

Aquatic Ecosystems

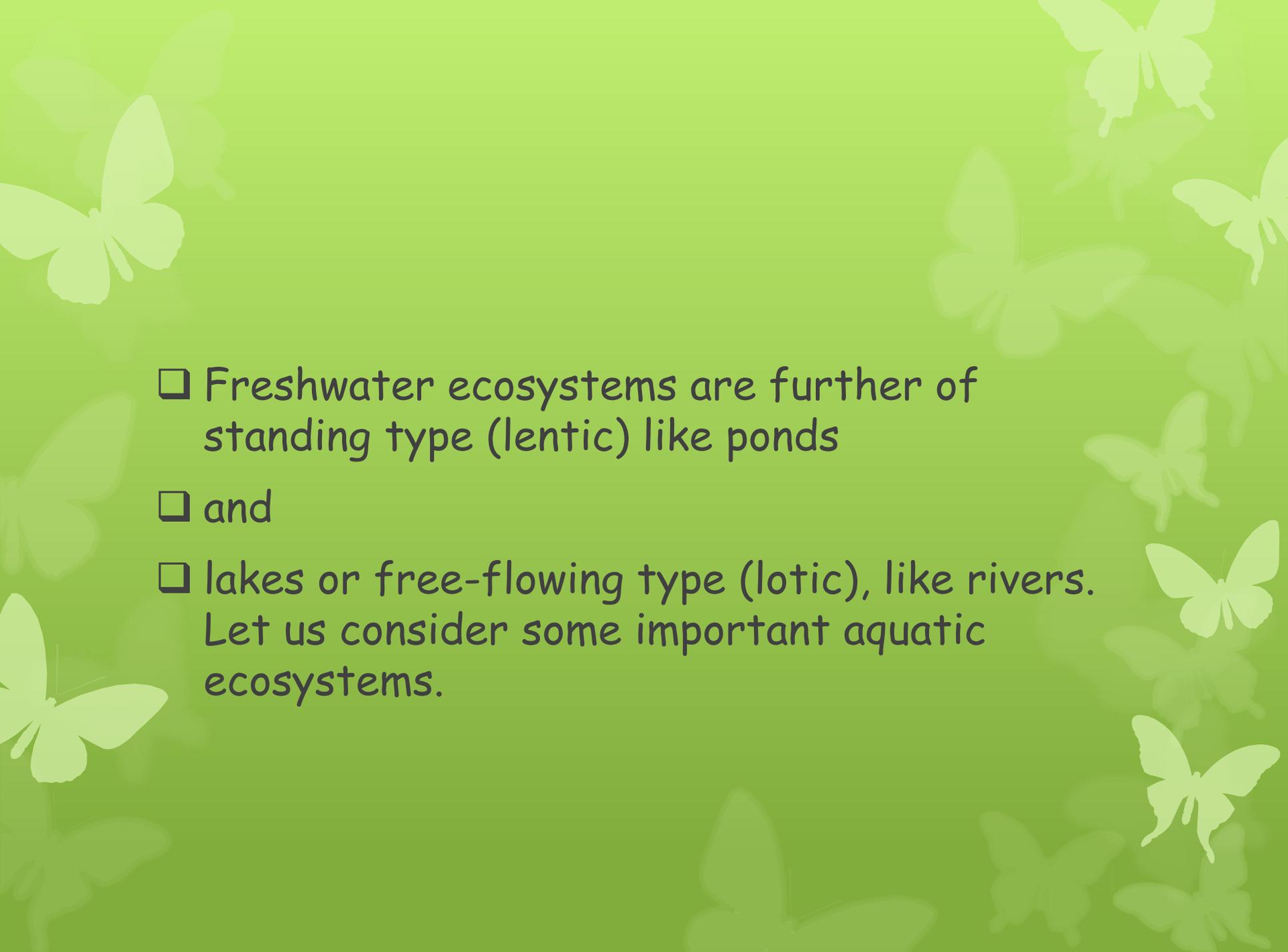
The background of the slide is a light green gradient. It is decorated with numerous white butterfly silhouettes of various sizes and orientations, scattered across the frame. The butterflies are semi-transparent, allowing the green background to show through them.

Aquatic Ecosystems:

- ❖ Aquatic ecosystems deal with biotic community and abiotic components present in water bodies.
- ❖ In terrestrial ecosystem, carbon dioxide & oxygen are present in gaseous form *whereas in aquatic ecosystem, these are available in dissolved state.*
- ❖ Depending upon the quality and nature of water, the aquatic ecosystem are categorized into:
 - ❖ Freshwater Ecosystem and
 - ❖ Marine Ecosystem.
 - ❖ Estuarine

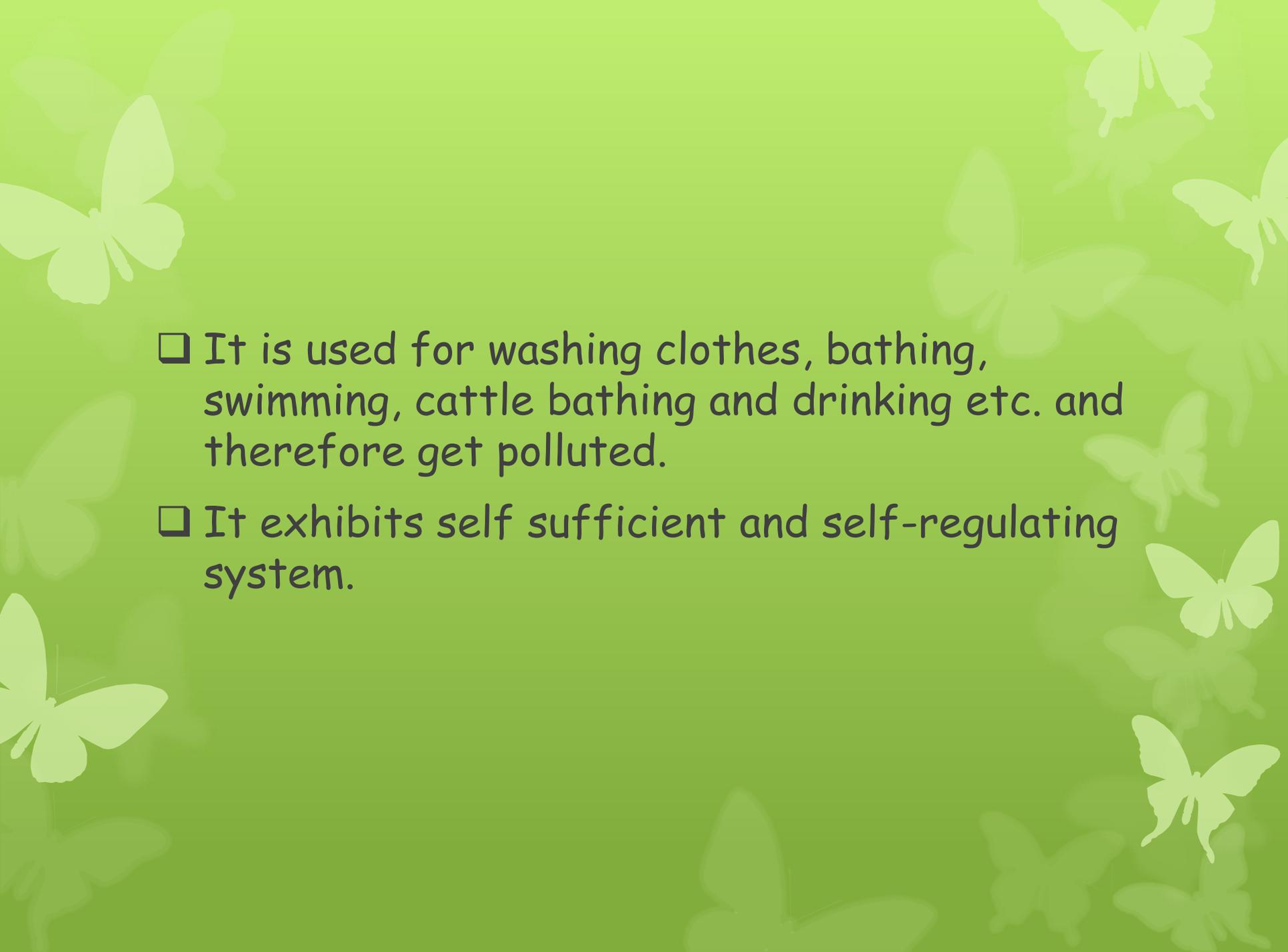
Freshwater Ecosystems:

- ❖ Freshwater ecosystems cover **0.8%** of the Earth's surface and contain **0.009%** of its total water.
- ❖ Freshwater ecosystems contain **41%** of the world's known fish species.
- ❖ Aquatic ecosystems perform many important environmental functions. For example:
 - They recycle nutrients, purify water, attenuate floods, recharge ground water and provide habitats for wildlife.
 - Aquatic ecosystems are also used for human recreation, and are very important to the tourism industry, especially in coastal region.
- ❖ There are three basic types of freshwater ecosystems:
 - ❑ **Lentic:** slow-moving water, including **Pools, Ponds, and Lakes.**
 - ❑ **Lotic:** rapidly-moving water, for example **Streams and Rivers.**
 - ❑ **Wetlands:** areas where the soil is saturated with water or inundated for at least part of the time

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- ❑ Freshwater ecosystems are further of standing type (lentic) like ponds
 - ❑ and
 - ❑ lakes or free-flowing type (lotic), like rivers. Let us consider some important aquatic ecosystems.

(i) Pond ecosystem:

- ❑ It is a small freshwater aquatic ecosystem
- ❑ where water is stagnant. Ponds may be seasonal in nature i.e. receiving enough water during rainy season.
- ❑ Ponds are usually shallow water bodies which play a very important role in the villages, where most of the activities center around ponds.
- ❑ They contain several types of algae, aquatic plants, insects, fishes and birds.
- ❑ The ponds are, however, very often exposed to tremendous anthropogenic (human-generated) pressures.

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- ❑ It is used for washing clothes, bathing, swimming, cattle bathing and drinking etc. and therefore get polluted.
 - ❑ It exhibits self sufficient and self-regulating system.

ii) Lake ecosystems:

- ❑ Lakes are usually big freshwater bodies with standing water.

They have a shallow water zone called Littoral zone,

an open-water zone where effective penetration of solar light takes place, called Limnetic zone .

A deep bottom area where light penetration is negligible, known as profundal zone

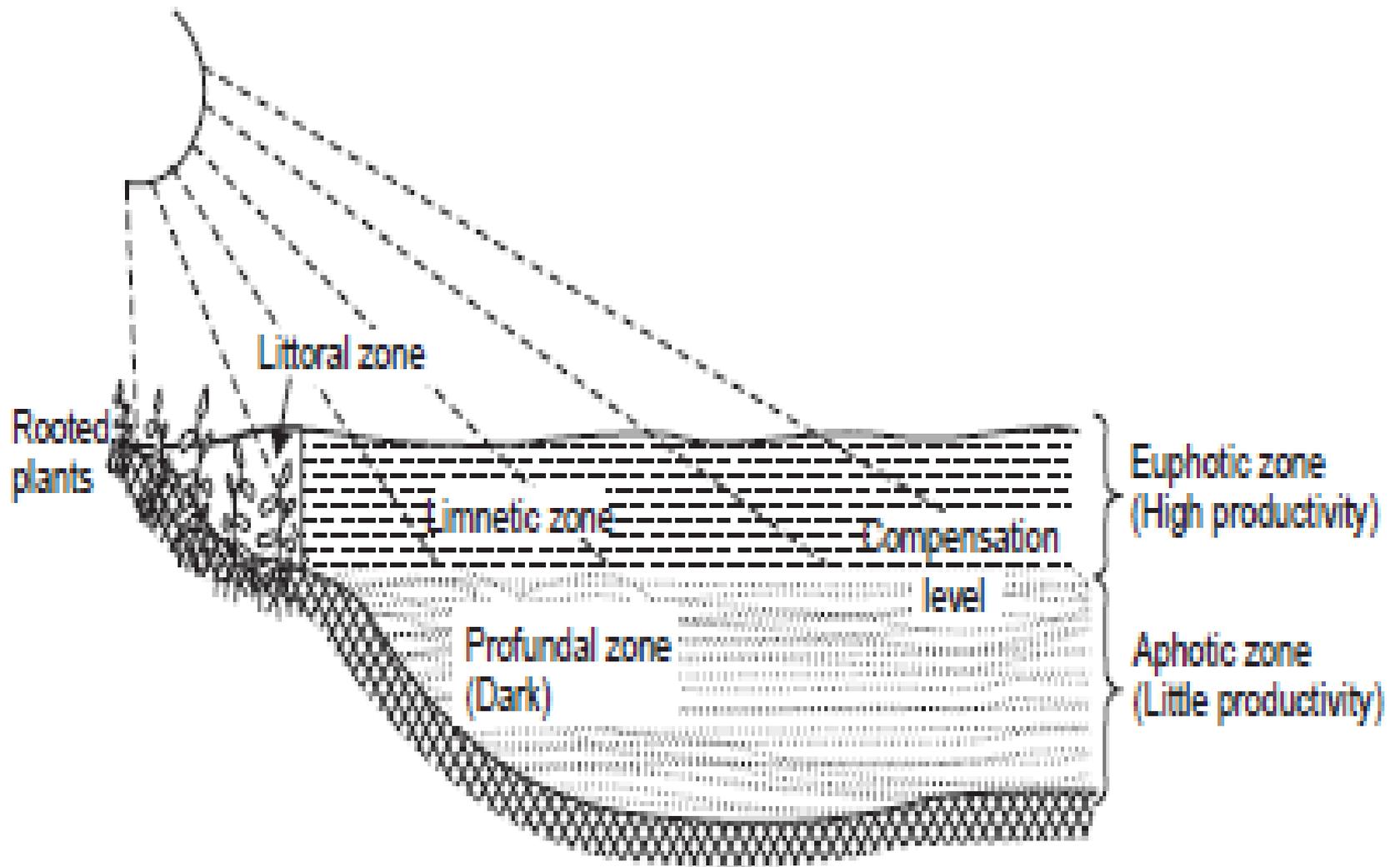


Fig. 3.16. Zonation in a lake ecosystem.

- ❑ Producers: macrophytes (rooted plants, partly or completely submerged, floating) and phytoplanktons (minute, floating or suspended lower plants (filamentous algae))
- ❑ Consumers: are heterotrophs which depend on the organic food manufactured by green plants.

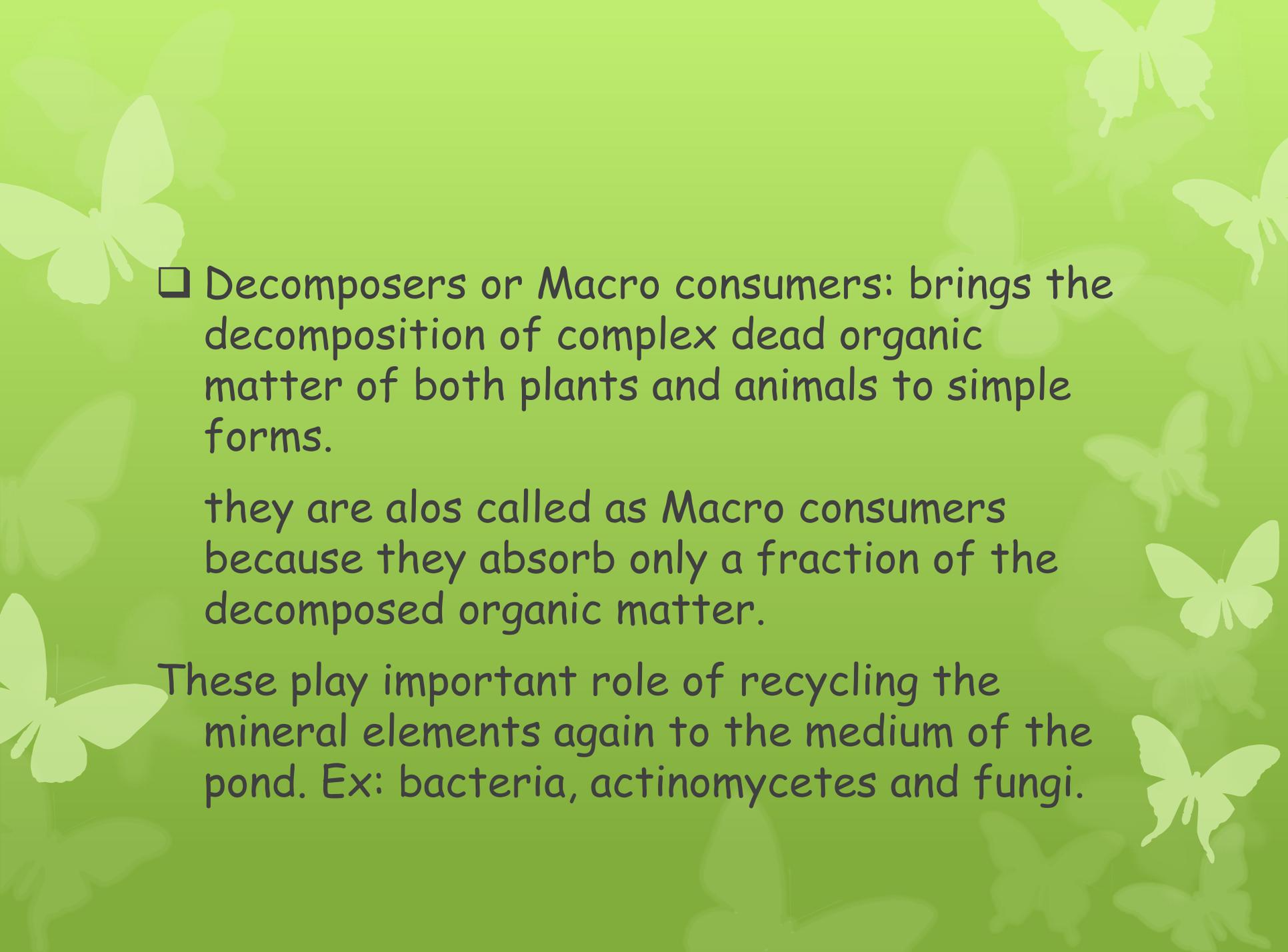
i) benthos: animals associated with living plants and bottom forms; which feed upon the plant remains lying at the bottom of pond; called as detritivores. Ex: fish, insect larvae, beetles, mites, crustaceans etc.,

ii) zooplankton: feed on phytoplankton, Ex: protozoans

Secondary consumers(carnivores): feed on primary consumers, insects and fish which feed on zooplankton.

Tertiary consumers(carnivores): some large fish feed on small fish and thus become the Tertiary (top) consumers. thus in a pond fish may occupy more than one trophic levels.

the small fish(herbivores) feed on phytoplankton while some fish feed on zooplankton at carnivore level



□ Decomposers or Macro consumers: brings the decomposition of complex dead organic matter of both plants and animals to simple forms.

they are also called as Macro consumers because they absorb only a fraction of the decomposed organic matter.

These play important role of recycling the mineral elements again to the medium of the pond. Ex: bacteria, actinomycetes and fungi.

Abiotic component

- 1. heat, light, pH, inorganic and organic compounds (H_2O), CO_2 , O_2 , Ca, N_2 , phosphates, amino acids,

River Ecosystem:

- ❑ Flowing water ecosystem in which all the living forms are specially adapted to different rates of flow.
- ❑ The community of flora and fauna of rivers depends on the clarity, flow and oxygen content as well as the nature of their beds.
- ❑ The river can have a sandy, rocky or muddy bed, each type having its own species of plants and animals.

❖ Biotic components:

1) Producers: It includes phytoplanktons.

2) Consumers:

a) **Primary consumers:** These are herbivores and feed directly on producers.

b) **Secondary consumers:** These are carnivorous fishes.

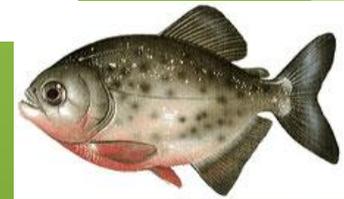
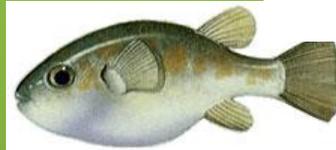
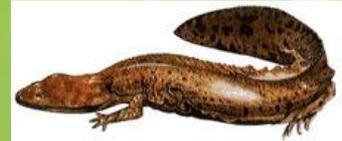
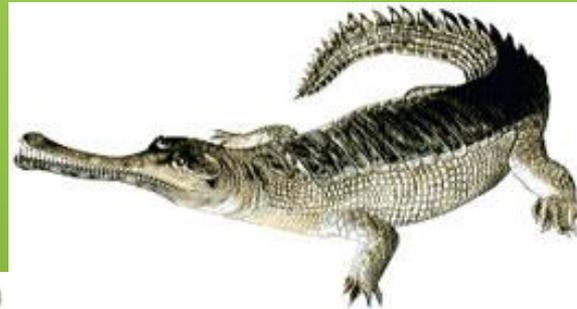
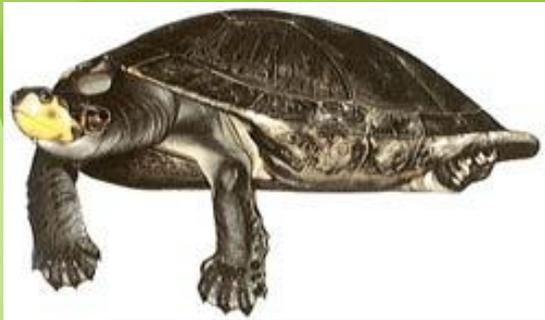
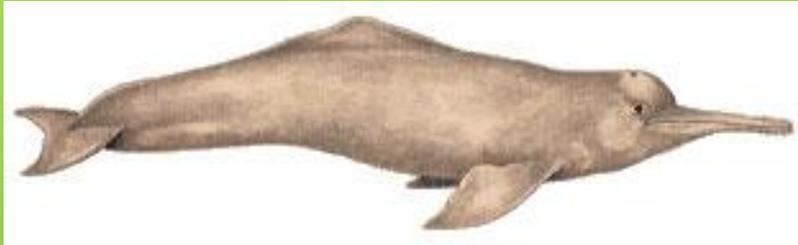
c) **Tertiary consumers:** These are top carnivorous fishes.

3) Decomposers: These are micro - organisms like bacteria, fungi

❖ Abiotic components:

❖ Variable dissolved oxygen content, light & temperature

Inside river ecosystem



Marine Ecosystem

- ❖ Marine ecosystems in India - the Indian Ocean, the Arabian Sea and the Bay of Bengal.
- ❖ Producers - Vary from microscopic algae to large seaweeds. There are millions of zooplankton and a large variety of invertebrates on which fish, turtles and marine mammals live on.

Ocean Ecosystem:

- ❖ Marine ecosystems are among the Earth's aquatic ecosystems. They include: **Oceans, Estuaries and Lagoons, Mangroves and Coral reefs, the Deep sea and the Sea floor.**
- ❖ These are the gigantic reservoirs of water covering approximately **71%** of the Earth's surface (an area of some **361 million square kilometers**).
- ❖ These ecosystem is different from freshwater ecosystem mainly because of its salty water.
- ❖ The salt concentration in an open sea is usually **3.5%** (30-50 g/L).
- ❖ Average temperature of Marine ecosystem is **2-3 °C**, devoid of light.



❖ Biotic components:

1) Producers: It includes phytoplanktons (diatoms, dinoflagellates), large seaweeds (mainly algae like chlorophyceae, phaeophyceae & rhodophyceae; angiosperms like *Ruppia*, *Zostera*, *posidonia* etc.), and mangrove vegetation (like *Rhizophora*, *Carapa* etc.)

2) Consumers:

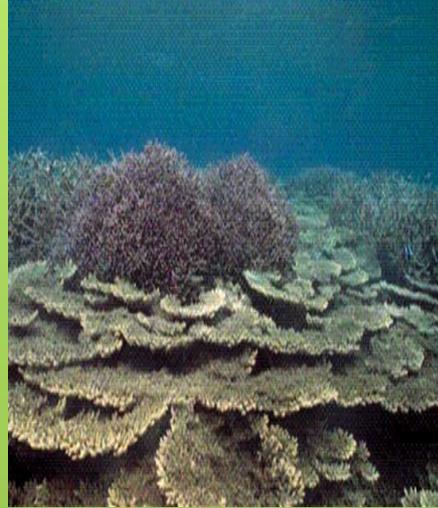
- a) **Primary consumers:** These are herbivores and feed directly on producers (Crustaceans, Mollusks, fish etc.)
- b) **Secondary consumers:** These are carnivorous fishes (Herring, Sahn and Mackerel)
- c) **Tertiary consumers:** These are top carnivorous fishes (Cod, Haddock, etc.)

3) Decomposers: These are micro - organisms like bacteria, fungi

❖ Abiotic components:

- ❖ High Na, Ca, Mg and K salt concentration, variable dissolved oxygen content, light & temperature make a unique physiochemical conditions in marine water.

Inside Marine or Ocean Ecosystem:



Coral Reef Plants

Algae



Green



Red

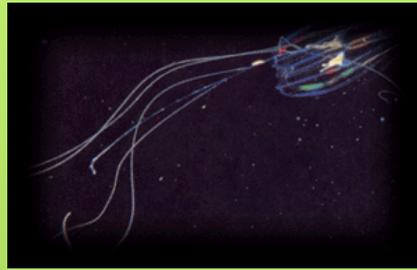


Brown algae





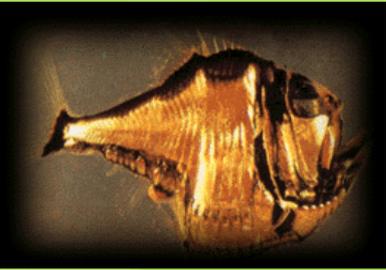
Big Scale - ambush predator



**ctenophore – related to jellyfish
cilia can be illuminated**



Firefly squid



Hatchet Fish



Viperfish



Dragon fish



Snipeel



Siphonophores are colonies of animals

Narcomedusa



Vampire Squid



Snake Dragon



Angler Fish



Amphi - crustacean



Ctenophore – voracious predator



Deepstaria very slow swimmers, no tentacles, close flexible bells (up to a meter across) around their prey



Big Red grows to over a meter across



Threats to aquatic ecosystems

- ❑ Water pollution due to sewage and poorly managed solid waste in urban areas.
- ❑ Excessive use of fertilizers causes an increase in nutrients, which leads to eutrophication.
- ❑ Eutrophication - destroys life in the water as the oxygen content is severely reduced.
- ❑ Pesticides - pollute water and kills off its aquatic animals.
- ❑ Chemical pollution from industry kills a large number of life forms in adjacent aquatic ecosystems.
- ❑ Contamination by heavy metals and other toxic chemicals affects the health of people who live near these areas as they depend on this water.
- ❑ Over exploitation of Resources

Conservation of aquatic ecosystem

- ❑ For sustainable use of an aquatic ecosystem, water pollution must be prevented.
- ❑ Changing the nature of the aquatic ecosystem (from a flowing water ecosystem to a static ecosystem) destroys its natural biological diversity.
- ❑ **Example:** construction of dams across rivers decrease the population of species that require running water.
- ❑ Protecting wet lands: conversion to agriculture lands