LAKE ECOSYSTEM

- Study of fresh water ecosystems is called "LIMNOLOGY".
- LENTIC habitat means the fresh water that remains static without flow. Eg: Lake, Tank and Pond.
- LOTIC habitat means the fresh water which keeps on flowing Eg: Canals, Streams, Rivers.
- Lakes which are poor in nutrients are called **oligotophic lakes**
- Lakes rich in nutrients and oxygen are called **Eutrophic lakes**
- Lakes rich in nutrients but poor in oxygen are called **Dystrophic lakes.**
- Lakes can be distinguished from ponds by greater depth and water throughout the year
- Vegetation does not occur below a depth of 200 meters in the aquatic medium.
- The relatively wanner and shallow region close to the bank (shore line) of a lake is called "LITTORAL" zone. Producers and consumers are abundant in this zone.
- Producers of Littoral zone include rooted plants and phytoplankton. The rooted plants include Emergent, Floating and submcrgent plant.
- Small floating animals present on the surface of water are called **zooplakton.**
- Eg: Rotifera, cladocera, copepoda.
- Animals that are capable of swimming are called **"Nekton".**
- **Ex:** Insects like Ranatra Notonecta, All fishes, Amphibian, Terrapins.
- Animals living at the air water interface are called **Neuston.**
- Animals living on the upper region of air water interface are called epineuston or supra neuston.
- **Ex:** Beetles and Gerrus.
- Animals living on (attached to) the under surface of air water interface are called Hyponeuston or Infra neuston.
- **Ex:** Mosquito larvae.
- Animals that cling to the aquatic plants are called **periphyton.**
- **Ex:** Nymphs of insects, Bryozoa, Water snails.
- Animals that move on the bottom region (sand or debris) of Littoral zone are called **Benthos.**
- **Ex:** Annelida, Isopoda (class crustacea) cray fish etc.
- Chaoborus lives as plankton in limnetic zone during night and lives as benthos during day time.
- The open water zone away from the bank of a lake extending upto a depth of effective light penetration is called **limnetic zone.**
- The only producers in Limnetic zone are phytoplankton. (Blue green Algae, Euglena).
- Consumers of this zone are Zooplankton (copepoda, cladocera) and nekton (fishes and snakes).
- The deep zone of a lake beyond a depth of 200 meters is called profundal zone.
- It is the zone with a thick layer of mud and sand; with less 0_2 content. Producers are absent.
- Bacteria are abundant and bring about recycling of Nutrients.

POPULATION ECOLOGY

- The science that deals with dynamics of species populations and their interactions with environment is called population ecology or Autecology
- The concept of expanding population must exceed supply of needed natural resources was put forwarded by **Thomas Malthus (**Essay on the principles of populations)
- Increasing competition for food, shelter etc due to exponential growth of population is called **Malthusian growth model** / **simple exponential growth model**.
- Logistic growth curve was first put forward by **Pierre Francois Verhulst**
- Population may be defined as a group of organisms of the same species occupying a unit area at a given time.
- Population size is determined by the carrying capacity of the habitat.

- The carrying capacity is the maximum number of individuals which the environment can support or sustain at a given time.
- Population growth is determined by the number of organisms added to the population [through birth or immigration] minus the number of organisms lost [through death and emigration].
- When the number of individuals added to the population equals to the number of individuals lost, the population remains constant or shows zero population growth.
- **Natality**: (birth rate) refers to the average number of new individuals produced by a population in a given time. In case of human beings birth rate is usually expressed as the number of birth per thousand head of population per year.
- **Mortality:** (death rate) refers to the number of individuals dying in a population at a given time i.e., the number of deaths per thousand per year.
- Natality is a population increasing factor. Mortality is a population declining factor.
- **Density of population:** is defined as the number of individuals per unit area (for land organisms) or unit volume (for aquatic organisms) in a unit time. Eg: (i) 40 tigers per 100 sq. kms of forest (ii) 50 paramecia per cubic mm. of water (iii) 5 million Diatoms per cubic meter of water.
- Formula for population Density is D= n/a D= Density, n= number of individuals, a=area,
- Population density depends on the natality, mortality, emigration, immigration and environmental factors. Hence the density of a population in a given area does not always remain constant.
- Increase in size of the populations is determined by the reproductive potential of the organisms concerned and by the environmental resistance.
- External factors such as predation, food supply, light and space and internal factors such as intraspecific competition are collectively referred to as **"Environmental Resistance".** It prevents the population to reach the biotic potential.
- **Biotic potential:** It is defined as the maximum reproductive potential of a population under unlimited favourable conditions. It depends on the age groups and the ratio of males and females in a population.
- Age distribution can be used to estimate whether the population is increasing or declining
- Pre-reproductive age group includes immature individuals.
- Reproductive age group includes sexually mature individuals
- Post-reproductive age group comprises old individuals, where the reproductive ability has been stopped.
- A growing population contains a large population of young individuals.
- A stable population includes even distribution of all the age groups.
- A declining population has a large population of old individuals.
- An age pyramid is a graph showing the different age groups of a population.
- In the age pyramid pre-reproductive age group is represented at the base, the reproductive age group at the top.
- If the age pyramid is urn-shaped it shows that the population is stable.
- If the age pyramid is triangular in shape it indicates that the population is growing.
- If the age pyramid is bell-shaped it shows that the population is stable.
- The increase in size of a population is called population growth.
- A population grows when the birth rate is high and in death rate is low.
- The increase in the number of animals is plotted against time factor, a curve is obtained called the growth curve.

- Population characteristically increases in size in a sigmoid or s-shaped or logistic fashion
- The sigmoid growth curve has three phases - positive acceleration phase, logarithmic phase and negative acceleration phase.
- **In sigmoid growth curve,** population grows gradually, until the equilibrium level is reached at which there is neither increase nor decrease. This type of population growth is said to be density dependent.
- **In J-shaped growth curve** or Exponential growth curve. The growth is very rapid and the number of individuals increases in compound interest fashion and then the growth stops abruptly and the population suddenly declines. This is called **"Crash".** It is exhibited by algal blooms and insects like aphids. This type of population growth is density independent.
- The intrinsic factors or density dependent factors that regulate population growth includes predation, emigration, diseases, competition, territorial behaviour, overcrowding etc.
- The extrinsic factors or density independent factors that regulate population growth are temperature, space, shelter, food, weather etc.