

18.2 Biodiversity

Name: _____ Class: _____ Date: _____

Total: 11 marks

Objective

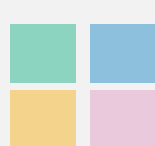
Build the skills to answer exam questions on **biodiversity** — **ecosystem** 生态系统 and **niche** 生态位, the levels of biodiversity, **random sampling** 随机取样 methods, and **Simpson's index** 辛普森指数.

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 Worked examples

■ Levels of biodiversity



ecosystem
diversity



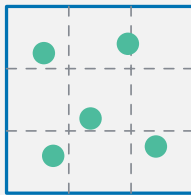
species
diversity



genetic diversity
(within a species)

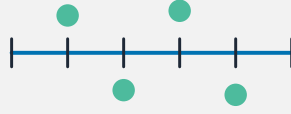
Biodiversity = the range of ecosystems, the number of species (and abundance), and genetic variation within a species

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



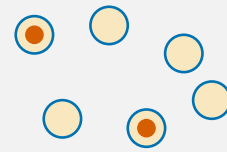
quadrat

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 $\times$ second catch $\div$ marked recaptured).

■ 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]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **18.2 Biodiversity** past-paper sheet in the Library, or try these in **Practice mode**:

- 9700/42 N25 —Q8 (biodiversity)
- 9700/41 J25 —Q5 (sampling and diversity, calculation)

Solutions

2.1 the role and position of a species within its ecosystem.

2.2 (a) quadrats / transects; (b) mark-release-recapture.

3.1 B. Random sampling avoids bias, giving a representative result.

3.2 B. A higher D means greater diversity and usually greater stability.

3.3 (a) $N = \frac{60 \times 80}{24} = 200$ snails.

(b) any one: no births/deaths/migration; marks do not affect survival; marked animals mix randomly.

3.4 $\sum(n/N)^2 = (5/10)^2 + (3/10)^2 + (2/10)^2 = 0.25 + 0.09 + 0.04 = 0.38$; $D = 1 - 0.38 = 0.62$.