

Populations and communities Define population (IB wording).	Populations and communities How is one population of a species distinguished from another?
Populations and communities What is sampling error?	Populations and communities What does a large standard deviation of quadrat counts indicate?
Populations and communities Lincoln index: what do M, N and R stand for?	Populations and communities Give three assumptions of the Lincoln index.
Populations and communities Which organisms suit capture-mark-release-recapture?	Populations and communities Define carrying capacity.

By reproductive isolation: members of one population rarely or never breed with members of the other.

An interacting group of organisms of the same species living in an area. Members normally breed with each other.

Wide variation between quadrats: the population is spread unevenly (clumped).

The difference between the estimate of population size from a random sample and the true size of the whole population.

Marks are not lost and do not harm or change behaviour; marked animals mix randomly; no significant births, deaths or migration between samples.

M = number caught and marked first; N = total caught in the second sample; R = number of marked individuals recaptured.
Estimate = $(M \times N) \div R$.

The maximum population size of a species that an environment can support.

Motile animals, which move in and out of quadrats, such as beetles, snails and small mammals.

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Name three density-dependent factors.

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How do density-dependent factors control population size?

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Why does a population grow exponentially at first?

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How do you test growth against an exponential model?

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Name the phases of a sigmoid growth curve (IB).

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Which organisms are recommended to model sigmoid growth?

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Give an example of intraspecific cooperation.

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Define community.

By negative feedback: their effect grows with density, raising death rate or lowering birth rate, pushing numbers back towards carrying capacity.

Competition for limited resources, increased risk of predation, and the transfer of pathogens or pests in dense populations.

Plot population size on a logarithmic y-axis against time on a linear x-axis: exponential growth gives a straight line.

Abundant resources, little competition, few predators or pathogens, so birth rate far exceeds death rate.

Yeast (cell counts or turbidity) and duckweed (frond counts).

Exponential phase, transitional phase, plateau phase at the carrying capacity. No lag phase is expected.

All of the interacting organisms in an ecosystem: all the populations in an area, including plants, animals, fungi and bacteria.

Grey wolves hunting in packs; meerkats acting as sentinels; emperor penguins huddling for warmth.

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Name the six categories of interspecific relationship.

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Define mutualism.

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Root nodules in Fabaceae: benefit to each partner?

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Mycorrhizae in Orchidaceae: benefit to each partner?

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Zooxanthellae in hard corals: benefit to each partner?

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Why does an introduced species become invasive?

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Name three approaches to testing for interspecific competition.

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Why does better success without a second species not prove competition?

An interspecific relationship that benefits both species.

Herbivory, predation, interspecific competition, mutualism, parasitism and pathogenicity.

Orchid: sugars and mineral ions from the fungus, essential for seedlings. Fungus: carbon compounds (sugars) from the adult orchid once it photosynthesises.

Plant: fixed nitrogen (ammonium) from *Rhizobium*. Bacteria: sugars from photosynthesis and a protected site in the nodule.

It has a competitive advantage over endemic species in resource acquisition, often lacking its natural predators and pathogens, so it spreads.

Coral: sugars and oxygen from photosynthesis. Zooxanthellae: CO₂, ammonia and a protected, well-lit position.

Other factors could explain the difference; competition is indicated but not proven.

Laboratory experiments, field observations by random sampling, and field manipulation by removal of one species.

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Chi-squared for two species: how is an expected value calculated?

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Name a real predator-prey case study.

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Distinguish top-down and bottom-up control.

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Give an example of top-down control.

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What is allelopathy?

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Give an example of antibiotic secretion.

Canada lynx and snowshoe hare: Hudson's Bay Company fur records show roughly 10-year cycles, with lynx peaks after hare peaks.

Expected = (row total × column total) ÷ grand total. Degrees of freedom = 1; critical value at $p = 0.05$ is 3.84.

Sea otters eat sea urchins; without otters, urchins increase and destroy kelp forests.

Top-down: limited by consumers at the level above (predators). Bottom-up: limited by resources from below (nutrients, producers).

Penicillium secretes penicillin, which inhibits bacterial cell wall synthesis, deterring competing bacteria.

Release by a plant of chemicals that inhibit germination or growth of nearby plants, e.g. juglone from black walnut.