18.2 Biodiversity

Name: _____ Class: _____ Date: _____ **Total: 23 marks**

KEY WORDS biodiversity • mark-release-recapture • ecosystem • niche • quadrat

Objective

Build the skills to answer exam questions on **biodiversity** – **ecosystem** and **niche**, the levels of biodiversity, **random sampling** methods, and **Simpson's index**.

You must be able to:

- define ecosystem and niche and explain the levels of biodiversity
- describe sampling methods (quadrats, transects, mark-release-recapture)
- use the Lincoln index and Simpson's index of diversity

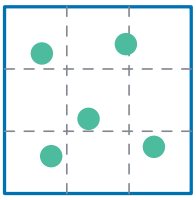
1 Key knowledge and worked examples

■ Levels of biodiversity

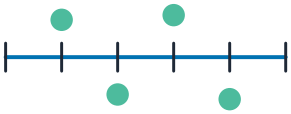
Biodiversity = the range of ecosystems, the number of species (and abundance), and genetic variation within a species

An **ecosystem** is the living things in an area plus their non-living surroundings; a **niche** is a species' role and place within it.

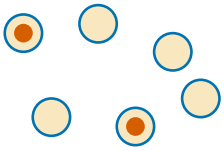
■ Sampling methods



quadrat
count species in a square



transect
record along a line



mark-recapture
mark some (red), release, then re-catch

Quadrats and transects sample fixed organisms; mark-release-recapture estimates mobile animals

Random sampling avoids bias. The **Lincoln index** estimates a population: $N = \frac{n_1 \times n_2}{m}$ (first catch × second catch ÷ marked recaught).

■ Simpson's index of diversity

$$D = 1 - \sum \left(\frac{n}{N}\right)^2$$

where n = number of one species and N = total of all species. A higher D means more diverse and usually more stable.

2 Practice

2.1 Define the term **niche**. [1]

2.2 Name a sampling method suitable for (a) plants in a field and (b) mobile beetles. [2]

3 Exam-style questions

3.1 Why is random sampling important when measuring biodiversity? [1]

☐ **A** it counts every organism
B it avoids bias and gives a fair, representative sample
C it is faster than other methods
D it only samples the rarest species

3.2 A higher value of Simpson's index of diversity (D) indicates: [1]

- **A** fewer species
- **B** a more diverse, usually more stable, community
- **C** a smaller area
- **D** more abiotic factors

3.3 In a mark-release-recapture study, 60 snails are caught, marked and released. Later, 80 are caught, of which 24 are marked.

(a) Use the Lincoln index to estimate the population size. [2]

(b) State **one** assumption of this method. [1]

3.4 A pond contains 3 species with 5, 3 and 2 individuals (N = 10). Calculate Simpson's index of diversity, D. [3]

3.5 A student used ten randomly placed quadrats, each 0.25 m^2, to sample a grassland. Species **A** was present in 7 quadrats, with a total of 84 individuals across all ten.

(a) Explain what is meant by *ecosystem* and by *niche*. [2]

(b) Calculate the percentage frequency and the density per square metre of species **A**, showing your working. [4]

(c) Describe how the student should have positioned the quadrats, and explain why random positioning matters. [3]

(d) Name the three levels at which biodiversity is measured, and explain why counting species alone can be misleading. [3]