

**Council of Europe  
Conseil de l'Europe**

# **The conservation and management of the European badger (*Meles meles*)**

Nature and environment, No. 90

# **The conservation and management of the European badger (*Meles meles*)**

(Revised results of an enquiry into the species, originally presented as a report to the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats, on the population and management status and conservation needs of the species in the Western Palearctic)

**Huw I. Griffiths**

Research Institute for Environmental Science and Management, School of Geography and Earth Resources, University of Hull, United Kingdom

and

**David H. Thomas**

School of Pure and Applied Biology, University of Wales, Cardiff, United Kingdom

Nature and environment, No. 90

Council of Europe Publishing

French edition :

*La conservation et la gestion du blaireau européen (Meles meles)*

ISBN 92-871-3446-4

For a full list of titles in this series please see at the back of the book.

Council of Europe Publishing  
F-67075 Strasbourg Cedex

ISBN 92-871-3447-2  
© Council of Europe, 1997  
Printed at the Council of Europe

## CONTENTS

### GENERAL INTRODUCTION

Badgers in their zoological context .....	5
Background to the current study .....	6

### SECTION 1: NATIONAL ACCOUNTS

Albania .....	8
Austria .....	10
Belarus .....	10
Belgium .....	11
Bosnia-Hercegovina .....	12
Bulgaria .....	13
Croatia .....	14
Czech Republic .....	15
Denmark .....	16
Estonia .....	17
Finland .....	18
France .....	19
Germany .....	21
Great Britain .....	23
Greece .....	25
Hungary .....	26
Ireland .....	27
Italy .....	28
Latvia .....	29
Liechtenstein .....	30
Lithuania .....	30
Luxembourg .....	31
"the former Yugoslav Republic of Macedonia" .....	32
Netherlands .....	33
Norway .....	34
Poland .....	35
Portugal .....	36
Romania .....	37
Slovakia .....	37
Slovenia .....	39
Spain .....	40
Sweden .....	40
Switzerland .....	41
Turkey .....	42
Yugoslavia .....	42

### SECTION 2: BADGERS IN A MODERN WORLD

Badgers as pests .....	44
Badgers as game .....	47
Badgers and disease .....	48
Road-traffic mortality .....	49

Landscape changes . . . . . 50  
The effects of pollutants . . . . . 52  
Badgers as a source of commodities . . . . . 52  
Illegal "sports": badger baiting . . . . . 53

**BADGER POPULATION BIOLOGY: A BRIEF REVIEW**

Population models . . . . . 54  
Causes of natural mortality . . . . . 54  
Density dependence and habitat colonisation . . . . . 54

**SECTION 3: CONCLUSIONS**

1. Conservation-based recommendations . . . . . 56  
2. Management-based recommendations . . . . . 57

ACKNOWLEDGEMENTS . . . . . 61

REFERENCES . . . . . 62

APPENDIX 1: Names and affiliations of correspondents in national accounts . . . . . 73

APPENDIX 2: Scientific names of species cited in the text . . . . . 76

APPENDIX 3: Distribution maps . . . . . 77

## GENERAL INTRODUCTION

### Badgers in their zoological context

The badgers are a somewhat heterogeneous group of small to medium-sized carnivores within the family Mustelidae, a group encompassing martens, weasels, stoats, polecats, otters and the wolverine (amongst others). Badgers form a distinct "cluster" within this group, the subfamily Melinae, that is made up of at least four distinct lineages (see Petter, 1971; Long & Killingley, 1983). These are: the North American badgers (*Taxidea*), Eurasian badgers and East Asian hog badgers (*Meles* and *Arctonyx*, respectively), the ferret badgers (*Melogale* - also from east Asia), and the stink badgers or teledus (*Mydaus*) from Java and the Philippines. Some authors (e.g. Ewer, 1973) believe that one of the Philippines' species belongs in the monospecific genus, *Suillotaxus*, although most authorities now accept synonymy within *Mydaus* (e.g. Long & Killingley, 1983; Wilson & Reeder, 1993). Despite being of rather similar appearance, the Afro-Asian honey badger or ratel (*Mellivora capensis*) is a more distant relative that belongs within the subfamily Mellivorinae, and which is probably more closely akin to the skunks (Mephitinae) than to the "true" badgers (Petter, 1971).

The Eurasian badger, *Meles meles* (L., 1758), is endemic to the Palaearctic region. The species is widely distributed with an enormous range between 15°N and 65°N, encompassing Britain and Ireland in the west, Norway, Sweden and the Baltic Republics in the north, Iberia, Crete, Rhodes, and the Balkans, Israel and Iraq in the south, and running as far east as southern Siberia, China and Korea (Ognev, 1931). Although it was previously thought that all populations belonged within one species, there is now mounting evidence to suggest that *Meles anakuma* (TEMMINCK, 1844) from Japan is probably a distinct species (see Baryshnikov & Potapova, 1990; Masuda & Yoshida, 1994).

Intraspecific variation and evolutionary divergence within *Meles* are poorly understood. A large number of subspecies has been described, although many of these are probably no more than local races or variants, and no published work has as yet offered a detailed analysis of these. The number of subspecific taxa recognised differs between various authors: Schreiber *et al.* (1989) list nineteen possible subspecies, Long & Killingley (1983) cite fifteen, whilst Heptner & Naumov (1974) have eight from the former USSR alone. Following Long & Killingley (1983), Europe hosts a total of five possible Eurasian badger subspecies:

*Meles meles meles* (L., 1758): north-western Europe.

*M. m. marianensis* GRAELLS, 1897: Iberia.

*M. m. arcalus* MILLER, 1907: Crete.

*M. m. rhodius* FESTA, 1914: Rhodes.

*M. m. danicus* DEGERBØL, 1933: Denmark.

The Pleistocene biogeography of Europe suggests that the most genetically distinct of these would probably be the Cretan (*M. m. arcalus*), Iberian (*M. m. marianensis*), and Rhodian (*M. m. rhodius*) forms. The status of both island subspecies is very much in need of re-appraisal - if they do represent true "endemic" island races, they must merit the attention of conservationists (Schreiber *et al.*, 1989). Confusingly, presently it is unclear whether the Rhodian subspecies is endemic to Rhodes, or whether it also occurs on other Aegean islands (Ondrias, 1965). Further confusion is attached to the status of the Cretan form, and Lynch (1993) and V. Vigne (pers. comm.) suggest that it may be an anthropogenic introduction.

Recent multivariate studies of badger skulls derived from various Eurasian subspecies reports clinal variation across Eurasia, with only *M. anakuma* being cranially distinct (Lynch, 1993). In the current study, we have not split Eurasian badger populations between these subspecies, although a partial exception is made in the cases of those from Crete and Rhodes.

### **Background to the present study**

Accounts of the natural history or autecology of the badger are available in several languages (e.g. Aaris-Sørensen, 1992; Dirkmaat, 1988; Henry *et al.*, 1989; Kruuk, 1989; Krze, 1986; Mehlhardt, 1947; Neal, 1948, 1986; Neal & Cheeseman, 1996; Pease, 1898; Suminski, 1989), and the reader is referred to these works for details of the species' basic biology and natural history.

The first extended account of the history, distribution, and population status of any national badger population appears to be van Wijngaarden & van de Peppel's (1964) study of the badgers of the Netherlands. Subsequently, a number of national accounts have appeared, notably the detailed analyses undertaken for mainland Britain (Cresswell *et al.*, 1990) and the island of Ireland (Smal, 1995a,b). The late Charles Killingley attempted to collate all the distributional data then available on the species, his findings being published in the monograph "*The Badgers of the World*" (Long & Killingley, 1983). Since then, several authors have attempted to update, broaden or clarify this information: Koenders (1990) presents details for several western European countries, and Stubbe *et al.* (1993) provide a useful review of badger distributions and density data in Europe. (Data on badger populations in the countries of the Near East and Asia Minor can be found in Ognev (1931), Koch & Kinzelbach (1982), Etemad (1980) and Harrison & Bate (1991), whilst those of the former USSR are reviewed by Heptner & Naumov (1974), and Mongolian and Afghan records are presented by Hassinger (1973) and Mallon (1985), respectively.)

For several years, one of the present authors (HIG) has been collating and analysing data on badger population densities, distributions, trends, legislative status, and conservation and management problems (see Griffiths, 1991a,b; 1994a; Griffiths & Kryštufek, 1993; Griffiths & Thomas, 1992). This database forms the foundation of much of the present report, and builds upon a previous discussion document submitted to the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats in Strasbourg on 6th July 1993 (Griffiths *et al.*, 1993).

Data are derived from the use of letters of enquiry sent to all independent states within Europe, and from extensive literature searches (full methodological details are given by Griffiths & Thomas, 1993). Much of the study deals with the hunting of badgers, a subject that arouses strong opinions (both for, and against) in many persons. In an attempt to eliminate biases in incoming data, wherever possible information received has been cross-checked against accounts in the scientific literature, or by the use of corroborative enquiries to other national sources. During the course of the study we have also become increasingly aware of our own inherent ethical and national biases, and we are particularly grateful to Dr. Yves Lecocq (Fédération des Associations de Chasseurs de l'UE) for helping to correct many misconceptions. We must stress, however, that errors remaining within the text are entirely our own.

The study area includes all of Europe west of the border with the former Union of Soviet Socialist Republics (USSR), but includes four of the former republics of the USSR: Latvia, Lithuania, Estonia and Belarus (White Russia). Badgers occur throughout all the independent political entities within this geographic area, with the exceptions of the island republics of Iceland, Crete and Malta, and also the Danish dependency of the Faeroe Islands.

We have omitted the micro-states of Monaco, San Marino and Vatican City from consideration. One further state (Andorra) is said to have badgers, although it has not proved possible to obtain any information on them. Thus the current study excludes a total area of 528.04 km<sup>2</sup>; a tiny percentage of the European landmass, and representing *c.* 2% of the area of the island of Sicily.

The names and organisational affiliations of all correspondents referred to in the national accounts are given in Appendix 1. Throughout the text, animal species are referred to by their English vernacular names. A full listing of formal scientific names for these species is given in Appendix 2. (Appendix 3 consists of a compilation of badger distribution and density maps.)



## SECTION 1: NATIONAL ACCOUNTS

In the following national accounts, no attempt has been made to manipulate or filter numerical data in any way, although some data are expressed as simple averages. In instances where national badger population estimates are not available, those quoted here are based on minimum population estimates. These are derived from data on the numbers of badgers known to be killed by hunters, road-traffic, and in pest or disease control (see Griffiths & Thomas, 1993; Griffiths, 1993b). These estimates rely on the assumption that badger populations can only sustain annual losses of approximately 20% without declining (Anderson & Trehalla, 1985). Thus, total "anthropogenic" mortality in a population that is not decreasing, must represent a minimum of 20% of the population as a whole. It must be stressed, however, that these estimates are only valid as estimates of minimum national population levels and, when extrapolated into densities, can only be used as a rough guide to minimum mean national badger densities. These figures are provided for comparison only, and must not be considered as valid assessments for management purposes.

### ALBANIA

Correspondents: F. Bego, D. Habili.

**Distribution:** The badger seems to occur throughout much of the Albanian Republic, some distributional data being provided by Ministria e Bujqesise (1982), although data are not available for all of the 26 District Forestry Enterprises (Fig. 1). Badgers are said to have disappeared from many areas, and to have become rare in others in recent years. A badger population census by the Department of Forestry in 1991 estimated the national population at 1,400 animals. This figure is much lower than would have been required to yield the pelt returns recorded, and would yield a national density of only 0.087 badgers/km<sup>2</sup>. It is believed that this represents an under-estimate.

**Legal status:** Some details of Albanian conservation laws and policy are given by Atkinson *et al.* (1991) and Bego (1992). The badger was formerly considered as small game, and could be trapped, shot, or hunted with dogs between 1st September and 30th November (Koçi, 1961). Hunting of badgers was forbidden at the end of the 1989 hunting season, and there is some degree of additional regulation of hunting at the local level by the District Forestry Enterprises. The implementation of these laws is almost impossible, and badger hunting is said to continue almost undiminished. Protected species (including all mustelids) may be killed as pests or for scientific research, but only following special dispensation from the Ministry of Agriculture (Bego, 1992).

**Conservation and management:** Badgers were formerly hunted for their flesh and fur, the latter being sold to the state for export. Badger kills were in the region of 3,000-3,500 head/annum in the late 1970s, and pelt returns to the Ministry of Agriculture averaged 500 per year in the 1980s. There is no rabies in Albania, thus the major problem facing Albanian badgers appears to be the almost complete lack of control of hunting, both by Albanian nationals, and by hunters visiting from other countries, notably Italy. These seem to hunt uncontrolled, even in nature reserves to which access is forbidden to the Albanian people. Hunting laws were rigidly enforced in the time of Enver Hoxha, but now there is comparatively little state control outside the major cities. Chronic rural poverty exacerbates such problems (Atkinson *et al.*, 1991). Poaching is widespread and subsistence hunting is common: 80% of all badgers killed are taken in subsistence hunting by villagers. Although

only 9,200 Albanians have official permission to hunt, most are familiar with firearms through participation in the national civil defence programme, and wildfowling is popular (Nowak, 1980) and poaching widespread. Chronic pollution in some areas (a result of over-use of domestically produced agrochemicals), coupled with extensive land-use changes, are also believed to represent a significant threat to Albanian wildlife (Atkinson *et al.*, 1991).

**Recommendations:** Few genuine data are available on the status of most of Albania's wildlife. There are virtually no funds available for wildlife research of any kind, and the few zoologists working in Albania have very limited equipment and resources. There is also a pronounced conflict of interest between conservation considerations and the need to obtain foreign capital, one example being the influx of tourist hunters. Albania has a genuine wealth of wild fauna and flora, including large populations of wolf, jackal, bear, wild cat and lynx. The Albanian people have a great deal of pride in the natural beauty of their country, but are in no position to protect it. National and youth conservation societies having been formed recently, with accompanying appeals for assistance from other states. Given Albania's dire financial situation and high levels of male unemployment (>50%), faunal conservation can only come about with the assistance of the international community.

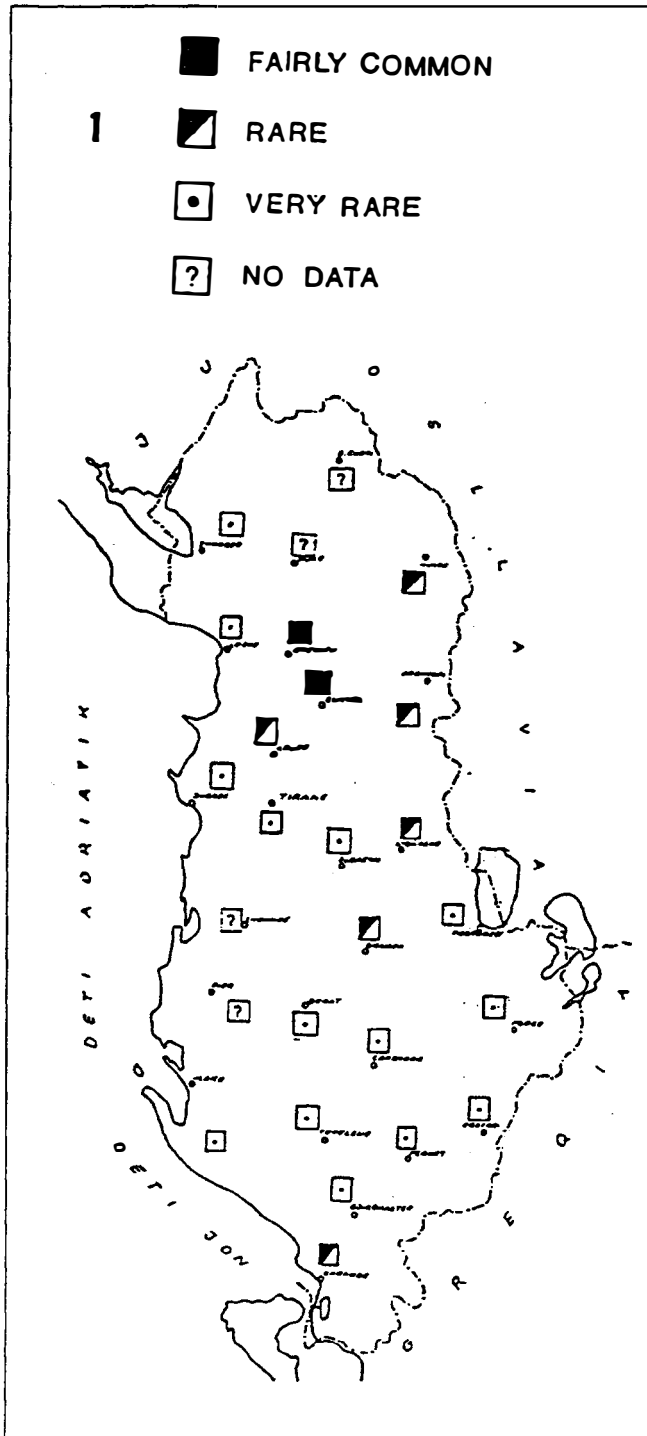


Figure 1 Albania. Distributions from Ministrija e Bujqesise (1982) (courtesy of D. Habili), semi-quantitative data from Mr F. Bego (unpublished).

## AUSTRIA

Correspondents: P. Lebersorger, Tiroler Jägerverband.

**Distribution:** The badger appears to occur throughout much of Austria, although it is absent from the higher Alpine regions. There are no formal population, distribution or density data available, but population trends are monitored through a rigorous system of hunting and "fallwild" returns (*i.e.* data on road kills, etc.). These data suggest a minimum population of 30,000 head at a minimum mean overall national density of 0.36 badgers/km<sup>2</sup> (Griffiths & Thomas, 1993). Both Niederösterreich and Oberösterreich annually claim bags in excess of over 1,200 badgers (e.g. Sternath, 1990), although whether these represent areas of higher badger abundance is unknown.

**Legal status:** Badgers are small game under Austrian law. Hunting is permitted in all Bundesländer, each of which have their own hunting regulations (Deutscher Jagdschutz-Verband, 1993). Burgenland, Salzburg and Steiermark allow badger hunting throughout the year as part of the effort to control rabies, although breeding females are protected in Burgenland. Kärnten (Carinthia) operates a closed season between 1st January and 31st May, Niederösterreich between 16th January and 15th June, Oberösterreich between 16th January and 30th June, Tirol between 1st January and 30th June, Vorarlberg between 1st January and 31st August, and Wien (Vienna) between 1st January and 31st May. Badgers may be shot at any time under local rabies control dispensations. Hunting is almost exclusively by shooting, although there are some local variations.

**Conservation and management:** Badger populations decreased during gassing to control rabies but, since the cessation of gassing these have either stabilised or increased. An average of approximately 5,500 badgers are killed by hunters each year, a further 400 by road-traffic, and another 200 by other causes. Badgers are hunted for sport and in rabies control and, to a much lesser extent, for fur and trophies, and to protect crops and fruit production in the Tirol. 1,057 rabies-positive wild mammals were reported in 1992, including 55 badgers (Anon., 1992).

**Recommendations:** The Austrian hunters' associations take great pride in the practice of ethical hunting and the principle of "wise use", coupled with a rigorous programme of hunter accreditation (see Z.Ö.L., undated). The continuing problem with rabies (in contrast to Switzerland) may, to some extent, stem from common borders with some of the less economically advantaged eastern European states, and cross-border movements of infected foxes. Although there are no official data on badger distributions or densities, as the species is of no economic significance there is little incentive for these to be compiled. Overall, there are no indications that badger populations are at risk.

## BELARUS

Correspondent: V.E. Sidorovich.

**Distribution:** Although there are few distributional data from much of the country, the badger appears to be quite widespread in Belarus, although irregularly distributed (Fig. 2). Badger data are based on the area occupied by one sett, and peak densities are between 1 sett/2-6 km<sup>2</sup>. Badgers are much less common in the area around the city of Minsk, where there may be only a single badger sett in an area of 20-30 km<sup>2</sup>.

**Legal status:** All mustelids, including otter and European mink, are considered as game in Belarus, but the badger is a Red Data Book species and protected (Nikiforov *et al.*, 1991). Under former Soviet law, illegal hunting was punishable by a fine of 200 roubles (about one month's salary), and this increased substantially for hunting protected species, hunting by proscribed methods, hunting out of season, or in nature reserves. The only other protected mammals listed by Nikiforov *et al.* (1991) are brown bear, lynx, Russian desman and Russian flying squirrel.

**Conservation, management and recommendations:** There are few data available on the status of the badger. The species is protected, although it is probable that some illegal hunting for fur and fat continues. At present the few resources available for carnivore research are concentrated into research on the status of the European mink.

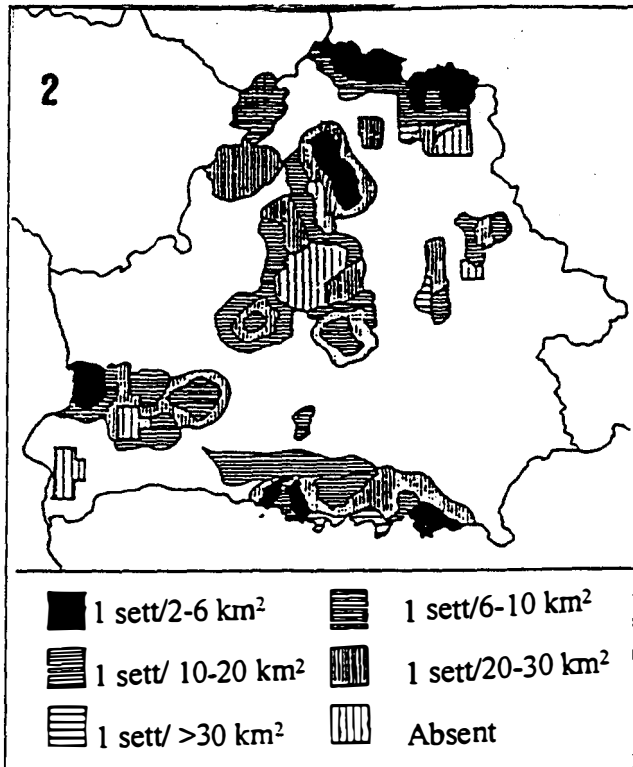


Figure 2 Belarus. Badger sett densities (unpublished data of Dr V.E. Sidorovich).

## BELGIUM

Correspondents: D. Criel, R. Libois, J. Mertens, D. Ryelandt.

**Distribution:** Badgers originally occurred throughout much of Belgium, but during this century both the species' range and numbers have contracted markedly. The Wallonian population exceeds 1,000 animals, and may attain 3,000 head (Libois, 1992), but densities are much lower in Flanders, where only 28 inhabited setts are known, indicating a population of perhaps 90-110 animals (Econnection, 1992). Distributions of Belgian badger populations are discussed by Libois *et al.* (1983, 1986) (Wallonia), Baudin *et al.* (1989) (Luxembourg Province) and Econnection (1992) (Flanders). Even assuming the maximum possible national population (3,000 head), this gives a mean national density of

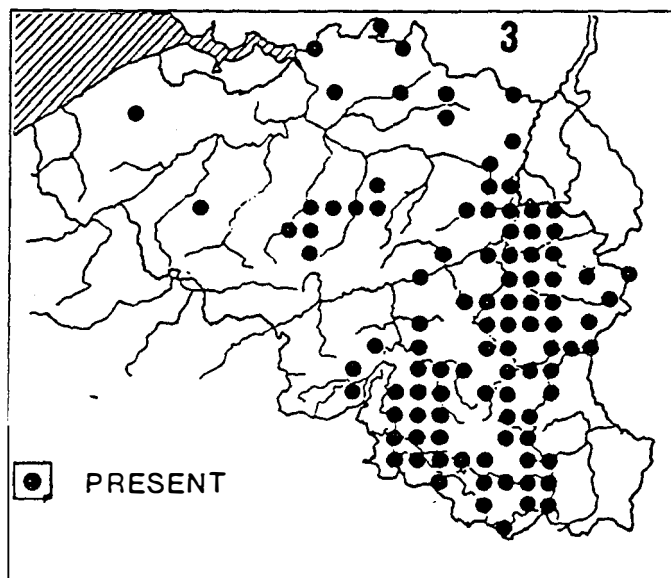


Figure 3 Belgium. Badger distributions (unpublished data of Dr D. Criel).

0.098 badgers/km<sup>2</sup>, which is very low. Despite this, badger numbers have almost certainly increased over the last decade.

**Legal status:** Badgers have had legal protection in national and regional law since 1973. The species was initially protected by not opening the hunting season, but is now fully protected throughout Belgium (Libois, 1983). Hunting with snares is also forbidden.

**Conservation and management:** Traditionally badgers were hunted as pests, and for their fur and fat, the fat being used in folk remedies (Libois, 1983). Belgium's initial response to rabies included the initiation of bounty payments for badger carcasses. The payment statistics showed rapid declines in badger numbers between 1967 (697 badgers) and 1972 (58 badgers) (Libois, 1983). Nowadays, small numbers of badgers are still killed illegally, and setts are sometimes damaged. Deliberate badger snaring has been reported (Econnection, 1992; Ryelandt, 1986), as has the use of baits poisoned with the proprietary toxin TEMIK. Much of this is driven by illegal attempts at pest control but, despite this, in 1992 the Wallonian parliament refused to allocate BF 400,000 to compensate claims for damage caused by otters and badgers (Libois, 1992).

It seems that throughout Belgium as a whole, rabies and its control have been the major cause of badger declines (see Libois, 1983). Rabies is still recorded sporadically from the south-east, and 17 rabies-positive wild animals (all foxes) were reported in 1992 (Anon., 1992). The implementation of fox immunisation programmes with the SAD and VVTGgRAB vaccines have been highly successful, however (Baudin *et al.*, 1989; Brochier *et al.*, 1991), and rabies may now be regarded as having been eradicated from native Belgian wildlife. Unfortunately, gassing badger setts and fox earths did not end until 1981, by which time the Wallonian population was reduced to a mere 10% of its pre-rabies level (Libois, 1983). Econnection (1992) have also emphasised the roles of habitat destruction and landscape fragmentation in the continuing plight of the badger in Flanders. The Flemish population also suffers losses from road-traffic mortality, and from various types of both accidental and deliberate human interference.

**Recommendations:** Protective legislation and the recession of the threat of rabies means that Belgian badger populations no longer represent the cause for concern of a decade ago, and there are also some signs of badger population recoveries in some areas of Wallonia. Although it is usually thought that badger numbers have increased in recent years, a lack of resources for concerted research makes this difficult to either quantify or validate. The Wallonian population appears to be doing comparatively well, but the population of Flanders is both small and fragmented. In those parts of Flanders that are still inhabited by badgers, careful consideration of road-building and other rural planning schemes may prove useful. Some attempts have been made to reduce road-traffic mortality by the use of badger tunnels, but the future of the badger seems bleak in the extensive agricultural monocultures that typify much of the region.

## BOSNIA-HERCEGOVINA

Correspondents: B. Kryštufek, M. Paunovic.

**Distribution:** There are few data available on the status of the badger in Bosnia-Herzegovina. The species was apparently quite widespread and common in the early 1960s, and once thought to be most common in the areas adjacent the coast (Long & Killingley, 1983: 293).

**Legislation:** When still a republic within the Yugoslav Federative Republic, badgers were regarded as small game and hunted between 1st April and 31st December. The situation at present is unclear.

**Conservation and management recommendations:** It is impossible to assess the status of the badger in Bosnia-Herzegovina. Before independence, the combined badger-bag of Croatia and Bosnia-Herzegovina accounted for an average of 1,734 animals/year between 1988 and 1990, perhaps suggesting that c. 1,400 were killed annually in Bosnia. Since then, it is entirely possible that subsistence hunting by refugees, the army and the various militias will have resulted in declines in badger numbers, as may the effects of land mines and shelling. There is a low incidence of rabies in the Republic, with eight cases being reported in 1992 (Anon., 1992); it is hoped that a resurgence of the disease has not accompanied civil war.

## BULGARIA

Correspondent: A. Stavrakev.

**Distribution:** Badgers occur throughout the territories of Bulgaria, but not above 600 m asl. According to Grigorev (1986, 1987) badger densities in the seventeen National Forest Economic Combines range between 0.13 badgers/km<sup>2</sup> (Smolyan) and 0.41 badgers/km<sup>2</sup> (Berkovitsa) (Fig. 4). Densities were reported as 0.9 badgers/km<sup>2</sup> in the "oak zone", 0.3 badgers/km<sup>2</sup> in the "beech-conifer zone", 0.1 badgers/km<sup>2</sup> in the national reserves, and between 0.13 and 0.44 badgers/km<sup>2</sup> in the hunting grounds (Grigorev, 1986). The national population was assessed at 35,000 head, at an overall mean density of 0.35 badgers/km<sup>2</sup> in the area under hunting management (Grigorev, 1986).

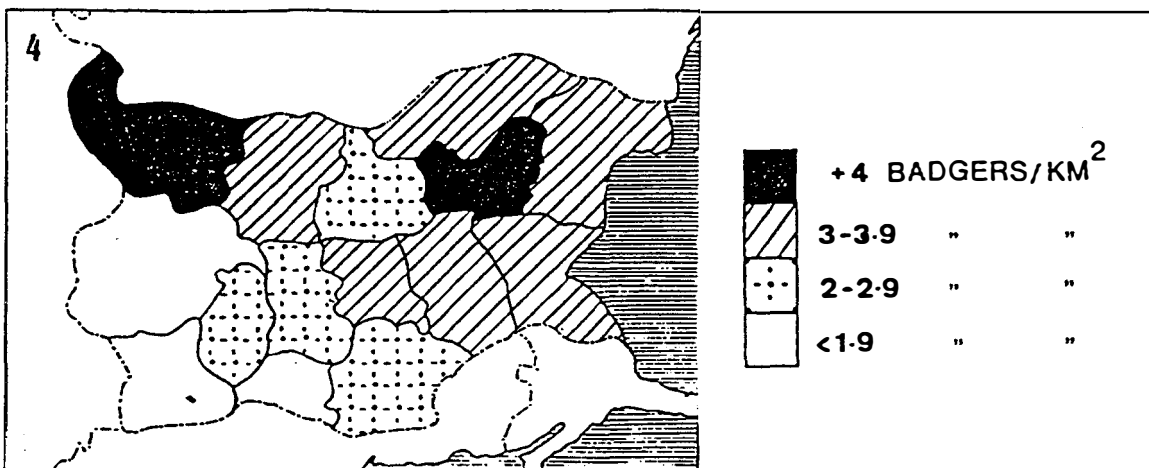


Figure 4 Bulgaria. Badger densities in hunting grounds (from Grigorev, 1986).

**Legislation:** Since 1981 Bulgarian law has provided penalties for the wounding or killing of protected species (Tassev & Mileva, 1990). Predatory mammals such as canids, wildcat and polecat can be hunted all through the year, and the hunting of large game is regulated by closed seasons and quotas. According to the information available, badgers are considered to be small game, and therefore hunting is not regulated, either by closed seasons, or by quota. Hunting with snares is illegal.

**Conservation and management:** Grigorev (1986, 1987) gives the annual badger-bag as c. 1,000 per year throughout the 1970s (0.02 badgers/km<sup>2</sup>), increasing dramatically to 14,900 animals

in 1983 (0.15 badgers/km<sup>2</sup>). Grigorev (1987) believed that the level of badger hunting was just sustainable, but that several Forest Economic Combines were hunting at the limits of sustainability, and prophesied population decreases if badger hunting was not moderated. In 1983, 14,900 badgers were reported killed from an estimated national stock of 35,000; if this is correct, then this level of hunting intensity would certainly not have been sustainable. Badger stocks are believed to have stabilised in more recent years, and hunting pressure to have decreased (possibility to a level of c. 2,000 animals/year). However, as badgers are not now of any economic significance, either as pests or furbearers, strict reportage of badger kills is not enforced.

Most badger hunting is for sport, although sometimes they are also killed for damaging crops, and occasionally for their pelts. Bulgaria has a minor problem with rabies, with seven rabies-positive foxes reported in 1992 (Anon., 1992), but there is little killing of badgers in rabies control. The pelt is said to be of little value, and badgers cause considerably less agricultural damage than do wild boar. The result is that the hunting of the species is not popular, although illegal snaring does occur. In many parts of the country, badgers face intense competition from other wild carnivores, e.g. raccoon dog, red fox, stone marten, and most particularly, golden jackal.

**Recommendations:** The density of badgers in Bulgaria is within the normal range for much of Europe, and there appear to be no grounds for concern about current population status on the basis of the data available. It seems that the species was being over-hunted a decade ago, although there are now indications that this situation no longer pertains. Bulgaria is one of the few European countries currently not to regulate the hunting of the species.

## CROATIA

Correspondents: M. Grubešić, B. Kryštufek, M. Paunovic.

**Distribution:** Few recent data are available on badger distributions in Croatia. Although they are said to be present in many areas under hunting management (Raguz & Grubešić, 1992) they also only inhabit "the most adequate biotopes" (M. Grubešić, pers. comm.). According to Long & Killingley (1983) the species was believed to be quite common along the Adriatic Coast, although absent from all the islands of the upper Adriatic. The badger population was estimated at 1,103 head in 1979 and, using a pre-war national area of 56,538 km<sup>2</sup>, this yields an overall mean population density of 0.02 badgers/km<sup>2</sup>. M. Grubešić (pers. comm.) estimates that badger numbers are probably now higher than before (perhaps 2,000 head nationally), thus giving a density of 0.035 animals/km<sup>2</sup>.

**Legal status:** According to the hunting law (NN No. 61/94) badgers can be hunted between 1st September and 30th November in the continental parts of Croatia, and from 1st August to 30th November along the coast. Hunting with dogs and shooting are permitted. Badgers are killed as pests occasionally, but do not appear to have been killed systematically in the fight against rabies.

**Conservation and management recommendations:** There are few data on the present status of the badger in the Croatian Republic. An estimated 318 badgers were hunted in 1978 and, according to data from the State Statistical Institute, 426 badgers were killed by hunters in 1994, with a further 20 being found dead ("fallwild"). The compilation of full game data was almost impossible during the period of conflict, although it is known that tank battles and shelling damaged many hunting grounds and game reserves (Raguz & Grubešić, 1993). Many areas are also badly affected by abandoned land mine fields, and these mines are said to have caused many animal (and human) casualties (M. Grubešić, pers. comm.). Despite this, the

extensive damage reported to some of Croatia's most important natural areas during the war (e.g. Anon.<sup>(2)</sup>, 1992) is known now to have been exaggerated. Rabies does occur in Croatia, but no infected badgers were amongst the 170 wild animal cases reported in 1992 (Anon., 1992).

Overall, there are presently insufficient data to allow a formal assessment of the status of the species in the Croatian Republic, although this will probably improve with the recent cessation of fighting.

## CZECH REPUBLIC

Correspondents: M. Andera, P. Hell, K. Pachinger.

**Distribution:** Badgers occur throughout much of Bohemia and Moravia (Fig. 5), although the species is absent from small areas in southern and western Bohemia, and from some upland areas (Andera, 1979). Badgers are most common in northern Moravia and northern Bohemia (Zedja & Nesvadbova, 1983). Survey work has led to estimates of the national population at c. 17,000 animals, at a mean density of 0.31 badgers/km<sup>2</sup> in the hunting grounds, but higher in broad-leaved and mixed coniferous woodlands, and reaching 2.65 badgers/km<sup>2</sup> in Plzen North (western Bohemia) and 5.13 badgers/km<sup>2</sup> in Vyskov (southern Moravia) (Zedja & Nesvadbova, 1983). Badgers are certainly widespread in many areas, and a recent atlas of the mammals of the Šumava Mountains (south-western Bohemia) using a 11.2 X 12 km (134.4 km<sup>2</sup>) grid shows badgers to be present in all fifty squares (Andera & Cervený, 1994).

### Legal status:

Badgers are listed as small game, and once were hunted between 1st August and 30th September by lying-in-wait, with dogs, and by shooting. However, badger hunting has been controlled since 1975 and the species is accorded Red Data Book status (Romanowski, 1991), receiving all-year protection since 1988 (Andera & Cervený, 1994). The only exception is in the areas around pheasantries, where badgers still may be killed under licence. Digging into badger setts is illegal-but, despite these protective measures, poaching is said still to be common.

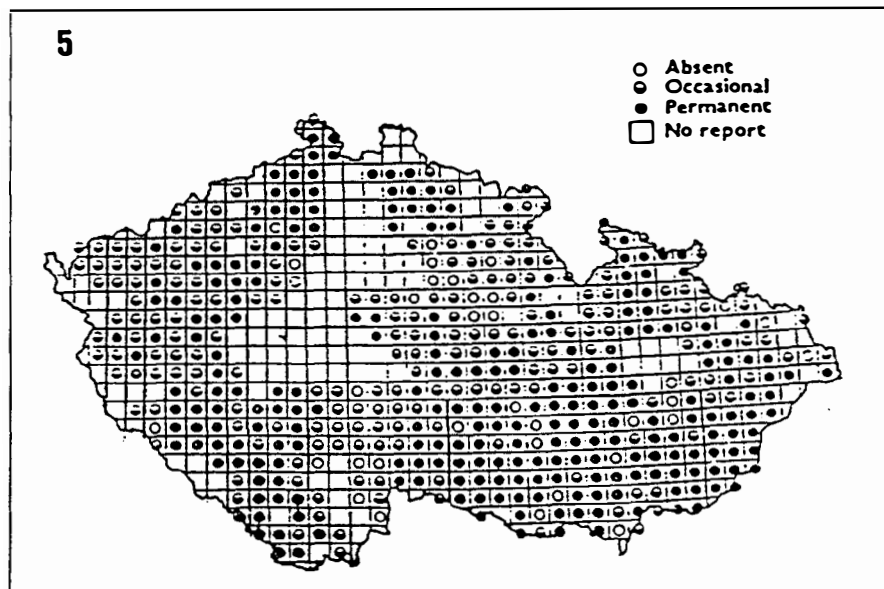


Figure 5 Czech Republic. Badger distributions (from Zedja & Nesvadbova, 1983).

digging into badger setts is illegal-but, despite these protective measures, poaching is said still to be common.

**Conservation and management:** Badgers were traditionally hunted for their furs, flesh, fat, and skin (this being considered a delicacy when roasted). Den hunting with dogs was popular, and the national team of the former Czechoslovak Federative Republic held the



international challenge cup for badger and fox hunting with dogs throughout much of the 1970s (Lederer, 1979). Badgers were extensively dug out, gassed and poisoned (usually with eggs laced with strychnine) during early attempts at rabies control. This, undertaken during the continuance of hunting, led to marked decreases in badger numbers, with the annual badger-bag falling from 1,201 in 1970 to 479 in 1982 (Hell, 1987). The game-bag finally fell to only 200-300 badgers/year in the last years before protection.

The absence of the species from some areas and its decline in others, were blamed on incorrect hunting management following the outbreak of rabies by Andera (1979). (The intense badger persecution that followed rabies was also remarked upon by Zedja & Nesvadbova, 1983.) Since that time badger populations have recovered and stabilised, but without a corresponding increase in the game-bag (Hell, 1987). Oral fox-vaccination schemes have now been implemented, and the level of rabies in wildlife appears to be falling. Andera (1979) records badger road casualties from both Bohemia and Moravia, and Zedja & Nesvadbova (1983) note the deleterious effects of land-use changes, and the digging-out of badger setts by game-keepers and during hunting.

**Recommendations:** The Czech republics (Bohemia and Moravia) have rather less of a tradition of badger hunting than does the now independent eastern republic of Slovakia. Badger status and distributions are comparatively well-known, but there are few good data on densities or numbers. The species is certainly no longer subject to persecution at the levels reported previously. Despite this, Bohemia and Moravia still suffer from poaching, but the incidence of rabies cases in wildlife has decreased over the last few years. Zedja & Nesvadbova (1983) recommended that the hunting of badgers should be kept to a minimum, and the present regime of protection for the species is said possibly to have led to small increases in species numbers (M. Andera, pers. comm.).

## DENMARK

Correspondents: J. Aaris-Sørensen, T. Asferg.

**Distribution:** The badger is widespread in Denmark, and most common in central and northern Jutland (Fig. 6). Badgers are present on all the major Danish islands except Bornholm, but absent from many of the smaller ones. The status of the badger is reviewed by Asferg *et al.* (1977) and distribution maps of badger kills have been published by Asferg *et al.* (1977) and Strandgaard & Asferg (1980). Asferg *et al.* (1977) estimated the national population level at about 25,000 animals in mid summer, giving a national overall mean density of 0.58 badgers/km<sup>2</sup>. Field surveys of badger setts in mid-Jutland have suggested a density of c. 1.35 badgers/km<sup>2</sup> (Asferg *et al.*, 1977) whilst Aaris-Sørensen (1992) suggests a density of 0.5 badgers/km<sup>2</sup> in North Zealand. Badger numbers are believed to have remained relatively constant in recent decades, except in the area around Copenhagen.

**Legal status:** Until recently the badger was regarded as small game, with an open season between 16th June and 28/29th February (Asferg *et al.*, 1977). The hunting law has since been amended, firstly to shorten the open season (1st October to 15th February: hunting by shooting only), and then to close it completely from 1st April 1994. Although the new hunting law does not provide protection to the badger sett, hunting is carefully regulated, and the poaching of badgers is unknown.

**Conservation and management:** The Danish badger-bag decreased steadily from around 3,000 head/year in the 1960s to only 1,000 in the 1990/1991 hunting season (Deutscher Jagdschutz-Verband, 1993). This decrease may reflect the loss of suitable habitat, perhaps

some decreases in badger numbers, but certainly reduced interest from hunters (Asferg, 1984). In the early 1960s badgers were gassed in southern Jutland during rabies control and this may have affected population levels. Badgers were once perceived rather negatively, but this is no longer so much the case; one survey of Danish hunters showed only 2% to regard the species as a major pest (Asferg, 1984). Immediately prior to protection, the majority of badgers shot (75%) were killed to free dens for occupation by foxes for shooting: 50% being shot at artificially constructed dens, and 25% at natural dens. Of the remainder, many were shot opportunistically, and only 10% (about 100 badgers/year) were hunted as the species of choice, each badger hunter claiming an average of 1.4 badgers/year (Asferg *et al.*, 1977).

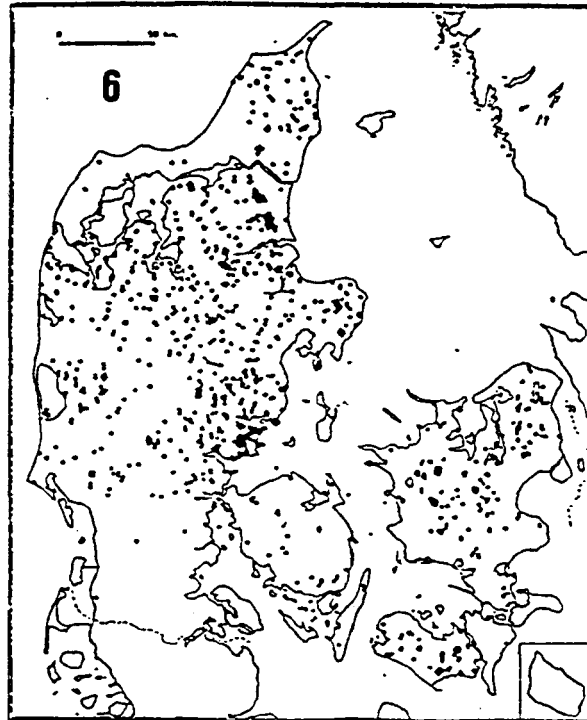


Figure 6 Denmark. Badger game-bag return data, 1972/73 season; dots = equal kill localities (from Asferg *et al.*, 1997).

In the early 1970s, between 200-300 badgers were believed to be killed on the roads of Denmark each year, and a belief that this figure had increased was confirmed when a total of over 3,600 road-kills was reported by the Danish Motorists' Club ("Falck") in 1991 (Aaris-Sørensen, 1995). Although most areas of Denmark are thought to have stable badger populations, steady decreases in the numbers of badgers in the Copenhagen area, and the large number of road-kills, are probably a cause for some concern (Asferg *et al.*, 1977; Aaris-Sørensen, 1987, 1995).

**Recommendations:** There is no evidence to suggest that the level of hunting of badgers in Denmark actually effected the viability of the species directly. Road-kills, which are more intense in some regions than others, may lead to problems in some areas, particularly if coupled with sett destruction through urban or infrastructure developments or afforestation. Griffiths & Thomas (1993: 26) suggested that a national population decrease was possible should road-kill attrition exceed 3,500 *per annum* (assuming that population estimates were reliable). Thus, although there is presently no evidence to suggest that Danish badger populations are directly vulnerable, they may not have been sustainable had hunting continued. Comprehensive population monitoring would offer the best means of securing this national (and possibly subspecific?) population.

## ESTONIA

Correspondent: T. Maran.

**Distribution:** Although apparently widespread, no formal data are available on the distribution of the badger in Estonia. The species is considered vulnerable, although numbers are said to have increased in recent years. Surveys by the Estonian Forestry Department estimate that there are about 2,000 animals in the entire country, equivalent to an overall national mean density of 0.04 badgers/km<sup>2</sup>.

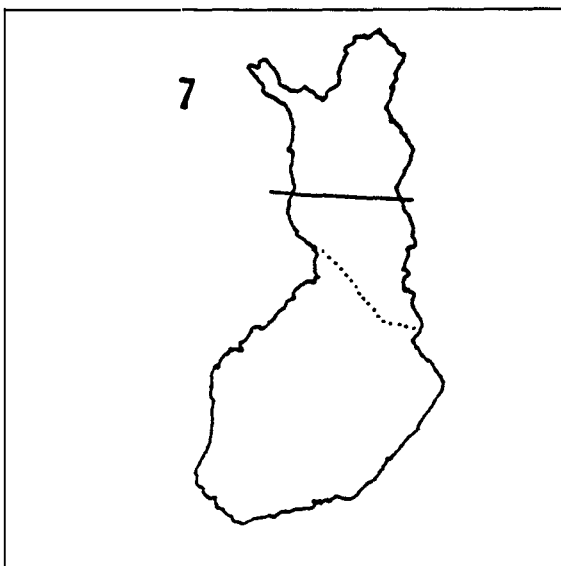
**Legal status:** Badgers have Red Data Book status (Romanowski, 1991) and are protected in law. The hunting of badgers is currently forbidden, although formerly permitted between 1st November and 31st January. Badger hunting was never popular, but the species was sometimes killed during raccoon dog hunting.

**Conservation and management:** Badgers appear to be living at very low densities in the Estonian Republic, although the species is said to have benefited from recent protective measures. 77 wild animals were found to be infected with rabies in 1992, including 4 badgers, and fox and cat vaccination programmes are now underway (Nautras, 1992). There are no other overt conservation problems, although disturbance and killing of badgers during the hunting of other species has been reported. No data are available on the effects of road-traffic kills or other anthropogenic mortality effects.

**Recommendations:** As badger densities are low, the continued protection of the badger seems necessary in Estonia. Despite this, presently there are no indications that the numbers of badgers killed accidentally during hunting represent a serious threat, nor that the species is under any threat generally.

## FINLAND

Correspondents: A. Ermala, V.-R. Cajander, S. Havu, C. Krogell, P.S. Tunkari.



**Figure 7** Finland. Badger distribution; straight line = Arctic Circle, broken line = northern limit of badger distribution (from Kauhala & Helle, unpublished ms).

**Distribution:** Badgers occur only in southern and central Finland, and not on the island of Åland (Kauhala & Helle, 1995: Fig. 7) (although a badger was sighted there in April 1994: Kauhala, 1995). As in other Scandinavian countries, the range of the badger is slowly spreading northwards, with an estimated 100 km advance since the mid-1940s (Kauhala & Helle, 1995; Kauhala, 1995). Extrapolation from hunting data indicate a minimum national population of 51,600 badgers. Assuming that 60% of Finland is habitable to badgers, this would give an approximate minimum overall national mean density of 0.39 badgers/km<sup>2</sup> (Griffiths & Thomas, 1993). Badger numbers may be increasing.

**Legal status:** The Ministry of Agriculture and Forestry is responsible for badger management and hunting, and supervises both the Finnish Game and Fisheries Research Institute and the Hunters' Central Organisation. The Hunting Law provides for hunting within the conceptual framework of "wise use", sustainability, and the prevention of "unnecessary" damage to the environment, or suffering caused to animals. Badgers may be hunted throughout the year, but females with cubs and badger setts are protected between 1st May and 31st July (during this period badger hunting effectively ceases).

Some hunters use box-type traps, but most animals are shot (by shotgun), although there is some use of Conibear-type "instant-kill" traps. Den hunting with dogs is also permitted.

**Conservation and management:** Finland has Europe's most highly hunting-oriented culture: 5.87% of the population are registered hunters, and 17% of the population of Åland (Myrberget, 1990). However, there is little interest in badgers for sporting purposes and, furthermore, badger hunting is almost impossible during the winter months. There is some domestic use of badger pelts and leather, and some killing for trophies. Despite this, most animals are killed to protect game birds, particularly Hazel Grouse, Black Grouse, Partridge and Capercaillie. No data are available on other anthropogenic sources of mortality, although it is presumed that road-kills occur, especially around the cities. The annual official badger-bag (collected by the Finnish Game & Fisheries Research Institute) is variable, but usually c. 10,000 head/annum. Hunter numbers are increasing, but the lack of a decline in the badger bag, and the continuing range increase of the species, provide no evidence of population decreases, or of increases in hunting pressure.

**Recommendations:** Aspects of Finland's attitudes to carnivore conservation have been criticised, particularly continued hunting under licence of bear, lynx and wolf (Anon., 1991). Despite this, the numbers of badgers taken is monitored closely, and does not seem a cause for concern. Previous statements made reflecting possible concern over the status of the badger in Finland (e.g. Griffiths & Thomas, 1993) are unfounded.

■  
FRANCE

Correspondents: M. Bourand, C. Henry, L. Lafontaine, L. Lecocq, P. Migot.

**Distribution:** Badgers occur throughout most of mainland France, but are absent or uncommon around Paris, from parts of Orleans and Artois, and absent from the off-shore islands, including Corsica (Henry *et al.*, 1988: Fig. 8). Questionnaire surveys of local hunters' associations allowed Bourand (1989) to estimate a possible national badger population of approximately 80,000 head (Fig. x) but this gives a national density of only 0.15 badgers/km<sup>2</sup>. Griffiths & Thomas (1993) argue that a much larger number of badgers probably inhabits France than is generally believed.

**Legal status:** French law with respect to the badger is complex (Henry *et al.*, 1988; Bourand, 1989), a situation not eased by the degree of local executive authority afforded to regional government. The badger was once listed as a pest in French law, but the number of Départements regarding badgers as such declined in the 1960s and 70s and, since a Ministerial edict on 26th June 1987, badgers have been listed as small game (Bourand, 1989). Pest control legislation may be reinstated locally at prefectural discretion following crop damage, although this is unusual. Under such circumstances badgers may be hunted at any time, but gassing is strictly licensed, and poisoning, snaring and trapping are forbidden (Bourand, 1989). Under normal circumstances, badgers may be dug between 15th September and 15th January ("détassage en période normale") or shot between 15th September and 28/29th February. There is a second, optional four month open season ("détassage en période complémentaire") from either 15th May or 15th June, again at prefectural discretion. All French hunters must be licensed, and digging teams must obtain licences from the Ministry of Agriculture, and obtain a "Certificat de Venérie" from L'Association Française des Équipages de Vénérie (Bourand, 1989).

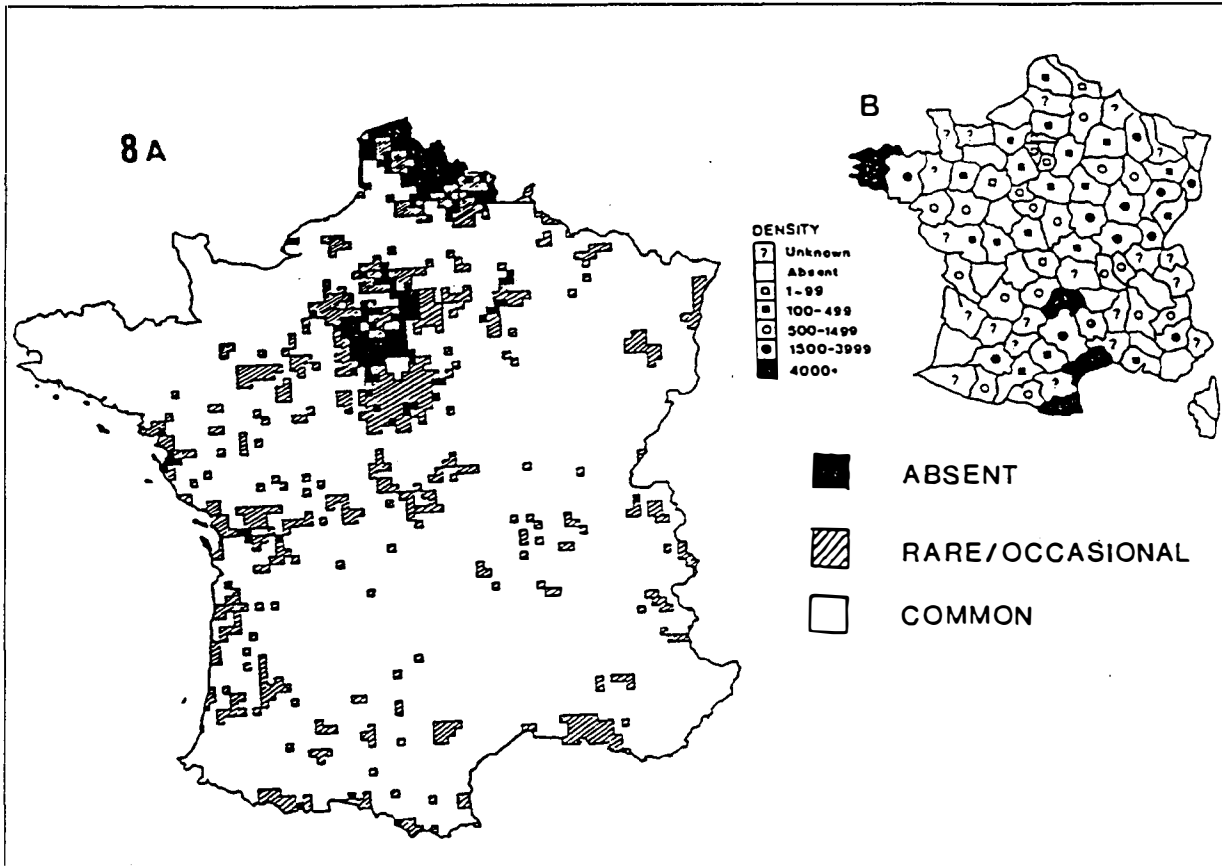


Figure 8 France. (a) general distribution (Data of L'Office National de la Chasse, courtesy of Dr P. Migot), (b) abundance estimates, redrawn from Koenders (199) from Bourand (1989).

**Conservation and Management:** Hunting by shooting and digging are certainly common, digging being increasingly popular in the west (L. Lafontaine, pers. comm.). No detailed statistics appear to be available for small game, although it has been estimated that each year 2,000-3,000 badgers are dug, 1,000 shot in front of dogs, and a further 1,500 gassed (Bourand, 1989). Bourand also contends that many badgers captured during "déterrage" are released as an act of sportsmanship, and to further species conservation. Unlike Britain and Ireland, badger baiting no longer seems to occur in France.

Extensive gassing took place in the 1970s as part of the rabies control programme; this has now been replaced largely by a fox vaccination scheme. Despite this, rabies remains prevalent in some parts of the north-west, with reports of 1,067 animal rabies cases in 1992, including 16 badgers (Anon., 1992). Bourand (1989) also collated evidence of 2,000 road-killed badgers each year, although the actual figure is probably substantially in excess of this (Bekker, 1991). Badgers are still often regarded as pests by farmers, although Henry & Lambert (1988) suggest methods of minimising badger-related problems. Despite this, in a study area in central France, Bourand (1989) estimated the average badger sett to cause inconvenience and damage to the value of Fr. 240 per annum.

**Recommendations:** A questionnaire survey at the end of the 1980s reported decreases in local badger numbers in only 9 of the 93 Départements (Bourand, 1989). Unfortunately, there are few reliable data on French badgers. Each Département collates its own game-bag statistics, and there seems to be little reportage on small game. Data are available for other species, but

it is extremely difficult to assess the level of anthropogenic badger mortality each year, or to place it within a meaningful context. Bonnin-Laffarge (1964) states that 60,000 badgers were killed by hunters each year in the early 1960s, but provided no further details or corroboration; it is known, however, that 500 badgers were hunted between 1982 and 1983 in Côtes du Nord alone. Griffiths & Thomas (1993) suggest that large numbers of badgers may live unrecognised in France, and the climate and landscape of the country do not contradict this. To enable effective and ethical population management, there must be some attempt to assess population and mortality levels. Surveys of the French badger population are impossible given the size of the country and the expense of such an exercise, but the collation and publication of game-bag statistics for badgers would allow trends in population harvesting to be monitored.

In areas where the second open season is operated, this allows eight months of badger hunting each year. This situation has attracted criticism in some hunting circles (e.g. Chambre, 1988), and placing this extension of the hunting season onto a sound scientific basis would seem advisable.

## GERMANY

Correspondents: Herr Beindorf, Deutscher Jagdschutz-Verband, J. Dussel, V. Guthörl, K. Hoenisch, E. Schneider, M. Stubbe.

**Distribution:** Badgers seem to occur throughout almost the whole of Germany. Although they do not tend to occur high in the mountains, Stubbe (1989a) records an occupied sett at c. 1,500 m asl. Stubbe et al. (1993) provide a distribution map and some density data for the "neuen Bundeslander" *i.e.* the former DDR (Fig. 9), and Guthörl (1990) and Herrmann (1991) give records for Saarland. A kill-density and "fallwild" map by Spittler (1992) shows badgers to occur throughout much of Nordrhein-Westfalen. Stubbe (1989b) estimated the badger population of the former DDR to be at least 5,900 animals in the mid 1980s, and recent Ministry of Agriculture surveys give figures of 4,431 badgers in Mecklenburg-Vorpommern and 3,093 in Thuringia. The largest badger kill is registered by the hunters of Bayern (e.g. 9,355 in 1991/92), but whether this reflects especially high levels of badger abundance is unknown. Game-bag statistics allowed Griffiths & Thomas (1993) to estimate an absolute minimum German population of 75,000 badgers, at a minimum mean national density in the FDR of 0.29 badgers/km<sup>2</sup>. New data permit a revised estimate: a minimum of 100,000 badgers in the former FDR alone, at 0.4 badgers/km<sup>2</sup>.

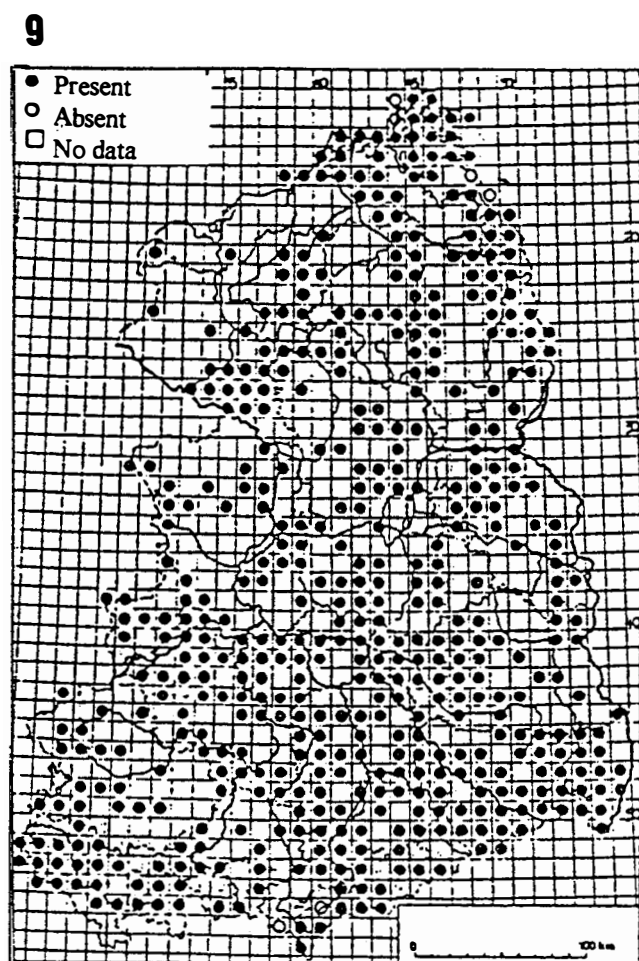


Figure 9 Germany (former DDR). Badger occurrence (from Stubbe *et al.*, 1993).

**Legal status:** A single badger hunting season is applied throughout the German Bundeslander, and the species is protected between 1st November and 31st July. Various methodological prescriptions also exist: traps other than "humane" and "instant-kill" traps are forbidden, as is hunting with hounds (Lecocq, 1991), although not den hunting with dogs. The former DDR operated a longer closed season (1st January to 30th September) but now complies to former FDR hunting law.

**Conservation and management:** Badger hunting is fairly common in West Germany, but much less so in the East. Many German badger populations were reduced by rabies and its control in the 1960s, severe decreases being reported in several Bundeslander (e.g. Moegle & Knorpp, 1978; Wachendorfer & Schwierz, 1980; Guthörl, 1990). These were reflected in the badger-bags. The western badger-bag peaked at 21,293 in the 1959/60 season, but fell by an order of magnitude during the 1960s and 1970s (Deutscher Jagdschutz-Verband, 1984). Since then a steady increase has been registered, to 18,500 in the 1991/92 season (Deutscher Jagdschutz-Verband, 1993). The "neuen Bundeslander" of the former DDR show the same pattern, but on a smaller scale. Badger bags peaked at 1,529 in 1961 (Stubbe, 1989a) but fell rapidly thereafter, with no badger hunting between 1971-1974 because of the effects of rabies (Goretzki & Liess, 1989). In 1989 only 325 badgers were killed: 173 in traps, the rest being shot. Germany still has a rabies problem, with 1,151 rabies-positive wild animals detected in 1992, including 24 badgers, most from the former DDR (Anon., 1992). This does, however, represent a substantial improvement upon previous years. Fox vaccination schemes have certainly led to badger population increases, but badgers are still sometimes shot from fear of rabies.

Badgers are killed opportunistically, for sport (and to a minor extent for trophies), during crop protection (especially maize), and to protect ground-nesting game, e.g. Ring-necked Pheasant. A very small number of badgers are also taken for pelts (Stubbe, 1989b). Both fur and the flesh were used in the past, but the utilisation of badger products is now unusual. There has also been some concern amongst hunters with regard to the role of badgers (and martens) as reservoirs of viral encephalitic distemper recently (Geisel, 1989), a disease which can infect hunting dogs. As in most countries, badgers are also killed on the roads (e.g. Spittler, 1992), and there are even occasional records of animals drowning in canals (Hartwig, 1992).

**Recommendation:** Hunting in Germany is controlled rigorously, and the German hunters' exam (the "Jägerprüfung") is said to be one of the most difficult in Europe. Game-bag and "fallwild" statistics are collected methodically thus, although there are few data on badger distributions, badger kills are closely monitored. The number of hunters (which is increasing) correlates very closely with the badger-bag (Griffiths & Thomas, 1993) but provides no evidence of declines in catch/unit effort, hence these levels appear sustainable. The game-bag statistics alone suggest that Germany hosts quite a large badger population, although how much larger than indicated by the minimum estimate derived from hunting statistics is unknown. Certainly, badger densities in some areas may be very high: Stubbe (1989b) estimates 2-4 badgers/100 ha in the Hakel Research Area (near Halle), the highest badger density estimate of which we are aware.

Overall, there is every indication that the badger is common in much of Germany. However, there is an argument for changes in management strategy and the hunting laws. Stubbe *et al.* (1993) argue that badgers should only be hunted when they can be put to some use, e.g. as a furbearer. They point out that badger furs are not ready for harvest until between 1st October and 3rd December and, on these grounds alone, the species should not be hunted at all in August and September *i.e.* before the pelt is mature. Hunting badgers for fur was compatible with the laws of the DDR, but the current hunting season allows sport hunting, but precludes commodity hunting.

## GREAT BRITAIN

**Distribution:** Badgers occur throughout the whole of mainland Britain, although are absent from most of the off-shore islands except the Isle of Wight, Arran and Anglesey (Neal, 1977). An introduced population was present on Skye until the 1980s, but has since disappeared (P. Yoxon, pers. comm.). Badgers are least common in central and western Scotland (Cresswell *et al.*, 1990) but very abundant in some areas, particularly in the south-west of England, with a density of  $>20$  badgers/km<sup>2</sup> having been reported from the Cotswold Escarpment (Cheeseman *et al.*, 1988). A series of distribution and density maps have been produced (Neal, 1972; Clements *et al.*, 1988; Cresswell *et al.*, 1989, 1990; Arnold, 1993) (Fig. 10), the most recent survey (Cresswell *et al.*, 1990) showing Britain to have about 250,000 badgers in c. 42,000 social groups (see also Harris *et al.*, 1992). Sett surveying is on-going, and a further census is being undertaken at the time of writing. The overall mean national density of badgers is 1.08 animals/km<sup>2</sup>, although this is skewed downwards by the almost complete absence of badgers in some areas of Scotland and north-central England (see Cresswell *et al.*, 1990).

**Legal status:** Britain is the only country to have legislation that deals specifically with badgers, which have received increasing degrees of "full" legal protection since 1973. Currently, the species is protected through the Protection of Badgers Act 1992, under which both badgers and their setts are fully protected, and it is a criminal offence to kill, harm or disturb the species (see Skinner *et al.*, 1989; Clements, 1992). Despite this, badgers still are killed in sport and pest control, and occasionally to prevent their presence from interfering with land development proposals (see Cox, 1993). ADAS (the government's Agricultural Developmental and Advisory Service) receive usually c. 1,000 complaints each year about badgers and their activities. Certain governmental agencies are

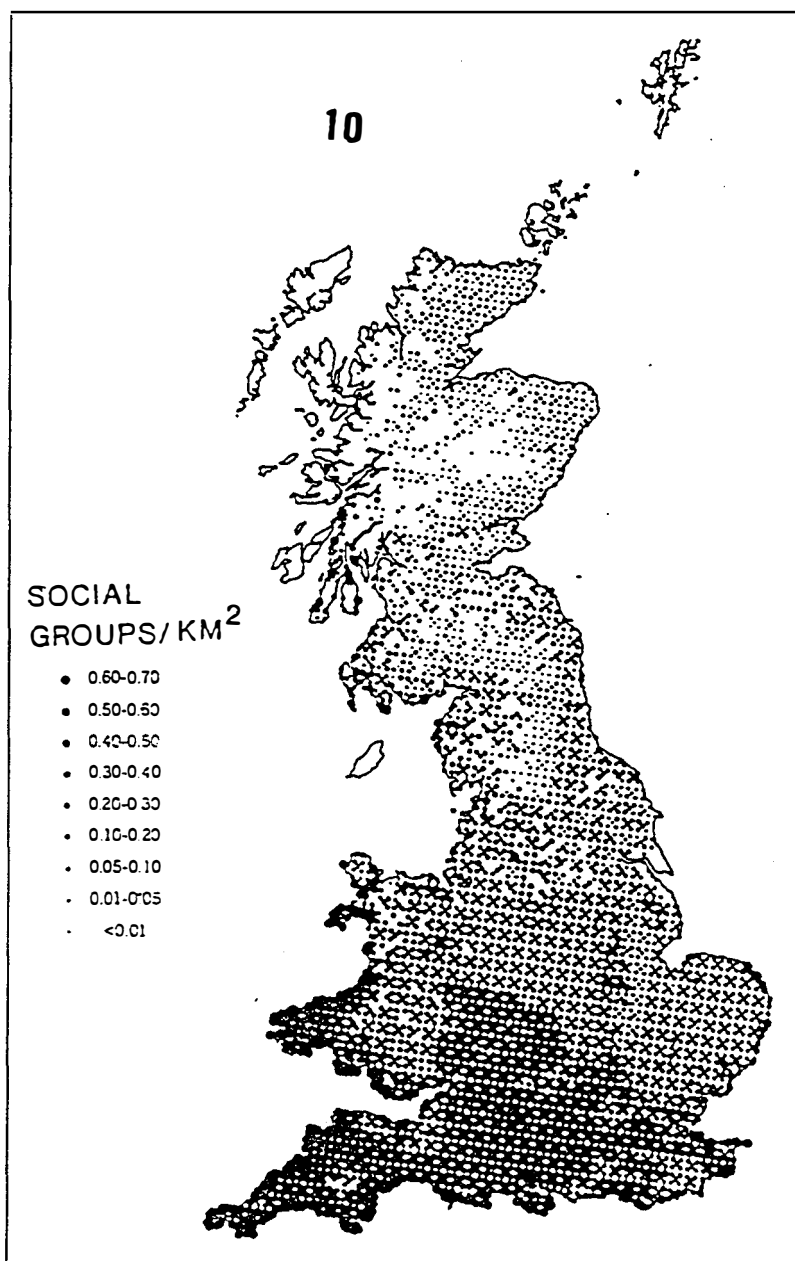


Figure 10 Great Britain. Badger densities (from Cresswell *et al.*, 1993).



empowered to issue licences for strictly regulated remedial action against pest badgers, and these usually result in badger translocations rather than in badgers being killed (Symes, 1989, Harris *et al.*, 1990). An exception to this is that badgers are culled regularly in the control of bovine tuberculosis, full details of this being available in the annual reports of the Ministry of Agriculture, Fisheries and Food (MAFF) (1977-1995). Illegal hunting and other breaches of the protective legislation are punishable with fines of up to £2,000 per offence (*i.e.* per badger) plus up to six months imprisonment. Despite this, enforcement is difficult and most offences remain undetected and unprosecuted (Griffiths, 1992, 1994a).

**Conservation and management:** Badgers are remarkably popular in Britain. There are a great many local badger protection societies, and these raise considerable amounts of money for badger conservation and protection projects. Despite this, illegal sport and pest control result in *c.* 9,000 badgers being hunted illegally each year, and there is still some incidence of badger baiting (Cresswell *et al.*, 1989). Much of this represents the results of the activities of illegal den hunting gangs (Griffiths, 1994a). It is further estimated that approximately 50,000 badgers are killed each year in road traffic accidents (Harris *et al.*, 1992) and, in recent years, an additional 1,600 badgers/year in bovine tuberculosis (TB) control (Ministry of Agriculture, Fisheries and Food, 1977-1995). Reason *et al.* (1993) emphasise the legacy of past persecution by game-keepers has had in some areas, and the work of Skinner *et al.* (1991a,b) demonstrates the effects of land-use changes on badger population densities. It is certain that agricultural practices alone have considerably changed the British landscape since the end of the 1939-1945 war (Rackham, 1987) and this process is expected to continue as further land is afforested or taken up into agricultural production (Brown & Taylor, 1988). To this may be added the effects of housing and infrastructure development, and the growth of open-cast mineral abstraction. The most seriously effected aspects of the landscape are often also prime badger habitat.

**Recommendations:** The effective operation of conservation law reflects the will of official bodies to enforce it (Griffiths & Kryštufek, 1993). Many of the problems related to badgers in Britain arise despite protective legislation, and arguably the basis of this is a lack of genuine political will for species protection. There is a great deal of illegal sport hunting in Britain, in which a very small minority of "rogue" hunters cause a disproportionately large number of problems (Griffiths, 1994a). Although badgers are both common and widespread, there is evidence that the actual number of badgers in Britain may be decreasing, this being the result of the combined effects of habitat-based effects, persecution and road-traffic mortality (Griffiths & Thomas, 1993). Badger setts are still illegally destroyed in civil and industrial engineering, and badgers are the victims of illegal pest control, the careless use of snares, illegal den hunting, and increasingly, lamping (nocturnal poaching). Reason *et al.* (1993) calculate that the British badger population could be some 35% higher if persecution and land-use changes did not operate to depress it.

As the species is already extensively protected in law, the answer to the badger's problems may lie in part in better law enforcement. However, the major source of losses from the UK population is due to road casualties, and any increase in conservation effort should focus directly on the reduction of road-kill levels. In addition, the provision of compensation for those who suffer damage or loss throughout the presence of activities of badgers might reduce the incidence of illegal pest control. Badgers are sometimes killed for taking lambs (Kruuk, 1989) and badger setts are certainly occasionally destroyed by dairy farmers who fear bovine TB - even in areas of the country where the disease does not occur. The appropriate action here would be an information programme. The continued culling of badgers in TB control is controversial, and seen as pointless, expensive and misleading by many people, and by wildlife and conservation groups in particular. Despite this, given the size of the British badger population, the number of animals taken by MAFF is actually not significant.

British badger legislation is welfare rather than conservation oriented, and represents a reaction to the mistreatment of the species and particularly to badger baiting. Despite this legislation, and the large amounts of time and money spent on badger protection by members of the public, problems with the species continue. The British badger thus provides an excellent example of the difficulty of conservation programmes at a grassroots level, even in an affluent country, when the species in question is not uncommon, and the projects are both well-financed and resourced.

## GREECE

Correspondents: S. Bogakias, A. Legakis, C. Tsipiras.

**Distribution:** There is little information on the distribution of the species in Greece. In continental Greece badgers have been described as "frequent" in the plains (Ondrias, 1965) and "widely distributed" with the appearance of "a notable density" in some areas, although no formal population data are available (Adamakopoulos *et al.*, 1991). Despite this, the Greek Hunters' Association estimates the population to consist of "several thousand animals" and to be "probably increasing" (S. Bogakias, pers. comm.). The badger seems to be absent from most of the Greek islands, but it is represented by the subspecies *M. m. arcalus* and *M. m. rhodius* on Crete and Rhodes, respectively. Badgers are also known on the island of Tinos and possibly on several others, with the map by Adamakopoulos *et al.* (1991) showing it to be present on Andros and Kithnos (Fig. 11). Occurrence on islands such as these is surprising, although Dr. V. Vigne (pers. comm.) has suggested that the species has been introduced to Crete. The Cretan population is said to be in serious decline (A. Legakis, pers. comm.), but no formal data are available.

**Legal status:** There is some confusion with regard to the legal status of the badger in Greece, with different sources providing different information. The Greek Hunters' Association states that the species has been protected since 1985, whilst Adamakopoulos *et al.* (*op. cit.*) note that hunting "pest" badgers has been permitted since 1988. However, it is acknowledged that some illegal hunting does occur, although a total kill of 1,500 badgers/year (20% for fur) provided by an animal welfare group is said to be an over-estimate by the Hunters' Association. Furthermore, large numbers of badgers are known to be killed on the roads. Legakis (pers. comm.) writes that badgers are regarded as a pest on Crete, and commonly poisoned.

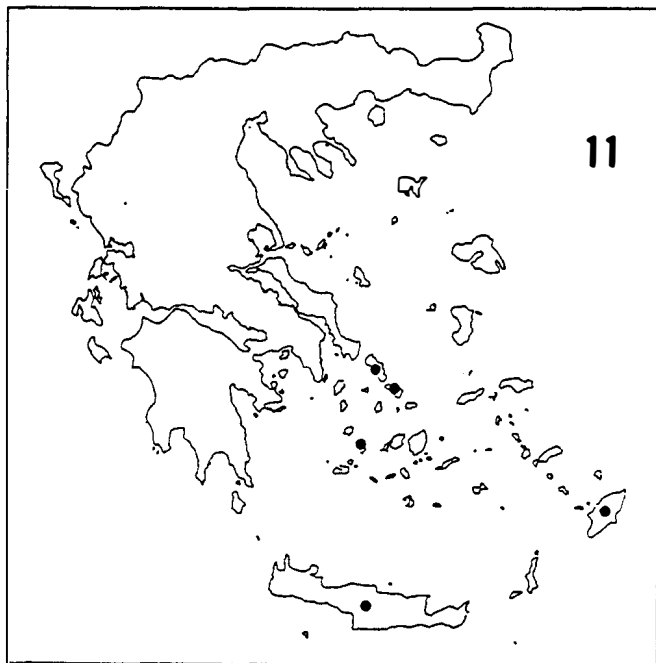


Figure 11 Greece. Badgers on islands (from Adamakopoulos *et al.*, 1991).

**Conservation and management:** It is difficult to obtain details of badger distributions let alone population figures from Greece. This is the result of a lack of scientific research, and the strongly conflicting claims of pro and anti-hunt groups. All parties agree that poaching does occur, and there also appear to be problems with road-traffic mortality. The report of

extensive illegal poisoning from Crete is worrying, and this population is said to be in serious decline. Before the 1939-1945 War, badgers were apparently common on the island with 3,000 pelts being exported each year to Germany alone (Zimmermann, 1949). Ondrias (1965) similarly describes the badger as "frequent" on Crete. All parts of Greece are now rabies-free (Anon., 1992) thus the badger has no place in rabies management.

**Recommendations:** There is a need to obtain at least some data on the distribution and population status of the badgers of Greece. Illegal hunting does occur, and enforcement of badger protection legislation is likely to be extremely difficult. The effects of road casualties also need to be assessed. The contention that there is an illegal badger pelt industry needs to be investigated, and either refuted or acted upon. It is generally agreed that all endemic races and sub-species should be protected, and the populations of Crete and Rhodes are designated as formal sub-species (see Schreiber *et al.*, 1989). Palaeontological and archaeological work (Klippel & Snyder, 1991; Chelyna, 1991: 244) testify to the antiquity of *M. m. arcalus*, but Ondrias (1965) doubts the validity of *M. m. rhodius*, and further information on the actual status of both forms is urgently required. No recent data are available from Rhodes.

## HUNGARY

Correspondent: L. Szemethy.

**Distribution:** Badgers are fairly widespread in Hungary, distributional data being presented by Szemethy (1989). The highest densities appear to be in the south of the country, but numbers seem lower in the west (Fig. 12). Badger densities are not generally high, with a

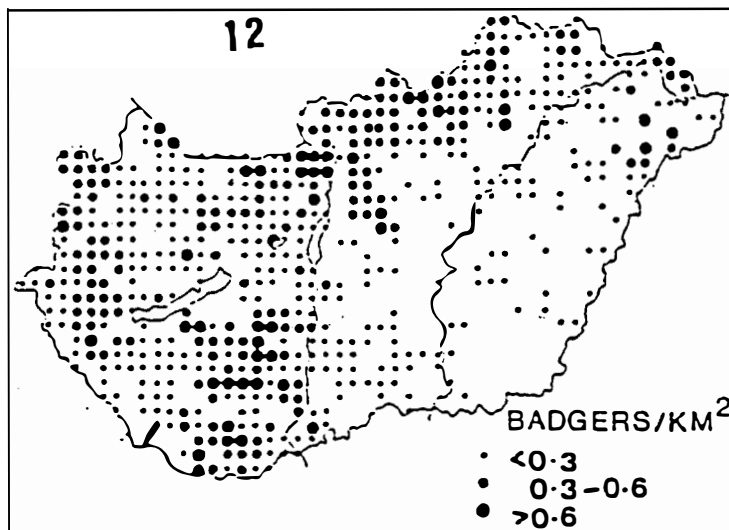


Figure 12 Hungary. Badger densities (from Szemethy, 1989).

peak reported density of 1.5 badgers/km<sup>2</sup>. Griffiths & Thomas (1993) calculated the national population to be somewhere in excess of 20,000 head.

**Legal status:** Badgers have been protected since 1974, and hunting is prohibited. Dispensation may be obtained for the killing of badgers that damage crops, but this is said to be rare and to account for only 5-10 badgers/year.

**Conservation and management:** Badger protection seems to have been very successful in Hungary, and the population is reported to have increased correspondingly.

Some illegal hunting for furs and trophies is said to occur. Badgers may also be killed during den hunting for red fox, or by poisons used to control other predators, but the effects of road-traffic kills are said to be more significant.

Hungary still has a significant rabies problem, with 707 wild animal cases reported in 1992, including one badger; both dog and fox vaccination programmes are now underway (Kerekes, 1992). It is not known whether badgers are culled in rabies control.

**Recommendations:** The protection of endangered carnivores is considered to be one of Hungary's conservation priorities (Anon., 1990). Despite this, increases in badger numbers are said to have led to increasing problems with damage to vine and maize crops (Szemethy, 1989). The privatisation of forestry has also led to some conflicts of interest between commercial and conservation concerns, and there have been calls for the resumption of badger hunting within a restricted open season.

## IRELAND

Correspondents: S. Feore, F. Fox, G. Marshall, P. Sleeman, C. Smal.

**Distribution:** Badgers occur throughout Northern Ireland and the Irish Republic (Smal, 1995a,b: Fig. 13). There is an overall mean of 0.46 badger setts/km<sup>2</sup> in the Republic, and

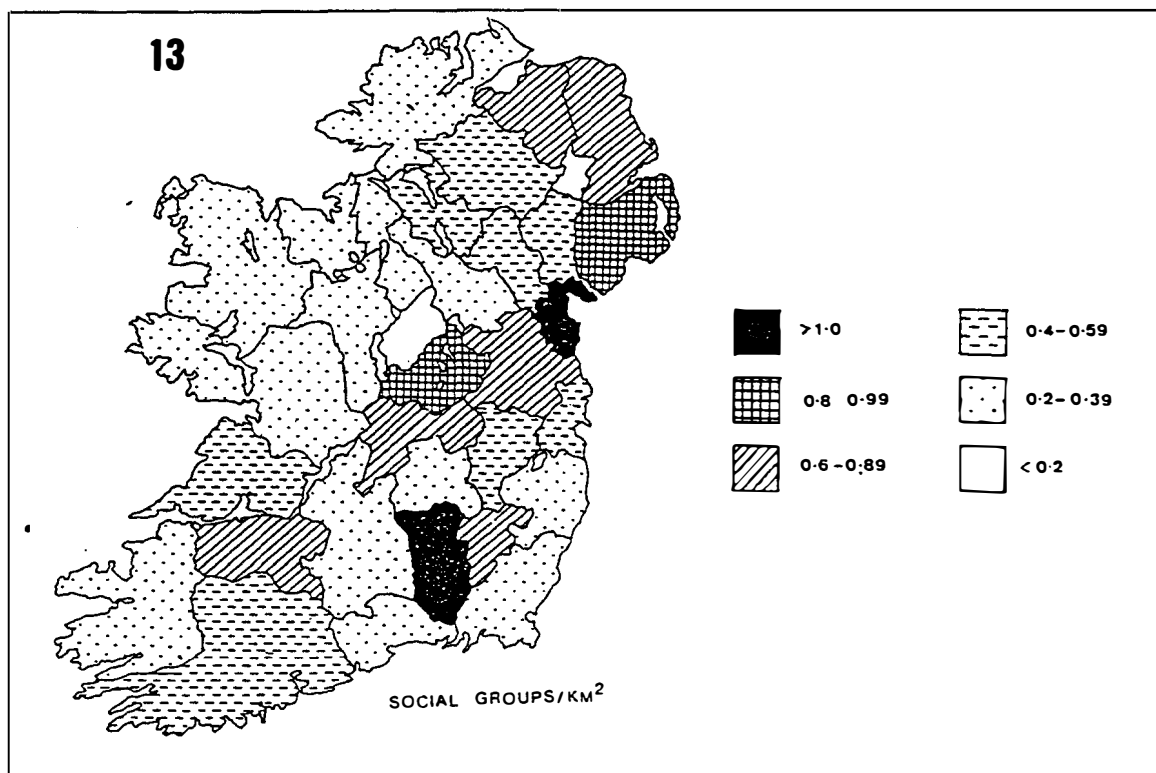


Figure 13 Ireland. Badger densities (from Smal, 1995a, b).

preliminary results indicate 0.62 setts/km<sup>2</sup> in the North. Overall, badgers appear to be most common in some parts of the west of the Republic (particularly in Counties Kilkenny and Louth), but much less so in areas such as Counties Longford and Galway. A recent national survey in the Republic (Smal, 1995a) reports an estimated 200,500 adult badgers living in c. 34,000 social groups, whilst preliminary data from the North suggest the presence of a further 8,900 social groups. These figures further suggest a total Irish population of 240,000 - 250,000 head, at an overall mean density of 3.03 badgers/km<sup>2</sup> in Ireland as a whole. There is some suggestion that badgers may have been introduced to Ireland by early man by Lynch & Hayden (1993) (but see Griffiths, 1994b).

**Legal status:** The badger is protected in both the North and South. In the North the Wildlife (Northern Ireland) Order 1985 gives full protection to the badger and the sett. In the Republic, the badger and its breeding grounds are protected by the Wildlife Act. Offenders are normally fined: up to £<sub>UK</sub>200 being usual in the North, but £<sub>IRL</sub>50 is more typical in the

South. Badgers have been identified as a reservoir of bovine TB, and the law permits the culling of c. 900 badgers each year in the Republic (O'Connor & O'Malley, 1989). (A number of papers on Irish badgers and TB can be found in Hayden (1993).)

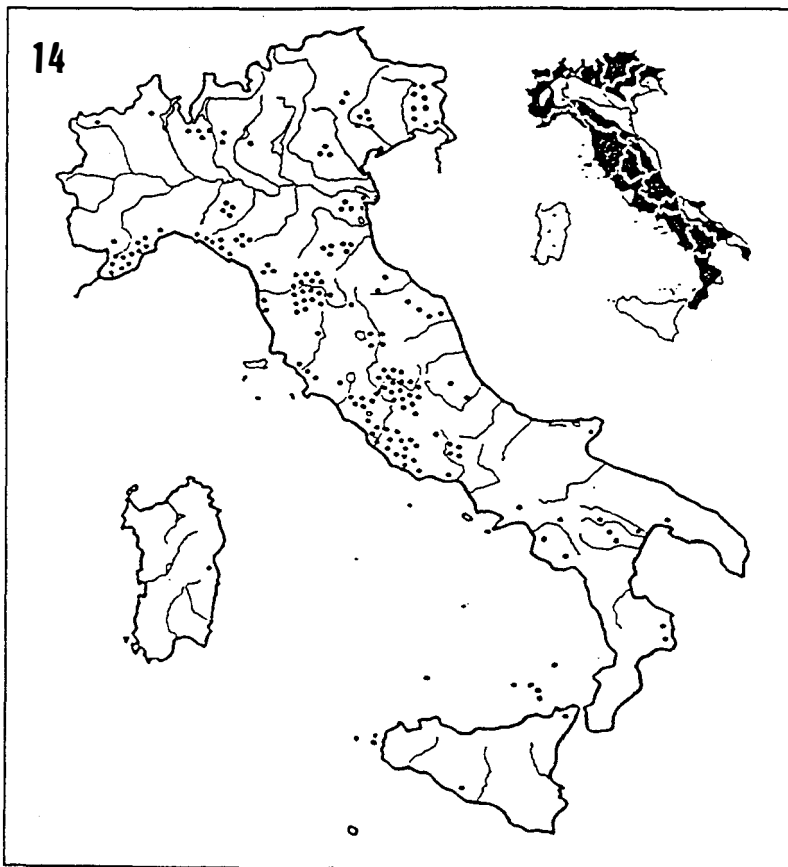
**Conservation and management:** Despite protection, the illegal killing of badgers is widespread and common, badger baiting occurs and there is also evidence of British den hunters travelling to the Republic to hunt, thus taking advantage of the minimal chance of prosecution. Smal (1993, 1995a) reports 10% of the setts in the Republic to have been dug (higher than in the UK), and 1% to have been snared. The fears of dairy farmers are also responsible for at least some badger persecution, and Sleeman (1992) records the pouring of farm slurry into setts. There appear to be no data on other forms of anthropogenic mortality, although road-kills do occur.

**Recommendations:** Badgers seem to be common in Ireland, despite illicit hunting and killing of the species, and culling to control bovine TB. The low penalties for illegal persecution, and the tiny chance of detection, provide little disincentive to illegal badger persecution. Better law enforcement is recommended. Similarly, bovine-based TB control should be investigated and applied more rigorously. Again, compensation for damage and inconvenience caused by badgers would reduce the level of illegal killing. All these are matters of resource availability, and difficult, given the current economic climate.

## ITALY

Correspondents: L. Biotani, P. Cavallini, C. Consiglio, G. Pigozzi.

**Distribution:** The distribution of Italian badgers is rather poorly known. Distributional data are provided in maps by Prosperi *et al.* (1979) and Pawan (1981), but the two maps conflict



slightly (Fig. 14). Although badgers occur throughout much of Italy, they appear to be uncommon in the "heel" of Italy, in the north (particularly in the Po Valley), from some areas along the Adriatic Coast, and (as elsewhere) from most off-shore islands, including Elbe. Badgers are often said to be absent from Sardinia (Vigne, 1990) and Sicily (Vigna Tagliante, 1988), but Prosperi *et al.* (1979) seem to show the species to be present on both, as well as on the Lipari Islands, Egadi Island and Ustica.

**Legal status:** Most Italian carnivores are now protected, with the exception of the red fox (Cassola, 1991). The hunting, capture, killing,

Figure 14 Italy. (a) badger distribution (from Prosperi *et al.*, 1979), (b) (inset) general distribution (from Pawan, 1981).

possession and sale of badgers have been forbidden since the mid 1980s. One exception is in the northern semi-autonomous province of Bolzano, where badgers may be hunted following crop damage.

**Conservation and management:** Most correspondents reported that there was little illegal hunting of badgers, nor much tradition of such. However, in some areas (e.g. Tuscany) badgers were formerly hunted for meat, a distinction being made between the edible "tasso porcino" (pig badger) and the inedible "tasso canino" (dog badger). Badgers are still said to be eaten in some rural areas. Also in central Italy, the badger is still occasionally taken in sport, and cubs are sometimes killed during den hunting for crested porcupines which cohabit in the sett (Pigozzi, 1986).

Between 1977 and 1988, cross-border movements of red fox led to occasional outbreaks of rabies in the north (Giovannini & Prospero, 1991) and the introduction of fox oral vaccination schemes (Civardi, 1991). In 1991 and 1992 there was a slight resurgence of the virus in Alpine regions. 22 wild animals, including 19 foxes and one badger were diagnosed as rabies-positive in 1992. Oral fox vaccination programmes continue, and in some areas the vaccination of dogs, equids, cattle, sheep and goats is mandatory (Prospero, 1992).

**Recommendations:** Although there are no estimates of the number of badgers present, badger conservation legislation seems to have been rather successful. Some illegal hunting is reported, but it seems localised and uncommon. There have been some claims that the incidence of crested porcupine has had adverse effects on some local badger populations, although there appear to be no data that support this.

## LATVIA

Correspondent: A. Zoss.

**Distribution:** Badgers are both widespread and fairly common in Latvia (see Fig. 15) and, in the late 1980s, the national population was estimated at approximately 6,000 animals (a national mean density of 0.09 badgers/km<sup>2</sup>) (Ozolinš & Pilāts, 1995). Despite this, the only detailed studies undertaken have been in the area of the Slitere State Reserve, where there are between 40 and 50 badgers, living at a density of about 0.3 badgers/km<sup>2</sup> (Zoss, pers. comm.).

**Legal status:** Badgers are still hunted for sport and fat, with hunting under licence being allowed between 1st September and 1st January. Both shooting and den hunting with dogs are permitted during the open season, with about 100 badgers/year being reported killed to the hunting authorities in the late 1980s (Ozolinš & Pilāts, 1995).

**Conservation and management:** As the badger is common and without Red Data Book status (Pilāts, 1994), and also of little interest to hunters, there are presently no proposals to accord further protection to the species. Although hunting is permitted, the levels reported are not significant when placed within the context of population size estimates. Despite this, illegal hunting does occur, and badgers are also killed sometimes during the hunting of raccoon

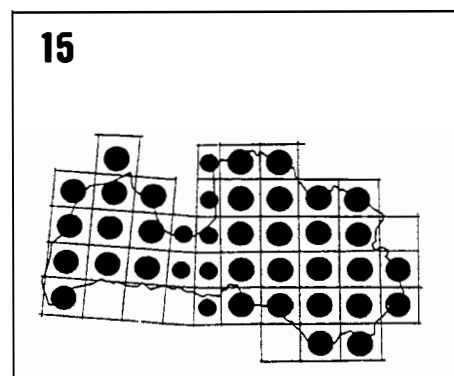


Figure 15 Latvia. Badger distribution (from Ozolinš & Pilāts, 1995).

dogs. As the badger is not usually considered to be an agricultural pest, and neither is its fur valuable, there is little hunter interest in the species.

The incidence of rabies is said to have decreased in Latvia in recent years. 81 cases of wildlife rabies were reported in 1992, including three badgers (Anon., 1992). We have no information that suggests that badgers are killed in rabies control.

**Recommendations:** Badger hunting is not popular but, although there is little interest in them as game, as a furbearer, or as a pest, some are killed during other hunting activities. Most indications are that badgers are not uncommon, and from the information available, there appears to be no cause for concern for the well-being of the badger population of Latvia.

## LIECHTENSTEIN

Correspondent: G. Willi.

**Distribution:** There are no data available on the distribution of badgers in Liechtenstein, although with an area of only 160 km<sup>2</sup>, a population density of 0.5 badgers/km<sup>2</sup> would result in a national population of only 80 animals.

**Legal status:** Badgers are regarded as small game, and may be hunted, exclusively by rifle, between 1st September and 31st December.

**Conservation and management:** Although officially classed as game, the game-bag is very low. In practice, few badgers are actually shot, and no more than 10 badgers have been killed in any single hunting season since 1967/68; in some years during the last decade no badgers were shot at all. It has been suggested, however, that at least some badger kills are not reported to the authorities.

The badger population of Liechtenstein must, of necessity, be very small, but there is the potential for immigration from both Switzerland and Austria. Badgers are said to have become less abundant after gassing to control rabies, but their numbers have since increased. Rabies no longer seems to be a problem, although the rabies statistics for Liechtenstein are published with those for Switzerland. Badger hunting is mainly for trophies. A small number of badgers are also said to be killed on the roads.

**Recommendations:** It is difficult to assess the status of badgers in Liechtenstein, but the population is contiguous with those of Switzerland and Austria. Even if the level of population attrition were to exceed sustainable levels, this could still be readily offset by immigration. From what little is known, it is difficult to imagine that the population is a cause for concern, especially given the low levels of anthropogenic mortality reported.

## LITHUANIA

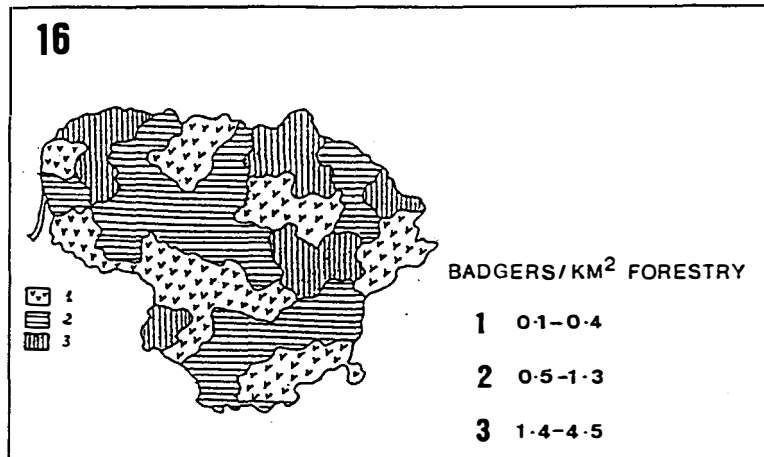
Correspondents: K. Baranauskas, E. Mickevicius.

**Distribution:** Badgers occur throughout Lithuania (Fig. 16). A total of 1,180 head were recorded in a census in February 1991, densities averaging 0.29 head/km<sup>2</sup> forest area (Mickevicius & Baranauskas, 1992). It is acknowledged, however, that the population may be as much as 300% higher than surveys suggest in some areas.

**Legal status:** Badgers are regarded as game, and hunting is permitted between 3rd November and 1st January. Illegal hunting is punished by fines of 500 roubles (c. 10 weeks salary), with increases for offences in nature reserves, when snares are used, or if the sett is damaged.

**Conservation and management:** Traditionally badgers were hunted for trophies, fur and fat, although hunting of the species has never been popular. Official pelt return figures never exceed

20 furs/year, but this figure may have been depressed in the past by black market trading. Red fox and raccoon dogs are the game species of choice, and badgers are sometimes killed during den hunting for these species.



**Figure 16** Lithuania. Badger densities (from Mickevicius & Baranauskas, 1992).

Lithuanian badgers have been surveyed regularly since 1934, but the antipathy of the Lithuanians for the Soviet Union's policy of "rational game management" resulted in many distortions of the data, often to reduce obligations to hunt the species. Rabies occurs in half of Lithuania's administrative districts. In 1992, the twenty incidences of rabies detected in wildlife included one badger. Incidence was higher in domestic animals and livestock (66 cases), and there were two human fatalities, one resulting from the bite of an infected raccoon dog (Dranseika, 1992). Badgers are not killed in rabies control.

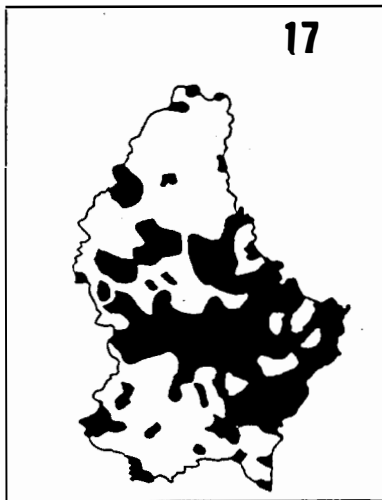
**Recommendations:** Legal proscriptions do certainly result in some minor under-reporting of the number of badgers killed, but the animal is not significant in Lithuanian hunting culture, and hunter interest is low. Badgers were once said to be absent from several areas, but are now known to occur in all Lithuanian provinces. Baranauskas (1992) records a small population decrease around Vilnius, but elsewhere the species seems to be doing well. The only overt problem is the comparatively minor one of the accidental killing of the species in raccoon dog hunting.

## LUXEMBOURG

Correspondents: A. Krier, J. Mersch, M. Molitor.

**Distribution:** Badgers occur throughout much of the Grand Duchy, but are absent from the south west, the area around Luxembourg City, along the valleys of the Syr and Moselle, from some parts of the Ardennes Plateau, and some areas along the Belgian border (Fig. 17). The 1989 forestry survey questionnaire (response rate = 67%) reported badgers to have permanent populations in 46% of the forestry districts replying, to occur sporadically in 20%, and to be absent from 34%. A total of 459 setts were registered, and 1,423 animals; this indicates an estimated national population of c. 2,100 head and 675 setts at an overall mean density of c. 0.77 badgers/km<sup>2</sup>.





**Figure 17** Luxembourg. Badger occurrence; badgers present in filled areas, elsewhere absent or no data. Redrawn from Koenders (1990) from unpublished data of La Direction des Eaux et Forêts.

**Legal status:** Badgers were considered as game until June 1990, the length of the hunting season being determined by ministerial regulation. In practice, the hunting season has not been opened since 1974, and there has been no badger hunting since then. In 1985 badgers were placed into the domain of the nature protection laws. These forbid the hunting, killing, capture, transport, import, export, sale or purchase of badgers living or dead, or any part thereof.

**Conservation and management:** Badger numbers declined severely in the 1970s following gassing in rabies control. The badger-bag clearly shows these decreases: c. 300 badgers were hunted each year in the early 1960s, this falling to 18 in 1973, which led to protection. Rabies control is now pursued by fox immunisation, and no wild animals were found to be rabies-positive in 1992 (Anon., 1992). Since the cessation of gassing, and the hunting moratorium, the badger population seems to have recovered well. No information is available on illegal hunting or on road-traffic mortality.

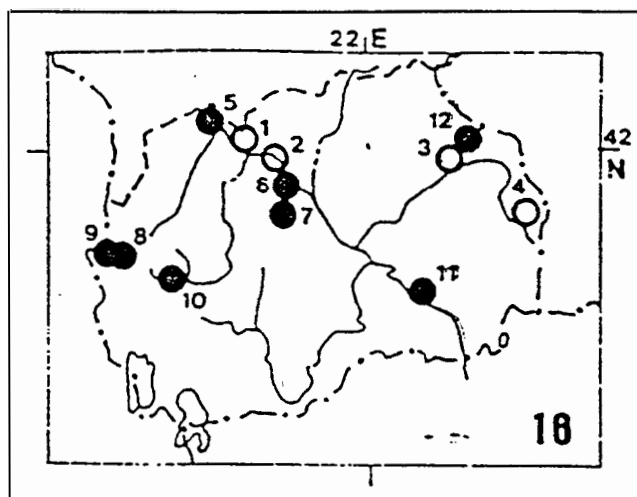
**Recommendations:** The apparently successful re-establishment of badgers has led to some discussion as to whether the species should again be hunted during a short open season. From the population data available, a little hunting may be sustainable, although not if road-traffic casualty levels exceed 400 animals/year.

**Recommendations:** The apparently successful re-establishment of badgers has led to some discussion as to whether the species should again be hunted during a short open season. From the population data available, a little hunting may be sustainable, although not if road-traffic casualty levels exceed 400 animals/year.

## "THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA"

Correspondents: B. Kryštufek, M. Paunovic, S. Petkovski.

**Distribution:** There are few data on the distribution of badgers in "the former Yugoslav Republic of Macedonia", although Kryštufek & Petkovski (1990 and unpublished data) suggest that the animal is present throughout much of the country (Fig. 18).



**Figure 18** Macedonia. Badger occurrence; open dots old data, closed dots new recent (from Kryštufek & Petkovski, 1990).

**Legal status:** Badgers currently receive no protection under either "the former Yugoslav Republic of Macedonia" hunting or nature conservation laws. There is no closed season for badger hunting, and hunting by shooting and trapping, and at the den with dogs are permitted.

**Conservation and management:** There are presently few data on the badger in "the former Yugoslav Republic of Macedonia", and apparently little interest from government departments in mammalian conservation *per se*. The National Museum of Natural History (in Skopje) is in the process of compiling a distributional atlas of Macedonian mammals and a Red Data Book (S. Petkovski, pers. comm.). These

new data may prove valuable as a spur to a revision of the conservation legislation in place at present. Macedonian conservation legislation is weak - only four mammal species are fully protected, and even these may be hunted under special dispensation. "Grass roots" enforcement of conservation law is extremely difficult, particularly in the remoter parts of the country such as the mountainous border areas.

Generally there is little interest in badgers, except when they attract attention as pests. Neither local or tourist hunters pursue the species and hunting ground catalogues (e.g. that of Osogovo in the eastern part of "the former Yugoslav Republic of Macedonia") do not mention the species. In rural areas the pelts of badgers killed as pests or by traffic can be purchased from hunters. Such pelts cost c. \$<sub>us</sub>10 "raw" and \$<sub>us</sub>20 fully prepared (in comparison, wolf pelts are \$<sub>us</sub>50 and \$<sub>us</sub>100, respectively). The declared game-bag for badgers averages about 750 animals/year, but outside the larger fenced hunting grounds hunting is poorly organised and regulated, and poaching is both widespread and common. Rabies does not occur in "the former Yugoslav Republic of Macedonia".

**Recommendations:** The introduction of a closed season during the badger's breeding period (and thus of more ethically-based hunting) would be welcome. Although there is a national hunters' association, at a local level the hunters are very poorly organised. At a governmental level, conservation planning seems to be both poorly resourced and disorganised, furthermore, despite an invitation to do so, "the former Yugoslav Republic of Macedonia" had not (as of 31.01.1996) signed the Bern Convention.

## THE NETHERLANDS

Correspondents: P. Koenders, M. Montizaan, H. Smulders, J.W. Sneep, J. Vink, J. Wiertz.

**Distribution:** Dutch badger setts have been censused in detail on several occasions (van Wijngaarden & van de Peppel, 1964; Wiertz & Vink, 1986, Wiertz, 1991, 1993). Distribution is sporadic, with major population centres in Limburg, Brabant and Veluwe, but badgers are almost absent from Noord- and Zuid-Holland, Groningen, and Zeeland (Wiertz & Vink, 1986) (Fig. 19). The current population is estimated at c. 2,200 head (Wiertz, 1991, 1993), with a mean overall national density of only 0.06 badgers/km<sup>2</sup>.

**Legal status:** Until September 1994 the badger was fully protected under the National Hunting Act. The Hunting Fund, financed by owners of a hunting licence and the Ministry of Agriculture, Nature Management and Fisheries, compensates farmers for badger damage to crops. Shooting permits

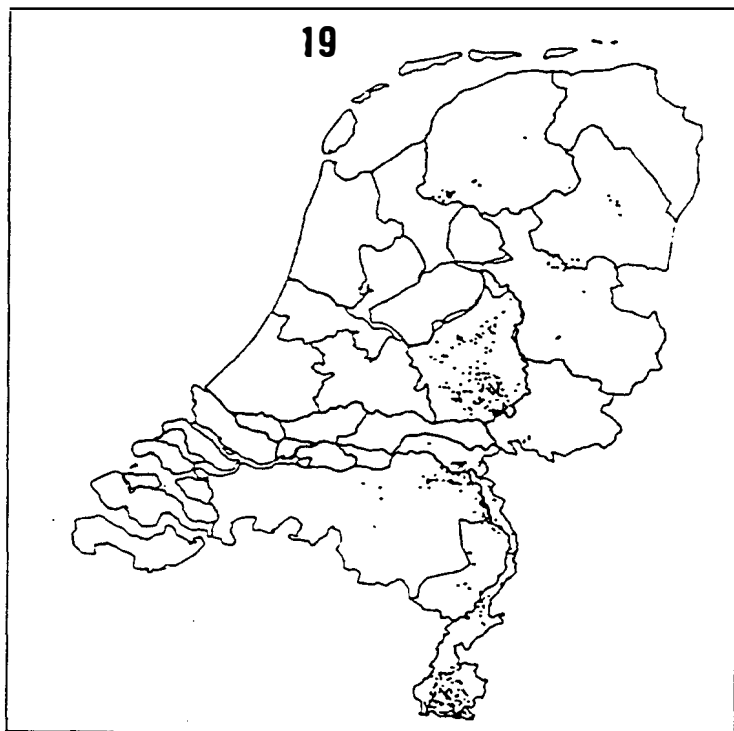


Figure 19 The Netherlands. Badger distribution (from Wiertz, 1991).

are not given out. The good will of the local hunters is promoted by giving subsidies for badger management. Since 1st September 1994 the badger has been protected fully under the Nature Conservancy Act, thus giving protection not only to the badger itself, but also to its habitats. This change of the legal status of the badger has not affected the financial compensations mentioned above.

**Conservation and management:** Until 1980, badger populations in the Netherlands decreased at an alarming rate (Wiertz, 1991). Poaching and sett-digging have occurred in places, but do not seem to be the main threats to the Dutch population. The decrease can be attributed largely to land consolidation and modern agricultural practices, resulting in large-scale loss of habitats. Furthermore, urbanisation, road construction and intensified traffic have caused fragmentation and isolation of populations. Road casualties account for an annual badger mortality of approximately 10%. In 1984, the Ministry of Agriculture, Nature Management and Fisheries issued a national conservation plan for the badger (Ministerie van Landbouw en Visserij, 1984). Within this conservation framework, a range of measures have been taken (including road underpasses and fencing, habitat management and local reintroductions). This was done in co-operation with the Ministries of Transport, Public Works and Water Management, and conservation societies such as the NGO Vereniging Das & Boom. Recent counts indicate that the badger population has somewhat recovered. It seems probable that at least part of the recovery can be attributed to the conservation measures, although the available data do not yet permit an adequate analysis of the causes. On average, the Dutch badger population is back at its 1960 level, although some areas still show a negative trend. Despite the overall recovery of the population, local densities are still dangerously low. As yet, the Netherlands has largely escaped terrestrial rabies, although bat rabies is reported occasionally.

**Recommendations:** It is difficult to envisage what more can be done for Dutch badgers. Preventing sett and habitat destruction and further isolation of local populations must have top priority.

## NORWAY

Correspondent: K. Bevanger.

**Distribution:** Changes in badger distributions have been discussed by Aune & Myrberget (1969), Bevanger (1985) and Bevanger & Lindström (1995) (Fig. 20). Permanent badger populations previously occurred only in southern and central Norway (Bevanger, 1985) but the species' range has been expanding, and it is now found throughout much of Sub-Arctic Norway, and is even reported occasionally within the Arctic Circle itself (Bevanger & Lindström, 1995). The mid-Norwegian population has been founded since the 1939-1945 War, probably via the Gubgrandsalen and Österdalen valley systems (Nordland and Trøndelag in the west may have received immigrant badgers from Sweden: Bevanger, 1985).

**Legal status:** Badgers may now be hunted between 21st August and 31st January, although "pest" badgers can be killed at any time. Shooting and the use of cage traps are most common, although there is some hunting with dogs. A review of Norwegian wildlife management and hunting policies is provided by Stensaas (1989). ■

**Conservation and management:** Badgers are often seen as pests, especially in the south. Much hunting is for sport and trophies, with the popularity of the latter increasing in central Norway, where badgers are still something of a novelty. Range expansion has also included the colonisation of some urban areas (notably parts of Trondhiem) and led to some pest-

related problems (Bevanger, 1990). The Norwegian badger-bag accounts for some 4,500 animals *per annum*, but badgers usually are believed to be abundant and, although no population density data are available, a steadily increasing game-bag, coupled with range expansion, seem to indicate a healthy population status. This is confirmed by the fact that 61% of the 246 Norwegian wildlife boards reporting badger occurrences also report population increases within the last 10 years (35% report a stable population, and 4% cite a decrease) (Bevanger & Lindström, 1995). Sub-Arctic Norway is more mountainous than Sweden, suggesting that badgers are possibly concentrated at higher densities in the lowlands.



Figure 20 Norway. Badger occurrence; filled areas = permanent populations, hatched areas = zone of colonisation (from Bevanger, 1985).

**Recommendations:** Problems associated with the urban badgers of Trondheim have been described in some detail by Bevanger (1990). Here the provision of educational material has alleviated the worries of many people with regard to badgers, although badger removal is still sometimes necessary. The hunting season has been shortened recently, and now accommodates the cubbing season of all females. No data are available on road-kills, although they are known to be quite common in neighbouring Sweden. Overall, badger populations appear to be doing well.

## POLAND

Correspondents: J. Kłowski, R. Ratajszczak, J. Romanowski, Z. Peilowski.

**Distribution:** Although not the subject of consolidated research, badgers seem to occur throughout most of Poland (see Pucek & Raczinski, 1983) and are most common in the north and east of the country. In addition, semi-quantitative data (apparently based mainly on hunting returns from the different administrative districts) are presented by Suminski (1989) (Fig. 21). The national population is estimated at c. 12,000 head at a density of c. 0.1 animals/km<sup>2</sup>.

**Legal status:** Hunting is permitted between 1st September and 31st March and a quota system is operated. Digging into badger setts is forbidden.

**Conservation and management:** Traditionally there were markets for fur (brush-making) and fat (folk medicine), but these have largely died out. Badgers are still hunted in sport and a few for fur. Official statistics record a bag of 350-400 badgers/year, but poaching may double this. Badger hunting is now comparatively unpopular, and some of the skills involved (especially the breeding and use of den hunting dogs) have been lost. Most hunting is by den

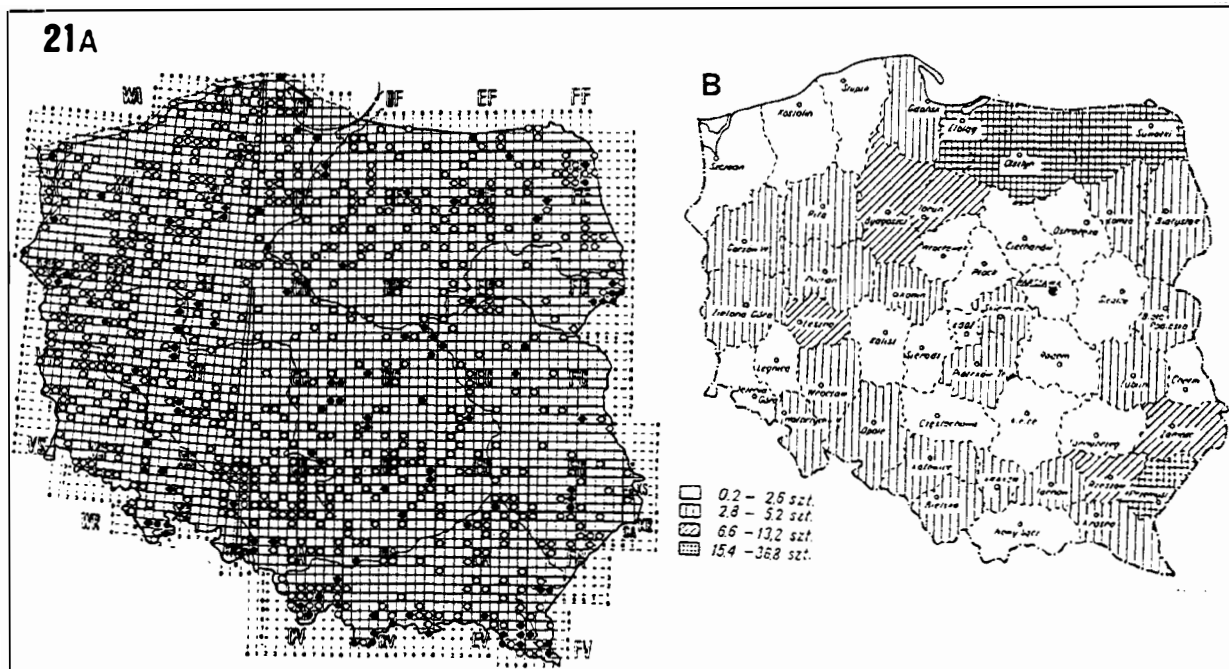


Figure 21 Poland. (a) badger occurrence (from Pucek & Raczynski, 1983), (b) game-bag data; numbers refer to numbers of animals taken between 1981-1985 (from Suminski, 1989).

hunting or shooting and sometimes badgers are killed accidentally in wild boar shooting. Badgers are sometimes killed by road-traffic, but do not appear to be killed in rabies control, although Poland is one of the centres of the disease in Europe. 2,546 wild animals (including 25 badgers) were found to be infected with the virus in 1992 (Anon., 1992).

**Recommendations:** Although the game-bag would be sustainable from the population reported, badger densities are low. The reasons for this are unclear. Poland is a core rabies area, but it also has severe environmental problems with over 11% of the country officially designated as an "ecological disaster zone" (Klimek, 1991). Rabies will certainly have effected badger densities, as may pollution problems. Despite this, badger numbers are said to be increasing slightly.

## PORTUGAL

Correspondents: J. S. Carvalho, J. M. Ferreira.

**Distribution:** Little information is available on the status of the badger in Portugal. The species was described as "fairly common in the whole country" by Santos Reis (1983) (Fig. 22) who provides some distributional data. These seem to indicate that the species is less common (or at least less commonly reported) from the northern Atlantic Coast.

**Legal Status:** The badger is considered as small game, but has received some degree of protection since 1981 and, under hunting laws formulated in 1986, hunting is regulated by edicts called "portaria" issued jointly by the Ministries of the Environment and Agriculture. The hunting of badgers is forbidden at present, although provision exists for the killing of pest animals. The portaria are not enacted against badgers at present.

**Conservation, management and recommendations:** No information is available on either illegal hunting (if it occurs) or other anthropogenic effects upon badger populations. The available data do not permit assessment of the status of badgers in Portugal, although the species is said to be widespread and not to be threatened. Despite this lack of data, there appear to be few grounds for concern, although continued protection seems desirable and further research would be welcome.

## ROMANIA

Correspondents: D. Manoliu, D. Munteanu.

**Distribution:** We have no data on badger distributions in Romania.

**Legal Status:** Badger hunting is permitted between 1st September and 30th April. Shooting and den hunting with dogs are permitted and traps are used by forest wardens. Illegal hunting is punished by fines. Badger stocks were estimated in 1987, when 27,000 badgers were reported.

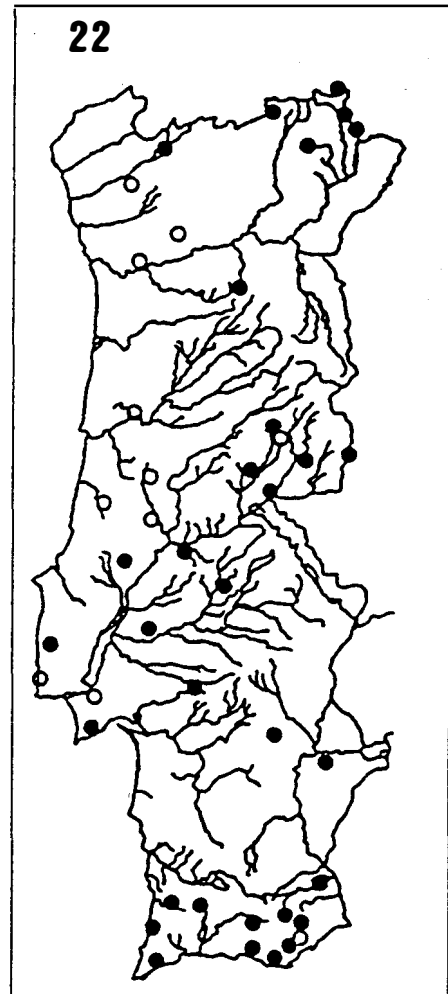
**Conservation and management:** Badgers are hunted for fur, fat, pelts, for sport, in pest control and in game management. Shooting and den hunting are most common, but the government does not maintain records of small game and there is no obligation to report badger kills to the authorities. The hunters' association recorded a kill of 9,000 in 1987. Unfortunately, the validity of this figure is said to be highly suspect (as are the badger counts themselves). The same applies to pelt return data because of domestic use and black-market sales. Despite this, badger populations are said to be stable and may be increasing. Gassing formerly took place to control rabies, but the virus is now uncommon, although hunting wardens do trap badgers in rabies control. Of 21 cases of rabies in wild animals reported in 1992, none involved badgers (Anon., 1992).

**Recommendations:** The data available for Romania are not helpful and the collation of reliable game-bag statistics would seem to be a necessary step forward in the development of appropriate management strategies for badger hunting.

## SLOVAKIA

Correspondents: P. Hell, K. Pachinger, Slovak Hunters' Union.

**Distribution:** Badgers occur throughout the Slovak Republic, although they seem least common in areas adjoining the Polish and Austrian borders (Fig. 23). Badgers are rare above 500 m asl and absent above 1200 m. Stollman (1967) estimated 2,742 badgers at a mean



**Figure 22** Portugal. Badger occurrence; open circles = modern data, closed circles = literature records (from Santos Reis, 1983).

density of 0.18 badgers/km<sup>2</sup> forest area in 1961. Hell & Cimbal (1977) report the results of more detailed surveys, estimating a population of 3,800 animals, at an average density of 0.2 badgers/km<sup>2</sup> of woodland. The Slovak Hunters' Association now estimate a national population of approximately 2,000 head.

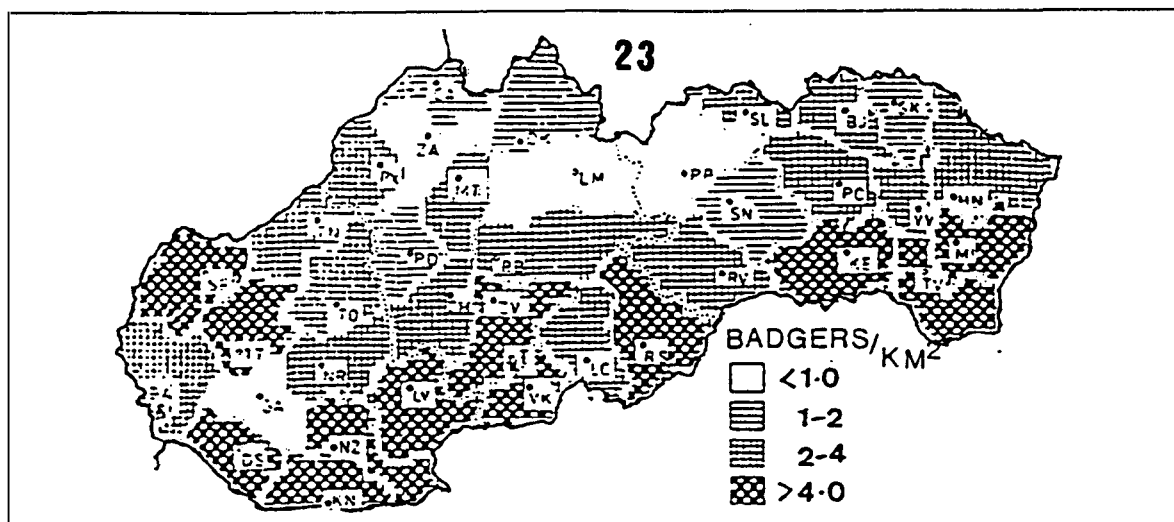


Figure 23 Slovakia. Badger densities (from Hell & Paule, 1977).

**Legal status:** Badgers are regarded as small game and hunted between 1st August and 30th September. According to Hell & Cimbal (1977) 65% are shot, 20% dug and trapped, the remainder being gassed. Gas and poisons are no longer permitted, neither is digging for badgers, although dogs are used to drive them from the sett. In the last few years the game-bag has usually been between 550-600 animals/year. Poaching is said to be common and reportage of badger kills inaccurate. Badgers had Red Data Book status when Slovakia was part of the Czechoslovak Federative Republic (Romanowski, 1991) but whether this is still the case for the new Slovak Republic is unclear.

**Conservation and management:** In the 1970s rabies was controlled by gassing and the placing of poisoned eggs. By 1976 rabies control, coupled with the effects of the disease and continued hunting, led to badger-bags decreasing to only 27% of their 1970 level (Hell, 1987). Rabies is still present, although now much less common, with rare cases of infected badgers, but a human fatality in December 1990 (Matouch, 1990). Badgers are hunted for sport and also for flesh, fat and lard - the lard commanding prices of 500-600 koruna/kg. Badgers are sometimes seen as a pest: 2% of those replying to a questionnaire recorded the species as a serious pest and 12% reported some damage (Hell & Cimbal 1977).

**Recommendations:** Badger populations seem to have recovered since the use of gas and strychnine to control rabies ceased and game-bags have increased as a result. The badger lives at comparatively low densities in the Slovak Republic and the national population level is quite modest. Despite this, it appears that the badger is hunted enthusiastically, particularly for the population levels reported; this may represent some cause for some concern. The last national badger survey was over 20 years ago, thus reassessment would seem wise. Again, the implementation of managed hunting seems to be compromised by poaching and by apathy with regard to the notification of badger kills to hunt masters. Unfortunately, we have been unable to obtain any new data since the Slovak Republic's independence from the former CSFR.

■

## SLOVENIA

Correspondents: M. Adamic, B. Kryštufek.

**Distribution:** Badgers are widely distributed in Slovenia (Kryštufek 1991, 1993) and absent or rare only in mountainous areas and those under intense cultivation (Fig. 24). The Slovene Hunters' Association have estimated the national population at 4,302 animals from surveys undertaken in spring 1990 (Kryštufek 1993). In areas under hunting management (84.8% of Slovenia) the average density is 0.25 badgers/km<sup>2</sup>, but peaks at between 6.1 and 7.5 badgers/km<sup>2</sup> in some western areas (Kryštufek 1993).

**Legal status:** Slovene legislation with respect to the badger is reviewed by Kryštufek (1993). Badgers may be hunted exclusively by registered hunters, in the period between 1st August and 31st January. Badgers may only be killed by shooting by rifle, with snares and other traps being prohibited. Badgers can be killed in rabies-infected areas at any time. Den hunting with dogs was formerly popular, although the karstic country of much of Slovenia is unsuitable for this type of hunting and den hunting was forbidden at the outbreak of rabies in the 1970s.

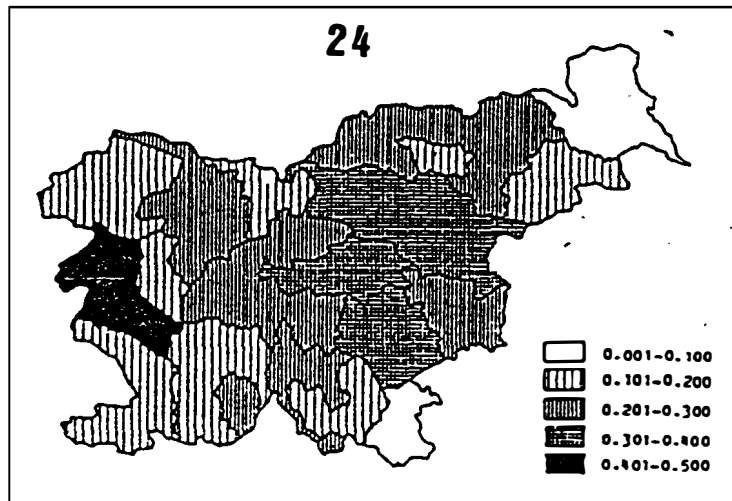


Figure 24 Slovenia. Badger densities (from Kryštufek, 1993).

**Conservation and management:** Badgers were traditionally hunted for their fur and flesh and the badger is still considered edible. Trophy hunting is important to Slovenian hunters, who do not regard the badger as an acceptable trophy species but, as hunters must pay for the damage caused to crops by game, badgers are persecuted as crop pests. Crop damage (particularly to maize) is now less important than previously and the badger kill has correspondingly diminished from 1,157 in the 1971/72 hunting season (Krže, 1986) to an average of 711 animals/year between 1988 and 1990 (Kryštufek 1993). Although badgers are said to have decreased during the outbreaks of rabies, their numbers have since increased and the population is stable. An oral fox-vaccination programme has commenced in Slovenia and has reduced the number of detected wildlife cases from 761 in 1989 to 224 (including nine badgers) in 1992 (Anon., 1992).

**Recommendations:** In a review of the status of the badger in Slovenia, Kryštufek (1993) identified popularisation of the standards for bronze, silver and gold medal standard badger skins and skulls as undesirable and contradictory to nature conservation efforts. In addition, the killing of carnivores in rabies infected areas was also criticised. The campaign against rabies is going well and it is hoped that the rabies regulations that allow this killing will be removed in the near future. The Slovene Hunters' Association have a responsible and strictly enforced attitude to wildlife, and have recently distributed free books on carnivore natural history to all their members to explain the ecological roles of these species (Kryštufek 1993).



## SPAIN

Correspondents: J. M. de Benito Ontañón, M. Delibes, V. Gil, J. Jiménez, C. Nores.

**Distribution:** Badgers seem to occur throughout much of the Spanish mainland. A semi-quantitative distribution map (Fig. 25) is provided by Long & Killingley (1983: 287), although its exact origin is unclear. Badgers are most common on the Atlantic coast, but less common

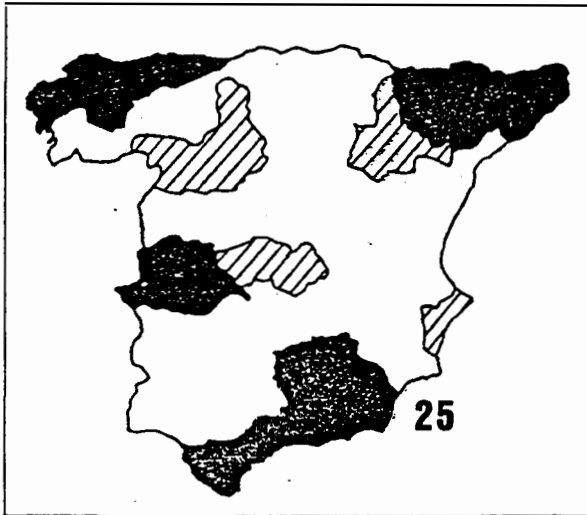


Figure 25 Spain. Badger occurrence; filled areas = common, hatched areas = scarce, open area = uncommon. Unpublished data of ICONA (from Long & Killingley, 1983: 290).

also reported. Spain is currently regarded as rabies-free, as all reported cases derive from the Spanish north African territories (Anon., 1992).

**Recommendations:** Although the badger has only been protected for a short period, protective legislation seems successful; signs of illegal hunting such as the sale of pelts at village fairs being less evident. Badger distributions remain poorly known and further research is needed.

## SWEDEN

Correspondents: E. Lindström, P. Skoog.

**Distribution:** Badgers occur throughout Sweden to about 66°N but are generally absent further north, from the mountain heights, and from the island of Gotland although, as elsewhere in Scandinavia, the species' range has increased over the last 50 years (Bevanger & Lindström, 1995). Mark and recapture studies have reported densities between 1-2 badgers/km<sup>2</sup> (e.g. Lindström, pers. comm.; Stenström, 1991). Griffiths & Thomas (1993) use game-bag and other data to estimate a population of 350,000-400,000 head, giving a minimum mean national density of c.1.35 badgers/km<sup>2</sup>.

on the Mediterranean coast and absent from the Balearic Islands (Delibes, 1983). There are no population data available, although ICONA consider the species vulnerable (ICONA, 1986). Densities reach 0.5 badgers/km<sup>2</sup> in Doñana National Park, but are much lower elsewhere (Delibes, pers. comm.).

**Legal status:** Badgers were regarded as small game, but have had protected status since 1989. All hunting is forbidden, but pest badgers can be taken under licence, although licensing policy depends on the individual autonomous communes.

**Conservation and management:** One of the few problems reported is the capture of badgers in snares set for other species, notably red fox. These problems are said to be greatest on some of the big estates. A little poaching and illegal persecution are

**Legal status:** Badgers are small game and hunted between 1st August and 15th February (adults) and between 1st June and 31st July (cubs). Shooting, trapping and den hunting with dogs are permitted.

**Conservation and management:** Few Swedish hunters specialise in badger hunting, although in rural areas the species is often seen quite negatively. Hunting is opportunistic, in pest control and crop protection, sport and in game management. There was some traditional use of badger products, but this is now rare. The badger-bag has increased steadily over the last 20 years to 35,500 in 1989, but there are no signs that the species is decreasing as a result, and an even greater number of badgers are said to be killed on the roads. Badger range and density are thought to be increasing, possibly encouraged by changes in land-use resulting from the abandonment of rural homesteads and changing forestry practices.

**Recommendations:** Swedish game are carefully monitored but the continued collation of game-bag data would seem advisable, as may additional research into the species' reproductive biology and population dynamics. Seiler *et al.* (1995) suggest that coniferous afforestation and decreasing availability of agricultural land could lead to decreases in badger numbers in some areas. Despite this, although formal data are lacking, it seems certain that there is a surprisingly large number of badgers inhabiting Sweden, and that the species is not at risk.

## SWITZERLAND

Correspondents: S. Capt, P. Lüps, H. Matter, C. Mosler-Berger.

**Distribution:** Badgers occur throughout Switzerland, although not above 1,800 m asl. There are no national distribution or population data, although Long & Killingley (1983: 289) give a map based on game-bag data from the mid 1960s to mid 1970s. Density surveys have, however, been undertaken in the 29 national nature reserves, these showing an average of 0.5 badgers/km<sup>2</sup>, with 1.75 badgers/km<sup>2</sup> in Kiental. This was after rabies and will probably have increased subsequently. Ecological studies have been undertaken in several areas, notably Neuchâtel (Monnier, 1992) and Bern (e.g. Lüps, 1990; Lüps & Roper, 1988; Lüps *et al.*, 1987, 1991).

**Legal status:** Badgers may be hunted by den hunting and by rifle between 16th June and 15th January. This period may be shortened (but not lengthened) by the various canton authorities. The use of gas and traps is forbidden. Hunting by members of the public is not permitted in Geneva Canton. Some cantons pay compensation for badger damage. Rabid animals may be killed at any time, those causing damage may also be killed out of season, following dispensation.

**Conservation and management:** Bovine TB is known in Swiss badgers, but badger control is not pursued as a means of managing it (O'Connor & O'Malley, 1989). Badgers were badly affected by rabies formerly, but rabies incidence has now decreased greatly in Swiss wildlife, following a carefully executed rabies control programme (see Wandeler *et al.*, 1988): only 122 wildlife rabies cases were detected in 1992, which included 16 badgers (Anon., 1992). Badger populations have recovered as a result and now c. 1,500 badgers are hunted each year, either in sport or pest control. In the latter case, Roper *et al.* (1995) report that, in 1990 in Bern Canton alone, 75 badgers were killed by game wardens for crop damage, and 143 farmers were paid a total of Fr. 24,201 - mainly as compensation for damage to maize crops. There appear to be no data on road traffic mortality, although it is known to occur.

**Recommendations:** The Swiss badger population is clearly recovering following rabies and its status currently appears satisfactory. The game-bag indicates a minimum population of some 7,500 animals (0.18 badgers/km<sup>2</sup>), although the population is almost certainly considerably higher than this. If the data from Bern Canton are typical, then the number of badgers taken as pests seems rather higher than is usually the norm.

## TURKEY

Correspondent: A Erkman.

**Distribution:** No recent, first-hand data are available on the badger population of Turkey, although Koch & Kinzelbach (1982), Turan (1984) and Harrison & Bate (1991) provide some records - mostly from non-European Turkey (Fig. 26). Turan (1984) states that the species is widely distributed.

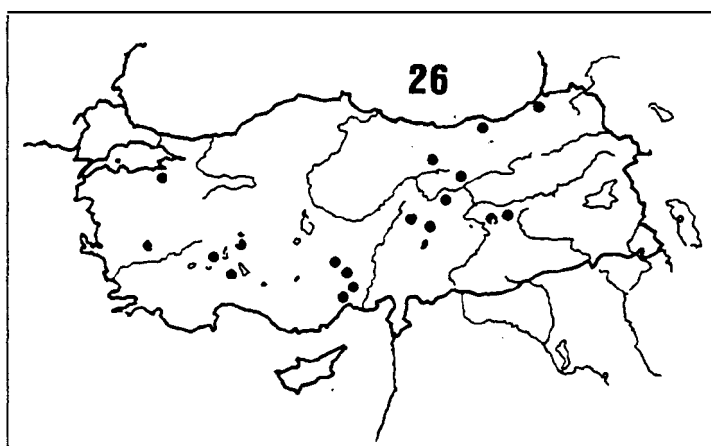


Figure 26 Turkey: Badger occurrence (compiled from Koch & Kinzelbach, 1982; Harrison & Bate, 1991).

**Legal status:** Turkish law considers the badger as small game. A closed season operates between 1st March and 31st August and nocturnal hunting, the use of snares and poisoned baits are illegal, and a quota of one badger per hunter per day is enforced. It is said (Peachey, 1992) that comparatively large penalties (fines equivalent to c. £80) are incurred for taking animals in the closed season, or over quota.

**Conservation and management:** Although some crop damage occurs, the badger is said to be of little interest to Turkish hunters and therefore not hunted systematically - one Turkish hunting book is said to fail to mention the species. Rabies is dog-based rather than fox-based in Turkey, although it is sometimes reported in Turkish badgers. The incidence of the virus has declined from 2,260 cases in 1981 to only 320 in 1992 (Anon., 1992) and it is uncommon west of the Bosphorus and the Sea of Marmara. The only account of Turkish legislation with regard to the badger is that of Peachey (1992) although this may not be reliable. All our other attempts to obtain information on badgers in Turkey have failed.

**Recommendations:** Some formal research into the status of the badger in Turkey would be most welcome.

## YUGOSLAVIA

Correspondents: M. Adamic, V. Habijan-Mikes, M. Paunovic, N. Simonov.

**Distribution:** Badgers occur throughout almost all of Serbia and Montenegro. There are reputed to be more than 10,000 badgers in Yugoslavia, with at least 6,000 in Serbia and including c. 650 in the northern province of Vojvodina. A population of 10,000 head would give a mean national density of 0.098 badgers/km<sup>2</sup>. No information is available for Montenegro.

**Legal status:** Badgers are small game, although there are local variations in the exact legal status of the species. A closed season operates from 1st January to 31st March throughout Yugoslavia, although this was introduced as recently as 1989 in Vojvodina. Den hunting with dogs and shooting are common, den hunting being popular where geology permits.

**Conservation and management:** Badger setts and fox earths were gassed during rabies control and this may have led to population decreases. Rabies occurs in Serbia and its northern province of Vojvodina. 115 cases of wildlife rabies were diagnosed in 1992 (all but one in red fox) and almost all in Vojvodina (Jakovljevic, 1992). Badger populations are said to have recovered throughout Serbia, but still seem to be depressed in Vojvodina. Badgers are hunted as pests in some areas, but also for trophies and sport. Some badgers are also killed during fox, boar and roe deer hunting. The species is still taken for meat locally and also for fat (as in Pozarevac in Serbia). Badger kill data are available: the Serbian badger-bag is usually approximately 1200 badgers/year, with c. 200 badgers/year being taken in Vojvodina, and c. 200-250 badgers/year in Kosovo. Montenegro takes a mean of 575 badgers/year. The game-bag for all of these regions varies somewhat from year to year. Road-traffic kills are said to be uncommon, although the species suffers some ill-effects from habitat change and habitat loss.

**Recommendations:** Reasonably good hunting data are available for the whole of the country. Although the overall national population density is not high, it is thought the status of the badger is satisfactory. The incidence of rabies is now much lower than before, but it still represents a problem in the north. Here, any increases in habitat loss, hunting mortality or road-kills may be to the detriment of the species. The status of the badger seems relatively satisfactory in most of Serbia (and also probably in Montenegro). This is not the case for Vojvodina, where there is an overall estimated density of only 0.03 badgers/km<sup>2</sup>.

## SECTION 2: BADGERS IN A MODERN WORLD

Badgers and humans interface in a number of ways. These include the direct effects of human actions upon badgers, *i.e.* as in the killing of the species in pest and disease control, in sport, in game management, and for various commodities. Probably more important, however, are the effects of the indirect, unconscious actions of humanity - these being the result of living in a human-dominated world. These include pesticide toxicity, road and rail-traffic casualties, habitat loss, and the destruction of setts by agriculture, civil engineering, mineral extraction and infrastructure development. A very small number of animals are also maliciously destroyed for cruel amusement, as in the case of badger baiting in Britain and Ireland.

Badgers now inhabit a world that is changing with increasing rapidity, and is largely dominated by the actions of the human species. It is appropriate, therefore, to review the possible effects of these changes upon badger populations in any review of the status of the species in modern Europe.

### Badgers as pests.

Badgers are killed as pests in most parts of Europe, and the legislation of states that protect the species (with the exception of the Netherlands) usually includes provision for the taking of pest badgers, if deemed necessary. In states where the hunting of the species is permitted but regulated, pest badgers may often be taken both during the closed season, and by methods that would otherwise be proscribed.

Most authors on the natural history of the badger comment on damage to crops, although few give any concrete data, and most modern authors downplay its significance. In fact, the status of the badger as an agricultural pest has been the source of much debate, and is perhaps more a matter of personal experience than anything else: for example, a farmer who has lost twenty head of cattle to bovine TB may be expected to be less kindly disposed towards badgers than a neighbour who has suffered no losses. A survey of farmers from the British Midlands by Macdonald (1984) found many (14.3%) to regard badgers as a minor nuisance, but only 1.2% thought them to be a serious pest and similar percentages have been reported from surveys in Denmark and Slovakia (Asferg, 1984; Hell & Cimbal, 1977). Despite this, a survey of Devonshire farmers (Devon being a bovine TB "hotspot") undertaken by the British National Farmers' Union (NFU) found that of 83% of those with badgers on their land, 75% had suffered problems with badgers, and 30% regarded these problems as serious (Symes, 1989).

The nutritional ecology of the badger is well studied, with over 110 research reports on this subject being listed by Vink (1993). Although often thought of as an "earthworm specialist" in north-western Europe (Kruuk, 1989; Kruuk & Parish, 1981), badgers are really opportunistic feeders that will take a very wide variety of the food items available within their immediate environment (e.g. Roper & Mickevicius, 1995; Martín *et al.*, 1995). Not surprisingly, many studies report cereals or fruits to comprise major components of badger diets, at least at certain times of the year (e.g. Henry & Lambert, 1988; Kruuk & De Kock, 1981; Lüps *et al.*, 1987, 1991; Pigozzi, 1988; Prigoni *et al.*, 1988; Roper & Lüps, 1995; Skoog, 1970). Moreover, badger feeding activity is not the main source of crop damage, but crop trampling (Bourand, 1989). Thus Symes (1989), reviewing complaints made to the British Ministry of Agriculture, found *c.* 1,000 badger complaints each year, with crop damage being a common cause of grievance, whilst 23.9% of Macdonald's farmers had experienced at least

some crop damage through trampling. Henry & Lambert (1988) studied badger damage to crops in France, and concluded that the level of damage done was generally minimal, however Bourand (1989) (working in central France), claims that, on average, each badger sett caused damage to the value of Fr. 240 per annum. In Britain, Wilson (1993) found badgers occasionally caused damage to up to 10% of the area of oat crops, whilst Roper *et al.* (1995) report Sussex badgers as affecting only 0.25% and 0.025% of the areas of wheat and barley crops, respectively (which involved the actual loss of less than 1% of the total crop).

In strict economic terms, a "pest" should only be controlled when causing an economically significant level of injury or damage, and when the costs of control are outweighed by the financial benefits accrued by that control (Stern, 1973). No data exist on the actual costs of badger control, but in states such as the Netherlands, Austria, Slovenia and Switzerland, where farmers are compensated for badger damage, the levels of compensation paid can represent significant sums of money. Some workers argue that in many cases, and particularly in western Europe, it may actually be both simpler and cheaper just to ignore the damage (see Harris *et al.*, 1990). Certainly, at the levels reported by Roper *et al.* (1995), it is hard to envisage that badgers could cause severe economic injury to even the most modest agricultural venture. Moreover, Henry & Lambert (1989) and Lambert (1990) point out that crops such as wheat and maize are taken by badgers as replacement foodstuffs in times of hardship and, as these are available in a regular and predictable manner, damage caused by feeding and foraging can be avoided by the supplementary feeding of the badgers. Although similar advice has been given to farmers in some areas of Britain by the Ministry of Agriculture, advice such as this does not, however, take account of damage caused by trampling. Furthermore, on occasion badgers may take very large amounts of fruit crops such as strawberries, grapes or olives. Under such circumstances badgers may be very difficult to deter, and crops may suffer extensive damage, both from fruit eaten and fruit spoiled. To this may be added the costs of replacing damaged plants and repairs to anti-bird netting. Some authors have suggested crop protection by electrified fences, although reports differ with regard to the degree of success of such tactics (Roper, 1987; Wilson, 1993). Even where their deployment is appropriate, fencing is expensive, and clearly beyond the budgets of many farmers and growers.

Another form of pest activity often ascribed to badgers is the killing of small game and livestock. The view of the badger as a killer of game-birds and a predator of their eggs was largely responsible for the widespread and massive persecution of the species in Britain before the 1914-1918 War (Pease, 1898; Cresswell *et al.*, 1990). This view is still common to most cultures, although there has generally been a gradual change in attitudes towards the species over the last few decades (e.g. Asferg, 1984; Krze, 1986). Skoog (1970) did find evidence for badgers feeding on game birds, but was not convinced of their ability to take adult birds themselves, and believed that most of the bird remains in faeces and stomach contents actually came from carrion. As he did occasionally find identifiable egg fragments and nestlings, this does suggest that badgers may sometimes attack the nests of ground-nesting birds. Both this study, and that of Leitch & Kruuk (1986), which deals specifically with avian remains, show that game-birds are not taken commonly, and that most of the remains encountered in nutritional studies were those of passerines, corvids and pigeons (again consistent with carrion feeding). Indeed, the Game Conservancy (the major game biology research organisation in Britain) considers that damage by badgers to pheasant rearing is insignificant (Neal & Cheeseman, 1995: 219). Despite this, in situations where there is a prey surfeit (as in pheasant runs, poultry compounds or waterfowl colonies) surplus killing by badgers can sometimes occur, as in other carnivores (Kruuk, 1972; Lodé, 1989) and, on the very rare occasion that a badger develops a pattern of hen-house raiding, this can constitute a very real problem (Symes, 1989). As regards the killing of livestock, it is known that badgers will forage on sheep carrion (Hewson & Kolb, 1976), but the killing of live lambs

is much more difficult to substantiate. Although a frequent accusation against badgers in South Wales (H. Griffiths, unpublished) no complaints arising from lamb killing have ever been made to the Welsh Office Agriculture Department. Neal (1987) was only aware of "about seven" substantiated incidents of lamb-killing by badgers in over forty years of research. Kruuk (1989), however, reports the phenomenon to be more common in Scotland, and often representing a reason for illegal badger control. Elsewhere lamb-killing seems to be extremely rare.

Badgers may cause severe problems through their various burrowing activities, both by the location of the sett, and by the presence of badger tunnels (see Neal & Roper, 1992). An incident some years ago involving badger excavations in a churchyard in Castle Carey in Somerset (England) caused considerable public concern, as has the blockage of drainage ditches with spoil, excavations into sea walls and golf courses, and also the undermining of fields, pathways, roads, railways, and buildings. Furthermore, many farmers believe that hoofstock are at risk from leg-break injuries when badgers tunnel into pasture. Complaints such as these constituted 42% of those in the NFU survey (Symes, 1989), whilst 16.7% of Macdonald's (1984) sample of English farmers had experienced vehicles falling into badger tunnels. Compensation claims arising from axle damage and spill-over accidents have caused some British insurance companies to refuse accident cover to farmers using vehicles or machinery in fields in which badgers have been active (Symes, 1989). In some such cases badgers can be dissuaded from using the holes in question by the use of exclusion fences, after which the burrows can be back-filled. In more serious cases, the badgers can be humanely translocated from the locality and established elsewhere (Harris *et al.*, 1990) or, in states where the species does not have protected status, culling is the usual result.

In circumstances where humans and badgers live in close proximity, increased scope for conflict can be expected. Harris (1984) investigated the urban badgers of Bristol and found that 36.7% of his correspondents ascribed some sort of damage to badger activities, including burrowing under buildings, the digging up of vegetable plots, lawns and flower beds when feeding or latrining, fighting with (and injuring) domestic pets, the consumption of vegetables and market garden produce, and the overturning and raiding of rubbish bins. In his study of the urban badgers of Trondheim, Bevanger (1990) reported a similar list of complaints, but also found many town's people (92%) to be tolerant of badgers, some actually enjoying their presence. Many of the remainder, often afraid for their personal safety or that of their pets, could be re-assured by the provision of information and advice. A Welsh suburban badger population investigated briefly by Tavecchia (1991) did cause some minor nuisance, but was still extremely popular with local residents who both fed the badgers and protected their sett, whilst simultaneously altering their own behaviour to prevent badgers from gaining access to domestic refuse, etc.. Although the urban badgers of most towns (e.g. Copenhagen, Vilnius, Bristol) are viewed as relict populations (Aaris-Sørensen, 1987; Baranauskas, 1992; Harris, 1984), the badgers of Trondheim have colonised urban areas in recent years (Bevanger, 1990). The presence of badgers in central Norway is still something of a novelty, although it is possible that the public will become less tolerant of them when familiarity sets in.

## Badgers as game

Badgers are recognised as small game by the Conseil International de la Chasse et de la Conservation du Gibier, who have formal standards for bronze, silver and gold medal badger trophies, based upon cranial and pelt characters (Hell & Paule, 1986). In addition, there is an international den hunting competition known as the "European cup of terriers in fox and badger baiting" (Lederer, 1979), although here the term "badger baiting" refers to what would be more correctly termed "den hunting with dogs". Recreational, trophy and sport hunting of badgers are relatively popular in some parts of eastern Europe and Scandinavia, although badgers are generally of very minor interest when compared to cervids, lagomorphs and, in the case of den hunting, red fox. In terms of proportions of mammalian game, only in Sweden, Switzerland and Norway do the numbers of badgers hunted exceed 4% those of the most popular mammalian game species (Griffiths & Kryštufek, 1993).

It is often difficult to ascertain why badgers are hunted and by whom, although in a survey of Danish hunters, Asferg *et al.* (1977) found that only 10% of badgers were taken as the game species of choice, and 75% were taken to free dens for use by foxes for shooting. Of those hunters registering badgers in their annual game-bags, the average kill was 1.4 badgers/year, although a small percentage of hunters were more interested in the species. Data which specifically relate to hunters who take badgers is exceptional, but throughout the European states, not a single country has a badger kill as high as 0.2 badgers/hunter.year<sup>-1</sup>, *i.e.* one badger taken for every five hunters (Griffiths & Kryštufek, 1993). Perversely, it seems that where badger hunting is illegal, it may be followed rather more enthusiastically; Griffiths (1994a) estimates that as few as 400 illegal den hunters may account for the massive annual illegal badger kill reported in the UK.

In many areas, much hunter interest in badgers stems from the use of earth dogs for den hunting, the badger being traditionally regarded as an excellent test of the stamina, courage and tenacity of the dog. Den hunting with earth dogs is particularly popular in Britain, Ireland, western France, and parts of eastern Europe. In parts of Europe where this type of hunting is either illegal, unpopular, or difficult because of the nature of the geological solid, badgers are usually of considerably less interest. It seems badgers or their young may also sometimes be killed accidentally during den hunting for other species (red fox, raccoon dog, crested porcupine) or whilst shooting other woodland game (particularly wild boar and roe deer).

The role of badgers in European hunting cultures is discussed at length elsewhere (Griffiths, 1991a,b; Griffiths & Kryštufek, 1993) and will not be discussed in further detail here. There appears to be no European country where the hunting of badgers is currently a cause of decline in the species' abundance (Griffiths & Thomas, 1993) although, where extensive mortality from road-traffic and other causes operate, the additional burden imposed by hunting must obviously be considered in national population management schemes.

Griffiths & Thomas (1993) estimated that the combined legal badger-bags of Europe account for *c.* 118,000 badgers/year, although poaching (which is usually unquantifiable) considerably increases this figure. Illegal den hunting is particularly significant in Britain and Ireland. In Britain it is said to lead to an illegal kill of some 9,000 badgers/year (Cresswell *et al.*, 1989), and 10% of the badger setts in the Irish Republic are said to have been dug illegally (Smal, 1995a).  
■



## Badgers and disease

Carnivores are often reservoirs of diseases of either man or his domestic animals and livestock. The Eurasian badger has featured significantly in the control of two such diseases: bovine tuberculosis (TB) and rabies.

Bovine TB, caused by the bacterium *Mycobacterium bovis*, is endemic to hoofstock in many parts of the world (Tessarò, 1990). Although known in a number of European countries (e.g. Greece, Italy, Spain) only in Switzerland, the UK and Ireland has the badger been identified as a wildlife reservoir (O'Connor & O'Malley, 1989). At present both the UK and the Irish Republic attempt to control bovine TB by badger removal operations. Currently about 900 animals are killed annually in the Irish Republic, and almost 1,700 were taken in Britain in 1995. The UK Ministry of Agriculture (MAFF) culled a total of 12,901 badgers in the period 1974-1992. At present there is no foreseeable end to this practice due to a continued failure to control bovine TB, despite mounting claims that the badger culling campaign has had little or no impact on the incidence of the disease in cattle

■ The position with regard to rabies is more serious. Following the 1939-45 war, rabies spread rapidly from Poland, into Germany and then on into central and western Europe (Turner, 1971). Two forms of rabies currently occur in Europe: bat rabies and "terrestrial" rabies, the latter being the form that infects man and his domestic animals and livestock. Very few human fatalities are now reported within Europe, but the disease remains one of the most feared of all viral diseases.

Throughout all of Europe the red fox is the primary reservoir of the disease itself (Steck & Wandeler, 1980). Until recently several other species (including badgers) were also thought to be involved in the maintenance of the virus in wild animal populations (Steck, 1982). Current opinion no longer supports the belief that European rabies exists in distinct, non-vulpine, mustelid-based epidemiologies (W. Müller, pers. comm.)

■ Steck (1982) makes the point that the control of secondary reservoirs of the rabies virus is neither cost-effective, nor efficient. A great many badgers may become infected with the virus (Steck, 1982) and there may be extensive mortality from the disease (Moegle & Knorpp, 1978). In the early days of the rabies epidemic, badger populations were adversely effected by both the disease, and by the campaign to eradicate it. Natural mortality from the effects of the epidemic was often exacerbated by the gassing of fox earths and badger setts. A programme of gassing and poisoning was associated with a 60% decline in the badger-bag of the former Czechoslovakia in the 1970s (Hell, 1987). Similarly, in Hesse (Germany) in the early 1960s, badger population levels were reduced to some 50% of their former levels, with some localities suffering an estimated 90% reduction (Wachendörfer & Schweirtz, 1980). A 90% fall in badger numbers has also been claimed for Wallonia (Belgium), although here the problem was compounded by a system of bounties paid for culling badgers (Libois, 1983).

In most countries the gassing of badger setts and fox earths has now been superseded by fox vaccination schemes, although the shooting of foxes remains a component of the rabies control programmes of some areas, and in Germany (and some other states) badgers are said to be shot from fear of the disease still. This policy change stemmed from the realisation that, as foxes are the primary wildlife reservoir involved, control effects could be optimised by vulpine-based strategies based on the use of vaccines (Steck & Wandeler, 1980). Once the density of infected foxes falls below a certain threshold, the disease can no longer be sustained within the population and disappears. As foxes are no longer able to infect other species, the virus disappears from these also. Fox vaccination is thus not only more effective, but is often cheaper than the bounty-shooting of foxes (e.g. Giovannini & Prosperi, 1991). At

present rabies can be regarded as having been exterminated from Swiss, Belgian and Italian native wildlife. In Switzerland the early adoption of a fox vaccination scheme (coupled with dog, and in some areas, cat vaccination) led to the isolation of the virus in areas contained by natural barriers such as rivers, lakes and mountains, and allowed systematic eradication (Wandeler *et al.*, 1988). As the disease disappeared from foxes, so did it disappear from badgers.

In 1990, Europe reported 17,305 cases of animal rabies, with 278 involving badgers and 12,833 involving foxes. The reported incidence in 1992 was the lowest since monitoring began in 1977: 8,360 wild animals testing positive for the virus, including 165 badgers and 7,318 foxes. More recently, worries about residual virulence in SAD (South African De-attenuated) rabies vaccine have led to the development and use of the recombinant vaccine VVTGgRAB, which has been field-tested with very promising results (Brochier *et al.*, 1991). In the main, it seems that the political changes over recent years have done much to enhance international co-operation in the battle against rabies, and this, coupled with improved control measures, seems to be having a marked effect on the incidence of the disease.

It seems that many national badger populations in continental Europe decreased alarmingly during the early days of rabies control. Most are now said to be recovering and increasing, and in some areas may have regained their former levels. It is clear, however, that rabies and its control had a devastating effect on the badger populations of northern and central Europe during the last thirty years.

Less common diseases in which badgers have been implicated include trichinellosis and encephalitic distemper. Trichinellosis is caused by parasitic nematodes (*Trichinella* spp.), and has been reported in badgers from Italy, Slovenia and Yugoslavia. Badgers are not an important reservoir for the disease, red fox usually being considered more significant in disease transmission (Pozio, 1991). Encephalitic distemper is a highly contagious, acute viral infection (particularly for canids), and has been reported as a natural infection of badgers in both Germany and Slovenia (Geisel, 1989; Kryštufek, 1993). In Germany, fears have been expressed that badgers suffering distemper could infect hunting dogs, leading to outbreaks of the virus in kennels. In fact, both these conditions appear to be very minor concerns, and there is currently no justification for badger control in the management of either trichinellosis or encephalitic distemper.

### Road-traffic mortality

Sainsbury *et al.* (1995) estimate that road-kills lead to the deaths of between 100,000 - 1 million wild animals in Europe each year, a figure that, in our opinion, is probably rather conservative. Although rarely the subject of scientific study, large numbers of badgers are now known to be killed on the roads of Europe, and several British authors have reported high levels of road-traffic mortality in research populations (e.g. Gallagher & Nelson, 1979; Neal, 1986; Cheeseman *et al.*, 1989). Despite this, there is little reliable information on the magnitude of road-kill mortality. Harris *et al.* (1992) suggest that as many as 50,000 badgers are killed on the roads of Britain each year, roughly equivalent to 20% of the national population. In the Netherlands average annual road-traffic mortality accounts for 250-300 badgers, again almost 20% of the total population (Koenders, 1990; Lankester *et al.*, 1991), whilst Broekhuizen *et al.* (1994) point out that because of this, 10-11% of all Dutch badger litters will die underground because of the loss of their mothers. van der Zee *et al.* (1992) have found a strong correlation between road-kill levels and road development since the 1960s. Elsewhere in Europe, fewer data are available: a figure of c. 400 badgers/year has been reported from Austria (P. Lebersorger, pers. comm.), and Bourand (1989) collated data on almost 2,000 badger kills/year in France. Asferg *et al.* (1977) reported 200-300 road-kills/year

from Denmark, and this has since increased so that in 1991 alone the Danish Motorists' Club ("Falck") confirmed 3,600 badger road deaths (Aaris-Sørensen, 1995). No figures are available from other states, but the phenomenon of road-kills is said to be particularly significant in Sweden, Germany and Greece, and has been reported from almost every European country except Albania, where (as yet) motor vehicles are still comparatively few (Atkinson *et al.*, 1990). Even these sporadic data indicate *c.* 56,300 European road-deaths per year, whilst the Swedish Sportsmen's Association state that the annual national badger road-kill exceeds the game-bag, perhaps suggesting another *c.* 30,000 head/year at least). So, despite an apparent lack of data, there are clear indications that road-traffic mortality may be important in determining badger population viabilities, and at both the local and the metapopulation level.

Some of the basis of the problem lies in the behaviour of badgers themselves, as shown by an analysis of seasonal patterns of road-mortality in the UK (Davies *et al.*, 1987). Here (as in earlier studies) there is a bimodal pattern of mortality, showing pronounced peaks in spring and autumn. These are believed to reflect increased population mobilities associated with mating activity and dispersal. Although no bias towards males was reported in this particular study, other workers have observed inter-sexual effects, which are also known in other mustelids (e.g. Sleeman, 1989). It is well-known that badgers utilise well-defined "badger paths" to move from the sett to the feeding grounds (Neal, 1986). When badgers are active in the area of railways and roads, the potential for mortality increases. An infamous British example (cited by Harris *et al.*, 1990) is the death of over 100 badgers following the electrification of the railway line between Hastings and Tunbridge in 1986.

In recent years, the practices of translocating badgers from vulnerable areas to empty or artificial setts, and the building of exclusion fences or tunnels to prevent or divert animals from crossing roads, have become increasingly common. Badger tunnels have been built in the UK (Harris *et al.*, 1990), the Netherlands (Vereniging Das & Boom, 1990) and Flanders (Econnection, 1992), and consideration is being given to the problem in France (Bekker, 1992). Germany now provides road-crossing tunnels for otters (Streise & Schreyer, 1993), but to our knowledge, not for badgers. Many British Highways Departments are sympathetic to the problem of badger road-kills. According to Neal & Cheeseman (1996), between 1990 and 1994 the UK Department of Transport spent £5 million on reducing the harm caused to badgers by road-building schemes, mainly by placing badger tunnels under new roads. However, in some areas this goodwill has fatigued, as well-meaning, but ill-advised amateur conservation groups design and place the tunnel systems. A badger tunnel that is badly sited and lacks exclusion fencing will not be used. The result is continued road-kills, a waste of public money, and the disillusionment of the formerly sympathetic local authorities. In countries where the resources can be made available for badger road-traffic protection schemes, these must be carefully designed and sited, and undertaken by responsible, experienced and competent persons, and preferably placed within the framework of other conservation activities (as in the Netherlands).

## Landscape changes

Various studies (e.g. Anrys & Libois, 1983; Cresswell *et al.*, 1990; Smal, 1995a) emphasise the habitat preferences of badgers. Although the species is opportunistic, there are habitat classes (hedgerows and broad-leaf woodland) that are actively selected by badgers. On the other hand, improved, semi-improved, and arable grasslands are often selected against (Cresswell *et al.*, 1990). Thus, the preferred habitat classes are often those that are most threatened by the trend towards systems of high-intensity monoculture cropping and afforestation.

In the UK, Rackham (1986: 97) points out that more woodland has been lost since 1960 than during the preceding four centuries. Furthermore, predicted changes in rural land use over the next decades may involve substantial loss of preferred habitat, particularly through the uptake into production of marginal lowlands (Brown & Taylor, 1988), although this may be offset to some small extent by the "set-aside" scheme. Throughout the European Community, the operation of the Common Agricultural Policy (CAP) has encouraged the abandonment of long-established farming and forestry systems" in the "continuing drive to increased agricultural productivity associated with specialisation, intensification and structural change" (Baldock, 1990). Most important to wildlife (including badgers) is the abandonment of small-scale agriculture (based on arable, pastoral, perennial crop or balanced silvo-pastoral systems) coupled with the removal of hedgerows and small stands of woodland, to permit intensive, monoculture cropping. Coniferous afforestation is also widespread, and often receives aid in the form of state grants (as in parts of the UK). The result of coniferous afforestation is an environment that is hostile to badgers, in marked contrast to the natural coniferous forests of Scandinavia. Even in Scandinavia, however, Seiler *et al.* (1995) point out that continued landuse changes could lead to a reduction in badger numbers.

The effects of land-use changes on badgers have been documented in some few agricultural landscapes. Petukhov (1982) describes badgers inhabiting irrigation ditch embankments in areas under risiculture. Here, as a result of intense cultivation, the embankments of irrigation channels are the only suitable habitat remaining, resulting in crowding, and competition for setts both between badgers, and between badgers and other carnivores. In Essex in eastern England, Skinner *et al.* (1991a,b) demonstrate marked decreases in badger numbers since the 1960s. These changes are associated with the intensification of agriculture, coupled with pressure from house building and infrastructure development schemes. The Flemish conservation group Econnection (1992) have also pointed out that fragmentation of the range of Flemish badgers by agriculture and road building are a major obstacle to population recovery, and similar conclusions have been reached by workers in the Netherlands (Lankester *et al.*, 1991; van der Zee *et al.*, 1992). Harris *et al.* (1992) and Reason *et al.* (1993) estimate that the combination of past persecution and recent land-use changes, have acted together so that the British badger population is now some 30% lower than its potential level.

Few workers have attempted to access the effects of disturbance on badger setts. Palmer (cited by Neal & Cheesman, 1996: 92) found badgers to emerge later from a disturbed sett than from an undisturbed one. Similarly, Lindsay & Macdonald (1985) found sett blocking by fox hunts to have little direct effect on badgers, but suggest that in winter this could lead to nutritional stress if the time of emergence was delayed (but see also NFBG, 1990). Even though badgers often appear relatively tolerant of human disturbance, however, sometimes even quite modest levels can cause badgers to desert their setts. Jenkinson (1994) found the use of country footpaths by walkers to have no effect on sett sustainability, but the proximities of roads, housing, and the activities of children did.

Eastern Europe is less intensely affected by these changes, unfortunately these states have their own problems (IUCN East European Programme, 1991), the effects of which upon badgers can only be guessed at. Moreover, as state-owned forestry and agriculture are privatised, there are bound to be changes in the way in which they are operated, and some conflicts of interest between private, commercial land-use and conservation concerns are already reported.

## The effects of pollutants

A common cause of concern to lay people is the effect of pollutants such as agrochemicals on badgers. This is also an area in which there is little published research. Mustelids generally are susceptible to the bioaccumulation of (and subsequent mortality from) lipid-soluble compounds such as organochlorines and polychlorinated biphenyls (PCBs) (Hancox, 1991). The majority of studies thus far have featured species such as American mink, fisher, or American marten (Proulx *et al.*, 1987; Steves *et al.*, 1991). Of European forms, the polecat has been examined in the context of heavy metal and organochlorine accumulation (Mason & Weber, 1990) and there are several reports of the bioaccumulation of heavy metals, PCBs and organochlorines in otters (Jefferies, 1984, 1986; Strachan & Jefferies, 1996).

Badgers seem to be largely at risk from the pollutants taken up and bioaccumulated in the tissues of their prey, particularly earthworms. Morbidity and some subsequent mortality from the bioaccumulation of organochlorine compounds has been reported by Jefferies (1969) and Keij *et al.* (1972), although there has been little subsequent work. The bioaccumulation of heavy metals, again presumably through feeding on contaminated earthworms, has been discussed by Ma & Broekhuizen (1989), although no deaths were reported. There are also reports of secondary poisoning of badgers through the ingestion of prey or carrion contaminated with rodenticides such as thallium sulphate (Munch *et al.*, 1974) and warfarin (Kelshaw, undated).

In the case of many agrochemicals it is often extremely difficult to discriminate between poisoning that had occurred through the accumulation of residual compounds in the diet, and deliberate poisoning through the abuse of such compounds. Agrochemicals are sometimes administered in contaminated baits to control predators, although obviously these may also be taken by a wide range of non-target species (e.g. Cadbury, 1991). In the UK, MAFF's Wildlife Incident Investigative Scheme investigated 102 reports of the poisoning of badgers between 1991 and 1993, with pesticide poisoning being confirmed in 17 of these, as well as several instances of illegal gassing (Fletcher *et al.*, 1994).

## Badgers as a source of commodities

The use of the badger as a commodity species has been discussed by Griffiths (1993b), although nowadays it usually represents the last vestiges of fading rural or ethnic cultures. There are a wide range of folk traditions involving the use of various badger parts, although these seem to have died out universally. In many rural communities (e.g. in the Low Countries, the Baltic States, and the Balkans) badger fat and grease are used in folk medicine, and the fat is believed to be efficacious against skin problems, chest infections and rheumatic pains. There are reports that badger fat is still used in the Irish Republic as a medicament for sprains in racehorses, and in the Czech and Slovak Republics badger fat still commands quite high prices (c. 500 koruna/kg). van Wijngaarden & van de Peppel (1964) noted the open (if illegal) sale of badger fat in the southern Netherlands as recently as the 1950s. Badger fat was also sometimes used for water-proofing shoes.

Badgers were once eaten quite widely, and are still considered edible in many localities, including Tuscany, Slovenia, Yugoslavia, and the Czech and Slovak Republics. A distinction is often made between the edible pig badger (which is fat) and the inedible dog badger (which is lean). The biological basis of these distinctions are uncertain, although they are mentioned in hunting books from the Fifteenth Century. In the Slovak Republic, the roasted skin of badgers is considered a delicacy somewhat akin to the British "pork crackling".

The final commodity for which badgers are known is hair and pelts. Badger hair is famous for its use in shaving brushes, and some states still purchase badger hair for export, although most badger hair brushes now come from China. The hair can also be woven, and is occasionally made into cloth in some rural areas. Badger pelts are of poor quality and texture when compared to those of other mustelids, but are warm and hard-wearing. They can be used for making carpets and rugs, and also for bags such as hunting bags and rucksacks (as can badger leather). There does not appear to be a large industry in badger pelts from Europe, and the majority of the world's production derives from the North American badger (Gill, 1990).

### Illegal "sports": badger baiting

Although a very minor contributor to population attrition, the "sport" of badger baiting deserves mention, if only to demonstrate the mindless cruelty with which some people, even today, persist in treating animals. It is worth pointing out that there has been some confusion between "badger baiting" and "den hunting" in some European works. Badger baiting, as practised in the British Isles, is in no way related to any form of hunting as practised in Europe today.

Historically, badgers were involved in several village sports: Brusewitz (1969) cites both badger coursing and badger baiting. Badger coursing seems to have been popular in some areas of central Europe in the last century, but has been illegal for many years, and we are aware of no modern accounts of the sport. This is regrettably not the case for the Medieval pastime of badger baiting. Badger baiting now seems to be an exclusively British phenomenon, and we are not aware of authenticated, modern reports from states other than the UK and Ireland, although baiting certainly did occur in the Netherlands in the 1950s (van Wijngaarden & van de Peppel, 1964). Although badger baiting probably once took place in many (or even most) parts of Europe, it is now universally illegal.

In badger baiting, an imprisoned badger (sometimes held in a barrel or a pit, or restrained by a nail through its tail) was fought against the villagers' dogs for a small prize (van Wijngaarden & van de Peppel, 1964). Sparrow (1961), drawing on "*Alken's National Sports of Great Britain*" published in 1825, gives a short, historical account of badger baiting, whilst photographs of a modern badger baiting contest are provided by Mayer (1986).

There are no data available on how many badgers are baited in Britain or Ireland, but there are police prosecutions for badger baiting in most years in Britain. Animal welfare sources such as the Royal and Ulster Societies for the Prevention of Cruelty to Animals (RSPCA and USPCA) contend that such practices are often linked to the rising popularity in urban areas of dog-fighting and other conflict-based sports. There certainly are known instances in which people have been prosecuted by the police for capturing badgers for sale to dog-fighting teams. The continuation of baiting is one of the main reasons for the badger's protected status in the UK. It is obvious that the continued occurrence of badger baiting is an affront to all the values of modern society.

## BADGER POPULATION BIOLOGY: A BRIEF REVIEW

### Population models

Badger population dynamics have been reviewed in detail by Anderson & Trehalla (1985). In general, badgers have the potential to increase naturally at a rate of about 70% per year, but of this 50% is accounted for by natural mortality. The residual 20% represents the potential rate of annual badger increase. This figure is considered to be labile, the authors stating that cooler climates would favour lower potentials for increase (perhaps only 16%). Lankester *et al.* (1991) have proposed a population model showing that, in terms of conservation and management, mortality acting upon adults is likely to have the greatest effect upon both badger population persistence and dispersal, at both the levels of the clan and the metapopulation.

### Causes of natural mortality

Outside the context of studies of rabies and bovine tuberculosis, there is surprisingly little information available on causes and patterns of natural mortality in badgers. Badgers are certainly host to a variety of parasites and pathogens (Hancox, 1980) and many of these can cause morbidity and/or mortality under certain circumstances. Of 1,206 badgers autopsied by the British MAFF, these included 70 cases of presumed "natural death" (Gallagher & Nelson, 1977). Here high levels of mortality through infected bites were recorded, as well as other conditions including starvation (both in very young and very old badgers), pyometritis, enteritis, polyarthritis, arteriosclerosis, respiratory infections, nephritis and lymphosarcoma. Various other pathologies have also been reported.

As in other mammals, it is probable that mortality acts most strongly upon the very young, although this can be difficult to verify in badgers as the cubs remain below ground for the first two months of life. Cresswell *et al.* (1993) have shown cub mortality to be very high, both through natural causes, and through presumed cannibalism and infanticide (see also Lüps & Roper, 1990), and Harris *et al.* (1992) suggest that 37.5% of badger cubs die before emerging from the sett. Similarly, in a Swiss study of 200 sows, Wandeler & Graaf (1982) found many to have fresh placental scars, but no signs of lactation, indicating the loss of neonates or cubs.

### Density dependence and habitat colonisation

Whether density-dependent regulation occurs in badgers remains the source of some debate. There is some evidence of density-dependent regulation from a recolonisation study which suggests that badger reproductive rates may increase during phases of range expansion or re-colonisation via social changes engendered by reduced population densities (Cheeseman *et al.*, 1993). The badger is not usually regarded as an invasive species, having been termed "contractionist" by Kruuk & Macdonald (1984), *i.e.* they "maintain the smallest economically defensible area, living in larger groups if resources within the area will allow". Traditional understanding is that badger populations develop slowly, and have a limited capacity to colonise new ranges. The rapidity of European post-rabies population recoveries do seem to challenge this view, and the Norwegian experience of the badger seems directly contrary to it. Badgers were almost absent from central Norway before the 1939-1945 war, but have now colonised the entire area and are occasionally reported within the Arctic Circle (Bevanger, 1985). This range expansion has been coupled with the active colonisation of urban areas such as Trondheim (Bevanger, 1990). Cheeseman *et al.* (1993) suggest that during

recolonisation, vacant territories do not seem to be filled by the range expansion of adjacent clans. Sleeman (1992) suggests that long-range movements by badgers may be most likely when social systems are unstable or disrupted. Thus, it is possible that the colonisation of new territories occurs through gradual recruitment from neighbouring clans, coupled with the influx of animals living outside the confines of the established clan system (see Kruuk, 1989). Harris *et al.* (1992) found no significant differences between the reproductive outputs of females from different ecological classes or different types of badger sett, but do report significant differences between females from different classes of "annexe" setts, caused by younger females breeding. Thus, although there were no differences in the numbers of placental scars between the two groups, "annexe setts are correlated with increased reproductive output by the social group" (see also Cresswell *et al.*, 1993). Anderson & Trehwella's (1985) population model suggests that badgers should be able to recolonise habitats from which they have been lost within a period of about five years. There is little doubt that badgers can (and do) recolonise such habitats (where possible), but Cheeseman *et al.* (1993) have shown that the five-year threshold is unlikely under natural conditions. A study of the dynamics of the badgers of either central Norway or Sweden would be most interesting; here reproductive rates are supposed to be lower because of the climate, but the species is apparently undergoing active expansion. The Swedish badgers studied by Ahnlund (1980) failed to show any unusual trends, although there was no attempt to follow this work over a period of several years.

Anderson & Trehwella's (1985) model does predict some cycling of populations, particularly at the level of cub production. Long-term field studies show little evidence for this (C. Cheeseman, pers. comm.). Perhaps this is not overly surprising as badgers have little dietary dependence upon those rodent and game-bird species which themselves exhibit marked population cycling. However, long-term studies of badger population dynamics have only been undertaken in high density areas in south-western England (Harris & Cresswell, 1987; Cheeseman *et al.*, 1987). The behaviour of badgers at low densities is very poorly known and may be different, as appears to be the case for social organisation (Kruuk, 1989).

There are few data that deal with the adaptability of badgers to changes in their environment, although some studies suggest that they are not as ecologically conservative as is sometimes thought. In northern Europe, badgers are classically regarded as an earthworm specialist (e.g. Skoog, 1970; Kruuk & Parish, 1981) although it is acknowledged that they are also opportunistic. Urban badgers have been shown to take a wide range of foodstuffs, including market garden produce and human refuse (Harris, 1984). The badgers of Monte Baldo in Italy, studied by Kruuk and De Kock (1981), fed largely on cultivated olives, whilst badgers living in the xeric environments of Italy and southern Spain (where earthworms are scarce) may eat large amounts of fruit, arthropods, or young rabbits (Ciampalini & Lovari, 1985; Rodriguez & Delibes, 1992; Martín *et al.*, 1995). Kruuk (1989) has shown that the traditional badger clan system can break down in non-productive environments, where animals lead largely solitary lives. Changes in social structure in response to environmental conditions are known from other mustelids; the territoriality of pine martens breaks down in Finland in winter, and animals forage in small groups, the high cost of defending territories precluding a solitary existence (Sleeman, 1989). The issue of behavioural plasticity in badgers is largely unresearched at present, but the indications are that badger ecology may not be as stereotyped as currently believed.



### SECTION 3: CONCLUSIONS

The data available at this time do not evoke a great deal of concern for the status of the badger in Europe as a whole, although there are several states where the status of the species requires continued and robust legal protection. In several other states continued or enhanced population monitoring seems advisable. Overall, the data currently available suggest the following:

#### Conservation-based recommendations

1. Badgers are almost certainly decreasing in Albania, Vojvodina (northern Serbia), and possibly Bosnia and Croatia. Badgers are protected in Albania, but not in Bosnia, Croatia or Serbia. Here protection pending clarification would seem wise. No improvement seems possible in Bosnia for the foreseeable future, and Albania has very real problems with the enforcement of wildlife law, and also severe conflicts of interest arising from a desperate need for foreign currency. The latter has led to a recent influx of tourist "hunters" from other states, who show little respect for either Albania's laws or wildlife. This is said to have already badly affected some populations of rare species (F. Bego, pers. comm.).
2. National badger densities are very low ( $<0.1$  badger/km<sup>2</sup>) in the Netherlands, Belgium, Poland, Estonia and Vojvodina (Serbia). All these states (except Poland and Serbia) already protect their badger populations, and continued protection seems advisable, particularly in the Netherlands. The situation in Poland is less clear, and it is possible that badger densities have been under-estimated, although further study and population monitoring are recommended. Vojvodina has only introduced a closed season comparatively recently, and further vigilance seems appropriate.
3. Badger populations appear to be approximately stable in the UK, the Irish Republic, Belgium, the Netherlands, Bulgaria and Finland. Badgers are fully protected in all these states with the exception of Bulgaria and Finland. It is suggested that protection continues in all these states, and that vigilance is required in both Finland and Bulgaria. In addition, a fully-implemented closed season for badgers seems wise in both. Despite the data discussed here, there is reason to believe that the badger population of the UK is not as healthy as it may seem, and increased vigilance is required, coupled with considerably better enforcement of conservation legislation, and efforts at the reduction of road-traffic mortality.
4. Overall badger densities seem moderate (between 0.1 and 0.99 badgers/km<sup>2</sup>) throughout most of central and eastern Europe: France, Switzerland, Austria, Germany, Denmark, Norway, Lithuania, the Czech Republic, Slovenia, the Slovak Republic, Hungary, Luxembourg, Romania and Bulgaria. All these states (except Hungary and Luxembourg) permit hunting during an open season, but Hungary and Luxembourg are said to be reconsidering protected status for the badger. Little comment can be made on any of these states, although badger densities are said to be increasing in Lithuania, and may also be increasing in many other countries. Better provisions against poaching and road-traffic are recommended in all, as is the formal compilation of game-bag statistics in states where this is not already undertaken (see also management recommendations).
5. Badger densities can not be assessed (even approximately) in Belarus, "the former Yugoslav Republic of Macedonia", Norway, Turkey, Greece, Italy, Spain or Portugal. Directional population trends are uncertain in the case of Belarus, Turkey, Greece, Italy, Spain and Portugal. There is, however, good evidence for believing that badger numbers are increasing

in Norway. Of the remaining states, only Turkey and "the former Yugoslav Republic of Macedonia" do not accord full protection to the species. Further research is recommended in all these countries, with the exception of Norway, which already has a badger research programme.

6. A reappraisal of the status of the Cretan and Rhodian subspecies *M. m. arcalus* and *M. m. rhodius* should be undertaken immediately. If these taxa do genuinely represent endemic island subspecies, every attempt should be made to ensure population security. In the case of the Cretan population, this seems to be matter of some urgency. Funds should be made available for genetic and morphometric study of these two populations, and field studies instigated.

#### Management-based recommendations

1. Properly regulated, ethical hunting, in accordance with the principle of "wise use", should not threaten harvested populations. Currently, very few countries that permit the hunting of badgers operate a robust game management policy towards the species. In such circumstances hunting losses, coupled with other non-natural causes of mortality (e.g. poisoning, destruction of setts in civil engineering, road casualties, etc.) simply add to the burden placed upon populations. It is difficult to make definitive statements, although badger populations in some states (e.g. Albania and Bulgaria) have probably been over-exploited.

2. Over the last few decades one of the major causes of badger population declines in continental Europe has been the action of the rabies virus, coupled with attempts at rabies control. As the red fox is the main reservoir of the disease, fox vaccination programmes using attenuated and recombinant vaccines should lead to greatly improved disease management. The current political situation is particularly auspicious for improved international co-operation in the implementation of co-ordinated control programmes. Some badger protection legislation stems from the era of badger population decreases at the peak of the rabies epizootic. Since this time many populations have shown signs of recovery, and thus the status of the species has improved throughout much of central Europe. Eradication of rabies will also reduce the killing of badgers from fear of the disease. The potency of the fear of rabies was recently illustrated by hysterical articles in British newspapers after two women were bitten by a rabid Daubenton's bat (see Schoon, 1996).

3. The UK and Ireland continue to attempt to control bovine TB by killing badgers, despite appearing to achieve a conspicuous lack of success. It is debatable whether badger culling does any good, and it should not be undertaken unless the disease persists despite properly implemented bovine-based control measures. The blanket removal of badgers should not be undertaken. The early stages of the UK's TB control programme cost between £10.5m and £12.5m, to accrue benefits estimated at between £1.4m and £1.8m (O'Connor & O'Malley, 1989). In the context of Stern's (1973) economic injury thresholds, costings such as these strongly argue against badger control, not for it.

4. At present there is no evidence at all to suggest that badgers should be culled in the control of either trichinellosis or encephalitic distemper.

5. In terms of the actual value and extent of the damage caused by badger, there is usually little justification for regarding badgers as significant agricultural pests, except under certain circumstances. States that still regard badgers as a pest should redefine the species as small game.

6. There are few indications that badgers do genuinely represent a significant threat to ground-nesting game-birds, or that badgers are a significant predator of their eggs. Where conflicts do occur, badger activities often can be curtailed without recourse to culling.

7. All countries that permit the hunting of badgers should make every attempt to protect their badger stocks. This must include the collation of accurate game-bag data, and ideally also data on hunter effort. Even if overall badger population monitoring is not plausible (as in most states), determining catch/unit effort is generally feasible, and would allow a reliable assessment of population status, and the application of appropriate game management strategies. The value of game-bag data is considerably enhanced if given context (see Myrberget, 1988). This may be achieved either by a licensing scheme, or quota allocations. Some states already monitor hunter interest in badgers in this way (e.g. Czech Republic, Turkey) and this seems to be both the easiest and cheapest method of instilling a robust strategy for badger population management. Furthermore, as road-traffic accidents represent a major source of mortality for some badger populations, the collection of quantitative data on road-kills may be useful in the formulation of management policy in some areas. In Nordrhein-Westfalen, data on the number of game animals killed in traffic accidents have been successfully collected through the co-operation of the police and national motorists' and hunters' associations (Hartwig, 1991; Spittler, 1992; Aaris-Sørensen, 1995).

8. Although the current authors have no wish to encourage trade in furs, it is recognised that ethnic hunting for furs is important in some rural economies. We accept the contention by Stubbe *et al.* (1993) that the legislations of some countries (e.g. Germany) prohibit the hunting of badgers during the season when the pelt is mature, although to do otherwise would not overlap with the cubbing season. This situation provides an incentive for illegal pelt-hunting.

9. Compensation is paid by several governments (notably that of the Netherlands) to those persons suffering damage from the actions of badgers. States that genuinely wish to protect the species must make such funds available for the legislation to be effective; not to do so is simply a means of encouraging illegal pest control. Some states have legislation whereby hunters must pay compensation for crop damage caused by game, and this has a similar effect. State agencies would seem the most appropriate source of such payments.

10. With the exception of their listing in Appendix III of the Bern Convention (Council of Europe, 1979) badgers are not currently a component of any international treaty or legislation (Reid, 1994). It may be that they should at least be considered for inclusion in EC habitat and fauna directives.

11. In countries where badgers are protected, and attract the attention of local badger protection groups, the activities of such groups should be properly co-ordinated, preferably by a state-sponsored NGO. This would provide continuity in conservation efforts, guidance in areas where there are conflicts of interest, and ensure the availability of expertise to a high standard. The Dutch group Vereniging Das & Boom provides an excellent example of a badger NGO operating within a framework agreed at a national level between all relevant parties.

12. Hunting by use of gas, poisons, spring-jawed traps and unstoppered snares, are generally forbidden under the Bern Convention, and signatory countries are bound to enforce these proscriptions. Apart from humanitarian objections, the mere fact that snares are non-selective argues against their use in efficiently managed hunting. Of those hunting methods commonly in use, hunting by rifle is the most desirable. Hunting by digging into setts, often structures of great complexity and age (Roper, 1992), not only adversely effects badgers, but also a variety of cohabiting species, and should be forbidden.

13. Although already a component of most national game-management policies, females should be protected throughout the whole of the breeding season (including the whole of the period of lactation). As the breeding season of the badger may differ slightly across the area of Europe, hunting states must ascertain the duration of the breeding season of their national populations. As it is impossible to identify breeding females by eye, badgers should not be shot during the breeding season.

14. Badgers have a slow reproductive rate and are slow to recolonise areas from which they have been removed. Although there is some evidence that badgers may be able to increase their reproductive output under some circumstances, there is a very strong case for careful monitoring of population densities. There is a genuine need for a full appreciation of how badger populations operate, including the study of badger population dynamics at low densities and in situations where populations appear to be expanding (e.g. central Norway and Sweden).

15. Perinatal cub mortality in badgers appears to be high (Hancox, 1980; Wandeler & Graf, 1982; Harris *et al.* 1992; Cresswell *et al.*, 1993). Cub-hunting must interfere with population recruitment, which may be undesirable in a species with as slow a reproductive rate as the badger. At present there is little or no information on which badger age-classes are affected by hunting. It would be possible to institute skull collections from hunters, allowing the compilation of more precise hunting mortality statistics. Despite the wide range of techniques available for ageing badgers and other mustelids (Hancox, 1988a,b; Poole *et al.*, 1994) many are inappropriate for this type of exercise, for example, the baculum is present only in males, provides no data on adult ages, and its morphology can be affected by disease (see Whelton & Power, 1993). As a result, skulls still provide the best solution to this problem.

16. Badgers are subject to intense levels of mortality in some areas from the action of road-traffic. This level of mortality must be taken into account in badger management programmes.

17. Even the best wildlife management strategies are of little use if they can not be implemented on the ground. There is widespread abuse of both hunting and conservation laws with respect to the badger, and illegal hunting and pest control is reported from almost every European state. The only possible answer to such problems is the rigorous enforcement of legislation that is relevant to the species. This includes the provision (and proper enforcement!) of penalties for breaches of hunting or conservation laws. This would be of general benefit, both to wildlife and the environment as a whole.

18. In areas where humans and badgers are in conflict, it is now appreciated that there are often humane solutions to the problem other than killing the badgers. Recent improvements in welfare-based approaches to badger management involve the development of traffic protection schemes, translocation of problem badgers, and the provision of artificial setts (see Harris *et al.*, 1990). All animals, even those that must be killed, should be treated both humanely and with respect.

19. Where badger extermination is unavoidable in the control of damage or disease, animals should be cage-trapped (if possible) and then humanely destroyed. The methods of choice for destruction are high-velocity rifle or shotgun of appropriate bore. Gassing is inhumane, environmentally damaging, and sometimes dangerous to human operators, thus its use in the field must be avoided. The use of tunnel dogs such as terriers within the confines of the sett (which is illegal in many countries) can not be regarded as either efficient or humane, and is a sport, not an accredited form of pest control.

20. In countries where badger population numbers or densities are low, badgers should be considered during urban and rural planning. As badgers are generally inhabitants of "old" parts of the countryside (hedgerows, broad-leaf woodlands, etc.) they may be considered as indicators of such in many parts of Europe. Such consideration will also benefit other aspects of wildlife and habitat conservation.

21. Despite a large scientific literature (see Vink, 1993) there is surprisingly little known about many aspects of badger biology, and there remains a need for further badger research. This should focus on population biology, sub-specific systematics, the patterns and magnitude of road-traffic casualties, and the effects of land-use changes on population genetics. The advent of PCR-based molecular biological techniques (see Schön & Griffiths, 1996) provides many new possibilities, such as the quantification of gene exchange in anthropogenically isolated subpopulations (Schön, 1993).

## ACKNOWLEDGEMENTS

It is a great pleasure to thank the many people who have so kindly provided information for use in this study. Although space does not permit individual acknowledgement here, a full list of our correspondents is given in Appendix 1. In addition, we have pleasure in expressing our particular thanks to Dr. Boris Kryštufek of the Slovene Museum of Natural History in Ljubljana, who went to very great efforts to help us obtain data from the republics of the former Yugoslavia, to Mr. H. Vink who provided a great deal of difficult and obscure literature, and Prof. Dr. M. Stubbe, Dr. V. Sidorovich, Dr. P. Sleeman, Dr. C. Smal, Drs. P. Koenders, Dr. J. Lynch and Mr. F. Bego who provided unpublished data. Dr. Y. Lecocq (FACE) corrected many misconceptions, whilst Mrs. K. Murray, Dr. B. Kryštufek, Dr. B. Lynard, Dr. T. Namiotko, Miss. M. Lako, and Dr. H. van Rompaey provided translations. Virtually all the rabies data cited in this report derive from Rabies Bulletin Europe, a periodical compiled and published by the WHO Collaborating Centre for Rabies Surveillance & Research at Tübingen. We are most grateful to Dr. W.W. Müller for providing copies of this publication. Similar thanks are due to Deutscher Jagdschutz-Verband, whose Handbuch Jagd is the source of much of the game-bag data cited here. HIG would like to thank colleagues in the IUCN Small Carnivore Specialist Group for their help and encouragement.

We further gratefully acknowledge the contributions made by those who made comment on accounts made in the original discussion document (Griffiths *et al.*, 1993), particularly P. Koenders, M. Montizaan, H. Smulders, J.W. Snee, J. Vink and J. Wiertz (the Netherlands) and S. Havu and C. Krogell (Department of Fisheries and Game, Ministry of Agriculture and Forestry, Finland).

Mr. E. Fernández-Galiano (COE, Strasbourg) was the impetus behind the writing of this report, which would not have been completed without his encouragement.

## REFERENCES

- Aaris-Sørensen, J. (1987). Past and present distributions of badgers *Meles meles* in the Copenhagen area. *Biological Conservation*, **41**: 159-165.
- Aaris-Sørensen, J. (1992). *Grævlinger i Danmark - en håndbog*. Frederiksberg; Foreningen til Dyrenes Beskyttelse i Danmark.
- Aaris-Sørensen, J. (1995). Road-kills of badgers (*Meles meles*) in Denmark. *Annales Zoologici Fennici*, **32**: 31-36.
- Adamakopolous, P., Adamakopolous, T., Bousbouras, D., Giannatos, G., Hatzirvassanis, V., Ioannidis, Y., Papaioannou, D.H. & Sfougaris, A. (1991). Les grandes mammifères de Grèce (Carnivores et Artiodactyles): situation actuelle, répartitions, habitat - les espèces menacées, perspectives de protection. *Biologia Gallo-hellenica*, **18**: 107-126.
- Ahnlund, H. (1980). Sexual maturity and breeding season of the badger, *Meles meles* in Sweden. *Journal of Zoology (London)*, **190**: 77-95.
- Albanese, F. (1991). Quel rôle pour la chasse? L'action du Conseil de l'Europe pour un chasse compatible avec les exigences de la conservation de la nature. In Y. Lecocq (Ed.) *Wildlife Management in the Community. The Future of Fieldsports*: 66-76. Brussels; Fédération des Associations de Chasseurs de la CEE.
- Andera, M. (1979). Soucasny stav rozšírení jezevce lesního (*Meles meles*) v českých zemích (Mammalia; Mustelidae). *Acta Scientiarum Naturalium Musei Bohemoslov meridionalis Ceskych Budejovicich*, **19**: 17-30.
- Andera, M. & Cervený, J. (1994). Atlas of distribution of the mammals of the Šumava Mts region (SW-Bohemia). *Acta Scientiarum Naturalium Academiae Scientiarum Bohemicae Brno (N.S.)*, **28** (2-3): 1-111.
- Anderson, R.M. & Trewhella, W. (1985). Population dynamics of the badger (*Meles meles*) and the epidemiology of bovine tuberculosis (*Mycobacterium bovis*). *Philosophical Transactions of the Royal Society of London (Series B)*, **310**: 327-381.
- Anon. (1990). Hungary. In IUCN East European Programme (Eds.) *Environmental Status Reports; 1988/1989, Volume 1*: 59-98. Cambridge; International Union for the Conservation of Nature and Natural Resources.
- Anon. (1991). Carnivores in danger in Finland. *Oryx*, **25**: 66.
- Anon. (1992). Rabies case data from Europe. *Rabies Bulletin Europe*, **16** (4): 20-42.
- Anon. (2) (1992). War wrecks Croatian parks. *Oryx*, **26**: 9.
- Anrys, P. & Libois, R.M. (1983). Choix de l'habitat chez le Blaireau européen (*Meles meles*) en Belgique. *Cahiers d'Ethologie appliquée*, **3**: 15-38.
- Arnold, H.R. (1993). *Atlas of Mammals in Britain*. (Institute of Terrestrial Ecology Research Publication no. 6). London; Her Majesty's Stationery Office.
- Asferg, T. (1984). Jagtudbyttet er indirekte mål for antallet af dyr. *Dansk Vildforskning*, **14**: 385-413.
- Asferg, T., Jeppsen, J.L. & Aaris-Sørensen, J. (1977). Graevlingen (*Meles meles*) og graevlingejakten i Danmark 1972/1973. *Danske Viltundersøgelser*, **28**: 1-56.
- Atkinson, R.I., Bouvier, M., Hall, D. & Prigoni, C. (1991). Albania. In IUCN East European Programme (Eds.) *Environmental Status Reports; 1990, Volume 2*: 3-38. Cambridge; International Union for the Conservation of Nature & Natural Resources.
- Aune, O.A. & Myrberget, S. (1969). Grevlingens, *Meles meles*, nåvaerende utbredelse i Norge. *Fauna (Oslo)*, **22**: 27-33.
- Baldock, D. (1990). *Agriculture and Habitat Change in Europe (WWF International CAP Discussion Paper No 3)*. Gland; Worldwide Fund for Nature.
- Baranauskas, K. (1992). Changes in the occupation of badger setts in the environs of Vilnius within the last decade. *Small Carnivore Conservation*, **6**: 4.
- Baryshnikov, G. F. & Potapova, O.R. (1990). [Variability of the dental system in badgers (*Meles*, Carnivora) in the USSR fauna]. *Zoologicheskii Zhurnal*, **69**: 84-97.

- Baudin, B., Brochier, R., Paquot, A., Libois, R., Ryelandt, D., Thomas I. & Pastoret, P.-P. (1989). Évolution des populations de blaireaux (*Meles meles*) dans le Province de Luxembourg au cours de la période 1986-1988. *Cahiers d'Ethologie appliquée*, **9**: 31-40.
- Bego, F. (1992). *Data on the distribution of Albanian Mammals*. (Transcript of paper presented at the Second International Seminar of the European Mammal Mapping Scheme, Vienna, January, 1992). (Unpublished manuscript).
- Bekker, G.J.H. (1991). Badgers and highways. In M. Barnard (Ed.), *Routes et Faune sauvage: Actes du Colloque*: 351-352. Strasbourg; Council of Europe.
- Bevanger, K. (1985). Utvikling av grevlingbestanden og utbredelse i Norge. *Fauna (Oslo)*, **38**: 120-131.
- Bevanger, K. (1990). Grevling som konfliktfaktor i et urbant miljø. *Norsk Institutt for Naturforskning Forskningsrapport*, **011**: 1-22.
- Bevanger, K. & Lindström, E. (1995). Distributional history of the European badger *Meles meles* in Scandinavia during the 20th century. *Annales Zoologici Fennici*, **32**: 5-9.
- Bonnin-Laffarge, M. (1964). *Contribution à l'Étude de l'Histopathologie de l'Appareil génital femelle du Blaireau européen (Meles meles L.)*. Unpublished PhD thesis. Bordeaux; Université de Bordeaux.
- Bourand, M. (1989). *Le Blaireau (Meles meles)*. C.S.T.C. Thesis. Nivernais-Morvan; Syndicat des Chasseurs de France/Union nationale des Fédérations de Chasseurs.
- Brochier, B., Kieny, M.P., Costy, F., Coppens, P., Baudin, B., Lecocq, J.P., Languet, B., Chappuis, G., Desmettre, P., Afiademayo, K., Libois, R. & Pastoret, P.-P. (1991). Large-scale eradication of rabies using recombinant *vaccinia*-rabies vaccine. *Nature (London)*, **354**: 52-522.
- Broekhuizen, S., Müskens, G.J.D.M. & Sandifort, K. (1994). *Invloed van sterfte verkeer op de voortplanting bij dassen. (IBN-rapport 055)*. Wageningen; Instituut voor Bos- en Natuuronderzoek.
- Brown, D.A.H. & Taylor, K. (1988). The future of Britain's rural land. *Geographical Journal*, **154**: 406-411.
- Brusewitz, G. (1969). *Hunting*. New York; Stein & Day.
- Cadbury, J. (1991). *Persecution. Birds of Prey and Owls Killed in the UK, 1979-1989*. Sandy (Beds.); Royal Society for the Protection of Birds.
- Cassola, F. (1991). L'ultimo "nocivo". La volpe nella legislazione Italiana e nella pratica venatoria. *Hystrix (n.s.)*, **3**: 247-252.
- Chambre, D. (1988). *Le Blaireau européen dans le Département du Rhône. Étude des Populations, des Degâts et des Prélèvements*. CSTC Thesis. Vendonne; Syndicat des Chasseurs de France/Union nationale des Fédérations des Chasseurs.
- Cheeseman, C.L., Wilesmith, J.W., Ryan, J. & Mallison, P.J. (1987). Badger population dynamics in a high-density area. *Symposia of the Zoological Society of London*, **58**: 279-294.
- Cheeseman, C.L., Wilesmith, J.W., Stuart, F.A. & Mallinson, P. (1988). Dynamics of tuberculosis in a naturally infected badger population. *Mammal Review*, **18**: 61-72.
- Cheeseman, C.L., Wilesmith, J.W. & Stuart, F.A. (1989). Tuberculosis: the disease and its epidemiology in the badger. *Epidemiology and Infection*, **103**: 113-125.
- Cheeseman, C.L., Mallinson, P.J., Ryan, J. & Wilesmith, J.W. (1993). Recolonisation by badgers in Gloucestershire. In T. Hayden (Ed.) *The Badger*: 78-93. Dublin; Royal Irish Academy.
- Chelyan, G. (1991). Patterns of Pleistocene turnover, current distribution and speciation among Mediterranean mammals. In R.H. Groves & F. di Castri (Ed.) *Biogeography of Mediterranean Invasions*: 227-262. Cambridge; Cambridge University Press.
- Ciampilini, B. & Lovari, S. (1985). Food habits and trophic niche overlap of the badger (*Meles meles* L.) and the red fox (*Vulpes vulpes* L.) in a Mediterranean coastal habitat. *Zeitschrift für Säugetierkunde*, **50**: 226-234.
- Civardi, A. (1991). Esperienze Italiane di immunizzazione orale delle volpi contro la rabbia: validità del metodo e risultati ottenuti. *Hystrix (n.s.)*, **3**: 159-165.



- Clements, D.K. (1992). Brock's defence - a brief examination of the law relating to badgers. *British Wildlife*, **3**: 193-199.
- Clements, E.D., Neal, E.G. & Yalden D.W. (1988). The national badger sett survey. *Mammal Review*, **18**: 1-10.
- Cox, P. (1993). *Badgers on Site. A Guide for Developers and Planners*. Reading; Berkshire County Council (Department of Highways and Planning).
- Council of Europe (1979). Convention on the conservation of European wildlife and natural habitats. *European Treaty Series*, **104**: 1-27.
- Cresswell, P., Harris, S., Bunce, R.G.H. & Jefferies, D. (1989). The badger *Meles meles* in Britain: present status and future population changes. *Biological Journal of the Linnean Society*, **38**: 91-101.
- Cresswell, P., Harris, S. & Jefferies, D. (1990). *The History, Distribution, Status and Habitat Requirements of the Badger in Britain*. Peterborough; Nature Conservancy Council.
- Cresswell, P., Harris, S., Cheeseman, C.L. & Mallinson, P.J. (1993). To breed or not to breed: an analysis of the social and density-dependent constraints on the fecundity of female badgers (*Meles meles*). *Philosophical Transactions of the Royal Society of London (Series B)*, **338**: 393-407.
- Davies, J.M., Roper, T.J. & Shepardson, D.K. (1987). Seasonal distribution of road kills in the European badger (*Meles meles*). *Journal of Zoology (London)*, **211**: 525-529.
- Deutscher Jagdschutz-Verband (1984). *DJV Handbuch Jagd 1984*. Mainz; Verlag Dieter Hoffmann.
- Deutscher Jagdschutz-Verband (1993). *DJV Handbuch Jagd 1993*. Mainz; Verlag Dieter Hoffmann.
- Dirkmaat, J.J. (1988). *De Das in Nederland*. Hogezaand; Uitgeverij Stubeg bv.
- Dranseika, A. (1992). Lithuania. *Rabies Bulletin Europe*, **16** (4): 11.
- Econnection (1992). *De Versspreiding van de Das (Meles meles) in Vlaanderen. Rapport 1: Knelpunten en Ontikkelingsmogelijkheden*. Schorisse-Maarkedal; Econnection.
- Etemad, E. (1980?). *The Mammals of Iran, Vol. 2*. Tehran; Department of the Environment.
- Ewer, R.F. (1973). *The Carnivores*. London; Weidenfeld & Nicholson.
- Fletcher, M.K., Hunter, K. & Barnett, E.A. (1994). *Pesticide Poisoning of Animals 1993: Investigations of Suspected Incidents in the United Kingdom (Environmental Panel Report)*. London; MAFF (cited by Neal & Cheeseman, 1996).
- Gallagher, J. & Nelson, J. (1977). Cause of ill health and natural death in badgers in Gloucestershire. *Veterinary Record*, **15**: 546-555.
- Geisel, O. (1989). Staupe bei hunde and wildtieren. *Die Pirsch*, **41**: 51.
- Gill, J.D. (Ed.) (1990). *Traps, Trapping, and Furbearer Management: a Review. (Wildlife Society Technical Review No. 90-1)*. Bethesda (Ma); Wildlife Society.
- Giovannini, A. & Prosperi, S. (1991). Epidemiologia e profilassi della rabbia silvestre in Italia. *Hystrix (n.s.)*, **3**: 137-148.
- Goretzki, J. & Liess, C. (1989). Die Streckentwicklung der jagdbaren Marderartigen (Mustelidae) in der Deutschen Demokratische Republic. In M. Stubbe (Ed.) *Populationsökologie Marderartiger Säugetiere. (Martin-Luther-Universität Halle-Wittenberg Wissenschaftliche Beiträge 1989/37 [39])*: 361-370. Hälle (Saale); Martin-Luther-Universität.
- Griffiths, H.I. (1991a). *On the Hunting of Badgers*. Brynna (Mid Glam.); Piglet Press.
- Griffiths, H.I. (1991b). Statut actuel du blaireau (*Meles meles*) en Europe: chasse et protection. *Cahiers d'Ethologie*, **11**: 67-80.
- Griffiths, H.I. (1992). Police prosecutions and badger persecution in England and Wales. *Animal Welfare*, **1**: 291-296.
- Griffiths, H.I. (1993a). Badger game-bag data estimates of badger (*Meles meles*) population sizes in Europe. *Small Carnivore Conservation*, **9**: 9-10.
- Griffiths, H.I. (1993b). The Eurasian badger, *Meles meles* (L., 1758), as a commodity species. *Journal of Zoology (London)*, **230**: 240-242.

- Griffiths, H.I. (1994a). The effects upon badgers (*Meles meles*) of the activities of a single, persistent poacher. *Animal Welfare*, 3: 219-225.
- Griffiths, H.I. (1994b). Pre- and early historic records of the Eurasian badger *Meles meles* (L., 1758) (Carnivora, Mustelidae), in Britain. *Studies in Speleology*, 9: 27-36.
- Griffiths, H.I. & Thomas, D.H. (1993). The status of the badger *Meles meles* (L., 1758) (Carnivora, Mustelidae) in Europe. *Mammal Review*, 23: 17-58.
- Griffiths, H.I. & Kryštufek, B. (1993). Hunting pressures and badgers *Meles meles*: patterns and possible futures. *Lutra*, 36: 49-61.
- Griffiths, H.I., Griffiths, C.A. & Thomas, D.H. (1993). *The Badger, Meles meles* (L., 1758): an Assessment of the Population Status, Conservation Needs, and Management Requirements of the Species in the Western Palaearctic. Report to the Permanent Committee of the Convention on the Conservation of European Wildlife and Natural Habitats [Document T-PVS (93) 18]. Strasbourg; Council of Europe.
- Grigorev, G.R. (1986). [Distribution, number and utilization of the weasel (*Martes foina* erxl.), the marten (*Martes martes* L.) and the badger (*Meles meles* L.) in Bulgaria]. *Gorskostopanska Nauka*, 23: 59-67.
- Grigorev, G.R. (1987). [On the number and exploitation of certain species from the Mustelidae family in Bulgaria during 1974-1983]. *Gorskostopanska Nauka*, 24: 48-54.
- Guthörl, V. (1990). Zur Verbreitung und Bestandssituation des Dachses (*Meles meles* L.) in Saarland. *Zeitschrift für Jagdwissenschaft*, 36: 145-150.
- Hancox, M. (1980). Parasites and infectious diseases of the Eurasian badger (*Meles meles* L.). *Mammal Review*, 10: 151-162.
- Hancox, M. (1988a). A review of age determination in the Eurasian badger. *Lynx (n.s.)*, 24: 151-162.
- Hancox, M. (1988b). Field age determination in the European badger. *Revue d'Écologie (La Terre et la Vie)*, 43: 399-404.
- Hancox, M. (1991). Badgers and otters - pesticides and pollution: a European perspective. *Mustelid & Viverrid Conservation*, 5: 10-12.
- Harris, S. (1984). Ecology of urban badgers *Meles meles*: distribution in Britain, habitat selection, persecution, food and damage in the City of Bristol. *Biological Conservation*, 28: 349-375.
- Harris, S. & Cresswell, W.J. (1987). Dynamics of a suburban badger (*Meles meles*) population. *Symposia of the Zoological Society of London*, 58: 295-311.
- Harris, S., Jefferies, D., Cheeseman, C. & Cresswell, W. (1990). *Problems with Badgers?* (2nd ed.). Horsham; Royal Society for the Prevention of Cruelty to Animals.
- Harris, S., Cresswell, W., Reason, P. & Cresswell, P. (1992). An integrated approach to monitoring badger (*Meles meles*) population changes in Britain. In D.R. McCullough & R.H. Barnett (Eds.) *Wildlife 2001: Populations*: 945-953. Barking; Elsevier.
- Harrison, D.L. & Bate, P.J.J. (1991). *The Mammals of Arabia* (2nd ed.). Sevenoaks (Kent); Harrison Zoological Museum.
- Hartwig, D. (1991). Erfassung der Verkehrsunfälle mit Wild im Jahre 1989 in Nordrhein-Westfalen im Bereich der Polizeibehörden. *Zeitschrift für Jagdwissenschaft*, 37: 55-62.
- Hartwig, D. (1992). Wild- und Haustierverluste an Kanälen. *Zeitschrift für Jagdwissenschaft*, 38: 187-194.
- Hassinger, J.D. (1973). A survey of the mammals of Afghanistan resulting from the 1965 Street Expedition (excluding bats). *Fieldiana (Zoology)*, 60: 1-201.
- Hayden, T. (Ed.) (1993). *The Badger*. Dublin; Royal Irish Academy.
- Hell, P. (1987). Racionalne s jazvecom. *Pol'ovnictvo a Rybarstvo*, 39: 238-239.
- Hell, P. & Cimbal, D. (1977). Rozsirenie e pocetnost jazveca obycajneho (*Meles meles* LINN.) na Slovensku. *Folia Venatoria*, 7: 190-202.
- Hell, P. & Paule, L. (1986). Prispevok k problematike bodoeho hodotenia trofeji lisky obycajnoj (*Vulpes vulpes* L.) a jazvece lesniho (*Meles meles* L.). *Folia Venatoria*, 16: 259-274.

- Henry, C. & Lambert, A. (1988). *Prédation Exercée par le Blaireau eurasién dans Différents Milieux de Plaine*. (Convention de Recherche no. 86 124). Orleans; Université d'Orleans.
- Henry, C., Lafontaine, L. & Mouches, A. (1989). *Le Blaireau (Meles meles LINNEUS, 1758)*. (*Encyclopédie des Carnivores de France* No. 7). Nort-sur-Erdre; Société Française pour l'Étude et Protection des Mammifères.
- Heptner, V.G. & Naumov, N.P. (1974). *Die Säugetiere der Sowjetunion, Band 2*. Jena; VEB/Gustav Fischer Verlag.
- Herrmann, M. (1991). *Säugetiere im Saarland. Verbreitung, Gefährdung, Schutz*. St. Wendel; Naturschutz Saarland e.v. (DBV).
- Hewson, R. & Kolb, H.H. (1976). Scavenging on sheep carcasses by foxes (*Vulpes vulpes*) and badgers (*Meles meles*). *Journal of Zoology (London)*, **180**: 496-498.
- ICONA (Eds.) (1986). *Lista Roja de los Vertebrados de España*. Madrid; Instituto Nacional para la Conservación de la Naturaleza.
- Jakovljevic, D. (1992). Yugoslavia. *Rabies Bulletin Europe*, **16** (4): 14.
- Jefferies, D.J. (1969). Causes of badger mortality in eastern counties of England. *Journal of Zoology (London)*, **157**: 429-436.
- Jefferies, D.J. (1984). An otter casualty from Breydon Water, Norfolk. *Otters (Journal of the Otter Trust)*, **1**: 23-24.
- Jefferies, D.J. (1986). Autopsy and chemical analysis of otter bodies. *Vincent Wildlife Trust Annual Report, 1986*: 42-44.
- Jenkinson, S.R.A. (1994). *The Influence of Public Access on Badger Sett Sustainability and Disturbance*. MSc thesis. Manchester; Manchester Metropolitan University.
- Kauhala, K. (1995). Changes in distribution of the European badger *Meles meles* in Finland during the rapid colonisation of the raccoon dog. *Annales Zoologici Fennici*, **32**: 183-191.
- Kauhala, K. & Helle, E. (1995). Distribution and abundance of the badger in Finland. Unpublished report. Helsinki; Ministry of Agriculture & Forestry (Department of Fisheries & Game).
- Keij, P., Keman, J.H. & Kruizinga, D. (1972). Onderzoek naar de belasting van de das (*Meles meles* L.) met persistent bestrijdingsmiddelen. *Natuurhistorisch Maandblad*, **61** (5): 65-72. [Cited by Libois (1983)].
- Kerekes, B. (1992). Hungary. *Rabies Bulletin Europe*, **16** (4): 9-10.
- Kilshaw, R. (undated). *The Care, Treatment and Rehabilitation of Badgers*. Aylesbury; Wildlife Hospitals' Trust.
- Klimek, K. (1990). Poland. In IUCN East European Programme (Eds.) *Environmental Status Reports; 1988/1989, Volume 1*: 99-127. Cambridge; International Union for the Conservation of Nature & Natural Resources.
- Klippel, W.E. & Snyder, L.M. (1991). Dark-Age fauna from Kavousi, Crete. The vertebrates from the 1987 and 1988 excavations. *Hesperia*, **60**: 180-186.
- Kock, D. & Kinzelbach, R. (1982). Der Dachs, *Meles meles* (LINNEUS, 1758), in NW-Syrien. *Zeitschrift für Säugetierkunde*, **47**: 316-317.
- Koçi, V. (1961). *Manual i Gjetisë*. Tiranë; Botim i Ministrisë së Bujqësisë.
- Koenders, P. (1990). *Grenzen Open, Dassen Weg?* Doctorandus Thesis. Nymegen; University of Nymegen (Faculteit der Beleidswetenschappen).
- Kruuk, H. (1972). Surplus killing by carnivores. *Journal of Zoology (London)*, **166**: 233-244.
- Kruuk, H. (1989). *The Social Badger; Ecology and Behaviour of a Group-living Carnivore*. Oxford; Oxford University Press.
- Kruuk, H. & De Koch, L. (1981). Food and habitat of badgers (*Meles meles* L.) on Monte Baldo, northern Italy. *Zeitschrift für Säugetierkunde*, **46**: 295-301.
- Kruuk, H. & Macdonald, D. (1985). Group territories of carnivores: empires and enclaves. In R.M. Sibly & R.H. Smith (Eds.) *Behavioural Ecology. Ecological Consequences of Adaptive Behaviour*: 521-536. Oxford; Blackwells.
- Kruuk, H. & Parish, T. (1981). Feeding specialisation of the European badger *Meles meles* in Scotland. *Journal of Animal Ecology*, **50**: 773-788.

- Kryštufek, B. (1991). *Seslaci Slovenije*. Ljubljana; Prirodoslovni Muzej Slovenije.
- Kryštufek, B. (1993). The status of the badger *Meles meles* in Slovenia. *Small Carnivore Conservation*, 8: 9-10.
- Kryštufek, B. & Petkovski, S. (1990). New records of mammals from Macedonia (Mammalia). *Fragmenta Balcanica Musei Macedonici Scientiarum Naturalium*, 14 (13): 117-129.
- Krže, B. (1986). Jazbec: *Meles meles* (LINNAEUS, 1758). In B. Kryštufek, B. Krže, M. Hönigsfeld & B. Leskovic (Eds.) *Zveri I. Kune - Mustelidae*: 45-84. Ljubljana; Izdala Lovska Zveza Slovenije.
- IUCN East European Programme (1991). *The Environment in Europe: 1990*. Cambridge; International Union for the Conservation of Nature & Natural Resources.
- Lambert, A. (1990). Alimentation du blaireau eurasienn (*Meles meles*) dans un écosystème forestier: variations spatiales du régime et comportement du prédation. *Gibier Faune Sauvage*, 7: 21-37.
- Lankester, K., van Apeldoorn, R., Meelis, E. & Verboom, J. (1991). Management perspectives for populations of European badger (*Meles meles*) in a fragmented landscape. *Journal of Animal Ecology*, 28: 561-573.
- Lecocq, Y. (1991). The future of red deer on the Quantocks - 10. A European perspective. *Deer*, 8: 297-298.
- Lederer, L. (1979). Vyoj lovu norovanim. *Folia Venatoria*, 9: 279-291.
- Leitch, A. & Kruuk, H. (1986). Birds eaten by badgers *Meles meles* (L. 1758) in Scotland. *Lutra*, 20: 16-20.
- Libois, R. (1983). *Animaux Menacées en Wallonie. Protégéons nos Mammifères*. Paris-Gembloux; Editions J. Ducolot.
- Libois, R. (1992). Quoted in Anon: "La loutre, le blaireau et les agriculteurs". *La Meuse*, 30.01.1992.
- Libois, R., Paquet, A. & Ryelandt, D. (1986). Aperçu de l'évolution des populations de blaireaux (*Meles meles*) en Wallonie au cours de la période 1982-1985. *Cahiers d'Ethologie appliquée*, 6: 359-372.
- Lindsay, I.M. & Macdonald, D.J. (1985). The effects of disturbance on the emergence times of Eurasian badgers in winter. *Biological Conservation*, 34: 289-306.
- Lodé, T. (1989). Le comportement de mise en réserve alimentaire des proies chez le putois (*Mustela putorius*). *Cahiers d'Ethologie appliquée*, 9: 19-30.
- Long, C.A. & Killingley, C.A. (1983). *The Badgers of the World*. Springfield (Il.); Charles C. Thomas Publisher.
- Lüps, P. (1990). Die Krallen-Längen beim Dachs *Meles meles* (L.). *Jahrbuch der Naturhistorisches Museum Bern*, 10: 131-139.
- Lüps, P. & Roper, T.J. (1990). Tooth size in the European badger (*Meles meles*) with special reference to sexual dimorphism, diet and intraspecific aggression. *Acta Theriologica*, 33: 21-33.
- Lüps, P. & Roper, T.J. (1990). Cannibalism in a female badger (*Meles meles*): infanticide or predation? *Journal of Zoology (London)*, 221: 314-315.
- Lüps, P., Roper, T.J. & Stocker, G. (1987). Stomach contents of badgers (*Meles meles* L.) in central Switzerland. *Mammalia*, 51: 559-569.
- Lüps, P., Roper, T.J. & Stocker, G. (1991). Magen-Analysen bei Dachsen *Meles meles* aus der Umgebung Berns (1987-89). *Kliene Mitteilungen, Naturhistorisches Museum der Burgergemeinde Bern*, 14: 1-10.
- Lynch, J. (1993). *Craniometric Variation in Selected Mustelidae*. PhD thesis. Dublin; National University of Ireland.
- Ma, W.-C. & Broekhuizen, S. (1989). Belasting van dassen *Meles meles* met zware metalen: invloed van de verontreinigde maassuiterwaarden? *Lutra*, 32: 139-151.
- Macdonald, D.W. (1984). A questionnaire survey of farmers' opinions and actions towards wildlife on farmlands. In D. Jenkins (Ed.) *Agriculture and the Environment*: 171-177. Cambridge; Institute for Terrestrial Ecology.

- Mallon, D.P. (1985). The mammals of the Mongolian People's Republic. *Mammal Review*, **15**: 71-102.
- Martín, R., Rodríguez, A. & Delibes, M. (1995). Local feeding specialization by badgers (*Meles meles*) in a Mediterranean environment. *Oecologia*, **101**: 45-50.
- Mason, C.F. & Weber, D. (1990). Organochlorine residues and heavy metals in kidneys of polecats (*Mustela putorius*) from Switzerland. *Bulletin of Environmental Contamination and Toxicology*, **45**: 689-696.
- Masuda, R. & Yoshida, M.C. (1994). A molecular phylogeny of the Family Mustelidae (Carnivora), based on comparison of mitochondrial cytochrome b nucleotide sequences. *Zoological Science*, **11**: 605-612.
- Matouch, O. (1990). Human rabies in Slovakia. *Rabies Bulletin Europe*, **14** (4): 13.
- Mehlhardt, D. (1947). *Der Dachs: Lebensbild eines heimischen Wildsäugetiers*. Berlin - Kleinmachnow; Verlag Naturkundliche Korrespondenz.
- Meyer, R. (1986). *The Fate of the Badger*. London; B.T. Batsford.
- Mickevicius, E. & Baranauskas, K. (1992). Status, abundance and distribution of mustelids in Lithuania. *Small Carnivore Conservation*, **6**: 11-14.
- Ministerie van Lanbouw en Visserij (1984). *Notitie inzake het dassenbeheersbeleid*. Leiden; Ministerie van Lanbouw en Visserij.
- Ministria e Bujqesise (1982). *Harta e Kafshëve dhe e Shpendëve të Gjuetisë në RPSSH*. Tiranë; Ministria e Bujqesise (Stacioni i Pyjeve dhe Kulturave Etero-Vajore) (2 sheets).
- Ministry of Agriculture, Fisheries and Food (1977-1995). *Bovine Tuberculosis in Badgers (Annual Report)*. London; MAFF.
- Moegle, H. & Knorpp, F. (1978). Zur Epidemiologie der Wildtiertollwut. 2. Mitteilung: Beobachten über den dachs. *Zentralblatt für Veterinärmedizin (Reihe B)*, **21**: 735-756.
- Monnier, M.-F. (1992). Le Blaireau (*Meles meles* L.) dans le Canton de Neuchâtel (Suisse). Diploma thesis. Neuchâtel; Université de Neuchâtel (Institute de Zoologie).
- Munch, B., Clausen, B. & Karlog, O. (1974). Thallium poisoning in red foxes (*Vulpes vulpes*) and badgers (*Meles meles*) in Denmark. *Nordisk Veterinærmedicin*, **26**: 323-338.
- Myrberget, S. (1988). Hunting statistics as indicators of game population size and composition. *Statistical Journal of the United Nations ECE*, **5**: 689-696.
- Myrberget, S. (1990). Wildlife management west of the Soviet Union. *Norsk Institutt for Naturforskning Utredning*, **018**: 1-47.
- Nautras, M. (1992). Estonia. *Rabies Bulletin Europe*, **16** (4): 8.
- Neal, E. (1948). *The Badger*. London; Collins.
- Neal, E. (1972). The national badger survey. *Mammal Review*, **2**: 55-64.
- Neal, E.G. (1977). Subfamily Melinae. Genus *Meles*. In G.B. Corbet & H.N. Southern (Eds.) *The Handbook of British Mammals* (2nd ed.): 357-366. Oxford; Blackwells.
- Neal, E. (1986). *The Natural History of Badgers*. London; Christopher Helm.
- Neal, E. & Cheeseman, C. (1996). *Badgers*. London; T. & A.D. Poyser Natural History.
- Neal, E. & Roper, T.J. (1991). The environmental impact of badgers (*Meles meles* L.) and their setts. *Symposia of the Zoological Society of London*, **63**: 89-106.
- NFBG (1990). *The Case for the Protection of Badger Setts*. London; League Against Cruel Sports for National Federation of Badger Groups.
- Nikiforov, M.E., Kozulin, A.V. & Sidorovich, V.E. (1991). [Okhotnichii Zveri i Ptitsi Belorussii]. Minsk; Urodzhai.
- Nowak, E. (1980). Wasservogel und Feuchtgebiete Albaniens (Status, Veränderungen, Nutzung und Schutz). *Beiträge zur Vogelkunde*, **26**: 65-103.
- O'Connor, R. & O'Malley, E. (1989). *Badgers and Bovine Tuberculosis in Ireland*. Dublin; Eradication of Animal Diseases Board.
- Ognev, S.I. (1931). [Mammals of Eastern Europe and Northern Asia. Vol. II: Carnivora (Fissipedia)] (English translation, 1962). Jerusalem; Israel Programme for Scientific Translations.

- Ondrias, J.C. (1965). Die Säugetiere Griechenlands. *Zeitschrift für Säugetierkunde*, **13**: 109-127.
- Ozolinš, J. & Pilāts, V. (1995). Distribution and status of small and medium-sized carnivores in Latvia. *Annales Zoologici Fennici*, **32**: 21-29.
- Pawan (1981). *Distribuzione e Biologia di 22 Specie di Mammiferi in Italia*. Rome. [Cited by Stubbe *et al.* (1993)].
- Pease, A. (1898). *The Badger; a Monograph*. London; Lawrence & Bullen.
- Peachey, B. F. (1992). *Hunting the Badger*. Yelverton (Devon); Press & Television Ltd./Shooting News Publications.
- Petter, C. (1971). Origine, phylogenie et systématique des blaireaux. *Mammalia*, **35**: 567-597.
- Petukhov, A.G. (1982). Characteristics of the burrowing of badgers in irrigation systems. *Vestnik Moskovskogo Universiteta, Biologiya*, **37**: 3-7.
- Pigozzi, G. (1986). Crested porcupines *Hystrix cristata* within badger *Meles meles* setts in the Maremma Natural Park, central Italy. *Säugetierkundliche Mitteilungen*, **33**: 261-263.
- Pigozzi, G. (1988). Diet of the European badger (*Meles meles* L.) in the Maremma Natural Park, central Italy. *Mammal Review*, **18**: 73-74 (abstract).
- Pilāts, V. (1994). Mammalogy in Latvia. *Newsletter of the European Society of Mammalogists*, **1**: 4.
- Poole, K.G., Matson, G.M., Strickland, M.A., Magoun, A.J., Graf, R.P. & Dix, L.M. (1994). Age and sex determination for American martens and fishers. In S.W. Buskirk, A.S. Harestead, M.G. Raphael & R.A. Powell (Eds.) *Martens, Sables and Fishers: Biology and Conservation*. Ithaca (NY); Comstock Publishing Associates/Cornell University Press.
- Pozio, E. (1991). La volpe (*Vulpes vulpes* L.) principale serbatoio della trichinellosi in Italia. *Hystrix (n.s.)*, **3**: 175-186.
- Prigioni, C., Tacchi, F. & Rosa, P. (1988). Variazioni stagionali della dieta del tasso (*Meles meles*) e della volpe (*Vulpes vulpes*) in aree della Pianura Padana. *Ricerche di Biologia della Selvaggina*, **14 (Suppl.)**: 447-451.
- Prosperi, S. (1992). Italy. *Rabies Bulletin Europe*, **16 (4)**: 9.
- Prosperi, S., Martini, M., Coluccia, D. & Loporati, L. (1979). Rabbia silvestre: censimento di carnivori selvatici in Italia. *Ricerche di Biologia Selvaggina*, **67**: 1-55.
- Proulx, G., Weseloh, D.V.C., Elliot, J.E., Teeple, S., Anghern, P.A.M. & Mineau, J.E. (1986). Organochlorine and PCB residues in Lake Erie mink populations. *Bulletin of Environmental Contamination and Toxicology*, **39**: 939-944.
- Pucek, Z. & Raczynski, J. (1983). *Atlas Rozmieszczenia Ssakow w Polsce*. Warsaw; Panstwowe Wydawnictwo Naukowe/Polska Akademia Nauk (2 vols.).
- Rackham, O. (1986). *The History of the Countryside*. London; J.M. Dent & Sons.
- Raguz, D. & Grubešić, M. (1992). Lovna fauna Hrvatskih suma. In J. Dundovic, M. Glavas, N. Komplenovic, A.P.B. Krpan, A. Krstinic, S. Matic & S. Mestrovic (Eds.) *Sume u Hrvatskoj*: 181-196. Zagreb; Sveuciliste u Zagrebu Sumarski Fakultet.
- Raguz, D. & Grubešić, M. (1993). Posljedice agresije na Republiku Hrvatsku u lovnom gospodarenju. *Glasnik sumarski pokuse posebno izdanje*, **4**: 147-154.
- Reason, P., Harris, S. & Cresswell, P. (1993). Estimating the impact of past persecution and habitat changes on the numbers of badgers *Meles meles* in Britain. *Mammal Review*, **23**: 1-15.
- Reid, C. (1994). *Nature Conservation Law*. Edinburgh; W. Green/Sweet & Maxwell.
- Rodriguez, A. & Delibes, M. (1992). Food habits of badgers (*Meles meles*) in an arid habitat. *Journal of Zoology (London)*, **227**: 347-350.
- Romanowski, J. (1991). Mustelids in the eastern Red Data Books. *Mustelid & Viverrid Conservation*, **4**: 18.
- Roper, T. J. (1987). Have you got badgers? *The Grape Press*, **57**: 24-28.

- Roper, T. J. & Mickevicius, E. (1995). Badger *Meles meles* diet: a review of literature from the former Soviet Union. *Mammal Review*, 25: 117-129.
- Roper, T. J., Findlay, S.R., Lüps, P. & Shepherdson, D.J. (1995). Damage by badgers *Meles meles* to wheat *Triticum vulgare* and barley *Hordeum sativum* crops. *Journal of Applied Ecology*, 32: 72-726.
- Ryelandt, D.-E. (1986). Stroperij doet de das de das om. *Carnivora*, 4: 2-9.
- Sainsbury, A.W., Bennett, P.M. & Kirkwood, J.K. (1995). The welfare of free-living wild animals in Europe: harm caused by human activities. *Animal Welfare*, 4: 183-206.
- Santos Reis, M. (1983). Status and distribution of Portuguese mustelids. *Acta Zoologica Fennici*, 174: 213-216.
- Schön, I. (1995). Die Besiedlung der Marburger Lahnberge durch *Microtus arvalis* (Feldmaus). *Philippia* 7: 109-127.
- Schön, I. & Griffiths, H.I. (1996) Molecular techniques and small carnivore conservation. *Small Carnivore Conservation*, 14: 2-6.
- Schoon, M. (1996). Bat brings fear of rabies back to Britain. *The Independent*, 3008 (8 June): 1.
- Schreiber, A., Wirth, R., Riffel, M. & van Rompaey, H. (1989). *Weasels, Civets, Mongooses and their Relatives. An Action Plan for their Conservation*. Gland; International Union for the Conservation of Nature & Natural Resources.
- Seiler, A., Lindström, E. & Stenström, D. (1995). Badger abundance and activity in relation to fragmentation of foraging biotopes. *Annales Zoologici Fennici*, 32: 37-45.
- Skinner, C., Skinner, P. & Harris, S. (1991a). An analysis of some of the factors affecting the current distributions of the badger *Meles meles* setts in Essex. *Mammal Review*, 21: 51-65.
- Skinner, C., Skinner, P. & Harris, S. (1991b). The past history and recent decline of badgers *Meles meles* in Essex: an analysis of some contributory factors. *Mammal Review*, 21: 67-80.
- Skinner, P., Jefferies, D.J. & Harris, S. (1989). *Badger Persecution and the Law (Mammal Society Occasional Publication 10)*. Bristol; Mammal Society.
- Skoog, P. (1971). The food of the Swedish badger. *Svenska Jagarförbundet - Viltrevy*, 7 (1): 1-120.
- Sleeman, D. P. (1989). *Stoats and Weasels, Polecats and Martens*. London; Whittet Books.
- Sleeman, D.P. (1992). Long-distance movements in an Irish badger population. In I.G. Pride & S.M. Swift (Eds.) *Wildlife Telemetry*: 670-676. London; Ellis Horwood.
- Smal, C.M. (1993). The National Badger Survey: preliminary results for the Irish Republic. In T. Hayden (Ed.) *The Badger*: 9-22. Dublin; Royal Irish Academy.
- Smal, C.M. (1995a). *The Badger and Habitat Survey of Ireland*. Dublin; The Stationary Office.
- Smal, C.M. (1995b). *The Badger and Habitat Survey of Ireland. (Summary Report)*. Dublin; The Stationary Office.
- Sparrow, G. (1961). *The Terriers' Vocation* (2nd ed.). London; J.A. Allen.
- Steck, F. (1982). Rabies in wildlife. *Symposia of the Zoological Society of London*, 50: 57-75.
- Steck, F. & Wandeler, A. (1980) The epidemiology of fox rabies in Europe. *Epidemiological Reviews*, 2: 71-96.
- Stensaas, E. (1989). *Wildlife Management in Norway*. Trondheim; Directorate for Nature Management.
- Stern, V.M. (1973). Economic thresholds. *Annual Review of Entomology*, 16: 259-280.
- Sternath, M. (1990). Österreichs jagd statistik 1989. *Österreichs Wiedwerk*, (Nov.): 21-24.
- Steves, T., Strickland, M., Frank, R., Rasper, J. & Douglas, C.W. (1991). Organochlorine insecticides and polychlorinated biphenyl residues in martens and fishers from the Algonquin region of south-central Ontario. *Bulletin of Environmental Contamination and Toxicology*, 46: 368-373.
- Stollman, A. (1967). Pacetny stav jazveca leshneho (*Meles meles* L.) na Slovensku. *Ochrana Fauny*, 1: 45-46.

- Strachan, R. & Jefferies, D.J. (1996). *Otter Survey of England 1991-1994. A Report on the Decline and Recovery of the Otter in England and on its Distribution, Status and Conservation in 1991-1994*. London; Vincent Wildlife Trust.
- Spittler, H. (1992). Zur situation des Dachses in Nordrhein-Westfalen. *Rheinland-Westfälisch Jäger*, 1992 (12): 34-35.
- Strandgaard, H. & Asferg, T. (1980). The Danish bag record II. 1976. *Danish Review of Game Biology*, 11 (5): 1-112.
- Striese, M. & Schreyer, R.M. (1993). Fischotter an Strassen - zur Passage von Brücken. *Tiere im Konflikt*, 1: 61-67.
- Stubbe, M. (1989a). Dachs - *Meles meles* (L.). In M. Stubbe (Ed.) *Buch der Hege, Band 1. Haarwild*, (5th ed.): 456-477. Berlin; Deutscher Landwirtschaftsverlag.
- Stubbe, M. (1989b). Die ökologischen Grundlagen zur Bewirtschaftung des Dachses *Meles meles* (L. 1753) in der DDR. In M. Stubbe (Ed.) *Populationsökologie Marderartiger Säugetiere. (Martin-Luther-Universität Halle-Wittenberg Wissenschaftliche Beiträge 1989/37 [39])*: 543-553. Hälle (Saale); Martin-Luther-Universität.
- Stubbe, M. & Stubbe, A. (1994). Säugetierarten und deren feldökologische erforschung im östlichen Deutschland. *Tiere im Konflikt*, 3: 3-52.
- Stubbe, M., Ebersbach, H., Goretzki, J., Waurisch, S. & Bickenbach, E. (1993). Beiträge zur Verbreitung und Populationsökologie des Dachses *Meles meles* (L., 1758) in Europa. *Beitrage zur Jagd und Wildforschung*, 18: 93-105.
- Suminski, P. (1989). *Borsuk* (3rd. ed.). Warsaw; Panstwowe Wydawnictwo Naukowe.
- Symes, R. (1989). Badger damage, fact or fiction? In R. Putnam (Ed.) *Mammals as Pests*: 196-206. London; Chapman & Hall.
- Szemethy, L. (1989). Die verbreitung des dachses (*Meles meles*) in Ungarn. In M. Stubbe (Ed.) *Populationsökologie Marderartiger Säugetiere. (Martin-Luther-Universität Halle-Wittenberg Wissenschaftliche Beiträge 1989/37 [39])*: 515-520. Hälle (Saale); Martin-Luther-Universität.
- Tassev, C. & Mileva, L. (1991). Bulgaria. In IUCN East European Programme (Eds.) *Environmental Status Reports; 1990, Volume 2*: 39-81. Cambridge; International Union for the Conservation of Nature & Natural Resources.
- Tavecchia, G. (1991). *The Badgers of Baglan*. Tondu (Mid Glamorgan); Glamorgan Badger Group (unpublished report).
- Tessaro, S. (1990). Bovine tuberculosis. In Anon. (Ed.), *Review of Wildlife Disease Status in Game Animals in North America*: 95-100. Regina; Saskatchewan Ministry of Agriculture and Food.
- Turan, N. (1984). *Türkiye'nin avveYaban Hayvanlari Memeliler. 1. Kitap*. No publication details given.
- Turner, G.S. (1971). Rural rabies. *Rural Medicine*, 2: 108-112.
- Vadineanu, A. (1991). Romania. In IUCN East European Programme (Eds.) *Environmental Status Reports; 1990, Volume 2*: 83-132. Cambridge; International Union for the Conservation of Nature & Natural Resources.
- van der Zee, F.F., Wiertz, J., ter Braak, C.J.F., van Apeldoorn, R.C. & Vink, J. (1992). Landscape change as a possible cause of the badger *Meles meles* L. decline in the Netherlands. *Biological Conservation*, 61: 17-22.
- van Wijngaarden, A. & van de Peppel, J. (1964). The badger, *Meles meles* (L.), in the Netherlands. *Lutra*, 6: 1-60.
- Vereniging Das & Boom (1990). *Provisions for Badgers Against Traffic*. Beek-Ubbergen; Vereniging Das & Boom.
- Vigna Taglianti, A. (1988). Stato attuale delle conoscenze sulla biologia e la conservazione dei Carnivori in Italia. *Ricerca di Biologia Selvaggina*, 14 (Suppl.): 401-417.
- Vigne, J.D. (1990). Biogeographical history of the mammals on Corsica (and Sardinia) since the final Pleistocene. *Atti dei Convegni Lincei*, 85: 369-392.



- Vink, J. (1993). *The Badger (Meles meles L.); a Bibliography of the Literature up to October 1993* (5th ed.). Utrecht; Vereniging voor Zoogdierkunde en Zoogdierbescherming.
- Wachendörfer, G. & Schwierz, G. (1980). Zur Epidemiologie und Bekämpfung der Wildtollwut - studie über mögliche Ursachen des starken Rückganges der Population des Dachses (*Meles meles*) in Hessen 1952 bis 1977. *Deutsche Tierärztliche Wochenschrift*, **87**: 255-260.
- Wandeler, A.I. & Graf, M. (1982). Der Geschlechtszyklus weiblicher Dachse (*Meles meles* L.) in der Schweiz. *Revue Suisse de Zoologie*, **89**: 1009-1016.
- Wandeler, A.I., Capt, S., Gerber, H., Kappeler, A. & Kipfer, R. (1988). Rabies epidemiology, natural barriers and fox vaccination. *Parasitologia*, **30**: 53-57.
- Whelton, H.J. & Power, S.B. (1993). The use of badger bacula as a method of age determination in a badger population infected with tuberculosis. *Biology and Environment: Proceedings of the Royal Irish Academy*, **93B**: 45-47.
- Wiertz, J. (1991). *De Dassenpopulatie in Nederland 1960-1990*. Leersum; Rijksinstituut voor Natuurbeheer.
- Wiertz, J. (1993). Fluctuations in the Dutch badger *Meles meles* population between 1960 and 1990. *Mammal Review*, **23**: 59-64.
- Wiertz, J. & Vink, J. (1986). The present status of the badger *Meles meles* (L. 1758) in the Netherlands. *Lutra*, **29**: 21-53.
- Wilson, C.J. (1993). Badger damage to growing oats and an assessment of electric fencing as a means of its reduction. *Journal of Zoology (London)*, **231**: 668-675.
- Wilson, D.E. & Reeder, D.M. (Eds.) (1993). *Mammal Species of the World: a Taxonomic and Geographic Reference* (2nd ed.). Washington; Smithsonian Institution Press.
- Zedja, J. & Nesvadbova, J. (1983). Habitat selection and population density of the badger (*Meles meles*) in Bohemia and Moravia. *Folia Zoologica*, **32**: 319-333.
- Z.Ö.L. (undated). *Jagd-Politische Leitlinien: Gedanken über eine Neuorientierung der Jagd*. Wien; Zentralstelle Österreichischer Landesjagdverbände.
- Zimmermann, K. (1949). Die Carnivora von Kreta. *Zeitschrift für Säugetierkunde*, **17**: 58-64.

APPENDIX 1: NAMES AND ORGANISATIONAL AFFILIATIONS OF  
CORRESPONDENTS CITED IN NATIONAL ACCOUNTS.

- Aaris-Sorensen, J.: Projekt Graevling, Foreningen til Dyrenes Beskyttelse i Danmark, Græsted, Denmark.
- Adamic, M.: Division of Wildlife, Department of Forestry, University of Ljubljana, Ljubljana, Slovenia.
- Andera, M.: Department of Zoology, National Museum (Natural History), Praha, Czech Republic.
- Asferg, T.: Division of Wildlife Ecology, National Environmental Research Institute, Kalø, Denmark.
- Baranauskas, K.: Institute of Ecology, University of Vilnius, Vilnius, Lithuania.
- Bego, F.: Chair of Zoology, Universiteti Tiranës, Tiranë, Albania.
- Beindorff, Herr.: Landwirtschaftsminister des Landes Mecklenburg-Vorpommern, Schwerin, Germany.
- Bevanger, K.: Norsk Institutt for Naturforskning, Trondheim, Norway.
- Bogakias, S.: Confederation of Greek Hunters, Halandri, Greece.
- Boitani, L.: Dipartimento di Biologia Animale e dell'Uomo, Università di Roma "La Sapienza", Rome, Italy.
- Bourand, M.: Independant consultant, Guerigny, France.
- Cajander, V.-R.: Department of Botany, University of Helsinki, Helsinki, Finland.
- Capt, S.: Sektion Jagd und Wildforschung, Bundesamt für Umwelt, Wald und Landschaft, Bern, Switzerland.
- Carvalho, J.S.: Direccao-Geral des Florestas, Ministério da Agricultura, Pescas e Alimentacao, Lisboa, Portugal.
- Consiglio, C.: European Federation Against Hunting, Rome, Italy.
- Criel, D.: Econnection, Huise-Zingen, Belgium.
- de Benito Ontañón, J.M.: El Sudirector General de Recursos Naturales Renovables, Instituto Nacional para la Conservacion de la Naturaleza (ICONA), Madrid, Spain.
- Delibes, M.: Estación Biológica Doñana, Consejo Superior de Investigaciones Cientificas (CSIC), Doñana, Spain.
- Deutscher Jagdschutz-Verband, Bonn, Germany.
- Düssel, Dr.: Thüringer Ministerium für Landwirtschaft und Forsten, Erfurt, Germany.
- Erkman, A.: Dogal Hayati Koruma Dernegi, Istanbul, Turkey.
- Ermala, A.: Game Division, Finnish Game & Fisheries Research Institute, Helsinki, Finland.
- Feore, S.: School of Biology & Biochemistry, Queens' University of Belfast, Belfast, Northern Ireland, UK.
- Ferreira, J.M.: Servico Nacional de Parques, Reservas e Conservacao da Natureza, Lisboa, Portugal.
- Fox, F.: Ulster Society for the Prevention of Cruelty to Animals, Lisburn, Northern Ireland, UK.

- Gil, V.H.: Departamento de Biologica Animal y Ecologia, Universidad de Murcia, Murcia, Spain.
- Grubešić, M.: Faculty of Forestry, University of Zagreb, Zagreb, Croatia.
- Guthörl, V.: Institut für Biogeographie, Universität des Saarlandes, Saarbrücken, Germany.
- Habili, D.: Stacioni i Pyjeve dhe Kulturave, Esterovajore, Tiranë, Albania.
- Habijan-Mikes, V.: Institute for Nature Protection, Novi Sad, Vojvodina, Yugoslavia.
- Havu, S.: Department of Fisheries and Game, Ministry of Agriculture & Forestry, Helsinki, Finland.
- Hell, P.: Vyskumny Ustav Lesného Hospodarstva, Zvolen, Slovakia.
- Henry, C.: Ecologie Animale et Zoologie, Université d'Orléans, Orléans, France.
- Hoenisch, Dr.: Bundesministerium für Ernährung, Landwirtschaft und Forsten, Bonn, Germany.
- Jiménez, J.: Generalitat Valenciana Conselleria d'Agricultura I Pesca, Castello, Spain.
- Kloskowski, J.: Zakład Ochrony Przyrody, Uniwersytet Marii Curie-Skłodowskiej, Lublin, Poland.
- Koenders, P.: Fakulteit der Beleidswetenschappen, Katholieke Universiteit Nijmegen, Nijmegen, Netherlands.
- Krier, A.: Direction des eaux et Forêts, Luxembourg, Grand Duchy of Luxembourg.
- Kroggel, C.: Department of Fisheries and Game, Ministry of Agriculture & Forestry, Helsinki, Finland.
- Kryštufek, B.: Slovene Museum of Natural History, Ljubljana, Slovenia.
- Lafontaine, L.: Réseau S.O.S. Loutres, Sizun, France.
- Lebersorger, P.: Zentralstelle Österreichischer Landesjagdverbände, Wien, Austria.
- Lecocq, Y.: Fédération des Associations de Chasseurs de l'UE, Bruxelles, Belgium.
- Legakis, A.: Department of Biology, University of Crete, Iraklion, Crete, Greece.
- Libois, R.: Institute Ed van Beneden, Université de Liège, Liège, Belgium.
- Lindström, E.: Grimsö Wildlife Station, Riddarrhyttan, Sweden.
- Lüps, P.: Naturhistorisches Museum der Burgergemeinde Bern, Bern, Switzerland.
- Manoliu, C.: Independant consultant, Busteni-Prahova, Romania.
- Matter, H.: Institut für Veterinär-Virologie, Universität Bern, Bern, Switzerland.
- Maran, T.: Tallinn Zoo, Tallinn, Estonia.
- Marshall, G.: Ulster Wildlife Trust, Belford, Northern Ireland, UK.
- Mersch, J.: Saint-Hubert Club du Grand-Duché de Luxembourg, Luxembourg, Grand Duchy of Luxembourg.
- Mertens, A.: Royal Saint-Hubert Club de Belgique, Bruxelles, Belgium.
- Mickevicius, E.: Institute of Ecology, University of Vilnius, Vilnius, Lithuania.
- Migot, P.: Centre National d'Etudes et de Recherche Appliquées sur les Predateurs et les Animaux Depredateurs, Office National de la Chasse, Domaine de Saint-Benoist, France.
- Molitor, M.: Direction des Eaux et Forêts, Luxembourg, Grand Duchy of Luxembourg.

- Montizaan, M.: Koninklijke Nederlandse Jagers Vereniging, Amersfoort, Netherlands.
- Mosler-Berger, C.: Swiss Wildlife Information Service, University of Zurich, Zurich, Switzerland.
- Munteanu, D.: Societatea Ornitologica Romania, Cluj, Romania.
- Nores, C.: Departamento de Biologia des Organismos y Systemas, Universidad de Oviedo, Oviedo, Spain.
- Pachinger, K.: Zoological Institute, Komenski University, Bratislava, Slovakia.
- Paunovic, M.: Prirodnjacki Muzej Beograd, Beograd, Yugoslavia.
- Petkovski, S.: National Museum of Natural History, Skopje, "the former Yugoslav Republic of Macedonia".
- Pigozzi, G.: Wildlife Consultant, Cislago, Italy.
- Pielowski, Z.: Polski Zwiazek Lowiecki Stacja Badawcza, Czempin, Poland.
- Ratajszczak, R.: Wielkopolski Park Zoologiczni, Poznan, Poland.
- Romanowski, J.: Department of Vertebrate Ecology, Polish Academy of Science, Dziekanow Lesny, Poland.
- Schneider, E.: Institut für Wildbiologie und Jagdkunde der Universität Göttingen, Göttingen, Germany.
- Sidorovich, V.E.: Department of Zoology, Belarussian Academy of Science, Minsk, Belarus.
- Simonov, N.: Republicki Zavod za Zastitu Prirode, Beograd, Yugoslavia.
- Skoog, P.: Consultant zoologist, Djursholm, Sweden.
- Sleeman, P.D.: Zoology Department, University College Cork, Cork, Irish Republic.
- Slovak Hunters' Union, Bratislava, Slovakia.
- Smal, C.: National Parks & Wildlife Service (Research Branch), Office of Public Works (Wildlife Section), Bray, Irish Republic.
- Sneep, J.W.: Ministerie van Landbouw, Natuurbeheer en Visserij, s'-Gravenhage, Netherlands.
- Smulders, H.: Vereniging Das & Boom, Beek-Ubbergen, Netherlands.
- Stavrakev, A.: Natural History Museum, Bulgarian Academy of Science, Sofia, Bulgaria.
- Stubbe, M.: Zoologisches Institut, Martin-Luther-Universität Halle-Wittenberg, Germany.
- Szemethy, L.: Department of Game Biology, Gödöllő University of Agricultural Sciences, Gödöllő, Hungary.
- Tiroler Jägerverband, Innsbruck, Austria.
- Tsipiras, C.: Elleniki Fisiolatriki Antikinyetiki Protovoulia, Athens, Greece.
- Tunkkari, P.S.: Department of Zoology, University of Oulu, Oulu, Finland.
- Vink, J.: National Forest Service, Houten, Netherlands.
- Wiertz, J.: Instituut voor Bos- en Natuuronderzoek, Wageningen, Netherlands.
- Willi, G.: Botanisch-Zoologisch Gesellschaft, Liechtensteins-Sargans-Vaduz, Liechtenstein.
- Zoss, A.: Slitere State Reserve, Dundaga, Latvia.

APPENDIX 2: Scientific names of animals referred to in text

American marten	<i>Martes americana</i>
American mink	<i>Mustela vison</i>
Bear (European brown bear)	<i>Ursus arctos</i>
Black grouse	<i>Tetrao tetrix</i>
Capercaillie	<i>Tetrao urogallus</i>
Crested porcupine	<i>Hystrix cristata</i>
Daubenton's bat	<i>Myotis daubentonii</i>
European mink	<i>Mustela lutreola</i>
Fisher marten	<i>Martes pennanti</i>
Hazel Grouse	<i>Bonasia bonasia</i>
Jackal (golden jackal)	<i>Canis aureus</i>
Lynx (European lynx)	<i>Felis lynx</i>
North American badger	<i>Taxidea taxus</i>
Otter (Eurasian river otter)	<i>Lutra lutra</i>
Partridge	<i>Perdix perdix</i>
Pine marten	<i>Martes martes</i>
Polecat	<i>Mustela putorius</i>
Raccoon dog	<i>Nyctereutes procyonoides</i>
Red fox	<i>Vulpes vulpes</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>
Roe deer	<i>Capreolus capreolus</i>
Russian desman	<i>Desmana moschata</i>
Russian flying squirrel	<i>Pteromys volans</i>
Stone marten	<i>Martes foina</i>
Wildcat	<i>Felis sylvestris</i>
Wild boar	<i>Sus scrofa</i>
Wolf (grey wolf)	<i>Canis lupus</i>

### APPENDIX 3: DISTRIBUTION MAPS

- Fig. 1: Albania. Distributions from Ministrija e Bujqesise (1982) (courtesy of D. Habili), semi-quantitative data from Mr. F. Bego (unpublished).
- Fig. 2: Belarus. Badger sett densities (unpublished data of Dr. V.E. Sidorovich).
- Fig. 3: Belgium. Badger distributions (unpublished data of Dr. D. Criel).
- Fig. 4: Bulgaria. Badger densities in hunting grounds (from Grigorev, 1986).
- Fig. 5: Czech Republic. Badger distributions (from Zedja & Nesvadbova, 1983).
- Fig. 6: Denmark. Badger game-bag return data (1972/73 season, dots = equal kill localities (from Asferg et al., 1977).
- Fig. 7: Finland. Badger distribution. Straight line = Arctic Circle, broken line = northern limit of badger distribution (from Kauhala & Helle, unpublished ms).
- Fig. 8: France. (a) general distribution (Data of L'Office National de la Chasse, courtesy of Dr. P. Migot), (b) abundance estimates, redrawn from Koenders (199) from Bourand (1989).
- Fig. 9: Germany (former DDR). Badger occurrence (from Stubbe et al., 1993).
- Fig. 10: Great Britain. Badger densities (from Cresswell et al., 1990).
- Fig. 11: Greece. Badgers on islands (from Adamakopolous et al., 1991).
- Fig. 12: Hungary. Badger densities (from Szemethy, 1989).
- Fig. 13: Ireland. Badger densities (from Smal, 1995a,b).
- Fig. 14: Italy. (a) badger distribution (from Prospero et al., 1979), (b) (inset) general distribution (from Pawan, 1981).
- Fig. 15: Latvia. Badger distribution (from Ozolinš & Pilàts, 1995).
- Fig. 16: Lithuania. Badger densities (from Mickevicius & Baranauskas, 1992).
- Fig. 17: Luxembourg. Badger occurrence. Redrawn from Koenders (1990) from unpublished data of Le Direction des Eaux et des Forêts.
- Fig. 18: Macedonia. Badger occurrence (from Kryštufek & Petkovski, 1990).
- Fig. 19: The Netherlands. Badger distribution (from Wiertz, 1991).
- Fig. 20: Norway. Badger occurrence (from Bevanger & Lindström, 1995).
- Fig. 21: Poland. (a) badger occurrence (from Pucek & Raczynski, 1983), (b) game-bag data (from Suminski, 1989).
- Fig. 22: Portugal. Badger occurrence (from Santos Reis, 1983).
- Fig. 23: Slovakia. Badger densities (from Hell & Paule, 1977).
- Fig. 24: Slovenia. Badger densities (from Kryštufek, 1993).
- Fig. 25: Spain. Badger occurrence. Unpublished data of ICONA (from Long & Killingley, 1983: 290).
- Fig. 26: Turkey: Badger occurrence (compiled from Koch & Kinzelbach, 1982; Harrison & Bate, 1991).

## Nature and environment

1. Aspects of forest management, 1968 (*out of print*)
2. Freshwater, 1968 (*out of print*)
3. Animals in danger, 1969 (*out of print*)
4. A handbook for local authorities, 1971 (*out of print*)
5. Soil conservation, 1972 (*out of print*)
6. Endangered Alpine regions and disaster prevention measures, 1974 (*out of print*)
7. Air pollution problems – Manual of experiments, 1975 (*out of print*)
8. Evolution and conservation of hedgerow landscapes in Europe, 1975
9. The integrated management of the European wildlife heritage, 1975 (*out of print*)
10. Threatened mammals in Europe, 1976 (*out of print*)
11. The effects of recreation on the ecology of natural landscapes, 1976 (*out of print*)
12. Heathlands of western Europe, 1976 (*out of print*)
13. The degradation of the Mediterranean maquis, 1977 (published jointly with Unesco) (*out of print*)
14. List of rare, threatened and endemic plants in Europe, 1977 (*out of print*)
15. Threatened amphibians and reptiles in Europe, 1978 (*out of print*)
16. Vegetation map (scale 1:3 000 000) of the Council of Europe member states, 1979
17. Model outline environmental impact statement from the standpoint of integrated management or planning of the natural environment, 1980
18. Threatened freshwater fish of Europe, 1980
19. European peatlands, 1980
20. Behaviour of the public in protected areas, 1981 (*out of print*)
21. Dry grasslands of Europe, 1981
22. Alluvial forests in Europe, 1981
23. Threatened Rhopalocera (butterflies) in Europe, 1981 (*out of print*)
24. Birds in need of special protection in Europe, 1981 (*out of print*)
25. Inventory and classification of marine benthic biocenoses of the Mediterranean, 1982
26. Town farms, 1982 (*out of print*)
27. List of rare, threatened and endemic plants in Europe (1982 edition), 1983
28. Nature in cities, 1982 (*out of print*)
29. The vegetation of the Alps, 1983
30. Salt marshes in Europe, 1984 (*out of print*)
31. Protected marine areas, 1985
32. European dune and shoreline vegetation, 1985 (*out of print*)
33. Ecological repercussions of constructing and using ski-runs, 1986 (*out of print*)
34. Environmental education for the farming community – Experimental schemes in Europe, 1987 (2nd edition, 1994)
35. Invertebrates in need of special protection in Europe, 1987
36. Development of flora and fauna in urban areas, 1987 (*out of print*)
37. Conservation of marine benthic biocenoses in the North Sea and the Baltic, 1987
38. The protection of dragonflies (*Odonata*) and their biotopes, 1988 (*out of print*)
39. Problems of soil conservation, 1988
40. Texts adopted by the Council of Europe in the field of the conservation of European wildlife and natural habitats, 1993

41. The biology, status and conservation of the monk seal (*Monachus monachus*), 1989
42. Saprobial invertebrates and their conservation, 1989
43. Possible causes of forest decline and research programmes in Europe, 1989 (*out of print*)
44. The biological significance and conservation of Hymenoptera in Europe, 1990
45. Status, conservation needs and reintroduction of the lynx (*Lynx lynx*) in Europe, 1990
46. Conservation of threatened freshwater fish in Europe, 1991 (2nd edition, 1994)
47. Status and conservation needs of the wolf (*Canis lupus*) in the Council of Europe member states, 1990
48. Marine turtles in the Mediterranean: distribution, population status, conservation, 1990
49. Evergreen forests in the Macaronesian Region, 1990 (*out of print*)
50. Marine reserves and conservation of Mediterranean coastal habitats, 1990
51. Towards the conservation of aculeate Hymenoptera in Europe, 1991
52. The means of giving greater prominence to environmental issues in agricultural education at secondary school level, 1992
53. Présentation et étude comparative de quatre réseaux de zones protégées en Europe, 1991 (*available in French only*)
54. The wild mink (*Mustela lutreola*) in Europe, 1992
55. Status and conservation of the pardal lynx (*Lynx pardina*) in the Iberian Peninsula, 1992
56. The conservation of natural habitats outside protected areas: legal analysis, 1992
57. The conservation of European orchids, 1992
58. Balanced development of the countryside in western Europe, 1992
59. Rehabilitation of natural habitats in rural areas, 1992
60. Datasheets of flora species – Volume I, 1992
61. Datasheets of flora species – Volume II, 1992
62. Datasheets of flora species – Volume III, 1992
63. Datasheets of flora species – Volume IV, 1992
64. Threatened non-marine molluscs of Europe, 1992
65. Potential long-term ecological impact of genetically modified organisms, 1993
66. Conservation of freshwater fish in Europe, 1994
67. Status and conservation needs of the otter (*Lutra lutra*) in the western Palaearctic, 1994
68. Guidelines to be followed in the design of plant conservation or recovery plans, 1994
69. Status and conservation of the wildcat (*Felis silvestris*) in Europe and around the Mediterranean rim, 1994
70. The integrated development of the countryside in central and eastern European countries, 1994
71. European soil resources, 1995
72. Underground habitats and their protection, 1995
73. Introduction of non-native organisms into the natural environment, 1996
74. Pan-European Biological and Landscape Diversity Strategy, 1996
75. Texts adopted by the Standing Committee of the Bern Convention on the Conservation of European Wildlife and Natural Habitats (19.IX.1979) (1982-97), 1997
76. Status and conservation of *Desmaninae* in Europe, 1996
77. Listing of biotopes in Europe according to their significance for invertebrates, 1996
78. A classification of Palaearctic habitats, 1996
79. Background information on invertebrates of the Habitats Directive and the Bern Convention – Part I: *Crustacea*, *Coleoptera* and *Lepidoptera*, 1996
80. Background information on invertebrates of the Habitats Directive and the Bern Convention – Part II: *Mantodea*, *Orthoptera* and *Arachnida*, 1996
81. Background information on invertebrates of the Habitats Directive and the Bern Convention – Part III: *Mollusca* and *Echinodermata*, 1996



82. Legal measures for the conservation of natural areas, 1996
83. Tourism and environment in European countries, 1996
84. Compensation for damage caused by wild animals, 1996
85. Private or voluntary systems of natural habitats' protection and management, 1996
86. Management of the beaver (*Castor fiber*): towards restoration of its former distribution and ecological function in Europe, 1997
87. Introduction of non-native plants into the natural environment, 1997
88. Comparative analysis of the effectiveness of legislation for the protection of wild flora in Europe, 1997
89. Legal obstacles to the application of nature conservation legislation, 1997
90. The conservation and management of the European badger (*Meles meles*), 1997
91. Study of biotopes and habitats losing wildlife interest as a result of ecological succession, 1997

#### **Environmental encounters**

1. Environmental training in agricultural circles, 1987 (*out of print*)
2. Parks, plans and people – Protected areas and socio-economic development, 1987 (*out of print*)
3. Workshop on the situation and protection of ancient natural and semi-natural woodlands in Europe, 1987
4. A new management of the environment in rural areas, 1988
5. Training course for managers of protected areas in Europe and Africa, 1989
6. The situation of the brown bear (*Ursus arctos*) in Europe, 1989
7. Nature tomorrow, 1989
8. The conservation of wild progenitors of cultivated plants, 1991
9. Nature museums: tools for learning about, promoting and protecting the natural heritage of Europe, 1990
10. Colloquy on the Bern Convention invertebrates and their conservation, 1990 (*out of print*)
11. The situation, conservation needs and reintroduction of the lynx in Europe, 1992
12. The management of Mediterranean wetlands, 1992
13. The conservation of the Mediterranean monk seal, 1992
14. Wetland invertebrates, 1992
15. Seminar for managers of diploma-holding areas, 1992
16. Seminar on the biology and conservation of the wildcat (*Felis silvestris*) (*Bilingual edition*), 1993
17. Seminar on the management of small populations of threatened mammals, 1994
18. Workshop on nature conservation in central and eastern Europe, 1994
19. Seminar on recovery plans for species of amphibians and reptiles, 1994
20. Pan-European conference on the potential long-term ecological impact of genetically modified organisms, 1995
21. Between the two extremes – dereliction and over-use: how shall the land be managed so as to benefit the wildlife, the countryside and the landscape?, 1995
22. Symposium on the United Nations Conference on Environment and Development (UNCED), the Convention on Biological Diversity and the Bern Convention: the next steps, 1995
23. Protection of coastal areas of the Adriatic Sea, 1995
24. Seminar on the conservation of the European otter (*Lutra lutra*), 1996
25. Seminar on the biology and conservation of European desmans and water shrews (*Galemys pyrenaicus*, *Desmana moschata*, *Neomys spp.*), 1996
26. Landscape diversity: A chance for the rural community to achieve a sustainable future, 1996
27. How hunting and fishing can contribute to nature conservation and rural development (*bilingual edition*), 1996
28. Seminar for managers of diploma-holding areas, 1996

29. Environmental education, 1996
30. Environmental education in school systems, 1996
31. Agriculture and related activities in protected areas, 1996
32. Sustainable tourism development, 1996
33. Colloquy on conservation, management and restoration of habitats for invertebrates: enhancing biological diversity, 1997
34. Colloquy on sustainable tourism development: reconciling economic, cultural, social, scientific and environmental factors (to be published)
35. Seminar on incentive measures for the voluntary creation and management of protected areas (*bilingual edition*) (to be published)

#### **Planning and management**

1. Hedges, 1988
2. Farming and wildlife, 1989
3. Watercourses. Conservation, maintenance and management, 1994
4. Rural landscapes in Europe: principles for creation and management, 1994
5. Amphibians and reptiles: conservation management of species and habitats, 1997

#### **Other publications**

*Naturoopa* journal

Management of Europe's natural heritage – twenty-five years of activity, 1987 (*out of print*)

A European cultural revolution: the Council of Europe's "Charter of invertebrates", 1986 (*out of print*)

The Bern Convention on Nature Conservation, 1991

Contribution to the United Nations Conference on Environment and Development (UNCED), 1993

European conservation strategy, 1993

The state of the environment in Europe: the scientists take stock of the situation, 1993

Model law on the protection of the environment, 1994

The Council of Europe and the protection of the environment, 1995

The Council of Europe and the environment, 1996

Texts adopted by the Council of Europe in the field of the environment, 1996 (*bilingual edition*)

The majority of the Council of Europe's publications are available in English and French editions.

**Sales agents for publications of the Council of Europe**  
**Agents de vente des publications du Conseil de l'Europe**

**AUSTRALIA/AUSTRALIE**

Hunter publications, 58A, Gipps Street  
AUS-3066 COLLINGWOOD, Victoria  
Fax: (61) 33 9 419 7154

**AUSTRIA/AUTRICHE**

Gerold und Co., Graben 31  
A-1011 WIEN 1  
Fax: (43) 1512 47 31 29

**BELGIUM/BELGIQUE**

La Librairie européenne SA  
50, avenue A. Jonnart  
B-1200 BRUXELLES 20  
Fax: (32) 27 35 08 60

Jean de Lannoy  
202, avenue du Roi  
B-1060 BRUXELLES  
Fax: (32) 25 38 08 41

**CANADA**

Renouf Publishing Company Limited  
5369 Chemin Canotek Road  
CDN-OTTAWA, Ontario, K1J 9J3  
Fax: (1) 613 745 76 60

**DENMARK/DANEMARK**

Munksgaard  
PO Box 2148  
DK-1016 KØBENHAVN K  
Fax: (45) 33 12 93 87

**FINLAND/FINLANDE**

Akateeminen Kirjakauppa  
Keskuskatu 1, PO Box 218  
SF-00381 HELSINKI  
Fax: (358) 9 121 44 50

**GERMANY/ALLEMAGNE**

UNO Verlag  
Poppelsdorfer Allee 55  
D-53115 BONN  
Fax: (49) 228 21 74 92

**GREECE/GRÈCE**

Librairie Kauffmann  
Mavrokordatou 9, GR-ATHINA 106 78  
Fax: (30) 13 23 03 20

**HUNGARY/HONGRIE**

Euro Info Service  
Magyarország  
Margitsziget (Európa Ház),  
H-1138 BUDAPEST  
Fax: (36) 1 111 62 16  
E-mail: eurinfo@mail.matav.hu

**IRELAND/IRLANDE**

Government Stationery Office  
4-5 Harcourt Road, IRL-DUBLIN 2  
Fax: (353) 14 75 27 60

**ISRAEL/ISRAËL**

ROY International  
17 Shimon Hatrssi St.  
PO Box 13056  
IL-61130 TEL AVIV  
Fax: (972) 3 546 1423  
E-mail: royil@netvision.net.il

**ITALY/ITALIE**

Libreria Commissionaria Sansoni  
Via Duca di Calabria, 1/1  
Casella Postale 552, I-50125 FIRENZE  
Fax: (39) 55 64 12 57

**MALTA/MALTE**

L. Sapienza & Sons Ltd  
26 Republic Street  
PO Box 36  
VALLETTA CMR 01  
Fax: (356) 233 621

**NETHERLANDS/PAYS-BAS**

InOr-publikaties, PO Box 202  
NL-7480 AE HAAKSBERGEN  
Fax: (31) 53 572 92 96

**NORWAY/NORVÈGE**

Akademika, A/S Universitetsbokhandel  
PO Box 84, Blindern  
N-0314 OSLO  
Fax: (47) 22 85 30 53

**POLAND/POLOGNE**

Główna Księgarnia Naukowa im. B. Prusa  
Krakowskie Przedmieście 7  
PL-00-068 WARSZAWA  
Fax: (48) 22 26 64 49

**PORTUGAL**

Livraria Portugal  
Rua do Carmo, 70  
P-1200 LISBOA  
Fax: (351) 13 47 02 64

**SPAIN/ESPAGNE**

Mundi-Prensa Libros SA  
Castelló 37, E-28001 MADRID  
Fax: (34) 15 75 39 98

Llibreria de la Generalitat  
Rambla dels Estudis, 118  
E-08002 BARCELONA  
Fax: (34) 343 12 18 54

**SWITZERLAND/SUISSE**

Buchhandlung Heinemann & Co.  
Kirchgasse 17, CH-8001 ZÜRICH  
Fax: (41) 12 51 14 81

**BERSY**

Route du Manège 60, CP 4040  
CH-1950 SION 4  
Fax: (41) 27 203 73 32

**UNITED KINGDOM/ROYAUME-UNI**

HMSO, Agency Section  
51 Nine Elms Lane  
GB-LONDON SWB 5DR  
Fax: (44) 171 873 82 00

**UNITED STATES and CANADA/  
ÉTATS-UNIS et CANADA**

Manhattan Publishing Company  
468 Albany Post Road  
PO Box 850  
CROTON-ON-HUDSON, NY 10520, USA  
Fax: (1) 914 271 58 56

**STRASBOURG**

Librairie Kléber  
Palais de l'Europe  
F-67075 STRASBOURG Cedex  
Fax: +33 (0)3 88 52 91 21

Council of Europe Publishing/Editions du Conseil de l'Europe

Council of Europe/Conseil de l'Europe

F-67075 Strasbourg Cedex

Tel. +33 (0)3 88 41 25 81 – Fax +33 (0)3 88 41 39 10 – E-mail: ce.publishing@seddoc.coe.fr

**T**he badger (*Meles meles*), belonging to the family *Mustelidae*, is one of the most interesting carnivores of Europe. Although badgers are widely distributed in Europe, the density of the badger population is low or moderate throughout most of central and eastern Europe.

Among the causes of the decline of the badger population are human persecution, the rabies virus, road accidents and, above all, the dramatic changes in the European countryside.

Council of Europe Publishing

ISBN 92-871-3447-2



9 789287 134479