22.1 Sampling populations without choosing the answer

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS population • quadrat

Objective

Sampling populations without choosing the answer. Original classroom practice for IB SL; not an official IB paper.

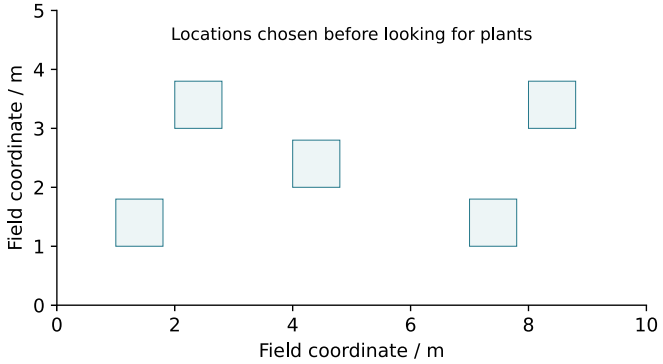
1 Key knowledge and worked examples

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.

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.

In the lab: 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

- 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.

Your turn: Mean count is 6 in a 0.5 square metre quadrat. Find density per square metre.

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.

Not true: Sampling only the most crowded patches gives an unbiased population estimate. Choosing the most crowded patches overestimates density, because the samples are not representative of the whole area. Unbiased estimation needs random or systematic sampling decided before looking at the plants.

Key:

- A population consists of organisms of one species in a defined area.
- Estimate total abundance by multiplying mean density by area, with consistent units.
- Watch for: quadrats suit organisms that do not move quickly.

Write from a density of 25 per square metre

- The mean count is 5 in a 0.20 square metre quadrat.
- Find the density per square metre. Sampling only crowded patches overestimates the population.

2 Practice

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

- **A** Take one convenient sample
- **B** Use a transect with fixed sampling distances
- **C** Choose only large plants [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 m^2. Compare density; propose a defensible sampling design. [4]

Solutions

2.1 B A transect samples at fixed distances along a line, so the change from open path into woodland is recorded systematically. Choosing only large plants or one convenient spot biases the sample and cannot show a gradient.

2.2 density=mean count/area=6/0.5=12 plants/m^2.

2.3 False. Choosing the most crowded patches overestimates density, because the samples are not representative of the whole area. Unbiased estimation needs random or systematic sampling decided before looking at the plants.

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

3.1 Densities=24 and 18 plants/m^2. The larger raw count has lower density. Random or stratified random positions, equal sampling effort and repeats reduce location bias; record uncertainty before extrapolation.