Biological Monitoring

Biological monitoring can be defined as the evaluation of environmental changes caused by human activities with the help of biological criteria. It includes several methods to assess the ecological quality of the aquatic habitats with presence/absence or abundance of several organisms, or analyzes of tissues, enzymes or body fluids.

In conventional methodologies related to environmental studies, physicochemical analysis has been used to determine environmental pollution. However, these methods indicate whether or not these contaminants are present in the environment, but they cannot give an idea of the possible harmful effects of these substances on living organisms in that particular environment. Furthermore, these measurements can vary both spatially and temporally, especially in rivers.

Therefore, to eliminate this deficiency encountered in traditional studies, in recent years studies have focused on **"bioindicator"** organisms that can store toxic substances. Since not all species in the ecosystem can be monitored, it is necessary to identify one or several suitable bioindicator species.

Bioindicators can be used:

To monitor of changes in natural environment,

To monitor the effects of pollution and human impacts on the ecosystem

To monitor the environment's response to these pressures

Ideal Bioindicator

1. It should be easily identified and its taxonomy should be clear
2. It can be found in many steps of food chain but usually is requested to be located in the upper rungs of the chain.
3. It should be able to be collected (harvested) by easy methods. If a biochemical or behavioral analysis of the living thing is mentioned, it is preferred to does not harm the living organism.
4. It should have a wide spread area. Its widespread presence allows for comparison in different ecosystems.

5. It should easily adapt to displacement or laboratory studies. But it must be sensitive to environmental variables.

6. They should be able to accumulate contaminants in their bodies

7. Its biology should be well known. They must be present in abundance and long-lasting in their habitat.

Finding biomonitors/bioindicators with all these ideal features is too difficult. In addition, the organisms selected as biomonitor/bioindicator may vary these characteristics according to the purpose of the research.

Types of Bioindicators

A. According to their biological response; are divided into two bioindicator and biomonitor organisms. Indicator or marker organisms are well-known species ecologically and reduction or proliferation of them in the ecosystem has indicated some cases such as climate change, the presence of pollutants, etcBiomonitor organisms, on the other hand, are organisms that take certain toxins from their environment into their body and accumulate them in their tissues within a certain period of time. The amount of pollutants in the tissues of these species indirectly gives information about the environmental conditions.

B. According to population characteristics, the response of any organisms in the aquatic environment that exposed to pollution varies with respect to biological and ecological characteristics of these species. While some low-tolerance species are completely eliminated from the environment, the number and abundance of high-tolerance species increases. In fact, species that have not been observed in this area before can come later and settle.

C. According to the species that used; microbial, plant and animal bioindicator organisms are divided into three.

Microbial indicator: can be used to evaluate both water and soil ecosystems.

Their presence in large quantities gives an advantage over other bioindicator types.

Some microorganisms produce a new protein, that called stress protein when exposed to Cd or benzene. This protein can be used as an early warning system.

2. Plant indicators: Detailed information can be obtained on the level of pollutants in soil, water and air by analyzing the concentration of toxic substances in plant tissues.

3. Animal indicators: There may be seen an **increase or decrease i**n the populations of animal indicators against the danger that occurs in the ecosystem due to environmental pollution. Except the changes of population, responses like: the accumulation of toxins in organism's tissues, presence of deformation/disease rate of population can be used as indicator criteria. Bentic invertebrate and fishes are used as bioondicator organisms prevalently.