The Management of Problems Involving Badgers (*Meles meles*)

Protection of Badgers Act 1992 licensing cases dealt with on behalf of the Ministry of Agriculture, Fisheries and Food in England from 1992 to 1996.

A report by the Farming and Rural Conservation Agency on behalf of the Ministry of Agriculture, Fisheries and Food.

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SUMMARY

The Ministry of Agriculture, Fisheries and Food (MAFF), with advice from Wildlife Advisers from the Farming and Rural Conservation Agency (FRCA), deals with a range of wildlife issues for which MAFF has a statutory responsibility. A number of different species are involved but a large number of cases concern badgers and the Protection of Badgers Act 1992. **These do not include cases relating to the spread of bovine TB to cattle which are dealt with under separate legislation by the Ministry's Field Veterinary Service.**

Great Britain has one of the largest badger populations in Europe and its legal protection has increased in recent years such that it now enjoys a level of protection equivalent to that for scarce species such as the otter. This is in contrast with the majority of other European states where the badger is unprotected or hunted as game. The development and main provisions of the legislation are summarised.

In England MAFF and English Nature (EN) have power under the Protection of Badgers Act 1992 to issue licences to allow actions against badgers or their setts for various purposes. MAFF has powers in relation to prevention of the spread of disease, prevention of damage to land, crops and other forms of property, and for agricultural or forestry operations, or for the maintenance or improvement of watercourses, drainage works or sea defences.

When MAFF receives an application for a licence a site inspection is carried out by an FRCA Wildlife Adviser to assess the case and make recommendations to MAFF. All such cases in England have been recorded on a computer database since the beginning of 1994, and in south west England, where the recording system was developed, since the beginning of 1992.

FRCA Wildlife Advisers dealt with 508 badger licensing cases in England in 1994, 522 cases in 1995 and 551 in 1996. About half of these were in the south west of the country where there had been an initial rapid rise in cases per year
from less than 100 in 1992 to almost 250 in 1994, probably, in part, reflecting increasing awareness of the legislation and the need for licences for sett interference, following the Badgers Act 1991.

Over 93% of the 1581 cases recorded from 1994 to 1996 concerned applications for licences to interfere with badger setts. A licence was issued in about 80% of such cases. More than half (52%) of all recorded cases were for closing down part, or whole setts, and a substantial proportion was for agricultural or forestry operations (17%).

Including the south west data for 1992 and 1993, 70 of the 1890 recorded cases concerned applications to kill badgers or take them from the wild. Only four of these cases resulted in licences being issued. However, eight further licences to kill or take badgers were issued either outside the south west in 1992 and 1993, prior to the recording system being adopted nationally, or without FRCA involvement. In total, under these 12 MAFF licences, three badgers were killed, six were trapped and translocated and six were trapped and held temporarily.

The number of badger sett cases dealt with showed slight seasonal peaks in spring/early summer and late summer/autumn, probably reflecting seasonal changes in badger behaviour.

Feeding damage by badgers was the main cause of complaint in only a small percentage of cases but these concerned some contentious issues such as alleged predation on livestock (2%), and were often those where a licence to kill or take the badgers was sought.

Almost a third of recorded cases involved badger setts encroaching onto farmland and posing a risk to stock or machinery and operators. Setts damaging buildings were reported in 13% of cases. Although a relatively small proportion of cases (8%) concerned setts undermining roads and railways, some of these involved A-class roads and main railway lines with clear potential for serious economic loss or safety problems.

The method of sett interference most frequently recommended was the use of one-way badger gates fitted directly in sett entrances to allow badgers to exit from but not re-enter the sett (39% of cases). These were normally required to remain in position for a minimum of three weeks to ensure badgers had emerged from the sett prior to the whole or part of the sett being destroyed.

Between 25% and 44% of sett interference cases were monitored each year. All kill or take licences were monitored. The results of monitoring suggested that about 76% of sett interference cases were resolved satisfactorily although, as expected, sett closure was less successful at main setts than at other sett types.

The results of monitoring also suggested that possible breaches of licence conditions occurred in about 6% of cases, mainly concerning failure to give notice of when action under the licence was going to take place.

It is estimated that about 104 main setts would have been closed down over the three years 1994 to 1996. When compared with a recent estimate of the number of badger social groups in mainland Britain this suggests that about 0.07% of social groups per year may have been affected by main sett closure under MAFF licences.

INTRODUCTION

The Ministry of Agriculture, Fisheries and Food (MAFF) has a range of statutory responsibilities in relation to wildlife. In fulfilling these it draws on technical advice from Wildlife Advisers in the Farming and Rural Conservation Agency (FRCA), a MAFF executive agency formerly the statutory part of ADAS. These Wildlife Advisers, based throughout England, advise the nine MAFF Regional Service Centres (RSCs) (Fig 1) on licensing under wildlife and agricultural legislation. Their key functions include making recommendations on the issue of licences and on the conditions which should be attached when licences are issued.

FRCA's functions do not include problems concerning the suspected transmission of bovine tuberculosis by badgers which are dealt with by MAFF's Field Veterinary Service. This aspect of MAFF's involvement with badgers is dealt with separately in other reports (e.g. MAFF, 1996).

Problems caused by a range of species are dealt with by FRCA Wildlife Advisers under legislation such as the Wildlife and Countryside Act 1981, the Agriculture Act 1947, the Pests Act 1954, and the Protection of Badgers Act 1992. In addition, MAFF is obliged under the Agriculture Act 1986 to ensure balance in the discharge of its functions with respect to agricultural interests, economic and social interests, conservation and public enjoyment of the countryside.

The wildlife problems dealt with include bird predation at fisheries, goose damage to crops, deer damage to crops and hedgebanks, and neighbour disputes over rabbit *(Oryctolagus cuniculus)* damage. However the largest number of cases (about 54% of visits made in 1995) concern licence applications made under the Protection of Badgers Act 1992 and problems caused either directly by the badgers *(Meles meles)* themselves or by their setts.

Great Britain has one of the largest populations of badgers in Europe (Griffiths & Thomas, 1993), with perhaps as much as a quarter of the British population in south west England (Cresswell *et al,* 1989; Cresswell, Harris & Jefferies, 1990). In the Cotswold Hills, Rogers *et al* (1997) have recorded densities of over 25 adult badgers per km^2, the highest recorded density anywhere in the badger's range. It is not surprising then that badger problems have made up a significant proportion of the workload for Wildlife Advisers for a number of years, particularly in the south west of England (Symes, 1989, Wilson, 1994).

The purpose of this report is to present and summarise data on licensing cases dealt with on behalf of MAFF in England under the Protection of Badgers Act 1992. The report also reviews the main types of problems reported and the solutions recommended, and attempts to assess the likely impact of licensing on the badger population.

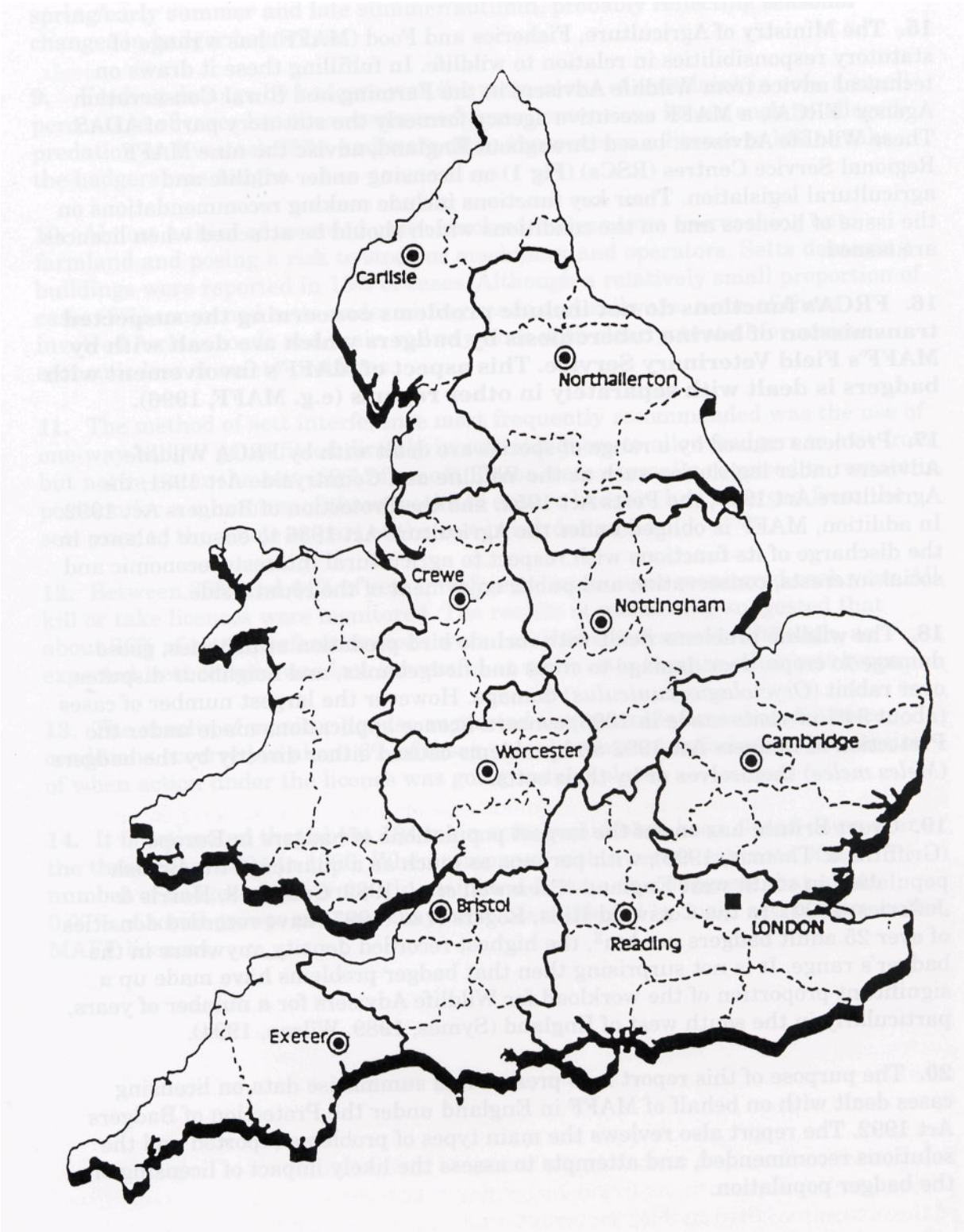

Figure 1. Location of MAFF Regional Service Centres in England showing regional boundaries (bold lines).

LEGISLATION

Legal Protection

Badgers were originally protected, primarily for welfare reasons (Harris *et al* 1994), under the Badgers Act 1973. That Act made it an offence under Section 1 to kill, injure or take a badger and under Section 2 to cruelly ill-treat a badger. However under Section 7 it provided exceptions for "authorised persons", normally the owner or occupier of the land on which the action took place or someone acting with his written authority, to kill or take badgers, outside "areas of special protection", and without the need to justify their action. Within areas of special protection, provided for in Section 6 of the Act, although the exceptions for authorised persons still pertained, any action had to be justified as necessary for the purpose of preventing serious damage to crops or other property or for preventing the spread of disease.

The 1973 Act was modified by subsequent legislation. Significant changes came with the Wildlife and Countryside Act 1981 which removed Sections 6 and 7 of the 1973 Act and extended the protection previously afforded to the badger only in the one existing area of special protection (West Yorkshire) to the whole of the country. Furthermore, the defence for authorised persons for killing or taking a badger in order to prevent damage or the spread of disease, or injuring it while attempting to do so, was modified to apply only where the need for such action was not foreseen. Thus, if the need for killing or taking badgers was anticipated it could only be done in accordance with a licence issued under Section 9 of the amended Act.

The Wildlife and Countryside (Amendment) Act 1985 made no substantive changes to badger protection. However it did amend Sections 1 and 2 of the Act such that if it could "reasonably be concluded" that someone was committing an offence under these Sections then it would be presumed that they were doing so "unless the contrary is shown".

A major change came with the Badgers Act 1991 which amended Section 2 of the 1973 Act to give protection to the badger's sett. This made it an offence to damage, destroy or obstruct access to a sett, to cause a dog to enter a sett, or to disturb a badger occupying a sett. At the same time it amended Section 9 to make provision for the issue of licences to interfere with setts where there was legitimate cause.

A legal definition of a sett was given for the first time in the 1991 Act as "any structure or place which displays signs indicating current use by a badger". Arguably this might include, for example, a disused outbuilding or a stack of straw bales in which a badger was taking refuge, but it has been suggested that it would not necessarily include the spoil heaps outside a sett. It also raised the question of what constitutes "current use". Interpretations have ranged from indications that a sett was probably occupied within the last few days, and likely to be reoccupied, to that it would be occupied at some time within the badger's annual cycle. Although the latter may be appropriate in some circumstances from a conservation viewpoint, the former is a more pragmatic interpretation which takes account of the welfare and humaneness issues likely to arise in licensing cases.

Few applications for licences to interfere with setts were received in the latter part of 1991, following the 1991 Act coming into force on 25 October, and no licences were issued. Effectively therefore, operation of the new licensing system, with provision for licences both to interfere with badger setts or to kill or take badgers, commenced at the beginning of 1992.

Also in 1991 the Badgers (Further Protection) Act 1991 conferred additional powers on courts where a dog was used or was present at the commissioning of certain offences but it did not affect the licensing arrangements.

Subsequently all the legislation specific to badger protection was brought together in a consolidation Act, the Protection of Badgers Act 1992. However the protection afforded to the badger and the provisions for licensing have remained unchanged since the Badgers Act 1991 became law. Thus the badger, a relatively common animal in Britain (Harris *et al,* 1995), continues to enjoy a level of protection equivalent to that given to endangered species such as the otter *(Lutra lutra)* (Morris, 1993), in contrast with the majority of European states where it is unprotected or hunted as game (Griffiths & Thomas, 1993).

Licensing Powers

Under the Protection of Badgers Act 1992 authority to issue licences in England is given to both English Nature (EN) and MAFF according to the purpose for which the licence is being issued. The division of licensing powers and the types of licences which may be issued are in summary as follows:

By English Nature under Section 10(1):

a) for scientific or educational purposes, or for conservation of badgers, *to kill or take badgers or to interfere with a badger sett;*

b) for the purpose of a zoological collection *to take or to sell badgers;*

c) for the purpose of ringing and marking badgers *to take and mark badgers;*

d) for the purpose of development as defined in the Town and Country Planning Acts *to interfere with a badger sett;*

e) for the purpose of the preservation or archaeological investigation of a scheduled monument *to interfere with a badger sett;*

f) for the purpose of investigating whether any offence has been committed or for gathering evidence *to interfere with a badger sett.*

By MAFF under Section 10(2):

a) for the purpose of preventing the spread of disease *to kill or take badgers or to interfere with a badger sett;*

b) for the purpose of preventing serious damage to land, crops, poultry or any other form of property, *to kill or take badgers or to interfere with a badger sett;*

c) for the purpose of any agricultural or forestry operation *to interfere with a badger sett;*

d) for the purpose of any operation to maintain or improve any watercourse or drainage works, or to construct new works for the drainage of land, including defence against sea water or tidal water *to interfere with a badger sett.*

By English Nature or MAFF under Section 10(3):

for the purpose of controlling foxes in order to protect livestock game or wildlife *to interfere with a badger sett.*

In relation to the last provision, which could allow the use of dogs to bolt a fox *(Vulpes vulpes)* from a badger sett, agreement has been reached between EN and MAFF that EN should licence for fox control to protect released game and wildlife whilst MAFF should licence for the protection of livestock and penned game.

It should be noted that there is no provision for licences to be issued to kill or take badgers or to interfere with badger setts for the purpose of protecting other wildlife from the badgers. Furthermore, whilst MAFF could licence the taking of badgers to prevent damage to penned game, as they could be considered "property", once released they may no longer be considered property (Parkes & Thornley, 1994), so again there is no provision for licensing, for example to protect released pheasants *(Phasianus colchicus).*

ASSESSMENT OF LICENCE APPLICATIONS SUBMITTED TO MAFF

Under Section 10(6) of the Act MAFF is required to consult with EN from time to time on the circumstances in which certain types of licences should be granted under Section 10(2)(b), (c), and (d). In practice this is usually achieved by regular consultation meetings between headquarters staff and not by consultation on each individual case. However, consultation on individual cases does take place where they involve new types of problems or solutions not previously licensed.

In assessing any application for a licence under the legislation criteria must be applied which are as objective as possible and reproducible from one case to another. Whilst each case is considered on its own merits there are certain general guiding principles which are applied.

The three main criteria used by FRCA and MAFF in assessing licence applications under Section 10(2)(b) to deal with damage caused by badgers are as follows:

a) Is there evidence of or the potential for a serious problem?

b) Are there no other practicable methods of preventing the problem?

c) Is licensed action likely to be successful in resolving the problem?

Licence applications under Sections 10(2)(c) and (d), to allow agricultural or forestry operations which may cause interference to a badger sett, or for maintaining or constructing watercourses or drainage works, are considered on a similar basis. However, the main function of the licence in these cases is to accommodate the action to be carried out whilst minimising any adverse effect on the badgers or their setts.

When a licence application is received at a MAFF RSC an FRCA Wildlife Adviser is asked to visit the site to assess the problem on the basis of the criteria outlined above and to discuss the possible options for resolving the problem with the applicant or his/her representative. Following this, the Adviser will submit a report to MAFF objectively describing the situation and making recommendations for the issue or refusal of a licence. In the former case this will include detailed conditions which should apply to the licence.

In addition to these pre-licence inspections a proportion of sites are revisited in order to monitor compliance with licence conditions and the effectiveness of the work being carried out. This also provides feedback on the suitability of the techniques recommended and enables ongoing development and improvement in the advice given by the Advisers.

As a result of these procedures, in all badger licensing cases dealt with by MAFF, at least one site inspection is made by a trained and experienced FRCA Wildlife Adviser.

RECORDING THE DATA

With the increase in licence applications following the protection of setts afforded by the 1991 Act the FRCA Wildlife and Environment Team in south-west England, then part of ADAS, established a trial recording system to monitor and summarise technical details of the badger licensing work in its area, covering the counties of Avon, Cornwall, Devon, Dorset, Gloucester, Somerset and Wiltshire. From 1994, at the request of MAFF, this recording system was extended to cover the whole of England.

For the purpose of recording, enquiries were treated as *cases* if they involved actual licence applications or were thought by the Wildlife Adviser dealing with the enquiry likely to result in a licence application. Thus they were normally initiated by receipt of a formal licence application via MAFF or as a result of a direct enquiry from a potential licence applicant. However, not all cases necessarily resulted in the receipt of a licence application or the issue of a licence.

For each case a site inspection was made by a Wildlife Adviser, usually accompanied by the applicant, to assess the problem, the status of any setts involved, and to gather information on which to base a recommendation to MAFF. A standard recording form and codes were used to record details and licensing recommendations for each case and periodically the data was transferred to a Microsoft® Excel spreadsheet, or in 1996, a Microsoft® Access database. Where the case concerned more than one type of problem the one most relevant to consideration of the licence application was recorded.

The data recorded provides the basis for this report which summarises details of all badger case work carried out by FRCA on behalf of MAFF in England from 1994 to 1996 with some reference also to that recorded for the south west of England only for the years 1992 and 1993.

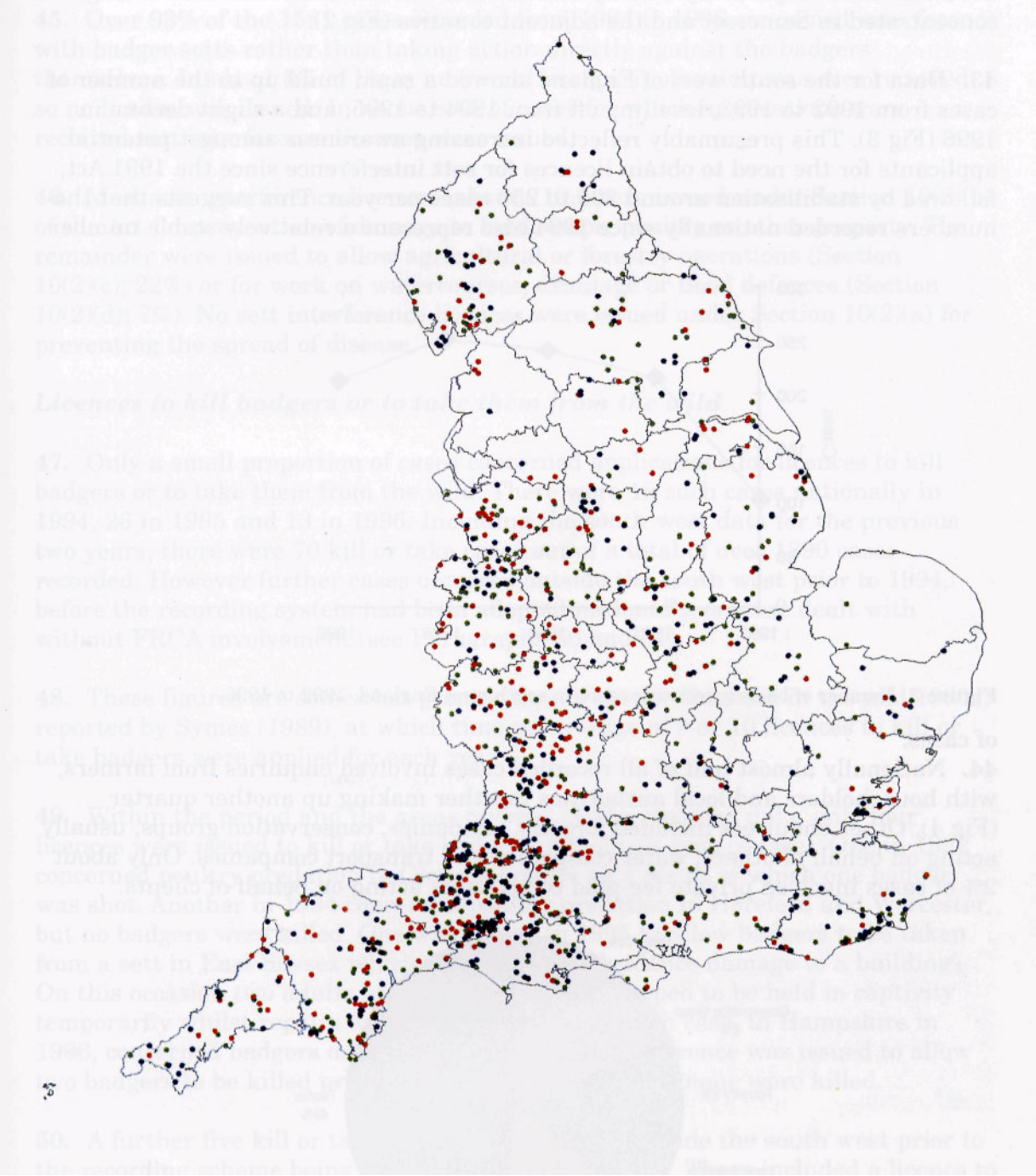

Figure 2. Distribution of recorded badger cases dealt with from 1994 to 1996 inclusive. Cases are plotted to the nearest 1km^2. Where more than one case was recorded in a 1km^2 this is not distinguished.

Key
- = 1994
- = 1995
- = 1990

NUMBER AND SOURCE OF ENQUIRIES

Throughout England, 508, 522 and 551 badger cases were dealt with in 1994, 1995 and 1996 respectively. Nearly half of these were in the south-west of England concentrated in Somerset and the adjacent counties (Fig 2).

Data for the south west of England showed a rapid build up in the number of cases from 1992 to 1993, levelling off from 1994 to 1995, and a slight decline in 1996 (Fig 3). This presumably reflected increasing awareness amongst potential applicants for the need to obtain licences for sett interference since the 1991 Act, followed by stabilisation around 200 to 250 cases per year. This suggests that the numbers recorded nationally since 1994 also represent a relatively stable number of cases.

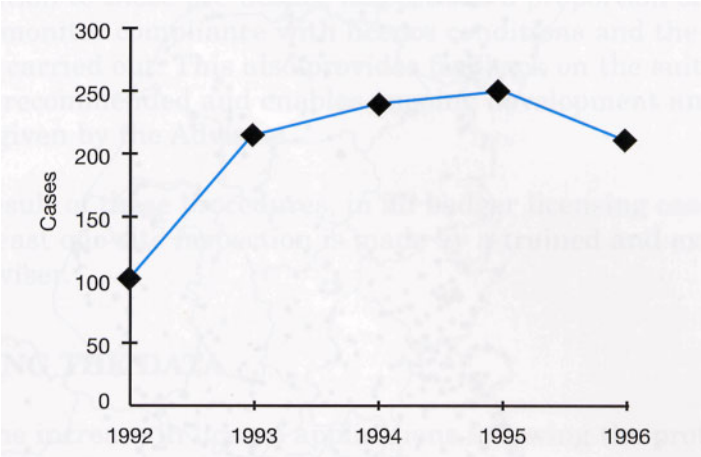

Figure 3. Number of badger licensing cases in south west England, 1992 to 1996.

Nationally almost half of all recorded cases involved enquiries from farmers, with householders and local authorities together making up another quarter (Fig 4). Other enquirers included forestry companies, conservation groups, usually acting on behalf of others, water companies and transport companies. Only about 2% of cases involved private fee-paid consultants acting on behalf of clients.

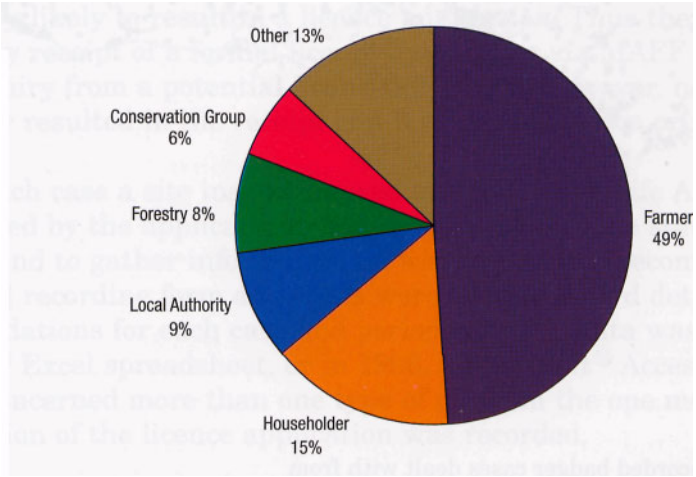

Figure 4. Types of enquirers involved in badger cases dealt with by FRCA Wildlife Advisers throughout England from 1994 to 1996 inclusive (n = 1458).

LICENCES RECOMMENDED

Licenses to interfere with Badger Setts

Over 93% of the 1581 cases recorded from 1994 to 1996 concerned interference with badger setts rather than taking action directly against the badgers themselves. In about 8% of these no formal licence application was ever received so no licence was issued. In about 80% of cases for which applications were received sett interference licences were issued.

Most sett interference licences (about 71%) were issued under Section 10(2)(b) of the Act for prevention of damage to land, crops, poultry or other property. The remainder were issued to allow agricultural or forestry operations (Section 10(2)(c); 22%) or for work on watercourses, drainage or flood defences (Section 10(2)(d); 7%). No sett interference licences were issued under Section 10(2)(a) for preventing the spread of disease.

Licences to kill badgers or to take them, from the wild

Only a small proportion of cases concerned applications for licences to kill badgers or to take them from the wild. There were 18 such cases nationally in 1994, 26 in 1995 and 13 in 1996. Including the south west data for the previous two years, there were 70 kill or take cases out of a total of over 1890 cases recorded. However further cases occurred outside the south west prior to 1994, before the recording system had been adopted nationally, or were dealt with without FRCA involvement (see Paragraphs 50 and 51).

These figures are somewhat greater than those for England in the mid 1980s, reported by Symes (1989), at which time an average of 9 or 10 licences to kill or take badgers were applied for each year.

Within the period and the areas covered by the recorded data, only four licences were issued to kill or take badgers (6% of this type of case). One in 1992 concerned poultry predation in Gloucestershire as a result of which one badger was shot. Another in 1994 concerned poultry predation in Hereford and Worcester, but no badgers were killed. One was issued in 1995 to allow badgers to be taken from a sett in East Sussex which was causing subsidence damage to a building. On this occasion two adults and three cubs were trapped to be held in captivity temporarily whilst repairs were carried out. The fourth case, in Hampshire in 1996, concerned badgers damaging a crop of maize. A licence was issued to allow two badgers to be killed prior to harvest of the crop but none were killed.

A further five kill or take licences were issued outside the south west prior to the recording scheme being adopted nationally in 1994. These included a licence to shoot a badger in Kent in 1992 to prevent poultry predation, and three in 1993 to prevent lamb predation; one in the Greater Manchester area and two in Hereford and Worcester. In fact, in none of these cases were any badgers shot or killed. The fifth licence was issued in July 1993 to allow badgers to be taken from a sett threatening to undermine a private house in East Sussex. In this case a group of six badgers was translocated to a woodland area in Suffolk (Brown & Cheeseman, 1996).

Three other kill or take licences were issued by MAFF but were not dealt with by FRCA Wildlife Advisers. One in Gloucestershire concerned another poultry predation problem in a badger research study area used by MAFF Central Science Laboratory (CSL). In this case CSL staff carried out the trapping under licence. However the only badger trapped was a lactating sow and because the animal was presumed to have dependant cubs it was released unharmed.

The other two were for the humane destruction of captive badgers diagnosed as having tuberculosis. These were in Gloucestershire and East Sussex and in each case one badger was killed.

In total therefore, from 1992 to 1996, MAFF issued 12 licences to kill badgers or to take them from the wild. Under these licences three badgers were killed, six were trapped and held temporarily and six were trapped and translocated (Table 1).

Table 1: MAFF Licences to kill or take badgers in England 1992 to 1996.

Year	Licences issued	No. of badgers killed	No. of badgers held temporarily	No. of badgers translocated
1992	2	1	0	0
1993	4	0	0	6
1994	3	1	1	0
1995	1	0	5	0
1996	2	1	0	0
TOTAL	12	3	6	6

SEASONAL OCCURRENCE OF PROBLEMS

The earliest recorded date of notification in each case would normally be expected to give some indication of when a particular problem was identified. Using these dates where available and excluding figures for applications specifically for kill or take licences, which were recorded separately in 1994 and 1995, there was a seasonal pattern in numbers of cases (Fig 5).

The pattern of peaks in spring/early summer and late summer/autumn appears fairly consistent and was also apparent in the south west data for 1992 and 1993 (Wilson, 1994). This could reflect seasonal behaviour of the badgers or of the people identifying and reporting problems. However the seasonal changes in badger digging behaviour summarised in Neal & Cheeseman (1996), where they describe peaks in activity in February-April and August-October, and a lull in June-July, might account for the pattern observed here, allowing perhaps for a time lag due to delays in reporting. This suggests that these problems, which mainly concern badger setts, reflect seasonal changes in badger behaviour, particularly sett digging activity.

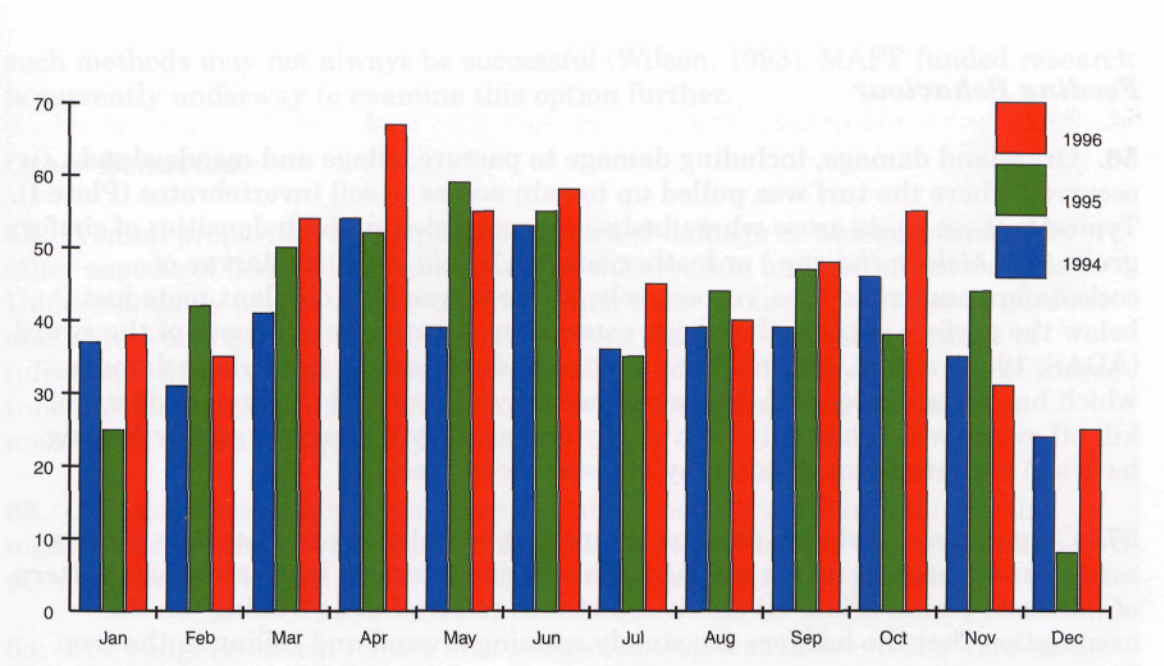

Figure 5. Monthly recorded totals of badger cases dealt with by FRCA throughout England in 1994, 1995 and 1996. Figures for 1994 and 1995 are for sett interference cases only.

PROBLEMS REPORTED

A wide range of problems was reported including those caused by badger feeding or other behaviour, or by the presence of badger setts (Fig 6).

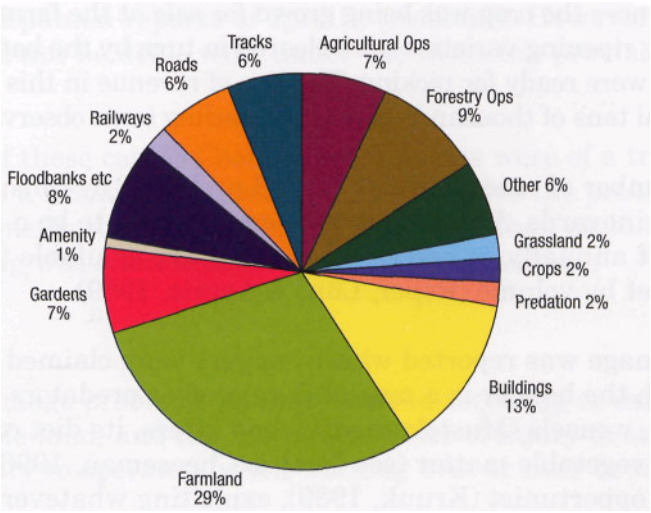

Figure 6. Subjects of problems reported by enquirers in badger cases throughout England from 1994 to 1996 inclusive (n = 1581). See text Paragraphs 57 to 72 for explanation of problem types.

Feeding Behaviour

Grassland damage, including damage to pasture, silage and meadowland, occurred where the turf was pulled up to gain access to soil invertebrates (Plate I). Typically these cases arose where badgers were exploiting high densities of chafer grubs (e.g. *Melolontha* spp.) or leather)ackets *(Tipula* spp.), the larvae of cockchafers and crane flies, respectively. These larvae feed on plant roots just below the surface of the soil and can cause poor growth or even death of the sward (ADAS, 1984i; ADAS, 1984ii). Arguably the badgers simply exacerbate damage which has already occurred. However they may also extend the area of damage, kill off sward which has only been partly damaged by the larvae, and by leaving bare soil encourage colonisation by invasive weed species.

Crop damage included damage to ripening cereal crops such as oats *(Avena sativa)* and wheat *(Triticum uulgare).* This is characterised by a criss-cross pattern of flattened plants (Plate II) and is sometimes referred to as "rolling" on the assumption that the badgers are simply running around and rolling in the crop. However evidence indicates that it is primarily a feeding behaviour (Neal & Cheeseman, 1996; Wilson, 1993). Whilst this is often patchy and probably not of economic importance (Roper *et al,* 1995), in some cases it can affect substantial areas of a crop (Wilson, 1993).

Badgers also damaged ripening maize, a forage crop, of which the area grown increased almost ten-fold from 1983, to 1995 (Nix & Hill, 1996). Typically near-ripe cobs are pulled down and some of the grain nibbled off (Plate III). This can be even more of a problem where the sweeter varieties are grown as sweetcorn for human consumption. In one such case, where the crop was being grown for sale at the farm gate, small 0.2ha plots of successively ripening varieties were cleared in turn by the badgers, in each case shortly before they were ready for picking. The loss of revenue in this case was estimated at several tens of thousands of pounds sterling (own observations).

In a small number of cases badgers caused problems by consuming grapes from commercial vineyards. Although grapes are unlikely to be a major component of the badger's diet annually, in season where they are available they can make up over 60% of the diet by volume (Roper, Liips & Lycett, 1989).

Predation damage was reported where badgers were claimed to have killed livestock. Although the badger is a mustelid, related to predators such as stoats *(Mustela erminea),* weasels *(Mustela nivalis)* and otters, its diet consists largely of invertebrates and vegetable matter (see Neal & Cheeseman, 1996). However it is to some extent an opportunist (Kruuk, 1989), exploiting whatever food is available to it, and individuals have been known to take lambs or poultry (Neal & Cheeseman, 1996). The reports of predation received mainly concerned these species, and whilst the evidence was usually only circumstantial, in a small number of cases it was considered strong enough to warrant the issue of a licence see Paragraphs 47 to 52). In one such case the complainant had shut the badger in the poultry house until the Wildlife Adviser visited the following morning, at which point it was allowed to escape back into the wild.

In many cases concerning feeding damage alternative methods of damage prevention such as proofing or electrified fencing were considered the most appropriate solutions, but on the scale required for some crop damage problems such methods may not always be successful (Wilson, 1993). MAFF funded research is currently underway to examine this option further.

Other Behaviour

A small proportion of complaints concerned damage or nuisance caused by other aspects of badger behaviour, such as the creation and use of latrine areas. Understandably people were concerned when these occurred in domestic gardens and were worried about possible disease risks. Badgers can carry a range of infections which can affect man, such as salmonellosis, leptospirosis and of course tuberculosis (Hancox, 1980), but the risk of picking these up from infected material is difficult to quantify.

Occasional complaints were received about noise disturbance during the night, although these were usually about the noise made by the complainants own pet dog when it became aware that there were badgers in the garden.

The badger's stoical nature also makes it persistent in breaching man-made barriers and consequently some damage was reported to fences which were repeatedly dug under or dry-stone walls repeatedly climbed over. The former is a recognised problem where rabbit-proof fences cross badger paths and the use of rabbit-proof badger gates in these circumstances is accepted practice (Rowe, 1976).

Whilst not exclusively involving behaviour problems, another category which should perhaps be mentioned here is complaints received claiming that there were simply "too many" badgers in a given area. Such non-specific claims, usually based on a perceived increase in numbers of setts and other badger signs, often accompanied reports of specific problems. However, in themselves they clearly could not be dealt with under the licensing provisions of Section 10 of the Act.

Thus many of these cases of behaviour problems were of a trivial or non-specific nature, so a licence was rarely required to solve the problem. However, where they did constitute a real or potential problem then exclusion of the badgers by effective fencing was often the most appropriate solution.

Problem Setts

Farmland damage problems mainly involved setts dug or extending into grassland or arable land, and the consequent risks of injury to stock, or damage to machinery or injury to operators when working over or near to setts.

Buildings damage, whether actual or potential, occurred not only to rural premises, but also to suburban houses. Similarly damage to roads, railways and tracks ranged from the undermining of A-class roads and main railway lines, to minor roads, farm tracks, and footpaths (Plate IV). This type of damage can often result in substantial repair costs (Symes, 1989) and other losses due, for example, to hold-ups caused by lane closures and speed restrictions, and ultimately the risk of personal injury to road or rail users.

Agricultural Operations and Forestry Operations accounted for 105 and 149 cases respectively, from 1994 to 1996. The operations for which licences were usually sought were those most likely to cause damage or disturbance to setts, namely ploughing over setts or tree felling or thinning.

Floodbanks, maintenance of watercourses and drainage or other related works accounted for 128 cases. In many of these there as potential for considerable damage to land and property if, for example, flood defences were breached as a result of tunnelling by badgers.

Other problems included 15 cases where dogs were reported to have become entrapped in badger setts. Normally the dogs, most of which were terriers, emerged again in good health within two or three days of disappearing, but two dogs were never recovered. In some cases, however, it was impossible to be certain that the dog had ever actually been in the sett for all or even part of the time that it had been missing.

RESOLUTION OF PROBLEMS

The results of cases where licences to kill or take badgers were issued are summarised in Paragraphs 47 to 52 above. A number of kill or take applications were rejected because alternative solutions to the problem, such as electrified fencing or proofing, had not been tried.

The recommendations made in cases concerning potential sett interference varied greatly in detail according to the circumstances of each case but they were based on a number of main options.

Recommendations for agricultural operations were aimed at minimising any adverse effects on setts. Consequently the main restriction was that ploughing over a badger sett would normally be limited to a maximum depth of 30cm (12 inches) and that more invasive operations such as sub-soiling should not be carried out within 20 metres (22 yards) of the sett. Often the main part of the sett was near the headland and was left undisturbed. Most farmers reported that setts ploughed over in this way were quickly reopened by the badgers but further monitoring would be needed to substantiate these claims.

Recommendations for forestry operations were also aimed at minimising impact on setts. Forestry Practice Guide 9, "Forest Operations and Badger Setts" (Forestry Authority, 1995) gives advice on carrying out forestry operations without disturbing setts but broadly similar precautions were often considered appropriate in licensable situations, where some risk of damage or disturbance was unavoidable.

The method of sett interference most frequently recommended was the use of one-way badger gates fitted in the sett entrances to close down whole setts or parts of setts (Fig 7). These are usually constructed from wood and are designed to allow badgers to exit from the sett but not re-enter (Plate V). This method, developed in the 1980's by David Trump, an FRCA Wildlife Adviser, is effective in evicting badgers (see Paragraph 85) but the gates need to remain in position long enough to be sure that badgers inside the sett have emerged. Currently the best information indicates that this should be a minimum of three weeks, as badgers have been known to remain underground this long (own observations). On the other hand, in one case a badger was observed to emerge mid-morning from a one-way gate within an hour of it having been fitted and while the personnel were still at the sett (own observations). Presumably this animal had been disturbed by the noise of the work going on above ground.

Plate I Damage to permanent pasture caused by badgers feeding on soil invertebrates, Cumbria, England *(A O'Connor, FRCA)*

Plate II Badger damage in a field of ripening oats, Devon, England *(C J Wilson, FRCA)*

Plate III Damaged maize cob showing where grain has been nibbled off part of the cob by badgers, Devon, England *(C J Wilson, FRCA)*

Plate IV Road subsidence caused by badger tunnelling into the road embankment, Devon, England *(C J Wilson, FRCA)*

Plate V A one-way badger gate fitted to a problem badger sett to allow badgers to exit but not re-enter the sett *(A O'Connor, FRCA)*

In a smaller number of cases it was recommended that badgers should be evicted from setts by surrounding the sett with a badger-proof electrified fence incorporating a number of one-way gates. This was usually recommended where there were a large number of sett entrances or where access to the entrances was difficult. Because electrified fences are not an absolute barrier to badgers (Wilson, 1993, & unpublished data) this may be less reliable than using gates fitted directly to sett entrances and it is essential that signs of badger activity at the sett itself are regularly checked. However, monitoring the success of cases using either method suggests that there was no significant difference between them (x^2 with Yates' correction = 1.041, *d.f.* = 1, NS) and in some cases both were allowed as options.

Blocking and filling, or "soft blocking" entrances with a light layer of soil were also recommended. These were usually in cases where the part of the sett being blocked was not considered by the Wildlife Adviser to be in current use by badgers, although the sett as a whole was so a licence was required.

Where part of a sett had undermined a road or a track a licence was sometimes recommended to allow digging into the active sett in order to make good the foundation of the road or track. Usually this involved reinstating the sett tunnel underneath by fitting a tunnel "roof of some kind, or an artificial tunnel such as a length of piping.

A variety of other solutions were recommended where appropriate, such as assessing sett activity before taking any further action, controlling invertebrate food species to reduce feeding damage, or using an approved repellent. In a number of cases it was recommended that no action be taken or that action be deferred, for example where it was thought that unweaned cubs could be present.

A proportion of cases was monitored by Wildlife Advisers to ensure compliance with licence conditions and to assess the effectiveness of the action taken. All kill or take licences were monitored and are reviewed above (Paragraphs 47 to 52). Between 25% and 44% of sett interference cases were monitored each year (Table 2).

In some cases this simply involved a telephone interview with the licensee, but in most one or more site inspections were carried out by the Wildlife Adviser dealing with the case.

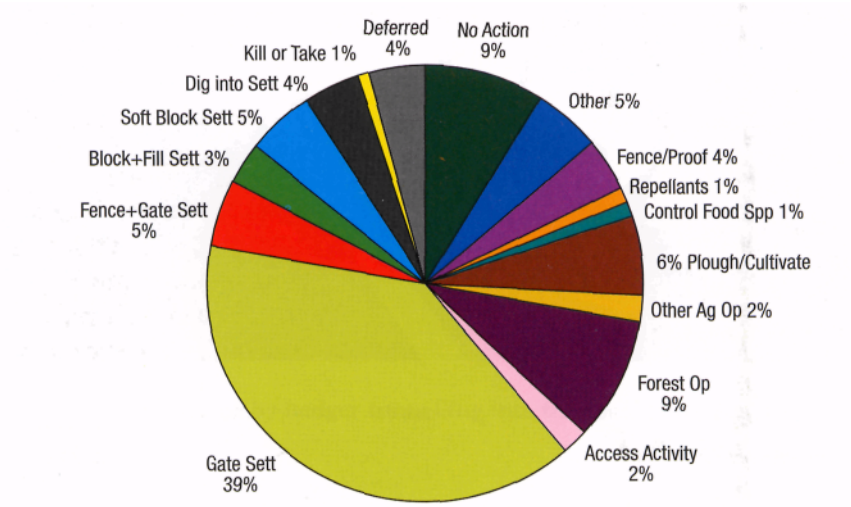

Figure 7. Main types of recommendations made in cases recorded for England from 1994 to 1996 (n = 1427; AgOp = Agricultural operation; Forest Op = Forestry operation).

Table 2: Results of FRCA monitoring of sett interference cases, 1992 to 1996, showing assessment of success or otherwise of the licensed action (1992 and 1993 figures for south west England only).

Year	Total Number of Cases	Number Monitored(%)	Number Assessed	Conclusion of Assessment		
				Successful(%)	Part Successful(%)	Unsuccessful (%)
1992	95	31 (33)	24	12 (50)	7(29)	5(21)
1993	202	64 (32)	57	42 (74)	10(18)	5(9)
1994	490	214 (44)	214	160 (75)	35 (16)	19(9)
1995	496	205 (41)	191	144 (75)	34 (18)	13(7)
1996	538	137 (25)	100	86 (86)	9(9)	4(4)
TOTAL	1821	651 (36)	586	444 (76)	95 (16)	46(8)

The success of licensed operations was usually judged following the site inspection by the Wildlife Adviser. Overall, about three-quarters of the cases monitored were considered to have been successfully resolved and there was some indication that the rate of success increased during the period covered (Table 2).

The number of cases in which the recommended action was considered not to have successfully resolved the problem was below 10% in all but the first year of recording and declined to below 5% in 1996.

From the beginning of 1994 the types of setts involved in cases were recorded as "Main", "Annexe", "Subsidiary", or "Outlier" setts, broadly following the definitions given by Thornton and Roper (1986). In addition a small number were recorded as "Abandoned", or "Unknown", where the Adviser was unable to assess the sett's status, or "Other", where it was judged to be the burrow or earth of another species.

The success of sett closure under licence at different sett types in 1994 to 1996 as assessed by monitoring was compared (Table 3). The sample sizes for some sett types were small but the overall relative success rates were as might be intuitively expected, with closure of part or whole main setts significantly less frequently successful than closure of other sett types to which the badgers might be presumed to be less attached ($x^2 = 10.263$, *d.f.* = 1, $P < 0.01$). However, although it might have been expected that part sett closure would have been more successful than whole sett closure, the data, pooled for sett type and technique, did not bear this out ($x^2 = 0.074$, d.f. = 1, NS).

Possible breaches of licence conditions were reported in 41 (6%) of the cases monitored from 1992 to 1996. Details of these were passed to MAFF for possible investigation but were not recorded on the database for 1992 to 1995. In 1996, 15 of the 23 possible breaches recorded were failures to comply with a condition requiring notification of when action under the licence was to take place. Seven involved non-compliance with the conditions governing the action permitted by the licence, and one was not detailed.

Table 3. Success of sett closure techniques at different sett types in sett interference licensing cases monitored from 1994 to 1996.

	Percentage of Sett Types where action considered successful (*n* = Number of cases assessed)				
Recommendation	Main	Annexe	Subsidiary	Outlier	*All Setts*
Close Whole Sett using:	*%(n)* 62	*%(n)*	*%(n)* 77	*%(n)*	*%(n)*
One-way Gates Pence	(53)	91(11)	(30)	84 (63)	76(157)
and Gates Block and	88(8)	100 (1)	100(3	100 (2)	93 (14)
Fill only Soft Blocking	50(2)	100 (2)		100 (3)	50(2) 80
	60(5)				(10)
All Techniques	65 (68)	93 (14)	79 (33)	85 (68)	77(183)
Close Part Sett using:					
One-way Gates	70 (43)		50(4)	100 (3)	72 (54)
Fence and Gates	82(11)	100 (4)			82(11)
Block and Fill only	83 (12)	100 (2)			86 (14)
Soft Blocking	75(8)	0(1)	100 (2)	100 (3)	86 (14)
All Techniques	74 (74)	86(7)	67 (6)	100 (6)	78 (93)
OVERALL	70 (142)	90 (21)	82 (39)	86 (74)	78 (276)

IMPACT ON BADGER POPULATIONS

The killing of three badgers and taking from the wild of a further 12, throughout England over a five year period, in the context of an estimated population in the mid 1980's in mainland Britain of 250,000 adults and an annual production of 105,000 cubs (Cresswell *et al,* 1990), is clearly insignificant. Furthermore, following a more recent survey, Wilson, Harris and McLaren (1997) estimated that the population has since increased by 77%, although because of reservations about the mean social group size used in the earlier estimate, they declined to give a figure for the total population. Of greater potential significance is the impact of interference with setts and the possible consequences for the affected badger social groups. However the impact in these cases is also likely to vary according to sett type.

Sett type was recorded in a total of 1492 cases from 1994 to 1996. In a small number of cases more than one sett was involved, but only the sett type most affected has been included in this analysis.

Main setts were involved in 835 (56%) of these cases, annexe setts in 75 cases (5%), subsidiary setts in 211 cases (14%) and outlier setts in 265 cases (18%). Main setts may be a limiting resource for a badger social group and it is possible that the loss of a main sett could lead to the break up of the group. The loss of the other less important sett types is unlikely to have as great an effect.

Whole sett closure was licensed in 160 (19%) of the cases involving main setts and part sett closure in 229 (27%) of these cases. As shown above (Table 3) whole sett closure was considered successful in 65% of the cases monitored. Assuming this success rate applies to all such cases about 104 main setts would have been successfully closed down over the three years covered. Wilson *et al* (1997) estimated that there were about 50,000 badger social groups in mainland Britain. Thus, on average in each of the three years recorded, about 0.07% of badger social groups may have been affected by the loss of their main sett in this way. Additional main setts may have been affected in Wales and Scotland but very few, if any, are likely to have been closed down as most licences in these countries were for forestry operations (Evans, FRCA Wales, and Brodie, Scottish Agricultural Science Agency, pers. comms.).

Sett closure was normally avoided during the main badger breeding season, particularly where it was thought that dependant, unweaned, cubs might be present. Thus it is unlikely that there was any significant impact on reproductive success, even at a local level.

While the fate of badgers excluded from main setts closed down under licence could not be determined by ordinary monitoring procedures, in most cases it was known that alternative setts, such as subsidiary or annexe setts, were available to them. The destruction of the main sett, therefore, does not necessarily equate to the disintegration of the social group. It is possible that the estimate given above indicates a maximum number of social groups dispersed as a result of loss of main setts under MAFF licence.

THE FUTURE

It is impossible to predict with certainty the numbers of badger problems and licences which will be sought in coming years. However the data presented here suggest that the number of cases per year is likely to be around, or a little above, the 1994 to 1996 figures. The techniques currently available for resolving these problems appear to be successful in the great majority of cases. These will continue to be refined in the light of experience and as new research, such as that currently being funded by MAFF, yields results.

The increase in the badger population indicated by the results of the recent National Badger Survey (Wilson *et al,* 1997) clearly places in context the removal from the wild, under licence, of the small numbers of badgers reported here. Even the number of badgers possibly affected by social group disintegration as a result of licensed sett interference is likely to be trivial when compared to the estimated 50,000 killed each year on British roads (Harris *et al,* 1995).

Whilst it would be wrong to disregard the possible threats posed to the badger population (Morris, 1993), it is reasonable to conclude that licensed management of badger-related problems is unlikely to have any significant impact on the future status of the badger in Britain. Thus, development should continue to be directed towards management methods which are as effective and humane as possible.

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