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The Mammal Society,  
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(Telephone 01-283 1266).

## Projects on Badgers

Stephen Harris, Don Jefferies, Chris Cheeseman and Paul Bright



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## Introduction

Badgers are widespread throughout much of Britain, and in some areas they are common (Cresswell, Harris & Jeffries, 1989). Yet despite their relative abundance, there are still many aspects of badger behaviour and biology which are poorly understood. Many of these gaps in our knowledge can easily be filled by straightforward observations by keen amateur mammalogists, and this booklet is designed to provide guidelines on how and why such data should be collected. The ideas presented here are open to anyone to pursue, although they are primarily aimed at people who are already keen badger watchers, many of whom will be active members of their local badger group. If you are not a member of your local badger group, you will undoubtedly find it of great benefit. Some of these badger groups are affiliated to the Mammal Society, whilst others are affiliated to the National Federation of Badger Groups; addresses of these organisations are given on page 28.

The history of badger studies is comparatively recent. The first authoritative book on the subject was by Neal (1948), whose monograph on the badger was widely and justifiably acclaimed as a model study. It showed clearly the value of diligent field work. Neal's book was the stimulus for many other people to study badgers, and the results of these various studies have been summarised by Neal (1977, 1986) in his two more recent books on badgers. Another excellent example of the value of careful field work is Page & Middleton (1974), who undertook a very detailed investigation of the badgers of Yorkshire and Humberside.

The more scientific study of badger behaviour did not commence until the early 1970s. Since then there have been three long term field studies in Britain; these were by Hans Kruuk and his colleagues in Oxfordshire and Scotland, Chris Cheeseman and his colleagues in Gloucestershire, and Stephen Harris and his colleagues in suburban Bristol. Whilst all three studies have made useful contributions to our knowledge on badgers, they should not be taken as being representative of all badger populations. All three were undertaken in areas where badgers are reasonably common, and so the results show what happens to badgers living at relatively high density and in stable social groups. Whether badgers living at low densities behave in the same way is at present unknown, but there is some evidence to suggest that they may not. In areas of Essex, where the badgers were living in agricultural land at very low densities, Chris and Paul Skinner (pers. comm.) found that sett use was intermittent, and badgers would move over large areas, regularly changing setts. A similar conclusion could be drawn from the results of the national badger survey, in which Cresswell, Harris & Jeffries (1989) found that in areas of low badger density there was a much higher incidence of

abandoned main setts; they suggested that this was probably due to the transient behaviour of the badgers in low density areas.

Obviously, we still have a great deal to learn about badgers, and observations by amateurs are invaluable in this respect. However, to be of greatest use the information collected by each observer must be compatible with that of others. Unless the information is collected in a standardised way, it is not possible to combine all the results to look at regional and national differences, or the frequency of rarely observed behaviours such as mating.

In this booklet we have tried to identify some of the types of information that need to be collected, what they will show and how to record your observations in a uniform manner. Then on page 13 we suggest how your information can be pooled into a national recording scheme that will analyse all the results and make these available through one of the various Mammal Society publications. Then we discuss various other types of projects that you may like to undertake. So there are plenty of ideas here for you to pursue. The main message is please try to collect data in the way we describe so that you can add to our fund of badger knowledge.

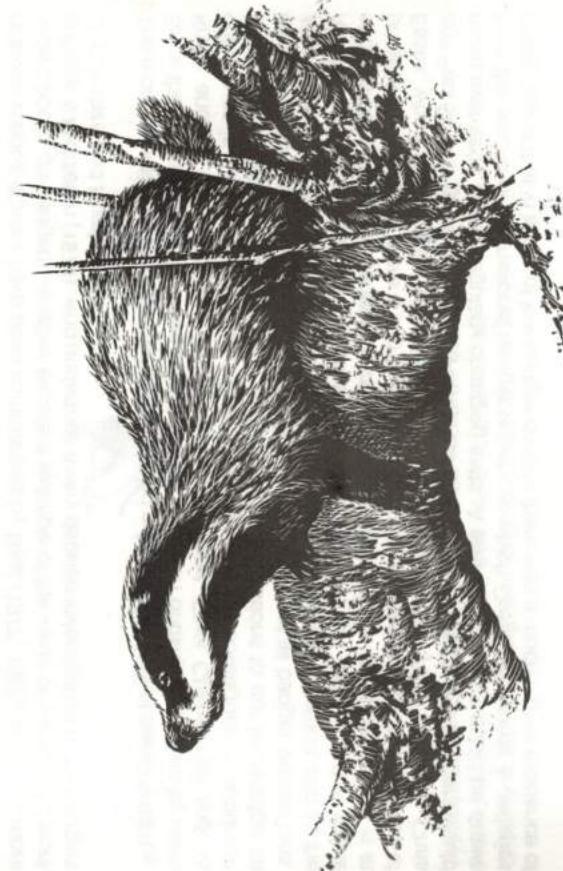
## **Studies on the behaviour of badgers at the sett**

### **What do we need to know?**

Many aspects of the annual cycle of badger behaviour are still poorly understood. Although we know that taking in bedding, digging, playing, mating, fighting, etc. tend to be seasonal activities, we do not have any quantified data to show exactly when most of these activities occur. This is particularly important if we are to understand how badger social groups operate. We have already mentioned that badgers seem to have a variable social structure at different population densities. There may also be regional variations in basic behaviour patterns, such as time of emergence, in relation to daylength and perhaps also weather conditions. Only a national recording scheme, using standardised methods, will answer these questions. The success of such schemes operated by the British Trust for Ornithology shows what can be achieved, and with enough badger watchers contributing we should collect some very valuable data on badgers. So in this first part of the booklet we will describe how to contribute to a national badger watching scheme.

### **Which sett to watch**

Since this project is centred on recording the behaviour of badgers between emergence and when they move off to forage, the first task is to select a good sett for your study. Careful selection of a good, active, easy-to-watch sett is important, so inspect several setts before you make your choice. Generally it is best if you watch at a main sett, since this is where most activity is likely to occur and where the cubs usually will be born. The criteria for recognising main setts are described in Harris, Cresswell & Jeffries (1989). It would probably also be best if you confined your observations to a few setts, preferably only one or two. In this way you will quickly discover the best positions to watch and where you are least likely to disturb the badgers. You may even learn to recognise some of the badgers individually, and in this way you will be able to interpret your observations much more easily. Regular watching at the same sett(s) is likely to be the most productive. The criteria to use to select your study sett are fairly obvious. You need a sett relatively close so that you can visit it regularly, and you must obtain the land-owner's permission to enter his land and watch at night. The sett should be of easy access, with a variety of potential watching positions depending on the direction of the wind, but with a clear view of most (preferably all) of the active holes. It is best to avoid a sett where other watchers or members of the public are likely to disturb you and/or the badgers. Before you start watching in earnest, put in some background work at the sett to select good vantage points, get used to trying to identify the individual animals.



and locate any other nearby setts, main paths and latrine areas. This will put your later work in context.

#### What equipment will I need?

Basically, very little. To collect the information that we suggest here, you will need a clip-board and several recording sheets (obtainable from the Mammal Society - see page 28) and a small torch attached to the top of the clip-board, which can be directed onto your recording sheets. This torch must be very weak, so that it does not disturb the badgers, and may be dimmed by covering it with layers of tissue paper or a piece of thick red plastic; all you need is enough light to write by. You will also need a watch, which is best tied to the top of your clip-board, so that the time can be read easily and without moving. Alternatively, a very cheap digital watch could be glued to the clip-board. If the watch is on your wrist you have to keep moving to see the time, and this may disturb the badgers.

Binoculars can be very useful for watching badgers, and it is worth paying as much as you can afford for the better quality models with good optics. The better the lenses and coatings, the greater will be the light transmission and the easier they will be on your eyes. Good twilight performance is essential and a guide to this can be calculated by multiplying the magnification of the binoculars by the diameter of the objective lens in millimetres and taking the square root. Thus  $7 \times 50$  binoculars have a factor of 18.7, which will give very good low light performance. Similarly,  $8 \times 40$  binoculars also have a good value at 17.9, whereas  $8 \times 20$ 's with a value of 12.6 would be useless at dusk or dawn. Bulk and weight are further considerations and these will increase as the magnification and objective lens diameter increase. Remember also that binoculars with higher magnification are more difficult to hold steady. All things considered, we would recommend  $7 \times 50$  binoculars as being the optimum specification for badger watching.

You will need to record some basic weather data, as described on page 13. The only equipment you will require is a small thermometer. This should be placed on the ground near where you are sitting, and all temperatures should be recorded in degrees Celsius (which is the same as °C). You may also want to take a camera and flash gun with you, since it is always tempting to try and photograph your badgers, particularly if you see something interesting. However, even if your flash-gun does not scare the badgers away, it will often if not invariably make them more wary and cautious in their behaviour. So if you take any photographs you should stop scoring the behavioural data for the rest of the night unless you are absolutely sure that they were not alarmed and continued to behave normally.

No other piece of equipment is essential, but you may like to have a torch with a red

filter to help you watch what the animals are doing. If there is a nearby source of electricity and you can gradually accustom the animals to white light, then this will greatly enhance your observations. You may also wish to make a number of hides in strategic positions to help you watch whatever the wind conditions. Alternatively, you could purchase a mobile deer stalker's high seat; these are foldable and can be lent against a tree to give you a watching platform. They are expensive, but useful at setts where good vantage points are difficult to find. They can be obtained from H.C. Slingsby (address on page 28), price £158 + VAT in 1988.

#### Tips on badger watching

Some useful suggestions for badger watching are given in Clark (1988). Remember that you cannot expect to collect structured data on your first badger watch, and you should obtain some experience watching badgers before you try to take part in this project. However, it will not take you long to learn what to do, and then you can start to collect useful information.

The most important point to remember is that observer induced bias must be avoided if you are to gain a true picture of badger behaviour patterns. To minimise this risk, explore the sett area thoroughly in daylight so that you know how to approach the sett with the least disturbance. Always approach the sett from downwind, and do not walk over the sett or nearby paths before you settle down. Ensure that you are in position well before the badgers are due to emerge. In winter, spring and autumn this should be at or very shortly after sunset. However, in summer emergence at some setts will occur even before sunset, particularly if the sett is in a remote or undisturbed area. So make sure that you are in position early enough not to disturb the badgers and delay their emergence.

When you select your position, try to keep above the sett if possible. A seat in a tree is useful; it gives you a good view and reduces the chances of a badger detecting you. Failing this, sit with your back to a tree or similar object so that you are not silhouetted against the skyline. Also, always wear dark or camouflaged clothes to make you less conspicuous, but do not wear nylon kaguls or over trousers, or any other clothes that will rustle. Finally, make sure you are comfortable long before the badgers emerge, and do not talk or fidget. In summer insect repellents may help reduce the desire to fidget, but keep them away from camera and binocular optics.

#### Sexing and identifying individual badgers

Being able to sex, age or identify a badger you are watching is of great value, but remember that it is never easy, and the problems are exacerbated when you are

watching animals in the gloom or only get a brief view. Even experienced badger watchers frequently make mistakes. So be careful, and do not record the sex, age or identity of a badger unless you are absolutely sure. In cases of doubt, you can use a question mark in your records.

Badgers reach adult weight in about a year, but from the autumn of the first year onwards it is often very difficult to be certain whether you are looking at a cub. Remember that some cubs can be as large as many adults by September, particularly in a year when there is plenty of food about, whereas some adults can be very small and look like three-quarters grown cubs. It is only once you have been watching a group of badgers for a while that you can be relatively confident about the ages of particular animals. Similarly, the sex of individual animals is a great deal harder to determine than was once thought. Boars tend to be larger than sows, with a more thick-set neck, have a broader, more domed head and a tail that is thinner and paler dorsally. However, these features are by no means infallible, and by relying solely on these characteristics you will make mistakes. Additional aids to sex identification are males mounting females, an obviously lactating female with large mammae, or a sighting of the scrotum of a male when it is lying on its back to scratch. Once an animal has been definitely sexed, other features such as body scars, can be used to help recognise that individual again.

Trying to identify individual badgers is the hardest task, and is probably only reliable where badgers are being watched in illuminated conditions. However, if you can find a way to recognise the badgers you are watching it will add greatly to the value of your observations. Size, old or new wounds or scars, and the appearance of the ears (these are often damaged or lost in fights) are useful starting points. Clark (1988) gives some good tips on individual recognition, and illustrates the faces of badgers in one social group he watched to show the differences in the widths and shapes of the facial stripes. Remember that these can appear very variable in different light conditions, or when the animal has been foraging in the rain and the fur is wet and muddy.

With all these problems, it may be tempting to think about trying to catch and mark your badgers. Remember however that this is not really practical, and can only be done with a licence from the Nature Conservancy Council.

#### What to record

##### 1. Time of first emergence

Try to record the time of first emergence for each badger. When badgers start to emerge they may come straight out of a hole, or may be much more cautious, often only sticking their nose or head out before going back in. Therefore take the time of emergence as

the time at which the whole animal comes out of the hole; even if it turns round and goes straight back in, that was the time of first emergence. Also, if you know the animals at the sett and can be absolutely sure of their identity, then record the order in which they emerge and a time for each. If you cannot recognise individuals then simply record the time of emergence for each animal but only do this if you are certain that no animal has gone back into the sett. If you think you are seeing the same badger emerging twice then only record the times for animals you are sure have emerged for the first time.

#### 2. Playing

This is fairly obvious and includes chasing, rolling, jumping on one another, and so on. Wherever possible, record whether the animal is a cub or adult. If possible, also record the sex, or the individual involved if you can be certain of this.

#### 3. Scent-marking one another

This involves one animal scent marking another with the secretion in its sub-caudal gland. It is a very characteristic piece of behaviour, and is sometimes called "bum-pressing". If possible record who has marked who, or if you cannot identify the individual animals, then if you are certain record the sex and/or age of the animals involved.

#### 4. Fighting

Again this is fairly obvious; if possible you should try to record who is fighting with whom, who was the victor, and you should grade the interaction as: slight e.g. a brief tussle or snarling session over a choice tit-bit; moderate e.g. a larger tussle or a period of fighting and chasing but with no serious damage done, or severe e.g. an extended period of fighting, usually with some deliberate attempt to inflict a bite wound on the opponent.

#### 5. Bedding collection

Try to record which individuals or the sex and age of any animals that are seen to collect bedding, the material that is being collected, and whether it is fresh or dry. Count how many times bedding is brought in and record the number of trips in each five minute interval. The day after your watch, attempt to estimate the maximum distance from which bedding was collected from the bits dropped along the way by the badger and add this to the notes at the end of your record sheet for that night.

## 6. Airing of bedding

It is unclear how often badgers deliberately take bedding out to air, and the reuse of old bedding may be more accidental than deliberate i.e. old bedding is turned out of the sett and some may be gathered in again with fresh bedding. If it is deliberate, why do badgers do it? Systematic records should be kept of instances where bedding is brought out of the sett and subsequently taken in again. How long is it "aired"? Is it taken in when fresh bedding is being collected? Is it only taken back in when other bedding is in short supply? If possible record the individuals or the sex and age of any badgers seen taking bedding out of the sett to air, and similarly for any badger seen to take it back in. Add any notes relating to the context in which bedding was aired at the end of your record sheet for that night.

## 7. Digging

Record which individuals are seen digging, or if you cannot identify the individuals, at least try to record their sex and age.

## 8. Vocalizations

Record any vocalizations you hear, and try to say which animal made them and in what context e.g. fighting, mating, being driven away, etc. Also, try to describe the noise and assign it to one of the seven categories described by Neal (1986). These are: growl; bark; scream; whicker; chatter in very young cubs; high-pitched staccato sounds; whinnying purr. Neal (1986) gives a full description of these sounds, and describes the context in which they are used. If you think you have heard a new sound, try to describe it in the notes at the end of your record sheet for that night.

## 9. Mating

If you observe two animals mating, try to record the individuals involved, and the length of time the boar was mounted in minutes and seconds. Record also, if possible, the behaviour of the other badgers. If you are sure you know all your resident animals, record the dates of visits by strange boars and their lengths of stay. It is of particular interest to know when a strange boar from another social group secures a mating with a resident sow. Record on your forms such instances when you are positive that the boar is a stranger and the reactions by other badgers to the stranger. Also note attempted matings by a boar, and the response of the female to all attempts, successful or otherwise. You can describe any particularly interesting observations at the end of your recording form.

## 10. Time of return to the sett

Although there is quite a lot of information on emergence times, very little is known about the times of return to the sett by individual badgers. These data are very useful since they can give you some idea on the lengths of foraging times; they can be obtained by doing all night badger watches. These can be hard work, but can also be a very rewarding experience and there is often a lot to see besides badgers. In summer, badgers tend to emerge early, stay out all night and return at dawn. In winter, however, the pattern is much more erratic, and some animals will emerge, forage and return to the sett for the rest of the night before others even emerge. Therefore it is most useful if you can identify at least some of the badgers as individuals, otherwise all the comings and goings of badgers to the sett can be very confusing.

Besides watching a sett all night, there are a number of gadgets that you can make with stick switches placed in the sett entrances. These are connected to a paper tape to record the comings and goings from each hole. The techniques are described in Southern & Corbet (1964) pages 153-154 and Robbins (1972), although modern data loggers may help you avoid some of the problems inherent with old fashioned paper tapes. There are a number of firms which sell the various components for making the gadgets you need; many advertise in *Exchange & Mart*. However, the disadvantage with this approach is that the tape simply records that an animal has entered or left a hole; often the recording does not enable you to determine which, and of course there is no way of saying which animal it was. These problems can be overcome using a transponder on a collar fitted to an individual animal and a data logger, but this approach is much more expensive, and you need a licence from the Nature Conservancy Council.

## 11. December emergencies

December seems to be a particularly bad month for watching setts since the weather may be dismal and the behaviour of the badgers is often very erratic. However, it is a month during which a lot of interesting things happen in the badger's calendar but about which we have little information. It is the month when the blastocysts implant in the uterus and appears to coincide with a period when the badgers are less active and stay below ground for several consecutive nights. It has been suggested that females whose blastocysts implant (but not other badgers) go through a short period of torpor around the implantation period. Watches during December will show when the badgers stay below ground (and the automatic recording devices discussed above will be a valuable aid here), which animals stay below ground and which emerge, and whether a period of inactivity by the sow coincides with the implantation of the blastocysts. How to calculate this is described on page 18. Other questions to answer include whether this period of reduced activity coincides with the first cold snap of the winter (it is certainly

not the coldest time of the year, which occurs in January or February when the badgers are more active), are there several periods of reduced activity in December or just one, and are there other periods of reduced activity in the winter?

#### 12. Use of the sett by other species

We know that foxes, rabbits, rats and mice will all emerge from occupied badger setts, but have little quantified data on the pattern of sett sharing. So record all the other species seen to emerge from the holes you are watching, and note the category of hole (well-used, partially-used or disused) as described by Harris, Cresswell & Jefferies (1989). Also, record whether you see that hole being used by badgers, and whether you know if animals other than badgers have bred in the sett. If so, are they breeding in a part of the sett that is away from the badgers?

#### 13. Scratching trees

Sometimes there is one tree near the sett which has scratch marks on it, suggesting that it has been used for scratching over several years (Neal, 1986). However, we know little about when and by which animals these trees are used. Is there a scratching tree at the sett you are watching? What species of tree is it? What are the other species of tree available within 50 metres of the sett (some idea of the numbers of the other species would be useful)? Is the tree dead or alive? Is it a log, low branch or tree trunk? Record on your sheet whenever you see the scratching tree being used, if possible the sex, age and identity of the animal using it, and what activity preceded the use of the scratching tree.

#### How to record the data

There are several possible ways to record these data, and the method proposed here should, we hope, be the easiest to use in the field. It allows the data to be quantified for subsequent analysis, so you must always record the time at which you start your watch, the time you finish and if anything untoward has happened to cause you to finish your watch early. For a quantified analysis, negative data are as important as positive data, so you should return a completed record sheet even for nights when the animals just moved straight off, and for watches when no badgers were seen. A specimen recording sheet is shown on page 31; blank copies can be obtained from the Mammal Society (page 28). It is divided into columns, one for each of the most common behaviour patterns described above, plus a column for the less frequent types of behaviour and a column to record the number of badgers you have been observing. The recording sheet is divided into five minute intervals; all you have to do is note the number of animals observed for each five minutes of your watch, and any details of their ages, sexes and

identities that you can supply. Then note in each column if any of the various behaviours were observed during the preceding five minutes and wherever possible the age, sex and identity of the badgers involved. Only for fighting, mating and bedding collection should you try to record any additional information on the severity and victor/loser (fighting), duration (mating) or number of trips (bedding collection), and for vocalizations the type of sound.

Information is recorded every five minutes after the first animal has emerged; if for instance it emerges at 9.03, then your first recording period is from 9.05 to 9.10, and you start recording the behaviour of the first animal even though more animals still have to emerge. For every five minute interval after the first badger has emerged, you must fill in a line on the recording sheet even if no badgers were visible during that five minutes. Record the time shown on your watch, irrespective of whether it is B.S.T. or G.M.T. (but say which it is). Do not try to correct all times to G.M.T., since this only leads to confusion. Times will be adjusted as necessary for the analysis.

For this exercise, your observations should if possible continue until you are sure that all the badgers have moved away. We suggest that you wait for thirty minutes after the last animal has gone, and if it seems that all the activity around the sett has finished, then leave. However, this may be a little difficult in practice, since sows frequently return to young cubs. Also, remember that to be of value we need to look at the patterns of activity throughout the year, and this will necessitate watches in all months. So try to spread your watches throughout the year, perhaps with a minimum number in each month. This may be easiest to achieve with a rota of observers. Although the winter months are not as profitable for watching badgers, since so little watching is done in the winter you may be rewarded by discovering something new.

During the course of your watch you will also need to record some simple weather data. These are (i) the temperature at ground level at the start and finish of your watch; (ii) cloud cover on a one-eighths scale (i.e. 0 = no cloud cover to 8 = complete cloud cover); (iii) if the moon is visible which quarter is it in, where 1 = first (new) quarter, 2 = second quarter, 3 = third quarter and 4 = fourth (full) quarter; (iv) some indication of the wind speed, using the categories calm, eddying, slight, moderate or strong; (v) rain during the watch as drizzle, light, moderate or heavy and (vi) rain during the preceding twenty-four hours using the same categories as for (iv).

#### What will happen to the data?

Send your completed data sheets to the Mammal Society's Conservation Officer (address on page 28). If you send sheets in batches from a few nights watching, this will minimise the work load. Receipt of your data sheets will be acknowledged, and some

more blank forms will be sent to you. If you want your completed sheets photocopied and a copy sent back to you, this will be done on request. All the data sent to the Mammal Society will remain confidential, and only the final analyses will be published, so please do not worry about data of a sensitive nature. When there are enough data, the results will be analysed and written up for publication in either *Mammal Review* or *Communications from the Mammal Society*, both of which are circulated to Mammal Society members.

If you have enough information yourself, and you feel that it will provide a really useful local study, then still send it to the Mammal Society for inclusion in a national analysis, but also publish it yourself as a self-contained paper. This could be either in your local county naturalists' society journal (contact the editor of this through your local museum) or in *Communications from the Mammal Society*, which are published in the *Journal of Zoology*. If you are unfamiliar with writing scientific papers, then get a copy of the chosen publication before you start and follow the conventions used for the style of the title, figures and references; these vary between journals. Draft out your paper, and then show it to local or national "experts" for advice on how to improve your presentation. The statistics are often a point where most beginners feel unsure but these are basically just a way of expressing the likelihood of differences or similarities being real or "significant". There are books you may like to read to give you the basics (Bailey, 1982; Fowler & Cohen, undated); otherwise seek advice.

### Other projects with the badgers you are watching

The project to study badger behaviour is a year round activity, and is centred on recording the behaviour of badgers in the period between emergence and moving off to forage. This is the most valuable time at which to record badger behaviour, but there are several other useful pieces of information that can be collected about your study group(s) of badgers. These are particularly useful because they will help you interpret the behaviour of the badgers you are watching.

#### 1. Territory size

It is very useful to be able to work out the size of the territory of your badgers, and also how many other setts they have. Many of the techniques have already been described by Harris, Cresswell & Jefferies (1989). Territories are marked by latrines, and these are largest and most frequent at the edge of territories. There may also be a conspicuous badger path on the territorial boundary running between the boundary latrines. Use of latrines is most pronounced in March and April, and these are the best months to look for latrines. So walk the area around your sett and mark all the paths and latrines you find on a large scale map (preferably 1:10,000 or even 1:2,500). From this you may even be able to work out the territorial boundary for your social group.

However, it is not always clear cut, in which case you may like to feed your badgers with a mixture of peanuts, syrup, and very small (not more than 5 mm across) pieces of coloured plastic. Kruuk (1989) describes how to do this by cutting up coloured plastic bags, which is a very cheap method. To identify the territorial boundaries of your group, you may have to feed them marked bait for seven to ten days, with ten to twenty baits (a spoonful of the mix) distributed around the main sett each day. It is not necessary to bait the smaller setts, even if they are active, and in fact this is best avoided since you may not be sure that they really do belong to the same group that you are studying. If two large, active setts are close to each other and not obviously connected, a different colour plastic should be used for each. Later recoveries will show whether or not they belong to the same social group. The baits will have to be buried under a small stone to prevent loss to other animals. Then look at all the fresh dung in the latrines you have located and see which latrines contain your coloured plastic markers. The survey will need to be meticulously undertaken; you should record the number of marked faeces per latrine, which colours end up where, and if you are using different colours to study adjacent groups how many latrines contain more than one colour marker. Complete your survey straight after bait marking is finished, otherwise fresh, unmarked faeces will obscure the marked ones. Repeat this until you find no new latrines with plastic markers. Then on your map draw lines from the main sett to all the points at which marked bait



was recovered. A boundary line can then be drawn round all the outermost points, and this gives you an indication of the minimum home range of that social group of badgers.

Bait marking and searching for latrines are simple techniques, but not invariably fool-proof. For instance, if a social group does not have a neighbouring group of badgers on one side, they will mark their territorial boundary less vigorously on that side. Similarly, in areas where badgers are very thinly scattered, territories may be very large and neighbouring groups of badgers are unlikely to meet. In such circumstances, territorial boundaries will be poorly defined. However, in most cases you should be able to mark out the size of the territory of your badger group fairly easily. Snowfalls can be very helpful here; if the badgers emerge after a fresh fall of snow you can follow their nocturnal perambulations and augment your ideas on the size of the territory and distribution of paths.

At the same time as you are looking for latrines, look for other badger setts belonging to your group. Fill in a record sheet for each sett and classify it as annexe, subsidiary or outlier as described by Harris, Cresswell & Jeffries (1989).

## 2.Badger density

It is also very useful to know the density of badgers in the area of the sett you are watching. This is a little more time consuming than calculating territory size, but is particularly useful if you are also doing a general badger survey in your area. For the national survey, Cresswell, Harris & Jeffries (1989) used the number of social groups as a measure of badger density. This was estimated by counting the number of main setts, since each social group has only one main sett. So in the winter months locate all the badger main setts in the area surrounding your study sett, mark them on a map, and then measure the nearest neighbour distances between main setts as described in Harris, Cresswell & Jeffries (1989). This nearest neighbour distance gives you a measure of badger density, but needs to be based on a minimum of twelve main setts. Of course, it is only a meaningful measure if you are sure that you have not missed any main setts in the area you surveyed!

## 3.Group size

We still know remarkably little about the size and structure of badger social groups, and particularly how these are affected by habitat and disturbance. For the national badger survey, Cresswell, Harris & Jeffries (1989) used a figure of six adults and 2.5 cubs as an average badger group. This figure was derived from a few studies on badgers living in high density areas, and may not be typical of low density populations. So try to work out the number of badgers in the group(s) you are studying. To do this, enlist colleagues

to help you for three nights during May. You need enough experienced watchers to cover every active sett in the territory of your social group and also enough people to ensure that all the holes from each sett are being observed. Make sure all your wrist-watches are synchronised, since accurate time-keeping is essential. Then arrange to watch for one and a half or two hours after normal emergence time. Ask everyone to record the time of emergence of each badger seen, note any distinguishing marks such as bad bite wounds, absence of white ear tufts, etc., the time it departed from the sett area, its direction of travel, and if it went back below ground, the time at which this happened. Also note whether the animals seen were cubs or adults, and try to determine their sex. It is easy to draw up a simple recording form, and later it should not be too difficult to piece all the observations together and calculate how many badgers were seen. If the exercise is undertaken for three nights, then the chances of missing any animals that may have emerged late on one night are reduced.

However, if this is difficult to organise, or does not work very well, it is fairly easy to get badgers used to feeding on peanuts left in an open area outside the sett. Once the badgers have learnt to expect the food source, they will emerge and go straight to it. This gives you a good opportunity to count them, and by repeating the procedure over several nights, followed by a watch to check that no new animals emerge later, it should provide an accurate population estimate. This technique usually works best during hot dry periods in the summer, when other food sources are in short supply and the badgers all tend to emerge at a similar time.

## 4.Litter size

We do not know very much about the productivity of badger social groups in different areas or habitat types. The mean litter size is 2.7, but individual litters can have up to six cubs. Chris Cheeseman and Stephen Harris, pooling their data from Gloucestershire and Bristol, estimated that each year 34.7% of badger social groups fail to breed, in 45.4% only one sow breeds, in 14.8% two sows, in 4.5% three sows and in 0.6% four sows breed. But again these data are for areas in which badgers are living at high densities and we do not know how typical they are for other badger populations.

Information on cub production should be collected at the same time as the group watches in May. Cubs are normally born in the main sett. Record at which sett the cubs are seen, how many cubs there are, and try to determine how many sows have bred. Differences in size between cubs is not a reliable guide to them being from different litters, but the number of sows seen with enlarged teats, or the number of different sows seen suckling cubs or with cubs in attendance are useful pointers. Remember that litters can be as small as one cub, so a sow regularly seen with only one cub could be the mother of that individual, whilst another sow regularly seen with two or three other cubs

could be the mother of a separate litter. Try to determine how many litters of cubs have been produced, and if possible how many cubs there are in each litter.

It is difficult to be absolutely sure how many sows have bred, and how many cubs have been born. It may take more watches than the three needed to estimate group size, and you may have to extend your observations into early June to ensure that you have not missed a late-born litter. Remember also that young cubs may not emerge until later in the night, so it is easy to miss them when they are very young. However, with your group size watches and the regular collection of behavioural data, you will probably be able to determine exactly how many cubs have been born and to whom.

The dates at which cubs are first seen above ground are also very useful, since they are a good indicator of the date of birth of those cubs. Badger cubs usually first come above ground when they are eight weeks old. Since gestation lasts seven weeks, the date at which cubs first emerge above ground enables you to calculate the approximate dates of birth and of implantation of the blastocysts. You can then see whether the date of implantation correlates with any changes in behaviour (page 11).

#### What do I do with these data?

Send a copy of your results to the Mammal Society's Conservation Officer, as described on page 13. These data will add to the analysis of the behavioural observations, since these may be affected by group size or population density. There is no special recording form, but it would help if you enclosed a copy of a large scale Ordnance Survey map with the sets clearly marked and their status as main, annex, subsidiary or outlier (page 5) written on the map. Also show the territorial boundary of your group, using solid lines where you are sure and broken lines in areas of uncertainty. Then on a separate sheet of paper give a brief written summary of your three watches to estimate group size, how many badgers of each sex and age you estimated to be present on each night, and then say how many cubs you think were born, and to which sows. Remember that since territorial boundaries, group sizes and productivity are all likely to change year by year, it is valuable to try to record these data for a number of consecutive years. In fact, good data spanning several years will be especially valuable. Finally, the points made on page 14 apply here; if your data merit independent publication, then also write them up yourself.

## Faecal analysis

### Introduction

Like many aspects of badger biology, our views on the diet of badgers are largely based on a few studies in optimal or near optimal habitats, and we know relatively little about what badgers eat in other types of habitat. What, for instance, do badgers eat in moorland areas, how important is scavenging in the uplands, and what do badgers living on coastal cliffs eat? To answer these questions is easy; all that needs to be done is for someone to collect enough faecal samples for a food analysis. This is a simple procedure, and this section describes what to do. Not only will you learn a great deal more about the badgers you are studying, but you will also make a useful contribution to our knowledge of badger biology. As an example of the sort of results that can be achieved, read the paper by Skinner & Skinner (1988) on the food of badgers in north-west Essex.

The technique described in this section is based on that developed by Kruuk & Parish (1981) and subsequently used by Harris (1984) and Skinner & Skinner (1988). It is very easy to follow, gives you quantified results, and if you use this method your results can be compared directly with other recent studies on the food of badgers.

### Collection of faeces

This may sound like an unpleasant task, but it is not really that bad, and badger faeces are far more pleasant to handle than those of many species. **ALWAYS REMEMBER THAT FAECES ARE POTENTIAL SOURCES OF DISEASE (INCLUDING BOVINE TUBERCULOSIS).** Wear disposable gloves to handle them and never examine faeces near food. Scrub your hands thoroughly after doing faecal analysis, and keep the faeces and all your equipment away from children and pets. Try to collect faeces monthly at the end of the month, and only take fresh material. This way you can be sure that the faeces you collect contain food eaten that month. Badger faeces are usually, but not invariably, left in latrines, and once you know where the main latrines are, it is an easy task to visit them once a month. Take with you a supply of small polythene bags, ties and labels. Badgers often leave several faeces together in a latrine. Try to collect each faeces separately; the easiest way is to invert a bag over your hand, pick up the faeces, and then pull the bag over the sample. Then tie it shut, and label it with the collection site and date. Faeces can be examined fresh, stored frozen in an old freezer (but not a food freezer) or stored in 10% formalin. Many chemists will be able to order formalin for you; it comes as a 40% solution of formaldehyde, and should be diluted with nine parts of water. Storing faeces in formalin prior to examination has the advantage that formalin

kills most of the organisms likely to cause disease, including that which causes bovine tuberculosis.

When setting out on your food study, try to have clearly defined goals. You may want to examine the food of badgers in a particular area, from a few selected social groups, or from a particular habitat type. Whatever your objectives, do not mix material from different habitats, since this simply obscures any differences between the badgers living in these areas. Instead, analyse the faeces from different habitats separately, since you can then make some useful comparisons. Also, set yourself a minimum number of samples to collect each month. For instance, at least twenty samples from a particular habitat/area each month for a two year period would give you enough results for a good analysis, and collecting over a two year period helps reduce any impact from a particularly unusual year. Finding faeces is easy in March and April, when latrine use is at its highest, is often hard in mid-summer when the vegetation makes things difficult to find, and is particularly hard in December to January, when badgers are a lot less active and eat much less.

#### Analysing the faeces

This is usually a simple job, but occasionally it is quite a challenge trying to identify what the badger has been eating from the fragments that remain. All the equipment you need is a fine mesh polythene flour sieve, a good hand lens or if possible a low power binocular microscope, and a flat white dish. The microscope is not essential, but it helps with the identification of difficult items. One can usually be borrowed from a local school, college or university during the vacation, or a cheap one can be purchased from Brunel Microscopes (page 28).

Simply put one faeces into the sieve, and wash it under running water until all the dirt and small particulate matter has been washed away. Then tip the remains into the white dish, cover them with about two centimetres of water, spread the material out with a pair of forceps, and examine the remains under a bright light.

Much of the food passes through a badger's gut with relatively little digestion, and it is easy to identify the remains of most food items. Noctuid moth caterpillars, beetle larvae and tipulid (leatherjacket) larvae all persist as empty skins, beetle elytra (wing cases) usually come through intact (count the left and right elytra separately, and the highest number is the number of beetles eaten), and you may find the remains of moths, adult craneflies, spiders, woodlice, etc. It is not necessary to identify the species, only the group (e.g. Carabidae - ground beetles) or type of invertebrate eaten e.g. "spider". Identification of the insect remains is greatly facilitated by reference to Chinery (1986).

and Carter & Hargreaves (1986). For insects score 1-5% of each faeces by volume as abundance 1, 6-10% as 2, 11-20% as 3, 21-30% as 4, 31-40% as 5 and over 40% as 6.

Earthworm remains can be identified in one of two ways. If you have access to a low power microscope, then look for chaetae (the little bristles found in the skin of earthworms). When you wash the faeces through the sieve, save the first 250 mls of water in a pot, let the fine particles settle out and spread 1.5 mls of this sediment thinly on a flat plate or petri dish 8.5 centimetres in diameter. Then under the x35 magnification of the microscope, scan ten fields of view (selected at random) for chaetae. They are clearly visible as small, golden yellow dagger-shaped structures. Count how many you see in the ten fields of view. Score the average number of chaetae from the ten fields of view as follows: a few only per dish as abundance 1, 1-2 chaetae in every x35 field of view as 2, 3-4 chaetae as 3, 5-10 chaetae as 4, 11-20 chaetae as 5 and over 21 chaetae as 6. If you do not have access to a low power binocular microscope, then look for gizzard linings in the food remains in your white dish. The gizzard linings persist, one from each earthworm, as transparent tubes about 2.5 mm long, and they are sometimes blocked by a small wad of grass. For an illustration see the paper by Bradbury (1977). Once you have identified all the gizzard linings, count and score them for abundance as for insects. When badgers have been eating earthworms they often ingest a lot of grass, and when this happens it can be a laborious task separating all the gizzard linings from the grass.

Vegetable food remains are usually easy to identify; make sure you can recognise the small pips in blackberries, strawberries and raspberries, can tell apple skin from pear skin (pear fruit has a gritty texture and appearance), and be prepared for exotic fruits. Mulberries, medlars (which have a woody, four-winged seed in the fruit), large ornamental hawthorn fruits and grapes are all consumed. Wheat can be identified fairly easily; it often comes through finely chewed but still recognisable. The remains of pignuts are fairly easy to recognise - they are small bulb-like structures. Scavenged food is sometimes harder to identify; bread, biscuits and cake usually only persist as a white paste, whereas bones from cooked meats persist as large pieces and are easy to recognise.

For the amateur, the identification of hair and feather remains is hardest, but is still not particularly difficult. There is no readily available key; the best one is in Day (1966). Your local library should be able to obtain a copy on loan via the Inter-Library Loan scheme, or you can go to your nearest University and photocopy the article. For mammals the hairs can usually be identified to genus level (and since many genera only have one species, this means to species level), but bird feathers are more difficult and can only be identified to the order of birds they come from (e.g. Passeriformes, all small birds, Columbiformes, pigeons, etc.). If the teeth or feet of the mammal come through in the

dropping, it is easy then to identify the animal without resorting to hair structure (for which you need a microscope), and the guides by Lawrence & Brown (1974) and Yalden (1977) will help here. For birds, remains of feet, beaks or coloured feathers may enable you to identify the species of bird, and here the book by Brown *et al.* (1987) is invaluable. Score all the food items other than those already described as 1-5% of each faeces by volume as abundance 1, 6-25% as 2, 25-50% as 3, 50-75% as 4, 75-95% as 5, and over 95% as 6.

If you cannot identify a particular item, label and save it, and get an expert at the local museum to sort out your problems later. You may find a reference collection of likely food items a help. Once you have analysed all the faeces, for each month calculate the abundance of each food item by combining abundance scales 1 and 2 and scales 5 and 6 so that you have four equal grades of abundance. Then for each month just add up the abundance scores for each food item and calculate the percentage this forms of the total scores for all the food items that month.

#### What do I do with the results?

Send copies of your monthly summaries to the Mammal Society's Conservation Officer. If you have collected the minimum number of samples per month in each area/habitat you are sampling, as recommended on page 20, then your results are self-contained and should be published as an independent study. How to do this is described on page 14. If you have adopted the procedures outlined here, then your results are directly comparable with those of other workers. Remember that to be of maximum value for other workers, it is important that you describe fully the area from which the faeces were collected. Information on the habitat, different land uses (by percentages if possible), and also the badger density if known are invaluable. For a useful model, see the paper by Skinner & Skinner (1988).

## Badger conservation studies

### Monitoring the effects of sett disturbance and badger digging.

We know from the national badger survey (Cresswell, Harris & Jefferies, 1989) that on any one day during the winter a large proportion of badger setts (15.7% of active main setts) have some or all of their holes blocked. For some setts this is a regular event, and the holes are sometimes blocked with objects or hard-packed soil that makes it very difficult for the badgers to dig out. We have no information on what effect this has on the behaviour of the badgers, their future breeding success, or their long-term occupation of a sett subjected to regular disturbance.

Similarly, the national badger survey showed that digging at badger setts was a very widespread problem, with 10.5% of active main setts, 5.5% of annexe setts, 3.2% of subsidiary setts and 2.3% of outlying setts showing signs of having been dug. As a very rough estimate, Cresswell, Harris & Jefferies (1989) suggested that this could mean that 9,000 badgers are killed by diggers each year. However, this estimate is very crude, and we need to learn a lot more about the effects of digging on badger populations, and this is where local studies would be particularly valuable.

#### 1. Which setts to monitor

To avoid any bias in selecting your setts, it is best to select an area of a few square kilometres in size, and then thoroughly survey this area for badger setts. Choose an area relatively close to your house to minimise the amount of travelling you have to do. The size of the area you survey will depend on the density of badgers, but you want to include about a dozen social groups. Once you have located all the setts, decide which are main, annexe, subsidiary or outlying setts as described by Harris, Cresswell & Jefferies (1989). If your badger group could cover more than one area, then so much the better. Try to select areas in different habitats and also areas in which you think the pressures on the badgers may be different. You may be able to combine this exercise with the survey to determine badger density (page 16).

#### 2. What to record

When you have completed your survey, arrange to visit all the main and annexe setts regularly once every two months, and keep an accurate record for each visit. For each sett record the number of holes which are well-used, partially-used and disused, as described by Harris, Cresswell & Jefferies (1989) and the number of holes showing any signs of fresh digging by badgers or other signs of activity. Then also record any signs of disturbance or digging by humans. For disturbance, note how many holes are

blocked, how many holes have been left open, what is used to block the holes, if you can revisit the sett more regularly following an incident find out how long it takes the badgers to dig out, and whether they re-open the old hole or dig a new one. For illegal digging, we need to know how long the signs persist, since this will help with the interpretation of the results from the national badger survey. So on your first visit following an illegal dig, describe in detail the damage that has been done, and if the corpses have been left behind, the number, sex and ages of the badgers killed. Then on every subsequent bi-monthly visit note the signs that still persist, and the date at which the evidence of the dig is no longer clearly visible (i.e. when you might have missed it on a casual visit).

For both disturbance and illegal digging, you may wish also to study the behaviour of the badgers, particularly if disturbance and/or digging are frequent events. Immediately following hole blocking, what is the behaviour of the badgers? Is their emergence delayed, do they stay near the sett or move off quickly, and if the setts in the area are regularly disturbed, does this affect cub protection? Watches at all the setts in your survey area in the spring will enable you to compare the number of adults and cubs in an area where the setts are regularly disturbed with the setts in an area where this is rare. However, this will require quite a lot of volunteers and a lot of organisation. Where a sett has been dug, try to record the behaviour of the badgers over the next few months. How many badgers are left, what are their sexes and ages, do they remain at the old sett or move to a new one, do new badgers move in, and if so when and what are the sexes of the new badgers, and finally do the badgers breed in the spring following on illegal dig?

### 3. What will happen to the data?

It is not possible to design a standard recording form; instead keep comprehensive notes on all your visits, even if you think that there is nothing new to record. All the data will help to build up a picture of the effects of disturbance and illegal digging on badger populations. Once you have several months data, send copies of it (or the originals, with a request for a copy to be returned to you) to the Mammal Society's Conservation Officer (address on page 28). With the first batch of records, a map identifying the positions of all the setts is also needed. All records will be treated in confidence. When sufficient records are available, they will be collated and a report produced for circulation to local badger groups. The final objective is to produce a map highlighting the extent, and main areas, of disturbance and digging, and also to find out how serious a threat these activities pose to the survival of local badger populations. However, this will only be possible if enough groups join in. Remember that it is important not to select individual setts which you think are at particular risk, since this will bias the results. We need to monitor small areas, and preferably lots of them, to be able to quantify the results.

## Monitoring road traffic accidents

By collating information on badger road mortalities, you can collect some very useful information on the effects of road deaths on badger populations. One estimate (by Chris Cheeseman and Stephen Harris, using their Gloucester and Bristol populations), suggests that road deaths account for at least 30% of the annual badger mortality. Collect records from the Ministry of Agriculture, Fisheries and Food, the local authority responsible for removing the corpses, the Police, and the local museum. Plot the distribution of road deaths on a map, and see if you can look at the pattern of mortality in relation to different road types and times of the year. The total length of each road type in your area can be measured from an Ordnance Survey map with an opisometer, and badger deaths per kilometre of road type calculated. By looking at the distribution and levels of occupancy of setts in relation to the nearest road type, you can look at the effects of traffic on the loss of individual social groups. Also, by plotting the road deaths on a map, you will be able to identify particular black spots, and perhaps experiment with the use of reflectors to see if you can reduce the incidence of badger mortality (Harris, Jefferies & Cresswell, 1988). Finally, when improvements to roads (e.g. widening, straightening, etc.) are proposed, you will be able to identify areas in which fencing or even tunnels are needed to help reduce badger deaths; see Harris, Jefferies & Cresswell (1988) for information on badger-proof fencing and tunnels.

## Studies on other causes of mortality

Although we suspect that up to a third of badger deaths are the results of road accidents, we do not know what accounts for the other two-thirds. Collecting information on the number of animals killed by diggers (page 23) will help, but if you find a dead badger away from a road, try to get a post-mortem examination done. Either a local veterinary surgeon interested in the work of your group or the local Ministry of Agriculture, Fisheries and Food office may help here; the latter will be particularly willing to examine animals that are suspected of being killed by pesticides or agro-chemicals. However, remember that there is a risk of disease even from just handling badgers. Therefore only handle a badger when wearing disposable gloves, transport it in a sealed polythene bag, keep pet dogs and cats away from the corpse, and thoroughly scrub your hands when you have finished.

## Rehabilitating and translocating badgers

Many local badger groups are faced with problems such as what to do with orphaned badger cubs, or with badger setts threatened by development. You may have to try to rehabilitate a hand-raised cub back to the wild, or relocate or translocate a group of wild badgers. All these tasks are incredibly time-consuming and are fraught with

problems; for details see Harris, Jeffries & Cresswell (1988). However, if you have to undertake such an exercise, discuss it with other badger groups who have had relevant experience, and keep very detailed notes on everything you do. It is only by compiling all this information that we can improve our techniques, which at present are very hit-and-miss.

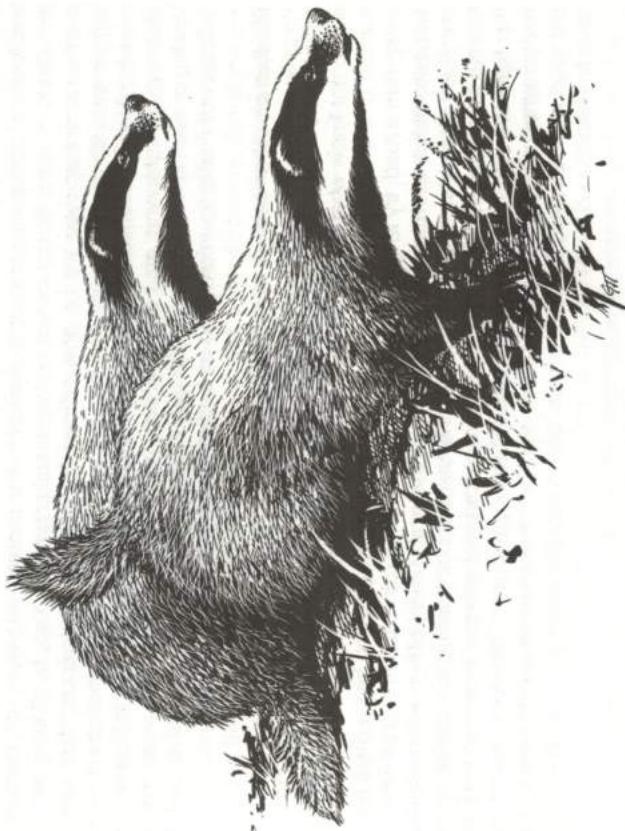
## Summary

In this booklet we have suggested various projects on badgers for local badger groups and enthusiasts to undertake. The aim is to provide guidelines so that the results from different individuals and groups can be compared directly, and combined for a detailed analysis. Of the projects outlined in this booklet, the behavioural work is simple; anyone can do it, and the results that can be obtained from quantified recording are considerable. So if enough people join in with the scheme, we should get some very interesting results. Faecal analysis is also fairly simple, and well within the capabilities of most people. Similarly, the conservation studies are easy, but post-mortem work is very specialised and beyond the scope of most people. There are also a variety of other ideas which you may like to pursue; the booklet by Harris, Jeffries & Cresswell (1988) describes how to deal with badger-related problems, the booklet by Skinner, Jeffries & Harris (1989) describes how to deal with problems of badger persecution, and the booklet by Harris, Cresswell & Jeffries (1989) and the national badger survey report by Cresswell, Harris & Jeffries (1989) show how to carry out a well-organised badger survey. Read in conjunction with this booklet, these publications will identify a very wide range of worthwhile projects and activities for badger groups. If you want any further help or advice before you start, write to:

The Conservation Officer, The Mammal Society,  
Baltic Exchange Buildings, 21 Bury Street, London EC3A 5AU  
(or Dexter House, 2 Royal Mint Court, London EC3N 4XX after February 1st 1990).

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## Useful addresses

### Organisations

**The Mammal Society:**Baltic Exchange Buildings, 21 Bury Street, London EC3A 5AU  
(or Dexter House, 2 Royal Mint Court, London EC3N 4XX after February 1st 1990) - for publications, addresses of county badger groups, help, advice and the address to which you should send completed recording forms.

**Ministry of Agriculture, Fisheries and Food:**for addresses of regional offices see telephone book - to report badger corpses and to seek advice and help.

**National Federation of Badger Groups:**c/o Mr John Taylor, 16 Ashdown Gardens, Sanderstead, South Croydon, Surrey CR2 9DR  
- for addresses of badger groups belonging to the federation.

**Nature Conservancy Council:**Northminster House, Peterborough PE1 1UA  
- for publications and advice on legal problems.

**Royal Society for Nature Conservation:**The Green, Nettleham, Lincoln LN2 2NR  
- for the addresses of County Wildlife Trusts and other useful contacts who may be able to help with badger work.

**Royal Society for the Prevention of Cruelty to Animals:**Wildlife Branch, Causeway, Horsham, West Sussex RH12 1HG  
- for publications and advice on legal problems.

### Suppliers

**Brunel Microscopes Ltd:**113 Henbury Road, Henbury, Bristol BS10 7AA  
- for inexpensive and second-hand microscopes.

**H.A. Slingsby:**Preston Street, Bradford, West Yorkshire BD7 1JF  
- for aluminium high seats.

**Watkins & Doncaster:**Four Thorns, Hawkhurst, Kent TN18 5ED  
- for general biological supplies.

## References

- + Bailey, N.T.J. (1982). *Statistical methods in biology*. Hodder & Stoughton: London.
- \*Bradbury, K. (1977). Identification of earthworms in mammalian scats. *Journal of Zoology, London*, 183: 553-555 (published in Notes from the Mammal Society No.35).
- + Brown, R., Ferguson, J., Lawrence, M. & Lees, D. (1987). *Tracks and signs of the birds of Britain and Europe: an identification guide*. Christopher Helm: London.
- + Carter, D.J. & Hargreaves, B. (1986). *A field guide to the caterpillars of butterflies and moths in Britain and Europe*. Collins: London.
- + Chinery, M. (1986). *Collins guide to the insects of Britain and western Europe*. Collins: London.
- + Clark, M.(1988). *Badgers*. Whittet Books: London.
- Cresswell, P., Harris, S. & Jeffries, D.J. (1989). *The history, distribution, status and habitat requirements of the badger in Britain*. Nature Conservancy Council: Peterborough (available from the Nature Conservancy Council - address on page 28).
- #Day, M.G. (1966). Identification of hair and feather remains in the gut and faeces of stoats and weasels. *Journal of Zoology, London*, 148: 201-217.
- Fowler, J. & Cohen, L. (undated). *Statistics for ornithologists*. British Trust for Ornithology: Tring (available from the British Trust for Ornithology, Beech Grove, Tring, Hertfordshire HP23 5NR).
- #Harris, S. (1984). Ecology of urban badgers *Meles meles*: distribution in Britain and habitat selection, persecution, food and damage in the city of Bristol. *Biological Conservation*, 28: 349-375.
- \*Harris, S., Cresswell, P. & Jeffries, D. (1989). *Surveying badgers*. Occasional Publication No. 9. Mammal Society: London.

Hanliss, S., Jephcott, D. & Cresswell, W. (1988). *Problems with badgers?* RSPCA: Horsham, West Sussex (available from the Royal Society for the Prevention of Cruelty to Animals - address on page 28).

## Specimen data sheet for recording badger behaviour

לעכדרו עמו כוונתו נסח בפערת הפה (בג'יג'ה 28).

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#Kruuk, H. & Parish, T. (1981). Feeding specialization of the European badger *Meles meles* in Scotland. *Journal of Animal Ecology*, 50: 773-788.

#Lawrence, M.J. & Brown, R.W. (1974). *Mammals of Britain: their tracks, trails and signs*. Blandford Press: London.

# Neal FG (1948) The badger Collins: London

# Neal, E.G. (1977). *Badgers*. Blandford Press: Poole, Dorset.

+ Neal, E. (1986). *The natural history of badgers*. Croom Helm: Beckenham, Kent.

#Parget, R.J. & Middleton, A.L.V. (1974). *Badgers of Yorkshire and Humberside*. William Sessions: York.

\*Robbins, C.S. (1972). A field activity recorder for use with the larger mammals. *Journal of Zoology, London*, 168: 430-433 (published in Notes from the Mammal Society No.25).

\*Skinner, C.A. & Skinner, P.J. (1988). Food of badgers (*Meles meles*) in an arable area of Essex. *Journal of Zoology, London*, 215: 360-362 (published in *Communications from the Mammal Society*, No. 56).

\*Skinner, P., Jeffries, D. & Harris, S. (1989). *Badger persecution and the law*. Occasional Publication No. 10. Mammal Society: London.

#Southern, H.N. & Corbet, G. (1964). Technical aids to the study of British mammals. In: *The Handbook of British Mammals* (First Edition), pp. 97-150. Faber, H.N. Southern, G. Corbet.

\*Yalden, D.W. (1977). *The identification of remains in owl pellets.* Occasional Publication No. 2. Mammal Society: London.

\*Mammal Society publications available from the address on page 20

++ Books currently still in print.  
#Out of print books and other publications only available from a library.

Name and address:

Site:

Count

Time of starting watch:

Temperature at start:

Cloud cover:

Rain during watch:

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time or lists emergence and animal involved:

Times of subsequent emergencies and animals involved:

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Additional notes:

**Specimen data sheet for badger dung analysis - use one per faeces**

Site:

Date collected:

Food items	Abundance category	Notes
Earthworms: gizzards chaetae		
Molluscs: radulae shell		
Insects: beetles - adults beetles - larvae tipulid larvae noctuid larvae other larvae other adult insects		
Vertebrates: fish amphibians reptiles birds mammals		
Plants: moss fungi monocots - grasses, etc. dicots - broadleaved plants underground parts apples plums other fruits		
Scavenged food		
Other food items		
Non-food items		