

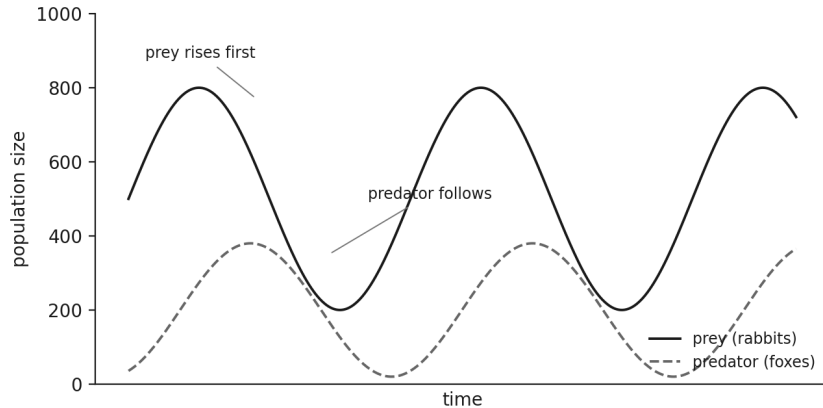
Exercise walk-through

7.4

Trophic levels and food security – biology only (4.7.4–4.7.5)

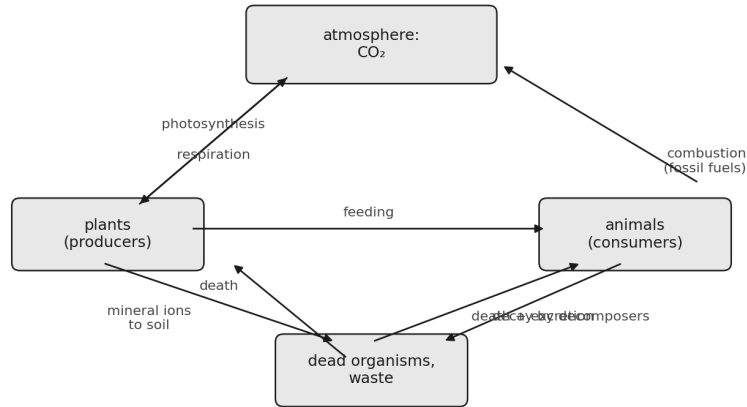
AQA · GCSE · Biology

Food chains and predator-prey cycles



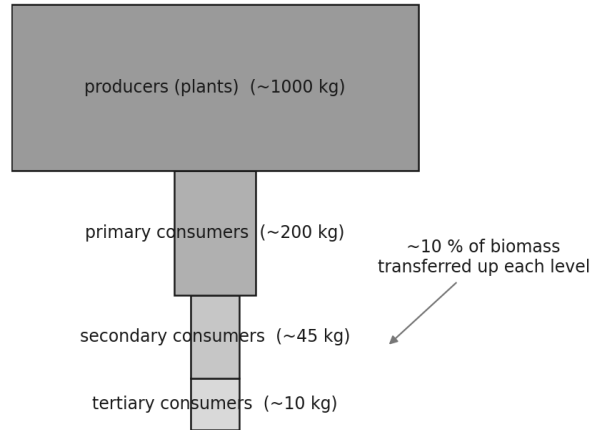
- Producer, primary, secondary, tertiary consumers.
- Prey rise first, predator follows, both oscillate.
- Photosynthetic organisms are Earth's biomass producers.

Carbon and water cycles



- Photosynthesis takes in CO₂; respiration and decay return it.
- Decomposers return mineral ions to the soil.
- Water — continuous evaporation and precipitation.

Trophic levels and the 10 percent rule



- Levels — producers, primary, secondary, tertiary; apex predators; decomposers.
- Only about 10 percent of biomass passes up each level.
- Lost — faeces, respiration, urine; producers store ~1 percent of sunlight.

Exercises 2.1·2.3

2.1 Name trophic levels 1 to 4.

[4]

2.2 500 kg of primary consumers supports 40 kg of secondary consumers. Calculate the transfer efficiency.

[2]

2.3 (*HT*) Name the fungus that produces mycoprotein.

[1]

Exercises 2.1·2.3

2.1 Name trophic levels 1 to 4.

[4]

2.1 Producers; primary consumers; secondary consumers; tertiary consumers.

2.2 500 kg of primary consumers supports 40 kg of secondary consumers. Calculate the transfer efficiency.

[2]

2.2 $40 \div 500 \times 100 = 8 \%$.

2.3 (*HT*) Name the fungus that produces mycoprotein.

[1]

2.3 *Fusarium*.

Exercises 3.1·3.2

3.1 Explain why a food chain rarely has more than four or five trophic levels. [4]

3.2 (*HT*) Explain how restricting the movement of cattle and controlling the temperature of their sheds improves food-production efficiency, and give one ethical objection. [4]

Exercises 3.1·3.2

3.1 Explain why a food chain rarely has more than four or five trophic levels. [4]

3.1 Only about 10 % of the biomass of each level is transferred to the next; biomass is lost in faeces – not all ingested material is absorbed; and in waste – carbon dioxide and water from respiration, water and urea in urine; so after four or five levels too little biomass remains to support another breeding population.

3.2 (*HT*) Explain how restricting the movement of cattle and controlling the temperature of their sheds improves food-production efficiency, and give one ethical objection. [4]

3.2 Limiting movement reduces energy transferred to the environment as movement/muscle work; so more of the food's energy becomes biomass – meat or milk; controlling the shed temperature means the animals do not burn food to keep warm. Objection – restricted movement and confinement are considered cruel / unnatural welfare conditions.

Exercise 3.3

3.3 (*HT*) Fish stocks in the North Sea are falling. Explain how net size and fishing quotas help maintain stocks, and describe one biotechnological solution to food demand. [6]

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3.3 Larger mesh (net size) lets young fish escape, so they can grow and breed before capture; quotas limit the total catch per species, leaving enough adults to breed; together they maintain stocks at a level where breeding continues. Biotechnology – the fungus *Fusarium* is grown on glucose syrup in aerobic conditions to produce mycoprotein, a protein-rich food; GM crops such as golden rice give more food or better nutrition; GM bacteria make insulin, though that treats disease rather than hunger – accept any described solution with its mechanism.