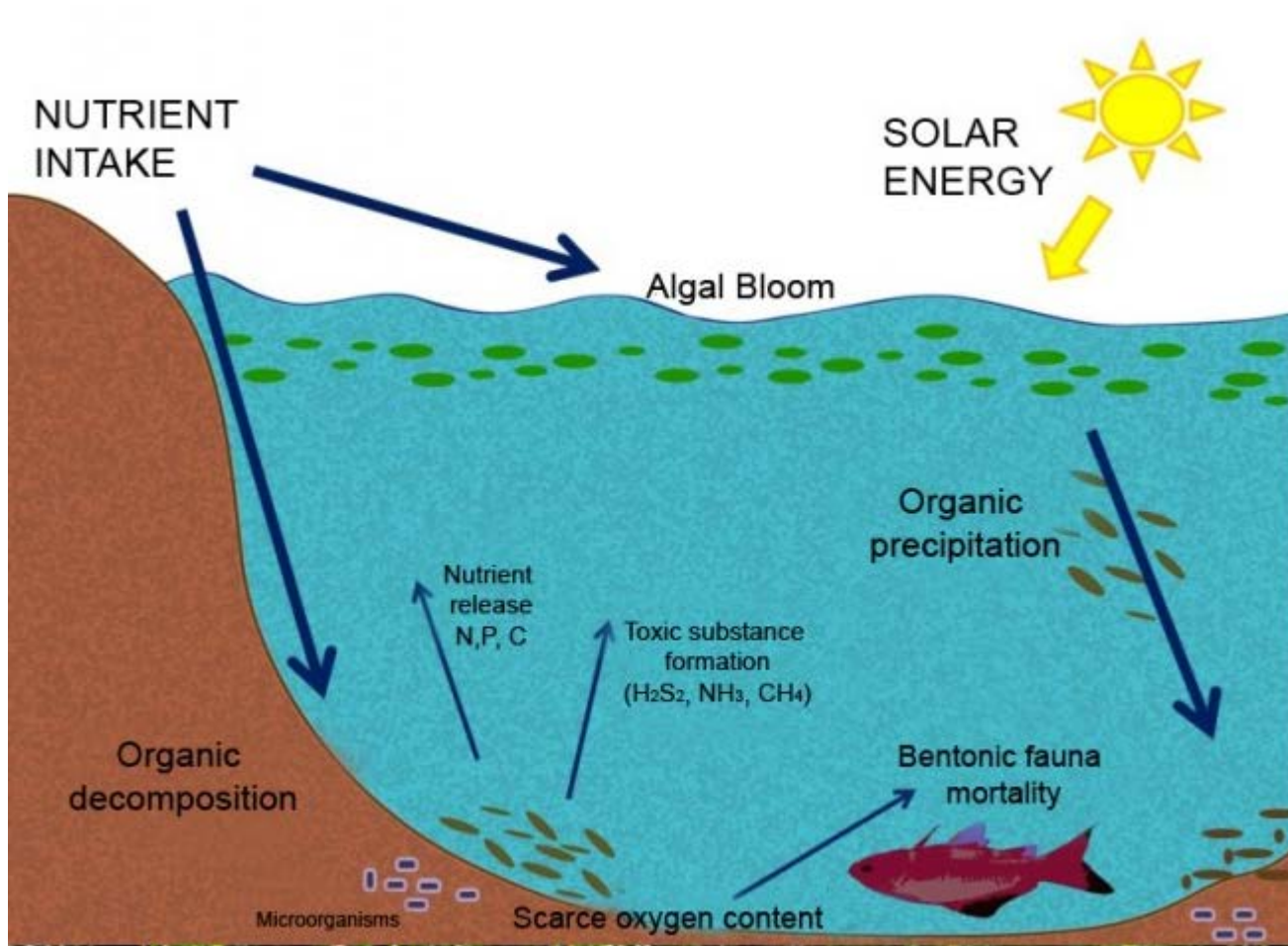
Effects of eutrophication

- The two most acute phenomena of eutrophication are hypoxia in the deep part of the lake/ oceans and algal blooms that produce harmful toxins, processes that can destroy aquatic life in the affected areas.
- Abundance of particulate substances (phytoplankton, zooplankton, bacteria, fungi and debris) that determine the turbidity and colouration of the water.
- Submerged aquatic vegetation is affected by eutrophication through:
 - Reduced light penetration and shadowing effects from phytoplankton modifies the depth distribution, biomass, composition and species diversity, leads to a decline of seagrass meadows and perennial macroalgae, which are important nursery areas for coastal fish populations.
 - Increased growth of filamentous and short lived nuisance macroalgae at the cost of long lived species, which leads to a change in structure of macroalgae communities with reduced diversity.
- Abundance of inorganic chemicals such ammonia, nitrites, hydrogen sulphide etc. that induce the formation of harmful substances such as nitrosamines suspected of mutagenicity.

...Effects of eutrophication

- Abundance of organic substances that give the water disagreeable odours or tastes.
- Disappearance or significant reduction of quality fish with very negative effects on fishing (instead of quality species such as trout undesirable ones such as carp become established).
- Possible affirmation of toxic algae with potential damage to the population and animals drinking the affected water.
- Coastal hypoxia contributes to ocean acidification harming the calcifying organisms such as mollusks and crustaceans.
- Anoxic and hypoxic water are associated with elevated carbon dioxide which causes acidification accelerating perturbation of ocean chemistry and influencing carbon dioxide emission into the atmosphere.
- Hypoxia and anoxia lead to dead zones whereby fauna is eliminated or diversity and abundance is reduced.
- The aesthetic value of the water body diminishes significantly.

Eutrophication process representation



Questions

- Write a short note on eutrophication.
- What are the effect of eutrophication
- What is natural and anthropogenic/ cultural eutrophication?