Housing and Keeping Animals

L56

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CLEAPSS

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Contents

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CLEAPSS
Brunel University
Uxbridge UB8 3PH

Tel: 01895 251496
Fax: 01895 814372
E-mail: science@cleapss.org.uk
Web site: www.cleapss.org.uk

Guide L56

Housing and Keeping Animals

1. Scope of this guide

This guide provides information about the basic care of the different kinds of animals likely to be kept in schools and the type of housing, both commercial and d-i-y, that will provide them with a healthy and stress-free existence. It is aimed at staff in primary, secondary and special schools. The range and detail provided is sufficient to cater for the needs of post-16 work; teachers in primary schools may therefore need to be selective in the information that they use.

Many animals can be housed in any convenient, clean container that is able to hold sufficient of the material on or in which they normally live. A brief description of these basic types of housing and equipment is given. The remainder of the guide is set out according to the types of animal to be housed, since their particular requirements determine the nature of any specialised provision that is needed. In addition to suggestions for housing animals, information is given about many of the accessories that are necessary to provide suitable living conditions - heaters, thermostats, food hoppers, water bottles, bedding materials etc. Each section includes information about suppliers and an indication of the cost of housing and equipment at the time of publication. In addition to the major suppliers, there are many local retailers of animal housing, so this information cannot be comprehensive.

Other CLEAPSS guides are available that deal with keeping and housing specific types of animal, eg, giant African land snails, stick insects etc. Where this is the case, reference is made to these publications and only basic information is given here. For secondary schools, all CLEAPSS publications referred to in this guide are on the most-recent issue of the *Science Publications CD-ROM*. Primary schools can request paper copies (or electronic files if desired) of these publications, free of charge.

2. Introduction

The range of animals kept in schools is very wide and includes protozoa (protists - single-celled animals), soil and garden organisms, various insects, crustaceans, fish, frogs, toads, newts, snakes, lizards, birds and small mammals such as rats, mice, gerbils, guinea pigs and rabbits. The educational value of having animals in or around the school must be balanced against the ethical concerns raised by keeping them in captivity. It is not the role of CLEAPSS to promote or oppose the keeping of animals in schools, although the educational benefits are clear. However, once a decision has been made to keep animals, it is important that they are provided with the most humane living conditions possible.

There are a number of principles that apply to the choice of all types of housing, no matter what animal they are intended for.

- The housing must be designed and maintained to ensure that the animals contained within it do not escape or suffer injury, disease, theft or interference by unauthorised persons.
- The housing must be designed to permit regular cleaning and the supply of food and water.
- Surfaces need to be such that they can be disinfected where necessary.
- It must be possible to provide temperatures and humidity levels at which the animals do not show distress or abnormal behaviour - usually similar to those in which the wild species live.
- Lighting should be as close as possible in duration and intensity to natural conditions, whilst not generating excess heat.
- It must be possible to examine the condition of the animals at regular intervals.

Sometimes these requirements may be achieved using housing that does not appear, to human tastes, to be particularly attractive or 'homely'. The laboratory mouse or rat cage, for example, consists of a plastic base with a metal wire lid that accommodates a food hopper and water bottle. It is draught-proof, airy and capable of being kept odour-free and warm. It may suit rodents, but many people consider that it looks bleak and inhospitable. Conversely, some animal housing sold for the domestic market may appear attractive but may not provide ideal conditions for its occupants. When selecting items for school use, the welfare of animals must be paramount - even if the choice needs to be explained to pupils.

3. Planning for keeping animals

Before any animal is acquired for classroom use, thought must be given to the choice of suitable housing. The need for such planning should be included as part of the school or science department policy on the educational use of animals and plants. Such a policy will also need to explain the rationale for keeping animals for educational purposes, bearing in mind the objections that some pupils and parents may have against the practice. Secondary schools in particular may wish to refer to CLEAPSS Guidance leaflet PS 3 *Keeping and using animals and plants* and PS 3A *The Use of Animals and Plants in School Science*.

On occasions, an animal may be brought into school that requires short-term 'emergency' housing. Plans should be in place to cope with such contingencies. Many of the items described in this guide will enable suitable provision to be made. CLEAPSS leaflet PS55 *Bringing pets and other animals into schools*, discusses issues involved when animals are or will be brought into school for a short period.

4. Health and safety issues when handling animals

Some types of animal present greater health or safety risks than others. Where such problems exist, they have been mentioned in the appropriate section of this document. The majority of animals available through suppliers present no hazards that good hygiene procedures cannot address.

When handling animals:

- do not consume food or drink,
- do not smoke,
- cover any open cuts or wounds with waterproof adhesive dressings and, if particular risks exist, wear suitable protective gloves, and
- wash your hands with soap and water before and directly after working with animals.

5. Housing animal collections

At one time, many secondary-school buildings may have included a specialist room to house the animals needed to teach the biology curriculum. Financial considerations and changes in modern biology curricula, and in attitudes towards the educational use of animals, have resulted in the virtual disappearance of this sort of provision. The reduction in technician time available for the care of animals has also contributed to this decline. Animal rooms are now considered expensive luxuries and may even be a target for animal-rights extremists. This is to be regretted, since properly-designed and maintained animal accommodation can provide a more peaceful and pleasant environment for animals than many of the alternatives - classrooms, laboratories or preparation rooms.

Whether in a purpose-designed room, or in a laboratory, classroom or preparation room, animal housing must be sited in a situation chosen to meet the following requirements.

- Fluctuations in temperature, humidity and light levels should be such that they do not prevent the housing from meeting the requirements described on page 1.
- There are few, if any, draughts.
- There are no sudden or loud noises.
- A sink with warm water is close at hand for cleaning and hygiene purposes.

From this, it is clear that animals should ideally be kept in rooms that are as quiet as possible, where frequent disturbance is unlikely and supervision levels are good (ie, a room where responsible adults are present most of the time). While central heating may provide the necessary warmth when a room is in use, at night and during winter holiday periods, temperatures may fall to an unsuitable level. This may call for the use of a supplementary heater, such as the small electrical heaters used to provide frost protection in lofts and greenhouses. The atmosphere in centrally-heated rooms is often too dry for moisture-loving species; a dish of water placed close to the room heater, may provide the necessary source of humidity. Windowsills may be unsuitable places for housing animals (perhaps depending on the direction faced). Light, temperature and humidity levels often fluctuate widely in these situations.

In reality, ideal accommodation may not be available and decisions must be made concerning the position that offers the best conditions for the type of animal that is being housed.

In addition, the animal housing must meet the specific needs of the species concerned. Often these can be met by simple adaptations to a basic form of housing. The following section describes some of these basic types. Where a supplier is mentioned in the text, contact details and basic information about the company is given in *Appendix I*.

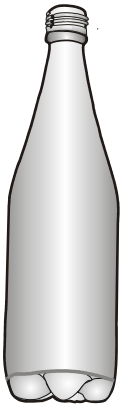
6. General housing provision

Many small animals can be housed, at least on a temporary basis, in any suitably-sized container that prevents their escape and accommodates any other essential items such as soil, food, twigs and bark.

6.1 Housing made from recycled or reject items

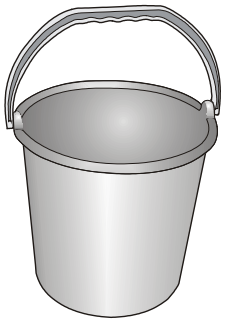
Everyday items can often be easily adapted to provide acceptable animal housing. If a lid is needed to prevent escape, it should have holes punched in it to allow air to enter. For keeping soil-dwelling animals, drainage holes may need to be punched through the base. Some commonly-used everyday items are shown below.

- Plastic drinks bottles are very versatile, since the top can be cut off to form a variety of containers or transparent tops for other containers.

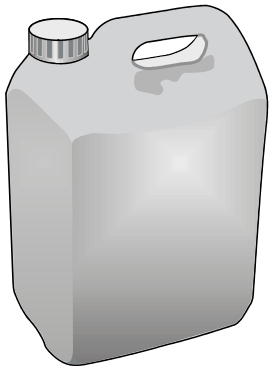


- Ice-cream tubs and margarine cartons are useful for carrying specimens around as well as forming temporary (if opaque!) housing. Because the plastic used for such containers is often white, they present a good background against which most animals show up well. A few products are sold in tubs with transparent lids - even better for observing the contents, provided the animals are not light-shy!

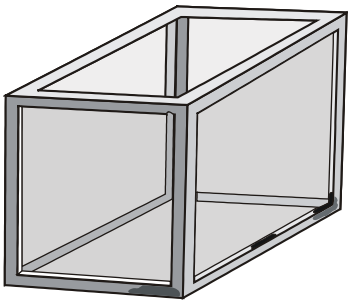
- Old plastic washing-up bowls and buckets, if still intact, can be used as temporary aquaria to house pond life. Containers with cracks are still useful for housing animals that prefer to live on or in a layer of moist soil (although additional holes may need to be made to provide sufficient drainage).



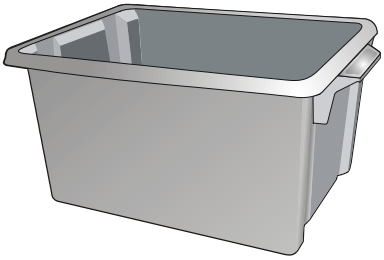
- Large plastic liquid containers can be cut up to make stable aquaria.

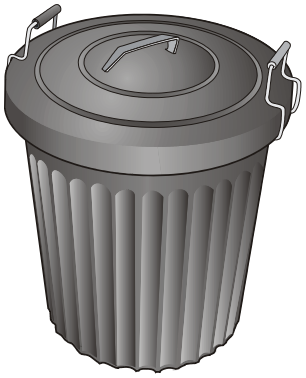


- Old metal-framed aquaria are increasingly difficult to obtain. When most aquaria were of this type of construction, it was easy to acquire a tank that had become leaky as a result of shrinkage of the putty seals or cracks in the glass. Fitted with a suitable lid, they make suitable housing for a wide range of animals, including those that require additional heating or lighting.



- Bins and crates are ideal for the large-scale cultivation of soil-living animals, provided they have drainage holes cut in their bases.





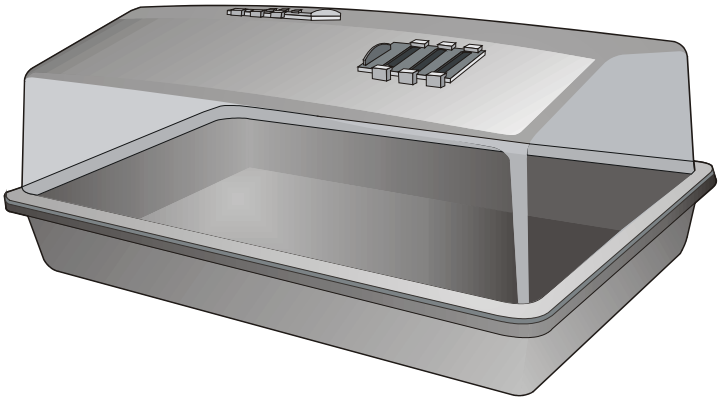
- Discarded balance cases (of the type used to house chemical beam balances).

- Metal or plastic cake and biscuit tins can be used to form the bases and lids of insect housing.

6.2 General-purpose, commercial housing and accessories

6.2.1 Plant propagators

Large tray propagators with transparent ventilated lids are widely available through garden centres. They can be quite useful for keeping small animals that are unlikely to escape when the lid is removed for feeding and cleaning. They are suitable for animals that require background heating, since they can be fitted with heating cables or pads.



Suppliers of plant propagators: Propagators are often stocked by educational suppliers (see *Appendix I*) but it is also worth exploring the products offered by local garden centres and horticultural suppliers, since these may be less expensive. Check *Yellow Pages* under 'Garden Centres' and 'Greenhouses' for details of these local sources. *Appendix II.1* gives some indication of the prices that you can expect to pay for some propagators.

6.2.2 Plastic boxes with lids

Small plastic boxes with lids are suitable for transporting and housing many smaller invertebrate animals. Many animals shy away from light so, unless the entire box is opaque, it will be necessary to place a dark cover over it to provide suitable conditions for the occupants and/or to add materials such as pieces of bark inside the container, under which the animals can retreat. If the lid is well sealed, holes must be drilled in it for ventilation purposes.

Suppliers of plastic-lidded boxes: A number of suppliers list plastic lidded boxes in a range of different sizes that are suitable for housing small invertebrate animals. *Appendix I* gives details of some of these suppliers and *Appendix II.2* a sample of catalogue prices for these items.

6.2.3 Commercial vivaria and terraria

The terms "vivaria" and "terraria" are applied to enclosures for housing small animals. They can be made from a variety of materials.

Melamine coated chipboard

This is often used by the manufacturers of flat-pack vivaria. These are usually fitted with sliding, toughened-glass doors. They can readily be fitted with heating and lighting equipment and are easy to

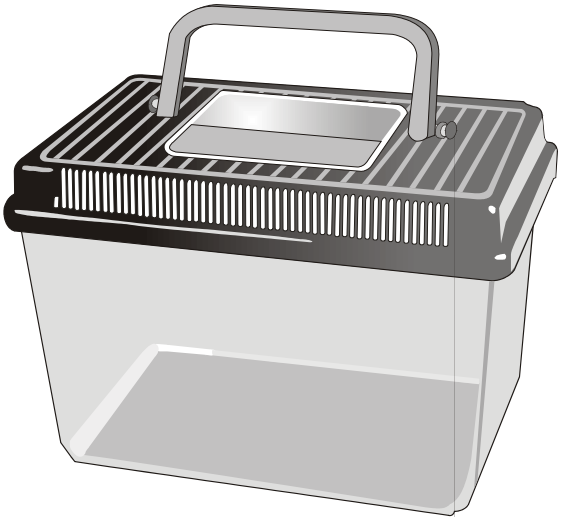
keep clean. However, they may have a restricted life because water can penetrate the chipboard causing the joints to separate.

Wood

This is a very suitable construction material for vivaria. It is a good insulator and can easily be adapted to accommodate lamp holders or heaters. If sealed with polyurethane paint, it has good resistance to water penetration.

Plastic

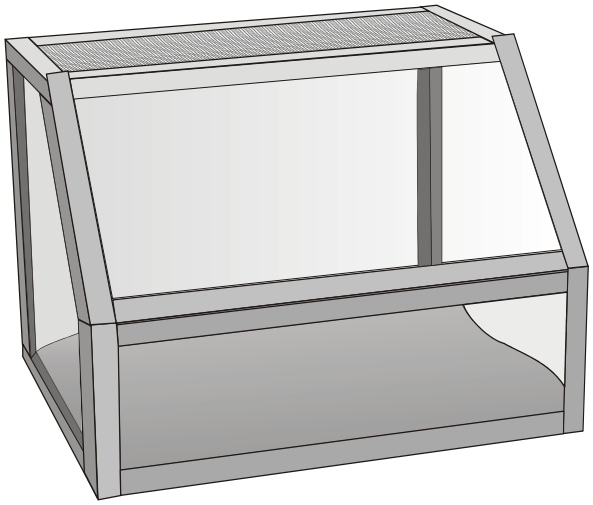
Small tanks of this type are cheap, yet provide a good general-purpose housing. The container is moulded from transparent plastic and is usually provided with a secure lid complete with ventilation holes. With their smooth interiors and rounded corners, these tanks are easy to clean and provide good security for the occupants. However, they provide little privacy for nocturnal or shade-seeking animals, scratch easily and cannot be used to house animals that require an intense source of heat. Many items described by retailers as "small plastic aquaria" are almost identical to some of these types and could serve equally well to house some land or aquatic animals.



A common type of plastic vivarium

Metal-framed glass terraria

These provide good accommodation for keeping and observing small amphibia and reptiles. The sides and top allow easy observation of the occupants but, in consequence, nocturnal or more-timid animals require some 'cover' in the form of vegetation, bark or other shelter. Being made of glass, the sides are not easily scratched by the occupants. They are, however, more difficult to clean than many other types since the corners are less accessible. These terraria are now very difficult to purchase but worth looking out for.



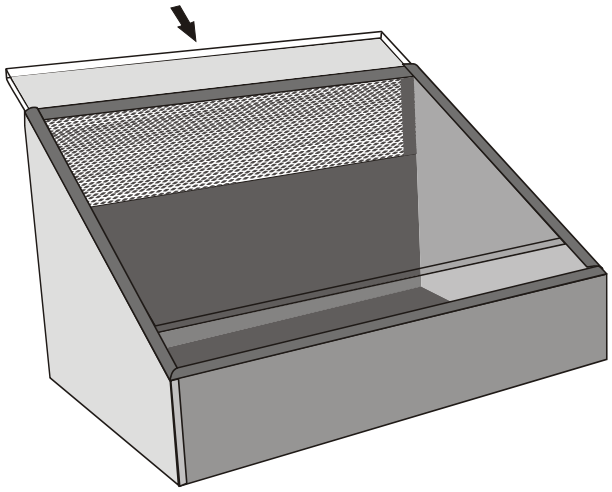
Metal-framed glass terraria

Metal-based vivaria

These are robust and durable. They do not rot and cannot be chewed or scratched. Doors or observation panels are usually made of *Perspex* and larger types allow heating and lighting equipment to be fitted. If made of steel, check that this has been well galvanised and shows no signs of rusting (a dab of *Hammerite* or an equivalent paint should be used to cover any chips). The metal walls provide screening for the inhabitants while the glass panels allow them to be observed.

A disadvantage of this type of housing (unless a good ventilation panel is fitted) is the relatively limited circulation of air that it provides and a build up of humidity. This may not be adequate for animals that require more-arid conditions. The problems of cleaning in corners that are discussed above for metal-framed terraria also apply to this type of housing.

As with metal terraria, this type of housing is now difficult to purchase.

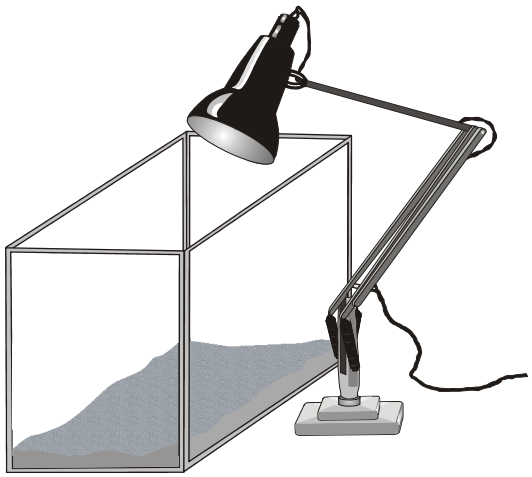


A small metal vivarium

Suppliers of vivaria and terraria: These are listed in *Appendix I* and guide prices for various types in *Appendix II.3 and II.4.*

6.2.4 Heating

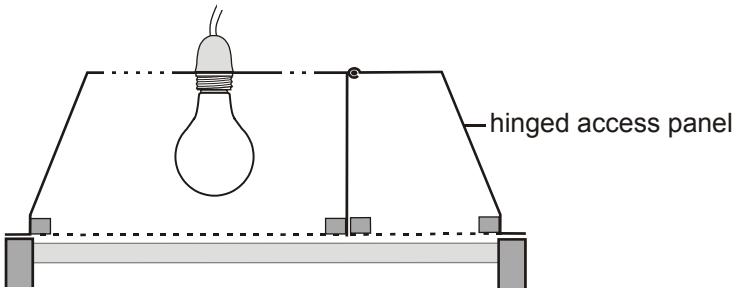
Some animals require a warmer environment than can be provided by the average classroom or laboratory. If the space that is to be heated is relatively small (a small storeroom for example) a small oil-filled radiator (such as that supplied by companies including Small Life Supplies - see *Appendix I* and *II.5*) may provide adequate heat. Where animal housing is kept in larger rooms a more direct means of heating will be necessary. A simple way of providing this is to direct an Anglepoise-type lamp towards the housing. The heating level can be easily adjusted either by altering the position of the lamp or by changing the wattage of the tungsten-filament lamp used (without exceeding the maximum permitted for use in the holder). The light emitted by the bulb is likely, however, to affect the activity of the animals at night. A piece of red acetate sheet (such as that used in theatrical lighting) placed in front of the lamp may help, since nocturnal animals are generally insensitive to red light.



Such heating is not very efficient, however, so it is worthwhile purchasing a purpose-made heating system for use with larger containers or for longer periods of use.

Heated tank covers

A simple development is to purchase or make a hood that fits over the tank and has batten holders for heating lamps. The hood should be ventilated and designed to prevent the occupants of the tank escaping or gaining access to the hot surface of the lamps. A means of accessing the tank for feeding or cleaning purposes without the need to remove the entire hood is a very useful feature. Note that many of the lamps sold for heating purposes have an Edison screw fitting and require the appropriate batten holder. Check that the construction of the hood is suitable for continuous use with the heating lamps that you intend to use.



Section through a vivarium tank hood

Heating cables

Those for use with plant propagators are equally effective in providing background heating for animals, either alone or as a supplement to an incandescent lamp. If buried in the substrate covering the bottom of the enclosure, care must be taken to ensure that the animals cannot damage the cable.

Heat mats and under-tank heaters

Heat mats or pads contain low-wattage, nichrome electrical heating elements embedded in a heat-resistant sheet. They are very useful for providing the general warmth that is necessary for heat-requiring species. They can be scratched by claws and so must be well-buried or (more usually) placed *outside* the vivarium. Some are suitable for use *underneath* the tank, others must be positioned next to one of the walls *above* the level of the substrate. If necessary, they can be regulated by connection to a thermostat placed inside the tank. They are available in various sizes and powers and are sold by pet shops and many of the reptile suppliers listed in *Appendix I*. Since they transmit heat in the form of infra-red radiation, they are able to provide warmth through a glass or acrylic wall, but not through wood or metal.

Some animals require more sophisticated heating systems. Information about these more-complex systems is given in section 7.10 *Reptiles.*

Suppliers of heating equipment: These are listed in *Appendix I* and guideline prices in *Appendix II.5.*

6.2.5 Lighting

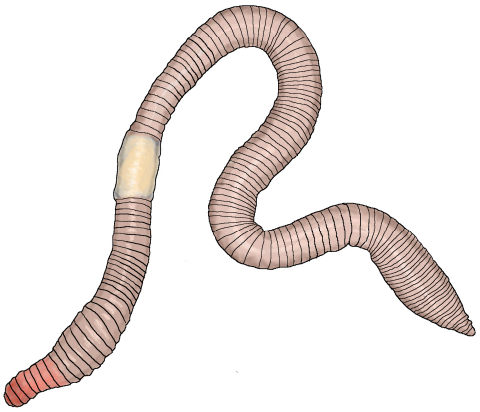
Apart from provision for observation purposes, additional lighting is often unnecessary (indeed, many animals actively avoid bright lights). There are, however, a few exceptions. If plants are to be cultivated within the animal housing, additional lighting will usually be necessary. Certain reptiles also require additional lighting for their health. Reference should be made to sections 7.8.4 *Hoods and the need for lighting* and 7.10.1 *Sources of heat and ligh*t for further information about tank hoods and lighting.

⚠ It is particularly important that sources of artificial lighting present no electrical hazards to observers and those that care for the animals. Aquaria present particular problems because of their close proximity to water.

Suppliers of lighting systems: These are listed in *Appendix I* and examples of costs in *Appendix II.19* and *II.26.*

7. Housing particular types of animal

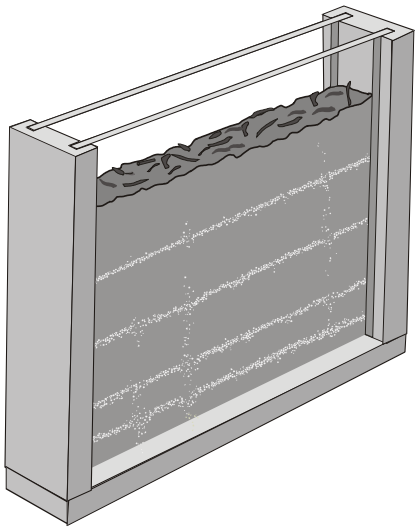
7.1 Earthworms



Housing needs

A spadeful of good garden loam will normally contain a number of worms, at least some of which will flourish when transferred to a container of moist (but **not waterlogged**) sieved, loamy soil covered with a layer of leaf litter as a source of food. Earthworms do not survive freezing temperatures or drying out, moving to more favourable conditions in order to survive. They also do not thrive at the higher temperatures normally found indoors. The most amenable conditions are provided by a covered large box, plastic bowl or bucket, with one or more small holes in the base for drainage, sited out of doors in a sheltered, frost-free position.

An alternative form of housing is the *observation wormery*, designed to make burrowing activities of worms easily visible. Such a wormery consists of a thin transparent container with an open top. Moist, humus-rich soil is then added to the container, together with a few earthworms. A layer of leaf litter is placed on the soil surface to provide the necessary food material. The entire wormery is then ***covered with a light-proof box, cloth or black plastic*** and left for a day or two before being examined for evidence of burrowing and reduction in leaf litter cover. To make the burrowing activities more visible, the wormery can be set up using alternate layers of soil and sharp sand, natural chalk (*not* crushed blackboard 'chalk') or fine gravel (to act as markers). The marker layers *must be thin* if worms are not to be discouraged from burrowing through them. Furthermore, far from every species of worm comes to the soil surface to drag down leaf litter. It is much more difficult to maintain healthy living conditions in the small volume of soil contained in an observation wormery than in the simple container type. Observation wormeries are therefore unsuitable for the long-term culturing of earthworms.



An observation wormery

7.1.1 Commercial sources of housing

Three types of housing are available on the market.

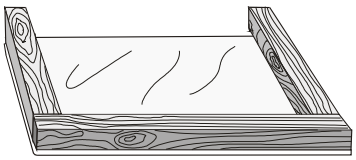
- *Observation wormeries*, which are available from both scientific and general school suppliers. Many are based on a design developed at the Rothamsted agricultural station. The original design had grooves in the end walls that allowed the glass to be removed for cleaning purposes but some modern versions lack this facility. The depth of the container should not be too large - distances greater than 25 mm between the two observation panels may not allow burrowing to be seen easily.
- *Cultivation wormeries* contain enough soil to maintain a colony of several worms for a period of months. Any large, opaque, covered container with one or two small drainage holes cut in the base will provide satisfactory housing. Some companies offer kits containing soil, 'bedding', a guidance booklet and a starter stock of worms (often *Lumbricus terrrestris,* a common surface-feeding type). This convenience comes at a cost, and may not represent best value for money for schools.
- *Composting kits.* These are usually designed for outdoor use and consist of a growing chamber to which kitchen vegetable scraps and garden waste are added, and a starter colony of worms. Some composters consist of several tiers each separated from that above and below by perforated partitions. As the worms break down the added vegetable matter, it gradually falls to the lower tiers. As a result, the lowest tier contains the finely-divided fibrous compost suitable for garden use.

  The usual type of worm supplied with such kits is the Tiger worm or Brandling (*Eisenia fetida*). The common names refer to the distinctive rings around its body that give it a striped appearance, the red streaks supposedly resembling brand marks. The retailers of kits usually provide full and helpful instructions for maintaining the product that they supply. Some retailers also operate informative web sites and telephone helpline services. Although they do not permit first-hand study of the behaviour of worms, the kits are a convenient way of learning about the recycling of organic material in the soil.

Suppliers and costs of observation wormeries, cultivation wormeries, composting kits and earthworms: These are given in *Appendix I, Appendix II.6, II.7* and *II.8* and *Appendix III.1*.

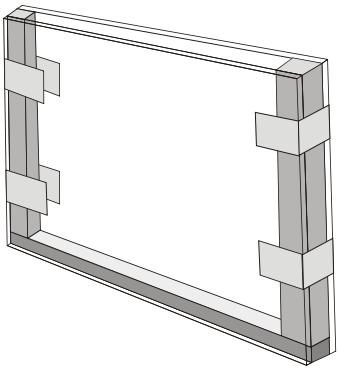
7.1.2 D-i-y suggestions

Observation wormeries need not be complicated - it is not necessary to spend much time or money making an elaborate construction. All that is required is a means of containing a thin section of soil inside a transparent container. For example, two sheets of *Perspex* or glass approximately 250 mm square, held apart by three wooden spacers approximately 25 mm square, make an effective observation wormery. Wider spacing is not recommended, since it prevents the activities of the worms from becoming visible. The 'sandwich' should be bound together using adhesive fabric tape (*Duck* tape or its equivalent). If glass is used, the top edges should also be covered with tape to reduce the risk of cuts. The gap between the sheets of glass is then filled with moist loam and leaf fragments added to the surface as a food supply.



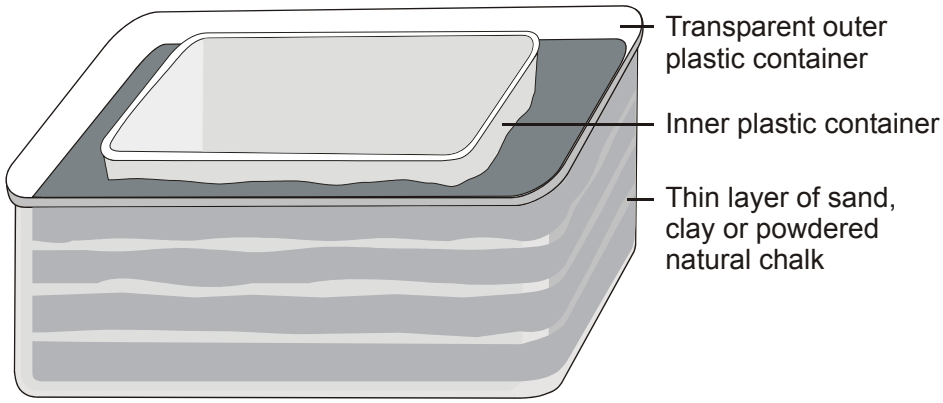
Wooden spacers laid onto a sheet of glass

The finished wormery ready for adding soil

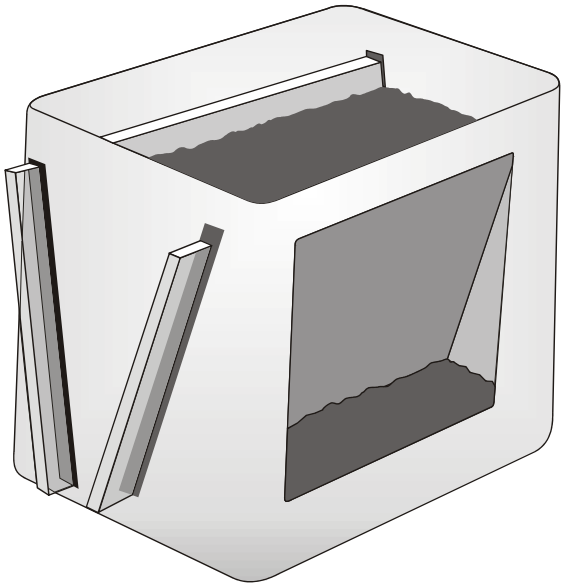


Other ways of creating an observation wormery without the need for carpentry skills are illustrated overleaf.

Box-in-box wormery Moist soil is placed in the bottom of a transparent food container. A smaller container (such as a margarine carton) is then placed on the soil to act as a spacer. The narrow space between the two cartons is then also filled with soil and a few earthworms. The narrow gap between the cartons allows the burrowing activities of the worms to be seen. *Thin* layers of sand or chalk (calcium carbonate) can be introduced as the wormery is set up.

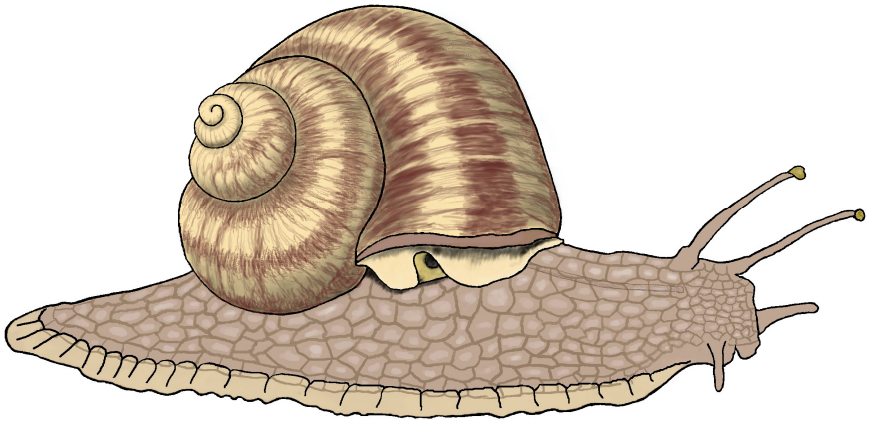


Carton wormery – slots cut in the ends of a plastic carton or box allow pieces of glass or *Perspex* to be pushed in to form a V-shaped container for moist soil and worms. The sides of the carton/box are cut out to allow viewing of the soil and the animals within it. Any sharp edges should be ground off or covered with tape.



[This arrangement is also suitable for studying the germination of large seeds such as those of broad bean or maize; plant the seeds near the transparent sheets and when the roots grow they will be clearly visible.]

7.2 Snails and slugs



Housing needs

Land snails and slugs are easily collected from any cultivated plot - indeed, some gardeners might even *pay* pupils to do so! Since slugs and snails have no waterproof outer layer over most of their bodies, they rapidly lose water when they extend their bodies for movement. They use their rasp-like tongues to scrape food from the surface of their food plant. Any housing that contains a supply of acceptable food and is sufficiently moist to prevent the animals from drying out will suffice. The top of the container needs to be closed sufficiently firmly to prevent the occupants from escaping but must **not** be airtight. This could be achieved by taping a sheet of *Perspex* onto the top of a tank - but raised up on several pieces of modelling clay or *Blutac*. A 20 mm layer of coarse gravel should be placed in the bottom of the container (to allow for drainage). This should be covered with a layer of leaf mould and planting compost that is then thoroughly moistened and maintained in this condition. A dish of water placed on top of the compost will help to maintain the humidity within the container. Fresh vegetation, such as lettuce leaves, should be provided daily. Uneaten food should be removed every day or so and the entire vivarium will require cleaning out every 4-6 weeks. Snails also require a source of calcium. This can be provided in the form of a piece of cuttlefish 'bone', some limestone or natural chalk - **not** modern blackboard chalk, which contains a high proportion of gypsum (calcium sulfate) rather than calcium carbonate. The company Offa Rocks can supply suitable samples; contact details are given in *Appendix I*. Eggshells are another alternative source, provided they have been washed, crushed and baked dry in a hot oven for 20 minutes.

Further information about keeping British land snails and using them as a basis for scientific investigations is in CLEAPSS Guide L213, *Science with Minibeasts: Snails*. For information concerning freshwater molluscs see section 7.7, *Aquatic invertebrates - Pond Creatures*.

Although it is not difficult to maintain land slugs and snails, pond snails such as the Ramshorn snail, *Planorbis corneus,* require even less attention, while allowing their body form and feeding habits to be easily observed as they graze on the film of algae growing on the glass of an aquarium (see section 7.7, *Aquatic invertebrates - pond creatures).*

7.2.1 Commercial sources of housing

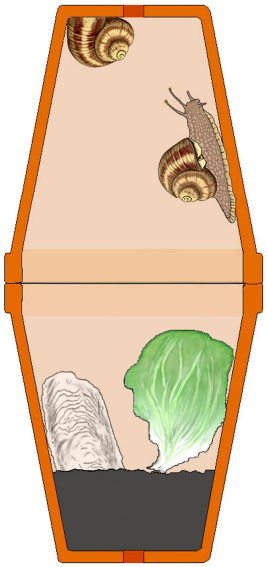
Small plastic vivaria, such as those listed in section 6.2.3, small propagator trays or pots with covers are perfectly suitable for housing small land snails.

Although they are eminently suitable, the more substantial metal and glass vivaria / terraria are expensive and their purchase cannot be justified for keeping just a few garden snails. However, if the school already possesses one for housing amphibia and reptiles it can be useful for keeping a large stock of snails when not otherwise in use. It is also ideal for housing tropical snails.

7.2.2 D-i-y suggestions

In addition to the d-i-y, general-purpose housing already described, quick and easy temporary housing for indigenous land snails and slugs can be provided by inverting one 8 inch terracotta flowerpot over another. Plastic pots are less stable (and retain less moisture) but could be taped together for stability. Longer-term housing needs to provide sufficient space for food plants to be introduced and have a

transparent cover (such as a cut-off plastic drinks bottle) to allow the animals to be observed. Propagators fit these requirements well.



A flower pot snail house

Temperate species (including those captured from the wild) require no additional heating. The housing containers should be placed in a cool, sheltered place.

Suppliers and costs of native land & pond snails: These are included in *Appendix I* and *III.2*.

7.2.3 Giant African land snails

These animals are widely available from biological suppliers and some pet shops. If larger numbers of the animal are to be housed, they require a tank measuring at least 1000 x 300 x 300 mm and some form of heating if they are to be kept successfully. Full details of the housing and care of these fascinating animals are given in CLEAPSS Guide L197 *Giant African Land Snails*.

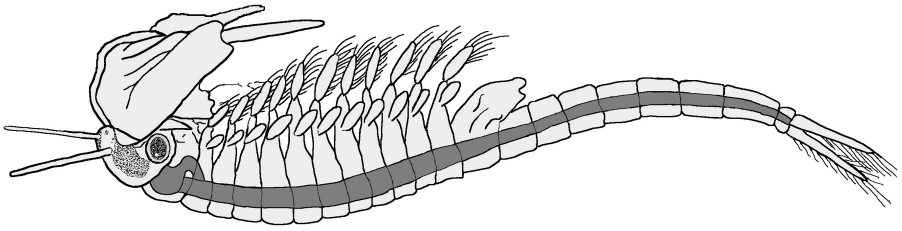
Suppliers and costs of giant African land snails: These are included in *Appendix I* and *III.2*.

7.3 Crustaceans

Crustaceans form a group that includes crabs, lobsters, shrimps, water fleas and woodlice. With the exception of woodlice, they are characterised by the possession of a tough *exoskeleton* covering most of their bodies. Many are marine animals and live in rock pools; they can be kept in salt-water aquaria (see section 7.8.6, *Coldwater marine aquaria)* but these require constant attention and can be difficult to maintain for long periods. Land hermit crabs offer an attractive alternative, since they are large enough for easy study and much less demanding in their housing needs.

Microscopic crustaceans, such as brine shrimps and freshwater *Daphnia* (water fleas), also find a place in school science work. Woodlice are not typical members of the group, since they have evolved to live on dry land. They have not fully adapted, however, since their exoskeleton is relatively permeable. As a result, they are only found in moist situations, often emerging at night when conditions are less drying. (Some species, such as *Ligia oceanica*, the sea slater, are found in coastal habitats, although many do not actually enter the water.)

7.3.1 Brine shrimps

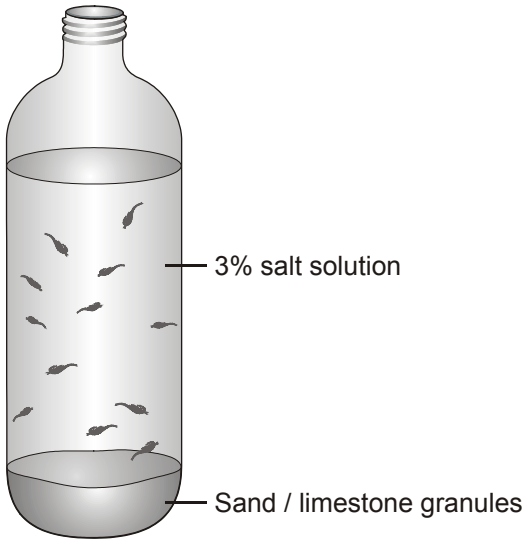


Brine shrimps (sometimes bizarrely called ‘sea monkeys’) are easy to keep and provide excellent material for studying the structure, behaviour and function of crustaceans. (Related species such as fairy shrimps are also available.) The brine shrimp normally available through suppliers, *Artemia salina*, occurs naturally in salt lakes and flats in the United States and elsewhere (it is no longer found naturally in the UK). Brine shrimp eggs survive complete drying out, providing a convenient form in which they can be purchased from educational scientific suppliers, pet shops and aquarists. When returned to salt water, the eggs hatch into juvenile shrimps. These swim upside-down, filtering out food in the form of algae and other microorganisms as they do so.

Housing needs

The eggs can be hatched in 3% sea salt solution placed in a covered dish (such as a Petri dish) kept warm by the heat from a tungsten-filament lamp. Non-iodised table salt can be used if sea salt is unavailable. A temperature of at least 20 °C is necessary for the eggs to hatch; 25 °C is ideal. If tap water is used to make up the brine in which the eggs are to hatch, it must be allowed to stand for 2-3 days before being used, in order to allow any dissolved chlorine to escape. Alternatively, treat the water with conditioning chemicals, available from aquarists.

Once hatched, the young shrimps should be transferred to a larger culture container to mature. A 1-litre soft drinks container or a small plastic aquarium is suitable for this purpose. The bottom of the container should be covered with a layer of sand or limestone (oyster shell grit from pet stores is quite suitable) to provide a surface on which microorganisms can flourish. A 3% sea salt solution (30 g in a litre of tap water) is then added, together with a few drops of Baby Bio. The culture container should then be placed in a warm, well-lit position (such as a window sill). After a few days, algae will start to grow, causing the water to become slightly green. At this stage the young shrimps can be introduced into the container. Alternatively, if warm conditions can be provided in the larger culture, the eggs can simply be added and allowed to hatch without the need for a separate hatching container.



A culture of brine shrimps

Although the adult shrimps are small (about 12 mm long fully grown), they are not difficult to observe using a Fresnel lens taped to the side of the container in which they live. Alternatively, a binocular microscope or an Intel-type digital microscope can be used. There are many investigative activities that can be carried out in the classroom using these fascinating animals. Further details on keeping and using brine shrimps are available from the ASE’s Science Year materials - ‘Can we? Should we? at:

www.sycd.co.uk/can_we_should_we/pdf/explore/miniprojects/mini_teach.pdf

The British Ecological Society has also published an invaluable book describing the culturing and use of brine shrimps.

Brine Shrimp Ecology by Michael Dockery and Stephen Tomkins ISBN 1900579103.
Price £14.50, including post and packing. This includes a starter kit with a substrate that includes the necessary microorganisms to colonise the salt water.

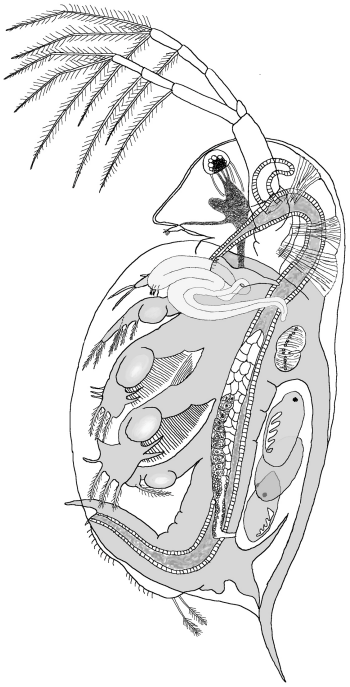
The book is available from the Homerton Brine Shrimp Project; see *Appendix IV*. Downloadable material from the book is also available from the British Ecological Society's web site:

www.britishecologicalsociety.org/articles/education/resources/curriculum/brineshrimp/

Brine shrimps make good food for many freshwater animals. They should be sieved out from the culture solution using a fine net and rinsed with a little aquarium water before being used.

Suppliers of brine shrimps: See local aquarists, *Appendix 1* and *Appendix III.3* for a price guide for brine shrimps, eggs and kits.

7.3.2 *Daphnia* (water fleas)



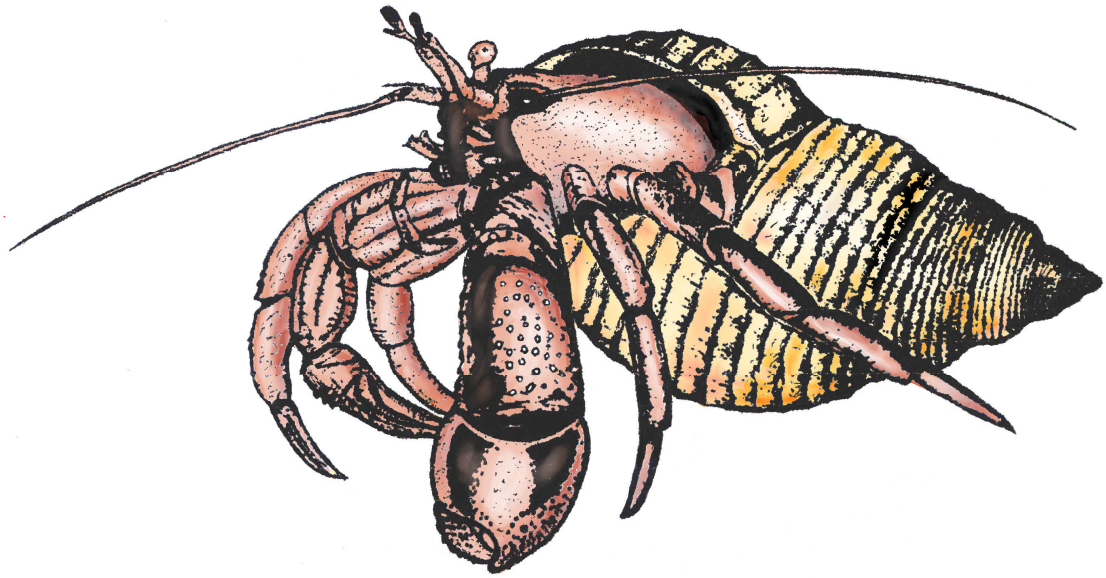
Commonly found in ponds and lakes and widely sold as live fish food, these animals are fascinating objects for observation and study in their own right. They feed by filtering minute particles, such as bacteria and algae, from the fresh water in which they live. They can be kept in any watertight container containing tap water that has been allowed to stand for a few days. Live cultures can be purchased from suppliers, including pet shops and local aquarists. Some scientific suppliers sell viable dried *Daphnia* eggs and culture kits. Alternatively, adult *Daphnia* can be collected by pond dipping but strict hygiene procedures must be observed, since pond water may be contaminated by pollutants and the bacteria causing Weil's disease. Stock purchased from aquarists is usually free from this hazard.

To provide the necessary food, many recipes for stable or farmyard 'tea' have been published. Extracts of manure provide a concentrated liquid rich in bacteria that could be added to the colony of *Daphnia*. However, it is safer, more hygienic and convenient to feed the animals on a few drops of a suspension of fresh yeast or of egg-yolk medium (made by blending a hard-boiled egg in 500 ml of water). Alternatively, food such as *Liquifry* No 1 or *Spirulina* powder can be purchased from aquarists or scientific suppliers. Small, regular supplies of food are required. Provide only sufficient to cause the water to turn just faintly cloudy. After a few days the *Daphnia* will have filtered out the suspended particles of food, making the water clear once more, whereupon more food should be added. Scum should be cleared from the surface of the water; debris that sinks to the bottom should be left - it may contain *Daphnia* eggs.

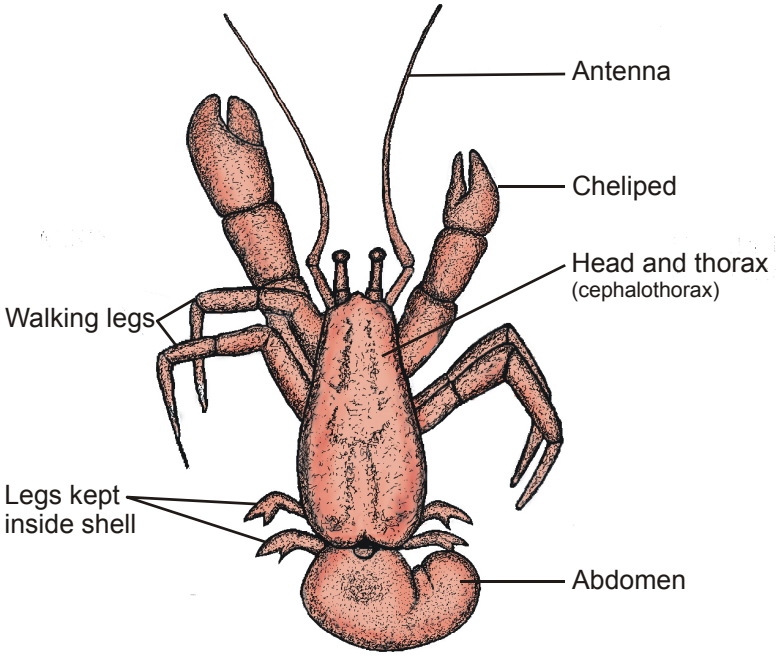
Keeping a few *Daphnia* is not difficult, but cultivating a vigorous, dense colony requires some care. A good supply of oxygen is necessary, either by aeration or by using a large shallow tank to ensure that a large surface area of water is exposed to the air. Warming the water to about 15 °C also ensures rapid growth of the colony.

***Suppliers of* Daphnia:** Cultures are widely available from aquarists and pet shops. *Appendix I* and *III.4* gives some sources and an indication of likely costs.

7.3.3 Land hermit crabs



Tropical land hermit crabs are available through a number of specialist suppliers and larger pet stores. The most common species available is *Coenobita clypeatus*. As with other hermit crabs, the exoskeleton covering the abdomen is relatively delicate and the animal protects it by occupying an empty mollusc shell.



Housing needs

Land hermit crabs begin life in tropical oceans but later move onto land and spend their adult life on warm sandy beaches. Here the humidity reaches 70 - 90% and temperatures between 24 and 28 °C. Their housing must therefore provide similar conditions.

Basic housing is not difficult to provide. Ideally, the crabs should be kept in a *glass*-walled tank, since plastic types soon become scratched (see section 6.2.3 for details). A glass aquarium with a lid can also provide suitable housing. A tank with dimensions of 600 x 300 x 300 mm will accommodate up to about 10 crabs. A secure lid is essential, both to maintain a humid atmosphere and to prevent escape, since the crabs are active climbers. At its simplest, this may consist of a sheet of glass supported above the top of the tank on small pieces of modelling clay or *Blutac*. An anglepoise-type lamp placed close to the tank could provide the necessary warmth, once positioned correctly.

Although not essential, tanks with ventilated lids and built-in holders for heating lamps make the provision of suitable conditions even simpler. If the animals are housed in a room that becomes cold at night, additional heating, such as heating pads placed under the base of a glass tank or against one of its sides, should be considered. Heating cables are not recommended, since the animals are strong burrowers and could damage them.

The floor of the tank should be covered with a layer at least 80 mm deep of moist silver sand (*not* builders' sand), or a sand and gravel mix. This should be shaped into shallow mounds and hollows. As with other arthropods, hermit crabs regularly moult their outer skin to allow for growth. They usually burrow into the substrate during this process and so require sufficient depth to permit this.

In order to provide the correct humidity, the contents of the tank should be sprayed with water from a hand spray each day. In addition, the hollows in the sand should be kept moist by the addition of small quantities of fresh water. Some authorities believe that a dish of brackish water should also be provided (5 tablespoons of sea salt in a gallon of water is the suggested concentration). Others suggest that sea salt should be added to the sandy substrate at a rate of about 25g for each 1000 square centimetres of surface.

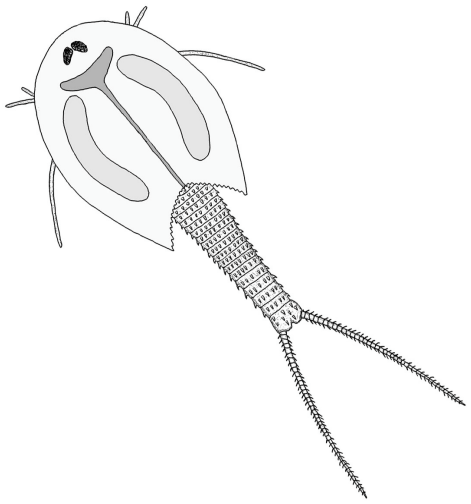
Drinking water must be provided in a *shallow* dish and replaced every 2 or 3 days. If tap water is to be used for drinking it should be left to stand for several days to release the chlorine added by water companies.

The furnishing of the accommodation is also important. Land hermit crabs are active climbers, often seeking food in trees and bushes. Some surfaces such as small branches should therefore be provided, although care should be taken to ensure that these do not reach the top of the tank thereby providing the crabs with a means of escape. Large stones, slate or pieces of bark are needed to provide places of retreat, together with a variety of differently-sized marine mollusc shells for the crabs to choose as a suitable 'home' after moulting. Do not offer shells of *land* snails, since these are rarely accepted. The shells need to be larger than those currently used by the crabs. A piece of cuttlefish should be provided to ensure the crabs have an adequate supply of calcium, which will be used to produce the hardened exoskeleton after moulting.

Land hermit crabs are scavengers and eat a variety of foods. Soft fruit and vegetables are particularly acceptable, while many authorities state that raw fish and dog food are also well received. Special hermit crab food is also available. Some experimentation will be necessary to determine the preferences of the particular individuals concerned. No matter what is offered, it should be provided in small quantities and placed in a dish so that it can be removed before it decays.

Suppliers of tropical land hermit crabs: Stocks are usually only available from specialist suppliers of exotic animals. *Appendix 1* and *III.5* provides sources and some indications of the likely cost of stock.

7.3.4 Tadpole shrimps - *Triops*

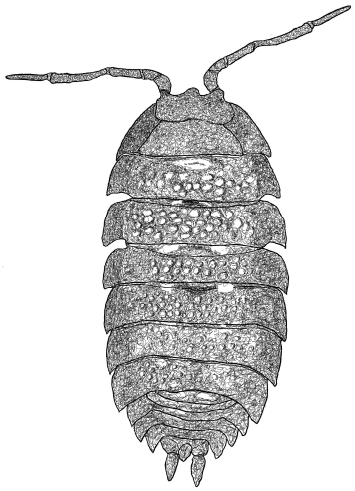


Fossils of this type of crustacean, a relative of *Daphnia*, occur in rocks from the Triassic age. Unsurprisingly, they are advertised by some suppliers as 'animals from the age of the Dinosaurs'. Their eggs resemble those of the brine shrimp in being able to survive long periods in a completely dry condition, hatching out only when returned to water. Unlike the brine shrimp, however, these animals live in *fresh* water. The eggs hatch out and develop when placed in a tank of warm *distilled* water. The temperature

should be maintained between 20 and 24 °C, either by means of an aquarium heater/ thermostat unit (see section 7.8.5 *Tropical freshwater aquaria*) or by placing a lamp close to the tank. In these conditions, the animals grow very rapidly, reaching an adult size of between 20 and 60 mm. *Triops* should be fed on commercial fish food supplemented by small dead organisms such as insects or small fish. Uneaten food should be removed before it decays and fouls the water. Despite being a scavenger, *Triops* is an indiscriminate feeder and may attack and devour small living creatures, including other *Triops*. For this reason, they should be kept in as large an aquarium as would be used to accommodate similar quantities of fish (see section 7.8.1 *Choice and siting of the aquarium*). Between 4 and 6 hatchlings can be expected from each pack of *Triops* purchased. As with all non-native animals, the adults must not be released into the 'wild' but rather allowed to live out their lives in captivity.

***Suppliers of* Triops:** *Appendix I* and *III.6* gives an indication of sources and the likely cost of supplies. They are also available from several Internet sites but often at inflated prices.

7.3.5 Woodlice



Woodlice are crustaceans that have adapted to life on land. They are often required in large numbers for choice-chamber studies of their behaviour. As this may create problems for urban schools, establishing one or more colonies to provide the necessary specimens is a sensible approach. Woodlice favour conditions very similar to those described for earthworms. They survive in any reasonably-sized container such as an old aquarium or trough full of moist soil and leaf litter. This should be covered to exclude light and retain moisture and placed in a relatively cool and sheltered place out of direct sunlight. The soil should be kept moist but not waterlogged. A variety of stones, bark and rotting wood should be placed onto the top surface of the soil to provide places for the woodlice to colonise.

If kept outdoors, such an environment will often become naturally colonised by woodlice. However, if this does not happen, or the animals are intended for use in choice-chamber work, it is worthwhile 'seeding' it with individuals of the *same* species, ie, the animals should *look* the same! The container and contents should then be brought indoors to prevent further colonisation.

At intervals, a food supply consisting of plant material, such as potato, carrot and other root vegetables, cut up into medium-sized pieces should be added. A lump of cuttlefish or chalk (natural, *not* blackboard chalk) should also be added to the soil to provide a supply of calcium carbonate.

Where a school has developed an environmental area, placing pieces of wood, bark or stone on the soil will encourage colonisation by woodlice. This will provide a source of material for observation as well as extending the range of microhabitats in the area.

7.4 Giant millipedes

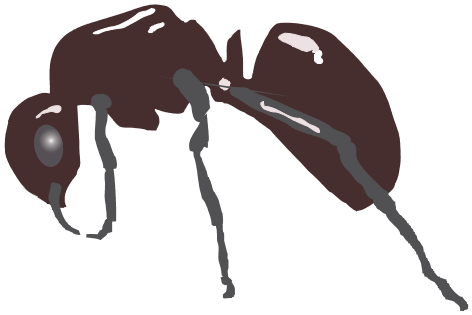
Reference should be made to CLEAPSS Guide L201, *Giant Millipedes*, that gives full details about keeping these unusual animals. They require warm background heating (20-27 °C) in a secure vivarium, tank or propagator containing a layer of moist, fibrous soil. They feed on pieces of soft fruit, vegetables and leaf litter.

Suppliers of giant millipedes: *Appendix 1* and *Appendix III.7* provide suggested sources and an indication of the likely cost of stocks.

7.5 Insects

This is a very large group containing animals that live in a variety of different environments. A range of housing is therefore required to provide for different types of insect. Housing for each of the insects most commonly kept in schools is therefore described under separate headings.

7.5.1 Ants



Given some thought and preparation, it is possible to keep ants in the classroom or laboratory, thereby enabling pupils to gain a valuable insight into the life of a social insect. However, it is necessary to plan carefully if they are not to die a premature death or to escape.

Housing needs

The basic requirements for housing a colony of ants are:

- a surface on which the ants can build their nest,
- sufficient, suitable nest-building material (if a ready-made nest is not provided),
- access to food (usually in a foraging area),
- a means of maintaining the moisture level in the nest,
- suitable temperatures to ensure that the ants remain healthy and active (in winter a tungsten-filament lamp placed near the nest may be required if room heating is inadequate; in summer, colonies kept indoors must be sited to avoid overheating),
- a cover to provide dark conditions in the nest (except when ant behaviour is being observed), and
- some means of preventing their escape.

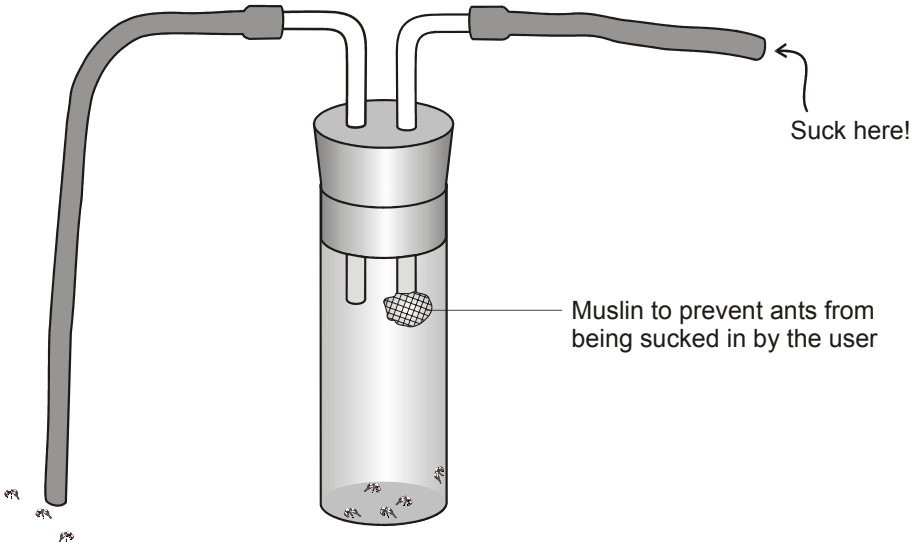
Once a colony has settled into suitable housing (a *formicarium*), routine maintenance is relatively easy. Most types of ant feed quite readily on a solution of sugar or honey in water. This should be positioned so that the ants have easy access to it. Occasionally a crushed multivitamin-and-mineral tablet should be added to the mixture. Every few days the food container should be cleaned and replenished, to ensure that fresh food and liquid is always available. Occasionally, for variety, small pieces of sugary fruit (such as banana, apple or peach) and freshly killed insects should be offered; uneaten portions must be removed before they decay. If capturing insects for this purpose proves difficult, crickets from pet shops provide a suitable alternative if they are killed (by putting them into a freezer or ice compartment) and then cut up into pieces. Surplus insects can be frozen for later use. In addition to food, ants require a source of water. A piece of moist sponge or cotton wool provides a suitable supply.

Commercial ‘kits’ are usually supplied with a small colony of ants, but it will be necessary to collect specimens from the wild when setting up d-i-y formicaria or restocking purchased ant ‘towns’. There is a variety of views about the suitability of different species for cultivation. The shiny red ant, *Myrmica rubra,* found quite commonly in gardens, appears to survive successfully in captivity. The yellow and brown garden species (*Lassius flavus* and *Lassius niger)* produce formic acid and seem to tolerate disturbance and transportation less well.

The nests formed by ants are of two different types, mounds and horizontal underground gallery systems. Different types of formicarium may therefore be necessary to provide suitable housing for the different ants. The woodland ant, *Formica rufa,* and *Lassius flavus* build mounds; *Myrmica rubra* builds horizontal galleries and can easily be encouraged to form nests by spreading flat stones onto a sunny patch of soil early in the year. The ants are likely to establish nests underneath them by early summer.

Once a nest has been located it can be carefully excavated using a border spade or a long trowel. A pooter (see *Appendix II.9*) is then used to collect individual ants. Ants can move very rapidly, so all the necessary collecting equipment should be at hand before excavation begins!

Collecting ants with a pooter



Once the pooter tube is full of ants it can be removed and quickly plugged with cotton wool. If spare tubes are available it is possible to continue collecting further ants. (If more than one pupil uses a pooter, each must use a different mouthpiece. In any case, each mouthpiece must be disinfected after use by immersing it in a solution of *Milton* for at least 30 minutes.) Sufficient soil must also be taken from the area to enable the ants to build a new nest in the formicarium to which they are transferred.

If it proves difficult to catch ants using a pooter, the entire nest can be carefully dug up and transferred to a black plastic refuse sack, leaving plenty of air above the contents. The sack should be securely sealed before attempting to move the colony to its new home. No matter how carefully the move is undertaken, the ants undergo considerable disturbance and will not display normal behaviour for several days.

If possible, workers carrying larvae and at least one queen ant should be collected together with a number of individual worker ants. Queens are considerably larger than the workers and are often surrounded by larvae. **Most colonies last no more than one or two months without a queen ant.** Long, flat-pointed tweezers are ideal for lifting the queen, which should be placed in a separate tube for safe-keeping. Nests of *Myrmica rubra* each contain several queens, so the chances of catching one are not as remote as with some other species.

If all else fails, a colony can be purchased from one of the wildlife suppliers.

When observation of the animals is complete, the entire colony should be returned to the site from which it was originally obtained. Ants forming part of a commercial kit cannot be returned in this way. If the ants belong to a native species they can be released into an environment that matches their normal one as closely as possible. However, in the unlikely event that non-native ants have been supplied, they should be killed by placing the colony in the freezing compartment of a fridge or a freezer for several days; it is *illegal* to release non-native species into the wild.

Commercial housing equipment

Ant towns and nests

These are usually simple, transparent, plastic containers with a lid or a lip to discourage the escape of the occupants. Other than convenience, they offer no advantages over the simple d-i-y housing described later. The colonies provided with the equipment rarely include queens, so the life of the colony is certain to be limited. A recent development is the use of a moist gel medium for the ants to burrow into.

Suppliers of ant towns and nests: See *Appendix II.10* for sources and guide prices of some ant housing.

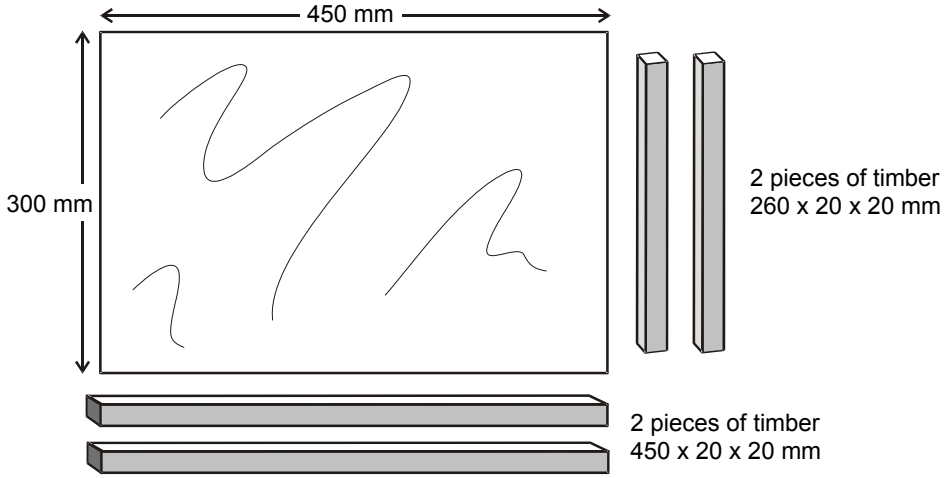
Suppliers of ants: *Appendix 1* and *III.8* suggests sources and price information on some suppliers.

D-i-y suggestions

Vertical designs

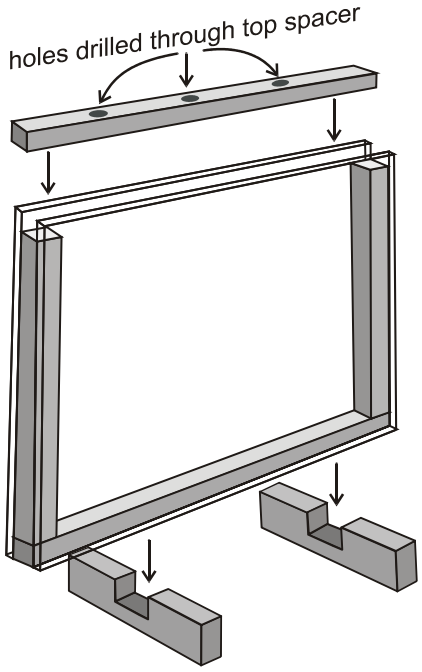
(Suitable for mound-building species such as *Formica rufa*, and *Lassius flavus*)

One simple, well-tried design consists of a 'sandwich' made from two sheets of glass or *Perspex* approximately 300 mm x 450 mm, held apart by four wooden spacers each 20 mm in cross-section.



Components of a d-i-y formicarium

The glass and three of the spacers are held together with fabric adhesive tape (such as *Duct* tape). Any remaining exposed sharp edges should also be taped over. The removable top spacer has three 10 mm diameter holes bored through it as shown below. Two or three slotted 'feet' are required to hold the formicarium upright. (NB. The slots need to be cut to make a tight fit!)

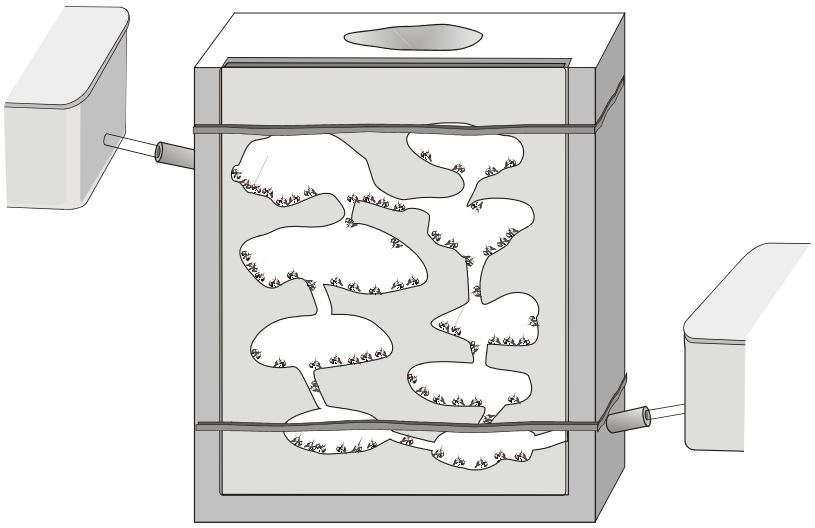


The space between the sheets is then filled with damp, sandy soil to which the collected ants are added. If the local soil is heavy, add *horticultural* sharp sand to lighten it. Plug one of the holes in the top spacer with a piece of moist foam 'sponge' or absorbent fabric. Plug the second hole in the same way but moisten the foam with a honey or sugar solution. The third hole allows insects or pieces of fruit to be added and should be kept firmly plugged when not in use. If ants are seen to escape, smear the exit point with fluon (a Teflon-based paint available from some suppliers, including Blades Biological) to contain them or, failing this, vegetable oil.

When ants are not being observed, sheets of card or hardboard should be placed over the nest to exclude light. Ensure that the formicarium is kept in conditions so that it will not become too hot or dry.

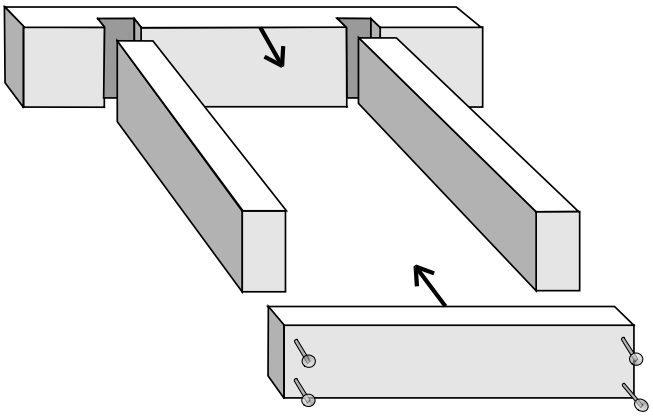
A vertical plaster formicarium

Nests made from Plaster of Paris provide ready-made accommodation and do not allow ants to engage in nest-building activities. They do, however, make observation easy and can be used repeatedly. The front of this type of formicarium consists of a sheet of glass or *Perspex* that allows for observation of the colony and provides access for setting up the colony and cleaning. This sheet is held in position using elastic bands or string. A depression in the top of the plaster allows water to be added to maintain the humidity. Plastic or rubber tubing connects the nest to containers in which food and water can be supplied. These containers can be left open to allow observation of the activities of the ants, provided that the rim is liberally smeared with fluon or mineral oil. The nest is normally covered with a sheet of dark cloth or paper to exclude light.

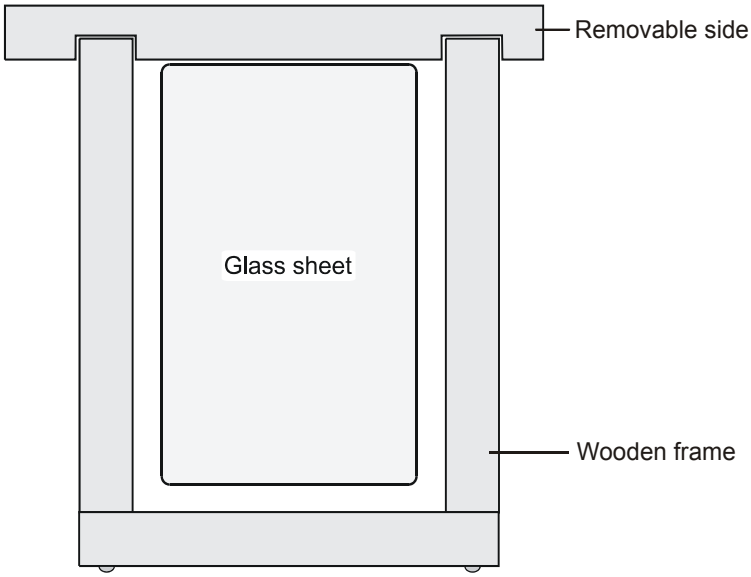


Instructions for constructing a vertical plaster formicarium

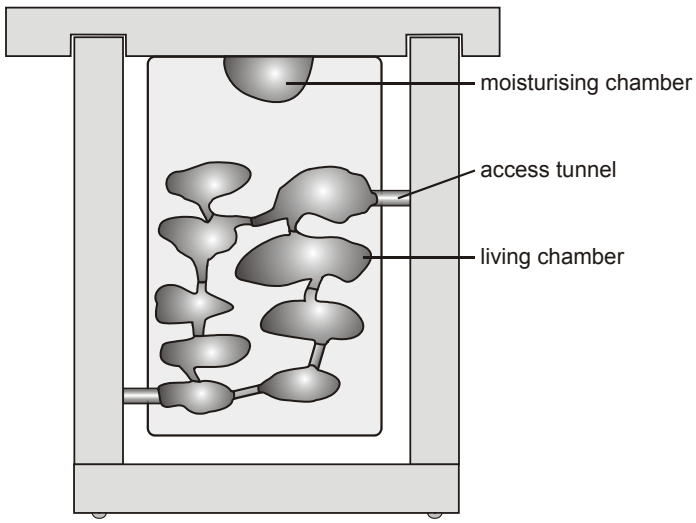
- Protect the work area with a piece of stout polythene sheeting (waterproof membrane used by builders is ideal).
- Obtain a sheet of window glass or *Perspex* at least 250 x 200 mm. Ask the supplier to polish and round off the edges.
- Make up a frame approximately 40 mm deep into which the plaster will be poured. It should be 20 mm longer and 40 mm wider than the sheet of glass you are using. One side of this frame needs to be easily removable. Place the frame on the sheet of polythene.



- Position the glass inside this frame so that one of the edges is in contact with the removable side of the frame.



- Lightly smear a film of petroleum jelly onto the glass surface.
- Create the chambers and interconnecting tunnels by moulding their shapes using modelling clay. Press the clay forming these structures firmly onto the glass. The moisturising chamber is made by pressing modelling clay onto the removable side of the frame. This produces a large depression at the top of the nest, unconnected to the living chambers, into which water can be poured.
- Create two access tunnels by pressing pieces of wide-bore glass or plastic tubing between the frame and two of the clay chambers.



- Pour a Plaster of Paris mix into the frame. When first mixed, the recommended ratio of two parts of plaster to one of water is sufficiently runny to ensure that the spaces are filled and there are few air bubbles in the set plaster. However, the plaster begins to harden within a few minutes and it may be necessary to remoisten the mix to ensure that a satisfactory cast is produced. If desired, the plaster can be coloured using a non-toxic colouring such as a food dye.
- Once the plaster has set, remove the frame and carefully prise out the glass. Take out the tubes used to form the entrance and exit.
- Use a wooden spatula to remove as much of the clay from the plaster as possible.
- Clean up the glass, if necessary using industrial methylated spirits (HIGHLY FLAMMABLE) on a cotton wool swab. Polish off with a soft cloth.
- Use a file or rasp to remove any excess plaster, particularly any that would make it difficult to reposition the glass over the plaster.
- Connect plastic or rubber tubing between the access tubes and the foraging chambers as illustrated earlier. Use modelling clay to seal any gaps.

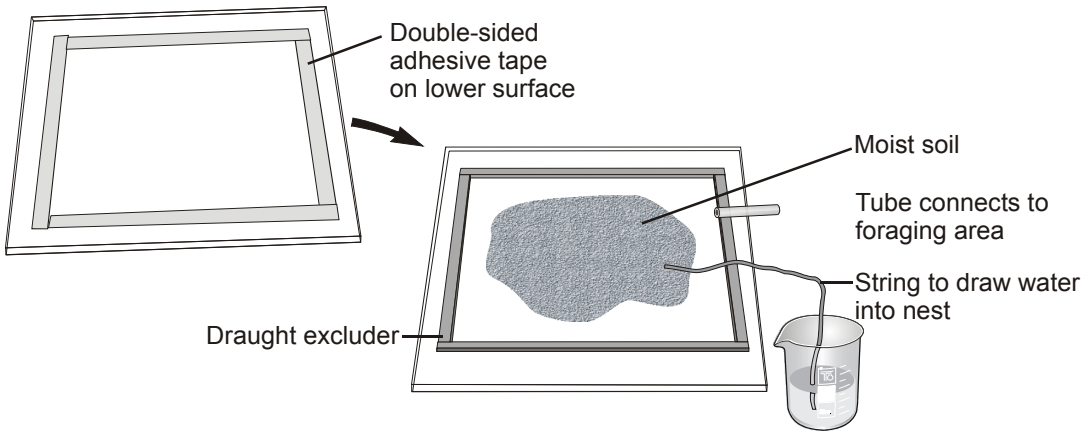
Horizontal designs

(Suitable for species such as *Myrmica rubra* that build horizontal galleries)

Horizontal nests can be constructed using similar principles to those used for vertical nests.

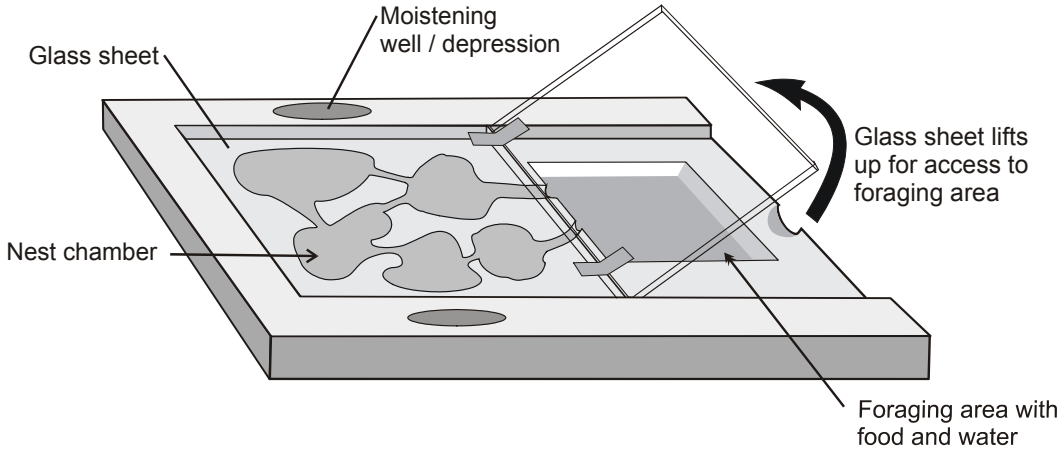
Horizontal soil nests

In these types, the nest consists of soil sandwiched in a narrow (about 7-15 mm wide) gap between two sheets of glass or *Perspex*. The nest is contained by a wall of modelling clay or draught excluder that separates the two sheets of transparent material. Drinking straws or similar tubing pass through the wall to provide access to a foraging area containing food and water. The soil can be kept moist by means of a string wick connecting the soil to a container of water.

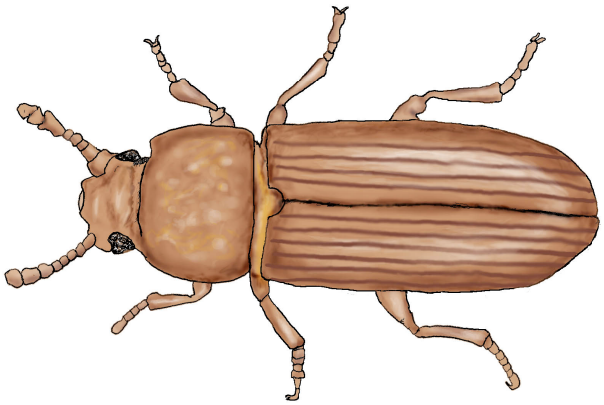


Horizontal plaster nests

These are constructed in the way described for vertical plaster nests, but the shape allows the foraging area to be built into the nest. This design uses two sheets of glass or *Perspex*, one of which covers the nest while the other can be lifted to enable the food supply to be changed. As usual, the nest should be covered with an opaque sheet when not being observed.



7.5.2 Beetles



A number of beetles are sometimes kept in schools to provide examples of different types of insect, for studies of behaviour, genetics and the exoskeleton, or as food for carnivorous animals such as frogs or lizards. Small beetles available from suppliers include **flour beetles** (*Tribolium spp.),* **mealworms**, (the larval stage of the beetle *Tenebrio sp.),* the **seed beetle** (*Callosobruchus maculatus*), the **grain weevil** (*Sitophilus sp.)* and **larder beetles** (*Dermestes sp.*).

In addition, a variety of much larger, tropical beetles which, as adults, feed on fruit is now available. These include animals commonly called Sun or jewel beetles which often have spectacular colours.

Small beetles

Any large plastic box with a ventilated lid will provide adequate housing for keeping **mealworms**. The mealworms should not be exposed to light. The larvae can be fed on a layer of dry porridge oats, bran or breakfast cereal placed in the bottom of the box. To provide moisture, pieces of sliced apple or potato can be placed on the surface of the food. Alternatively, a small jar half full with cotton wool that is kept moist can be stood inside the box, provided that this will not be upset. The larvae feed actively and grow rapidly, moulting several times during the process. After some weeks the larvae become pupae, gradually darkening over the first few days. Pieces of broken-up egg boxes or crumpled paper provide suitable places to which the beetles retreat while this process is occurring. The pupal stage lasts for about 20 days, after which the adult beetles emerge and commence feeding on the same diet of cereal products. If culturing mealworm beetles as a food, several colonies should be started in succession, since the life cycle takes about four months even at 30 °C. (Note that the *giant* mealworm is a different species, *Zoophobas morio*, requires more moisture in its housing and has a longer life cycle.)

Other small beetles can be kept in a similar way, varying the food to meet the dietary requirements of the species concerned and the size of the container. Seed beetles eat the seeds of legumes and thrive on black-eyed beans, grain weevils on barley or wheat seeds. (Make sure that seeds have not been treated with pesticides!) For flour beetles, use a 4:4:1 mixture of white flour, wholemeal flour and finely-powdered baker's yeast. Alternatively, proprietary diets for some beetles are available from certain suppliers.

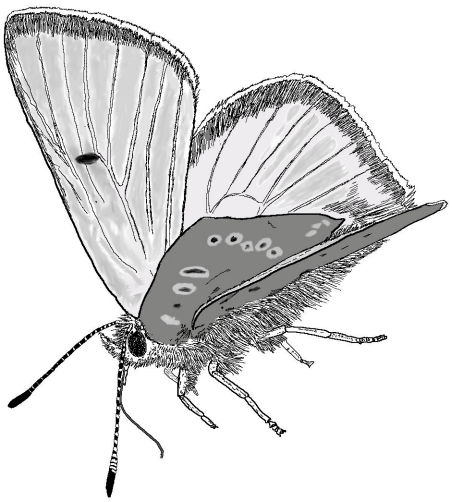
Fruit beetles

These can be housed in any convenient transparent container with a well-ventilated lid to which is added at least a 20 cm layer containing a mixture of peat and leaf litter (preferably from oak trees). Pieces of rotting wood are added to this mixture. The substrate should be moist but not wet and sprayed occasionally with water. A temperature of 22-25 °C is needed, so a heat mat will often be required, depending on the normal temperature of the surroundings.

Any type of fruit is normally acceptable. Beetle larvae feed on decayed wood and leaf litter but also on fruit; bury some pieces in the substrate. Remove uneaten fruit before it spoils. Sunlight stimulates the adult beetles to mate, so the animals' housing should be placed near a window but not in direct sunlight.

Suppliers of beetles and their food: See *Appendix I* and *III.9* for sources and prices of a number of different beetles and diets.

7.5.3 Butterflies and moths



Butterflies and moths are educationally useful, both as a means of raising pupils' interest in the natural world and as examples of insects with a complete life cycle - one in which the larval stage results in the formation of an inactive pupa, within which a complete internal transformation occurs, resulting in the emergence of an adult, able to exploit a different environment from that of the immature stages.

Obtaining stock and housing needs

A wide variety of species is marketed by educational scientific suppliers and specialist companies. Web sites of companies such as Worldwide Butterflies (see *Appendix I*) identify easy-to-care-for types that are currently available for sale. These include native British butterflies which can be released to the wild but there are also several spectacular exotic moth species with large and colourful caterpillars and adults.

Information about suitable food plants for each type is included in the publicity provided by many companies that supply eggs or larvae. Ensuring the availability of food plants is an essential preliminary before ordering stock. For a few species, educational suppliers sell an artificial diet which allows such butterflies or moths to be reared when the normal food plant is not readily available or easily collected.

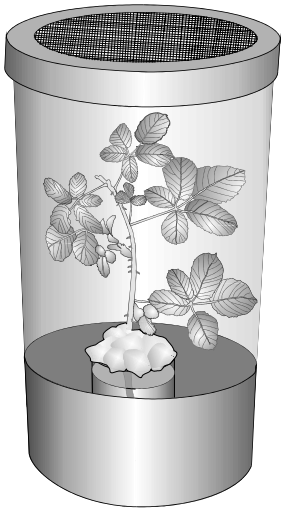
Alternatively, eggs can be harvested from the leaves of many shrubs and trees although the progeny that emerge from such finds will inevitably be rather uncertain. Oak, hawthorn and willow trees are particularly rewarding sources of stock. Leaves on which eggs have been found should be transferred to a small transparent plastic box with as little disturbance as possible. Eggs will normally hatch within a period of three weeks, after which the now-dead leaves can be replaced with fresh ones from the host plant. Larval stages of these insects can be kept in any cage that will accommodate the food plants favoured by the caterpillars. Once mature, the caterpillars will pupate. It is important to provide suitable conditions for this to take place - some caterpillars climb onto twigs or branches to pupate while others (particularly those of moths) bury themselves underground. Such information is widely available in the literature.

Commercial butterfly and moth housing

There is a variety of cages on the market that are suitable for housing insects. Most cages fall into one of three broad categories.

- Plastic cages (usually cylindrical).
- Netting cages of various shapes.
- Substantial rectangular types, often with door panels and mesh walls to provide ventilation.

Plastic-bodied cages



This type of cage, with a clear cylinder of plastic sheeting, is widely available and suitable for a variety of insects. Most examples, however, are too small or inappropriate to accommodate the adult stages of butterflies and moths, although they are quite suitable for housing caterpillars and pupae.

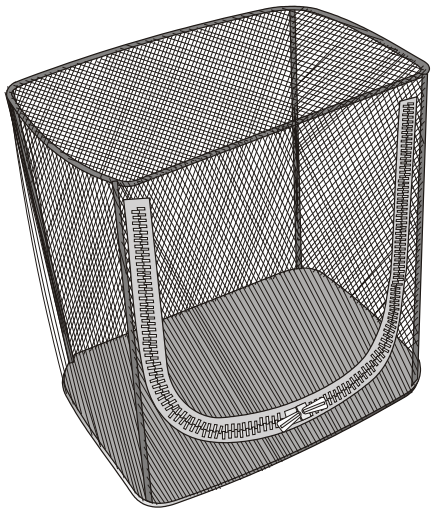
Suppliers of plastic-bodied cylinder insect cages: *Appendix II.11* lists some sources and prices for this type of cage.

Netting cages

These may be cylindrical or box-shaped. There is one type, the *Bug hut*, that is too small to accommodate insects for more than a day or so. The remaining commercially-available cages are of three types.

- Bottomless cages that can be placed over a plant (or part thereof) on which caterpillars are feeding and tied to prevent the escape of insects.
- Hanging, cylindrical cages, usually with zips. Can be made free-standing by inserting supports.
- Free-standing, rectangular cages with a base that can contain both caterpillars and adults together with their food plant.

Free-standing types are the most versatile, since they are suitable for the long-term care of a wide variety of insects, not just butterflies and moths.

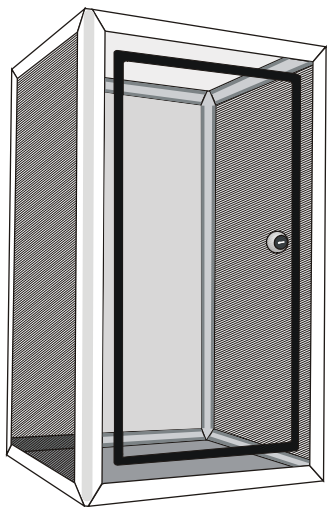


Free-standing netting cage with zipped entrance

Suppliers of netting cages: *Appendix II.12* gives sources and costs for a number of netting cages.

Large rectangular cages

These cages, sold by specialist suppliers, are designed for the long-term housing of adult butterflies, moths and other species such as stick insects. They are usually constructed around a framework and differ from netting types in having more-rigid walls, sometimes with locking doors. Because they are more substantial and complex, they are more expensive than other types. However, they are likely to last longer, which may, in the long term, justify the extra cost. Small-Life Supplies also sells liners for the base of its cages.



A typical commercial insect cage

Suppliers of large rectangular insect cages: Sources and costs of this type of cage are given in *Appendix II.13*.

Complete butterfly and moth 'kits'

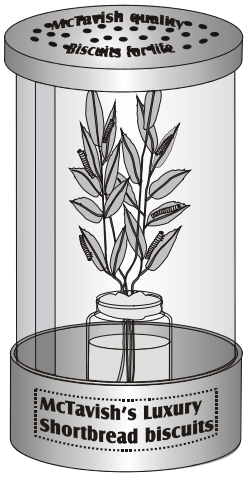
It is now possible to buy complete culture kits (including cage, care instructions, accessories and a voucher for the necessary eggs or caterpillars) for various species of butterfly and moth. In some kits, a supply of artificial food is included. Although relatively costly, these kits reduce some of the uncertainties in studying insect life cycles in the classroom.

Suppliers of butterflies, moths and kits: Sources and prices are given in *Appendix I* and *III.10.*

D-i-y suggestions

It is relatively easy to construct a cage using simple materials. For short-term use, a framework can be constructed from wooden strips glued and pinned together. A covering of fine nylon netting can then be attached using staples or a low-temperature glue gun. Many cage suppliers stock suitable netting for this purpose. If it is necessary to open the cage, for example, to replenish the food plant, one side of the cage must be independent and held in position with wire or clips.

If larval and pupal stages are of particular interest, it is possible to use smaller cages than those designed for adults. D-i-y versions of cylindrical cages can be made from transparent acetate (OHT) sheet taped to form a cylinder and secured to a plant pot or biscuit tin. The open top of the cylinder should be covered with netting or the lid of the biscuit tin, pierced with ventilation holes. Even cut-down plastic soft-drinks bottles can be converted into quite effective cages for keeping caterpillars; see below.



A good use for biscuit tins…

... and discarded soft-drinks bottles

The d-i-y, timber and netting cage described in Guide L227, *Stick insects,* is also quite suitable for keeping all stages of the life history of butterflies and moths.

Timber and netting cage

Some secondary schools may still have purpose-made locust cages (see section 7.5.7, *Locusts* for information about these insects). These cages can be used to keep a variety of insects provided the holes in the perforated floor that accommodate locust egg-laying tubes are blocked off (eg, with large corks or bungs). The adjustable heating of these cages is a useful feature when keeping tropical animals requiring elevated temperatures.

7.5.4 Cockroaches

Cockroaches were once widely used as a teaching example of a winged insect. Although the native species are serious pests and an indicator of unhygienic conditions, imported species from more tropical countries are worthy of consideration for teaching purposes in schools.

Housing needs

Of the several species of cockroach that have been used, the Giant Madagascan Hissing cockroach (*Gromphadorhina portentosa*) is widely-available. As its name suggests, it is large (up to 75 mm long), hisses when touched and, since it does not survive cold conditions, unlikely to cause infestations if it escapes, unlike native species. It is also relatively slow-moving and has the further advantage that it is relatively odour-free. Another giant species is *Blaberus cranifer*.

Such cockroaches live in warm, dark, damp places; conditions that can easily be provided in an old aquarium or large plastic tank (one about 450 x 350 x 200 mm is ideal). This must be fitted with a secure lid and the floor covered with a layer of sand, soil or other moisture-retentive medium about 50 mm deep. A hand-pumped sprayer should be used daily to dampen the medium and keep it moist (but **not** wet). The substrate needs to be replaced every few months but, other than feeding, no other routine care is necessary. Pieces of bark or broken-up egg cartons should be provided to allow the insects to retreat out of sight during daylight hours.

Place the housing near a gentle source of heat such as a radiator or tungsten-filament light bulb - heat pads or cables are only essential during periods when the room heating is likely to be turned off during winter. Another good source of heat is an infra red-emitting sheet that can be attached to the glass side of the tank in which the animals are living (see the section 7.10 *Reptiles* for further details of these heaters).

Cockroaches eat a wide variety of scrap foods such as dry dog-food pellets, stale bread, raisins, cheese or portions of boiled eggs. A neater way to provide food is to spread a thick layer of a paste made up of rolled oats, powdered milk, sugar and water onto heavyweight paper and allow it to dry. Small squares of this can then be offered to the insects once or twice a week. Alternatively, cockroach diet can be purchased from some of the major suppliers. A test tube of water plugged with a *tight* wad of cotton wool will supply the water necessary for these insects.

Suppliers of cockroaches and their food: See *Appendix 1* and *III.11* for an indication of some sources and costs of these items.

7.5.5 Crickets

The diet of some reptiles, spiders and other carnivores consists of (or includes) *live* animals. Crickets are particularly useful for meeting this requirement, since they are easy to keep, breed in large numbers and are widely accepted as food. The breeding of species as a food source for other animals is an issue that teachers may wish to discuss with their students, since it raises a number of moral questions.

Although crickets are widely available from pet shops and specialist reptile dealers, schools may prefer to keep their own stocks in order to ensure a limited but regular supply, rather than purchasing large numbers of individuals, many of which may not be used as food. Two main types of cricket are widely available, the house or brown cricket (*Acheta domesticus*) and various species of the field or black cricket (*Gryllus spp*).

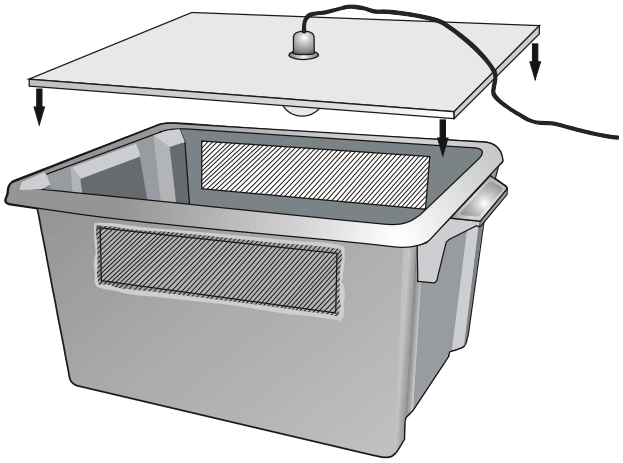
Housing needs

A large aquarium or a plastic crate provides adequate space for a colony of up to 50 insects. The smooth, deep walls of these containers prevent the insects from climbing out and reduce the need for a lid to

prevent them from escaping. Note, however, that adults can leap one foot, especially when disturbed! A band of fluon or petroleum jelly spread around the inside lip of the container can further discourage the more adventurous insects.

All crickets thrive in warm conditions (25-30 °C and even up to 35 °C). Heating should be provided either by means of a tungsten-filament lamp fitted to the lid or placed close to the tank. If the container is heat-resistant, a heat pad or cable can be used.

Crickets require *well-ventilated* conditions, similar to those described for locusts (see Section 7.5.7). If containers are deep enough, they need not be covered with a lid. In many situations, however, a lid will prove necessary; care must be taken to maintain good ventilation. If a solid lid is used to cover a plastic crate, holes should be cut towards the top of the container. Nylon netting can then be glued over the holes using a hot glue gun or another suitable adhesive.



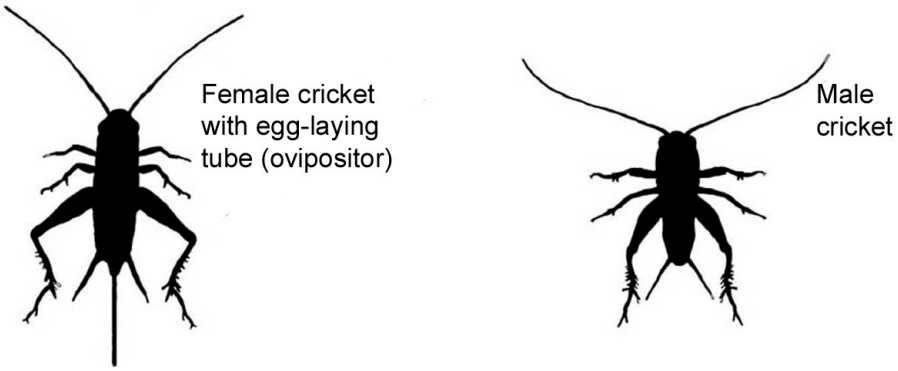
Alternatively, a securely-fitting lid, consisting of a timber framework covered with netting, can be used.

A layer of *dry* horticultural vermiculite about 10 mm deep should be placed in the bottom of the container to absorb moisture and waste material. This must be removed and replaced with fresh absorbent once or twice a week. A small scoop is useful for removing the vermiculite but care must be taken not to dispose of young crickets together with the soiled substrate.

Some pieces of paper egg cartons, cardboard tubes or inverted cardboard flower pots (with a V-shape cut out) should be added to provide shelter and a surface on which the crickets can climb. Water is provided by placing wet paper towel or cotton wool in a small container (such as a coffee-jar lid) but this will need regular attention to keep it wet. Alternatively, use the method suggested in the section on cockroaches.

Crickets eat bran, a variety of fruit and vegetables, supplemented by some protein in the form of dry dog food or fish flakes. Alternatively, they can be fed on rabbit diet pellets, poultry feed or cricket diet. Placing the food on small dishes allows uneaten food to be removed and replaced every day or two.

Female crickets can be distinguished from males in their possession of a long egg-laying organ (the ovipositor) on the tip of their abdomen.



A container of moist sand or peat should be placed in the cage if crickets are to be encouraged to breed.

Suppliers of crickets and their food: Some indication of sources and the cost of these items is given in *Appendix I* and *III.12*.

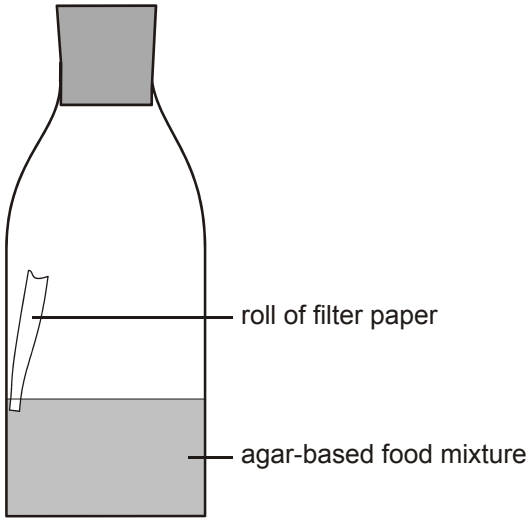
7.5.6 Drosophila (fruit flies)

Fruit flies occur naturally wherever there is decaying fruit. They have been extensively used in research into genetics because they are simple to keep and show a range of easily visible inherited variations such as wing shape and eye colour. They can be used as food for very small amphibians.

Housing needs

In the wild, adult flies are almost invariably to be found feeding on the natural yeast that grows on the surface of decaying fruit. They can be collected by inverting a wide-necked jar over the fruit. A sheet of stiff card or plastic is then slid under the mouth to prevent their escape. The flies can be transferred for culturing to glass or plastic bottles each containing a small portion of ripe banana. The necks of the bottles should be plugged with foam stoppers to prevent the flies from escaping. For many years, research workers and school science departments alike cultured *Drosophila* in the one-third pint milk bottles that were then widely available. Now that these are much less common, scientific suppliers market glass bottles or vials specifically for the purpose. Colonies of flies succeed best when kept in a warm situation (25 °C) out of direct sunlight. If available, an incubator allows optimum temperatures to be provided. A temperature of 25 °C is necessary for genetics work in order to ensure the shortest life cycle from egg to adult.

If flies are required for experimental studies, both wild-type (ie, red eyed, long winged and grey bodied) and a range of mutant forms can be purchased from scientific suppliers. A drier food medium is also necessary so that the flies do not become trapped and can be handled without spilling the other contents of the culture tubes. Various recipes have been developed to meet these requirements, all of them are based on agar jelly to provide the necessary firm consistency. Sugar is added to this jelly together with a source of starch and an anti-fungal agent to help prevent contamination. A little powdered yeast is then sprinkled onto the surface of the medium. A recipe for one such nutrient medium appears on CLEAPSS *Recipe Card* 22. Ready-mixed products are also available from some of the major scientific educational suppliers.

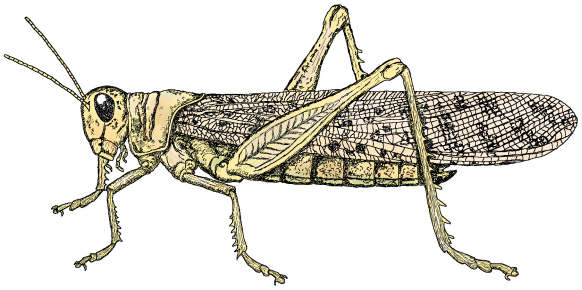


The eggs laid in the medium by the adult flies hatch quickly into larvae that eat their way into the food supply. Once full-grown, the larvae seek out a surface on which to pupate. This can be provided by pushing a roll of filter paper into the partly-set nutrient medium. The paper also helps to keep the medium more solid, since it permits water to evaporate from its surface. Alternatively, some suppliers, such as Blades Biological, sell plastic 'ladders' that are claimed to hold the medium firmly in place.

Details of handling the flies and carrying out investigations of genetic mechanisms appear in some biological textbooks; contact CLEAPSS if such references are needed. See also CLEAPSS *Bulletins* 106 and 107 for information about methods of anaesthetising the flies for examination.

Suppliers of* Drosophila, *food and accessories: Suggested sources and sample prices for these items are given in *Appendix I* and *III.13*.

7.5.7 Locusts



The locust was, for many years, the 'type' insect that biology students studied and dissected. It is a good example of a winged insect with an incomplete life cycle, ie, one in which the immature stages (instars) are similar (but smaller) to the adult, only gaining their wings at the final moult.

Housing needs

In the absence of a purpose-built locust cage (see below), any of the larger frame cages described in section 7.5.3 is suitable for keeping locusts, provided that they can be maintained at temperatures between 25 and 34°C (ideally 28-34 °C by day and 25-28 °C at night). Sufficient heat may be provided by placing an electric light bulb next to the cage. Some twigs or other surfaces should also be provided for the insects to climb and to carry out their final moult into the winged stage. Their diet consists of almost any type of vegetation: grass, other leaves (including leaf vegetables such as Brussels sprouts), seeds, root vegetables, bran and cereal products. It can be convenient to germinate cereal seeds (barley, oats, wheat etc) in shallow trays or dishes of water. Sections of the 'mat' of germinated seeds and shoots can then be cut up and fed to the locusts. Water is only necessary when the insects are fed exclusively on dry products such as bran. Maintaining a shallow dish with a pad of paper towelling or cotton wool in a moist condition should provide an adequate source of water. Containers of moist sand (about 100 mm deep) are required to allow the females to deposit their eggs (but note the comments below concerning the advisability of maintaining long-term colonies of locusts).

Commercial locust housing equipment

Until recently, locust cages designed specifically for the maintenance of large colonies of the insect were available, albeit at high cost. Many are still to be found in secondary schools. They differed from the basic insect cage in having an elevated perforated floor with holes, into which are fitted tubes of moist sand for egg laying. Two tungsten filament bulbs supply heating, one above the floor and the other below it. The upper bulb can be switched off at night, leaving the lower one to maintain the temperature. Some versions include a thermostat to regulate the temperature inside the cage.

⚠ Locusts should not be maintained in continuous culture because particles from their skin and droppings may provoke an allergic response in those caring for them. If locusts were to be maintained throughout the year, the likelihood of allergies developing would be increased.

*For this reason, the sand tubes in commercial cages should **not** be used and the holes in the flooring blocked off with suitably-sized corks or bungs.*

For short-term studies (ie, until the adults reach the end of their natural lives after a few weeks), the risk of allergic reactions is small. Nevertheless, care must be exercised when cleaning out the cages to avoid raising dust.

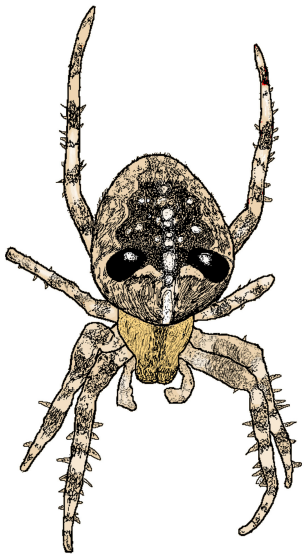
Suppliers of locusts: *Appendix I* and *III.14* give some sources and prices for these animals.

7.5.8 Stick insects

Details of the housing and care of these insects are given in CLEAPSS Guide L227, *Stick Insects*. The various cages described in the guide represent good, general-purpose types that will be suitable for many other insects. Cylinder cages, whether commercial or d-i-y types constructed from a cylindrical biscuit box and an OHP transparency sheet, are suitable for insects requiring moderate or high levels of humidity. Frame cages with mesh walls are necessary for insects that flourish in drier conditions.

Suppliers of stick insects: *Appendix I* and *III.15* give some sources and prices for these animals.

7.6 Spiders and harvestmen



Housing needs - Native species

British spiders can be kept for *short* periods in a sandwich box or similar container. Spiders collected outdoors may not survive the relatively warm conditions in classrooms and need to be kept in a cool place. For longer-term housing, a small glass tank with a secure, well-ventilated lid is necessary. This could take the form of a wide-mouthed jar, the lid of which is either perforated by a number of holes or replaced with fine netting held in place by an elastic band. Alternatively, a small aquarium can be converted into a vivarium by the addition of a secure mesh-covered lid. Ground-nesting species require a layer of soil or sand about 40 mm deep in the bottom of the container and a supply of water in a small vessel such as a bottle cap. A broken flowerpot or piece of bark will provide adequate shelter. The substrate should be kept moist (but not waterlogged) by the use of a hand spray. Web-building species require a framework on which to construct their webs. This can be provided in the form of a branched twig, the base of which has been pressed into a ball of modelling clay. Spraying the web with water each day provides the necessary moisture.

Being carnivorous, spiders require a supply of fresh insects. Dead insects are not accepted, so it will be necessary to trap fruit flies and introduce them into the container in which the spider is housed. A weekly feed is normally sufficient.

Housing needs - Tropical spiders

Large tropical spiders make interesting pets. Despite their fearsome reputation, many tarantulas and similar species are docile unless disturbed and are therefore safe to keep in schools, **provided they are housed in tanks that cannot be interfered with.** They should be handled as little as possible and due care taken to avoid contact with, or inhalation of, the hairs that cover the body of these spiders. These hairs can cause an allergic reaction in some individuals. It is important to ensure that they cannot be blown into or otherwise transferred to the eyes, which can be penetrated by some sharp hairs.

All tropical species require larger housing than indigenous species - a tank about 300 x 300 x 300 mm - with a layer about 50 mm deep of moist **horticultural** vermiculite in the base. The floor must be sprayed with water at least twice a week to keep the substrate moist (**not wet**) at all times. Some form of heating (such as a pad or a warming cable) will be required to maintain the optimum temperature of approximately 24 °C. Ideally this should be regulated using a thermostatic probe placed inside the tank.

Water must be provided in a shallow dish such as an upturned coffee jar lid. Large tropical spiders can be fed on crickets, maggots, mealworms or locusts. Maggots can be obtained from fishing tackle shops. Other live food can normally be obtained from retailers that stock spiders and reptiles, or from specialist insect live foods suppliers who send by post (several companies are listed in *Appendix I*, *III.9, III.12, III.13* and *III.14*).

Spiders moult regularly as they grow. They must not be fed during the moulting period when their skin is soft. This will be complete by about 5 days after moulting has occurred.

Suppliers will advise on suitable species. The range of species available changes rapidly, so it will be necessary to establish availability before placing an order. The Chilean Rose *Grammostola (Phrixotrichus) spatulata*, Entre Rios *Grammostola (Phrixotrichus) iheringii*, Curly Haired *Brachypelma (Euathlus) albopilosa*, Red Rump or Black Velvet *Brachypelma (Euathlus) vagans*, Mexican Red Knee *Brachypelma (Euathlus) smithi* and Mexican Red Leg *Brachypelma (Euathlus) emilia* all have a good reputation as being docile and easy to keep. It is important to remember that tropical spiders are a costly investment, meriting careful preparation before committing the necessary money and time.

For those interested in keeping tropical spiders, the British Tarantula Society provides access to a great deal of guidance as well as providing a mechanism for members to dispose of their surplus stock to fellow enthusiasts. Contact details are provided in *Appendix IV*.

Suppliers of spiders, their food, housing and accessories: Sources and prices of some tropical spiders are given in *Appendix I* and *III.16*.

7.7 Aquatic invertebrates - pond creatures

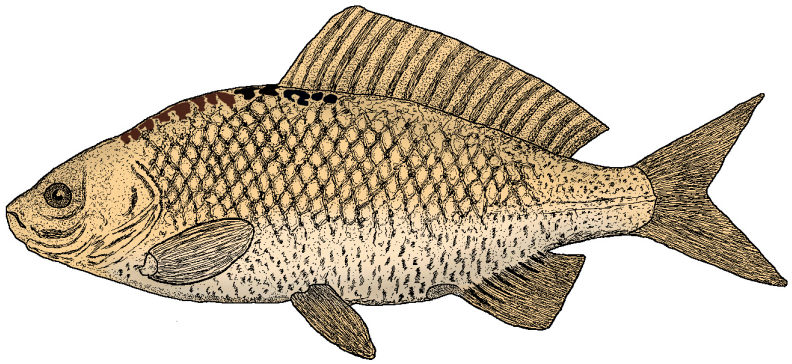
Provided they are kept separately from their natural predators, many of the animals collected during 'pond dipping' or purchased as examples of particular freshwater invertebrate groups can be kept for a few days in a small tank or dish in the classroom or laboratory. This provides invaluable opportunities to make extended studies of their structure and behaviour before returning them to the wild. They have relatively limited capacities for regulating their internal body fluids and often cannot tolerate fluctuations of temperature, pH, osmotic concentration or salt balance. It is possible to set up a long-term 'complete' environment if pond water, mud, stones and aquatic plants are housed in a large, well-illuminated container, such as a clean crate. Avoid exposing the container to long periods of sunlight, however, since this may cause the temperature to rise excessively.

Plastic containers should be used in preference to metal ones, since the latter are better conductors of heat and may also introduce harmful chemicals into the water. Containers should be kept out of sunlight and away from draughts to minimise temperature fluctuation. Scrupulous hygiene must be observed when handling the contents of the tanks, since the pond water used to fill them might be contaminated with bacteria causing Weil's disease. Tap water should not be used to top up tanks unless it has been allowed to stand for two or three days.

Suppliers of suitable housing

See section 6 *General housing provision* and references given in section 7.8 below.

7.8 Fish and other totally-aquatic vertebrates

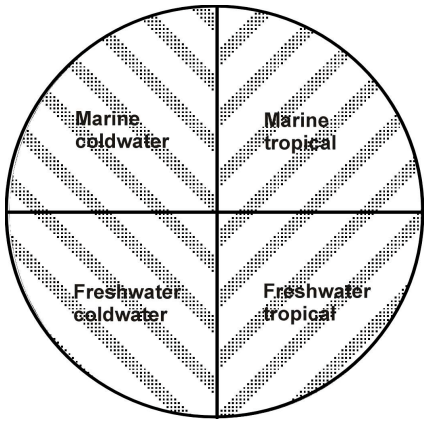


Fish keeping is a very popular hobby and there is an enormous amount of literature dealing with the subject. This section is merely an introduction to the basic principles of fish keeping and aquaria. The information provided is equally relevant for housing various species of amphibia which remain aquatic throughout their adult lives, such as axolotls and the African clawed toad.

Those wishing to develop their interest further should refer to specialist magazines such as *Practical Fishkeeping*; see *Appendix IV*. CLEAPSS Guide L181, *Cold water aquaria* (for primary schools) and section 14.3 of the CLEAPSS *Laboratory Handbook* (for secondary schools) provide further information that supplements that given here.

Housing needs

There are four broad categories of aquatic environment, as indicated by the diagram below. Providing the correct general environment is the first step towards successful fish keeping.



Types of aquaria

There are four different types of aquarium construction.

- Most *small* aquaria are one-piece mouldings pressed out of a transparent plastic material. As a result, they are strong and relatively cheap but liable to scratch easily.
- Metal-framed tanks with a glass base and sides held in place with putty. These are virtually a thing of the past. They are prone to leaks because the putty hardens, shrinks and cracks. Tanks that have reached the end of their watertight life are nevertheless valuable and can be used to house various terrestrial animals - see section 6.1, *Housing made from recycled or reject items.*
- Larger, standard-sized tanks are usually constructed from sheets of toughened glass bonded together with silicone rubber adhesive. This adhesive is strong and forms a powerful and elastic bond, giving the aquarium a long and trouble-free life. Such aquaria may be trimmed with a plastic or metal framework but this does not form part of the structural integrity of the tank.
- Very large custom-made aquaria, designed to fit particular situations. These are usually constructed from thick sheets of acrylic that, although extremely tough, are easily scratched.

Some examples of the cost of different types of aquaria Sources and sample prices for different types of aquaria are given in *Appendix II.14* and *II.15*. Fish are available from local aquarists, etc.

7.8.1 Choice and siting of the aquarium

The materials and method of construction are *not* the main criteria on which to base one's choice of aquarium. Far more important are the volume and shape of the tank and the ease with which accessories for lighting, heating and filtering can be provided.

It is wise to choose the largest tank that can be afforded and accommodated. Although factors such as the activity of the fish, the average temperature of the water and the effectiveness of any water purification system all affect the growth of fish, their ability to reach full adult size is ultimately limited by the volume of water that they live in. In addition, water quality is easier to maintain in larger volumes of water.

Aquaria should not be overstocked. A rule of thumb (from the days of Imperial measurements!) was '*an inch of fish to a gallon of water'*. This assumed that no means of aeration or filtration was to be used, but it is still a good starting point for deciding the amount of fish a tank will support. Table 1 provides stocking information for many of the commonly-available aquarium sizes.

Table 1 Stocking densities for different sizes of aquaria

Capacity of tank in gallons	Dimensions (inches)	Dimensions (cm)	Supportable length of fish (inches)	Supportable length of fish (cm)
10	20 x 10 x 12	50 x 25 x 30	8	20
15	24 x 12 x 12	60 x 25 x 25	12	30
20	30 x 14 x 14	76 x 36 x 36	17	43
25	32 x 18 x 15	81 x 46 x 38	24	61
50	50 x 22 x 15	127 x 56 x 38	46	117

Before use, the outside surface of the back and ends of the tank should either be covered with coloured paper or painted with emulsion paint. This will reduce the disturbance to fish caused by movements outside the tank and also improve its appearance. If the correct colour is chosen (black, green or dark blue are favourites), fish will show up better.

If the aquarium is not supplied complete with a lighting hood, it is wise to choose a model that is 100 mm or so longer than the standard 600 or 900 mm fluorescent lighting tubes. This will avoid problems if it is decided to add a hood at a later date.

Site the tank out of direct sunlight (to reduce temperature fluctuation) and as close as practicable to a mains socket (to enable aeration, lighting and heating equipment to be provided when necessary).

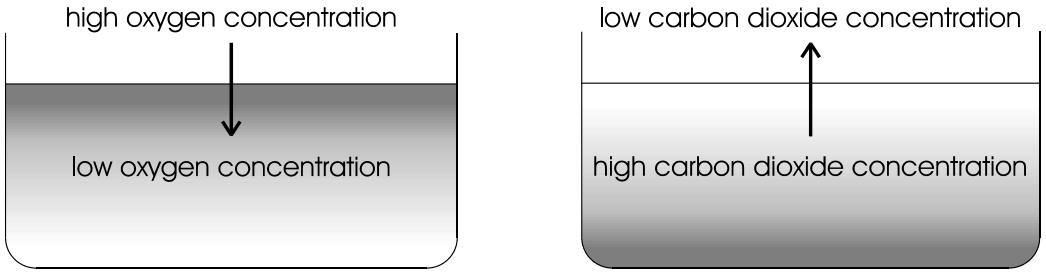
Filling the tank

When establishing a new freshwater aquarium, it is simplest to fill it with tap water. Although the hardness and pH of the water will vary according to the rocks through which it passed prior to collection, it can be guaranteed to be relatively unpolluted and free from harmful microorganisms. It will, however, contain chlorine, added by the water company to destroy bacteria. As this is likely to be harmful to fish, the filled tank must be allowed to stand for around two or three days to allow the gas to escape. Only when this maturation period has passed should fish and other organisms be introduced into the aquarium. (Alternatively, treat the water with conditioning chemicals, available from aquarists.) Rainwater is an attractive alternative - provided it can be collected from a clean surface (ie, one that does not introduce harmful pollutants). Since it is chlorine-free, it can be used immediately. Water taken from natural sources such as ponds and rivers should be used with care. It may be polluted by fertilisers and minerals and could also contain disease organisms. It is probably best avoided.

If the tank is minimally populated, very little additional equipment is necessary to maintain the health and normal behaviour of the occupants. Increasing the stock in a tank eventually leads to the need for equipment to maintain the necessary water quality.

7.8.2 The need for aeration

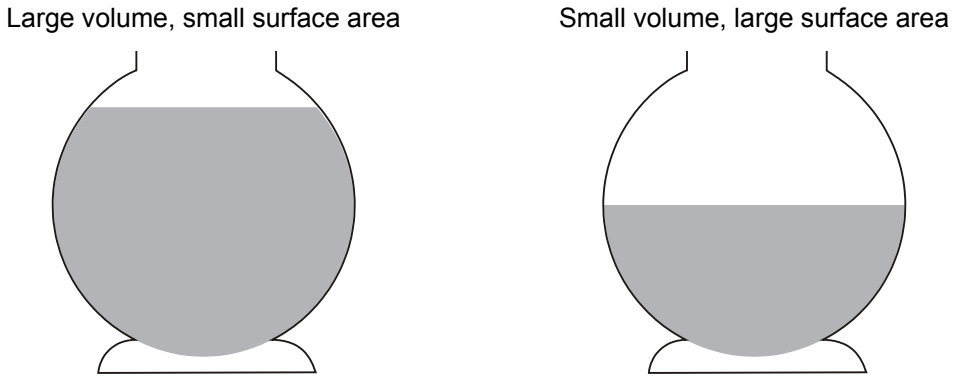
Aquatic animals obtain the oxygen that they need to respire from the surrounding water, releasing the resulting carbon dioxide into it. Maintaining the correct levels of these gases in the aquarium is vital for the well-being of its inhabitants. Gases normally enter and leave the aquarium at the water/air surface by *diffusion*. In this process, particles move from regions where they are in high concentration to those of low concentration, the rate depending on the concentration *difference* between the regions. The area of water surface in contact with the air also sets a limit to the amount of gas that can be transferred.



For efficient gas exchange to occur, the water surface should be:

- as large as possible;
- clean - free from dust, bacterial scum and oil;
- in contact with moving air, and
- relatively cool (since gases are less soluble at higher temperatures).

It should be noted that the traditional goldfish-bowl shape provides a relatively small water surface area. For this reason such tanks are best avoided. If they must be used, reducing the water volume will improve the surface area to volume ratio, thereby improving the oxygen and carbon dioxide levels in the water. Alternatively, they can be aerated by the use of an air pump (see *Aquarium pumps* below).

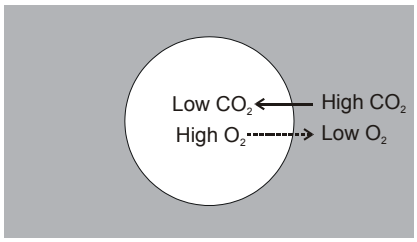


Aquarium pumps

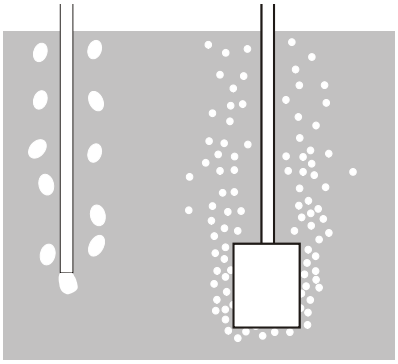
> ⚠ **Electrical connections to aquaria**
>
> Installations must be designed and constructed with due attention to safety. Secondary schools should refer to CLEAPSS *Laboratory Handbook* Section 14.3. For primary schools and other establishments that do not have access to this information, use Guide L124, *Aquaria in Primary Schools: Electrical Safety.*

Diffusion is a slow process and sets a limit to the number and size of fish that an aquarium can support. One way of raising this limit is to install an aquarium air pump.

The stream of air bubbles that an air pump produces provides a large surface area across which gas exchange can take place. Oxygen from the air inside each bubble diffuses out into the water and carbon dioxide diffuses in, to be liberated when the bubbles burst at the top of the tank.



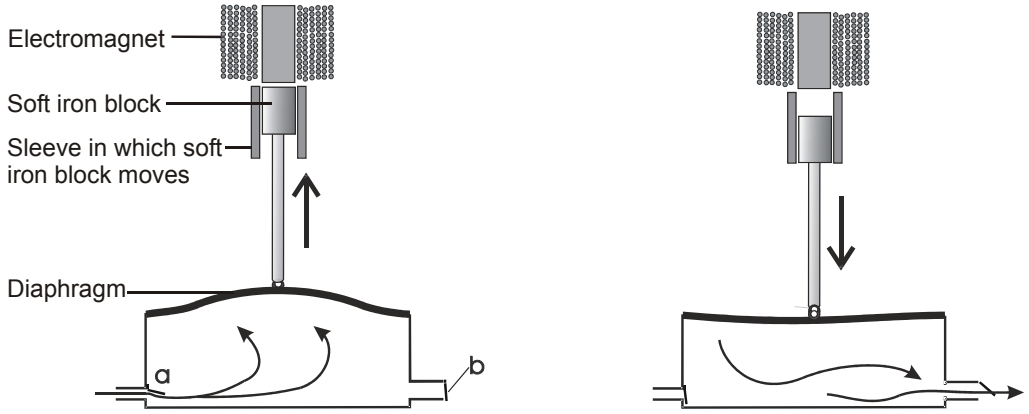
The efficiency of gas exchange is greatly increased by passing the output of the pump through a diffuser stone. This produces a stream of minute bubbles that have a much larger total surface area across which gas exchange can occur.



In addition to this direct exchange of gases, the stream of bubbles causes the water in the tank to circulate. This carries water rich in dissolved carbon dioxide up to the surface of the tank (where it diffuses into the atmosphere) and oxygen-rich water from the surface layers downwards. The beneficial properties of air pumps result from water circulation as much as from the gas exchange that takes place across the bubbles that they produce. The water flow also creates turbulence at the water surface, further increasing the rate of gas exchange that occurs there. As a consequence of all these effects, air pumps significantly increase the quantity of stock that an aquarium can hold.

Virtually every modern air pump is a diaphragm type. This consists of a buzzer-type mechanism, the arm of which drives a neoprene diaphragm to and fro. Valves in the wall of the chamber of which the diaphragm is a part ensure that air is drawn in and then pushed out through a pipe into the aquarium.

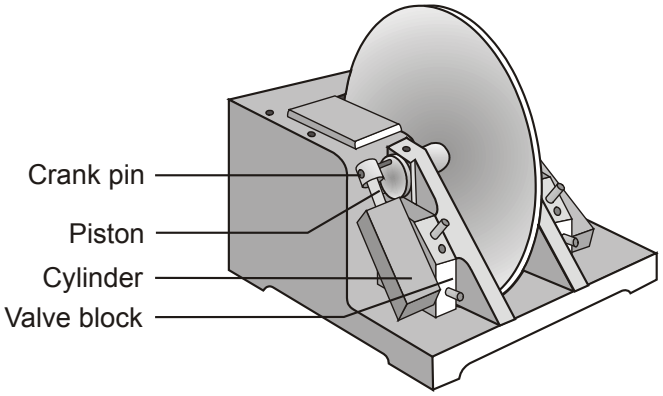
The valve system of a diaphragm pump



a and b are valves that ensure a one-way flow of air

The diaphragm and valves require occasional replacement but otherwise this type of pump is virtually maintenance-free.

Older installations may feature a piston pump. These pumps, almost all of which are referred to as Hy-flo pumps, are no longer manufactured but their extended life means that many are still to be found in schools. All that is necessary to ensure trouble-free operation is the application of a drop or two of light machine oil to the bearings every week or so. Oil must be applied sparingly, however, because any excess can be drawn into the air stream to contaminate the water.



⚠ Unless a reliable one-way valve is inserted into the air line, **a*ll*** air pumps should be kept *above* the surface level of the water in the tank so that, in the event of power failure or pump breakdown, water is not siphoned away.

Power heads and circulating pumps

Many modern systems for purifying aquarium water require large quantities of water to be pumped through various types of filter (see section 7.8.3.) Although it is possible to use the circulation of water that a stream of air bubbles sets up, the volume of water that can be moved in this way is relatively small. In marine set-ups, in particular, a very high rate of flow is needed. This is more easily achieved by means of a water pump consisting of a motor-driven rotating rubber vane known as an impeller. In some systems, a water pump is built into the filter unit.

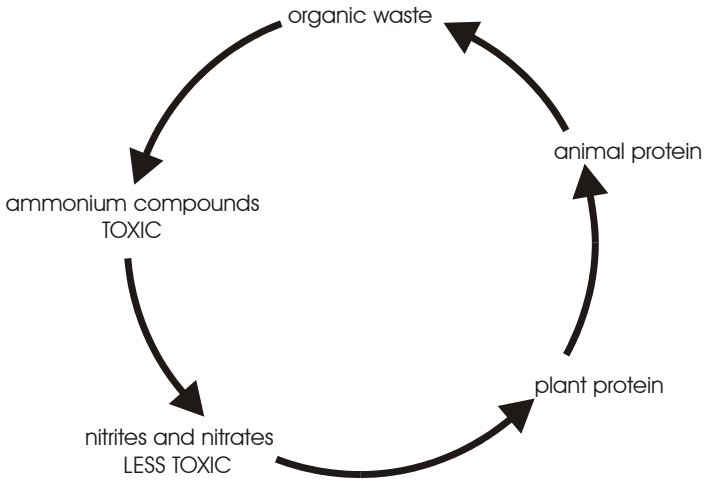
Suppliers of aquarium pumps and power heads: Many local aquarist shops are able to supply a good range of equipment to help maintain water quality. Details of local sources can be found in *Yellow Pages* under 'Aquarium and Pond Supplies'. There is also a growing number of internet-based companies that advertise a wide range of tanks and equipment, often at competitive prices. It is important to check availability and delivery charges from these outlets. Details of some educational and specialist suppliers are given in *Appendix II.16* and *II.17*, together with an idea of the cost of these items.

7.8.3 Reducing the build up of harmful wastes

Even when the levels of oxygen and carbon dioxide are maintained at an optimum level, uneaten food, excrement and some of their associated breakdown products may soon affect the water quality in the aquarium.

OVER FEEDING - particularly providing excess dried food at intervals - is the major cause of the build up of toxic waste in aquaria.

In natural bodies of water, bacteria break down these pollutants, firstly into ammonia and then into nitrites, both of which are harmful to fish. Nitrites are then further converted (by other species of bacteria) into nitrates. These are less toxic and are taken up by aquatic plants for use in their growth. Ultimately, animals consume some of this plant material, thereby completing the cycle of nitrogen compounds. This series of chemical changes is known as the *nitrogen cycle*.



In lakes, rivers and seas, these toxic compounds are greatly diluted and pose no threat to aquatic animals. In the small volumes of water used in aquaria, however, higher concentrations rapidly develop unless action is taken to remove them. A number of test kits are available from aquarists and pet shops to check on the concentrations of these pollutants so that steps can be taken to improve water quality before the fish stock is damaged. The maximum concentrations of toxic products for most fish are listed below.

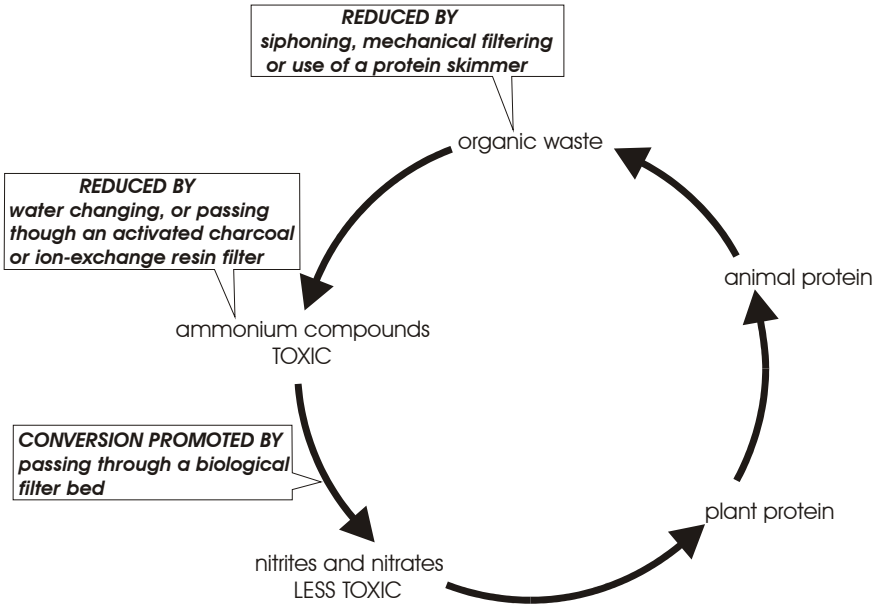
Ammonia	0.5	milligrams per litre
Nitrite	15.0	milligrams per litre
Nitrate	250.0	milligrams per litre

Methods for maintaining water quality in aquaria

A number of methods can be used to counteract the build up of toxic substances, including:

- siphoning off organic debris;
- mechanically filtering the water by forcing it through a layer of foam or a fine sieve;
- adsorbing materials onto activated charcoal or an ion-exchange resin, and
- the use of biological filters.

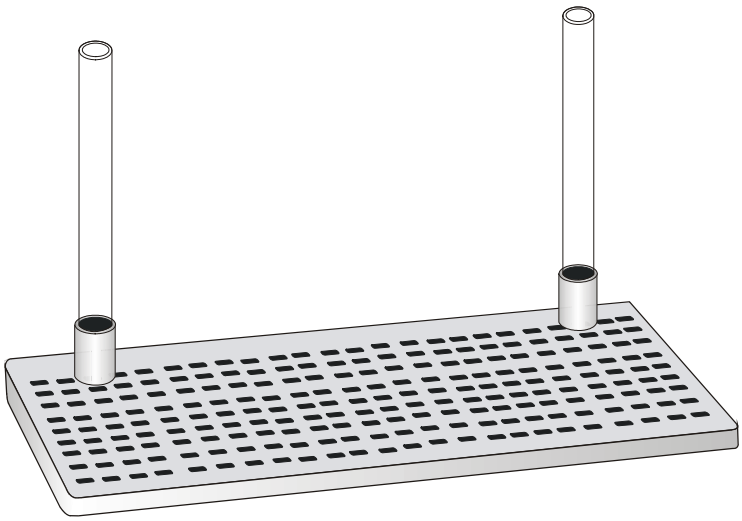
Commercial filtering systems may incorporate several of these mechanisms within the same unit. The various processes act at different stages in the nitrogen cycle; see overleaf.



Mechanical filtering and adsorption systems make use of physical principles and take effect as soon as they are installed. If such filters are kept clean and the active adsorption medium is replaced at regular intervals, little further maintenance is required. The operation of biological filters and protein skimmers, however, requires some further explanation.

A biological filter consists of a quantity of inert material (such as gravel or mineral particles), on the surface of which a film of denitrifying bacteria becomes established. It is these bacteria that carry out the breakdown of toxic substances. Denitrifying bacteria do not need to be artificially introduced - they occur very widely and soon colonise any body of water that is exposed to the air. Obviously, the larger the surface area on which bacteria can develop, the more effective the filter will be at removing toxic compounds. Finer grains have a larger surface area for their volume and so make more efficient filters. Some commercial canister filters contain sufficient filtering material to support an effective bacterial film but a less-costly method is to make use of an under-gravel filter.

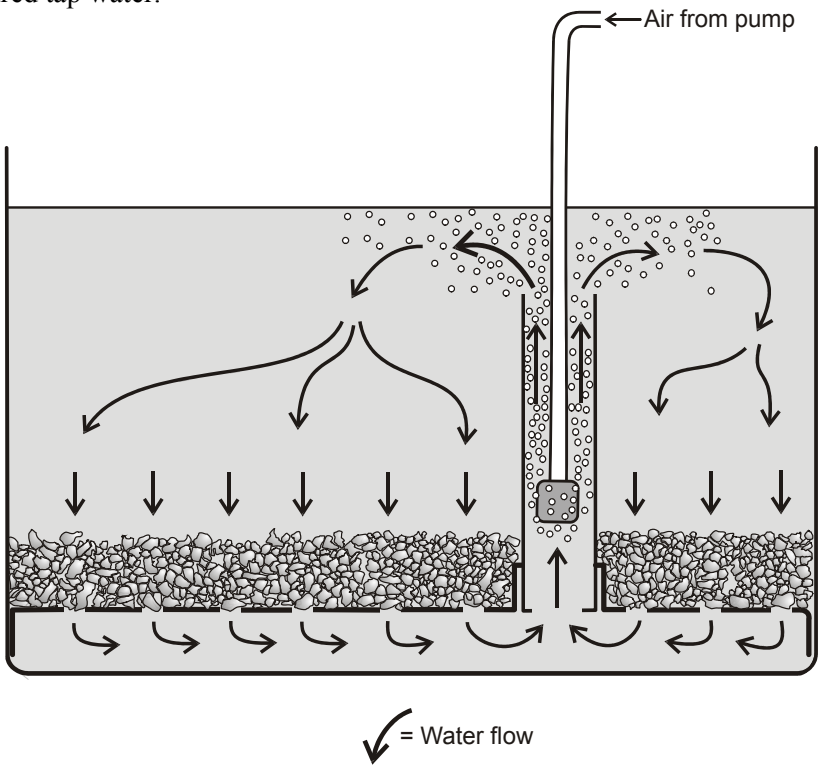
Under-gravel filters These consist of a layer of gravel placed on top of a perforated plate at the bottom of the tank. Water is drawn through the gravel either by means of a stream of air bubbles or a power head pump. Some filters make provision for more than one stream of air bubbles to draw water through the filter. Other systems can be extended to provide areas of filter that match the floor of the tank.



Filter plate with provision for two air-pump inputs

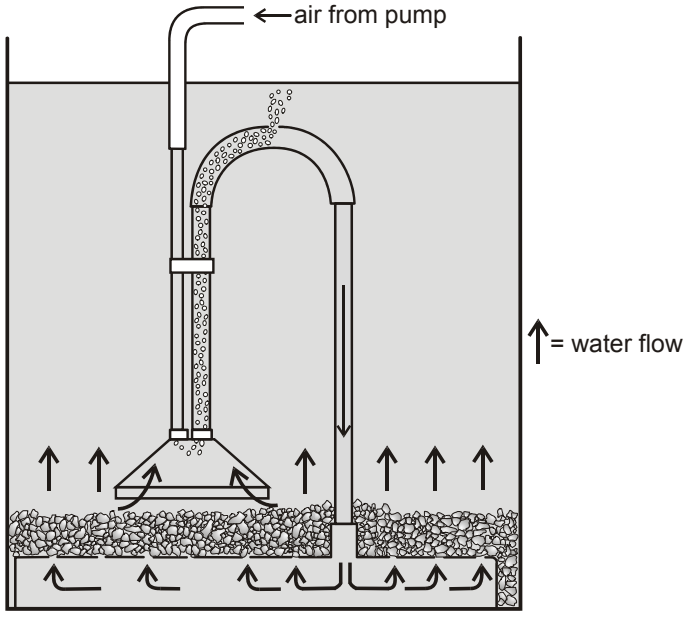
The enormous surface area provided by the gravel piled on top of the filter plate makes for a very effective biological filter. Even so, in a well-stocked tank it will be necessary to siphon off any accumulating organic debris at regular intervals, since the filter is unlikely to be able to break down solid waste quickly enough. Unfortunately, the flow of water through under-gravel filters also causes rooted aquatic plants to grow less well than they do in stagnant conditions.

The usual arrangement draws water from the tank down through the gravel with the result that debris accumulates in the spaces between the granules. Eventually this material must be removed by washing the gravel in matured tap water.



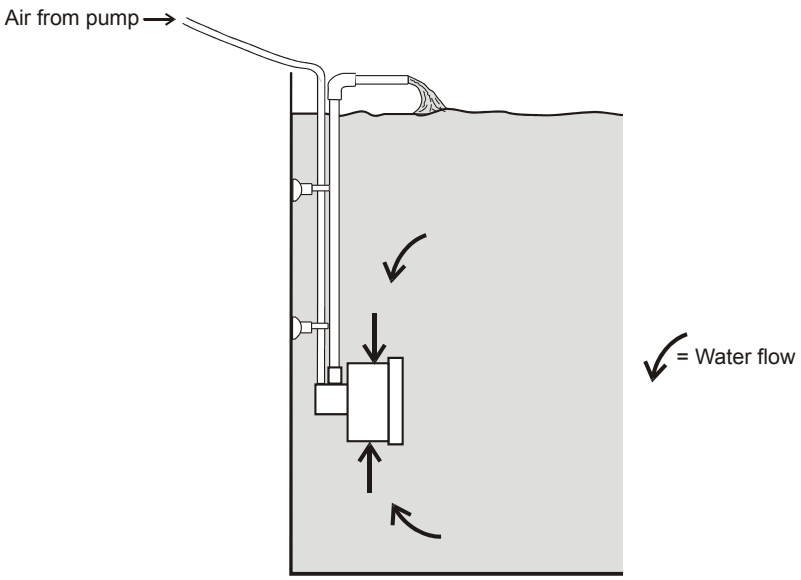
Conventional undergravel filter system

An alternative arrangement that avoids the need for washing the gravel is to draw water into the space below the filter. Any trapped debris is easier to separate and remove (first scoop out the gravel, then take out the filter and use a siphon to pick up any particles).



Reverse flow filter, traps debris below the gravel

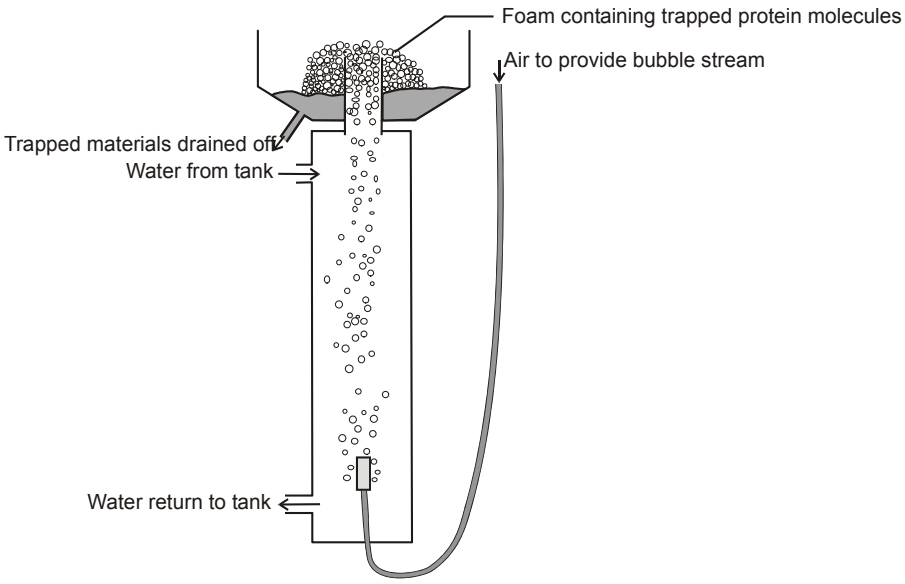
Internal (box) filters These are small systems that are placed *inside* the tank to filter out solid particles mechanically. A stream of air (or an integral water pump) draws water through a canister with perforated sides. The canister contains a sponge or other material that acts as a filter; it should be cleaned regularly to maintain its efficiency. The limited size of the filter element means that these units are only suitable for smaller aquaria containing relatively few fish. However, they do not add, aesthetically, to the appearance of an aquarium.



Small in-tank filter system

External (power) filters Large, well-stocked aquaria require very efficient filtration. External filters are capable of providing this without occupying valuable space within the aquarium and detracting from the visual impact of the set-up. Water is drawn out of the tank and passed through a canister containing filtering materials before being returned to the aquarium. Filter elements may include mechanical filters such as nylon wool, foam rubber or fine gravel, together with layers of activated charcoal to adsorb waste chemicals. Mechanical filter elements must be cleaned before they become completely blocked with particles. Charcoal elements eventually lose their activity and must be replaced. However, if an exhausted charcoal filter is left in operation, nitrifying bacteria may develop on the filter surfaces. It *may* retain sufficient of its denitrifying properties to enable it to support a small, lightly-stocked aquarium.

Protein skimmers These devices are able to separate out the protein of the waste that accumulates in the water so that it can be removed before it is broken down into toxic waste. They do this by injecting fine bubbles of air into the water, causing the protein to form foam at the surface. This foam presents a large surface area onto which organic compounds and particles are absorbed. The resulting material can be drained away and discarded. How the air bubbles are created to form the foam varies between different models of skimmer. In some, a fine air stone creates small bubbles; in others a current of water is shaped in such a way that it traps air while, in other types, water flows through beads that help to trap air.



Principle of operation of one type of protein skimmer

Various protein skimmers are available from marine aquarium specialist retailers. They are particularly useful in coral-reef aquaria where the organisms being housed are extremely sensitive to toxins. Other types of aquaria can be successfully maintained using any of the filters previously described, but without the need for a protein skimmer.

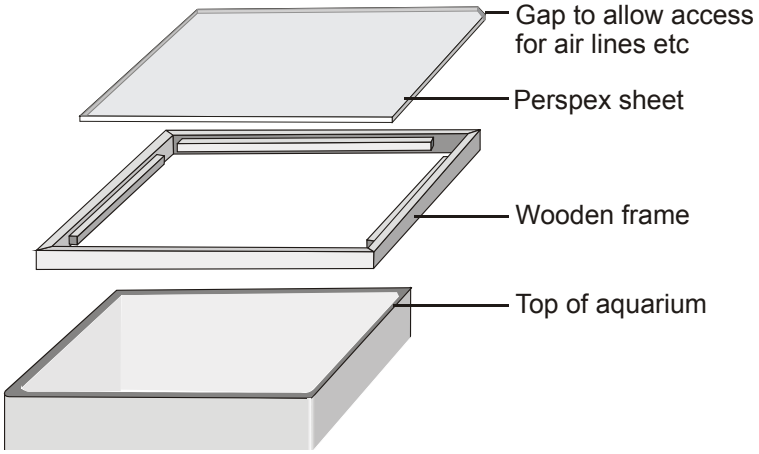
Suppliers of aquarium filters: Details of some suppliers of under-gravel filters and their costs are given in *Appendix II.18*. For other types of filter, refer to specialist aquarist suppliers.

7.8.4 Hoods and the need for lighting

⚠ **Electrical connections to aquaria**
Installations must be designed and constructed with due attention to safety. Secondary schools should refer to CLEAPSS *Laboratory Handbook* Section 14.3. Primary schools should refer to Guide L124, *Aquaria in Primary Schools: Electrical Safety.*

Aquaria should be covered in order to reduce the amount of liquid lost through evaporation from the water surface. At its simplest, this may consist of a sheet of transparent *Perspex* or similar material placed directly on the top of the tank. Glass can be used to cover smaller tanks if all sharp edges have been ground off or the edges have been protected with a strong tape such as *Duct tape*.

A more-secure, d-i-y arrangement is to construct a wooden frame that holds the cover in place and provides access for the various supplies to pumps, heaters and filter systems. Such a cover is straight forward to construct using simple hand-tools.



If a more attractive appearance is required, and particularly if a balanced community of fish and plants is to be maintained, artificial lighting will be necessary. Plants are helpful in maintaining water purity, since they absorb minerals from the water, including those produced as a result of nitrification. Where mineral levels are high and light levels only moderate, microscopic algae are able to grow more rapidly than flowering aquatic plants, such as the pond weeds. As a result, algae flourish to the extent that they make the water green and murky. If high light levels are provided, however, the pond weeds are able to compete more effectively with the algae, with the result that the water eventually becomes clear again.

In order to house the necessary units, a **lighting hood** will be required. Such a cover would be more complex to construct than the simple cover previously described. However, many aquaria are either sold with such a hood or a suitable unit can be purchased as an accessory. This will house one or more fluorescent tubes together with the electrical equipment necessary for the lamps' operation. A transparent, moisture-proof barrier should be placed between the water surface and the lighting equipment. Normally a sheet of glass or *Perspex* is built into the hood to achieve this. All-metal hoods (*but no other part of the tank or its contents*) must be earthed. Any equipment placed in the water must be 'all insulated' or 'double insulated'.

Fluorescent tubes provide an ideal light source for aquaria. They are available in a range of different sizes and powers, are cool-running and cost little to run. The energy emitted by the basic mechanism of the tube is in the form of ultra-violet light. However, this is largely converted into visible light when it strikes a layer of *phosphors* coating the inner surface of the tube. Manufacturers are able to modify the composition of this layer in order to alter the colour of the light emitted. Most tubes emit a relatively low proportion of red light, but some types, such as *Gro lux* tubes, are formulated to produce a more balanced light. Red light is strongly absorbed by chlorophyll and so is important in enabling plants to carry out photosynthesis. This type of tube is therefore widely used by plant growers and aquarists alike.

The popularity of large marine aquaria has resulted in the development of more intense and colour-stable lighting necessary to promote the growth of corals. Lighting developed for this application is suitable for use in other situations where intense light is required. A recent development has been the production of a

range of 8 mm diameter tubes. These are more energy efficient than the standard 12 mm diameter types and are available in a range of intensities and colour balances. Further details of the range of dimensions and outputs are given in section 7.10.1.

The efficiency of aquarium lighting is greatly increased if the aquarium hood has reflective qualities. If not already treated, it is worth painting the inside of the hood with white or silver paint. Some fluorescent tubes are sold complete with their own reflectors.

Suppliers of aquarium lighting: Aquarium hoods are often sold along with aquaria (see *Appendix II.15*), either complete with fluorescent tubes or 'empty', for the fitting of suitable lighting. Purchasing a hood, sold as a complete unit with fluorescent tubes and reflector, is always preferable. Suppliers of lighting control units, fluorescent tubes and their costs are given in *Appendix II.19*.

7.8.5 Tropical freshwater aquaria

Tropical aquaria are usually kept at a temperature of 23.5-25.5 °C. Other than this additional requirement, the maintenance requirements for water purity and correct oxygen/carbon dioxide levels apply to tropical aquaria as they do to cold-water types.

To achieve the necessary water temperature requires the use of sufficiently powerful submersible heaters controlled by a reliable temperature-sensitive switch. Enough heat must be provided to maintain the water temperature when the room is at its coldest. The power necessary to do this will depend on the volume of water in the aquarium and the maximum temperature difference likely to be met. Table 2 shows the wattage of heaters necessary to achieve this.

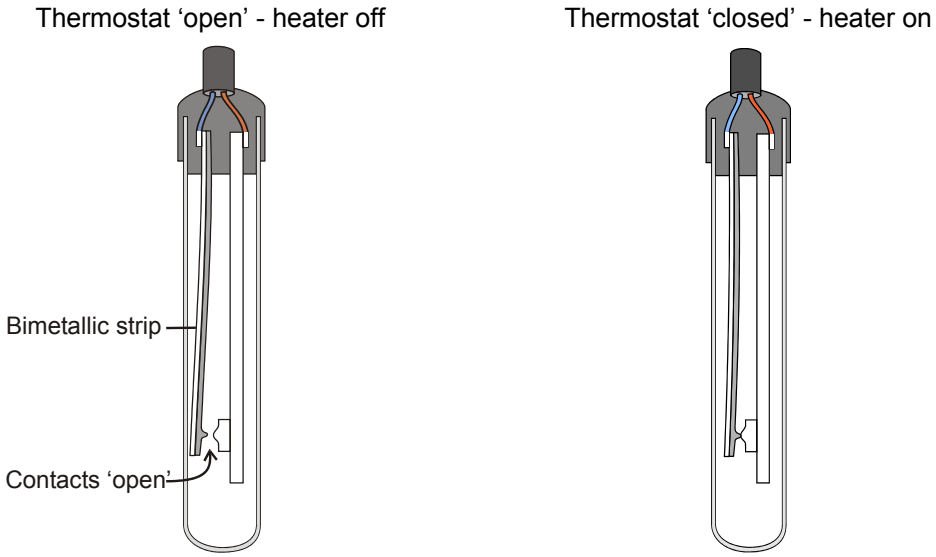
Table 2 Total heater wattage to maintain temperatures in aquaria of different sizes

Volume of aquarium (in litres)	Maximum temperature difference required between aquarium contents and room temperature (°C)									
	1	2	3	4	5	6	7	8	10	12
10	1	3	4	5	7	8	10	11	14	17
20	2	4	6	9	11	13	15	17	22	26
40	3	7	10	14	17	20	24	28	35	42
60	4	9	13	18	22	27	31	35	45	54
80	5	11	16	22	27	33	38	43	54	65
100	6	13	19	25	31	38	44	50	63	76
120	7	14	21	28	36	43	50	57	70	85
150	8	15	25	33	41	50	57	66	83	98
200	10	20	30	40	50	60	70	80	100	120
250	12	23	35	46	58	70	80	93	115	140
400	16	32	48	63	80	95	110	130	160	190
600	20	40	62	83	104	124	145	166	200	250
800	25	50	76	100	126	151	176	200	250	300
1000	30	60	88	117	146	175	205	235	290	350

A useful rule of thumb guide for aquarium heating in the UK is 'one watt of electricity per litre of water'.

Temperature control

There is a variety of thermostats designed to control the heat sources to provide suitable temperatures for the occupants of an aquarium. The simplest type consists of a bimetallic strip that changes shape in response to temperature changes. Electronic controls are now available that avoid the need for mechanical switches.



Lowering the temperature causes the strip to straighten, ultimately closing the contacts and turning the heater on.

This strip forms part of the electric circuit that includes a heating element. In some cases, the heating element is separate from the thermostat but, if a single heater can maintain the desired temperature, one of the many combined heater/thermostat units available provides a convenient solution.

Suppliers of aquarium heaters: Details of some suppliers and an indication of likely prices are given in *Appendix II.20*.

7.8.6 Coldwater marine aquaria

It is not difficult to maintain rockpool animals *for a couple of days*. All that is necessary is to place them, together with some of the seawater in which they were found, in a clean plastic or all-glass tank in a ***cool*** area. Most coastal animals are well-adapted to survive the usual fluctuations in temperature and salt concentration that result from the ebb and flow of the tides. Few, however, can tolerate a build-up of waste products, since the same tides regularly wash such materials away. For this reason, it is useful to obtain a reserve of seawater (in clean plastic containers) when the animals are collected. This is then used to replace the water in the tank when it becomes clouded by waste particles. It is important to observe good hygiene when carrying this out, since coastal sea water may be polluted. Once observation of the animals has been completed, they should be returned to the environment from which they were taken.

Extreme temperature fluctuations must be avoided. In hot weather, keep the temperature of the water below 20 °C by placing sealed plastic bags containing ice cubes in the water. *Small* tanks and their occupants can safely be placed in a refrigerator (**not** one used to store food) for short periods.

It will not be necessary to feed many of the animals during their brief period in captivity, since many are filter feeders and will feed on the plankton and debris present in the water. Larger crustaceans, such as crabs, can be fed on small portions of fresh meat or small invertebrates.

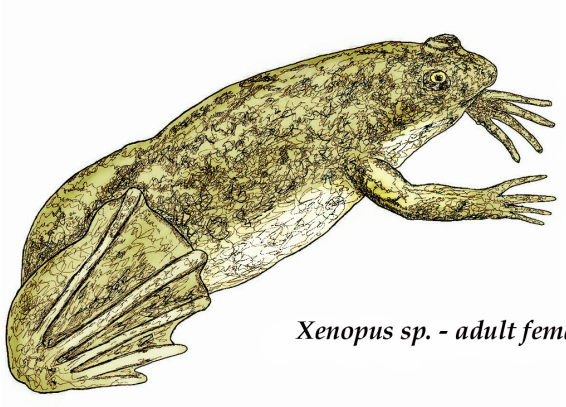
To keep native marine animals for periods longer than a few days requires the maintenance of a quantity of salt water, free of nitrogenous waste, at a steady temperature *lower* than that found in most classrooms. This requires a complex set-up that is probably beyond the resources of all but a few schools. The largest available tank should be used, with an efficient under-gravel filter system. Coastal sea water may contain pollutants and unknown organisms (both microscopic and otherwise) that make it unsuitable for long-term use in such a tank. It is better to make up sea water using commercially-available artificial formulations that can be purchased from one of the major aquatic suppliers. If tap water is used to dissolve the salts, it will be necessary to allow it to mature to ensure that all added chlorine has dissipated. The water must be kept cool at all times. This can be achieved by pumping water out of the tank in food-grade plastic piping that passes through an old refrigerator unit. The pipe then returns the cooled water to the tank. Pumps sold for use in tropical marine tanks will, of course, be suitable for this application. Food-grade plastic piping, obtainable from larger d-i-y stores, contains fewer harmful chemical products than other types.

Temperature regulation presents some problems, since the water-circulating pump should be switched ON when the temperature RISES - the reverse of conventional thermostatically-controlled systems.

7.8.7 Tropical marine aquaria

Many exotic marine creatures - both vertebrate and invertebrate - inhabit the coastal waters of tropical and subtropical seas. It is the provision of animals for this area of the aquatic market that has driven the development of many of the filtration and illumination systems described above. Although reef animals are undoubtedly very colourful and exotic, they provide few educational advantages over freshwater types. Stock is expensive and considerable investment in filtration equipment will be necessary to ensure long-term maintenance. These aquaria are only for the committed enthusiast with a vast budget!

7.9 Amphibia



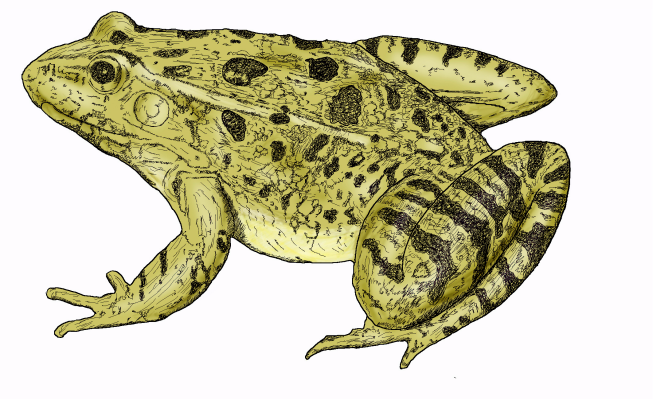
Xenopus sp. - adult female

Housing needs

The life cycle of amphibia usually includes an aquatic stage (the tadpole) that metamorphoses into the adult form with limbs capable of living on land and reproducing. A few species, such as the African clawed toad, *Xenopus laevis*and the axolotl, *Ambystoma mexicanum*, remain completely aquatic, while others are semi-aquatic, spending much of their adult life in water. The housing provided must take into account the animals' requirements. For detailed guidance on collecting, keeping and studying the *aquatic* stages of frogs, toads, newts and other amphibia, reference should be made to CLEAPSS Guide L206, *Tadpoles* and L181, *Cold water aquaria*.

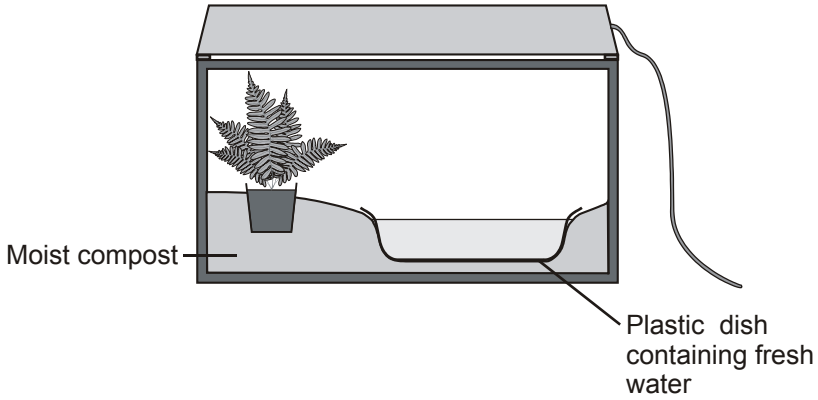
Aquatic amphibia, including the tadpole stage of native species such as the common frog and toad, can be housed in any suitably-sized aquarium or other watertight container provided that it is not overcrowded. The water in which they live must not be allowed to accumulate high levels of waste compounds and uneaten food. To achieve this, a proportion of it must be replaced at regular intervals - at least a quarter every two weeks for lightly-stocked tanks. The replacement water must be chlorine-free and at the same temperature as that of the tank.

Although there is little difficulty in rearing the tadpoles of many amphibia, the recently-metamorphosed, young adults of most amphibia are much more challenging. They require easy transition between water and land and a regular diet of small live insects; despite every care, they frequently die of starvation or desiccation. Tadpoles of native species are best returned to the environment from which they were taken.



More mature adult frogs, toads, and newts, including non-native species such as the American grass frog, *Rana pipiens,* the oriental fire-bellied toad, *Bombina orientalis* and the fire salamander, *Salamandra salamandra* can often be maintained without much difficulty. They are best kept in a ***vivarium.*** Details of commercially-available types are given in Section 6 *General housing provision*. The shape of the housing must be chosen to take account of the activity of the occupants. Animals that jump and climb require a tall container; those that spend their lives on or under the soil will need the largest floor area possible.

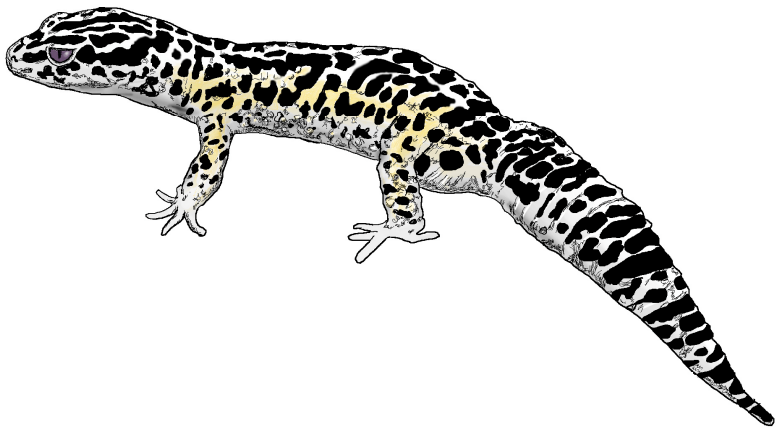
Because the skin of adult amphibia is an important surface for gas exchange, it is necessarily permeable and hence moist. The housing should therefore provide moist conditions, together with a source of fresh water. This can be achieved by covering the floor of the vivarium with a layer of moist, peat-free compost or chopped Corsican pine bark (a moist, clean-smelling material available from specialist reptile and amphibia suppliers). A dish or bowl of fresh water pressed into the surface enables the water to be regularly replaced without causing too much disturbance. There must be a gentle slope between the soil surface and the edge of the water to allow the animals to move easily between the two media.



Adult amphibia are carnivorous and require live food (since their vision is particularly sensitive to *moving* objects). Earthworms and slugs are usually fairly easy to find (see Section 7.1 *Earthworms* and 7.2 *Snails and slugs* for details concerning culturing details). There are also other less time-consuming ways of providing live food. Mealworms and other insects can easily be purchased from aquarists and shops selling fishing tackle and are usually accepted as food.

Suppliers of amphibia and their food: Suggested sources and likely costs of amphibia are given in *Appendix I* and *III.17*. Suppliers of live foods are given in *Appendix I, III.9, III.12, III.13* and *III.14.*

7.10 Reptiles



Lizards and snakes have a reputation for requiring greater care than many other animals if they are to be kept successfully in schools. However, if healthy stock of the correct type is obtained, it is perfectly within the capacity of many schools to maintain some of the less-demanding reptile species.

Housing needs

Terrestrial reptiles can be kept in a vivarium similar to those described for housing amphibia.

Some tropical and desert reptiles, however, require very specific conditions in order to survive. In the wild, they regulate their temperature by moving between warm sunny spots and shaded areas. Some types also need to absorb heat from the ground in order to warm their stomach contents and speed up digestion. In addition, some diurnal reptiles require high levels of light by day to ensure normal patterns of behaviour, together with a source of the ultra-violet radiation normally present in sunlight. UV-A radiation is believed to promote the behaviour of many reptiles while UV-B is required for the formation of vitamin D3, necessary for normal calcium metabolism and hence healthy bone growth.

The conditions necessary to maintain these exotic species may therefore include:

- warm temperatures (21-35 °C);
- areas within the housing that are warmer than others, allowing the reptiles to regulate their internal temperature;
- a temperature cycle with night-time temperatures a few degrees lower than day time ones;
- heated areas of ground on which to recline and digest their food;
- an intense source of light during day time to simulate tropical or desert lighting;
- a source of ultra-violet radiation, and
- dietary supplements to boost vitamin D levels.

A wide range of commercial heating and lighting products is available that is designed to provide these particular heating/lighting requirements.

7.10.1 Sources of heat and light

Heating

The simplest device for heating a vivarium is a **tungsten-filament bulb** placed in a reflector or white-painted hood. Even a 60 watt bulb will provide sufficient background heating for most reptiles found in temperate climates. However, normal tungsten-filament heating is unsuitable for night-time use because the light emitted affects the behaviour of the residents. To overcome this problem, 'night bulbs' have been developed with filaments that emit more heat and less light than conventional bulbs and a red glass envelope that transmits only those wavelengths of light to which reptiles are insensitive. This type of heater can be allowed to run continuously since it does not affect the behaviour of reptiles. If a day-light and a night-light bulb are wired into the vivarium hood and provided with separate switches, it is possible to provide a good basic temperature regime for less-demanding reptiles.

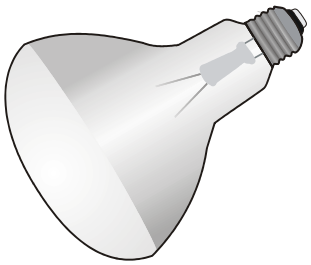
Temperature control There is a maximum temperature that each species of reptile is able to tolerate. For more-tolerant species, it is possible to control heating by switching the heat sources on and off manually in order to provide suitable day-time and night-time temperatures. A thermometer should be placed on an inside wall of the housing to check the effectiveness of this control.

If more-demanding reptiles are to be kept, it will be necessary to include some form of thermostat. Controls specifically designed for use with vivarium heating systems are available through specialist suppliers.

Basking lamps These have a large reflecting layer to direct a beam of heat and light onto a small area of the tank. They are also produced in the form of red spot lamps for night use.

Ceramic heaters have a similar shape to floodlight bulbs but emit only heat. They are therefore suitable for 24-hour use. The heating element is much more robust than that of a conventional lamp and is therefore likely to last much longer. As the heaters become very hot, they have a screw fitting designed for use with ceramic, heat-resistant holders.

Basking lamp



Ceramic heater

Heat mats or pads are very useful for providing the general warmth that is necessary for heat-requiring species. See section 6.2.4 *Heating*.

Heat rocks are heating pads embedded in ceramic material cast into the shape of rocks. They are not suitable as general heating but are useful for reptiles that require heat from below. When working, these rocks should feel **neutral or barely warm to the touch**, otherwise they will burn the animals. They should be checked occasionally**.**

Suppliers of vivarium heaters and suggested costs: These are provided in *Appendix II.21-25*. These also include information about holders for heaters, thermostats and thermometers.

Lighting

Although some 'full-spectrum', tungsten-filament bulbs emit useful amounts of ultra-violet radiation, **fluorescent lighting** is more efficient and cost-effective and so is normally used to provide the high levels required by some reptiles. The use of a reflector (which might just be a sheet of aluminium foil fixed to the hood behind the fluorescent tube) greatly increases the effectiveness of the tubes. Despite their efficiency, the ultra-violet output of all fluorescent tubes declines rapidly with age, so they should be replaced **at least** every six months. UV radiation does not penetrate glass, plastic or even fine mesh, so *nothing* must be placed between the lamp and the contents of the vivarium. Fluorescent lighting tubes must be wired into electrical starter units, which are normally housed in the hood together with the tubes.

The amount of UV radiation and light reaching a surface also diminishes with distance, as a result of which the tubes must be no more than 460 mm from the basking spot used by the reptiles. It is essential to include items such as rocks and branches in reptile housing on which occupants can climb to adjust their position in relation to sources of UV radiation, light and heat.

Table 3 Some standard sizes of fluorescent tube on the market

Length (mm)	Length (inches)	Wattage	Manufacturer or type
300	12	8	*Tropic Sun*
380	15	14	*Gro lux, Tropic Sun, Ultra Sun, Flora Sun.*
450	18	15	*Tropic Sun, Ultra Sun, Flora Sun,*
534	21	13	*Gro lux*
600	24	18	*Tropic Sun, Ultra Sun, Flora Sun,*
750	30	25	*Tropic Sun, Ultra Sun,*
900	36	25	*Ultra Sun, Flora Sun,*
1050	42	38	*Tropic Sun, Ultra Sun, Flora Sun,*
1200	48	32	*Ultra Sun, Flora Sun,*

UV-B Heat lamps Compact mercury-vapour lamps have now been developed that resemble a basking spot lamp in appearance. Unlike ordinary spot lamps, they emit intense white light, significant levels of UV-A and UV-B light and quantities of heat. Although more expensive than fluorescent tubes, they maintain their ultra-violet output for much longer, performing well even after 3,000 hours of use. They are suitable for use with most daylight reptiles such as iguanas, chameleons, tortoises and turtles and can be inserted directly into a suitable heat-resistant fitting, requiring no external starter. The UV radiation also carries further than with fluorescent tubes.

Suppliers of UV fluorescent lighting tubes and units: These are given in *Appendix II.26-27*.

7.10.2 Substrates

A range of commercial substitutes for soil or sand has been developed. These include Aspen sawdust (good for snakes), a sand-and-limestone mix that is suitable for most lizards, turf substitute for tortoises or bigger reptiles and chopped Corsican pine bark (a moist, clean-smelling material that is useful when housing amphibians and larger reptiles that require moist conditions).

Suppliers of vivarium substrates: These are given in *Appendix II.28.*

7.10.3 Keeping reptiles in schools

It will be evident that most tropical and desert reptiles require specialist equipment and high levels of care if they are to remain healthy. Experience in rearing less-demanding species is needed before attempting to

keep more-exotic varieties. Suppliers of such animals usually provide good levels of information and support for their customers, including details of heating, humidity and dietary requirements.

Less-demanding species suitable for beginners

The ***leopard gecko*** is the least-demanding lizard available, having simple dietary requirements and requiring **no** source of UV-B radiation (because it has evolved as a nocturnal animal). A vivarium, aquarium or plastic tank with a ventilated lid provides suitable housing. Day-time temperatures of 28-30 °C should be maintained by the use of heating cables, a heat pad or mat or ceramic heating. A basking temperature of 35 °C is appropriate. At night, the heating can be reduced to allow temperatures to fall to 24-27 °C. Note that the leopard gecko does not appreciate bright light and may remain hidden if heating is provided using bright lamps.

The floor of the housing should be covered with sand and rocks. A few branches should be arranged so that they provide a place for the animals to climb, enabling them to adjust their distance from any overhead heat source. A shallow bowl of fresh water should be provided, together with retreats of bark and logs, positioned in hotter, average temperature and cooler areas, to allow the animals to hide away at chosen sites. To assist in successful skin shedding, it is helpful to make the cooler shelter humid by the use of moist sphagnum moss to which water is added to maintain the moisture. This should be replaced every fortnight.

The leopard geckos should be fed every other day primarily on crickets, with mealworms, waxworms and small locusts provided occasionally for variety. A vitamin supplement (eg, *Nutrobal* or *Cricket Plus*, available from reptile suppliers) must be dusted onto the animals used as food.

The ***garter snake*** is also relatively easy to keep, requiring an average day-time temperature around 25 °C (falling to 15 °C at night) and a basking temperature of up to 35 °C. A source of ultra-violet radiation is probably not required though some enthusiasts suspect that it is beneficial. Garter snakes can be fed earthworms and selected types of fish such as trout, plaice and lancefish (including skin and bones). Other types of fish contain an enzyme which breaks down the essential B vitamin, thiamin. Such fish can be used but it must be boiled to destroy the enzyme. A very secure lid is *essential* for the vivarium, since garter snakes are very agile and readily escape through small apertures and may lift a lid that is not tightly fitting. A bowl of water, large enough to enable the snake to submerge itself, should be sunk into the substrate, the water being changed as soon as it appears soiled. Corn snakes, king snakes and rat snakes are also easy to care for but require vertebrate food, such as defrosted frozen mice.

Suppliers of reptiles, housing, stock and materials: Since reptiles are expensive and require specialist attention, not all pet shops stock them. *Yellow Pages* may list local specialist suppliers (look under 'Pet Shops'*)*. There are a number of web sites offering reptiles and reptile housing; live animals will usually need to be collected from the retailer. *Appendix I* and *III.18* include a number of suppliers of reptiles. The web site www.reptileallsorts.com/reptileshops.htm lists reptile suppliers grouped by county. Suppliers of live foods are given in *Appendix I, III.9, III.12, III.13* and *III.14*.

7.11 Birds

Cage birds provide opportunities for pupils to observe feeding methods, behaviour and flight mechanisms. However, before embarking on setting up cages or an aviary, several important issues must be considered.

- There are important health issues that may arise when certain birds are kept in captivity.
- Birds demand *daily* attention, so it is particularly important to plan how this can be provided during holiday periods.
- Birds can be easily disturbed in noisy classrooms.
- The cages in which they are kept must be of a sufficient size to enable birds to fly adequately, often making siting difficult.

7.11.1 Health issues

Parrots, parakeets, pigeons and doves may be carriers of the organism *Chlamydia psittaci* causing a disease known as ornithosis (sometimes also referred to as parrot disease, or psittacosis when it occurs in

members of the parrot family of birds). Since this disease can be transmitted to humans, these birds are best not kept in schools. Despite being common household pets, similar concerns also apply to budgerigars. Schools would therefore be well advised to choose a less susceptible, noisy and aggressive species. Other wild or recently-imported species may also be affected by the disease. Even if disease-free birds are purchased, any contact with wild bird populations introduces the risk of their acquiring the disease and passing it on to those caring for them.

Symptoms in birds This can affect all organ systems of the bird's body, resulting in diarrhoea, sneezing and pneumonia. Other symptoms may include anorexia, lethargy, runny nose and eyes, and fluffed feathers. If left untreated, the bird will usually die of malnutrition or pneumonia. Some birds can have a latent infection, appearing to be healthy but able to develop symptoms later in response to nutritional deficiencies, overcrowding, breeding, egg-laying or prolonged transport.

Symptoms in humans Humans become infected if they breathe in the organism when the urine, saliva or dried faeces of infected birds becomes dispersed as very fine droplets or dust particles during cage cleaning and handling. In humans, the disease usually produces mild flu-like symptoms but, in children and more-elderly people, the condition can be more severe and even life threatening.

Particles from feathers and droppings may also cause ***asthma*** in sensitive individuals.

7.11.2 Choosing a suitable species of bird to keep in school

Bearing in mind the health problems already described, one of the small finches available through local pet stores represents the best purchase for schools wishing to maintain a small colony of birds. These are small, easy to manage and can live for up to five years. Widely-available varieties include zebra, fire and Bengalese finches. A pair of finches can be kept in an indoor cage but, being social birds, they flourish best as groups in an aviary.

One of a wide range of differently-patterned Zebra finches

7.11.3 Housing

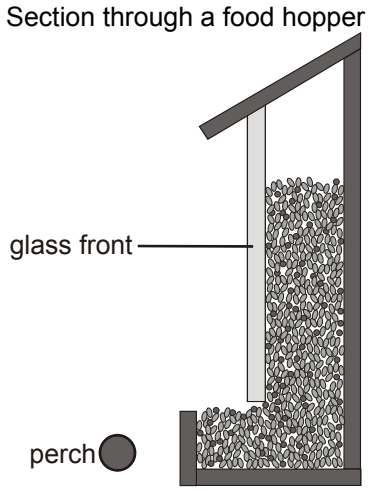
Indoor housing

Small groups of finches can be kept indoors in a cage with a solid back, top and sides. These are to be preferred to the open-wire type, since they provide greater security and freedom from draughts. Small varieties can escape by squeezing between the vertical bars of some wire cages; take this into account when choosing your stock or ensure that the spacing of the wire bars is sufficiently narrow. A cage should be positioned so that some parts of it are in the light and others in shade, enabling the birds to seek shelter or warmth when necessary. Finches are active flyers, so it is important to provide the largest cage that can be accommodated; length is more critical than height. A 'double breeder'-size cage with dimensions of *at least* 900 x 300 x 300 mm is required. This is capable of housing four adults or a breeding pair and their young. Some versions of these cages can be divided into two halves by a partition so that, if necessary, two incompatible adults can be housed! A flight cage measuring 1830 x 914 x 1830 mm with a small sheltered feeding area is enough to house 4 to 5 breeding pairs of finches. Choose a cage with a removable base tray for cleaning purposes. The flooring should be covered with clean, dry sand (or a sanded sheet in smaller cages). Sand and droppings should be removed at least once a week. Bearing in mind the

health risks mentioned above, it is a wise precaution *particularly where the birds could have any contact with wild species*, to wear gloves and a dust mask when cleaning out the cage.

Equipping the cage Perches are essential and should be chosen to suit the feet of the finch. A variety of perch sizes, shapes and diameters should be provided in order to exercise the birds' feet and toes. When calculating the length of perch required, work on the basis that each bird will require at least 76 mm of perching space. Place the perches strategically to ensure that droppings do not contaminate water and food dishes and to prevent the tail from hanging in dishes or on the floor. A solid front to the cage about 100 mm high is also useful, since it reduces the amount of material that the birds can cast out of the cage. Toys, such as bells and mirrors, in the finch's cage will help to enrich the birds' environment.

Food can be provided in any convenient dish or pot, if it cannot be easily overturned. However, although cheap and easy to clean, they can readily become contaminated and require regular topping up. Hoppers, on the other hand, can supply sufficient seed to last for several days. Hoppers with glass inspection fronts are ideal since they give a clear picture of how much seed is in reserve. Seeds from the hopper trickle down into a tray from which the birds can feed.



Water for bathing should be provided in shallow dishes or trays. Water for drinking is best supplied in pots hung on the inside walls of the cage.

A supply of cuttlefish bone should be hung from the bars to provide the birds with the source of calcium necessary for healthy bone growth. A small dish of grit should also be provided. The birds swallow this, retaining it in their gizzards where it aids the breakdown of the seeds that form the main component of the diet.

Outdoor housing

Finches, once acclimatised, can be housed in outdoor aviaries with small draught-proof indoor compartments to provide sleeping and feeding quarters. Although the construction of such an aviary from timber and 10 x 10 mm mesh galvanised wire netting is not difficult, aviaries can also be purchased in self-assembly form from some companies specialising in the manufacture of wooden buildings and garden furniture. Some such manufacturers are listed in *Appendix 1* but it is also worth checking the 'Animal & Bird Housing' and 'Pet Shops' entries in *Yellow Pages*.

A frost-free site should be chosen for the aviary, the sheltered section of which must be maintained above 7 °C at all times. An electric tubular heater is usually sufficient to achieve this. In winter it is wise to shut the birds in their shelter on cold days and at night. Day length is also a problem for zebra finches since winter days are too short to provide them with sufficient time to feed adequately. Switching on a fluorescent light in the frost-free shelter for a few hours will solve this problem.

Plentiful perching could be provided in the form of dowelling. If a more-natural appearance is preferred, well-scrubbed apple or pear branches can be introduced into the aviary. It is helpful to plant climbers against one wall of the flight area in order to provide nesting sites and sources of insects for food. Gravel, bark or sand make suitable flooring.

7.11.4 Caring for birds

Finches are very active and rapidly burn off energy. As a result, without an adequate food supply they may starve to death in as little as 24 hours. In captivity, they live on a diet of fresh fortified finch seed or specially-formulated pellets. As they only eat the top layer in the hopper, the food must be stirred whenever it is topped up in order to prevent seed from becoming stale. The basic diet should be supplemented with chopped dark-green and yellow vegetables, a variety of fresh fruits and a source of protein such as hard-cooked chopped egg or grated cheese. Fresh fruits and vegetables should be removed within 2 hours of being offered in order to prevent spoilage. Millet spray is a popular addition to the diet and small quantities of powdered vitamins can be sprinkled on the food or added to the water. Fresh water should be provided each day, washing out the water cup on each occasion to reduce bacterial growth. This is especially important if vitamins have been added to the cup. Finches are keen bathers and water should be provided in shallow dishes during the early part of the day.

7.11.5 Alternative ways of studying birds

Bearing in mind the health issues and the need for high levels of care and supervision involved in keeping birds, schools may wish to consider alternative ways of observing their anatomy and behaviour. Bird feeders and nesting boxes (see suppliers listed in *Appendix I*) will attract birds close enough to the class-room or laboratory for such studies to be made. Equipment of this sort is, of course, widely available from garden centres and nurseries, but children learn much more by designing and building it themselves. Much useful guidance on this approach is available from a number of sources, particularly the RSPB, the details of which are given in *Appendix IV*.

Suppliers of birds, cages and aviaries: Names of some suppliers of finches and aviaries are given in *Appendix I, II.29* and *III.19*. Stock can sometimes be purchased from pet stores and garden centres as well as specialist suppliers. Visit personally to collect and transport your purchases. Check also the *Yellow Pages* entries under 'Bird Breeders and Dealers'.

7.12 Poultry

Guidance on incubators and brooders for housing developing chicks, ducks and other domesticated species is given in CLEAPSS Guide L71, *Incubating and Hatching Eggs*. This includes a brief discussion of keeping the adult birds. It is advisable to consult with local authority Education, Planning and/or Health departments since they may have specific requirements concerning the keeping of livestock out-doors on school premises.

7.13 Small mammals

CLEAPSS Guide L52, *Small Mammals,* provides detailed information about the choice, housing and care of a variety of mammals including:

- mice
- rats
- syrian and russian hamsters
- mongolian gerbils
- guinea pigs
- rabbits.

The following information should be read in conjunction with the Guide, which was written some time ago, with consequent developments in some aspects of the information.

7.13.1 Choosing a suitable cage

It is most important to provide sufficient space for the animals. The Universities' Federation for Animal Welfare suggests the following *minimum* requirements.

Table 4 Cage sizes

Species	Minimum floor area, cm^2	Minimum height, cm
Mouse (pair or trio)	500	12.5
Rat, gerbil, hamster (pair)	1000	25.0
Guinea pig (pair)	2500	30.0
Rabbit (single up to 4 kg)	5500	45.0

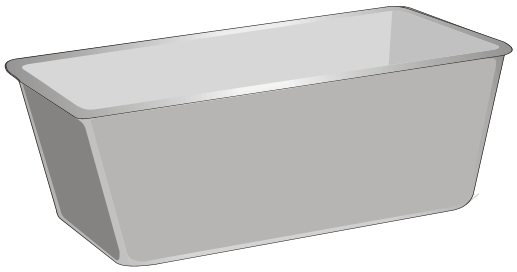
Check that metal, glass or acrylic parts in the cage have well-rounded edges. Any wood used in its construction should be coated with polyurethane varnish so that it can be easily cleaned. All doors should close securely and any removable parts should fit well to prevent escapes. If possible, choose a design that allows the animals to be taken out without the need to remove the entire cage top (in many cases the door is only suitable for adding fresh food). Plastic cages should not have any edges that animals can gnaw. Particular attention should be paid to the food and water containers provided with the cage; they must be stable and easy to maintain and of a design such that the occupants do not easily soil them as they burrow through the substrate lining the cage. Make sure that the base of the cage is deep enough to shelter the occupants from draughts - a depth greater than the height of the animal to be housed is necessary. This will also ensure that the animals have the opportunity to conceal themselves in their bedding. The environment can be enriched using ladders, platforms and tubing.

7.13.2 Types of housing available

Three types of mammal cages are commercially available, 'laboratory' cages, pet-market cages and hutches.

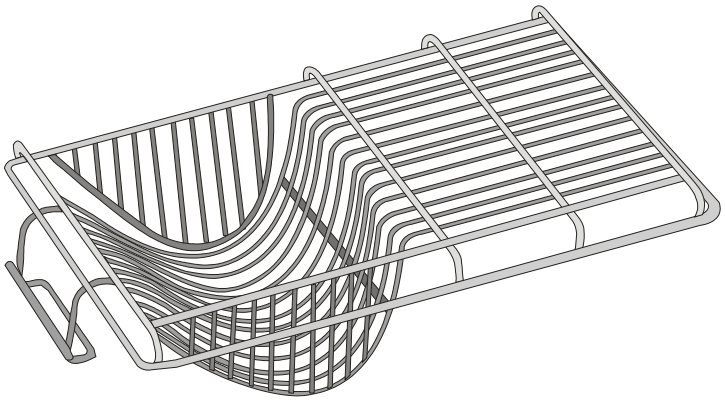
'Laboratory' cages

These are all similar in basic design but differ in the materials from which they are made and the accessories that they can accommodate. A typical laboratory cage consists of an opaque plastic tray at least 130 mm deep, with smooth, rounded corners. The walls are deep enough to shield the occupants from draughts and to provide them with some degree of privacy. The plastics from which these cages are constructed, polycarbonate or polypropylene, are impervious to liquids, while the rounded corners make cleaning easy, thereby contributing to the maintenance of hygienic living conditions. However, they are normally opaque or translucent, making the animals more difficult to observe. Transparent versions are available from some manufacturers but are not recommended for schools, since they provide little privacy for the occupants. Various sizes of cage are available, with versions to suit mice, rats and guinea pigs.

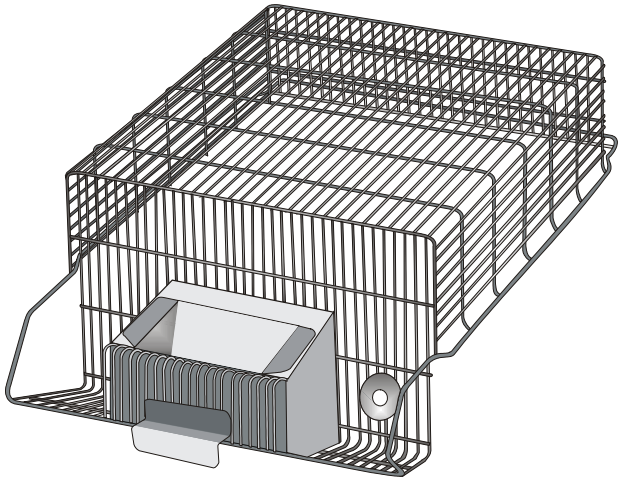


The base of a laboratory mammal cage

Lids for these cages consist of a stainless-steel wire top that clips securely to the base. The lid can be flat or domed to provide greater height. Provision is normally made for food to be held in the lid, together with a water bottle. (Such lids may be available separately from North Kent Plastics; see *Appendix 1*.) These cages are designed to provide good living conditions for small mammals but are not the best for displaying and observing them.



A flat lid with food hopper



A raised lid with food hopper and dedicated provision for a water bottle

Wire cages

These consist of a shallow plastic or metal tray onto which a metal wire cover fits. The sides of this tray serve to reduce the risk of debris being thrown out by the occupants, while the cover provides support for exercise wheels, food hoppers and water containers. Covers of different height allow for different volumes and arrangements of accessories to be provided. Many of these cages are not wholly satisfactory for many mammals. They do not shield the occupants from draughts and prying fingers. Without substantial quantifies of bedding, there are few places into which the animals can withdraw. Cages supplied by pet shops are often of this type and should be carefully examined to make sure they provide suitable accommodation for use in schools, where a warm, quiet environment cannot be guaranteed.

The Rotastak system

This was originally designed to house hamsters and consists of a large range of moulded, transparent-plastic, housing modules that can be linked by tubes. Modules can be added to create a structure, the extent of which is limited only by cost and floor space. The publicity for, and philosophy behind, this system creates a rather ‘humanised’ and sentimental view of animals that may conflict with the teaching and learning intentions of schools.

Opinions of the system vary. Many owners find its appearance attractive and its structure does encourage the occupants to become active and explore. However, it has a number of significant disadvantages. Earlier versions allowed the occupants to escape. The cylindrical elements of the design provide few places for the occupants to seek refuge and it is not easy to keep clean and hygienic.

Hutches

These are designed for larger mammals and for outdoor use. They are often made by small, specialist manufacturers, retailing through local pet stores and garden centres. Look for a cage of adequate size (see the table in Section *7.13.1 Choosing a suitable cage)* with a secure nesting area. If kept outdoors, the addition of a secure exercise pen area should be considered. Hutches are usually designed to provide a secure nesting box and an open 'living' area. Make sure that the nesting area has a secure door to enable the bedding material to be cleaned out and replaced. All timber surfaces should be smooth, well-finished and sealed with a good-quality polyurethane-type varnish. In particular, the flooring (which is usually made of composition board) must be waterproof and secured with glue and nails to the walls to ensure a good seal. Cheap cages are rarely good value in the longer term. If the hutch is to be situated out of doors it is important to find a situation that is sheltered from strong winds and both frost-free and shaded from direct sunlight, since extremes of temperature can be harmful to the occupants.

Suppliers of mammal cages: Details of retailers and guide prices of relatively shallow-based wire mammal cages are in *Appendix II.30*. Information about manufacturers and the single school retailer (Timstar Laboratory Suppliers) of the North Kent Plastics laboratory mammal cages are given in *Appendix II.31*. If it proves impossible to locate a retailer that can provide a suitable item, the manufacturers listed in *Appendix I* are usually willing to help genuine enquirers. Suppliers of animal hutches and typical costs are given in *Appendix II.32*.

Suppliers of small mammals: In the past, it was possible to purchase small mammals such as rats, mice and gerbils from several scientific suppliers in the knowledge that the conditions in which they had been kept were closely monitored as part of an accreditation scheme. Such a scheme, from which schools can benefit, is no longer open to them. Transportation has also become more rigidly regulated with the inevitable result that many schools now have limited access to a supply of small mammals other than local pet shops or local breeders, where these are known. (Philip Harris and Timstar Laboratory Suppliers are the only educational science supply companies that sell live mice and rats - the latter only to schools in its van delivery area; see *Appendix III.20*.)

The web site of the Pet Health Council - www.pethealthcouncil.co.uk/contacts.shtml - publishes a list of useful contacts which includes details for national societies of breeders of small mammals. It may be possible to obtain details of local breeders (likely to be reliable sources of healthy stock) from such contacts.

When purchasing from local sources, it is therefore important when considering keeping small mammals to pay careful attention to the standards of care and hygiene applied by these local suppliers. In particular, it is necessary to request a view of the animal accommodation and to ask:

- from where does the shop obtain its stock?
- what health checks are carried out before animals are put up for sale?
- what veterinary advice does the shop seek?
- in what conditions are animals housed? How is weekend and holiday supervision maintained?
- what advice does the shop provide for customers?

Only when satisfied that the stock is healthy and well-cared for should purchase be considered.

APPENDIX I Suppliers of animals, housing and other equipment

This list is not comprehensive. In addition to the suppliers listed here, it is always worth searching *Yellow Pages* (ideally using the web site *www.yell.com*) under 'Animal and Bird Housing' for local sources of supply. Details have also been given of some manufacturers of products, such as animal hutches and aviaries that are usually supplied by local garden centres or pet stores. If identifying a local source proves difficult, manufacturers are usually prepared to provide details about the retail outlets that they supply.

The supply of livestock from various companies frequently changes depending on what is available at the time an enquiry is made. The types of animals supplied in the lists below should be used as a guide only.

NB Inclusion of companies in this list has not been made on the basis of any evaluation of the quality of their services or products. Schools should check prices and availability before placing orders. Companies offering vertebrate livestock should be questioned about their policies relating to sourcing, housing and care of the animals that they supply.

John Allan Aquariums

Eastern Way Industrial Estate
Bury St Edmunds
IP32 7AB
Tel: 01284 755051
Fax: 01284 750960
E-mail: sales@johnallanaquarium.com
Web site: www.johnallanaquariums.com

A long-established company that sells not only its own range of aquaria but those of other manufacturers, together with a very wide range of pumps, power heads, filters, lighting units and various sundries. In addition, the company retails vivaria, aviaries and animal pens, largely for the pet-shop trade.

Although it principally deals with commercial clients, the company is happy to supply to schools.

Anglia Aquatics

Deeply Rooted Garden Centre
Ellingham
NR17 1AW
Tel: 01953 457150
Fax: 01953 457150
E-mail: sales@angliaaquatics.com
Web site: www.angliaaquatics.com

Specialises in marine and invertebrate aquarium supplies. It lists an extensive range of equipment including aquaria, filters, heaters and lighting units.

Animal Allsorts (The Reptile House)

55 - 57 & 65 - 67 Stephenson Road
High Heaton
Newcastle upon Tyne
NE7 7SA
Tel: 0191 266 6290
Fax: 0191 240 0612
Mobile: 0976 306643
E-mail: -
Web site: www.reptileallsorts.com

Not only stocks a wide range of animals and accessories, but has an informative web site that includes a **useful list of reptile suppliers and clubs / associations on its home page.**

The Aquarium Shop

Just Buy Online Ltd
45D Victoria Road
Surbiton KT6 4JL
Tel: 0870 740 8835
Fax: 0870 870 8833
Email: Via web site
Web site: www.theaquariumshop.co.uk

A web-based company advertising a wide range of aquaria, pumps, filters, skimmers and other fish-keeping accessories.

Aquatics Direct

Silk Street
Congleton CW12 4DJ
Tel: 01260 275144
Fax: 01260 298141
E-mail: sales@aquatics-direct.co.uk
Web site: www.aquatics-direct.co.uk

Juwel brand aquariums, pumps, heaters, filters, power-heads, skimmers, lighting, marine salts etc.

Aquatics Online

6/3 Newlands Avenue
Brackla Industrial Estate
Bridgend CF31 2DA
Tel: 01656 663427
Fax: 01656 663427
E-mail: mail@aquatics-online.co.uk
Web site: www.aquatics-online.co.uk

Advertises an extensive range of aquaria, filters, lighting units, heaters etc (but not livestock). Also sells various formulations of marine salt.

Aquatics Warehouse

Lancaster
LA2 0HE
Tel: -
Fax: -
E-mail: info@aquatics-warehouse.co.uk
Web site: www.aquatics-warehouse.co.uk

An internet company which stocks a full range of aquaria together with accessories of all types. Marine salt.

Armitages Pet Products

Armitage House
Colwick NG4 2BA
Tel: 0115 938 1200
Fax: 0115 938 1234
E-mail: enquiries@armitages.co.uk
Web site: www.armitages.co.uk

Produces the *Rotastak* range of plastic small mammal housing. Products in this range include: starter kit; deluxe starter kit; adventure zone; cosmo pod; super pod; mega pod; pod extension; maxi mansion; maxi penthouse; tunnel of fun; rainbow runner; spaghetti junction; curvy tube; burrow basement; room extension with playwheel; attic bedroom; space station; ladder; crossroad; tunnel system etc.

Aviary Accessories

21 St Peter's Avenue
Hayling Island PO11 0SA
Tel: 023 92 466626
Fax: 023 92 460737
E-mail doug.riley@aviaryaccessories.co.uk
Web site: www.aviaryaccessories.co.uk

Manufactures an extensive range of aviaries and animal hutches, both custom-made and standard items. Aviary design includes types suitable for siting indoors. Also supplies feeders, perches, nest boxes, various cage toys and seed winnowers.

Beecroft & Partners Ltd

Northfield Road
Rotherham S60 1RR
Tel: 01709 377881
Fax: 01709 369264
E-mail: sales@beecroft-science.co.uk
Web site: www.beecroft-science.co.uk

General science suppliers listing a wormery, an insect cage, pooter, aquariums, aquarium hoods, lighting, heating, pumps and filtration systems.

The Bird Shop

53A Gosport Road
London E17 7LX
Tel: 0208 509 2079
Fax: -
E-mail: anitalincoln@dsl.pipex.com
Web site: www.thebirdshop.co.uk

Stocks birds, including zebra finches, together with cages and accessories.

Blades Biological Ltd

Cowden
Edenbridge TN8 7DX
Tel: 01342 850242
Fax: 01342 850924
E-mail: sales@blades-bio.co.uk
Web site: www.blades-bio.co.uk

Also agents for the US company Carolina Scientific.
Web site: www.Carolina.com

A major supplier of a wide range of living organisms: various species of earthworm, land snails (including giant African snails); brine shrimps, locusts; fruit flies; blowflies and maggots; butterflies; cockroaches; ants; stick insects; woodlice; various beetles; crickets; axolotls; sticklebacks and some native marine invertebrates.

Also supplies plastic tanks, aquarium heaters and pumps, butterfly cages, fluon paint, marine salt and many other items.

B & K Universal Ltd

The Field Station
Grimston, Aldbrough
Hull HU11 4QE
Tel: 01964 527555
Fax: 01964 527006
E-mail: info@bku.com
Web site: -

Manufacturers of laboratory-type rodent cages and research items. In the absence of many educational sources of laboratory-type mammal cages it may be necessary to enquire of the manufacturer for the name of a retailer.

Bransby Bunny

Bransby
Lincoln LN1 2PH
Tel: 01427-788385
Fax: 01427-787062
Email: info@bransby-bunny.co.uk
Web site: www.bransby-bunny.co.uk

Manufactures pressure-treated kennels, aviaries and other timber animal housing. Delivers across the UK.

Bugs Direct UK

2 Well Cottages
Devon TQ11 0JU
Tel/Fax: 01803 762409
E-mail: sales@bugsdirectuk.com
Web site: www.bugsdirectuk.com

Supplies a wide range of invertebrates including giant African snails, fruit and other beetles, cockroaches, millipedes, tarantulas and stick insects. Also sells live foods and insect 'starter kits' of animals with basic equipment for giant African snails, tarantulas, stick insects, millipedes, cockroaches etc.

Ernest Charles

Copplestone Mills
Copplestone
Crediton EX176 5NF
Tel: 0800 7316 770
Fax: 01363 84147
E-mail: -
Web site: www.ernest-charles.com

Supplies wormeries and composting materials, bird tables and feeders, nesting boxes and bird food, as well as various boxes to provide outdoor accommodation for native insects, birds and mammals.

Virginia Cheeseman

21 Willow Close, Flackwell Heath
High Wycombe HP10 9LH
Tel: 01628 522632
Mobile: 07971 838724
Fax: 01628 522632
E-mail: Virginia@virginiacheeseman.co.uk
Web site: www.virginiacheeseman.co.uk

Retails an extensive range of stick insects, millipedes, beetles, cockroaches, crickets, spiders, praying mantis and snails. Also sells black netting cylinder cages (while stocks last), nylon netting, heating & other equipment and books.

Coast to Coast Exotics

124 New Road
Darlington DL1 2EJ
Tel: 01325 283756
Fax: 01325 255060
E-mail: c2cexotics@aol.com
Web site: www.coasttocoast.co.uk

A wide range of invertebrates, reptiles, amphibians and herpetological supplies (including live food animals such as locusts and crickets) is listed on the company web site. A number of useful care sheets can also be downloaded.

Commotion

Unit 11, Tannery Road
Tonbridge TN9 1RF
Tel: 01732 225800
Fax: 01732 773390
E-mail: sales@commotiongroup.co.uk
Web site: www.commotiongroup.co.uk

Primary school equipment supplier which lists a limited range of products including an ant observation kit, wormeries and plastic aquaria.

Custom Aquaria

Units E & F, Mark Grove House
Allen Road
Rushden NN10 0DU
Tel: 01933 356894
Fax: 01933 356894
E-mail: -
Web site: -

This company stocks a wide range of glass aquaria and will also manufacture tanks to customers' specification. It also supplies vivaria and small mammal cages.

Euro Rep

The Cottage in the Wall
Dawley Road
Hayes UB3 1EF
Tel: 0208 573 4311
Fax: 0208 561 1650
E-mail: sales@eurorep.co.uk
Web site: www.eurorep.co.uk

A major breeder of amphibia and reptiles for retail outlets; sells live foods, animal housing, heating and lighting equipment and other accessories.

Faunology

PO Box 107
Pontefract WF9 1YW
Tel: 01977 651187
Fax: 01977 644884
E-mail: info@faunology.co.uk
Web sites: www.faunology.co.uk
www.frozendirect.com
www.globallivefood.com

This company supplies a range of living organisms including land hermit crabs, giant African millipedes, giant African land snails, praying mantis, hissing cockroaches, crickets, scorpions, tarantulas, stick insects and beetles. Also, vivaria, heating and lighting equipment, videos and books.

Subsidiary companies, *Frozen Direct* and *Global Live Food*, supply foods for reptiles and amphibia such as frozen mice, locusts, crickets etc.

Frozen Direct
Global Live Food

See Faunology.

GLS Educational Supplies Ltd

1 Mollison Avenue
Enfield EN3 7XQ
Tel: 020 8344 4000
Fax: 020 8344 4044
E-mail sales@glsed.co.uk
Web site: www.glsed.co.uk

General school equipment supplier which lists a limited range of animal housing such as housing for ladybirds, ant world, plastic boxes / tanks and propagators.

Griffin Education

Bishop Meadow Road
Loughborough LE11 5RG
Tel: 01509 233344
Fax: 01509 231893
E-mail: griffin@fisher.co.uk
Web site: www.griffineducation.co.uk

An educational scientific supplier with a very limited range consisting of a wormery, one plastic aquarium, aquarium air pumps and power filters.

Growing Success

Wessex House
Units 1-3, Hilltop Business Park
Devizes Road
Salisbury SP3 4UF
Tel: 01722 337744
Fax: 01722 333177
E-mail: enquiries@growingsuccess.org.uk
Web site: www.growingsuccess.org.uk

Manufacturers of a range of timber wildlife housing, including traditional bird boxes, owl roosts and nesting containers for bumble bees, mason bees, dormice, bats and a variety of other animals. The web site also has a facility to search for the location of local retailers.

J E Haith

65 Park Street,
Cleethorpes DN35 7NF
Tel: 0800 298 7054
Fax: 01472 242883
E-mail: sales@haiths.com
Web site: www.haiths.com

Supplies bird tables & feeders, nesting boxes and bird food.

Philip Harris Education

Findel House, Excelsior Road
Ashby Park, Ashby de la Zouch LE65 1NG
Tel: 0845 120 4520
Fax: 01530 419492
E-mail: orders@philipharris.co.uk
Web site: www.philipharris.co.uk

Another major supplier to the education market. Stocks a complete aquarium and air pump/heater accessories, plastic vivaria, wormeries, an insect cage and a ladybird house resource pack. Also sells a limited range of live animals including *Drosophila*, locusts, and kits for rearing butterflies, moths and stick insects.

Rob Harvey

Kookaburra House
Gravel Hill Road
Holt Pound
Farnham GU10 4LG

Tel: 01420 23986
Fax: 01420 23078
E-mail: rob@robharvey.com
Web site: www.robharvey.com

Supplies hutches and poultry housing, aviaries, bird tables and feeders, nesting boxes and bird food. Lists a range of equipment for keeping reptiles including plastic vivaria, heat mats, thermostats, lighting, substrates etc. Also sells live foods including mealworms, locusts, crickets and waxworms.

John Hopewell

6 Hellaby Lane
Hellaby Industrial Estate
Rotherham S66 8HN

Tel: 01709 542428
Fax: 01709 541430
E-mail: info@johnhopewell.co.uk
Web site: www.johnhopewell.co.uk

Manufactures a range of metal-and-wire housing for small mammals, including a range of rat and chinchilla cages. Also manufactures and retails systems for feeding and watering mammals, details of which are given on the web site.

Hutch Co

7 Sunfield
Stanningley
Pudsey LS28 6DE

Tel: 0113 255 9382
Fax: -
Email: sales@hutchco.co.uk
Web site: www.hutchco.co.uk

This company lists a large number of hutches and runs for guinea pigs, rabbits and poultry and offers to deliver across the UK.

Arnold Johnson

1 Bron y Glyn
Bronwydd
Carmarthen SA33 6JB

Tel: 01267 236 329
Fax: -
E-mail: -
Web site: -

Sells a range of rigid-framed netting insect cages.

Insect Lore

PO Box 1420
Kiln Farm
Milton Keynes MK19 6ZH

Tel: 01908 563338
Fax: 01908 262654
E-mail: orders@insectlore.co.uk
Web site: www.insectlore.co.uk

Retails a range of kits and books dealing with maintaining animals, aimed at the primary school market. Housing for butterflies, worms, ants, snails and pond life. Also supplies live animals including ants, snails, ladybirds, worms, *Triops* and hissing cockroaches.

Interplay UK Ltd

Crown Lane
Marlow
SL7 3HL.

Tel: 01628 488944
Fax: 01628 476700
E-mail: sales@interplayuk.co.uk
Web site: www.interplayuk.co.uk

Manufactures Ant World, Worm World etc. Worksheets for using these products can be downloaded from the web site. Products are sold by a number of the general school suppliers that are included in this list.

John Hopewell

6 Hellaby Lane
Hellaby Industrial Estate
Rotherham
S66 8HN

Tel: 01709 542428
Fax: 01709 541430
E-mail: info@johnhopewell.co.uk
Web site: www.johnhopewell.co.uk

Manufactures a range of metal-and-wire housing for small mammals, including a range of rat and chinchilla cages. Also manufactures and retails systems for feeding and watering mammals, details of which are given on the web site.

Juwel Aquaria

Gateway 11
Penfold Drive
Wymondham
NR18 0WZ

Tel: 01953 606363
Fax: 01953 603839
E-mail: service@juwel-aquarium.co.uk
Web site: www.juwel-aquarium.com

Manufacturer of aquaria, hoods and accessories. This is a brand that is widely stocked by many of the aquarium suppliers mentioned in this list. The web site enables a search for local suppliers to be made.

Linpac Materials Handling

Newfield Close
Green Lane
Walsall WS2 7PB

Tel: 01922 726060
Fax: 01922 643422
E-mail: lmhsolutions@linpac.com
Web site: www.linpac.com

Part of the Linpac group, this company manufactures tanks, plastic troughs, trays and containers. Some of these items are stocked by retailers included in this list.

Livefoods Direct

Houghton Road
North Anston Trading Estate
Sheffield
S25 4JJ

Tel: 01909 518888
Fax: 01909 568666
E-mail: sales@livefoodsdirect.co.uk
Web site: www.livefoodsdirect.co.uk

Live crickets, mealworms, locusts and waxworms. Also frozen foods for reptiles and amphibians.

Livefoods UK

The Acres, Gills Lane
Rooks Bridge BS26 2TZ
Tel: 01934 750743
Fax: -
E-mail: Info@livefoods.co.uk
Web site: www.livefoods.co.uk

In addition to a range of live invertebrate and frozen vertebrate food animals, this company offers a range of vivaria, heating and lighting accessories, substrates and literature.

Living Designs

20 Victoria Road
Wood Green
London N22 7XB
Tel: 020 8881 1594
Fax: 020 8881 1594
E-mail: anniehouse@designs.co.uk
Web site: -

PVC animal cages, both ready-made and as flat pack, in a range of sizes and designs.

D & P Marchant

Pentre Bach Uchaf
Llanaelhaearn
Caernarfon LL54 5BE
Tel: 01758 750469
Fax: 01758 750125
E-mail: sales@dandpmarchant.co.uk
Web site: www.dandpmarchant.co.uk

Wooden bird cages, aviaries and pet housing.

MICROclimate International Ltd

Unit 4, Wombourne Enterprise Park
Bridgenorth Road
Wombourne WV5 0AL
Tel: 01902 895351
Fax: 01902 897613
E-mail: sales@microclimate.co.uk
Web site: www.microclimate.co.uk

Suppliers of heat mats, ceramic heating units and thermostats from simple to sophisticated.

Moncaster Wire Products Limited

Belvoir Way
Fairfield Industrial Estate
Louth LN11 0JG
Tel: 01507-600666
Fax: 01507-600499
E-mail: sales@moncaster.co.uk
Web site www.moncaster.co.uk

Manufactures wire cages, including some for small mammals. Also aviaries.

Monkfield Nutrition Ltd

Church Farm Barn
Wendy, Nr Royston SG8 0HJ
Tel: 01223 208261
Fax: 01223 208424
E-mail: sales@monkfieldnutrition.co.uk
Web site: www.monkfieldnutrition.co.uk

Flat-pack melamine vivaria, heating and lighting equipment, live invertebrate and frozen vertebrate food animals for reptiles and amphibia.

Morley Aviaries and Birds

Hill Road
Morley St Peter
Wymondham NR18 9UB
Tel: 01953 452321
Fax: 01953 457356
E-mail: morleyaviaries@btinternet.com
Web site: www.morleyaviaries.co.uk

Stocks a wide range of birds, including zebra finches. Also supplies aviaries and d-i-y panels for aviary construction.

NES Arnold

Findel House
Excelsior Road
Ashby Park
Ashby de la Zouch
LE65 1NG
Tel: 0845 120 4525
Fax: 0800 328 0001
E-mail: orders@nesarnold.co.uk
Web site: www.nesarnold.co.uk

Primary school equipment supplier which lists a limited range of products including, an ant observation kit, wormery, plastic aquaria and butterfly kit.

The Netfysh

PO Box 143
Haxby
York YO32 3XY
Tel: -
Fax: -
E-mail: support@netfysh.com
Web site: www.netfysh.com

Internet mail-order company that sells *Triops, Daphnia*, fairy shrimp and brine shrimp ('sea monkey') eggs / kits.

North Kent Plastic Cages (NKP)

Unit 4 Gills Court
Medway City Estate
Strood
Rochester
ME2 4NR
Tel: 01634 295888
Fax: 01634 725877
E-mail: northkenpl@aol.com
Web site: -

Manufacturers of laboratory-type plastic cages and equipment for small mammals. Some of this manufacturer's cages are sold by Timstar Laboratory Suppliers. Schools requiring an alternative retail source of cages not stocked by Timstar should seek guidance direct from NKP.

Offa Rocks

Lower Hengoed
Oswestry SY10 7AB
Tel: 01691 650469
Fax: 01691 659051
E-mail: robin@offarocks.co.uk
Web site: www.offarocks.co.uk

Supplies a variety of geological specimens, including chalk and calcareous limestone suitable for including in the housing of lime-loving species such as snails etc.

Original Organics Limited

9 Langlands Business Park
Uffculme
EX15 3DA
Tel: 01884 841515
Fax: 01884 841717
E-mail: sales@originalorganics.co.uk
Web site: www.originalorganics.co.uk

Wormeries (for making compost) and tiger worms.

Oxford Bee Company Ltd

Unit 21
Meadow Lane Industrial Estate
Gordon Road
Loughborough
LE11 1JP
Tel: 01509 261654
Fax: 01509 211556
E-mail: info@oxbeeco.com
Web site: www.oxbeeco.com

Bee nesting boxes, ladybird homes, bat boxes, and a range of literature concerned with encouraging wildlife.

Peak Aquatics

Staden Business Park
Ashbourne Road
Buxton
SK17 9RZ
Tel: 01298 24438
Fax: 01298 27340
E-mail: peak@aquatics99.freeserve.co.uk
Web site: -

Aquaria and stands. Aquarium lighting kits, filters, air and water pumps. Sea salt. Vivarium supplies for reptiles, including heaters, lighting units and live food.

Does not deal directly with schools but can be contacted for details of a retailer.

Peregrine Livefoods Ltd

PO Box 45
Loughton
IG10 3FX
Tel: 01992 815181
Fax: 01992 814787
E-mail: sales@peregrine-livefoods.co.uk
Web site: www.peregrine-livefoods.co.uk

Supplies reptiles, amphibia, spiders, some stick insects and other invertebrates. Also sells live food and frozen products, vivaria, heaters, lighting equipment etc. The company also supplies to the retail trade; see web site for details of stockists.

Pet House Ltd

16 Towerfield Road
Shoeburyness
Southend-on-Sea
SS3 9QE
Tel: 01702 296007
Fax: -
E-mail -
Web site: -

Manufactures rabbit hutches and other wooden housing for pet animals.

Pet Planet Co

10 Lindsay Square
Deans Industrial Estate
Livingstone EH54 8RL
Tel: 0845 345 0723
Fax: 0845 601 2765
E-mail: info@petplanet.co.uk
Web site: www.petplanet.co.uk

Together with a variety of items aimed at the pet market including *Rotastak* cages, this company sells a range of wooden hutches designed for housing small mammals in an outdoor environment.

Pets Parade Ltd

PO Box 2423
Stourbridge
DY7 5YR
Tel: 01384 878813
Fax: 01384 877101
E-mail: via web site
Web site: www.petsparade.com

This is a large retailer of pet supplies, including aquaria, heating and lighting accessories and some cages and hutches for small mammals.

Pet Planet Co

10 Lindsay Square
Deans Industrial Estate
Livingstone EH54 8RL
Tel: 0845 345 0723
Fax: 0845 601 2765
E-mail: info@petplanet.co.uk
Web site: www.petplanet.co.uk

Together with a variety of items aimed at the pet market including *Rotastak* cages, this company sells a range of wooden hutches designed for housing small mammals in an outdoor environment.

Recycle Works Limited

Unit 1 Bee Mill
Ribchester
Nr Longridge PR3 3XJ
Tel: 01254 820088
Fax: 01254 820055
E-mail: sylvia@recycleworks.co.uk
Web site: www.recycleworks.co.uk

Manufactures and retails a range of compost makers and the necessary worms to go with them. A version with transparent plastic walls is available for educational use.

Rep-Tech

PO Box 1922
Windsor SL4 4ED
Tel: 01753 830444
Fax: 01753 831551
E-mail sales@rep-tech.co.uk
Web site: -

Reptiles, amphibia, terrarium animals as well as live and frozen food for reptiles and amphibia. Also a wide range of equipment including vivaria, small mammal glass cages, repti-rock, pumps, thermostats, lighting, heat plates and mats, heat lamps and cables, tubular heaters etc.

Reptile Centre Online

159 Weedon Road
St James
Northampton NN5 5DA
Tel: 01604 753823
Fax: 01604 590059
E-mail sales@reptilecentreonline.co.uk
Web site: www.reptilecentreonline.co.uk

Live and frozen food for reptiles and amphibia. Also a wide range of equipment including vivaria, thermostats, lighting, heat plates and mats, heat lamps and cables etc. The Northampton Reptile Centre at this address supplies reptiles, amphibia and invertebrates including stick insects and spiders.

Riversway Aviculture

1 Romsey Road
Yeovil
BA215XN
Tel: 01935 427023
Fax: -
E-mail: riverswaymail@aol.com
Web site: www.riverswayonline.co.uk

Sells a range of food hoppers, water containers and other accessories for use in budgerigar cages. These will fit the majority of wire cages**.**

RS Biotech

Tower Works, Well Street
Finedon
NN9 5JP
Tel: 01933 680133
Fax: 01933 680155
E-mail: -
Web site: -

Listed in our previous guides as retailing the *Tecniplast* range of cages. It no longer does so; enquiries for items from this extensive range should be made direct to Tecniplast UK.

Safari Select

Commercial House
Vicarage Road
Waddon
Croydon CR0 4JS
Tel: 0870 753 4000
Fax: -
E-mail: safariselect@hotmail.com
Web site: www.safariselect.co.uk

Web site lists a wide range of cages, livestock and accessories for keeping birds.

Scientific & Chemical Supplies Ltd

Carlton House
Livingstone Road
Bilston WV14 0QZ
Tel: 01902 402402
Fax: 01902 402343
E-mail: education@scichem.co.uk
Web site: www.scichem.co.uk

A major school science equipment supplier that lists a range of aquaria, filters, air pumps, powerheads, lighting and heating equipment, an insect cage, glass and plastic tanks, wormery, wire animal cages.

Sciento

61 Bury Old Road
Whitefield
Manchester
M45 6TB
Tel: 0161 773 6338
Fax: 0161 773 6338
E-mail: sales@sciento.co.uk
Web site -

Supplies small living organisms including *Drosophila*, locusts and freshwater invertebrates.

Small-Life Supplies

Station Buildings
Station Road
Bottesford
NG13 0EB
Tel: 01949 842446
Fax: 01949 843036
E-mail: sales@small-life.co.uk
Web site: www.small-life.co.uk

A long-established supplier of stick insects, mantids, butterflies, millipedes, hissing cockroaches and giant African land snails. Also stocks three sizes of insect cages with ventilated panels (*Bug Studio*, *Bug Cage*, and *Bug XL Cage*) and accessories necessary for their care including a radiator to provide background heating. Runs a useful Helpline on its web site.

Southcoast Exotics

109 London Road
Cowplain,
Waterlooville
Portsmouth PO8 8XJ
Tel: 023 9226 9362
Fax: 023 9226 9363
E-mail: sales@southcoastexotics.com
Web site: www.southcoastexotics.com

Stocks a wide variety of reptiles and amphibia and suitable live and dry foods. See Southcoast Invertebrates for other animals and equipment.

Southcoast Invertebrates

109 London Road
Cowplain,
Waterlooville
Portsmouth PO8 8XJ
Tel: 023 9226 9362
Fax: 023 9226 9363
E-mail: sales@southcoastinverts.com
Web site: www.southcoastinverts.com

Stocks a wide variety of invertebrate animals including tropical spiders, stick insects, land crabs, millipedes, cockroaches, giant African land snails and suitable live and dry foods. Also vivaria and heating accessories.

The Spider Shop

Mobile: 07976 068549
E-mail: info@thespidershop.co.uk
Web site: www.thespidershop.co.uk

A small specialist outlet dealing in tropical spiders and some beetles. Also supplies equipment and books and offers ‘starter kits’ of equipment for keeping tarantulas, fruit beetles and praying mantis.

The Spiders Trap

Tel: 01442 395805 / 07957 902690
Fax: 01442 395805
E-mail: thespiderstrap@freeuk.com
Web site: www.thespiderstrap.freeuk.com

A small specialist outlet dealing exclusively in tropical spiders. The stock list frequently changes.

Taylors Garden Buildings

Ashwelthorpe Industrial Estate
Norwich
NR16 1ER
Tel: 01508 489260
Fax: -
E-mail: mail@taylorsgardenbuildings.co.uk
Web site: www.taylorsgardenbuildings.co.uk

In addition to large sheds and garden rooms, this company lists a number of wooden hutches and aviaries. Retail outlets around the UK.

Tecniplast UK Ltd

2240 Parkway
Kettering Venture Park
Kettering
NN15 6XR
Tel: 01536 312512
Fax: 01536 312505
E-mail: info@TecniplastUK.com
Web site: www.tecniplast.it

Large-scale international manufacturer of laboratory cages for animals of all sizes, plus a range of accessories. Contact the company directly for names of retailers.

Timstar Laboratory Suppliers

Timstar House
Marshfield Bank
Crewe
CW2 8UY
Tel: 01270 250459
Fax: 01270 250601
E-mail: sales@timstar.co.uk
Web site: www.timstar.co.uk

Major supplier of a general range of science education equipment, including aquaria and air pumps/ lighting/ heating accessories, insect cages, wormery and plastic vivarium. It is now the only UK supplier that lists traditional laboratory mammal cages (from North Kent Plastics) in its catalogue. It also sells brine shrimps, crickets, locusts, mealworms, *Drosophila*, *Triops*, stick insects, native land and aquatic snails, rats and mice (but only these small mammals to schools in the Timstar van-delivery area).

Top Up

12-24 Elizabeth Street
Congleton
CW12 4AJ
Tel: 01260 275144
Fax: -
E-mail: -
Web site: -

Specialises in the supply of propagators and vivarium base heaters.

TTS

Nunn Brook Road
Huthwaite
Sutton-in-Ashfield
NG172HU
Tel: 0800 318686
Fax: 0800 137525
E-mail: sales@tts-group.co.uk
Web site: www.tts-group.co.uk

A major supplier of science equipment to primary schools, its *Active Science* catalogue lists a few items of animal housing such as a wormery, butterfly garden kit, plastic tanks, various boxes to provide outdoor accommodation for various native insects, birds and mammals, as well as equipment for making observations.

Waterlife

Bath Road
Longford
UB7 0ED
Tel: 017573 685696
Fax: 01753 685437
E-mail: aquatics@waterlife.co.uk
Web site: www.waterlife.co.uk

Aquaria, freshwater and tropical fish and equipment.

The WaterZoo

439 Lincoln Road
Millfield
Peterborough
PE1 2PE
Tel: 01733 312142
Fax: -
E-mail: aquatics@waterzoo.co.uk
Web site: www.waterzoo.co.uk

This company stocks a wide range of aquaria, air pumps, powerheads, filters, heaters and lighting units as well as fish and aquatic plants.

Watkins & Doncaster

The Naturalists
PO Box 5
Cranbrook
TN18 5EZ
Tel: 0845 833 3133
Fax: 01580 754054
E-mail: sales@watdon.com
Web site: www.watdon.com

A long-established company that stocks aquaria, nets, butterfly cages, transparent plastic boxes and other equipment for handling and keeping insects.

Wharf Aquatics

65-67 Wharf Road
Pinxton
NG16 6LH
Tel: 01773 861255
Fax: 01773 863606
E-mail: enquiries@wharfaquatics.co.uk
Web site: www.wharfaquatics.co.uk

On-line retailer of a wide range of aquaria, accessories and livestock: freshwater and tropical. Also manufactures custom glass tanks to order.

Wiggly Wigglers

Lower Blakemere Farm
Blakemere HR2 9PX
Tel: 0800 216990 and 01981 500391
Fax: 01981 500108
E-mail: wiggly@wigglywigglers.co.uk
Web site: www.wigglywigglers.co.uk

Retails large-scale garden composters including the *Can-O-Worms* composter. This allows the composting process to be observed by separating out different layers within the composting mass. Worm kits of 1000 native worms. In addition, garden bird boxes and feeders are available.

C J WildBird Foods Ltd

The Rea, Upton Magna
Shrewsbury SY4 4UR
Tel: 0800 7312820 and 01743 709545
Fax: 01743 709504
E-mail: enquiries@birdfood.co.uk
Web site: www.birdfood.co.uk

Supplies bird tables, feeders, nesting boxes & bird food.

Wild World Supplies

PO Box 7449
Epping CM16 7WR
Tel: 0845 634 1111
Fax: 0845 634 2222
E-mail: sales@wildworldsupplies.co.uk
Web site: www.wildworldsupplies.co.uk

Supplies live and frozen foods for invertebrates, reptiles and amphibians, equipment for keeping reptiles and amphibians and also food and feeders for garden birds.

Jamie Wood Products

Unit 17 Oaks Farm Workshops
Blackboys Road
Framfield TN22 5PN
Tel: 01825 890990
Fax: -
E-mail: sales@birdbox.co.uk
Web site: www.birdbox.co.uk

Supplies bird tables, feeders, nesting boxes & bird food.

Worldwide Butterflies

PO Box 101
Liskeard PL14 3ZS
Tel: 01579 384050
Fax: 01579 384430
E-mail: sales@wwb.co.uk
Web site: www.wwb.co.uk

Stocks an extensive range of butterflies and moths (including indigenous species), stick insects, net cages and accessories.

APPENDIX II Sample prices for housing & equipment

This section is intended to give an indication of the relative cost of items mentioned in the text, correct at the time of issue of this guide. The suppliers and items quoted ***are far from exhaustive***, but have been chosen to provide an idea of the range of items available and likely costs. Specialist suppliers often have a wider range of sizes or types of equipment than is reflected here. Items have been listed in the same order as they arise in the main text. Many items can be obtained from local aquarists, pet stores and larger garden centres with prices which may be more competitive than those from the companies listed here (especially because there may be no delivery charges). Local retailers may be willing to offer favourable terms for local schools - it is always worth enquiring before making a major purchase!

All prices quoted from educational suppliers exclude VAT and delivery charges; items from mail-order companies may include VAT but delivery is usually extra.

II.1 Price guide for plant propagators

Supplier	Description/dimensions	Cat no.	Price
Beecroft	Seed tray 350 x 210 x 50 mm Propagator cover	TR01101 TR01102	£1.45 £7.50
GLS	520 x 420 x 60 mm Seed tray also required	347197 347288	£8.25 £4.75
Philip Harris	215 x 155 x 160 mm	A63538	£5.41
Timstar	350 x 210 x 210 mm	HO09155	£6.52

II.2 Price guide for plastic boxes with lids

Supplier	Description/dimensions	Cat no.	Price
Virginia Cheeseman	250 x 180 x 80 mm clear, with push-on lid 279 x 159 x 102 mm, rigid, close-fitting lid	- -	£2.50 £6.00
GLS	60 x 174 x 115 mm (pack of 3)	341269	£10.25
Philip Harris	Q-Box 65 x 80 x 70 mm, stackable	A25537	£3.20
Scientific & Chemical	140 x 79 x 60 mm, pack of 5 228 x 121 x 86 mm, each	BXS 020 040 BXS 020 070	£13.81 £5.79
Small-Life Supplies	QBox 73 x 73 x 80 mm stackable, pack of two	-	£8.80
Timstar	140 x 140 x 187 mm clear polystyrene 228 x 121 x 86 mm clear polystyrene 279 x 159 x 102 mm clear polystyrene	BO03308 BO03310 BO03315	£6.12 £7.65 £9.67
Watkins & Doncaster	140 x 79 x 60 mm 174 x 115 x 60 mm 279 x 159 x 102 mm	E60530 E6052 E60532	£2.04 £3.80 £6.20
Worldwide Butterflies	174 x 115 x 60 mm, each 279 x 159 x 102 mm, each 77 x 45 x 20 mm, pack of 10	Size 5 Size 6 Size 7	£4.95 £6.95 £6.00

II.3 Price guide for plastic vivaria

Supplier	Description	Dimensions	Cat no.	Price
Blades Biological	Invertebrate tank, 2 litres Invertebrate tank, 4.5 litres Invertebrate tank, 8.5 litres Invertebrate tank, 12 litres	220 x 120 x 120 mm 290 x 160 x 160 mm 360 x 195 x 195 mm 405 x 225 x 225 mm	ACS 035 ACS 040 ACS 045 ACS 046	£3.93 £7.59 £10.94 £12.42
Commotion	Aquarium, with lid	300 x 200 x 200 mm	34097-2S	£7.99
Griffin Education	Aquarium, with lid	300 x 200 x 200 mm	YSL-210-X	£9.65
Philip Harris	Plastic vivarium	300 x 200 x 200 mm	A50180	£10.44
Insect Lore	Snail Observation House	210 x 160 x 140 mm	252-345	£5.49
Livefoods UK	Exo-Terra Faunarium	230 x 170 x 150 mm 280 x 210 x 190 mm 360 x 250 x 210 mm	- - -	£3.53 £5.29 £7.64
TTS	Plastic tank with lid	295 x 195 x 205 mm 410 x 300 x 260 mm	SLE011 SLE012	£8.15 £17.50
Timstar	Aquarium	300 x 200 x 200 mm	AQ00400	£8.35

II.4 Price guide for vivaria/terraria

Supplier	Description	Cat no.	Price
Beecroft	Vivarium kit (for use with aquaria AQ00201/00202*)	AQ00204	£48.23
Euro Rep	Flat pack, sliding toughened-glass doors 610 x 580 x 380 mm 910 x 580 x 380 mm	 VI000100 VI000200	 £70.49 £103.39
Faunology	Flat pack, sliding toughened-glass doors 610 x 580 x 380 mm 914 x 580 x 380 mm Glass terrarium 300 x 300 x 300 mm Glass terrarium 300 x 300 x 300 mm	 18774 18775 19283 19285	 £54.99 £79.99 £29.99 £54.99
Livefoods UK	Flat pack melamine, sliding-toughened glass doors 24 x 23 x 15 inch 36 x 23 x 15 inch	 - -	 £51.94 £78.22
Peregrine Livefoods	See web site for list of flat-pack and ready-built vivaria and details of stockists.	-	From £63.00

*** See *Appendix II.15*.

II.5 Price guide for heat mats etc

Supplier	Description	Cat no.	Price
Blades Biological	Ultratherm heat mat: 430 x 280 mm, 20 watt	ACS 087	£16.92
Euro Rep Ltd	Habistat heat mat: 150 x 280 mm, 7 watt 740 x 280 mm, 20 watt 590 x 280 mm, 28 watt	H000002 H000004 H000005	£14.16 £17.10 £19.31
Livefoods UK	Habistat heat mat: 11 x 6 inch, 7 watt 11 x 17 inch, 20 watt 11 x 29 inch, 35 watt	- - -	£11.40 £14.77 £18.42
MICROClimate	Heat mat: 178 x 305 mm, 8.5 watt 254 x 305 mm, 13 watt 406 x 305 mm, 21 watt	Prices include VAT and delivery	£11.36 £12.15 £15.46
Peregrine Livefoods	See web site for list of heating mats and details of stockists.	-	From £12.00
Small-Life Supplies	Oil-filled 450 watt room heater (Inc VAT + delivery)	-	£83.11
Virginia Cheeseman	150 x 280 mm, 7 watt heat mat 430 x 150 mm, 22 watt heat mat 740 x 280 mm, 35 watt heat mat	- - -	£15.00 £17.00 £23.00

II.6 Price guide for observation wormeries

Supplier	Item	Dimensions (mm)	Cat. No	Price
Beecroft	Wormery	Not stated	WO00601	£30.05
Commotion	Rothamsted pattern Worm World	380 x 280 x ? mm Not stated	34079-2S 34005-2S	£23.95 £9.95
GLS	Worm World	Not stated	389694	£8.90
Griffin Education	Worm World	Not stated	YSK-165-N	£14.60
Philip Harris	Rothamsted pattern Worm World	340 x 225 x 55 mm Not stated	A57549 A92058	£52.00 £11.55
Insect Lore	Table Top Wormery	260 x 345 x 85 mm	17-960	£55.99
NES Arnold	Worm World	Not stated	A92058	£11.75
Scientific & Chemical	Rothamsted pattern Rothamsted pattern	280 x 210 mm, glass 280 x 210 mm, plastic	YAH 020 010 YAH 020 020	£32.22 £32.22
TTS	Wormery	300 x 300 x 50 mm	SWORM	£16.95
Timstar	Plastic frame & sides	380 x 280 x ? mm	CA18050	£38.40
Wiggly Wigglers	Desktop Wormery: Aluminium + Perspex	Not stated	P0282	£40.00 inc VAT

II.7 Price guide for cultivation wormeries

(See section 6 for a discussion concerning the choice of suitable containers)

Supplier	Item	Cat no.	Price
Insect Lore	Earthworm Study Kit (6 worms [voucher], bedding, sand and booklet (housing not supplied)	17-200	£17.86

II.8 Price guide for composting kits (using worms)

Supplier	Item	Cat. no	Price
Insect Lore	Can-O-Worms with value pack: Complete composter and approx 1000 worms	17-821	£99.99
Original Organics Ltd	Junior Wormery 23 litre bin and worms Original Wormery 95 litre bin and worms	OO-TJN OO-TOW	£31.45 £49.95
Recycle Works Ltd	Maxi Waste Buster Educational Maxi Waste Buster Midi Waste Buster Mini Waste Buster	WB-MAXIEDU WB-MAXI WB-MIDI WB-MINI	£182.50 £166.50 £157.00 £140.00
Wiggly Wigglers	Can-O-Worms with value pack: 4 tier composter, approx 1000 worms, bedding block, lime mix, moisture mat and booklet Can-O-Worms with education pack. As above but with book and 4 posters Can-O-Worms wormery only	P0017 P0254 P0371	£89.00 £111.00 £60.00

II.9 Price guide for pooters

Supplier	Item	Cat no.	Price
Beecroft	Pooter; colour-coded tubes; pack of 5	PO00401	£8.69
Philip Harris	Plastic, with suction & collecting tubes Glass, flared inlet & glass outlet tubes	A24995 A25008	£2.32 £7.69
Scientific & Chemical	Large pooter, pack of 5	YFS 190 010	£10.37
Timstar	Perry's plastic construction, pack of 5	EN07036	£8.83
TTS	'Bug Hunter', pack of 5	BUG-HUNTER	£8.50
Watkins & Doncaster	Perspex, with suction & collecting tubes Pocket pooter	E710 E714	£9.99 £5.79

II.10 Price guide for ant towns / nests

Supplier	Item	Description	Cat no.	Price
Commotion	Ant World	Plastic housing + feeder and sand	34004-2S	£9.95
GLS	Ant World	Plastic housing + feeder and sand	377422	£9.25
Philip Harris	Ant World	Plastic housing + feeder and sand	A92095	£11.55
Insect Lore	Antquarium	A glass container with a gel that provides both nutrition and material into which ants can burrow and create a nest (includes voucher for ants to be sent separately)	312-006	£16.16
	Ant Zone	Container 100 x 190 x 250 mm, with rounded lip to discourage ant esc-ape (includes voucher for ants, sugar nutrient, water dish, magnifier etc)	07-134	£15.31
	Live ants	10 to 12 garden ants	177-001	£5.25
NES Arnold	Ant World	Plastic housing + feeder and sand	A92095	£12.25

II.11 Price guide for cylindrical plastic insect cages

Supplier	Description	Cat no.	Price
Beecroft	230 x 240 mm diameter. Ventilated cover	CA01301	£21.66
Blades Biological	410 x 230 mm diameter. Plastic top and bottom	ACS 010	£31.46
Small-Life Supplies*	C- Tubes (2) 125 x 100 mm diameter with push-on lid	-	£5.99
Timstar	250 x 115 mm diameter. Perforated zinc cover	CA18000	£6.25
Watkins & Doncaster	400 x 200 mm diameter. Plastic top and bottom	E611	£16.75
Worldwide Butterflies	300 x 230 mm diameter. Metal top and bottom 230 x 125 mm diameter. Metal top and bottom	Large cylinder Mini cylinder	£32.00 £3.95

* Items direct from Small-Life Supplies include VAT and delivery.

II.12 Price guide for netting insect cages

Supplier	Description	Cat no.	Price
Blades Biological	450 mm height x 300 mm dia, hanging, black 550 mm height x 400 mm dia, hanging, black 900 mm height x 600 mm dia, hanging, black 610 mm height x 390 mm dia, collapsible, white 900 x 750 x 460 mm, internal framework, black	ACS 015 ACS 021 ACS 025 ACS 026 ACS 027	£13.01 £15.26 £31.27 £12.95 £34.95
Virginia Cheeseman*	460 mm height x 300 mm dia, hanging, black 560 mm height x 410 mm dia, hanging, black 460 mm height x 300 mm dia, hanging, bottomless 560 mm height x 410 mm dia, hanging, bottomless	**While stocks last**	£8.50 £10.50 £11.00 £13.00
Insect Lore	Butterfly Garden, 300 mm high, white Butterfly Pavilion, 630 mm high, white	111 115	£11.91 £19.99
Arnold Johnson*	450 x 355 x 450 mm (w x d x h), free-standing, black 580 x 500 x 580 mm (w x d x h), free-standing, black	Standard Large	£29.00 £39.00
Watkins & Doncaster*	450 mm height x 300 mm dia, hanging, black 550 mm height x 400 mm dia, hanging, black 460 mm height x 300 mm dia, hanging, bottomless 560 mm height x 410 mm dia, hanging, bottomless	E6990 E6091 E6092 E6093	£16.20 £19.15 £16.80 £21.90
Worldwide Butterflies*	500 mm height x 300 mm dia, hanging (+ supports £5) 560 mm height x 410 mm dia, hanging (+ supports £6) 560 mm height x 410 mm dia, hanging, bottomless	Small hanging Large hanging Skirt	£17.50 £23.50 £23.50

* Also supplies netting separately.

II.13 Price guide for more substantial insect cages

Supplier	Description	Cat no.	Price
Virginia Cheeseman	635 x 370 x 370 mm, Flexarium, internal framework, black netting walls	-	£25.00
Faunology	635 x 370 x 370 mm, Flexarium, internal framework, black netting walls; inc VAT	19159	£21.99
Philip Harris	*Bug cage*, 460 x 270 x 250 (h, w, d)	A57502	£63.00
Small-Life Supplies*	*Bug studio*, 460 x 250 x 250 mm (h, w, d) *Bug cage*, 460 x 270 x 250 mm (h, w, d) *Bug-XL cage*, 550 x 400 x 250 mm (h, w, d)	- - -	£29.50 £73.50 £95.50
Timstar	*Bug cage*, 460 x 270 x 250 mm	CA18035	£62.95
Watkins & Doncaster	300 x 300 x 300 mm, Bugdorm, plastic top and base, mesh sides	E6099	£43.05
Worldwide Butterflies	Wooden-framed, netting walls: 250 x 180 x 180 mm 410 x 430 x 230 mm 410 x 355 x 460 mm As above, but flat-packed. 510 x 300 x 300 mm 610 x 300 x 300 mm	 Mini Standard Extra deep Flat-pack, small Flat-pack, tall	 £15.95 £33.00 £38.95 £31.00 £38.00

* Items direct from Small-Life Supplies include VAT and delivery.

II.14 Price guide for plastic aquaria

Supplier	Description	Cat no.	Price
Beecroft	Moulded plastic + hood, 300 x 200 x 200 mm	AQ00101	£9.42
Commotion	Moulded plastic, 300 x 200 x 200 mm Moulded plastic + hood, 300 x 200 x 200 mm	34049-2S 34097-2S	£5.99 £7.99
GLS	Moulded plastic, 310 x 215 x 200 mm	224386	£7.65
Griffin Education	Moulded plastic + hood, 300 x 200 x 200 mm	YSL-210-X	£7.91
Philip Harris	Moulded plastic, 300 x 200 x 200 mm Moulded plastic + hood, 300 x 200 x 200 mm	A50167 A50179	£10.10 £11.11
Scientific & Chemical	Moulded plastic, 300 x 200 x 200 mm	AQU 010 010	£11.59
Timstar	Moulded plastic + hood, 300 x 200 x 200 mm	AQ00400	£8.35
TTS	Recycled plastic, 295 x 195 x 175 mm Recycled plastic, 350 x 230 x 205 mm Recycled plastic, 410 x 260 x 300 mm	MTANK LTANK XLTANK	£5.95 £7.75 £14.95

*II.15 Price guide for glass aquaria**

Supplier	Item	Dimensions	Cat no.	Price
John Allan Aquariums	Web site shows models available; eg, *New Horizon*; contact John Allan for retailers.			
Aquatics Direct	Juwel Rekord 60 aquarium + hood	610 x 360 x 310 mm	-	£69.25
Beecroft	Bonded glass with hood and plinth	305 x 178 x 178 mm 457 x 254 x 254 mm	AQ00201 AQ00202	£10.99 £17.80
GLS	Hexagonal, with pump, filter, lighting etc	420 x 267 x 232 mm	371286	£44.25
Philip Harris	Bonded glass Hood for above Lighting control unit	610 x 305 x305 mm	A50210 H79313 L09635	£33.53 £25.75 £37.40
	Complete: aquarium + hood, lighting, air pump, heater/thermostat etc	Not stated	A50155	£173.00
Timstar	Bonded glass Hood for above Bonded glass Hood for above	600 x 375 x 300 mm 900 x 375 x 300 mm	AQ00410 AQ00440 AQ00420 AQ00450	£28.25 £16.35 £41.95 £23.75

* See also local aquarists for available models.

*II.16 Price guide for aquarium air pumps**

Supplier	Model	Capacity	Cat no.	Price
Aquarium Shop	Rena Air 100 Interpet Airvolution AV3	100 litres per hour 250 litres per hour	- -	£17.95 £25.95
Aquatics Direct	Rena Air 50 Rena Air 100 Interpet Airvolution AV1 Interpet Airvolution AV2	50 litres per hour 100 litres per hour 170 litres per hour 200 litres per hour	- - - -	£9.95 £14.95 £14.45 £21.25
Beecroft	Not stated Not stated	210 litres per hour 360 litres per hour	AQ00701 AQ00702	£11.85 £16.10
Griffin Education	Not stated Not stated	210 litres per hour 360 litres per hour	YSL-475-010P YSL-475-020M	£19.25 £25.75
Philip Harris	Not stated Not stated	80 litres per hour 600 litres per hour	A50398 A50404	£22.44 £40.42
Scientific & Chemical	Interpet Interpet	For 460 mm tank For 1200 mm tank	AQU 090 010 AQU 090 030	£14.30 £25.24
Timstar	Not stated	90 litres per hour 180 litres per hour 240 litres per hour	AQ00607 AQ00609 AQ00611	£8.85 £11.75 £16.70

* See also local aquarists for available models.

*11.17 Price guide for power heads**

Supplier	Item	Cat no.	Price
Aquarium Shop	Eheim Universal pump 1048 (600 litres per hour) Interpet Powerhead PH4 (1000 litres per hour)	- -	£47.95 £32.95
Aquatics Direct	Interpet Powerhead PH1 (170 litres per hour) Hagen Aquaclear 301 (570 litres per hour)	- -	£16.25 £23.99
Beecroft	Powerhead	AQ00905	£20.00
Griffin Education	Interpet Powerhead PH1 (170 litres per hour)	YSL-470-C	£23.05
Scientific & Chemical	Interpet Powerhead PH1, for 460 mm tanks Interpet Powerhead PH4, for 910 mm tanks	AQU 060 010 AQU 060 040	£23.16 £37.86

* See also local aquarists for available models.

*II.18 Price guide for undergravel filters**

Supplier	Dimensions	Cat no.	Price
Beecroft	For 610 mm tanks For 760 mm tanks For 910 mm tanks	AQ00901 AQ00902 AQ00903	£6.79 £8.65 £9.79
Scientific & Chemical	For 610 mm tanks For 910 mm tanks For 1200 mm tanks	AQU 050 010 AQU 050 030 AQU 050 040	£6.24 £9.34 £11.48
Timstar	425 x 300 mm 600 x 300 mm	AQO0470 AQO0475	£5.80 £6.45

* See also local aquarists for available models.

*II.19 Price guide for aquarium lighting control units and tubes**

Supplier	Description	Cat no.	Price
Aquatics Direct	*Arcadia* control unit 15 watt *Arcadia* control unit 36 watt Interpet *Triplus* fluorescent tube, 15 watt, 450 mm Interpet *Triplus* fluorescent tube, 30 watt, 900 mm	- - - -	£13.99 £15.99 £7.99 £10.99
Beecroft	Control unit 18 watt for use with 610 mm tubes Fluorescent tube, 18 watt, 610 mm Control unit 25 watt for use with 760 mm tubes Fluorescent tube, 25 watt, 760 mm Control unit 36 watt for use with 1220 mm tubes Fluorescent tube, 36 watt, 1220 mm	AQ00501 AQ00504 AQ00502 AQ00505 AQ00503 AQ00507	£15.99 £6.70 £15.99 £8.81 £15.99 £10.31
Scientific & Chemical	Control unit for use with 15 watt, 460 mm tubes Control unit for use with 30 watt, 910 mm tubes	AQU 080 010 AQU 080 020	£16.84 £16.84
Timstar	Control unit for use with 15 watt tubes Fluorescent tube, 15 watt, for 600 mm tank Control unit for use with 25 watt tubes Fluorescent tube, 25 watt, for 900 mm tank	AQ00575 AQ00580 AQ00585 AQ00590	£15.50 £7.20 £15.50 £12.40

* See also local aquarists for available models and *Appendix II.26* for items described for vivaria.

*II.20 Price guide for aquarium heaters with thermostats**

Supplier	Model	Capacity	Cat no.	Price
Aquatics Direct	Interpet Deltatherm	100 watt 200 watt 300 watt	- - -	£12.99 £13.99 £13.99
Beecroft	Not stated	100 watt for 610 mm tank 200 watt for 910 mm tank	AQ00601 AQ00602	£25.95 £26.65
Philip Harris	Not stated	100 watt for 610 mm tank 200 watt for 910 mm tank 300 watt for 1220 mm tank	G74771 H06504 H06516	£23.51 £23.97 £25.00
Scientific & Chemical	Thermasure	100 watt 200 watt 300 watt	AQU 110 010 AQU 110 020 AQU 110 030	£24.16 £24.16 £26.24
Timstar	Thermasure	100 watt 200 watt 300 watt	AQ00540 AQ00551 AQ00552	£21.00 £21.80 £22.20

* See also local aquarists for available models.

II.21 Price guide for specialist vivarium heating - basking spot lamps

Supplier	Model	Capacity	Cat no.	Price
Euro Rep	Basking spot lamp, screw fitting	100 watt	LC000001	£4.19
	Basking spot lamp, bayonet fitting	100 watt	LC100002	£4.19
	Basking spot lamp, screw	60 watt	LC100001	£4.19
	Red, night, basking lamp, bayonet	60 watt	LC000003	£4.71
	Spot lamp fitting, bayonet	-	LC000010	£6.30
	Spot lamp fitting, screw	-	LC100010	£6.30
Faunology	Day Glo basking lamp, screw	75 watt	18955	£4.39
	Day Glo basking lamp, screw	100 watt	18949	£5.39
Livefood UK	Heat Glo Infra-red basking spot lamp, screw	75 watt 100 watt	PT2142 PT2144	£6.45 £7.29

II.22 Price guide for specialist vivarium heating - ceramic heaters

Supplier	Model	Capacity	Cat no.	Price
Euro Rep	Pearlco Pearlco	100 watt 250 watt	P000002 P000004	£18.37 £22.67
Faunology	Pearlco ceramic IR, screw Exo Terra ceramic, screw	100 watt 150 watt	18518 19276	£16.99 £17.99
Livefood UK	Exo Terra Heatwave, screw Exo Terra Heatwave, screw	100 watt 250 watt	- -	£14.46 £16.99

II.23 Price guide for specialist vivarium heating - holders for ceramic heaters

Supplier	Model	Details	Cat no.	Price
Euro Rep	Zoo Med Clamp lamp Pearlco	Porcelain clamp Bulb holder & fixing	ZM01LF10 P000007	£20.86 £13.38
Faunology	Pearlco	Bulb holder & fixing	18516	£12.50
Livefood UK	Not stated	Ceramic bulb holder	-	£9.49

II.24 Price guide for specialist vivarium heating - thermostats

Supplier	Model	Capacity	Cat no.	Price
Blades Biological	Habistat Mat stat	For mats up to 100 watt For mats up to 300 watt	ACS 073 ACS 074	£25.66 £37.37
Virginia Cheeseman	Habistat Mat stat	For mats up to 100 watt	-	£28.00
Euro Rep	Habistat Dimming thermostat Habistat Mat stat	For light bulbs 40-600 W For mats up to 100 watt	TO00005 T000009	£51.79 £26.88
Livefood UK	Habistat Dimming thermostat	For light bulbs 40-600 W	-	£45.48

II.25 Price guide for specialist vivarium heating - thermometers

Supplier	Model	Type	Cat no.	Price
Virginia Cheeseman	Not stated	Digital strip Dial-type analogue	- -	£2.95 £4.45
Euro Rep	Exo-Terra Not stated	Dial-type analogue Digital	ET02465 M000017	£2.69 £8.39
Faunology	Not stated	Digital	18699	£7.99

II.26 Price guide for fluorescent lighting units (to fit into vivarium hoods)

Some companies supply the necessary starter and tube fixing clamps as a unit ready to fix inside a hood. Others supply starters, reflectors and clips separately - a more flexible option but requiring the user to assemble the items before fixing. See also *Appendix II.19* for items described for aquarium hoods.

Supplier	Product	Details	Cat no.	Price
Euro Rep	Arcadia starter unit only	For 18" x 1" tube; 15 W For 24" x 1.5" tube; 20 W	LS000001 LS000010	£16.99 £16.99
	Arcadia reflectors	For 18" tube For 24" tube	LR000011 LR000012	£5.49 £5.99
	Light fixing clips	25 mm; pack of 6	LM000001	£2.62
Faunology	Lighting pack: General diurnal for 24" vivarium	Starter, tube, spot lamp + holder for reptile vivaria	19228	£59.99

II.27 Price guide for fluorescent tubes in reptile vivaria

Supplier	Product	Details	Cat no.	Price
EuroRep	Arcadia *D3 Reptile* lamp	18" 15 watt tube 30" 25 watt tube	LD000001 LD000002A	£20.49 £22.49
	Arcadia *Natural Sunlight* lamp	18" 15 watt tube 24" 18 watt tube 36" 30 watt tube	LDS00002 LDS00003 LDS00004	£10.99 £11.49 £12.49
	ZooMed *ReptiSun 5.0*	UVB (long life) 18" x 1" tube	ZM03FS18	£26.95
Livefood UK	ZooMed *PowerSun UV* spot lamp	100 watt 160 watt	- -	£51.64 £51.64

II.28 Price guide for vivarium substrates

Supplier	Substrate	Quantity	Cat no.	Price
Euro Rep	Aspen snake Repti-sand Desert Rainforest Vermiculite	1 kg 2.5 kg 2.27 kg 10 litre 10 litre	SA100001 SS000001 SC000002 SB200002 SV000011	£3.27 £5.63 £7.13 £6.00 £4.77
Faunology	Jungle bed (Orchid bark + sphagnum) Granulated orchid bark - fine	10 litre 10 litre	18652 18654	£8.99 £4.49
Livefood UK	ZooMed *Repti-bark*	8.8 litre	-	£7.76

II.29 Price guide for bird housing

Supplier	Model and	Dimensions	Price
Aviary Accessories	Wooden aviary	36" x 30" x 21"	£91.60
Safari Select	Terenzo breeder cage	500 x 1000 x 500 mm	£79.50

II.30 Price guide for mammal cages - wire sides, relatively shallow base

Supplier	Model	Dimensions	Cat no.	Price
John Hopewell	Rat cage, single Rat cage, large Rat cage, giant	610 x 460 x 600 mm 920 x 460 x 600 mm 920 x 460 x 920 mm	8RS24 8RL36 8RG36	£45.00 £55.00 £75.00
Pet Planet	Marchioro Tommy 102	1020 x 530 x 520 mm	-	£64.99
Pets Parade	Duval rat cage	720 x 450 x 370 mm 720 x 450 x 680 mm	- -	£43.99 £49.99
Scientific & Chemical	Small Medium Large	380 x 205 x 200 mm 460 x 300 x 230 mm 480 x 300 x 560 mm	YAH 010 010 YAH 010 020 YAH 010 030	£8.76 £12.34 £29.98
Timstar	Hamster cage	350 x 300 x 230 mm	CA18005	£9.36

II.31 Price guide for mammal cages - laboratory type

Supplier	Model	Dimensions	Cat no.	Price
Timstar	Mouse cage + water bottle Rat/gerbil cage + water bottle	450 x 280 x 130 mm 450 x 280 x 250 mm	CA18015 CA08020	£49.95 £77.95

II.32 Price guide for small mammal hutches

Supplier	Model	Dimensions	Cat no.	Price
Bransby-Bunny	Hilton House Rabbit Hutch	36” x 18” x 18” 48” x 24” x 24”	- -	£69.00 £131.00
Rob Harvey	4 foot Proper Rabbit Hutch	1250 x 520 x 635 mm	-	£116.00
Hutch Co	Guinea pig hutch Rabbit hutch	36” x 15” x 15” 36” x 18” x 18” 48” x 15” x 15” 48” x 18” x 18”	- - - -	£66.97 £78.97 £65.00 £75.00
Pet Planet	Orpington 48” Sandhurst 36” Pethouse 4’ Drop Hutch and Run	1220 x 410 x 410 mm 910 x 410 x 460 mm 1220 x 405 415 mm 1220 x 840 x 457 mm	- - - -	£44.99 £39.99 £107.00

APPENDIX III Sample prices for livestock

All prices quoted from educational suppliers exclude VAT and delivery charges; items from mail-order companies may include VAT but delivery is usually extra.

NB. Reptiles, birds and mammals may only be sent by courier or company van services. For these animals, it is best to seek a local source (using *Yell.com* for example) and collect them personally. Thought must be given to the most suitable type of container in which to carry the purchases.

It is *essential* to check availability and price immediately before making a purchase, since these are liable to change *from moment to moment,* at least for sources other than educational suppliers!

*III.1 Price guide for stocks of earthworms**

Supplier	Item	Cat no.	Price
Blades Biological	*Lumbricus terrestris* (earthworm) - 10 *Lumbricus terrestris* (earthworm) - 25	LZG 025 LZG-030	£7.39 £16.24
Insect Lore	Composting worms, large pot *Lumbricus sp*. - 6	17-400 17-600	£8.99 £4.50
Sciento	*Lumbricus terrestris* (earthworm) - 10	T90	£5.85

* See also suppliers of composting kits in Appendix I for stocks of worms.

III.2 Price guide for stocks of giant African land and other snails

Supplier	Item	Cat no.	Price
Blades Biological	Giant African snails - 5 juveniles Single adult	LZH 065 LZH 070	£8.67 £5.00
Bugs Direct UK	Giant African land snail kit (2 snails + housing etc)	-	£19.99
Virginia Cheeseman	Giant land snails - small, juvenile Large adult	- -	£1.50 £5.00
Coast to Coast	*Achatina fulica* (giant land snails) *Achatina achatina* (really giant land snails)	- -	£4.99 £9.99
Insect Lore	*Achatina sp*. (giant land snails) - 5 juveniles; 2-4 cm *Lymnea stagnalis* (pond snails) - 10	177-065 177-002	£17.50 £14.99
Peregrine Livefoods	*Achatina fulica*, 2-4 cm	-	£3.50
Sciento	*Lymnea stagnalis* (pond snails) - 10 *Planorbis corneus* (Ramshorn snail), 10	Z412 Z430	£6.45 £6.20
Small-Life Supplies	Giant African land snail kit (2 snails + housing etc)	Inc VAT + postage	£22.99
South Coast Inverts	Giant African land snails, *Achatina sp.*	-	From £0.95
Timstar	*Helix aspersa* (common land snail), 5 *Lymnea sp.* (water snail), 10 *Planorbis sp.* (Ramshorn snail), 10	BL80375 BL80380 BL80385	£4.85 £7.60 £10.90

III.3 Price guide for brine shrimps and eggs

Supplier	Item	Cat no.	Price
Aquatics Online	Hobby brine shrimp eggs, 20 ml Hobby brine shrimp eggs/salt mixture 195 g	- -	£3.49 £4.98
Blades Biological	Brine shrimp ecology kit. Includes the BES book, eggs and ingredients for their culture Brine shrimp eggs; *Artemia franciscana*, 60 ml Brine shrimp adults (30-50)	LZM 050 LZM 390 LZJ 391	£43.88 £10.07 £4.50
Sciento	Brine shrimps adults (about 100) Brine shrimp kit (with eggs, sea salt, dried plankton)	Z175 ZK9	£7.85 £18.00
Timstar	Brine shrimp kit (simple instructions but no book) Brine shrimp (*Artemia*) eggs (30 ml)	BL80156 BL80157	£21.50 £6.60

III.4 Price guide for Daphnia

Supplier	Item	Cat no.	Price
Blades Biological	Bag of about 300 *Daphnia* Instant *Daphnia* culture kit: dried eggs, growing tub, buffer, food and instructions *Daphnia* dried eggs, pack *Daphnia magna* (30-50)	LJZ 345 LZJ 346 LZJ 347 LZJ 354	£3.97 £17.56 £7.92 £7.50
The Netfysh	*Daphnia* eggs Food	CE7 CE3	£1.25 £1.00
Sciento	*Daphnia magma* (200+) Includes supply of algal food *Daphnia pulex* (500 ml)	Z225 Z235	£9.45 £9.45
Timstar	Bottle of *Daphnia*	BL80130	£5.55

III.5 Price guide for tropical land hermit crabs

Supplier	Item	Cat no.	Price
Virginia Cheeseman	*Coenobita clypeatus* - single, small - pair *Coenobita rugosus* (Vietnam hermit crab), medium Land hermit crab food, 127 g	- - - -	£7.50 £12.00 £10.00 £3.00
Faunology	*Coenobita clypeatus* - large	-	£9.99
Southcoast Invertebrates	*Coenobita clypeatus*, medium *Coenobita rugosus* (Vietnam hermit crab), medium	- -	£8.95 £12.95

III.6 Price guide for Triops *kits*

Supplier	Item	Cat no.	Price
Insect Lore	*Triops* eggs and food only	74-005	£5.25
The Netfysh	Instant *Triops* set (Eggs + food) *Triops* eggs only *Triops* eggs only (5 packs; 1 free) Food only	CE2 CE4 CE5 CE3	£3.50 £1.25 £5.00 £1.00
Timstar	*Triops* kit (includes eggs, food and instructions)	BL80295	£4.95

III.7 Price guide for giant millipedes

Supplier		Cat no.	Price
Bugs Direct UK	Several species, including *Archispirostreptus gigas*	-	£10.00
Virginia Cheeseman	Six species are available, including giant chocolate, ruby-legged and giant train millipedes	-	£4.00 -£15.00
Coast to Coast	Red/orange-legged millipedes, *Isulus* spp.	-	£9.95
Faunology	Giant African millipede, *Archispirostreptus gigas*	18480	£9.99
Peregrine Livefoods	Giant African train millipede	-	£10.50

III.8 Price guide for ants

Supplier	Item	Cat no.	Price
Blades Biological	'Ants', about 100, suitable for a temporary colony *Lassius niger*, about 100	LZJ 175 LZJ 170	£6.93 £9.09
Insect lore	Antquarium (gel-based nesting in clear box) Live ants (10-12)	312-006 177-001	£18.99 £5.25

III.9 Price guide for beetles and their food

Supplier	Item	Cat no.	Price
Blades Biological	*Tribolium castanum* (flour beetle), culture 100 adults *Tribolium confusum* (flour beetle), culture 100 adults *Tribolium* culture medium, 250 g *Tenebrio* (mealworm) adults, pack of 10 *Tenebrio* (mealworm) larvae, 250 g *Sitophilus* (grain weevil) adults, culture *Callosobruchus maculatus* (seed beetle), culture Black eyed beans, 250 g (for seed beetles)	LZJ 425 LZJ 424 LZJ 430 LZJ 429 DTS 010 LZJ 227 LZJ 222 LZJ 525 LZJ 228 DTS 056	£5.76 £15.36 £5.76 £15.36 £4.92 £7.29 £10.58 £9.30 £9.30 £1.25
Bugs Direct UK	Lists an extraordinary range of 31 species	-	£4-£35
Virginia Cheeseman	Speckled sun beetle *Pachnoda franceoisi* Green/bronze jewel beetle *Eudicellia gralli* Purple jewel beetle *Smagdethnes africana oertzeni* Rhinoceros beetle *Xylotrupes gideon* (larva) *Tenebrio* mealworms Tub	- - - - -	£6.00 £3.00 £2.50 £10.00 £4.00
Coast to Coast	Rhinoceros beetle (larva) Rhinoceros beetle (adult)	- -	£9.95 £11.95
Global Livefood	*Tenebrio* molitor (mealworm larvae) 60 g *Zoophobas morio* (giant mealworms) 40 g	16177 16178	£2.49 £2.49
Philip Harris	*Tribolium castanum* (flour beetle), Wild type Pearl eye Sooty body	A03888 A03918 A03929	£8.63 £8.63 £8.63
Livefoods Direct	Mealworm larvae, 55 g	1Tub	£2.64
The Spider Shop	Flower beetle larva, *Pachnoda m. peregrina*	-	£5-£10
Timstar	*Tenebrio* - larvae, 50	BL80150	£5.10

*III.10 Price guide for butterflies, moths and kits**

Supplier	Item	Cat no.	Price
Blades Biological	Painted lady butterfly kit, [10 larvae, food & net cage (ACS 015)] Cabbage white butterfly kit (eggs and artificial diet)	LZJ 452 LZJ 252	£29.33 £12.41
Philip Harris	Rear and release Puss moth kit [Eggs (voucher) + flat-pack net cage, containers, CD-ROM and book] Q box caterpillar kit [4 Tortoiseshell butterfly larvae (voucher)]	L04285 A23619	£56.65 £10.84
Insect Lore	Painted lady butterfly school kit (33 larvae, food & net cage) Painted lady butterfly school kit (10 larvae, food & net cage) Painted lady butterfly refill kit (33 larvae and food only)	105c 103c 123	£47.98 £28.99 £27.99
NES Arnold	Butterfly garden	H34585	£20.45
Small-Life Supplies	Various species are bred during the year and available as kits. E-mail for details to adam@small-life.co.uk typing 'Caterpillar' in subject box.	-	-
TTS	Butterfly garden school kit (Net cage + 5 larvae and food)	GARD	£16.70
Worldwide Butterflies	A very wide range of butterfly and moth species, sold as eggs, larvae or pupae, is available at different times of the year. Particularly good species for school work include the Puss moth, Chinese oak silkmoth and Indian moon moth.	-	£5-75 - £14.95

* Availability of eggs, larvae, pupae and kits is seasonal - mostly during the spring/early summer.

III.11 Price guide for cockroaches and their food

Supplier	Item	Cat no.	Price
Blades Biological	*Periplaneta americana* Mixed adults, Pack of 5 Pack of 25 Giant deathshead cockroach *Blaberus cranifer,* Pack of 5 Giant hissing cockroach *Gromphadorhina sp,* Pack of 5 Giant Peruvian cockroach *Archimandrita tesselata* Pack of 5 Cockroach diet, 1 kg pack	LZJ 095 LZJ 100 LZJ 165 LZJ 160 LZJ 277 DTS 079	£5.61 £26.29 £11.45 £11.45 £11.45 £3.28
Bugs Direct UK	Giant hissing cockroach *Gromphadorhina portentosa,* Each Breeding cultures of 16 other species	- -	£2.99 £6.95
Virginia Cheeseman	10 types of cockroach are currently available including various giant cockroaches and smaller species, Each or tub	-	£1.50 - £5.00
Coast to Coast	Cuban burrowing cockroach *Byrsotria fumigata,* Each Giant deathshead cockroach *Blaberus cranifer,* Each	- -	£4.95
Faunology	Giant hissing cockroach *Gromphadorhina portentosa,* Each Cuban burrowing cockroach *Byrsotria fumigata,* Each Giant cockroach *Blaberus giganteus,* Each Cockroach chow, 450 g	18477 18476 18476 19260	£2.49 £2.99 £3.99 £6.95
Insect Lore	*Gromphadorhina sp,* Pack of 5 Cockroach food, 250 g	177-160 177-079	£20.99 £5.50
Peregrine Livefoods	Giant deathshead cockroach *Blaberus cranifer,* Each	-	£2.50
Southcoast Inverts	*Gromphadorhina portentosa,* Each	-	£2.95
Timstar	*Periplaneta americana,* Pack of 10	BL80140	£16.85

III.12 Price guide for crickets and their food

Supplier	Item	Cat no.	Price
Blades Biological	House cricket *Acheta domestica,* 100 medium-sized 500 medium-sized 1000 medium-sized Black cricket *Gryllus sp,* 75 adults & large nymphs	LZJ 210 LZJ 218 LZJ 217 LZJ 585	£6.36 £16.58 £21.19 £8.59
Virginia Cheeseman	Various species, tub	-	£3.75
Euro Rep	Brown crickets, 500 Medivet Cricket Diet Plus, 150 g	LFC30005 MV000001	£8.67 £4.38
Global Livefood	*Gryllus bimaculatus,* 50 Bug Grub, 259 g	16134 16189	£2.49 £3.99
Livefoods Direct	Banded crickets, large, tub of 100-125 Black crickets, large, tub of 60-70	CL1TUB CBL1TUB	£2.64 £2.64
Timstar	*Acheta domestica,* 250	BL80108	£16.40

III.13 Price guide for Drosophila*, food and accessories*

Supplier	Item	Cat no.	Price
Blades Biological*	Wild type (9 mutant varieties also available) Kit to keep 25 cultures - food, vials, etc *Drosophila* quick mix medium -250g (50 small vials)	LZJ 395 ACS 146 DTS 005	£4.67 £25.87 £6.74
Virginia Cheeseman	Tub of larvae of *Drosophila sp*, 1 oz pot	-	£1.25
Philip Harris*	Wild type (11 mutant varieties also available), small culture Wild type (11 mutant varieties also available), large culture Ready mix dried food, 100 g	A02999 A03001 A03864	£5.47 £8.52 £4.00
Sciento*	Wild type (19 mutant varieties also available), small culture Wild type (19 mutant varieties also available), large culture Instant dried medium, 250 g	G1 G1 807	£5.35 £7.25 £5.40
Timstar	Wild type (6 mutant varieties also available)	BL80200/a	£4.85

* These companies also supply vials, bottles, foam stoppers, ladders for medium, etherisers etc.

III.14 Price guide for locusts

Supplier	Item	Cat no.	Price
Blades Biological Ltd	*Schistocerca gregaria*, pack of 5 *Schistocerca gregaria*, pack of 25	LZJ 050 LZJ 060	£4.53 £16.34
Virginia Cheeseman	Pot of large, medium or small instars	-	£4.00
Euro Rep	Large instar, pack of 25	LFL30003	£7.76
Global Livefoods	*Schistocerca gregaria*, 6 large adults *Schistocerca gregaria*, 8 large instar	16163 16167	£2.49 £2.49
Livefoods Direct	Locusts, tub of 6 large adults Locusts, tub of 8 large instars	LA1TUB LL1TUB	£2.25 £2.25
Timstar	*Schistocerca gregaria*, adult, pack of 10	BL80185	£12.25

III.15 Price guide for stick insects

Supplier	Item	Cat no.	Price
Blades Biological	Stocks 7 species, packs of 2-5	As specified	£6.60-£9.95
Bugs Direct UK	Giant Prickly, *Extatosoma tiaratum*, 12 eggs	-	£9.99
Virginia Cheeseman	Stocks 19 species, Nymphs Adults	- -	£1-£18 £2-£6
Coast to Coast Exotics	Sabah stick insect, *Aretaon asperimus* Pink-winged stick insect, *Sipyloidea sipylis*	- -	£1.95 £3.99
Faunology	Sabah Thorny stick insect, *Aretaon asperimus*	18497	£3.99
Insect Lore	Giant Prickly stick insect, *Extatosoma sp*	177-004	£11.25
Peregrine Livefoods	Giant Spiny stick insect, *Eurycantha calcerata*	-	£7.95
Small-Life Supplies	Currently lists 4 species, sold as kits with cages	Inc VAT + P/P	£42-£53
Southcoast Inverts	Guadeloupe stick insect, *Lamponium sp.*	-	£3.95
Worldwide Butterflies	Web site lists Indian & Spiny stick insects. Details of further species available on request.	5 nymphs	£6.95 - £8.95

III.16 Price guide for some tropical spiders

Supplier	Item	Cat no.	Price
Bugs Direct UK	20+ species, including *Grammostola rosea*	-	£15.99
Virginia Cheeseman	Stocks an astonishing 60+ species including Chilean rose *Grammostola spatulata* Curly hair *Brachypelma albopilosa* Mexican red rump *Brachypelma vagans*	-	 £5-£25 £5-£25 £10-£25
Coast to Coast Exotics	Stocks 20+ species, including Chilean rose *Grammostola rosea* Mexican red rump *Brachypelma vagans*	-	 £19.99 £14.99
Faunology	Stocks 9 spp, but none of the more common types	-	£17-£90
Peregrine Livefoods	Stocks 11 species including Chilean rose *Grammostola rosea* Mexican red rump *Brachypelma vagans*	-	 £19.50 £20-40
The Spider Shop	Chilean rose *Grammostola rosea*, spiderling Curly hair *Brachypelma albopilosa,* spiderling Mexican red rump *Brachypelma vagans,* spiderling		£2.00 £2.00 £3.00
The Spiders Trap	Stocks 19 species including Mexican red rump *Brachypelma vagans* Curly hair *Brachypelma albopilosa*	-	 £15-£25 £35.00
South Coast Inverts	Stocks 40+ species including Chilean rose *Grammostola rosea* Curly hair *Brachypelma albopilosa* Mexican red rump *Brachypelma vagans*	-	 £12.00 £15.95 £9.95

III.17 Price guide for amphibians

Supplier	Item	Cat no.	Price
Blades Biological	*Ambystoma mexicanum* (axolotl), small (3") large (6") *Pleurodeles sp.* (ribbed newt) 7 cm sub adult	LZL 105 LZL 125 LZL 130	£14.32 £25.42 £10.26
Coast to Coast Exotics	Lists 27 species, including Oriental Fire-bellied toad *Bombina orientalis* Fire salamander *Salamandra salamandra*	 - -	 £12.95 £29.99
Philip Harris	*Rana temporaria* or *R. pipiens*	A19689	£5.28
Peregrine Livefoods	Lists 14 species, including Oriental Fire-bellied toad *Bombina orientalis* White's Tree frog *Littoria caerula* Fire salamander *Salamandra salamandra*	 - - -	 £12.50 £12.50 £22.50
South Coast Exotics	Lists 29 species, including Oriental Fire-bellied toad *Bombina orientalis* White's Tree frog *Littoria caerula* Fire salamander *Salamandra salamandra*	 - - -	 £9.95 £10-£20 £32-£40
Timstar	*Rana temporaria* (common frog)	BL80300	£4.95

III.18 Price guide for some reptiles

Supplier	Item	Cat no.	Price
Peregrine Livefoods	Leopard gecko, *Eublepharis macularius* Carolina corn snake, *Elaphe (Pantherophis) guttata* Chequered garter snake, *Thamnophis marciarus*	- - -	£24-£28 £48.50 £39.50
Coast to Coast	Leopard gecko, *Eublepharis macularius* Carolina corn snake, *Elaphe (Pantherophis) guttata*	- -	£39.95 £59.95
South Coast Exotics	Leopard gecko, *Eublepharis macularius* Ribbon snake, *Thamnophis sirtalis* Carolina corn snake, *Elaphe (Pantherophis) guttata* Albino garter snake, *Thamnophis m. marciarus*	- - - -	£32-£60 £19.95 £39.96 £75.00

III.19 Price guide for some birds

Supplier	Item	Cat no.	Price
Morley Aviaries	Zebra finches, pair Zebra finch, Crested	-	£6.00 £9.00
The Bird Shop	Zebra finch, pair	-	£12.00

III.20 Price guide for some mammals

Supplier	Item	Cat no.	Price
Philip Harris	*Mus musculus* (mouse), albino *Rattus norvegicus* (Hooded rat)	A19720 A19732	£7.10 £10.30
Timstar	*Mus musculus* (mouse), albino *Rattus rattus* (rat), albino	BL80415 BL80430	£4.90 £12.85

APPENDIX IV Sources of information and help

Societies

Amateur Entomologists' Society (AES)

PO Box 8774
London SW7 5ZG
Web site: www.amentsoc.org
www.ex.ac.uk/bugclub (the Bug Club web site)

For publications only:
1 Tower Hill
Brentwood CM14 4TA
E-mail: aespublications@btconnect.com

The Society offers membership to adults and young children (under 16) who are interested in all aspects of the study of insects.

It also produces various publications.

- The *Bulletin* journal issued to members six times a year which contains articles on insects in the UK and abroad.
- The *Bug Club* magazine issued to junior members six times a year.
- A wide range of very useful booklets and leaflets on collecting, studying and keeping insects.
- A series of *Caresheets* for eight types of insects and arachnids. These can be accessed via the AES web site.

British Herpetological Society (BHS)

c/o The Zoological Society of London
Regent's Park
London NW1 4RY
Web site: www.thebhs.org

A long-standing society for the study of reptiles and amphibians and their captive husbandry.

Publishes the following items.

- *Herpetological Journal* four times a year. This contains articles reporting original research in herpetology from all over the world and has an international editorial board.
- *British Herpetological Society Bulletin*. Issued quarterly, this contains reviews and general articles on all aspects of herpetology.
- The *Natterjack* - the British Herpetological Society Newsletter, published monthly, contains details of meetings, events, news and views and animals offered for sale by members.
- The *Young Herpetologist Newsletter* - the junior section's own publication with articles, quizzes and news of events.
- Free information leaflets - produced regularly on various aspects of conservation and captive breeding.

Meetings - about eight are held each year covering all areas of the society's activities.

British Tarantula Society

3, Shepham Lane
Polegate BN26 6LZ
Tel: 01323 489047
Fax: -
E-mail: angehale@thebts.co.uk
Web site: www.thebts.co.uk

Established in 1984, this is the world's oldest tarantula society. Aims include furthering the correct keeping and breeding of therapsids; encouraging the sharing of knowledge amongst members, producing a quarterly *Journal* and encouraging long-term, captive-breeding programmes. Members have the opportunity to market their captive-bred spiders at shows via the society stand.

International Herpetological Society

15 Barnett Lane
Wordsley DY8 5PZ
Tel: -
Fax: -
E-mail: membership@international-herp-society.co.uk
Web site: www.international-herp-society.co.uk

An international organisation with a British background.

- *The Herptile*, the major publication of the Society, is published quarterly and contains articles from members and non-members on all aspects of herpetology.
- *The Newsletter* contains Society news, details of forthcoming events and local branch information, along with a members' free-advertising section.

Royal Society for the Protection of Birds

The Lodge
Sandy SG19 2DL
Tel: 01767 680551
Fax: -
E-mail: membership@rspb.org.uk
wildlife@rspb.org.uk
Web site: www.rspb.org.uk

Formed in 1860, the Society promotes thoughtful use of the environment in the interests of all wildlife, including birds. It publishes a seasonal magazine providing a great deal of topical background information about wildlife matters. A 32-page booklet *Birds in your Garden* is available free to members and non-members alike. For students under the age of 16, the Society operates the Young Ornithologists' Club, receiving a newsletter 6 times a year.

Society for Conservation in Aviculture

PO Box 385
Winchester SO22 6YZ
Tel: 01962 886777
Fax: -
E-mail: secretary@thesca.org.uk
Web site: www.thesca.org.uk

The Society aims to promote and develop all species and varieties of birds kept by aviculturists, with special regard being paid to threatened and endangered species, both wild and domesticated. Membership is open to all those with a genuine concern for the future welfare and conservation of birds, whether they are a pet owner or an experienced aviculturist.

Zebra Finch Society

Membership secretary
11 Primrose Way
Seaton EX12 2UR
Tel: 01297 625475
Fax: -
E-mail: zebfinsoc@aol.com
Web site: www.zebrafinchsociety.co.uk

Dedicated exclusively to the zebra finch. Issues four magazines each year. Starter information pack for new members. Books & videos at reasonable prices. Open shows, with trophies for members.

Periodicals and Web sites

Cage and Aviary Birds

IPC Media Ltd
Rockwood House
9-17 Perrymount Road
Haywards Heath RH16 3DH
Tel: 0845 676 7778
Fax: 0845 123 8010
E-mail: ipcsubs@qss-uk.com
Web site: www.ipcmedia.com

A magazine with a very wide readership.

Faunology

This company also has a number of associated web sites where there is information about keeping various animals - with links to the other Faunology web sites for purchasing equipment, live foods and livestock.

www.easyamphibians.co.uk

www.easyexotics.co.uk

www.easyinsects.co.uk

Pet Health Council

The web site link below includes details of useful contacts, including national societies of breeders of small mammals.

www.pethealthcouncil.co.uk/contacts.shtml

Practical Fishkeeping

Greatmagazines.co.uk
Tower House, Sovereign Park
Market Harborough LE16 9EF

Tel: 0845 1204 600
Fax: -
E-mail: enquiries@greatmagazines.co.uk
Web site: www.greatmagazines.co.uk

A popular magazine, published every 4 weeks, covering all aspects of fish keeping.

There is also an online version of this magazine at:

www.practicalfishkeeping.co.uk

This web site also provides articles and a discussion forum for those interested in setting up aquaria and fish keeping. The buyers' guide is extremely valuable, since it describes the principles of operation and criteria for choosing a wide range of accessories for fish keeping. The 'Frequently-Asked Questions' section is also very informative, particularly for the less-experienced aquarist.

Reptilian, Insecta and Arachnida

C-View Media
PO Box 1006
Southampton SO19 7TS
Tel: 0870 321 3764
Fax: 0870 321 6268
E-mail: info@cviewmedia.com
Web site: www.cviewmedia.com

This magazine is published 6 times a year. Each edition includes articles about the care of particular species of reptiles & exotic insects and spiders. It is a useful source of information about suppliers of animals and housing in the UK, since a number of them advertise in its pages.

Projects

Homerton Brine Shrimp Project

Dept of Biological Sciences
Homerton College
Cambridge CB2 2PH
Helpline: Tel: 01223 507174
E-mail: spt22@cam.ac.uk