Population ecology

- Definition:
  - study of aggregation and interdependencies between individuals of the same species where various factors governing such process are called “Population ecology”.

- Types of population
  - Monospecific population:
    - It is the population of individuals of only one species.
  - Mixed or polyspecific population:
    - It is the population of individuals of more than one species.
    - Polyspecific population generally referred as “community”.

Types of interactions

- Most ecologist uses the term "Symbiosis", proposed by De Bary in 1879 showing living together.

- Types of interactions
  - Positive interaction
  - Negative interaction

    - The relations where at least one of the species is harmed have been grouped under "antagonism".

Possible combination

Combination	Detailed effect	Interaction type
0-0	Neither population affects the other	Neutralism
- -	Direct inhibition of each species by other	Competition (direct interference type)
- -	Indirect inhibition where common resource is in short supply	Competition (Resource use type)
- 0	Population 1 inhibited, 2 not affected	Amensalism
+ -	Population 1, the parasite smaller then 2 the host	Parasitism
+ -	Population 1, the predator, generally larger than 2, the prey	Predation
+ 0	Population 1, the commensal, benefits while 2, the host, is not affected	Commensalism
+ +	Interaction favorable to both but not obligatory	Protocooperation

Positive			Examples
	Mutualism	Both species derives benefits, association is compulsory for survival of both species	Pollination, Lichens, nitrogen fixer enzymes, Mycorrhizae
	Protocooperation (non-obligatory mutualism)	Association is non-obligatory	Sea anemone and hermit crab
	Commensalism	Only one species benefited, neither is harmed	Linas, Epiphytes , crab in mental cavity of oyster, birds in crocodile mouth etc.
Negative	Exploitation	1 sp. harm other by making it direct or indirect use for support, shelter or food.	Some bird and ants inhabit other dwelling sites.
	Parasitism	Population 1, the parasite smaller then 2 the host	
	Predation	Food derived by killing host	Plant as food, carnivore plants
	Antibiosis	1 sp. harmed another by producing chemical	Microbes, antibiotics
	Competition	Direct inhibition of each other, Types: 1. Interspecific, 2. Intraspecific	

Subject of population ecology

- Population characteristics:
  - Various characteristics to a group or population not to an individual.
- Dynamics:
  - The various theories to explain the population growth.
- Regulation:
  - The factors which govern population density

Population characteristics

- Population size and density
- Dispersion
- Age structure
- Natality (Birth rate)
- Mortality (Death rate)
- Life tables

Size and density

- Expressed as the number of individuals in a population.
- Density:
  - Express as the total number of individual per unit area or volume at a given time.
  - Density = Total number of individual/area or space
- Types of density
  - Crude density: density per unit total space.
  - Specific (ecological) density: density per unit of habitat space (available of area that actually colonized by population)

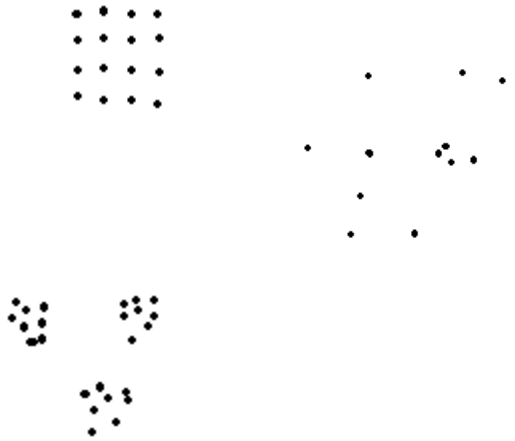
Growth rate = $\Delta N/\Delta t$, ΔN= current population - initial population

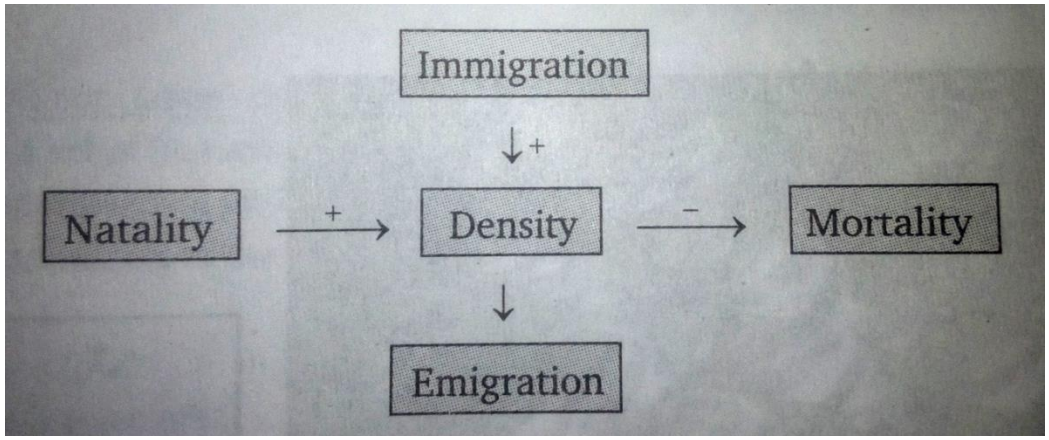
Δt= current time - initial time

Specific growth rate = $\Delta N/N\Delta t$, N = initial number

Dispersion

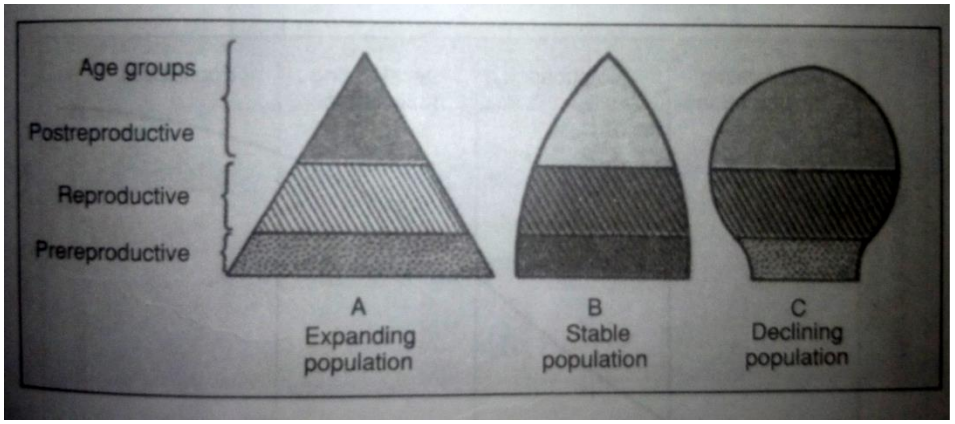
- Spatial pattern of individual
- Types:
  - Regular/uniform dispersion
    - (cropland, animal with territory)
  - Random dispersion
    - (trees position)
  - Clumped dispersion
    - (fishes, new born, antilope)





Age structure

- The proportion of individuals in each age group is called “age structure”.
- Types of ecological ages:
  - Pre reproductive
  - Reproductive
  - Post reproductive
- The model representing geometrically called “age pyramid”.
- Types
  - Triangular age pyramid
  - Bell shaped age pyramid
  - Urn shaped age pyramid



Natality (Birth rate)

- Birth at particular time called natality.
- Types:
  - Maximum/absolute/potential/physiological natality:
    - Reproduction under ideal condition
  - Ecological or realised natality:
    - Population increase under actual condition
- Absolute natality rate: $\Delta Nn/\Delta t$
- Specific natility rate: $\Delta Nn/N\Delta t$

  N = initial number of organisms

  n = new individuals in the population

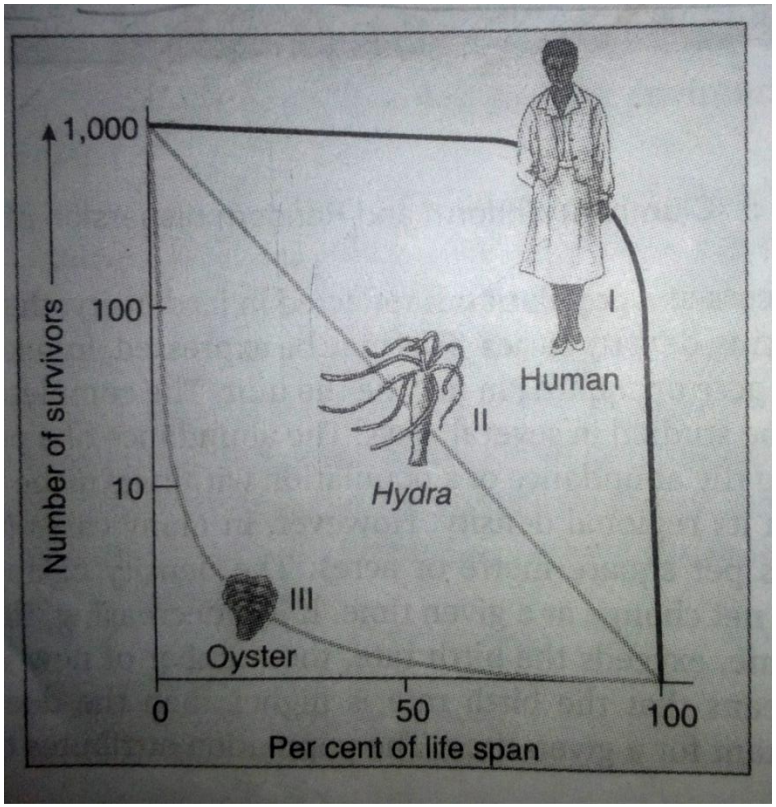
Fecundity: is the reproductive output, usually of an individual or number of offspring produced or capacity of reproduction.

Mortality (Death rate)

- Types:
  - Specific/potential/minimum mortality:
    - Under ideal condition
  - Ecological or realised mortality
    - Actual loss of individuals under environmental condition.

Vital index = Natality/Mortality × 100

- Survival rate is expressed by survival curve
  - Highly convex curve
  - Highly concave curve
  - Diagonal curve



Thanks