CHAPTER - 14

MARINE ORGANISMS

14.1 PLANKTON

- The term 'plankton' refers to the group of organisms which float in the surface waters of the rivers, lakes and oceans.
- Includes both microscopic plants like algae (phytoplankton) and animals like crustaceans and protozoans (zooplankton) found in all aquatic ecosystems, except certain swift moving waters.
- The locomotory power of the planktons is limited so that their distribution is controlled, largely, by currents in the aquatic ecosystems.
    - The growth rate, productivity and species diversity of plankton in tropical waters especially in mangrove waters are high.

14.2 PHYTOPLANKTON

- Derived from the Greek words phyto (plant) and plankton (made to wander or drift), phytoplankton are microscopic plant organisms that live in aquatic environments, both salty and fresh.
- Some phytoplankton are bacteria, some are protists, and most are single-celled plants. Among the common kinds are cyanobacteria, silica-encased diatoms, dinoflagellates, green algae, and chalk-coated coccolithophores.
- Phytoplankton produce more than 60% of oxygen produced from all plants.
- Like land plants, all phytoplankton have chlorophyll to capture sunlight, and they use photosynthesis to turn it into chemical energy. They consume carbon dioxide, and release oxygen. All phytoplankton photosynthesize, but some get additional energy by consuming other organisms.
- These micro-algae are present throughout the lighted regions of all the seas and oceans including the Polar Regions.
- Their total biomass is many times greater than that of the total plants on land and they serve as the "pasture grounds" in the aquatic environment.

Do you know?

Sea Kraits are one of the few sea snakes that go to land to lay their eggs while most others, like the Olive sea snake will give birth in the water.

14.2.1. Factors Affecting Phytoplanktons Biodiversity

Light

- Phytoplanktons are limited to the uppermost layers of the ocean where light intensity is sufficient for photosynthesis to take place.
- The photosynthetic rate varies with light intensity.

Nutrients

- The major inorganic nutrients required by phytoplankton for growth and reproduction are nitrogen and phosphorus.
- Diatoms and silicoflagellates also require silicate (SiO_2) in significant amounts.
- Some phytoplankton can fix nitrogen and can grow in areas where nitrate concentrations are low.
- They also require trace amounts of iron which limits phytoplankton growth in large areas of the ocean because iron concentrations are very low.

Temperature

- Temperature acts along with other factors in influencing the variation of photosynthetic production.
- Generally, the rate of photosynthesis increases with an increase in temperature, but diminishes sharply after a point is reached.

- Temperature, together with illumination, influences the seasonal variation of phytoplankton production in the temperate latitudes.

Salinity

- Besides light and temperature, salinity also is known to influence primary production.

Grazing by Zooplankton

- The grazing rate of zooplankton is one of the major factors influencing the size of the standing crop of phytoplankton, and thereby the rate of production.

Distribution

- Marine phytoplankton are not uniformly distributed throughout the oceans of the world. The highest concentrations are found at high latitudes, with the exception of upwelling areas on the continental shelves, while the tropics and subtropics have 10 to 100 times lower concentrations.
- In addition to nutrients, temperature, salinity and light availability; the high levels of exposure to solar UV-B radiation that normally occur within the tropics and subtropics may play a role in phytoplankton distributions.
- Phytoplankton productivity is limited to the euphotic zone, the upper layer of the water column in which there is sufficient sunlight to support net productivity.
- The position of the organisms in the euphotic zone is influenced by the action of wind and waves.

14.2.2. Importance of phytoplankton

The food web

- Phytoplanktons are the foundation of the aquatic food web, the primary producers, it feeds everything from microscopic animal-like zooplankton to whales. Small fish and invertebrates graze on the phytoplanktons, and then those smaller animals are eaten by bigger ones.

Do you know?

sea snakes are usually found in shallow waters of the Indian Ocean, and warmer areas of the Pacific Ocean. They eat fish, fish eggs and eels.

14.2.3. Phytoplankton - the Carbon Cycle and climate change

- Phytoplankton are responsible for most of the transfer of carbon dioxide from the atmosphere to the ocean. Carbon dioxide is consumed during photosynthesis, and the carbon is incorporated in the phytoplankton, just as carbon is stored in the wood and leaves of a tree. Most of the carbon is returned to near-surface waters when phytoplankton are eaten or decompose, but some falls into the ocean depths.
- Worldwide, this "biological carbon pump" transfers about 10 gigatonnes of carbon from the atmosphere to the deep ocean each year. Even small changes in the growth of phytoplankton may affect atmospheric carbon dioxide concentrations, which would feed back to global surface temperatures.

Do you know?

1. Sharks have a sensory organ called the "ampullae of Lorenzini" which they use to "feel" the electrical field coming from its prey.
2. Silverfish is an insect that can be found in old unused books

14.3. ZOOPLANKTON

- Zooplankton play vital role in food web of the food chain, nutrient recycling, and in transfer of organic matter from primary producers to secondary consumers like fishes.
- They are more abundant within mangrove water-ways than in adjacent coastal waters, and a large proportion of the juvenile fish of mangrove habitat are zooplanktivorous.
- The zooplankton determine the quantum of fish stock. Hence, zooplankton communities, based on their quality and species diversity, are used for assessing the productivity vis-à- vis fishery resource, fertility and health status of the ecosystem.
- Tiny flagellates, giant jellyfish (>50 μm).

14.4. SEA-GRASS

- Sea grasses are (angiosperms) marine flowering plants that resemble grass in appearance.
- They produce flowers; have strap-like or oval leaves and a root system.
- They grow in shallow coastal waters with sandy or muddy bottoms & require comparatively calm areas.
- They are the only group of higher plants adapted to life in the salt water.
- Major Sea grass meadows in India occur along the south east coast of Tamil Nadu and in the lagoons of a few Lakshadweep Islands. There are few grass beds around Andaman and Nicobar islands also.

- The rich growth of seagrasses along the Tamil Nadu coast and Lakshadweep islands is mainly due to high salinity, clarity of the water and sandy substratum.

14.4.1. Functions

1. Sea grass beds physically help
   - to reduce wave and current energy,
   - to filter suspended sediments from the water and
   - stabilise bottom sediments to control erosion.
2. Provides habitat for marine invertebrates and fishes.
3. Seagrass beds are widespread in lagoon & in such areas, the population of fish and migratory birds are also higher due to the availability of food and shelter.
4. Sea grasses on reef flats and near estuaries are also nutrient sinks, buffering or filtering nutrient and chemical inputs to the marine environment.

Do you know?

The five species of turtle that nest on Indian coast are Leatherback sea turtle, Green turtle, the Olive Ridley, the Hawksbill, and the Loggerhead turtle.

- IUCN has accorded high priority for the conservation of sea grass.
- Out of 58 species found in the world, Fourteen species of seagrasses have been recorded from Indian coast.
- They are commonly distributed from inter-tidal to sub-tidal region down to 8 m depth.
- Dugong, a mammal dependent on sea grass for food, is also on the verge of extinction.

14.4.2. Threats to sea grass beds

- Eutrophication, siltation, trawling, coastal engineering constructions and over exploitation for commercial purposes are the major threats for sea grass beds.

14.4.4. Management

- The major seagrass beds should be mapped and areas has to be identified for preservation.
- Dredging should be carried out far away from seagrass beds as siltation /turbidity destroys seagrass beds.

14.5. SEAWEEDS

- Seaweeds are (thalloid plants) macroscopic algae, which mean they have no differentiation of true tissues such as roots, stems and leaves. They have leaf-like appendages.
- Seaweeds, the larger and visible marine plants are found attached to rocks, corals and other submerged strata in the intertidal and shallow sub tidal zones of the sea.
- Seaweeds grow in shallow coastal waters wherever sizable substata is available.
- Based on the colour of their pigmentation, sea weeds are broadly classified into different classes such as
  - blue- green,
  - green,
  - brown,
  - red etc.

14.5.1. Functions of seaweeds

- Food for marine organism,
- habitat for fish breeding grounds,
- Source of sediment.

14.5.2. Uses of seaweeds

- Seaweeds are important as food for humans, feed for animals, and fertilizer for plants.
- Seaweeds are used as a drug for goiter treatment, intestinal and stomach disorders.
- Products like agar-agar and alginates, iodine which are of commercial value, are extracted from seaweeds.
- By the biodegradation of seaweeds methane like economically important gases can be produced in large quantities.
- Extracts of some seaweed species show antibacterial activity.
- Seaweeds are also used as the potential indicators of pollution in coastal ecosystem, particularly heavy metal pollution due to their ability to bind and accumulate metals strongly.

14.5.3. Harmful effects of seaweeds

- Rotting seaweed is a potent source of hydrogen sulfide, a highly toxic gas, and has been implicated in some incidents of apparent hydrogen-sulphide poisoning. It can cause vomiting and diarrhoea.

14.5.4. Threats to seaweeds

- Threats are similar to that of sea grass.

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