OCR (A) Biology A-level

Module 1: Development of practical skills in Biology

PAG 3: Sampling Techniques

Please note: You only need to do one from each PAG, and you don't need to do the PAGs listed here, as long as you show the same skills that these are testing (see 5f of the specification for more information). However, you need to at least be able to design your own method for most of these experiments in the exam.

Types of sampling:

Types of sampling		Explanation	Positives	Limitations
Random		This is where sample sites are selected randomly. For example, this can be done by using random numbers as coordinates.	This prevents selective sampling, ensuring the data is not biased.	Not all areas/types of habitat may be sampled equally, leading to inaccurate data. Also, species with a small population may be missed, leading to an underestimate of biodiversity.
Non-random	**Stratified**	In this method, the habitat is divided into groups that appear different, and each area is sampled separately. Each group should be mutually exclusive (each population can only be in one group) and collectively exhaustive (no population must be left out). An example of this is if gorse patches are sampled separately from patches of bracken.	This ensures that all areas are sampled and prevents small populations from being missed out (e.g. in random sampling). It also allows areas of different population levels in the same habitat to be sampled equally (e.g. an area with a higher population could be sampled with more transects in the same area).	This may lead to some over-representation of some areas in the study, for example small areas may be sampled more than necessary because they look different from other areas.
	Opportunistic	This method is when areas are chosen to sample by the researcher either using their prior knowledge, or choosing areas that interest them as they are collecting data.	This is easier and quicker than random sampling, and produces more data.	This method has a potential for bias. Species which are more noticeable (e.g. due to size or being colourful) may be included more often than less noticeable species, leading to an overestimation of their importance, and an inaccurate estimate of biodiversity.

	Systematic	This is when samples are taken at set distances (e.g. every 5 metres). An example of this is using a transect.	This is good to view a change in biodiversity or populations along a line	This method has the risk of missing species as only a small area is sampled. This could cause biodiversity to be underestimated.

Calculation of species diversity:

Species diversity is a measure of the **number of different species in a given community** (a community is the sum of the populations of different species living in the same place and time).

1. Select a suitable area for sampling.
2. Place **two long tape-measures at right angles to each other** along the border of the region you are going to sample (see diagram).
3. **Randomly generate numbers** to decide where to sample. For each position, a random number for the x coordinate (read off the horizontal tape measure) and a random number for the y coordinate (read off the vertical tape measure) should be generated.
4. To sample at each random location, place the left-hand corner of the quadrat at the position where the two coordinates meet/intersect.
5. Identify the different species in the quadrat using a key (e.g. a dichotomous key) and count the number of each present. Calculate the percentage cover. Record this in a table or spreadsheet.
6. Generate new coordinates and repeat the sampling process at least 9 times more.
7. Use Simpsons index of diversity to calculate the species diversity (D) using the following formula:

$$D = 1 - [(n / N)^2]$$

N = total number of organisms of all species
n = total number of a particular species
= sum of – in this equation you need to work out $(n / N)^2$ for each species, then add these together

Calculation of species abundance:

Species abundance is a measure of the **amount of a certain in a specific habitat.**

This method is very similar to the method for calculating species diversity.

1. Perform steps 2-6 of the above species diversity method

2. The population size of each species can be estimated by multiplying up the sample size.
3. Produce a graph of species abundance in different areas.

Calculation of species abundance and distribution:

Species distribution is a measure of where species are located / how species are distributed.

Note that this practical will produce more interesting results if conducted across a length where the habitats (and therefore species) change along it. A good example of this is along a beach, or across sand dunes.

1. Use a measuring tape to make a **transect** over the area you wish to sample.
2. Place quadrats at given intervals along the tape measure (e.g. every 5 metres). The **bottom left-hand corner of each quadrat should be touching the relevant metre mark, and the left-hand edge runs along the tape measure** (so the quadrats should be immediately to the right of the tape measure).
3. Identify the different species in each quadrat using a key and count the number of each present. Calculate the percentage cover. Record in a table.
4. Produce a graph of species distribution against distance along transect (e.g. a **kite diagram**).