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PLANKTONS AS INDICATORS OF ORGANIC POLLUTION

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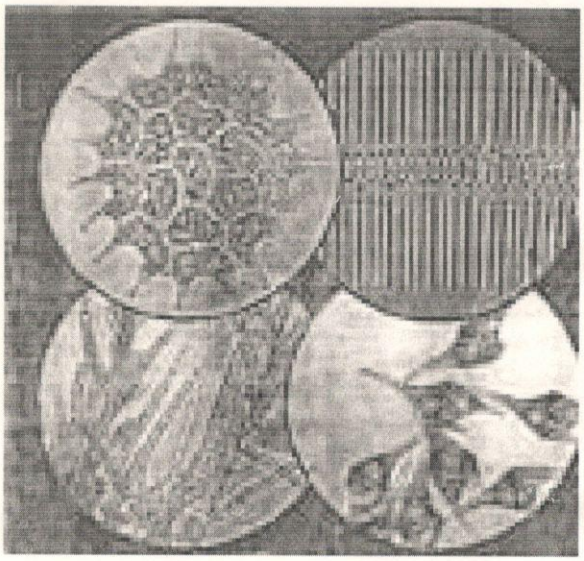

Planktons specific for particular environmental conditions are best indicators of environmental quality.

INTRODUCTION

Planktons are those plants and animals floating on the water which are passively carried by the water current. Biological species viz. phytoplankton and zooplankton specific for particular environmental conditions are the best indicators of environmental quality. Phytoplanktons, as a collective group, generally are sensitive to toxicants. Because of their rapid physiological response and short generation time, it is possible to detect deleterious effect of toxicants in relatively short period of time. Phytoplankton forms the most important group of primary producers in the aquatic food webs. Studies on biological aspects of Eco-system are important in environmental impact assessment in view of the conservation of the environmental quality and safety of natural flora and fauna including human beings. Information about the impact of environmental stress on the community structure serves as inexpensive and efficient "early warning and control system" to check the effectiveness of control measures to prevent damage to a particular ecosystem.

PHYSICO – CHEMICAL PARAMETERS INDICATING WATER QUALITY

The nature and quality of biological species in a water body is dependent on various

physicochemical characteristics of water such as pH, conductivity, nutrients, BOD (Biological Oxygen Demand), alkalinity etc. and also on the type of water, stagnant water and saline water. Thus, the quality and quantity of plankton obtained in any water body is an indicator of the physico-chemical quality of water as well as the type of water body. The estimation of plankton community structure in water bodies is thus helpful to assess the baseline status details.

- **TOTAL BIO-MASS**

  The total biomass expressed as count or by weight increases with the increase in levels of nutrients and BOD in water and vice-versa, and serves as a good indicator of trophic status of water body.

- **QUALITY**

  Planktons indicate the effect of organic pollution on receiving water by the presence of different species.

  - **-Effect on Planktons**

    (i) At the point of organic discharge.

    a) Lowering of available oxygen in water and increase of BOD – reducing fitness.

    b) Increasing turbidity i.e., increase of salts and suspended solids.

    c) Reducing light available to phytoplanktons and other photosynthetic plants.

    d) Setting of organic materials on the bottom of water body thus altering the characteristrics of the substratum.

    (ii) Self-purification

    Large increase in the number of bacteria immediately below the outfall which oxidized the organic materials and release nutrients (energy from them). This nutrient is used by photosynthetic plants. Thus firstly, increasing the available oxygen in water, secondly decreasing turbidity, finally increasing light available to plants.

  - **Effect on Phytoplankton**

    The filamentous *Stigeoclonium tenue,* being most tolerant to organic pollution is found

immediately below the region of gross pollution. As recovery begins Cladophora (Blanket weeds) increase in numbers. Its dense growth in the recovery zone is linked to an increase in nutrients and especially to Phosphate present at concentration greater than 1mg/litre.

LIST OF SPECIES OF PHYTOPLANKTONS FOR CLEAN WATER & POLLUTED WATER

Clean water species	Polluted water species
Chlorophyseae	**Chlorophyseae**
1. Pediastrum	1. Pteromonas
2. Coelastrum	2. Pandorina
3. Spirogyra	3. Eudorina
4. Euastrum	4. Chlorella
5. Cosmarium etc.	5. Stigeoclonium etc.
Bacillariophyceae	**Bacillariophyceae**
1. Synedra	1. Cyclotella
2. Achnanthes	2. Pinnularia
3. Cymbella	3. Gomphonema
4. Gyrosigma etc.	4. Nitzschia
	5. Navicula etc.
Cyanophyceae	
1. Chroococcus	1. Oscillatoria
2. Merismopedia	
3. Spirulina etc.	
Euglenophyceae	
-	1. Euglena
-	2. Phacus etc

Other characteristic species of recovery zone are Diatoms, Nitzschia palea and *Gomphonema parvulum.*

The blue-green alga Chaemaesiphon species, the green *Ulvella frequence* and the diatom, *Cocconeis placentula* appear in clean water when the pollution has disappeared.

- Algal bloom patterns indicating Organic pollution
  - ❖ Eutrophic conditions – Blooms of bluegreens, euglenoids, volvocales and chlorococales.
  - ❖ Mesotrophic conditions – Blooms of *Anabaenopsis raciborskii.*
  - ❖ Oligotrophic conditions – Intermittent blooms of Euglena and Nitzschia.

- **Effect on Zooplankton**

As the bacterial count increases immediately below the outfall the count of protozoans also increase as they are the chief predators on bacteria. Also, decline in numbers as the bacterial count fall after the process of self-purification. The tubeficids, *Tubifex tubifex* being most tolerant of organic pollution is found immediately below the point of organic discharge. Species in order of decreasing tolerance to organic pollution are :

Tubifex tubifex

Chironomus reparius (Diaptera)

Asellus aquatics (Isopoda)

Gammarus pulex (Amphipoda)

Ecdyonurus venosus (Ephemeroptera)

Dinocras cephalotes.

As the nutrients are released from materials, Copepods and Cladocerans increase. Rotifers are indicator of clean water.

➢ DIVERSITY OF PLANKTONS

It depends on physico-chemical characteristics of water especially on trophic levels. In oligotrophic water diversity of plankton is high. While in increasing level of pollution such as mesotrophic and eutrophic condition, diversity of planktons decreases.

Shanon Weaver Diversity Index is a measure of diversity of planktons, which takes into account the total count and individual species count in a water sample.

$$d = - \Sigma (ni/n) \log2 (ni/n)$$

Where d = Shannon Weaver Diversity Index &

ni = number of individuals of each individual species in a sample

n = total no. of individuals of all species in the sample

Shannon Weaver Diversity Index is most popular because it is :

- Relatively insensitive to the size of the sample.
- Also insensitive to any random selection within the sample.
- Needs least taxonomic expertise just to recognize species not to identify them by name.

CONCLUSION

A widely accepted ecological concept is that communities with large number of species i.e., with high diversity will have high stability that can resist adverse environmental factors. Decrease in the value of index may thus be taken as indicator of pollution.

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