



# Feedback

The ASAB education newsletter

Issue 39

September 2007

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Association for the  
Study of  
Animal  
Behaviour

## Dear Colleague

For the last 13 years the ASAB education newsletter has been arriving in pigeon holes in schools, colleges and universities and dropping through letter boxes in homes around the UK, and beyond, each term. Newsletters from many organisations are now only available in electronic form and we now need to give this matter consideration. Fortunately, ASAB Council is willing for the newsletter to continue in hard copy if readers are keen for it to be in that form but clearly savings could be made by sending it out by e-mail. So we would be keen to hear which option you would prefer. Do please let me know, by either completing the form on page 10 or, better still, let me have your preference by e-mail, as obviously I would need this to send out an electronic newsletter!

The choices would be:

- a) preference for a hard copy of the newsletter, in January, May and September:
- b) preference for an electronic version, with an e-mail alert when it is sent – this would mean a colour version of the newsletter would be available rather than the current monochrome publication. Could you please let me have your preference before the half term break, (i.e. by 21st October 2007). The ASAB Education Committee meets in early November and we will make a decision then as to which course of action to follow. It is likely that the January 2008 version will be a hard copy version anyway, in order to allow me sufficient time to ensure that I have e-mail addresses for everyone, if we go down the electronic route.

### ASAB Education Officer,

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Health Science,  
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ASAB education website is:

<http://asab.nottingham.ac.uk>

On 30th November one of the secondary teachers on the ASAB Education Committee will have served her three year term and we will be looking for a replacement. If you are keen to serve on the committee do please let me know. The duties are not too onerous. The committee meets twice a year (usually May and November), once in Manchester and once elsewhere. ASAB would reimburse you for any travel and other expenses incurred (alas not supply cover!) in attending the meeting. You would also be asked to look at a draft copy of one of the exercises in the newsletter, in order to check for relevance, whether it matches the syllabus (if this applies), any typos, etc.. Occasionally you might be asked to provide a review of a resource but that is about it. A bonus is that we will happily supply you, or your school, with a free copy of all our resources! Do please think about it and let me know if you are interested in joining the committee. We don't want any formal application, but a paragraph on why this might appeal to you would be valuable and would certainly help Nicola and the committee make a decision. We look forward to receiving 500 + applications!

## WHY NOT JOIN ASAB?

### ***By becoming a member you can:***

Receive Animal Behaviour each month  
 Receive our regular newsletter  
 Attend ASAB conferences  
 Qualify for ASAB grants

### ***How much does it cost?***

£35 a year, with online access to the journal  
 Animal Behaviour

£45 a year, with hard copy of the journal

£15 a year for students\*, with online access to the journal Animal Behaviour

£25 a year for students, with a hard copy of the journal

\* student rate includes students, retired members and those not in paid employment.

### ***For details write to:***

ASAB Membership Office  
 82A High Street,  
 Sawston,  
 Cambridge  
 CB22 3HJ

## ***Forthcoming Events***

### **2007**

5 – 7 September ASAB Summer Meeting,  
 University of Newcastle

2 November ASAB Conference for Primary  
 Science Teachers, Manchester  
 Metropolitan University

6 November ASAB Education Committee  
 Meeting, Manchester  
 Metropolitan University

5 – 7 December ASAB Winter Meeting,  
 Zoological Society of London

### **2008**

3 - 5 January ASE Winter Meeting, University  
 of Liverpool  
 (ASAB will have an exhibition  
 stand at the event.)

January RSPB School Watch

7 – 16 March National Science & Engineering  
 Week

March ASAB Easter Conference,  
 University of Edinburgh

## NEWS

Earlier this year I was leisurely strolling down an aisle at an education exhibition in GMEX Manchester when a book cover, *Talented Animals*, caught my eye. I hadn't expected to see a book on animal behaviour on a stand at a nursery/primary conference so went over to look at it and talk to the representatives of the publishers, **Gardner Education**. In fact, it was one of six books with an animal theme in a reading scheme consisting of 24 books, *Alpha Explore*. All are profusely illustrated and have 24 or 32 pages. In addition, each book has a set of monochrome Teacher Notes (16 pp) with very helpful chapter summaries, follow-up activities, worksheets and task cards. A note of the key concepts, text features and reading and thinking skills completes the booklet. I have provided a short review of three of the books in this newsletter (see pages 9 – 10) and I hope to include three mini-reviews by primary teachers of the other three animal books in our next issue in January 2008.

Our **first resource for Key Stage 1** will be ready and on our website in October 2007. It is titled *'Birds' Nests'* and has been written by **Anne Woodfield**, Science Co-ordinator at Moss Park Infant School, Stretford, Manchester. This new ASAB resource consists of a Powerpoint presentation for teachers to use in the classroom illustrating many different types of nests, background notes for teachers on various aspects of the nests, their types, materials, etc., a set of worksheets, an A3 poster *'Why birds build nests'*, a practical activity on nest-building in the classroom and another Powerpoint presentation with many of the typical birds children might expect to see in gardens and in school grounds. The whole of the resource can be downloaded from our website. ASAB is very grateful to Professor Mike Hansell at the Hunterian Museum at the University of Glasgow for giving Anne permission to photograph many of the nests in the National Nest Reference Collection which is housed at the museum.

We have had an excellent response to our next **Conference for Primary Science Teachers** on Friday 2nd November and currently (mid-August) we have > 50 delegates attending. It is still not too late to apply for a place; just complete the application form on page 8 and I will send an invoice to your school. I look forward to meeting colleagues from primary schools in NW England in Manchester in November.

On pages 6 and 7 of the newsletter you will see details of an innovative development to mark the two hundredth anniversary of the birth of **Charles Darwin** and the one hundred and fiftieth anniversary of the publication of *Origin of Species*. **Evolution Megalab** will focus on getting schools and members of the public to look for banded snails in gardens, school grounds and other open spaces. The aim is to count the numbers of different morphs (types) found and report the data to the Open University which is running the event, with support from the Royal Society. There is a website with material specifically for teachers so it should be well worth browsing – the address is: <http://groups.google.co.uk/group/evolution-megalab>

We will be manning an exhibition stand at the Winter Meeting of ASE in January (3rd – 5th), which will be held at the University of Liverpool. By then we hope to have **two new resources** available, **tailored to the new Edexcel GCSE Biology module 'Human and Animal Behaviour'**. The first will blend aspects of genetics and anti-predatory behaviour and focus on moths: the second will link animal communication and anti-predator behaviour and will focus on ladybirds. Both should be able to be viewed at the ASAB stand.

Do please send me your e-mail or completed form (see page 10) stating whether you favour the continuation of the newsletter in hard copy or will be happy with an e-mail version. Don't forget to let me have your e-mail address when you return the reply slip.

## Animal Cameo

### Forest Elephant *Loxodonta africana cyclotis*

[Pictures taken at the Mbeli Bai Study.]

When you think of African elephants, you probably picture savannah sunsets, with elephants majestically making their way across the plains surrounded by lions and other big game. But around 10% of African elephants live in a totally different environment - the dense rainforests of Central Africa. This forest block represents the largest continuous area of elephant habitat anywhere on Earth. Scientists are working to establish the genetic background of both types of African elephant, but generally forest elephants look quite different from those that live in the savannahs. In particular, they have very rounded ears and downward-pointing tusks. Some populations may also be smaller than savannah elephants, but with many males still reaching 2.5m

at the shoulder, they are still very big animals!



© Vicki Fishlock



#### Five Fascinating Facts about Forest Elephants

1. Elephants are architects in the forest; their paths are used by many other animals, and go directly between important fruit trees and forest clearings. A forest without elephants would look very different (see also fact 2).
2. Certain tree species, such as *Omphalocarpum* (om-fal-o-carp-um) have evolved fruits that can only be dispersed by elephants; these incredibly tough fruits can only be split open by the force of an elephant's tusk – even people have trouble opening them with an axe! They're so tough and durable, local people use them as ashtrays, or to support hot pans from the fire.
3. Their rainforest habitat is so dense it's possible to be less than 5m from an elephant, and not see it!!! They move almost silently through the dense vegetation, so sometimes the only way of detecting them is the noise of their ears flapping as they fend off insects.
4. Forest elephant ivory is pink-tinged, and less brittle than other ivory, so it's highly prized, especially for carving *hankos* (Japanese signature seals). Forest elephants are under a lot of pressure from poaching, and this risk is increasing all the time.
5. The price of ivory in 1989 when the CITES ban came into effect was around US\$100 per kg. Today it is around \$850 per kg. Much of this ivory is coming out of Central Africa.

Unlike most savannah elephant populations, which are stable or increasing in size, forest elephants are hugely threatened by ivory poaching. Political instability in the region has made it easy to find routes for ivory smuggling. In addition, these animals inhabit some of the last great tracts of wilderness on the planet, so protecting them is difficult, and requires dedication and money. Governments are working hard to develop co-operative strategies, but much remains to be done. Of course, forests also house valuable timber, and working with logging companies to minimise the impact of their activities is crucial for protecting the forest as a whole, and the elephants and other species that live there.

Compared to savannah elephants we know almost nothing about the social behaviour of forest elephants. It is thought that forest clearings provide a place for elephants to socialise and exchange social information. Given that savannah elephants are known to have complex social lives, we are missing a huge amount of information about how forest elephants use their environment. Answering these exciting questions will help us understand their needs so we can better protect them.

**Vicki Fishlock,**

University of Stirling.

Supported by the Leverhulme Trust.

## Animal Cameo

### The Fruit Fly: *Drosophila simulans* (Sturtevant, 1919)

The 'fruit fly' is probably most well-known as the stalwart of genetics research, and will certainly be familiar to most biologists from their undergraduate days as a standard laboratory organism. However, while it is generally the case that most of what we know about *Drosophila simulans* has indeed come from laboratory based populations, they are part of a cosmopolitan group of insects that have adapted to a wide variety of habitats from deserts, tropical and temperate zones to urban areas and even alpine zones.



© Michelle Taylor

*Drosophila simulans* is one of 1500-2000 species in the genus *Drosophila*, one of two groups of flies commonly known as 'fruit flies'. They are 'true flies' in that they have only one pair of functional wings for flight, the second pair seen in other winged insects is reduced to a pair of halteres or 'paddles' used to aid stability in flight.

They are typically found around sources of rotting and fermenting fruit. Females lay their eggs on the fruit and the eggs hatch after around 24 hours. Larvae spend up to five days feeding on the fruit before pupating, which can take a further five days, after which they emerge as adult flies. Males can become sexually mature after just twelve hours, but females take three days to mature, making a total lifecycle from egg to egg of approximately fifteen days.

#### Five fascinating facts about *D. simulans*:

- The name 'Drosophila' is a scientific adaptation of the Greek and Latin words for 'dew' and 'loving', meaning 'dew-loving'.
- Males have a courtship 'song and dance' whereby they follow the female closely and then raise and vibrate their wings. Females use this courtship behaviour to assess suitability of males as mates and accept or reject their courtship accordingly.
- They have only four pairs of chromosomes and the sex of offspring is determined by the number of X chromosomes, rather than XX or XY as in mammals. One X chromosome produces a male, whereas two X chromosomes produces females.
- They are sexually dimorphic; males are generally smaller than females and have 'sex combs' on their forelegs, which are used to grip the female during copulation.
- They may also be known as 'vinegar flies', 'wine flies', 'pomace flies' or 'picked fruit flies' due to their tendency to be found around fermenting fruit and substances of an alcoholic nature! However, it is not the fruit itself but microorganisms such as yeast that the flies actually feed on.

*D. simulans* is a sibling species of *D. melanogaster*; they are thought to have separated from a common ancestor around 2mya and although their geographic ranges overlap extensively and they will hybridise, these hybrids are sterile. This makes them an interesting model for comparative research into speciation events, reproductive isolation and ecological diversification. Their polygamous mating system, courtship behaviour and rapid generation cycle also makes them ideal for studying life-history strategies, behavioural ecology and sexual selection.

**Michelle Taylor,**  
University of Exeter.

# Evolution MegaLab

**Hands-on  
science  
outreach for  
Darwin 200**



## The opportunity: Darwin year 2009

The year 2009 marks the two hundredth anniversary of Charles Darwin's birth and the 150<sup>th</sup> anniversary of the publication of *Origin of Species*. From Darwin's birthday on February 12<sup>th</sup> to the *Origin's* anniversary on November 24<sup>th</sup> there will be an unequalled spate of high-profile broadcasting and public events throughout the world. There will be public interest in every area of Darwin's life, his science and his world. A central feature of Darwin's genius was his ability to see evolutionary processes operating within commonplace observations of natural history. The aim of the Evolution MegaLab is to show the public, of all ages from schoolchildren to grandparents, that thanks to Darwin's illuminating insight, they too can see evolution at work in the natural world around them. Evolution is not some remote theoretical idea, it is an everyday occurrence (albeit a slowly operating one) that you can witness for yourself. The most accessible example of the science arising from this perception of evolution is provided by research on banded snails in the genus *Cepaea*.

## Why a megalab?

A megalab enables large numbers of people to contribute simple observations made at their individual locations to a geographical survey in order to investigate a scientific hypothesis. It of-

fers the general public, including families and school children, the opportunity to do real science and to experience the excitement of discovery for themselves. The Open University has been involved in megalabs since the 1970s. The results of a survey by Science Foundation Course students of polymorphism in peppered moth were even the basis of a primary research paper published in the journal *Science* in 1986 (Cook, Mani & Varley; *Science* 231:611-613). Megalabs of various kinds have become a regular feature of BBC programming, most recently in the highly successful Springwatch.

## Why *Cepaea*?

The banded snails, *Cepaea nemoralis* and *C. hortensis*, occur through many parts of the UK and continental Europe and in most populations display easily seen polymorphism in shell colour and banding. The genetic basis of this variation is quite well established. In the 1930s *Cepaea* polymorphism was often quoted as a classic example of non-adaptive variation. Then, work by A.J. Cain and many others showed that in some places shell polymorphism was subject to natural selection involving predation by birds and that different morphs were adaptively camouflaged against different backgrounds. We now also know that there are correlations with temperature and latitude that indicate that snail behaviour and shell morph are also locally adapted to climate, together with many patterns of geographic variation which have not yet successfully been explained in terms of natural selection. During this work an unprecedented amount of information on the genetics of British *Cepaea* populations has been



© Michael Dockery

accumulated, with many thousands of samples taken from most parts of the British Isles, collected over almost a century.

Evolution of shell polymorphism over the last 50 years can be expected because the two principal known selective agents, predation by thrushes and environmental temperature, have both changed over the period. Thrushes are much scarcer now and our climate has become warmer. These events provide us with a scientific rationale for re-surveying *Cepaea* polymorphism in 2009. The link to declining bird populations and to climate change will help motivate the general public to participate and also illustrate the on-going nature of natural selection.

### The Evolution Megalab in the UK

The Royal Society is supporting the Evolution Megalab by funding the digital capture of published and unpublished historical data on the estimated 7,500 populations of *Cepaea* in which polymorphism has been recorded over the last 80 years. Analysis of these data by leading geneticists Dr Laurence Cook, Dr Robert Cameron & Prof. Steve Jones will provide the scientific underpinning and historical context for the Megalab which will be run by the Open University in 2009. In that year the public will be invited to look for banded snails in gardens and public open spaces across Britain and to report the numbers of different types (morphs) they find using mobile phones and the internet. Maps will be produced and compared with the historical data. All participants will receive automated, personalized interpretations of their observations. The megalab will be publicised in the press, on BBC 2 in a series called *Darwin's Garden* and in other media. Participants will be able to follow-up an interest in evolution *via* a web-

site and a short course on evolution that will be specially produced by the Open University. We also hope to provide resources for schools and for use by children of all ages.

### Extension of the Evolution Megalab to continental Europe

*Cepaea nemoralis* and *C. hortensis* are found throughout W.Europe, extending Northwards into Scandinavia and as far East as Russia. The polymorphism has been studied by local scientists in the Netherlands, France, Spain, Germany, Italy, Poland, Denmark, Norway, Sweden, Ireland and Iceland. Subject to funding being found, the software being created for the UK Megalab will be versioned to provide a Europe-wide megalab that will be run collaboratively with institutions elsewhere in Europe.

If you represent an organization that would like to participate in any aspect of the *Evolution Megalab*, please contact Prof. Jonathan Silvertown: [j.silvertown@open.ac.uk](mailto:j.silvertown@open.ac.uk)



© Mick Hoult



# Conference for Primary Science Teachers

*Manchester Metropolitan University , Friday 2 November 2007*

The **Association for the Study of Animal Behaviour** (ASAB) is organising a half-day conference for Key Stage 1 & 2 teachers in N W England. The meeting will be an opportunity to meet and hear:

- **Anne Goldsworthy** - *‘Conversation is Crucial: getting children to learn science by talking about it’*; [Anne will suggest exciting classroom activities, some great games to teach science enquiry skills and offer different ways of recording – all with the intention to make those crucial conversations happen. Come with a sense of humour. Go away with great ideas for the classroom.]
- **Karen Devine** - who will talk on *‘Investigating outdoors: a practical guide to making use of opportunities in the school grounds’*; [Karen is the BES Education Officer]
- **Dr. Michael Dockery** – *‘Practical ideas for the classroom, using live animals’* – simple ideas using an easy to rear and maintain aquatic invertebrate.

Venue: Room 205, Sandra Burslem Building, Manchester Metropolitan University  
[A map will be sent to those attending.]  
Date: Friday 2 November 2007  
Time: 1245 - 1545  
Cost: **£55** [This includes refreshments during registration and the mid-afternoon break.]  
[Hopefully, we will have educational books on display at the venue from 1230.]

## Programme

1245 - 1315 Registration and coffee/tea biscuits  
1315 - 1415 Anne Goldsworthy – Conversation is crucial  
1415 - 1435 [Mid-afternoon break]  
1435 - 1510 Karen Devine – Investigating Outdoors  
1510 - 1545 Michael Dockery – Practical ideas for the classroom.

To book a place at the conference please complete the form below. You can:

**either** send a cheque (payable to **‘ASAB’**) with your completed form to: ASAB Membership Office, 82A High Street, Sawston, Cambridge CB2 4HJ.

**or** send the form to Michael Dockery and he will send an invoice to your school.

The address is: Dr. Michael Dockery, ASAB Education Officer, Department of Biological Sciences, John Dalton Tower (Room T1.33), Chester Street, Manchester Metropolitan University, Manchester M1 5GD (Tel: 0161 247 E-mail: m.dockery@mmu.ac.uk)

-----  
Please reserve ..... place (s) for the **ASAB Conference for Primary Science Teachers** at Manchester Metropolitan University, on Friday 2 November, 2007.

**Either:** I enclose a cheque for £ ..... [A receipt will be sent to the school.]

**Or:** Please send an invoice to the school ..... [Please tick if needed.]

Name ..... Position .....

Address .....

.....

..... Postcode .....

Telephone ..... E-mail .....

## Review – Alpha Explore Reading Scheme

### (Gardner Education) - Animal Books

*Animal Lifetimes* (Reading Age 8.5 – 9.5 years), 24 pp.

The theme is clear, as the book illustrates what happens over the lifetime of a variety of animals. The first chapter takes an unusual approach by comparing a dragonfly and an elephant in a series of questions. The questions are answered as a child progresses through the book, by using a symbol to alert the reader. A welcome feature of this first chapter is an attempt to encourage the child to think like a zoologist and to do so by getting them to study an animal which would be fairly easy to track over some of its significant life events, such as a caterpillar, a chicken and a fish. Starting life, Growing up and Being an adult are the next three chapters with a wide variety of animals chosen to exemplify the points made. Variation in lifetime is the final topic, with a very useful table of over 25 species listed each with the oldest recorded age in years (mathematical opportunities here). A very useful glossary completes the book.



*Talented Animals* (Reading Age 8.5 – 9.5 years), 32pp.

The first chapter looks at Staying Alive and after a brief summary of some key requirements for life it takes a unusual approach by making a case study of one feature of an elephant's anatomy, its trunk. With a series of photographs the pupils consider how the trunk enables an elephant to survive. Movement is the topic of chapter two and uses the idea of a master runner (cheetah), master climber and swinger (gibbon), master jumper (kangaroo), master flier (Arctic tern) and master swimmers (sailfish and penguins) as the animals of interest. Four very helpful tables would again provide opportunities for, say, graphical work. The chapter on Extraordinary senses considers each in turn and provides some very nice examples which clearly illustrate the sensory capabilities of a number of animals, including long fingers (aye-aye), long tongues (chameleon) and a diversity of beak shapes. The final chapter deals with tool use, focusing on the well-known examples of chimpanzees and Egyptian vultures but also includes a tool-using bird new to me, the orange-winged titella!



*Animal Shelters* (Reading Age 9 – 10 years), 32 pp.

The first chapter sets the scene by asking the children to identify shelters in a series of photographs and listing names of shelters (burrows, dens, etc.) to enable the correct term to



(Continued overleaf)

be attributed to each animal home.

Chapter 2 focuses on builders of several kinds, including the nests of birds, mounds of termites and dreys of squirrels. Another unusual element is a two page spread given over to outlining how an Australian research biologist studies the animal shelters of her study species, alligators! Scary stuff. Chapter 3 looks at burrows of various kinds, including the prairie dog, platypus and polar bear. The fourth chapter, Building grand shelters, compares honey bees and termites and then offers a detailed look at a beaver lodge. The final chapter is titled Shelters on the move and considers kangaroos, wolf spiders, sea otters and various animal with shells. An opportunity to design their own animal completes this book, an exercise that will appeal to all primary children.

I found this a fascinating series of six books which should certainly inspire children to pick them up and read them. I don't suppose too many Science Co-ordinators will be scouring the Literacy catalogues searching for books but these would be a very welcome addition to a staff library, a school library and as classroom readers. The books are generously illustrated with high quality photographs, are generally well-researched and their Australian origins should not put off any British reader, child or adult. A further plus is that the series is also available as a CD-Rom for use with interactive whiteboards.

Check their website for prices, ordering, etc.

[www.gardnereducation.com](http://www.gardnereducation.com)



### *Future issues of FEEDBACK*

Please tick the appropriate box to indicate your preference.

I would prefer to receive a hard copy of the newsletter

I would prefer to receive an electronic copy of the newsletter.

Name ..... Position .....

Address .....

.....

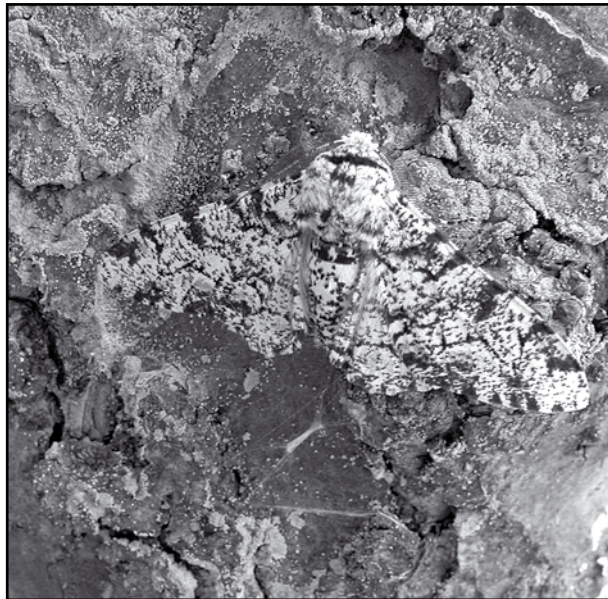
.....

Postcode ..... Telephone .....

E-mail .....

**KEY STAGE 1 - ANIMALS**

1. Here is a photograph of a moth resting on a tree trunk during the day. When it is resting, the moth keeps very still.



© Michael Dockery

The moth is black and white in colour. Write down why you think the moth has chosen to rest on the tree trunk during the day?

.....  
.....

2. Many birds eat moths. Write down why the moth keeps very still during the day.

.....  
.....

3. Adult moths drink nectar. Where do the moths find nectar? Underline your answer.

- a) in the soil
- b) at flowers
- c) from puddles
- d) in the webs of spiders
- e) on the trunks of trees.

**CHALLENGE**  
 Sometimes these moths are black, they do not have the black and white speckles of the moth in the photograph. Why might black moths be more easily spotted and eaten by birds?

.....  
 .....  
 .....

4. Put birds, flowers and moths into a food chain.

..... → ..... → .....

[‘Suggested’ answers - page 30]

**KEY STAGE 2 - ANIMALS**

1. Here is a photograph of a cat.

What type of animal is a cat. Underline your answer.

- i) fish      ii) bird      c) mammal
- iv) amphibian      v) insect



© Mick Hoult

2. Cats are carnivores. What is a carnivore?

.....

3. Blue tits eat caterpillars; oak leaves use sunlight to grow; oak leaves are eaten by caterpillars; cats catch and eat blue tits. Put blue tits, leaves, sun, caterpillars and cats into a food chain.

..... → ..... → ..... → ..... → .....

4. Suggest **ONE** way that cat owners could make it less likely for their cats to catch garden birds.

.....  
.....

5. Other than a blue tit, suggest **ONE** other garden bird a cat might catch.

.....

6. On page 13 are three drawings of cats.

i) What do you think cat A is doing?

.....

ii) Drawing B shows a cat that has been cornered by a dog. Identify **ONE** way that you can tell that the cat is threatened.

.....  
.....

iii) What do you think the adult cat in drawing C is doing?

.....

**KEY STAGE 2 - ANIMALS**

iv) When adult cats in drawing C behave like this the kitten never struggles to get free. Give **ONE** reason why a kitten does not struggle.

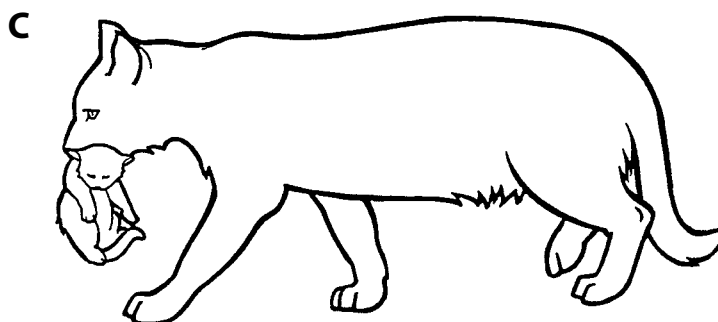
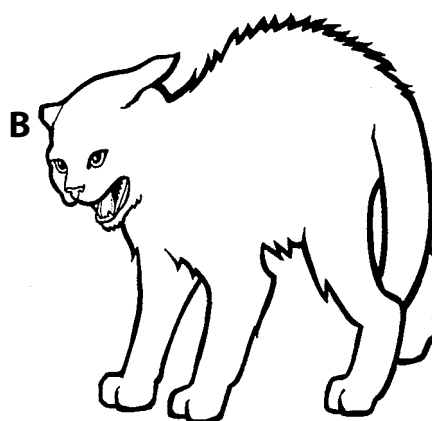
.....

7. Cats are taken into catteries or shelters if they are lost or their owners can't look after them. People visit the shelters to give a cat a home. When people visit they are shown a number of cats in similar enclosures before they decide which cat they may adopt. Suggest **THREE** things about the cats or their enclosures that might make people choose one cat rather than another.

i) .....

ii) .....

iii) .....



© UFAW

['Suggested' answers - page 30]

**KEY STAGE 3 - BIOLOGY**

Here is a photograph of a nuthatch, a British bird.

*Figure 1 A nuthatch*



© Mike Taylor

Nuthatches are about 140 mm in length with blue-grey upper parts and pale chestnut-brown underparts, whitish cheeks and a very striking black eye stripe. They have a wingspan of 80 - 95 mm and a mass of 15 - 25 g. Their legs are short but they possess quite large feet with very strong claws. Their feet enable them to walk down as well as up a tree trunk, hence their nickname, the `upside-down bird`.

Nuthatches are generally found in deciduous woodland and spend most of their time on trees looking for food. When searching, they concentrate on the lower and middle part of the trunk, and on the branches too. A feature of their searching is that they often peel back and remove pieces of bark to get at food. They eat spiders and insects, both adults and larvae. Nuthatches also store food, putting seeds and nuts into crevices and holes in the trunks of trees. They are also regular visitors to garden feeders and bird tables in winter, taking fats, peanuts, cheese and bread.

1. Nuthatches are sometimes eaten by sparrow hawks. Caterpillars eat oak leaves. Nuthatches eat caterpillars. Oak leaves use sunlight (plus water and carbon dioxide) for food. Put these 5 elements into a food chain.

..... → ..... → ..... → ..... → .....

2. How are the feet of nuthatches adapted to moving around on tree trunks?  
.....

3. How is the bill of a nuthatch adapted to peeling back bark?  
.....

4. Nuthatches eat both animal and plant food. What term describes this type of diet.  
.....

**KEY STAGE 3 - BIOLOGY**

Figure 2 shows how many times nuthatch parents take food to their young.

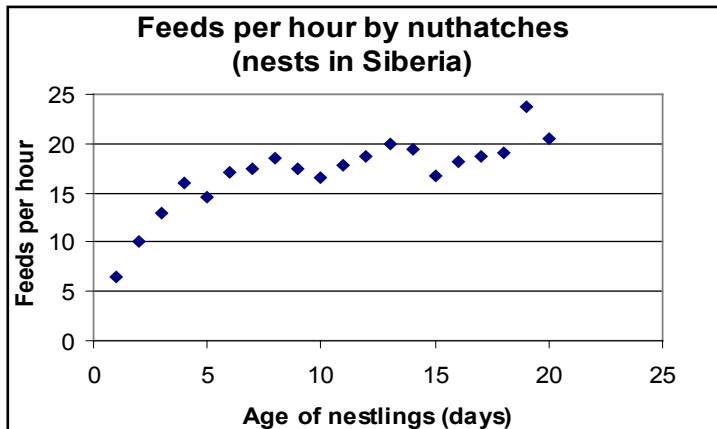


Figure 2 Mean number of feeds per hour taken to chicks (nestlings) for the first 20 days after hatching; these data are from a sample of nests in Siberia.

5 i) When the nestlings were 2 days old, how many feeds per hour did the parents make to the nest?

.....

ii) Most nuthatch parents seem to be able to provide up to 20 feeds per hour. At this rate, how long, on average, might the chicks have to wait between feeds before a parent returns with food?

.....

iii) Students try to explain what the graph shows. Which student do you think has given the best answer? Underline the answer you think is best.

- Student A: as the nestlings get older they have more time to play; .
- Student B: as the nestlings get older they need less food;
- Student C: as the nestlings get older they need more food;
- Student D: as the nestlings get older they hunt for more food;
- Student E: as the nestlings get older they want fast food!

iv) If parent nuthatches are making 20 trips per hour back to the nest with food, what does that tell you about how far they go to find food?

.....  
 .....

v) Give **ONE** reason why nuthatches are frequent visitors to feeders and bird tables in our gardens in winter.

.....

[‘Suggested’ answers - page 30]

**GCSE BIOLOGY**

*Can owls tell hooting neighbours from hooting strangers?*

Many birds show territorial behaviour. Having a territory means that the owner has exclusive access to the food, mates and nest sites within it. To keep a territory a bird needs to stop feeding and call to advertise that it owns the territory, to patrol it, to chase away rivals and to avoid predators. However, the immediate neighbour, in the next territory, may be accepted by the owner provided it keeps in its own territory. So it should help birds if they can recognize a neighbour. Can they?

A recent study\* showed that little owls, *Athene noctua*, can tell neighbours from strangers. Little owls are nocturnal and rely on sound signals (hoots) to let other little owls (see Figure 1) know they own a territory. The scientists recorded the hoots of stranger and neighbour owls in an area of France. They then played back their recordings of hoots to see if little owls with territories could tell a stranger from a neighbour.



© Mal and Jan Moore

Figure 1 A little owl

\* Hardouin, L. A., Tabel, P. & Bretagnolle, V. 2006. Neighbour-stranger discrimination in the little owl, *Athene noctua*. *Animal Behaviour*, **72**, 105 – 112.

**Foundation tier**

1. The little owl is a nocturnal bird. What does nocturnal mean?

..... (1)

2. Little owl males hoot to defend their territories. What type of signal is a hoot? Underline the correct answer.

..... (1)

- i) visual signal      ii) touch signal      iii) sound signal      iv) chemical signal

3. Give **TWO** reasons why this type of signal is the type that male little owls use to defend their territories.

.....  
 ..... (2)

## GCSE BIOLOGY

4. What is an animal's territory? Underline the best answer. (1)

- i) the forest where it lives;
- ii) an area of land;
- iii) an area where an animal is found;
- iv) an area where an animal finds water to drink and all of the food that it eats;
- v) an area that is defended by an animal, a pair of animals or a group of animals.

5. Give **ONE** advantage and **ONE** disadvantage to any animal that has a territory.

.....  
 ..... (2)

6. The scientists recorded the hoots of male owls on a tape recorder and then played them back to observe the behaviour of male owls in their test area. Give **ONE** advantage to scientists of using playback calls in studies of animals.

..... (1)

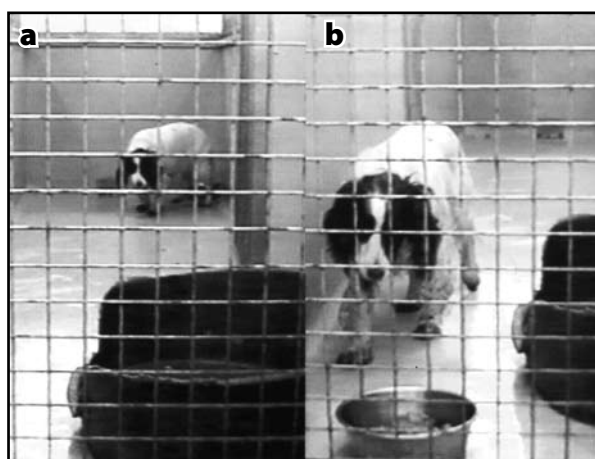
### Pets/Companion animals

In the UK, dogs that have strayed or been abandoned are taken into shelters to be housed and cared for. Members of the public can visit the shelters to adopt a dog as a pet. There are many dogs to choose from, so how do people decide which one to have as a pet?

A scientist\* was interested in finding out what factors may be important in deciding which dog to choose. The kennel itself and the behaviour of the dog during a visit were two of the factors she investigated. She took several pairs of photographs at a shelter showing dogs in kennels. For each pair of photographs the same dog was used but one feature was different: this feature either concerned the behaviour of the dog or the environment of the kennel. Figure 2 is one pair of photographs, showing a dog at the front (a) or back (b) of the kennel. She gave these pairs of photographs to university students to look at and asked them which of the two dogs in each pair would they choose as a pet.

[\* We are very grateful to Dr Debbie Wells for her permission to use these photographs and for the data in Table 1.]

*Figure 2 One of the dog pairs: the dog in (a) is at the front of the kennel, in (b) it is at the back of the kennel.*



© Dr Debbie Wells

**GCSE BIOLOGY**

Some of her data for 4 of the dog behaviour factors are in Table 1.

Table 1

Dog behaviour factors	Choices of students			
1. Dog`s position in kennel	At front	478	At back	49
2. Direction of dog`s gaze	At camera	437	Away from camera	90
3. Sound made by dog	Dog quiet	481	Dog barking	46
4. Activity of dog	Sits or stands	406	Rests or sleeps	121

- How many students took part in the study? ..... ( 1 )
- Which dog behaviour factor was the least important in determining which dog of each pair the students chose?  
..... ( 1 )
- Which dog behaviour factor was the most important in determining which dog of each pair the students chose? Suggest **ONE** reason why this was so.  
..... ( 2 )
- Suggest **ONE** reason why a person might want a dog as a pet?  
..... ( 1 )

**Higher tier**

- Little owl males hoot to defend their territories. What type of signal is a hoot? Underline the correct answer. ( 1 )  
i) visual signal    ii) touch signal    iii) sound signal    iv) chemical signal
- Give **TWO** reasons why this type of signal is the type that male little owls use to defend their territories.  
.....  
..... ( 2 )
- What is an animal`s territory? Underline the best answer. ( 1 )  
i) the forest where it lives;  
ii) an area of land;  
iii) an area where an animal is found;  
iv) an area where an animal finds water to drink and all of the food that it eats;  
v) an area that is defended by an animal, a pair of animals or a group of animals.

<b>GCSE BIOLOGY</b>
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4. Give **ONE** advantage and **ONE** disadvantage to any animal that has a territory.

.....  
 ..... (2)

5. The scientists recorded the hoots of male owls on a tape recorder and then played them back to observe the behaviour of male owls in their test area. Give **ONE** advantage to scientists of using playback calls in studies of animals.

..... (1)

6. Scientists often try to determine if animal signals are `honest` or whether an animal sending a signal could `cheat`, i.e. send a signal that would not indicate its real condition. Suggest **TWO** features of a sound signal that an animal could use to test whether the sender of the signal is being `honest` and suggest **ONE** reason why each of them would be `honest` signals.

..... (4)

**Pets/Companion animals**

1. Why did the researcher use the same dog in each pair of photographs?

..... (1)

2. Which dog behaviour factor was the most important in determining which dog of each of the pairs the students chose? Suggest **ONE** reason why this was so.

..... (2)

3. Suggest **ONE** other dog behaviour factor, i.e. one not already in Table 1, that might influence a person making a decision about which dog to choose as a pet.

..... (1)

4. Comment on the choice of this group of human subjects for this research?

..... (1)

[`Suggested` answers - page 30]

**AS/A2 BIOLOGY**

**A. Living in groups**

Many species of animals form social groups for all or part of the year. Social behaviour brings advantages to individuals in the group, though some individuals, by being more competitive perhaps, may gain greater advantages than others. These dominant animals may show that they have higher status by their behaviour or their appearance. Great tits, for example, have a black stripe, or badge, down their chest and the width of the badge varies: high status birds have wider stripes and other great tits defer to them at bird feeders.

A recent study\* of Northern bobwhite, *Colinus virginianus*, in the USA (see Figure 1) tried to discover if the size of a group in the non-breeding season influences a number of variables, such as the food intake of individuals in the group. Bobwhites live in social groups called coveys and in a series of field experiments the researchers manipulated covey size and then observed the behaviour of the birds.



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Figure 1 A Northern bobwhite

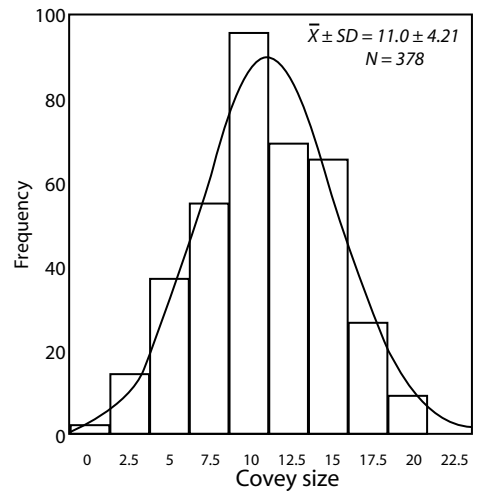
\* Williams, C. K., Lutz, R. S. & Applegate, R. D. 2003. Optimal group size and northern bobwhite coveys. *Animal Behaviour*, 66, 377 – 387.

1. What is a field experiment?

..... ( 1 )

2. The researchers determined covey size over a 3 month period. Some of their data are illustrated in Figure 2.

Figure 2 Distribution of covey sizes between 9 November and 31 January over 4 years.



a) What type of distribution is shown in Figure 2?

.....( 1 )

b) Why does the distribution have this name?

.....( 1 )

c) Give **TWO** characteristics of this distribution.

.....  
 ..... ( 2 )

[We are grateful to Elsevier Science for permission to use Figure 5 page 383 and Figure 9 page 384 from the article by Williams, C. K. et al. in *Animal Behaviour*, 2003, 66, 377 – 387.]

**AS/A2 BIOLOGY**

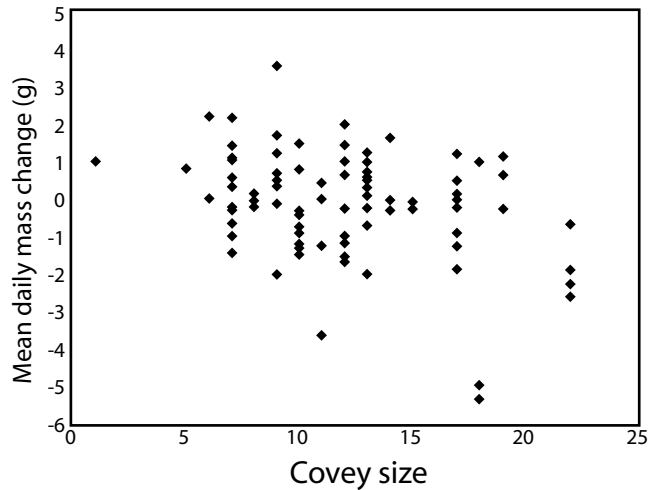
d) Figure 2 has this information above the plot:  $X \pm SD = 11.0 \pm 4.21$ .  $N = 378$ .

What do X, SD and N stand for? ..... ( 3 )

e) How are X and SD related to the distribution curve? ..... ( 1 )

Figure 3 shows the influence of covey size on mean daily mass change (g) during the three month period over 4 years.

Figure 3 Influence of covey size on mean daily mass change (g).



3. a) What type of graph is illustrated in Figure 3?

.....( 1 )

b) What does the graph show?

..... ( 1 )

c) Suggest **ONE** reason why this relationship was found...

..... ( 1 )

**B. The functions of grooming**

Grooming is behaviour that is concerned with taking care of the surface of the body. An animal may groom itself (autogrooming) or another animal of the same species (allogrooming). Some examples are known in which one animal grooms another of a different species, fish coming to `cleaning stations` on the sea floor for example. Grooming may serve a number of functions, see below, which can vary from one grooming session to another.

A recent study\* of meerkats, *Suricata suricatta* (see Figure 4), tried to find out if the pattern of grooming reflected the type of social relationships in the group. The scientists used focal sampling to collect their data and carried out their observations in the early morning and evening, 608 hours in total.



© Dr Andy Russell

Figure 4 An adult and juvenile meerkat

[ 'Suggested answers' - page 31 ]

<b>AS/A2 BIOLOGY</b>
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1. Grooming has a number of functions: these include hygiene and the relaxation of both the groomer and the groomee, as grooming reduces the heart rate.

i) Suggest **ONE** way in which grooming helps hygienically in meerkats.

..... (1)

ii) Suggest **ONE** other possible function of grooming.

..... (1)

2. Suggest **ONE** other mammal that engages in grooming other individuals of the same species.

..... (1)

3. In meerkat societies, dominant females produce about 80 % of the litters of pups. Dominant females often attack and evict older subordinate females in the group but do not behave in the same way to the younger subordinate females. Give **ONE** reason why dominant females do not attack and evict young subordinate females.

..... (1)

4. This research took place in the Kalahari Desert where "**all individuals were habituated to close observation**".

i) What does habituation mean? Underline which definition you think is best. (1)

a) a behaviour that is repeated;

b) a decline in the response to a particular stimulus over time, when the stimulus is repeatedly presented;

c) a response to a sudden stimulus, such as a loud noise;

d) a particular stimulus that is repeatedly presented.

ii) What does the phrase in quotation marks (in bold) mean?

..... (1)

iii) Why was this an advantage to the researchers?

..... (1)

**AS/A2 BIOLOGY**

5. The researchers used focal sampling when collecting data. Which definition below best describes focal sampling? Underline the answer you think is best. (1)

- a) a researcher records what all the animals in a group are doing;
- b) a researcher waits until she/he sees something interesting;
- c) a researcher records behaviour with a digital camera with a lens of a certain focal length;
- d) a researcher focuses on just one individual animal and records what it is doing.

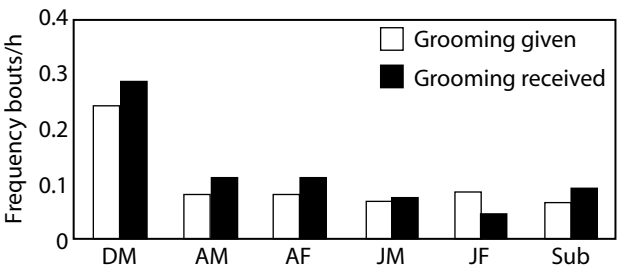
6. The scientists recorded grooming episodes, including their frequency, duration, the individuals involved and whether grooming was reciprocated. What does reciprocated grooming mean?

..... (1)

7. Figure 5 shows the duration of grooming between the dominant female (DF) and other meerkats in the group. Give **TWO** conclusions you can draw from the graph.

.....  
..... (2)

Figure 5 Variation in grooming frequency between dominant females and other group members. DM – dominant male; AM – adult male; AF – adult female; JM – juvenile male; JF – juvenile female; Sub – all subordinates, male and female. [Data are means.]



8. In the summary of the research report is this sentence: "Grooming between dominant individuals was the most common and symmetrical interaction." What does this mean?

..... (1)

We are grateful to Elsevier Science for permission to use Figure 1 (a) page 1063 from the article by Kutsukake, N. & Clutton-Brock, T. H. 2006, in Animal Behaviour, 72, 1059 – 1068.]

['Suggested' answers - page 31]



**Scottish Advanced Higher**

**B. Living in groups**

Many species of animals form groups for all or part of the year. Social behaviour brings advantages to individuals in the group, though some individuals, by being more competitive perhaps, gain greater advantages than others. These dominant individuals may show that they have higher status by their behaviour or their appearance.

1. Give **ONE** advantage and **ONE** disadvantage to living in a group.

..... ( 2 )

2. Give **ONE** example of any species you know in which dominance is indicated by appearance and outline how dominance is shown in this species.

..... ( 2 )

A recent study\* of Northern bobwhite, *Colinus virginianus*, in the USA (see Figure 2) tried to discover if the size of a group in the non-breeding season influences a number of variables, one variable was the food intake of individuals in the group. Bobwhites live in social groups called coveys and in a series of field experiments the researchers manipulated covey size and then observed the behaviour of the birds.



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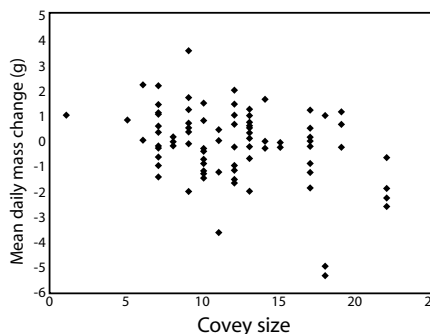
Figure 2 A Northern bobwhite

\* Williams, C. K., Lutz, R. S. & Applegate, R. D. 2003. Optimal group size and northern bobwhite coveys. *Animal Behaviour*, 66, 377 – 387.

3. What is a field experiment? ..... ( 1 )

4. Figure 3 shows the influence of covey size on mean daily change in mass of birds (g) during the three month period over 4 years.

Figure 3 Influence of covey size on mean daily change in mass of birds (g).



a) What type of graph is illustrated in Figure 3? ..... ( 1 )

b) What does the graph show? ..... ( 1 )

c) Suggest **ONE** reason why this relationship was found. .... ( 1 )

[We are grateful to Elsevier Science for permission to use Figure 9 page 384 from the article by Williams, C. K. et al. in *Animal Behaviour*, 2003, 66, 377 – 387.]

**AS/A2 PSYCHOLOGY**

**A. Bystander effects in fighting fish**

Territorial disputes between two male animals are usually witnessed by others. The observers, called bystanders, might be other males or receptive females. Could the behaviour of observers be influenced by watching such disputes? Recent research\* using male fighting fish, *Betta splendens*, tried to answer this by comparing the behaviour of bystander males with naïve males.



©Precha Jintasaerwong

Figure 1 A male fighting fish

Two males at a time were tested, after being drawn randomly from a population of fish kept in the laboratory. The two males were placed in two halves of a tank, separated by an opaque divider. One was the bystander fish, who could see two other male fish in a tank who interacted for a period of 15 minutes. The naïve male did not see the two males interacting. After the period of 15 minutes elapsed, the divider was removed and the naïve and the bystander males were allowed to interact. The researchers measured how many aggressive behaviours (displays, chases and bites) were shown by each male for 15 minutes. This allowed them to recognize a winner and a loser for each pair that were tested. The researchers found that bystander males were dominant over naïve males in a significant number of encounters.

\* Clotfelter, E. D. & Paolino, A. D. 2003. Bystanders to contests between conspecifics are primed for increased aggression in male fighting fish. *Animal Behaviour*, 66, 343 – 347.

1. The researchers predicted that a bystander fish would defeat a naïve fish. Based on this prediction, provide a suitable directional hypothesis.

..... ( 1 )

2. What is the difference between a directional hypothesis and a non-directional hypothesis?

..... ( 1 )

3. The researchers used “a population of 40 male fish” in one of their experiments. Give a definition of the term population.

..... ( 1 )

4. Four male fish were tested at a time, all being randomly selected from the population.

i) What is a random sample?

..... ( 1 )

ii) Give **ONE** advantage to using this method of selecting individuals for a study.

..... ( 1 )

<b>AS/A2 PSYCHOLOGY</b>
-------------------------

5. The researchers identified three mutually exclusive categories of aggressive behaviours, viz. displays, chases and bites. Explain what mutually exclusive means.

..... ( 1 )

6. From any area of Psychology, identify **ONE** example of a study that categorized individuals using two, or more, classes or categories.

..... ( 1 )

7. The research report noted that "to reduce inter-observer differences all behavioural data were collected by one observer".

i) What are inter-observer differences? . .

..... ( 1 )

ii) Why would it be important to reduce these differences as much as possible?

..... ( 1 )

8. The researchers used a t-test to compare the number of displays, chases and bites shown by bystander males and naïve males.

i) Why was a t-test an appropriate one to use to analyse these data? . .

..... ( 1 )

ii) Is a t-test a parametric or a non-parametric test?

..... ( 1 )

iii) Give **TWO** of the requirements needed to determine if a parametric test can be used to analyse a set of data.

.....

..... ( 2 )

**AS/A2 PSYCHOLOGY**

**B. How the environment can modify courtship criteria in snakes**

Locating and courting a female is a long and risky process in some animals, so we might expect that if the chance of encountering females was high then males should be choosy and court larger and more fecund females. But if the chance of meeting females is low then males should be less choosy. This was recently tested in USA using red-sided garter snakes, *Thamnophis sirtalis* parietalis. Large numbers of these snakes (maybe several tens of thousands!) often over-winter in underground dens in grassland whereas in woodland nearby there are relatively low numbers where males are much less likely to encounter females. So would den males be more choosy?

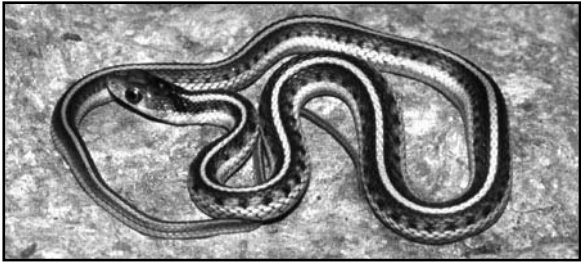


Figure 2 A red-sided garter snake

In this study, snakes were captured as they emerged from the den, or by using traps in the woodland, and their length measured. The animals were then tested in grassy arenas (1 x 1 x 0.8 m) close to the den. When testing the animals, each arena had either 2 males and 1 female or 1 male and 2 females. The researchers found that male red-sided garter snakes from the den site are very choosy courters of females, preferring larger ones.

\* Shine, R., Webb, J. K., Lane, A. & Mason, R. T. 2006. Flexible mate choice: a male's preference for larger females is modified by the sizes of females encountered. *Animal Behaviour*, 71, 203 – 209.

1. The researchers collected their sample of snakes as they emerged from a communal den. What type of sample would this be? Underline your answer. (1)  
 i) random    ii) biased    iii) systematic    iv) opportunity    v) quota
2. The researchers measured the snout-vent length (cm) on each snake. What scale (level) of measurement is this?  
 ..... (1)
3. Give **ONE** characteristic of this scale (level) of measurement.  
 ..... (1)
4. In one part of the study, 1 male snake was placed in an arena with two female snakes to see how long the male spent courting each one. The researchers divided females into two groups based on their size (snout-vent length). One of the two females in the arena was 'large' and one was 'small'. Suggest **ONE** measure that the researchers could have used to divide the females into two groups on the basis of size.  
 ..... (1)

**AS/A2 PSYCHOLOGY**

5. Explain why the measure you suggested for your answer to question 4 would have been appropriate.

..... ( 1 )

6. Figure 3 shows the distribution of female snakes of particular snout-vent lengths that were collected in the den.

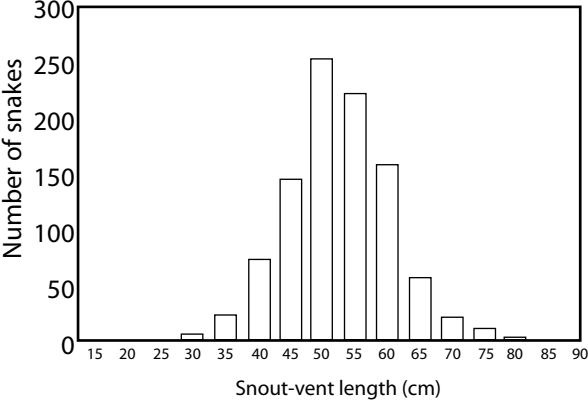


Figure 3 Snout-vent length distribution of female garter snakes collected in the den.

i) What type of distribution is shown in the graph?..... ( 1 )

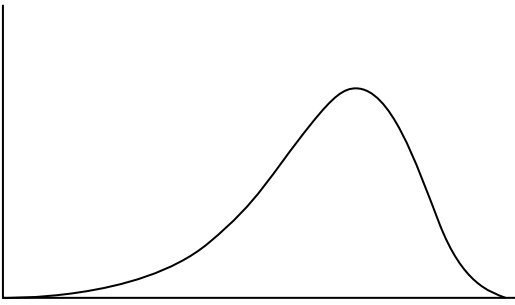
ii) Identify **TWO** characteristics of this type of distribution.  
..... ( 2 )

iii) What is the modal class of this distribution?..... ( 1 )

iv) The mean and **ONE** other measure can be used to describe the shape of the distribution shown in Figure 3. Identify what the measure is and explain how this measure is related to the overall shape of the distribution.  
..... ( 2 )

v) Identify the type of distribution shown in Figure 4 below..... ( 1 )

Figure 4



[We are grateful to Elsevier Science for permission to use Figure 1a page 206 from the article by Shine, R. et al. in Animal Behaviour, 2006, 71, 203 – 209.]

**KEY STAGE 1 - ANIMALS**

1. the colours of the moth are like those of the tree trunk – the patterns on the moth's wings are like the patterns on the surface (lichen encrusted) of the tree
2. so that it is less likely to be seen by a bird – the eyes of any animal are more easily drawn to a moving object
3. b) at flowers
4. flowers > moths > birds

**Challenge**

they would not be so well-camouflaged as the black and white moths as a black moth would stand out more clearly to a bird

**KEY STAGE 2- ANIMALS**

1. c) mammal
2. an animal that catches, kills and eats other animals – a meat-eating (flesh-eating) animal
3. sun > oak leaf > caterpillar > blue tit > cat
4. put a bell on the cat's collar to warn birds of its presence – keep the cat indoors during the day
5. house sparrow, robin, wren, blackbird, great tit, greenfinch, etc.
6. i) focusing on possible prey – focusing on another cat that may have entered its territory/garden  
ii) it has exposed its teeth, ready to perhaps bite the dog if it comes nearer – it has raised its fur to emphasise its size – it has arched its body and has a stance that suggests it may jump at or lash out at the dog if the dog advances  
iii) it is retrieving one of its kittens that has wandered away from the home – it is moving the kittens, one at a time, to a new home  
iv) if it struggled the kitten may be harmed, perhaps being bitten or dropped – if it relaxes, the kitten can be carried quickly to a new home or away from danger which is to the advantage of the kitten and its mother
7. the colours/pattern of a cat – the size/age of a cat – whether the cat is close/fairly close to the front of the enclosure – if there are toys in the enclosure – if the cat responds to a visitor when the person approaches the front of the enclosure

**KEY STAGE 3 - BIOLOGY**

1. sunlight > oak leaf > caterpillar > nuthatch > sparrowhawk
2. their feet are relatively large and they have strong claws to enable them to grip the bark tightly, especially useful when going 'down' a tree trunk
3. it is stout so that it can exert sufficient force to strip back bark to expose any larvae beneath – its chisel-like appearance helps the bill to enter gaps to extricate larvae
4. omnivorous
5. i) 10 feeds per hour ( $\pm$  2 feeds per hour)  
ii) 3 minutes  
iii) Student C  
iv) they cannot be flying too far to find it since they would have to fly out to the food source, find it, manipulate it and fly back to the nest with it in the time, which would be around 3 minutes  
v) many people put out food regularly so it is a reliable food source – the food is nutritious so very valuable in winter – the food is usually fresh – water is available too

**GCSE BIOLOGY****Intermediate tier**

Hooting of owls

1. active at night
2. iii) a sound signal
3. sound signals travel well over distance – sound signals are not affected in their efficiency by darkness – sound signals can move around objects, such as trees
4. v) an area that is defended by an animal, a pair of animals or a group of animals
5. adv: an animal has exclusive use of the resources – the size will give reasonable assurance of being sufficient to enable young to be reared – survival chances are greater with a territory  
disadv: need to defend the area so it is costly in terms of energy – may incur injury in defending the territory – there is an ever-present threat of a take over as there is always a surplus of animals ready to take ownership of the territory
6. can record the signals fairly easily and playback ensures the signals are standardized – the signal can be fairly easily manipulated by the researchers if they need to do so – the signals can be played back as and when needed – easy to use the apparatus in the field

Choosing a pet dog

1. 527 students
2. activity of the dog
3. sound made by the dog, e.g. dog barking or howling – visitors may assume that the dog would be noisy at home and so they might not want to choose the dog – they might assume that the previous owner may not have been able to control the dog very well and that they would also find it troublesome and so they would not choose it as a pet
4. for companionship – to protect their home – to train for a specific purpose, such as mountain rescue

**Higher tier**

Hooting of owls

1. iii) a sound signal
2. sound signals travel well over distance – sound signals are not affected in their efficiency by darkness – sound signals can move around objects, such as trees
3. v) an area that is defended by an animal, a pair of animals or a group of animals
4. adv: an animal has exclusive use of the resources – the size will give reasonable assurance of being sufficient to enable young to be reared – survival chances are greater with a territory  
disadv: need to defend the area so it is costly in terms of energy – may incur injury in defending the territory – there is an ever-present threat of a take over as there is always a surplus of animals ready to take ownership of the territory
5. can record the signals fairly easily and playback ensures the signals are standardized – the signal can be fairly easily manipulated by the researchers if they need to do so – the signals can be played back as and when needed – easy to use the apparatus in the field
6. duration of the hooting calls, the loudness of the hooting calls – it would be difficult to cheat on duration since an owl would have to be in good health to keep up a lengthy duration of hooting – it would be difficult to cheat on loudness since this is likely to be a function of the size of an owl and, other things being equal, a larger owl is more likely to gain a territory than a smaller one

Choosing a pet dog

1. to act as a control – so, if there was a difference in the frequency with which students selected one of the pair over the other then it could be attributed to the difference between the behaviour factors only, since the same dog was in both photos
2. the sound made by the dog, i.e. dog barking – visitors may assume that the dog would be noisy at home and so they might not want to choose the dog – they might assume that the previous owner may not have been able to control the dog very well and that they would also find it troublesome and so they would not choose it as a pet
3. if the dog was wagging its tail – if the dog was baring its teeth – if the dog jumped up at the kennel in an aggressive manner when people approached
4. University students are readily available and are happy to participate in research – they are as likely to represent human feelings about pets as any other group – they are possibly not typical pet owners in view of their status as students.

**AS/A2 BIOLOGY****A. Living in groups**

1. an investigation in the natural environment of the animal that has an experimental design (i.e. an independent variable and a dependent variable)
2. a) normal distribution  
b) it is a type of distribution that is very commonly found for a great many biological variables, like the distribution of height in a population of human adults  
c) the distribution is symmetrical – the mean and standard deviation describe the shape of the distribution curve – the mean, mode and median values are the same and at the peak of the curve  
d) X is the mean value, SD the standard deviation value and N the size of the sample  
e) the mean and standard deviation describe the shape of the curve – these two values identify sections of the curve, usually  $\pm 1$ ,  $\pm 2$  and  $\pm 3$  standard deviation values around the mean
3. a) scattergraph  
b) as covey size increases, the mean daily mass change decreases – a negative relationship (correlation) is evident  
c) there would be more competition for food in a large covey so individuals would feed less efficiently and lose mass – a larger covey would use up the food resources more quickly and have to move on to find alternative food, so they would increase the distance they would travel and so use more energy

**B. The functions of grooming**

1. a) dead skin is removed, parasites are removed, bits of food can be removed  
b) recognizes and cements social status, forges alliances between individuals, provides information about the reproductive state of individuals, nepotism,
2. primates, antelopes, mice, etc.
3. younger females may not yet be sexually mature and thus would be unable to breed – younger females are more likely to be the daughters of the dominant female and so it may pay a dominant female to groom them as they may help caring for her pups
4. i) b) a decline in the response to a particular stimulus over time, when the stimulus is repeatedly presented  
ii) all the meerkats were used to being closely followed and occasionally manipulated by the researchers  
iii) the researchers could pick up the meerkats and measure, weigh, assess them, etc. and this did not appear to be stressful for the meerkats nor did it change their subsequent behaviour in any way
5. d) a researcher focuses on just one individual animal and records what it is doing
6. a groomee subsequently groomed the groomer
7. the dominant female generally received more grooming than she gave from the other group members – more grooming took place between the two dominant meerkats than any other liaison – the dominant female groomed at about the same frequency to other group members (just < 0.1 bouts/h) but the frequency of grooming she received varied
8. it means that grooming between the dominant male and dominant female was the most frequent interaction and that it was reciprocated at a similar level

**Scottish Advanced Higher****A. The use of videotape recording to study animal behaviour**

1. *ads*: can look at the videotape again to check a recorded piece of behaviour – can use it to check inter-observer reliability if two or more people are recording behaviour  
*disads*: can be time consuming if you have to look through several hours of videotape to search for an unusual behaviour – can be expensive in terms of equipment as several cameras may be needed to record and/or track the behaviours of interest
2. *ads*: can control variables more easily – can control the breeding programmes of the animals used in the study – the genetic history of the animals is often fully known  
*disads*: the habitat is not a 'normal' one for the animal – the behaviours shown may not be those evident in wild animals – it is not possible to witness some behaviours in the laboratory, the migration of wildebeest, for example
3. a) a testable statement  
b) an individual of the same species (in this case, another Japanese quail)
4. a sample  
5. the larger the sample, the less likely there is to be sampling bias – the larger the sample, the more likely it is to reflect the population from which it is drawn

**B. Living in groups**

1. *ads*: often easier to find food – if the animals are predators, a group can bring down bigger prey – groups usually detect predators more quickly  
*disads*: have to share food, though some individuals often do better than some others in the group – disease may spread more easily in groups
2. Harris sparrow – birds with darker chest and head feathers are dominant to those with paler heads and chests  
great tits – the width of the chest stripe indicates birds that are dominant over others
3. an investigation in the field that has an experimental design (i.e. an independent variable and a dependent variable) but takes place in the natural habitat of the animal
4. a) scattergraph  
b) as covey size increases, the mean daily change in mass of birds decreases – a negative relationship (correlation) is evident  
c) there would be more competition for food in a large covey so individuals would feed less efficiently and lose mass – a larger covey would use up the food resources more quickly and have to move on to find alternative food, so they would increase the distance they would travel and so use more energy

**AS/A2 PSYCHOLOGY****A. Bystander effects in fighting fish**

1. observer fish will show greater aggression than naïve fish
2. a directional hypothesis is predictive, indicating how the IV is likely to affect the DV whereas a non-directional hypothesis will indicate that the IV may affect the DV but won't predict the outcome or in which direction it will occur
3. all the available animals which could be used in a study – all the individuals in the potential group of animals for inclusion in the study
4. i) a sample that is free from bias – a sample in which each individual animal has an equal chance of being selected  
ii) the sample would be representative, if it is reasonably large – the sample would be objectively selected
5. any observed behaviour could be placed into one, and only one, of the three categories
6. extraversion, introversion – Type A and Type B personality –
7. i) differences that exist in the recording of a piece of behaviour between two, or more, observers due to the individual interpretation of the behaviour – the same behaviour would be scored differently by two, or more, observers  
ii) if the same behaviour was scored differently by two observers then the data would not be comparable – the data would lack reliability, i.e. it would not be consistent, since two observers would score it differently
8. i) because the number of displays, chases and bites would be measured on at least an interval scale  
ii) a parametric test  
iii) each of the two sets of scores is normally distributed – the variances of the two sets of scores are same/similar – the sets of scores are measured on at least an interval scale

**B. How the environment can modify courtship criteria in snakes**

1. iv) opportunity sample
2. ratio scale
3. has a true zero – measurement is made on a continuous scale
4. the median
5. the median divides a set of data into two groups by selecting the middle value when the scores are ranked – it divides data into two groups in an objective manner
6. i) normal distribution  
ii) bell shaped – symmetrical – the mean, median and mode have the same value – it is a very commonly occurring distribution for body measures of most animals  
iii) 50 cm  
iv) standard deviation – for two distributions with the same mean, the one with the relatively larger standard deviation will have a smaller peak and longer tails than the one with the relatively smaller standard deviation which will have a taller peak and shorter tails  
v) negative skew

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## Books

- ..... copies of *Animal Behaviour: practical work and data response exercises for sixth form students*
- ..... copies of *Animal Behaviour: practical work and data response exercises at GCSE*
- both books written by Michael Dockery and Michael Reiss - £1

## Resource Packs

- Finding Food* - Michael Dockery - for Key Stage 2: on the ASAB education website.
- Observational studies of ringtailed lemurs in zoos* - Mary White - on the ASAB education website.
- The North Atlantic Gannet: observing and recording selected behaviours* - Carole MacLaren - on the ASAB education website. [The video for the pack can be purchased from Michael Dockery for £6.50.]
- The Birds and the Bees* - Jan Morton and Amanda Eggert - on the ASAB education website.
- Parental behaviour of burying beetles* - Melanie Gibbs - free to download from the ASAB education website but DVD can be bought from Michael Dockery for £2.
- Parental behaviour of blue tits* - Michael Dockery and Tor Yip - on the ASAB education website - a CD-Rom version (plus video footage) can be bought from Michael Dockery for £3.
- Environmental Enrichment* - Frances Steel - on the ASAB education website - the CD-Rom (with film footage) can be bought from Michael Dockery for £3.
- Foraging behaviour in bumblebees* - Patricia Stewart - free to download from the ASAB website - a CD-Rom is available from Michael Dockery for £3.

## Poster

- ..... copies of the A2 poster *When is a moth not a moth?* - Michael Dockery - (includes four worksheets for Key Stage 2 pupils) Copies of poster and the worksheets are £1.

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