Populations and communities

International Baccalaureate · IB Diploma · Biology · HL

Scope and prerequisites

This handout covers selected HL topics for the course first assessed in 2025; it is not the whole syllabus.

Prerequisites: read the stated quantities and units, and use arithmetic and the model conditions below.

The examples are original and fictional: they are not real measurements or real student investigations.

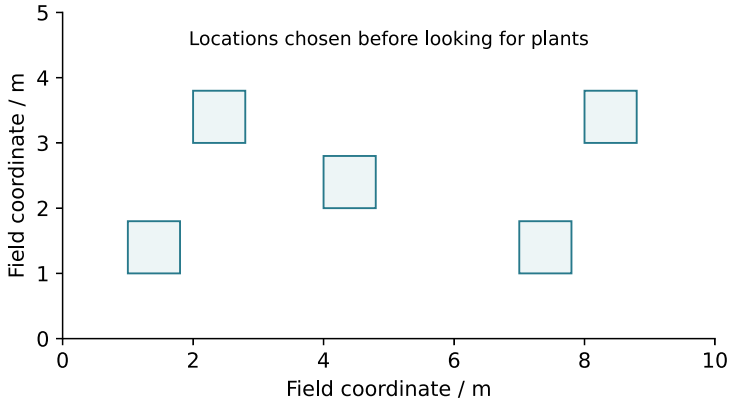
Sampling populations without choosing the answer

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.



Quadrat positions chosen before looking at the plants avoid sampling bias

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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 20 plants per square metre

- Three quadrats of 0.20 square metres contain 2, 4 and 6 plants.
- Find the mean count and the density. The estimate assumes the quadrats represent the habitat.