

Classification and Ecology Basics

Matthew Williams • Biology • May 8, 2026

Classification and Ecology Basics

This page covers the starting point of Section A: how organisms are grouped, how ecologists describe the environment, and the vocabulary needed for food webs, population questions, and conservation topics.

Ecology questions often begin with definitions, then move into application. Strong answers name the term, explain it clearly, and link it to the example in the question.

Classification

Classification is the grouping of organisms based on shared features. It helps biologists identify organisms, compare them, and understand relationships among living things.

In field work, organisms may first be grouped using visible features. Useful features include hairiness, colour, shape, leaf venation, number of legs, number of wings, antennae, body covering, and body segmentation.

In a school garden, insects could be separated from spiders by counting legs: insects have six legs, while spiders have eight.

A useful starting point is the five-kingdom system:

Kingdom	Main Features	Examples
Plantae	multicellular; cell walls; usually contain chlorophyll; make food by photosynthesis	flowering plants, mosses, ferns
Animalia	multicellular; no cell walls; cannot photosynthesise; usually move from place to place	humans, insects, fish, birds
Fungi	usually have cell walls; do not photosynthesise; absorb nutrients	mushrooms, moulds, yeast
Prokaryotae (Monera)	unicellular; no true nucleus	bacteria

Protocista	mostly unicellular; have a nucleus; may be plant-like, animal-like, or fungus-like	Amoeba, algae, Paramecium
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Modern context: domains and the bacteria split

For CSEC, the expected system is the **five-kingdom classification** shown above. The syllabus names **Prokaryotae (Bacteria)** as one kingdom. In modern classification, the older **Prokaryotae/Monera** grouping is usually separated into two major prokaryotic groups: bacteria and archaea.

In modern biology, organisms are often placed first into **three domains: Bacteria, Archaea, and Eukarya**. This separates ordinary bacteria from **Archaea**, a different group of prokaryotes often associated with extreme environments such as hot springs or very salty lakes. The older kingdom **Prokaryotae/Monera** roughly corresponds to the prokaryotic domains **Bacteria** and **Archaea**, while **Eukarya** contains Protocista, Fungi, Plantae, and Animalia.

Modern Domain	Main Cell Type	Relationship to the Five-Kingdom System
Bacteria	prokaryotic; no true nucleus	part of the older Prokaryotae/Monera grouping
Archaea	prokaryotic; no true nucleus; biochemically distinct from bacteria	also part of the older Prokaryotae/Monera grouping, but separated in modern systems
Eukarya	cells have a true nucleus and membrane-bound organelles	includes Protocista, Fungi, Plantae, and Animalia

Exam Tip

If a CSEC question asks for the five kingdoms, give the five-kingdom answer: **Plantae, Animalia, Fungi, Prokaryotae/Bacteria, and Protocista**. Use the three-domain system only if the question specifically asks about domains or modern classification.

Remember

Plants and fungi may both have cell walls, but fungi do not contain chlorophyll and do not photosynthesise.

Labelled comparison of representative organisms from the five kingdoms

Animal Kingdom Subdivisions

The Animal Kingdom can also be subdivided into phyla, then classes, then smaller groups down to species.

The order is:

For CSEC, the main skill is using visible features to place organisms into sensible groups. Features such as body segmentation, number of legs, wings, shell, backbone, and body covering are useful.

Animal Group	Major Features	Examples
Cnidaria	simple aquatic animals; radial symmetry; tentacles with stinging cells; one body opening	jellyfish, sea anemone, coral, Hydra
Platyhelminthes	flat, soft bodies; no backbone	tapeworm, planarian
Annelida	segmented worms; no backbone	earthworm, leech
Mollusca	soft body; many have shells	snail, octopus, clam
Arthropoda	jointed legs; segmented body; exoskeleton	insects, spiders, crabs
Echinodermata	marine animals; spiny skin; tube feet; adults often show radial symmetry	starfish, sea urchin
Chordata	have a notochord at some stage; vertebrates have a backbone	fish, amphibians, reptiles, birds, mammals

Arthropods are especially common in classification questions because their visible features are easy to compare.

Arthropod Class	Useful Features	Examples
Insecta	three body parts; six legs; often wings	butterfly, beetle, grasshopper
Arachnida	two body parts; eight legs; no antennae	spider, scorpion
Crustacea	many have hard shells; usually two pairs of antennae	crab, shrimp
Myriapoda	long segmented body; many legs	centipede, millipede

Chordates include the vertebrate classes students meet most often:

Vertebrate Class	Useful Features	Examples
Fish	scales; fins; gills	snapper, tilapia
Amphibians	moist skin; young often live in water	frog, toad
Reptiles	dry scales; lungs	lizard, snake
Birds	feathers; wings; beak	hummingbird, chicken
Mammals	hair or fur; mammary glands	human, bat, dog

In classification questions, the best feature is usually the one that separates organisms cleanly. Number of legs, wings, antennae, segmentation, and backbone are often more useful than colour.

Ecology

Ecology is the scientific study of interactions between organisms and their environment.

An environment includes:

- living factors, called biotic factors
- non-living factors, called abiotic factors

Biotic and Abiotic Factors

Biotic factors are the living parts of the environment, such as plants, animals, fungi, bacteria, and humans. Abiotic factors are the non-living parts, such as light intensity, temperature, water availability, soil type, pH, salinity, and air currents.

If mangrove seedlings grow poorly in very salty soil, salinity is an abiotic factor affecting their distribution.

Soil, Water, and Climate

Soil affects organisms because it provides water, mineral nutrients, oxygen for roots and soil organisms, anchorage, and different pH or salinity conditions. Air provides oxygen for respiration, carbon dioxide for photosynthesis, and nitrogen that can enter nutrient cycles through bacteria.

Light affects photosynthesis and activity patterns. Temperature affects enzyme-controlled reactions, growth, reproduction, and survival.

When an answer uses an abiotic factor, the effect matters: low light reduces photosynthesis, while very high salinity can make water uptake harder for plants.

Levels of Ecological Organisation

Ecology moves from one organism to the whole biosphere.

Level	Meaning
Organism	one individual living thing
Population	members of one species living in the same place at the same time and able to interbreed
Community	all the interacting populations in an area
Ecosystem	a community plus the abiotic environment and the interactions between them
Biosphere	the life-supporting parts of Earth: land, air, fresh water, and salt water



Levels of ecological organisation

Habitat and Niche

A **habitat** is the place where an organism lives, such as a pond, forest, rotting log, coral reef, or mangrove swamp. A **niche** is the role a species plays in a community. It includes where the organism lives, what it eats, what eats it, when it is active, and how it affects other organisms.

A frog's habitat may be a pond. Its niche includes feeding on insects, being prey for birds and snakes, breeding in water, and helping to control insect populations.

Limiting Factors

A limiting factor is any biotic or abiotic factor that restricts the size, distribution, or survival of a population.

Common limiting factors include food, water, space, mates, temperature, predators, disease, and competition. When a population stops increasing, limiting factors are usually involved: food may run out, disease may spread more easily, or competition may become stronger.

Ecological Investigations

Ecologists use different tools and methods depending on the habitat and the organisms being studied. Choosing the right method matters: a quadrat works well for plants or slow-moving animals, but a sweep net or pitfall trap is better for mobile insects.

Sampling Methods

Method	Best for	How it works
Quadrat	plants, slow invertebrates	place a square frame on the ground; count organisms inside; repeat at random positions
Line transect	distribution along a gradient	stretch a tape across the area; record every organism touching the line
Belt transect	distribution with detail	record all organisms within a fixed width on each side of the line
Pooter	small insects	suck air through a tube; insects enter a collection chamber
Sweep net	flying and vegetation insects	sweep through vegetation or air; collect organisms
Pitfall trap	ground-dwelling invertebrates	bury a container flush with the surface; animals fall in and cannot escape

For plants, a quadrat can give **percentage cover** (how much of the frame is occupied) or **density** — the number of organisms per unit area sampled.

Mark-Release-Recapture

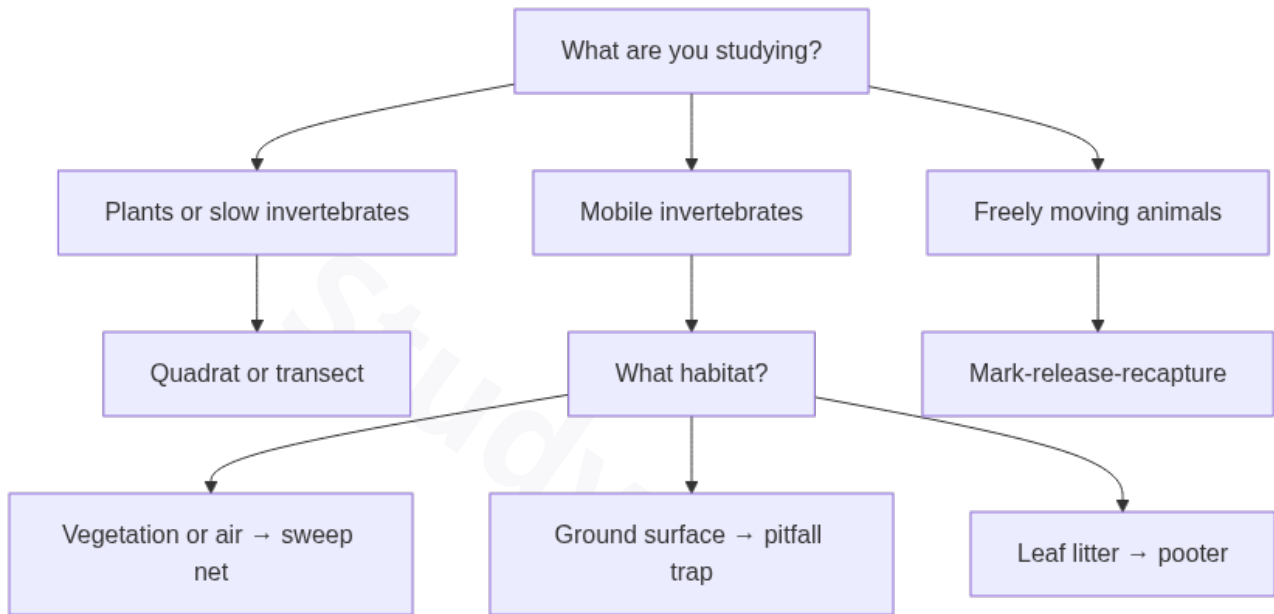
When animals move freely through a habitat, direct counting is difficult. The **mark-release-recapture** method estimates population size using the **Lincoln index**:

$$N = (M \times C) \div R$$

- **N** — estimated population size
- **M** — number captured and marked in the first sample
- **C** — total number captured in the second sample
- **R** — number in the second sample that carry the original mark

Exam Tip

The Lincoln index assumes the marks do not affect survival, marks are not lost, the population does not change significantly between captures, and marked individuals mix fully with the rest of the population. Exam questions often ask you to state these assumptions or explain why a result might be inaccurate.



Choosing a sampling method

Quick Comparisons

Pair Often Confused	Difference
Habitat and niche	habitat is where an organism lives; niche is its role
Population and community	population is one species; community is all populations in an area
Species and population	species refers to organisms that can interbreed to produce fertile offspring; population is members of one species living in a particular habitat
Biotic and abiotic	biotic is living; abiotic is non-living
Ecosystem and biosphere	ecosystem is one interacting system; biosphere is all life-supporting parts of Earth

Core idea

Classification groups organisms. Ecology explains how organisms live, interact, and respond to their environment.

PRACTICE — CLASSIFICATION AND ECOLOGY BASICS**Classification**

Grouping organisms based on shared features.

Habitat

The place where an organism lives.

Niche

The role a species plays in a community.

Population

Members of one species living in the same habitat at the same time.

Community

All the populations of different species living in a habitat.

Biotic factor

A living part of the environment.

Abiotic factor

A non-living part of the environment, such as light, temperature, water, soil, pH, or salinity.

Species

A group of similar organisms that can usually interbreed to produce fertile offspring.

Quadrat

A square frame placed on the ground to count or estimate organisms within a defined area.

Line transect

A tape stretched across a habitat along which all organisms touching the line are recorded.

Mark-release-recapture

A method of estimating animal population size by marking, releasing, and recapturing individuals.

Lincoln index

$N = (M \times C) \div R$ — used to estimate population size from mark-release-recapture data.