National Deer-Vehicle Collisions Project

England
(2003-2005)

Final Report for period
Jan 2003 - December 2005

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Acknowledgments

The National Deer Vehicle Collisions Project has been administered throughout by The Deer Initiative, and much additional support in kind has been received from its many partners* to help promote the project as well as through direct provision of data.

Numerous other organisations and many hundreds of individual contributors have submitted information on deer road casualties and related vehicle accidents, and many thanks are due to everyone who has supported the work in this way. Particular thanks are due to David Hooton who assisted extensively with contacting potential data sources and data entry for England especially during the first two years of the project, and to Rory Putman who led data collection for Scotland and for many helpful discussions throughout the project.

Lead funding for the study in England has been provided by The Highways Agency, with additional financial support from the Scottish Executive, Deer Study & Resource Centre, Woodland Trust, and the National Forest. I would like to thank Tony Sangwine of The Highways Agency also for his personal enthusiasm and support for the project, and Peter Watson and all his staff at The Deer Initiative who have assisted in various ways at differing times over the duration of the project.

*The Deer Initiative is a broad partnership of statutory, voluntary and private interests dedicated to ensuring the delivery of a sustainable, well-managed wild deer population in England and Wales. A list of its partner organisations is provided at www.thedeerinitiative.co.uk/html/partners.htm

The present report has been prepared under contract to The Deer Initiative and Highways Agency, but its contents reflect the views of the author and do not necessarily reflect official views of the above organisations.

National Deer-Vehicle Collisions Project: England (2003-2005)

Summary

Background

S.1 Traffic accidents involving deer have presented a major problem in the UK for many years. With recent reported increases in both the numbers and distribution of several deer species in Britain, combined with continuing rise in traffic volumes nationwide, it seems likely that this problem will continue to worsen. Prior to commencement of the present project there had been no system for central collection of data on road traffic accidents involving deer in the UK, and it is clear that this lack of information has posed a major handicap to development of effective management to deal with this problem.

S.2 Earlier analyses commissioned by The Highways Agency (SGS 1998) and The Deer Commission for Scotland (Staines *et al.* 2001) attempted to draw together as much information on Deer Vehicle Collisions (DVCs) as might already be available from a range of potential data sources. Both studies however commented on the difficulty of drawing meaningful conclusions from retrospective analysis of data not specifically collected for such a purpose, and recommended that a national system for recording deer-vehicle incidents should be established to assess the true scale and geographical distribution of the problem, and research key factors influencing accident risk.

S.3 The 'Deer-Vehicle Collisions Project' was launched in England in January 2003 by ***The Deer Initiative*** with lead funding by ***The Highways Agency***. Funding made available by The ***Scottish Executive*** made it possible to extend the project to full coverage also across Scotland from June 2003. The main objectives of the study were to build for the first time a national database of road traffic collisions involving deer in Britain occurring during the three year study period; to collate, verify and evaluate all data accrued and then interrogate the database, not merely to help estimate the overall toll of DVCs within England and Scotland as a whole, but rather to explore regional differences in frequency of DVCs and identify current or potential future black spots (or areas of relatively higher DVC occurrence). In addition the project aimed to investigate the effect of season, road type, roadside habitat and of other factors on the risk of deer-related accidents.

The present report focuses foremost on findings for **England**, drawing as appropriate on comparison with results of parallel data collection undertaken in Scotland [Fuller details of findings specifically for Scotland form the subject of a separate report (Langbein & Putman, 2006b), available for download via The Deer Commission for Scotland web-site: www.dcs.gov.uk]

Approach and data collection

S.4 Records of traffic accidents involving deer have been obtained from a wide range of differing sources, including Regional Police Forces and Local Authority Road Safety Units to provide details on incidents involving human injury/fatality recorded on statutory STATS19 returns. A number of Police Forces and/or Councils were also able to supply information on reported 'damage-only' road traffic collisions, or other incidents by interrogating control centre logs. Data were also sought from Motor Insurance Companies to obtain additional data on numbers and distribution of damage-only accidents and information on claims costs for material damage. Efforts were made to recruit information from Trunk-Road Maintenance Agents and Council Road Cleansing Departments responsible for uplift or clearance of carcases reported respectively on the trunk-road network and local roads, to capture information also on other accidents which have not necessarily always caused significant damage. RSPCA and other animal welfare and rescue organisations provided important further information in that high proportion of instances where the deer is not killed outright, and their attendance is required for humane dispatch or treatment of the animal at the roadside. Additional information was sought from specific target sources who are also professionally involved in dispatch or clearance of carcases from their own area, such as

Forestry Commission rangers as well as managers of community forests or others involved with deer management on privately owned estates. Finally members of wildlife organisation and the general public were asked to report any deer vehicle incidents, or dead deer seen at roadside either on-line via a dedicated project website set up for that purpose (www.deercollisions.co.uk), or by e-mail or post.

S.5 It was recognised from the outset that different data-source categories are likely to sample quite differing sub-sets of incident types. The present study was therefore set up quite deliberately to seek information from a wide range of different data source categories, some of which may be better suited than others to help answer some specific questions (such as the relative frequency of Personal Injury Accidents (PIAs), the actual economic costs of deer-vehicle collisions or the relative frequency of involvement of different deer species). A further reason for targeting a range of different sources is that this provides opportunities to cross-check estimates of accident frequency and thus offers the potential for extrapolation of findings to areas for which only limited information is available.

S.6 However, collection of data independently from a number of different sources carries with it the potential for duplicate reporting of incidents. Possible duplicate records were identified and excluded from overall counts as far as possible by searching for incidents reported by more than one source with similar location and date details (i.e. same 10km grid-square or local authority). The level of duplicate reporting of the same incidents among data received from two or more independent major data sources categories can itself be utilised to aid in assessment of the likely sampling intensity achieved by a given source category, and estimation of the probable overall 'population' of DVCs within the country or sampling region.

S.7 The primary focus of data collection was to obtain as large a sample as possible of the total number of deer-vehicle incidents occurring within an initial 2-year period (Jan.2003-Dec.2004) using comparable recording methods and a consistent network of sources. The initial data collection period was later extended to include also records throughout all of 2005, but focussing on a more restricted set of those data sources found most useful during the first two years, and, in England such more limited data collection is now set to continue also into early 2008 supported by the Highways Agency. Where sources indicated that they could in addition provide some information on DVCs occurring during past years, this information was also sought and logged: for up to three previous years (i.e. Jan 2000 onwards) for all available records of DVCs, and if possible for five previous years (Jan.1998 onwards) in case of deer-related PIAs.

Public Awareness

S.8 Approaches to major known potential contributors such as police forces, local authorities, insurance companies, conservation and animal welfare organisations were in the first instance made via phone or written requests near the beginning of the study. In addition, a dedicated project web-site was set-up to provide further information about the study and advice on how to avoid DVCs. The study has also been publicised very widely throughout all three main study years via several press releases, flyers and posters, car stickers, numerous articles in magazines, and has received regular widespread media interest and publicity. This has included several national and regional television programmes and newspaper coverage, radio interviews, as well as county shows and conferences. Aside from stimulating reporting of DVCs, the publicity obtained has also helped to fulfil the secondary objective of raising public awareness; and has helped to raise and maintain interest in the project, as illustrated by receipt of over 1200 unique visits to the project web-site recorded each month since January 2004.

National estimates of overall numbers of DVCs

S.9 During the present study reports on over 30,500 DVCs occurring in Britain between 1/1/2000 – 31/12/2005 have been collated: including 24,500 in England and 6060 in Scotland. In addition around one thousand further records were submitted relating to earlier incidents prior to 2000, and several thousand more are already available for continuation of monitoring for

2006. For the three study years of most comprehensive data collection (January 2003 to December 2005) samples collated to date extend to 14,897 records in England and 4902 in Scotland.

S.10 Data gathered during the present study provide far larger samples of DVCs than have been available to any previous assessment of the deer collisions issue in Britain. It is clear however, that even the large annual samples of incidents reported on here represent merely a small proportion (most likely less than 20%) of all deer road kills or related incidents nationwide. An indication of the scale of under reporting can be obtained in a number of ways [see 4.7-4.13]:

In the first instance total numbers of carcases or incidents in a number of specific case studies where DVCs were recorded much more intensively through roadside searches, were compared with the number of reports received by the Deer Collisions Project for those same areas. In a similar way we may also assess the probable proportion of the true national toll recorded by particular major independent data-sources through assessing the percentage of DVCs captured by one source-type (e.g. from nationwide samples of Insurance claims) that were also 'captured' by another independent source (e.g. RSPCA). Finally similar extrapolations may be based on assessment (again using specific areas where it is likely that at least the great majority of incidents are reported) of the proportion of all reported incidents which result in human injury and are retrievable from official police records, and then multiplying this figure by the total number of human injury accidents with deer nation-wide.

S.11 Estimates based on the ratio of recorded human injury incidents against all other DVC recorded within a series of major forest sites with most comprehensive recording, indicates that PIAs 'recorded' by police forces and attributable to involvement of deer in England are unlikely to represent more than 1.0% to 1.5% of all the DVCs occurring. On the basis of these figures taken in combination with a nationwide estimate that each year approximately 425 human injury accidents reported to police involve deer in some way [see S.19 below and main text 5.9], we may estimate that DVCs in Britain as a whole are unlikely to number any fewer than 28,250 to 42,500. Of these over 81% (34,000) may be expected to occur in England, and 18.5% (8000) in Scotland [see S.21].

However, recent annual reports prepared by Dft suggest that all human injury road accidents collated via statutory police returns tend themselves to under record actual national numbers of incidents by a factor of >1.7. Estimates of DVC based instead on the levels of overlap between deer related incidents reported by differing independent source-types (e.g. those reported to us from both insurance claims data as well as by RSPCA or deer managers) indicate that the true toll of DVCs for England alone may well exceed 60,000 per year; and 74,000 for Britain as a whole.

Only relatively little detailed study has been made during the present project of the situation in Wales; but although deer populations are known to also be increasing there, it is unlikely that so far DVC in Wales number more than a few hundred per year.

S.12 Accurate estimation of the true national toll of DVCs as above remains difficult, and can only provide a guide to the overall scale of the problem in England and Scotland. However, the above figures are far from unusual if seen in the context of other countries in Europe and the US. In Germany, for example, reported DVC now regularly exceed 120,000 per annum and are estimated by many to actually lie nearer 200,000; while the most recent figures from North America suggest that close 1.5 million DVC occur there per annum, with several individual States in the US reporting over 70,000 deer collisions per annum.

Distribution and relative frequency of DVCs

S.13 The main objective of the present study was to not to determine precise numbers of deer road casualties overall, but rather to build up a sufficient body of data to enable investigation of regional differences in frequency of DVCs, and identify hot spots where greatest effort at reducing problems should be targeted. Generalised mapping of the distribution of data collected from all sources in England (**Map 1**) shows that at least some DVCs have been

recorded in the majority of all 10km OS grid squares within England; distribution of recorded DVCs is most continuous throughout the South-East which is also the area where by far the highest **frequencies** of DVCs have been recorded (**Map 5**). Frequency of those DVC reports possible to map with confidence at a finer scale of 5 km by 5 km OS squares enables many major hot-spots to be identified more clearly (**Map 6)**.

S.14 Specific roads or road sections with particularly high DVC risk can also be identified by comparing accident frequencies with national averages recorded for given road-types. **In England –** the major roads (A class or Motorways) for which the highest numbers of DVCs have been logged during 2003 to 2005 include the **A22, A14, M3, A303, A30, A11, M4, M27, A34, A4136 and A4146**. The total number of DVC records available for these roads range from 0.15 – 0.85 per km per annum when averaged out across the entire length of each road; i.e. in some cases reaching up to 6 fold the average 'reported' rate (0.14/km) calculated across all major roads in England. However, for a number minor of roads, including the **B4506, B1106, B2188, B2026, B1393**, as well as for specific sections of the above major roads, average recorded deer collision rates rise to near 5 DVC/km (calculated for stretches of >5km), including for example parts of the M27, A4136, B4506, B2026, and reach over 10 DVC/km for the A22 near at Ashdown in East Sussex (**Table 10)**

Human Injury Accidents

S.15 Records of Personal Injury Accidents (PIA) arising through direct collisions or swerving as a consequence of trying to avoid deer form an important element of the present study, not merely because of the serious nature and high economic and human costs of these incidents, but also their potential to provide small but well stratified annual data of relatively high location accuracy. Although details of the species concerned in accidents involving animals is not at present accessible via national statistics for human injury accidents collated centrally by DfT, at least a significant sample of such records was possible to search out from accident records provided to the study by individual police or county road safety departments in England.

S.16 Information on human injury accidents involving deer in the DVC database to date extends to over 1150 incidents. The most consistent and widest spread of information on deer related PIAs for England relates to years 2000 to 2004, with some PIA data from across 26 different major counties and seven unitary authorities for at least two to five of those years. [Although data are also available for most of these counties for 2005, for many these are not directly comparable to previous years due to changes in how animal accidents are coded on revised statutory ST19 accident report forms introduced for 2005 onwards]. For our sample of local authorities 785 different PIAs were identified which specifically mentioned deer as a hazard at the scene of the accident, including 20 that led to human fatalities, 134 to serious injury and 634 causing one or more slight casualties per accident; but even within this counties the figures are likely to present only a sample of all PIAs with deer.

S.17 It is apparent from more detailed inspection undertaken of all animals accident records provided to the study by police and road safety departments that a very high proportion of PIA incidents involving deer will not be readily identified by general searches if considering only the main animal related categories provided for on current ST19 forms. These forms are not currently designed to capture any information on type of animals involved (except for dogs and ridden horses), nor always capture animal related incidents in cases where the animal involved presented a dead rather than live hazards within the carriageway; in addition many other accidents where descriptions do mention involvement of animals, are not coded under any of the available animal or object related hazard categories, for instance if another hazard such as collision with a second vehicle was also involved.

S.18 Further detailed assessments undertaken during this study of the accident descriptions recorded by police officers at the scene for all animal related incidents, based on information from 14 different police forces for which most comprehensive data were made available for assessment, allowed determination of the proportion of reported animal related PIAs that are

not currently likely to be logged within the 'animal in carriageway' hazard category in national statistics, as well as the proportion of all reported animal related traffic PIAs which are known to have involved deer rather than other types of animals.

Firstly, the general proportion of deer related incidents was determined through examination of accident descriptions for a sample of 1400 incidents reported as involving "other animals" (animals other than dogs) obtained from across a sample of 14 English counties. The animal type was stated in 1120 of these, of which 25% involved deer, a further 24% involved other wild mammals (badger, fox, rabbits), and the remainder was made up by incident with domesticated animals and birds (including e.g. cats, sheep, pheasants etc.). On inclusion also of incidents involving dogs (recorded in a separate category in past years) **the proportion of deer related incidents may be estimated to lie close to 23.5% of all reported animal related PIAs**.

S.19 From 2000 to 2004, the annual number of all PIAs reported in GB wide national road accident statistics as having involved animal hazards averaged 2350 per year (Dft, 2004); but during that time may have included an uncertain proportion of incidents where pedestrians rather than animals contributed as a road hazard. Since 2005 pedestrians are specifically excluded from being coded within the new 'animal in carriageway' option on ST19 record forms; but newest published figures for 2005 also tend no longer to include for example accidents where collision or avoidance of dead rather than live animals may have contributed. For 2005 only 1034 incidents were logged in national statistics within the new, more limited 'animal hazard' category. However, detailed assessment of a sample of over 200 recent animal related PIA records provided to us from across 10 different police forces showed that on average only 54% (±12%) of these incidents were also retrievable from Dft statistics logged within in the new 'animal in carriageway' hazard category alone, while the remainder were identified only if extending searches to a range of other carriageway hazard types and contributory factor codes. The true annual number of PIAs involving animals as a hazard, object or contributory factor reported to police for 2005 is therefore likely to lie closer to 1900, of which 425 (23.5%, see above) may be expected to have involved deer.

S.20 The economic 'value of prevention' of that level of human injury accidents (excluding damage only incidents) may be calculated as c. £30M for Britain as a whole, of which over 80% may be expected to be incurred within England [based on government figures used for assessing economic impact of injury road accidents: Highways Economic Note 1, 2005]. Even that figure is likely to be a conservative estimate, as recent research into the level of under reporting of all human injury accidents by police demonstrates that although most fatal accidents tend to be recorded in national statistics, serious and slight injury PIA are likely to be underreported by factors of 2.5 to 1.7 respectively (DfT: Road Accidents in Great Britain, 2005). Such level of general under reporting suggests that true numbers of human injury accidents involving deer may well lie in excess of 700 per annum.

Costs of Damage to Vehicles and Insurance

S.21 In addition, based on extensive claims data provided by one major insurance company over the seven years 1999-2005 (Fortis Group) we may estimate that around 11,000 privately insured vehicles are likely to suffer significant damage (i.e. above common insurance claim excess of c.£250) as a result of DVCs in Britain each year, costing approximately 13.9 Million in material damage. As private vehicles are known to contribute only c.82% of motor policies held by insurance companies, inclusion for likely involvement of commercial vehicles at similar frequency and claims costs increase cost estimates to at least 17 million per annum.

Among all those insurance claims identified as relating to deer within the available sample of Fortis Group policies, on average, 81 % were located in England, 18.5% in Scotland, and just 0.5% in Wales. This provides a further useful indicator (independent of ST19 statistics above) as to the relative proportion of DVCs likely to occur overall in each of the three countries, and allows separate estimates of the likely minimum costs of material damage arising through DVC occurring in England at £13.5 Million plus a further £3 Million through accidents in Scotland [see 6.8].

S.22 While these estimates consider merely the actual cost of claims and damage to vehicles, they are likely to be substantial underestimates of the total costs arising from damage-only DVCs. Although allowance has been made above for vehicles not insured non-comprehensively. many further collisions with deer involve levels of damage which are below the policy excess or which drivers voluntarily absorb themselves (rather than lose No Claims bonuses). In addition to material damage there are often further hidden costs such as necessity of hire of replacement vehicles, loss of time, and lost output in case of commercial vehicles, for which no allowance has been made in the above estimates.

Impact on deer welfare and populations

S.23 Discussion in previous sections has focussed mainly on the human costs of DVCs, partly as some of the best stratified data relate to human injury accidents and those causing material damage; but also as human injury accidents are the main and often sole criteria used by roads departments for prioritising funding for road safety projects in the UK. In the first instance, however, the vast numbers of deer injured or killed in traffic incidents every year presents what is probably the single greatest welfare issue for wild deer in the UK. At an estimated total population in England of around 700,000 deer, the average risk per deer of being involved in one of the estimated 34,000 to possibly 60,000 DVCs may be calculated to be as high as one in 20 to one in eight; that risk is inevitable higher for deer with Southeast England where traffic density is greatest.

S.24 From view of animal welfare a more important concern than the overall numbers of deer killed through DVC, are those deer which are not killed instantly through collision, but instead may suffer for prolonged periods from their injuries until a suitably qualified person can attend to humanely dispatch them; while many others may run off to suffer or die of their injuries later. Over 3500 live deer casualties were reported to the project for 2006 alone mostly by RSPCA and others called upon to treat or dispatch road casualty deer. Although reporting of live injured deer is likely to be somewhat better than for DVCs in general, it is highly unlikely that even half of all such instances are reported to the study.

Finding from the present study indicate that as many as a 1/3rd of DVC involving fallow deer (applicable most likely also other large species such as red and sika) and around 1/5th of those involving roe and muntjac will tend to leave live casualties needing dispatch at the roadside; the overall toll of such severely injured deer which are not killed outright is expected to exceed 8500 in England and over 10,000 for Britain as a whole [see 7.5]

S.25 The total mortality imposed through DVCs in England as a proportion of national population sizes is estimated to lie between 3 to 7% for roe deer, 1 – 3 % or red deer and from 7 – 13% for fallow deer [7.6], making DVCs almost certainly the major cause of annual mortality among our wild deer aside from deliberate culls taken as part of management. As annual mortality levels required to limit overall population increase exceed 25% of the pre-breeding spring population for all the species, DVC only rarely pose a threat from view of conservation of local populations. However – this does not imply that DVCs do not matter or that they might even help to control populations. The large numbers of deer killed and injured unintentionally by motorists present not only a very inhumane but also highly unselective 'cull', which often hinders deer management and achievement of stable sustainable populations which are in balance with their environment.

Influence of Road Type

S.26 The number of DVCs logged during 2003-05 on English roads, for which road type was identified is 10475, of which 63% of occurred on major roads (A roads or motorways) and 37% on minor roads (B, C or unclassified). Divided by total recorded road length in England as 35195 km (A+M) and 262,584 km (more minor roads), our records suggest average annual rates of reported incidents on major vs minor roads as respectively 0.1 per km and 0.007 per km per year, and suggest that deer accidents are much more frequent per unit road length on the more major roads (A and M). However, although 'major' roads only make up 12% of the total road length in England they carry 64% of total traffic volume. Our finding

that near 63% of reported DVCs occurred on major roads is therefore almost directly in line with the relative distribution of all traffic among differing road types within England. Restricting analysis to those incidents involving human injury (for which road types are reported most consistently), suggests that at least for these most serious DVCs only 50% occur on major roads (i.e. somewhat lower than expected on traffic volume alone).

Deer Density vs Traffic Density

S.27 It immediately apparent, even from superficial examination of accident distribution maps [**Map 5**] that areas of high frequency of DVCs are not simply related in any direct way to deer density. Higher than average levels of DVCs at the landscape scale are determined in the first instance not by the abundance of deer *per se*, but rather an interaction between high deer numbers in areas which also have a high density of roads and high traffic volume. It is clear from the nationwide maps that the areas with most DVC records do not occur in those regions with the overall highest deer abundance, but instead occur around the rural periphery of major conurbations where highest traffic flows occur; especially in the South and South-East of England. A similar pattern is apparent in Scotland, where greatest numbers of DVCs fall not in the Scottish Highlands, but in the Grampian, Tayside and Central regions where high abundant roe deer populations are exposed also to some of the highest levels of traffic.

S.28 The highest overall numbers of DVCs within a single county were consistently received for Hampshire (**Tables 3&4**), which has high populations of several species of deer, but is also one of the counties with highest total traffic volume. If taking into account differences in traffic volume between local authorities by ordering them according to the rate of reported DVCs per driven 'vehicle kilometre' (**Table 3**), then the three counties that emerge as having the highest average DVC rates per annum are Suffolk, East Sussex and Norfolk (all with rates close to 50 'reported' DVC/bVkm per year), followed by Hampshire. Also ranked among the twelve counties with highest rates of DVC after accounting for traffic volume are Oxfordshire, Bath and NE Somerset, Gloucestershire, Dorset, Lincolnshire, West Berkshire and Bracknell Forest, and Buckinghamshire.

Deer Species

S.29 Information on the deer species involved in reported collisions is available for just over a third of all records obtained. If analysis is restricted to information provided by our most 'deer-knowledgeable sources, in England this shows the three most common species involved to be Fallow (40%) , Roe (32%), and muntjac (25%), with Red, Sika, and Chinese Water deer contributing less than 3%. In Scotland, where fallow are far less widespread, Roe (69%) and Red (25%) are most commonly recorded in DVCs. However, in England and also in Scotland, the species most commonly associated with localised 'hotspots' of accident risk is fallow [see 8.10].

S.30 In addition different species of deer, in part due to differences in size, are differentially implicated in DVCs including in terms of severity of damage and likelihood of injuries caused to drivers [see 8.8], as well as likelihood of the deer themselves not being killed outright in collisions and consequent heightened impact in terms of animal welfare [see section 7.4].

Effects of Season and Time of Day

S.31 Although some DVCs occur throughout the year, for the species most commonly involved in DVCs in England distribution between months deviates significantly from random (Chi-squared test : $p<0.0001$ (fallow) and $p<0.0001$ (roe), and $p<001$ (muntjac).

- For fallow (and red deer) highest numbers of collisions occur during October to January, most likely associated with the increased movement of deer during and after the rutting period during October, and also co-incidence at this time of year of peak daily activity periods of deer with highest levels of daily traffic flow.
- For roe deer in England the highest numbers of DVCs consistently occur during May, when almost twice as many incidents are reported than in other months (**Figure 2.b**). This spring peak occurs around the time when young male roe deer tend to disperse from natal ranges, and when adult females whilst accompanied by young kids may also be

more vulnerable to involvement in road accidents. A secondary peak in DVCs for roe also occurs again from October to December when day length shortens.

- For muntjac frequency of collisions is less variable between months, though some increase tends to occur from October to January as above in relation to daylight change and possibly lasting longer into winter related to a need for them to forage more widely while vegetation is more scarce.

S.32 Based on those DVC records for which time of incident is mostly recorded most accurately (human injury accidents), the periods of highest incidence of DVCs may be identified as occurring from early evening until midnight (1800-2400 hrs) and early morning (0600-0900 hrs). This pattern remains broadly similar across all seasons, though as may be expected as result of shorter daylight periods, peak accident times tend to occur rather earlier into the evening in winter and latest in summer.

Other factors

S.33 A host of other factors which may influence frequency and severity of DVCs include driver speed, vehicle types involved, vegetation near roadside, road tortuosity, deer behaviour, and presence/absence of effective mitigation, and are discussed in greater detail in the body of the report. In practice, only limited conclusions regarding effects of these other factors on accident frequency are possible from the data recorded within the database itself, primarily since relatively few respondents logged detail of such (additional) features or sufficient accuracy of accident locations to enable such features to be assessed retrospectively by map-reference. To investigate such factors in greater depth it would be useful as part of future work to ground-truth samples of those DVCs that have been logged to a reasonably high degree of accuracy, in order to determine in more detail the characteristics of a range of road sections known to experience high , moderate and low levels of accidents.

Assessment of Mitigation measures

S.34 In parallel to the present data collection, a comprehensive literature review of the different mitigation measures currently being deployed in different parts of Europe and North America, together with an analysis of effectiveness and cost-effectiveness of the different measures available was undertaken as part of a separate contract for the Deer Commission for Scotland; Putman, Langbein & Staines, 2004. This report is available online on the Deer Collisions website at www.deercollisions.co.uk/ftp/mit_review.doc. The review considers the entire range of mitigation measures available in Europe and the US and patterns of usage, and summarises the conclusions of the various scientific studies which have been undertaken to assess actual efficacy of these different measures.

S.35 Such systematic research into deer mitigation options as has been undertaken has, however, nearly all been carried out in the US or continental Europe, where the deer species, deer management and traffic situations are often quite different from the Britain. In addition a number of new types of mitigation have recently been brought onto the market including new types of acoustic reflectors, rumble strips, and novel types of digital signage activated by animals at the roadside and/or speed of approaching vehicles (Langbein & Putman, 2006a).

In response to this a number of practical trials have been initiated in parallel to compilation of the national DVC database. A series of studies is now underway in England, to evaluate some of these newer forms of deterrent, including:

i. monitoring of a trial of rumble strips in Thetford Forest,
ii. two trials of WEGU-acoustic wildlife warning reflectors on county roads in Hertfordshire and Somerset,
iii. trials of EUROCONTOR Ecopillars installed in 2005 on a B road Hertfordshire, as well as
iv. two parallel trials to test Ecopillar effectiveness installed during 2006 on sections of trunk roads in Devon and Herefordshire.
v. monitoring of the effect of digital warning signage activated by animals on the verge and by vehicle-speed installed in Hertfordshire, and
vi. investigations of the usage of new accommodation structures (road and footbridges, and underpasses) incorporated with a recent new-build trunk route in Essex.

vii. Some similar mitigation projects are likely to be established shortly in a number of Priority Areas established by the Deer Commission for Scotland.

Careful monitoring of all of these trials in England and Scotland should help establish which if any of these new methods have greatest potential for wider application on different parts of the road network [see 9.3].

Wider utilisation of data

S.36 Information on DVC records and other preliminary results from the database being compiled by the project have already been requested and provided by the study to assist HA and SE consultants for a number of surveys of TPI (Targeted Programme for Improvements) trunk road schemes in both England and Scotland, to feed into ecological impact assessments and evaluation of need for and location of appropriate mitigation measures. To date requests for DVC information for trunk roads in England have included TPI schemes on the A419, A303, A11, A74, M27 and M1; and reviews of existing wildlife mitigation on the A35/A30, as well as A49 and A38 where trials of new types of deer deterrents are now underway). In England, information on DVCs from the present project have also been utilised by several county councils to assist with planning of traffic calming and deer mitigation schemes on non-trunk roads (including B1106 in Suffolk, B4506 in Hertfordshire and Buckinghamshire, and A39 in Somerset) where mitigation schemes are now underway; while others are being considered in Gloucestershire and East Sussex.

S.37 More systematic identification of high/medium/low risk areas based on relative abundance of DVC reports received in differing OS grid squares nationwide, or for particular road sections, is also now possible from interrogation of the database when queries arise; and is planned to be incorporated shortly with Highways Agency GIS systems to enable trunk road managers to utilise available information. There is thus clearly real potential for much further practical application of the DVC database both in relation to the Trunk road network managed by The Highways Agency, as well as by Local Authorities across in England for identification and prioritisation of areas where there is greatest need for measures to help minimise DVCs in future.

Future monitoring and other recommendations

S.38 The results outlined in this report demonstrate not only the very large numbers and widespread occurrence of DVCs nationwide, but also provide information on regional and local differences in the distribution and frequency of such collisions across differing parts of the country, and within individual local authorities. It is clear, from the extent of use of the database already and from our estimates of the scale of DVCs within England as a whole, that DVCs do represent a serious increasing problem, whether from the point of view of the animals themselves and the consequent welfare issues, or simply in terms of human injury and the significant economic costs of damage caused by such collisions. While the study has been useful to assess the broad overall scale and distribution of the DVC issue across Britain, the information gathered is likely to be of greatest use at a more localised level: that is by local authorities and Highways Agency Area managers for assessing and prioritising needs for measures to reduce deer accident risk on local roads and on the trunk road network respectively.

S.39 It is suggested therefore that some long-term monitoring of the number of DVCs within England and their geographical distribution should continue, albeit at a lesser intensity of data collection than in the current programme.

In practical terms (given the difficulties experienced in the current project in obtaining comparable data from a high proportion of all local district council road clearance departments or police control rooms) it is suggested that the best index of trend in England – as well as for identification of localities with the most significant DVC problems, is likely to be obtained in future through focussing data collection on the following five key data sources::

i. Trunk Road Maintenance agents and Highways Agency Traffic Officers – to provide details of all deer incidents and requests for removal of carcases from the 14 main trunk road management areas and ideally also for all DBFO trunk road schemes.

ii. Records of all deer related human injury records retrievable via police forces and local authority road safety departments. As DfT do not at present log different animal types involved in national statistics, this will require request to all counties and unitary authority road safety departments to undertake an annual search of their accident databases using standardised search criteria to ensure comparable and consistent levels of data retrieval.
iii. Consistent contribution of records by at least one major nationwide insurance company should continue to form part of any future monitoring, and it is recommended that similar input continues to be sought from a number of additional companies to obtain a rather higher proportion of all DVC motor claims nationwide than has been possible to date.
iv. RSPCA call out requests to injured deer at the roadside: The RSPCA have been able to provide the single most extensive and consistent annual data-sets towards the present study, recently rising to over 3000 incidents per year distributed widely across all counties in both England and Wales. One present limitation of these mostly very detailed records is that grid references for incident locations are often allocated according to the centre of the nearest known post-code 'locale' rather than actual incident location, resulting in relatively poor location accuracy for rural as compared to more urban locations and limit their use in identification of local black-spots. The possible provision of GPS devices in future for all RSPCA patrol cars would enable much improved location accuracy based on actual incident sites, and could greatly improve the usefulness of this valuable data source.
v. Continued collection of detailed records for a selection of 8 to 10 case study areas (major deer forests) which have the largest concentrations of DVC incidents in England (**Map 5**). For most of the areas proposed records are also available for many past years, and provide the potential both to help monitor long-term trends, and to study effectiveness of differing measures and management approaches to minimise accidents; in addition their inclusion is considered important for future monitoring to fill significant gaps in recording which would otherwise be likely, as for such major deer forests the local rangers rather than RSPCA or others tend to be the primary contacts attending to DVCs.

S.40 To address the very major animal welfare as well as road safety issues posed by live deer casualties arising through DVCs, it is essential that efficient systems should be in place throughout England to enable casualty deer to be attended to as quickly as possible. Although good call-out schemes supported by police are in place in some regions, in many cases those called on for dispatch of deer often have to travel long distances to attend with inevitable delays. There remains an important need for organisations including in particular ACPO, RSPCA, Forestry Commission, BASC, BDS and The Deer Initiative to work closely together to ensure efficient schemes with joint call-out lists are put in place for each County or Unitary authority in England, so that road casualty deer can be dealt with more promptly, and the ever increasing burden of such calls is shared more effectively among all those best placed to assist.

S.41 From the data collated during this study on numbers and distribution of DVCs, together with review of the scientific literature, and results emerging from ongoing trials to investigate effectiveness of various different means of minimising accidents, it is apparent that in most situations sustained reductions in DVCs are most likely to be achieved by integration of several complementary approaches, rather than reliance on any single measure. Appropriate measures will vary from area to area, but may include better signage, wildlife deterrents, management of road verges, and traffic calming, as well raising awareness of DVC risk among the public and improving coordination of deer management among landowners. This requires direct involvement of a range of organisations, including highways departments, landowners, deer managers, police and animal rescue organisations. It is recommended that in areas identified as having high or very high numbers of DVCs in England local panels should be set up [if not already in place] to develop plans for integrated actions specifically to minimise local DVC problems. It is also suggested that the many organisations who have supported the present study through submission of records, and others organisations with an interest in management of deer and the DVC issue, should meet to discuss the findings of the present study, and consider what further joint action may be taken at national and local level to help minimise DVCs in future.

1 INTRODUCTION

Background

1.1 Traffic accidents involving deer and other wildlife have presented a major problem in the UK and other parts of Europe for many years, although it is clearly collisions with the heavier-bodied deer which are of greatest significance in terms of economic damage and human injury. From such limited data as have been available prior this study, it was estimated that there are at least 30,000, and most likely over 50,000, deer-vehicle collisions in the UK each year, with an additional (unknown) number of accidents resulting from drivers swerving to avoid deer in the roadway. Over the past 5 years alone such deer/vehicle collisions in the UK have resulted in over 1500 known cases of injury to drivers and passengers, over 50 human fatalities, as well as resulting in the death or serious injury of some 150,000 or more deer. With recent reported increases in both the numbers and distribution of several deer species in Britain, as well as significant rises in traffic volume and speed, it seems likely that this problem will continue to get worse.

1.2 Until now there has been no system for central collection of data on road traffic accidents involving deer in the UK, and previous attempts to build a picture of the full extent and geographical distribution of deer-related road traffic accidents in the UK have been hampered by the need to rely on retrospective analysis of such patchy data as happened to be available - none of which had been specifically collected to address the questions now being asked of it (SGS, 1998; Staines, Langbein & Putman, 2001). Even when records relating specifically to deer can be retrieved at all, they tend to be maintained in a very incomplete and inconsistent manner by those organisations who might collect such information at all (e.g. Police, Council Road Safety Departments, Local Authority Roads Departments, or Departments responsible for Cleansing Services and thus uplift of carcases from the roadside, RSPCA/SSPCA, Wildlife Hospitals, Insurance companies, forest rangers, private stalkers, amongst others). The survey commissioned by the Highways Agency during 1996 then already suggested that the toll of deer injured or killed annually in traffic collisions in the UK was estimated to be between 30,000 - 50,000 (SGS, 1998), although fewer than 1800 recorded incidents per year were available at the time on which to base these assessments and distribution of DVCs. The lack of good information on DVCs within the UK and limited understanding of the factors which influence the frequency or risk of DVCs has posed a major handicap to development of effective management.

1.3 Although past national data for the UK are rather limited, review of figures for other countries in Europe where more regular records of deer casualties have been maintained, offers clear illustration of the scale of the problem - and of the fact that the numbers of collisions involving deer have been increasing in recent years. In Sweden, for example, some 10,000 road accidents were recorded in 1982 due to collisions with moose, red deer and roe deer; by 1993 the number of deer-vehicle collisions in Sweden had risen to 55,000 (Groot Bruinderink and Hazebroek, 1996). Overall, current levels of deer-related RTAs show annual rates of some 140,000 deer involved in traffic accidents in Germany; over 55,000 in Sweden; 35,000 in Austria; 10,000 in Denmark, and 9,000 in Switzerland. In total it is estimated that the number of deer killed each year on roads in Europe lies in excess of 500,000. Similar estimates are presented for the number of road traffic accidents involving deer each year in the United States where, again, numbers of incidents appear to be increasing (e.g. see Romin and Bissonette, 1996; Putman, 1997; Hedlund, 2003; Putman et al., 2001; State Farm Insurance, 2006).

1.4 Studies in other European countries also suggest that between 1% and 5% of all 'reported' deer-related accidents would be expected to involve human injury or death; varying partly influenced by the size of the main deer species present; highest proportions of human injury DVCs tend to occur in countries where large deer such as moose, red or fallow predominate, with somewhat lower rates where roe (or muntjac – as in England) contribute to a high proportion of collisions. In continental Europe as a whole, it has been estimated that close to

300 people are killed and 30,000 people injured in collisions with deer and other hoofed game each year ((Groot Bruinderink and Hazebroek, 1996). Estimates of material damage caused as the result of such accidents are harder to assess, but lay in the region of 1billion Euro a year.

1.5 As noted above, while it is estimated that the annual toll of deer involved in collisions with vehicles in the UK as a whole is in excess of 30,000, accurate information on the actual scale of this problem within Scotland, England and Wales, patterns of geographical distribution and the systematic location of accident black-spots within each country have been lacking. The paucity of reliable recording of such incidents across a range of authorities and other potential data sources was highlighted in the short-term studies commissioned by the Highways Agency in 1997 (ed. Smith & Langbein, SGS Environment, 1998) and the Deer Commission for Scotland in 2000 (Staines, Langbein, and Putman, 2001). The authors of both the above studies strongly recommended that a national system for recording deer/vehicle incidents should be established, and jointly put forward proposals to develop such a database to assess the true scale and geographical distribution of the problem, and research key factors influencing accident risk (Langbein et al. 2001), in order to help identify and better target suitable preventative measures in the future.

1.6 From that basis the 'National' Deer/Vehicle Collisions Project' was launched in England early in January 2003 under the auspices of The Deer Initiative, with lead funding provided by The Highways Agency. The project was extended to include full coverage of Scotland from June 2003, with funding made available by the Scottish Executive. Further financial assistance has been provided by the National Forest Company, Woodland Trust, and the Deer Study & Resource Centre, as well as assistance in kind by numerous other organisations and individuals to help publicise the study and contribute information. The project has not researched incidents as fully for Wales, as in the case of Scotland and England, but where nationwide data sources (such as Insurance companies) have been able to provide records for Wales these have also been retained for the combined database.

1.7 It was proposed at the outset that the projects in both England and Scotland should span a minimum of two full data collection years (2003 & 2004); and this study period was subsequently extended in both countries to include information also for any incidents occurring up to the end of 2005. In Scotland the project officially concluded in March 2006; in England the project remains on-going with data collection planned to continue throughout 2007.

1.8 The present document focuses primarily on findings of the study in **England** during the main 2003–2005 study period. [Fuller details of findings specifically for Scotland form the subject of a separate report (Langbein & Putman, 2006b), available for download via The Deer Commission for Scotland web-site: www.dcs.gov.uk]. However, the objectives and approach followed have been very similar for the studies in both England and Scotland, and in many cases cross-comparison between the different situations pertaining in the two countries can also be very illuminating. Where appropriate, some findings available for Scotland are thus also presented in this report for comparison with results in England. Figures and Tables referred to in the report that relate specifically to Scotland are provided with the suffix [**S**].

1.9 **Contractors and Sub-Consultants:** The Deer Collisions Project for both England and Scotland has been administered by The Deer Initiative. The direction and planning of the study was undertaken for the DI under sub-contract by Deer Management Research Consultants Dr Jochen Langbein and Professor Rory Putman, and to oversee data collection and analysis in England and Scotland respectively.

Objectives

1.10 The main deliverables laid down at commencement for the overall project were:

- To design and initiate a well-stratified, nation-wide system for the collection of standardised information on DVCs from all relevant sources in England and Scotland over an initial 2-year period, and to collate, verify and evaluate all data accrued.

- To investigate factors which may affect accident risk and explore the effectiveness of differing mitigation measures; on that basis make recommendations regarding potential improvements in the design, installation and maintenance of deterrents aimed at reducing accidents.

1.11 More specific goals include to :

i. assess the overall and comparative level of DVCs within different counties or regions.
ii. determine the key factors associated with increased frequency/risk of DVCs in differing parts of the country and in relation to road types, deer species involved, traffic volume, presence/absence of differing types of mitigation and other influencing factors (daylight, time of day, roadside habitats, fencing, road signs, type of vehicle involved etc.).
iii. to identify localities with relatively high risk of DVCs (black-spots), where installation of deer mitigation may be more readily justifiable than in others,
iv. increase public awareness of deer related traffic collisions and how to avoid them.

1.12 The project was later extended for one further year in Scotland (to March 2006), and at present is set to continue in England until March 2008.

1.13 **NOTE** - **Terminology**: For purpose of the present report the term **DVCs** (Deer/Vehicle Collisions) refers to all reported incidents where it may be concluded that a deer has either collided directly with a vehicle, or that a deer has been involved in an accident as a 'carriageway hazard' causing the driver to swerve or take other avoiding action.

As such, evidence that a DVC has occurred may come either from observation of a deer found dead or injured on or close to the carriageway, or from the accident description provided (usually to police and/or insurance) recording that a deer has been hit or is reported to have been involved in causing the accident. As there is no requirement at present in law to report collisions with deer or other wildlife, nor for police to maintain details of such cases unless one or more people have been injured, only a small minority of incidents with deer would generally be included in official DfT Road Traffic Accident (RTA or RTC) statistics. Those DVCs where it is known that human injury or fatality has also resulted are referred to as **deer-related PIAs** (personal injury accident).

2 APPROACH AND METHODOLOGY

Range of differing data sources targeted, and their use for corroboration of findings

2.1 A very wide range of differing organisations and individuals were identified as potentially able to provide some information to the study on deer road kills and traffic accidents involving deer. The type of data and sub-set of DVCs on which they hold information may, however, be expected to vary widely between organisations, and it was anticipated from the outset that different datasets might be more or less suitable for differing questions. Thus for example:

2.1.1 Police, and/or County Council Road Safety or Accident Investigation Units can (theoretically!) provide data for all incidents involving human injury / fatality, which must be recorded on statutory 'STATS19' returns at the scene of the accident. In practice detail of animal type may not always be recorded in accident descriptions and even where included in original police records, that same detail is not currently retained or retrievable from the national records of Road traffic accidents maintained centrally by the UK Department for Transport (DfT) and SEERAD. For identification of known 'deer' related incidents information had to be obtained through approaches to individual police forces and road safety teams, to search out those involving deer from the accident descriptions recorded by attending officers. In addition some, but not all, Regional Police Forces also retain information in similar detail for any 'damage-only' traffic accidents as are reported to them in similar format as for ST19 form.

[The information from ST19 returns to Dft maintained for cases where an animal (other than ridden horse) was implicated as a carriageway hazard distinguished (until end 2004) only between either 'dog', or 'other animal or pedestrian', and hence interrogation of the national DfT road accident database could not provide the detailed data required for the present study. Revised ST19 forms introduced nationwide from 2005 still do not distinguish between differing animal types, but carriageway hazards posed by live animals are now entered in a separate category from uninjured pedestrians].

2.1.2 Motor Insurance Companies could potentially provide data on deer related accidents involving sufficient damage to justify an insurance claim and information on the cost of such claims for material damage. However, once again, motor claims records maintained by many insurers do not clearly identify type of animal when animal related claims arise. In addition, even where insurance data attributable to deer may be abstracted, this would at best only 'sample' those incidents where damage was both comprehensively insured and also sufficiently severe to warrant a claim; (i.e. exceeding policy 'Excess', or sufficient to be worth risking loss of no-claims-bonus), and so will underestimate the true numbers of damage accidents. Insurance claim reports will also not tend to capture information on other incidents where no significant damage occurs but the deer is nevertheless killed or injured.

2.1.3 Main Trunk Road Agents [contracted by Highways Agency in England; or SEERAD in Scotland to maintain the trunk network of major strategic road links in their respective regions of the UK], and local District or Unitary council roads departments responsible for uplift of carcases on more minor roads, can capture information on deer road kills which have not necessarily caused significant damage or led to insurance claims. Once again however, these if taken alone would greatly under-record overall accident frequency since they relate only to those incidents which result in death of the animal concerned and only those which represented an actual carriageway hazard or are otherwise reported to them by the public Many incidents will go unreported; many carcases may be removed by other agencies or members of the public without being reported to roads authorities, and only incidents resulting in death of the deer (rather than injury) are likely to be logged by such sources.

2.1.4 RSPCA and SSPCA; Vets; deer-stalkers, and animal rescue centres: By contrast, these individuals, and organisations can often provide important additional information in those

instances where the deer is not killed outright, but they were asked to attend for humane dispatch or treatment of the animal at the roadside; in most cases such organisations will not, however, attend if called to remove an animal already known to be dead at the roadside.

2.1.5 Finally, members of the general public have been encouraged to report dead deer seen at roadside or incidents they have been involved in direct to the study (including via a dedicated project website). Some of these are regular reporters (stalkers, members of BASC, BDS, NT and SGA and others) who may be expected to have detailed knowledge of deer and thus can provide most accurate information of deer species, age and sex; although information from the general public will tend to provide 'samples' of unknown and variable size, influenced by extent, location and timing of publicity about the project and need for such data.

2.2 Aside from 'sampling' quite different sub-sets of incidents, the different source types will also tend to vary widely in the amount and reliability of detail available, as well as their potential to provide well stratified samples needed to enable direct and fair comparisons across regions, or between road types or other features. While records from e.g. insurance claim data or animal up-lifts by road maintenance departments may have potential to provide some of the largest and geographically representative samples of data, such sources will often lack precise details on location, or details on deer species / age / injuries. Such increased level of detail is more likely to be available from those accidents where a deer manager, vet or others knowledgeable about deer attended. Unfortunately however, those more detailed reports may often be restricted to just certain regions where most recorders have been recruited to assist, and may thus not be particularly well-stratified as a sample, or (if relating only to PIAs) may wholly under-represent total accident frequency.

2.3 It is important to stress from the out-set that the present study was set up quite deliberately to seek information from a very wide range of different data sources, not simply to increase the overall numbers of records collected - but explicitly in response to the recognition that different data sources will provide information better tailored to answering some questions than others. In consequence, parts of the analysis presented in this report have to be addressed by interrogation restricted to particular sub-sets of the overall database (even if comparatively small) best suited to addressing specific questions. There is inevitably some risk that through approaching a wide range of sources, records of the same incident may on occasion be received more than once; screening procedures have therefore been used to identify possible duplicate records (with e.g. similar – even if not exact same date, and same local authority region or OS grid square, and road number or other location information) in the combined database to ensure that these are counted only once when assessing total numbers of reported incidents. However, as long as they are screened in this manner, duplicate reports can in some instances be useful in adding valuable additional insights, such as whether damage occurred to the vehicle, which may not have been available if another reporter merely noted a dead deer at the road side.

2.4 A further reason and major benefit of acquiring collisions records from across differing source types, some of which are largely independent of one another, is that they provide opportunities for corroboration and cross calibration of source types and provide the potential for identification of key groups which might be used for future monitoring work. For example, where we have found that the number of incidents returned from any one given source type (such as the number of personal injury accidents recorded in different counties; or, as a different example, the number of incidents attended by the RSPCA/SSPCA or captured by those Insurance companies able to provide some data) shows a very clear and consistent relationship to the total numbers of DVCs retrieved through other means (e.g. full searches of all deer related calls logged by police control rooms), this can enable us to assess the minimum actual numbers of DVCs occurring in other counties where no data from such fuller searches been possible. Similarly, data from some particular local case studies where special efforts have been made to record the majority of all deer casualties (such as

undertaken by DCS and police through road-verge carcass searches along some roads in 'Priority Sites' in the Scottish Highlands) may be used in assessments of the minimum level of under-recording that would result if relying purely on records retrievable from our more 'conventional sources' such as road maintenance departments or official road accident records [see 4.7 - 4.13]

2.5 An overview of the major different categories of data sources contacted, the type of data they can provide, and the main outputs for which information from each category may best contribute is provided in **Tables 1** & **2**.

Period for data collection

2.6 Although previous studies attempting to collate national records on past DVCs (SGS 1998; Staines et al. 2001) were hampered by inconsistent and/or sparse recording among many of the potential data sources, many individuals and organisation approached at that time indicated that they might be able to retain better detail over a given period if given advance warning. The present study was in England was therefore set up with primary focus on collection of information on a high proportion of DVCs occurring during an initial 2 year study period from January 2003 (April 2003 in Scotland). In practice the project was granted funding to allow data collection to continue to cover also 2005 in full. In England the project remains on-going, with data collection (focussed mainly on a reduced set of prime sources) now scheduled to continue until at least early in 2008.

2.7 The first 12 months of the study were anticipated to provide a lead-in period whilst identifying, recruiting and where necessary training data contributors, and that actual data input over that initial 12 months would most likely be somewhat less comprehensive. It was hoped however that data sources would be fully up and running during the project's second year and that thus data provided during 2004 and 2005 would be the most widely representative. Although complete recording of all DVCs would be an unrealistic goal, the study aimed to record as large a sample as possible each year based on comparable sources and methods of data collection across different regions.

2.8 While the major effort for data recording was concentrated on incidents occurring from 2003 onwards, where contributors indicated they could also provide some information on DVCs from previous years, this information was also sought and logged: for up to three previous years (i.e. 1 January 2000 onwards) for all available records of DVCs, and for five previous years (Jan.1998 onwards) in case of deer-related human injury accidents (PIAs).

Calls for Data / Contributors

2.9 The majority of organisations likely to be able to contribute records to the study (see **Table 1**) were in the first instance contacted directly by phone/ letter near the beginning of the study. In addition, a dedicated project web-site was set-up to provide further information and a ready point of contact with the project for these and additional contributors, and opportunity to submit records directly on-line. The study was also publicised widely via press releases, articles in magazines, and other publicity including via TV, radio, county shows and conferences at the beginning of the study; and publicity about the project in the media and via newsletters has been maintained at frequent intervals throughout.

2.10 ***Mail shots/Direct approaches*** - Major sets of key organisations contacted in the first instance via mail shots have included Regional Police Forces, Roads and Cleansing Services Departments of Local and Regional Councils , Trunk Routes maintenance agents, Council and or Police Road Safety / Accident Statistics Departments, Forestry Commission, and RSPCA/SSPCA. Initial approaches were followed up in the majority of cases by telephone or personal visit to ensure that requests for assistance were addressed to the most appropriate individual within each organisation and to establish personal contact. In addition later agreements with e.g. the British Deer Society enabled mailing out of records forms to all their membership (c. 5000) via 'Deer' magazine.

2.11 ***Web-site -*** To ensure a ready point of contact with the project from the out-set, a dedicated web-site www.deercollisions.co.uk was activated in February 2003 and up-dated soon after confirmation of expansion of the project to Scotland in June 2003. This Internet web-site provides a range of differing pages including introduction and latest news about the project, and links to facility for entering data on-line, downloads of record forms and posters, and preliminary advice on accident avoidance:
[home] background | objectives | participation | avoidance | links | form | downloads].
Visits to the web-site increased steadily after its launch to around 400 unique visits per month (i.e. numbers of visitors viewing more than one page) in 2003, but rising to an average of 1300 visits during 2004 and 2005 (with peaks in excess of 2000 unique visits in some months usually following any major press releases and media coverage for the project during the preceding month (e.g. in Nov. 2004 and Nov. 2005).

2.12 ***Publicity/Promotion of study*** - To help launch the study and maintain its momentum, numerous interviews have been given on national television, national and local radio programmes, and general Press releases given to Newspapers and magazines. Further, more specific articles about the project were submitted and published in specialist magazines such as Deer, Veterinary Record, Mammal News, Shooting Times, Scottish Gamekeepers' Association Magazine, Scottish Wildlife, as well as on other web-sites including National Farmers Union, National Forest, and The Deer Initiative. A brief initial Progress report was prepared in March 2004 and circulated once again to the Press, and to all current contributors to the project; with further such up-dates, other publications and press releases regularly added to the web-site since. All media 'releases' serve the dual purpose of maintaining momentum of the project, but also in increasing public awareness of the risk of DVCs; the majority, including in particular press releases organised jointly with the RAC and AA have also contained specific advice to individuals on how to minimise the personal risk of accident. In addition several hundred colour posters and flyers were produced early on during the project for inclusion with mail shots, distribution at shows / events, and also made available for download at the web-site. In 2005 production of 3000 'Slow-down-for-Wildlife' car-stickers was funded through separate sponsorship – showing also Wildlife warning signs and the Deer Collisions web-site URL – again to continue to help raise awareness of the issue.

Data Input / Consolidation / Validation

2.13 As expected, the quality and detail available per incident reported varies widely between source types and individual contributors. In general only those records with an accurate or at very least an approximate date of the incident, as well as reasonable detail regarding location are of value for retention in the main database, as without these it is not possible to protect against duplicate recording. However, in the great majority of cases additional identifiers such as time, precise location details, road number, deer species and/or sex/age have tend to make identification of potential duplicates reasonably straightforward; while those where location details are too vague to identify them clearly as a distinct incident have generally been excluded from final analysis unless no other incidents were recorded within the same local authority around that date.

2.14 One major, often time consuming task during data entry has been ascribing map locations (OS grid references) and associated accuracy levels to records where the location has been reported only imprecisely. Thus, while it was requested that contributors provide six-figure or better OS grid references whenever possible, people noting a dead deer on the roadside or reporting a collision (not least while driving) often do not actually know very exactly where they were at the time. Thus, many reports received may state e.g. "A9 between Perth and Dunkeld" (thus although defining an actual section of road, but not an actual point along that particular section), or e.g. "M4 near Swindon" in which case the incident may have been located within a few miles to either side. Even though neither of such records would be possible to include for identifying specific local black-spots, such records are nevertheless extremely useful in building up a complete picture of total numbers of DVCs for a county as a

whole, or along a specific road section, district, or 10km or smaller OS grid square. Records where some reasonable location details but no grid references were provided by the source were therefore checked against computer mapping programs (such as OS Interactive atlas for PC, or MS-Autoroute) or with hard copy maps, and a grid reference allocated to allow placing of the record close to the relevant road section. Whenever possible a six-figure or longer reference has been allocated, so as to map the record on the correct road if named, but recording for each database entry the likely 'level of accuracy' depending on the detail of the location description provided by the reported; that is, to indicate whether a given record is actually likely to be accurate to within 100m (as implied by a six fig reference), or whether it may in fact only be accurate to identify with confidence the most likely 1km, 5km or 10km OS grid square. Allocation of at least six figure or longer grid references (e.g. SU345635 or 4345E , 1635N) helps to avoid mapping records at grid corners instead of close to the appropriate roadside, while the ascribed level of accuracy enables identification of the sub-sets of those records which may legitimately be included in total counts e.g. per 10 km^2 or 1km^2 OS grid square.

3 DATA SOURCES – LEVEL AND QUALITY OF RESPONSES

3.1 The number of different organisations from which data were requested by us are summarised in **Table 4** for England (and for comparison in **Table 5**[**S**] for Scotland) broken down according to the broad source categories described in section [2.1.1 -2.1.5] and local authorities. Also shown are the number of those organisations approached which provided usable data, the total volume of reports received during our main three year (2003-05) study period, as well as numbers of different incidents after exclusion of any identified as possible / likely duplicates submitted by more than one source. **Table 3** shows the numbers of reports received in the main individual study years, and additional records received for incidents occurring prior to 2003; figures are also provided in the same Table for the length of the public road network in each local authority area.

3.2 Information had been requested from seven major categories of organisations and individuals: i. Animal Carcass Up-lift requests [**U**] received via either Trunk Road Managing Agents (UT) or Local Authorities Roads Departments (UC), ii. Police / County Council Road accident databases for Human injury accidents, and 'recorded' damage-only accidents involving deer [**ST**], iii. Police Call Control Room Logs [**P**], RSPCA and other Wildlife Welfare/Rescue [**R**], 'Deer-Knowledgeable' Contributors [**D**] (such as e.g. forest rangers, BDS and BASC members), and members of the General Public / Private Individuals [**G**]; Insurance Companies [**IC**] - several attempts were also made to obtain animal accident information across a range of national insurance companies, but FORTIS Group Insurance to date still remains the only major UK motor insurer who were able to abstract substantial nationwide samples of specifically deer related claims.

3.3 In brief, for England the following numbers of records **(Table 6)** have been received and collated for analysis within each of these main categories. [The extent of overlap of records is relatively small, with fewer than 500 of those shown identified as possible / likely duplicates; this low level of duplication due most likely to still only a modest proportion of all actual DVCs occurring being reported to the project]

Table 6 Summary of numbers of DVC records for ENGLAND entered to database by source:

Source Categories and numbers of records received:		**2000 to 2005**	**Jan. 2003 - Dec. 2005**
ST	**Road Accident Statistics Departments**	1435	613
UC **UT**	**Council Road Carcase Clearance** **Trunk Road Carcase Clearance**	1605 1981	1075 1526
IC	**Motor Insurance Claims** **(via 1 company – FORTIS Ins - only)**	1640	974
D	**'Deer-knowledgeable' contributors**	5899	3950
R	**Animal Welfare / Rescue** **(of which RSPCA alone):**	9472 (8714)	4808 (4260)
P	**Police Control Call Rooms**	1537	1182
G	**General Public contributors (incl. via web-site)**	986	769
	TOTAL:	**24555**	**14897**

3.4 As illustrated above volume of reports received varied considerably between these different main source categories. In terms of overall numbers of incidents reported the single most extensive set of records of deer casualties in England has been that provided annually by

RSPCA (8714 records since Jan.2000); the great majority of these relate to live injured deer that required attendance for dispatch or rescue. A similar further number of records per year were contributed by rangers and deer managers who also get called out to deal with injured deer, followed by numbers reported by council and trunk road departments. Records obtained via each of the remaining categories extended to on average two to four hundred per study year, but nevertheless provide important information on particular aspects of deer collisions.

3.5 However, there is also a great deal of variation between the categories in the detail that tends to be available per incident. Therefore, while some sources may be able to produce largest volumes of records, which are helpful to assess the minimum overall scale and distribution of the problem (e.g. Police control room reports, local roads authority carcass uplifts), others smaller sets of data are often equally as useful by virtue of the greater detail associated and more precise with each incident (e.g. major community forests or other individual estates), higher location accuracy. Some of the latter, albeit often smaller data sets may also be able to provide better geographically well-stratified samples of records providing for fairer comparisons of risk across entire counties or larger regions. For example, although human injury accidents logged by police fortunately appear to make up only a fairly minor proportion of around 1.0 – 1.5 % of the overall number of all DVCs in England [see 5.13 – 5.15], these more serious incidents tend to be logged in a relatively accurate and comparable manner across most if not all police forces nationwide; and are therefore particularly valuable not only in themselves, but also as a basis for checking whether data from other sources for which we can not be sure of regional variation in levels of reporting, are distributed in the same manner. By contrast, among some of the largest data-sets received are records of carcass uplifts via some district council roads departments, which are very useful to assess the minimum known level and spread of DVCs across their particular districts; but these have been available only for a minority of district councils approached, and in many cases record relatively imprecise detail on location, dates and other particulars, making them less suitable as basis for assessing regional or national patterns.

3.6 The level of response received, the manner of data retrieval, and the particular qualities and limitations of records from each of the different major source categories [UT, ST, R, D, P, I, & G] are discussed in turn in further detail in **Appendix IV**.

4 RESULTS

Overview of data collated and used for analysis

4.1 Two short-term pilot studies commissioned by The Highways Agency and The Deer Commission for Scotland have previously attempted to draw together as much retrospective information on DVCs as could be obtained across a range of potential data sources for Britain as a whole (SGS 1998) and more recently specifically within Scotland (Staines et al. 2001). For both of these studies, the *sample* of different incidents on which usable information could be retrieved for any one year was limited, and estimated as probably representing less than 5% of the true numbers of collisions occurring per year. The nationwide SGS study accrued 1723 records for incidents occurring in the 12 months between November 1995 and October 1996, with a total of 2533 records obtained for 1995+1996. In the DCS study restricted to Scotland alone, the highest number of records collated for any one year was 427 (in 2000), with an overall sample of just 954 records available for the five year period to Dec 2000. The main limitation of those datasets for assessment of national patterns was not just the limited number of records found, but more that the great majority of data were restricted to a small number of counties or districts where some system of regular recording of DVCs had already been in place, with no data available in many other areas.

4.2 The primary task for the present study was to build up a much more comprehensive database based on collection of as high a proportion as possible of recent Deer-Vehicle Collisions (DVCs) occurring throughout the country over a specific period. Following commencement of the project in January 2003 in England, and its extension to Scotland confirmed from April 2003, it was decided to focus effort foremost on compilation of the most extensive information for any incidents occurring during a two year data collection period from 1 January 2003 to end December 2004. The study was later extended to enable data collection for a further year up to December 2005. However, where sources indicated they could also provide some information on DVCs occurring during previous years, this information would generally also be sought and logged: for up to three previous years (i.e. Jan 2000 onwards) for all available records of DVCs, and for five previous years (Jan 1998 onwards) in case of deer-related personal injury accidents (PIAs).

4.3 The main initial purpose for the database was to provide a source for:

i) assessment of the overall scale and distribution of the problem [*based on analysis of data specifically recruited in complete years 2003-2005*].

ii) identification of accident hot-spots, where levels of recorded DVCs are noted to be notably above average compared to the surrounding region. [*all data*]

iii) evaluation of factors which may influence risk of deer-vehicle collisions, such as e.g. traffic volumes and speed, road types, road side habitats, deer species and density, time of day / year. [*all data*]

iv) design of a simplified longer term monitoring programme for DVCs.

4.4 During the present study we have accrued over 30,000 records relating to DVCs occurring within the UK between 1/1/2000–31/12/2005, including [22,555] for England (leaving c.22250 separate incidents when likely duplicates reported by more than one source are excluded). The way these different records are broken down between study years (and between different source-types and Local Authorities) is shown in **Tables 3** and **4.** (Breakdown of data for Scotland are included for comparison at **Table 5**[**S**]).

4.5 The greatest number of records per year were collated for England during 2003 and 2004 (4949 and 5636 records respectively); during 2005 data collection was focussed down on a smaller subset of the most useful sources for continued monitoring, though for that year still extends to 4130 records entered to the database to date; however, some major sources

(including insurance claims information) for 2005 were only received late in 2006, and have not yet been possible to grid reference and allocate fully to government regions, local authorities and roads; while many further records from other sources are also still likely to be added to the database for that year.

4.6 Numbers of DVC records accrued in the parallel study in Scotland were considerably lower, at around 1500 per annum. However, as discussed further in later sections [see 8.3], even though Scotland holds probably just over 50% of all wild deer in Britain, a much lower toll of DVCs may be expected there than in England simply from view of far lower levels of road density and traffic volume (i.e. total annual volume of traffic within Scotland = 43 billion vehicle kilometres cf. 430 bVkm in England – see **Table 9c**). This inevitably leads to an overall reduction of the risk per deer of being involved in deer / vehicle interactions, although the risk per driver (or per vehicle kilometre driven) may actually be higher in Scotland than in England.

Actual Number of deer- vehicle collisions

4.7 It is important to emphasise that the statistics (as in **Table 3**) simply refer to the number of reports received by the study (or after elimination of duplicate reports, the number of incidents **reported**); this should not be seen as an indication of the number of DVCs actually **occurring**. Even these comparatively large 'samples' of over 7000 incidents logged nationwide annually represent only a small proportion of the true annual toll of collisions with deer in Britain each year. As suggested in section 2.4, the approximate actual extent of such underreporting may be estimated through comparisons of the rate of data capture by differing sources from within those regions where data from several types are available; or in some instances from more localised case studies where rather more intensive recording of DVCs has been undertaken.

4.8 An indication of the scale of under reporting can be obtained in a number of ways:
In the first instance total numbers of carcases or incidents in a number of specific case studies where DVCs were recorded much more intensively through roadside searches, were compared with the number of reports received by the Deer Collisions Project for those same areas [4.9]. In a similar way we may also assess the probable proportion of the true national toll recorded by particular major independent data-sources through assessing the percentage of DVCs captured by one source-type (e.g. from nationwide samples of Insurance claims) for which those same incidents were also 'captured' in our samples from another independent source (e.g. RSPCA) [4.12]. Finally estimates of the true scale may be based on assessment (using again specific areas where it is likely that at least the great majority of incidents are reported) of the proportion of all reported incidents in those 'case study' areas which result in human injury; and in turn using that figure together with overall national tolls of human injury accidents to predict total numbers of DVCs nationwide.

Carcass searches

4.9 Firstly, data are available from a number of assessments from Scotland, where independent counts were made on a regular basis of deer carcases seen within 50 metres of the road verge on both sides of a stretch of carriageway. In one example a police officer from Highland with a personal interest in the issue, undertook regular searches during 2004 to record all deer carcasses he was able to find for a 20km stretch of the A830 between Glenfinnan to the Ardbuith viaduct, and also assessed how many of these actually corresponded to entries in police call-logs received by their control room; these carcase counts could also be compared with all reports received from other sources by our national Deer Collisions study in Scotland over the same period (see table below).
A total of ten records were obtained for that particular stretch of road from police call logs and other sources for 2004; the more intensive carcass searches indicated that a minimum of 28 deer had been killed here as result of collisions with vehicles during that one year. The true total of incidents is likely to be higher still, as some deer casualties tend to be removed and 'used' by the public without any reporting; however, these figures suggest that in this

instance at best 35% (10/28) would have been captured in our database if just police call-log data and our normal level of public reporting had been available.

Road	Searches by	Length searched	Carcasses found'04	DVC recorded via all other data sources
A830	Mallaig Police (2004)	19 km	28	10
A82	DCS 1/1/04 to 1/3/05	48 km	33	19
A835	DCS 1/1/04 to 1/3/05	47 km	29	33
A87-A887 Shiel Bridge - Invermoriston	DCS 1/1/04 to 1/3/05	55 km	39	6

4.10 Similar programs of carcase searches have been organised by Deer Commission for Scotland (DCS, unpublished data) two to three times a year for defined sections within a number of sites along the A835, A832, A82, and A87. Carcasses found were marked or removed to avoid re-recording at subsequent searches. Results of these carcase searches are summarised in the Table above (together with those for the A830) and these DCS counts may also be compared against the number of reports received over the same period by the present DVC study in Scotland. Although in case of the A835, carcase searches revealed a similar number (29/33) to the number we recorded through other reports, in case of the A82, reports from other sources made up at most 57% , and in case of A87-A887 no more than 15% of the minimum number revealed by carcase searches. As indicated before even **this** will underestimate the actual level of underreporting, as many of the incidents reported to us from other sources are likely to be additional rather than the same as those found during roadside searches, as e.g. trunk road or local council and stalkers called to dispatch injured deer will often remove carcasses when called out unless they are too badly damaged, and thus an unknown number would not be available to be found by the above road side searches.

4.11 A wider assessment as to what %age of all DVCs occurring annually in England have been captured during the present study may be made by investigating the ratio of the numbers of human injury collisions (PIA) involving deer to the total number of DVCs recorded in a number of specific case study areas (such as major community forests or FC woodlands under single ownership: including The New Forest, Ashdown, Ashridge, Forest of Dean and Thetford Forest) where most comprehensive long-term systems have been in place to record at least a very high proportion of all deer road casualties. [The available background data for such assessments relating to human injury incidents are discussed in greater detail in sections 5.13 to 5.16 below]. Result suggest that such human injury incidents as are currently logged and retrievable from official police records make up on average less than 1.5% of all deer road casualties / collisions reported to our study within these above case study areas. Most deer managers even in these forests are of the opinion that the proportion of deer casualties that they attend or hear about is likely to be no more than 50 to 75% (with many picked up by drivers or the deer running off after being hit); and hence the reported human injury incidents may actually represent an even lower proportion (most likely merely 1% or less) of true DVC numbers.

On the basis of the above figures taken in combination with a nationwide estimate that each year approximately 425 human injury accidents reported to police do involve deer in some way [see 5.9], we may calculate that the minimum number of DVCs in Britain as a whole is likely to be no lower than 28,500 (i.e. if reported human injuries represent 1.5% of all incidents), but very likely will in reality exceed 42,500 (if, as seems highly likely, those deer specific PIAs retrievable from police records represent les than 1% of all DVCs).

Based on this estimate of 42,500 DVC in Britain per year, just over 80% of these (34,000) would be expected to occur in England, around 19% (8000) in Scotland, and less 1% in Wales [see 6.6]

4.12 A further indication of the likely sample size represented by the c.7000 incidents reported to our study annually, may be obtained from inspection of the levels of overlap (or 're-capture') of the same deer vehicle incidents in submissions from different source-types. The most useful, largely independent nationwide data sources for such comparisons available to us are reports of claims received via Insurance companies for deer related vehicle accidents, which can be evaluated to identify records of incidents reported for the same date and similar location within either a) records of call-outs to injured deer at the roadside dealt with by the RSPCA throughout England and Wales, or b) matched up with records by deer managers called out to incidents in a number of our major case study areas (as above 4.11).

Based on data for 2003+2004, among a sample of 519 deer related motor claims for England provided by Fortis Insurance for which adequate location detail is available to assess duplication, just 10 of these (c.2%) could be matched also with records within [2860] call-outs to injured deer dealt with by RSPCA over those same two years. Not all motor claims incidents would be expected to lead to calls to injured deer (as for 21% of these motor claims descriptions indicate swerving to avoid deer and hitting another object, and no deer may actually have been hit). On the assumption that most duplicates have been identified, these figures suggest that our annual samples of around [1420] RSPCA records are likely to represent as little 2% of all the DVC incidents in England; or around 2.5% of those incidents where an actual collision with a deer has occurred. Replicating the same approach to see how many of the Fortis Insurance claims for England could be matched instead with incidents logged by rangers in the six major forest areas for which we hold most accurate and extensive DVC information (Ashdown, Ashridge, Thetford, New Forest, Cannock Chase, and Forest of Dean), 8 of the 519 (1.5%) insurance claims could be identified as very likely referring to the same incidents.

Combination of the two above samples overall provided 18 motor claims (3.5%) that were 're-captured' in our samples of records from either RSPCA or else in our 'case study' areas. The combined annual sample of records received via these two sources averaged 2075. Use of the percentage overlap calculated as estimator, enables tentative extrapolation that the true toll of DVCs in England alone may well lie over 60,000 (or 48,000 if excluding those DVCs were a deer may not actually be hit). As these calculations are based on data from England alone, **this would raise the total national estimate to near 74,000** (see [4.11] above).

4.13 While the above assessments can serve as a general guide to the likely overall scale of the problem in England and Scotland, accurate estimation of the true national toll of DVCs remains difficult. However, our estimate that the total number of DVCs is highly likely to exceed 40,000, and may possibly be over 70,000 per annum in Britain, is far from unusual when seen in the context of similar estimates obtained in other countries in Europe and the US. In Germany, for example, reported DVCs now regularly exceed 120,000 per annum (DJV Handbook, 2005) and are estimated by many to actually lie nearer 200,000; whereas the most recent figures from North America suggest that close 1.5 million DVCs occur there per annum, with several individual States in the US reporting over 70,000 deer collisions per annum (State Farm Insurance, 2006)

Are DVCs increasing?

4.14 One of the first questions often posed is whether, or by how much, DVCs have been increasing compared to past years; and if this is attributable largely to the perceived rise in deer numbers over recent decades. The question of how much DVCs have in fact increased in recent years over and above what might be expected purely as a result of higher levels of traffic is however difficult to answer. Although it is unquestionable that there has been a considerable expansion in the distributional range of most our deer species over the last 25 years, there is a lack of quantitative information on both a) the actual extent to which deer

numbers have actually increased over recent years; and b) the actual number of DVCs which were occurring in previous decades to compare to results of the present, first systematic attempt at recording DVCs nationwide. However, it is **known** that traffic volumes on roads in Britain have doubled over that same period, and in the case of rural roads have nearly trebled (see **Figure 1**). Therefore, even without any rise in deer numbers the annual incidence of DVCs would be likely to have increased substantially in the UK over recent decades.

4.15 National analyses we can undertake within our own data are restricted to changes apparent over relatively recent short periods (e.g. 2000 to the present), where perhaps little change in accident frequency would be expected given the 'run' of years is short, and neither deer populations nor traffic volumes are likely to have changed dramatically over that period. However, data relating to motor accident claims to the Fortis Insurance Group, in respect of accidents known to have involved deer [discussed further in section 6.1-6.9], are now available to us in the same form for six consecutive years (see Table below). The exact figures received from this one company may be affected to some extent by changes in numbers of policy holders, but the percentage of national market share held by Fortis group has remained at around 4 – 4.5 % of all private motor polices. The figures do suggest an increasing trend in the number of claims relating to deer.

Another large national dataset with annual data since 2000 is provided via RSPCA. In this case although a steady increase in recorded call-outs to injured deer is apparent from 2000 to 2002, number of reports since have been more variable, possibly affected to some extent by a change from regional to national call management centre. However, while numbers of records submitted by RSPCA so far and entered to the database do not show a very significant increase over recent years, a recent internal review of past RSPCA data has noted that a large number of additional records for past years (several hundred per year) had not yet been abstracted and submitted to the deer collisions database, as around 500-1000 further records per year were logged as 'rescues' rather than 'RTA' incidents (see table below); inclusion these additional incidents not yet entered the database do indicate a significant rise in call-outs to injured deer at the roadside over the last four years.

Number of separate DVC incidents reported by Fortis Insurance, and the RSPCA

Source	year 1999	2000	2001	2002	2003	2004	2005
Fortis Ins. (all UK)	214	287	217	307	366	409	428
RSPCA England only	n/a	1216	1406	1592	1301 (1862)*	1535 (2360)*	1389 (2592)*

*(note – recent re-assessment by RSPCA indicates that records submitted to the DVC project and entered to database so far exclude c.500-800 further RSPCA records per year which will be available shortly; preliminary indications are that this will take the true total of RSPCA call-outs to injured RTA-deer to the total shown in brackets; and records for 2006 already exceeding 3100.

4.16 At a more local level much more dramatic increases in DVCs have occurred in some areas, whereas in others little consistent change is apparent over recent years. The most notable increase over recent years has occurred near Ashdown Forest, East Sussex, where numbers of DVCs attended by the Ashdown Forest rangers have seen a five fold increase over the last seven years; from just 74 in 2000, to 215 in 2005, and 317 during 2006. In most of the other major forest sites for which similar long-term DVC data are available to us, numbers of deer casualties have varied far less over the last decade, with only moderate increases noted in most, and decreases in some others. The underlying reasons for such local changes are likely to relate not merely to background variation in traffic speed and volume, but differences between sites and years in how deer population numbers are managed and of other preventative actions taken to prevent further escalation of DVCs.

National Spread of all reported DVCs

4.17 **Map 1** shows all those different 10km Ordnance Survey grid squares where we have information on at least one or more DVC records collected since Jan.2000 [based on a sub-set of 26174 records nationwide (of which 21144 in England) with location details sufficient for mapping at this scale]. This illustrates clearly the very wide nationwide spread with some DVCs recorded throughout almost all parts England and Scotland, as well as some parts of Wales. Within England distribution is almost continuous throughout southern England. Within northern England significant gaps occur only within Cheshire and adjoining northern parts of Staffordshire and Manchester; as well for a few grid squares in upland areas with relatively few main roads. An almost equally wide distribution pattern remains preserved even when restricting distribution mapping to include only data for the main three study years from Jan.2003 to Dec.2005 when most comprehensive data were logged (**Map 2**).

4.18 In **Maps 3 (a-h)** distributional data for England 2003-05 have been broken down further to help explore any regional differences in recording between our main source categories. Some regional bias is likely to arise among the samples of individual recorders (categories D and G) according to where we have been most successful at recruiting regular contributors to the project (although that in itself tends to be easiest in areas where there are indeed highest deer numbers and hence greatest concern about DVCs). In addition, we are aware of 'gaps' in continuity of recording particularly within those data provided by District Council Road Cleansing Departments and Police Force Control rooms, as these were only available to us in some counties or districts [see 3.5 and Appendix IV]. However, in terms of overall distribution the patterns emerging based on each of the separate source categories are in fact broadly similar, and the same predominance of records in the Southeast and East of England remains apparent not only for large nationwide datasets such as RSPCA and other animal rescue [**Map 3a**] and for Insurance claims [**Map 3b, Map 8**], but also among samples of records provided by our 'deer knowledgeable' contributors [**Map 3c**], and even among the rather smaller but apparently still reasonably well stratified samples received from Trunk Road Managing Agents [**Map 3e**] as well as entries submitted by the General Public [**Map 3d**].

Relative Frequency of DVCs in differing parts of England (and Scotland)

4.19 Although DVCs have been reported to this study from virtually all parts of mainland Britain very clear differences are apparent between different regions in how commonly such collisions are repored. **Map 4** shows how many of our different main data categories have contributed records in each area, while **Map 5** provides an overview of the**frequencies** of DVC for **Britain** as a whole, highlighting those areas where we have recorded the highest numbers of DVCs from 2003 to 2005 inclusive. To indicate relative differences in DVC occurrence all records with location details provided with sufficient accuracy have been allocated to the relevant 10 km by 10 km OS grid square, distinguishing in on the map between those squares with 1-10, 11-50, 51-100, and 101-400 reported incidents (after exclusion of any likely duplicates reported by more than one source).

4.20 The nationwide overview map (**Map 5**) for 2003-05 has been created using the entire database of DVCs reported from across all our sources, and the patterns apparent may to some extent be skewed as a result of somewhat fuller systems of recording in some areas than in others, in addition to real geographical differences in deer collision frequency; although as discussed above [4.18] this would appear to be a lesser problem than was at first anticipated. How well the patterns shown among these pooled data coincide with relative distribution of DVC across Britain evident among records from just those sources able to provide the best stratified data sets (e.g. insurance claims, human injury data) is explored further below ([4.24; and see **Map 7**].

4.21 However, it is readily apparent from the overall distribution map (**Map 5**) that **patterns of higher or lower frequency of DVCs do not relate in a simple way to deer density.** The highest frequencies of DVCs in England are recorded in those regions which also have highest traffic volumes, especially in the South-East within a belt of approximately 25 to 50

miles from the centre of London. This is unsurprising, as the risk to deer from deer / vehicle interactions will inevitably increase where they reside near centres of human population and road traffic. This is well illustrated, for example, by the far lower numbers of DVCs recorded in the parallel DVC study in Scotland (Langbein & Putman, 2006b), where an overall somewhat larger resident deer population suffers only a quarter of the total numbers of DVCs recorded in England. Within Scotland itself highest frequencies of DVCs have been recorded in the Grampian, Tayside and Central regions; again not necessarily the areas with the highest deer abundance overall, but where high deer numbers do coincide with some of the highest volumes of road traffic in Scotland.

4.22 Further illustration of regional variation of DVCs within England, and the influence of traffic volume, is provided in **Table 3**. Here the total number of incidents reported to the present study within different Local Authorities (Counties and Unitary Authorities) are shown, along with figures for the total traffic volume recorded in those areas (as measured by total numbers of driven Vehicle kilometres, based on national road traffic survey statistics; Dft 2005). Local authorities in Table 3 are listed in descending order based on to the total number of DVCs reported to the study during 2003 to 2005. In addition for each authority its relative rank is also shown if the Table were re-ordered instead based on the rates of reported DVCs per billion vehicle kilometres.

4.23 The highest total number of reports on DVCs was received for Hampshire, not only overall, but also in five of our eight main source categories (**Table 4**) including among insurance claims and RSPCA data. However, while Hampshire has very high populations of several species of deer, it is also one of the counties with highest total traffic volume. If taking into account differences in traffic volume between local authorities, by ordering local authorities according to the rate of reported DVCs per bVkm per annum (see final column – **Table 3**), then the three counties that emerge as having the highest average DVC rates per annum are Suffolk, East Sussex and Norfolk (all with rates close to 50 'reported' DVC/bVkm per year), followed by Hampshire. Also ranked among the twelve top counties based on rate of DVC after accounting for traffic volume, all with > 25/bVkm, are Oxfordshire, Bath and NE Somerset, Gloucestershire, Dorset, Lincolnshire, West Berkshire and Bracknell Forest, and Buckinghamshire.. By contrast, a number of counties such as Hertfordshire and Berkshire, which are among the worst ten counties if ranked purely on basis of total numbers of DVCs we have recorded over recent year, are ranked only 14th and 25th respectively if taking into account the very high traffic density and volume in these two counties.

Correspondence of frequency and distributional patterns revealed by differing data sources

4.24 The truest representation of regional differences in DVCs are likely to be shown by those of our data sources which are able to provide comparable data throughout the country, without any significant geographical bias towards higher rates of reporting (other than caused by higher volumes of traffic and hence higher risk of deer / vehicle interactions.

Potentially the best if relatively small source of well-stratified data are records of DVCs leading to human injury, for which at least in theory the majority should be recorded by police in all regions. However, while we have been able to obtain some such data for a high number of local authorities making up over 75% of the land area of England (see also **Map 3g**), the type of animal involved in PIA does not have to be recorded by law, and hence there are difference between counties in the proportion of deer PIAs likely to be possibly to identify; there are also some significant gaps in availability of any deer-specific PIA information for some counties (including e.g. for Staffordshire, which has high numbers of DVCs but manner of recording does not enable extraction of deer-specific PIAs).

Rather better truly nationwide coverage is presented by data provided to the study by FORTIS Insurance on motor insurance claims arising through DVCs for throughout 1999 to 2005. Although Fortis has only a 4.5% market share of private motor policies nationwide, its c. 1.1 million policy holders as well as its brokers are very widely distributed throughout all of Britain. **Map 8** illustrates the very wide and consistent patterns in distribution of DVC motor claims across years; and **Table 4** shows the breakdown of these insurance claims data and data from other source types among differing local authorities.

4.25 Using the above Insurance data as our baseline for regional distribution of DVC, we may examine further also the extent to which the same patterns are reflected among our other, often larger data sets. Examination of scatterplots of numbers of reports per county from Fortis insurance claims against number reported via other source categories shows strongest associations with other single categories [R] (RSPCA and other animal rescue; r=0.63), [D] (deer-knowledgeable contributors such as forest rangers / deer stalkers; r=0.61), and with [ST-Pia] (DVCs causing personal human injury – when using all 6-years of data; r-0.73). Lesser coincidence would be expected with the other categories such as police control room logs and district council up-lifts, as these could be provided only for a minority of local authorities.

4.26 Neither categories [R] or [D] alone would be expected to capture DVCs in an entirely even manner throughout the country; for example, while RSPCA will try to assist with animal RTAs when called upon almost anywhere throughout England and Wales, they are less likely to be called to help in many of the major forests with a long history of high numbers of DVCs and local call-out system in place to deal with injured deer (e.g. Cannock, Thetford, New Forest, Ashdown, Ashridge etc.; or Dorset and North Somerset where there are well-established injured deer call-out schemes supported by police). A more complete and regionally representative picture of DVC distribution is therefore likely to be obtained through combination of these two major categories; and such combination does indeed lead to a stronger association (r=0.75) when plotted against the independent distribution pattern based on insurance data (see also **Map 7**). This provides confidence that these data provide a reasonably accurate picture as to regional and local distribution of DVCs. Furthermore this suggest that data collection focussed on records from RSPCA and from deer rangers from a number of the major forest and accident hotspots could provide a firm foundation for long-term monitoring of future changes of DVCs in England; although this would still ideally be underpinned also by records of carcass uplifts from motorways and other major trunk roads (where RSPCA may be less often involved), and human injury accidents and DVC insurance claims (see also section 10.1 – 10.8).

Local regions of peak DVC occurrence

4.27 Aside from gross regional patterns, **Maps 5** perhaps more importantly also help to identify some more localised areas where collision rates are seen to be considerably higher than those in surrounding areas. In these overview maps however, in order to make use of the maximum number of records, data have been mapped only to an accuracy of a 10 by 10 km grid square (i.e. 100 km^2); at this scale, some more localised differences and particular black-spots will tend to be obscured. While we cannot locate all incidents more precisely, a large subset of reported incidents can be much more accurately identified to within 1 km, or at worst 5km. **Map 6** provides such a closer view for Southern England and enables presentation of 'relative' frequencies recorded during 2003-2005 at finer resolution of 5 km by 5 km OS grid square. At this scale the location of some of the most significant local collision 'hot-spots' become much more readily apparent.

4.28 The areas highlighted with overall highest concentrations of DVC in **MAP 6** include firstly a number of well known major forests areas with mostly a long-history of significant numbers of DVCs (Cannock Chase, The New Forest, Thetford, Epping Ashdown and Ashridge Forest, The Forest of Dean, Dinmore Hill and Halden Hill). In all these areas (with exception of Thetford) the predominant species involved are fallow; fallow in these areas and elsewhere often occur in large herds sizes and at very high localised density by comparison to other less sociable, territorial species such as roe and muntjac; and fallow are the most common species associated with such local hot-spots nationwide. However, in addition numerous other regions of still high but somewhat less localised DVC frequency are also apparent not associated with any particular major forests, such as for example between Southampton – Portsmouth, The Mendips, and The Chilterns and Berkshire and Surrey; and here (as well as

in Thetford Forest) roe and /or muntjac often contribute the greatest proportion of DVCs. [re species see also [4.33 & 8.6].

DVC rates and hot-spots on specified roads

4.29 For many DVCs the actual road number has also been provided by our contributors or could be added retrospectively where good grid reference detail was provided. Assessment of the database in relation to specific roads, can also help in identification of those routes (or route sections) which currently experience relatively high frequencies of DVCs – and thus to help target future mitigation efforts and/or identify potential trials sites for more detailed field research.

4.30 **Table 10** summarises information for those roads in England for which we currently hold the highest numbers of DVCs reported to the study during 2003 – 2005. To identify those roads with highest DVC rates, the total number of records for each named road was first totalled and then divided by the approximate length of that entire road to provide a minimum estimate of the rate of (reported) DVCs per kilometre. The major roads (A class or Motorways) for which the highest numbers of DVC km^{-1} have been lcalculated along their entire length include the *A22, M27, M3, A11, A134, A303, A14, A34, A30, A47, M4,* as well as shorter A-roads including the *A1065, A4136 and A4146*.

The total number of DVC reports available for these roads range from 0.15 – 0.85 km^{-1} $year^{-1}$ averaged out across the full length of each road; i.e. in some cases reaching up to 6 fold the average 'reported' rate (0.10 DVC km^{-1}) calculated across all major roads in England. However, for a number minor of roads, including the *B4506 (Herts/Bucks), B1106 (Suffolk), B2188 & B2026 (East Sussex) and B1393 (Essex)*, as well as for specific sections of the above major roads, average recorded deer collision rates rise to near 5 DVC/km (calculated for stretches of >5km), including for example parts of the *M27, A4136, B4506, B2026*, and reach well in excess of 10 DVC/km for the *A22* running through Ashdown Forest, East Sussex.

4.31 To put these figures into context: Overall road lengths in Britain are estimated 387,674 km, with 56,715 km in Scotland. At an *estimated* 42,000 DVC per annum [see 5.16], this suggests an average 'actual' rate overall of approximately 0.11 DVCs km^{-1} $year^{-1}$ across all British roads; the greatest proportion of these DVCs (>35,000) relate to incidents in England, where the average rate remains similar at just below 0.11/km. Based merely on our samples of [14144] DVC records collated for 2003-05 in England (which we know to be a sample only of the total number of incidents which do occur) we may calculate a minimum *confirmed* rate of, on average, 0.014 DVC km^{-1} $year^{-1}$ for the entire English road network. However, as around two thirds of our current reports of DVCs relate to major roads ('A' roads plus Motorways), which make up only 12% of the road network, the number of **reported** DVCs in our sample suggests a minimum rate of approximately 0.08 DVC km^{-1} $year^{-1}$ across major roads (A + M) in England. Against such background values it is clear that all the named roads identified above record significantly greater (from double to six-fold) the rates of DVCs 'typical' for major roads elsewhere; and along some identifiable sections of 5km or more rates recorded rise to between 20 to over 50 fold that general average.

4.32 Given the background of average or 'normal' rates of 'recorded' incidents on major roads outlined in the previous paragraphs, and general sections identified within those roads with overall highest totals of DVCs, records in the available database can also help to pinpoint other short road sections which show very significantly higher than the average rate of reported accidents. **Maps 10a,b** provide a number of examples where data have been mapped at finer scale for particular roads, using only those records believed to be recorded most accurately (to within 1 km), in order to identify the worst black spots and areas where any possible preventative measures would best be targeted.

Deer Species Involved

4.33 Details of the deer species are available only for about one third of all DVC records received by the project, as this information is generally not available in the case of most reports from

police control rooms, human injury reports, insurance records and road clearance departments. In addition, even in those cases where such reports do provide details on deer species, the accuracy of that information cannot always be guaranteed. In considering differences in the proportion of DVC involving different species it is useful therefore to restrict assessment in the first instance at least to that subset of data sources with greatest reliability of reporting. Of a total of 6873 DVC for England and Scotland available to us for which the species was stated (restricted to records for 2003-2005), 5013 came from data sources where we may be confident that most contributors are likely to be able to distinguish species with a good level of accuracy (e.g. members of BDS/BASC/SGA/DI/DCS/FC and RSPCA/SSPCA, other wildlife rescue or Mammal Society).

4.34 In England when analysis is restricted to information provided by our most 'deer-knowledgeable' sources (n= 4563), this shows the three most common species involved countrywide to be Fallow (40%) , Roe (32%), and Muntjac (25%), with Red, Sika, and Chinese Water deer contributing less than 3%. This proportional representation in fact alters only slightly if analysis is extended beyond this initial 'most accurate' subset of data to include all records, from whatever source, where species has been attributed (**Table 11**). In Scotland, by comparison, fallow are far less widespread, and here Roe (69%) and Red (25%) were most commonly recorded, followed by Fallow (4%) and Sika (3%).

4.35 The distribution of those DVC reports within England for which the deer species is known and for which reasonable location details are available is illustrated in **Maps 9a-c**, plotting for each species all those 10 by 10 km OS grid squares with at least some species-specific records during 2003 to 2005. Very widespread of DVC are apparent for both roe and fallow throughout most counties, with more restricted distributions of muntjac, red deer, sika and Chinese Water deer in line with what is known about the general distribution of these species. However, not only in England but also in Scotland, the deer most commonly associated with localised 'hotspots' of accident are fallow [see also 4.28 and 8.10].

5 IMPACT IN TERMS OF HUMAN INJURY

Deer related Vehicle Collisions leading to Human Injuries (PIA)

5.1 Personal Injury Accidents (PIA) arising through collisions or swerving to avoid deer form an important element of the present study, not merely because of the serious nature and economic cost of these incidents, but also because such data when available are also generally of high quality, with precise details on location, date/time, severity of casualties, and road conditions. Although deer related PIA fortunately make up only a small percentage of all DVC, human injury records (in theory) should also provide a well stratified source of information countrywide. Furthermore, human injury accidents are the main and often sole criteria used for prioritising funding for local road safety projects in the UK. Therefore, although a very major concern about DVCs relates to the huge toll of deer road casualties, and high level of animal suffering caused to tens of thousands of deer which are hit but not killed outright, information on the 'human' costs forms a vital part in the decision making processes where expenditure from public funds is required for preventative measures.

5.2 Unfortunately, (see paragraph [2.1.1]) from the level of detail of Road Traffic Accidents involving human injury collated in a central database for the UK by The Department of Transport (DfT), it is not at present possible to distinguish between incidents involving differing types of animals other than dogs and ridden horses. Thus, the main ST19 returns completed by police for any human injury road accidents up to 2005 (and detailed retained by DfT for compiling national statistics) for cases where an animal is implicated as a carriageway hazard will distinguish only between either 'dog', or 'other animal or pedestrian', and hence interrogation of the national DfT databases cannot provide the detail required for the present study. From January 2005 a new version of the ST19 form was introduced with some changes to the categories where 'live' animals are recorded as 'carriageway hazards' or else as 'objects' hit (including dead animals); but although uninjured pedestrians are now recorded in a separate field from animal hazards, the new forms still do not enable systematic centralised abstraction of information on animal types.

5.3 Although deer-specific incidents could not be abstracted centrally for us from the national road accident database held by Dft, the original report forms and their own accident databases maintained by Police forces or by Council accident investigation departments do often contain further detail, including commonly a short free form text description of the accident circumstances as noted by the attending police officer. After making direct contact with most police forces or else in many cases with Road Safety departments at county councils, in England at least a significant sample of such PIA records was possible to search out from official accident records for the majority of counties.

5.4 The most consistent and widest spread deer PIAs data we have been able to accrue for England relates to the period 2000 to 2004. [Although similar data are also available for many of these same authorities for 2005 and part of 2006, in many cases these do not provide directly comparable samples to those retrievable in previous years, due to changes in how animal accidents are coded on revised statutory ST19 accident report forms introduced from 2005 onwards]. A number of polices forces or county road safety teams informed us that they are unable to search for and identify 'deer' incidents separately from other animal related PIAs, as no text descriptions of incidents are retained within their road accident databases. The majority of counties approached could provide information on some PIA incidents, but often only a limited proportion of all incidents with deer involvement could be extracted; that is mostly those which were coded in the 'carriageway hazard = animal categories' and also specifically mentioned involvement of deer rather than just an 'animal'. Additional deer PIAs logged within 'hit object in road' categories or various 'contributory' factors could be searched only by some but not other accident investigation teams.

Nevertheless, although likely to represent only a proportion of all human injury incidents involving deer that occurred over this period, information was obtained on 785 different deer related PIAs in England for the period 2000-2004, including 20 that led to one or more

human fatalities, 134 to serious injury and 634 causing one or more slight casualties per accident. (in addition, information on a further 365 PIAs is available to us for other years).

5.5 The breakdown of the above incidents reported by different local authorities is shown in **Table 8**). Data were available for all six years for 17 of local authorities listed; and for between three to five years for a further 14 authorities. (In case of the latter, the totals shown in Table 8 over six years have been grossed up based on the annual average over the 3 to 5 available years). Highest annual levels of deer PIAs were reported consistently from Hampshire, Essex, Suffolk Norfolk and by Thames Valley Police Force (Bucks/Berks/Oxon), averaging between 10 to 20 such accidents per year in each of these areas. Somewhat lower levels of 4 to 9 PIA with deer are also recorded in many smaller or less densely populated counties, such as for example Dorset and Devon and Lincolnshire, where despite similar levels of deer abundance, levels of traffic flow are much lower than in Southeast England (see also **Table 3**).

5.6 However, it is apparent from more detailed inspection of all those accident records provided to the study by police and road safety departments that a very high proportion of PIA incidents involving deer will not be readily identified within statutory accidents records if considering only the main animal related categories provided for on current ST19 forms. Many other accidents where text descriptions do mention involvement of animals are not always coded under any of the available (live) 'animal' or 'object' (incl. dead animal) related hazard categories; nor for instance if another hazard such as collision with a second vehicle was also involved. Furthermore, many accident descriptions will state merely that an animal was involved, without mentioning the type ('e.g."driver swerved to avoid an animal causing loss of control ...")

Are deer more commonly involved in PIAs than other wild mammals?

5.7 As discussed above, present ST19 forms are also not currently designed to capture any information on the type of animals involved (except ridden horses); and even when its is possible identify 'deer' related incidents from computer text searches of accident descriptions, there are many additional accidents where such descriptions refer only to involvement of an unidentified 'animal'. To investigate further what proportion of all animal related accidents involve deer, and to put this in the context of involvement of other animal species, a wider assessment was undertaken early on during the present study (Langbein, 2003) based on information on all animal PIAs for 1998-2003 as could be provided from across 14 different police forces. Among a total sample of 1450 human-injury RTAs involving animals, 603 were due to wild mammals (mainly deer, fox, badgers and lagomorphs), 558 due to domesticated animals and birds, and 290 recorded merely as 'animal' in road. For all those PIAs involving 'wild' mammals, deer were by far the most common cause (50%), with rather fewer with rabbits and hares (21%), foxes (20%) and badgers (9%) [see **Table 7**; from Langbein, 2003]. On inclusion also of incidents involving dogs (which until 2005 were recorded in a separate category) the overall proportion of deer related incidents among all reported animal related PIAs could be detaermined. **Overall, it could be concluded that deer related incidents on average made up 23.5% of all 'animal' related PIAs reported to police.**

Estimates of the actual number of deer related PIAs per year, and their economic cost

5.8 As noted above [5.1-5.6], figures available for the number of PIAs involving specifically deer rather than other animals within given administrative regions are likely to be substantial underestimates for various reasons relating to the manner in which animal incidents are recorded at police force and national level.

5.9 During 2000 to 2004, the annual number of all PIAs reported in GB wide national road accident statistics as having involved animal hazards (Dft: Road Accident in Great Britain, Annual reports) averaged 2350 per year; but during that period, although published figures state merely 'other animal' they may at this time have included an unclear proportion of

incidents where pedestrians rather than animals contributed as a road hazard.

Since 2005 uninjured pedestrians are now specifically excluded from being coded within the new 'animal in carriageway' field on revised ST19 record forms; but new figures from 2005 onwards also tend no longer to include e.g. accidents where collision or avoidance of dead rather than live animals may have contributed. In new published national accident statistics for 2005, only 1034 incidents were logged within the new, more limited 'animal hazard' category. However, our own detailed assessment of a sample of over 200 recent animal related PIAs records provided to us direct from across 10 different police forces for 2005, shows that on average only 54% (+-12%) of these incidents were logged also within a complete listings provided to us by Dft for all those animal accidents logged centrally within in the new 'animal in carriageway' hazard category alone. The remainder of incidents reported to us by police, were retrieved by them only through extending searches also to a number of other 'carriageway hazard' options and 'contributory factors'.

The true annual number of accidents involving animals as a hazard, object or contributory factor reported to police for 2005 is therefore likely to lie above 1900. On the basis of the percentage previously determined above [5.7], of these 425 (23.5%) PIAs may be expected to have involved deer.

5.10 Even that figure is however likely to be a very conservative estimate, as recent national research into the level of under reporting of human injury road accidents demonstrates that although most fatal accidents tend to be recorded in official statistics, serious and slight injury PIA are likely to be underreported by factors of 2.5 to 1.7 respectively (DfT: Road Accidents in Great Britain, 2005). Such level of under reporting suggests that true numbers of human injury accidents involving deer may well lie in excess of 700 per annum.

5.11 The value to the economy of the prevention of Road Accidents, is outlined in regular updates of 'Highways Economics Note 1' published by the Department for Transport, and used in part for the purposes of assessing various road safety schemes. At 2005 values, the expenditure considered to be justifiable for the prevention of road traffic accidents was as follows :

Average value of prevention per accident: GB 2005 (DfT, 2006)

• Fatal:	£ 1,645,110
• Serious:	£ 188,960
• Slightly injured:	£ 19,250
• **Average across all PIA incidents:**	**£ 64,460**
• Damage only	£ 1,710

Based on the above estimate that in excess of 425 DVCs per annum will involve human injury (including c. 10 fatal, 70 serious and 345 slight accidents) the economic 'value of prevention' of that level of human injury accidents (excluding damage only incidents) may be calculated as c.£35M for Britain as a whole, of which over 80% may be expected to be incurred within England.

If as suggested above [5.10], the true annual toll of DVCs involving deer lies in excess of 700 PIAs , that economic impact would be estimated to approach 60M per annum.

Estimating the total number of DVCs on basis of proportion showing up in PIA records

5.12 Several previous studies in the United States and Europe have suggested that in some countries as many as 2% to 5% of all deer collisions may result in human injury (Hartwig 1993, Conover et al. 1995). However, these figures are in practice mostly calculated not as a proportion of all DVCs which may occur, but simply as a proportion of those incidents actually **reported** to police or insurance companies. Since accidents which are worthy of report are likely to be biased towards those which involve human injury or material damage sufficient to warrant an insurance claim, and many accidents which do not cause (human) injury or significant vehicle damage will remain unreported, it would seem probable that such

calculations will overestimate actual rate of human injury accidents as a proportion of the real total of **all** deer road collisions occurring.

5.13 Even our own database offers a significant under-recording of DVCs overall [see 4.7 - 4.13]. Indeed if we accept (as at paragraph 5.9) that the number of human injury accidents occurring per annum in the UK lies around 425 and possibly as high a 700, and IF we relate this to the actual total number of incidents recovered by us during the present study (c. 7000 per annum), it is simple to calculate that this would suggest that around 6% to 8% of such DVCs would result in human injury. However, in reality evidence presented below [5.14, 5.15] based on several of those localities where DVCs have been logged most diligently for many years shows that the actual rate of PIAs resulting from deer collisions is far lower, and unlikely to exceed more than around 1.0 to 1.5 %.

5.14 The most complete DVC records available to us are those recorded by local wildlife rangers within the major lowland forest regions such as the New Forest, Thetford, Ashridge and Ashdown Forests, the Forest of Dean and Ashridge (all in southern England); as for each there is a team of local rangers who will tend to deal with at least the majority (though unlikely all) local deer road casualties, while some others are known to us from other reporters. All of these forests also lie in counties for which good information on human injuries is available to us for at least the three year period January 2002 to December 2004 (analysis has not been extended to include 2005 as PIA records were not possible to retrieve in directly comparable detail that year for all counties). During those three years a total of 2370 deer road casualties were recorded within the five forest areas. Deer PIA records within the same areas totalled 28 over that time (ranging from 2 to 9 per forest); making up just 1.18% overall of all the recorded DVCs.

5.15 In reality the percentage of the total number of DVCs occurring represented by the recorded human injury accidents may be lower still, as even in these major forests a significant proportion of deer casualties are known not be reported. On the other hand, in about 20% of PIAs logged in official police records the animal type is not discernible from the accident description (e.g. when this simply states that the driver hit or swerved to avoid 'an animal' in the road, without giving the type), and thus actual numbers of deer related PIA may also lie somewhat higher. The result however do indicate that such human injury incidents as are currently logged and retrievable from official police records make up on average no more than 1.0 to 1.5% of all deer road casualties / collisions reported to our study within the case study areas. Most deer managers even in these forests are of the opinion that the proportion of all deer road kills that they attend or hear about is likely to be no more than 50 to 75% (for many others the deer may be picked up by drivers or the deer may run off after being hit); and if so, then the reported human injury incidents may actually represent an even lower proportion (most likely below 1%) of true DVC numbers.

5.16 On the basis of the above figures, and assuming that similar proportions of animal-hazard accidents result in PIA in England and Scotland, we may conclude that **it is unlikely that human injury accidents make up more than 1% to 1.5 % of all DVCs occurring in Britain.** Taken in combination with our estimate that annually there are in the region of 425 deer related human injury accidents reported to police (PIAs) [see 5.9], then backward extrapolation enables us to calculate that the minimum number of DVCs in Britain as a whole is unlikely to be any lower than 28,500 (i.e. if reported PIAs represent 1.5% of all DVCs), but in reality probably exceeds 42,500 (if, as seems likely, those deer specific PIAs retrievable from police records represent less than 1% of all DVCs). This nationwide estimate is of not dissimilar magnitude to the upper bound of the earlier estimates (20,000 – 42,000) proposed some years ago by SGS (1998), despite the present figures being derived using entirely differing methods of calculation.

On the basis of a national estimate of 42,500, just over 80% of these (34,000) may be expected to occur in England, around 19% (8000) in Scotland, and less 1% in Wales (but see also section [4.12])

6 NUMBERS AND COSTS OF VEHICLES DAMAGED IN DEER RELATED COLLISIONS.

Background

6.1 Data from motor insurance companies on the numbers of deer related accident claims have the potential to provide some of the most extensive and best stratified samples of information, not only on the material damage cause by such incidents, but for assessment of the numbers and distribution of DVC in general. This is well recognised in the United States, where insurance companies take a much greater interest in this issue, partly as a much higher proportion of all motor claims relate to wildlife collisions than has been the case in Britain to date. The US Insurance Institute for Highways Safety now compiles regular annual reports on DVCs to help monitor the situation, using an index based foremost on combination of records of insurance claims , combined with official reports of human injury accidents ([HIS 2006; McGowan, 2006]). Recent information released by one of the largest US wide insurers (State Farm Insurance, 2006) estimate that 1.5 million DVC occur annually in the US, and State Farm alone handled 198,000 insurance claims arising from deer related accidents.

6.2 Although during the present study all major national insurance companies in the UK have been approached to request information on DVC claims, only one major insurer (Fortis Insurance) has so far been able to provide extensive deer-specific records. Most other claims manager approached stated that they are unable to readily extract those claims relating to deer, as their computer logs at best tend to enable extraction of all 'animal' related incidents; suggesting that thereafter searches would require time-consuming (& thus costly) individual retrieval of paper files if feasible at all. A claims manager from one other major national company did ask all his claims staff to try and record any deer related incidents from beginning of the study, but very few data were received.

Fortis Insurance data

6.3 By sharp contrast, however, Fortis Group Insurance (with c. 4.25 % of the UK private motor insurance market) have, and continue to provide an extremely useful source of data on DVCs, with information on over 2228 deer related claims now available from their policy holders throughout a seven year period (1999 – 2005). A map of the distribution of all Fortis DVC records collated to date is shown in **Map 8**, illustrating the very widespread sample provided by even this one company alone. Though representing only 4.25 % of the national private insurance market, the above records from Fortis are determined from annual searches of around 200,000 motor claims arising from the c. 1.2 million private motor policies held by Fortis Insurance in Britain.

6.4 Although their market share has remained fairly constant between 4 – 4.5 % between 2000-2005, the number of deer related claims identified by Fortis show an upward trend ever since 2001 :

Number of DVC related motor claims identified by FORTIS Insurance in Britain

Source	Year 1999	2000	2001	2002	2003	2004	2005
Fortis Ins. (all UK)	214	287	217	307	366	409	428

Numbers and cost of Insurance claims

6.5 On the basis of the extensive claims information for 1999-2005, together with knowledge of the market share held by Fortis, and knowledge of the numbers of comprehensive / third party insured vehicles, we may derive an estimate that around 10,700 vehicles may be expected to be damaged significantly (i.e. above average insurance excess level of c.£250) as a result of DVCs in Britain every year. The average cost per deer related claim in 2004 amounted to £1320 (closely similar to the average across all types of motor claims), and allows conservative estimation of the total nationwide cost in material damage to private

vehicles through DVCs at just over 14 Million.

The above estimate is derived for private policy holders only. Private vehicles are known to contribute c.82% of all motor policies held by UK Insurance companies (excluding Lloyds underwriters) as based on national statistics (DfT: Road Accidents GB, 2005). Extension of our estimate to include for damage incurred to an estimated 1900 commercial vehicles (in addition to 10,700 private vehicles) at similar average claims costs to those for private vehicles, increases the overall national estimate to over 17 million per annum.

6.6 Among all those insurance claims identified as relating to deer within the available sample of Fortis Group policies, on average, 81 % were located in England, 18.5% in Scotland, and just 0.5% in Wales. This provides a further useful indicator (independent of ST19 statistics in Section 5 above) as to the relative proportion of DVCs likely to occur overall in each of the three countries; and allows separate estimates of the likely minimum costs of material damage arising through DVC occurring in England as £13.5 Million, with a further £3 Million incurred by DVC accidents in Scotland.

6.7 Even these estimates consider merely the actual cost of claims and damage to vehicles, they are likely to be substantial underestimates of the total costs arising from damage-only DVCs. Although allowance has been made above for vehicles insured non-comprehensively, many further collisions with deer involve levels of damage which are below the policy excess or which drivers voluntarily absorb themselves (rather than lose No Claims bonuses). In addition to material damage there are often further hidden costs such as necessity of hire of replacement vehicles, loss of time, and lost output especially in case of commercial vehicles, for which no allowance has been made in the above estimates. Government guidelines for estimating the full economic impact of road accidents (Highways Economic Note 1: 2005; see also [5.11]) put the actual cost of 'damage only' accidents at £1,710. Employing that higher figure (rather than the average recorded claims cost of £1,320) would raise the full material damage costs for c. 12,600 vehicles involved in significant '*damage-only'* accidents to £ 22 Million.

Deer Species vs risk of significant damage

6.8 In addition to insurance claims arising through DVCs provided by Fortis Insurance, further information incidents causing damage to vehicles was obtained from reports received direct from members of the public via the project web-site; and for the latter in at least some cases the deer species involved was also reported. Within the database compiled during the present study, information on the deer species involved is available for [100] out of 522 DVCs for which contributors stated that significant damage to vehicles had occurred during the accident. **Table 13** shows the percentages of 'damage' DVC with each of the different deer species. Comparison with the proportional representation of different deer species among all those DVCs for which it was reported that no significant damage occurred, and also with those for which no information as to whether damage occurred was available, confirms, as might be expected, that the likelihood of significant damage arising is somewhat greater in collisions involving the larger deer species (red, fallow, sika), than for the smaller species such as muntjac and roe. The effects on level of risk associated with collisions with differing deer species, and also between differences vehicle types, are also explored further in section [8.6 & 8.17].

7. IMPACT ON DEER WELFARE AND POPULATIONS

7.1 The results presented so far on numbers and distribution of DVCs illustrate that there are few deer herds anywhere in Britain today which are left unaffected by collisions with road traffic. On the basis of information submitted to the present study, we may be confident that no fewer than 35,000 to 42,500 deer are likely to be involved in road traffic collisions in Britain each in year. However the true figure (not least if making allowance also for additional deer injured but running off and not found after collisions) may well exceed 74,000 nationwide and 60,000 in England alone [4.12].

Discussion in previous sections has focussed mainly on the human costs of DVCs, partly as some of the best stratified data relate to human injury accidents and those causing material damage; but also as human injury accidents are the main and often sole criteria used by roads departments for prioritising funding for road safety projects in the UK. In the first instance, however, the vast numbers of deer injured or killed in traffic incidents every year presents what is probably the single greatest welfare issue for wild deer in the UK. At an estimated total population in England of around 700,000 deer, the average risk per deer of being involved in one of the 34,000 – 60,000 DVCs may be calculated to lie as high as between one in eight to one in 20; while that risk is inevitable higher still for deer with Southeast England where traffic density is greatest.

Numbers of live deer casualties requiring treatment or humane dispatch

7.2 From view of animal welfare a more important concern than the overall numbers of deer killed through DVC , are those deer which are not killed instantly or quickly after the collision, but instead often suffer for prolonged periods from their injuries; that is either until a suitably qualified person can attend to treat or humanly dispatch deer that are left debilitated through broken limbs or other severe injuries at the roadside, as well as those that though able to run off for some way immediately after the incident can not be found and hence often left to die of their injuries. Although only a small proportion of all DVCs are reported to the present study, those instances where assistance is required for someone to attend to live injured deer are at least somewhat more likely to be reported. Latest figures available indicate that the RSPCA alone in England was called on to attend to over 3000 live injured deer in England [see 4.15] during 2006. In addition on average 400 hundred records have been received per year by the study from other animal welfare hospitals whose staff also only attend to RTA deer when live casualties require attention; and a further 250-300 records received each year from various Forest rangers and deer managers who are regularly called on to dispatch deer injured in DVCs. These figures for merely for incidents actually 'reported' to the present study shows that the very minimum number of deer that are badly injured and left to suffer for some time at the roadside exceeds 3500 per year. However, while reporting of live injured deer is likely to be somewhat better than for DVCs in general, it is highly unlikely that even half of all such instances are reported to us.

7.3 The rate of severe injury sustained by deer as compared to numbers of deer killed outright as result of collision with vehicles may be assessed further from specific sub-sets of records collected for just some sites or sources types. Records provided by RSPCA or other wildlife rescue organisation cannot be utilised here, as these organisations will generally only deal with emergency calls to live deer. While many FC forest rangers and other deer managers may attend or record also some calls to remove dead deer from the roadside, data from many such rangers may tend to be biased towards greater recording of those incident where they are need to assist to deal with live casualty deer.

The best but still extensive data set available to us for assessment of the proportion of DVC deer leading to live casualties are records for Ashdown Forest over recent years; here the rangers team attends to at the great majority of all DVCs in the Ashdown area irrespective of whether animals are killed outright or require humane dispatch. The breakdown according to fate of the deer for 851 DVC records for Ashdown logged in the database so far is shown in the Table below:

Fate of animals (fallow deer only) involved in DVCs where this has been recorded for those incidents attended by Ashdown Forest Rangers 2001-2005

Fate	Number	%
Killed - dead on arrival at scene	439	51.6%
Dispatched / shot	302	35.5%
Not found	90	10.6%
Ran off	18	2.1%
To vet	2	0.2%
Total	851	100.0%

Results indicate that for 36% of DVCs attended the deer (fallow data only) was alive and needed to be dispatched or taken to vets, while another 2.2% ran off after the collision and may also be assumed to also have been injured to some extend; a further 10% were not found after rangers had been called to attend, for which fate is uncertain (i.e. the deer may have been killed outright and picked up by a passing motorist, or have been injured but ran off by the time a ranger could attend). However, these findings suggest that in the case of fallow (and this is likely to apply also for the other large species such as red and sika), around 1/3 of deer involved in collisions will tend not be killed outright, and are hence lead to live casualty deer which are likely to 'suffer' for very variable times depending on how soon a suitably qualified person can attend to treat or dispatch the animal humanely.

7.4 As discussed above, data from some other forestry rangers and stalkers may have some inherent bias towards overrepresentation of calls to dispatch injured deer that were alive at the time of call (as depending on local arrangements significant extra numbers of deer which are killed outright maybe left for pick up by district council staff). Nevertheless, data from rangers in other areas do allow assessment as to any differences between deer species in the likelihood that they survive the initial impact with vehicles and end up as live casualties. To explore this further 2211 DVC records for which the deer species was known during 2003-2005 were pooled for all those forest rangers and deer managers who generally provide details to the study of both injured deer attended for dispatch as well as other deer road kills . This again illustrated, as suggested above, that the rate of survival (and need for humane dispatch or treatment) is significantly higher for fallow deer (c. 45 % among the sample of forests), than for the smaller species such as roe (22%) and muntjac (19%); lower rates of animals needing to be dispatched than was the case for fallow were are also noted among that sample for red deer (22%) and sika (26%); but for these species assessment was based on only much more limited numbers of animals, and it seems likely that the likelihood of survival of the initial collision will increase with the size of the animal concerned.

7.5 From results outlined above it seems probable that around 1/3 of DVCs involving fallow (and the other large species) and around 1/5 of the smaller species such as roe, muntjac and water deer will lead to live animal casualties that are likely to suffer for significant periods from their injuries (i.e. at least until such time when a suitably qualified person can attend to treat or dispatch the animal humanely). Using these values in combination with the proportion of all DVCs countrywide involving differing deer species in England (see **Table 12**) indicates that the total number of deer injured rather than killed outright as a result of collisions will lie in the region of 8500 (based on countrywide estimate of 34,000 DVCs in England), or up to 15,000 if based on the higher estimate of 60,000 DVC per annum.

Impact of DVCs on deer populations

7.6 **Table 12** presents also a summary of the overall numbers of deer of each species estimated to die as a result of DVCs each year, together with information on estimates of total population size for each species in England, to allow evaluation of the impact of losses through DVCs on the populations. While accurate information on deer population sizes in England is lacking, two recent estimates are available from reports by Munro (2002) and The

Deer Initiative (Leicester, 2006). Based on the average population sizes suggested by those two reports per species, percentage annual losses to DVCs in England may be calculated to lie in the region of 4 - 7% for roe, and 7 to 13% for fallow and muntjac. Values for red are c. 1 – 3%, sika (3 -6 %) and CWD 7 – 13%, although in case of these three species both national population sizes and estimates for DVCs are based on comparatively sparse information.

7.7 The very substantial numbers of deer killed in collisions with vehicles make DVCs almost certainly the major cause of annual mortality among wild deer populations aside from any such deliberate culling that is undertaken to manage population numbers. The annual cull or other losses required to prevent further increase among deer populations lies in excess of 25% of the pre-breeding (spring) population (or c. 20% of autumn numbers) for all the species. Hence, although DVCs may make up a substantial proportion of such sustainable losses, they are unlikely to present a significant issue from view of conservation or survival of deer populations in most areas. **However – this should not be misunderstood as suggesting DVC do not matter or that they may even help to control populations**. The large numbers of deer killed and injured unintentionally by motorists present not only a very inhumane but also highly unselective 'cull'. Deer management to maintain healthy reasonably stable populations in balance with their environments requires careful planning of not just of the numbers culled, but also the proportion of males and females, and young and adult that are taken. The very unselective cull taken by vehicles aside from being very inhumane, may therefore also hinder good management of local populations; and over and above the human costs through injury to motorists, damage to vehicles and traffic delays, they also lead to lost revenue from unsaleable deer carcasses, costs for uplift and environmental disposal, and significant time and other resources for attendance to live casualties. On the other hand, in areas where there is a lack of deer management co-ordinated across sizeable areas which should ideally encompass the main home range of local populations, the absence of such management may itself lead to heightened levels of DVCs.

Call out systems to deal with live deer casualties at the roadside

7.8 To address the very major animal welfare issue posed by DVCs as outlined by the above figures, it is essential that efficient systems should be put in place in all parts of England to ensure live casualty deer are attended to as quickly as possible. Additional concerns arise from view of road safety where often live deer casualty deer remain in the carriageway or on the verge for any length of time (frequently during hours of darkness) causing continuing hazards for drivers.

While a number of police forces do have good systems in place enabling them to call on the services of a significant number of people who can assist in dealing with live deer casualties in their own local area, in many areas those asked to help with dispatch of injured deer often have to travel many miles to attend incidents. The only nationwide service currently available covering all of England and Wales is provided by the RSPCA, who already deal with over 3000 deer road casualties per year, but only have a very limited number of inspectors available in each region to attend not only deer but also numerous other animal casualties, making it difficult to cope with the ever increasing numbers of animals involved in vehicle collisions. Aside from RSPCA, many police forces at present only have very limited numbers of people they can call on for help when alerted to a live deer road casualty, with policy often merely to call on local vets or a limited number of deer managers known to them, who may as a consequence often have to travel many miles with inevitable delays until casualties can be dealt with.

7.9 A good example of a system that can help to reduce such delays has been established for some years now run by Dorset Police Force, where a comprehensive list has been built up of deer managers and others living in different parts of that county who are able to attend to live casualties, so that there are usually one or more people listed who live no further than within a 20 minute drive of any incident. A similar scheme first established within the Mendip Hills in North Somerset but now expending to a wider area, is the Avon & Somerset Injured Deer

Policy team, who in close consultation with police have formed a team of trained deer managers of which each member can take on responsibility for call-outs to deer casualties (via police or RSPCA or others) within a particular area. However, similar organised schemes are still lacking to cover much of England. It is recommended therefore that each police force in England who do not already have a significant pool of people they can call on for help when calls are received by their control rooms regarding live deer (and other?) animal road casualties, should establish such a list as soon as possible. Ideally such lists should include not only RSPCA and other wildlife rescue organisations, but also many local deer managers so that someone is likely to be available within a reasonably short distance of any incident.

7.10 Some national guidance already exists for formation of such call-out schemes and dealing with road casualties [see BASC and BDS, 2001]. However, there remains an important need for organisations including in particular ACPO, RSPCA, Forestry Commission, BASC, BDS and The Deer Initiative to work closely together to ensure efficient schemes (with ideally joint call-out lists) are put in place for each County and Unitary authority in England, so that road casualty deer can be dealt with more promptly, and the ever increasing burden of such calls is shared more effectively among these organisations and those of their members best placed to assist.

8. FACTORS ASSOCIATED WITH INCREASED FREQUENCY OR RISK OF DVC

8.1 It is clear from the published literature (reviewed by SGS 1998, Staines et al 2001; Putman et al 2004; Hedlund et al. 2004) that variations in frequency of DVCs in different areas or on different road stretches may be affected by a multiplicity of contributing factors such as (*inter alia*) season, time of day, deer species, deer density, traffic volume, road types, average traffic speed, road tortuosity (and thus driver visibility), presence (and character) of vegetation close to the roadside (affecting both visibility of deer to the driver, and visibility of approaching vehicles to the deer themselves, as well as the probability that deer may be close to the carriageway in the first place) . While not all of these factors are susceptible to management (and thus cannot necessarily be manipulated in order to reduce accident risk in particular instances) some may offer such potential. More importantly, fuller understanding of all contributing factors (and their interaction) may be very helpful in predicting likely current or future problem areas to target alternative measures of mitigation.

8.2 In the event, the quality of data submitted to the database, and in particular the accuracy of map references or other locations details provided when submitting records, greatly limit formal analysis for all but a few factors. However, some general observations are offered below which may be deduced from particular sub-samples of those records in the database for which additional information about road characteristics or animals involved is available.

Deer Density and Traffic volume

8.3 It is immediately apparent, even from superficial examination of accident distribution maps presented above in section 4, that **areas of high frequency of DVCs are not simply related in any direct way to deer density**. Higher than average levels of DVCs at the landscape scale are of course determined in the first instance not by the abundance of deer *per se*, but rather an interaction between high deer numbers in areas which also have a high density of roads and high traffic volume. **The highest frequency of DVCs tend to be mostly located within those regions and counties within England where traffic flows are greatest.** For fuller discussion of the relationship of numbers of DVC recorded per county or unitary authority in England, and differences in levels of traffic volume experienced in these areas see Section 4.17 – 4.23 and **Table 3**, as well as **Map 5** & **Map 6**.

8.4 In brief – the county with the overall highest number of DVCs recorded during this study was Hampshire, followed by Essex, Suffolk and the Thames Valley (Bucks., Berks., Oxon). As shown in **Table 3** and **Map 5**, these and in fact the eight counties with the overall highest total numbers of DVCs all lie within Southeast England (the government region with greatest traffic volume) or East of England. However, when re-ordering counties according to the rate of recorded DVC per driven 'vehicle km' (the common measure of traffic volume used in national traffic statistics), the eight counties with highest **rate of DVCs** include not only ones from the South East and East of England (Suffolk, East Sussex, Norfolk, Hampshire and Oxfordshire, but also Dorset, Gloucestershire and Bath & North East Somerset in the South West.

8.5 While a strong relationship of DVC (as indeed of traffic accidents in general) with traffic volume is unsurprising, this should not be misunderstood as implying that the actual 'risk' for drivers being involved in collisions with deer is necessarily any lower in more remote areas; not least as more remote areas with lower road density and traffic volume often have greater deer abundance. On the contrary, while the overall total number of accidents may be lower in such areas the risk to individual drivers of being involved in a deer collision may well be as great or greater in areas with high deer density despite lower traffic volumes overall.

This interaction between deer density and traffic volume is well illustrated by considering the level of DVCs recorded (2003-2005) in the parallel study in Scotland (Langbein & Putman, 2006b) with data accrued for England over the same period. Only some 22% [4276] of all DVC incidents recorded by the project in Britain were located in Scotland. However,

traffic in Scotland contributes only around 9% to the total traffic volume for both countries combined. Thus the average **risk to drivers** of hitting a deer in Scotland per driven mile may be assessed as being approximately twice as high as in England. By converse, the **risk to deer** themselves being involved in a collision is far greater in England. Thus, using an approximate estimated total population of deer in England as c. 700,000 head (all species combined) suffering around 28,000 deer vehicle collisions – equates to 4 DVC per 100 deer each year. In Scotland, a somewhat higher total population of c.750,000 deer suffers a smaller number of collisions overall (estimated at a minimum of 7000 collisions), thus approximately 1 per 100 deer.

Deer Species

8.6 It is apparent in addition that different species of deer, in part due to differences in size, are differentially implicated in DVCs throughout the year, including in terms of:

- the proportion of all DVCs with different deer species
- severity of damage and injuries caused to drivers,
- likelihood of drivers swerving to avoid collisions, and
- dispersion of accidents relating to differences in herding / territorial behaviour.
- likelihood of the deer surviving impact with vehicles.

8.7 Within England the great majority of reported DVC were with fallow (c.40%), roe (c.32%) and muntjac deer (25%), while red, sika and Chinese Water deer contributed less than 3%. By comparison, in Scotland the majority relate to incidents with roe (c.69%) and red deer (c.25%). [For fuller breakdown of DVC by species see **Table 11** & discussion in section 4.33 - 4.35].

8.8 The severity of DVCs (in terms level of damage sustained to vehicles and injuries to drivers), may generally be expected to increase with the size of the animal or deer species concerned. Among the six main free ranging deer species in England, the largest by far are red deer, with fully grown females commonly reaching weights in excess of 100kg and stags up to 200kg; the next largest species are fallow and sika (mean adult female weight c.50kg) at approximately half the size and weight of red deer. The remaining three species are all significantly smaller, with roe approximately half the weight of adult fallow, while muntjac and Chinese Water deer somewhat smaller still.

Hartwig (1991) in a study of DVCs reported to police authorities in western Germany found that 97.5% of collisions with roe deer caused only minor damage (up to 3000 DM; equiv. c.£1000) and therefore often go unrecorded, with the remainder causing more extensive damage and/or injury. For red deer, equivalent figures provided by Hartwig were 88% of collisions leading to minor damage, and 12% with major damage or injury; while figures for fallow were intermediate with 93% causing minor damage and 7% major damage or injury. Similarly, Haikonen and Summala (2001) in Finland estimated that the percentage of white-tailed deer-vehicle collisions resulting in human injuries lies at 1.3%, but rises to 9.9 % for incidents involving moose.

8.9 Comparable information available from the present study is presented in **Table 13**. Among those 5307 incidents for which the species was known, the fact that significant damage occurred was reported in 392 cases, while for 349 reported positively stated that no significant damage was sustained. The percentages of incidents involving each of the three larger species (red, fallow, sika) was higher for 'damage' incidents than 'no damage' incidents, but lower for the smaller species (With results similar when compared against all 5000 incidents for which species is known). Overall, the three 'large' species contributed to 49% of 'damage' incidents but only to 40% of all the DVCs reported to the study.

To date the type of wild animal involved does not have to be recorded by law even for human injury accidents, and many police officers attending traffic incidents may not necessarily be able to differentiate readily between different deer species. Hence, among our sample of 1020 personal injury accidents for England currently logged in the DVC database, information on the species of the deer involved is discernible from the accident descriptions

in just 34 cases (**Table 13**). However, among this small sample, as in case of 'damage' accidents, the larger species again contributed to 50% of these most serious incidents, even though contributing to only 40% of DVCs countrywide. The most notable increase here related to red deer, which make up only 2% of all DVCs in England, but were reported as involved in 17.6% of the human injury incidents for which we have deer-species information (Table 13).

Although based on limited sample sizes in case of injury accidents, our findings do generally support the above conclusion from other European countries of some increase in the level of risk from DVC with the larger deer species, and especially red deer. However, the difference in the overall level of risk associated with the other species is not very large, as although the actual impact if colliding with the larger species may be more severe, a very high proportion of the most serious accidents with deer tend to arise through swerving to avoid the animal and subsequent collision with other vehicles or objects; in such cases the actual size of animal is likely to be a lesser factor other than in terms of a somewhat higher likelihood of eliciting avoidance manouvers by drivers in the first instance.

8.10 While the majority of DVC records submitted to the present study for England relate to fallow (c.40%), roe deer (with c.32%) also contribute a very significant proportion, and the latter may to some extend be underestimated by comparison to somewhat better recording particularly in large 'fallow' deer forests where there is often a single major landholder responsible for dealing with most DVCs. However, fallow are noted to be the species most associated with major regional and local 'hotspots' of DVC occurrence throughout Britain. For all those areas in England where we have so far recorded the highest concentrations of collisions (i.e. >30, and in some cases as many as 85 per year within single 5km by 5km OS grid squares; see black squares **Maps 5&6** the majority relate to locations with very high fallow deer density. Curiously enough, while fallow deer are not very widespread through Scotland, and contribute a very small proportion of all DVCs recorded there overall, the location with the overall highest concentration of DVC in Scotland lies near Dunkeld; and at that localised site the majority of DVCs also relate to fallow.

The concentrated nature of DVC locations for fallow may in part relate to facet of their social organisation, as fallow not only often move around in social groups but also often aggregating into much larger herds on favoured grazing areas; and hence may lead numerous animals to cross roads on their way to such locations. Similar feeding herds will also be formed by red and sika who also often move around in relatively large groups; but within England (as well as Scotland) locations where red and sika occur at their greatest density tend to lie mostly in relatively remote areas of low to moderate traffic volume, whereas in the case of fallow many of the forest with highest densities occur within regions of very high traffic volume, including e.g. Ashdown, Epping and Ashridge Forests all located within 30 miles of the centre of London.

By contrast, the distribution of roe and muntjac DVCs is rather more evenly spread out across their main population range in England, with rather fewer obvious hot-spots (except e.g. Mendip Hills , Thetford, New Forest; see **Maps 9a-d**).

8.11 Difference between the deer species in terms of injuries and animal suffering caused, as well as impact on their populations are discussed separately in **Section 6** of this report.

Effects of Season

8.12 Several previous studies in the UK have demonstrated clear peaks in DVCs during late autumn (Langbein, 1985; SGS, 1998; Staines et. al, 2001; Langbein & Putman, 2006b) and also a further peak during late spring. The much greater volume of nationwide data accrued during the present study allow re-examination of the extent to which the same seasonal patterns occur across England as well as Scotland, and how they differ between species. **Figure 2** [a to d] illustrates the seasonal distribution of all DVCs recorded during the three main study years in England [Figure 2a ; n=>14,000], as well as separately for the smaller sub-set of around 4500 incidents for which good information on the breakdown by deer species is known.

8.13 It is clear from the overall figure [2a] that, although some DVCs occur throughout the year, the distribution among months is non-random (Chi-squared test : $p<0.001$): The most prominent overall peak in accidents is shown to occur during May, with a secondary peak from October through to January.

Roe: That same pattern remains apparent for the distribution of incidents involving roe deer [2b], with the main peak from mid April and throughout May and into early June, and a less prominent peak from October to January.

Fallow: By contrast the graph for fallow [2c] shows a significant increase in accidents in late autumn but not the spring increase noted for roe (with highest fallow DVCs from late October and November, and continuing at relatively high level until January, but then a fall to around half the monthly levels with little varitation from February to September).

Muntjac: For muntjac some DVCs do peak in May and again during late autumn-winter (Oct-February), but these peaks are less prominent than for either roe or fallow respectively.

While countrywide samples available for assessment in case of each of the above species extend to well over a thousand DVCs, only much more limited species specific records are available to us from England for red, sika ad Water deer. Nevertheless, for each of the latter among between 30 to 65 records per species, again the months with highest DVC frequency are mostly from October to January. For rather the rather larger sample of DVC with known red deer involvement recorded during our parallel study in Scotland (n=321), a peak in accidents was again also apparent during October and November, with however rather lesser seasonal variation overall, and also a significant peak during June (calving time).

8.14 The consistent peak in late autumn found for all three of the larger species (fallow, red. sika) is likely to be associated both a) with the increased movement of these deer species during and after their peak mating period (rut) in late October; and b) with peak daily traffic flows (rush hours) falling around dawn and dusk at that time of year, which are generally the periods of the day when deer are most actively moving between lying up and feeding areas (see also **Figure 3**).

The spring peak in DVC patterns, which is shown most clearly for roe deer (and only to a lesser extend for muntjac), occurs at the time of year when young male roe deer tend to disperse from natal ranges in search of area where they can establish their own territories, making them more likely to cross main roads; at the same time adult females and young may also be more vulnerable to being involved in traffic accidents whilst accompanied by young kids. The fact that for roe, as well as the other small species accidents also rise during late autumn (even though the roe deer rut occurs during summer, and muntjac breed throughout the year), is likely to be associated with coincidence of high traffic flows with twilight and longer night periods in general; whereas that increase is merely compounded still further in case of those species which rut and are hence much more mobile during late autumn.

Influence of Time of Day on DVC risk

8.15 As already alluded to in relation to seasonal variation in the previous paragraph, diurnal variation in traffic flows and how that relates to diurnal variation in deer activity period may lead to certain times when DVC are most likely to occur. In order to investigate the distribution of DVC occurrence in relation to the time of day, it is important to focus on those records for which we may be most confident that times of actual incidents have been recorded accurately; that is, as for many deer road casualties the time when most deer are found may be biased towards the early hours of the morning simply as road kills may be more easily spotted then by greater numbers of drivers. The data least likely to be affected by any such possible observer bias are records obtained for DVCs leading to human injury, which are generally attended and recorded by police in detail.

8.16 The diurnal distribution of 1020 DVCs involving human injury, for which accurate incident times are available to us from police records, is presented in **Figure 3**. Incident times have been allocated to one of eight different 3-hour periods, and are presented separately for four different ‘seasons’ , as follow (Winter: Dec-Feb; Spring: Mar-May; Summer: Jun-Aug; Autumn: Sep-Nov). A clear, broadly similar diurnal pattern is apparent in each of these

seasons, with an early morning peak in incidents between 0600 – 0900 hrs, as well as an even higher peak during early or late evening. As may be expected as a result of shorter daylight periods, the evening peak occurs earliest during winter and latest during summer. However, in general the periods of highest incidence of DVCs may be identified as from early evening until midnight (1800-2400) and early morning (0600-0900).

Involvement of differing Vehicle types

8.17 Although requested as one of the data fields for public entry of information on DVCs at the web-site, the vehicle type (as car / van / lorry / bus / other) is currently logged within our database for only around 200 DVCs (including for 106 that led to human injury).

Among the overall sample, 78% involved one or more cars or vans, 11% involved motorcycles, and 8% to lorries or buses. Motorbikes make up only 2% of all (insured) motorised vehicles in Britain, and based on this admittedly rather limited sample there is some indication that motorcyclists run a higher risk of involvement with deer collisions.

If restricting assessment to human injury DVCs alone, motorbikes where involved in 22 (21%) of all 106 PIA incidents for which vehicle type is currently logged, and 10 (29%) of 35 KSI (killed or seriously injured) accidents. By comparison, national statistics (DfT, 2005) record that in 2005 motorcycles were involved in 10.6 % of all road accidents causing human injury, and in 22% of KSI () accidents. This again suggests that motorcyclist may also have a greater than expected likelihood of being involved in serious DVCs than in accident in general, although the very small sample of figures inspected to date for which vehicle types are known does not allow any firm conclusions in this regard. Further details on vehicle types have recently been provided by many police forces for human injury DVCs for 2006 as well as for some earlier years, which have yet to be entered to the database, and should enable this analysis to be updated shortly.

Influence of Road Type

8.18 Among our collated sample of incidents recorded in England (2003-2005) the road type for the incident is at present known for 10678 of which 63% occurred on major roads (A roads or motorways) and 37% on minor roads (B, C or unclassified). (see **Table 9a** below; for comparison data for Scotland over the same period are also shown).

Table 9a Number of DVC reports during 2003-2005 for which road type is known.

Years 2003 to 2005	No. of DVC where road type known	Motorway	'A' Roads	'B' roads	'C' roads	'D' to Un-Classified
Scotland	**3355**	258 (7.7%)	2434 (72.5%)	507 (15.1%)	27 (0.8%)	129 (3.8%)
England	**10678**	777 (7%)	5985 (56%)	2078 (20%)	616 (6%)	1222 (12%)

NOTE – some caution is required when interpreting these results from the overall database of records submitted to the study, as for several reasons the likelihood of the road type and/or road number given for DVC reports received might be prone to overrepresentation of the more major roads: Firstly, contributors reporting deer casualties are more likely to know the road type and or number of the road they are travelling on for major roads when noting a deer casualty or being involved in a DVC themselves. Secondly, the level of reporting of deer casualties via roads maintenance departments is more comprehensive for motorways and trunk roads, than for minor roads. Although some local authorities also provide very extensive data to us, such reporting is far less complete across local roads departments than it is in case of the trunk road network. Finally, analysis will also be affected by the relative total length of roads of different type within the road network overall – as shown in the Table below:

8.19 The total road length in Great Britain (2004) is 387,674 kilometres. This divides among countries and major road types as follows (km):

(Table 9b)

	Motorways + all A roads	**All minor roads**	**Total**
England	35195 (12%)	262584 (88%)	297779
Scotland	**10682 (19%)**	**46033 (81%)**	**56715**
Wales	4315 (13%)	28865 (87%)	33179
Total	**50192 (13%)**	**337482 (87%)**	**387674**

When assessed in relation to total recorded road length in England as 35195 km (A+M) and 262,584 km (minor roads) the numbers of DVCs reported by road type during the present study indicate that deer accidents are much more frequent per unit road length on the more major roads (A and M). However, although 'major' roads only make up 12% of the total road length in England they carry 64% of total traffic volume. Our finding that near 63% of reported DVCs (for which the road type is known) occurred on major roads is therefore almost directly in line with the relative distribution of all traffic among road types within England.

8.20 Whether the relative proportion of accidents occurring on different road types remains similar for the most serious incidents may be assessed by restricting analysis to those DVCs leading to human injuries and for which the road type is also known. Among 406 incidents in England for which such detail is available during the years 2003-2005 only 49% occurred on major (A+M) roads, and 51% on minor roads. By contrast to the results for DVCs in general (see above), this suggest that PIAs involving deer may actually be somewhat more likely to occur on minor roads than would be expected in relation traffic volume. A lower rate of human injury DVC on major roads could arise for numerous reasons such related to better visibility or possible differences in the likelihood that drivers swerve in attempted avoidance manoeuvres. However, it is unclear at this stage, whether the lower rate on major roads suggested here on basis of inspection of PIA records truly relates to a difference between injury and non-injury DVCs, or whether (as discussed above – see [8.18) minor roads may actually be somewhat underrepresented within our database due to better levels of reporting (including information on road type) in the case of major roads.

8.21 In summary, however we may conclude that although 'major' roads only make up 12% of the total road network in England (but carry 64% of all road traffic), between 50 to 63 % of DVCs will occur on major (A + M) roads. This very high proportion of DVCs on major roads despite contributing comparatively small proportion of total road length also suggests that major roads should form an important part of any future monitoring programmes if aimed mainly at monitoring overall trends in DVCs [see 10.1].

8.22 The figures presented above for numbers of DVCs by road type, when divided by total recorded road length in England suggest average annual rates of reported incidents on major vs minor roads as respectively 0.1 per km and 0.007 per km per year. This provides us with an additional estimate of what constitute 'normal' average rates of reported DVCs overall by road type per kilometre, and can serve as a useful guide in terms of identifying notable blackspots, where for example, recorded rates lie well in excess of that average level [see 4.19 - 4.22; and **Table 10**].

Other factors

8.23 As noted above (7.1) a host of other factors which may influence frequency of DVCs include driver speed, vegetation near roadside, road tortuosity, deer behaviour, and presence/absence of effective mitigation. In practice it has proved difficult to undertake detailed analysis to date of the effects of these features on accident frequency from data recorded within the database itself. This is due to a number of factors.

8.24 In the first place relatively few recorders have specifically noted roadside vegetation at the location of the incident in a consistent manner, or presence/absence of fencing or other mitigation. Further, given the lack of precision of recording of locations (grid reference), it is not often practicable for to determine these attributes retrospectively (if, as in the majority of instances an accident description is accurate only to within a 1 km or longer stretch of road, it will generally not be possible to determine for example, whether the particular location of the accident was within wooded or open country, or whether there may have been warning signs, reflectors or fencing at the accident location), even if we were able to determine presence or absence of such measures on that particular stretch of road as a whole. Therefore the available number of incidents where roadside vegetation is relatively low (c.3000 of 14,000 incidents during 2003-2005), and generally provided information at only a fairly gross level – such as wood / farmland or other main habitat to either side of the road.

8.25 Secondly, even if on interrogation of the database it is found that a certain proportion of accidents are associated with cases where roadside vegetation has been accurately recorded as woodland, while a (different) number of accidents are recorded as associated with open moorland, this in itself does not tell us whether accidents are more, or less, likely to occur in wooded stretches of roadway by comparison with more open stretches, unless we actually know what proportion of the overall road network is bordered mainly by wooded or open land to either side in nature in the first place.

[Thus, for example, if 30% of those incidents in which habitat is accurately recorded occur in wooded areas while 70% occurred in open habitats, this might imply that accidents are more *likely* in open areas, but does not show that actual accident risk is affected by habitat. There may in effect be no effect of habitat on accident risk, if the 30:70 ratio observed in wooded or open stretches of road reflects nothing more than the fact that 70% of the road network as a whole is 'open' in nature, while only 30% has woodland near to the road verge on one or both sides. Without at present detailed knowledge of the actual proportion of different habitats along the road network at a rather finer level, and some field studies to 'ground truth' at least a sample of our data for which habitats have been reported, it is not at present feasible at this stage to assess with a good level of confidence whether accident frequencies are affected by habitat or are in effect randomly distributed.]

Similar problems of lack of 'control' data affect feasibility at present of using DVC reports in general for analyses of the effectiveness of mitigation measures such as roadside fencing (unless it is known what proportion of the overall road network is fenced to varying specifications against differing deer species and or other livestock), or effectiveness of deer mirrors or other forms of mitigation.

8.26 While such considerations limit present analyses in relation to factors such as road side habitats, road alignment and presence / absence of mitigation, these could usefully be addressed through means of follow-up field studies to ground-truth data obtained during the present project for a selection of roads or road sections; to determine the background data for significant sections of road, against which the subset of records with good location references in our data could then be evaluated in greater detail. For purpose of the present study however, exploration in the paragraphs below is limited to descriptive assessment of data provided by contributors with regard to the main habitat or land type they observed to either side of the road at DVC accident locations.

Effects of roadside habitat

8.27 Among our sample of 14685 records for the three main study years, some indication of roadside habitat on one or both sides was recorded by contributors for 2988 incidents. Although habitats stated by contributors were more varied, for present purpose these have been grouped into four broad categories : farmland, wood, built-up, or 'other'. As shown in the summary table below, 1655 (55%) recorded woodland on at least one side of the road, while 883 (30%) noted woodland near both sides. Farmland (arable / pasture / or rough

grassland) was recorded on both sides for 925 (30%) or on at least one side for 1799 (60%) of those DVCs for which information on road side habitat was stated. DVCs reported in locations with built-up or urban or other habitats not included above to either side of the road made up only about 10% of the records with habitat data.

Habitats at locations for 2988 DVCs in England (2003-2005) for which information as to broad habitat categories to either side of the road were stated by contributors to the study.

Habitat: Side one / side two	farmland	wood	built	other	blank	on one or both sides
farmland	925	585	68	43	178	(1799)
wood		883	62	28	97	(1655)
built			53	15	40	(218)
other				11	0	(97)

8.28 From these limited assessments it would appear that more or less similar numbers of incidents (in those cases where habitat is recorded at all) were recorded in predominantly open farmland areas, as near wooded locations. However, as noted above, without detailed knowledge of the proportion of wooded / open locations along the entire road network, it is not possible to assess conclusively to what extend accident risk is affected by habitat or whether in effect DVCs are fairly randomly distributed. That said, although exact figures are not available for the proportional representation habitat types adjacent to the total road network, overall woodland covers only around 11% of the land area of England. On the assumption that woodland will also only be present within the vicinity of a fairly modest proportion of road sides, it would appear likely that accident frequencies are indeed rather higher per unit km of roadway in areas with woodland on at least on side of the road rather than in more open farmland environments. Such conclusion accords with various studies in continental Europe that have also reported higher collisions rates (if not overall higher numbers of DVCs) with roe deer where roads were located between forest and fields (Kofler & Schultz, 1987; Seiler, 2004).

9. CURRENT USE OF DVC DATABASE AND OTHER PROJECT OUTCOMES

Efficacy of Mitigation measures

9.1 Alongside the main aim of the project in development of a nationwide system for collection of data on DVCs, a secondary objective was to investigate such aspects of deer behaviour and deer management which may affect accident risks and effectiveness of differing mitigation measures. In the first instance, concurrent to the present study, a comprehensive literature review of the different mitigation measures currently being deployed in different parts of Europe and North America, together with an analysis of effectiveness and cost-effectiveness of the different measures available, was undertaken as part of a separate, but parallel contract for the Deer Commission for Scotland (Putman, Langbein & Staines, 2004). This report is available online on the Deer Collisions website at www.deercollisions.co.uk/ftp/mit_review.doc. The review considers the entire range of mitigation measures available in Europe and the US and patterns of usage, and summarises the conclusions of the various scientific studies which have been undertaken to assess actual efficacy of these different measures.

9.2 Such systematic research into deer mitigation options as has been undertaken has, however, nearly all been carried out in the US or continental Europe, where the deer species, deer management and traffic situations are often quite different from Britain.

9.3 In addition a number of new types of mitigation have recently been brought onto the market (Langbein, 2006; Langbein & Putman, 2006a) including new types of acoustic reflectors, rumble strips, and novel types of digital signage activated by animals at the roadside and/or speed of approaching vehicles. In response to this a number of practical trials have been initiated in parallel to compilation of the national DVC database. A series of studies is now underway in England, to monitor and evaluate some of these newer forms of deterrent, including:

- A trial of rumble strips in Thetford Forest,
- Two trials of WEGU-acoustic wildlife warning reflectors on county roads in Hertfordshire and Somerset,
- Trials of EUROCONTOR Ecopillars on a B road Hertfordshire, as well as
- Two parallel trials to test Ecopillar effectiveness installed during 2006 on two trunks roads in Devon and Herefordshire.
- Monitoring of the effect of recently introduced Animal and Speed activated digital warning signage in Hertfordshire, and
- Investigations of the usage of new accommodation structures (road and footbridges, and underpasses) incorporated with a recent new-build trunk route in Essex.
- Some similar mitigation projects are likely to be established shortly in a number of Priority Areas established by the Deer Commission for Scotland.

Careful monitoring of all of these various trials in England and Scotland will help establish which if any of these new methods have greatest potential for wider application in differing parts of the road network.

Raising Public Awareness of DVCs

9.4 As noted above (2.12), the present study has been widely publicised over the last two years not only via the dedicated project web-site, but also in numerous magazine articles, and through numerous local and national radio and TV interviews. Although aimed initially at publicising the database and maintaining momentum of data input, such interviews/articles also help to fulfil another of the study's objectives; that is, increasing public awareness of the problems of deer-related RTAs, and in offering advice on how to minimise risk of accidents. In addition to an initial publicity drive to inform people about the study, at the launch of the

project, further major media releases were undertaken during October 2004 with assistance of RAC Foundation, and various regional TV and radio stations, to coincide with timely advice just prior to the common seasonal peak in incidence of DVCs during October to December.

9.5 This was repeated with further widespread media coverage in autumn 2005 about the general issue of DVCs , and more specifically following widespread media interest in the trials of novel deterrents [see 9.3] commenced around the same time. Since beginning of the study in 2003, the DVC issue and Deer Collisions Project has now been discussed in well in excess of 100 newspaper articles, as well as also in many longer magazine and journal articles written by the project team, and also numerous TV and radio interviews and news items about the study.

9.6 While efforts to raise awareness among the general public are continuing, it is also seen as important to attempt to increase understanding of the issues surrounding DVCs among professionals, including local authorities, road builders and ecological consultants. To this end presentations about the project have been given by members of the project team to several specialist conferences over the project period, including papers on the wider economic implications of all wild mammals on roads at the *Mammal on Roads* Conference organised by Mammal Society and Highways Agency (November, 2003); presentations to the Institute of Civil Engineers Municipal Group in Scotland (February 2005), The Transport Statistic User Group (at DfT October, 2005), and UK Insurance Claims Managers Association (December, 2006). Numerous other talks about the Deer Collisions project have included presentations to the DI Conference in March 2003; Mammals Trust UK conference Feb'04; Sheffield Urban Deer seminar, April'04; IEEM Transport and Ecology conference, May'06; as well as numerous talks to Wildlife Trusts and British Deer Society Branches, as well as Local authority Roads and Environment Departments. Publications targeted specifically at a range of relevant 'professionals' concerned with deer collisions have included amongst others articles in *The Veterinary Record*, *Deer* Magazine, *In-Roads* and *Surveyor* Magazines (for details, see reference list).

Data requests and current use of DVC database

9.7 The information gathered by the Collisions Database on location and seasonality of DVCs is already proving of direct value for Highways Agency (and Scottish Executive) in providing important background information on DVC accident frequencies and current or potential hotspots, for consideration within their Targeted Programme for Improvements (TPI) of the trunk road network. Ecological and Engineering Consultants from several different Highways Agency TPI schemes in England, as well as Scottish Executive schemes have contacted the Deer Collisions project over the past three years with requests for local information on known DVCs to help inform their decisions as to whether detailed surveys of deer are likely to be required prior to environmental statements in proposed road schemes, or at later stages when planning optimal location of mammal mitigation.

9.8 To date requests for DVC information for trunk roads in Scotland information has been provided for environmental surveys for the A80/M80 improvements and the proposed Aberdeen western peripheral route. In England, requests for input have included TPI schemes on the A419, A303, A11, A74, M27 and M1 widening; and reviews of existing wildlife mitigation on the A35/A30). In addition trials of new mitigation measures have been put in place on two sections of trunk road (A49 Dinmore Hill and A38 Halden Hill) where hotspots of DVC have been identified.

9.9 In England, information on DVCs from the present project have also been utilised by county councils to assist with planning of several traffic calming and deer mitigation schemes on non-trunk roads. These include parts of the B1106 in Suffolk, B4506 in Hertfordshire and Buckinghamshire, and A39 in Somerset where mitigation measures and monitoring research are now underway; while data from the present project is also being utilized in preparation of

a number of other mitigation proposals with the Forest of Dean (Gloucestershire) and Ashdown Forest (East Sussex).

There is thus clearly real potential for much further practical application of the DVC database both in relation to the Trunk road network managed by The Highways Agency, as well as by Local Authorities across in England for identification and prioritisation of areas where there is greatest need for measures to help minimise DVCs in future.

9.10 Considerable use has also been made of the database by the Deer Commission for Scotland, as part of their review of road traffic accident frequency in areas where they have received from the public formal Expressions of Concern in relation to deer posing a risk to Public Safety through involvement in RTAs. For four of these roads (sections of the A82, A835 and A87), now confirmed as **Priority Sites** for Action, the Commission has established local consultative Panels to investigate more fully the problems and suggest possible solutions.

10. FUTURE MONITORING AND OTHER RECOMMENDATIONS

Longer term monitoring of DVCs using restricted data sources

10.1 It is apparent from the increasing use made of the DVC data by Local Authorities, Trunk road agents and contractors (see above Section 10) that the development of the database has proved a valuable resource. It is similarly clear, from increasing interest in this resource and from the estimates of the scale of DVCs within England as a whole (estimated at over 34,000 – 60,000 per annum), that DVCs do represent a serious and increasing problem, whether from the point of view of the animals themselves and the consequent welfare issues, or simply in terms of road safety, human injuries and the significant economic costs of damage caused by such collisions. It is recommended therefore that some continuing programme should be maintained to monitor numbers of DVCs occurring within England and their geographical distribution, albeit at a somewhat lesser level of intensity than in the current programme.

10.2 Long-term annual collections of data from all of the diverse sources utilised in the present study would most likely be prohibitive and inefficient in terms labour. However, as discussed in section [4.18. 4.24], the overall pattern of incidents reported from several major source types is quite similar or complementary, and it is probable that a good indicator, at least of gross changes in national and regional DVC frequency may be derived from a relatively small number of well-stratified sources. It is also apparent that the frequency of incidents per unit road length is significantly higher on major roads (A roads and motorways), which make up only 12% of the road network; but as figures from the present study indicate that between 50 to 63% of all DVCs in England occur on major roads, indicates that focus of data collection mainly on major roads would still have good potential for monitoring at least long term national trends. Overall the data source categories emerging as the best candidates on which to build a relatively simpler and more efficient, but nevertheless still useful longer term system of assessing DVCs nationwide, are a combination of:

- ST19 Personal injury accidents that involve deer in some way
- Trunk road deer carcass clearance
- Insurance claim records from at least one or more major national insurance companies
- RSPCA call-out incident logs to attend injured RTA deer
- Continued collection of DVC reports for around 10 major deer forests and other case study areas.

10.3 The relatively small sample of DVCs causing human injuries annually (making up possibly only around 1% of the total) although able to provide some of the most accurate and detailed data, is unlikely to suffice on its own to enable identification also of local regions or road sections with high or low DVC risk. Further, at present records of deer-related accidents are not immediately identifiable in ST19 records maintained at DfT (where many are simply 'lost' within a larger category of "other animal". Improved monitoring of PIAs arising through deer collisions could be achieved through revision of the ST19 form itself, though more likely require a request to all Police Forces and and/or Local Authority Road Safety departments to submit annual listings of all PIA records which can be identified as having involved deer (through computerised 'key-word' search for <deer> and/or <_stag_> in the short text accident description for each incident which are nowadays held in databases by the majority (if not yet all) county or police force accident departments. [note search queries for 'stag' are best surrounded by spaces, to avoid abstraction of records mentioning e.g. 'staggered junction' etc].

10.4 Trunk-road up-lift data alone would clearly sample only the small percentage of all roads nationwide made up by the strategic trunk net-work (c.2.6 %) and c.22% of all major roads. However, the trunk road network carries around 1/3 of all traffic in England, and hence as discussed previously, has the potential to sample a quite high proportion of DVCs overall.

The management of most of these carcass up-lifts on the trunk network on behalf of Highways Agency by a limited number of main areas agents (c. 14 plus 10 for DBFOs) and more recently now assisted further by Highways Agency's own Traffic Officers on motorways, also make potential future collection of information for trunk roads a far less onerous task than for non-trunk roads; where for the latter in England animal carcass up-lifts are managed by several hundred different local district or unitary councils. Incidents on the trunk roads can (potentially) also be recorded to a relatively good degree of location accuracy, by reference to marker posts when available, chainage or other reference points along each route.

10.5 Insurance data providing information on accident claims relating specifically to vehicle collisions with deer remains potentially one of the most comprehensive ways of nationwide sampling of DVC frequency (and is extensively used for this purpose in the US; e.g. State Farm Insurance, 2006; McGowan, 2006), not least as we estimate that around 20 to 25% of all DVCs in the UK may lead to insurance claims. However such information has proven difficult to obtain from all but one major company, Fortis Insurance, to date, as most other companies were not readily able to retrieve deer related claims from among other animal related incidents. Further recent approach has been made to the UK Claims Managers Association, and possibility of input of data from a wider range of insurers continues to be explored.

10.6 Some of the most detailed and long-term DVC data (for 10 to 20 years in some cases) is available for around 8 major deer forests located in different parts of England. Inclusion of continued data collection from these areas in a nationwide monitoring scheme, has the potential to provide valuable information not only on long-term trends, but also for evaluating information form other data sources (e.g. %age sample size also recorded by other data sources) and monitoring the effectiveness of differing measures and approaches to minimise deer vehicle collisions.

10.7 In practical terms therefore (given the difficulties experienced in the current project in obtaining comparable data from a high proportion of all local district council road clearance departments or police control rooms) it is suggested that the best index of trend – as well as identification of localities with the most significant DVC problems, in England is likely to be obtained in future through focussing data collection on the following five key data sources::

vi. Trunk road Area maintenance agents and Highways Agency Traffic Officer patrol vehicles – to provide details of all deer related incidents and requests for removal of deer (and other animal?) carcases from the 14 trunk road areas and ideally all major DBFO schemes.

vii. Records of all deer related (and ideally also all other known animal related) human injury records retrievable via police forces and local authority road safety departments. As DfT do not at present log different animal types involved, this will require request to all counties and unitary authority road safety departments to undertake an annual search of their accident databases using standardised search criteria to ensure equal levels of data retrieval.

viii. Consistent input of records by at least one major nationwide insurance company should continue to form part of any future monitoring, and it is recommended that input is sought from additional companies to sample a rather higher proportion of motor claims nationwide than has been possible to date.

ix. RSPCA call out requests to injured deer at the roadside: The RSPCA have been able to provided the single most extensive and consistent annual data-sets towards the present study, extending to around 1750 incidents distributed across all counties is both England and Wales. One present limitation of these mostly very detailed records is that grid references for incident locations are generally allocated according to the centre of the nearest known post-code 'locale' rather than actual incident location, resulting in relatively poor location accuracy for rural as compared to more urban locations; and limit their use in identification of localised black-spots. The possible provision of GPS devices in future for all RSPCA patrol cars would enable much improved location accuracy based on actual incident sites, and could greatly improve the usefulness of this valuable data source.

x. Continued collection of detailed records for a selection of 8 to 10 case study areas (major deer forests) which have the largest concentrations of DVC incidents in England (see **Map 6**). In these areas records are also available for many past years, and provide the potential both to help monitor long-term trends, study effectiveness of differing measures applied to minimise accidents; in addition their inclusion is considered important for future monitoring to fill significant gaps in recording which would otherwise be likely, as in such major deer forests the local rangers rather than RSPCA tend to be known to police and others as the primary contact to deal with DVCs.

10.8 There is clearly real potential for much further practical application of the DVC database, not least if it can be regularly updated; that is both in relation the Trunk road network managed by The Highways Agency, as well as by Local Authorities across in England for identification and prioritisation of areas where there is greatest need for measures to help minimise DVCs in future. Data collection for the National Deer Collisions Database is currently scheduled to continue throughout 2007 supported by continuation funding by Highway Agency. To make fullest use of the information gathered it is proposed that records accrued to date should be incorporated initially with the Highways Agency's Geographical Information System (HAGIS) so that key information can be accessed by HA staff, managing agents and ecological contractors for purpose of road impact assessments. Information uploaded should not be restricted to data for deer incidents occurring on trunk roads, but these and those from other sources should be separately identifiable to enable ready assessment of frequency of known incidents on particular selected sections of roads, but also for wider corridors to either side of the trunk road network. Consideration should also be given to how data can best be made available for local authority (non-trunk) road departments, to help inform decisions on requirements for deer mitigation.

Field studies to ground truth DVC records received

10.9 One limitation of the present study has been that a high proportion of records submitted provide only fairly imprecise locations details and limited information on characteristics which may influence likelihood of DVCs, such as road side habitats, forward visibility for drivers, presence of fencing or other mitigation. It is suggested therefore that such factors could usefully be investigated by setting up some field studies to 'ground truth' samples of DVC records in a number of areas for which good detail on map locations are available, and determine in detail the characteristics of a range of road sections known to experience relatively high, moderate and low levels of DVCs.

Improving co-ordination of call-outs to deal with injured deer

10.10 To address the major animal welfare issue as well as road safety concerns posed by live deer casualties arising through DVCs, it is essential that efficient systems should be in place throughout England to enable casualty deer to be attended to as quickly as possible. Although good call-out schemes supported by police are in place in some regions, in many cases those called on for dispatch of deer often have to travel long distances to attend leading to inevitable delays. There remains an important need for organisations such as in particular ACPO, RSPCA, Forestry Commission, BASC, BDS and The Deer Initiative to work closely together to ensure efficient schemes with joint call-out lists are put in place for each County or Unitary authority in England, so that road casualty deer can be dealt with more promptly, and the ever increasing burden of such calls is shared effectively among all those best placed to assist.

DVC panels and management plans

10.11 A number of research trials have been set in parallel to work on the DVC database to investigate the effectiveness of differing deterrents and aspects of deer behaviour when crossing roads and traffic [see 9.3]. Research on the novel deterrent and other measures being trialled remains at too early a stage to reach firm conclusions as to their individual effectiveness. However, it is clear from this work and elsewhere that in most situations sustained reductions in DVCs are most likely to be achieved by integration of several complementary approaches, rather than reliance on any one measure. Significant reductions

of DVCs have already been noted in a number of the sites where trials are being undertaken, where aside from installation of the deterrents discussed above, public awareness of the issue of deer accidents has been actively raised with help of the local media, traffic calming measures have been installed, whilst at the same time co-ordination of deer management among landowners has been improved to help gain control over expanding deer populations.

The proper integration of many of these measures which can all contribute to help minimise DVCs, requires involvement and liaison among a wide range of organisations, including highways departments, landowners, deer managers, police and animal rescue organisations. It is recommended that in all areas identified as having high or very high numbers of DVCs in England local panels should be set up [as for DVC priority areas in Scotland see [9.3]), unless Deer Management Groups already exist, to develop management plans and integrated actions specifically to minimise local DVC problems.

10.12 It is further recommended that the many organisations who have supported the present study through submission of records, and others organisations who also have an interest in management of deer and the DVC issue, should meet to discuss the findings of the present study, and consider what further joint action may be taken at national and local level to help minimise DVCs; that is ranging from practical measures at the roadside, to raising public awareness among the public and co-ordination of deer control among landholders. Many of the key organisations that should be involved in such discussions are partners in The Deer Initiative including ACPO, Highways Agency, British Deer Society, BASC, RSPCA and Forestry Commission. In addition it would be useful to involve national representatives of local authority roads departments (e.g. LAROSA) and insurance companies (e.g. the Association of British Insurers) in such discussions.

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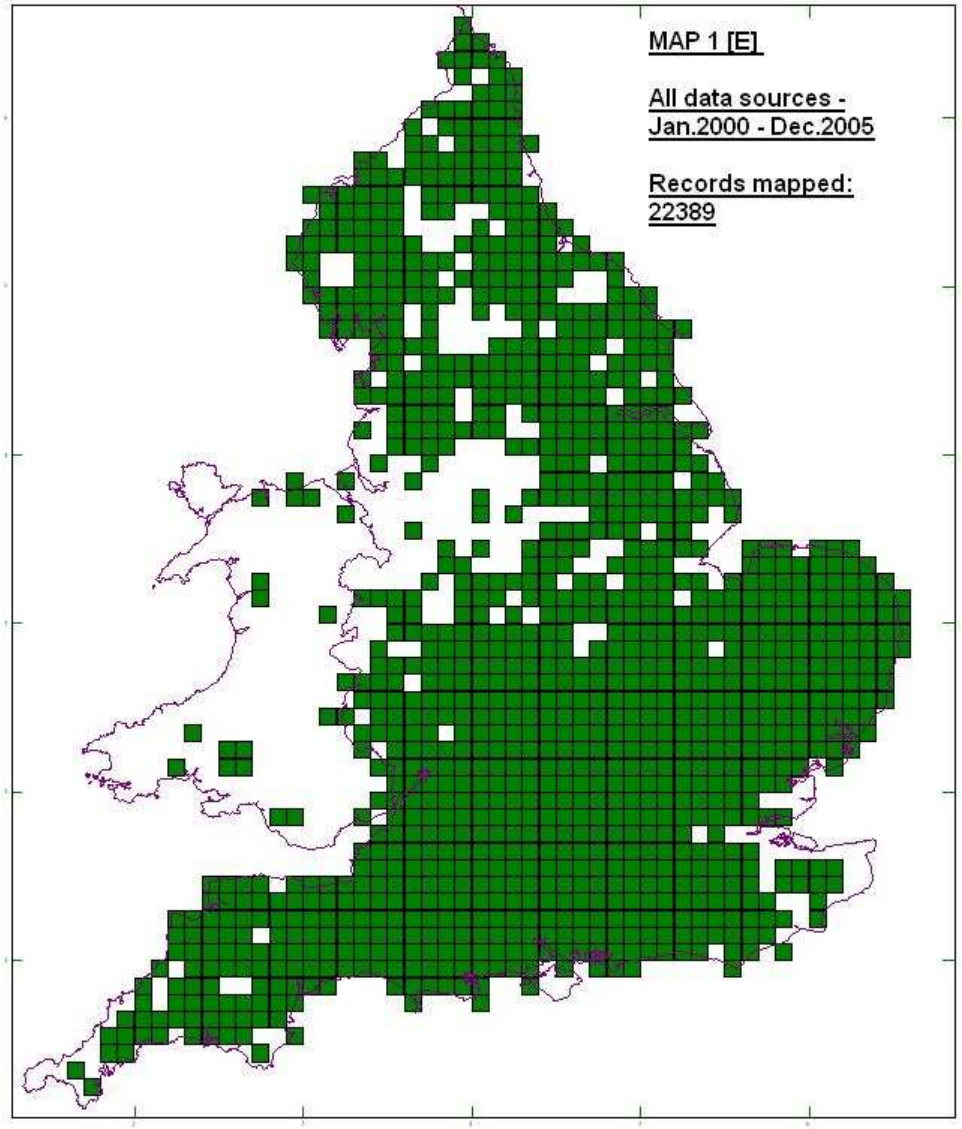
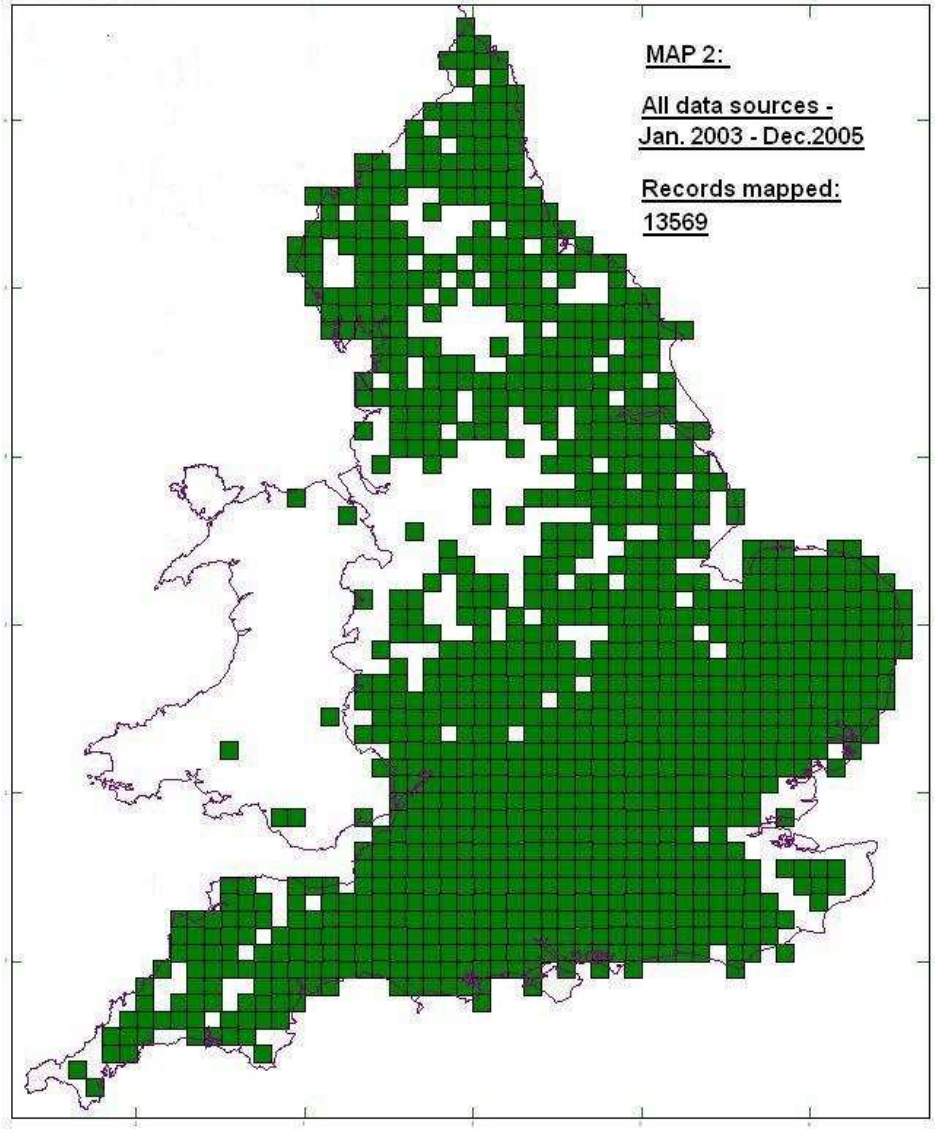
APPENDIX I : MAPS 1 – 10

General distribution of Deer-Vehicle Collisions (DVC) in England & Wales : **Map 1 Map 2**

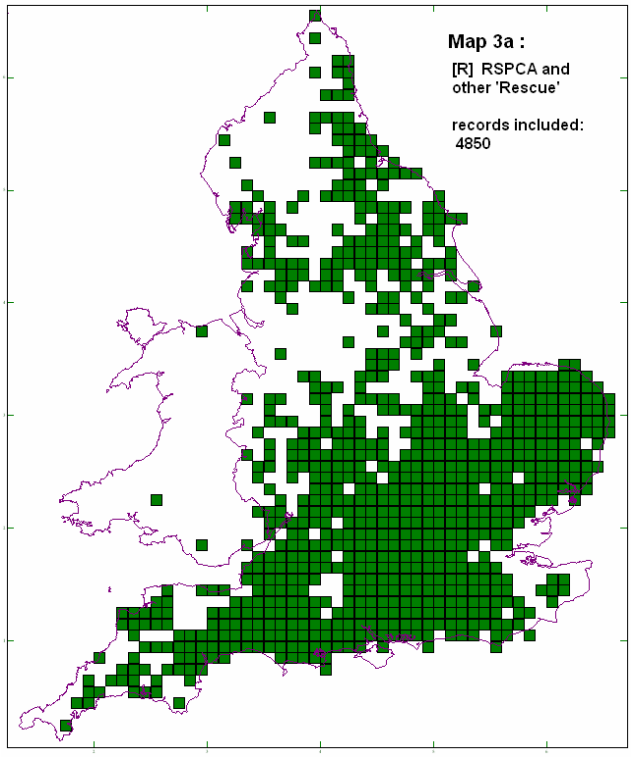
Filled squares shows the distribution of all 10km Ordnance Survey Grid squares for which at least one or more DVC have been reported to the project. Map 1 shows distribution if including all records for which adequate location details are available for incidents during January 2000 to December 2005; Map 2 replots data restricted to records collected for the main three year study period (2003 – 2005).



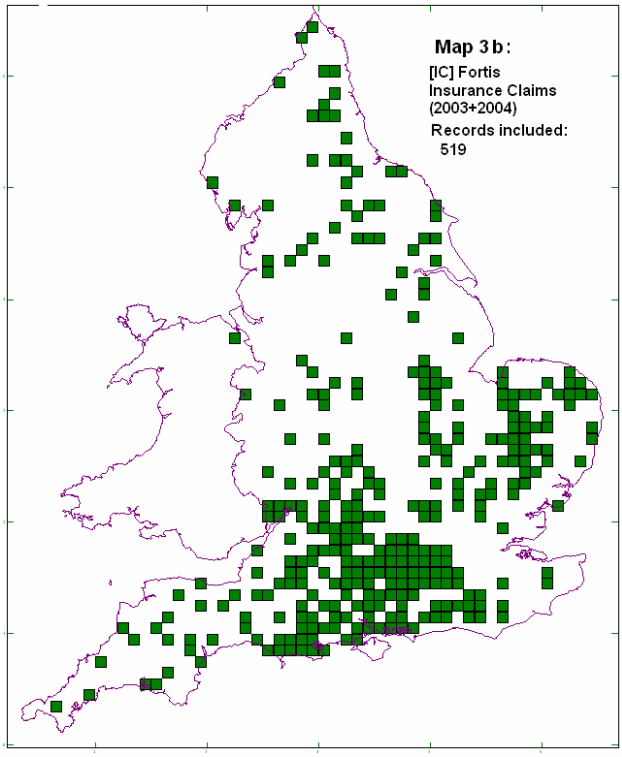


Map 3 : **(a – h)** Distribution of Deer-Vehicle Collisions (DVC) reported by differing source categories during main study period (Jan. 2003 to Dec. 2005). Filled squares indicate at least one or more records in that 10km by 10 km Ordnance Survey Grid square.

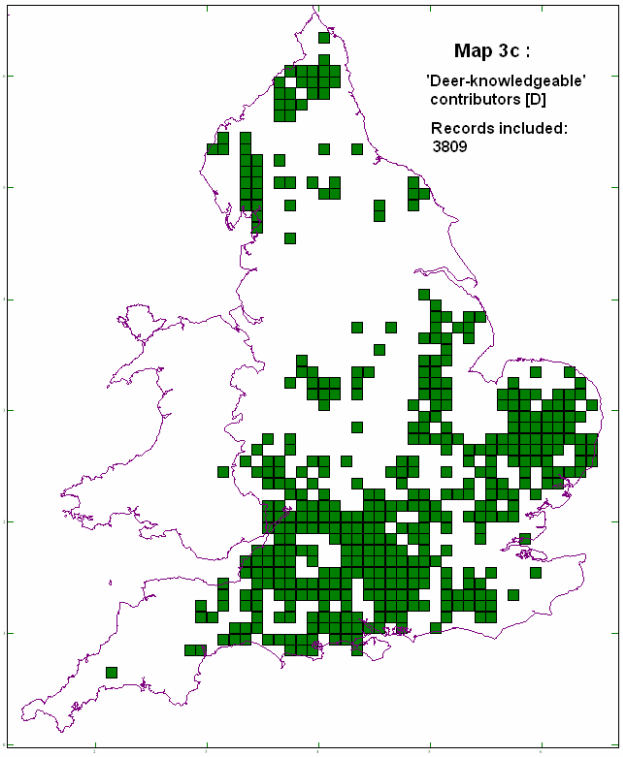
Map 3 (a)



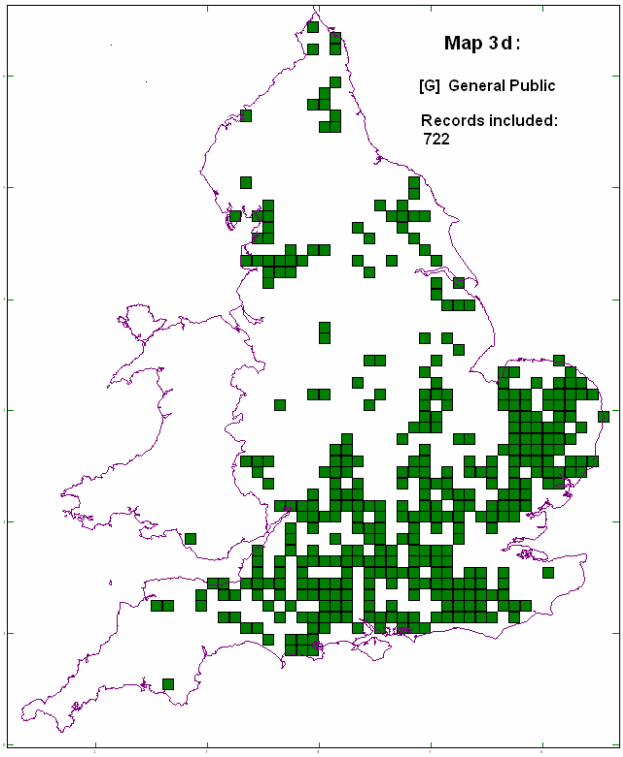
Map 3 (b)



Map 3(c)

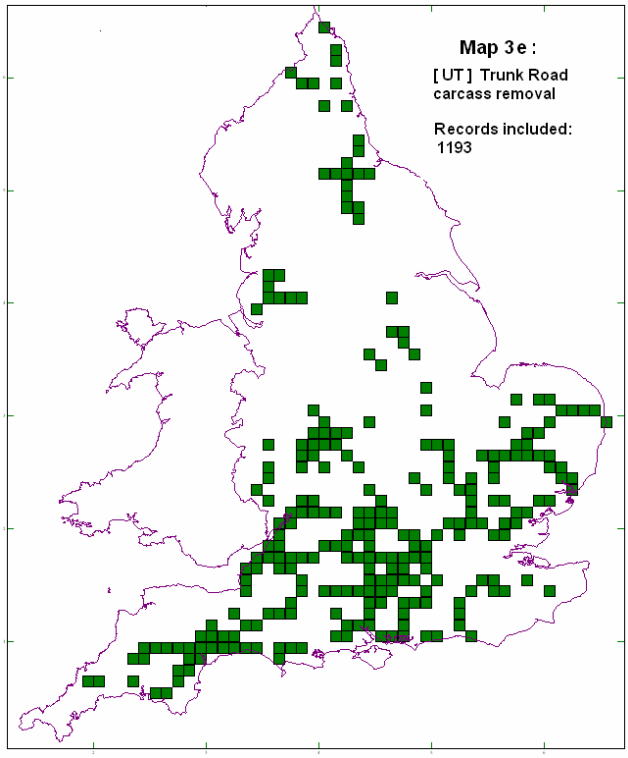


Map 3(d)

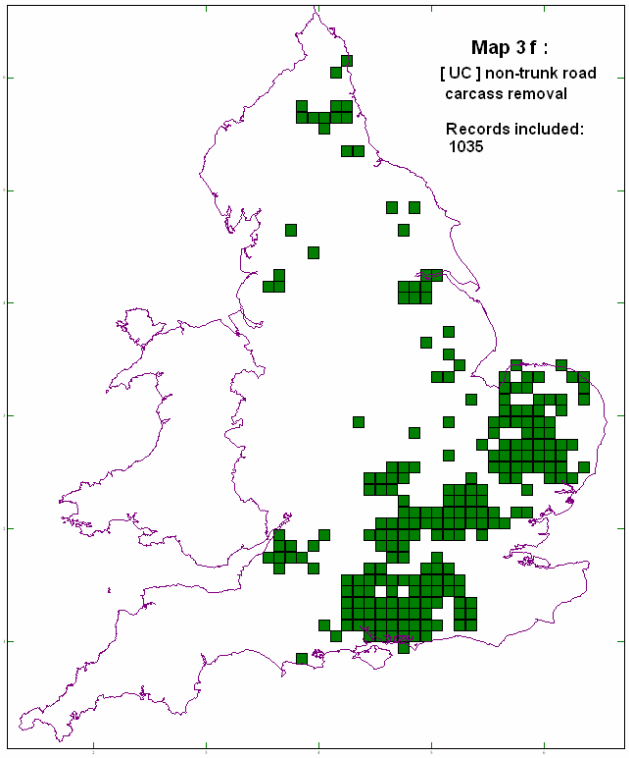


Map 3 : (a – h) (continued..)

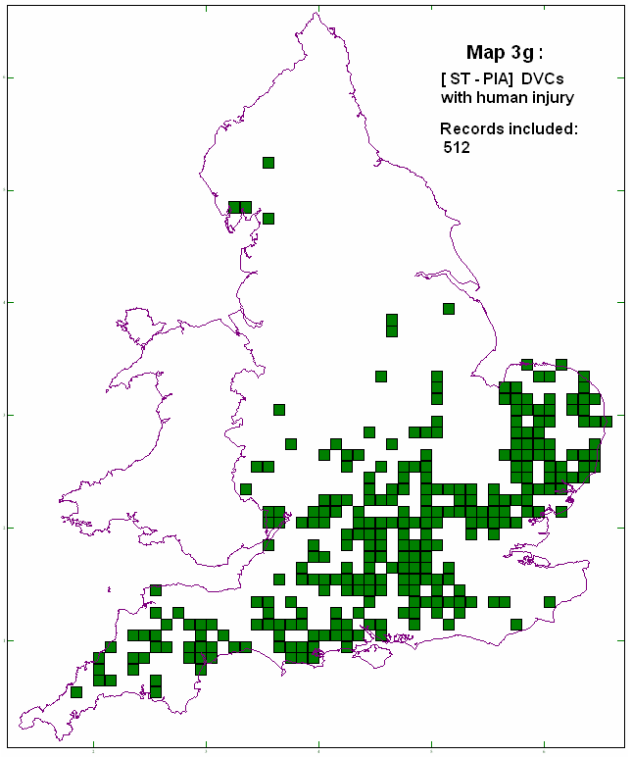
Map 3(e)



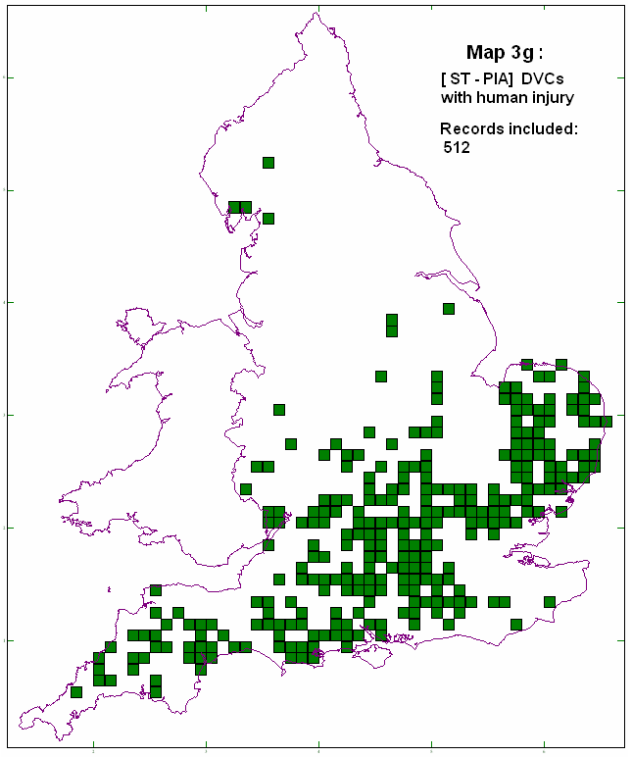
Map 3(f)



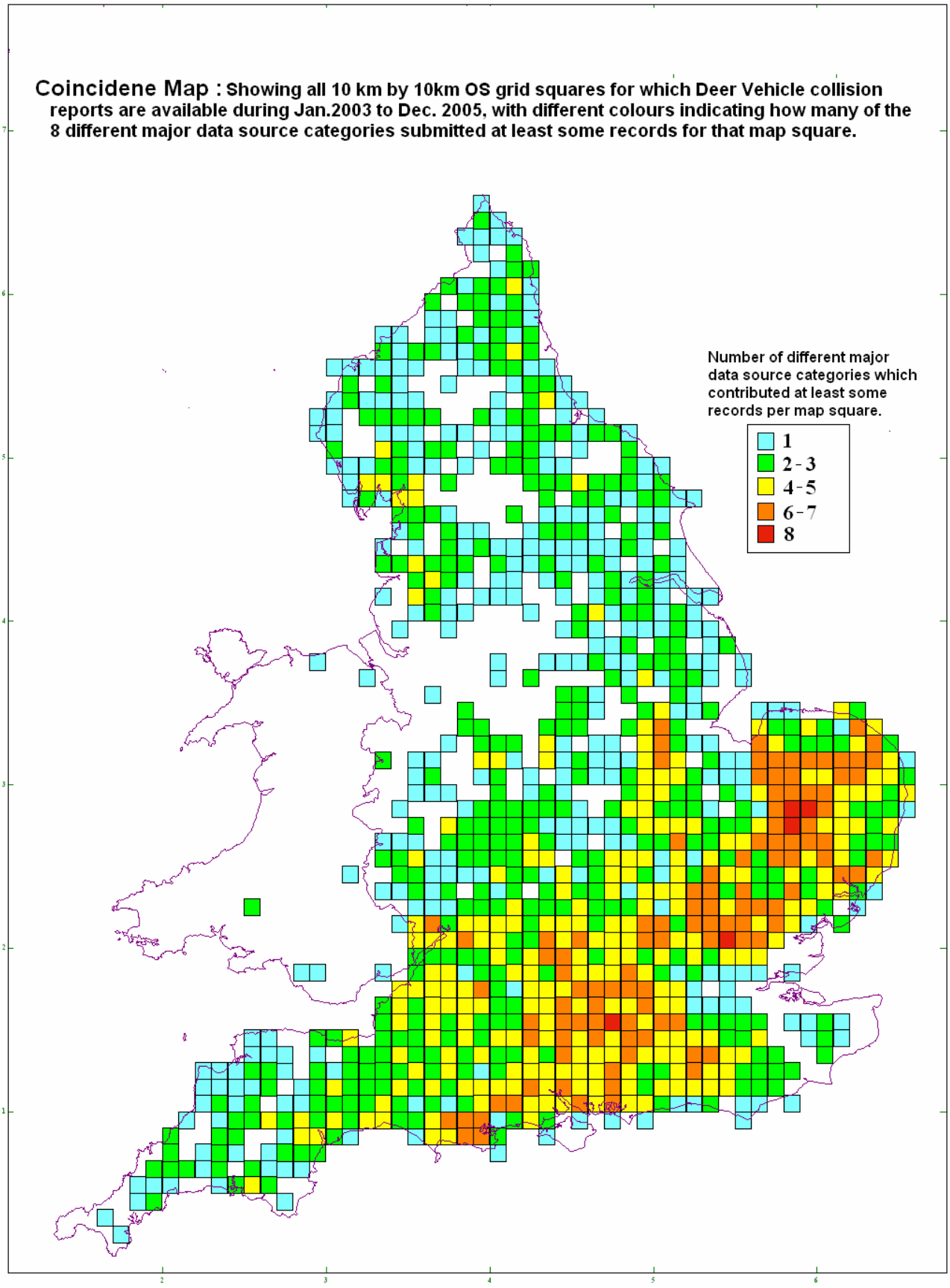
Map 3(g)



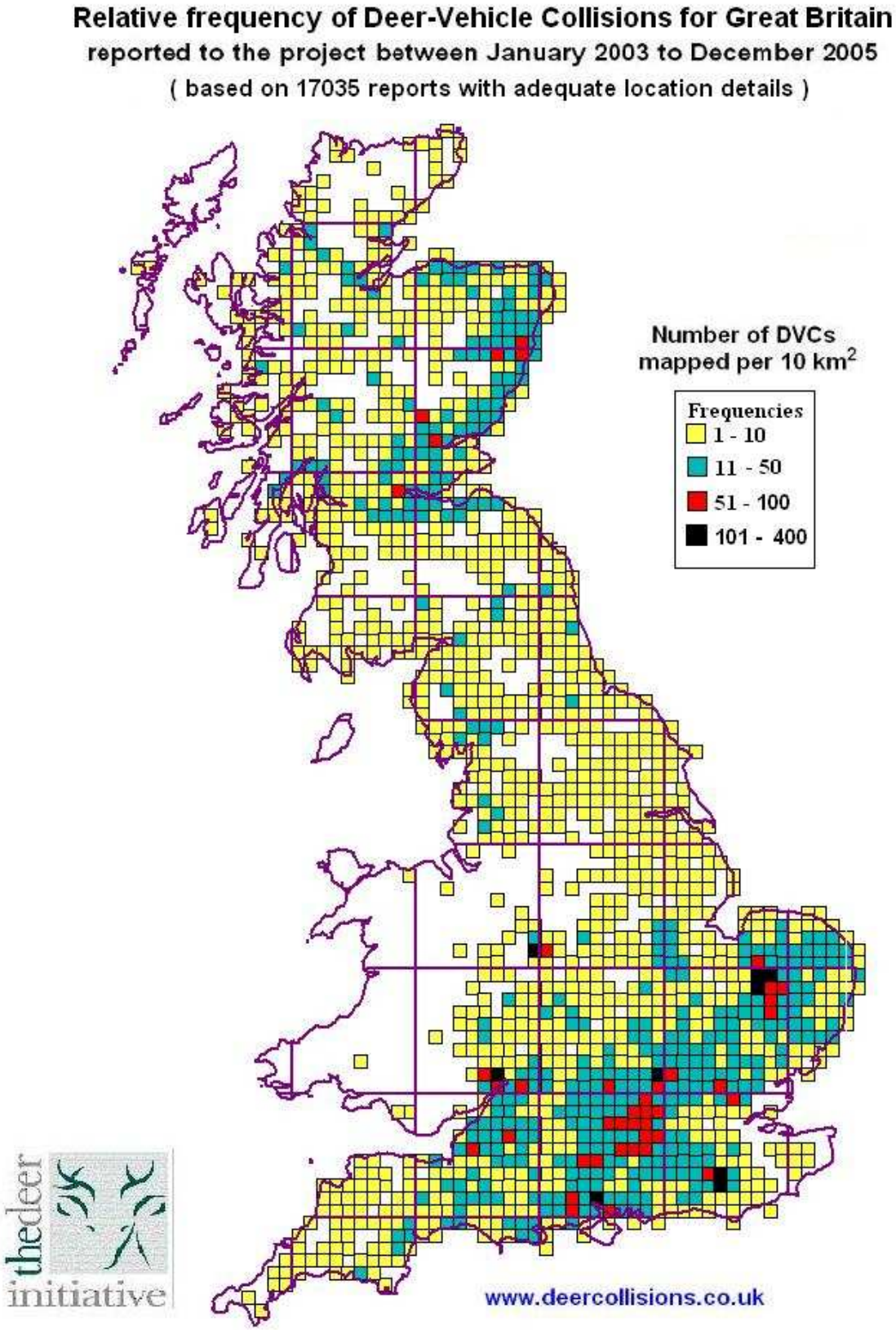
Map 3(h)



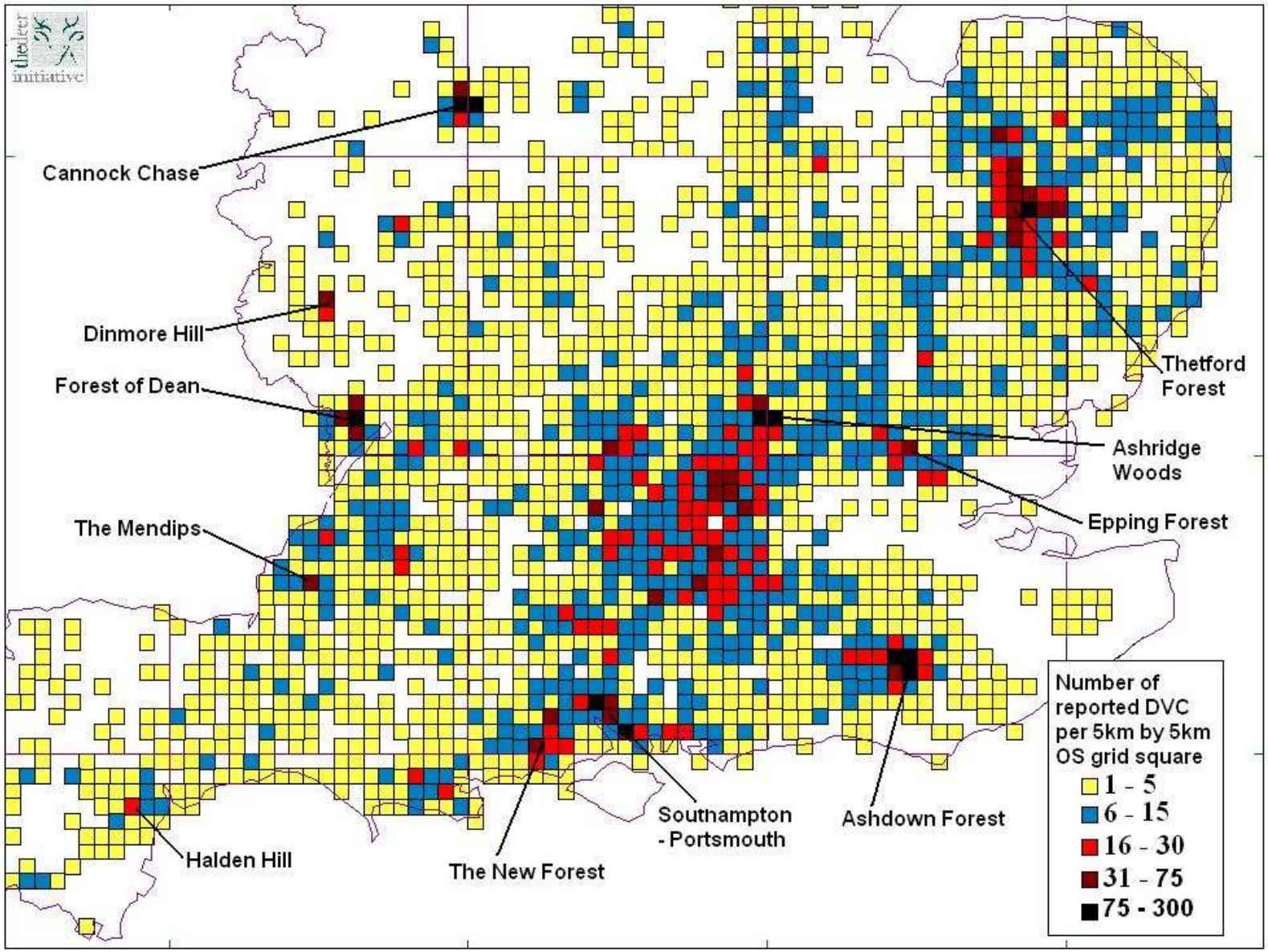
Map 4: Co-incidence Map



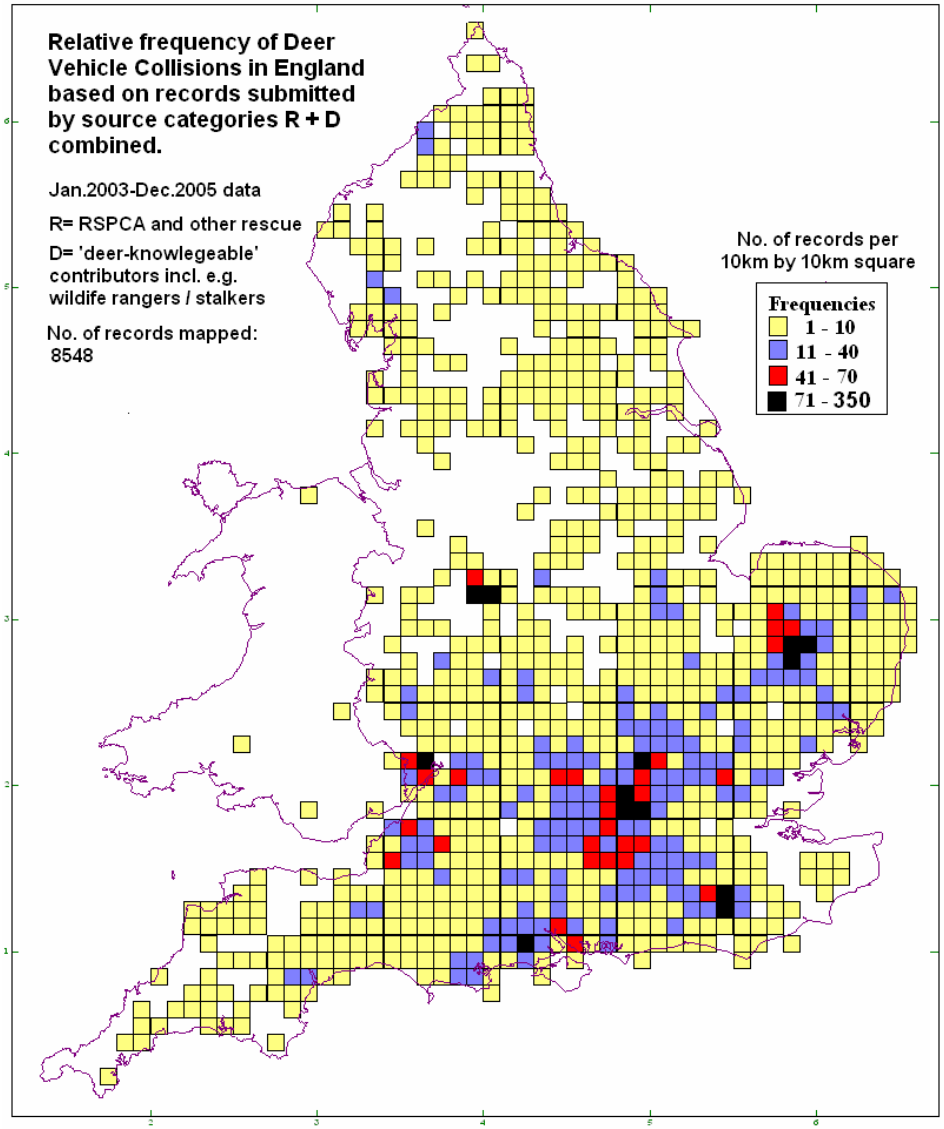
Map 5 :


Relative frequency of Deer-Vehicle Collisions for Great Britain
reported to the project between January 2003 to December 2005
(based on 17035 reports with adequate location details)
Number of DVCs mapped per 10 km2
Frequencies
1 - 10
11 - 50
51 - 100
101 - 400
thedeer initiative
www.deercollisions.co.uk

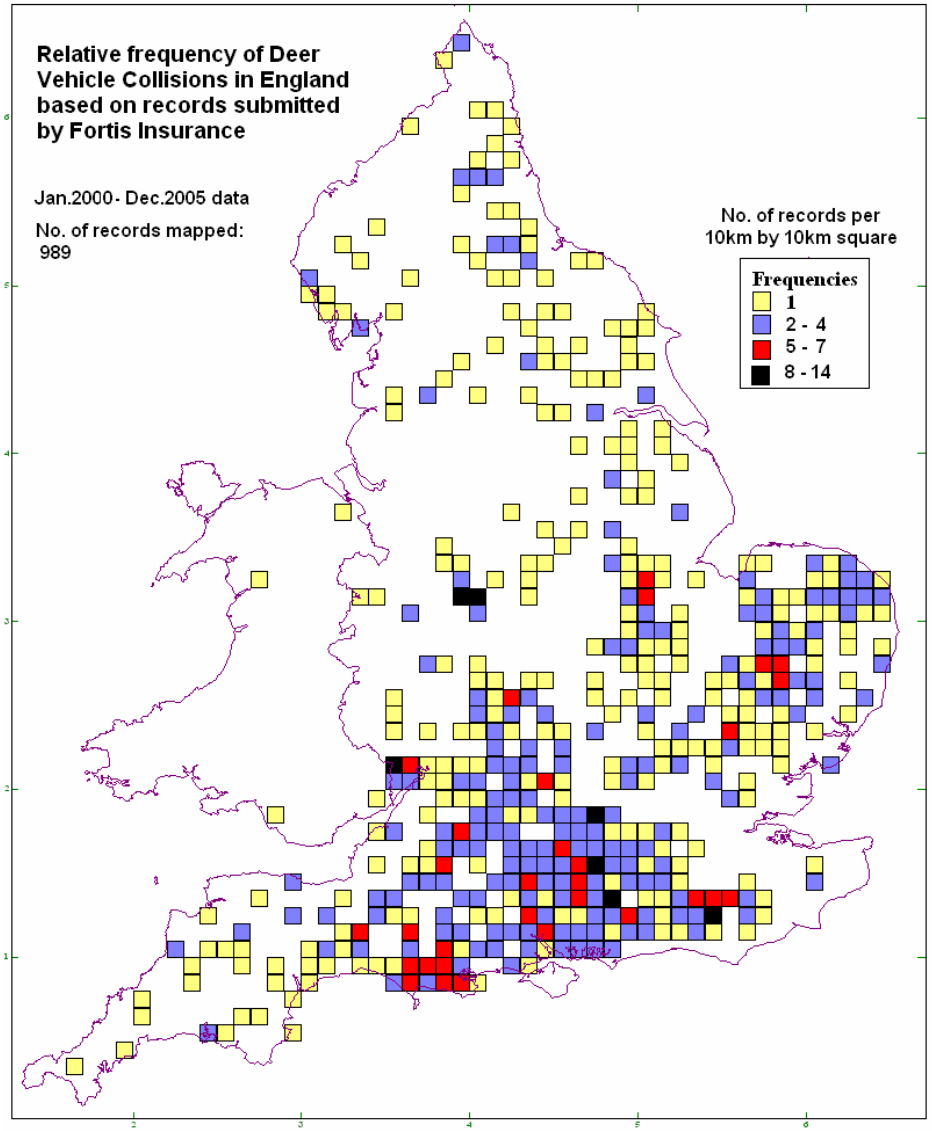
Map 6 : Overview of frequency of Deer-Vehicle collisions in southern England within 5km by 5km grid squares (based on available records for 2003-2005 with adequate location details for mapping at this scale)



Map 7a & 7b : Comparison of pattern of relative distribution and abundance of DVCs based on Motor Insurance Claims data (Fortis) with independent pattern shown by combination of records from source categories R + D (see text).

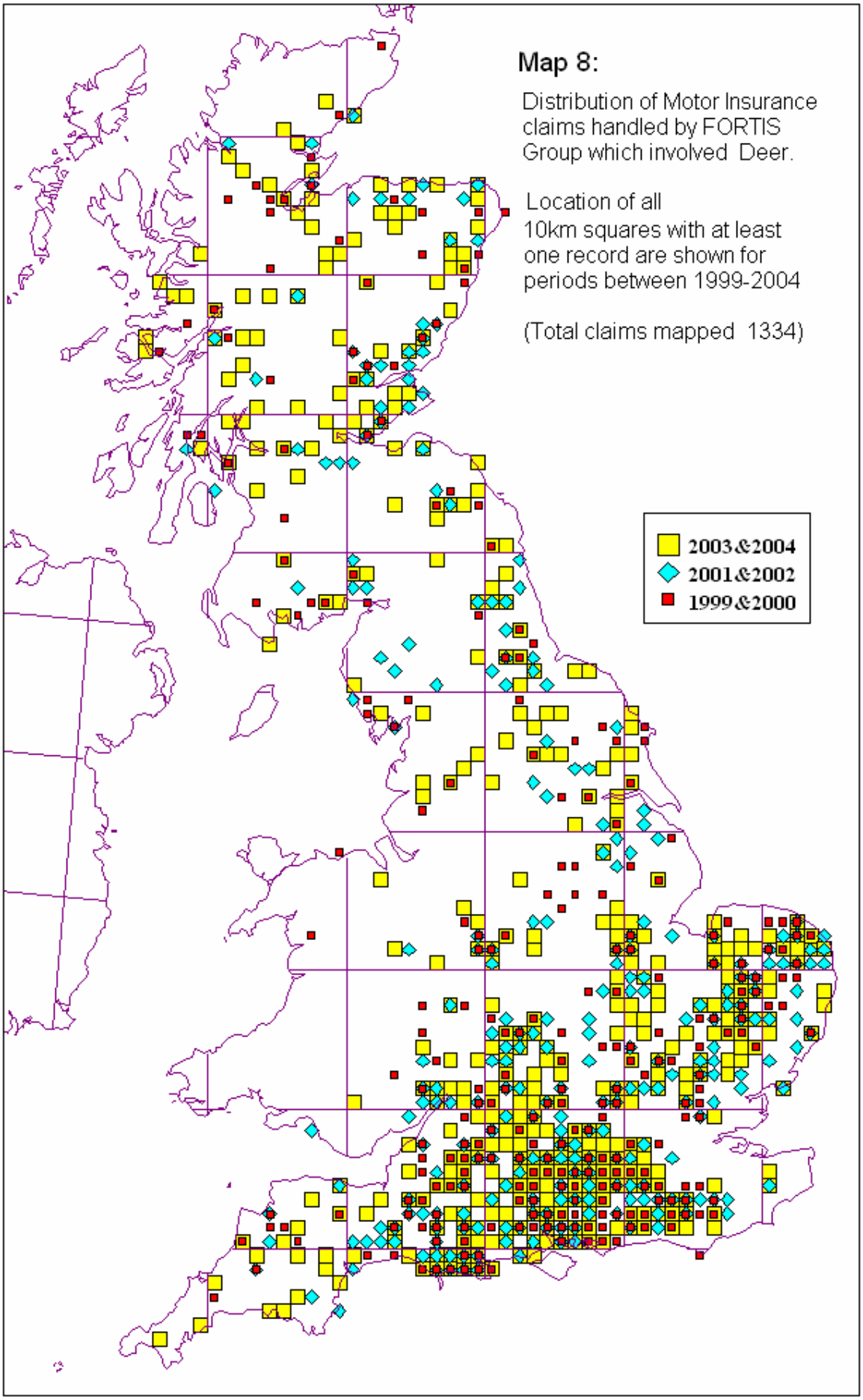


(a)

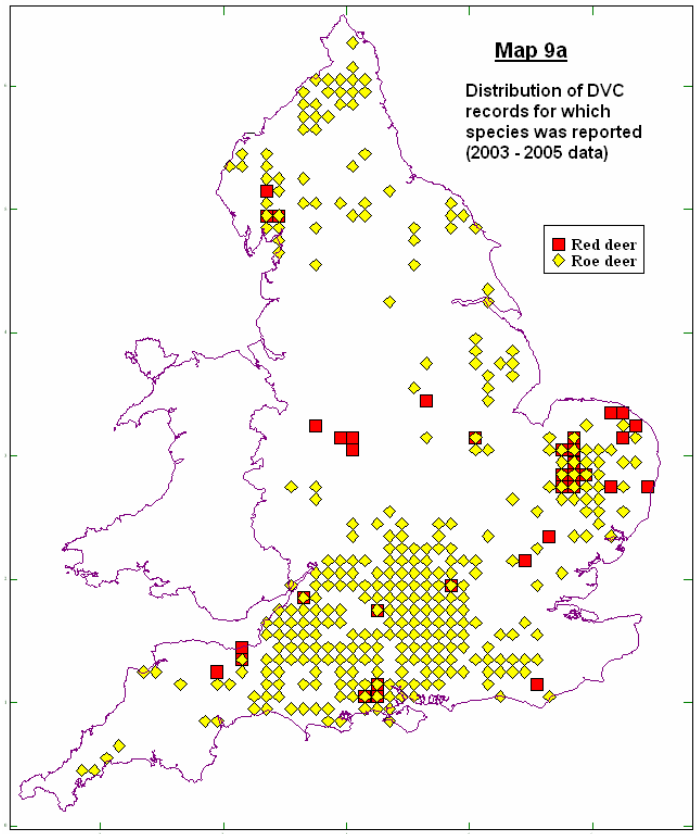


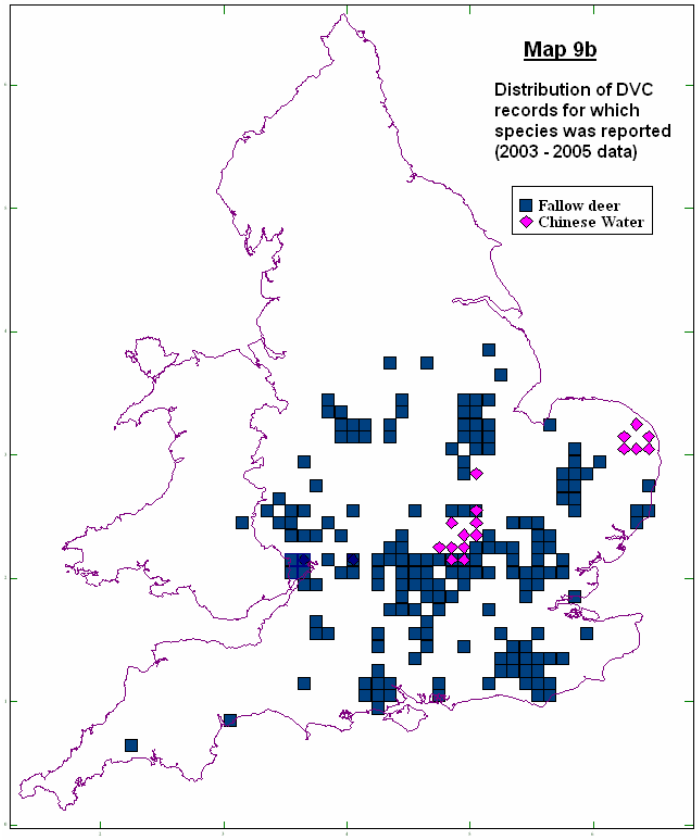
(b)

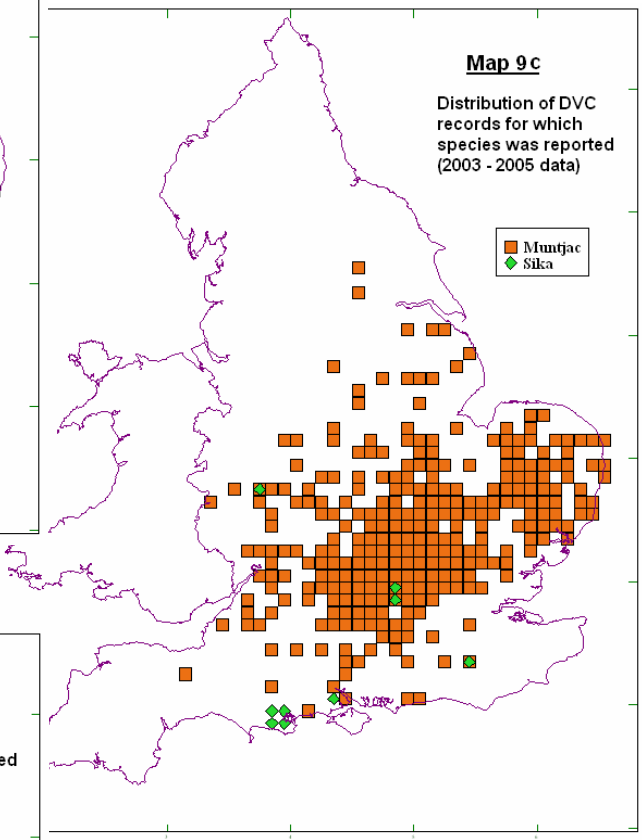
Map 8 :


Map 8:
Distribution of Motor Insurance claims handled by FORTIS Group which involved Deer.
Location of all 10km squares with at least one record are shown for periods between 1999-2004
(Total claims mapped 1334)
2003&2004
2001&2002
1999&2000

Map 9 : Distribution of Deer-Vehicle Collision records where Species is known

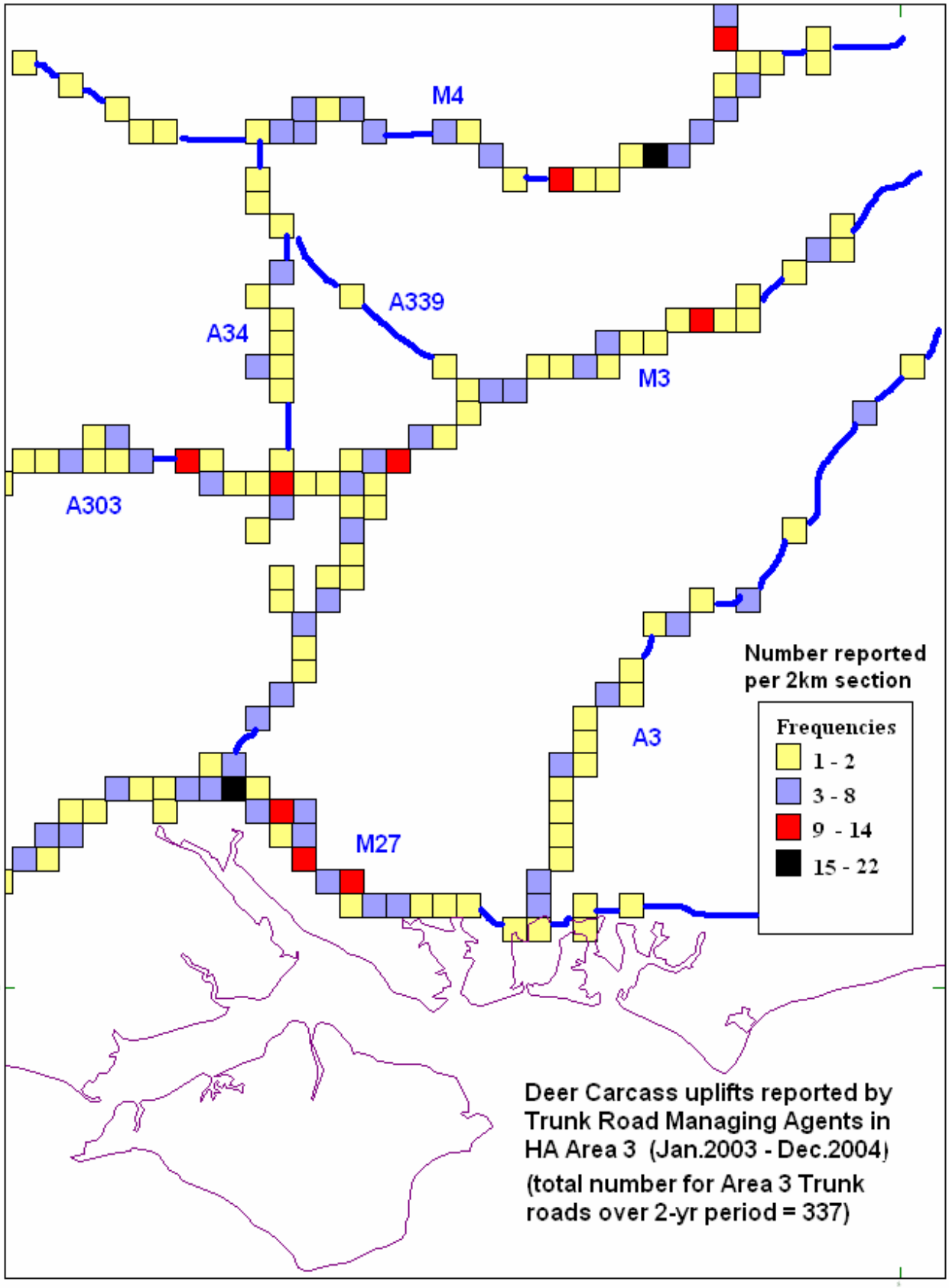




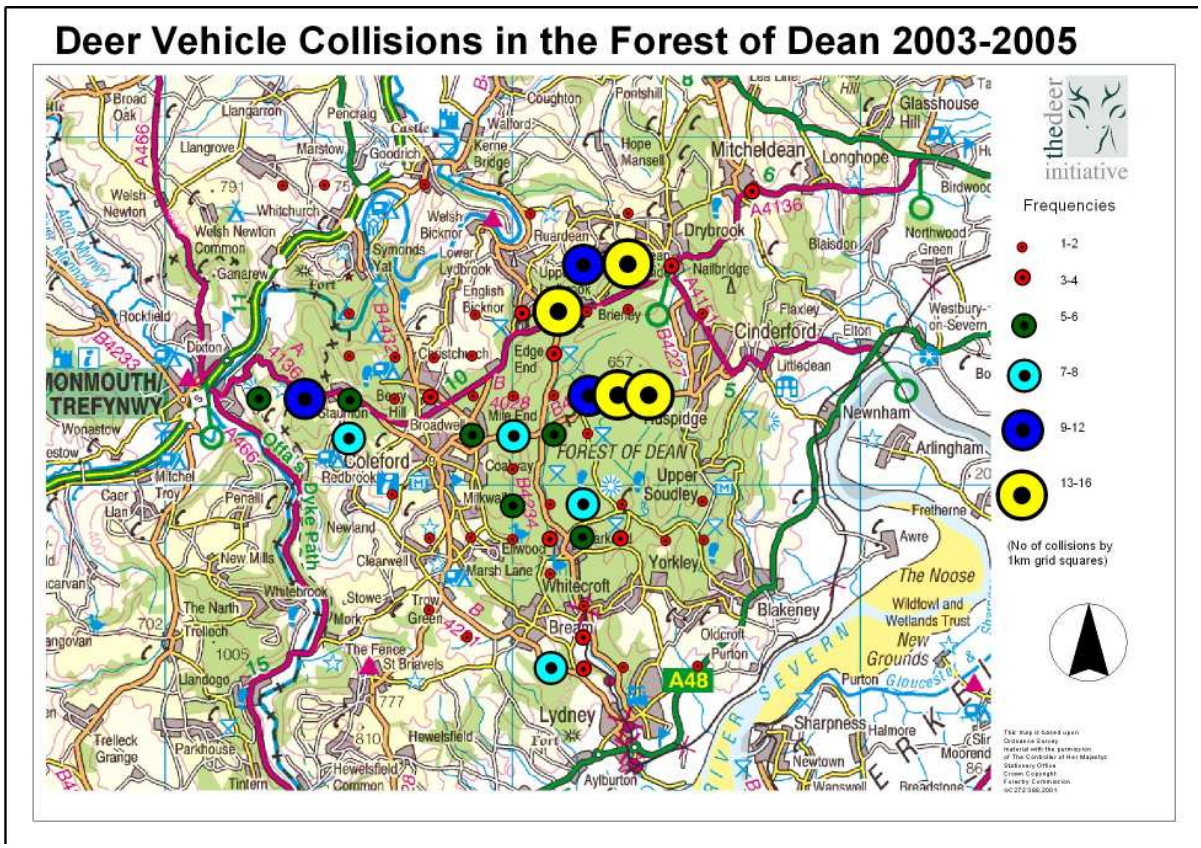


Map 10 a-c : Example views of DVC incidents mapped at finer resolution using only records for which reported locations believed to be accurate to with 1km or better.

Map 10 a: Deer-casualties dealt with by Trunk Road Managing agents in HA Area 3

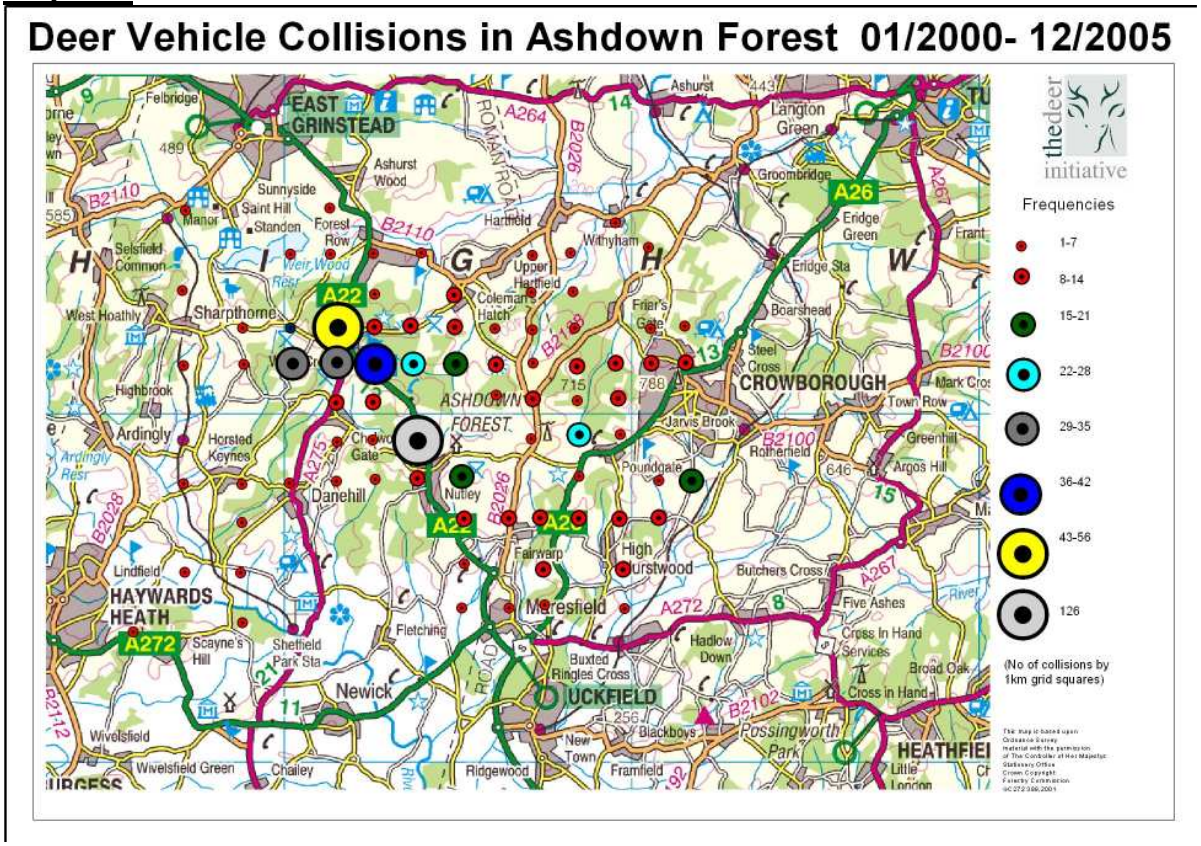


Map 10 b: **Deer-Vehicle collisions recorded at Forest of Dean 2003-2005**



[coloured circles and their size indicate the number of reported collisions per 1km by 1km OS grid square; pooled data are shown mapped at centre for each square rather than by separate roads.]

Map10 c:



DVC England Final Report (2003-2005)

APPENDIX II : TABLES (pages 1 – 12)
&
APPENDIX III : FIGURES (see pages 13 - 14)

APPENDIX II : TABLES

Table 1 **Data Source Categories Approached**	
U	Carcase Clearance / Uplift requests (recorded by Trunk Road Maintenance Agents [**UT**]; or Local Authority Departments [**UC]**)
IC	Motor Insurance Claims Departments; Motoring Roadside Rescue Companies ; major Nationwide Car hire firms.
D	'Deer-knowledgeable' contributors : incl. wildlife managers / gamekeepers for landholding organisations (e.g. Forestry Commission rangers, MOD Deer Management, National Trust, Community Forests & County Parks) ; Independent Deer Managers / Stalkers; members of BDS, BASC, DCS; Ecological Consultants; Mammal Recorders and Researchers.
R	Animal Welfare/Rescue organisations: RSPCA / SSPCA / Vets / Wildlife hospitals and Rescue Centres
P	Police Control Call Rooms & Wildlife Liaison Officers (for logs of any calls relating to deer / vehicle incidents);
ST	Road Accident Statistics Departments (Regional Police Forces ; and/or Council Road Safety teams, including ST19 records)
G	General Public contributors (via web-site, email or direct contact)

Table 2	**Main Outputs / Issues to be assessed**	**Main data sources best suited to contribute**
Minimum total numbers of Deer/Vehicle Collisions ;		**U; IC; D; R; P; ST;G;**
Human and Economic Costs (Personal injuries accidents and fatalities; Car repair / insurance cost costs)		**ST; IC; G;**
Relative frequency and Geographical distribution		**U; IC; R; ST;**
Deer Species involved; effects of age/sex; fate / injuries;		**D; R;**
Effects of other key influencing factors: Road type & layout ; roadside habitats, mitigation measures, season, time of day;		**D; ST; R; (G – part);**
Identification and characterisation of local 'hot-spots' (i.e. requires records with reasonably precise location detail)		**D; ST; P; U (part); G part;**

TABLE 3: Number of Deer Vehicle Collision reports per County and/or Unitary Authority obtained for differing years. Local authorities are listed in descending order based on the rate of reported DVCs per year per driven Billion Vehicle kilometres (traffic volume).

Local Authority	Number of Deer-Vehicle collisions reported							Annual Traffic volume MVkm	DVCs per annum / BVkm	Rank on total DVCs 2003-05	Rank on rate of DVC / bVkm
	Total 2000 to 2002	2003	2004	2005	Total 2003 to 2005	Total 2000 to 2005	Incidents excluding duplicates				
Suffolk	591	342	319	230	891	1482	1461	5,947	49.9	3	1
East Sussex	321	182	232	233	647	968	956	4,373	49.3	6	2
Norfolk	447	350	601	253	1204	1651	1620	8,158	49.2	2	3
Hampshire	959	451	605	443	1499	2458	2435	15,187	32.9	1	4
Bath&North East Somerset UA	64	50	41	19	110	174	164	1,118	32.8	28	5
Oxfordshire	351	232	303	144	679	1030	1020	7,441	30.4	4	6
Gloucestershire	133	236	172	127	535	668	657	6,015	29.6	9	7
Dorset inc. B'mouth & Poole UA	228	154	121	42	317	545	542	3,779	28.0	16	8
Lincolnshire + Rutland	105	148	219	133	500	605	594	6276	26.6	11	9
Buckinghamshire inc. Slough UA	406	210	221	116	547	953	949	7,035	25.9	8	10
Berkshire (of which):	356	191	226	168	585	941	934	7,892	24.7	7	11
- Bracknell Forest UA	*35*	*25*	*20*	*21*	*66*	*101*	*101*	*743*	*29.6*		*11*
- Reading UA	*13*	*9*	*11*	*6*	*26*	*39*	*38*	*565*	*15.3*		*11*
- West Berkhire UA	*172*	*79*	*108*	*80*	*267*	*439*	*437*	*2,990*	*29.8*		*11*
- Windsor&Maidenhead UA	*56*	*42*	*31*	*25*	*98*	*154*	*151*	*1,903*	*17.2*		*11*
- Wokingham UA	*77*	*35*	*53*	*35*	*123*	*200*	*200*	*1,691*	*24.2*		*11*
Northumberland	46	63	72	40	175	221	220	2,646	22.0	22	12
North Somerset UA	97	68	53	21	142	239	237	2,200	21.5	25	13
Hertfordshire	530	290	267	116	673	1203	1189	11,357	19.8	5	14
Cumbria	167	207	61	60	328	495	492	5,573	19.6	15	15
Wiltshire	235	156	120	35	311	546	542	5,362	19.3	17	16
Herefordshire UA	16	52	19	32	103	119	116	1,829	18.8	29	17
Somerset	283	115	122	57	294	577	571	5,941	16.5	19	18
West Sussex inc. Brighton&Hove	236	145	161	86	392	628	611	9,105	14.4	14	19
Bedfordshire	154	59	69	51	179	333	333	4,161	14.3	21	20
Cambridgeshire	100	90	129	68	287	387	383	7,084	13.5	20	21
Devon	252	114	115	78	307	559	554	7,619	13.4	18	22
Staffordshire incl S-oT UA	25	111	153	139	403	428	420	10,610	12.7	13	23
South Gloucestershire UA	57	44	49	34	127	184	178	3,652	11.6	27	24
Essex inc. Thurrock	452	219	179	112	510	962	937	15,068	11.3	10	25
Surrey	358	161	186	123	470	828	817	14,001	11.2	12	26
Peterborough UA	16	14	25	13	52	68	67	1,760	9.8	36	27

Table 3 - continued:

Local Authority	Number of Deer-Vehicle collisions reported							Annual Traffic volume MVkm	DVCs per annum / BVkm	Rank on total DVCs 2003-05	Rank on rate of DVC / bVkm
	Total 2000 to 2002	2003	2004	2005	Total 2003 to 2005	Total 2000 to 2005	Incidents excluding duplicates				
Southampton UA	25	13	10	9	32	57	55	1,174	9.1	44	28
Milton Keynes UA	41	20	20	10	50	91	91	2,418	6.9	37	29
Northamptonshire	113	45	72	52	169	282	278	8,293	6.8	24	30
Luton UA	13	9	4	3	16	29	29	821	6.5	51	31
Swindon UA	29	11	14	9	34	63	62	1,783	6.4	43	32
North Yorkshire inc. York UA	114	48	82	44	174	288	288	9,168	6.3	23	33
Redcar&Cleveland UA	18	7	6	4	17	35	35	961	5.9	50	34
Warwickshire	103	41	41	47	129	232	230	8,674	5.0	26	35
Worcestershire	41	19	39	38	96	137	136	6,601	4.8	30	36
Darlington UA	6		10	2	12	18	18	860	4.7	54	37
Bristol, City of UA	17	8	16	6	30	47	46	2,180	4.6	46	38
Durham	22	9	33	11	53	75	75	3,976	4.4	35	39
East Riding of Yorkshire UA	42	15	15	8	38	80	80	3,280	3.9	41	40
Shropshire inc. Telford&Wrekin	17	10	27	9	46	63	62	4,360	3.5	39	41
Plymouth UA	7	5	7	2	14	21	21	1,372	3.4	53	42
North Lincolnshire + NE L UA	22	6	15	4	25	47	43	2,609	3.2	47	43
Cornwall&Isles of Scilly	25	14	16	9	39	64	64	4,508	2.9	40	44
Lancashire	24	25	53	10	88	112	110	11,190	2.6	32	45
Tyne&Wear	21	13	9	3	25	46	45	3,307	2.5	48	46
Middlesbrough UA	12	5	3		8	20	20	1,330	2.0	55	47
Nottinghamshire incl. Notts UA	23	13	18	16	47	70	69	8,226	1.9	38	48
Portsmouth UA	11	1	2	4	7	18	18	1,274	1.8	56	49
Blackburn with Darwen UA	4	1	3		4	8	8	733	1.8	58	50
Kent	45	21	39	18	78	123	123	14,486	1.8	33	51
Kingston upon Hull, City of UA	8	1	3	2	6	14	14	1,236	1.6	57	52
Leicestershire incl Leiceter UA	22	13	13	9	35	57	56	8,704	1.3	42	53
Derbyshire incl Derby UA	14	10	18	3	31	45	43	9,134	1.1	45	54
Greater London	95	32	37	27	96	191	191	32,685	1.0	31	55
South+West Yorkshire (inc. UAs)	75	22	25	14	61	136	135	25500	0.8	34	56
Greater Man. / Merseys. / Warringto	9	1	12	3	16	25	25	7,639	0.7	52	57
West Midlands (excl. Heref./Worcs.)	22	2	7	13	22	44	44	16,968	0.4	49	58
CHESHIRE	3		2	1	3	6	6	8,437	0.1	59	59
(uncertain/ unallocated)	62	55	125	517	697	759	759				
Grand Total	**8090**	**4949**	**5636**	**4140**	**14465**	**22555**	**22278**	**429,705**	**11.2**		

Table 4 : Nos. of organisations contacted & nos. of DVC reports obtained during the main study period (1/1/2003 to 31/12/2005)

	Trunk Road Uplift requests	District Council uplifts	Police RTC data (PIA + damage only)	Police Control call logs	Fortis Gourp - Insurance Claims	RSPCA and other wildlife rescue	Rangers / stalkers / naturalists	General public and 'others'	Total Reports received	Total incidents excluding duplicates
Souce code:	**UT**	**UC**	**ST**	**P**	**IC**	**R**	**D**	**G**		
Nos. sources contacted:	22	c.350	40	40	32	80	nk	nk		
Nos. submitted records:	16	39	28	8	1	7	c.175	c.550		
Local Authority	**Number of Deer-Vehicle Collision Reports submitted**									
Hampshire	388	191	41	2	64	419	345	49	1499	1481
Norfolk	25	72	54	323	44	199	414	73	1204	1176
Suffolk	56	104	100	11	29	165	335	91	891	877
Oxfordshire	43	135	26		29	303	119	24	679	670
Hertfordshire	40	114	19	37	12	236	189	26	673	661
East Sussex		1	2	1	14	65	538	26	647	641
Berkshire (incl. 5 U.A.s)	110	6	19	2	20	304	104	20	585	579
Buckinghamshire inc. Slough UA	17	16	20		2	355	111	26	547	544
Gloucestershire	13		23	10	18	85	359	27	535	524
Lincolnshire + Rutland	3	9	4	335	17	50	83	19	520	509
Essex inc. Thurrock	19	35	30	95	16	170	110	36	511	498
Surrey	15	50	18	1	17	323	24	22	470	462
Staffordshire incl S-oT UA	1			1	17	22	353	3	397	395
West Sussex incl. Brighton & Hove	10	127	10		19	142	59	25	392	387
Cumbria			4	244	4	23	48	5	328	325
Dorset inc. B'mth & Poole UA	22	1	27	7	40	112	82	26	317	314
Wiltshire	25	5	12	1	43	88	104	33	311	309
Devon	112		42		13	116	17	7	307	304
Somerset	29		9	1	21	148	52	34	294	289
Cambridgeshire	17	27		53	11	117	39	23	287	283
Bedfordshire	11	1	6	2	4	116	26	13	179	179
Northumberland	26	13		3	12	23	86	12	175	174
North Yorkshire inc. York UA	19	7			12	93	26	17	174	174
Northamptonshire	4	41	14	1	4	71	21	13	169	165
North Somerset UA	12				2	30	94	4	142	140
Warwickshire	22	1	8		10	68	4	16	129	128
South Gloucestershire UA	14	62	1	1	1	23	22	3	127	122

continued overleaf ….

Table 4. continued :

Souce code:	UT	UC	ST	P	IC	R	D	G		
Nos. sources contacted:	22	c.350	40	40	32	80	nk	nk		
Nos. submitted records:	16	39	28	8	1	7	c.175	c.550		
Herefordshire UA	20		6		3	10	56	8	103	100
Bath & North East Somerset UA	11	2			2	68	26	1	110	100
Worcestershire	15		1		4	49	26	1	96	96
Greater London	2	3			2	79	4	6	96	96
Lancashire	5	5		11	4	25	4	34	88	86
Kent	11		3		3	47	8	6	78	78
Durham	9	7		1	7	27	2		53	53
Peterborough UA		2		17	2	25	5	1	52	51
Milton Keynes UA			2			42	1	5	50	50
Nottinghamshire incl. Notts UA	15		4	1	1	20	4	2	47	47
Shropshire	3		3		6	17	16	1	46	45
Cornwall & Isles of Scilly	5		8		4	20	1	1	39	39
West Yorkshire					1	33		4	38	38
East Riding of Yorkshire UA					8	27		3	38	38
Swindon UA	5				4	20	3	2	34	34
Leicestershire incl Leiceter UA	1			11	2	17	1	3	35	34
Southampton UA	3	11			1	16		1	32	32
Derbyshire incl Derby UA				1	1	8	17	4	31	31
Bristol, City of UA	1	2			1	18	8		30	29
Tyne & Wear	4	7			1	11		2	25	25
North Lincolnshire + NE L UA		13			2	6	1	3	25	24
South Yorkshire	1	1		8	2	11			23	23
West Midlands	6					15	1		22	22
Redcar and Cleveland UA					3	14			17	17
Luton UA						16			16	16
Greater Man.+Merseys.+Warrington	7	1				7		1	16	16
Others	37	3	0	0	3	32	0	7	82	54
(yet unallocated / received late)	312		97	1	412	262	2		1086	1086
Grand Total	1526	1075	613	1182	974	4808	3950	769	14897	14670

Trunk Road Uplift requests | District Council uplifts | Police RTC data (PIA + damage only) | Police Control call logs | Fortis Gourp - Insurance Claims | RSPCA and other wildlife rescue | Rangers / stalkers / naturalists | General public and 'others' | Total Reports received | Total incidents excluding duplicates

Table 5[**S**]: Numbers of organisations contacted and DVC reports obtained in SCOTLAND during main study period (1/1/2003 to 31/12/2005)

	Trunk Road Uplift requests	Coucil road /cleansing departments	Police / AIU RTA records incl. ST19	Police Control call logs	Fortis Gourp - Insurance Claims	SSPCA and other wildlife rescue	Deer 'informed' individuals	General public and 'others'	Total Reports received	Total incidents excluding duplicates
Souce code:	UT	UC	ST	P	IC	R	D	G		
Nos. sources contacted:	*2*	*29*	*10*	*15*	*c.30*	*3*	*nk*	*nk*		
Nos. submitted records:	*2*	*19*	*5*	*9*	*1*	*1*	*64*	*c.100*		
Local Authority	**Number of Deer-Vehicle Collision Reports submitted**									
Aberdeen City	1	3		58	2	14		1	79	**73**
Aberdeenshire	6	723		183	16	38	33	10	1009	**966**
Angus	24	184	9	86	3	13	4	4	327	**288**
Argyll and Bute	107	3		5	12	5	121	8	261	**256**
Ayrshire (E+N+S)	4	5	0	2	4	8	3	2	28	**27**
Clackmannan		1	1	2		1		1	6	**6**
Dumfries and Galloway	15	99	13		14	7	34	5	187	**185**
Dunbartonshire (E+W)	2	0	0	0	2	18	3	0	25	**25**
Dundee	2	1		5	2	1		1	12	**11**
East Lothian	25	16			1	9		2	53	**52**
Edinburgh City	14				1	8			23	**23**
Falkirk	43	11		4	1	4	1	1	65	**62**
Fife	45	4	59	32	9	26	1	5	181	**175**
Glasgow City	1	2			2	14			19	**18**
Highland (+Islands)	139	118	155	60	38	17	163	61	751	**725**
Inverclyde	1			2		3	1		7	**7**
Mid Lothian	14	1		1		5			21	**21**
Moray	9	161		54	6	11	19	3	263	**219**
North Lanarkshire	20	11		1	1	21	2	1	57	**57**
Perth and Kinross	104	251	19	125	8	30	38	16	591	**519**
Renfrewshire	3					4		1	8	**8**
South Lanarkshire	5	15		1	2	3			26	**26**
Stirling	60	36	2	41	5	9	37	6	196	**162**
The Borders	17		2		6	14	2	3	44	**43**
West Lothian	21	1		1		10		2	35	**35**
(un-certain)	73	1		159	10	39	4	2	288	**287**
Grand Total	**755**	**1647**	**260**	**822**	**145**	**332**	**466**	**135**	**4562**	**4276**

Table 6 : Summary of overall numbers of Deer Vehicle Collision records for England entered to database by source:

Source Categories and numbers of records received:		2000 to 2005	Jan. 2003 - Dec. 2005
ST	**Road Accident Statistics Departments**	1435	613
UC **UT**	**Council Road Carcase Clearance** **Trunk Road Carcase Clearance**	1605 1981	1075 1526
IC	**Motor Insurance Claims (via 1 company – FORTIS Ins - only)**	1640	974
D	**'Deer-knowledgeable' contributors**	5899	3950
R	**Animal Welfare / Rescue (of which RSPCA alone):**	9472 (8714)	4808 (4260)
P	**Police Control Call Rooms**	1537	1182
G	**General Public contributors (incl. via web-site)**	986	769
	Total:	**24555**	**14897**

Table 7 :

Involvement of differing animal types in Personal Injury Road Accidents where carriageway hazards was recorded in the 'Other animal in Road' category of ST19 accident forms.
(based on inspection of sample data from 14 English counties for 1999-2003 where comparable data were available for inspection in sufficient detail – making up c.33% land area of England)

Animal Type	Nos. Injury RTAs	Number of Casualties			% age
		Slight	KSI (Killed or Seriously injured)	Total	
Wild Mammals					
Deer	292	309	63	372	48%
Badger	52	58	11	69	9%
Fox	123	127	18	145	19%
Rabbit/Hare	127	151	18	169	22%
Others	9	16	1	17	2%
Total	603	661	111	772	100%
Birds and Domesticated mammals					
Pheasants	87	81	5	86	12%
Other Bird	47	71	2	73	10%
Horse/Pony	222	258	35	293	41%
Cows	83	100	14	114	16%
Sheep	29	40	2	42	6%
Cats	90	105	4	109	15%
Total	558	655	62	717	100%
Non-Specific 'Animal' in road	292	349	32	381	
Overall Total	1453	1665	205	1870	

(from Langbein, 2003)

Table 8 :

Deer-Vehicle Collisions (DVC) leading to Human injury, as identified within road traffic accidents records for a sample of 26 English counties plus eights Unitary Authorities for which data were available for between three to six years each

County / Unitary Authorities	Year						No. of years with data	Total	Annual mean
	2000	2001	2002	2003	2004	2005			
Hampshire	13	20	16	18	18	10	*6*	95	**16**
Essex	17	4	21	19	11	9	*6*	81	**14**
Suffolk	9	14	16	11	16	15	*6*	81	**14**
Norfolk	na	na	6	8	8	16	*4*	38	**10**
Oxfordshire	9	6	10	9	11	7	*6*	52	**9**
Hertfordshire	6	7	6	5	10	5	*6*	39	**7**
Devon	8	5	6	6	10	3	*6*	38	**6**
Surrey	3	4	10	7	10	3	*6*	37	**6**
Buckinghamshire	3	4	3	6	10	4	*6*	30	**5**
Gloucestershire	1	5	10	7	3	3	*6*	29	**5**
Northamptonshire	na	na	6	3	5	0	*3*	14	**5**
Dorset	2	5	1	9	7	2	*6*	26	**4**
Wiltshire incl. Swindon UA	na	na	1	6	7	3	*4*	17	**4**
Somerset	na	5	4	5	5	2	*5*	21	**4**
West Berkshire UA	5	4	2	5	3	3	*6*	22	**4**
Bedfordshire inc. Luton UA	3	5	4	3	3	na	*5*	18	**4**
Lincolnshire	2	3	4	4	na	na	*4*	13	**3**
Warwickshire	3	4	2	5	2	2	*6*	18	**3**
West Sussex	na	1	1	1	9	3	*5*	15	**3**
Herefordshire UA	na	na	2	2	3	2	*4*	9	**2**
Kent	3	4	3	0	1	2	*6*	13	**2**
East Sussex	1	2	3	1	0	3	*6*	10	**2**
Nottinghamshire	2	1	0	2	1	1	*6*	7	**1**
Cumbria	1	1	0	0	1	3	*6*	6	**1**
Shropshire	na	na	1	1	1	1	*4*	4	**1**
Windsor and Maidenhead UA	1	1	0	1	1	1	*6*	5	**1**
Wokingham UA	1	1	0	0	2	1	*6*	5	**1**
Bracknell Forest UA	1	0	0	2	0	1	*6*	4	**1**
Cornwall and Isles of Scilly	1	0	0	1	2	0	*6*	4	**1**
Milton Keynes UA	2	0	0	2	0	0	*6*	4	**1**
Lancashire	1	0	1	na	nd	nd	*3*	2	**1**
Worcestershire	na	1	na	na	na	1	*4*	2	**1**
Total	**98**	**107**	**139**	**149**	**160**	**106**		**759**	

(Note: not all English counties / police forces in England have been able to search out and provide any 'deer' specific information, depending on whether text accident descriptions are held in searchable format on computer; for areas where information was obtainable, in many cases rather fewer records were retrieved in 2005 believed due to changes in how PIAs are coded on new ST19 forms since January 2005). na = data not available.

Table 9 :

Table 9a : Number of DVC reports during 2003-2005 for which road type is known.

Years 2003 to 2005	No. of DVC where road type known	Motorway	'A' Roads	'B' roads	'C' roads	'D' to Un-Classified
Scotland	**3355**	258 (7.7%)	2434 (72.5%)	507 (15.1%)	27 (0.8%)	129 (3.8%)
England	**10678**	777 (7%)	5985 (56%)	2078 (20%)	616 (6%)	1222 (12%)

NOTE – some caution is required when interpreting these results from the overall database of records submitted to the study, as for several reasons the likelihood of the road type and/or road number given for DVC reports received might be prone to overrepresentation of the more major roads: Firstly, contributors reporting deer casualties are more likely to know the road type and or number of the road they are travelling on for major roads when noting a deer casualty or being involved in a DVC themselves. Secondly, the level of reporting of deer casualties via roads maintenance departments is more comprehensive for motorways and trunk roads, than for minor roads. Finally, analysis will also be affected by the relative total length of roads of different type within the road network overall – as shown in the Table 9b below:

Table 9b : Total length of major and minor roads in Britain

The total road length in Great Britain (2004) is 387,674 kilometres. This divides among countries and major road types as follows (km):

	Motorways + all A roads	All minor roads	Total
England	35195 (12%)	262584 (88%)	297779
Scotland	**10682 (19%)**	**46033 (81%)**	**56715**
Wales	4315 (13%)	28865 (87%)	33179
Total	**50192 (13%)**	**337482 (87%)**	**387674**

Table 9c : Variation of Traffic Volume between major regions of Britain in 2004

(source: National Road Traffic Survey – Department for Transport

Country / Region	Billion Vehicle kilometres
Scotland	**42.5**
Wales	**27.3**
England	**428.8**
of which:	
Southeast	86.6
London	32.7
Northwest	56.6
East of England	55.1
West Midlands	48.6
Southwest	47.1
Yorkshire & Humberside	41.6
East Midlands	40.7
Northeast	19.9

Table 10:

DVC rates recorded for the 40 main roads (class B and above) where the highest average numbers of incident records are available per year between 2003 – 2005.

The rate of 'reported' DVC per km per annum is shown calculated as : a) averaged out across the entire length of that road; and b) the highest rate per km for any one stretch of 5km or longer within each road where rates exceeding 1.0 / km have been logged.

(Note: even these high rates of Deer-Vehicle Collisions represent merely those reported to the study, and true figures are likely to be significantly higher in many cases)

Road Number	Total length of route *(kilometres)*	Reported DVCs 2003-2005	Average number DVCs/year	DVC per km/year	Highest rate/km recorded over any 5km stretch (& location)	
A22	83	203	68	0.82	>10 / km	Ashdown Forest
B4506	11	124	41	3.76	>5 / km	Ashridge Forest
B2188	17	37	12	0.73	>5 / km	Ashdown Forest
B4226	9	40	13	1.48	>4 / km	Forest of Dean
B1106	31	125	42	1.34	>4 / km	Thetford Forest
A4136	*26*	67	22	0.86	>4 / km	Forest of Dean
B2026	28	49	16	0.58	>4 / km	Ashdown Forest
A134	111	116	39	0.35	>4 / km	Thetford Forest
M27	49	113	38	0.77	>3 / km	So'ton-Portsmouth
A4146	42	50	17	0.40	>3 / km	nr. Ashridge
A35	159	117	39	0.25	>3 / km	New Forest
A31	120	70	23	0.19	>3 / km	New Forest
B1393	10	26	9	0.87	>2 / km	Epping
A1066	30	60	20	0.67	>2 / km	Thetford Forest
B1107	21	37	12	0.59	>2 / km	Thetford Forest
A1065	64	112	37	0.58	>2 / km	Thetford Forest
A4130	48	47	16	0.33	>2 / km	nr. Henley
A419	58	50	17	0.29	>2 / km	nr. Coates
A38	239	114	38	0.16	>1.5 / km	Halden Hill
A49	228	76	25	0.11	>1.5 / km	Dinmore Hill
A303	152	140	47	0.31	>1.5 / km	Andover
M3	96	142	47	0.49	>1.0 / km	several(Hants)
A11	111	129	43	0.39	>1.0 / km	nr. Thetford Forest
A143	118	83	28	0.23	>1.0 / km	nr. Thetford Forest
M4	310	127	42	0.14	>1.0 / km	several(Berkshire)
A1122	32	43	14	0.45		
A3	65	84	28	0.43		
B2110	34	35	12	0.34		
A14	231	206	69	0.30		
A4074	37	31	10	0.28		
A404	68	56	19	0.27		
A339	49	40	13	0.27		
A10	172	108	36	0.21		
B3078	42	26	9	0.21		
A140	93	52	17	0.19		
A505	78	42	14	0.18		
A420	84	45	15	0.18		
A34	245	127	42	0.17		
A12	202	97	32	0.16		
A47	256	122	41	0.16		

(average recorded number of DVC/km per annum for all major roads (Motorways + A-roads) in England = 0.14/km/ year)

Table 11:

Table 11: Proportion of Deer Vehicle Collisions involving differing species of deer
(During 2003-2005 Species detail is available for 6873 reported incidents)

a) Breakdown among those records submitted by contributors with known knowledge of deer

	Number	Fallow	Roe	Muntjac	Red	Sika	CWD
England	4563	40.4%	32.0%	24.7%	1.4%	0.9%	0.7%
Scotland	450	3.8%	69.1%	0.0%	24.4%	2.7%	0.0%
	5013	37.1%	9.4%	22.5%	3.4%	1.1%	0.6%

b) Breakdown among all records for which detail of species was provided by contributors

	Number	Fallow	Roe	Muntjac	Red	Sika	CWD
England	5307	37.7%	33.5%	25.3%	1.9%	1.0%	0.6%
Scotland	1566	1.5%	76.9%	0.1%	20.5%	1.0%	0.0%
Total	6873	29.5%	43.4%	19.5%	6.2%	1.0%	0.5%

Table 12:

Estimated total population size by deer species in England, and likely annual percentage lost to DVCs based on range of estimated total numbers of DVC nationally (see text – section 7.6)

Species	Population estimate (Munro, 2002)	Population estimate (The Deer Initiative, 2006)	Average of population estimates	Low' estimate of losses to DVC	Upper estimate of losses to DVC	Range of likely losses (% of spring population)
Roe	228000	325000	276500	11200	19200	4 - 6.9
Fallow	104000	262000	183000	14000	24000	7.6 - 13.2
Muntjac	100000	123700	111850	8750	15000	7.8 - 13.4
Red	12500	56000	34250	525	900	1.5 - 2.6
Sika	3300	16800	10050	350	600	3.4 - 6
Cwd	1300	5000	3150	231	396	7.3 - 12.6
Total	449100	788500	618800	35056	60096	5.7 - 9.7

Table 13:

Table 13: Influence of Deer species on Severity of Damage to Vehicles or injuries sustained during DVCs

Total number of DVC where species known	**Fallow**	**Red**	**Sika**	**Roe**	**Muntjac**	**CWD**	**Total**
	2001	102	51	1778	1341	34	5307
	37.7%	1.9%	1.0%	33.5%	25.3%	0.6%	100%
Vehicle Damage reported as:							
Significant damage'	151	30	11	143	56	1	392
	38.5%	7.7%	2.8%	36.5%	14.3%	0.3%	100%
No damage'	118	4	9	159	58	1	349
	0.338	0.011	0.026	0.456	0.166	0.003	100%
Human injuries	9	6	2	9	8	0	34
(where deer spp. Known	26.5%	17.6%	5.9%	26.5%	23.5%	0.0%	100%

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APPENDIX III : FIGURES (see pages 13 - 14)

Figure 1 : Increase in Road vehicle traffic in Britain 1965 – 2004
(measured in Billion Vehicle kilometers driven per annum)

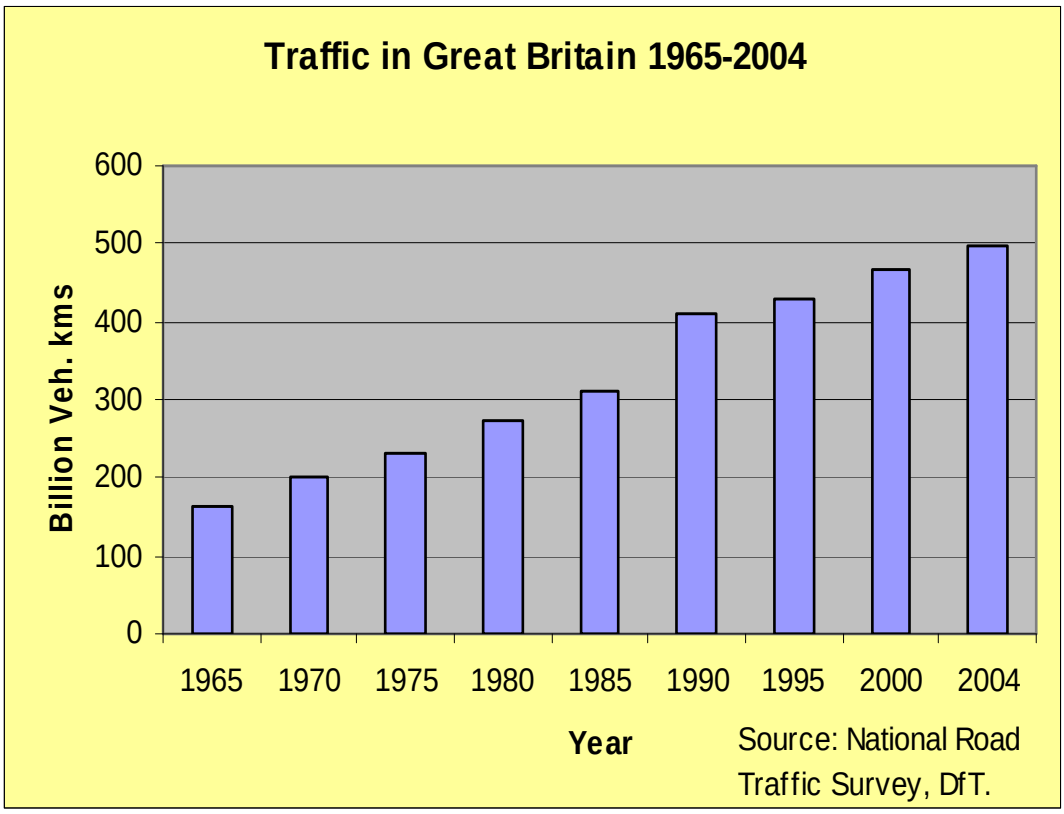
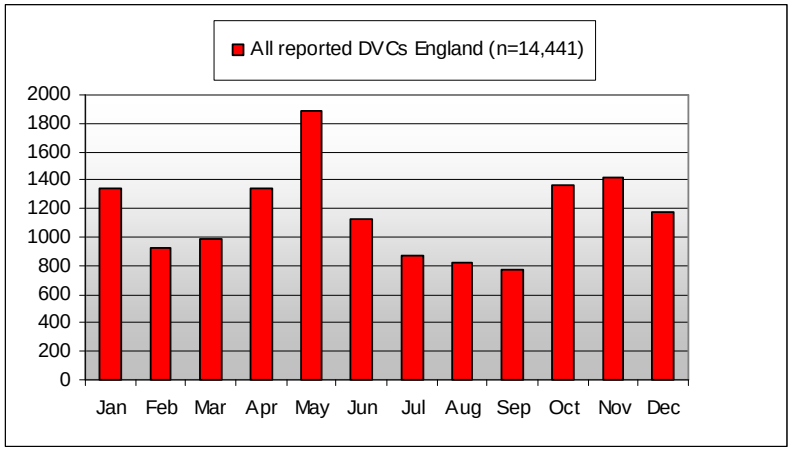
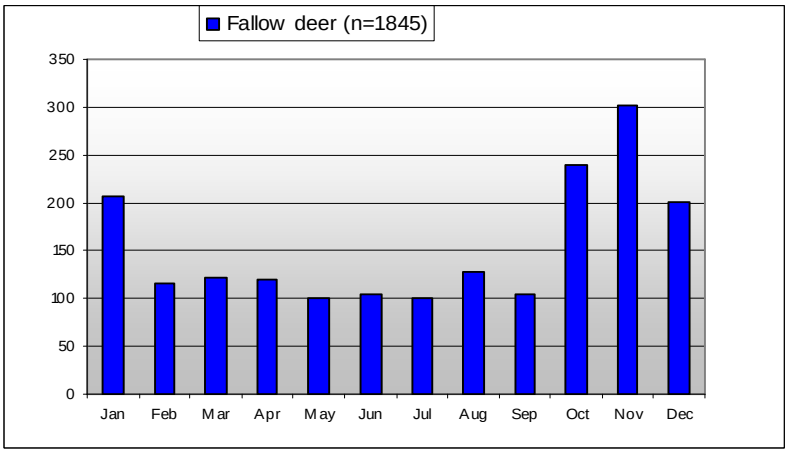
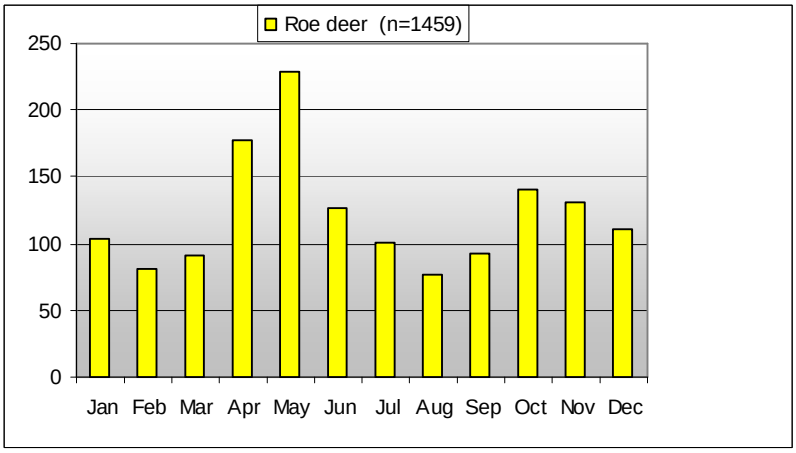


Figure 2 : Seasonal Variation in the occurrence of Deer Vehicle Collisions in England, and comparison of patterns between the most common species involved.







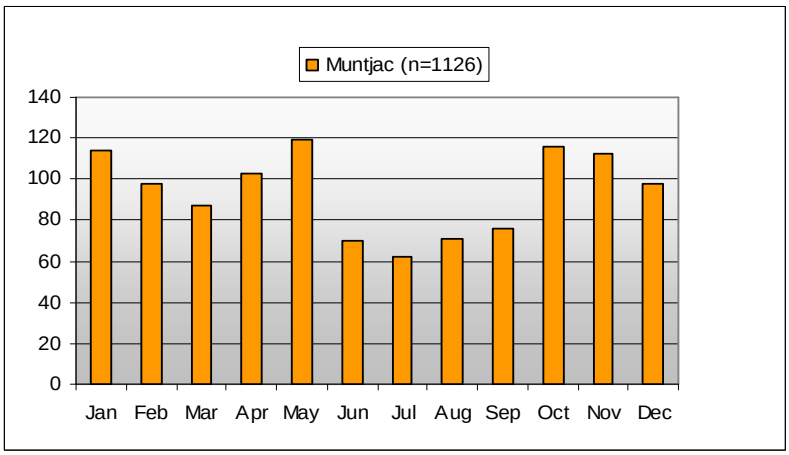
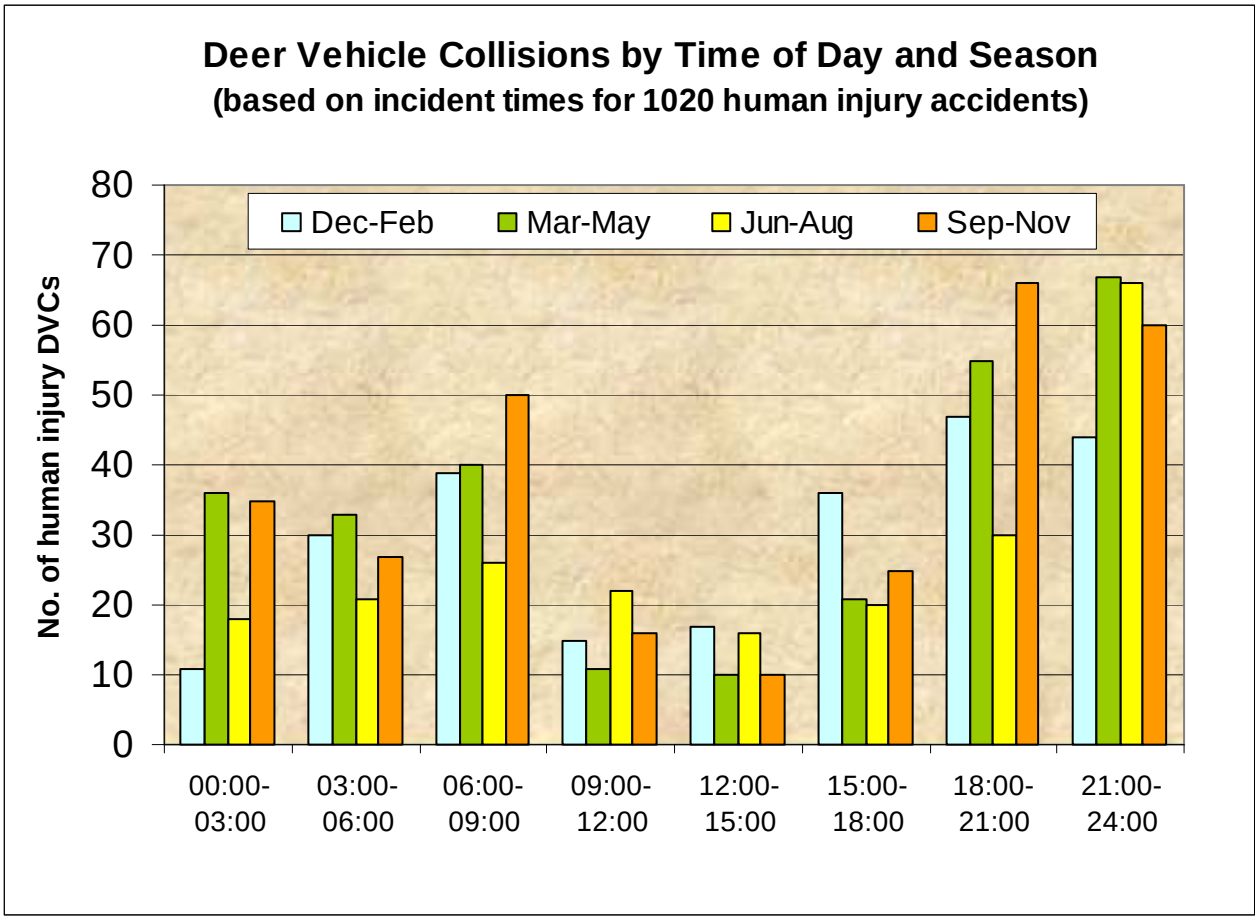


Figure 3: Daily accident peaks and the influence of season.
(analysis is restricted to human injury accidents only, as incidents times tend to be recorded most accurately and reliably for that sub-set of data)



APPENDIX IV :

Discussion of the level of responses, manner of data retrieval and available detail of deer collision records received from among the seven major data source types

i) [U] Animal Carcass Up-lift requests received by Trunk Road Agents or Local Authorities

a) [UT] Trunk road agents

Maintenance of the Trunk Road Network (i.e. motorways and major strategic transport routes) within England is managed on behalf of Highways Agency by a series of Managing Agents, each responsible for one of the 14 main regions of the network, plus a number of additional companies responsible for managing maintenance of specific DBFO roads (design, build, finance, operate). In each case these maintenance agents are generally responsible for handling calls (from police as well as public) regarding debris including animal carcasses which may cause a hazard on trunk route carriageways, and for organising their removal. All 14 MAC agents approached in England have now provided at least some data (including retrospective data form around 2001 onwards for some, though only rather more sparse records are available for others for just one or two years)

Details on deer up-lifts from trunk road agents are generally limited to date, road number and location, with little if any other detail on the incident. For a high proportion of records locations are logged to a good degree of accuracy by reference to the nearest marker-post number if marker posts are present (i.e. for most motorways, and some of the major trunk roads commonly at 100m intervals). Agreements to provide the information needed for our project via managing agents has in some cases been delayed until quite recently due to requiring authorisation via Highways Agency to release data and undertake the relevant searches. In addition, difficulty in extracting such data on animal up-lifts (and deer specifically) from the very large numbers of calls received regarding other incidents on the network, varies widely between agents depending also on the way such data are recorded; while some MAC agents are able to abstract such data very quickly, in other cases comparable abstraction can involve much more work with data from some areas received only late in the project or still outstanding for latest years.

Even with data from a number of agents yet outstanding, records on close to 750 deer up-lifts per year from trunk roads have been received by us for some years, making this a very important if as yet somewhat incomplete source of information. With introduction of better computer systems over recent years, it is likely that in future the great majority of trunk road agents in England, should be able to provide such information. In addition the recent introduction of Highways Agency Traffic Officers who patrol the motorway network to help deal with any traffic incidents, may aid additional and more efficient reporting of DVCs on the trunk network in future.

Conversion of marker-post numbers (where these are the only location detail given) to OS map references has presented some initial difficulties. However, map references have now been provided to the project via Highways Agency for a high proportion of known marker post locations in England; this enables logging incidents to an improved degree of accuracy than early on in the project. Although records from trunk agents are mostly limited to DVCs on trunk routes this data source category also has the potential to provides a well-stratified sub-sample across much of England not least if input from all trunk road contractors can be standardised better in future,

b) [UC] Local Authority Road Cleansing Departments

Responsibility for dealing with requests to up-lift dead animals on all roads other than trunk-roads, within England generally falls to the local authorities (that is District Councils or Unitary authorities) rather than the wider County Councils. In England alone close to 400 such local authorities were approached by us by letter at end 2003 (and in many cases followed up by phone) to request past information and/or records of deer up-lifts to be retained by them in future. Responses received have been highly variable, with useful records of deer up-lifts provided by 39 district councils to date, with a further 20 having indicated that they will try to maintain and send records in future. However, numerous districts did not respond. In many especially of the smaller, more urban authorities this may be due to this being seen as too rare an event to be recorded or worth searching records for, while other authorities may simply not yet have computer recording systems in place to enable ready retrieval of such information.

Potentially input from such district authority road cleansing departments presents one of the widest and comprehensive sampling systems. However, the very large numbers of different small

authorities and often sub-contractors involved, with often quite disparate procedures regarding carcass up-lifts and how these are recorded, makes this an area where, in England, much further enquiries would need to be made to see if standardised records can be made available in future. By contrast, in Scotland carcass uplifts by local roads departments (generally overseen there by Regional Councils equivalent to English Counties rather than at district council level), formed one of the most important and extensive sources of data available for that parallel study (Langbein & Putman, 2006b). Similar co-ordination of data provision in England at county level on our behalf has only been possible by for example, Hertfordshire, where all roads are maintained by Hertfordshire Highways on behalf of the council.

ii) [IC] Insurance Companies / Motor Rescue

Input of information from all but one major insurance company has been very disappointing, with most claims managers stating that they are unable readily to extract those claims relating to deer, as computer logs at best tended to enable extraction of all 'animal' related incidents; suggesting that thereafter searches would require time-consuming (& thus costly) individual retrieval of paper files if feasible at all. A regional claims manager for NFU Mutual did ask all his claims staff to try and record any deer related incidents from beginning of the study, but very few data were received.

By sharp contrast, however, Fortis Group Insurance (with c. 4% of the UK private motor insurance market) have proved an extremely useful source of well stratified DVC data across all of Britain, with information on over 2200 deer related claims available to date from their policy holders during 1999 – 2005 (average >300 per annum). These data although originating from just the one Insurance Group (formerly consisting of several smaller companies) do provide a very wide sample of incidents from throughout the UK, and show the very high potential for equally useful information from other Insurers. Although recruitment of data from additional insurers remains a high priority for the ongoing project, the 2000+ DVC claims already identified by Fortis are based on a very high overall number of private-vehicle motor claims handled by Fortis overall (c. 110,000 – 130000 claims in each of the six years). As such they provide a good basis sample from which to estimate minimum proportions of DVC related insurance claims nationwide which may be expected across the Insurance sector.

Further input from Insurers was recently sought via discussions with the UK Claims Managers Association, and it is hoped that at least some further companies may provide data on DVC claims handled by them during the present extension of data collection for 2006 and 2007. Motor Road-side Rescue Organisations and Car-Hire firms presented a further potential source of information on DVC occurrence. However, discussions to date with the AA and RAC indicate their record systems are unlikely to be able to capture data on DVCs, as incidents are generally logged according to a wide range of differing 'damage' types rather than the causes of the damage or accident. Similar replies were obtained from a number o f national car-hire firms we appoached.

iii) [D] 'Deer-Knowledgeable' Contributors

Contributors with some degree of specialist knowledge of deer (including amongst others professional wildlife/ deer managers, rangers, amateur stalkers, members of BDS, BASC, DCS; Mammal Society, ecological consultants and researchers) were able to provide us with some of the most detailed information. In many cases these contributors are persons called to the incident to attend to injured live deer, and hence able to provide details on the species and sex of animal, and at times information on other accident circumstances, accurate location details, and habitats.

Major Forests / Estates: Systems for detailed recording have been set-up with managers / rangers from major forests with long standing problems with DVCs (including Forestry Commission forests such as Cannock Chase, Thetford, New Forest, The Dean, and Wyre Forest; as well as non-FC forests including Ashridge, Ashdown, Epping, Dinmore, and others). The nine above named sites alone have submitted around 750 records per annum since 2003 (with records for several of these sites also available for many earlier years). These DVC records are now increasingly being maintained by all the sites to a comparatively high level of precision regarding date, time and location (i.e. mostly to within 100 to 500 m), with usually also supplementary details available on species / sex / fate of animal (i.e. whether requiring dispatch or killed outright etc.). Although focussed on specific forest areas with often high deer densities, and thus not necessarily representative of the situation in the wider countryside, these data are particularly useful to look into, for example, species/sex differences in seasonality of accidents, affects of habitats, road

alignment, public access, presence of mitigation / speed limits and so forth, as well as identification of black-spots within the sites themselves.

Further large numbers of similarly detailed records outside such extensive individual forests are also being contributed by Forestry Commission rangers in other regions of the country. Records on deer-RTAs are often logged in the overall national cull databases maintained by FC, and for Scotland this has recently also helped to extract several hundred past records since 2000. While for past records location detail is often limited to forest names or districts, more standardised recording of RTAs has been possible to instigate for future recording to include greater detail on locations when possible. MOD Conservation Deer Management Section provides a further source of DVC incidents dealt with by their deer managers from MOD landholdings throughout the UK.

Regular Individual reporters: Some 150 or more private individuals have to date submitted at least 2 or more, and in some cases over 40 records each. Many of the latter are deer managers / stalkers who are called out by police or others to assist with injured deer; but include also academics, naturalists, ecological consultants and others particularly interested in this subject. Some of these sources provide very extensive and detailed information, and do form the basis of a useful regional network of recorders, not least when combined with records from within organisations such as RSPCA, Wildlife Hospitals and FC Rangers. Nevertheless, it had been hoped that the overall number of members of deer welfare and management organisations such as BDS, and BASC submitting data might have been rather more extensive. This may in large part be due simply to other priorities than to make a written record when having has to deal with a deer casualty often in the middle of the night; while others seeing dead deer at the roadside may often make the wrongful assumption that it will have been reported by someone else.

iv) [R] RSPCA / SSPCA and other Wildlife Welfare/Rescue

The RSPCA [England and Wales], have been able to pull together one of the most extensive and useful datasets provided by any single source towards our project so far. Abstraction of the required detail on individual animal incidents dealt with by RSPCA from their national TAILS call-logging system had been difficult in the past (e.g. see SGS 1998), but following considerable amount of effort on our behalf, the RSPCA have already provided over 8750 deer road casualty records (for the period from 1/1/00 – 30/6/05); in additions recent re-assessment within the RSPCA database suggest that in some years an additional 700-1000 records also relating to RTAs with deer were not previously submitted to the project, and once abstracted are likely to raise the annual total of RSPCA DVC records to over 3000 per year since 2005. In the great majority of cases records relate to calls where RSPCA have been asked to attend to live/injured deer casualties following DVCs, which have then been dealt with either by there own inspectors, or sometimes passed on to vets or other suitable persons able to attend on their behalf. The RSPCA records generally provide good detail on date, time, fate of deer, road number if known, and in many cases the deer species.

Although map locations in TAILS are usually recorded as a full 12fig grid references, unfortunately the reference allocated tends to be based on the post-code locale of the nearest known dwellings rather than the precise location of the incident, and thus accuracy is rather variable. This also potentially introduces some ‘false-accuracy’. Thus, while the existing references are likely to allocate the great majority of incidents at least to within the correct 10km OS grid square (and in practice generally better than 5 km), in order for these same records to be included for our analyses at a finer scale, the true location of every incident would need to be rechecked by us individually. That is, to confirm that grid references based on text descriptions logged during the call or by the attending Inspector are correct, or else re-allocate them to a reference actually locating the incident on the named road. Nevertheless, the very extensive dataset available via RSPCA, which is collected in a broadly comparable manner throughout most of England and Wales, presents a comparatively well-stratified source of information both geographically and across those recent years for which it is available.

SSPCA [Scotland] also provide a good, widespread source of DVC information across Scotland, although not collected in directly comparable format. Details on around 150 DVCs logged by SSPCA are available to us over the last two years, generally in form of the telephone calls log, giving details of dates, times, incident description and general location details from which we ourselves can then allocate at least an approximate grid reference depending on descriptions.

In addition to the RSPCA and SSPCA, a large number of independent Wildlife Rescue/Hospitals were also contacted. While only a small number of these provide regular data, a number have provided extensive input – including notably St Tiggywinkles (100-300 records per year), Wiltshire Wildlife Rescue, and Somerset Secret World. The response to request input from among Veterinary Practices, who in many areas are the first point of contact by police for call-outs to injured deer, has been rather disappointing. Two articles about the project have been run in Veterinary Record during 2003 & 04 to encourage vets to submit information on DVCs attended by them, but to date only around 10 vets regularly submit records, although some additional incidents dealt with by vets on their behalf are also logged within RSPCA call data..

v) [P] Police Control Room Logs

Records of calls made to police about deer/roads are potentially one of the most extensive sources of information throughout the entire country. However, in view of the sheer volume of calls handled by some police control rooms, the majority of Forces approached initially indicated to us that they felt unable to allocate the necessary resources to undertake regular searches of call logs for us. Nevertheless, over the course of this project, active interest and involvement by members of a number of Police Forces has led some to retain records on computerised "Station logs" of any enquiries/reports received from the public in relation to involvement in DVCs, whether or not these have resulted in injury or damage. So far a sample of seven Forces in England have each been able to abstract several hundred deer road kill / DVC records per annum for us in this way (including Lincolnshire, Cumbria, Lancashire, Gloucestershire, Norfolk (incl. part Cambs), and Dorset). Similar level of Station log data is also available for a number of Scottish Forces, including in particular Tayside, Grampian and Central. In each case, however, it is difficult to ascertain what actual proportion of calls relating to deer received are likely to be captured by such searches; and as such these data-sets tend to be most useful to i) provide a minimum estimate or cross-check of minimum numbers of deer incidents in that region, and ii) adding to the overall numbers of incidents logged.

Police control room records are also, however, the source with greatest potential for overlap / duplication with information received from a number of other sources; as in many cases information received by police will be passed on by them either to someone able to assist with live/injured deer at the road side (e.g. stalkers / vets / animal rescue) or to the local or trunk roads authority for removal of the carcass. One of the most problematic aspect of records which may be passed from police to local roads uplift departments is that the date of the initial call taken by police may differ sometimes by one or more days from the dated log of an animal being removed from a roadside by local authorities; and as a consequence there is some risk of duplication if we were to accept all records with differing dates; equally there is some risk of wrongful exclusion of some records occurring close to the same location where another recent record is already logged, not least as incidents may well happen in close succession at the same location. Nevertheless, to avoid duplication, in general we recorded once only any incidents reported by two different sources for the same or closely similar location unless dates are separated by three or more days; that is, unless it is clear from other details (e.g. species / sex) that they are clearly separate incidents.

vi) [ST] Human injury (ST19) Accidents and other Police 'damage-only' accident records.

Every Police Force in the UK is required to record and forward a detailed statutory return (ST19) to the Department for Transport for all those road traffic incidents where human injury has occurred. Unfortunately, on the ST19 forms for incidents when an animal is implicated as a carriageway hazard noted present at the accident (which generally make up only c. 1- 1.5 % of the 200,000 to 250,000 PIAs reported annually to Dft in the UK) this distinguishes at best between the hazard noted being identified either a 'dog', or else as 'other animal or pedestrian', without any further details of animal types noted. ST19 data as currently submitted and collated by Dft therefore do not enable systematic centralised identification of all those incidents which are believed to have involved specific types of animals such as deer. Even though specific attribution to deer can not be made from records collated centrally, the Dft agreed to provide us with information they do hold on the dates, locations, accident reference and police forces concerned for all human injury accidents involving animals as a carriageway hazard over the last five years. This overall data is useful in verifying and cross-checking against the more detailed information (as below) provided to us by at least some but not all police regions nationwide.

Fortunately, many Police Forces and/or Council Roads Departments do maintain fuller details for injury accidents than required for submission to Dft, including often a brief accident description recorded by the attending police officer. Many of the individual police forces concerned (or else in some areas County or Regional Road Safety or Accident Investigation authorities who may collate these same police accident data in further detail) have kindly agreed to search their own databases for accident descriptions that include key words such as <deer> or < stag > to attempt to extract any incidents implicating deer. Although this does not necessarily capture all existing incidents with deer, and will exclude any where accident descriptions state simply that 'an animal' of unknown type was involved, such searches can be very helpful to extract and provide at least a minimum indication of those involving deer. For regions or counties where police data can be made available on all animal related RTAs including also the brief accident descriptions, this can also help to determine the average proportion of animal related incidents contributed by those involving deer across a sample of regions; and in turn allows estimation of the total number deer related PIAs as a proportion of all those 'animal-related' incidents collated annually for the UK as a whole by Dft. For such ST19 records which are positively identifiable as involving deer, the level of detail available is generally good, and will usually include information on date, times, severity of human injury sustained (as slight / severe / fatal) , road number and class , and location (often as OS grid reference).

Some Police Forces, although by no means all, do also keep records in similar detail to requirements for human injury accidents for such 'damage-only' accidents which are reported to or are attended by police. Where possible we requested for these damage-only incidents also to be included in searches undertaken on our behalf .

For England we have so far been successful in obtaining some ST19 type data covering just over half the country (incl. for c.26 of the 40 major counties, and in addition often covering also areas of unitary authorities falling within former county boundaries), with data mostly available for between two to five or more years. In some instances the relevant police force or Council have provided (non-confidential) details of all incidents in the former ST19 'Carriageway Hazard = 5' (other animal or pedestrian; now equiv. CH 7 = animal) category; from which we were able to filter out all those relating to 'deer' or 'stag' etc. using searches on the accident description; while other counties/regions have done such filtering on our behalf. Although we are still awaiting details from a number of other counties, within England and Wales, a small number have replied saying this will almost certainly not be feasible, due to the appropriate 'accident description' field not being held on record there. In many instances, however, in view of other police work priorities our requests for up-dates of such data can not always be dealt with quickly, and in some cases can take quite a long time to be processed by individual forces / counties, with accident database generally not fully complete until six to nine months after year end. While most records to end 2005 have now been received some still remain outstanding, but currently provide comparable coverage for about 75% of England.

vii) (G) General Public / Private Individuals

Aside from the various organisations above, the number of differing private individuals submitting information either via the web-site or record forms by post extends to close to 500. Some of these are members of the general public reporting incidents they themselves have been involved in, including in some cases reports of PIAs, 'damage-only' accidents, as well as records where they may just have seen dead deer at the roadside; and often include interesting notes on circumstances surrounding the accident, and more general comments on areas which they feel constitute black-spots. Some of the records included in this category may at times also include persons who may possibly be deer stalkers or other 'deer-knowledgeable' sources not known to us, but which we cannot classify as such unless indicated in some way by stating membership of deer related or wildlife organisations. While some members of the public contribute only a single record when involved themselves in a DVC, most contributors have been contacted by the project since to encourage continued regular contribution to the database whenever they note deer casualties at the road side. Input from the general public via the project web-site has made up a useful but only fairly contribution to overall data collated in the database, and on its own does not present a very well stratified sample as input tends to be affected by for example whether there has been more local media coverage of DVC issues in some areas than others.