



Water eutrophication

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Abstract:- Water eutrophication has become a worldwide environmental problem in recent years and understanding the mechanism of water eutrophication will help for prevention and remediation of after eutrophication. Water eutrophication in lakes, reservoirs, estuaries and rivers is widespread all over the world and the severity is increasing all over especially in developing countries like China. Different parameters like Nitrate, phosphate concentration, electrical conductivity, dissolved oxygen, total dissolved solids, pH and temperature have been measured. The occurrence of water eutrophication is actually a complex function of all the possible influencing factors. The mechanism of algal blooming are not fully understood and need to be further investigated.

Introduction:- Water eutrophication is one of the most challenging environmental problems in the world. Increasing severity of water eutrophication has been brought to attention of both the government and public in recent years. Nutrient load of lakes and rivers has increased dramatically over the past 50 years in response to increased discharge of domestic wastes and non-point pollution from agricultural practices and urban development. For more than 30 years, nutrient enrichment especially phosphorus (P) and Nitrogen (N) has been considered as a major threat to the health of coastal marine waters. Once a water body is eutrophicated, it will lose its primary functions.

Eutrophication

The inorganic nutrients in the run-off from agricultural fields reaching a water body increases the nutrient content of the water body. This nutrient causes the profuse growth of algal (algal bloom) in it.

1. Natural Eutrophication
2. Cultural Eutrophication

Natural Eutrophication:- Nutrient enrichment of the lakes promotes the growth of algal, aquatic plants and various fauna.

Cultural Eutrophication:- Nutrient enrichment of lakes at an accelerated rate is caused by Human activity (discharge of wastewater or agricultural run off) (Shankar, 2017)

Definition of Eutrophication

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 fishes, deterioration of water quality.

OECD (Organization for Economic Cooperation and Development) 1970.

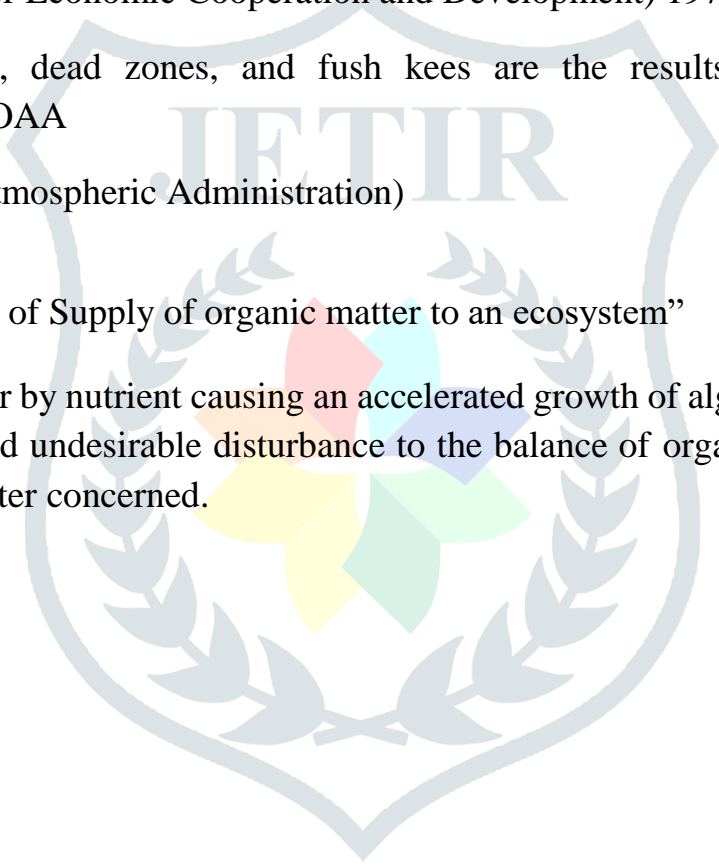
Harmful algal blooms, dead zones, and fish kills are the results of a process called eutrophication as defined by NOAA

(National Oceanic & Atmospheric Administration)

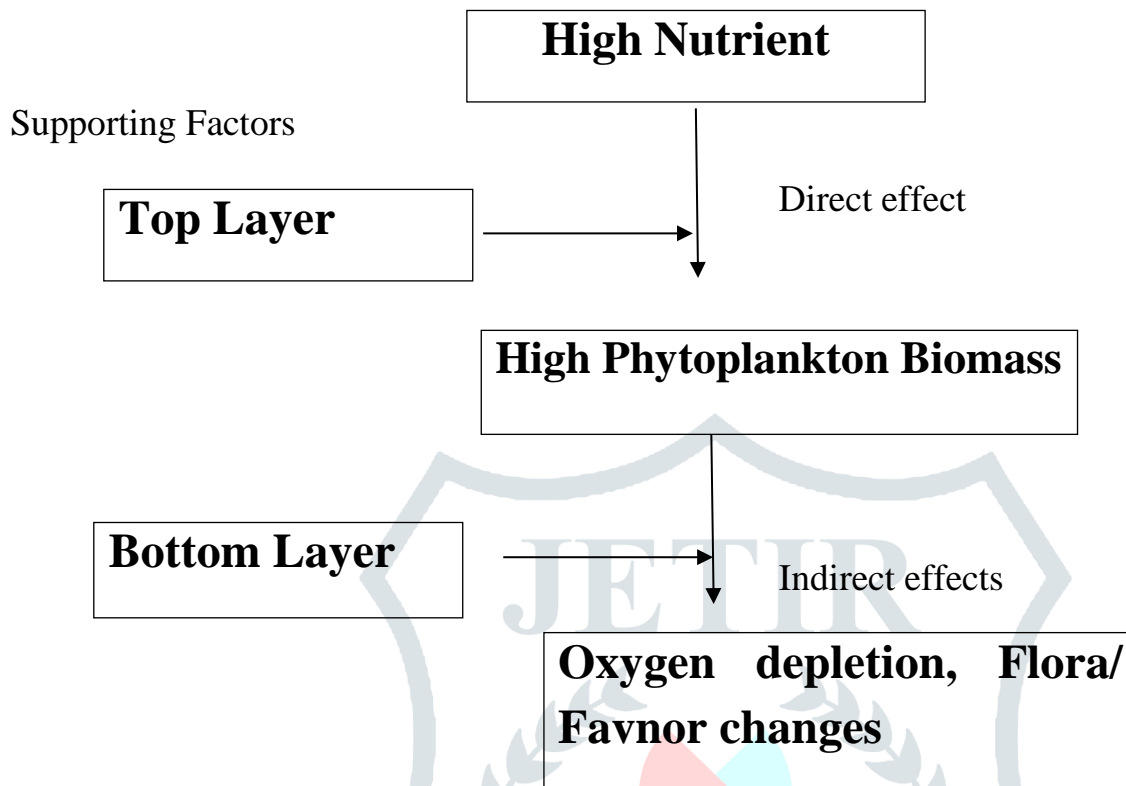
“An Increase in the rate of Supply of organic matter to an ecosystem”

The enrichment of water by nutrient causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in water and to the quality of water concerned.

LIOSPAR 2003



Process of Eutrophication Cause



1. Druon J.N eutrophication rise index.
2. Marc Boulam (University of Nancy)

Mainly two components:- Nitrogen & Phosphastes

Table:- Nitrogen/ Phosphorous ratio in (Weights)

For various limiting conditions in Freshwater and estuarine/Coastal water

	N- Limiting (Ratio N/P)	Intermediate (Ratio N/P)	P-Limiting (Ratio N/P)
Freshwaters	4.5	4.5-6	6
Estuarine	5	5-10	10
Coastal water			

Environmental resource Management 2001 (in Marine and coastal waters)

1. Nitrates: Main source of Nitrogen pollutants is run off from agricultural land.(Acc to European Union)
2. Phosphorous:- Pollution comes from households and industry, including phosphorus based detergents. (Acc to European Union)

Nitrates: From the year 1950 until 2000 the use of mineral nitrogen in Fertilizers from agriculture use in 15 EU States has been increased from 1 to 9-10 million tons. (EU-European Union)

Since 1980 nitrogen/nitrate concentration remained constant and there is no evidence that reduced application of nitrogen fertilizers to agricultural land.

Phosphorous concentration also increased from 1980-2000 and no evidence is found regarding declining of phosphorous concentration.

Example:- Rhine rivers (Europe)

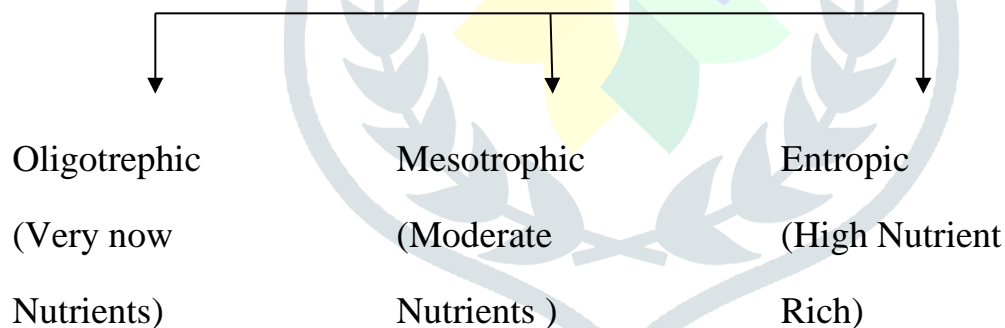
Li suffered from Eutrophication due to excess of Nutrients (by European Union)

Uisoor Lake (Bangalore)

(Phosphate, Nitrogen, Chlorophyll level is too high) Nitya Mandiya January 07,2021 (Times of India)

Types of Eutrophication

On the basis of Nutrient content



- Oligotrophic:- Word “Trophic” in Greek means food or nutrient, where as the word “Oligo” for rare. (Leura Valtera 1983 Research Manger Italy)
- Oligotrophic means very little nutrients (Phosphorous and Nitrogen)
- Fish Found in oligotrophic Lakes like cold, high oxygenated water, example include lake trout and white fish.
- In oligotrophic oxygen is found at high levels throughout the water column.
- Low algal concentration allows deeper light penetration and less decompositions .

Mesotrophic:- “Tropic” means in greek “Food on restraint and “Meao” means middle or mid

- Therefore mesotrophic means a medium amount of Nutrient (Phosphorous and Nitrogen)
- Mesotrophic separates into layers in the summer Top Layer of Water becomes Warm from the Sun An contains algae.
- Bottom Layer remains Coolen & can become anoxic in mid- Summer.

Eutrophic:- “EU means true/high/excess

- Therefore Eutrophic means excess amount of nutrients (Phosphorous & Nitrogen)
- These nutrients support high biomass of algae, Fish and other aquatic organisms.
- Oxygen demand is low
- Algal concentration which lead to “marine ecological disaster”.

Vast Majority of lakes in India are either eutrophic or mesotrophic (Shankar Singh,2017) (Environment)

Process of Eutrophication

1. Eutrophication is a syndrome of ecosystem response to the addition of artificial or natural nutrients such as Nitrates and phosphates through fertilizer, sewage etc.
2. It is primarily caused by the leaching of phosphate and or nitrate containing Fertilizers from agricultural land into lakes or rivers.
3. Growth of green algal which we see in the lake surface layer is the physical identification of Eutrophication.
4. The growth of blue- green bacteria trine on the extensions & a population explosion course almost entire surface Layer is known as algal bloom. This growth is unsustainable.
5. Algal bloom covers the surface layer, it restricts the penetration of sunlight.
6. Oxygen is required by all respirating animals in the water and it is replenished by diffusion and photosynthesis of green plants.
7. The oxygen level is already low been of the population explosion and further oxygen is taken up by microorganisms which feed off the dead algal during decomposition process.
8. Due to reduced oxygen level, fishes and other aquatic organisms suffocates and they die.

9. All this eventually heads to degradation of aquatic ecosystem and details of its organisms.

List of some areas of World scuffed From Eutrophication

1. Gulf of Mexico:- Widespread Hypoxias over many decodes (1.58% during 2002-2012) (by USGS united state government)
2. Missi Sipi rinse basin of Hypoxias conditions developed nutrients form 1992 (by upper Mid west water science center US)
3. Dal Lake in – Srinagar:- Due to urbanization & Industrialization.
4. Over 415 area worldwide that are experiencing symptoms of eutrophication (World resource institute)

78% of united states continental coastal area and approximately 65% of Europe's Atlantic coast exhibit symptoms of Eutrophication (by Survey of US & Europe).

Effect of Eutrophication on Marine Ecosystem

- Excessive plant production
- Blooms of harmful algal.
- Increased Frequency of aroxic events
- Death of Fish
- Hoses Wildlife production
- Ocean acidification

(Lucy Ngatia, Johnny Mgrace Dariel Moriasi 2018)

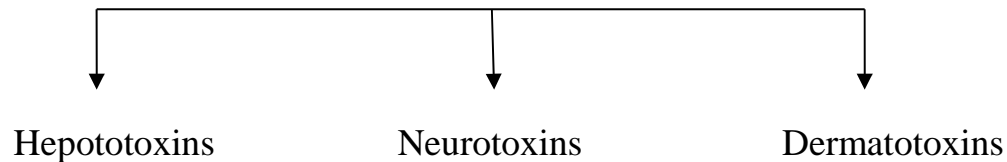
Ocean Acidification:- Coastal Hypoxia contributes to ocean acidification handing the calcifying organisms such as mollusks and crustaceans. Anodic and hypoxic water associated with elevated carbon dioxide which cause acidification accelerating perturbation of ocean chemistry and influencing carbon dioxide emission into atmosphere.

Dead Zones:- Hypoxias and aroxier heads to dead zones when by fauna is eliminated or diversity and abundance is reduced. Dead zones in the coastal area horse spread since 1960s the increase are, triggered by increase in primary production as a result of increased marine eutrophication, which accelerates microbial activity and consumption of dissolved oxygen in bottom waters resulting death of fish. (Lucy Nagatia, Johnny Mgrace 2018).

Species Extinct:- US to Japan, the black sea & Chinese coastal water increased reorient, which head to approximately 60-80 species of about 400 known phytoplanken are extant. May June 1998 the mortality of own 200 California seanioms are signs of reurdological dysfunction attributed to harmful algal bloom. (Lucy Nagatia, Johnny Mgrace Daniel Moriasi 2018).

Change in algal Population:- During dtrophication microalgae, phytoplankton & cynobactereia which depend upon nutrient , height, Hmprature and water will experience excessive growth. They release toxin into the water and toxin marineecosystem. Which decline in productivity. (WHO web sides European Union).

Types of Toxins



1. **Hepototoxins:-** Most frequently observed toxin Animal experiments have shown liver injury from reported oral exposure to micros tins.
2. **Neurotoxins:-** Less common & act on Nervous system 4 in mice & aquatic bird they cause rapid deatn by respiratory arrest, sometimes occurring in fewminutes. (European Union)
3. **Dermatotoxins:-** These include irritant and allergic response in tissue by simple contact. (European Union)
4. **Algaltoxin in Marine waters:-** Algaltoxin observed in marine ecosystem where they can accumulate in shellfish, seafood, reaching dangerous level forHuman and animal health.
5. Various effects are:- Diarrhea shellfish poisoningParalytic shellfish poisoning (PSP)

Prevention From Eutrophication

1. Regulating levels of phosphorus and nitrogen
2. Agricultural fertilizers .
3. Waste water from villages
4. Planting vegetation alone stream bench to slow erosion and absorb nutrients.
5. Controlling application and amount timing of fertilizer
6. Controlling run off from Feedlots.
7. Preventing excess reaching nutrients from water bodies
8. Regular soil nutrient analysis fertilization in plants and registers at float level
9. Green cover of soil during winter use of cash crop in crop rotation
- 10.Promotion of permanent grassland rather than temporary forage crops
- 11.Sufficient manure storage capacities For spreading of of manure at appropriate periods

12. Precise irrigation management that is drip irrigation fertilization soilmoisture control
13. Public awareness is must.

(European Environment Agency 1998)

Conclusion

Human induced eutrophication has heavily degraded freshwater system worldwide by reducing water quality and altering the structure and functioning of ecosystem these anthropogenic influences have severe environmental and economic repercussion. It takes a very long time to overcome the problem of eutrophication but can be minimised to a substantial level by incorporating some preventive measures.

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