Organisms and Populations

- **Ecology:** It is the field of science that deals with the interrelationship between biotic and abiotic factors.
- It includes four levels of biological organisation: organisms, populations, communities and biomes.
- o **Major abiotic factors:** Light, temperature, water, air, soil, etc.
- o **Eurythermal:** Organisms that can tolerate wide range of temperature
- **Stenothermal:** Organisms that live in a narrow range of temperature
- o **Euryhaline:** Organisms that can tolerate wide range of salinity
- Stenohaline: Organisms that live in a narrow range of salinity
- Responses of organisms to abiotic factors -
- **Regulators** are organisms that have the ability to maintain their constant body temperature. Example: birds and mammals
- **Conformers** are organisms that cannot maintain their constant body temperature with respect to their surrounding environment.
- The heat gain or heat loss from the body of an organism is the function of the body surface area relative to volume.
- Therefore, the smaller organisms have larger surface area relative to their volume, and tend to lose body heat at a faster pace. Hence, small-bodied animals are rarely found in the Polar Regions.
- **Migration** is the ability of an organism to move away temporarily from a stressful habitat to a hospitable habitat
- Example: migratory birds
- **Suspend** involves suspension of metabolic activities of organisms during unfavourable conditions. It includes:
- o **Hibernation (winter sleep):** Example, Polar bear.
- o **Aestivation (summer sleep):** Example, some snails and fishes.





o **Diapause (stage of suspended development):** Example, many zooplanktons.

Adaptations

- Adaptation is the process of adjustment which enables an organism to adapt to its new environment.
- There are three types of adaptations
 - Physiological adaptation: Example, kangaroo rat producing highly concentrated urine Morphological adaptation: Example, presence of a thick cuticle on the leaf surface of desert plants
 - Behavioural adaptation: Example, desert lizard basking in the sun to absorb heat, to maintain its body temperature

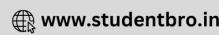
Population

- It is a group of organisms inhabiting a given area.
- Attributes of population are –
- Birth rate
- Death rate
- Sex ratio
- Age distribution
- **Age pyramid:** It shows the age distribution pattern for a population.
- Age pyramid for human population shows –
- Expanding population: Has a broader base, representing more number of individuals in pre-reproductive (young individuals) age group
- Stable population: Has almost equal number of individuals in the pre-reproductive and reproductive age groups, converging at the post-reproductive age group
- Declining population: Has lesser number of individuals in the pre-reproductive group and greater number of individuals in the reproductive age group

Demography

- The Statistical study of human population considering the following factors:
- Distribution of population
- Size and Density of population
- Birth rate
- Death rate





- o Growth rate of population
- Population density fluctuates due to –
- Natality (B)
- o Mortality (D)
- o Immigration (I)
- Emigration (E)

So,

$$N_{t+1} = N_t + [(B+I) - (D+E)]$$

Where, N_t is the population density at time t and N_{t+1} is the population density at time t+1

- Population growth curve
- When resources are unlimited, the growth curve is known as exponential growth curve.
- Exponential growth equation:
- $Nt = N0 \text{ ert} \Rightarrow 2$ Where,

 N_t = Population density after time t

 N_0 = Population density at time 0

r = Intrinsic rate of natural increase

e = Base of natural logarithm

- o When resources become limiting, the growth curve is said to be logistic growth curve.
- Verhulst-Pearl logistic growth equation:

Where,

N = Population density at time t

r = Intrinsic rate of natural increase

K = Carrying capacity

Population interaction

- There are six types of population interaction
 - 1. **Mutualism**: It is a symbiotic association between two species where both of them are benefited. Example, fungi and roots of higher plants
 - 2. **Competition:** It is a type of interaction where both the species are negatively affected. Example, Abingdon tortoise getting extinct due to the introduction of goat
 - o **Gause's competitive exclusion principle** states that two or more closely related species having identical patterns of resource use cannot coexist in a stable







environment; one which will be better adapted will out-compete or otherwise eliminate the inferior one.

- 1. **Predation and Parasitism:** It is the population interaction where one species is positively affected while the other species is negatively affected. Example, *Pisaster* hunting on sea urchin is an example of predation while *Cuscuta* deriving nutrition from its host represents parasitism. Parasitism is of two types -
- o Endoprasitism: Example, tapeworms and roundworms in the human body
- o Ectoparasitism: Example, lice on the human skin and ticks on dogs
- 1. **Commensalism:** It is the population interaction where one species gets positively affected while the other remains unaffected. Example, clown fish living in the poisonous tentacles of sea anemone
- 2. **Ammensalism:** It is the population interaction where one species gets negatively affected while the other remains unaffected.

