

Eutrophication in Shallow Lakes and Water Dams

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Definition of Eutrophication

Eutrophication is popularly defined as enrichment of water in lakes, reservoirs and water dams by inorganic plant nutrients especially compounds of nitrogen and phosphorus, leading progressively to the luxuriant growth of plants due to dumping of organic pollutants in the water body, it is a slow process of aging in nature and the natural process is accelerated by human's activities, and it is mainly occurred in shallow water in man made lakes and water dams, as well as narrow and closed lakes as a result of pollution.





Type of Eutrophication

There are several types of eutrophication which may occur in the shallow lakes and water dams, such as; incipient eutrophication; advancing eutrophication; seasonal or periodic eutrophication; and pseudo-eutrophication.

1. Incipient eutrophication

The incipient eutrophication may mean biologically a quantitative increase in biomass; qualitative and quantitative changes in the littoral, benthic, planktonic and in the fish population. On the physico-chemical side the term may mean decreasing transparency and change in colour of water; overall decline in dissolved oxygen content in the hypolimnetic layers of a lake during summer thermal stratification and the resultant buildup of the chemically detectable average nutrient level of nitrogen and phosphorus.

2. Advanced eutrophication:

It may mean that the above symptoms have become more pronounced. A luxuriant growth of phytoplankton particularly the blue-green algae; complete absence of dissolved oxygen; in summer in the bottom layers and accumulation of the resultant products of anaerobic decomposition; and the disappearance of the fauna may be noted.

3. Seasonal and / or periodic eutrophication

This results from a gradual decrease in water level due to evaporation and draw-off for irrigation purposes in lakes with a concomitant increase in organic matter content so that one can easily calculate the values for organic matter content from the lake or reservoir level. This type of eutrophication also can be defined as "a disturbance due to the increase in level of primary production of organic

substances on the basis of anthropogenic growth of nutrients.

4. Pseudo – eutrophication:

It is another kind of enrichment in organic matter when the water in lake penetrates the top layer of sand at the bottom of the lake. Anaerobic conditions are created inside the three feet depth of fine sand layer of a slow sand filter when the sulphate reducing spirillum desulfuricans begins to be active and reduces the sulphate in raw water to H₂S and the concomitant production of sulphur bacteria or sewage fungus in the filtered water appears in grey colour scum on the surface of the lake.

Symptoms and Indices of Eutrophication

Microscopic algae or macroscopic water weeds when seen in abundance in any piece of water, indicate eutrophic conditions, where this process starts slowly to spread over all the lake surface, and the following are the main symptoms associated with it;

- Changes in the rate of aquatic plant primary production, and increase in chlorophyll content.
- Changes in the diversity of phytoplankton.
- Increase values of chlorophyll-A, and decrease of ranges in plankton productivity.

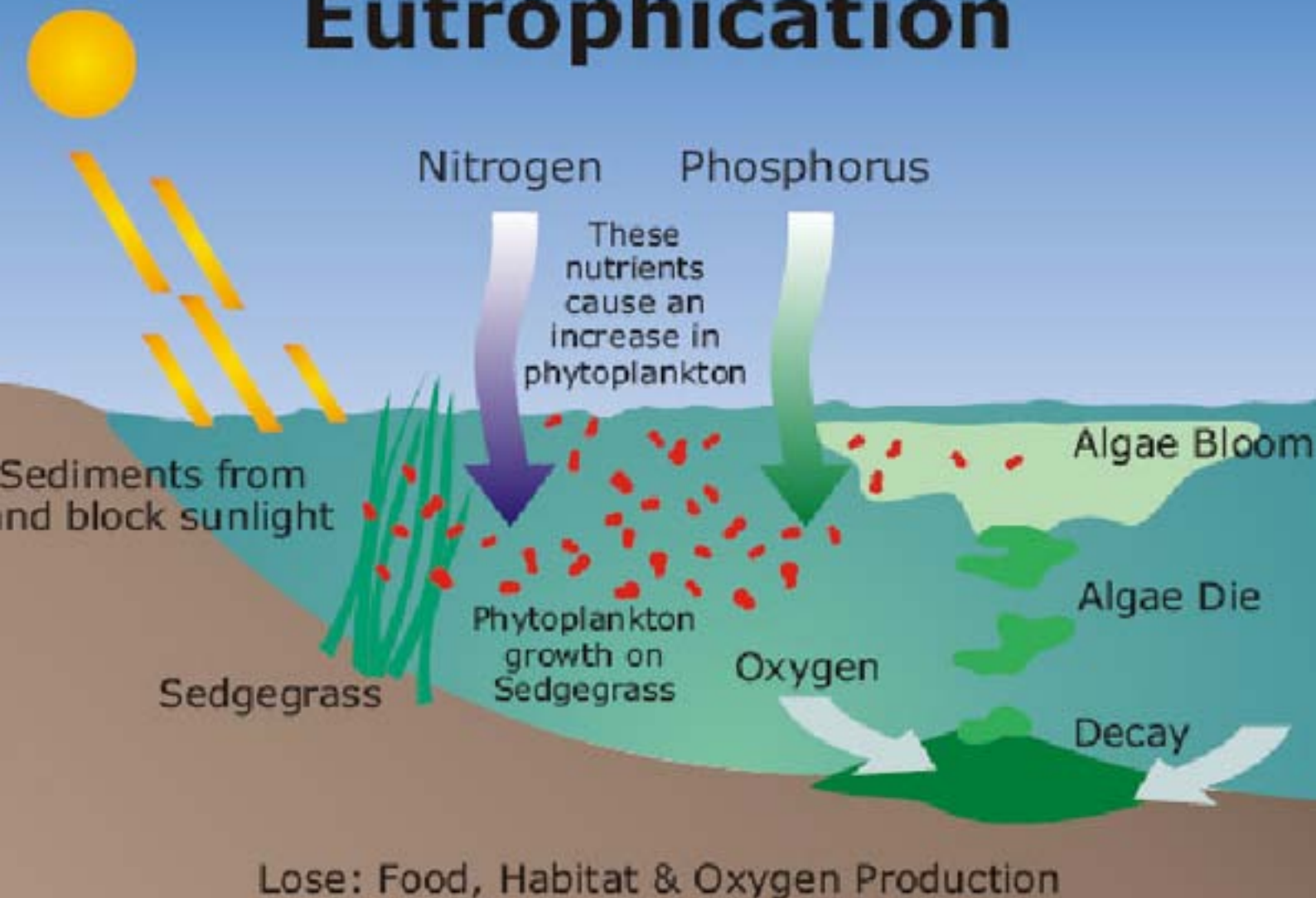
Sources of Nutrients

The aquatic plant nutrients "nitrogen and phosphorous" are produced in lakes and dams from the following sources:

- Living organisms in the water.
- Decomposition of organic deposited matters at the bottom of lake.
- External sources of the atmosphere, and the environment around the lake and water sources fed.



Eutrophication



Side Effects of Eutrophication

Excessive growth and development of aquatic weeds and or microscopic algae are a source of nuisance, cause health and environment hazards, and reduce the quality of the water quality and make it unfit for aquatic organisms, in addition to the pose of odors offensive and appearance is grainy as a result of algae and organic matter rotting floating on the surface of the water where they become a suitable environment for the breeding of insects, especially mosquitoes.

Control of Eutrophication

1. Mechanical Treatment

Remove the floating layer (Scum & Floating algae), using a fine mesh light screen dragging by boats, also the same method can be used for collection of aquatic plants suspended in the water. This method is very effective in reducing the level of eutrophication and slowing it down.

2. Biological & Bio-Mechanical Treatment:

This type of treatment includes the following methods;

- The use of biological filters (Bio-filters), by passing the lake water in the biological filters where the bacteria is working to reduce the biological content by 90%, as well as reduction of phosphorus and nitrogen in a high level, where the more contact time of water in the interior biomass increase the effectiveness of these filters.
- Conduct quality control of water in the lake at different depths, as well the sediments at the bottom, measuring the concentration of elements and compounds of nitrogen and phosphorous, dissolved oxygen, biological oxygen demand (BOD), PH, and chlorophyll "a", where these measurements must be periodically to monitor changes in water quality in the lake.
- Clean the bottom of the lake deposits of organic materials that make up an for anaerobic environment produce gases such as carbon dioxide CO₂, ammonia NH₃, which is re-build the eutrophication.
- Ventilation the lake water to maintain the level of dissolved oxygen at different depths in which, using a ventilator Aerator moving on the surface of the lake, or the work of Falls and pumping water from the lake to it, or work Fountains at the middle of the lake or any other type of ventilation, taking into consideration the control level of nitrogen which can be obtained from the air as a result of ventilation, where its benefit fed the blue-green algae to feedback in the waters of the lake.

3. Chemical Treatment:

Chemical treatment of eutrophication depends on the use of coagulants such as ferric chloride FeCl₃ and aluminum sulfate Al₂(SO₄). These chemicals consolidate the suspended materials in lakes water to be precipitated, and it is also working to reduce the concentration of soluble nutrients of eutrophication to be insoluble.