

# 18.2 Biodiversity

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 11 marks**

**KEY WORDS** biodiversity 生物多样性 • ecosystem 生态系统 • simpson's index 辛普森指数 • simpson's index of diversity 辛普森多样性指数  
 • random sampling 随机取样

## Objective

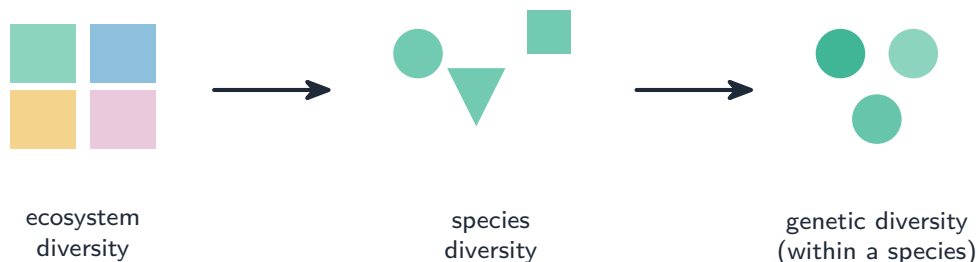
Build the skills to answer exam questions on **biodiversity** — **ecosystem** 生态系统 and **niche** 生态位, the levels of biodiversity, **random sampling** 随机取样 methods, and **Simpson's index** 辛普森指数.

**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

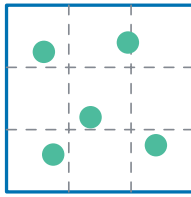
### ■ Levels of biodiversity



*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



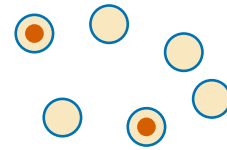
**quadrat**

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  $\times$  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]

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