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**Module Name: Aquatic Environments: Microflora of freshwater and marine habitats- Part 1**

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**Notes**

**Aquatic Ecosystem**

Habitat is a part of an ecosystem. The climate, plants, and animals are the identities of a habitat. Ecosystems primarily have two domains:

1. Terrestrial or Land ecosystem
2. Aquatic or Water ecosystem.

Water supports many lives. Organisms which survive in water are called aquatic organisms. They depend on water for their food, shelter, reproduction and all other life activities.

An aquatic ecosystem includes a group of interacting organisms which are dependent on one another and their water environment for nutrients and shelter. Examples of aquatic ecosystem include oceans, lakes and rivers.

An aquatic ecosystem includes freshwater habitats like lakes, ponds, rivers, oceans and streams, wetlands, swamp, etc. and marine habitats include oceans, intertidal zone, reefs, and seabed and so on. The aquatic ecosystem is the habitat for water-dependent living species including animals, plants, and microbes.

Different types of aquatic ecosystems are as follows:

1. **Freshwater Aquatic Ecosystem**

They cover only a small portion of earth; nearly 0.8 per cent. Freshwater involves lakes, ponds, rivers and streams, wetlands, swamp, bog and temporary pools. Freshwater habitats are classified into lotic and lentic habitats. Water bodies such as lakes, ponds, pools, bogs, and other reservoirs are standing water and are known as lentic habitats. Whereas, lotic habitats represent flowing water bodies such as rivers and streams.

2. **Marine Aquatic Ecosystem**

Marine ecosystem covers the largest surface area of the earth. It constitutes of oceans, seas, intertidal zone, reefs, seabed, estuaries, hydrothermal vents and rock pools. Each life form is unique and native to its habitat. This is because they have adaptations according to their habitat. In the case of aquatic animals, they can't survive outside of water. Exceptional cases are still there which shows another example of adaptations (e.g. mudskippers).

**Classification of Aquatic Organisms**

They are classified on the basis of their zone of occurrence in the aquatic system and their ability to cross these zones. The organisms in the aquatic ecosystem are unevenly distributed on the basis of their life form or location into five groups as under:

i) Neuston: These are unattached organisms which live at the air-water interface such as floating plants and several types of animals. e.g., beetles and back-swimmers.

ii) Periphyton: These are organisms which remain attached or clinging to stems and leaves of rooted plants or substances emerging above the bottom mud.

iii) Plankton: This group includes both microscopic plants (phytoplankton) and animals (zooplankton) found in all aquatic ecosystems, except certain swift moving waters.

iv) Nekton: This group contains animals which are swimmers. The nektons are relatively large and powerful as they have to overcome the water currents.

v) Benthos: The benthos or the benthic organisms are those found living in or on the bottom or benthic region of the water mass. They exhibit a variety of adaptations to the environment.

**Factors Limiting the Productivity of Aquatic Habitats**

Some of the important limiting factors which exert controlling influence on productivity of aquatic ecosystems are sunlight, transparency, temperature and oxygen.

**Classification of Freshwater Ecosystem**

i) Lentic or standing or basin series ecosystems. Examples of this division are lakes, pools, ponds, swamps, marshes etc.

ii) Lotic or running or channel series ecosystems. Examples of this division are rivers, streams, springs etc.

**Types of Freshwater Ecosytems**

A. **Lentic Ecosystems**

**Lakes**: Lakes arise in several ways. Some, like the tectonic lakes, are formed in basins created by geological activities. Others may be a result of glacial activity. For example most lakes of North America originated due to glacial erosions and deposition, whereby glacial abrasions of slopes in high mountain engraved basin which later became filled with melting snow and rain.

**Impoundments**: In addition to these there are a number of lakes both small and large artificially created by man called reservoirs or impoundments. These have been built to fulfill specific requirements - hydroelectric power generation, fisheries, water supply, irrigation, industries, recreation, control of floods, etc. Impoundments may be called offstem or onstem depending on how they have been created.

**Wetlands**: Wetlands are permanently or periodically water covered areas. They can be defined as submerged or saturated lands either artificially or naturally, and either periodically or permanently up to a depth of six meters by water which may be fresh brackish or saline.

These wetlands may be classified into two categories: Inland wetlands and Coastal wetlands

**Characteristics of Lake Ecosystems**

The environment of static waters of lakes and ponds sharply contrasts with those of lotic ecosystems. Light penetration in lakes is usually up to a certain depth which as you knows is affected by turbidity. Temperature and dissolved oxygen also vary with depth. Dissolved oxygen in stagnant water is generally less compared to lotic systems because only a relatively small surface of the water body is indirect contact with air. Decomposition of organic matter usually takes place at the bottom of the lake. The oxygen content usually decreases with depth.

**Biota of Lakes**

Lakes exhibit life zones. The lakes can be divided into horizontal zones. This division is on the basis of life forms existing in lakes. The penetration of sunlight in the lake influences the vertical gradient of sunlight, temperature and oxygen. The horizontal gradation of lakes is affected by distribution of organisms in the waters. This results in definite zones as follows:

i) **Littoral zone**: This is the shallow water zone, near the shore, where light penetrates to the bottom. Rooted plants can grow only in this region.

ii) **Open Water Zone**: This extends beyond the littoral zone and is too deep for light to penetrate till the bottom and for rooted plants to grow. This zone is divided on the basis of light penetration and distribution of organisms into: a) **limnetic region** which is **photic**; b) **profundal region** which is **aphotic**

iii) **Benthic Zone**: This forms the floor of the lake and underlies the littoral and limnetic zone.

**Types of Lakes**

Lakes of the world exhibit a great diversity of shape, size and combination of properties. However, on the basis of nutrient status and primary productivity they can be divided into three categories:

a) Oligotrophic (nutrient poor) lakes

b) Eutrophic (nutrient rich) lakes

c) Mesotrophic (medium nutrient) lakes.

**Eutrophication:** The nutrient content of lakes thus acts as a limiting factor for organisms as the quantity and diversity of organisms in a lake is dependent on the rate at which nutrients are cycled within it. The process of aging of lakes through nutrient enrichment is called 'eutrophication'.

**B. Lotic Ecosystems - Rivers**

The lotic or flowing water habitats include rivers, streams, brooks etc. The most outstanding features of such habitats is the continuously flowing water which moulds the characteristics of the water bed and influences the distribution of organisms within.

The two most important points are that:

1) Rivers are open or heterotrophic systems whereas lakes are closed or self contained systems except for some gains or losses from inflowing or out flowing streams; and

2) Nutrients in a lake may be used several times whereas in rivers at any point, plants and animals must avail of temporarily available nutrients.

**Characteristics of River Systems**

The basic function of the rivers is to convey surplus rain water from land to sea. Annually the rivers carry fresh water, equivalent to 25 cm of rain, evenly distributed over the whole land surface. The point of origin of the river is the 'source'; the path it takes, is the 'course'; the streams which pin it along the course are the 'tributaries'; and the channel within which it flows is the 'bed'. Its point of entry into the sea or lake or estuary is called its mouth.

**Classification of River**

**1. Rapidly Flowing Waters**

Some organisms' occuring in the rapidly flowing section of the river, the water current is the dominant feature. The habitat itself is diverse, as different microhabitats occur here - a) on the surface of rock fragments b) between rock occurring in rapidly waters fragments and c) beneath rock fragments. Animals found here are annelids, flatworms, clams, some snail species and other insect larvae. In the rapidly flowing habitat, nekton occurs only in areas where current is not too strong and include cold water fish species such as trout or salmon.

2. **Slow Moving Waters**

The habitat of a slowly moving part of the river results in the deposition of smaller sediments on the bottom, instead of being carried away by the stream. Zooplankton is common here and includes an assemblage of protozoa and smaller crustacean, such as water flies, and copepods. Neuston occurring here are several insects such as water striders, water boatman, backswimmers and predaceous diving beetles, all of which spend most of their time at the surface of the stream.