

Lesson 1. Food chains and food webs

Lesson objectives

By the end of the lesson, students should be able to:

1. Draw and interpret food chains and food webs.
2. Give reasons for identifying organisms as carnivores, consumers, herbivores, omnivores, predators, prey, producers.
3. Explain how changes in a population or community in an ecosystem affect other populations, and predict these changes using food webs.

1. Introduction

5 mins

- What is meant by a food chain?
- Can you write one out?
- What does the arrow represent?

2. Food chains (LOs 1 and 2)

15 mins

- Read the section **Food chains** and write definitions of the following key words and phrases:
 - carnivore
 - food chain
 - herbivore
 - predator*
 - prey*
 - primary consumer
 - producer
 - secondary consumer
 - tertiary consumer
 - trophic levels
 (* these words should be known from your primary school work)
- If you are struggling, use any available resources (i.e. dictionary, glossary at the back of a textbook, online reference source) but make sure you understand the definitions you are writing down.
- Check your answers with the supplied mark scheme.
- Finally, write down two different food chains and annotate them with this extra information. For example: grass → chicken → fox, you could then label the grass as a producer, chicken as a herbivore, etc.

3. Food webs (LOs 1 and 3)

20 mins

- Read the section **Food webs** and complete the activities below.
 1. Write out the longest food chain in food web C.
 2. Choose one or more of these words for each organism in your food chain: carnivore, consumer, herbivore, omnivore, producers top predator. Explain your choices.
 3. Why are goshawks and wolverines in competition with each other?
 4. Use food web C to predict what would happen to the vole population if: a) the snowshoe hares all died; b) there was no rain for a long time.
- Self-assess using the mark scheme.

4. More complex food webs (LOs 1, 2 and 3)

15 mins

- Look at the **More complex food webs** diagram taken from an IG Biology textbook. Use it to work out what might happen if the leech population were to decline through disease. Try to write at least three statements.
- Finally, for each organism in the food web, write an additional label (e.g. predator or carnivore). It is possible for some organisms to have more than one label.

5. Reflect

5 mins

- Write a question about the food web from section 3 and design a mark scheme for the answer.
- Try to think up questions that are worth more than two marks.
- If you can, swap your question with someone else for them to try it out.

Lesson 2. Ecological pyramids

Lesson objectives

By the end of the lesson, students should be able to:

1. Interpret and draw pyramids of numbers.
2. Compare models of energy transfer in food chains (pyramids of number, biomass).

1. Introduction (LO 1)

5 mins

- Look at food web C from the last lesson (**A food web in northern Canada**).
- How many of each organism do you think there might be in the habitat? Don't worry about actual numbers, just in roughly, e.g. lots, a few, one.
- Is there a pattern as you go further up the food web?
- Sketch a diagram or flowchart to represent the number of organisms at each stage of the food web. If possible, share and discuss what you have done with another student. Do they look similar?

2. What are pyramids of numbers? (LO 1)

15 mins

- The numbers of organisms usually decrease through a food chain. There are normally lots of producers and far fewer primary consumers, fewer still secondary consumers, and so on. The reason for this is the loss of energy at each level. So much energy is lost that there is very little left to support vast numbers of top predators. This relationship is shown as a pyramid of numbers.
- Read the section **What are pyramids of numbers?**
 1. Look at the food web from the introduction. Write out three food chains from the food web, starting with grass.
 2. For each food chain, sketch a pyramid of numbers for this food chain. You do not need to use a ruler to measure anything.
- If possible, swap over your work with another student to peer assess. If you struggle with coming up with statements, just stick to What Went Well (WWW)/Even Better If (EBI):
 - WWW – What Went Well – look at the other student's work and decide what is good about it, e.g. excellent detail with scientific terms, good explanation, well made points.
 - EBI – Even better if – look at the other student's work and decide what they could do to improve it, but explain this in a constructive way, e.g. use more scientific terms, try to explain why.

3. Constructing pyramids of numbers (LO 1)

15 mins

- Read the section **Constructing pyramids of numbers**.
 1. Draw an accurate pyramid of numbers for each of the following food chains (the number of organisms is given in brackets beside the organism).
 - grass [100] → mite [20] → spider [10] → blackbird [1]
 - oak tree [1] → aphid [100] → blue tit [10] → sparrowhawk [1]
 - grass [100] → rabbit [10] → fox [1] → flea [25]
 2. What do you notice about the shapes? If you can, compare with another student to see if you got the same shapes.

4. Pyramids of biomass (LO 2)

20 mins

- Read the section **Pyramids of biomass**. Use the information presented to answer the following questions:
 1. What does the word 'biomass' mean?
 2. Sketch pyramids of biomass for each of the pyramids of numbers. You do not need to add any figures, just draw the shapes.
 3. To work out a pyramid of biomass, the dry masses of the organisms are used. Why?
 4. The biomass of an oak tree changes during the course of a year. Why is this?
 5. Describe the advantages and disadvantages of using pyramids of biomass compared with pyramids of numbers.

5. Reflect

5 mins

- Think of one new thing you have now remembered or learnt today. Talk to another student about it if possible.

Lesson 3. Energy flow in ecosystems

Lesson objectives

By the end of the lesson, students should be able to:

1. Explain the gains and losses of energy from living organisms.
2. Compare models of energy transfer in food chains (pyramids of number, biomass).

1. Introduction

5 mins

- Look at Diagram D on your lesson notes. Why is it not pyramid shaped?

2. Energy flow in a food chain (LO 1)

15 mins

- The numbers of organisms usually decrease through a food chain. There are normally lots of producers and far fewer primary consumers, fewer still secondary consumers, and so on. The reason for this is the loss of energy at each level. So much energy is lost that there is very little left to support vast numbers of top predators.
- Read the section **Energy flow through a food chain** and answer some or all of the following questions.
 1. Why do organisms respire?
 2. What does the red arrow on the left of diagram A show?
 3. Why does the fox not get all the energy that was in the lettuce eaten by the rabbit?

3. The flow of energy through ecosystems (LOs 1 and 2)

20 mins

- Read the section **The flow of energy through ecosystems**.
- You need to make notes about what you have just read. Do not copy the work. A good technique is to use read-cover-write-check. Read a section, cover it up, jot down some notes about it – doesn't need to be full sentences – and check what you have written down.
- Scan your notes and select 5 keywords and highlight or underline these.

4. Energy flow calculations (LO 1)

15 mins

- It is possible to assign values for the energy losses from an organism. With these values it is possible to work out the efficiency of energy transfer by an organism using the equation:

$$\frac{\text{energy transferred to biomass}}{\text{total energy supplied to organism}}$$

- Efficiencies are usually on a scale of 0 to 1 but can be converted to percentages by multiplying by 100.
- Look at the diagram of the cow in section **Energy flow calculations** and complete the following activities.
 1. Write down the equation.
 2. Calculate the efficiency of the cow. Show all of your working out.
 3. List two ways the cow loses energy.
 4. Suggest what may happen to the 18450 kJ of energy in the grass that was not eaten by the cow.

5. Reflect

5 mins

- What was easy about this lesson? Why?
- What was difficult about this lesson? Why?
- If you can, discuss with another student.

Lesson 4. Applying your knowledge

Lesson objectives

By the end of the lesson, students should be able to:

1. Describe the sources and effects of some pesticides.
2. Explain the effects of some persistent pesticides on ecosystems.
3. Apply knowledge of food chains and food webs to unfamiliar situations and/or real-world issues

1. Introduction

5 mins

- Look at the diagram in your notes, which shows a pyramid of biomass for a field. The units are g/m^2 . Describe what this pyramid tells you in as much detail as you can.

2. Poisons and the food chain (LO 1)

15 mins

- Read the section **Poisons and food chains** and answer the following questions.
 1. What effect did removing cats from Macquarie Island have?
 2. Why did it have this effect?
 3. Suggest what has happened to the populations of birds on Macquarie Island since 2011. Explain your reasoning.

3. Bioaccumulation (LOs 1, 2 and 3)

20 mins

- Read the section **Bioaccumulation** and use this information to answer the following questions.
 1. Look at diagram F and read the text that is with it. Explain why the peregrine falcon population in the UK decreased in the 1960s and 1970s.
 2. Look at the food web in diagram C and read the text that is with it. Beetles can kill aspen trees. To save the aspens in an area it has been suggested that the beetles be poisoned. Suggest a problem with using poison.
 3. Predict the effects of the poison on the thrush and aspen populations.
- You can self-assess how you have done with the mark scheme.

4. IG exam question (LO 3)

15 mins

- Look at the section **IG exam style question**. This task links together all the topics you have studied in these lessons at IG level. Use the information provided to answer the following question. Work on your own, and if your teacher provides any guidance or pointers, make sure you take notice.
 1. a) Use the information in the table to draw an accurate pyramid of numbers for this data on graph paper. **(4 marks)**
 b) Describe how a pyramid of biomass from the same data would differ from the pyramid of numbers. **(2 marks)**
 c) Explain why not all the energy in a producer passes to the primary consumer. **(2 marks)**
 d) Some farmers are removing hedges in order to increase the size of their fields. This means that the number of hedgerows is decreasing. Suggest how removing hedgerows will affect the size of the sparrow population. **(2 marks) (Total for question = 10 marks)**
- There is a mark scheme available which you can use if you need to assess or correct your answers.

5 Reflect

5 mins

- RAG your feeling on the topics and key words recapped in these intervention lessons and feed this back to the teacher, if possible.
 - Red – I'm not feeling confident
 - Amber – I have some doubts
 - Green – no problems
- You might be asked to explain your responses.