

Exercise walk-through

2.1

Sampling populations without choosing the answer

International Baccalaureate · IB Diploma · Environmental Systems and Societies ·

2.1 Sampling populations without choosing the answer

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS population • quadrat

Objective

Sampling populations without choosing the answer. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

1 Key knowledge and worked examples

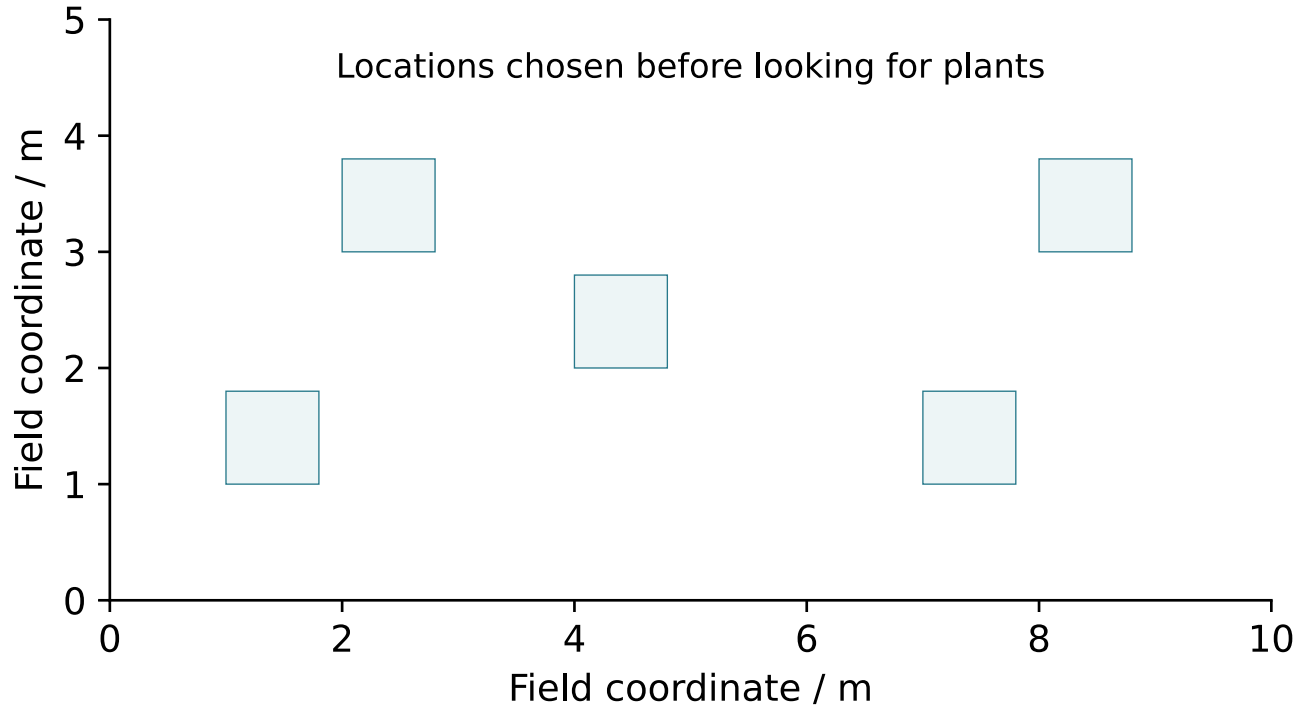
■ What would explain this observation?

- A field edge looks richer in plants than its centre. Choosing only the richest patches would build the desired result into the sampling method.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- A **population** consists of organisms of one species in a defined area. Random **quadrats** estimate density without deliberately selecting patches. A transect investigates change along an environmental gradient.

- quadrat: A defined area used for sampling; population: Organisms of one species in a defined area.



■ Choose evidence that can test it

- Estimate total abundance by multiplying mean density by area, with consistent units. This assumes sampled areas represent the habitat. Patchiness and too few samples widen uncertainty.
- Choose coordinates with random numbers before visiting the patches. Record quadrat area and counting rules. For a transect, use fixed distances and measure a relevant abiotic variable. Do not damage habitats or sample unsafe locations.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions

fit this case, then rearrange before substitution.

- Known: five 0.25 square metre quadrats contain 3, 4, 6, 5 and 2 plants. Mean count = $20/5 = 4$. Density = $4/0.25 = 16$ plants per square metre. Estimated abundance in 100 square metres = $16 \times 100 = 1,600$ plants.

Example:

Mean count is 6 in a 0.5 square metre quadrat. Find density per square metre. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- Quadrats suit organisms that do not move quickly. A food chain arrow shows the

direction of energy transfer, not the direction a predator travels.

- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Sampling only the most crowded patches gives an unbiased population estimate. This claim is false: Quadrats suit organisms that do not move quickly. A food chain arrow shows the direction of energy transfer, not the direction a predator travels.

Key:

Sampling populations without choosing the answer: Estimate total abundance by multiplying mean density by area, with consistent units. This assumes sampled areas represent

the habitat. Patchiness and too few samples widen uncertainty.

Exercises 2.1·2.3

2.1 Which method investigates change from a path into woodland? Choose one answer.

- **A** Choose only large plants
- **B** Use a transect with fixed sampling distances
- **C** Take one convenient sample

[1]

2.2 Mean count is 6 in a 0.5 square metre quadrat. Find density per square metre. Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: Sampling only the most crowded patches gives an unbiased population estimate.

[2]

Exercises 2.1·2.3

2.1 Which method investigates change from a path into woodland? Choose one answer.

- **A** Choose only large plants
- **B** Use a transect with fixed sampling distances
- **C** Take one convenient sample

[1]

2.1 B Estimate total abundance by multiplying mean density by area, with consistent units. This assumes sampled areas represent the habitat. Patchiness and too few samples widen uncertainty.

2.2 Mean count is 6 in a 0.5 square metre quadrat. Find density per square metre. Show the relation, substitution and units.

[2]

2.2 $\text{density} = \text{mean count} / \text{area} = 6 / 0.5 = 12 \text{ plants/m}^2$.

2.3 Decide whether this claim is true and justify: Sampling only the most crowded patches gives an unbiased population estimate.

[2]

2.3 False. Quadrats suit organisms that do not move quickly. A food chain arrow shows the direction of energy transfer, not the direction a predator travels.

Exercises 2.4·3.1

2.4 A defined area used for sampling: write the technical term.

[1]

3 Exam-style questions

3.1 Two fictional sites have mean quadrat counts 6 and 9, but areas 0.25 and 0.50 m². Compare density; propose a defensible sampling design.

[4]

Exercises 2.4·3.1

2.4 A defined area used for sampling: write the technical term. [1]

3 Exam-style questions

2.4 quadrat. quadrat means A defined area used for sampling.

3.1 Two fictional sites have mean quadrat counts 6 and 9, but areas 0.25 and 0.50 m². Compare density; propose a defensible sampling design. [4]

3.1 Densities=24 and 18 plants/m². The larger raw count has lower density. Random or stratified random positions, equal sampling effort and repeats reduce location bias; record uncertainty before extrapolation.