Section 1.1 – Populations and ecosystems

Ecology

The study of inter-relationships between organisms and their environment
Abiotic – non living components
Biotic – living components
The supporting layers of land, air and water that surrounds the earth is called the biosphere.

Ecosystems

Made up of all the interacting abiotic and biotic features of a specific area
Species are made up of many groups of individuals called populations.

Populations

A population is made up of all the interbreeding organisms of one species in a habitat
Boundaries of populations can be difficult to define
Populations of different species form a community

Community

A community is made up of all the different populations of different species living and interacting in a given place at a given time.

Habitat

A habitat is a place where a community of organisms live.

Ecological niche

Describes how an organism fits into its environment
Refers to where an organisms lives and what it does there
Includes all biotic and abiotic requirements for an organism to live
No two species will occupy the exact same niche

Section 1.2 – Investigating Populations

Due to time constraints and collateral damage, only small areas within a habitat are studied in detail; these samples represent the population as a whole.

The larger the number of samples, the more representative of the community the results will be.

Random sampling – Quadrat
Systematic sampling – Transect

Size of quadrate – Larger quadrats are used to measure larger species. If the species occurs in groups, a large number of small quadrats should be used.
Number of quadrats – Greater number of species, greater number of quadrats
Position of quadrats – Random

<u>Systematic Sampling</u>

Line transect – used to illustrate a transition along which communities of plants/animals change. E.g. Zonation

Provides a way of being able to clearly visualise the changes taking place
Any organism over which the line passes is recorded.

Belt transect – provides information of the density of a species. If detailed density is required a belt transect should be used.

Abundance – Number of species in a given space
Frequency – chance of a particular species occurring within a quadrat
Percentage cover – Estimate of the area within a quadrat that a species occupies

To measure the abundance of a mobile species:

$$\textbf{Estimate of population} = \frac{\textbf{no. individuals caught in first sample x no. caught in second sample}}{\textbf{No. recaptured}}$$

Assumptions:

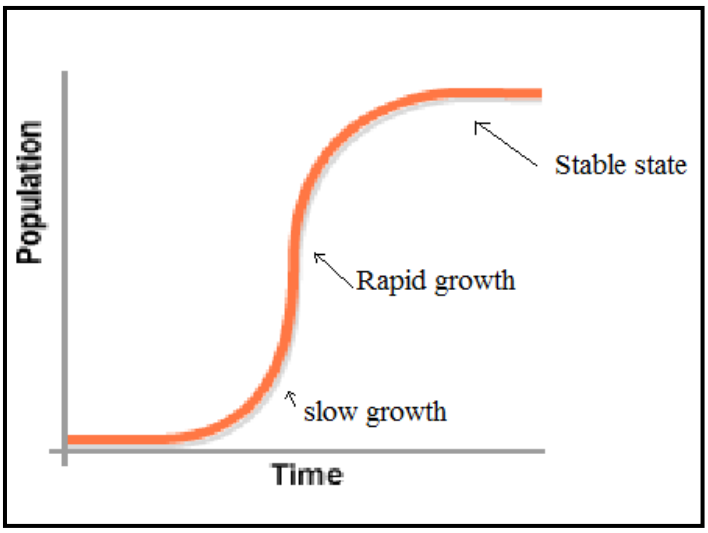
- Proportion of marked/unmarked individuals is the second sample is the same for the whole population
- Individuals in the first sample distribute themselves evenly
- The population has a definite boundary. (no immigration/migration)
- Birth/Death is low
- Marking method is not toxic/ conspicuous
- Marking is not lost

Section 1.3 – Variation in population size

Population growth curves

Growth curves of populations usually have three main phases:

1.) A period of slow growth due to the fact that there is only a limited number of interbreeding species
2.) A period of rapid growth, caused by the ever increase in organisms that are able to reproduce. For each interval of time the population size doubles
3.) Population size begins to level off as there are limiting factors on the population growth such as availability of resources.



Population size

No population growth will continue indefinitely. This is because in time there will eventually be limiting factors that will limit the population size.
The various factors that limit population size can be of two types, abiotic and biotic.

Abiotic

- **Temperature** – Each species has an optimum temperature at which they survive best at. The further a group of organisms are away from this temperature, the smaller there growth rate will be. If they are below the temperature, metabolic rate maybe lower if they are cold blooded. However if they are mammals, they will produce heat during respiration, at low temperatures more energy is used to maintain a stable body temperature and less is used for growth.

- **Light** – Light is the ultimate source of energy for an ecosystem. If light intensity is greater in plants, the more energy they can use to create spores and seeds and so they reproduce quicker.

- **pH** – Affects the function of enzymes. Enzymes work best at different pH levels and so if an organism exists somewhere where there are more appropriate pH levels then they will likely have a larger population.

- **Water and** humidity – humidity affects transpiration rates in plants and the rate of evaporation of water from animals.

Section 1.4 / 1.5 – Competition / Predation

Competition between members of the same species is intraspecific
Competition between members of different species is called interspecific

Intraspecific competition

Populations that undergo intraspecific competition are often limited by the number of resources available.
An example of intraspecific competition is when oak trees compete for resources. In a large population of small oak trees, the larger ones will grow and out-compete the others for water minerals and light. The final population will eventually be fewer large oak trees.

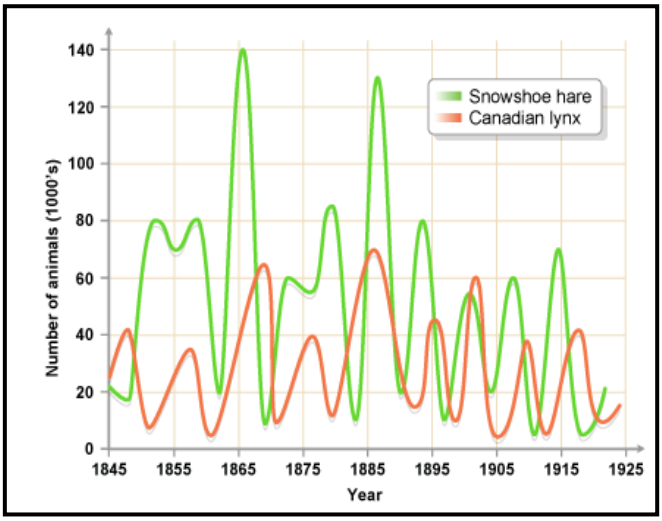
Interspecific competition

The competitive exclusion principle states that where two species are competing for limited resources the one that uses these resources most effectively will ultimately eliminate the other one.

Predation – occurs when one organisms is consumed by another

Effect of predator – prey relationship on population size

The affect of population size for the predator prey relationship is summarised as follows:



Predators eat there prey, thereby reducing the population of the prey
With fewer prey available, the predators are in competition with one another for the prey that is still left
Predator population decreases due to some predators not being able to catch enough prey
With fewer predators around, fewer prey are consumed
Prey population increases
More prey available, predator population also increases

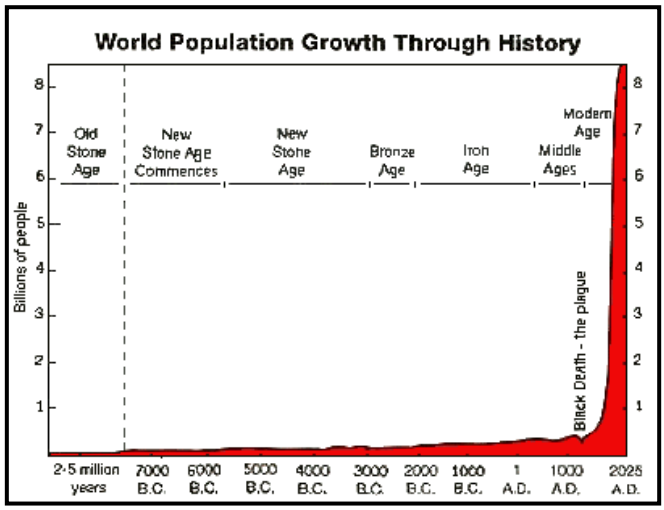
In reality, there is normally more than one food source available so population size fluctuations are rarely so severe
Periodic population crashes create selection pressures that only allow certain individuals with the alleles to survive adverse conditions.

Section 1.6 – Human Populations

Human population size and growth rate

There are two major factors that have caused an increase in the size of the human population:
The development of agriculture
The development of manufacturing that created the industrial revolution

Factors affecting growth and size of human populations



It is the balance between the birth and death rate that ultimately determines whether or not the population is increasing, decreasing or remaining the same.
Individual populations are affected by migration
Immigration – joining a population from outside
Emigration – leaving a population

Population growth = (Births + immigration) – (deaths + emigration)

% growth rate in a given period = <u>population change during a period</u> x 100
population at the start of a period

Factors affecting birth rates

Economic conditions – less developed countries tend to have higher birth rates
Cultural/religious backgrounds – some countries/religions encourage larger families
Social pressures – in some countries, a larger family improves social standing
Birth control – the extent at which contraception/abortion is available affects birth rate
Political factors – governments can influence birth rates through education and taxation

Birth rate = <u>number of births per year x 1000</u>
Total population in the same year

Factors affecting death rate

Age profile – the greater the proportion of elderly, the higher the death rate
Life expectancy at birth – Residents of more developed countries tend to live longer

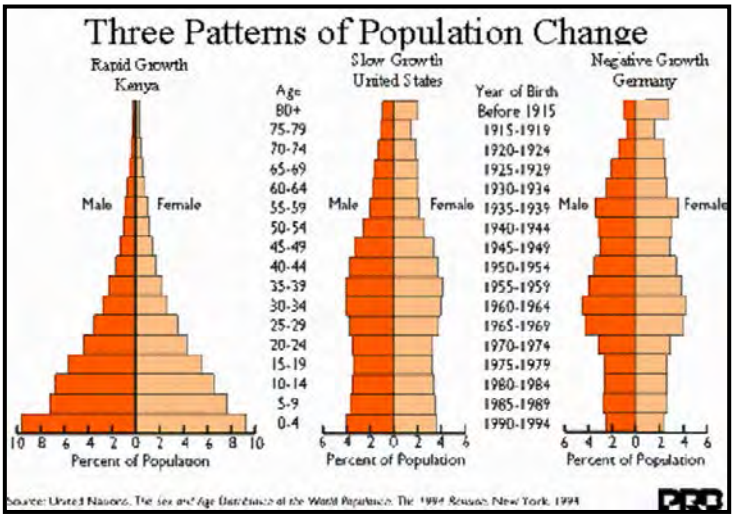
Food supply – Poor nutrition will cause an increase in death rate
Safe drinking water – poor quality drinking water will cause an increase in water born diseases thus increasing death rate
Medical care – access to medical care will reduce death rate
Natural disasters – the more prone a region is to drought/famine, the higher the death rate
War – War will cause an increase on death rate

Death rate = <u>number of deaths per year x 1000</u>
Total population the same year

Population structure

The change in societies regarding the change from life expectancy being short at birth and birth rates being high to those where life expectancy is long and birth rates are low, is an example of demographic transition

A graphical representation of the % of males and females of certain age groups in populations is called an age population pyramid



Stable population – birth and death rate is fairly the same. Population does not grow
Increasing population – Has a wide base to the pyramid indicating that there is a high birth rate
Decreasing population – Narrow base to the pyramid as there is a low birth rate.

Survival rates and life expectancy

Shows the % of people still alive in a population after a given amount of time
The average life expectancy is the age at which 50% of the population is still alive