

## 5.6 Bio-indicators as index of Pollution and their Significance

Bio indicators are living organisms such as plants, planktons, animals and microbes which are utilized to screen the health of the natural ecosystem in the environment. They are used for assessing environmental health and biogeographical changes taking place in the environment.

Each biological system provides an indication regarding the health of its surroundings such as planktons respond rapidly to changes taking place in the surrounding environment and serves as an important biomarker to know about the quality of water as well as an indicator of water pollution.

Flow chart of Planktons indicating pollution

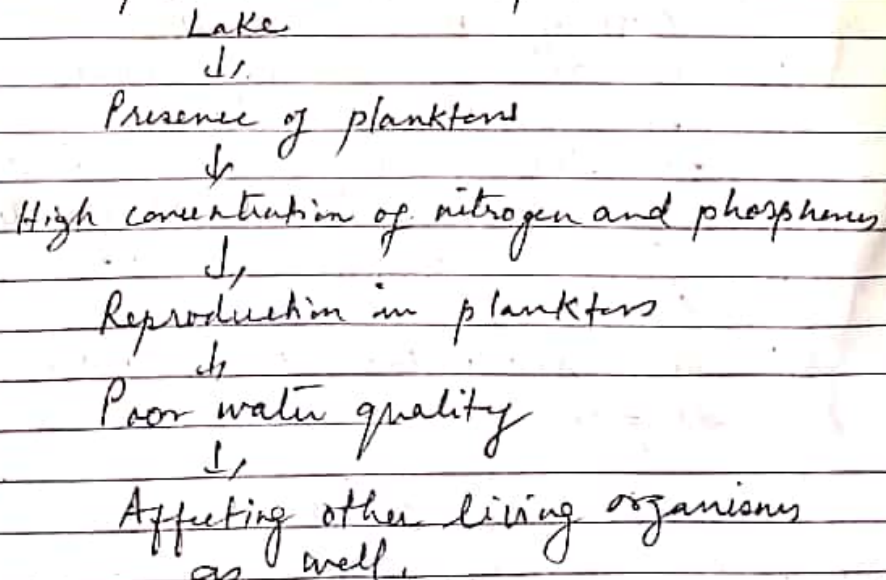


fig - Planktons as indicators of water pollution.

Any change in the population status, behaviour or physiology of bioindicator organism predicts the occurrence of any environmental problem within an ecosystem.

Generally bioindicators are designated as species which respond to anthropogenic inputs on the environment, and assessment of the quality of the environment over a given period of time.

Various species of plants, animals, algae, birds, lichens, zooplanktons, insects, amphipods, molluscs, echinoderms and other micro organisms acts as bioindicators. They provide a quick assessment of any environmental disturbance.

#### Characteristics of Bioindicators.

- 1) wide distribution and high abundance in environment
- 2) It should be site specific, highly sensitive, cost effective and robust.
- 3) low mobility with low genetic and ecological variability.
4. It should concentrate and accumulate the toxins to a measurable levels.
5. Sampling, sorting as well storage should be simple
6. They should not have economic or ecological importance.

#### CLASSIFICATION OF Bioindicators -

Based on the aim of indicators

- 1) Compliance indicators - for eg forth population attributes are measured at the population, community or ecosystem levels and are focussed on issues such as the sustainability of population.

(3)

(2) Diagnostic indicators - They are used to measure on the individual or sub organism (bio marker)

(3) Early warning indicators - They focus on rapid and sensitive response to environmental changes.

(4) Accumulation indicators - They are distinguished for toxic effects bioindicator with the effects being studied on different biological organization level eg lichens and mussels.

Plants as Bio indicators -

1) Plant are very important as provide oxygen control organic substance circulation, biological balance of soil and bottom deposits provide food and shelter to other organisms.

2) They are used as bioindicators since they are sensitive towards chemical changes in environment and they accumulate pollutants.

3) They are low cost which have high availability and long term sampling facility.

4. Lower plants (grasses, mosses, lichens, fungi and algae) are used to analyze the atmospheric decomposition, soil quality and water purity.

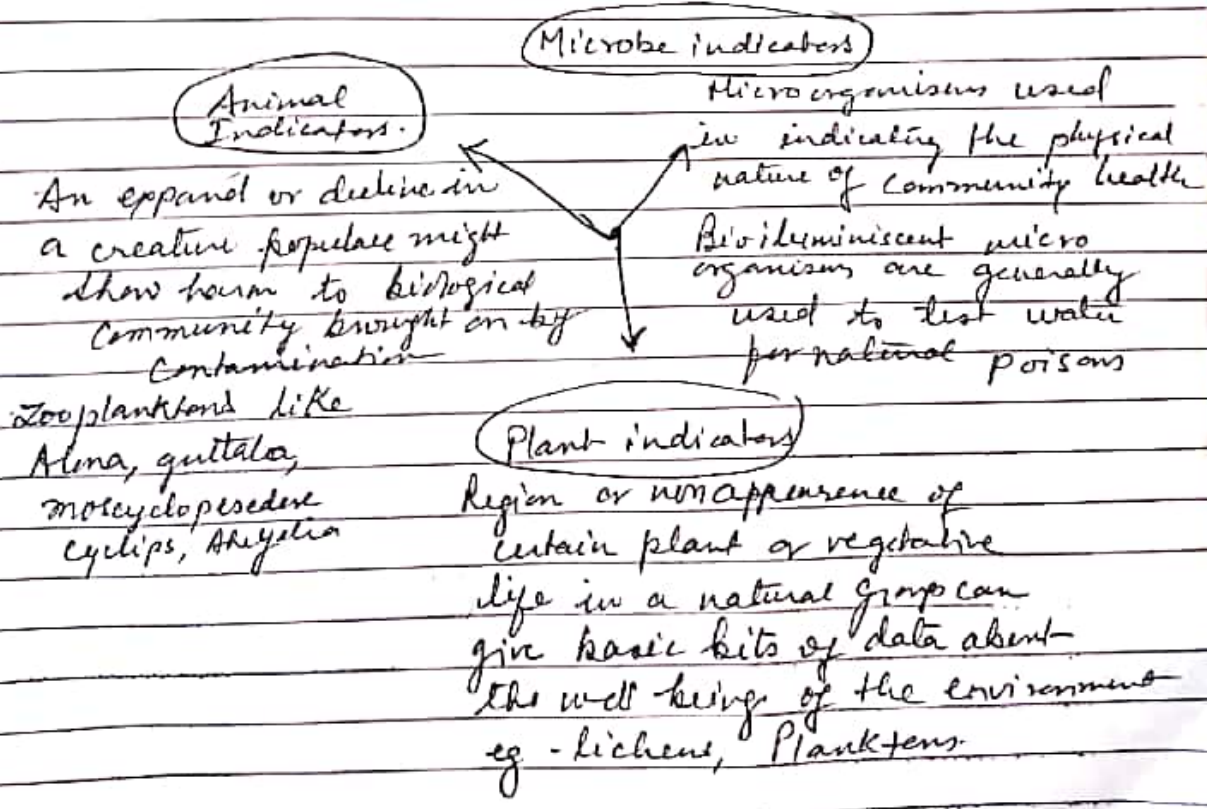
Animals as Bio indicators - Worms and mussels are animal bioindicator which show sensitivity towards soil pollution, there is a remarkable changes in the functioning of the nervous system of worms showing the levels of soil pollution.

2) Many animals change their behaviour or physiology if a toxin is present for, Example -

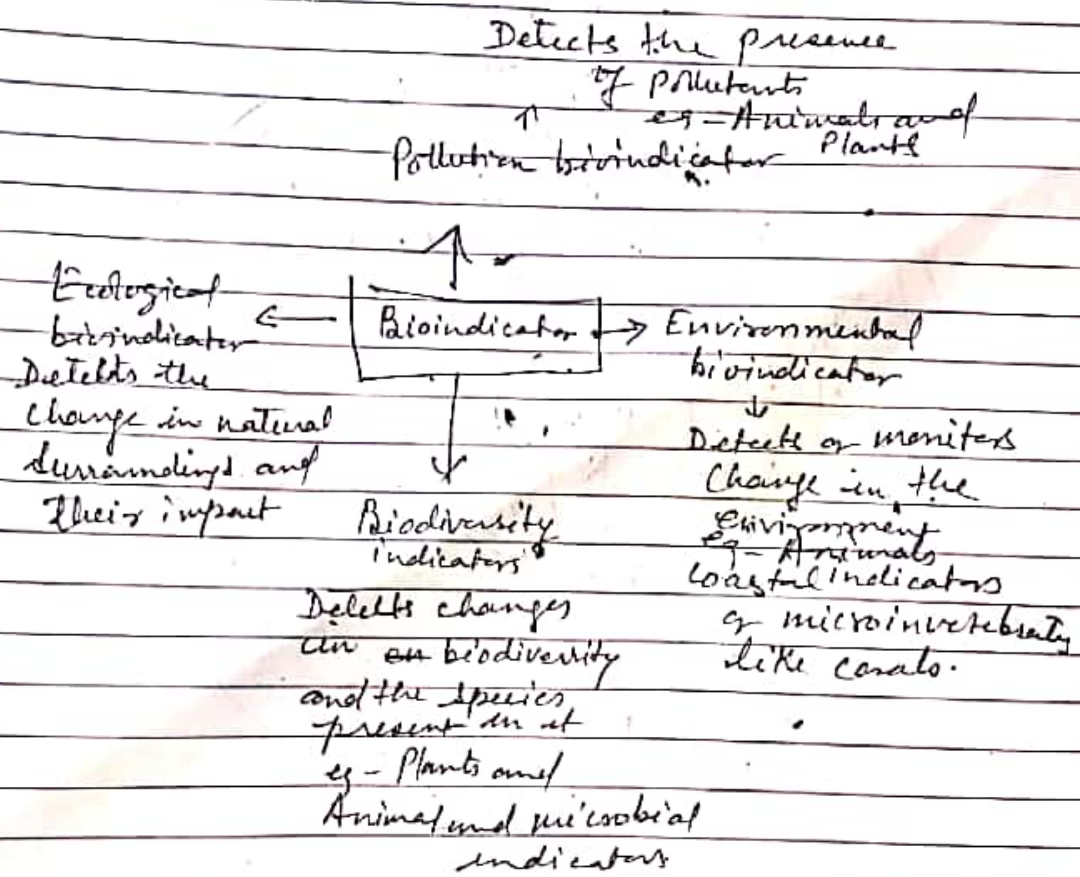
- ② The levels of certain liver enzymes in fish increase if they are exposed to pollutants in water.
- 3) The increase in the number of mutated frogs found in the USA is used as an indicator of toxins in their environment.

Micro-organisms as bioindicators - Microorganism can also be used as indicators of toxicity in an ecosystem. Some microorganism will produce stress proteins if exposed to certain pollutants. By measuring the levels of stress proteins, we can get an idea of the level of pollution in the environment.

Type of Bioindicators



Bioindicators are presently utilized and promoted by various organizations (The world Conservation Union International union for Conservation of Nature) as a means to handle biomonitering and evaluate human effect



Many fold advantages of Bioindicators are that they are helpful, objective straight forward and reproducible. Bioindicators can be used cell to environmental level, for assessing the changes taking place in a specific biological community. Planktonic moniters unite biological, physical, chemical factors and are utilized as an important part of evaluating health stature of water bodies. Bioindication and biomonitering have become promising methods for studying the impacts of external factors on an ecosystem and its development and for differentiating polluted and unpolluted areas

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Bioindicators using organisms to measure Environment impacts.

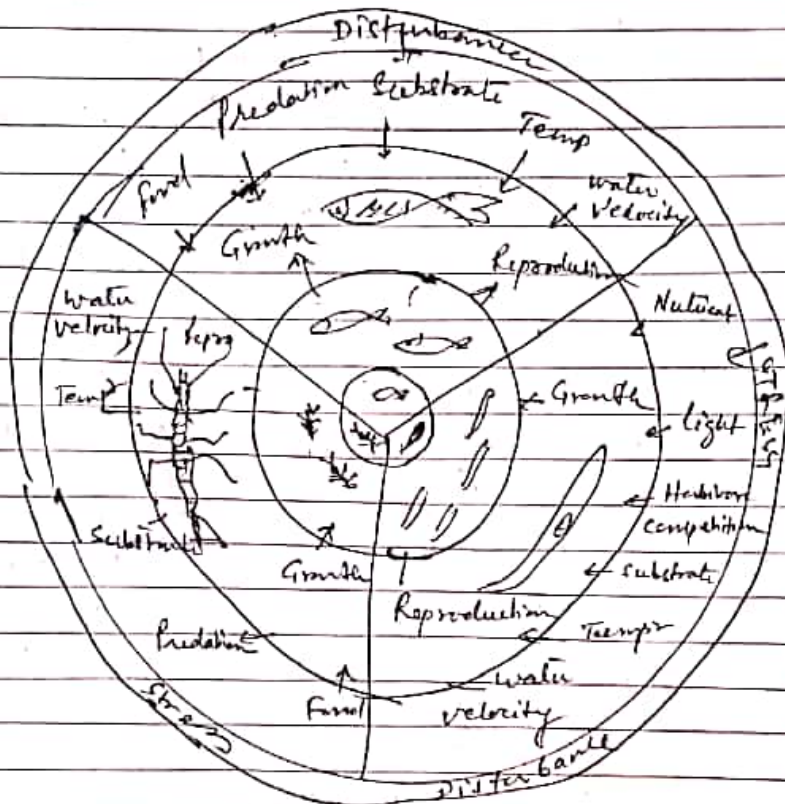


Diagram of the hierarchical levels of an ecosystem that respond to anthropogenic disturbances or natural stress.

The ordering of environmental variables includes factors that may directly altered by disturbances or stress. These alterations affects individual organisms, the middle ring represents population of those organism, and the inner ring represents the community in which all three species co-exists. Disturbances and stress may positively or negatively affect energy resources (eg food, light) biotic interactions, physical chemical changes may increase or decrease growth and reproduction of an organism impacting size and productivity of the population.