7 Organisms in ecosystems

Planning page

Getting started

7.1 Living in a food web page 139
- Activity page 139
- Investigate 17 Photosynthesis and respiration
- Activity page 145
- ICT skillsheet Getting started with Microsoft Word—drawings and pictures

7.2 Ecosystems page 148
- Activity page 148
- Activity page 149
- Activity page 150
- Activity page 151
- Assessment task 7 A food web

7.3 Living in groups page 154
- Activity page 156

Main ideas
- Chapter 7 crossword

Review
- Chapter 7 test

Essential Learnings for Chapter 7

Essential Learnings	*References*		
	Student book (page number)	***Workbook (page number)***	***Teacher Edition CD (Assessment task)***
Knowledge and understanding *Life and living* In ecosystems, organisms interact with each other and their surroundings	pages 139–145 pages 148–152	pages 54–56	Assessment task 7 A food web
Changes in ecosystems have causes and consequences that may be predicted	pages 155–156	page 59	
Ways of working Communicate scientific ideas, explanations, conclusions, decisions and data, using scientific argument and terminology, in appropriate formats	pages 139–152	pages 54–56	Assessment task 7 A food web
Research and analyse data, information and evidence	Activity page 145 Case study page 155 Activity page 156	page 59	

QSA *Science Essential Learnings by the end of Year 9*

Vocabulary

biologist
carnivore
chlorophyll
community
consumer
decomposer
ecosystem
energy
habitat
herbivore
oxygen
photosynthesis
population
producer
respiration
scavenger
terrarium

Focus for learning

Discuss how we obtain food and how organisms are adapted to their environment (page 138).

Equipment and chemicals (per group)

Investigate 17 page 141

Part A: small beaker, methylene blue indicator (in dropping bottle), oxygen-removing solution (16 g/L sodium dithionite/hydrosulfite, $Na_2S_2O_4$, in water, freshly prepared), spatula, test tube and one-holed stopper with a right-angled piece of lass tubing, hydrogen peroxide solution, 'pinch' of manganese dioxide powder, 2 test tubes with stoppers, piece of aquarium water plant (eg Elodea)

Part B: test tube and stopper with a right-angled piece of glass tubing (from Part A), bromothymol blue solution, 2 or 3 marble chips (calcium carbonate), 1 M HCl, distilled water, drinking straw, 250 mL beaker

Activity page 150

Teacher demonstration: large jar with screw lid, large plastic container (eg tote box), about 10 ants

Activity page 151

6 preserved animals or photos of animals

Special preparations

Investigate 17 page 141

To make bromothymol blue solution, prepare 0.1% solution by dissolving 0.5 g of the powder in 500 mL distilled water, and adding one drop of ammonium hydroxide to the 500 mL to turn the solution deep blue.

Starting point

This topic has the capacity to engage students' higher-level thinking skills. Their ability to understand and relate to real life examples makes for fun learning. Assignments for this unit can range from posters, models, oral and/or PowerPoint presentations and short role plays. There are documentaries available on video or DVD that will show students food webs in action, ecosystems and animal behaviours. Ensure that you visit your library or local video store prior to commencing, and let your school librarian know that you are commencing this topic so they can record any upcoming programs.

Start this topic with a visual aid. For example, watch a small segment of a video showing animals in a food web in nature, eg a lion hunting for food, sharks circling fish, etc. Students may recall footage that they have seen at home, and start to question and engage with the topic.

7 Organisms in ecosystems

Getting Started

Work in a small group to discuss the following questions.

- You eat food to obtain the materials and energy for growth. But where does food come from? List all the types of food in a hamburger and suggest where they come from.
- Seals and crocodiles live in different places and if they swapped their living places they would die. What features does each of these animals have to help it survive successfully in its living place?

7.1 Living in a food web

Food chains

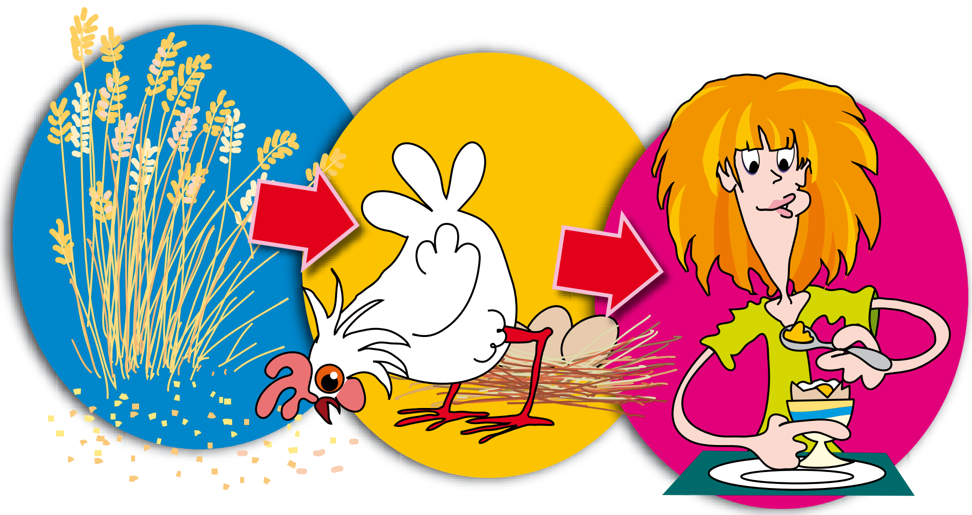
What did you eat for breakfast this morning? The food you eat supplies you with materials for growth, and energy for muscle movement. Let's find out where your breakfast food may have come from. Take eggs for example. These are made by hens which eat grain to make the eggs, and the grain comes from plants such as corn and wheat.

Plants are able to absorb sunlight as an energy source to make food. So the energy you obtained from your breakfast foods came originally from the Sun's energy, which the corn and wheat plants absorbed.

The diagram below is called a **food chain**. It shows the feeding relationships among organisms. One organism provides the food for the second. The second provides the food for the third, and so on. The food chain can be written simply as:

plants (grain) ➡ hen (egg) ➡ human

The arrows show the direction in which the food passes.



Activity

1. List all the foods you have eaten in the last 24 hours.
2. Beside each food item list the source of the food. For example, if you ate a pie for dinner, the meat would come from cattle and the pastry from plants (grain).
3. Draw a food chain for each food item.
   Food chains are usually not very long. Each food chain in the examples on this page contains three organisms. How many organisms did your food chains contain?
   Did any of your food chains contain four or more organisms? Can you think of a food chain that might contain four or more organisms?

Other food chains for your breakfast foods can be drawn.

plants (nectar) ➡ bees (honey) ➡ human

plants (grass) ➡ cows (milk) ➡ human

Hints and tips

Remind students that all life requires the continual input of energy. Light energy from the Sun is converted into chemical energy, and some of this energy is used to make plant life to sustain animal life. Animal life also needs energy to grow and function. Energy cannot be created or destroyed, simply transferred or transformed, even energy in biological processes.

Hints and tips

Students often reverse the arrows in food chains. One way to explain the arrow direction is to remind students that the energy is being transferred from one organism to the other.

Learning experience

Use the food webs on this page to consider the number of each organism that would be needed by the organism consuming it. This explains the relative abundance of these organisms in nature, and this hierarchical organisation in ecosystems is vital for the survival of the different organisms in them.

Note: food pyramids are introduced in *ScienceWorld 2*.

Learning experience

Get the students to discuss what energy is, particularly in the context of ecology. Encourage them to come up with a formal definition.

Learning experience

Make up sets of cards with photos of different organisms on them for the students to correctly arrange into a food chain. The cards could be laminated, and a second set of cards with arrows on them might be helpful.

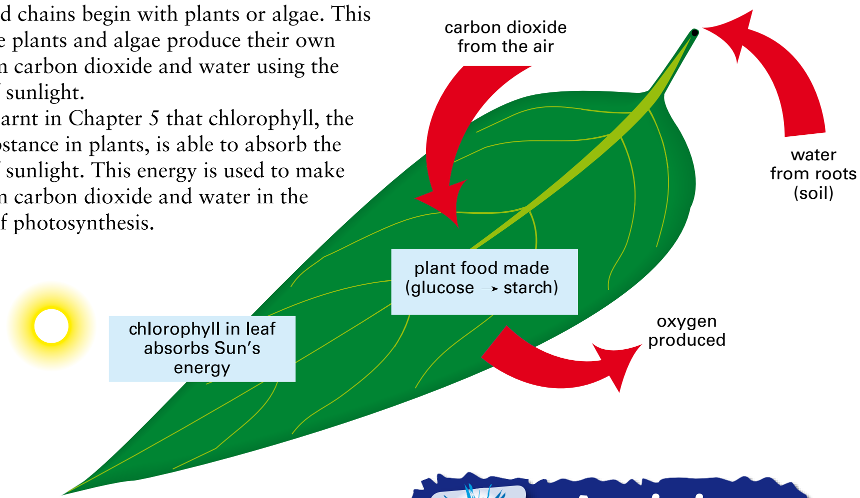
Hints and tips

It is important for students to understand that sugars (glucose, fructose, sucrose, etc.) are an important food source for all organisms. Students should be aware that photosynthesis only occurs in the green parts of the plants where chlorophyll is present, such as the leaves. The sugars that are produced are then converted to starch and usually transported to other parts of the plant, such as roots and tubers, for storage.

Photosynthesis and respiration

Most food chains begin with plants or algae. This is because plants and algae produce their own food from carbon dioxide and water using the energy of sunlight.

You learnt in Chapter 5 that chlorophyll, the green substance in plants, is able to absorb the energy of sunlight. This energy is used to make food from carbon dioxide and water in the process of photosynthesis.



The main products of photosynthesis are simple sugars such as glucose, which are then converted to starch for storage. The other important product made in photosynthesis is oxygen. This is released into the air, or into the water if the plant lives in water.

PHOTOSYNTHESIS

carbon dioxide + water ➡ glucose + oxygen
glucose ➡ starch

All living things need food as a source of energy for movement, growth and other body functions. The process of getting energy from foods is called respiration. Respiration occurs in cells. Here glucose, the fuel, reacts with oxygen to release energy. Carbon dioxide and water are given off.

RESPIRATION

glucose + oxygen ➡ carbon dioxide + water

Activity

A bean plant was kept out of sunlight for a number of days. By the end of this time, the plant had lost its bright green colour and looked sick.

Do green plants need sunlight to survive? Work in a group to discuss this question. Design an experiment that you think would be a 'fair test' to answer this question.

Learning experience

Students could test a plant for the production of glucose and starch.

To test for sugar, use Benedict's solution. Crush small pieces of a leaf in a mortar and pestle, transfer this to a test tube, add 5 mL of Benedict's solution and heat gently until it boils. A colour change from blue to orange indicates that glucose is present. (The colour change is due to the reduction of Cu^{2+} in $CuSO_4$ to Cu^{+} in Cu_2O by glucose, and Benedict's solution can detect as little as 0.15% to 0.2% glucose in solution.)

You may want to allocate specific parts of the plants to different groups and then come together and share findings.

Test for starch by adding iodine to the plant. The iodine will turn blue–black in the presence of starch. Test different parts of the plants for the presence of starch, eg a leaf (you will need to boil it for a few minutes to soften the leaves), stem and roots. You could also test potatoes, sweet potatoes, onions and other vegetables to see what happens.

Students should tabulate their data and write a scientific report about the activity for homework.

Investigate
17 PHOTOSYNTHESIS AND RESPIRATION

Aim
To test for the gases given off in photosynthesis and respiration.

Planning and Safety Check
Read through the investigation carefully, then answer these questions.

- You need at least 40 minutes to do Part A. Work in a group and discuss in which order you will do the various steps in Part A and Part B of the investigation.
- Why have Steps 1 and 2 in Part A and Part B been included in this investigation?
- Make a list of all the safety precautions you have to take in this experiment.

PART A
Testing for oxygen

Materials


Wear safety glasses.

- small beaker
- methylene blue indicator (in dropping bottle)
- oxygen-removing solution (16 g/L **sodium dithionite/hydrosulfite**, $Na_2S_2O_4$, in water. Prepare the solution just before use.)

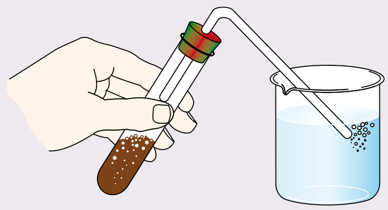
Toxic

- spatula
- test tube and one-holed stopper with a right-angled piece of glass tubing
- hydrogen peroxide solution
- 'pinch' of manganese dioxide powder
- 2 test tubes with stoppers
- small piece of aquarium water plant (eg Elodea)

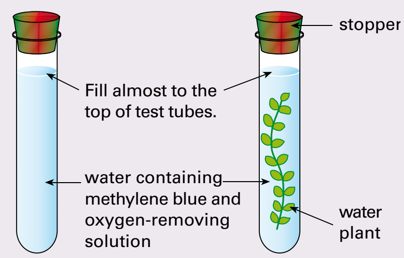
Method
1 Half fill the beaker with tap water. Add 4 or 5 drops of methylene blue solution. Then add drops of oxygen-removing solution until the blue colour just disappears.

2 To make oxygen, use a spatula to add a rice-grain size quantity of black manganese dioxide powder to a test tube. Pour a small amount of hydrogen peroxide into the test tube, and immediately put the stopper in the test tube. Bubble the gas into the solution in the beaker.

The blue colour indicates that oxygen has been produced.



3 To test that plants produce oxygen, first make up a beaker with water, methylene blue and oxygen-removing solution as in Step 1. Then follow the instructions in the diagram below.



4 Leave your set-up near a window or bright light for at least 20 minutes.

Record your results.

Discussion
1 Which things did you keep the same for both test tubes?

2 Why did you have one test tube without a plant?

3 Discuss ways in which the test could be improved?

Lab notes
- Hydrogen peroxide solution is usually supplied as 35%. It is much better if it is diluted to 5%—it will still work. Hydrogen peroxide should be stored in dark bottles and in the fridge, otherwise it will decompose into water and oxygen quite quickly.
- Each group will need to label their equipment and put it in a place where it will not be interfered with by other students/classes.
- Warn students to be very careful when handling glass tubing—when it breaks it is very sharp!

PART B
Testing for carbon dioxide

Materials

- test tube and stopper with a right-angled piece of glass tubing (from Part A)
- bromothymol blue solution
- 2 or 3 marble chips (calcium carbonate)
- dilute **hydrochloric acid** (1 M)
- distilled water
- drinking straw
- 250 mL beaker


Corrosive

Method

1 Half fill the beaker with distilled water. Add 2 or 3 drops of bromothymol blue solution.

2 Put a few marble chips into a test tube. Then add a small amount of hydrochloric acid. Immediately put the stopper in the test tube, and bubble the gas into the solution in the beaker.

Bromothymol blue turns green then yellow when carbon dioxide is present.

3 Empty the beaker and repeat Step 1.

4 Use a drinking straw to blow gently into the blue solution in the beaker.

Record any colour change.

Write a report of your findings.

try this

Design a test to show that plants produce carbon dioxide when they respire.

Discuss the plan with others in your group, and write up a draft. In a well designed test, you need to compare the test (the container with the plant in it) to an identical container without a plant.

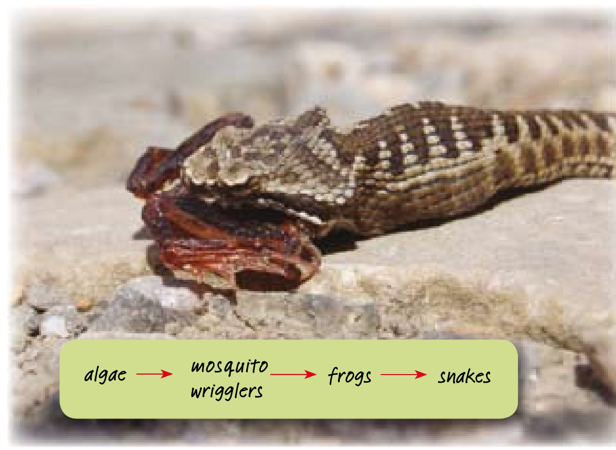
Make a list of the equipment you will need. Then show the draft plan to your teacher for approval before you begin.

Producers and consumers

Organisms such as plants and algae that can photosynthesise and make their own food are called **producers**. The algae are the producers in the food chain on the right.

Organisms that eat other organisms are called **consumers**. Animals are consumers because they do not make their own food and have to rely on other organisms for food.

In the food chain, the mosquito wrigglers, frogs and snakes are all consumers. The mosquito wrigglers are called first-order consumers, the frogs are second-order consumers and the snakes are third-order consumers.



algae → mosquito wrigglers → frogs → snakes

Try this note

The plants need to be placed in black bags and in a cupboard; even a small amount of light will interfere with the results.

Homework

Ask students to give reasons why the further you go along a food chain the less energy (food) remains available. Give some hints about energy being lost (not destroyed) at each link, so the amount of transferred energy becomes less. How is the energy being lost?

Learning experience

Prepare a series of thinking questions for the class to answer. For example:

- Why can't there be too many links in a single food chain (usually about four or five links)?
- Why does a change in the size of one population in a food chain affect other populations?

Students may like to work in pairs or small groups to come up with their responses.

Learning experience

Ask the class to come up with reasons why they think there are more herbivores than carnivores. Refer students to the Homework exercise.

Learning experience

Hold up pictures of different organisms and ask students to identify them as either producers or consumers. If they are consumers, ask students to decide if they are a first-, second-, third- or fourth-order consumer, by giving a small food chain sequence.

Food webs

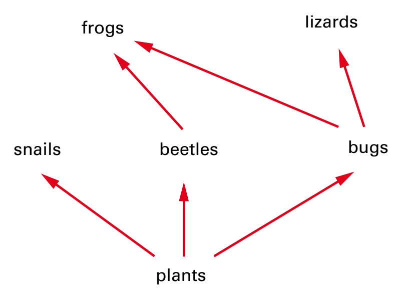
Suppose you were asked to observe the feeding relationships among the organisms in a garden. Using these observations you then constructed the food chains below.

plants → snails
plants → bugs → frogs
plants → beetles → frogs
plants → bugs → lizards

Fig 11 Herbivores are consumers that eat only producers.

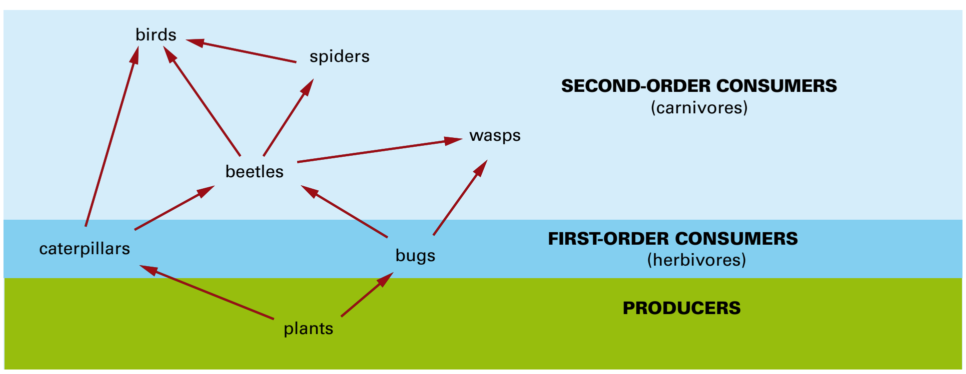
To get a more complete picture of the feeding relationships in the garden, these food chains can be combined to give a **food web**.

Food webs show the feeding habits of all the organisms that live together in a particular place. For example, you can see from the food web that frogs eat beetles as well as bugs, but lizards eat bugs only.



Food webs can be very complex since animals usually eat many different foods. Biologists have agreed to draw food webs in a standard way.

Look at the forest food web below. The producers are placed at the bottom. Next come the consumers that eat the producers. These animals are first-order consumers and are also called **herbivores** (HER-be-vores). After the herbivores come the animals that eat other animals. These are second-order and third-order consumers and are called **carnivores** (CARN-e-vores)—*carne* is Latin for *meat*.



Hints and tips

Generally organisms are part of more than one food chain and consume more than one kind of food in order to meet their food and energy requirements. A food web is many different food chains connected together. The interdependence of the populations within a food chain helps maintain balance.

Learning experience: whole class food web

In preparation for this activity, you will need to book the class into the library or computer room for the first session in which students research their selected organism. You will also need to print out some large arrows on A4 paper to be used later.

Organise students into small groups and allocate them a selection of plants or animals that may be found in the same ecosystem. They select one plant or animal for research. Make sure you allocate various orders of consumers to different groups so that a food web can be constructed later, eg grasses, shrubs, soil organisms, worms, herbivorous and carnivorous insects and a variety of vertebrates.

Ask students to draw or paste a picture of their chosen plant or animal on an A4 sheet of paper. Students research the plant's characteristics or the animal's diet and other relevant characteristics, such as their method of hunting.

Then, as a whole class group sitting around in a circle, construct your food web using the arrows you have prepared earlier. Pin the food web up in the classroom.

Hints and tips

It may be possible to set up a time-lapse recording of an organism decomposing to show the class—it can be quite spectacular.

When living things die

The photo above shows the remains of a dead wallaby. After a while only the bones will remain. Animals that eat the flesh and organs of dead animals are called **scavengers**. These include ants, insect maggots, crows and hawks. In aquatic habitats, bottom-dwelling animals such as crabs, lobsters and prawns are very effective scavengers.

The breakdown (decay) of dead organisms is due to microscopic bacteria and fungi. These organisms are called **decomposers**.

Scavengers are classed as consumers in a food web even though they usually eat dead organisms. However, decomposers are not classed as consumers because their method of obtaining food is quite different. Consumers eat food and then digest it internally. Bacteria and fungi, on the other hand, release chemicals which break down the organism's body.

Decomposers are a very important part of a food web. The materials in a dead organism's body are broken down into simple substances that pass into the air, water or soil. Carbon dioxide and other gases such as hydrogen sulfide (rotten egg gas) pass into the air. Some substances pass into the soil and increase the soil fertility, and plants use these substances for growth. In this way decomposers recycle materials in the food web.

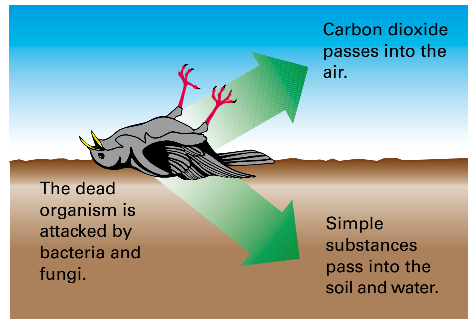


Fig 13 Decomposers recycle materials in the food web.

Science in action

How decomposers can help solve murders

A body has been found just off a forest track. Police investigators call a *forensic entomologist* to help them determine the time since death.

An entomologist (ENT-a-MOL-o-gist) studies insects and other arthropod relatives such as spiders, centipedes, mites and ticks.

Soon after death certain flies will lay their eggs in body openings such as eyes, nostrils and ears, or in wounds that may be present. These eggs then hatch into maggots that start to decompose the body. Certain beetles also lay their eggs in the body. These eggs hatch into larvae that start to decompose the body.

At the scene of the crime, the forensic entomologist takes samples of any fly maggots or beetle larvae. By knowing which insects attack the body first, and the size and weight of the maggots, the scientist can tell police how long the person has been dead.

By observing the types of insects attacking the body, the forensic entomologist may also be able to infer whether the person died at the scene or was dumped there after death.

Learning experience

The students could create their own ecosystem crosswords. Each crossword should contain at least 10 clues.

Learning experience

Observe bacteria and fungi breaking down organic matter. Cut up small pieces of food items, such as fruit and sandwiches, and place them in clear plastic sealable bags. Leave them for a week. Ask students to make predictions on which will decay the fastest and have the most fungal and bacterial growth. Tabulate results.

Warning: Do not re-open the sealed plastic bags. Take responsibility for disposing of all bags.

Activity

Karen and Ian are two biologists who observed the feeding habits of animals and plants around a small freshwater creek and pond over 4 months. Here is a report of some of their observations.

'We found a number of types of water plants growing in the pond and the creek that flowed into it. Many animals such as turtles and waterhens ate these plants. There were also waterlilies growing in the pond. The underside of the leaves contained lots of small animals such as snails and water insects, as well as eggs. We did not see any animals eat the leaves.

The water contained microscopic plants and algae that were eaten by the tiny waterfleas and mosquito wrigglers. The waterfleas could be just seen with your eye. These waterfleas were eaten by small fish, water beetles and shrimp.

Snails moved slowly over the rocks in the creek and ate the green algae on the rocks. Turtles also ate the algae.

Water beetles ate mosquito wrigglers and small fish, as well as shrimp if they could catch them.

At night we observed frogs eating beetles and mosquitoes. Green snakes ate fish, frogs and beetles. During the day, herons would fly into the pond to feed on the beetles, snails and fish.'

1 Draw a food web from the biologists' observations.
2 Which organisms are producers in the food web? Which are herbivores? Which are second-order consumers?
3 Are there any organisms in the creek and pond that were not eaten by other organisms?
4 From the food web, draw a food chain that includes microscopic plants, snakes and water beetles.
5 Could herons be in a food chain that included water beetles and shrimp? Draw the food chain.
6 What would happen to the numbers of other organisms in the creek and pond if the number of fish suddenly increased? Explain how you arrived at your answers.
7 Why are waterlilies important to some of the animals in the creek and pond?
8 Do you think that this food web would be the same through the whole year? Give reasons for your predictions.
9 What other factors may influence the life in the creek and pond? Which of these factors might have a major effect on the food web? Explain the reasons for your answer.

If you would like to use the computer for drawing food webs, open the ICT skillsheet Getting started with Microsoft Word– drawings and pictures on the CD. Working with technology

Activity note

It might be fascinating to have a local biologist give a presentation to the class about their work with ecosystems. (Try your local government or the Environment Protection Agency of the Queensland Parks and Wildlife Service.)

Learning experience

Organise a field trip to a nearby creek or river and ask students to collect and study the organisms that live in the ecosystem. Construct food webs that exist in the area.

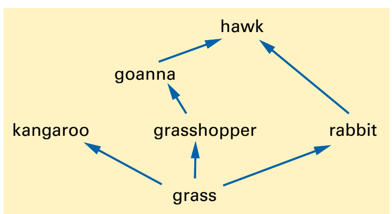
Alternatively, show the class a DVD or recorded program that examines a particular ecosystem and construct food webs based on the program.

Check!

1 Copy and complete the following sentences
  a Food chains generally begin with _____ or _____.
  b Animals that eat other animals are called _____.
  c In food chains and webs, plants and algae are called _____ because they make their own food.
  d The energy needed by plants and algae to make their own food comes from _____.
  e _____ and _____, which break down the bodies of dead organisms, are called _____.

2 Some of the following statements are false. Select the false ones and rewrite them to make them correct.
  a Producers make their food by the process of photosynthesis.
  b First-order consumers are also called carnivores.
  c Organisms that contain chlorophyll are called consumers.
  d A domestic cat could be classed as a first-order consumer.
  e Decomposers break down the bodies of dead organisms and recycle the materials in the food web.

3 Look at the food web below.



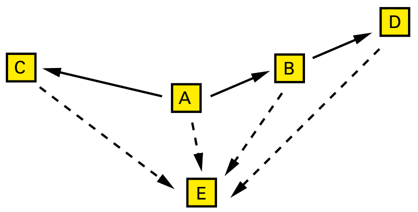
  a Which organisms are consumers?
  b Which of the animals are herbivores?
  c Which are carnivores?
  d Draw a food chain that includes the goanna.
  e Suppose the number of grasshoppers increased. What effect would this have on the food web?

4 Can an organism be a first-order consumer and a second-order consumer at the same time? Give examples with your explanation.

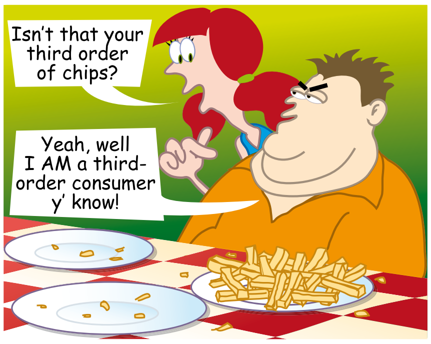
5 From the animals below, make a list of the carnivores and a list of the herbivores. Make another list of the animals that eat both animals and plants. These are called omnivores. For ones you are not sure of, make a separate list and write NOT SURE above it.

cow, shark, wombat, beetle, moth, tuna, fly, parrot, goldfish, cat, mouse, bee, jellyfish, wallaby, seagull, human, guinea pig, blue whale, seal, tadpole, squid, dog

6 The diagram below shows a food web containing a carnivore, a decomposer, a herbivore and a plant. For each of the letters in the diagram, choose the description that matches it. (One is used twice.)



7 Draw food chains to show humans as:
  a herbivores
  b first-order consumers
  c third-order consumers.



Check! solutions

1 a Food chains generally begin with **plants** or **algae**.
  b Animals that eat other animals are called **carnivores**.
  c In food chains and webs, plants and algae are called **producers** because they make their own food.
  d The energy needed by plants and algae to make their own food comes from **the Sun**.
  e **Bacteria** and **fungi**, which break down the bodies of dead organisms, are called **decomposers**.

2 a True
  b True
  c False. Organisms that contain chlorophyll are called **producers**.
  d True
  e True

3 a Consumers are the kangaroo, grasshopper, rabbit, goanna and hawk.
  b The kangaroo, grasshopper and rabbit are herbivores.
  c The goanna and the hawk are carnivores
  d grass → grasshopper → goanna → hawk
  e An increase in the number of grasshoppers is likely to cause an effect on all other members of the food web. For example, there will be less grass for other herbivores and more food for the goannas and hawks.

4 Yes, this is possible, because some animals eat both plants and other animals. Humans are a good example; when we eat our breakfast cereal we are first-order consumers and when we eat eggs and bacon we are second-order consumers.

5

Carnivores	*Herbivores*	*Omnivores*
shark	cow	fly
beetle	wombat	human
tuna	moth	dog
cat	parrot	mouse
jellyfish	goldfish	
seal	bee	
squid	wallaby	
blue whale	guinea pig	
tadpole		

6 Organism A is a plant.
Organisms B and C are herbivores.
Organism C is a carnivore.
Organism E is a decomposer.

7 a cereals → humans
  b same as **a**
  c algae → shellfish → fish → humans

challenge

1 Most of the food chains of the organisms that live in the soil start with the decaying remains of plants. For example, earthworms eat decaying plant remains and microscopic animals that live in the soil.

a Would you expect to find earthworms in desert areas of Australia? Give a reason for your answer.

b Draw a food web that includes earthworms.

c To a gardener, earthworms in the soil are a good indicator of fertile soil. Suggest a reason for this.

2 A company wants to build a tourist resort on an area now covered with mangroves. Suppose you are a biologist who studies the feeding relationships in mangroves. The local council hires you to make recommendations about the biological importance of the mangroves.

You make the following observations.

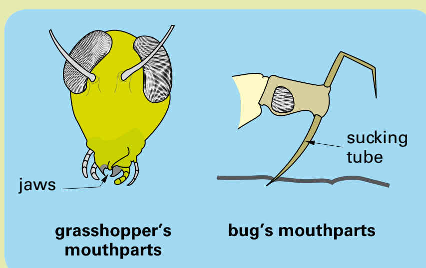
The mangrove leaves fall into the mud and are decayed by fungi and bacteria. Microscopic unicellular algae grow rapidly in areas where there is a lot of leaf decay. Small prawns, mud whelks and microscopic animals feed on the algae and the bacteria. Mud crabs feed on the microscopic animals and the decaying leaves. Small fish feed on the prawns and the microscopic animals. Larger fish feed on the small fish and prawns. Many types of birds, including stilts and herons, feed on the small fish, prawns and crabs.

a Draw a food web for the mangrove area.

b The developers of the tourist resort say that it would bring in millions of dollars to the town. What arguments would you put forward to keep the mangroves as they are?

Fig 18 There is an abundance of life in mangroves.

3 The diagrams below show the mouthparts of two types of herbivorous insects. They have been magnified many times. Suggest how each insect uses its mouthparts to obtain food.



Issues

State and local governments determine when natural environments should be developed for houses, industries and roads. Before these decisions are made, an environmental impact study is done to determine the effect on the natural flora and fauna.

Suppose there is a large area of natural bushland close to your school. The task for the students is to determine the impact on the food webs in the bushland if construction was to occur. Alternatively, have a class debate on the topic 'Progress is more important than animals'.

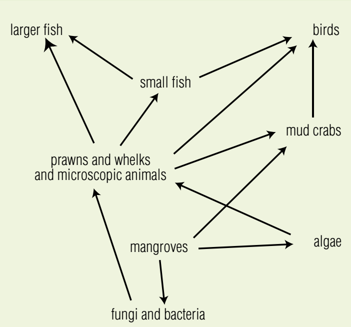
Challenge solutions

1 a You would not expect to find earthworms in desert areas because there are not enough decaying plants in the soil for the worms to eat.

b decaying plants → earthworms → bird

c Earthworms will only live in soil which is moist and well aerated. They also move decaying plant material and soil particles up and down thereby increasing the fertility.

2 a



b The food web shows that all these living things depend on the mangroves. If the mangroves are destroyed then all living things in this food web will die or move away to another area.

Sometimes mangroves are called nurseries because this is where fish and other animals breed.

Arguments you could use would include:

- we should take care of the breeding grounds for all of these organisms
- you could develop the resort so as to make a feature of the mangrove community
- mangroves take a very long time to grow (unlike resorts).

3 The grasshopper cuts its food into pieces. The bug sucks blood or other fluids from other organisms.

Hints and tips

Explore with the students some possibilities for what may happen to a habitat if an introduced organism enters it. Prepare some examples of what has happened when non-native species (eg rabbits, cane toads, honeybees, fire ants) have been introduced.

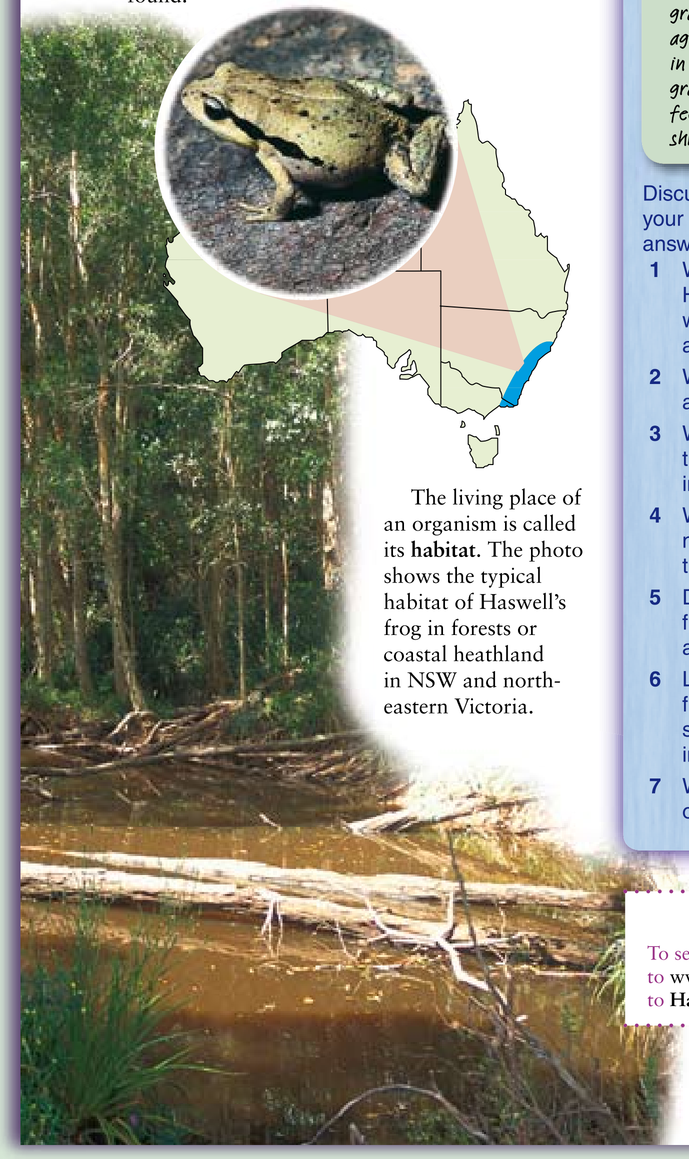
Assessment task

Assessment task 7: A food web, found on the CD, can be set at anytime during this section.

7.2 Ecosystems

Why does a particular type of animal or plant live in the place it does?

The frog in the photo below is called Haswell's frog. Its scientific name is *Paracrinia haswelli*. The map shows the region of Australia in which it is found.



The living place of an organism is called its **habitat**. The photo shows the typical habitat of Haswell's frog in forests or coastal heathland in NSW and north-eastern Victoria.

Activity

Work in groups of 3 or 4 for this activity. Read the following description of the places in which Haswell's frog is found.

> *The frog lives in wet temperate forests and near creeks within coastal heathland. It hides under stones, logs and in the mud between grasses in late autumn, and becomes active again in the early spring nights. It breeds in late spring to early summer, calling from grasses and beside creeks and dams. It feeds on insects and spiders and sometimes shrimps and worms.*

Discuss each of the following questions in your group. Be prepared to discuss your answers with the whole class.

1 Write a description of the living place of Haswell's frog. In your description explain what you think 'wet temperate forests' and 'heathlands' are.
2 Why does the frog hide between late autumn and early spring?
3 Why does the frog breed at a certain time of the year? Is the time of year important?
4 Why does the frog become active at night? Suggest what it might do during the daytime?
5 Draw a food web that includes Haswell's frog. Extend your food web to include the animals that might feed on the frog.
6 Look at the colour and texture of the frog's skin. Suggest why it hides under stones, logs and in the mud, rather than in the vegetation around creeks.
7 Why do you think Haswell's frog is found only in this region of Australia?

WEBwatch

To see more pictures and listen to frog sounds go to www.scienceworld.net.au and follow the links to **Haswell's frog**.

Learning experience

Have students research the different types of ecosystems, eg tropical, desert, woodlands, rainforest etc, which exist in Australia. Using a colour code, mark their locations on a map of Australia.

Organisms in ecosystems

Haswell's frog and the other organisms that live in and around the creek interact with one another and depend on each other for their survival. The organisms also depend on the non-living things in their habitat for their survival; for example, water, soil minerals and temperature. The complex system of feeding relationships and interactions with the non-living things is called an **ecosystem**.

A terrarium ecosystem

A terrarium can be set up using a glass aquarium and filling it with sand, soil, rocks, algae, plants, fungi, dead leaves and bark, small logs and even some small animals such as insects, spiders and worms. When water is added to the soil and the glass lid placed on the aquarium to keep the moisture in, you have a terrarium ecosystem. Each of the animals, plants, algae and fungi interact with other organisms and with the non-living parts of the terrarium.

The terrarium can operate for a long period of time without materials from the outside being added to it. All the materials needed for the living things are contained in the ecosystem. No materials are added from the outside—no food for the animals or fertilisers for the plants. The only input is the sunlight which is needed for the process of photosynthesis.

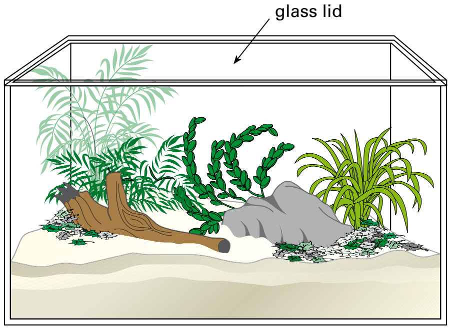


Fig 20 A terrarium is an example of an ecosystem. It contains non-living things such as soil, rocks and logs, and living things such as animals, plants and fungi.

Activity

In this activity you will work in a small group to design a terrarium and write instructions on how it might be set up. Use the websites below to help with your write-up.

1 **Designing a terrarium**
Your task is to write instructions on how to construct a terrarium so that other people can easily follow them. In your instructions you should:
- list the non-living things you need, eg soil, water, etc.
- list the living things that you think should go in the terrarium, and in which order to add them
- write details and draw sketches of the layout of the terrarium.

WEBwatch

Go to www.scienceworld.net.au and follow the links to the websites below.

Terrariums
Outlines the basic steps in creating a terrarium.

Terrarium questions and answers
Useful and practical information about setting up terrariums.

2 **How the terrarium functions**
Your terrarium should operate as a functioning ecosystem. For this to occur you need to consider the following questions. For each question, discuss the answers with other members of your group, come to a consensus and then write the group's answer.
- How would you position the terrarium to ensure there is enough sunlight, without it overheating?
- How are oxygen, carbon dioxide and water used and recycled in the terrarium?
- What happens when organisms die?

3 If you have time, set up the terrarium and test your design. Take care with any animals in the terrarium.

Hints and tips

Brainstorm a class list of why non-living things affect survival in a habitat. Why does the amount of water or nutrients or temperature affect survival rate? Discussing possible outcomes/effects leads nicely into the next section on why organisms live where they do.

Learning experience

Ask students to work in small groups to make a model of a particular ecosystem. They can use recycled materials or small toys, but try to limit the cost, encouraging students to improvise with their materials. Ask them to attach an information sheet to the model, detailing where the ecosystem can be found, the animals that live in it and some possible food webs that exist within it.

Alternatively, set up an aquarium or terrarium as a class project, allowing different groups to care for it each week.

Activity notes

- Discuss with the students some guidelines for collecting and handling small living animals, especially ants.
- To capture the ants, use jars and glass rods or wooden sticks to coax the animals under the upside-down jar, then carefully slide a piece of cardboard beneath the insects and turn the jar up the right way.
- Treat the animals with respect and return them to the place where they were found.

Hints and tips

At the start of the lesson ask a set of 'Quick Questions' to gauge what the students have learnt. Revise any areas that are not satisfactorily answered.

Homework

Ask students to research animal behaviours that allow them to accommodate for varying body temperatures and climate changes. An animal's behaviour or breeding time is often related to climate. Students should research all these factors. They could research domesticated animals or animals found in the wild.

Why do organisms live where they do?

There are four important reasons for this.

1. For animals, there is **ample food**. For plants, the soil contains adequate **minerals and moisture**.
2. There are few animals that feed on the particular organism. These animals are called **predators**. (For example, the Eastern small-eyed snake is a predator of Haswell's frog.)
3. There are few other organisms that need the same type of food, soil nutrients and living space. These other organisms are called **competitors** because they compete for food and living space. (Another frog called the Brown tree frog is a competitor because it lives in the same area as Haswell's frog and eats the same type of food.)
4. The **climate** and **weather conditions** are suited to the particular organism. This includes a good supply of water and clean air.

Temperature and activity

The body temperature of frogs changes with the outside temperature. So in the colder weather of winter, frogs hide away in logs or crevices.

On the other hand, the body temperature of mammals (such as possums, wombats, mice, wallabies, bats and humans) and birds remains fairly constant all year round. These animals can be active all year round.

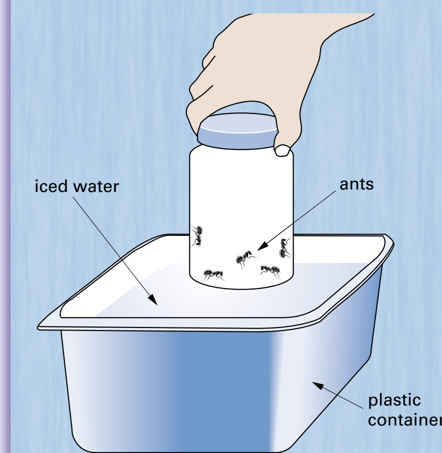
Most animals that have a changing body temperature live in warm climates. Those that live in regions that become cold in the winter have special ways to survive the lower temperatures: they hide underground or in logs, and become inactive. Some animals, for example many butterflies and moths, lay eggs as the weather becomes cooler and then die. The eggs last through the winter and do not hatch until the weather becomes warmer. Without these special methods of survival these animals would die.

Activity

Your teacher will do this as a class activity. You need about 10 ants in a small bottle with a lid, and a plastic container (ice-cream container).

1. Observe the way the ants move about at room temperature.
2. Pour iced water into the container and place the jar of ants into it.

WARNING: You are using living animals. Take care of them, and when finished put them back outside.



Observe the movement of the ants over the next few minutes. Compare it with their movement in Step 1.

3. Pour out the cold water and replace it with warm water. Make sure the water is 'hand hot'. (If you can leave your hand in the water it is at the right temperature.)
4. Place the jar of ants in the warm water.

How did the higher temperature affect the movement of the ants?

Suggest why more insects are found buzzing around lights on a summer evening than in winter.

Survival—eat or be eaten

Any animal or plant in a food web can be the food for another animal. To survive in a particular habitat, animals have to find enough food to eat and be clever enough not to be eaten.

To find food, an animal should have:

1. very keen senses—sight, smell, hearing or touch
2. fast muscle reactions—carnivores need to be able to move quickly to catch their prey
3. claws to hold prey and suitable mouthparts to eat the prey.

To avoid being eaten, an animal might:

1. be able to move very quickly
2. avoid being seen by blending in with the colour or texture of the surroundings
3. be poisonous to other animals or have spines, barbs or prickly skin.

Fig 24 Echidnas have sharp spines to keep predators away.

The colour and texture of an animal's skin are important for its survival in its habitat. For example, Haswell's frog is brown and has a rough skin texture. When hiding amongst stones and in the mud banks of creeks, it is not easily seen by predators such as snakes and birds.

Activity

In this activity you are going to make inferences about how animals survive in their particular habitat.

You will need about 6 preserved animals or coloured photos of animals.

1. Before you begin, draw up a data table like the one shown. Use at least half a page.
2. Observe each animal carefully. Look for structural features such as shape, size, spines, claws, type of body covering and colour.
3. Write your inferences about survival in the right-hand column of the table. Discuss with your group inferences about the animal's habitat, the foods that it might eat, how it gets its food.

You could also write inferences about what might eat the animal and how it might avoid being eaten.

What advantages do spines, horns, poisons or stings give animals?

Why do some animals 'play dead' and others roll into a ball shape?

Animals	Observations	Inferences

Hints and tips

Prepare a set of flash cards on ecosystems which can be used throughout the chapter. It may be a useful exercise for the students to develop their own so they can use them as a revision tool.

Learning experience

Ask students to design defence mechanisms for a hypothetical animal in an ecosystem to decrease its risk of being eaten. Students should explain how the defence mechanism works and what protection it could offer in its chosen ecosystem. Try to make the design as creative and imaginative as possible. Ask each person to show their design and explain their methods of protection to the class.

Alternatively, ask students to select an Australian animal and come up with ways that could make it a more successful predator or better at avoiding being eaten by predators.

Learning experience

Set a challenge to design a 'survival in a habitat' board game or interactive computer game. This is a great extension exercise, especially for gifted students.

Discovering ecosystems

This page gives you an opportunity to learn about some different ecosystems. You will find interesting and informative websites that you can use to discover more about the ecosystems and the animal and plant life in them.

Polar ecosystems—Antarctica

Antarctica is the world's coldest ecosystem (the lowest temperature recorded was –89.6 °C in 1983). The land ecosystem on the Antarctic continent is very simple. Plants and animals have to be able to withstand harsh conditions.

WEBwatch

Go to www.scienceworld.net.au and follow the links to the websites below.

Australian Antarctica Division—Science

This is an excellent website giving information about science in Antarctica.

Use it to find out about:

1 the types of animals and plants in the Antarctic ecosystem, what they feed on, their predators and how they breed

2 how the organisms survive the harsh conditions of the Antarctic ecosystem.

Antarctica webcam

Want to find out what the weather's like at Mawson Station today?

There are many other good websites on Antarctica. Type *Antarctica* in your search engine.

Rocky shore ecosystems

Australia is surrounded by the sea. The coastline contains sandy beaches, rocky headlands and offshore rocky and coral reefs.

The rocky shores are home to a wide variety of living things. Use the Rocky Reef website on the right to find out about the organisms on a rocky shore ecosystem.

Rainforest ecosystems

Plants that grow in rainforests have to compete for food, water and light in a habitat where there is a dense growth of plants. The leaves of rainforest plants are large to catch as much as possible of the sunlight that comes into the forest.

Use the internet and library to find out where rainforests occur in Australia and what types of conditions are needed for their survival. Also find out why rainforest ecosystems have such a diversity and abundance of life compared with other Australian ecosystems.

WEBwatch

Go to www.scienceworld.net.au and follow the links to the website below.

Rainforests Australia

This is a commercial website but it has detailed information about the animals and plants of Australian tropical rainforests and useful links to other sites.

WEBwatch

Go to www.scienceworld.net.au and follow the links to the websites below.

Rocky Reef

You will find a wealth of photos and information about organisms that live in this marine ecosystem.

MESA

Explore this website by clicking on any interesting links. You can also type your search word in the search frame.

Hints and tips

There are many commercial DVDs and videos available to show students these ecosystems. Some students have experienced them first-hand and may like to describe what they observed.

Learning experience

Construct a Y-graph for different ecosystems using the headings *Smells/feels like*, *Sounds like* and *Looks like.*

To construct a Y-graph simply draw a very large Y in the centre of the page, with a heading in each section. Students then place a series of descriptor words or sentences in each section. For example, the descriptors for a desert might be:

- *Smells/feels like*: dry, hot, sweaty
- *Sounds like*: vacant, windy, tumbleweeds blowing
- *Looks like*: dry, sandy, few plants

After students have completed this, you can hold a class discussion to describe other ecosystems.

Check! solutions

1 a The features enabling each of these animals to catch food are:
- The cat has keen senses, a quick reaction time and sharp teeth and claws.
- The hawk has a keen sense of sight and very sharp talons and beak to kill its prey and then tear it apart.
- The shark also has keen senses, is very quick and powerful and has long sharp teeth to kill its prey.
- The snake is able to detect the heat given off by other animals, can strike very fast and inject a poison which slows down or kills its prey.

b The features of these animals which help them avoid being eaten are:
- The cat can move very fast, climb trees and use its claws for defence.
- The hawk is strong and powerful and able to use its sharp beak and claws to defend itself against enemies.
- The shark is well camouflaged, can move quickly and has few natural enemies.
- The snake is usually well camouflaged, can move quickly and is protected by tough scales over its body.

Check!

1 Consider the following carnivores—cat, hawk, shark and snake.
   a What features do each of these animals have to be able to catch their food successfully?
   b What features do each of the animals have to avoid being eaten?

2 Kim has a pet mouse that she keeps in a terrarium in her house. One day she notices that her little brother has left the lid off the mouse house, and the mouse has escaped.
   a What are the four important factors that will determine whether the mouse survives outside its house?
   b Explain why each of these factors is important.

3 Consider the following herbivores—parrot, green leaf bug, tortoise and horse. What features does each animal have to avoid being eaten by predators?

4 Only mammals and birds are found on the Antarctic continent. Yet in the oceans around the land and icepacks, fish and other animals are found whose body temperatures change. How can these animals live there?

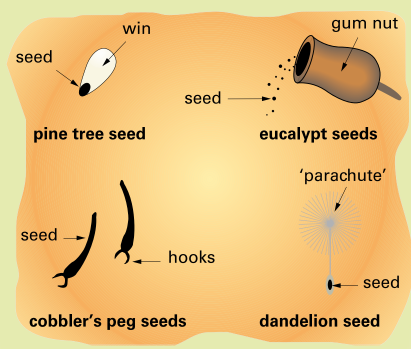
5 The jellyfish in the photo below feeds on small fish and prawns. It does not move very far or very quickly, and usually relies on currents to move it from place to place. Suggest how it might catch its food and avoid being eaten.

challenge

1 The European rabbit was originally found in Spain. It was introduced into Australia in 1788 and on several occasions after this to 'enrich the country'. By 1890, rabbits were in plague proportions in south-eastern Australia.

   a Suggest why rabbits spread so quickly in Australia.
   b What do you think 'enrich the country' meant to the early European settlers?
   c Suggest why the rabbits were not found in plague proportions in Spain or the rest of Europe?

2 Animals are found in different areas because they can move from place to place. Plants generally cannot move and have to rely on their seeds being scattered over a wide area. Each of the plant seeds below has a different method of being distributed. Suggest what these methods are. (The drawings show the actual sizes of the seeds.)



Challenge solutions

1 a The rabbit spread quickly because it had a good food supply, little competition and few predators in Australia.
   b The early settlers thought that rabbits might be a supply of food for them and also provide some shooting sport.
   c They were not in plague proportion in Europe because there were natural competitors and predators.

2 The following are suggested methods of seed distribution:
   - The pine tree seed can be carried by the wind and actually spins like a helicopter blade as it falls.
   - The eucalypt seeds are very small and numerous and can be carried by wind and water after they have fallen from the gumnut.
   - The 'cobbler's peg' seeds have little hooks which allow them to become attached to the feathers or hair of other animals and be transported over large distances.
   - The dandelion seed looks rather like a parachute and is carried in even the slightest breeze. You may have seen them blowing around in spring.

2 If the mouse escapes:
   a four factors which will determine whether it will survive or not are food, predators, competitors and the weather conditions
   b food is important because a mouse has a constant body temperature and must eat a lot of food to produce enough energy to be warm and active. Cats are among a number of animals (predators) which will catch and eat mice, therefore it is important that the mouse finds a hole for protection. There may be other animals which compete for the same food and shelter as the mouse. If the mouse cannot find shelter then it may be exposed to conditions which may make it difficult to survive.

3 Features which will help the animal avoid being eaten are:
   - parrot: camouflage, sharp claws, beak, nests in hollows in trees
   - green leaf bug: camouflage, remaining motionless
   - tortoise: diving and swimming underwater, withdrawing into its shell
   - horse: good senses, hard hooves and powerful legs to run and kick.

4 Animals can live in the ocean because the temperature of water cannot drop below zero degrees, whereas on land it can and frequently does. Only warm-blooded animals like birds and mammals are able to survive when this happens.

5 Jellyfish have tentacles with stinging cells which can paralyse and even kill small fish and prawns. It is almost colourless so it is very hard to see in the water and can also sting predators which attack it.

7.3 Living in groups

Populations and communities

Organisms rarely live alone. For example, the orange fish in the photo above live for most of their lives in a group or school. A number of organisms of the same kind that live in a certain area is called a **population**.

Each animal or plant has its own particular habitat, and generally a number of different populations live in the same habitat. For example, on a coral reef you will find populations of sea anemones, brain coral, brittle stars, anemone fish and coral sharks.

The different groups of organisms that live together in a particular habitat are called a **community**. Each of the organisms in a community relies on other organisms in that community for food and sometimes for protection.

Communities are usually named after the type of habitat in which they are found. For example, the organisms that live on a coral reef are called a coral reef community. Organisms that live on or under the leaf litter on a forest floor belong to a forest floor community. Sometimes a community is named after the dominant or most noticeable type of organism. For example, a mangrove community or a eucalypt community.

Population changes

A female house fly lays about 120 eggs at a time. Suppose that a female fly lays batches of eggs seven times a year. If none of the baby flies die and they reproduce, then after a year there would be 5 598 720 000 000 flies from one original pair of flies!

In nature we never see so many flies develop. There are certain factors in ecosystems that control populations. Populations in an ecosystem are affected by non-living factors, called physical factors, such as the weather, availability of water and soil conditions. They are also affected by biological factors such as availability of food, number of predators and competitors, and the presence of disease organisms.

The case study on the next page looks at a population of aphids on orange trees.

Research

Ask students to research and make a poster about an organism that reproduces in large numbers. They should comment on the reasons for the high reproductive rate, the rate of survival of the offspring and the factors that affect the survival rate. Students can also research breeding seasons and mating rituals.

Learning experience

The students could list about five populations of different species ranging from very small to very large populations. They could investigate why some species become extinct or endangered, or how rapidly the large or small populations build up.

Hints and tips

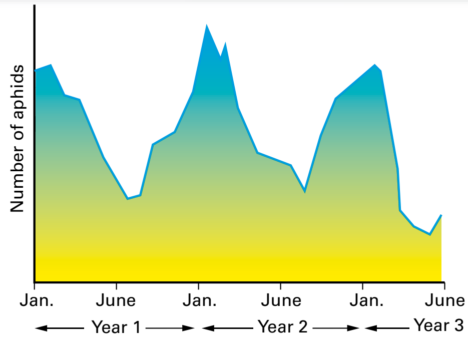
It may be useful to prepare some other case studies for the students to examine.

case study

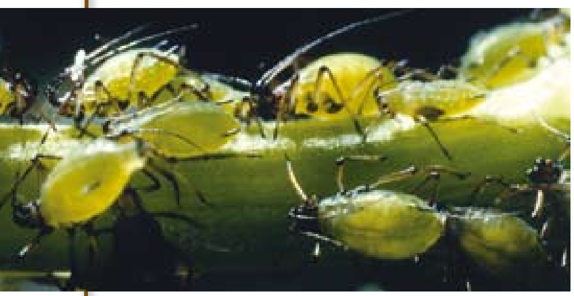
Aphids are small, flightless insects that suck the sap from the young leaves. They reproduce in very large numbers and it is these large numbers that cause damage to plants.

A biologist studied the populations of aphids on the leaves of orange trees in an orchard over a number of years. In particular she observed the changes in the number of aphids.

The biologist sampled 10 orange trees in the orchard and counted the number of aphids on them over a two-and-a-half year period. The graph shows her data. What can you observe from this graph?



- The aphid population is at a maximum around January and falls to a minimum around June.



- The number of aphids was greater in January of Year 2 than in January of Years 1 and 3. There was an unusually rapid decrease in the number of aphids after January of Year 3.

You can also make inferences from these observations to help explain the changes that occurred.

- As the weather becomes warmer the aphids begin laying eggs, and the warm weather in January causes the eggs to hatch.
- The number of predators increases around January, causing a decrease in the aphid population over the following months.
- Disease or poor weather conditions caused the rapid decline in the aphid population in Year 3.

Science in action

Population plagues

Peter Brown is a research scientist with CSIRO's Division of Wildlife and Ecology. He has been studying mice populations in the Wimmera and Mallee districts of Victoria.

Mice start breeding in spring when seeds form on plants, particularly grasses. If the rains have been good in winter and there are plenty of seeds, mice can breed in huge numbers producing a mouse plague. Their numbers are far too large to be controlled by predators such as cats, snakes, owls and foxes.

Peter has been working with farmers in these districts to reduce the mice food supply, limit the breeding sites and regularly check the mouse populations.

WEBwatch

Go to www.scienceworld.net.au and follow the links to **Mouse plagues**.

Learning experience: student survey

Have students conduct surveys of the other students in their class or other classes to determine the different groups which exist within the school population. Here are some examples of ways that students could be grouped:

- method of getting to school (walk, bus, ride, driven)
- type of food they eat
- pets they own
- sports they play.

Allow students to work in small groups to conduct the survey. They should tabulate results and discuss them with the class.

Activity notes

- Students may have difficulty interpreting the graph. It is important that you go over the graph with students, discussing the axes and the colour coding so that it is clear, prior to them answering the questions.
- In question 4, when predicting ask students to *justify* their prediction. This should be a standard practice for students.

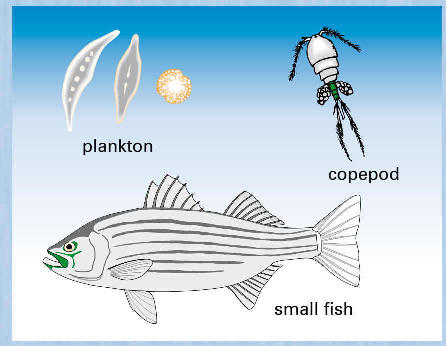
Activity

A team of biologists studying a lake community used a very fine net to collect organisms from the surface water in an area of the lake. They wanted to find the numbers of plant plankton (containing chlorophyll), copepods (microscopic animals) and small fish in that habitat.

Study the graph below and use it to answer the following questions.

Questions

1 Which organisms are the producers? Draw a food chain for the organisms.



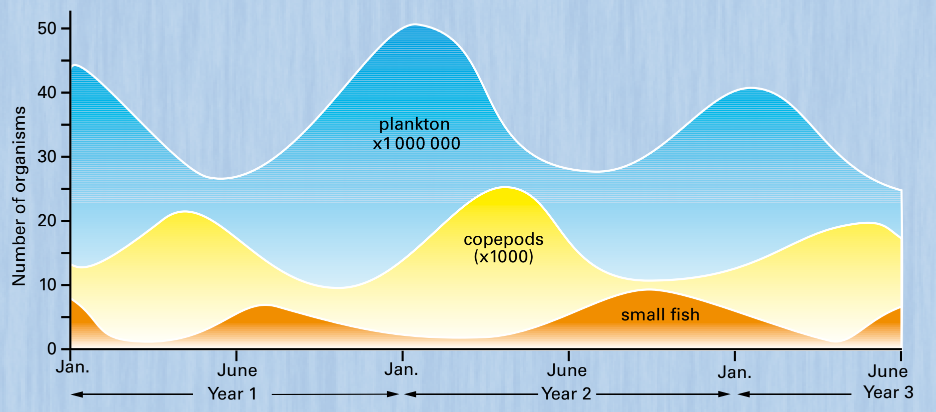
2 On the graph, suggest what the figures after the plankton (x 1 000 000) and after the copepods (x 1000) mean.

3 Make inferences to explain the following observations.

- The greatest number of plankton were found in January and February.
- The copepod population reached a maximum several months after the plankton population reached its maximum.
- The population of fish is generally much smaller than the population of copepods.
- A very large number of copepods was found in April of Year 2, followed by a rapid decrease in numbers.

4 Predict what might happen if:

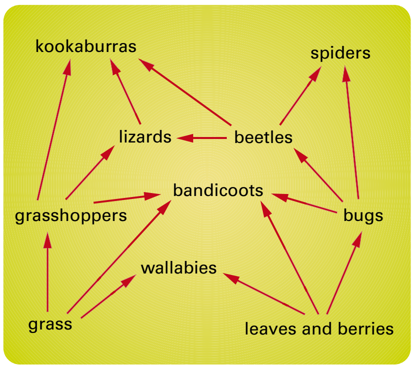
- a large amount of fertiliser ran into the lake from a nearby farm
- many copepod-eating insect larvae hatched in the lake in March of the second year.



Check!

1 Some of the following statements are false. Select the false ones and rewrite them to make them correct.
  a Water in the soil is classed as a biological factor in an ecosystem.
  b Communities are often named after the type of place in which they are found.
  c A community of organisms generally contains only consumers.
  d An increase in the population of an organism could be due to many competitors and predators in its habitat.
  e Communities are made up of different populations of organisms.

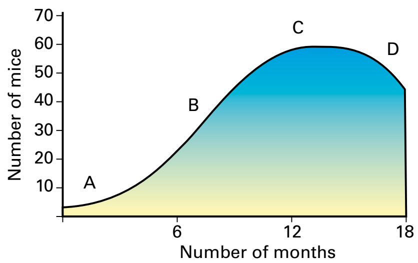
2 Use the food web to answer the questions below.



  a Describe the habitat of this community of organisms. What name would you give to this community?
  b Which organisms are predators of bugs?
  c Which organisms are competitors of beetles?
  d Which biological factors might affect the population of bandicoots? Which physical factors might affect the population?
  e Suppose feral cats killed many of the lizards in this community. Infer what might happen to the other organisms in the food web.

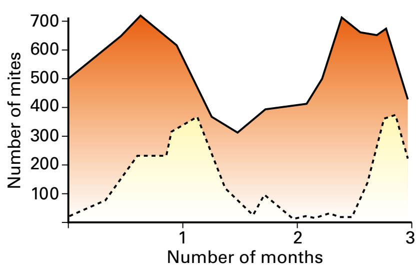
3 Look back at the food web for the freshwater creek community you drew in the activity on page 145.
  a What are some of the biological factors that might affect the population of frogs?
  b What are some of the physical factors that might affect tadpoles?
  c Would the physical factors that affect small fish be the same as those that affect herons? Justify your answer.

4 The graph below shows the population of mice in and around a hay shed on a farm.



  a Which part of the graph shows where the population is growing rapidly?
  b Which part of the graph shows where the population is decreasing? What factors might cause this change?

5 The graph below show the populations of two types of mites (microscopic animals with eight legs, similar to spiders). One type of mite eats microscopic plants and fungi, and one preys on the other. Which one is which? Give reasons for your answer.



Check! solutions

1 a False. Water in the soil is classed as a **physical** factor in the ecosystem.
  b True
  c False. A community of organisms generally contains **producers, consumers and decomposers**.
  d False. A **decrease** in the population of an organism could be due to many competitors and predators in its habitat.
  e True

2 a It is likely that this habitat is grassland with some shrubs. It could be called a grassland community.
  b Bandicoots, beetles and spiders are predators of bugs.
  c The competitors of the beetles are spiders and bandicoots.
  d Biological factors would include the grasshoppers, bugs, grass and shrubs. Physical factors would include temperature, water and sunlight.
  e If many of the lizards are killed you can infer that the numbers of grasshoppers and beetles might increase.

3 a Some biological factors which might affect the population of frogs are beetles, mosquitoes and snakes.
  b Some physical factors affecting the tadpoles would be water temperature, gases dissolved in the water and the amount of water itself.
  c Some factors such as water and temperature would be common for the fish and herons, whereas others such as dissolved materials in the water and wind would be different.

4 a The population is growing rapidly between A and C.
  b The population is decreasing between C and D. The reasons for this could include changes in the weather, food supply or predators.

5 The red graph shows the herbivorous mite and the yellow graph shows the carnivorous mite. You can infer this because the population of the herbivore is greater and the changes in the population of the predator always follows the herbivore.

Main ideas solutions

1 food web
2 glucose, oxygen, energy
3 producers, Sun, water
4 bacteria, fungi
5 habitat, ecosystem
6 population, community
7 organisms, predators

MAIN IDEAS

Copy and complete these statements to make a summary of this chapter. The missing words are on the right.

1 A food chain is a simple way of showing how animals and plants depend on each other for food. A _____ consists of a number of food chains linked together.

2 Respiration is a process in which all living things use _____ and _____ to produce _____, and give off carbon dioxide and water.

3 Plants and algae are called _____ because they photosynthesise and make their own food using the energy from the _____; carbon dioxide and _____ are used in the process.

4 Certain_____ and _____ are called decomposers because they break down the bodies of dead organisms into simple substances.

5 The living place of an organism is called its _____; the inter-relationships between living things and their surroundings is called an _____.

6 A _____ is a number of organisms of the same kind; different populations all living in a particular habitat form a _______.

7 A community will survive in a particular habitat if the _____ have ample food, few _____, few competitors, and a suitable climate and weather conditions.

bacteria
community
ecosystem
energy
food web
fungi
glucose
habitat
organisms
oxygen
population
predators
producers
Sun
water

Try doing the Chapter 7 crossword on the CD. Working with technology

REVIEW

1 Which statement is *not true* for food chains?
A They show which organisms feed on which.
B They mostly begin with plants or algae.
C They show the number of living things in each step.
D They show the order in which organisms are fed upon by others.

2 Which of the following food chains is correct?
A grass → snake → frog → grasshopper
B grasshopper → grass → frog → snake
C grass ← grasshopper ← frog ← snake
D grass → grasshopper → frog → snake

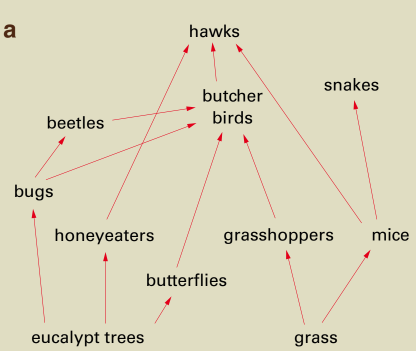
3 Read the paragraph below.
a Use this information to draw a food web.
b Give a name to the type of community to which you think these organisms belong.

Emily and Max were observing the organisms in a small area of open eucalypt forest. They noticed bugs sucking the sap from the eucalypt leaves and honeyeaters and butterflies eating the nectar from the eucalypt flowers. Grasshoppers ate the new grass shoots and mice ate the grass seeds. Beetles and butcher birds fed on bugs. The butcher birds also ate grasshoppers, beetles and butterflies. Hawks were seen to attack honeyeaters and butcher birds and to eat mice. Snakes were seen to eat mice.

4 In which ways are decomposers and scavengers similar? How are they different?

Review solutions

1 **C**
2 **D**
3 **a**



b The community could be called a eucalypt community or an open forest community.

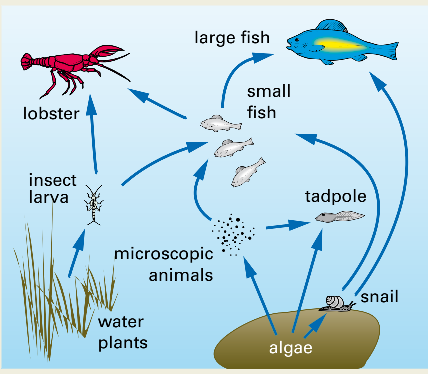
4 Scavengers and decomposers are similar in that they both attack dead organisms. However scavengers eat the dead organisms and digest them internally, whereas decomposers release chemicals which break down the organism's body externally.

5 The diagram below shows some of the animals and plants that live in a pond.

a Which organisms are producers?

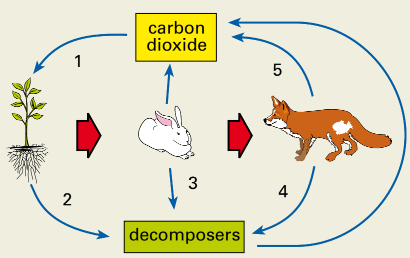
b Which organisms are second-order consumers?

c Which organisms are competitors of small fish? Which are their predators?



6 Explain why communities would not survive without decomposer organisms.

7 Matthew and Jessica drew the diagram below to show some interactions in a particular community.



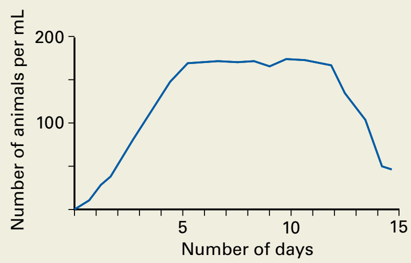
a What is the process labelled 5?

b Describe what happens in 2, 3 and 4.

c Why is process 1 important to this community?

d Matthew suggested that this diagram shows how carbon is recycled in this ecosystem. Do you agree with his suggestion? Justify your answer.

8 The graph above right shows the growth of a population of microscopic animals in a large jar containing sufficient food. Which of the following statements is an inference rather than an observation?



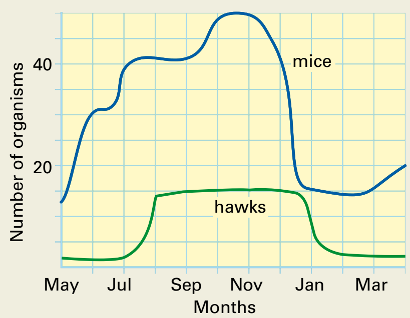
A The population grew constantly for the first 5 days.

B The population at day 4 was about 130 animals per mL.

C Shortage of food and poisoning by their wastes caused the population to decrease after day 12.

D The population was greater at day 12 than it was at day 3.

9 The graph below shows the populations of hawks and mice in a wheat field.



a Infer when the hawks' eggs hatch.

b What factors might be responsible for the decrease in the number of mice?

c Does this graph suggest that hawks feed on mice? Explain your answer.

Check your answers on page 302.

5 **a** Algaeand water plants.

b Small fish, lobsters, large fish and tadpoles are second-order consumers. (The large fish, lobster and tadpole can also be third-order consumers.)

c Tadpoles and lobsters are competitors of small fish because they eat the same type of food (tadpoles eat microscopic animals and lobsters eat insect larvae).

6 Decomposers are very important for communities because they:

- remove dead organisms by attacking and breaking down the bodies to simple substances
- recycle the simple substances into the soil and increase its fertility.

7 **a** respiration

b When the organisms die they are attacked by decomposers.

c This process is photosynthesis and it is important because the plants supply the food for the start of the food chain.

d The diagram does show carbon being recycled. Firstly, the carbon dioxide in the air is used by the plant in photosynthesis, then the carbon in the plant is eaten by the rabbit, which is then eaten by the fox. The dead bodies of all organisms are decomposed and carbon dioxide is released back into the air. The animals release carbon dioxide into the air through respiration.

8 **C** is an inference because it is an explanation of why the population decreased after day 12. All the other statements are observations that can be read directly from the graph.

9 **a** The hawk's eggs hatch from early July until the end of August. This is where the slope of the graph is increasing.

b The number of mice might have decreased because they were eaten by the hawks. Other factors might be that the amount of their food decreased, a disease killed many mice, other animals ate them or they migrated away from the wheat field.

c It does suggest that hawks feed on mice because the mouse population decreased when there were large numbers of hawks and started to increase again when the hawk population was low.