ORGANISMS AND POPULATIONS

- Ecology is the branch of biology that deals with the interactions among organisms and. between the organism and its physical (abiotic) environment .POPULATIONS
- A group of individuals of a species living in a geographical area ,who can interbreed and share similar resources is called a population .Population Attributes:

A population has certain attributes whereas an individual organism does not.

An individual may have births and deaths, but a population has birth rates and death rates

- a). Birth rate
- Average no. of young ones born in a period of time with respect to members of the. population.(No of individuals born per individual per unit time)
- b). Death rate.

Average no. of deaths in a period of time with respect to members of the population.

c), Sex Ratio.

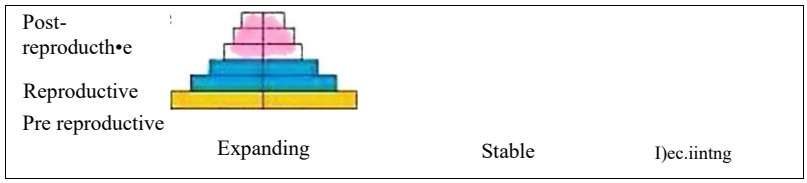
- Sex ratio is another attributes of population. An individual may be male or female but. population has sex ratio.
- It is the ratio between male and female in a population..

d). Age distribution

- Age distribution is also an important attribute of population.

A population comprises different age groups such as pre-reproductive, reproductive and postreproductive age groups.

- This age distribution is graphically represented as



e). Population size

It is determined by counting the no.of individuals,or by biomass.

The population size is more technically called as population density (N).

- Population density can be measured by Counting the number,by measuring percent cover or biomass.
- Some times,there is no need to know the absolute population densities,such cases relative densities used for measuring population size.
- Indirect estimation of population size using Pug marks and fecal pellets is also possible for some animals.
- Population Growth .

The size of population is not static.

- It keeps changing with time, depending upon food availability, predation pressure and reduce
- weather.
- The density of a population in a given habitat during a given period, fluctuates due to changes in four basic processes which are

1. Natality (B) : Number of births during given period in the population that are added to the initial density.
2. Mortality (D):Number of deaths in the population during a given period.
3. Immigration (I) :It is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration
4. Emigration (E) : Emigration is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration

- If N is the population density at time t, then its density at time t +1 is Nt+l = Nt + (B + 1) - (D + E)]

Where N Population Density B the number of births

- I : the number of immigrants D : the number of deaths E the number of Emigrants.
- Population density will increase if the number of births plus the number of immigrants (B + I) is more than the number of deaths plus the number of emigrants (D + E). otherwise it will decrease.

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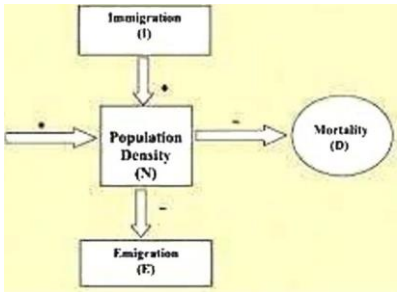

GROWTH MODEL

Growth of population takes place according to availability of food, habit condition and presence of other biotic and abiotic factors.

There are two main types of growth models

- Exponential Growth

Any species grow exponentially under unlimited resources conditions and can reach enormous
- population densities in a short time.

Population grows exponentially and after attaining the peak value ,the population shows sudden
- decrease.

For example many insect populations show rapid increase during rainy season followed by their disappearance at the end of season .

- This type of growth is not so realistic.

If in a population of size N, the birth rates as represented as b' and death rate as 'd'. Then increase
- and decrease in N during unit period time 't' will be dN / dt = (b - d) x N

Let (b - d) : r, then dN / dt = rN

- Then, the 'r' in this equation is called 'intrinsic rate of natural increase'
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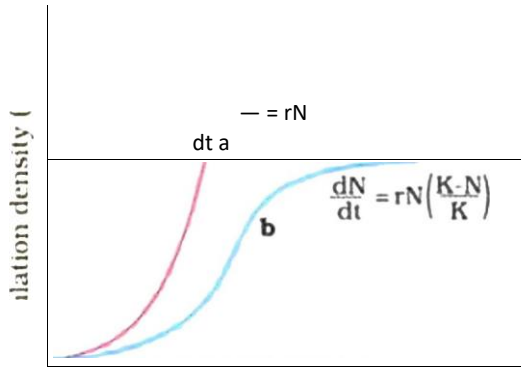
LOGISTIC GROWTH



➢ In nature, a given habitat has enough zresources to support a maximum possible number, beyond which no further growth is possible. This is called carrying capacity (K) of a habitat.

➢ Due to competition between individuals for a.limited resources, the fittest individual will 'l'ltne (t) ..—+ survive and reproduce.

A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and stationary phase, when the population density

➢ reaches the carrying capacity.

The logistic growth shows sigmoid curve and this is also called Verhulst-Pearl logistic growth.

➢ It can be shown by the following equation.

➢ ➢ Where N : Population density at time 't'

_dt rN r : Intrinsic rate of natural increase K : Carrying capacity

Since resources for growth for populations are finite and become limiting , the logistic growth model is considered a more realistic one.

➢ POPULATION INTERACTION

All animals, plants and microbes in a biological community interact with each other These interactions may be beneficial, detrimental or neutral to one of species or both. Following types of population interactions are seen

➢ • Predation • Competition • Parasitism • Commensalism • Mutualism • Amensalism

➢ 1 . PREDATION

It is an Interspecific Interaction where one animal kills and consumes the other weaker animal.

Its is nature's way to transfer energy from plants to higher trophic levels (position

➢ of organism in food chain) <u>Roles of Predators</u>

- Predation keeps prey population under control (Prickly pear cactus- moth) ▪ Biological control

➢ of Agricultural pest

- Maintain species diversity by reducing intensity of competition among competing prey

➢ species

- Over exploitation of prey by the predators results in extinction of prey and predator.

Defence mechanisms developed by prey against predators:

In Animals:

- Insects and frogs are cryptically coloured (camouflage) to avoid being detected by the predator.

- Some are poisonous and therefore avoided by the predators.
- Phytophagous (feeding on plant sap and other parts of plants) insects like Monarch butterfly is highly distasteful to its predator (bird) due to presence of special chemical in its body. In Plants:
- Thorns in Acacia and Cactus are morphological means of defence.
- Many plants produce and store some chemical which make the herbivore sick if eaten. (inhibit feeding, digestion disrupt reproduction, and even kill the predators).
- Calotropis produces poisonous cardiac glycosides against herbivores.
- Nicotine, caffeine, quinine, strychnine, opium etc. are produced by plants as defenses against the grazers and browsers

2. COMPETITION

Competition generally occurs when closely related species compete for the same resources that are limiting.

Interaction either among individuals of same species or between individuals of different species.

In American lakes visiting flamingoes and resident fishes compete for their common food,zooplanktons.

- Resources need not be limiting for competition to occur.
- For example,Abingdon tortoise in Galapagos Islands became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats.
- Competitive release: A species, whose distribution is restricted to a small geographical area because of the presence of a competitively superior species, is found to expand its distributional range dramatically when the competing species is experimentally removed.
- Connell's elegant field experiment showed that superior barnacle Balanus dominates the intertidal area and excludes the smaller barnacle Chathamalus from that zone.
- Cause's 'competitive Exclusion Principle': Two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior will be eliminated eventually.
- Resource partitioning- Two competing species avoid competition by different feeding and foraging patterns .
- MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in their foraging activities. 3. PARASITISM
- Parasitism is generally defined as a relationship between the two living species in which one organism is benefitted at the expense of the other.
- The organism that is benefitted is called the parasite, while the one that is harmed is called the host.

Some parasites are host-specific (one parasite has a single host) in such a way that both host and parasite tend to co-evolve.

- Some of the adaptations of parasites are
  - Loss of unnecessary sense organs
  - Presence of adhesive organs or suckers to cling on to the host.
  - Loss of digestive system.
  - High reproductive capacity.
- The life cycles of parasites are often complex, involving one or two intermediate hosts or vectors to facilitate parasitism on its primary host.
- The human liver fluke depends on two intermediate hosts, a snail and a fish to complete its life cycle

Effects of parasites on the host.

- Majority of the parasites harm the host.

They may reduce the survival, growth and reproduction of the host and reduce its population density.

They make the host more vulnerable to the predators, by making it physically weak.

Types of parasite

- ECTOPARASITE: Feeds on the external surface of the host. Eg.Lice on human ,Ticks on dog, Cuscuta ,a parasitic plant grow on hedge plants.
- ENDOPARASITES: Parasites that live inside the host body at different sites.Eg. Tape worm, liver fluke.

Brood parasitism: Special type of parasitism found in birds.

- The parasitic birds lay its eggs in the nest of its host and let the host incubate
- them. The egg of the host is very similar with the egg of the host. Eg.Cuckoo lays eggs in the nest of the crow.
- 4. COMMENSALISM•.
- This is the interaction in which one species benefits and the other is neither benefited nor
- harmed.

Orchids growing as an epiphyte on a mango Barnacles on back of whales.

- branch. Cattle Egret and grazing cattle.

5. MUTUALISM

- Clown fish living among tentacles of

sea anemone.

Mutualism is the interaction between two living organisms where both the organisms are equally benefitted and no one is harmed.

- Lichens represent an intimate mutual relationship between a fungus and photosynthetic algae.

Mycorrhizae are associations between fungi and the roots of higher plants .

- Plants provide nectar and pollen for pollinating agents and the pollinating agents in turn pollinate the flowers of plants.
- Animals disperse the seeds of plants and plants provide juicy fruits for seed dispersers. Female wasp uses the fruit as an egg-laying place and also uses the developing seeds within the fruits for nourishing its larvae.
- Wasp pollinates the fig inflorescence while searching for egg laying site, in return fig offers developing seeds as food for developing larvae.
- Sexual deceit
- Mediterranean orchid Ophrys employs 'sexual deceit'.
- Petal of the flower resembles the female bee.
- The male bee attracted to what it perceives as a female, 'pseudocopulates' with the flower but does not get any benefits.