

27.1 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.

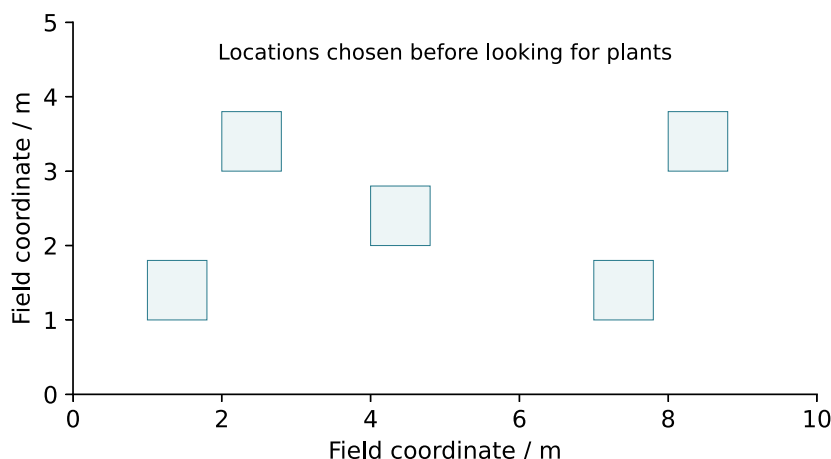
1 Key knowledge and worked examples

■ 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 → model → relation → substitution → 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.

2 Practice

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]

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]

Solutions

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

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.

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

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.