

Exercise walk-through

Biodiversity ■ 18.2

eXercise

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

Method — Levels of biodiversity

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

Method — Levels of biodiversity

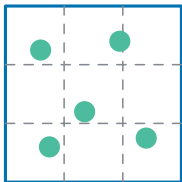


Method — Sampling methods

Random sampling avoids bias. The **Lincoln index** estimates a population:

$$N = \frac{n_1 \times n_2}{m} \text{ (first catch} \times \text{second catch} \div \text{marked recaptured).}$$

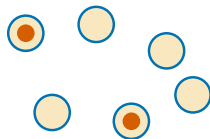
Method — Sampling methods



quadrat
count species
in a square



transect
record along
a line



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

Method — 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.

Practice 2.1 ■ 1 mark

Define the term **niche**.

Solution 2.1

Worked steps

the role and position of a species within its ecosystem **B1**.

Practice 2.2 ■ 2 marks

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

Solution 2.2

Method: Sampling methods

Worked steps

(a) quadrats / transects **B1**; (b) mark-release-recapture **B1**.

Exam-style 3.1 ■ 1 mark

Why is random sampling important when measuring biodiversity?

- 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

Solution 3.1

Method: Sampling methods

- 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

Worked steps

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

Exam-style 3.2 ■ 1 mark

A higher value of Simpson's index of diversity (D) indicates:

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

Solution 3.2

Method: Simpson's index of diversity

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

Worked steps

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

Exam-style 3.3 ■ 2 marks

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.
- (b) State **one** assumption of this method.

Solution 3.3

Method: Sampling methods

Worked steps

(a) $N = \frac{60 \times 80}{24} = 200$ snails **M1** **A1**.

(b) any one: no births/deaths/migration; marks do not affect survival; marked animals mix randomly **B1**.

Exam-style 3.4 ■ 3 marks

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

Solution 3.4

Method: Simpson's index of diversity

Worked steps

$$\sum (n/N)^2 = (5/10)^2 + (3/10)^2 + (2/10)^2 = 0.25 + 0.09 + 0.04 = 0.38 \quad \text{M1} \quad \text{M1};$$

$$D = 1 - 0.38 = 0.62 \quad \text{A1}.$$