WJEC (Wales) Biology GCSE

Topic 2.1: Classification and Biodiversity

Notes

('Higher Tier only' in **bold**)

Classification

Classification is the organisation of organisms into groups. Living organisms can be broadly classified into five groups:

- Plants - flowering and non-flowering
- Animals - vertebrate (backbone) and invertebrate (no backbone)
- Fungi
- Protoctists (single celled organisms)
- Bacteria

Organisms are often classified into groups based on similar physical features. The classification of organisms is important because:

- It makes it easier to identify organisms.
- It aids communication between scientists.

Organisms are given scientific names to facilitate universal communication:

- Scientific name given in two words.
- First name (genus) begins with a capital letter.
- Second name (species) begins with a lowercase letter.
- Words written in *italics*, or if handwritten underlined.
- e.g. *Panthera tigris* or Panthera tigris.

Adaptations

Adaptations are characteristics of an organism that increase its chance of survival. They are maintained by natural selection. There are two types of adaptation:

- Morphological - structural adaptation e.g. camouflage.
- Behavioural - aspect of behaviour that aids survival e.g. bird calls.

Competition

Organisms require different resources from the environment:

- Light
- Food
- Oxygen
- Carbon dioxide
- Water
- Minerals

These resources are limited, creating competition between organisms.

Competition occurs between members of the same species (e.g. for the same food) and also between members of different species (e.g. for space).
Competition, (as well as predation, disease and pollution) limits population sizes within a community. It is important as the driving force of evolution by natural selection.

Biodiversity

Biodiversity is a combination of:

- Species diversity (variety of living organisms)
- Genetic diversity (number of different genes)
- Ecosystem diversity (range of ecosystems)

Importance

It is important for a number of different reasons:

- Safeguards future food supplies by maintaining food chains important to humans.
- Many plant species are yet to be discovered and may contain chemicals that could be used in future medicines.
- Reduces damage to food chains.
- Protects valuable future resources e.g. fuels, paper.
- Biodiversity creates stable ecosystems that are more likely to be able to adapt to future environmental change.
- Aesthetic reasons.
- Ecotourism benefits communities.

Maintenance of biodiversity

Biodiversity can be maintained by…

- Protection of endangered species e.g. breeding programmes increase population sizes.
- Conservation schemes to protect entire ecosystems e.g. national parks.
- Reforestation
- Sustainable farming e.g. fishing quotas, fewer pesticides.
- Minimising global greenhouse gas production.
- Legislation to protect a single species or an entire habitat.
- Seed banks

Passing legislation to protect habitats can be difficult because the needs of the human population sometimes conflict with the conservation of the environment e.g. a rising human population means we need more food, however, farmland disrupts natural habitats and reduces biodiversity.

It is important to balance the need for resources with the need to preserve the biodiversity of ecosystems. This is essential to protect ecosystems and endangered species, whilst still maintaining quality of life for humans.

Sampling

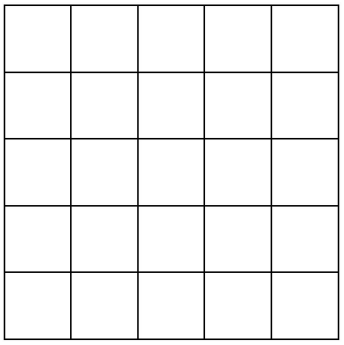
Biodiversity can be estimated by sampling areas of an ecosystem.

When choosing a sample area, ensure:

- Sample is of a sufficient size - the larger the sample size, the more representative of the area and the greater its validity
- Avoid bias when choosing sample areas
- Sampling method has no effect on the results

Quadrats

A quadrat is a square frame divided into smaller square sections. It can be used to investigate the biodiversity of an area by:



- Counting members of each species present in the quadrat.
- Estimating the % coverage of each species
  (e.g. each smaller square in the diagram represents 4% of the total area of the quadrat on the right).

A quadrat can be used as follows:

1. Position two 20 m tape measures at right angles along the border of the sample area.
2. Use a random number generator to randomly select two numbers which serve as the x-coordinate and y-coordinate with the tape measures as the axis.
3. At each location, place the lower left hand corner of the quadrat at the coordinate point.
4. Identify and record the numbers of each species present or the % coverage of each species.

<u>Example calculation</u>

The number of daisies in an area of 1000 m^2 is to be estimated. The sample is 100 quadrats of with sides that measure 0.5 m. 220 daisies are counted. Calculate the number of daisies in the area.

Area of each quadrat = 0.5m × 0.5m = 0.25 m^2
100 quadrats ∴ total area = 100 × 0.25m^2 = 25 m^2

220 daisies in 25 m^2 ∴ total number of daisies = $\frac{1000}{25}$ × 220 = 8800 daisies

Capture-recapture technique

The capture-recapture method is used to sample animal populations:

1. **Capture a number of individuals of one species.**
2. **Mark the captured individuals.**
3. **Release back into the sample area.**
4. **After a suitable period of time, recapture more individuals of the same species.**
5. **Count the number of marked individuals.**
6. **Estimate the total population using:**

$$N = \frac{M \times C}{R}$$

where…

N = total population size estimate
M = total number of animals initially captured and marked
C = total number of animals captured the second time
R = total number of marked animals recaptured the second time

Accurate results are obtained only when:

- **Adequate time between first and second samplings.**
- **No significant movement of the population into or out of the area during the time between samples.**
- **Marking method does not adversely affect animal survival e.g. disrupting camouflage.**
- **Marking method does not affect the probability of recapture.**
- **Marks do not rub off.**
- **Few births or deaths in the population.**

Example calculation

The number of snails in an area is to be estimated. 75 snails are captured, marked and released. 3 days later a sample of 60 snails are captured, 25 of which are marked. Calculate the total number of snails in the area.

$$N = \frac{M \times C}{R} = \frac{75 \times 60}{25} = 180 \text{ snails}$$

Biological control

Biological control is when a new organism (often described as an 'alien species') is deliberately introduced into an ecosystem to control a pest or pathogen.

An alien species is a new species that is introduced into an area (where it is not naturally found). There are many problems associated with the introduction of alien species:

- Alien species population may grow out of control if they do not have a natural predator
- They may outcompete or prey on existing species
- They may carry new diseases that could infect existing species

Detailed research and trials must be carried out before the introduction of alien species into an area.