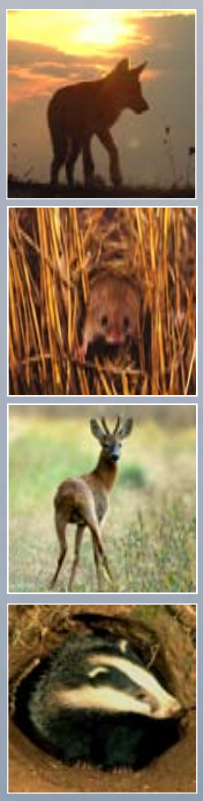
PROTECTING OUR NATIVE ANIMALS AND THEIR HABITATS

Mammals Trust UK



The State of Britain's Mammals 2007

Written by David Macdonald
and Dawn Burnham

WILD CRU
WILDLIFE CONSERVATION RESEARCH UNIT

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Preface


Stephen Oliver

Seven years have passed since we published the bumper report[1] on the challenges facing conservation of Britain's mammals which spawned this, the sixth annual update on the *State of Britain's Mammals*. It doesn't seem long ago – less than the lifetime of a moderately lucky fox, or even of a single ESA agreement[2] – but thumbing through the pages of the five predecessors of this year's report it's clear that a lot has changed. Most notably, environmental issues, and associated dilemmas in biodiversity conservation, have rocketed to prominence in the political agenda and public mind, and amongst them there are even cases where mammals – including some British ones - find themselves centre stage. Think, for example, of the 2007 perspective on climate change, infectious disease, the future of farming or even, albeit far offshore, whaling.

As we write it is raining, hard, again, and the July floods that have scarcely subsided were sufficiently catastrophic that they are likely to secure an unhappy place in history. Whether or not this unseasonal weather is a symptom of climate change, and whatever proportion of it originates from human excesses, it has certainly brought abstract discussion of climate change into vivid focus. It has also provided an opportunity to see the impact of changing weather patterns on mammalian populations – innumerable small bodies floated on the many square kilometers of water that immersed the fields around our homes – a phenomenon that would have been useful to monitor systematically if Britain had a formal mammal monitoring network. Certainly, a question mark hangs over the fates of the hundreds of water voles whose reintroductions our team had completed, following months of meticulous labour, just days before the floods. The sight of rabbits clustered on diminishing islands, wood mice shivering in the upper branches of hedgerows, and a roe deer splashing waist deep across a field all give a sense of meaning to concepts like mitigation and adaptation in the face of climate change, not to mention the planning implications for those three million new house that the Prime Minister hopes to see swiftly built – hopefully all with an eye to sustainability, green spaces and urban nature.

With a new foot and mouth disease scare, the role of infectious diseases in the countryside is also freshly in mind. In a broader context, SARS and avian influenza highlight the awkward fact that an unwelcome aspect of humanity's contact with nature is epizootiological, with risks that are likely to increase as humanity drives its enterprise ever deeper into the remotest crevices of wilderness. In Britain, we have our own intractable tragedy in the involvement of badgers with bovine tuberculosis. The conception by Lord Krebs' team of the Randomised Badger Culling Trial was reported in our first report '*Britain's Mammals: The Challenge for Conservation*[1]', and in this sixth issue the definitive conclusion of those overseeing it, the Independent Scientific Group, is unambiguous: that although badgers contribute significantly to the prevalence of bTB in cattle in some parts of the country, no practicable method of badger culling can reduce the incidence of cattle TB to any meaningful extent and culling may make matters worse (see page 10). The counter-intuitive result that killing badgers does not help, and often makes thing worse, has brought to prominence the now widely accepted perturbation hypothesis – which has widespread relevance to the general need to be alert to perverse outcomes when managing wildlife. This is a deeply frustrating reality, especially for the beleaguered farmers directly affected by bTB for whom one's heart bleeds, and it forcibly reminds our bombastic, technological age that the complexity of nature renders some problems insoluble with current knowledge (although in this case, hope lies immediately in biosecurity, and ultimately in vaccination technology).

The roll-call of environmental topicality seems more strident in 2007 than ever before, and wild mammals are touched by every topic on the list. How are agri-environment schemes to deliver food, biodiversity and rural livelihoods, how is society to balance its respect for individuals and humaneness with its desire to use, manage and develop, how is this nation to provide its ever-more urban citizens with contact with nature that is increasingly recognized as important for their well-being and health? The glimpse of a small furry creature may seem a trivial thing, but it is increasingly the hallmark of quality of life issues that reverberates through the biggest debates of our times.

David Macdonald & Dawn Burnham

Acknowledgements

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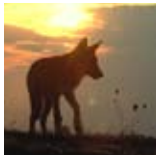


UK BAP update

THE UK BIODIVERSITY ACTION PLAN (BAP) resulted from the Government's commitment to the Convention on Biological Diversity 'to achieve by 2010 a significant reduction of the current rate of biodiversity loss', signed at the Rio Earth Summit in 1992.The first full review of the original 1994 UK BAP was completed in June this year[3] recommending almost double the number of species (1149), and adding 16 new habitats (total 65) for inclusion in the revised UK Priority List of Species and Habitats. The recommendations were formally adopted by ministers from all four UK countries in August. The revision serves to focus priorities in the light of new information and mark progress against existing action plans.

Eight additional terrestrial mammals are now included on the UK Priority List of Species. Of the new species, harvest mice and hedgehogs are thought to have declined significantly, polecat distribution data suggest a positive trend, mountain hare numbers are recorded as cycling but possibly show a downward trend, and the precarious status of Scottish wildcats and pine martens continue[4].

New Selection Criteria[3]

Terrestrial species: Threat *International or European importance* rated as Vulnerable/Endangered/Critically Endangered by IUCN[7]; **Reponsibility** *Moderate decline with international responsibility* decline of more than 25% over the last 25 years and with at least 25% of the global or European population supported by the UK; **Decline** *Marked decline in the UK* of more than 50% over the last 25 years, based on either population size or distribution, or inferred from loss of relevant ecosystem function; **Other** *Other important factors* e.g. restricted range, threatened key resource, pressure from disease, not yet recovered existing BAP species, indicator species for decline of taxonomic group/threatened habitat.
Marine species: Threat *Proportional importance* globally, requiring 20% or more of the population to occur within the UK or regionally, requiring 30%; **Responsibility** *Rarity* populations less than 250 individuals; **Decline** reduction in range, or decline in genetic/demographic quality of population; **Other** *Threat of significant decline* expected due to human activity or global/regional decline

Threats to UK BAP Priority List Species[6]

Existing UK BAP Species	Assessment	Accidental mortality (vehicle & boat collision, bycatch)	Changes in species dynamics (food decline/ disease)	Invasive/ non-native species (predation & competition)	Climate change	Agriculture	Infrastructure development	Management practice	Woodlands/ forestry	Overfishing	Human disturbance	Marine & freshwater pollution
Water Vole	Decline & Other			•			•					
Red Squirrel	Other		•	•					•			
Brown Hare	Other					•						
Otter	Other (Recovering towards BAP targets - major threats receded)											
Dormouse	Decline & Other				•	•	•	•	•			
Barbastelle Bat	Threat & Other	•					•	•	•		•	•
Bechstein`s Bat	Threat & Other					•	•	•	•			
Soprano Pipistrelle Bat	Decline & Other				•	•	•	•			•	
Greater Horseshoe Bat	Other					•	•					
Lesser Horseshoe Bat	Other					•	•		•		•	
Harbour Porpoise and grouped cetaceans	Threat & Other	•	•							•	•	•

New UK BAP species selection criteria assessment Hedgehog, decline; Scottish wildcat, threat & other; Mountain hare, other; Pine marten, other; Harvest mouse, decline & other; Polecat, other; Noctule, decline; Brown long-eared bat, decline; Common seal, threat & responsibility.

Noctules show indications of a slight increase, and brown long-eared bats are thought to be declining but neither trend is statistically significant[5]. These eight newcomers to this unhappy list join the existing ten terrestrial mammals already covered by individual Species Action Plans. The now inappropriately named common (or harbour) seal met the new selection criteria, with low numbers at many sites, bringing the total number of marine mammals to 20, covered by three grouped cetacean plans and a Species Action Plan for harbour porpoise (See articles on pages 6, 8, 14 and 16, for more information about mountain hares, harvest mice, Scottish wildcats and harbour seals).

Two bat species were removed from the UK BAP list; the common pipistrelle, with a now stable population, and the greater mouse-eared bat, which is not present as a breeding population due to its rarity.

The review was coordinated by the Biodiversity Reporting and Information Group (BRIG) and consisted initially of a selection stage, with assessment against four new criteria (see Table). Experts then agreed the conservation measures required for all species on the UK Priority List, grouping them into categories or 'signposts'. The signposts will be used to maximise the efficiency of conservation action, linking species with habitats. In the future it is hoped that signposting will inform policy, so delivering an integrated approach to biodiversity conservation in the UK, against the backdrop of new drivers such as 2010 targets, devolution, climate change, sustainable development and ecosystem function. Habitat loss and degradation through factors such as agricultural intensification, the demise of traditional practises in forestry management and infrastructure development are key threats linked to drivers for all the listed terrestrial mammals[6] (see Table).

Mapping the distribution of Bechstein's bat

Bechstein's bat is a priority species for conservation in both the UK and Europe, but there are currently no reliable estimates of population sizes, and only very limited information on its distribution. This is because Bechstein's bats are very elusive woodland specialists, making them difficult to catch or monitor. Until recently, most records of the species were from opportunistic finds of dead or hibernating individuals.

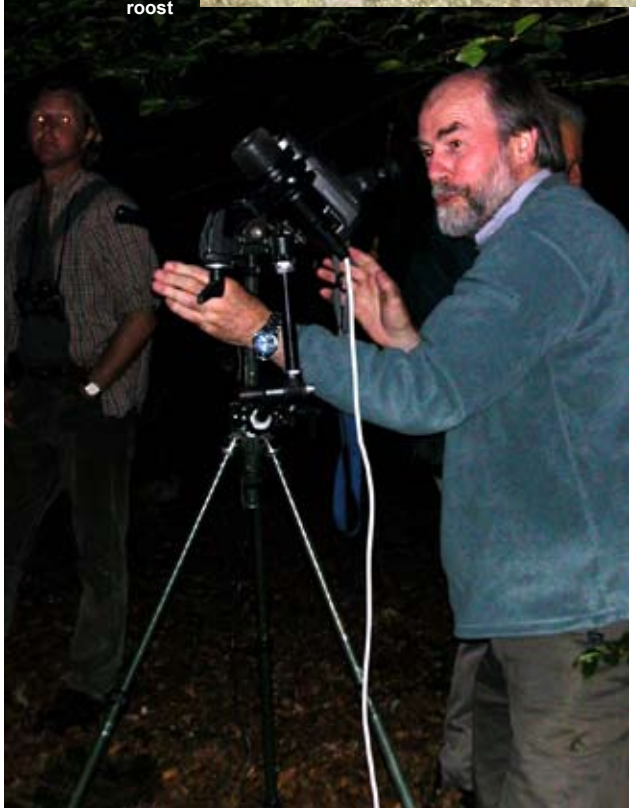
In 2001 researchers from the University of Sussex developed an acoustic lure, the Autobat, enabling them to locate and study Bechstein's bat[8]. The Autobat is an ultrasound synthesiser that mimics the bats' social calls. Bats respond by approaching the speakers and can then be caught in mist nets. Initial surveys found that adult female Bechstein's were usually caught in woods of over 25 hectares, with good canopy cover, including a high proportion of oak, and a well-developed understorey. A preliminary model of suitable habitat for a breeding colony was defined using these characteristics.

Using the Sussex Autobat the researchers conducted systematic surveys for Bechstein's bats in southeast England in two phases, supported by funding from MTUK. In 2005, 52 woods of over 25 hectares were surveyed in a grid system across Hampshire, Surrey, West Sussex, East Sussex and Kent. Female Bechstein's were caught in six of the 15 woods that matched the preliminary model and none of the 37 that did not. The understorey of all six woods was dominated by native species, especially hazel, hawthorn and holly, so this characteristic was added to the model.

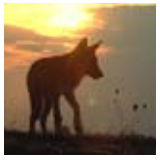
In 2006 they made a more intensive survey of the counties of East and West Sussex, selecting a target wood as close to the model as possible in each grid square. Female Bechstein's were recorded in 10 out of the 35 squares. All but one of these were in West Sussex, where woodlands also matched the model more closely. Males were caught in a further 10 squares in East and West Sussex, but mostly in less suitable habitat. Importantly this suggests that presence of Bechstein's alone, without knowing the sex of individuals, cannot be taken to indicate the presence of a breeding colony. The researchers plan to extend the same survey technique across southern England to provide the first reliable baseline data on the national distribution of the breeding population of one of Britain's rarest bats.

Stephen Oliver

ABOVE RIGHT: Bechstein's bat BELOW: monitoring bats emerging from a roost



PTES, Ian Davidson-Watts



New BAP species: mountain hare

THE MOUNTAIN HARE IS AN ICONIC, although often elusive, native of the uplands, but there is growing concern for its population in Britain. For the first time, the UK Biodiversity Partnership and UK Government have made mountain hares a UK BAP priority species.

The recently published Species and Habitat Review[1] recommended the inclusion of mountain hares on the BAP list on the grounds that there is perceived to be a population decline that is likely to continue with increased impacts of climate change on fragile upland habitats. There are also increasing concerns that disease transmission and hybridisation with brown hare populations of northern Europe[9] may be occurring here in the UK too. The mountain hare is potentially a useful indicator species for the upland environment, which makes research into its population demography, biology and ecology a priority.

Historically mountain hares were native only to the Highlands of mainland Scotland, where the vast majority are currently found. However, translocations in the 19th century to the Edinburgh area and the Peak district, and about 40 years ago to the Isle of Man for game shooting, led to the establishment of other small populations.

In Northern Ireland a subspecies of mountain hare, the Irish hare, occurs. The Irish hare differs in some morphological and behavioural characteristics and is the only species of hare endemic to Ireland.

The survival of the mountain hare is threatened by a number of factors. In Scotland these hares are found predominantly in the moorland habitat of the uplands, with a large proportion of their diet consisting of common heather. These moorlands, created and managed primarily for grouse, are on the decline as the profitability of grouse shooting decreases. Moorland management for agricultural purposes is also declining due to the Common Agricultural Policy (CAP) reform which has affected the profitability of hill sheep farming. Subsequent habitat fragmentation and changes to land management threaten the survival of hares in these areas. Mountain hares are sometimes considered a pest as they may compete with grouse for the young heather and are also reservoirs for louping ill, the tick-borne disease that affects grouse and sheep. Consequently, as well as being hunted as game, there are areas where they are killed in an attempt to prevent disease transmission and to control their numbers[3].

Assessing the current population trends and status of the mountain hare is difficult because both mountain hare and Irish hare populations naturally cycle, with cycling between 4 – 15 years[10]. To date there are few long-term datasets to build an accurate picture of population trends. The current population is thought to be around 360,000 in Scotland and England, with Irish hares numbering just 82,000. Five surveys have been conducted on the UK population in the last couple of decades, although another is planned for later this year[11]. The Derbyshire Wildlife Trust organises annual counts of the Peak District population. Walking transects indicate around 1,000 animals[12] in the locality with no evidence of decline over the last six years. However,

Mountain hares and parasites

The causes of population cycles in mountain hares, as with other cyclic mammal populations, are difficult to determine. Recent work has however indicated that one of the major causes with this hare species may be a nematode, gastro-intestinal parasite.

Gastro-intestinal parasites have been shown to have a role in the regulation of reindeer and grouse populations. As the host population increases there is a subsequent increase in parasite accumulation. The high parasite load may then impact the host's ability to acquire nutrients, and to successfully survive or reproduce, so population numbers fall. The parasite load then declines in the hosts as transmission between individuals is reduced, causing a subsequent improvement in survival or reproduction which allows the host population to rise again. The parasite can therefore potentially regulate the host's density.

Research on mountain hares in Scotland has indicated that a reduction in parasite burden can improve the fecundity of the female hares[15]. Researchers from the Game Conservancy Trust and the University of Stirling treated a number of hares with Ivermectin, a drug that expels parasitic worms, and compared them with untreated hares the following spring. Although no significant difference was found in body condition between treated and untreated hares, the treated hares had lower parasite burdens and higher fecundity, as measured by the condition of their ovaries. This suggests that the treated hares had been able to accumulate more nutrients which they invested in reproduction. The researchers concluded that gastro-intestinal nematodes have the potential to regulate mountain hare populations by affecting the birth rate.

However, the relationship between host and parasite is highly complex, and affected by diverse factors. The distribution of parasites within the host population, and the route of transmission between hosts, affect how parasites influence host population dynamics. External factors such as climate and habitat variation also affect the survival and reproduction of both hosts and parasites, influencing the cycle of the host-parasite relationship.

Jonathan Reynolds

due to problems with detectability this is likely to be an underestimate. An action plan is already in place to conserve Irish hares. A 2006 survey of Irish hares estimated the population in northern Ireland to be 36,200 which was lower than in 2004[13]. However, it is unknown whether this is part of a trend, or of a cycle or the result of alterations in habitat management practices.

There is an emerging anxiety regarding hybridisation between brown hares and mountain hares. Brown hares are thought to have been introduced to the UK by the Romans and the ranges of both species overlap naturally in parts of northern Europe[9]. In addition to the potential for competitive exclusion by brown hares, there is also evidence of hybridisation between the two species[9,14]. Research in Sweden has indicated that milder winters are enabling the brown hare to expand its range whilst the mountain hare is less flexible. As the overlap in their ranges increases, the risk of hybridisation between brown and mountain hares rises, and this exacerbates the threats posed by climate change.

Brown hare game shooting

The brown hare was listed in the first UK BAP in 1995 owing to its drastic population decline since the 1960s, attributed primarily to habitat changes due to modern farming practices. Game bag records showed an average decrease of 6% per year to the mid 1980s, but numbers now appear to be stable at approximately one million, and the current Species Action Plan (SAP) target is to double brown hare spring numbers by 2010. In the mid-1990s the Brown Hare SAP Steering Group identified the need to review legislation relating to hunting and shooting[16], but a close season has never been recommended as hunting or shooting were not considered as major factors in the decline.

Since the Hunting Act (2004), hare coursing with dogs is illegal incurring penalties of up to £5,000. However, the brown hare is the only game species in the UK which is not protected by a close shooting season. Hares are shot throughout their breeding season, including lactating females, which means their unweaned leverets die of starvation. The majority of game shooting in England occurs in areas where hares are abundant, such as East Anglia. In February this year Rodney Hale, Chairman of the Hare Preservation Trust, with the support of 493 signatures, petitioned the Prime Minister '*to introduce a shooting close season for the brown hare from February to September inclusive*'. He wrote, *'Our campaign for a close season does not imply we approve of hare shooting at other times of the year. We simply see a close season as a realistic objective and a minimum requirement for the welfare and conservation of hares. We remain firmly opposed to shooting hares for "sport" at all times'.*

The government response argued that to fully avoid the culling of pregnant and nursing females the close season would need to span most of the year, with the open season lasting for only 6 weeks between December and January. Even with a close season, culling by farmers during the breeding season would be permitted for pest control, as hares cause significant agricultural damage, particularly in eastern England. The argument was that under these circumstances a close season would have only limited welfare benefit for brown hares. In addition the government does not anticipate significant conservation benefits from a close season, citing that in Europe close seasons have not halted the decline of hare numbers and intensive game shoots at the beginning of the breeding season do not appear to impact on hare populations. In conclusion the government stated:

'It is important to remember changing legislation is only justified if there is clear evidence that the changes are necessary and that they will achieve their stated goal. It does not appear that the case for a close season for the brown hare has yet been convincingly demonstrated[17].'

Mammal monitoring

THE HARVEST MOUSE IS ARGUABLY ONE OF our most endearing wildlife species in the UK. Part of its appeal lies with its close association with farming and a romantic view of the rural countryside. Robert Burns immortalised the formerly intimate relationship between the farmer and the harvest mouse in his famous ode To A Mouse (On Turning Her Up in Her Nest With The Plough, November 1785: *Wee, sleeket, cowran, tim'rous beastie…*).

A national survey of breeding nest locations was carried out by The Mammal Society in the 1990s and a follow-up survey is being considered to determine the overall status of harvest mice and any changes in the population. The North of England Zoological Society's Harvest Mouse Project has involved over 15 years of captive breeding, experimental reintroductions and, since 2005, surveying and monitoring of wild populations in Cheshire. An equal number of male and female captive bred harvest mice were released in 2002 (128) and 2003 (268) at two field sites adjacent to Chester Zoo. Half of the mice were acclimatised in enclosures at the release sites for 48 hours, followed by one week during which the opened enclosures remained in place, with food and water (soft release, SR). The other half was placed directly into the release site (hard release, HR). Post-release individuals of both sexes survived and dispersed equally well, with no apparent advantage by SR harvest mice, although results may be confounded by the HR mice feeding in the SR enclosures. Encouragingly harvest mice are still being found on both of the release sites. However, more needs to be learnt about wild populations of harvest mice, and any threats to this emblematic species within a rapidly changing rural landscape.

A recent study by WildCRU, funded by MTUK, looked at the current status and distribution of harvest mice in the Upper Thames tributaries region and what population changes had occurred over recent years. Between 2004 and 2006, in some sites densities of harvest mice had plummeted to as low as 0.02 to 0.76 animals per hectare. This compares with an estimated average of 27.5 wood mice and 16.8 bank voles per hectare in these study areas.


Dave Bewan

Breeding and non-breeding nests were used as indicators of harvest mouse presence, and were found principally in linear habitats, particularly diverse mature hedgerows. At the landscape scale, harvest mice were found in areas of mixed habitats, including patches of woodland and urban/suburban areas although, interestingly, not arable land. The distribution of nest sites across the landscape became more aggregated between 2004 and 2006 and the density of nests declined from 3.6 to 0.7 per km^2 over this time. The team suspects that connectivity between suitable habitats may limit the ability of harvest mice to recolonise areas from which they have disappeared. If so, this is yet another reason to restore and enhance connectivity in agricultural landscapes.

HogWatch

Between 2001 and 2005, MTUK's *Mammals on Roads* survey suggested a decline of 20% in hedgehogs numbers; as high as 50% in some places. PTES and the British Hedgehog Preservation Society joined forces last year to fund work at Royal Holloway, University of London, to find out why hedgehogs are declining and what can be done. As part of a wider project a public survey of hedgehog distribution, *HogWatch*, was conducted during 2006, recording presence and absence of hedgehogs sightings since 2005. Nearly 20 000 people took part – testament to the great affection the public has for hedgehogs.

Royal Holloway's researchers found that hedgehogs are still widely distributed although not necessarily common everywhere and they are more likely to be encountered in the east than the west. The data fit well with the *Mammals on Roads* finding that there are relatively large numbers in north-east England and in Norfolk.

The majority of records, unsurprisingly, were from people's gardens. Hedgehogs were also seen in a great range of other habitats, including pastures, arable land, woodlands, village greens, parks, moorland and heathland.

A higher proportion of records were submitted from centres of human population such as London, Cardiff, Manchester and Edinburgh and also many smaller towns and villages. This geographical bias was taken into account by weighting the records according to the number of households in each area.

As to why hedgehogs are more widely distributed in some areas than others, the preliminary analysis suggests that increasing urbanisation and 'tidier' gardens are pushing hedgehogs out from the places where most of us live. This is being further examined by comparing current hedgehog distribution with that in Greater London in the 1960s. On a wider scale, 'fine grain' landscapes which have smaller-sized fields, appear better for hedgehogs than 'coarser grain' landscapes with larger field sizes.

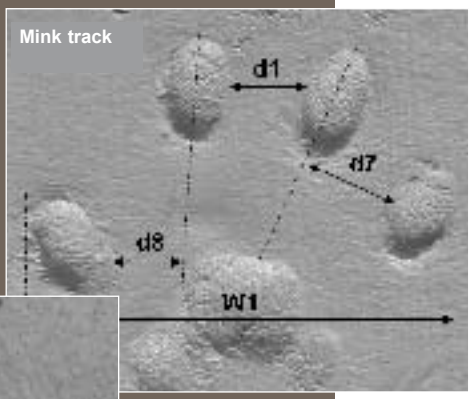
Although unconfirmed, the increase in badger numbers and their predation on hedgehogs is often suggested as the reason why hedgehogs are declining. We know from *HogWatch* that in some places hedgehogs occupy much of the landscape where badgers are very common, such as the southern Welsh borders and parts of Sussex and Kent. *Mammals on Roads* recorded a decline of hedgehogs in the east of England, but this is not an area where badger are particularly numerous.

As yet, it is not clear why hedgehogs are declining however *HogWatch* provides data on their national distribution for future population monitoring.

Distinguishing tracks of mink and polecat

Mink rafts, designed by the Game Conservancy Trust, are now being used across the country for detecting the presence of American mink and for monitoring and targeting trapping efforts for this invasive species. Use of the rafts relies on correct identification of the tracks found and, whilst the tracks of mink can easily be distinguished from those of stoat and otter on the basis of size[18], the distinction between mink and polecat (that are very similar in size) is more problematic. This distinction is particularly important because the protected status of the polecat (Schedule 6, Wildlife and Countryside Act 1981) means that intentional trapping of polecats is prohibited in the UK. Polecats are often found along riverbanks, particularly where rabbits are plentiful (and they have occasionally been trapped on rafts set for mink). It is important, therefore, given the increasing countrywide efforts towards local mink control, to be able to distinguish polecat tracks from those of mink.

WildCRU, funded by MTUK and the Esmee Fairbairn Trust, has recently developed an equation based on three simple measurements that can be used to distinguish between the tracks of these two species[19]. Measurements can be taken directly in the field using callipers or later from calibrated photographs, either from prints or from digital images using software such as ArcGIS or Photoshop. Two measures relate to the size and shape of the track overall: the total width of the track (shown on the diagram as W1) and the distance between the inner edges of the two middle toes (d1).The third measurement relates to the spread of toes in more detail and is the average of two distances, one for each side of the track. These are the perpendicular distances between the midline of the middle two toes and the inner edge of the outer two toes (d7 and d8). Testing has found that at least 90% of tracks can be correctly identified using this method although the authors stress that testing, so far, has only been carried out on tracks from tracking rafts (tracks on natural substrates may differ) and on adult tracks (care should be taken in identifying small mustelid tracks found in early summer). They also recommend regular smoothing of the clay used on tracking rafts in areas where polecat presence is suspected. This method is particularly promising since it suggests that the potential exists to develop a terrestrial version of the tracking plates as a survey method and monitoring tool for polecats.



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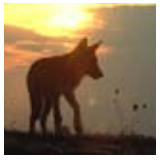


Wildlife diseases

Badgers and bovine tuberculosis

AFTER NEARLY TEN YEARS OF RESEARCH on bovine tuberculosis (bTB), much of it carried out through the Randomised Badger Culling Trial (RBCT or Krebs' Trial), the UK government's Independent Scientific Group on Cattle TB (ISG) published its final report on 18th June 2007[20]. Entitled *Bovine TB: The Scientific Evidence*, the report evaluates the potential of badger culling for TB control among cattle and the likely effectiveness of enhanced cattle-based control measures.

The ISG's final report marks the end of the RBCT and summarises the results. These show that small-scale culling can increase levels of TB in cattle. The report also says that proactive culling, as practiced in the RBCT, can bring benefits, but only if culling is sustained over a number of years and coordinated over a large area. The ISG are not convinced that it would be practical or economical to deliver a cull in this way. Therefore, they conclude that badger culling could not contribute meaningfully to the control of bovine TB in Great Britain. The ISG also concluded that, although badgers contribute significantly to the prevalence of bTB in cattle in some parts of the country, no practicable method of badger culling can reduce the incidence of cattle TB to any meaningful extent and culling may make matters worse. The ISG also concludes that rigidly applied control measures targeted at cattle can reverse the rising incidence of disease, and halt its geographical spread.

In response to the ISG report, The Secretary of State for Environment, Food and Rural Affairs, David Miliband, highlighted the importance of cattle control measures for tackling this disease. The Department of the Environment, Food and Rural Affairs (Defra) has already tightened these measures and the number of herds tested each year has increased, with increased costs to both the taxpayer and farmers. Defra, which, as the Ministry for Agriculture, Food and Fisheries (MAFF) had commissioned the nine-year study, responded by suggesting that more could be done to tackle transmission between cattle. However, it highlighted that new cattle measures would increase the cost of the TB control regime. It therefore pledged to 'work with the farming industry and the veterinary profession to assess the implications of these recommendations'.

Cattle tuberculosis (TB) was almost cleared from Britain in the 1970s but has since re-emerged as a major problem for British farmers. Badgers were implicated in spreading the infectious agent (the bacterium Mycobacterium bovis) to cattle and between 1973 and 1998 cattle-based TB controls were supplemented by various forms of badger culling.

A scientific review of the issue, chaired by Professor John Krebs (now Lord Krebs) and completed in 1997, concluded that there was 'compelling' evidence that badgers were involved in transmitting infection to cattle. However, it noted that the development of TB policy was hampered because the effectiveness of badger culling as a control measure could not be quantified with data then available. Professor Krebs' team therefore recommended the establishment of a large-scale field trial of the effects of badger culling on cattle TB incidence, to be overseen by a group of independent experts. The ISG was formed in 1998 and, in addition to designing and overseeing the RBCT, it identified and initiated a broad array of research related to the diagnosis, pathogenesis, dynamics and control of TB in cattle and badgers. Publishing the Report, ISG Chairman Professor John Bourne said:

'*Having shown that the main approach to cattle TB control should be rigorously targeted to cattle, we hope that the overwhelming scientific evidence we have provided to support this view, and the policy options we present, will enable the farming industry and Government to work together in a constructive and cooperative manner to tackle this very serious disease of cattle which causes so much economic loss and hardship to cattle farmers*'.

Initial reactions to the report from farming organisations have largely dismissed the ISG's conclusion that badger culling could not contribute meaningfully to the control of bovine TB in Great Britain. Farming organisations such as the National Farmers Union and the Farmers Union of Wales have expressed concern that increased cattle control measures will harm the farming industry and prove ineffective in the presence of a significant wildlife reservoir of the disease. Many have pointed to the Irish Four Areas study, which suggested (under their different circumstances) a decline in cattle TB following widespread badger removal. The ISG was informed by ministers that the elimination of badgers from large tracts of the countryside would be unacceptable. Furthermore, the capture technique used in the Irish study (snaring) has also been widely criticised on animal welfare grounds and is judged to be publicly unacceptable in the UK.

Suggestions that farmers might be able to conduct an effective cull under licence from Defra or Natural England have also been dismissed by the ISG. It claims that such action would result in a piecemeal culling operation that would amplify disease rates through increasing badger movements – referred to as perturbation. This effect was reported from earlier culling strategies and during the RBCT, through work carried out by WildCRU.

The Protection of Badgers Act 1992 allows for the culling of badgers under licence to prevent the spread of disease.

Laurie Campbell

There has never been a license issued for this purpose. Now that the RBCT has ended, a number of licence applications have been submitted and farmers are waiting to see how the government reacts. If licences are not granted, farming groups may legally test the government through the courts. Although the publication of the ISG's final report draws this particular chapter to an end, the story of badgers and bovine TB is not yet finished.

Health of Britain's otters

A series of studies commissioned by the Environment Agency (EA) has concluded that the UK's otter populations are healthy and expanding. Reports published in March 2007 collate research from 1988 to 2003 on factors affecting otter health and survival, and include the results of 1,027 post-mortem examinations[21,22,23].

Road traffic accidents (RTAs) were found to be a significant cause of recorded mortality amongst otters (83% of reported deaths in southern England and 92% in the rest of England and Wales), with the majority of deaths occurring during winter and more males than females being killed on roads. A particular sadness was the number of breeding females killed on Britain's roads (30% of females examined from Wales, 40% from the South West of England). Nonetheless, national surveys show that otters continue to expand their range, so it seems that the RTAs are not limiting their recovery.

At post mortem, a sample of otters was screened for pollutants, including organochlorine compounds (OCs) and polychlorinatedbiphenyls (PCBs). The OCs most commonly detected were dieldrin and the para para (pp) isomers of DDE and TDE (both derivatives of DDT), all potent insecticides, once used extensively by farmers. The results varied between regions. Otters from south west and southern England showed a highly significant decline in the levels of ppDDE, ppTDE and dieldrin over time. This correlates with the withdrawal of these chemicals from 1962 onwards, culminating in a complete ban by 1989.

Pollutant concentrations were higher in adult males than in adult females. Some of the highest levels occurred in juveniles, probably though the transfer of these compounds by females to their young during pregnancy and lactation. It seems that OCs and PCBs accumulate with age in males, while in females an initial increase is followed by a decline in concentration following sexual maturity, when pollutant off-loading occurs through lactation. Since Rachel Carson's *Silent Spring*, OCs have been known as a scourge of wildlife – they interfere with vitamin A metabolism, leading to reproductive abnormalities such as retinal dysplasia (a distorted retina) amongst other conditions. Of 100 otters from south west and southern England, analysed between 1996 and 2000, almost half had vitamin A levels below the normal threshold for domestic animals and 14 were reported as '*critically low*'. Interestingly, the size of otter thyroid glands has decreased since 1996, in parallel with the decline in levels of DDT in the environment.

There are few studies of the impacts of man-made chemicals on wild mammals, and the EA report highlights some physiological impacts associated with exposure to OCs. However, attributing cause and effect is difficult in wild populations, and long-term surveillance is vital. The crash in otter populations in the latter half of the 20th century was generally attributed to OC levels, and the decline of these toxins is now associated with the otter's recovery and continued expansion.


Paul Bright

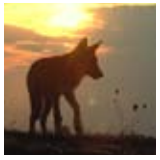
Red squirrels and parapox virus

Early 2007 saw the dismal discovery of the first reported cases of squirrelpox virus (SQPV) from wild red squirrels in Newborough forest, Anglesey[24], Wales and in Lockerbie, Dumfries and Galloway, Scotland[25].

The red squirrel is amongst the UK's most endangered native mammals, and numbers have been declining for at least the last 50 years[26]. Red squirrels are absent from most of their former range, existing only in the north of England, Scotland (75% of the UK population), and small pockets in Wales and southern England. Although the reasons for the decline of the red squirrel were unknown for many years, it became clear that competition with the introduced grey squirrel and changes in woodland management and habitat were playing a role. Then it was discovered that grey squirrels are responsible for carrying and transmitting the SQPV to reds, which are highly susceptible to the disease, resulting in high fatality rates. SQPV, which is apparently harmless to greys, has been responsible for the devastation of the red squirrel population across England[27].

Upon discovery of the virus in the Anglesey population in December 2006, emergency control measures were implemented to halt its spread (trapping and removing greys, and disinfecting nest boxes and wooden feed hoppers). The red squirrel population has been monitored closely for further signs of disease. By the end of May 2007, there had been no signs of population decline.

SQPV was first recorded in Scottish grey squirrels in 2001, but the new case in red squirrels in Lockerbie this May sounds an ominous warning. Control measures, as described above, to minimise the spread of SQPV in Scottish grey squirrels have been in place since May 2005, when emerging evidence revealed that the virus was more widespread amongst them than had been realised. SQPV has been reported in the red squirrel population across the border in northern England, so most experts have judged the spread of disease to Scottish red squirrels as inevitable. Scottish authorities are continuing to target grey squirrel control in affected areas in an attempt to limit spread and are urging people not to use garden feeders that might draw the two species together.



Laura Hurt, inset: Terry Whittaker

Reintroducing extinct mammals

Economics of bringing back beavers

THE EURASIAN BEAVER WAS HUNTED TO extinction in Britain in the 16th century, and almost eradicated from Europe by the 1900s. A series of European reintroductions has resulted in successful expansion of the wild populations on the continent, but the prospect of a beaver reintroduction in Britain remains tantalizingly unfulfilled. Last year[28], we reported that there were 10-20 captive beavers in at least five sites across Britain. Since then, animals from three of these groups have escaped (a lone beaver currently resides near Oxford, from where no problems have been reported, whereas another, in Perthshire, felled six apple trees and damaged six more). Beavers are relatively easy to control and such occasional escapes are unlikely to result in an inadvertent 'reintroduction', but they do emphasise the unsatisfactoriness of protracted dithering over whether beavers should be returned to the UK. Over a decade has passed since the first major review of this issue[29] prompted a series of studies by SNH which suggested that the benefits outweigh the risks of reintroducing beavers.

The early emphasis on Scotland is shifting. In 2005 the Wild Wales Inititative hosted a meeting to assess opportunities for beaver reintroduction, resulting in the 'Beaver Information Exchange for Wales'[30] website. Over 20 organisations and authorities are now involved in consultations on reintroduction, including the farmers union of Wales, the Environment Agency and the Welsh Salmon and Trout Angling Association. The potential for reintroducing the beaver to the Brecon Beacons was debated at the 2007 Wales Conservation Management Conference. PTES hosted a similar meeting in England and, in concert with Natural England, are currently commissioning a scoping study on the environmental and social impacts and the feasibility of a beaver reintroduction in England.

In 2007 the WildCRU completed a desk study (funded by the Wild Britain Initiative) to explore the potential for eco-tourism and the economic consequences of reintroducing beavers to Britain. In the UK wildlife tourism is a thriving and significant industry worth £13.8 million per annum in Wales and £7.8 million from whale watching alone in the West of Scotland. Previous reintroduction sites such as the Osprey Centre at Loch Garten, Scotland attracted on average 33,600 visitors between 1998 and 2001 and the Red Kite Centre, Wales attracted 33,350 in 2004. In addition to nominal entrance fees visitors typically spent approximately £50. WildCRU made a conservative estimate of potential income from beaver tourism of £94,000 based on three reintroduction sites in Europe totalling only 1850 visitors. Nonetheless, the figure rose to £1.25 million when they factored in the business required to support increased tourism, comparable to £¾ million seen in the locality of beaver releases in Europe. Holidays that provide an opportunity to see a charismatic species (bear, wolf, lynx, elk, wild boar and beaver) can increase the price by £63 per person (based on 20 UK operators providing wildlife holidays and 120 European holidays aimed at British tourists).

The experience of conflict associated with beaver reintroductions has varied widely (and were not straightforwardly related to the size of the area or beaver population nor the age of the reintroduction). It seems that the worst case scenarios would cost tens of thousands of pounds per region (including instances where dykes were threatened in Holland) whereas the best would be negligible.

These estimates of both costs and benefits are tentative, but they suggest that the financial benefits of a beaver reintroduction would significantly exceed the costs, notwithstanding any intrinsic value attributed to the reintroduced beavers. The costs are likely to be low because the semi-aquatic behaviour of beavers limits the areas available to them and there are mitigation techniques to ameliorate damage. Problematic individuals could easily be killed with appropriate licensing legislation. Furthermore, on the plus side, they contribute to wetland creation with consequent water purification (estimated value in Latvia in 1982 of £120 million per annum) and flood retention (flooding in England and Wales costs the economy around £600 million per annum). When these non-market benefits are factored in, the end result appears to be a very healthy balance sheet in favour of reintroducing the beaver.


Chris Sandom

Impact of wild boar

In the early 1980s wild boar farms emerged in Britain providing the unintended opportunity to re-establish wild boar in the UK after an absence of over 300 years. Natural England's (NE) Policy Steering Group (PSG) met at the end of April to discuss its policy position on feral wild boar. Writing in the scoping paper for the PSG[31], Charles Wilson, the Senior Wildlife Advisor, summarised the proposed NE policy position.

'Natural England recognises feral wild boar as a former native species which can contribute to our Strategic Objective that England's natural environment be conserved and enhanced. However, we also recognise that they have the potential to harbour or spread some livestock diseases and can cause significant damage to agriculture and other interests, including biodiversity. We therefore encourage their positive management and favour a regional approach, where they are removed in areas where their impact would be unacceptable, but are managed sustainably where the balance of their impact is likely to be neutral or beneficial. We do not condone unregulated releases.'

Crucial to future management of wild boar is an evaluation of their likely impact on the British environment[32,33].Where they are endemic they are considered both an economic asset and a pest due, respectively, to hunting opportunities and crop damage. As an invasive species they can be devastating. In the Smoky Mountains rooting by boar caused a reduction of 95% in herbaceous cover, severely reducing numbers of five lily species[34]. In the 'unnatural' absence of wild boar, bluebell forests in Britain have developed to a status of international renown. In southern England the re-established boar root up bluebells, strip bark and expose tree roots (increasing the possibility of toppling in high winds). There is also some concern that they may predate dormice over-wintering in nests close to the ground. However, wild boar can play an important role as ecosystem engineers. In native woodlands wild boar arguably increase habitat diversity, disturbing and aerating soil and potentially altering the dynamics of pest species such as Ixodid ticks.

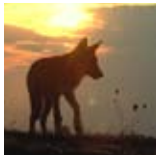
Ultimately, the impact of wild boar is expected to increase in areas where they become numerous. Road traffic accidents might also become an issue at high densities in wooded regions, as for deer, with associated economic cost (see Deer Vehicle Collision, page 15). However, even at high densities in parts of Europe the risk of disease transmission from classical swine fever (CSF) and foot and mouth disease (FMD) to and from livestock appears to be very low. The vast majority of wild boar populations are CSF free, and in areas occupied by both wild boar and livestock, FMD outbreaks have not infected wild boar.

In places where wild boar are regarded as an asset it is generally because they provide sport, and meat, to a hunting sector. This is a component of the profit and loss equation, alongside damage to natural habitats, agriculture and perhaps to people and pets, that is not straightforward in discussions about wildlife and sustainability in 21st Century Britain.

Estimating potential lynx populations

The EU Habitats Directive (Annex IV) states that the formerly native Eurasian lynx should be considered for reintroduction by member states. The case was recently strengthened by evidence suggesting that human's were instrumental in their dying out in Britain. Deforestation, declining deer populations and persecution led to lynx becoming extinct during the medieval period. Due to extensive reafforestation and recolonization by both native and introduced deer species these limitations have been reversed.

Previously the University of Aberdeen identified two areas in Scotland which would provide suitable habitat for lynx. The researchers now estimate that these areas, with roe, red, sika and fallow deer at current densities, could support lynx populations of 400 in the Highlands and 50 in the Southern Uplands[35]. Their estimate is based on predictions from the strong relationship they found between lynx density and ungulate prey densities in Norway, Switzerland and Poland, and average Scottish deer densities, but does not include other possible, although less likely, prey such as brown hares and mountain hares.



Human wildlife interactions

Reintroducing wolves to Scotland

A RECENT REPORT PUBLISHED IN *Proceedings of the Royal Society* [36] examined the potential ecological impacts of and public attitudes towards reintroducing wolves to the Scottish Highlands. Grey wolves, hunted to extinction in Scotland in the 18th century, are symbolic of human wildlife conflict in Western folklore, gaining their reputation for being 'big and bad' through predation on domestic livestock and a perceived threat to human safety. In reality, livestock are taken infrequently and attacks on humans are extremely rare[37].

If wolves were reintroduced to the Scottish Highlands, conflict with farmers would be highly likely due to predation on sheep. Interestingly, the researchers from the University of Oslo, Hedmark University College and Imperial College London found that attitudes of farmers were substantially less negative than those of their representative organisations[36]. Agri-environment schemes, which contribute to the income of many highland farms, could include reparations for any loss through sheep predation. This might explain why individual farmers are not as strongly opposed to the notion of reintroduction of wolves as might be expected. Urban attitudes were generally positive and people cited advantages such as '*restoring the balance of nature* and *preserving Scotland's heritage*'. The researchers also suggested that adequate compensation policies for farmers in light of any sheep losses, might improve public tolerance towards a wolf reintroduction in Scotland.

The team used computer modelling techniques to simulate the impact of wolves on red deer populations. Deer numbers are currently at detrimentally high densities in the Highlands, hindering attempts to re-establish Caledonian forest and impacting on bird populations. The most stable wolf density, from the simulations, was approximately 25 individuals per 1000km^2, which more than halved simulated deer densities. Currently land managers harvest deer to meet the Deer Commission for Scotland's population target of six deer per km^2. The reintroduction of wolves might reduce the need for costly deer culls, allowing natural regeneration of the Caledonian pine forests.


Barbara Promberger


Stephen Oliver

Genetic markers for Scottish wildcats

The Scottish wildcats' decline, due to persecution and hybridization with domestic cats may have, at worst, reduced numbers to as low as only 400 individuals surviving in northern parts of Scotland[38]. Previously categorised as a 'species of conservation concern', the Scottish wildcat now features on the revised UK BAP list of Priority Species, which is expected to confer a greater focus of conservation effort and monitoring towards the 2010 biodiversity targets for the UK. Hope for the Scottish wildcat's future comes from new genetic research by an international team led by WildCRU and the National Cancer Institute and may be a very significant breakthrough in the history of Scottish wildcat conservation. The team discovered a genetic marker, which can be used to distinguish between pure Scottish wildcats and cross-breeds with feral cats[39]. This should be an invaluable tool with which to assess the current wild-living cat population in Scotland and determine accurately how many 'pure' Scottish wildcats persist.

WildCRU has worked on the conservation of Scottish wildcats for ten years, tackling the serious problem of contention over the wildcat's identity. Previously, a collaboration with the National Museum of Scotland defined a diagnosis system for Scottish wildcats based on the quantitative scoring of twenty pelage characteristics from benchmark specimens[40]. This method provided a relatively simple but scientific means of identifying a Scottish wildcat compared with feral domestic cats, aiding the enforcement of protective legislation of the Countryside and Wildlife Act (1981).

The domestication of the cat is possibly the oldest and most successful of all human wildlife interactions. The new study analysed mitochondrial DNA from a total of 979 individuals of both domestic and wild cat species, including the near eastern wildcat, the central Asian wildcat, the

sub-Saharan African wildcat and the Chinese desert cat. Their assessment shows that each wild group represents a distinctive subspecies of wildcat, and that the ancestors of these and of domestic cats diverged around 130,000 years ago. The separation of this lineage, which unites the domestic cats and the near eastern wildcat, extends back far earlier than previously suspected; the earliest archaeological evidence of cats associated with people dates back to 9,500 years ago when cats were thought to have lived alongside humans in Cyprus. The research published in *Science* reveals five distinct lineages, attributable to five female cats from the near east. It is likely that cats domesticated themselves, attracted by the rodent food associated with hunter gatherer settlements in the Fertile Crescent, and their descendants spread across the world transported by humans.

Moles and mole control in Britain

Moles are a well-known part of the British countryside (many people have read about 'Moley' in *The Wind in the Willows*[41]) - but they are rarely seen alive. Most people, however, are familiar with the molehills that moles produce when excavating their underground feeding tunnel systems. Molehills and tunnels lead to moles being blamed for damaging farming, amenities, and gardening interests. Damage to gardens and amenity areas, such as golf courses, bowling greens and sports fields, can be merely aesthetic but might also be financial if users are deterred by their presence. On race-courses, grass airstrips and sports fields, molehills could conceivably present risk of injury to pilots, horses, riders, and others participating in sport. Farmers report a wide range of impacts including: contamination of silage, covering pasture with soil, injury to animals on pasture, damage to young plants, agricultural machinery, drainage systems and watercourses, and also weed invasion and subsequent degeneration of pasture on molehills[42].

The most commonly used methods of controlling moles in Britain have been strychnine poisoning, kill-trapping, and gassing. Strychnine has been particularly favoured for larger-scale mole control because it is said to be very cost-effective. It causes death through asphyxia by paralysing the respiratory muscles. Strychnine was withdrawn from use as a biocide for controlling moles in Britain, on 1st September 2006, as part of a wider EU pesticides review.

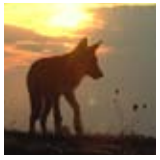
It is now illegal to use strychnine to control moles in the UK. However, the continued availability of strychnine until last year has deterred the development of alternative control methods. The withdrawal of strychnine will force mole controllers to reassess their need for control, and which - if any - control methods they use. Mole control is in a time of flux and this is the ideal opportunity to study mole control needs and methods. In January 2007, WildCRU began a three-year project which aims to examine mole activity, and quantify the perceived need for mole control, across Britain. The project will go on to explore the effectiveness and welfare implications of alternative mole control methods where necessary. MTUK is soon to launch a nationwide public participation survey, *MoleWatch*, which aims to create a map of the distribution of moles across Britain.

Deer vehicle collision

The Deer Initiative has recently completed a national study on behalf of the Highways Agency identifying the scale and extent of deer vehicle collisions (DVCs)[43]. The team has analysed 30,500 DVCs from the whole of the UK over a five year period. They estimate that the annual number of deer-related road traffic accidents to be in excess of 74,000. DVCs occur in virtually all areas of the UK, which might be expected from the widespread coverage of the six main species of deer living wild in Britain. The south east of England is the worst affected, with hotspots associated with wooded areas such as Ashdown Forest, New Forest and Thetford Forest among others. Results show that most collisions involving fallow and red deer occur after the rutting period when movements are at their highest, and coincide with the peak times of traffic activity. Roe deer are most susceptible during May when young males disperse from their natal range.

So far measures taken to reduce DVCs, such as roadside reflectors and acoustic deterrents triggered by oncoming traffic, offer little promise. The Deer Initiative continues to work on road design and fencing, but it is likely that the single most important factor for mitigating DVCs is driver awareness. Deer-related road traffic accidents result in several hundred human injuries and some human fatalities each year, at an estimated economic cost of £30 million. There are also serious welfare considerations for the deer involved, as those animals which are not killed outright in collisions suffer unpleasant injuries. The Deer Initiative recommends the development of a national response network to deal efficiently with deer casualties and a wider campaign to raise driver awareness.


Robin Hamilton



Human wildlife interactions

Seal fisheries conflict

AS FISH STOCKS CONTINUE TO DECLINE the fishing industry has repeatedly called for populations of fish-eating predators to be reduced in the hope of improving fish yields. The industry has historically perceived such predators as pests that compete with fishermen for limited and diminishing stocks. The issue is emotive, complex and divisive. Debate has focused on the conflicting topics of conservation, animal welfare and the sustainability of an industry under pressure. In the UK, harbour and grey seals have long been the focus of fishermen, policy makers, conservationists and scientists with regard to their impact on fish stocks and calls for their populations to be managed.

The UK supports 40% of the world's population of grey and harbour seals, with an estimate of between 97,000 and 159,000 grey seals and between 50,000 and 60,000 harbour seals around British coasts. Both species are protected under the Conservation of Seals Act 1970 (England, Wales and Scotland) and the Wildlife Order 1985 (Northern Ireland). A recent analysis of aerial counts at haul-out sites by the Sea Mammal Research Unit (SMRU), University of St Andrews showed that the majority of large harbour seal colonies around Britain, with the exception of the west coast of Scotland, are declining[44]. SMRU detected a 40% decline in the Orkney and Shetland populations over the past five years, suggesting that harbour seals in these areas experienced, as yet unexplained, increased mortality or very low recruitment over this period. The decline in the population of the harbour seal following outbreaks of phocine distemper virus led to both species being afforded additional protection under the Conservation of Seals Order in 1999 (England) and 2004 (Scotland). Seals are also protected under Annex II of the European Habitats Directive. However, seals can be shot under licence if it is deemed necessary to protect a fishery. The protection of fisheries and the efficacy of population control are central to the debate surrounding the impact of seals.

In 2002, grey seals in the North Sea were shown to eat commercially important species including sandeels, cod, haddock, whiting, saithe, plaice and lemon sole. As seal populations have increased, the biomass of fish estimated to be consumed by grey seals has also increased from 39,000 tonnes in 1985 to 116,000 tonnes in 2002. Cod consumption increased from 4,100 to 8,300 tonnes, a biomass estimated to be 3.7% of the total North Sea cod stock[45]. Seals also cause economic loss by damaging fishing gear. Damage to gear occurs when seals remove or attempt to remove fish from fixed nets, drift nets and long-lines, and is a particular problem at fish farms where damage to nets can result in fish escaping. It is also thought that the activities of seals around nets can lead to fish becoming stressed with a resultant reduction in growth rate. Seals also damage fish, reducing their commercial value - one study of a cod fishery in Mayo found that 10% of the catch was damaged by grey seals over a period of three years[46].

It is also relevant to consider the impact of commercial fishing on seal populations. Seals become entangled in nets and there is a long list of fishing equipment for which records of bycatch exist, including wreck, trammel, fyke and tangle nets, pair and mid-water trawls, active line gear, seine nets, anti-predator nets around fish farms and discarded fishing gear. Globally, seal bycatch has contributed to the decline of several species including the harbour seal in Newfoundland and Alaska and grey seals in the Eastern Baltic. Although the level of bycatch in the seas surrounding the UK and Ireland is difficult to determine, it is not currently thought to have a substantial impact on seal populations[47]. Fifty one grey seals were caught during a 3 year study of a Mayo cod fishery and four grey seals were caught during a study of pair trawling in the Celtic sea. Probably, illegal culling of local seal populations is a more serious issue. The most recent example of this was the illegal cull of 60 grey seal pups on the Blasket Islands off the Irish coast in 2004, whilst 40 seals were shot by salmon

Richard Caswell

fishermen off Arbroath in Scotland during 1999.

Not all fish consumed by seals would otherwise be available to the fishing industry[45]. Seals and other large marine mammals are more visible than other fish-eating predators, and hence are more commonly blamed, but clearly predation by other species must also be considered. It is estimated that in the North Sea around seven tonnes km^{-2} of fish are eaten by piscivorous fishes compared with only 0.1 tonnes km^{-2} consumed by marine mammals. The conflict between seals and the fishing industry makes it important to understand the foraging ecology of the harbour and grey seal. However, the complexities of marine food webs make the commercial impact of seals, and the outcomes of population control, difficult to determine.

Anti-otter fences around fisheries

Many fisheries and anglers welcome the recovery of the otter from very low numbers in the 1970s, not least because this is evidence of good water quality and healthy fish stocks. However, for some fisheries the otters' increasing success has brought them into conflict with anglers over prized fish. Although a post mortem analysis of the stomach contents from otters showed that the majority of otter diet consisted of smaller fish species[23], the Specialist Anglers Alliance (SAA) say that specimen carp are particularly vulnerable and pike, large eels and tench are all at risk. They report that some fisheries have been devastated by otter predation.

A recent report commissioned by the SAA[48] and funded by the Environment Agency (EA), investigated the most efficient use of fencing to prevent access by otters to still-waters fisheries. Subsequently the EA has announced that it will fund grants to angling clubs for anti-otter fences in a move to mitigate future conflict.

Bats and climate change

Climate modelling has predicted that some of the UK's most threatened bat species will not suffer and may even benefit under projected global warming scenarios. In a report produced by the UK Climate Impacts Programme (UKCIP), greater and lesser horseshoe bats were predicted to expand their ranges and increase in number under climate change, whilst barbastelle bats were predicted to shift their range north, but not decline[49].

The Modelling Natural Resource Responses to Climate Change (MONARCH) programme at Oxford University modelled in detail the potential for changes in the ranges of 32 BAP species in the UK. Three of the species considered were mammals, all of them bats. The MONARCH programme used UKCIP climate predictions based on low and high levels of greenhouse gases. These scenarios predict mean annual temperature rises of between 2-3.5°C by the 2080s, with the southeast of England warming by as much as 5°C.

Species are likely to face hotter summers, longer growing seasons for plants, wetter winters and an increase in extreme weather events like prolonged drought, intense storms

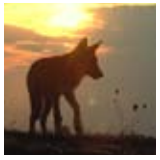
Nature Photographer (NP)/ S.C. Bisserot

and high winds. The report highlights observations that many species are already showing evidence of a northward extension or retreat in their distribution in the UK as a result of a warming climate.

The greater and, probably, lesser horseshoe bats exist at their climatic limits within Britain, and unsuitable weather is thought to have been responsible for historical declines of greater horseshoe bats. The timings of when they give birth, and hence the success of raising young and ultimately population sizes, are constrained by spring temperatures, with a minimum of 10°C required during April and May. These species are currently restricted to the southwest of England and southern Wales, but warmer conditions should enable them to expand their range.

The barbastelle bat is found sparsely throughout southern England, occurring mostly within woodlands. This species is highly susceptible to disturbance and their expansion into northern areas may be limited more by suitable hibernation sites than by the availability of feeding sites. BAP targets for this species remain achievable under climate change scenarios. However, if carbon emissions increase, the species may disappear from southern England as the climate there becomes similar to parts of southern Europe where barbastelle bats are currently scarce.

The report also draws attention to the inherent uncertainties in all computer simulation models. The quality and diversity of biological input data and the sophistication of data manipulation affect both the robustness and reliability of results. A model is only a model, and should thus be interpreted cautiously, but the MONARCH assessment nonetheless raises interesting prospects for bat conservation. There will be direct impacts from a changing climate on these species. Doubtless there will also be other indirect impacts, for example through changes in timing of migration movements, community composition, land use, competition from invasive species and the effects of extreme weather events.



MTUK update

IT IS SIX YEARS SINCE MTUK was launched to conserve wild mammals and their habitats throughout the British Isles. This year we have awarded over £100,000 for research into species including bats, water voles, red squirrels and pine martens. Seven recent graduates have been awarded internships to spend time based in conservation-related NGOs researching dolphins, dormice, bats and red squirrels.

Populations of any species fluctuate in response to natural changes in conditions or ecosystems or as a result of human activity. To be confident that we are concentrating our efforts with the best chance of success, systematic monitoring and surveillance of mammals over the long-term is vital. MTUK supports monitoring schemes run by some other conservation organisations as well as maintaining its own two general mammal surveys.

Twenty six species were identified by volunteer surveyors at 566 sites in the *Living with Mammals* survey of urban and built environments in 2006, as well as groups of species such as bats and voles. Nearly 80% of site reports listed Species of Conservation Concern, again highlighting the importance of the urban environment in conservation. Otters were identified at nine sites, all of them gardens, not to mention the panther reported in Buckinghamshire! *Living with Mammals* is now in its sixth year and the first five years are being analysed for early trends.

Over the last couple of years, information collected from *Living with Mammals* and *Mammals on Roads*, our survey of mammals spotted from the roadside (dead or alive), alerted us to a possible striking fall in the numbers of hedgehogs observed in eastern and north west regions of the UK. In response MTUK is supporting research (see box & page 8), in conjunction with the British Hedgehog Preservation Society, into the possible causes of a decline in this much loved animal.

Following the success of *HogWatch* last year with over 16,000 records received and a species distribution map created, MTUK is planning *MoleWatch* in the Autumn of 2007 to map the distribution of molehills in the nation's gardens. These surveys provide useful basic data on distribution and are an ideal way of encouraging people to get involved with conservation on their doorstep.

MTUK is part of the Tracking Mammals Partnership (TMP), a collaboration of 25 organisations all interested in British mammals. Both the MTUK annual surveys are part of the TMP surveillance and monitoring programme.

Research funded by MTUK in 2007

Dr David Hill, University of Sussex, is assessing the impact of light pollution on **bat** activity.

Save our Squirrels in the north of England is creating safe buffer zones for **red squirrels** against threatened incursion by the greys.

Matthew Zeale, University of Bristol, is analysing the dietary and foraging requirements of **barbastelle bats** to establish the implications for management and conservation.

Practical work to conserve **water voles** in north east Scotland carried out by **Professor Xavier Lambin**, University of Aberdeen, continues.

Jon Flanders, University of Bristol, is doing habitat surveys, faecal analysis and radio tracking of **greater horseshoe bats** in the landscape on the Isle of Purbeck.

MTUK and the **Bat Conservation Trust** continue investigating to see if more general mammal recording can be done alongside **bat** monitoring.

Dr Declan O'Mahoney, Ecological Management Group, is extending the **pine marten** survey of 2005-07 in Ireland to Northern Ireland.

The project to develop informed, practical strategies to reverse the **hedgehog** decline continues with **Dr Paul Bright** and **Anouschka Hof**, Royal Holloway University of London (RHUL).

Beth Nightingale, Wiltshire Wildlife Trust, is coordinating the Wiltshire **water vole** recovery initiative and **Dr Paul Bright** and **Jenny MacPherson**, RHUL, are now in the third phase of the national key sites for **water voles** project that creates safe and appropriate refuge areas.

Laura Barber

Student projects supported by MTUK in 2007

Rhian Hughes is researching **dormouse** populations in Bontuchel Woodlands in conjunction with the North Wales Wildlife Trust.

Ian Stride at Wildwood Discovery Park is looking into the optimal design of **dormouse** tunnel tubes for linking fragmented habitats.

Laura Barber is studying the distribution, home range and habitat use of **common bottlenose dolphins** around Cardigan Bay, Wales, in association with the Sea Watch Institute.

Claire Stevenson, University of Central Lancashire, is modelling **red squirrel** populations in fragmented woodlands on the Solway Plain in Cumbria along with partners Forest Research and Cumbria Wildlife Trust.

Robert Bacon is surveying **bats** and enhancing bat habitat and activity at the Hollywood Towers Estate, south Gloucestershire, in conjunction with Bristol Zoo Gardens.

Sharon Bond is assessing the importance of the Isle of Man waters to **Risso's dolphins** with the Manx Wildlife Trust.

Dean Alexander is working with the Bat Conservation Trust on the distribution and habitat use of **serotine bats** in Bedfordshire.

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Mammals Trust UK

Mammals Trust UK, which was created by the People's Trust for Endangered Species to provide a special focus for mammals in the British Isles, is dedicated to working in partnership with voluntary organisations, wildlife experts, government and industry to conserve wild mammals and their habitats throughout the British Isles.

Our Aims
To raise funds for research and practical conservation based on sound scientific understanding.
To increase public awareness, bring together all with an interest in mammal conservation and share knowledge.
To create opportunities for people to participate actively in mammal monitoring and conservation projects across the UK.
To manage key conservation sites to protect them for the future and to create opportunities for education, recreation and enjoyment of our natural heritage.

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WildCRU

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The Wildlife Conservation Research Unit's mission is to undertake original research on aspects of fundamental biology relevant to solving practical problems of wildlife conservation and environmental management.

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The State of Britain's Mammals is the sixth of the annual updates following the publication of *Britain's Mammals: The Challenge for Conservation* for the launch of Mammals Trust UK in 2001. Copies of both publications can be obtained by contacting Mammals Trust UK at the address and phone number above.

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