

Population Ecology

*use light purple
textbook*

Definitions:

• Individuals

↳ A single member of a population.

• Species

↳ A group of organisms that may interbreed and produce offspring that is also capable of reproducing the same kind.

• Population

↳ A group of the same species in the same place at the same time.

• Community

↳ A collection of populations in the same area of the same time.

• Ecosystem

↳ The community (biotic) and abiotic factors.

- Natural system in which life cycles of plants and animals are closely linked to each other and to the non-living environment.

- They can vary in size from Global to Micro.

- They are sustained by the energy flow through it - starting with plants converting the sun's energy (photosynthesis) then through the food chain's trophic levels.

Population Parameters:

lovely exam question!

- + • Natality - number of births per unit population per unit time
- • Mortality - number of deaths per unit population per unit time
- + • Emigration - number of individuals leaving per unit population per unit time
- • Immigration - number of individuals arriving per unit population per unit time

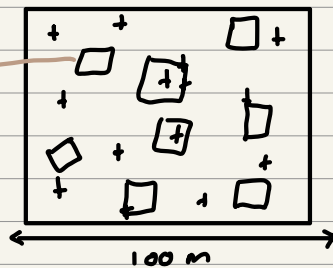
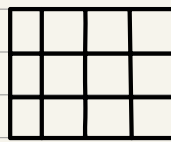
↑
Increases or decreases a population

Estimating Population Size / Density / Frequency :

- **Census** - complete count of a population
↳ In wild life they can use aerial photographs to then count the individuals. e.g. Elephants
- **Straight line survey aka Transect**
↳ Driving or walking in a straight line and only counting what you can see in a defined distance from that line.

- **Use of quadrats**

- Precautions**
- ↳ randomly placed
 - ↳ uniform landscape
 - ↳ reliable collection
 - ↳ sufficient done to represent population



- **Capture, mark, release & recapture technique**

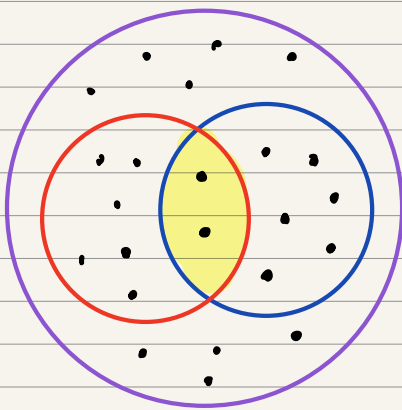
$$N = \frac{n_1 \times n_2}{n_3}$$

N = population estimate

n_1 = numbers captured, marked, and released (DAY 1)

n_2 = number captured on second occasion (DAY 2)

n_3 = number of marked individuals recaptured (DAY 2)



~~///~~ total population
~~///~~ 1st capture (n_1)
~~///~~ 2nd capture (n_2)
 ● recapture (n_3)

$$N = \frac{6 \times 6}{2} = 16$$

Example:

$$\frac{92 \times 64}{15} = 350 \checkmark$$

Group	Estimate	Actual
1	215	315
2	126	414
3	438	335
4	219	395

Total Estimate : 997

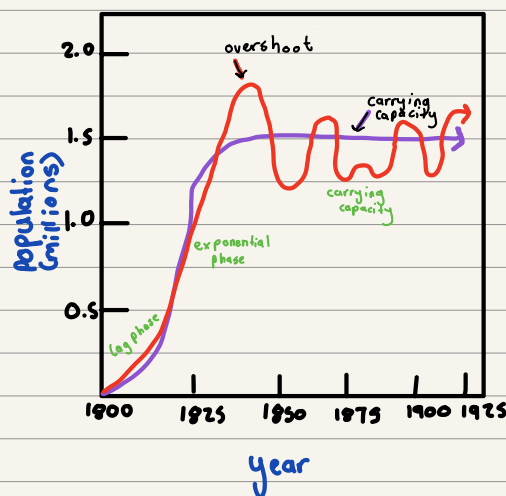
Total Actual : 1449

↳ precautions

- moving animal, cannot be a tree
- depending on the animal: short time between $n_1 + n_2$
- several trials
- higher number is more accurate
- marking technique must not harm, damage, or put the animal in danger
- effective releasing of individuals (don't hurt them)
- no immigration, emigration, deaths, births
- release them in the same place you captured them

Carrying capacity:

- How many of an organism can live on a piece of land or area.



↑ typical carrying capacity graph.

- Maximum population size a certain environment can support for an extended period of time.
- Under ideal conditions, a population naturally increases until it overshoots the carrying capacity.
- At this point, the environment can no longer provide for the species, due to a number of different environmental resistances.
 - ↳ including food, crowding, competition, etc.
- Due to lack of resources, the population will die out.
- Environment can recover.
 - ↳ and the species will flourish again leading to a fluctuation between the prosperity of the species and the prosperity of the environment.
- ★ This growth is called logistic growth, S-shaped

Limiting factors:

- Abiotic
- Biotic

Density Dependant	vs.	Density Independent
food shortage		flood
competition for breeding spaces		change in temp
production of waste		fire
use of pesticides		use of pesticides
destruction of habitat		destruction of habitat
competition for shelter		drought
parasites		earthquakes
increased predation		Phenomena (natural disaster)
disease		Abiotic factors (temp, CO ₂ level)
stress		Weather (floods, storms)
emigration		
predation risk		
Predators		
Availability of resources (e.g. shelter, water)		
Nutrient supply (food)		
Disease / pathogenic spread		
Accumulation of wastes		

Social Organization:

- Must improve the survival and reproductive success of an individual.

Prey-predator relationships

↳ impala and lion

↳ group

↳ impala and leopards

↳ alone

PREY - an animal hunted or seized for food, especially by a carnivorous animal.

PREDATOR - an animal that hunts and seizes, and eats another animal.

PREDATION - a relationship between two species of animal in a community, in which one (the predator) hunts, kills, and eats the other (the prey).

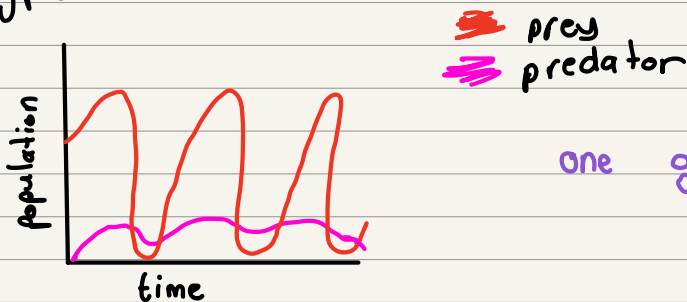
insect example: lady bugs eat juvenile lady bugs (nymph) because the ladybug thinks it is an aphid.
↳ parasite

live in water
Dragonfly nymphs eat mosquitos and tadpoles. Dragonflies make their legs basket shaped to pick up mosquitos in water and other flying insects.

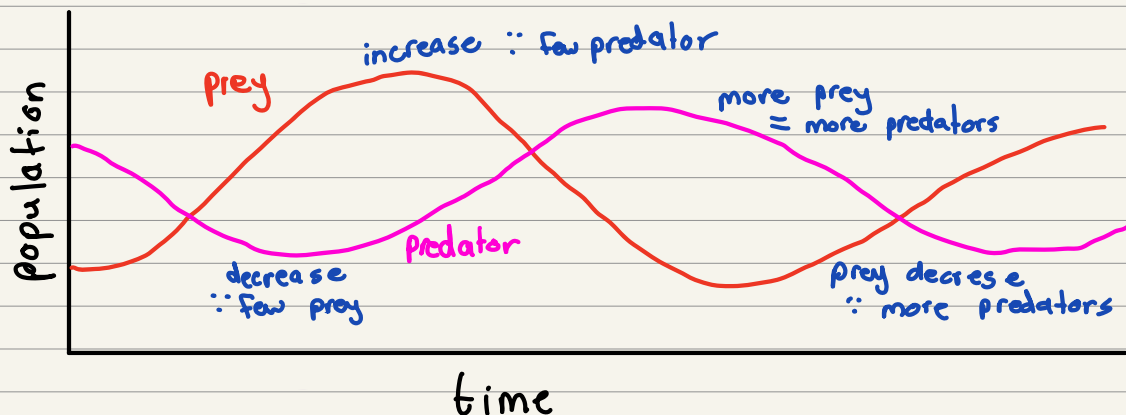
Prey-Predator graphs:

Heading → below
Scales
Axes
Type

table heading → above
picture heading → below

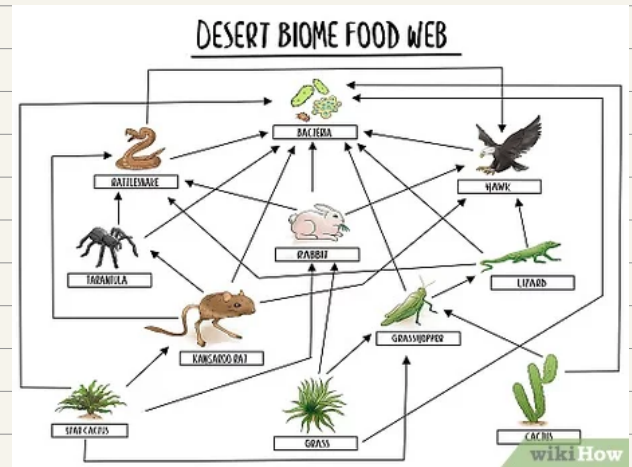
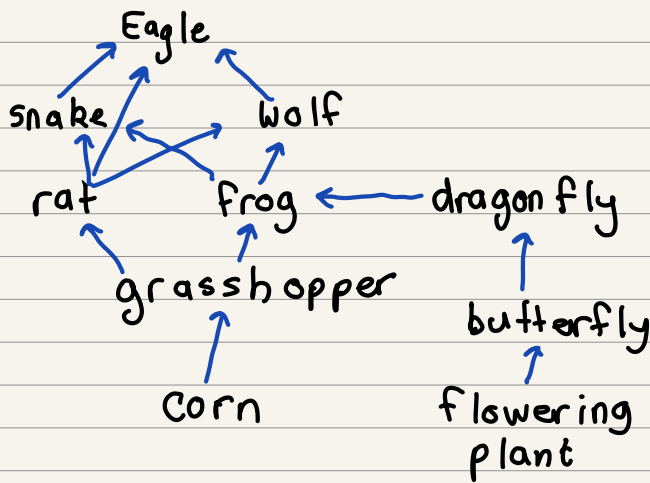


one goes up, other goes down



Food Web Rules:

- lines show flow of energy
- arrow shows which way the flow of energy is
- never include the sun
- always starts with an autotroph (photosynthesise)
 - ↳ no bacteria or mushrooms
- don't put unusual things



tree → aphid → ladybug → bird

Inter and Intra specific competition:

Inter : different species

↳ lions and hyenas fighting over a carcass

Intra : same species

↳ two groups of mongooses fighting over habitat

food

shelter/habitat

space

water

access to mates

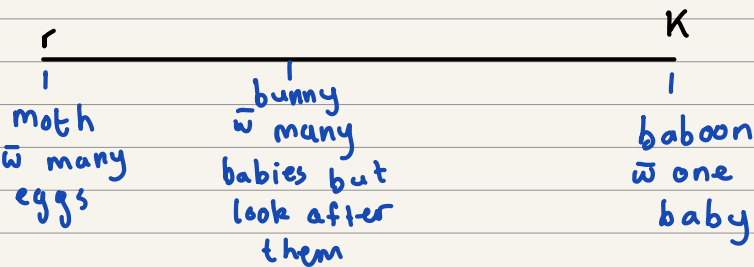
exam question: two photos
and determine which is
inter and which is intra.

r and K strategies:

r species : many offspring
rotten } } } limited or no overlap of generations
usually short lived
moth with many eggs
flowers that drop too many seeds that the land cannot germinate all

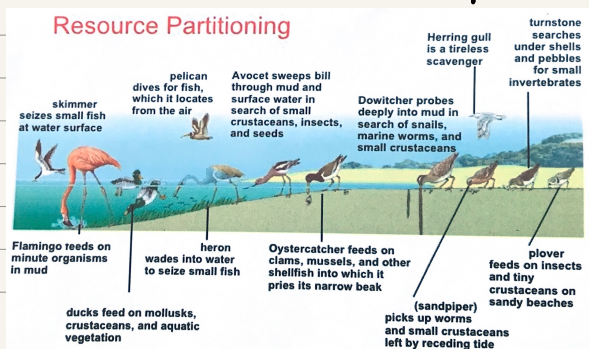
K species : few offspring
overlap of generations
often parental care
usually long lived
king
baboon with one baby
tree produces nurtured fruit to produce a good tree

there is a spectrum



Reducing competition through RESOURCE PARTITIONING:

Is the division of limited resources by species which means competition is minimised in an ecological niche. In any environment, organisms compete for limited resources, so organisms and different species coexist with one another because of resource partitioning.



anywhere where there is a shared resource

water birds in same area, eating different things

South African example:

giraffe → eat from trees

kudu → eat from bushes

zebra/impala → eat grass

} same area different food

In plants:

they share soil nutrients and water, pollinators

