KS3 Science Independent Learning Booklets

Interdependence

If you have internet at home, you can use bitesize to help you with some of the activities.

Try your hardest to work through the booklets

Information on the Topic

Food chains

The table describes some common terms used to describe living things in their environment:

Term	Description
Environment	All the conditions that surround a living organism
Habitat	The place where an organism lives
Population	All the members of a single species that live in a habitat
Community	All the populations of different organisms that live together in a habitat
Ecosystem	A community and the habitat in which organisms live

A food chain shows the different species of an organism in an ecosystem, and what eats what.

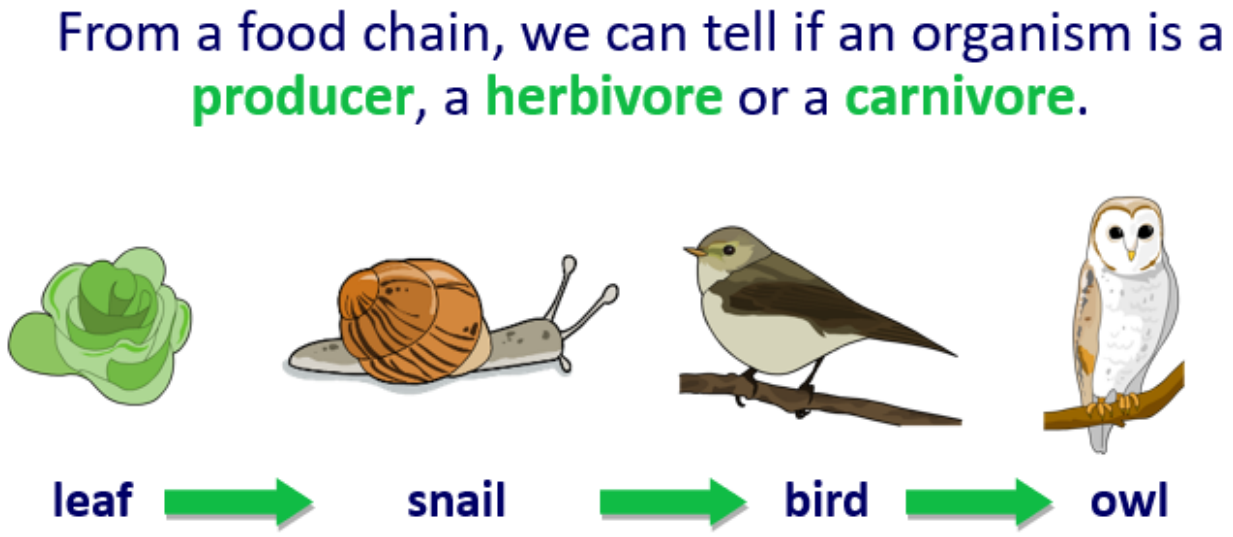
Producers and consumers

A food chain always starts with a producer, an organism that makes food. This is usually a green plant, because plants can make their own food by photosynthesis.

A food chain ends with a consumer, an animal that eats a plant or another animal.

Here is an example of a simple food chain:

grass → cow → human



The plant is the producer and the animals are consumers:

- the first consumer in the chain is also called the primary consumer
- the next one is the secondary consumer
- the one after that is the tertiary consumer

A consumer that only eats plants is called a herbivore, and a consumer that only eats other animals is called a carnivore. An omnivore is an animal that eats both plants and animals.

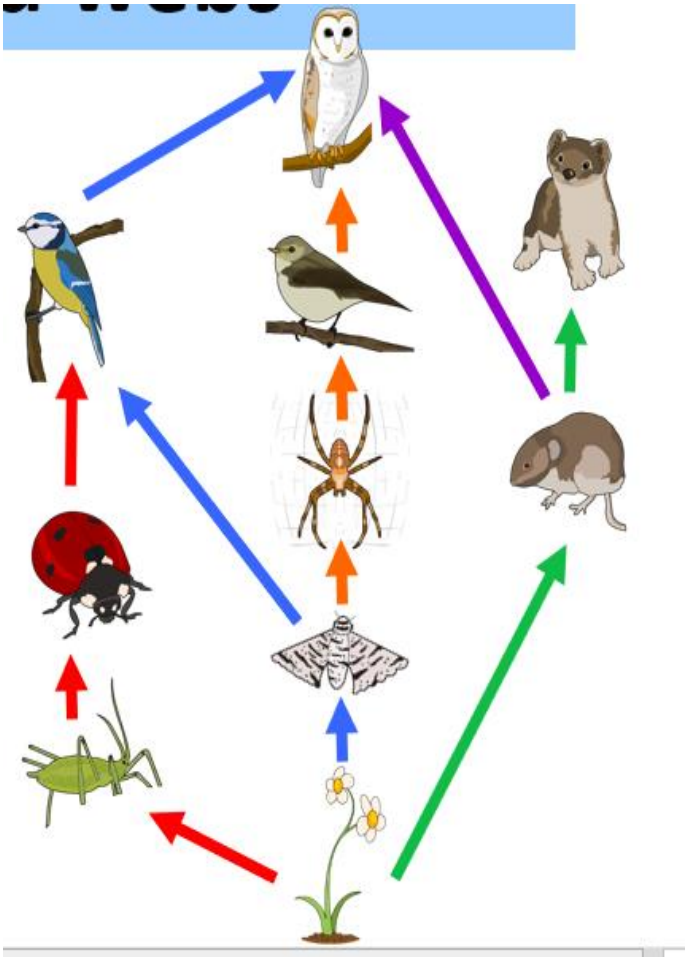
Predators and prey

A predator is an animal that hunts and eats other animals, and the prey is the animal that gets eaten by the predator. In the food chain above:

- the frog is a predator and the grasshopper is its prey
- the hawk is a predator and the frog is its prey

Food webs

When all the food chains in an ecosystem are joined up together, they form a food web. Here is an example of a food web:



Although it looks complex, it is just several food chains joined together. Here are some of the food chains in this food web:

grass → insect → vole → hawk

grass → insect → frog → fox

grass → insect → vole → fox

Notice that:

- the rabbits and slugs have just one predator
- the frogs and voles have two predators (the foxes and hawks)
- the insects have three predators (frogs, voles and thrushes)

This leads to some interesting effects if the population of a particular organism in the food web decreases. Some animals can just eat more of another organism if food is in short supply, while others may starve and die. This in turn can affect the populations of other organisms in the food web.

Changes to food webs

What would happen if the grass died?

The grass is the producer. If it died, the consumers that feed on it - rabbits, insects and slugs - would have no food. They would starve and die unless they could move to another habitat. All the other animals in the food web would die too, because their food supplies would have gone. The populations of the consumers would fall as the population of the producer fell.

What would happen if the population of slugs decreased?

Slugs, rabbits and insects all eat grass. If there were fewer slugs there would be more grass for the rabbits and insects to eat. With more food, the populations of rabbits and insects would increase. However, the thrushes would have to eat more insects to maintain their population, so it is also possible that the population of insects could decrease. This in turn may reduce the populations of voles and frogs.

What would happen if the population of insects decreased?

There would be more food for the rabbits and slugs, so their populations would increase. However, there would be less food for the frogs and voles, so their populations would decrease. This means less food for the foxes and hawks. However, there are likely to be more rabbits and thrushes for them to eat, so their populations might stay the same.

Food security

All the food we eat relies on plants. This includes meat because animals such as pigs, sheep and cattle eat plants. Grasses such as wheat, barley and rice use the wind for pollination. Vegetables and plants that produce fruit rely on insects and other animals for their pollination. If the population of pollinating insects goes down, it reduces the amount of fruit for us to eat, and also the number of seeds for new crop plants to grow.

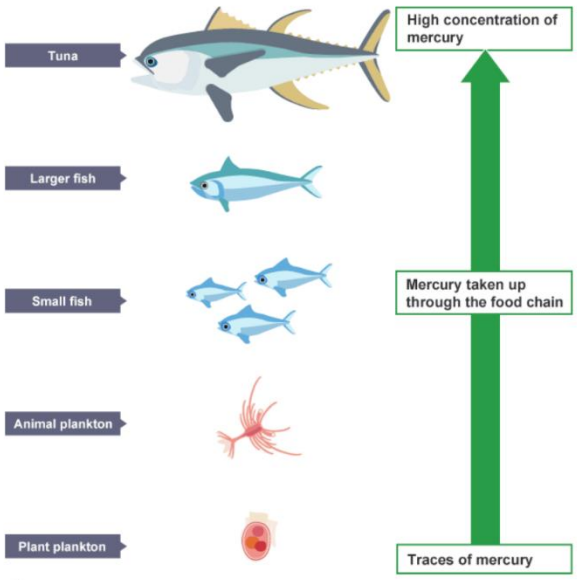
Toxic materials in the food chain

Toxic materials are poisonous. Some quickly break down into harmless substances in the environment. Others are persistent (they stay in the environment and do not break down). These substances accumulate in the food chain and damage the organisms in it, particularly in the predators at the end of the chain. This is because accumulating compounds cannot be excreted.

Mercury

Mercury compounds were used until recently to make insecticides (substances that kill the insects that damage crops), and special paints that stop barnacles growing on the hulls of ships.

Unfortunately, when mercury gets into a food chain, it damages the nervous systems and reproductive systems of mammals, including humans. The diagram shows how mercury can accumulate in the food chain.



Mercury accumulates as you move up a food chain

In the sea, tiny animals and plants called plankton absorb the mercury compounds. When the plankton are eaten by small fish, the mercury they contain stays in the fish. As the fish need to eat a lot of plankton, the concentration of mercury in them becomes higher than its concentration in the plankton.

Larger fish eat the small fish, and larger ones still (such as tuna fish) eat them. This creates a high concentration of mercury in the tuna. People eating contaminated tuna may get mercury poisoning. Mercury is now banned from many chemical products and mercury use in industry is carefully regulated.

DDT

DDT is an insecticide that can pass up the food chain from insects to small birds, and then from the small birds to birds of prey, like hawks. It can accumulate in the birds of prey, giving them a large amount of DDT. High concentrations of DDT in birds cause weakness in the shells of their eggs, which leads to a reduction in their population. DDT is now banned because of this.

Activities for this Topic

Definitions and Key words

Can you research the keywords below and write definitions/ explanations for each of them

Producer	An organism that makes its own food by photosynthesis
Primary Consumer	An organism that eats the producer in a food chain
Predator	An organism that hunts for and kills other organisms to gain energy
Prey	An organism that is hunted for and killed by another organism
Omnivore	An organism that will consume plants and animals to gain energy
Secondary Consumer	An animal that feeds on smaller plant-eating animals in a food chain.
Photosynthesis	The process by which green plants and algae are able to turn Carbon Dioxide and Water into Glucose sugar using energy from the sun
Herbivore	An organism that only consumes plants and algae
Carnivore	An organism that only eats animals
Interdependence	This means that organisms in a food web depend on the other organisms to survive

Food Chains and Food Webs Graded Task sheet

Key Exam words: Producer, Secondary consumer, Herbivore, Omnivore, carnivore, primary consumer, Tertiary (third) consumer, Trophic level

Entry Level Task: Food Chain

Draw your own food chain with at least four organisms. Use the key words to label the main parts of the food chain.

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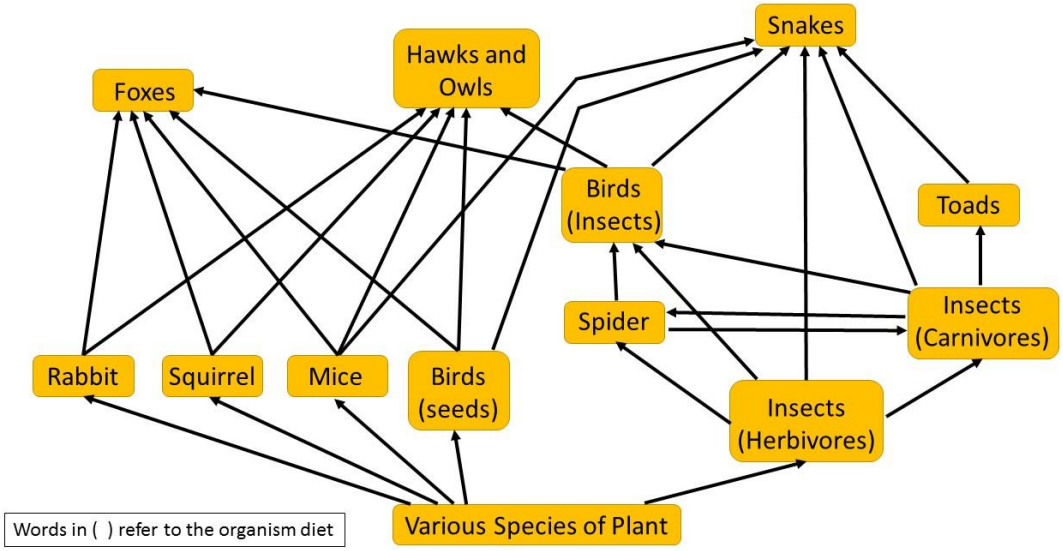
Intermediate Level Task: Food chain versus Food web

Draw your own food chain with at least four organisms. Draw the producer at the bottom and the tertiary consumer at the top. Label each of the four levels using the key words. Now add extra organisms to your food chain to create a food web.

Identify the similarities and differences between a food chain and a food web.

Advanced Level Task: Interpreting Food Webs



John won the lottery and decided to move to the countryside. He keeps chickens so he can have fresh eggs every morning for breakfast. He is upset at the fact that rabbits keep eating his lawn so he has decided to introduce some foxes to the area. What affect will this have on the other animals in the food web? After a while he notices that some of the chickens are being eaten by foxes so he goes hunting and kill lots of foxes. What affect will this have on the other animals in the food web? For maximum marks you must talk about how every organism could be affected.

Challenge: Problems with coral

The Great Barrier Reef is a world famous coral reef off the north-eastern coast of Australia. In the 1980s scientists noticed that the coral was decreasing. It was argued that the coral was being overeaten by a carnivore known as the Crown of Thorns starfish.

1. What affect would this have on other organisms living in the Great Barrier Reef?
2. Design an investigation to test if the Crown of starfish was responsible for the decrease in the coral.
3. How can the damage by the Crown of Thorns starfish be reduced or even stopped?

Can you fill in the gaps from the information in the box at the bottom to support the energy loss of this food chain.

Can I explain the energy loss from a food chain?

T_ _ _ _ _ _

L_ _ _ _ _

I am a...

Energy

___ %

___ %

___ %

WORD BANK

FIRST	PRIMARY CONSUMER	10	SECOND
SECONDARY CONSUMER		100	THIRD
PRODUCER	TROPHIC LEVEL	1	

Practice Questions on Toxins

1) The table shows the concentrations of DDT in the tissues of two types of bird from the same area.

type of bird	concentration of DDT in the bird's tissues, in parts per million	bird's diet
heron	20	mainly fish
moorhen	0.5	mainly aquatic plants

(a) Why does DDT build up in the tissues of animals?

_____

_____

(b) Why do the herons have more DDT than the moorhens?

_____

_____

2. Read the following information and answer the questions:

- Red scale insects are a pest to lemon trees
- Lemon trees were sprayed with DDT
- Lady birds eat red scale insects

(a) What will happen to the number of ladybirds if they eat the red scale insects that have been sprayed with DDT?

_____

(b) What effect will this change in ladybird numbers have on the number of red scale insects?

_____

_____

Literacy Task: Why insects are important-

Read the information then answer the questions

The demand for food production will double in the next forty years. This raises serious concerns about food security - how will we produce enough food to feed ourselves in the future?

Biodiversity is when there is a wide range of plants and animals in a habitat, and within this is a wide range of insects which make sure our crops grow well and remain healthy. For instance, 8 out of ten European crops depend on pollination by insects. Pollination is when the pollen from a male plant fertilises the female plant to create a seed. Most of these pollinators are bees, including honeybees and a wide range of wild bees such bumblebees, as well as hoverflies. Without bees transferring pollen most of our crops could not produce seeds and fruits.

Our diets are full of foods which depend on bee pollination. Breakfast examples are: Orange juice, fresh fruits, jam, marmalade, fruits in our yoghurts - these all rely on pollinators. As does coffee which is pollinated by bees in the tropics. Chocolate, which comes from cocoa, relies on a tiny midge to pollinate it. Even meat and dairy products partially depend on the work of pollinators, as part of the diet of many cattle relies on insect pollinated plants such as clover.

Our bees and other pollinators are not about to totally disappear but they are under great threat. For instance, the UK has an amazing variety of bees with more than 250 species. However, recent research has shown that since 1980 the diversity of bees has severely declined. The honeybee has declined by 54% in England since 1985. The reasons are destruction of bee habitats, pests, diseases, and misuse of pesticides.

So what can farmers do about this problem? One way would be to try and replace insects. So instead of bees we could use people to hand pollinate crops. This is already used in parts of China and Nepal for apples. However, to cover the cost of labour and equipment to pollinate all our crops in the UK would cost £1.5 billion a year! This is so expensive that it would make the price of these food products too high.

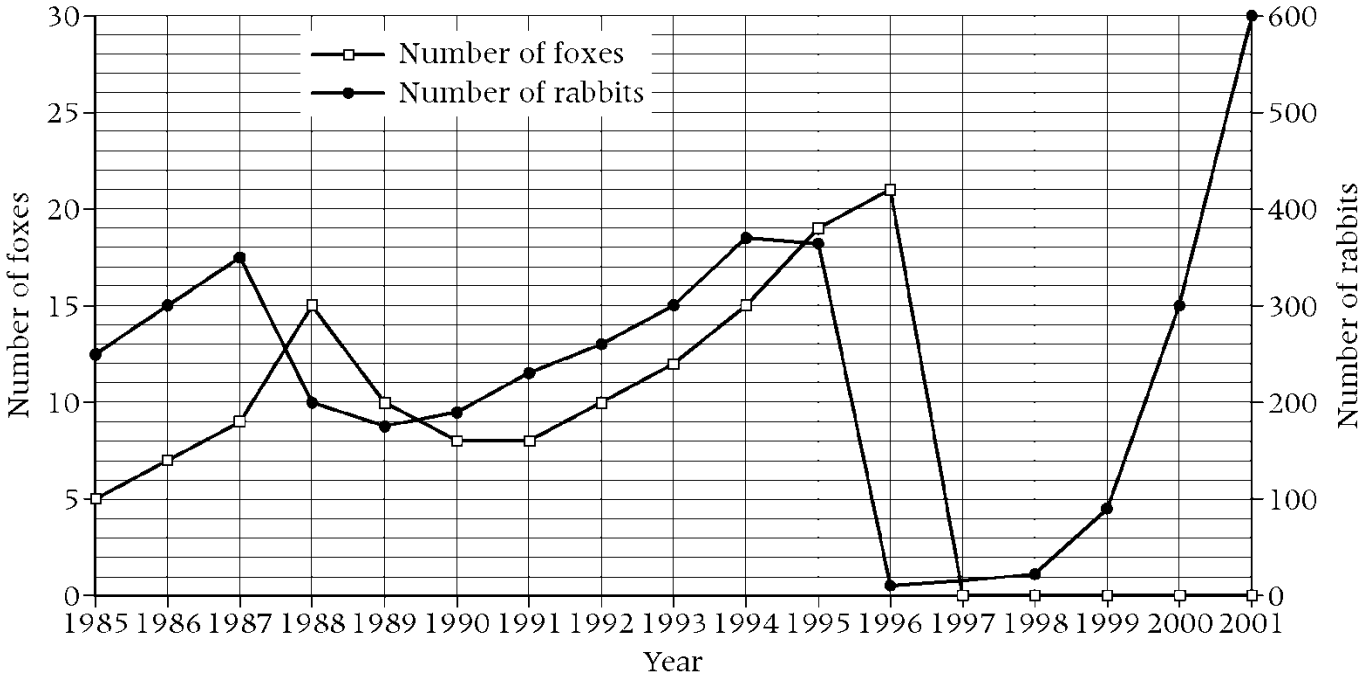
Thankfully there is another way to ensure our own food security. We can protect and conserve our British bees and keep them working to pollinate our crops. Our honeybees are being supported by the government's 'Healthy bee plan'. However, relying on a single bee species to do the job is risky as if a disease hits we lose them all. The answer is to try to maintain a wide range of different species of bee (biodiversity).

We know that wild bees, honeybees, butterflies and many other species such as birds greatly benefit from flower rich habitats. Farmers can easily add these habitats to the landscape around the edges of fields and many farmers already do this. The government pays the farmers to do this.

<u>Questions</u>

1. What is the PREDICTION for the demand in food supply in the next 40 years?
2. What does BIODIVERSITY mean?
3. What is POLLINATION?
4. Name 5 foods that depend on insect pollination.
5. What has happened to the honeybee and why? Use figures in your answer.
6. Explain why cows depend on insects.
7. What are the suggestions to replace pollination by insects?
8. Why would this not really work?
9. How is the UK government trying to protect bees?

1 Look at this graph. It has *two* vertical axes, one for the rabbits and one for the foxes. It shows how the populations of foxes and rabbits have changed in one area. Each population was measured at the middle of every year.



a Which animal is a predator?
b Which animal is preyed upon?
c How many rabbits were there in 1989?
d How many foxes were there in 1993?
e In which year were there the most foxes?
f Explain why the number of foxes fell between 1988 and 1990.
g During 1996 the rabbit population was almost totally wiped out. Give one possible reason for this.
h In 1997 there were no foxes. Give one reason for this.

2 A meadow is 400 m long and 200 m wide. 10 quadrat samples were taken at random around the field. The area of each quadrat was 0.25 m^2. The total number of buttercup plants in *all* the quadrats added together was 5.

a What is a quadrat?
b Why were the samples taken 'at random'?
c What was the area of the meadow?
d What was the total area sampled?
e Estimate the number of buttercups per m^2.
f Estimate the total population of buttercups in the field.