

Populations

Revision notes · Populations, communities and ecosystems, the factors that affect population growth, and the phases of the sigmoid growth curve.

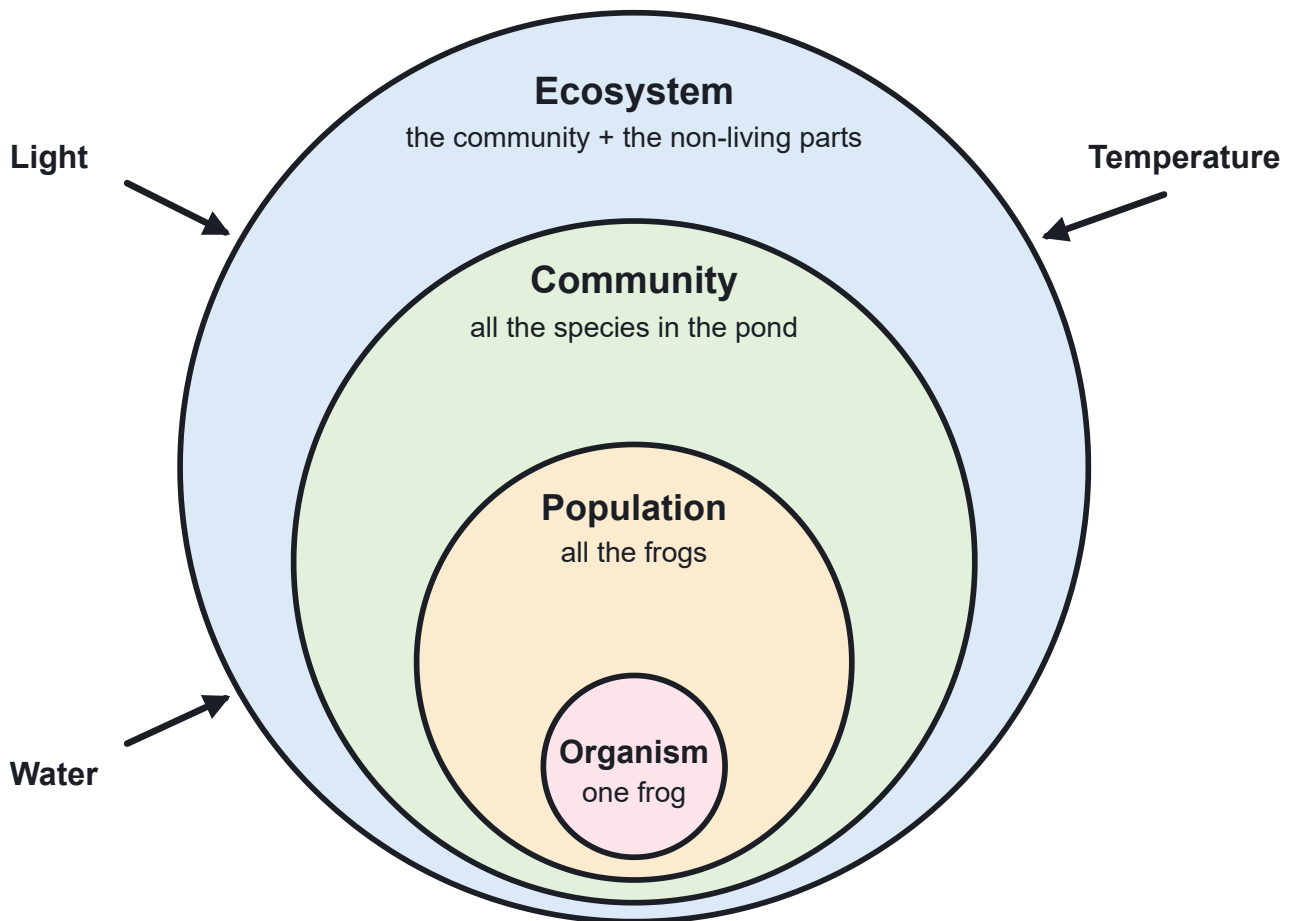
For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Populations Spec 19.4

Populations, communities and ecosystems Spec 19.4.1, 19.4.2, 19.4.3, 19.4.4

Population	A group of organisms of one species, living in the same area, at the same time.
Community	All of the populations of different species in an ecosystem.
Ecosystem	A unit containing the community of organisms and their environment, interacting together.

Levels of organisation, using a pond as the example		
Level	Meaning	Pond example
Organism	A single living thing	One frog
Population	One species, in the same area, at the same time	All the frogs in the pond
Community	All the populations of different species in the ecosystem	All the plants, animals and microorganisms in the pond
Ecosystem	The community and its environment, interacting together	The pond community plus the water, light and temperature



Each level contains the one before it. The **ecosystem** is the community plus its environment.

Factors affecting the rate of population growth

The rate at which a population grows depends on four factors: **food supply**, **competition**, **predation** and **disease**.

Factors affecting population growth	
Factor	Effect on population growth
Food supply	More food means more organisms survive and reproduce, so the population grows faster. Less food slows growth or makes the population fall.
Competition	Organisms compete for limited resources such as food, water, light and space. The more competition, the slower the growth.
Predation	Predators eat prey, so more predators slow the growth of the prey population.
Disease	Pathogens can kill or weaken organisms, so disease slows growth or reduces numbers.

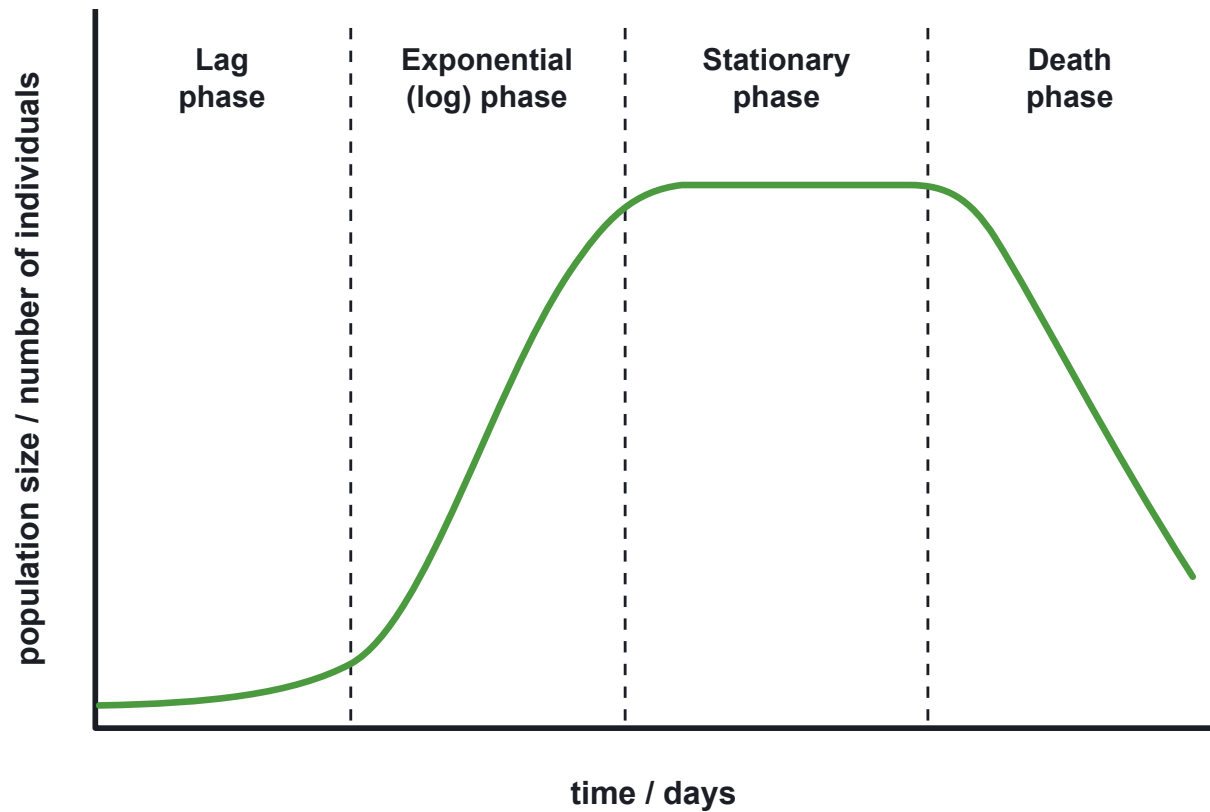
Common mistake: A population is one species only. If an answer includes different species living together, it is describing a community. Always include 'at the same time' in the definition of a population.

The sigmoid population growth curve Spec 19.4.5, 19.4.6, 19.4.7

When a small population enters an environment with limited resources, its growth follows an S-shaped curve called the **sigmoid curve**. It has four phases.

The four phases of the sigmoid growth curve

Phase	What the graph shows
Lag phase	Slow growth at the start, with few individuals
Exponential (log) phase	Rapid growth, with the curve getting steeper
Stationary phase	No overall growth; the curve levels off and the population stays roughly constant
Death phase	The population falls



The **sigmoid curve**: lag, exponential (log), stationary and death phases.

Supplement

Explaining the phases

Supplement

Why each phase happens

Phase	Explanation
Lag phase	There are few individuals to reproduce, and the organisms are adjusting to the environment. The birth rate is low, so growth is slow.
Exponential (log) phase	Food and space are plentiful, and there is little competition, predation or disease. The birth rate is much higher than the death rate, and more individuals reproduce, so growth speeds up.
Stationary phase	Limiting factors such as food supply, space and the build-up of waste restrict growth. Birth rate equals death rate , so the population stays constant.
Death phase	Resources run out or waste and disease build up. The death rate is higher than the birth rate, so the population falls.

Exam tip: When describing a graph, name the phase, quote figures from the axes with units, and say whether the population is rising, constant or falling.

Supplement

Common mistake: In the stationary phase, organisms are still being born and are still dying. The population is constant because the birth rate equals the death rate. When explaining any phase, link it to a limiting factor.

Quick check

1. Define a population.
2. Define a community.
3. State the four factors that affect the rate of population growth.
4. Name the four phases of the sigmoid growth curve in order.
5. **Supplement** Why does a population level off in the stationary phase?

Quick check answers

Populations

1. A group of organisms of one species, living in the same area, at the same time.
2. All of the populations of different species in an ecosystem.
3. Food supply, competition, predation and disease.
4. Lag, exponential (log), stationary and death.
5. Limiting factors mean the birth rate equals the death rate.