Finding Food

Practical work and exercises on animal behaviour for pupils at Key Stage 2

Michael Dockery

Association for the Study of Animal Behaviour

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Animal Behaviour in Primary Schools

Introduction

The purpose of this book is to encourage teachers to see how the study of animal behaviour will enable them to cover some areas of the National Curriculum for Science at Key Stage 2, and in particular *Life processes and living things* (Sc2). Though it focuses on Sc2 it also shows how the material is linked to Scientific Enquiry (Sc1) and this is achieved through a series of investigations/practicals and exercises.

For Sc2 *Life processes and living things*, the material in the book should be useful for teaching pupils:

- that nutrition is a key life process common to both human and non-human animals (1a);
- that food is required for activity and growth (2b);
- that an adequate and varied diet is vital for good health (2b);
- to recognise a number of British and non-British animals (4a, 4b);
- to identify elements in a food chain (5d, 5e);
- how animals exploit the habitat in which they live for food (1c, 5b, 5c);
- how animals are adapted to their environment (5b, 5c);
- about the variation and classification of living things (4c);
- to use correct vocabulary, such as *feeding, growth, activity, diet, incisors, molars, food chain, predator, prey, producer* and *consumer*.

The practical ideas will help in teaching pupils about scientific enquiry (Sc1), and specifically in:

- planning experimental work - for example, making predictions and testing them, designing fair tests and selecting relevant equipment (2a, 2b, 2c, 2d);
- obtaining evidence - for example, taking measurements in a careful and considered manner, doing so safely and aiming for reliable data (2e, 2f, 2g, 2h);
- considering evidence - for example, using appropriate graphical means to present results, assessing their findings, drawing conclusions and explaining their findings by relating them to current knowledge (2i, 2j, 2k, 2l, 2m).

The investigations will teach the children about the behaviour of familiar animals. Investigations 1 and 2 can be carried out in the school grounds but investigation 3 should be undertaken in the classroom. All three can be carried out within a 'normal' length lesson (45 - 60 minutes) and the apparatus required should be readily found in a primary school. Each investigation has three follow-up questions which can be used to reinforce the investigation. Each practical activity also offers a teacher the opportunity to assess the children on the extent to which:

- an idea suggested by the teacher was turned into a scientific investigation;
- their prediction was suitable to test;
- their choice of measures was appropriate;
- they tried to keep as many factors as possible constant in a fair test investigation;
- they selected suitable apparatus and used it correctly;
- they made careful observations and recordings;
- they replicated their observations and recordings;
- they used appropriate tables, graphs and diagrams to illustrate their findings;
- they used their graphs, tables and diagrams to tease out patterns and trends;
- they used their results wisely to draw conclusions;
- they used appropriate scientific terms to explain their results.

The book has a number of exercises concerned with feeding and by tackling them pupils will consolidate their learning experiences. The exercises will also introduce them to secondary-source information which will help the children to make careful, relevant observations from data and help them draw conclusions. The exercises will also aid the development and use of appropriate vocabulary for science in general and life processes in particular. The exercises, which can be used in the classroom or for homework assignments, are differentiated so that they can be used for Years 3 - 4 or Years 5 - 6. The puzzle sheets are additional exercises that could be used as end-of-lesson activities or as homework assignments.

The investigations and exercises will also offer opportunities for teachers to see links with other areas of the curriculum. For example:

Numeracy

• numbers	fractions, percentages;
• calculations	both mental and paper & pencil calculations; use of a calculator;
• measuring	use of appropriate measures and vocabulary; selection of suitable measuring equipment; measurement and calculation of area; measurement of time;
• handling data	collecting, organising, representing and interpreting data in tables, graphs and charts; practising the appropriate skills for drawing graphs and charts; using ICT.

Literacy (non-fictional elements)

• vocabulary extension	especially of scientific terminology;
• reading comprehension	reading and evaluating information; using sources such as videos, CDRom and internet information that is available; reading and following directions/instructions;
• writing composition	accounts of experiments and observations; providing appropriate phrases/sentences to answer questions; assembling and sequencing pictures and points; producing a table to contain data; developing notemaking skills; using ICT.

As they carry out the investigations and exercises in the book the children will hopefully develop an understanding of how animals find food, why they need to stay vigilant as they search for food, which foods they select to eat, whether animals 'learn' to find food sources and how animals can survive without food. We also believe that the material here will enable pupils to develop a respect for living creatures too. Finally, we hope that the activities will encourage the busy teacher to find time to try one or more of the investigations or exercises with their class and enjoy discovering something about the fascinating world of animal behaviour.

Children and animals

Primary school children are fascinated by the behaviour of animals, see Figure 1, whether through personal observations at school or home, in the wild, on television or in books and magazines.

Figure 1 Children in Year 5 carrying out animal behaviour studies with a) seed beetles (see drawings on page 37) and b) brine shrimps (see drawing on page 64).

a)

b)

Animals are part of the everyday life of primary school pupils and their teachers can utilise their observations and highlight the 'science' that these experiences encapsulate. Discussing their experiences in the classroom also allows the teacher to develop links with other areas of the curriculum (see above) and encourage their communication skills, not only those relevant to science but in other areas of the curriculum too. For example, some children might suggest experiments that would present moral/ethical dilemmas for teachers and children, such as feeding live bait to fish in a school aquarium, and these issues would generate an excellent opportunity for class and group discussion.

Of course, we hope that none of the activities in this book give rise to any moral or ethical problems, nor any possible health or safety issues, for the teacher or for the children. Nevertheless, every teacher should be familiar with the safety policies of their local education authority and/or their particular institution. All practical activities must be risk-assessed and any precautions that are to be taken should be recorded. It is also encumbent upon teachers to develop in their pupils a sound understanding of health and safety issues when working with animals so that they appreciate possible problems or hazards and take the appropriate action. So all children should, as a matter of course, wash their hands thoroughly with soap and water after any contact with animals, their food, their bedding or their housing/shelter.

A typical class in a primary school may spend 1 - 2 hours each week on Science, covering aspects of Sc1 and Sc2. Lessons dealing with *Life processes and living things* may be confined to one term in the year, or be spread out over the year, during which many topics, other than feeding, must be covered. This book is therefore aiming to provide some help and guidance with only a small part of the National Curriculum for Science. Nevertheless, we think that since animals are intrinsically interesting to all primary school children the activities and exercises contained herein will be valuable to both teachers and pupils because:

- the investigations require very simple and easily available equipment;
- they are non-invasive and the animals will come to no harm;
- children are genuinely interested in the animals they see - teachers seldom need to 'sell' animal behaviour to children in primary schools;
- the investigations can operate at a number of levels, can provide opportunities for differentiation and allow the teacher to assess pupil performance quite easily;
- studies provide opportunities for gathering a large amount of quantitative data;
- follow-up work can often be done just as easily at home;
- the investigations encourage the active involvement of the children in their work;
- the context in which the studies are set is clear, i.e. each investigation is purposeful to the children;
- the children develop a respect for animals;
- the children develop a respect for the scientific method.

The science of animal behaviour

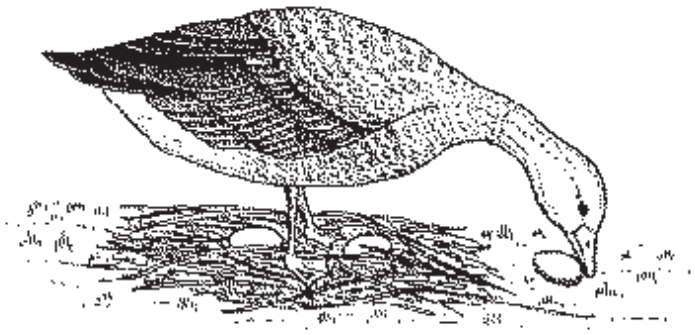
Behaviour is what humans and animals '**do**', the actions they engage in. This book deals mainly with the behaviour of non-human animals but involves some human behaviour too. When studies of animals are carried out humans invariably consider how their own behaviour compares with that of the animals under investigation. In many respects the behaviour of humans and animals is often similar, though there are obvious and important differences too. Teachers can use the materials and suggestions in the book to highlight similarities and differences in behaviour between the two.

The science of animal behaviour attempts to answer questions that researchers are interested in. When scientists try to answer the question "*Why is that animal doing that?*", (for example, "*Why is that goose rolling the egg with its beak*?" - see Figure 2), Niko Tinbergen, a 1972 Nobel Prize winner and one of the founders of the science of animal behaviour, recognised that they are really trying to provide answers to four separate questions. These four questions are:

1. what **mechanism** allows the behaviour to take place?
2. what is the **function**, or value, of the behaviour to the animal?
3. does the behaviour change during the lifetime of the individual animal? (i.e. how does the behaviour **develop**?)
4. how did the behaviour **evolve**?

At Key Stage 2, children tend to ask questions about the functions of behaviour.

Figure 2 Egg rolling behaviour in a greylag goose.



If an egg rolls out of its nest the goose streches out its neck beyond the egg and slowly draws it back into its nest. All greylag geese retrieve eggs in the same way.

Linking animal behaviour to the National Curriculum for Science at Key Stage 2

Life processes illustrate particularly well some of the functions of behaviour. Animals need to find food to sustain their energy levels, to move around their environment, to grow and for their current and/or future reproduction. In these respects, the needs of animals and humans are the same.

The developmental changes in the behaviour of certain animals can also be used to illustrate how living things are adapted to their environment. For example, at the caterpillar stage of development, a moth or a butterfly larva may consume leaves but this behaviour changes when it emerges from its pupal case as an adult and begins to search for nectar. Feeding relationships can also be used to help in categorising animals; thus the feeding behaviour of buzzards and rabbits is clearly different and so studying feeding behaviour allows children to recognise both predators and prey.

All scientists carry out activities that generate *numbers*. In the activities in this book the children can carry out investigations that will generate numbers. In trying one of the practicals in the book the pupils will learn about observational and experimental methods. Pupils can therefore be taught:

- what question, or questions, their research will address;
- to predict what might happen;
- to put forward a hypothesis;
- to question whether there are other hypotheses that could also be put forward;
- to ensure that the investigation is valid;
- to decide what to measure and how to undertake the measurements;
- how to plan experiments and carry out observations in response to their own, or teacher-generated, ideas;
- to suggest what equipment will be needed;
- how to deal with the data they collect.

They will also be guided through the processes necessary to obtain scientific evidence:

- to use the selected equipment appropriately and carefully;
- to take measurements carefully;
- to engage in replication in order to produce reliable results.

The children will also learn how to represent, analyse and consider the evidence from their experiments and observations by:

- using appropriate diagrams and graphs;
- looking for trends and patterns in the tables, graphs and diagrams;
- drawing conclusions based on their findings;
- deciding whether their evidence answers the questions they set at the start;
- explaining how their results tie in with previous knowledge about the behaviour of the animal under investigation.

Of course, this does not mean that other, non-quantitative, approaches are not extremely valuable. A piece of creative writing or an illustration can be particularly useful in describing specific pieces of behaviour. The scientific study of animal behaviour allows the subject to progress but it would be infinitely poorer if we were not able to listen and appreciate the song of a skylark as a marvellous aesthetic experience in itself. Indeed, music (for example, Beethoven's Pastoral Symphony) and art (perhaps a Stubbs painting of horses) might be the stimulus for a study of the behaviour of an animal.

Feeding behaviour of animals

Feeding, respiration, growth, movement, reproduction, sensitivity to their environment and excretion are the life processes and characteristics of living organisms. This book concentrates on just one of these, viz. feeding, and specifically the feeding behaviour of non-human animals. The food an animal consumes provides:

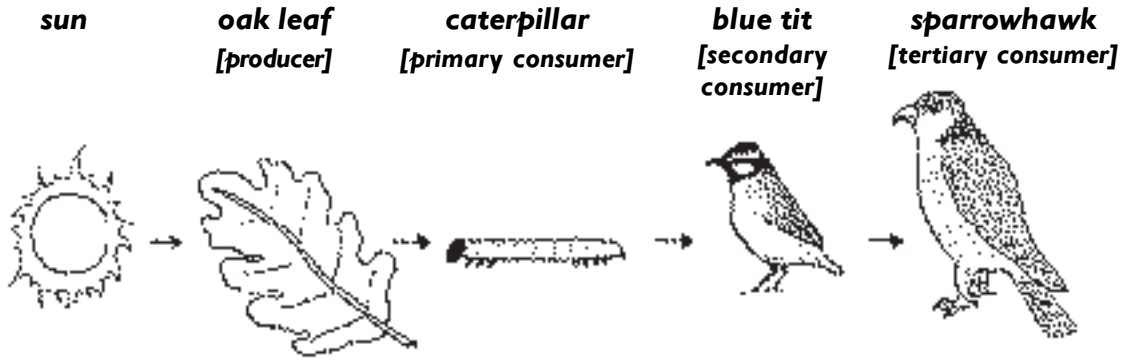
- energy;
- materials and chemicals for growth and repair;
- the means to stay healthy.

For humans, food supplies us with proteins, vitamins, carbohydrates, minerals, fats, fibre and water. Some foods are rich in protein (such as eggs, cheese, meat, soya, peas, beans and nuts), some are rich in carbohydrate (such as potatoes, pasta and bread) and some are rich in fat (such as cream, butter and pastry). It is important for humans to eat a balanced diet so it is recommended that we eat a variety of foods in order for the body to get all the different elements it needs. Many animals also eat a variety of foods, though some, for example herbivores like the koala bear, have a very restricted diet - in the case of the koala it is largely eucalyptus leaves. Cows eat grasses and other herbs which are high in fibre and so have evolved special adaptations to process the food and derive the energy and vitamins they need.

Plants (primary producers) are the food source for many species of animals. These animals are termed herbivores (primary consumers). Such animals may eat the stems of plants, their flowers, their seeds or their underground storage organs. Plants don't take direct action against the animals that are about to eat them, though many do have adaptations that minimise the likelihood of being eaten, for example, storing poisons in their tissues. Some plants, particularly those that produce soft, colourful fruits, need animals to eat the fruit and pass it through their digestive system in order for the seed to germinate successfully in the soil. Occasionally, some herbivores go around in very large groups, locusts for example, and under these circumstances they can do considerable damage to plants. However, even in such large groups of animals some individuals will be more efficient at grazing than others and so the benefits are not enjoyed equally by all the individuals in the group.

Herbivores are the food of predators (secondary consumers), which feed by hunting and killing their prey, though often in the process of killing the prey the predator may need to subdue and manipulate the prey item before eating it. Frequently, small predators are eaten by larger predators (tertiary consumers). The links between producers and consumers make up food chains, see Figure 3. The sun is included as it is the ultimate source of energy for nearly all life on earth. The arrows show the direction of the transfer of energy from one element in the food chain to the next.

Figure 3 A food chain.



FINDING FOOD

Investigations

1. Food preferences in birds

(Do birds make choices about which foods to eat?)

2. Finding prey

(How good are children as 'predators'?)

3. Finding food for offspring

(*Can female seed beetles distinguish between 'appropriate' and 'inappropriate' places to lay their eggs?)*

[The investigations and the 'suggested' answers are written solely for teachers; the follow-up material, exercises and the puzzle sheets are written for use by pupils.]

1. Food preferences in birds

This investigation asks the question - ***'do birds prefer to eat white or brown bread?'***
[Alternatively, the children could use two other foods, for example, two types of cheese with contrasting fat contents.]

This is a question about choice, viz. do birds make choices about the foods they eat? Children generally show a preference for white rather than brown bread. Do birds make a similar choice? If birds, and other higher animals, do make such active choices then this suggests that *animals are probably using their brains in deciding what to eat*. So in this respect, animals and humans can act in the same way.

Previous knowledge

It would be helpful for children to know that:

- different foods contain varying amounts of protein, fibre, fat, carbohydrate, vitamins, minerals and water;
- bread is rich in carbohydrate and fibre;
- the fibre content of brown bread is higher than white bread;
- bread is one of the foods that humans most frequently put out for birds;
- for many garden birds food scraps are an important addition to wild food;
- food scraps may significantly increase the survival chance of garden birds during a prolonged cold spell in winter.

[It is easy to get children involved in feeding birds in the garden or playground but it is very important to continue the feeding once it has begun, especially in winter, and tail it off slowly.]

Background information

Some important facts about fibre in the human diet are:

- it gives bulk to our food and is important in digestion;
- a high fibre diet has been linked to a reduction in cholesterol levels in the blood and a lower risk of bowel cancer;
- fibre (roughage) comes from plants such as wheat, maize, oats, potatoes, celery, apples, etc.. The source of the fibre is the cellulose from the cell walls and, since cellulose is very tough and difficult for us to break down, it is not digested. This is also why foods rich in fibre take longer to chew as we need to reduce the fibres by the grinding action of our teeth;
- bread is a rich source of fibre and we are encouraged to eat it;
- it is easier for us to chew and digest white bread since the fibre content is lower;
- some people, especially children, prefer white bread to brown, but many eat both.

Birds eat bread. Do birds show the same preferences as humans?

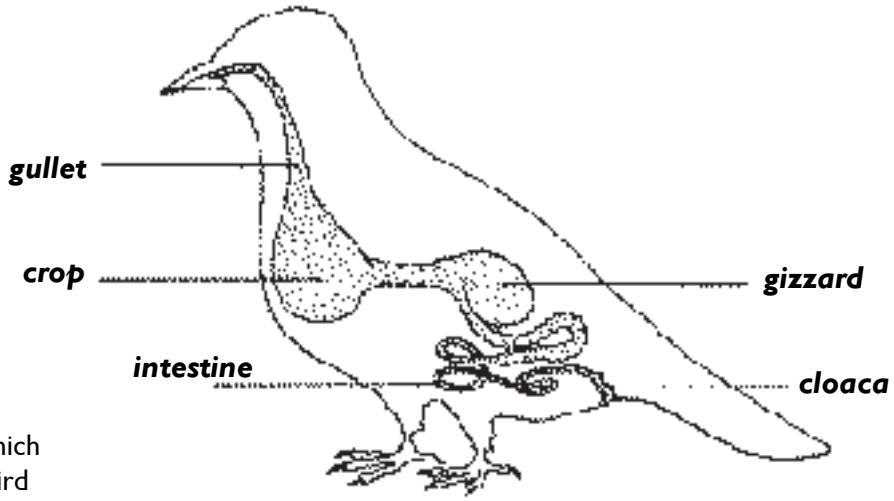
This study investigates the feeding behaviour of birds in the school grounds and whether they prefer white or brown bread. The question we are testing is: ***'do birds prefer to eat white or brown bread?'*** The digestibility of white bread is easier so we might expect that, like humans, birds may show a preference and thus consume more white bread than brown; (or perhaps consume it at a faster rate). The birds will almost certainly be familiar with bread, since humans often put it out on a regular and predictable basis.

We should not be surprised that birds take bread very readily since many birds eat seeds which are high in fibre. The seeds they eat may be from agricultural crops, such as wheat, or from grasses. However, very few birds eat the stems or blades of grasses, though ducks and geese do, because of the difficulty of breaking down cellulose.

A point to bear in mind is that birds have colour vision and so, presumably, can distinguish between white bread and brown bread. [Of course, it is likely that even birds, or any other animal for that matter, with monochromatic vision would be able to distinguish between white and brown bread.]

The digestive system of a bird is not like that of a human. This drawing shows the digestive system of a typical seed eating bird. Some points to bear in mind:

- birds do not have teeth to tear, break up and grind down food;
- so their digestive tract often has to break down large pieces of food, or whole food items;
- the breakdown of food takes place in the *gizzard*;
- birds often have grit and small stones in their gizzards to help grind down the food;
- many birds possess a *crop* which acts as a food store so the bird can eat quickly and then find a safe place to rest and digest the food.



Apparatus

[Since schools are unlikely to have more than one bird table, it may take several days to complete the study, so only one set of apparatus is needed.]

The following items are required:

- a bird table, if one is available. If not, the bread can be placed on a wooden board (hardboard would be fine as well) in the school grounds, preferably where it can be seen from a window or corridor where the observations will be made. [The children will need to be reminded of the need to keep quiet and still when carrying out their observations!]
- one white sliced loaf and one brown sliced loaf - (ideally with equally thick slices);
  [If loaves from one of the major manufacturers are used then the fibre content is displayed on the wrapper (g/100 g of bread), together with the mean mass (g) of a slice.]
- a couple of pairs of scissors will be helpful for the children to cut up the bread;
- scales are needed to weigh the bread that is put out and also to weigh any bread that remains at the end of the observation period.

What to do

The teacher needs to outline the aim of the study. In discussion with the rest of the group the children may suggest that they would predict an equal amount of brown and white bread is eaten per unit time. They also need to discuss what will make a *fair test*. Some obvious practical points include:

- how much bread will be put out by each group of children?
- what size and shape of bread pieces will be used? (Squares seem most likely to be suggested, but an alternative might be that a certain amount could be weighed and then that mass reduced to breadcrumbs, perhaps using a cheese grater. This is a task for the teacher, of course!)
- how many loaves need to be bought?
- what variety of loaves will be used?
- how long will the bread be left on the bird table?
- how will the outcome be indicated and what is going to be measured?
- what time during the school day will the study be carried out? - will break times affect the study?

In essence, how will the children make this a workable and valuable investigation?

As the investigation is being carried out the children should be encouraged to share the recording tasks and to try and ensure that the records are reliable. The children should also be ready to face the fact that perhaps very few birds will take the bread! [A training period is often useful before the 'real' study begins so that the birds '*learn*' to expect bread to be provided at the same time each day. Again this demonstrates the ability of birds to use their brains, a very useful lesson in itself! Pupils will probably notice that birds often appear in school playgrounds at the end of the morning break. The birds pick up the spillage from crisps and other snacks that children have eaten during break.] The children might also need to think about what happens after the investigation is completed - it may be necessary to wean the birds off the bread over a period of time.

A recording sheet(s) will need to be devised. Ideally, this would be generated by the children but teacher guidance may be needed. (You might wish to use the example at the end of this investigation.) When the materials and the recording sheets are ready the pupils can carry out the investigation in small groups, perhaps ones of 4 - 6 would be suitable. Naturally, a check will be necessary to ensure that the activity is running well. For example, on a windy day the pieces of bread, or the breadcrumbs, may blow away. How do the children cope with this situation?

Analysis

When each group have completed their study the data can be pooled, if the study has been replicated by other groups. Means (averages) can be calculated and pupils can suggest appropriate ways of representing the data in diagrams or graphs. The pupils should also summarise their findings in written form.

Conclusions

The conclusions can be written up and recorded alongside the graphs/tables/diagrams or recorded separately. The teacher could then use these to make comparisons between the findings from each of the groups.

Follow-up work

One topic that might be considered is whether there are seasonal differences in the consumption of bread. Perhaps the consumption of bread increases in the winter when other foods (especially 'natural' foods) are more difficult for birds to find.

Links with human behaviour might be of interest. The children could conduct a survey amongst their friends to determine the ratio of white to brown rolls/sandwiches they consume for their school lunch. The same information could be ascertained from the school cook too. Do children and garden birds behave in a similar way regarding their preference for the consumption of white and brown bread/rolls?

Does the application of butter and/or margarine make a difference to consumption? It is almost certain that if humans were offered a choice of bread either with or without butter/margarine they would choose the former, but what of garden birds?

Additional notes for teachers

Have the birds shown a preference for white over brown bread, or have they consumed similar amounts of each type? If the former is the case, it would appear to demonstrate that birds do have a preference. A key question, of course, is whether this preference is consistent and so replication would be needed to answer this.

If the consumption of white and brown bread does not differ then what does this mean? It could be that the birds are happy to get either type of bread. It might mean that they would prefer some other food if they could get it, say mealworms, so a study to compare 'natural' and 'non-natural' foods (bread) would be valuable. Bread may prove popular with birds because it is put out regularly, requires less effort to find than 'natural' food and is easily manipulated. So a bird would use less energy searching for bread than for, say, caterpillars, and so bread would be readily eaten.

Perhaps one or two astute children may notice that if a base board of wood or hardboard is used then this may not constitute a '*fair test*' since there will be a difference in the background contrast if pieces of white and brown bread are scattered over the wood or hardboard. This weakness could be overcome if the investigation is repeated but this time the bread is scattered over a piece of wood or hardboard that is painted white.

As the investigation proceeds, and assuming a preference for white bread is shown by the birds, the less preferred bread becomes increasingly available and so the birds have less opportunity to show a preference. This effect could be lessened if a pilot study is carried out first so that the volume of bread put out for the birds, and the time allowed for its consumption, can be altered in the light of the pilot data.

At the end of the investigation it may be that there is no bread of either colour left and children might interpret this to mean the birds haven't shown a preference even though one colour bread may have been greatly preferred initially. So it would be very instructive if at least one group of children recorded, if possible, the order and colour of the pieces of bread that the birds take. If a camcorder was available the children could film the feeding events and this would allow them to check their observations.

[This activity may stimulate further interest in the feeding behaviour of garden birds in your school. These studies may involve commercially available foods for garden birds. The RSPB magazine has adverts for a number of different suppliers of seeds and feeders, for example Haiths (www.haiths.com) and CJ WildBird Foods (www.birdfood.co.uk) and there are suppliers of mealworms too, for example, Garden Bird Supplies (www.gardenbird.com). Local pet shops, of course, sell these items too.]

Bird Number	Species of bird	Number of pecks at white bread	Number of pecks at brown bread
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
		Mass of bread left	Mass of bread left

Investigation 1 - follow-up exercise

1. Here is a house sparrow, a bird you can often see in gardens. Sparrows come to our gardens to eat bread. **Write down why you think they eat bread**.

Sparrows eat bread because .....

.....

2. Five children explain why sparrows come to bird tables to feed. Underline which you think is the best answer.

Anne: "They can meet their sparrow friends."

Salim: "Cats can catch sparrows more easily at a bird table."

David: "Worms come to a bird table to eat bread crumbs and the sparrows can then eat the worms."

Elaine: "People often put food and water out for birds."

Claire: "Sparrows are lazy and don`t like to search for their own food and so they come to bird tables to feed."

3. When sparrows land in a garden to feed they always look around first before eating. Why do you think they do this?

.....

.....

2. Finding prey

The investigation considers how successful 'human predators' are at finding 'prey'. As such, it tests how easily the sense organs (eyes) of children detect 'prey' against a fairly uniform background.

No prey animals encourage predators to see, chase or catch them. Rather, they try to minimise the possibility of being caught. How do they do this?

- Some prey species stay in the open and rely on seeing the predator approach and then running or flying away: for example, gazelles run away from cheetahs and pigeons fly to the nearest hedge or tree to escape from a hawk.
- Some prey, for example moths, settle on rocks or tree trunks during the day and keep very still, relying for survival on not being spotted by the predator.

This investigation asks the question ***'Do children (the 'predators') find more red (or yellow) pasta spirals (the 'prey') than green pasta spirals?*** The study tests the ability of children to detect a prey item when it keeps still and is against a fairly homogeneous background, namely, grass. So, in this regard, the 'prey' in this investigation are a little more like moths than gazelles or pigeons.

Previous knowledge

It would be helpful for children to know that:

- most feeding relationships involve 'predators' and 'prey';
- some animals, such as moths, fawns, etc., rely on keeping still and blending in with their background to survive predatory attack;
- predators learn and so generally improve their performance over time and thus catch similar prey more easily. For example, predators may develop a '*search image*' for prey. [An everyday phrase for developing a 'search image' is 'getting your eye in'.]
- predators may also catch more prey by simply searching more slowly or more carefully.

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Background information

Predators and prey are continually involved in what is termed an '*arms race*', i.e. both predator and prey are always trying to outwit each other. So predators try to run faster or develop keener eyesight to catch prey. Prey, on the other hand, could increase their vigilance or they could develop better protection or hide more effectively, see Figures 1 and 2.

Since individuals in a species vary, then some will be better at, say, running or at, say, catching prey and these individuals will be more likely to survive and reproduce. If an advantageous variation, like either of these mentioned here, can be inherited by the offspring then the next generation will have more individuals with this advantage. So changes in successive generations of animals over time (evolution) occurs through natural selection. Over time, natural selection commonly makes predators better at detecting and catching their prey and makes prey animals better at escaping from predators.

Figure 1 A tortoise - it can tuck its head and its legs inside its shell to protect itself and deter predators.

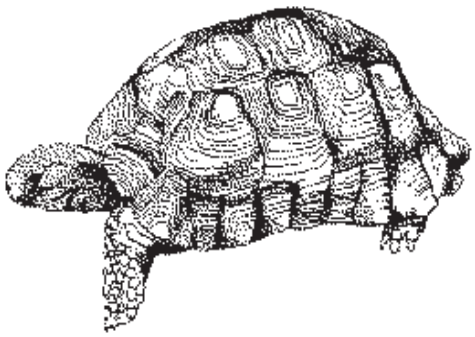


Figure 2 A Merveille du Jour moth, well concealed on a lichen-covered oak tree.

Most Key Stage 2 children will have seen wildlife programmes on the television in which a predator catches, subdues and then eats a prey animal. They may even have witnessed a predator - prey interaction in, say, their own garden. However, from an ethical standpoint we cannot set up live predator - prey interactions in the classroom so that the pupils can watch one animal eating another. So this investigation tries to provide an acceptable surrogate in which children are the 'predators' and they have to find 'prey', which we suggest are pasta spirals. So the study will test this question:

'do children find more red (or yellow) pasta spirals than green pasta spirals?'

Apparatus

- 1 20 m tape - 2 tapes would be helpful but this is not crucial;
- 4 wooden pegs (a hammer may be needed to drive the pegs into the ground);
- lightly coloured wool - wool with a nylon weave in it is best as it is quite tough;
- 1 kg pack of multi-coloured pasta spirals;
- 1 stop watch (stop clock);
- 6 - 12 margarine tubs (or equivalent).

Mark out a large square on the grass, say 15 m x 15 m, using the 20 m tape, the 4 wooden pegs and the coloured wool. The 1 kg pack of pasta spirals is probably sufficient for a number of groups, though two packs may be needed if there are only a couple of children in each group of 'predators'. A stop watch is needed to time the 'hunting' periods. It is also handy to have some margarine tubs available to hold the catch and for holding some sets of 20, 30 or 40 pasta spirals.

What to do

The teacher needs to outline the aim of the study to the groups of children. It will be difficult for the children to predict the possible outcome of the study, though they ought to be able to appreciate that some 'predators' are going to find more 'prey' items than others.

The teacher needs to discuss with the pupils what will be a *fair test*. So they would perhaps discuss:

- how the 'prey' will be scattered on the grass? (The best method will be if the teacher does this in a way that distributes the spirals **without any conscious bias**. The scattering can be done with the pupils standing outside the marked out search area - it is obviously best to ask the children in each hunting group to turn round and face the opposite direction when they are about to have their turn as hunters so that they don't see the spirals being thrown out.)

- how big will the search area be? (We have found 15 m x 15 m to be suitable.)

- how many 'prey' will there be? (This really depends upon whether the 'predators' hunt singly or in groups - if singly, 40 should be fine, if there are 2 in each group then 30 is fine, if 3 or 4 pupils per group then perhaps 20 is sufficient. Ideally, the teacher would probably want each 'predator' to find a few 'prey' and the best way of assessing this may be to conduct a pilot study as factors such as the length of the grass, for example, mean that it is difficult to give precise suggestions for the appropriate number. Whatever the number of spirals is, half need to be green and the other half need to be red (or yellow).

- how long will the search time be? (One minute is usually adequate, though it is rather dependent on the size of the searching group and the age of the children, so again a pilot study will be useful.)

When each group of 'predators' has completed searching for the prey in the time allocated it will be necessary for the teacher to ensure that all the spirals not located by the group are collected, otherwise the 'prey' of the current group could be caught by the following group. [It is best to make pupils that have already hunted do the search, otherwise some children will have the chance to develop a search image for the prey!] Alternatively, when the number of 'prey' caught by the current group is found the teacher can just scatter sufficient green and red (or yellow) spirals across the grass to bring the number up to the agreed quantity ready for the next group of 'predators'.

It would be helpful for each group of children to have a printed recording sheet so that their efforts can be noted. (You might wish to use the example at the end of this investigation.)

Analysis

The results from each group could be treated separately and this also allows variation in group performance to be commented on. On the other hand, the data can be pooled. A bar graph (perhaps a compound bar graph or one with two bars drawn side by side) might be suitable to show the number of green and red (or yellow) 'prey' items found by each group. Perhaps the mean (average) number of red and green spirals found can be calculated too.

Conclusions

The children can record their observations in the written form, to complement their graphs, tables and calculations.

Have the groups been more successful at finding red spirals than green spirals? The graphs and means should indicate whether the colour of the pasta spirals determines the detection rate by human 'predators'. It is likely that they have have found more red spirals than green ones, since the latter probably blend in better with the background, viz. grass.

Follow-up work

Constraints could be placed on the 'predators' which would regulate their hunting. Thus children will probably have put each piece of pasta into one hand, or perhaps a pocket, whilst they carried on collecting. This may mimic what a few foragers do, such as some species of monkey which store food in their cheek pouches. If the 'predators' can only carry one food item at a time from the search area then this may affect their searching behaviour: blue tits taking caterpillars back to their chicks in a nestbox usually forage like this.

The children could repeat the study after a suitable time period has elapsed, say a day or two, to see if their performance improves. If it does, then they have demonstrated the capacity to 'learn'. If they do improve their performance, have they improved their ability to detect green and red pasta spirals equally?

A 'top predator' could be introduced into the area. Before a group have, say, a minute searching for 'prey', they could be warned that a 'top predator' (the teacher or another adult!) has been spotted in the area and if it steps into the search area and touches one of the hunters on the shoulder then that hunter is 'caught and eaten'! This should lead to an increase in scanning time as the members of the group keep their eyes peeled for the 'top predator' and take the appropriate action if it is seen.

Additional notes for teachers

If more red ones have been found then the children may be able to appreciate parallels between their investigation and how moths need to find a safe resting place during the day.

Some of the 'predators' will undoubtedly have performed better than others, i.e. found more 'prey' items than other groups, and in discussion the children might suggest why this may be so.

One group may have found that their 'prey' were more clumped so that when one was spotted, others were quickly seen. This could be related to the idea of a predators developing a 'search image'.

Groups that were among the last groups to seach for 'prey' may have found that the grass was more likely to have been trampled down by the feet of earlier 'predators' and so they may have found more pasta spirals. Children may be able to suggest how this trampling effect could be reduced if the study was to be repeated.

There will, presumably, be variation in the visual acuity of the children, so those with sharper eyesight have probably found more pasta spirals. A teacher might think it worthwhile demonstrating this effect to the children if she/he wears spectacles or contact lenses by having a go at spotting 'prey' with, and then without, their lenses or spectacles!

It is possible that there may be a pupil in the class who is colour blind and this child may 'under-perform' compared to others. [Colour blindness affects about 1 in 25 people, with a higher incidence among males.] Of course, the defect does not mean they are blind to colour, rather they confuse certain colours. One of the most common is two-colour confusion (the person being unable to discriminate between the two colours) and since one of the most common forms affects red and green it might affect performance of an individual in this study.

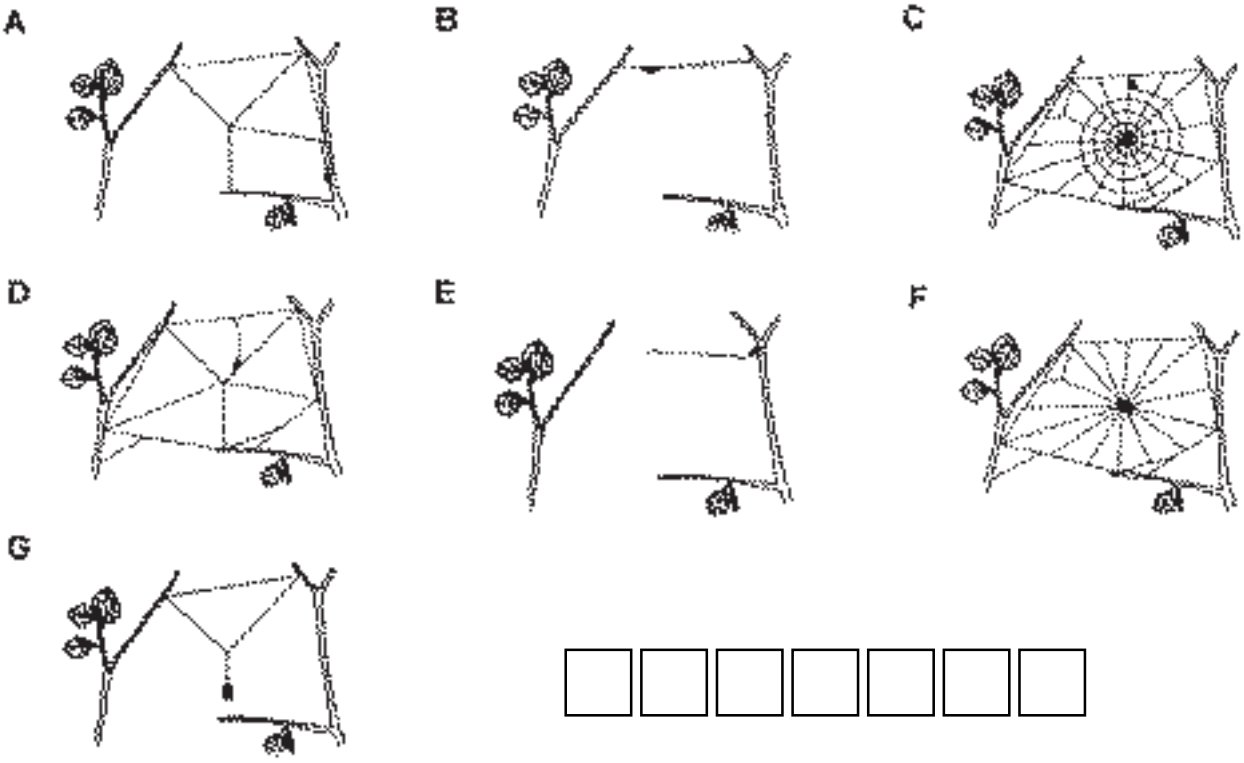
Group	Number of predators	Number of green splats found	Number of red splats found	Other information
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
		Mean =	Mean =	

Investigation 2 - follow-up exercise

1. Blackbirds are predators. We see them in gardens searching for earthworms, which are their prey. Here are 5 reasons why blackbirds look for worms in gardens. Tick the box that you think is the best reason:

a) they have eaten all the worms in the garden next door ☐
b) gardens often have a lawn and areas of bare soil where blackbirds can find worms ☐
c) blackbirds feed in gardens to annoy cats ☐
d) blackbirds can eat grass as well as earthworms ☐
e) people buy earthworms to feed to blackbirds. ☐

2. To catch their prey, many species of spiders make webs. Below are 7 drawings showing the stages of building a web. The drawings are not in the correct order. Write down the correct order for building a web:



☐☐☐☐☐☐☐

3. Suggest <u>one</u> good place for a spider to spin a web.

.....

3. Finding food for offspring

Many animal parents spend quite a lot of time finding food for their young. Having found it, they return to their nest, den, etc. and give it to their offspring for their growth and survival.

Some animal parents, for example many species of insects, never see their young as they die before the young hatch and so females need to leave their eggs on, or very close to, a good food supply for the offspring. Do female seed beetles distinguish between suitable and unsuitable places on which to lay an egg?

This investigation suggests that female seed beetles are suitable animals to use with Key Stage 2 children in order to discover if the ability to recognise an appropriate surface on which to lay an egg is there when they emerge as an adult. This study suggests that children conduct an investigation to answer this question: '***do female seed beetles lay eggs on 'Blu-Tack beans' as well as azuki, mung and black-eyed beans*?'** [Azuki, black-eyed and mung beans are 'appropriate' surfaces on which to lay eggs, Blu-Tack is not. Of course, it is not necessary to have all three types of bean, the minimum is one type of bean.]

Previous knowledge

It would be helpful for children to know that:

- feeding is a vital life process;
- most animal parents need to feed their offspring in order for the young to survive and reproduce themselves;
- some animal parents, such as moths and butterflies, never see their offspring and so need to leave their eggs in a suitable place so that the young find food soon after emerging from the egg. So it is crucial for these females to know the location of suitable places for leaving eggs so that their young hatch, feed, grow and survive to adulthood;
- female seed beetles lay eggs on the outer coat of the seeds of beans;
- female, and male, seed beetles never see their young;
- female seed beetles are larger, have more patterned wing cases and have more pointed ends to their abdomens than do male beetles. [See the drawings of the beetles in the follow-up exercise.]

Background information

The seed beetle (*Callosobruchus maculatus*) lives in tropical areas and its life cycle is linked to the seeds of leguminous crops, such as beans and peas. In the wild, a mated female looks for the seeds of such crops and then lays an egg on the outer surface of a bean. A few days later the egg hatches, a larva emerges and eats its way into the bean. The larva completes its stages of growth inside the bean and emerges as an adult 4 - 5 weeks after hatching.

As adults, the female and male seed beetles require neither food nor drink to survive and so they are very easy animals to maintain in a school classroom (Dockery 1998). The adults can live for 10 - 14 days and spend their time seeking, and perhaps mating with, adult beetles of the opposite sex. These are the only activities that males seem to engage in, though females do spend time looking for beans and laying eggs on the surface. Adult seed beetles will copulate with several mates and the females may lay 50 - 100 eggs over their adult life. As a consequence, their numbers can rise quite quickly and occasionally they will reach pest proportions. This is especially the case if the adults get into a seed store.

Females laying eggs on beans have an advantage over those not doing so since their eggs are likely to hatch, their larvae to grow, pupate successfully and emerge as adults ready to mate. Females laying eggs on Blu-Tack beans and/or a Petri dish, will not leave offspring since the larvae will starve. The larval food requirements are only met by leguminous seed.

So, '***do female seed beetles lay eggs on Blu-Tack as well as on azuki, mung and black-eyed beans***?'

Apparatus

A seed beetle starter culture is required and this can be obtained from an educational supplier (such as Blades Biological) or from Michael Dockery, the ASAB Education Officer (see the back cover of this book for contact details). The eggs on the beans will hatch a few days after being laid and the adult beetles will emerge 4-5 weeks after this. So to have good numbers of adult beetles available for a whole class activity you would need to order the egg-laden beans 3 - 4 weeks before they are needed. On the assumption that plenty of adult female beetles will be available when they are required, the following items of equipment, **per group of pupils**, will be needed:

- one Petri dish;
- two or three types of beans (say, azuki, black-eyed and mung - all these types are readily available in health food stores);
- Blu-Tack; (the Blu-Tack needs to be moulded into 3 or 4 'Blu-Tack' beans, which can be made to be, roughly, the same size as a black-eyed bean);
- a balance to weigh the beans (this is an optional item);
- an artist's brush;
- six female beetles, from the classroom culture;
- a hand lens (x 10 would be fine - this is an optional item). This might be useful for the pupils to help them spot the eggs on the surface of a bean. The eggs appear as white dots and are easily spotted on the azuki and mung beans, though not quite so clear on the black-eyed beans, especially on the day they have been laid. A day or two later the eggs are much easier to see.

What to do

Essentially, a similar mass of each of the three types of beans (again reinforcing the concept of the *fair test*), and a similar mass of Blu-Tack beans, are placed in the Petri dish. Then, using the artist's brush, female seed beetles from the culture need to be put into the Petri dish and the dish left for a while before a count is made of the total number of eggs laid on each type of bean. Once the pupils have set up the apparatus and added the animals, the Petri dish needs to be put in a place where it will not be disturbed, so the females will get on with egg-laying.

Some key points will need to be addressed in the discussion preceding the set-up of equipment.

- How many female seed beetles should be put in the Petri dish with the beans?
  Six is usually sufficient but a couple more could be added if there are plenty available.
  A practical point to bear in mind is that as the number of beetles increases so do the potential problems in setting up the dish since some beetles are likely to escape as the lid of the Petri dish is lifted to put females in. [It may help to practise this manoeuvre first.] Usually the noise level in the classroom rises when the children handle the animals, especially since a few seed beetles will invariably escape at this stage! However, they usually just walk across the desk or table. Even though they can fly, they seldom do!

- How many beans should be used?
  You may think the surface area of the four different types of beans should be similar but this is not needed at KS2. If a fairly sensitive balance is available the children can try to make the mass of the four types of beans the same (or as closely similar as is possible - a total mass of around 5 g of each type of bean is usually sufficient). If such a balance is not available then a ratio of 1:1:2:4 (black-eyed: Blu-Tack: azuki: mung) is a reasonably good approximation if the Blu-Tack beans are approximately the same size as the black-eyed beans.

- How long should the Petri dish, with the beans and beetles, be left undisturbed?
  In a 'typical' lesson of, say, 45 - 60 minutes, it may take the children around 15 minutes to set up the dish. So, if the beetles are left in the dish for 30 - 40 minutes, or more, this will be adequate. [We can **almost** provide a cast-iron guarantee that female seed beetles will lay eggs on clean beans within 30 - 40 minutes, especially if they have been recently mated.] On the other hand, the beetles could be safely left in the Petri dish overnight and the eggs counted the following day.

A printed check sheet would be very helpful to have ready so that each group of children can record the number of eggs laid on each of the four types of bean. The check sheet can also record the number of eggs laid by the female beetles in the other groups. (You might wish to use the example at the end of this investigation.)

Analysis

The data from each group can be pooled and the totals, and mean (average) number of eggs per bean type can be determined. A graph would be particularly helpful here to allow a visual comparison to be made:

1) between the groups of pupils;
2) between the different types of bean.

Conclusions

Observations can be made in the written, mathematical and graphical form. The children will usually find that females generally show a preference when laying eggs on the three types of beans. Female seed beetles rarely lay eggs on 'Blu-Tack beans'. So the children ought to be able to say that female beetles do seem to be able to recognise an appropriate surface on which to lay their eggs.

[However, *egg-dumping* (i.e. laying eggs on the surface of the container they are in when beans are either not available or already have several eggs on their surface) has been reported by some researchers so it is a good idea to ask the children to check if there are any eggs on the Petri dish. The hand lens would be helpful for this task.]

Follow-up work

Some children may notice that when a female is in contact with a bean she walks over its surface before she lays an egg. This 'inspection' phase always occurs and allows her to detect the presence of other eggs on the bean surface. So a follow-up investigation could be carried out with females being offered clean beans or beans with, say, 2 - 6 eggs already on their surface. Does the presence of eggs already on a bean influence the egg-laying behaviour of a female seed beetle?

To most humans, Blu-Tack appears to have no smell. [Of course, this is not to say that female seed beetles cannot detect olfactory cues from the surface of a 'Blu-Tack bean'.] Plasticene, on the other hand, does have a smell that humans can detect. So the children might wish to compare 'plasticene beans' and 'Blu-Tack beans' as potential egg-laying sites for female seed beetles.

The children might also suggest that they could try other man-made beans to see if female seed beetles are tempted to lay eggs on them. They could try glass or plastic 'beans' from a necklace, or even small glass marbles, if they are available. Pupils could also make their own 'beans' from clay, or pastry, or some other available medium.

Additional notes for teachers

Female seed beetles usually show a preference for egg-laying on the beans suggested here. The usual order of preference is mung beans, azuki beans and then black-eyed beans. Research suggests that a number of factors are influential. One factor is that if the beans offered to females are made to have the same mass, then obviously there must be more mung beans, since they are smaller than azuki or black-eyed beans, and so females will lay more on mung beans as there are more of them. Another important factor is the surface of each of the seeds: mung and azuki are both much smoother than black-eyed beans and so are probably more attractive to females. [Children will be able to see that black-eyed beans often have some well defined ridges on their surface. These can also be detected by running a finger across the bean surface.]

Female adult seed beetles certainly seem able to make a decision as to what is a suitable site for egg-laying very soon after they emerge from the bean as an adult. They can mate with males almost immediately on emergence and will begin egg-laying soon after. Children might suggest that a female could 'learn' what is a good egg-laying site by watching other females to see where they lay their eggs. It would be possible to check this by isolating females and, after mating, allow them to lay eggs on clean beans. Since they would not have had any opportunity to 'learn'

this behaviour it would be good evidence for believing the behaviour is innate.

There are a number of commercial sources of butterfly eggs, larvae or pupae and so it would be quite easy to set up a cage at school and provide the adult butterflies with mating opportunities. The pupils could then observe female butterflies laying eggs on plants inside the cage. If you can supply a plant that is known to be a host and one that is unlikely to be, the children can see a similar mechanism at work in another insect species.

Reference

Dockery, M. 1997. *Callosobruchus maculatus* - a seed beetle with a future in schools. *Journal of Biological Education*, **31**, 263 - 268.

[Michael Dockery can provide an offprint of this article should anyone wish to read it. It provides some useful suggestions for setting up and maintaining seed beetles, as well as offering some further practical suggestions.]

Group	Number of eggs - aduki	Number of eggs - mung	Number of eggs - black-eyed	Number of eggs - Blu-Tack
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
	Total =	Total =	Total =	Total =

Investigation 3 - follow-up exercise

1. Here is a drawing of a male and a female seed beetle. Spot **two** differences between male and female seed beetles.

a male seed beetle

a female seed beetle

a) .....

b) .....

2. Female seed beetles lay eggs on the surface of a bean. When the egg hatches a larva emerges, burrows into the bean and completes its growth inside the bean. What will the larva feed on?

.....

.....

3. Adult seed beetles don't eat or drink at all! How do you think they get the energy they need to live?

.....

.....

Exercises

1. Feeding relationships, Years 3 - 4
   Feeding relationships, Years 5 - 6

2. How birds feed and find their food, Years 3 - 4
   How birds feed and find their food, Years 5 - 6

3. How animals get their food, Years 3 - 4
   How animals get their food, Years 5 - 6, part 1
   How animals get their food, Years 5 - 6, part 2

4. How to avoid being eaten, Years 3 - 4
   How to avoid being eaten, Years 5 - 6

5. Humans and food, Years 5 - 6

6. Living without food and drink, Years 5 - 6

7. Miscellaneous, Years 5 - 6

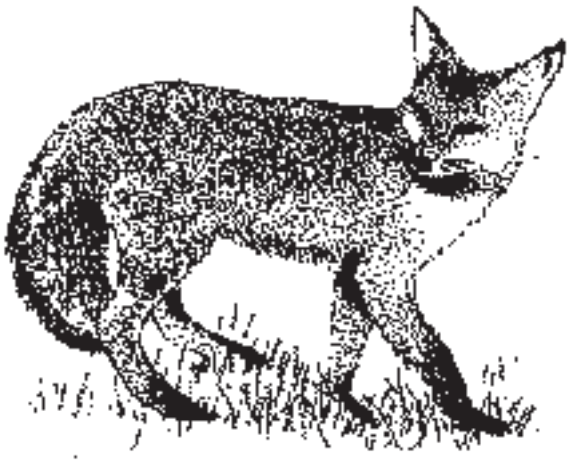
FINDING FOOD

Exercise 1 - feeding relationships (Years 3 - 4)

1. Here are the names of some living things. Write the letter P beside those that are plants and A beside those that are animals.

a) cabbage	.....	b) cat	.....
c) grass	.....	d) pig	.....
e) kestrel	.....	f) dandelion	.....
g) oak tree	.....	h) blue tit	.....
i) rose	.....	j) caterpillar	.....

2. Here are drawings of a rabbit and a fox. Foxes eat rabbits.



Are rabbits predators or prey? Rabbits are .....

3. Children see some animals on their playing field catch and eat another animal. They write the name of the animal in the first column and the name of the animal it ate in the second column.

Draw **two** more lines from an animal to its prey, one has been drawn for you.

Animal	Prey
cat	caterpillar
blue tit	hawk
spider	snail
fly	fly
thrush	sparrow
child	spider

4. Some birds eat food dropped by people. Write down **two** places where birds might find food that has been dropped.

a) .....

b) .....

FINDING FOOD

5. In the two circles below draw <u>two</u> foods dropped by people that birds might find and eat.

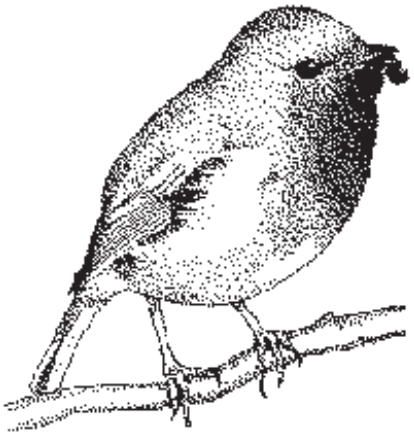
6. This is a squirrel. Squirrels eat acorns. In autumn they often bury acorns rather than eating them. Write down why they do this?

They bury nuts in autumn because

.....

.....

7. Here is a robin with a caterpillar. Which is the prey and which is the predator?



The caterpillar is the

.....

and the robin is the

.....

Exercise 1 - feeding relationships (Years 5 - 6)

In a salt lake there are large numbers of tiny plants, called *algae,* which are eaten by brine shrimps. The brine shrimps are eaten by flamingoes.

1. Complete the food chain for flamingoes, algae and brine shrimps.

..... ➔ ..... ➔ .....

2. Which <u>two</u> living things in this food chain are consumers?

a) ..... b) .....

3. Why will there always be fewer flamingoes than brine shrimps in the lake?

.....

.....

4. Occasionally the salt lakes dry out completely. What will the flamingoes do when the lake dries out?

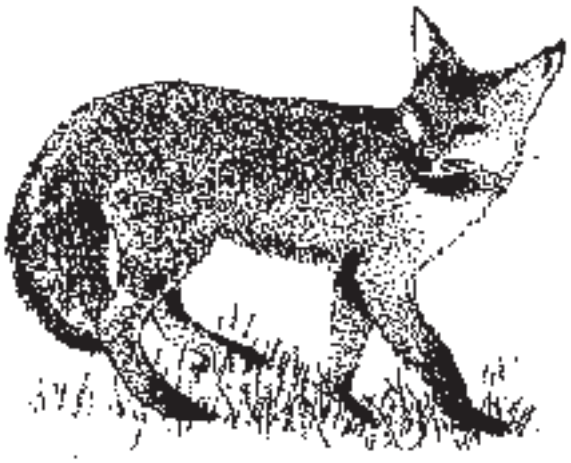
.....

.....

FINDING FOOD

5. Here are a fox and a rabbit. Foxes eat rabbits. Is a fox a predator or prey?

A fox is a .....



6. Write the name of <u>one</u> other animal a fox might eat?

A fox might eat a .....

7. Rabbits eat plants. Is a rabbit a producer or a consumer?

A rabbit is a .....

8. When hunting rabbits foxes often keep very low to the ground. Write down why you think they do this.

.....

.....

9. Which <u>two</u> senses might a rabbit use to warn it that a fox is nearby?

a) ..... b) .....

10. Foxes often hunt for food a long way from their den. Rabbits usually stay much closer to their burrows when looking for food. Why do you think foxes have to search much further to find their food?

.....

.....

11. Name <u>one</u> other animal that hunts rabbits.

.....

12. Write down <u>two</u> facts about this animal.

a) .....

.....

b) .....

.....

FINDING FOOD

Exercise 2 - how birds feed and find their food (Years 3-4)

1. Here are drawings of the heads and bills (beaks) of three British birds.

This is a kestrel. Why is its bill good for eating mice and birds?

.....

.....

.....

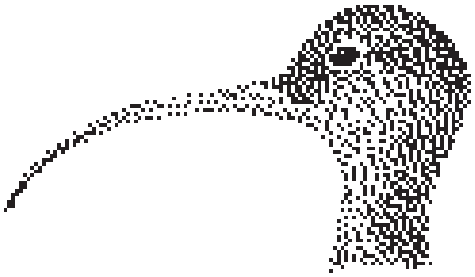
This is a greenfinch. Why is its bill good for eating seeds?

.....

.....

.....

This is a curlew. Why is its bill good for finding worms in sand and mud?



.....

.....

.....

FINDING FOOD

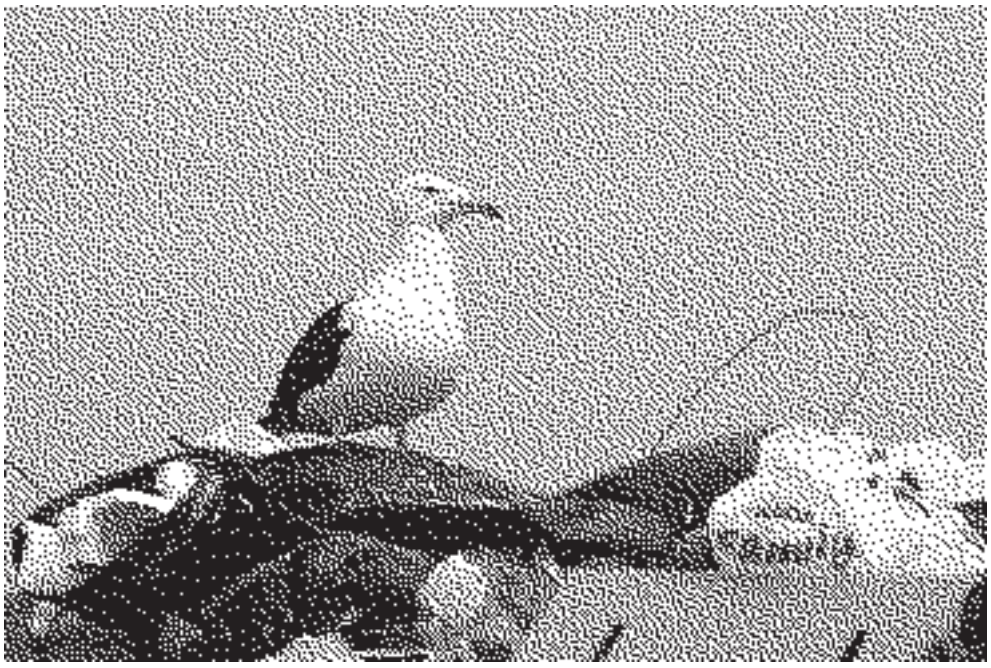
2. In this space draw the head and bill of a robin.

Write down **two** things that robins eat.

a) .....

b) .....

Below is a photograph of a gull. Gulls quite often search for food on rubbish tips.



3. Write down <u>one</u> food that gulls might find on a rubbish tip.

.....

FINDING FOOD

4. Why do you think gulls look for food on rubbish tips?

.....

.....

5. Write down <u>two</u> possible dangers for a gull when it is searching for food on a rubbish tip.

a) .....

.....

b) .....

.....

6. Some gulls eat the chicks of other gulls. Which word describes an animal that eats the young of other animals like itself? Write the word here, each dash means one letter. c a n _ _ _ _ l

Exercise 2 - how birds feed and find their food (Years 5-6)

1. **The song thrush is a bird that eats snails but a snail hides inside its shell when a thrush picks it up.** How do you think a song thrush gets a snail out of its shell to eat it?

Underline **one** of the statements below which you think is the best answer:

a) the thrush sits beside the snail and waits until it pops out of its shell

b) the song thrush picks up the shell and breaks it open on a stone

c) the song thrush flies back to its nest and waits until the snail pops out of its shell to feed

d) the song thrush asks a bigger bird to open the shell for it

e) the song thrush puts the snail on a road and waits until a car runs over it to break the shell.

FINDING FOOD

This is a drawing of a pelican. Pelicans eats fish. The bird has a pouch under its bill (beak).

2. How do you think the pouch would help a pelican to catch fish?

.....

.....

3. In Britain there are lots of birds that eat seeds. These birds usually have short, strong beaks (bills). Why might a short, strong beak be an advantage to a bird that eats seeds?

.....

.....

4. Write the name of <u>one</u> British bird that eats seeds.

.....

FINDING FOOD

Here is a drawing of a swallow. Swallows **only** feed on insects. The birds come to Britain in May and they leave in September.

5. Swallows eat insects. Are swallows predators or are they prey?

Swallows are .....

6. Is the swallow a producer or a consumer?

The swallow is a .....

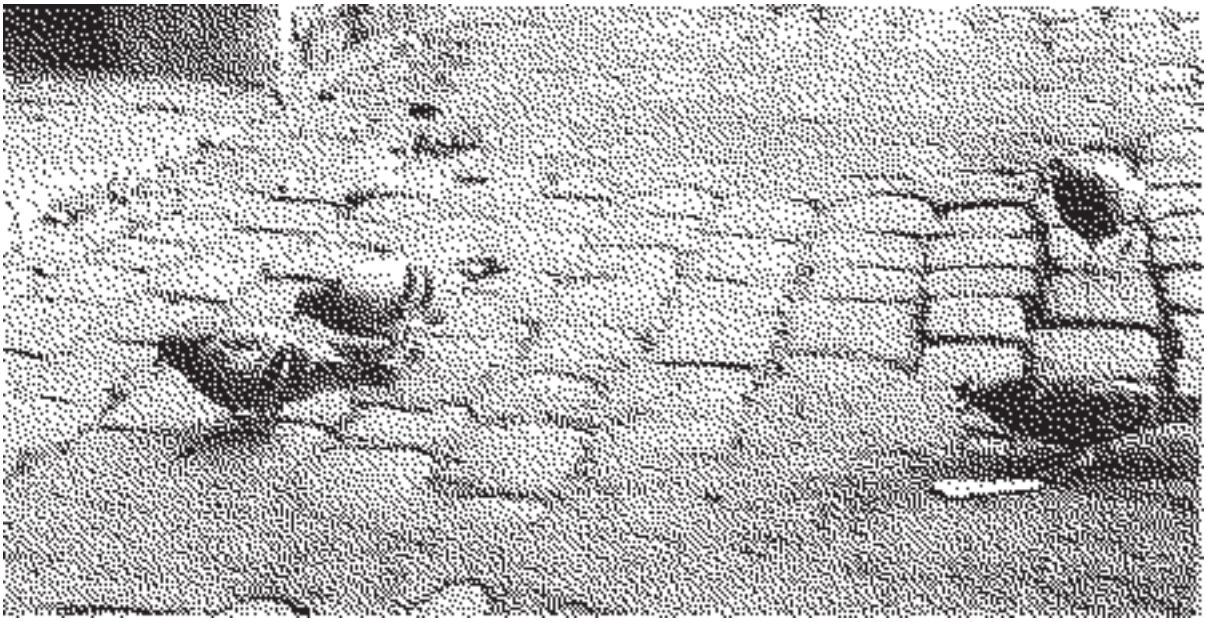
7. Why do you think swallows don't stay in Britain throughout the year?

.....

.....

FINDING FOOD

This photograph shows a small flock of pigeons feeding in a town.



8. Suggest <u>two</u> food items that pigeons might find to eat in a town or city.

a) ..... b) .....

9. Why do you think we see so many pigeons in towns and cities?

.....

.....

FINDING FOOD

10. Owls hunt mice and other animals at night. They do not use their sense of sight very much because it is very dark. Instead they use one of their other senses. Underline below which sense you think it will be.

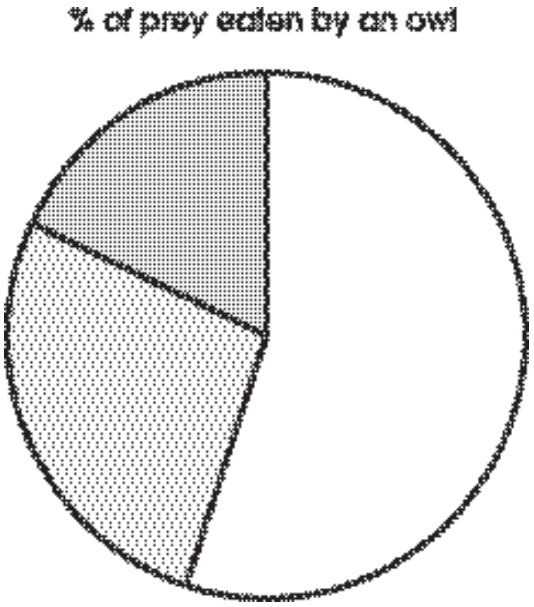
a) taste b) hearing c) touch

11. Owls swallow a mouse whole and don't tear bits of flesh from it. Write down **one** advantage of swallowing prey whole?

.....

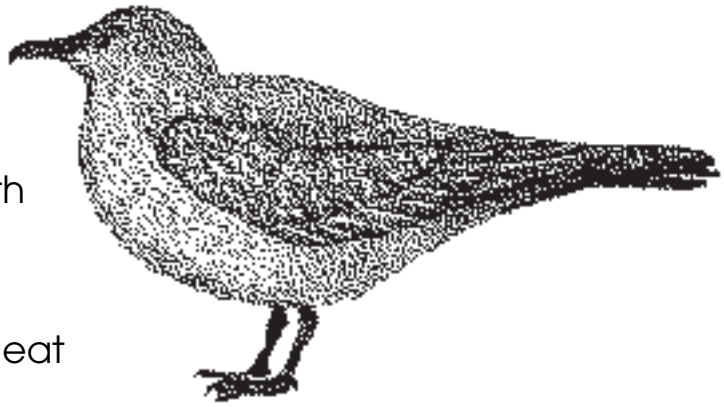
.....

12. A scientist finds that 55 % of the food an owl eats is insects, 27% is worms and 18% is voles. A pie chart is drawn but unfortunately the labels are missing! Place the words *insects, worms* and *voles* in the correct section of the pie chart.



FINDING FOOD

Here is a drawing of a skua. Skuas are large seabirds that chase other birds, like puffins, as they return with fish to feed their chicks. The skua tries to make the puffin drop its catch so that it can eat the fish the puffin caught.



13. Why is it good for the skua to take the puffin's fish?

.....

.....

14. Skuas are sometimes called 'pirates of the air'. Why do you think people use this phrase to describe the behaviour of skuas?

.....

.....

15. Skuas defend their nest and chicks if a person comes close to the nest. They do this by flying straight at the person and then they turn away at the last moment. Why do you think they behave like this?

.....

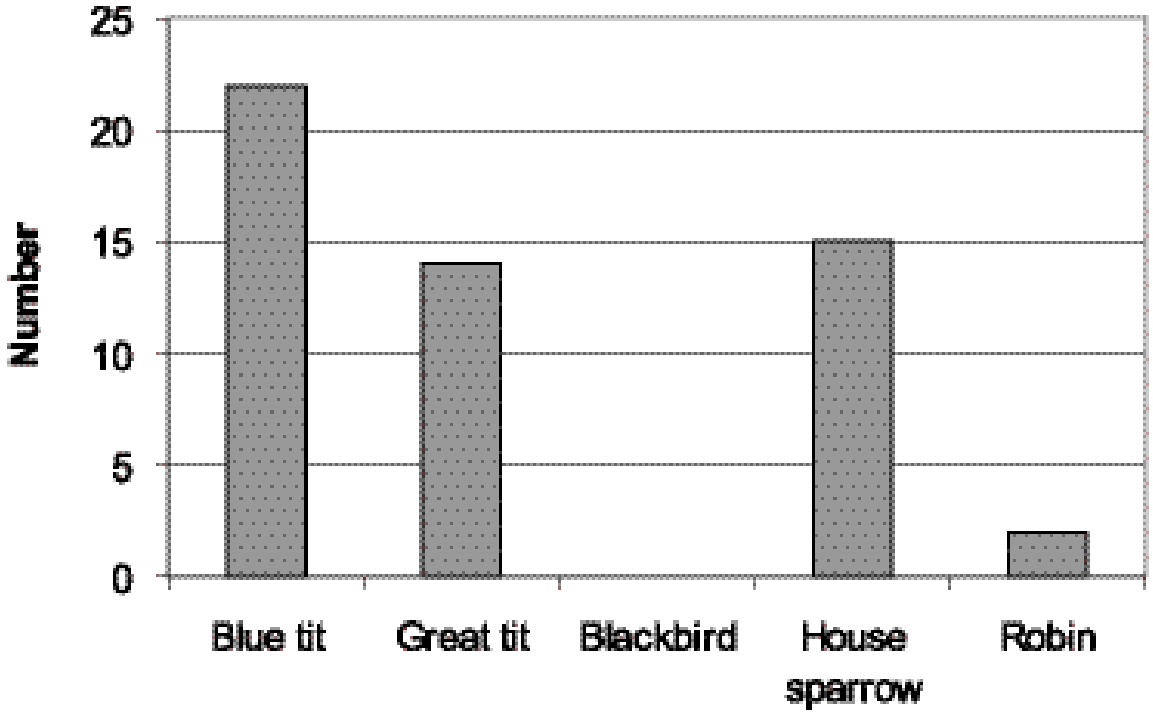
.....

FINDING FOOD

16. Children record how many birds land on a bird table in their school grounds on a winter morning. The information they collect is in the table below and is also shown on the graph.

Species of bird	Number of birds that landed
Blue tit	22
Great tit	14
Blackbird	7
House sparrow	15
Robin	2

Graph showing the number of birds that landed on the bird table.



FINDING FOOD

i) How many birds landed on the table altogether?

..... birds

ii) What fraction of the birds were tits?

.....

iii) Draw a bar on the graph to show how many blackbirds landed on the bird table.

iv) What percentage of the birds that landed were house sparrows?

..... %

17. Draw your favourite garden bird in the space below.

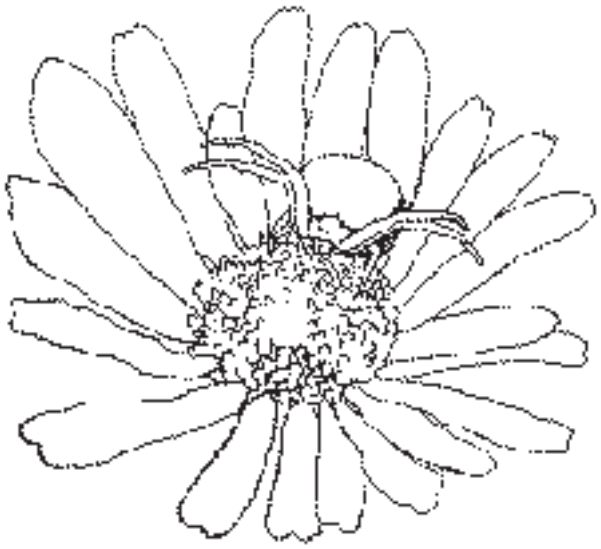
FINDING FOOD

Exercise 3 - how animals get their food (Years 3 - 4)

1. Many spiders catch insects in a web. Write down **one** type of insect a spider might catch in its web.

.....

Look carefully at the drawing. It shows a crab spider sitting on a flower.
Can you see the spider? Colour it yellow when you have spotted it.



Crab spiders eat insects but they don`t build a web. A crab spider sits very still on the top of a flower and if an insect lands, it grabs it and eats it.

2. Why does a crab spider keep very still?

.....

.....

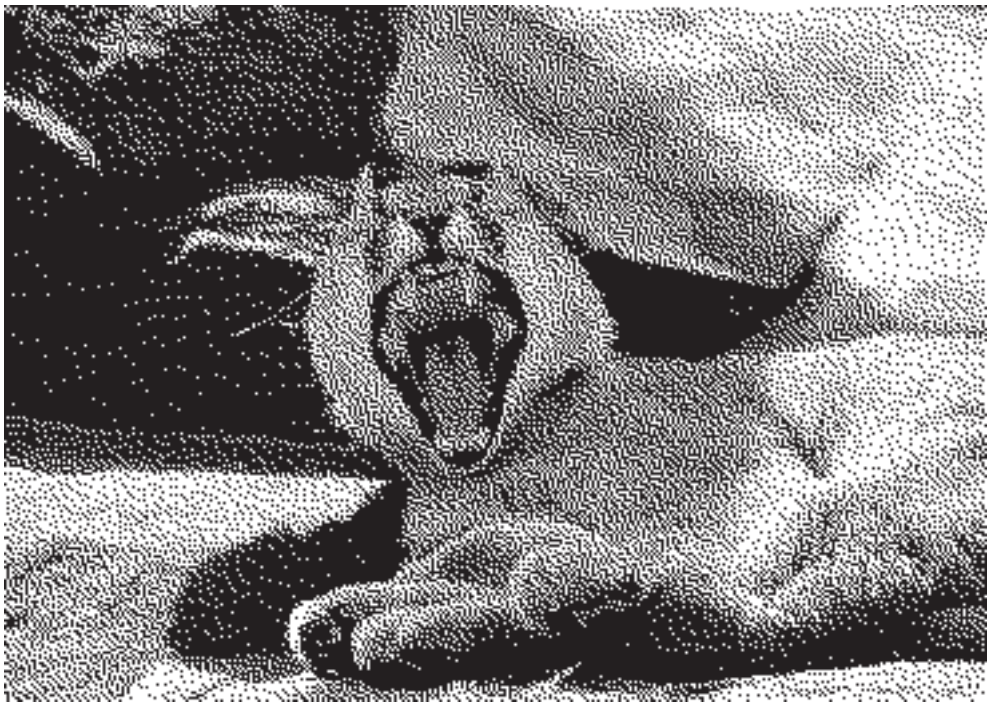
3. Why does a crab spider wait on top of the flower to catch its food?

.....

.....

FINDING FOOD

Here is a caracal. It is not found in Britain but in Africa. How can you tell from the photograph that the animal is a predator?



4. I can tell the caracal is a predator because

.....

.....

5. What do you think the caracal is doing? Say why you think so.

I think the caracal is ..... because .....

.....

6. Cheetahs are also found in Africa. They are predators and can run very fast. How does running fast help them to catch their food?

.....

.....

7. Sometimes cheetahs hunt together in groups of 2, 3 or 4. Why do you think it helps them to hunt in groups?

.....

.....

8. Underline which <u>three</u> of these animals are predators:
donkey, lion, zebra, leopard, gazelle, elephant and hyaena.

9. In the space below draw <u>one</u> of the three predators.

FINDING FOOD

Exercise 3 - how animals get their food (Years 5 - 6, part 1)

This is a drawing of the head of a greenfinch. Greenfinches often come into our gardens to eat seeds and nuts we put out for them.

1. Suggest <u>one</u> type of seed that people might put out for greenfinches.

.....

.....

2. Some animals eat mostly fruits, some animals eat mostly leaves. Write down **one** advantage to an animal of eating fruit rather than leaves.

.....

.....

3. Some animals in Britain eat fruits but fruit is not a very important part of their diet throughout the year. Why do you think British animals don`t eat only fruit?

.....

.....

FINDING FOOD

4. Write down <u>two</u> fruits that British animals could eat in the wild.

a) ..... b) .....

Here are the skulls of a rabbit and a mole.

Rabbit skull **Mole skull**

5. Why are the rabbit's teeth good for eating grass?

.....

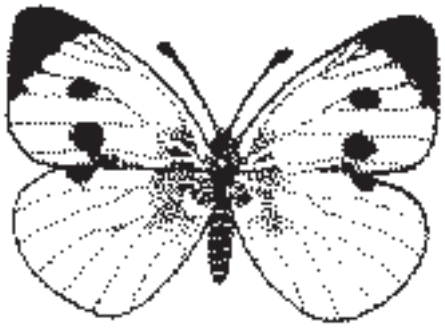
.....

6. Why are the mole's teeth good for eating flesh?

.....

.....

FINDING FOOD



Here is a Large White butterfly which feeds on nectar from flowers. Nectar is a sugary liquid. Most butterflies have very long tongues which they use to suck up the nectar from the flowers.

7. Is a butterfly a producer or a consumer? It is a .....

8. Why do you think the butterfly has a long tongue for sucking up nectar?

.....

.....

9. The tongue of the butterfly is coiled up when it is not feeding. Why do you think the butterfly coils up its tongue when it is not drinking nectar?

.....

.....

FINDING FOOD

10. Cheetahs are predators in Africa and chase prey such as gazelles. Cheetahs soon give up if they don`t quickly catch the animal they are chasing. Underline the statement that best explains why they do this:

a) they get bored very easily when chasing animals

b) they like to stop for a snack after running for just a few seconds

c) cheetahs are not well suited to long-distance running

d) they might trip up and hurt themselves if they run too far

e) they don`t want to run too far away from their friends.

11.From books or the internet, find <u>three</u> facts about the cheetah and write them below.

a) .....

b) .....

c) .....

FINDING FOOD

12. Brine shrimps feed on algae. A scientist records how long ten shrimps spend feeding on algae and the times are -
34 s, 76 s, 92 s, 18 s, 45 s, 51 s, 18 s, 20 s, 33 s and 13 s.

a) Put the times spent feeding in order, with the least time spent feeding first and the longest time last.

.....

b) What is the difference between the least time spent feeding and the longest time spent feeding?
..... seconds

c) What was the average (mean) time spent feeding on algae?
..... seconds

d) Suppose you wanted to find out how fast a shrimp can swim. How would you do it?
.....

.....

.....

.....

FINDING FOOD

Exercise 3 - how animals get their food (Years 5 - 6, part 2)

1. Cheetahs are predators and catch gazelles and antelopes.
Sometimes, lions and hyaenas take a kill away from a cheetah. Cheetahs often hunt in the middle of the day when it is hottest. Why do you think cheetahs often hunt in the middle of the day?

.....

.....

Here is a drawing of an Egyptian vulture trying to crack open the egg of an ostrich.

2. Explain how it breaks into the egg.

.....

.....

3. Name <u>one</u> other animal that eats eggs in the wild.

.....

FINDING FOOD

4. Name <u>one</u> animal, other than a bird, that lay eggs. Where are they laid?

A ..... lays eggs. The eggs are laid .....

.....

5. Here are two skulls. One skull is an animal that eats grass, the other is an animal that eats flesh. Identify which is which and explain how you know which is the skull of the flesh eater.

Skull A

Skull B

a) Skull ..... is the grass eater.

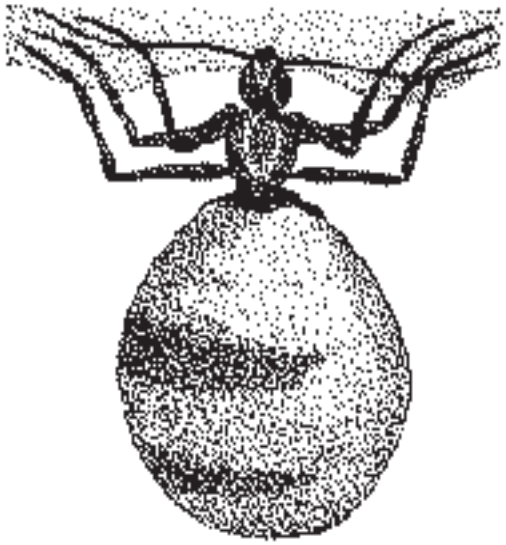
b) Skull ..... is the flesh eater.

I know skull ..... is the flesh eater because .....

.....

FINDING FOOD

Here is a drawing of a honeypot ant. Some of these ants store nectar in their abdomens, which swell up until they are about the size of a pea! If an ant in the nest is hungry, an ant that stores the nectar gives it a drop.



6. Why do the ants store nectar inside the bodies of these special 'storage' ants, rather than storing it in the soil?

.....

.....

7. Burying beetles (also called sexton beetles) find the bodies of dead mice and bury the body underground. Why do you think they do this? (Use a book, CDRom or the internet to help you find the answer.)

.....

.....

.....

FINDING FOOD

8. In the autumn, squirrels store acorns and nuts in the soil to eat later.
Tick a box to show which statement best explains why they do this:

a) they are too lazy to carry the acorns and nuts back to their nest ☐

b) they put acorns and nuts in the ground to fill up holes they find ☐

c) they enjoy hiding things for other animals to find ☐

d) they like to tidy up the countryside ☐

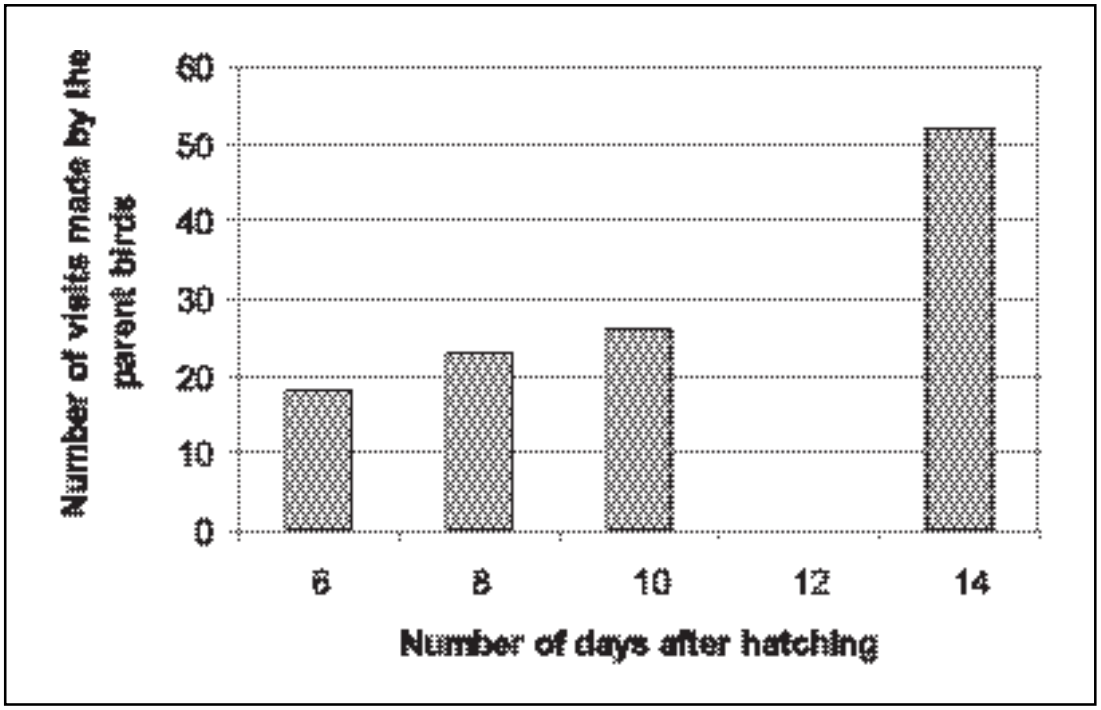
e) they have a good memory and know how to find the food they buried to eat when they are hungry in winter. ☐

A camera is placed in a nestbox in a tree in the grounds of a school. A pair of blue tits make a nest in the box. When the eggs hatch, the pupils record how many times the birds visit the nestbox with food between 0900 and 0930 each morning. They put their findings in a table and draw a graph.

Number of days after the eggs hatched	Number of visits made by the parent birds
6	18
8	23
10	26
12	40
14	52

Data kindly supplied by Nikki Rowland

FINDING FOOD



9. Draw a bar on the graph to show how many visits were made by the parent birds on the 12th day after the chicks hatched.

10. Why do you think the parents made more visits to the nestbox as the chicks got older?

.....

.....

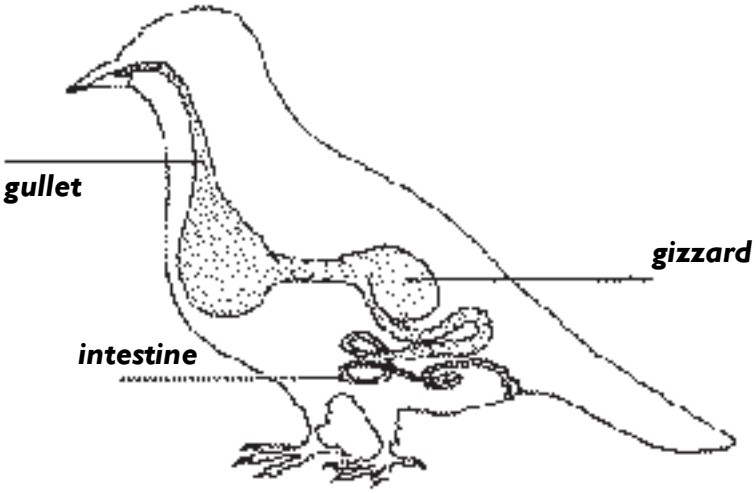
11. Suggest <u>one</u> food item blue tit parents might feed to their chicks and say why this food would be suitable for chicks to eat.

.....

.....

FINDING FOOD

Birds don't have teeth. Instead, at the end of their gullet is the **gizzard**, which is like a strong, muscular bag. Birds often swallow grit and the grit collects in the gizzard. When food enters the gizzard the grit grinds down the food into small pieces.



12. Why do birds need to grind down their food before it enters their intestines?

.....

.....

13. If birds swallowed stones rather than grit the stones might grind the food down faster. So, why don't birds swallow large stones?

.....

.....

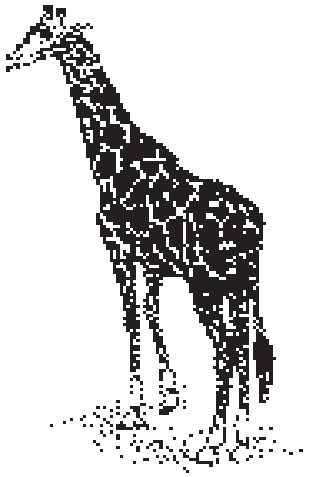
14. Swans sometimes swallow lead weights that fishermen use when they are fishing. How might swans be harmed if they swallow a number of lead weights?

.....

.....

FINDING FOOD

15. Here is a giraffe.
Giraffes feed on the leaves of trees, such as acacia trees.



Are giraffes producers or consumers?

Giraffes are .....

16. Giraffes have very long necks. Why might this be helpful to them when they are getting leaves to eat?

.....

.....

17. Predators, such as lions, can catch a giraffe more easily when it is drinking water. Write down **one** reason why a giraffe might be more likely to be caught when it is drinking.

.....

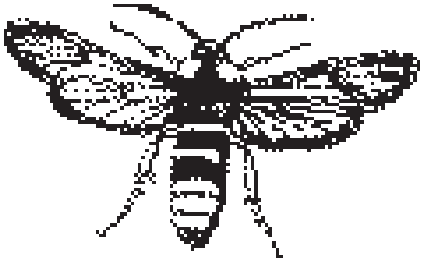
.....

.....

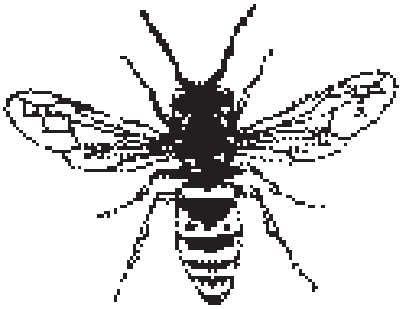
FINDING FOOD

Exercise 4 - how to avoid being eaten (Years 3 - 4)

This is a harmless moth



This is a wasp

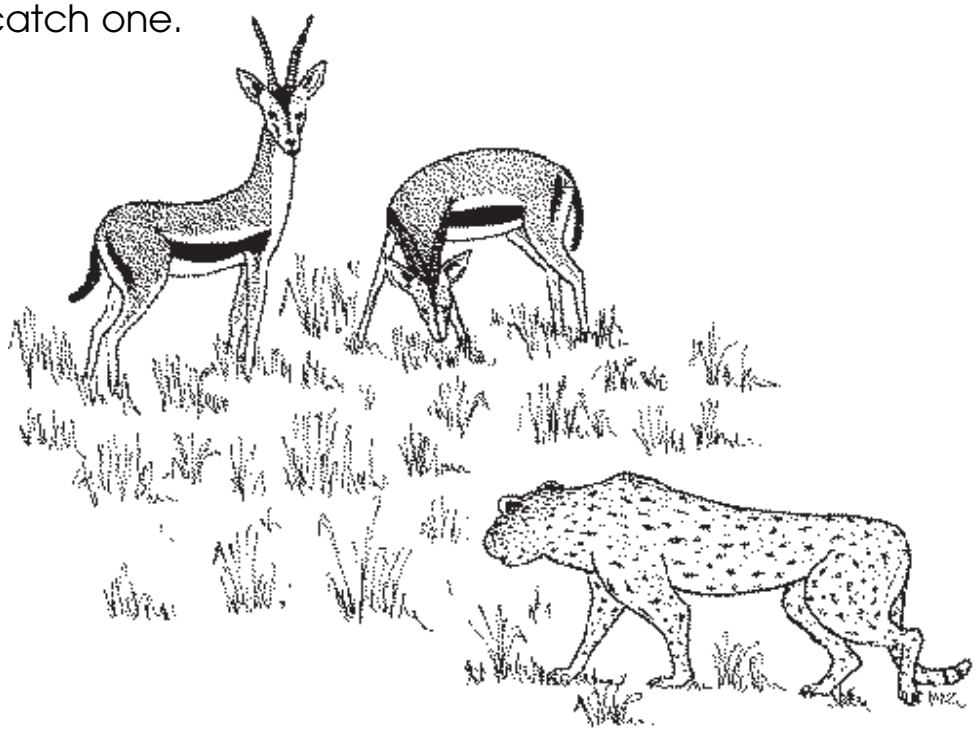


1. Why does it help the moth to look like a wasp?

.....

.....

In the drawing a cheetah is trying to get close to some gazelles to chase and catch one.



FINDING FOOD

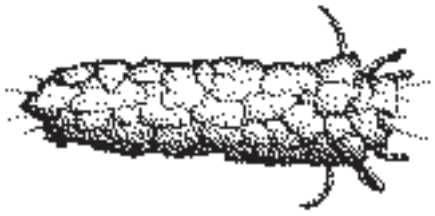
2. When a cheetah chases a gazelle, the gazelle dodges and turns quickly. Why does it do this?

.....

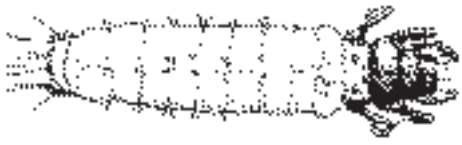
.....

A caddis fly larva can be found in a stream. The larvae stick bits of sand, stone or leaves to their bodies.

This caddis has pieces of leaf covering its body.



This caddis does not have its body covered.



Caddis figures ©M.Dobson

3. How do the bits of leaf protect the soft body of a caddis fly larva.

.....

.....

FINDING FOOD

If a cat is threatened by a dog it raises its fur and arches its back.

With the kind permission of Universities Federation for Animal Welfare (UFAW). Body arch (Plate 16) from 'An Ethogram for Behavioural Studies of the Domestic Cat (Felis silvestris L.)', 1995, by the Cat Behaviour Working Group, UFAW, Wheathampstead.

4. Why do you think the cat raises its fur and arches its back?

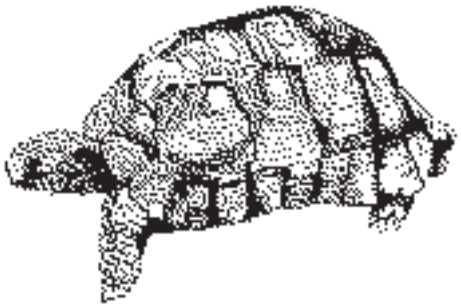
.....

.....

5. Write down <u>one</u> other thing the cat is doing.

.....

FINDING FOOD



Here are two drawings, one of a tortoise and one of a hedgehog.

6. A tortoise tries to protect itself if it is attacked. Tick the box which you think is how a tortoise protects itself:

a) it runs away very fast ☐

b) it pulls its head and legs into its shell ☐

c) it hopes a human writes `**PLEASE DON'T ATTACK ME**` on its shell so predators leave it alone ☐

d) it takes big breaths and swells up to twice its normal size ☐

e) it squeals when it is touched and its mother rescues it. ☐

FINDING FOOD

7. What part of the hedgehog's body protects it if it is attacked by dogs and foxes and how does the protection work?

.....

.....

.....

.....

8. Write down <u>one</u> other animal, apart from a caddisfly larva, whose body is protected. Draw the animal in the space below.

.....

FINDING FOOD

Exercise 4 - how to avoid being eaten (Years 5 - 6)

Here are some cinnabar moth caterpillars. They are very colourful, having a set of black and orange bands down their body. Birds do occasionally eat them but the birds are often sick afterwards and so don`t eat any others.
Colour the white areas orange if you like.

1. Why do you think it is an advantage for the caterpillars to have orange and black bands?

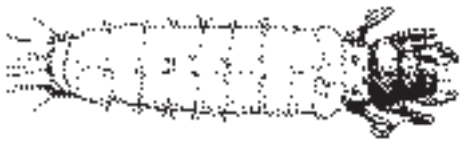
.....

.....

Caddis fly larvae are found in streams. They wrap themselves in a silken tube, or case, to which they stick bits of sand, stone or leaf. Some build cases to make the water flow past them, bringing food particles with it.

This caddis has pieces of leaf covering its body.

This caddis has had its case removed.



Caddis figures ©M.Dobson

FINDING FOOD

2. Give <u>two</u> reasons why the bits of leaf protect the soft body of a caddis fly larva.

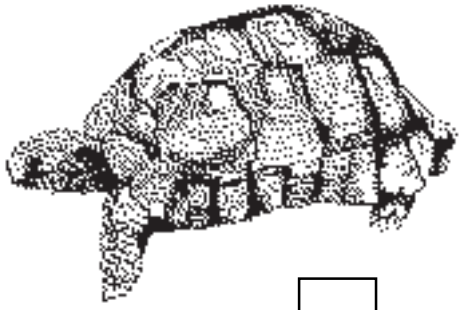
a) .....

.....

b) .....

.....

3. Here is a tortoise. Children suggest how a tortoise might protect itself if it is attacked.
Which **two** are best? Tick 2 boxes:



a) it runs away very quickly ☐

b) it pulls its head and legs into its shell ☐

c) it squirts liquid into the face of the animal attacking it ☐

d) it hopes a human writes `**PLEASE DO NOT ATTACK ME**` on its shell ☐

e) it has a hard shell and predators can`t get at its softer body parts very easily ☐

f) it takes very large breaths and swells up ☐

g) it squeals if it is touched and its mother rescues it. ☐

FINDING FOOD

Here is a lizard. When they are attacked, some lizards can lose their tail, and still live. A new tail can be grown too.

4. How does losing its tail help a lizard?

.....

.....

5. The lizard's tail continues to twitch for a while after it breaks off! Why is this helpful to the lizard as it tries to escape?

.....

.....

6. Some fish swim together in groups called shoals (or schools). When shoals are attacked the fish swim away in many directions. How does this make it difficult for a predator to catch one of the fish?

.....

.....

7. How do rattlesnakes tell other animals to move away and not attack them?

.....

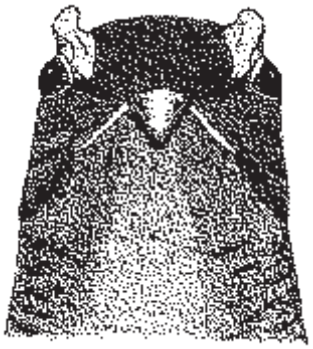
.....

FINDING FOOD

Here are two drawings, one of a predator (a buzzard) and one of a prey animal (a red grouse). Their eyes are in different positions on their heads.

Buzzard

Red grouse



8. Suggest <u>one</u> reason why it is important for a red grouse to have an eye high on each side of its head.

.....

.....

9. Why do you think the buzzard has eyes close together facing forwards?

.....

.....

10. Write down <u>one</u> other animal a buzzard might eat.

.....

11. Gazelles are often eaten by cheetahs. So when gazelles are feeding they spend time watching out for cheetahs. Cheetahs try to creep up close and then make a quick dash and try to catch one.

A scientist watches cheetahs creep up on different pairs of gazelles. The scientist records how much time each gazelle spends looking around for danger. She records which gazelle was chased and which was ignored by the cheetah. This is what she found.

Time spent looking around for danger (s)

Gazelles	Gazelle that was chased	Gazelle ignored
Pair A	8	18
Pair B	40	70
Pair C	50	90
Pair D	10	65
Pair E	72	90

a) For which pair was there the greatest difference in the time each gazelle spent looking around for danger?

Pair .....

b) What was the average (mean) time spent looking for danger by the gazelles in the `chased` group?

..... s

FINDING FOOD

c) Why do you think the cheetah selected the gazelle that it did chase?

.....

.....

d) Why don`t gazelles spend all their time watching for cheetahs and other predators?

.....

.....

e) Write the name of **one** other African predator that eats gazelles.

.....

f) Write down **three** facts about the predator.

i) .....

ii) .....

iii) .....

Exercise 5 - humans and food (Years 5 - 6)

1. Tick which <u>two</u> of these foods are rich in fat:

cheese ..... bread ..... grass ..... chips ..... weetabix ..... peas .....

2. Which of these meals is a better balanced meal?

<u>Meal A</u>	**<u>Meal B</u>**
burger	salad
chips	baked potato
cola	pure orange juice
ice cream	apple

Meal ..... is a better balanced meal.

3. Suppose you are ill and have to spend three days in bed. Your body will still be using up energy, even though you are not very active. Suggest **one** body activity that uses energy when you are lying in bed.

.....

.....

4. What happens to us if we eat too much food for several weeks?

.....

.....

FINDING FOOD

5. What happens to us if we do not eat enough food?

.....

.....

6. Write down <u>one</u> activity for 10 - 11 year old children that would use up a lot of energy.

.....

7. Tick the box that you think is the best advice to give someone if they want to lose some weight in a sensible way:

a) eat more food that is high in energy ☐

b) stop eating altogether ☐

c) stay in bed longer ☐

d) reduce the amount you eat and take more exercise ☐

e) encourage all their friends to eat a great deal more so they will look thinner. ☐

FINDING FOOD

8. The amount of food a human needs each day varies. Underline the **three** statements that best explain what the amount of food we need each day depends on:

a) if it is your birthday
b) if you have brothers and sisters
c) how fast you are growing
d) the size of your body
e) whether you like crisps
f) if you have blue eyes
g) if your pet gerbil is overweight
h) how active you are
i) whether or not you have spent all your pocket money.

9. It is very important for us to eat foods that contain calcium (such as milk and green vegetables, like cabbage) in order to develop strong bones and teeth. What might happen if we did not get sufficient calcium in our food?

.....

.....

10. A woman who is going to have a baby needs 'extra' calcium in her diet. Why do you think she needs extra calcium?

.....

.....

11. What important job do our teeth do to the food we eat?

.....

.....

FINDING FOOD

12. Which of our teeth are used to cut food? .....

13. Which of our teeth are used to chew our food? .....

14. Write down <u>two</u> things we can do to help look after our teeth.

a) .....

.....

b) .....

.....

15. Underline <u>one</u> statement below that best tells us how often dentists recommend we clean our teeth:

a) twice an hour throughout the day

b) once a week

c) just before we visit the dentist

d) at least twice a day

e) after you have eaten onions.

Complete these two sentences by filling in the missing letters, each dash is one letter.

16. Tooth decay is caused by b _ _ t _ _ _ _ in your mouth.

17. A chemical is sometimes added to toothpaste, or tap water, to make our teeth stronger.
The chemical that is added is f l _ _ _ _ _ _ .

18. Scientists want to ask some ten year old children some questions about brushing their teeth to find out if brushing their teeth is linked to the number of fillings children have. They decide to ask the children **three** questions to get the information they need.

Tick <u>three</u> boxes to show which 3 questions you think would be the best ones to ask.

a) Do you like your dentist? ☐

b) Do you use a red toothbrush or a blue one? ☐

c) How many times each day do you brush your teeth? ☐

d) How many minutes do you spend each day brushing your teeth? ☐

e) Does you dentist have toys to play with while you wait? ☐

f) How many fillings have you had in the last year? ☐

g) Do you hold your toothbrush in your right hand or your left hand? ☐

h) Do you like apples? ☐

FINDING FOOD

19. A teacher asks a class of 32 ten year old children how many times they usually brush their teeth each day. 8 children say once a day, 14 say twice a day and the rest say three times a day.

a) How many children brush their teeth three times a day?

..... children

b) What % of the children brush their teeth once a day?

..... %

c) What fraction of the class brushed their teeth more than once?

.....

20. In the space below, design a poster which might encourage children to brush their teeth regularly.

Exercise 6 - living without food and drink! (Years 5 - 6)

1. **During winter some bears hibernate.** Hibernation is rather like being in a very deep sleep and during this time the bears don`t eat. Tick a box to show which reason best explains why bears hibernate:

a) they lose their appetites when it snows ☐

b) they get tired very easily and so need a long sleep ☐

c) they don`t like eating frozen food in winter ☐

d) sleeping allows them to survive winter as they are using up very little energy when asleep ☐

e) a deep sleep means they can have some very exciting dreams. ☐

FINDING FOOD

Here is a hedgehog.

2. Hedgehogs also hibernate. They eat as much as they can in the weeks before they hibernate. Why do they do this?

.....

.....

3. When it hibernates, a hedgehog rolls up into a ball. Why do you think it does this?

.....

.....

4. A hedgehog hibernates in a nest of dried grass in a sheltered spot. Why do you think the hedgehog makes its nest of dried grass?

.....

.....

5. Bats also hibernate. Name **one** species of British bat.

.....

FINDING FOOD

6. In the wild, in what sort of place might a bat hibernate?

.....

7. Explain why this is a good place for a bat to hibernate.

.....

.....

8. Bats sometimes hibernate and roost in church towers. Write down **one** reason why a church tower might be a good place for bats.

.....

.....

9.When an animal hibernates, changes occur to its body. Underline the **two** changes that take place:

a) its temperature rises

b) its temperature falls

c) its heart beats more slowly

d) its heart beats faster.

10. During hibernation, the animals do not eat for several weeks. If humans did not eat for a few days, why would they lose weight?

.....

.....

FINDING FOOD

11. Here is a kingfisher.
Kingfishers feed on fish which they catch in streams and small rivers. Why might kingfishers sometimes find it difficult to catch fish during a long, cold, icy spell of weather in winter?

.....

.....

12. Small birds are more likely to starve to death in winter since there is less natural food for them to eat. So why do you think they are more likely to come into our gardens in winter?

.....

.....

13. Suggest <u>one</u> type of food that we can put out for birds and write down why this food would be good for them to eat.

.....

.....

14. The RSPB recommend we feed birds in winter. What do the letters RSPB stand for?

.....

FINDING FOOD

Exercise 7 - miscellaneous (Years 5 - 6)

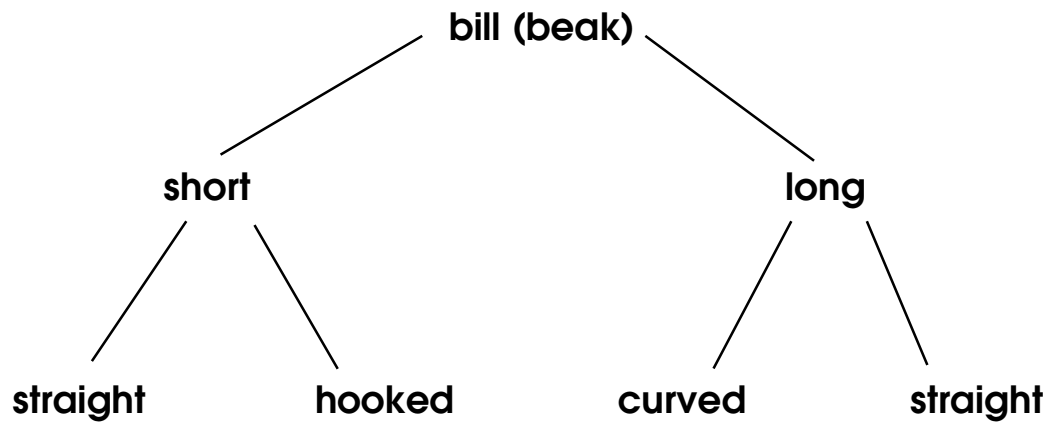
1. The curlew, greenfinch, heron and kestrel are 4 British birds. Using the key below, write the name of the correct bird on each dotted line.

curlew

greenfinch

heron

kestrel



a) ..... b) ..... c) ..... d) .....

FINDING FOOD

Here are seven British birds. The birds are not drawn to the correct scale - a barnacle goose is really several times bigger than a puffin!

curlew

puffin

barnacle goose

house martin

magpie

avocet

pied wagtail

FINDING FOOD

For questions 2 - 7, complete the sentences below with a few words of your own. Use the pictures of the birds to help you.

2. The pied wagtail is not a bird of prey because .....

.....

3. The avocet and curlew probably find food in the mud and sand because

.....

.....

4. The house martin eats insects that are flying in the air. The bird finds it quite easy to catch insects in flight because

.....

.....

5. Barnacle geese usually feed in flocks because

.....

.....

6. The puffin carries a lot of fish back to its nest in its bill (beak) because

.....

.....

7. More magpies are now living in towns and cities, as well as the countryside, because .....

.....

8. Pied wagtails are often seen in supermarket car parks. Tick a box that best explains why they might be in supermarket car parks.

a) They go there to do their shopping; ☐

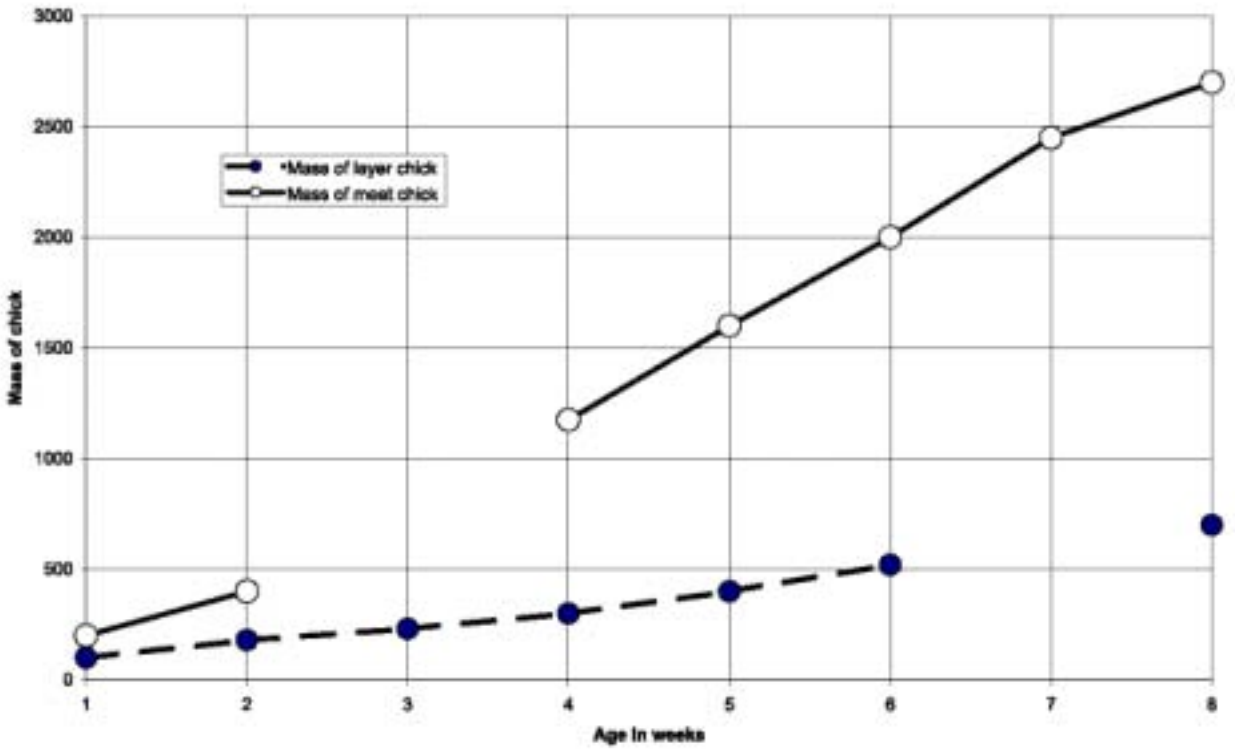
b) pied wagtails like to walk on flat areas; ☐

c) they can build a nest in a shopping trolley; ☐

d) they can eat any food that is spilt by people as they put shopping into their cars; ☐

e) pied wagtails can hide under parked cars if it rains. ☐

Graph of the gain in mass (g) of a layer chick and a meat chick.



Scientists weigh a chick reared to lay eggs (a layer chick) and a chick reared for meat (a meat chick) over the first 8 weeks of their lives. The mass of each chick is measured at the end of each week.

The scientists then draw a graph to show the mass of each chick over the first eight weeks of its life. The graph has two lines, one for the layer chick and one for the meat chick.

9. What happens to the mass of both chicks over the eight weeks?

.....

.....

10. What is the mass of the layer chick when it is 3 weeks old?

..... g

11. What is the mass of the meat chick when it is 6 weeks old?

..... g

12. How much heavier than the layer chick is the meat chick when they are both 1 week old and 8 weeks old? Fill in the missing numbers.

a) At 1 week old the meat chick is ..... (g) heavier than the layer chick.
b) At 8 weeks old the meat chick is ..... (g) heavier than the layer chick.

13. At 7 weeks old, the layer chick has a mass of 600 g. Put this point on the graph and draw lines to complete the line on the graph.

FINDING FOOD

14. At 3 weeks old, the meat chick has a mass of 760 g. Put this point on the graph and draw lines to complete this line on the graph.

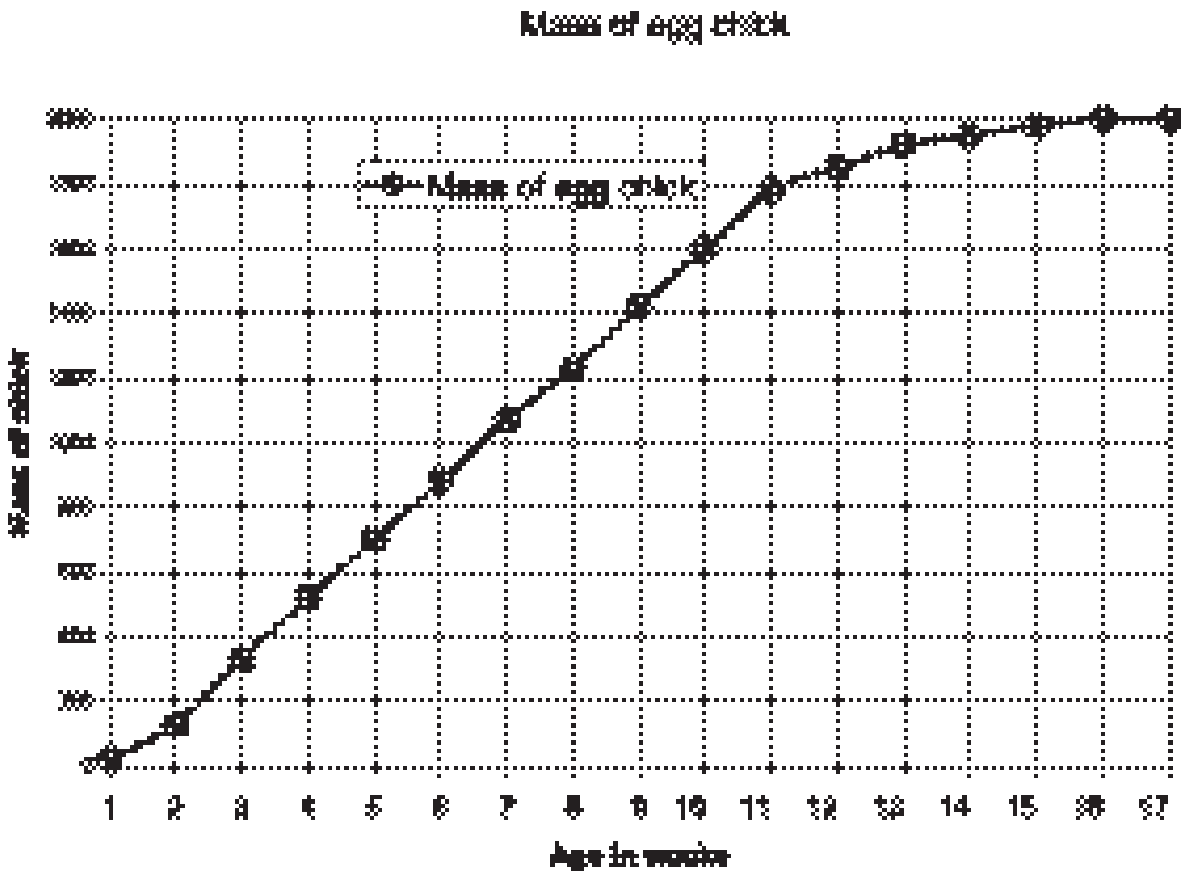
15. Meat chicks are more likely to suffer from broken feet or broken legs than are layer chicks. Suggest **one** reason why this is so.

.....

.....

This graph shows the change in the mass of a layer chick over the first 32 weeks of its life.

Change in mass (g) of an egg laying chick over the first 32 weeks of life.



FINDING FOOD

16. What happens to the mass of the chick over the first 20 weeks of its life?

.....

.....

17. What happens to the mass of the chick after it is 28 weeks old?

.....

.....

18. Explain why the line on the graph has the shape it does after 28 weeks.

.....

.....

FINDING FOOD

Here is a drawing of a harvest mouse.

A harvest mouse lives in fields and eats the seeds of crops that farmers grow. The mice use their tails as well as their paws to climb up the stems of the crops.

19. Suggest <u>one</u> crop a harvest mouse in Britain might eat.

.....

20. Why do you think the harvest mouse uses its tail to climb the stems?

.....

.....

FINDING FOOD

Puzzle sheets

FINDING FOOD

From the list of birds in the Word Search below, write down **one** bird that:

1. eats flesh

.....

2. eats fish

.....

3. eats insects

.....

4. eats water plants

.....

5. eats almost anything!

Anagrams

Cats sometimes catch birds in our gardens, though they don`t always eat them! Can you find the names of these birds that cats might catch?

1. obrin
2. elbu itt
3. wosarpr
4. bbikcrdla
5. hruths
6. newr
7. tareg tti
8. glarstin
9. odwo enpgio
10. efhciergnn

W	T	A	G	L	Y	E	J
R	E	R	U	F	F	A	A
E	A	G	L	E	Y	U	S
N	L	R	L	N	K	Z	W
L	E	E	I	S	P	C	A
W	V	B	T	T	E	R	N
O	O	E	S	C	O	O	T
R	D	K	T	F	I	W	S

Word search

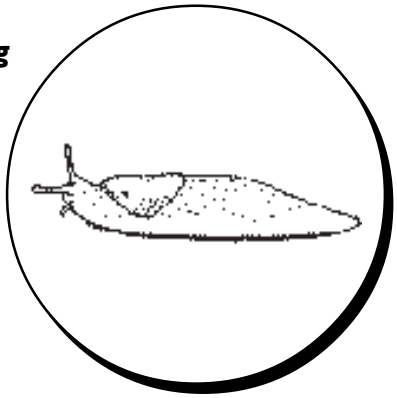
Try to find these 15 British birds in the word search - **eagle, wren, swift, dove, crow, jay, skua, ruff, coot, swan, tern, gull, grebe, owl, teal**. The words may run horizontally, vertically or diagonally and may be forwards or backwards.

FINDING FOOD

I'm not a fussy eater!

Badgers eat many different foods. Three of the 6 circles below have drawings showing some of the foods they eat. Draw 3 other foods that badgers might eat in the empty circles.

Slug



Cat food

Earthworm

FINDING FOOD

Down on the farm

Using this list of animals, answer these questions.

cow	**hippopotamus**
duck	**horse**
goat	**pig**
hen	**sheepdog**

1. Which animal would not be found on a farm?

.....

2. Which 2 animals provide us with milk?

.....

3. Name 4 animals that provide us with meat?

.....

.....

4. Which 2 animals provide us with eggs?

.....

FINDING FOOD

5. Which 2 animals provide the farmer with materials to make cheese?

.....

6. Which animal provides us with bacon?

.....

7. Which 2 animals help some farmers to do their work on a farm?

.....

8. Some farmers keep another animal on their farms which allows them to make honey. Which animal is this?

.....

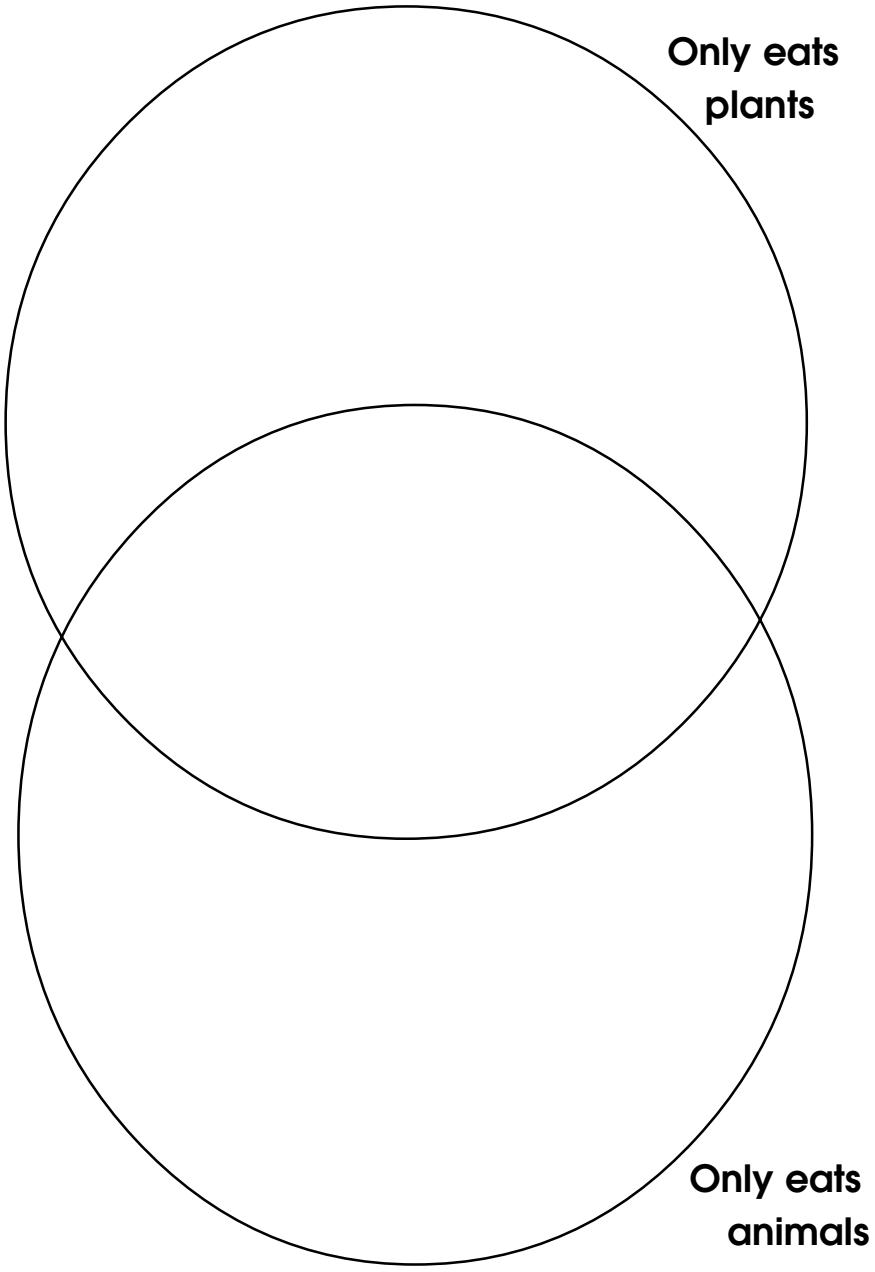
9. Name **one** other animal that might live on a farm.

..... Draw this animal in the space below.

Which animal eats which food?

From the list of animals below, write the names of animals that eat only plants in the top circle and the names of animals that eat only other animals in the bottom circle. The name of any animal that eats both plants and animals should be written in the area where the circles overlap. The animals are:

caterpillar
hedgehog
elephant
kingfisher
gorilla
human
cow
rhinoceros
wolf
sheep
goat
tiger
eagle
baboon
mouse
hen



Menu for lions!

Use the clues to help you solve the crossword.

1 Large monkey with big teeth - spends a lot of time on the ground, where it moves on all fours - males have thick manes. (6)

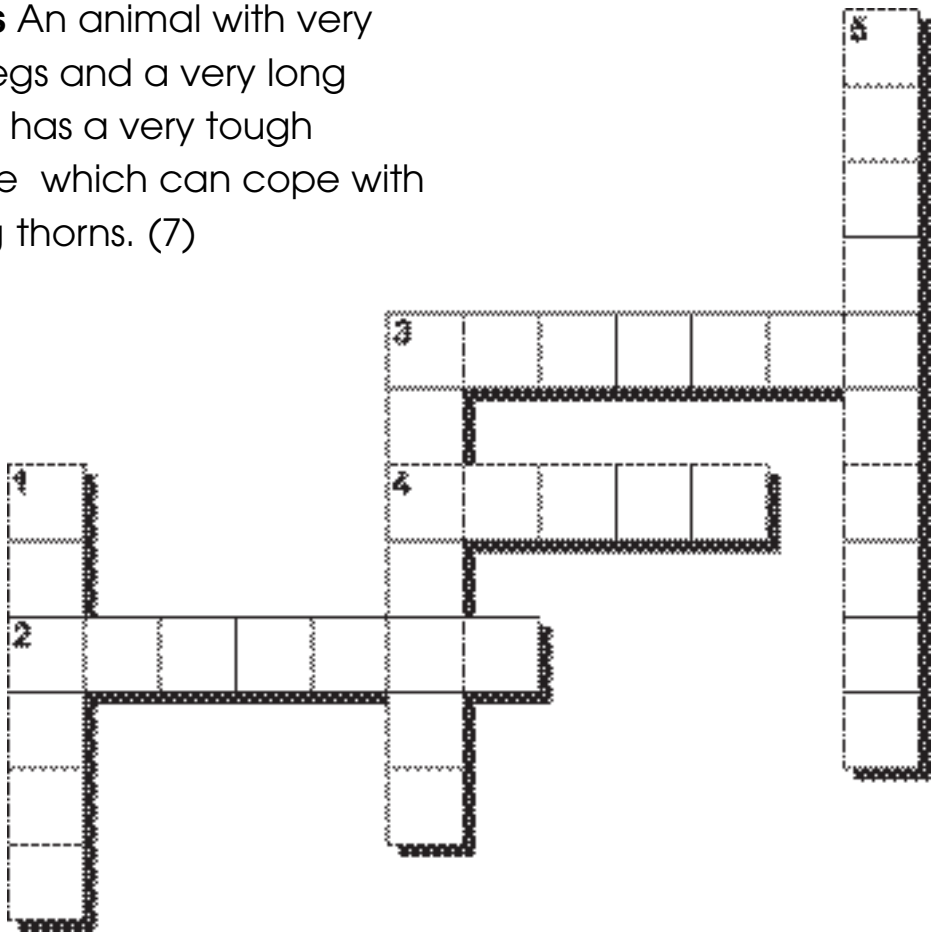
2 Big, dangerous animal with large, curved horns - lives in quite large groups - eats grasses. (7)

3 **Across** An animal with very long legs and a very long neck - has a very tough tongue which can cope with eating thorns. (7)

3 **Down** A small but fairly long-legged animal - eats grass and can run quite fast - lives in herds - one of these types is called Thomson`s. (7)

4 A large herbivore - they often live in big herds - looks like a striped horse. (5)

5 Large herbivore - the most common African antelope - lives in huge herds. (10)

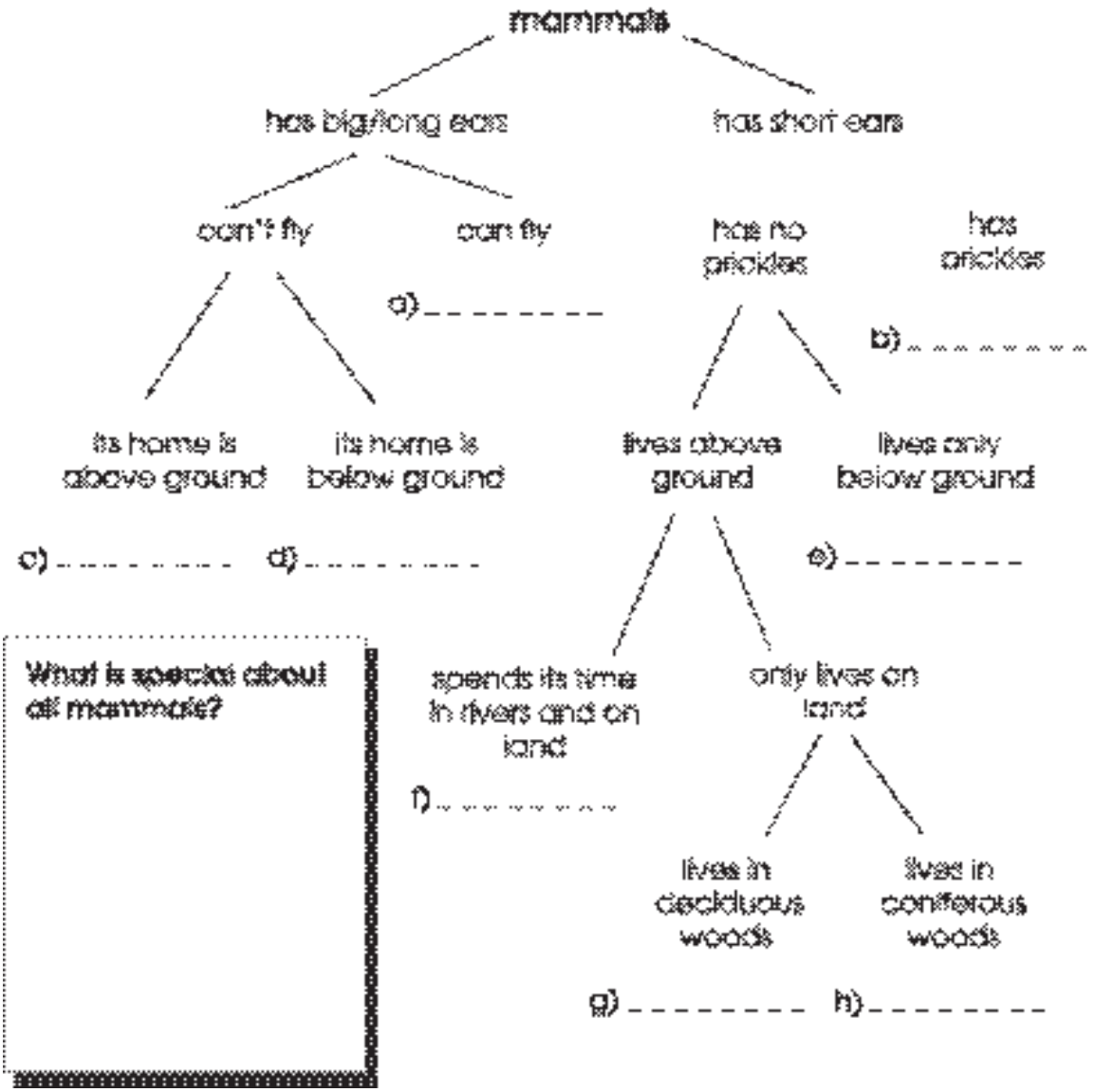


Which mammal is which?

Use the key below to identify these British mammals:

red squirrel	otter
grey squirrel	rabbit
long-eared bat	hedgehog
mole	hare

Write the name of an animal on each dashed line



Favourite foods

Find out what the favourite choices of your class, and their pets, are for these foods. Fill in the table below for your choice and then another table will be needed for the results from the rest of your class or group. Your teacher will help with this second table.

Animal	Food choice	Type
1. Yourself	Pizza topping	.....
	Way of eating potatoes	.....
	Flavour of crisps	.....
	Drink	.....
2. Your dog	Flavour of dog food	.....
	Type of dog treat	.....
	Type of meat	.....
	Drink	.....
3. Your cat	Flavour of cat food	.....
	Type of cat treat	.....
	Type of meat	.....
	Drink	.....

a) Do humans and their pets share any favourite food and drinks?

b) Do dogs and cats share any favourite foods?

c) Would it be cheaper to feed a human or a dog/cat for a week?
(Try to answer this question by carrying out your own study.)

References

Books

The following books may be helpful to teachers and/or their pupils.

Barker, S. and Norris, C. (2000) *Food Chains and Food Webs*. British Ecological Society, London.

Dawson, L. and Langman, M. (1995) *Bird Behaviour*. Hamlyn, London.

Feasey, R., Goldsworthy, A., Phipps, R. and Stringer, J. (2001). *New Star Science*: *Teeth and Eating* (Yr 3), *Habitats* (Yr 4), *Keeping Healthy* (Yr 5), *Food Chains* (Yr 6); pupil's books and teacher's notes for each. Ginn, Oxford.

Hallam, G. (co-ed.) (2001) *Key Stage 2 Science: The Study Book*. Co-ordination Group Publications, Kirkby in Furness.

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Keogh, B. and Naylor, S. (1996) *Scientists and Primary Schools: a practical guide*. Millgate House Publishers, Sandbach.

Kirk, S. (1998) *Investigating Life Processes and Living Things*. Folens Ideas Bank. Folens, Dunstable.

Lauber, P. (1995) *Who eats What? Food Chains and Food Webs*. Harper Collins, London.

Mackay, F. (1995) *Life Processes and Living Things*. Key Stage Two/Scottish Levels C - E. Curriculum Bank Series. Scholastic Ltd., Leamington Spa.

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Richards, R. (ed.) (1996) *Birds*. ASE, Hatfield.

Royal Society for the Protection of Birds. (1992) *Bird Studies for Primary Science*. RSPB, Sandy.

Royal Society for the Protection of Birds. (1992) *Food Chains and Predators*. RSPB, Sandy.

Treble, L. (2001) *Teacher's Resource Pack: Wildflowers and the National Curriculum*. National Wildflower Centre, Liverpool.

Videos

Association for the Study of Animal Behaviour (ASAB). (1997) *Let's Ask the Animals*. ASAB, London. [This video can be ordered at a special price of just £5 (usual price £10!) if the special order form in this book is used and a cheque for £5 (payable to '**ASAB**') is enclosed.]

BBC Trials of Life - '*Finding Food*'

BBC Life of Birds - '*Feeding*'

BBC Supersense - '*Soundsense*' and '*Superscents*'

Other resources

Blades Biological - suppliers of zoological materials, living specimens, preserved collections, etc.. Their contact details are: Blades Biological, Cowden, Edenbridge, Kent TN8 7DX Tel: 01342 850242. Their website is: www.blades-bio.co.uk/

Small-Life Supplies - suppliers of entomological materials. Their contact details are: Small-Life Supplies, Station Buildings, Station Road, Bottesford, Notts NG13 0EB Tel: 01949 842446. Their website is: www.small-life.co.uk

Worldwide Butterflies - supply entomological materials and equipment, including offers of livestock especially suitable for schools. Their contact details are: Worldwide Butterflies, Sherborne, Dorset DT9 4QN. Tel: 01935 474608. Their website is: www.wwb.co.uk

‘Suggested‘ answers

[N.B. These answers are written for teachers.]

Follow-up exercises

Food preferences in birds *(page 21)*

1. bread provides energy as it is rich in carbohydrates - bread is provided by humans on a fairly frequent and predictable basis
2. Elaine
3. they need to be vigilant in order to spot danger from predators and so after landing they scan before putting their heads down to eat (they also scan frequently as they eat)

Finding prey (page 29)

1. b)
2. E), B), G), A), D), F), C)
3. window frame, garden shed, ceiling, rose bush, gorse bush, cellar, etc.

Finding food for offspring (page 37)

1. females have a more pointed end to their abdomen - males have wing cases that are fairly uniformly marked whereas females have conspicuous spots on their wing cases [accept 'females are larger than males' - this is, in fact, true, although strictly speaking this can't be determined from the drawings as they are only drawn approximately to scale]
2. the food in the seed tissue inside the outer coat of the bean
3. from the store of energy laid down as a larva

Exercises

1. Feeding relationships

Years 3/4 (page 40)

1. a) P b) A c) P d) A e) A f) P g) P h) A i) P j) A
2. prey
3. [see the two suggestions the pupils makes] - could be cat, sparrow: blue tit, spider (caterpillar): thrush, snail
4. school yard/field, garden, town centre, car park, etc.
5. [see the suggestion the pupils makes - these could include sandwiches, pizza, crisps, rolls, etc.]
6. they can eat them in winter when there is less natural food about
7. prey - predator

Years 5/6 (page 43)

1. algae > brine shrimps > flamingoes
2. brine shrimps, flamingoes
3. it takes tens of thousands of brine shrimps to feed one flamingo so the number of brine shrimps (primary consumers) must always be much greater than the number of flamingoes (secondary consumers)
4. they fly off to a lake which still has water and, therefore, food (including shrimps)
5. predator
6. mouse, chicken, duck, earthworm, etc.
7. consumer
8. the fox is less easily spotted by the rabbit
9. a) sight b) hearing (other rabbits will thump the ground if they see a predator) - accept 'can detect vibrations in the ground' c) smell
10. the food of foxes is less concentrated than the food of rabbits (grasses, flowers, etc.) and so they need to forage further from their den in order to find sufficient food to sustain their own needs and the needs of their cubs
11. a buzzard, wildcat, stoat, polecat
12. e.g. a buzzard - a large bird (50 - 55 cm) - soaring, gliding flight - pounces on prey, killed by its talons - nests on rock ledges and in trees - builds a bulky nest of sticks, in which the female lays 2- 4 eggs

2. How birds feed and find their food

Years 3/4 (page 46)

1. kestrel - bill is sharp and hooked and good for tearing flesh

   greenfinch - bill compact and strong and can crack a seed coat quite easily to get at the tissue inside

   curlew - a long curved bill enables it to probe into the mud and sand and extract worms at depth
2. [see pupil's drawing] - insects, spiders, seeds, larvae
3. bread (sandwiches), chicken carcass, meat, food scraps (any other likely food too)
4. on a tip there is always food available since it is renewed almost daily - the gulls don't need to search very hard to find food - the food doesn't need to be killed and manipulated - the food is often in a processed form and so is readily digestible
5. they could eat contaminated food - there are potential dangers on a tip such as glass, plastic netting/string - disease may be prevalent on a rubbish tip - they can get into fights over food with other birds and may be injured
6. cannibal

Years 5/6 (page 49)

1. b)
2. it allows the pelican to take in large amounts of water and this increases its chance of catching a fish - it could catch more than one fish at a time with its pouch, rather than just having a more typical bill (beak)
3. their beak makes it easier to crack the husk in order to extract the seed
4. greenfinch, hedge/house sparrow, chaffinch, goldfinch
5. predator
6. a consumer
7. very few insects are available in winter, or at least they are too few to sustain the energy demands of a swallow - in winter the insects that are around are mostly moving around on the ground or on trees, not flying in the air where swallows catch their prey
8. bread, pizza, corn, burgers
9. people feed them - a town is a reliable source of food since there are a large number of food outlets with bins - people often discard food debris in the street - pigeons eat a variety of food items and cities are good places for opportunistic feeders, like pigeons
10. b) hearing
11. other animals can't easily steal it - it is easier to transport the prey back to the nest in the crop because the food item can't be dropped - better to eat it quickly, seek a safe place to rest and then digest the food slowly than stay in the open and rest because a bigger predator might catch it
12. [see pupil response]
13. it is easier than finding food for itself - it benefits from a puffin's ability to catch fish under water - the puffin often catches a beakful of fish so the benefit from harrying the puffin can be great
14. they harass other birds to release the food they have caught and so the skua benefits from the efforts of these birds - 'pirates' take items that belong to others, just as skuas do
15. they intimidate the intruder which leaves the area and so their eggs/chicks are safe
16. i) 60 birds ii) 3/5 iii) [see pupil response] iv) 25 %

3. How animals get their food

Years 3/4 (page 57)

1. moth, butterfly, fly (housefly, cranefly)
2. to allow the insect to settle so it can catch it - if it moves the insect may not land
3. because insects visit the flower head to reach the nectar and/or pollen
4. it is a cat - it has canine teeth - it has claws
5. yawning - its mouth is open wide and its eyes are closed - its mouth is open but there is no food in its mouth so it can't be eating - cats often rest/sleep during the day and yawning is associated with these behaviours
6. they can catch their prey when it runs away from them
7. they might catch prey more easily - they may catch bigger prey than if they hunt alone - several cheetahs can run at prey from different directions making it hard for the prey to escape
8. lion - leopard - hyaena

Years 5/6 (part 1 - page 60)

1. Sunflower seeds (black, striped), millet seed, canary seed
2. it is easier to digest fruit than leaves - there is more time available for other activities if it is a fruit eater because fruit is more readily assimilated than leaves (some animals that eat grass, such as cows, chew their food again in order to help this process) as breaking down cellulose is difficult and slow
3. seasonality means that there would be a glut of food in summer/autumn but little in winter/spring
4. blackberry, apple, raspberry, pear, plum and cherry
5. broad, flat back teeth are good for grinding down grass - the front teeth (incisors) are good for nibbling or cutting the grass which they then chew
6. they have canine teeth to grasp their prey and give it a powerful, killing bite - the incisors are good for cutting flesh
7. consumer
8. some flowers have nectar at the base of the flower head and so to reach it a long tongue is needed
9. a long tongue, if not coiled, would impede the butterfly as it moved around - the long tongue might also lessen its flying ability and prove a handicap when landing - the tongue is very delicate and could get damaged if not coiled
10. c)
11. [see the response of the pupil]
12. a) 13, 18, 18, 20, 33, 34, 45, 51, 76, 92 seconds b) 79 seconds c) 40.0 seconds d) [see pupil response] [essentially they need to time how long it takes a shrimp to cover a known distance - so they could confine the shrimp in a narrow plastic/glass tube which rests over a piece of graph paper and

then time how long the shrimp takes to swim, say, 10 cm]

Years 5/6 (part 2 - page 65)

1. rival hunters are not so active around midday, so the cheetah is less likely to lose a kill
2. it throws a stone onto an egg a number of times and eventually the egg cracks or breaks and the vulture can then eat the contents
3. magpie, jay, any gull species, cuckoo, monkey, mongoose, squirrel, snake.
4. moths and butterflies - their eggs are usually laid on the leaves of plants: crocodiles - their eggs are laid in a nest on the river bank: some snakes - grass snakes, for example, often lay their eggs in manure or compost heaps or piles of vegetation
5. skull B is the grass eater, skull A is the flesh eater - skull A is the flesh eater because it has canine teeth - it has very sharp teeth suitable for biting and killing
6. the nectar would seep into the soil if it was just stored in the nest - the nectar could 'go-off'if it was kept in the nest but if it is stored inside the body of a living ant it is fine and can be safely eaten by other ants
7. to feed on - after the female has laid eggs on the carcass, the larvae use it for food
8. e)
9. [see the response of the pupil]
10. as the chicks get older they increase their mass and so need more food for energy, growth and repair
11. caterpillars, spiders, flies - they are nutritious, they are small enough to swallow, they are abundant and can be found fairly easily, they can be digested relatively easily
12. so that it is easier to digest - it increases the surface area over which enzymes act
13. they might not be able to fly - their take off might be affected, as would be the effectiveness of their escape from predators - more energy would be needed for flight if the mass of the bird increased - they couldn't fit them down their throats
14. they could get lead poisoning - the fishing line might choke them if it is still attached to the weights - swans cannot digest lead
15. consumers
16. its long neck allows it to browse on leaves that other animals are unable to reach
17. they might not be so vigilant when they are drinking - they need to splay out their legs to reach the water and will therefore be more vulnerable to attack in this position

4. How to avoid being eaten

Years 3/4 (page 72)

1. wasps are potentially dangerous animals so other animals avoid them, hence the moth benefits by looking like the wasp
2. to reduce the chance of being caught - the cheetah is faster in a straight line sprint and so the gazelle dodges to try to counter this advantage of the cheetah
3. it adds mass to the caddis larva to make it less likely to be washed away by the current - if the caddis was swept along by the current the impact on its body, and hence possible damage, if swept onto a rock would be lessened by the leaf cover - the leaves may make it harder to eat if another animal attacked it - the bits of leaf may camouflage it so it is less likely to be spotted by predators
4. it makes it look larger - it is ready to strike out or spring away if attacked
5. hissing - opening its mouth and baring its teeth
6. b)
7. its spines - the fox/dog can't bite the softer, more vulnerable parts of its body since the hedgehog rolls up into a ball and thus presents just spines to the fox/dog - the spines could damage the fox/dog
8. snail, hermit crab, porcupine, tortoise

Years 5/6 (page 77)

1. the bands serve as a warning that the caterpillar is harmful (the caterpillars are distasteful to birds and may make them sick)
2. it adds mass to the caddis larva to make it less likely to be washed away by the current - if the caddis was swept along by the current the impact on its body, and hence possible damage, if swept onto a rock would be lessened by the leaf cover - the leaves may make it harder to eat if another animal attacked it - the bits of leaf may camouflage it so it is less likely to be spotted by predators
3. b) and e)
4. it can run away and hide after being attacked and so it survives - the tail does not contain any vital body parts so the lizard's life is not threatened
5. it looks alive and focuses the attention of the attacker on the tail while the lizard escapes - it might make the predator think that it had caught the lizard

6. it confuses the predator - it is difficult for the predator to catch one of the fish as some of them will swim directly at the predator
7. their rattle is an auditory warning, indicating that the snake is potentially dangerous
8. to scan for predators - the eyes are on either side of the head to give the grouse good all round visibility
9. to focus on the movements of their prey - to enable it to judge distance accurately
10. rabbit, small mammals, carrion
11. a) pair D b) 36 seconds c) the individual the cheetah chased spent more time feeding with its head down so the cheetah could probably get closer to it without being seen - the cheetah would increase its chance of catching that gazelle since the one it was going to 'chase' was the one of the pair that was less vigilant d) each gazelle needs to feed and engage in other activities - each gazelle has to trade-off the costs and benefits of each aspect of its life e) lion, wild dog, leopard, jackal, etc. f) e.g. leopard: yellowish coat with dark spots - found in Asia as well as Africa - solitary animals - very strong and can climb into a tree carrying their prey

5. Humans and food

Years 5/6 (page 83)

1. cheese, chips
2. meal B
3. beating of the heart, breathing, keeping your body temperature constant
4. our body mass increases - (accept 'we become unfit')
5. our body mass decreases
6. playing a team sport - engaging in a strenuous activity such as rock climbing - exercising in a gym
7. d)
8. c), d), h)
9. our bones would become thinner and we would be more likely to suffer fractures
10. to help the skeletal development of the foetus/ baby
11. our teeth break down the food so that it is easier to swallow - this action also allows the enzymes to act over a greater surface area
12. incisors
13. premolars/molars
14. clean your teeth frequently - only eat sugary foods at meals, since we can brush our teeth after - if no toothbrush is available we could finish a meal with an apple - we should replace our toothbrush regularly - visit the dentist regularly
15. d)
16. bacteria
17. fluoride
18. c, d, f
19. a) 10 children b) 25 % c) 3/4

6. Living without food and drink!

Years 5/6 (page 89)

1. d)
2. it allows them to build up food reserves to fuel their body during the cold winter period when they are asleep
3. it reduces heat loss as it exposes less surface area
4. the dried grass is a good insulator against heat loss - the dried grass offers the hedgehog good protection against frost and cold winds
5. noctule, long-eared, greater horseshoe, lesser horseshoe, Daubenton's, Natterer's, whiskered, Serotine, pipistrelle
6. caves, roof spaces, belfries
7. these (i.e. the ones mentioned in 6 above) are dark places in which the temperature does not vary much throughout the year - these sites experience little human or other disturbance
8. there are few, if any, predators in church towers - very little human disturbance - fairly constant temperature - it is dark and unlit during the time (daylight) when the bats are sleeping/resting
9. b), c)
10. all the body processes still function and the only energy available is from fat reserves so body mass will be lost as these reserves are used up to keep key body processes functioning
11. streams may freeze, or at least ice may form on their surfaces, and the kingfisher can't break through the ice so it may starve
12. for scraps of food we put out - for water we put out - for specialised food resources we provide, such as peanuts, fat, etc. - there is less natural food available in the wild in winter but gardens can supply supplementary food since some of our garden plants have berries which birds can eat
13. peanuts, seeds, bread - these foods are high in energy and are often replenished at regular intervals
14. Royal Society for the Protection of Birds

7. Miscellaneous

Years 5/6 (page 93)

1. a) greenfinch b) kestrel c) curlew d) heron
2. it does not have talons - it does not have a hooked beak
3. they have long bills suitable for probing in the mud and sand for worms, shellfish, etc. - the long bill can probe for food at greater depth than other birds can reach
4. it is a strong flyer - it has a streamlined shape - it can manoeuvre well in flight
5. in a flock of geese there are lots of eyes and ears that are vigilant for predators - the geese are also more effective when competing for food (such as grasses and aquatic insects) in a group, especially when they are in a family group
6. it saves on the number of trips it needs to make and so it uses less energy - it makes fewer trips if it carries several fish and so suffers less harrassment from other birds as it returns to its nest with food that is clearly visible to other birds
7. they are able to exploit food that is available in gardens and open spaces - there are plenty of trees for nest sites - they are very opportunistic in their feeding requirements
8. d)
9. the mass of both chicks increases, faster for the meat chick*
10. 250 g (accept ± 50 g)
11. 2010 g (accept ± 100 g)
12. a) 120 g (accept ± 50 g) b) 2170 g (accept ± 100 g)
13. and 14 [see graph]
15. they are bred to increase their mass very quickly and this increase puts stress on their still developing skeleton and they can suffer from skeletal fractures - crowding can result in injuries through accident and aggression between birds
16. it increases its mass steadily over this time period
17. it doesn't increase its mass any further
18. there is a limit to the total mass of a chick (at least under the conditions they experience in an intensive rearing unit) - the chick has completed its skeletal growth by then and weight gain tails off
19. barley, wheat, rye, oats, etc.
20. the tail helps the mouse to climb up and down the stems of the crops - using their tail, and their feet, for gripping, climbing and balancing frees the paws for feeding

[An ASAB video, *Let's Ask the Animals*, illustrates how the difference in the rearing conditions of each type of chick affects their growth. The 22 minute video focuses on farm animals, and the animals themselves answer questions about life processes they share with humans. Assisted by scientists at Britain's leading veterinary schools, hens run obstacle courses, chickens grow before your eyes, pigs demonstrate some of their remarkable senses and intelligence and sheep show how much they know about nutrition. Even turkeys turn out to have unexpected skills. Revealed as they have never been seen before, familiar farm animals surprise and stimulate pupils to want to learn more about the science of living things.
[See the flyer with the book for details of its purchase.]

*** The data used to produce the graph are:**

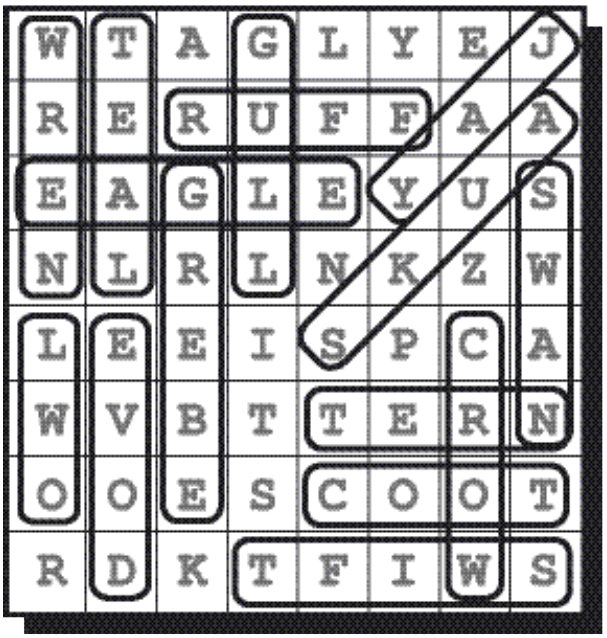
Age (weeks)	Mass of layer chick (g)	Mass of meat chick (g)
1	70	190
2	150	430
3	250	760
4	340	1160
5	420	1580
6	510	2010
7	600	2440
8	690	2860

Puzzle Sheets

Anagrams (page 102)
1. robin 2. blue tit 3. sparrow 4. blackbird 5. thrush 6. wren 7. great tit 8. starling 9. wood pigeon 10. greenfinch

Word search (page 102)

For position of the birds in the word search see the diagram opposite.



1. owl, eagle, gull, jay, crow
2. skua, grebe, tern, gull
3. wren, swift, jay, crow
4. swan, coot, teal
5. gull, crow

I'm not a fussy eater (page 103)
The foods that could be eaten by badgers include: roots, beetles, small rodents, plants, insect larvae, almost any food put out by humans, etc.

Down on the farm (page 104)
1. hippopotamus 2. goat, cow 3. duck, hen, sheep, cow, pig 4. hen, duck 5. goat, cow 6. pig 7. horse, sheepdog 8. honey bee 9. cat, ostrich, red deer,

Which animal eats which food? (page 106)

Plant eaters - caterpillar, elephant, cow, rhinoceros, sheep, goat, gorilla
Animal eaters - hedgehog, kingfisher, wolf, tiger, eagle,
Eat both - human, baboon, mouse, hen

Menu for lions (page 107)
1. baboon 2. buffalo 3. (Across) giraffe 3. (Down) gazelle 4. zebra 5. wildebeest

Which mammal is which? (page 108)

long-eared bat hedgehog
hare rabbit mole
otter
grey squirrel red squirrel

Mammals - all feed their newborn on milk, later supplemented by plant or animal food, or both - have body hair - young born live

Favourite foods (page 109)

[see pupil response for 1 - 3: it is almost certainly the case that it would be cheaper to feed a dog/cat for a week than a child of junior school age]

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FINDING FOOD: practical work and exercises on animal behaviour for pupils at Key Stage 2 tries to encourage teachers in junior schools to see how practical work concerning how animals find their food fits into the Science National Curriculum. It also provides a wealth of exercises and puzzle sheets for classroom use. The material in the book can be photocopied within the institution purchasing it, but the work remains the copyright of ASAB (The Association for the Study of Animal Behaviour).

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