Pesticide Poisoning of Animals 2001:

Investigations of Suspected Incidents in the United Kingdom

A Report of the Environmental Panel
of the Advisory Committee on Pesticides

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2002

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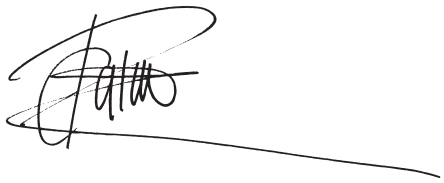
Preface

All years are exceptional in farming. But there can be no doubt that 2001 was exceptionally exceptional, with the Foot and Mouth Disease (FMD) outbreak raging. This had at least two consequences for a scheme that investigates deaths in wildlife and pets possibly arising from pesticide poisoning: a restricted access to the countryside and an understandable lack of interest in events not directly related to FMD. So no wonder the total number of incidents recorded in the UK Wildlife Incident Investigation Scheme (WIIS) for 2001 was down on previous years. Less expected, though, was an increase in the proportion of total incidents ascribed to deliberate abuse. These represent the highest proportion of incidents ever reported by the WIIS. All might be explained as a statistical aberration of the smaller sample, especially since the absolute number of abuse incidents reported for 2001 (81) was lower than for 2000 (93). But there may be grounds for concern here that should sharpen our focus for future years.

An "incidents" scheme is always likely to be an imperfect reflection of what is happening in the real world, but especially when reporting has been as seriously impaired as it was for 2001. Yet we need this kind of feedback because we need to be able to check that our assessments, management schemes and enforcement practices are working. A positive feature for future reporting is the increasing access to the countryside. We need to ensure that those walking and working in the countryside are easily able to report likely incidents so that we might broaden the "sample". This is surely the foundation on which we should build for future years.

As usual all those involved with the analysis and preparation of this current Report have done a splendid job in ensuring clarity and objectivity in the final product. It cannot be over-emphasised, though, that their work depends absolutely on the reporting procedures. I am sure they, like me, would welcome any ways of improving the effectiveness of these procedures.



PROF. P. CALOW
CHAIRMAN
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Summary

In the UK the Wildlife Incident Investigation Scheme investigates deaths of wildlife, including beneficial insects, pets and some livestock, where there is strong evidence to suggest that pesticide poisoning may be involved.

The Scheme provides a unique means of post-registration surveillance of pesticide use, so that registrations can be revised if necessary. In addition, it provides a measure of the success of the pesticide registration process, and helps in the verification and improvement of the risk assessments made in the registration of compounds. Evidence from the Scheme may also be used to enforce legislation on the use of pesticides and the protection of food, the environment and animals.

The data reported during 2001 has been influenced by the Foot and Mouth Disease (FMD) outbreak. Data for England was most severely affected (see Table 23), with the number of reported incidents nearly halved. There were 346 suspected poisoning incidents registered by the Scheme in 2001. The causes were determined in 173 incidents of which 109 (32% of those registered) were pesticide poisoning. In the remaining incidents either sufficient information or suitable tissues were not available, and/or pesticide residues were not detected (see Table 1).

There were three incidents arising from the approved use of pesticides (see Figure 1) in 2001 (includes one bee incident). This compares with sixteen in 2000 (includes seven bee incidents). Proportionately, this is 3% of pesticide incidents reported in 2001 compared with 10% in 2000. This is a decrease in number and proportion of approved use incidents, but it is not exceptional when compared with years prior to 2000 (see Table 24).

The number of misuse incidents (see Figure 1), often the result of the careless use of pesticides, was 7 in 2001 (includes one bee incident). There were 23 incidents in 2000 (includes one bee incident). This represents 6% of confirmed poisoning incidents in 2001, compared with 14% in 2000. The number and proportion of misuse incidents in 2001 is the lowest reported by WIIS since 1994 (see Table 24). However, this is almost certainly attributable to the impact of restrictions associated with FMD, rather than a real reduction in pesticide misuse.

Deliberate abuse of pesticides was identified in 81 incidents compared with 95 incidents in 2000. This represents 74% of all pesticide incidents (see Figure 1), compared with 59% in 2000. This is the highest proportion of abuse incidents reported by WIIS, but it is likely that FMD has influenced the 2001 data.

A further 17 poisoning incidents (16%) were attributed to unspecified use, including three bee incidents (see Figure 1). In 2000 there were 24 incidents (15%) (includes five bee incidents), where there was insufficient information available to identify the source of the poisoning.

For honeybees, there were 5 pesticide incidents involving bee deaths out of 23 incidents investigated (see Table 18), compared to 2000, where 13 pesticide incidents were confirmed out of 48 investigated.

There was one incident where a veterinary product was thought to be involved (see Figure 1), compared to 4 in 2000.

As in previous years, all incidents arising from the approved use and the illegal use of pesticides were thoroughly investigated. These are reported in Part 1 of the report. Where appropriate and with sufficient evidence, prosecutions were undertaken by Defra and other agencies (see

enforcement action) for the illegal abuse or misuse of pesticides. However, incidents of misuse or approved use can also highlight problems with the approval conditions or the label instructions for a pesticide and can provide valuable feedback into the regulatory process.

Of the 346 suspected poisoning incidents, vertebrates were involved in 288 incidents; beneficial insects in 23; suspected baits and suspicious samples, where no poisoned animals were found, in 35. These are reported in Part 2 of the report.

In England, 133 incidents were reported, of which 51 (38%) were found to be caused by pesticides; Scotland had 127 incidents registered, 35 (28%) were found to be caused by pesticides; Wales had 35 incidents registered, 6 (18%) were found to be caused by pesticides; and in Northern Ireland, 52 incidents were reported, 17 (33%) were found to be caused by pesticides (see Table 2 and Figure 3).

The number of suspected poisoning incidents registered by the Scheme in 2001 has been affected by FMD and it is impossible to characterise the extent of this impact. Overall, the proportion of pesticide incidents is the same as 2000, at 32%, but there are regional differences contributing to this proportion (see Table 2 and paragraph 99).

Twenty-five agricultural chemicals were identified in the pesticide poisoning incidents (see Table 4); Thirty-two compounds were found in 2000.

Introduction

1. In the United Kingdom, before approval is granted for the use of pesticides, the impact on wildlife and other animals, including beneficial insects such as honeybees, has to be assessed. If it is thought that an unacceptable risk may arise, restrictions on use in order to protect wildlife and domestic animals may be imposed in the conditions of approval under the Control of Pesticides Regulations (COPR) 1986 (as amended) and the COPR (Northern Ireland) 1987 or Plant Protection Products Regulations 1995, as appropriate.

2. The results of the four schemes, which investigate possible pesticide poisoning, which operate in the United Kingdom under the Wildlife Incident Investigation Scheme (WIIS), are reported. Fish are not usually covered by the Scheme.

(1) The Department for Environment, Food and Rural Affairs (Defra) and the Welsh Assembly Government Agricultural Rural Affairs Department (ARAD) examine cases of suspected poisoning by pesticides that involve vertebrate wildlife (chiefly birds and mammals) and companion animals in England and Wales. Over the years this scheme has widened its scope and now is able to detect most of the pesticides thought likely to cause animal deaths (Hardy *et al.,* 1986).

(2) Defra and ARAD investigate mortality of bees, usually reported by beekeepers, in England and Wales. This part of the WIIS has been in operation since 1981 (Fletcher *et al.,* 1994b).

(3) In Scotland, the Scottish Executive Environment and Rural Affairs Department (SEERAD) operates a scheme covering incidents in all categories.

(4) In Northern Ireland, the Department of Agriculture and Rural Development (DARD) operates a scheme in the same way as SEERAD. This was introduced in 1992 in line with the existing schemes operating in Great Britain. Prior to that a scheme operated on an informal basis.

3. The majority of this post-registration surveillance work carried out by Government Departments is funded by the agrochemical industry, under the Food and Environmental Protection Act 1985 (FEPA).

4. During the reported year, incidents shown to involve pesticides were assigned to one of four categories:

Approved use of the product, according to the specified conditions for use;

Misuse of a product, by careless, accidental or wilful failure to adhere to the correct practice;

Abuse of a pesticide, in the form of deliberate, illegal attempts to poison animals;

Unspecified use, where the cause could not be assigned to one of the above categories.

There is also a category of Veterinary use, where there is known involvement of veterinary products in incidents. These are investigated incidentally rather than deliberately. Veterinary incidents may include abuse, misuse, approved use or unspecified use of these compounds. Incidents suspected of involving veterinary medicines should be reported to the Veterinary Medicines Directorate (Tel. 01923-338427).

In addition, some reported animal deaths are subsequently found to be the result of causes unrelated to pesticide use, such as disease, starvation, trauma or other non-pesticide poisonings.

5. The results of investigations are reported to the Environmental Panel of the Advisory Committee on Pesticides (ACP). The information provided may result in a re-evaluation of the approvals previously granted to that product, or may affect the progress to full commercial use of products currently under provisional approval. Information from incidents assist in the validation and improvement of the risk assessment procedures for new and existing compounds.

6. In cases where there is evidence to indicate misuse or deliberate abuse of a pesticide, the results of investigations may also result in legal enforcement. Under FEPA and COPR, all aspects of pesticide advertisement, sale, supply, storage and use are fully regulated. If incidents reveal contravention of this Act, or of other legislation such as the Wildlife and Countryside Act 1981, Wildlife (Northern Ireland) Order 1985, Protection of Animals Act 1911, and the Welfare of Animals Act (Northern Ireland) 1972, then prosecution or other forms of enforcement may ensue. Any investigations carried out to enforce the legislation are paid for by the Home Departments.

Investigation procedures are described in Appendix 1.

The Campaign Against the Illegal Poisoning of Animals

7. During 2001 interested Government Departments led by Defra, continued the long-term Campaign Against the Illegal Poisoning of Animals. There has been much press and media coverage throughout the years and as a result the Scheme is now becoming much more widely known. The provision of a freephone number (0800 321600) has had a continuing good response, allowing ready access to the Scheme.

8. To prevent large numbers of dead animals being submitted and analysed, with the consequences on financial and resource implications, strict criteria are applied to potential incidents prior to acceptance. Incidents are accepted if they involve the death of animals or beneficial insects and where the approved use, misuse or deliberate abuse of pesticides may be implicated. Incidents involving the presence of baits intended or likely to cause deaths of animals are also accepted. Incidents are rejected for further analyses where they obviously involve trauma or disease, or are confirmed as doing so after veterinary examination. Unless there are special circumstances, substantial delay in notification of incidents or the unavailability of bodies or baits also leads to rejection.

Part 1: Incidents in 2001

Number of incidents in 2001

9. All incidents that were registered to WIIS, and which were investigated during 2001 are included in this report. There were 346 suspected poisoning incidents registered by the Scheme in 2001. The cause of death or illness (including pesticides and other chemicals, trauma, starvation and disease) was determined in 173 incidents (50% of those registered). In 109 of these incidents (32% of those registered) pesticide poisoning was identified. In the remaining incidents either sufficient information or suitable tissues were not available, and/or pesticide residues were not detected. Details of the animals and chemicals involved in all of the incidents reported to the Scheme are given in Part 3 of this report. For previous comparable data see Fletcher *et al.*, 1995, 1996, 1997, 1998, 1999 and Barnett *et al.*, 2000, 2002.

10. There were 3 incidents of approved use, 7 of misuse, 81 of abuse and 17 of unspecified use, where the source of the compound remained unknown despite thorough field investigations. Additionally, there was one incident thought to involve a veterinary product. Positive enforcement continued to be a priority in 2001 with prosecutions being taken against offenders following the investigation of incidents. These incidents together with any regulatory and/or enforcement activities are reported in Part 2 of this report.

Table 1: Numbers of incidents investigated in 2001

	Incidents investigated	Pesticide poisoning incidents	Other cause of death found
Vertebrate wildlife	176	55 (31%)	48 (27%)
Livestock	4	0	1 (25%)
Companion animals	109	34 (31%)	14 (13%)
Beneficial insects	23	5 (22%)	1 (4%)
Suspected baits and suspicious substances	35	16 (46%)	not applicable
TOTAL *	**346**	**109 (32%)**	**64 (18%)**

* Animals from more than one category may be involved in a single incident.

Part 2: Incidents in 2001 where regulatory and/or enforcement action was considered

Approved use incidents

Introduction

11. Information from the WIIS on incidents suspected to have resulted from approved use is very important, and is fed into the pesticide regulatory process (see Fletcher and Grave 1992). Where significant concerns are highlighted, thorough consideration is given to the most appropriate action needed. If a suspected approved use incident arises, the approval holder is contacted as a matter of course, and is given the opportunity to comment. Useful feedback from the companies has been received. Farmers, growers and other members of the public are strongly encouraged to report any poisoning incident which may have resulted from the approved use of a pesticide to their local Defra Rural Development Service office or freephone 0800 321600.

Incident summaries

12. Several ducks and a heron were submitted from a pond area near Forfar in early April. A relatively high mortality rate had occurred in a population (~150) of mostly mallard during the first two months of the year. The owners of the property had observed a green paste material, which dried to a powder, both in the area used by the ducks and on two goose eggs that the owners did not recall placing. There was a history of problems with neighbours and the owners were concerned that malicious poisoning was taking place. Post-mortem examination of the ducks revealed extensive internal haemorrhages, whilst the heron was emaciated and probably died as a result of starvation. Initial field information indicated that a 'Slaymor' rodenticide formulation had been in use for vermin control on the property. The gizzard material from one of the ducks was a dark green/blue colour, which may indicate ingestion of the bait material which carries a blue dye. Bromadiolone, the active ingredient of 'Slaymor' was identified in liver tissues from some of the ducks. The residues (0.34 to 0.38 mg/kg) were consistent with anticoagulant poisoning being the cause of death. A sample of the green paste, probably faecal material from the ducks that had ingested the rodenticide bait, was also shown to contain bromadiolone (0.42 mg/kg). Field investigation established that tunnel bait boxes, using wheat-based formulation, were in use on the property. The boxes had baffles to limit movement of the bait material from the central hopper area into the tunnels. The tunnel length was judged to have been insufficient to prevent access by the ducks to any bait that was transferred into the tunnel area. The owners were advised on better bait box design to meet the prevailing circumstances on their property.

13. Two hives in two separate apiaries had high numbers (18,000) of dead bees. The remaining bees were abnormally aggressive. Analysis of bees from one of the hives showed dimethoate at 0.045 µg/bee. This level of residue is consistent with bees having died of poisoning with this insecticide. A field of beans located approximately equidistant from both apiaries was well past flowering but there was evidence of what had been a heavy black bean aphid infestation. The crop had been treated with a mixture of dimethoate and tebuconazole according to approval, three days before the incident. Spray records indicated

that application was made between 15:00 and 17:00 i.e. when honeybees would have been actively foraging. It is likely that the bees died as a result of feeding on aphid honeydew, which contained high residues of dimethoate.

14. Two kittens became weak, dull, depressed and unresponsive, unable to stand unaided and had a very high temperature. They were hospitalized for 5 days and given intravenous fluids and made a full recovery. No samples were taken for analysis but the vet who treated the kittens was confident that their symptoms were the consequence of exposure to a benzonitrile. Five adult cats were not affected. Contractors had been observed making spot treatments with 'Sierraron G' (containing dichlobenil) according to the conditions of approval in the vicinity of where the kittens were playing. Dichlobenil is a benzonitrile. Circumstantial evidence suggests that the kittens' symptoms were the result of exposure to dichlobenil following approved use of 'Sierraron G'.

Misuse Incidents

15. A number of incidents were reported where misuse of pesticides was identified (see Figure 1). These often result from poor storage, spillage, chemicals not being used in the approved manner (rodenticide baits being left uncovered, spraying of crops in full flower), or compounds being disposed of in an inappropriate way (Barnett and Fletcher, 1998). The chemicals found in this category tend to be predominantly rodenticides, and molluscicides. In 2001, there were seven incidents, including one honeybee incident (6% in this category, involving five different compounds). In the previous year there were 23 incidents (14%, involving 15 different compounds), including one honeybee incident.

16. The misuse incidents involving slug pellets, containing metaldehyde, were associated with uncleared spillages. In one incident a dog was exposed, but in the other two incidents no casualties were found. Potentially, wild animals such as badgers and foxes, which are likely to find the pellets palatable, are equally at risk in such circumstances. The fact that they are likely to skulk in cover once affected, unlike dogs that are in close proximity to humans, will mean that they are less likely to be found and reported to the Scheme.

17. Uncovered rodenticide baits were found in three misuse incidents, involving three different compounds; brodifacoum, coumatetralyl and chlorophacinone. Two of the incidents involved dogs and in the other incident, only exposed grain was found.

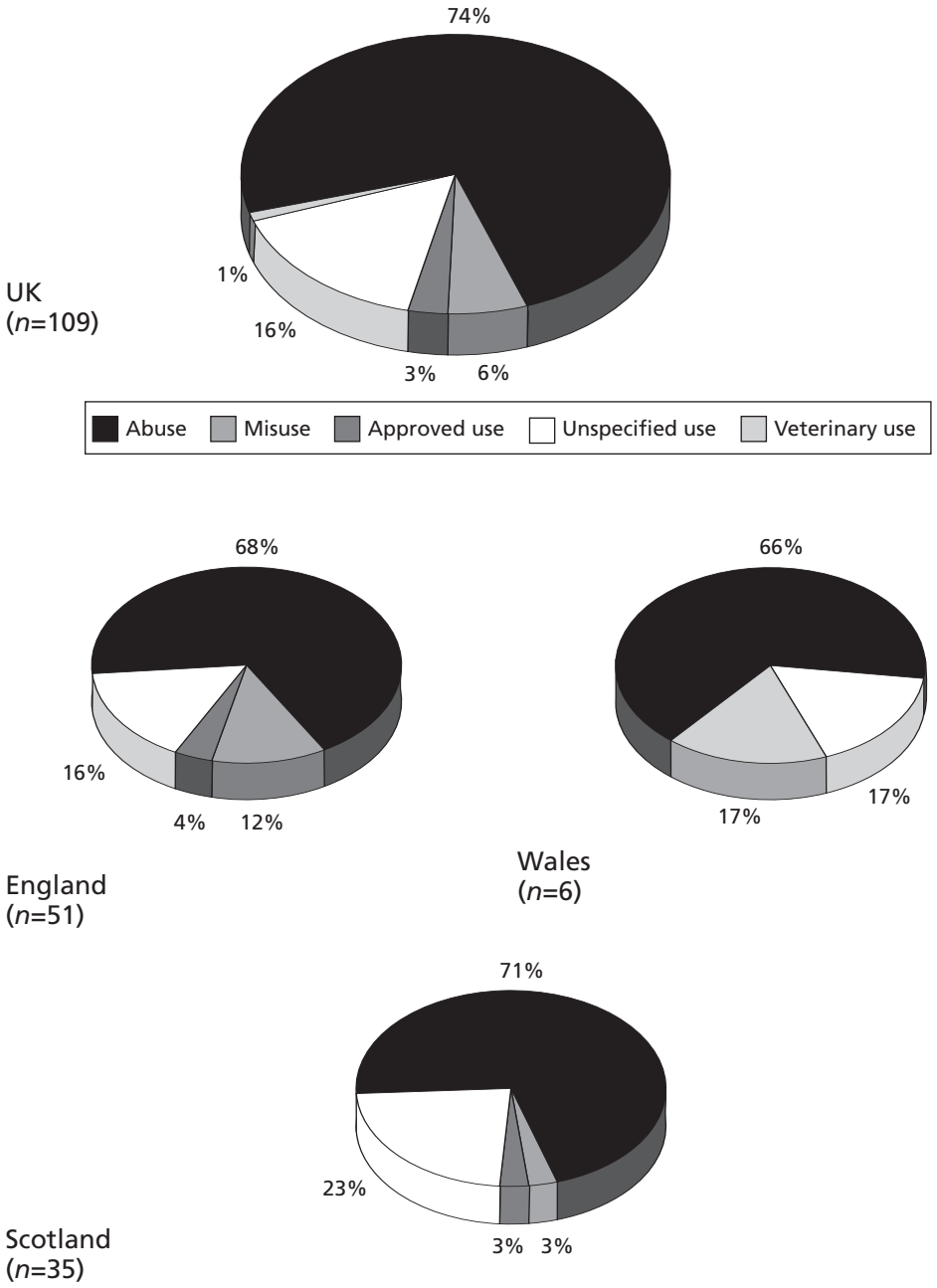
18. The remaining misuse incident involved honeybees and the use of dichlorvos to control wax moth.

19. Further information about these incidents can be found in Appendix 2.

Abuse Incidents

20. During 2001, an exceptionally high proportion of incidents involved the deliberate abuse of pesticides (see Figure 1, no incidents involving beneficial insects in this category). The number of poisoning incidents attributed to abuse was 81 (74% of pesticide incidents); 95 were found in 2000, which represented 59% of pesticide incidents.

Figure 1: Proportion of all incidents by category of pesticide involvement in 2001 (All pesticide incidents in Northern Ireland were abuse).



21. These abuse incidents involved 17 different compounds, compared with 19 in the previous year. Carbofuran and alphachloralose account for just over a half of these abuse incidents and aldicarb and metaldehyde are the next most abused compounds. Birds, mainly raptors, and some cats are the species usually involved in the alphachloralose and carbofuran incidents. The aldicarb and metaldehyde incidents predominantly involve baits, cats and dogs. The number of incidents attributable to these compounds are: carbofuran, 22 (27%); alphachloralose, 21 (26%); aldicarb, 7 (9%); and metaldehyde, 7 (9%). Five of these incidents involved more than one compound: aldicarb and bendiocarb; aldicarb and benfuracarb; mevinphos and phosphine; warfarin and bromadiolone; warfarin, bromadiolone and

brodifacoum. Carbofuran, aldicarb and alphachloralose were the compounds most found in abuse incidents in the previous year. Abuse incidents in 2000 involved: carbofuran, 24 (25%); aldicarb, 16 (17%); and alphachloralose, 15 (16%).

22. There were six (7%) incidents involving the abuse of paraquat, mostly dogs were involved, but one incident involved a cat. In 2000 there were three abuse incidents involving paraquat.

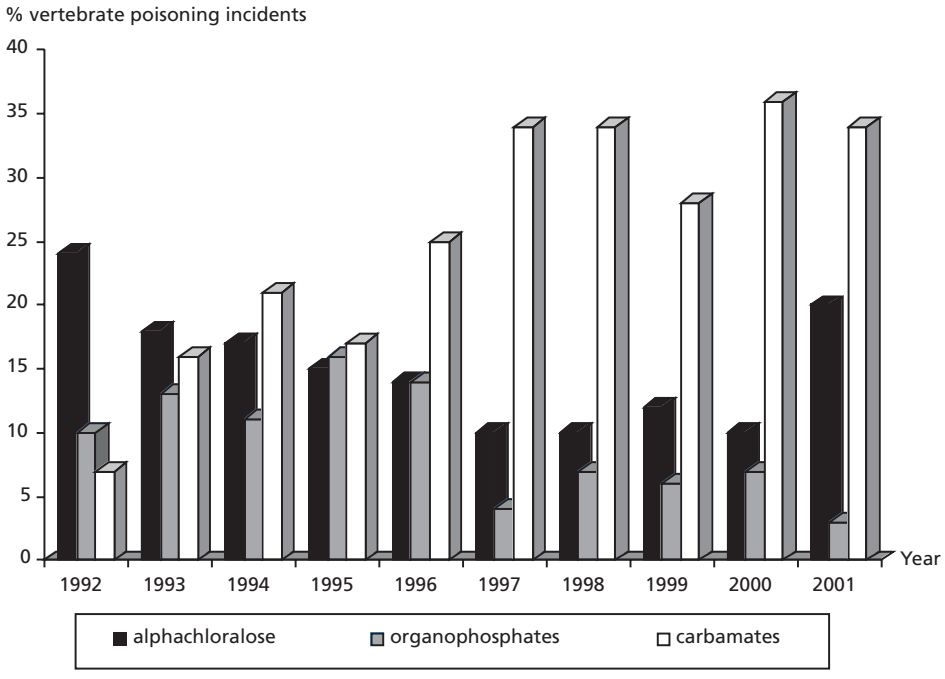
23. Strychnine abuse was identified in only two incidents during 2001, involving baits and dogs. This is a decrease on 2000 where there were eight incidents reported. There was only one incident involving a vertebrate gassing agent, where phosphine was found in a dog and a sample (mevinphos also found, see paragraph 49).

24. Carbamate abuse incidents, other than aldicarb and carbofuran mentioned above, were associated with seven (9%) incidents (four incidents in 2000). In three incidents bendiocarb was associated with, baits, samples, crows, magpies and feral pigeons. In two incidents methomyl was found in baits, dogs and foxes. In the remaining two incidents, benfuracarb was found in a seized sample and methiocarb in badgers. One bendiocarb and the benfuracarb incident also involved aldicarb.

25. The number of abuse incidents involving anticoagulant rodenticides is similar to 2000, with nine (11%) reported in 2001 and ten (13%) reported in 2000. Some incidents involved poison baits, with no animal casualties found, and others a golden eagle, fox and dogs. There were five incidents involving bromadiolone (one also involved warfarin and another one involved, warfarin and brodifacoum), three incidents involving warfarin (this includes two incidents which also involved other rodenticides), two incidents involving brodifacoum (this includes one incident which also involved other rodenticides), and two incidents involving difenacoum.

26. The abuse of mevinphos occurred in only one incident in 2001, compared to five incidents in 2000 (see Figure 2). The incident involved a badger and a bait and it also involved phosphine in a dog and a sample. In the final abuse incident, Jeyes fluid was poured into a garden pond killing fish and frogs.

Figure 2: Changing trends in the use of some pesticide classes in vertebrate incidents.



Unspecified Use Incidents

27. Every year there are always a number of incidents where the source of the compound is unknown, despite detailed field investigations. Animals may take some time to die after exposure, especially with certain chemicals such as anticoagulant rodenticides, and in this time may travel some distance. In 2001, there were 17 incidents of unspecified use (15% of pesticide poisoning incidents), including three bee incidents; there were 24 in 2000 (15%), including five bee incidents. There were 8 different compounds detected in these incidents and there were 15 in the previous year.

28. Dogs and metaldehyde were associated in two unspecified use incidents, which are likely to have arisen from either uncleared spillages of slug pellets or from the use of slug pellets to prepare poisonous baits. However, insufficient field information prevents them from being classified as misuse or abuse incidents. The other, vertebrate related, unspecified use incident involved feral pigeons and the seed treatment, imidacloprid (see later sections).

29. The compounds identified in the three honeybee incidents were, bendiocarb, dichlorvos and permethrin. It is possible that the bendiocarb was from a feral bee treatment, but none were known of in the area. The dichlorvos may be from a beekeeper treating hive frames for wax moth.

Anticoagulant rodenticides

30. There is increasing concern over the number of incidents involving anticoagulant rodenticides, particularly where birds of prey, mainly red kites, are killed. Therefore these incidents are being highlighted in this separate section. Given the species involved and the size of the residues present, it is likely that rodent control operations are the cause of these incidents. These compounds take some time to poison animals, as their mode of action is to delay the onset of symptoms so as to prevent the intended target species, rodents, from becoming bait shy. This combined with a large hunting area, makes it difficult to trace all sources of rodenticide use in an area. Birds of prey are almost certainly being poisoned by eating poisoned rodents, secondary poisoning, and this emphasises the need for thorough carcase searching during baiting operations. There have been some training initiatives undertaken by Defra and advice leaflets produced by English Nature highlighting the risks to red kites within the release areas. A leaflet has also been produced for Scotland by the RSPB, in partnership with Scottish Natural Heritage, Scottish Executive and Partnership for Action Against Wildlife crime.

31. During 2001, there were 11 unspecified use incidents involving these compounds (there were eight in 2000). Two of these incidents involved red kites (bromadiolone, brodifacoum and difenacoum in one red kite and difenacoum in the other), four involved buzzards (bromadiolone in two incidents, difenacoum in one and difenacoum and brodifacoum in the other). Bromadiolone residues were found in four seperate incidents, involving a tawny owl, a barn owl, a dog and a fox. Finally, a badger with a difenacoum residue was also found. In 2000, there were only two incidents involving birds of prey and the unspecified use of anticoagulant rodenticides, but there were seven reported in 1999. Although rodent control operations were known of in the vicinities of many of these incidents, it was difficult to establish all sources of rodenticide use in each area, which is why these incidents have been classified as unspecified use.

32. During 2001, raptors continued to be screened for anticoagulant rodenticides, even when death was attributable to the abuse of another pesticide. In 2000, there were eight incidents, five red kites and three buzzards, where deaths were attributed to abused pesticides, but

exposure to anticoagulant rodenticides had also occurred. In 2001, there have been 11 incidents, seven red kites and four buzzards, where death was attributed to carbofuran (six incidents) or alphachloralose (five incidents), but anticoagulant rodenticides were also detected. In six of these incidents bromadiolone was detected, three incidents were difenacoum and two incidents were a mixture of both of these compounds. There were also another three buzzards, two where no cause of death was found and one that was attributed to trauma, where small residues of difenacoum were found (flocoumafen was also noted in one buzzard).

33. Regionally, there were eight incidents from Scotland and the remaining three were in England. In the eleven incidents where abuse of other compounds was reported, six of the incidents were in Scotland, four were in England and one in Wales.

Enforcement Action

34. Where the information collected on an incident indicates that serious breaches of pesticides legislation may have occurred, appropriate formal investigation and enforcement action may be taken.

35. The fines and costs imposed by the courts, together with the publicity such cases attract, are an incentive to use pesticides properly. Even where there is insufficient evidence to prosecute, the fact that a Government investigator has been seen to be enquiring about an incident is often sufficient to dissuade the culprit and others from re-offending. Government Departments remain committed to use all available enforcement methods to help stamp out illegal poisoning.

36. In England, a total of four incidents were referred to Defra Investigation Officers for further investigation. No prosecutions have arisen from these cases in 2001, as all four cases are still to be resolved. Enquiries into these cases continued into 2002.

37. In addition, two cases carried over from 1998 were resolved, along with all four cases carried over from 1999. Five cases were carried over from 2000, four were resolved, and one was carried over to 2002. A successful prosecution arose from one of the 2000 cases, details of which are below.

38. A gamekeeper was found guilty of three counts of failing to take all reasonable precautions to protect the health of human beings and non-target species. A family dog became ill with anticoagulant poisoning, from which it recovered after veterinary treatment. The dog owner found a quantity of dull blue grains in his garden, and in the dog's faeces. Analysis revealed that the grains contained bromadiolone. The dog owner observed the gamekeeper placing similar grains in the vicinity of the garden on two further occasions, both visible and accessible to non-target species. The gamekeeper was fined £500 and ordered to pay £446.74 to cover veterinary bills.

39. In Wales, one incident was referred to Investigation Branch for further investigation. No prosecution has arisen from this case as it is still being investigated.

40. Two men from Port Talbot were successfully prosecuted by South Wales Police in April 2002. The two were found guilty of eight counts of storage of pesticide, putting bendiocarb on a pigeon in the open air, putting aldicarb on a pigeon in the open air, using bendiocarb on a pigeon bait for the purpose of killing a wild bird, using aldicarb on a pigeon bait for the purpose of killing a wild bird, having possession of bendiocarb with intent, attempting to kill a peregrine and being in possession of an unlicenced shotgun. A dead pigeon was

found underneath a peregrine nest in May and the incident was reported to ARAD and the local Police. Analysis revealed that the pigeon had been laced with aldicarb and bendiocarb. Although the pigeon's leg which may have had a ring on, had been cut off, there was a telephone number underneath its wing which enabled the Police to trace the owners. The two men received total fines in excess of £1000.

41. In Scotland, SEERAD officials frequently work in partnership with wildlife liaison officers from the various police forces, as well as staff from other organisations. Where possible, cases are referred to the Procurator Fiscal Service for prosecution. In circumstances where there is insufficient evidence to support prosecution, the fact that an investigation has been seen to take place around the locus may act as a deterrent to re-offending. Where poisoning or the risk of poisoning arises from misuse, and enforcement action is not possible or appropriate, those involved receive advice on how to employ better practice.

42. Opportunities to gather evidence to support enforcement action were severely limited for many of the relevant incidents in 2001 because of restrictions on access to land arising from the outbreak of FMD. Both SEERAD officials and police wildlife liaison officers kept off agricultural properties until the outbreak had been cleared. Only one case was reported to the Procurator Fiscal Service for breaches of the Wildlife and Countryside Act and the Control of Pesticides Regulations. This related to the abuse of strychnine by a retired gamekeeper. The offender admitted using sausages as a bait medium and placing these around dead pheasants and in a feed bin to control a fox that had been killing pheasants in a small wood around some rural dwellings. There was no evidence to indicate any of the bait material had been consumed by animals. The decision by the fiscal service not to proceed with a prosecution may have been influenced by the age of the offender. The investigation into the poisoning of a buzzard with alphachloralose in Tayside revealed that crow traps on an estate were not being checked. The gamekeeper was charged under the Wildlife and Countryside Act with killing a wild bird and using crow traps in an inappropriate manner. The SSPCA are pursuing charges in relation to the discovery of the carcase of a poisoned buzzard on a taxidermists premises. A prosecution arising from incidents involving the poisoning of buzzards with carbofuran during 1999 and 2000 was heard at Perth Sheriff Court in November 2001. The defendant was found guilty on charges under the Wildlife and Countryside Act relating to laying poisonous baits, poisoning wild birds, and possession of a substance capable of being used for committing the above offences; and under the Control of Pesticides Regulations for the improper storage of a carbofuran formulation. He was fined a total of £2400.

43. SEERAD Agricultural Staff carried out 20 field investigations during 2001. Many of these were joint operations with the police, and some also involved RSPB Investigation Officers. An investigation by police and SEERAD officials following the alphachloralose poisoning incident in Tayside resulted in a quantity of alphachloralose being surrendered for disposal. The police pursued three incident investigations independently, and the SSPCA undertook one investigation relating to pesticide abuse and other offences.

Part 3: Incidents in 2001: Species/Samples and the pesticides involved

Species/Samples involved

44. A total of 346 incidents were investigated during 2001. The categories of animals (animals of more than one category may have been involved in a single incident) and suspected baits involved are listed in Table 1. A total of 288 incidents involved vertebrates; 23 involved beneficial insects; 4 involved livestock; 35 were suspected baits and/or seized samples. The cause of death or illness (including pesticides and other chemicals, trauma, starvation and disease) was established in 50% of all incidents. A further 19 (5%) were classed as 'not applicable', as they involved suspected baits where no dead animals were involved and analyses or further information failed to show the involvement of any pesticides. Pesticides were implicated in 109 (32%) of the incidents (compared with 162 (32%) in 2000); 31% of incidents involving vertebrate wildlife, 22% of incidents involving bees, 31% of companion animal incidents and 46% of suspected bait incidents. A geographical breakdown of the data is shown in Table 2.

Table 2: Incidents investigated by country in 2001 (% pesticide as cause)

	England	Wales	Scotland	N.Ireland
Vertebrate wildlife	49 (37%)	22 (9%)	87 (34%)	18 (28%)
Livestock	0	0	2 (0%)	2 (0%)
Companion animals	44 (41%)	9 (22%)	30 (13%)	27 (37%)
Beneficial insects	18 (22%)	3 (33%)	2 (0%)	0
Suspected baits and suspicious substances	23 (52%)	1 (100%)	6 (17%)	5 (40%)
TOTAL*	**133 (38%)**	**34 (18%)**	**127 (28%)**	**52 (33%)**

* Animals from more than one category may be involved in a single incident.

45. A comparison of the number of poisoning incidents for each category of animal from 1994 to 2001 is shown in Table 3.

Table 3: Number of incidents in which pesticides were identified as a likely cause of poisoning 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Vertebrate wildlife	76	62	77	54	49	57	68	55
Livestock	3	2	2	1	4	2	0	0
Companion animals	101	91	97	86	90	48	58	34
Exotic species	0	0	0	0	2	0	0	0
Fish	0	0	2	0	0	0	0	0
Earthworms	0	0	0	0	1	1	0	0
Beneficial insects	20	33	8	15	12	9	13*	5
Suspected baits and suspicious substances	16	28	29	32	29	22	28	16
TOTAL**	**211**	**208**	**204**	**185**	**185**	**139**	**162**	**109**

* Four of these incidents are likely to be associated with one pesticide application.

** Animals from more than one category may be involved in a single incident.

46. A list of the pesticides detected (including beneficial insect incidents), is shown in Table 4, which also lists the species involved and the presence of compounds in seized samples. In addition, low-level residues of pesticides are sometimes detected in tissues of animals, but these residues are not thought to have been involved in the death of the animal and probably reflect sub-lethal exposure to particular compounds.

Table 4: Numbers of incidents* involving individual pesticides in 2001 and species and/or bait involved

Organophosphorus compounds		
dichlorvos	2	honeybee.
dimethoate	1	honeybee.
fenthion (veterinary product)	1	blackbird, feral pigeon.
mevinphos	2	badger, bait, sample.
Carbamate compounds		
aldicarb	7	cat, dog, bait, sample.
bendiocarb	4	crow, feral pigeon, magpie, honeybee, bait, sample.
benfuracarb	1	sample.
carbofuran	22	buzzard, crow, feral pigeon, golden eagle, magpie, red kite, cat, bait.
methiocarb	1	badger.
methomyl	2	fox, dog, bait.
Rodenticides		
brodifacoum	5	buzzard, golden eagle, red kite, dog, bait.
bromadiolone	18	barn owl, buzzard, duck, golden eagle,red kite, tawny owl, fox, pine marten, dog, bait.
chlorophacinone	1	bait.
coumatetralyl	1	dog, grain.
difenacoum	8	buzzard, red kite, badger, pine marten, bait, grain.
warfarin	3	golden eagle, dog.

In addition to the above, some residues of these compounds (and also flocoumafen) were detected and were considered to be background levels.

Pyrethroid compounds		
permethrin	2	honeybee, sample.

In addition to the above, small residues of fluvalinate were detected in six honeybee incidents. These were probably associated with varroa mite treatments.

Herbicides		
dichlobenil	1	cat.
paraquat	6	cat, dog, bait.

Table 4: Numbers of incidents* involving individual pesticides in 2001 and species and/or bait involved (continued)

Other compounds		
alphachloralose	21	buzzard, goshawk, jackdaw, red kite, tawny owl, cat, powder.
imidacloprid	1	feral pigeon.
metaldehyde	12	dog, bait, pellets.
phosphine	1	dog, sample.
strychnine	3	dog, bait, sample.
Jeyes fluid	1	fish, frog.

Causes of death other than pesticides			
disease	21	Azalea poisoning	1
starvation	14	ethylene glycol	4
trauma	23	euthanasia	1
		sodium hydroxide	1
unknown	153	not applicable	19

* Some incidents will involve more than one pesticide, see later sections and Appendix 2.

47. Appendix 2 lists all the incidents involving pesticides from throughout the United Kingdom.

Vertebrate wildlife: Mammals

48. A total of 30 incidents involving wild mammals was investigated and the cause of incident established in 14 (47%) of which 7 (23%) involved pesticides (see Table 5). Table 6 shows the number and percentage of pesticide poisonings for the past eight years.

Table 5: Numbers of incidents involving wild mammals in 2001

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Badger	England	8	3 (38%)	2 (25%)
	Wales	1	0	1 (100%)
	Scotland	1	0	1 (100%)
		10	**3 (30%)**	**4 (40%)**
Fox	England	4	2 (50%)	0
	Wales	1	0	1 (100%)
	Scotland	2	0	0
	N. Ireland	2	1 (50%)	1 (50%)
		9	**3 (33%)**	**2 (22%)**
Otter	Wales	1	0	1 (100%)
	N. Ireland	1	0	0
		2	**0**	**1 (50%)**

Table 5: Numbers of incidents involving wild mammals in 2001 (continued)

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Hedgehog	Scotland	**2**	**0**	**0**
Hare and rabbit	N. Ireland	**3**	**0**	**0**
Bat	Scotland	**1**	**0**	**0**
Mole	Scotland	**1**	**0**	**0**
Pine marten	Scotland	**1**	**1 (100%)**	**0**
Rat	N. Ireland	**1**	**0**	**0**
TOTAL	England	12	5 (42%)	2 (17%)
	Wales	3	0	3 (100%)
	Scotland	8	1 (12%)	1 (12%)
	N. Ireland	7	1 (14%)	1 (14%)
		30	**7 (23%)**	**7 (23%)**

Table 6: Incidents involving wild mammals 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	156	104	77	85	68	54	56	30
Pesticide incidents	11%	13%	26%	19%	12%	31%	16%	23%

Badger

49. There were ten incidents involving badgers submitted to the Scheme and the cause of death was established in 70% of these incidents, with pesticide poisoning confirmed in three incidents. Three badgers were suspected to have been poisoned following the abuse of methiocarb and another badger died following the abuse of mevinphos (incident also involved phosphine). In the remaining incident, a badger death was attributed to difenacoum exposure, but no source for this chemical was established.

50. There were no incidents during 2001 that involved the laying of poisoned baits outside badger setts.

Fox

51. As in previous years, there are always a large number of incidents involving foxes reported to the Scheme, particularly as they are considered a pest species and are often the target for illegal poisoning. Table 7 shows the number and percentage of pesticide poisonings for the past eight years.

Table 7: Incidents involving foxes 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	57	54	41	33	27	24	28	9
Pesticide incidents	18%	17%	34%	33%	15%	42%	25%	33%

52. There were nine incidents involving foxes investigated in 2001. The cause of the incident was established in five (56%) incidents with pesticides found to be involved in three (33%). Two of these incidents occurred following the abuse of pesticides, bromadiolone in one incident and methomyl in the other. The remaining incident was attributed to the unspecified use of bromadiolone.

Other mammals

53. The other mammal incidents reported include: two otter incidents; two hedgehog incidents; one hare incident; two wild rabbit incidents; one pipistrelle bat incident; one mole incident; and one rat incident. Low sub-lethal residues of bromadiolone and difenacoum were found in one pine martin, which was found with a poisoned buzzard at a taxidermist premises. An otter died from trauma injuries, but no other cause of death was identified in any of these incidents.

Vertebrate wildlife: Birds

54. A total of 150 incidents involving wild birds was notified to the Scheme in 2001. The cause of the incident was established in 90 (60%) and pesticides were involved in 48 (32%) (see Table 8). Table 9 shows the number and percentage of pesticide poisonings for the past eight years.

Table 8: Number of incidents involving wild birds in 2001

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Birds of prey including Owls	England	25	9 (36%)	10 (40%)
	Wales	15	1 (7%)	7 (47%)
	Scotland	65	27 (42%)	17 (26%)
	N. Ireland	6	4 (67%)	0
		111	**41 (37%)**	**34 (31%)**
Wildfowl and waterbirds	England	1	0	0
	Wales	1	0	0
	Scotland	5	1 (20%)	0
	N. Ireland	2	0	1 (50%)
		9	**1 (11%)**	**1 (11%)**
Gulls and waders	Wales	1	0	1 (100%)
	N. Ireland	2	0	1 (50%)
		3	**0**	**2 (67%)**
Pigeon and doves	England	3	2 (67%)	0
	Wales	1	1 (100%)	0
	Scotland	5	1 (20%)	0
		9	**4 (44%)**	**0**
Corvids	England	5	2 (40%)	0
	Wales	2	0	0
	Scotland	6	2 (33%)	1 (17%)
		12	**4 (33%)**	**1 (8%)**
Gamebirds	England	1	0	0
	Scotland	1	0	1 (100%)
		2	**0**	**1 (50%)**
Other birds	England	2	0	0
	Wales	2	1 (50%)	0
	Scotland	3	0	3 (100%)
	N. Ireland	1	0	0
		8	**1 (13%)**	**3 (38%)**
TOTAL*	England	37	13 (35%)	10 (27%)
	Wales	20	2 (10%)	8 (40%)
	Scotland	82	29 (35%)	22 (27%)
	N. Ireland	11	4 (36%)	2 (18%)
		150	**48 (32%)**	**42 (28%)**

* Birds from more than one category may be involved in a single incident.

Table 9: Incidents involving wild birds 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	267	232	199	155	192	151	178	150
Pesticide incidents	24%	22%	30%	26%	22%	28%	33%	32%

Birds of prey (including owls)

55. There were 111 incidents involving birds of prey (see Table 8 and 10) investigated and of these the cause of the incident was established in 75 (68%); 41 incidents (37%) were identified as involving pesticide poisoning. Table 11 shows the number and percentage of pesticide poisonings for the past eight years.

Table 10: Number of incidents involving birds of prey (excluding owls) in 2001

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Buzzard	England	14	5 (36%)	7 (50%)
	Wales	7	0	5 (71%)
	Scotland	33	13 (39%)	9 (27%)
	N. Ireland	4	3 (75%)	0
		58	**21 (36%)**	**21 (36%)**
Red kite	England	4	3 (75%)	0
	Wales	5	1 (20%)	1 (20%)
	Scotland	15	11 (73%)	0
	N. Ireland	1	0	0
		25	**15 (60%)**	**1 (4%)**
Eagle	Scotland	4	1 (25%)	1 (25%)
	N. Ireland	1	1 (100%)	0
		5	**2 (40%)**	**1 (20%)**
Peregrine	England	2	0	1 (50%)
	Scotland	1	0	0
		3	**0**	**1 (33%)**
Sparrowhawk	England	1	0	0
	Wales	1	0	0
	Scotland	4	0	3 (75%)
		6	**0**	**3 (50%)**
Kestrel	England	1	0	1 (100%)
	Wales	1	0	1 (100%)
	Scotland	2	0	1 (50%)
		4	**0**	**3 (75%)**
Goshawk	England	**1**	**1 (100%)**	**0**
Marsh harrier	England	**2**	**0**	**1 (50%)**

Table 11: Incidents involving birds of prey (including owls) 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	134	131	122	84	97	98	136	111
Pesticide incidents	28%	24%	34%	25%	30%	34%	38%	37%

Common buzzard

56. There were 58 reported incidents involving common buzzards in 2001 and of these the cause of the incident was established in 42 (72%), with 21 (36%) being attributed to pesticide poisoning.

57. Deliberate abuse of pesticides accounted for 17 of these incidents; the chemicals involved were alphachloralose (11 incidents) and carbofuran (6 incidents). In two of these incidents, sub-lethal residues of bromadiolone and difenacoum were also detected in the liver tissues from the poisoned birds. The four remaining pesticide incidents were associated with the unspecified use of bromadiolone (two incidents) and difenacoum (two incidents, one incident also involved brodifacoum).

Red kite

58. There were 25 incidents involving red kites reported to the Scheme, some of which were introduced birds. The causes of the incidents were identified in 16 of these incidents (64%), with 15 (60%) involving pesticide poisoning. Abuse of pesticides was confirmed in 13 incidents and the unspecified use of rodenticides in two incidents. The compounds abused were, carbofuran in ten incidents, and alphachloralose in three.

59. Anticoagulant rodenticide poisoning was confirmed as the likely cause of death in two separate incidents involving red kites. In both these incidents, the source of the anticoagulant rodenticides involved was uncertain. In one incident, difenacoum was found and in another, bromadiolone, brodifacoum and difenacoum. In more than half of the abuse incidents (five incidents, carbofuran and two incidents, alphachloralose), there were also anticoagulant rodenticide residues present. In at least one of these incidents, the residue was at a level which is often regarded as significant. There were five incidents where bromadiolone was found, one incident with difenacoum and the remaining incident, had both of these compounds present.

Eagle

60. Five incidents involving golden eagles were submitted. The cause of death was established in three incidents, with two incidents a result of pesticide poisoning. One was from the abuse of carbofuran and the other from the abuse of warfarin, bromadiolone and brodifacoum.

Peregrine falcon

61. Three incidents involving peregrine falcons were reported to the Scheme during 2001. The cause of death was established as trauma in one incident and there were no pesticide poisoning incidents.

Other raptor species

62. Other species of raptor were submitted as possible pesticide poisoning victims. These included: sparrowhawks (six), kestrels (four), goshawks (one), and marsh harriers (two). The cause of death was determined in three of the sparrowhawk incidents, three of the kestrel incidents and a marsh harrier incident. However, only the one goshawk incident, which involved the abuse of alphachloralose, was attributed to pesticides. In an incident involving two sparrowhawks, background residues of DDE and dieldrin were found.

Owls

63. Ten incidents involving owls were notified in 2001, six were barn owls and four were tawny owls. The cause of death of the birds was identified in six (60%) of the incidents, with three (30%) incidents (one barn owl and two tawny owls) due to pesticide poisoning. In one incident, where alphachloralose had been abused, a tawny owl and a buzzard were involved. The other two pesticide incidents, involved the unspecified use of bromadiolone.

Wildfowl and water birds

64. In 2001, there were nine incidents investigated by the Scheme that involved wildfowl and water birds. The cause was identified in two (22%) of these incidents, one of which involved pesticide poisoning. Ducks died following exposure to bromadiolone (see approved use section).

Gulls and waders

65. There were three incidents involving gulls and waders in 2001. The cause was established in two incidents, and none were attributed to pesticide poisoning.

Pigeons and doves

66. There were nine incidents involving pigeons and doves reported in 2001; the cause of four of the incidents was attributed to pesticide poisoning. Abuse of pesticides accounted for three of the incidents, all involving feral pigeons. The compounds involved were: carbofuran (two pigeons); bendiocarb (40 feral pigeons); and the veterinary compound, fenthion (20 pigeons and a blackbird). The remaining incident involved 12 racing pigeons, which returned to the loft and were clearly unwell. The pigeon keeper suspected that they had been poisoned and made the birds vomit. The regurgitated grain analysed contained imidacloprid. It was not possible to establish where the birds had been exposed, so this incident has been classified as unspecified use. It is the first time an incident involving imidacloprid has been reported by WIIS.

Corvids

67. This group of birds is often the target of deliberate pesticide poisoning as they are considered by some to be pests. In 2001, there were twelve incidents reported; the cause of incidents was found in five (42%), with four of these attributed to pesticide poisoning. All the incidents were attributed to abuse of the compound. Table 12 shows the number and percentage of pesticide poisonings for the past eight years.

Table 12: Incidents involving corvids 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	39	29	30	22	26	19	13	12
Pesticide incidents	33%	28%	57%	41%	15%	47%	31%	33%

68. Carbofuran was implicated in two incidents, one involving a magpie and the other a crow and red kite. Two crows and three magpies were the victims of bendiocarb poisoning and eighteen jackdaws died following exposure to alphachloralose on a bread bait.

Gamebirds

69. There were two incidents notified in this category in 2001, but neither were due to pesticide poisoning. One incident, with young partridges, was suspected to be due to an MCPA application. However, further investigation revealed that the birds had a *Salmonella* infection.

Other birds

70. This category includes passerines (mainly garden birds) and other birds not dealt with in earlier sections. There were eight incidents reported and the cause of the incident was determined in four (50%), with just one of these incidents resulting from pesticide poisoning. This was the abuse of the veterinary product, containing fenthion and involved a blackbird and feral pigeons. Two greenfinch incidents and a chaffinch incident were due to *Salmonella typhimurium* infection.

Livestock

71. Livestock are not normally included in the Scheme, but if there are other environmental samples associated with the incident they may be accepted. There were four incidents involving livestock reported to the Scheme in 2001 (see Table 13). The cause was determined in one incident, where sheep were poisoned after eating azalea.

Table 13: Number of incidents involving livestock in 2001

		Number of incidents investigated	Number in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Cattle	Scotland	1	0	0
	N. Ireland	1	0	0
Sheep	Scotland	1	0	0
	N. Ireland	1	0	1 (100%)
TOTAL	Scotland	**2**	**0**	**0**
	N. Ireland	**2**	**0**	**1 (50%)**

Companion animals

72. There were 108 incidents involving companion animals reported to the Scheme in 2001 (see Table 14). The cause of the incident was established in 47 (44%), with pesticides implicated in 33 (31%). Table 15 shows the number and percentage of pesticide poisonings for the past eight years.

Table 14: Number of incidents involving companion and other animals in 2001

		Number of incidents investigated	Number (%) in which pesticide poisoning was identified	Number (%) in which another cause of death was identified
Cat	England	16	7 (44%)	4 (25%)
	Wales	3	0	1 (33%)
	Scotland	11	2 (18%)	0
	N. Ireland	11	3 (27%)	2 (18%)
		41	**12 (29%)**	**7 (17%)**
Dog	England	25	10 (40%)	2 (8%)
	Wales	6	2 (33%)	2 (33%)
	Scotland	16	2 (12%)	2 (12%)
	N. Ireland	16	7 (44%)	1 (6%)
		63	**21 (33%)**	**7 (11%)**
Horse	Scotland	**1**	**0**	**0**
Ferret	England	1	0	0
	Scotland	1	0	0
		2	**0**	**0**
Rabbit	Scotland	**1**	**0**	**0**
TOTAL	England	42	18 (43%)	6 (14%)
	Wales	9	2 (22%)	3 (33%)
	Scotland	30	4 (13%)	2 (7%)
	N. Ireland	27	10 (37%)	3 (11%)
		108	**33 (31%)**	**14 (13%)**
Fish & Frog	England	**1**	**1 (100%)**	**0**

Table 15: Incidents involving companion animals 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	313	271	275	253	235	149	160	109
Pesticide incidents	49%	34%	35%	34%	38%	32%	36%	31%

Cat

73. There were 41 incidents involving cats investigated by the Scheme. The cause of the incident was established in 19 (46%). Pesticides were implicated in 12 (29%), with about 18 individuals being poisoned. Table 16 shows the number and percentage of pesticide poisonings for the past eight years.

Table 16: Incidents involving cats 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	125	90	112	110	91	58	63	41
Pesticide incidents	41%	33%	38%	37%	38%	24%	30%	29%

74. Pesticide abuse accounted for eleven incidents: five incidents involved alphachloralose; three incidents aldicarb; two incidents carbofuran; and an incident with paraquat.

75. An incident involving two young cats was suspected to involve the approved use of dichlobenil. However, this is based on veterinary opinion, as no samples were available for analytical tests (see approved use section).

76. Ethylene glycol (anti-freeze) poisoning was diagnosed in four incidents.

Dog

77. The Scheme registered 63 incidents involving dogs during 2001. The cause of the incident was determined in 28 (44%), with pesticides implicated in 21 (33%) incidents, with about 40 dogs found to have been poisoned. Table 17 shows the number and percentage of pesticide poisonings for the past eight years.

Table 17: Incidents involving dogs 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	183	170	163	138	149	89	98	63
Pesticide incidents	28%	39%	35%	33%	40%	38%	41%	33%

78. The abuse of pesticides was found in 15 incidents and involved a wide range of compounds. Vertebrate control products were abused in five incidents (strychnine, phosphine, warfarin, bromadiolone and an incident with both warfarin and bromadiolone). Paraquat was found in four incidents, metaldehyde in three incidents, aldicarb in two incidents and an incident with methomyl. The phosphine incident also involved mevinphos, which was found in a badger and a bait.

79. The misuse of pesticides accounted for three incidents, involving spillage of slug pellets (one metaldehyde incident) or accessible anticoagulant rodenticide bait (one brodifacoum incident and one coumatetralyl incident).

80. There were also three incidents where the source of the pesticides was uncertain. Two of these incidents involved metaldehyde and the other incident involved bromadiolone.

Other companion animals

81. There were four incidents involving other companion animals. Two involved ferrets and there were single incidents involving a horse and a rabbit. No cause of death was found for these incidents.

82. In 2001, there was also one incident where goldfish and frogs were killed after Jeyes fluid was poured in a garden pond.

Beneficial insects

83. There were 23 suspected beneficial insect poisoning incidents investigated during 2001 (see Table 18), with 18 incidents reported from England, 3 incidents reported from Wales and 2 incidents reported from Scotland. All of the incidents involved honeybees. Pesticides were implicated in five (22%) of these incidents; four were from England and one from Wales. In three of the 18 incidents from England, no chemical analyses were carried out as investigations revealed that pesticides were unlikely to be involved.

Table 18: Number of incidents involving beneficial insects in the UK during 2001

Number of incidents investigated:	**23**
Number of incidents attributed to pesticides:	**5**
Number of incidents where bee diseases were detected:	**6**
Number of incidents attributed to disease:	**1**

Pesticide detected*	Number of incidents	Number of colonies affected
Organophosphate compounds		
dichlorvos	2	5
dimethoate	1	2
Carbamate compounds		
bendiocarb	1	1
Pyrethroid compounds		
permethrin	1	1
TOTAL	**5**	**9**

*There were also six incidents where small residues of fluvalinate were detected, see Appendix 2 for further details.

84. Diseased bees were found in six incidents investigated and in one of these incidents the levels of disease were considered to be the likely cause of death. The cause of death of the honeybees in the remaining incidents could not be determined. There have been six incidents this year where small residues, around 0.003 micrograms per bee, of fluvalinate were noted in the bees examined. At these levels this pesticide is not the cause of death of the bees, but an indication of the use of the compound to control varroa.

85. Four different compounds have been detected and confirmed in the five incidents attributed to pesticides (see Table 18). For reviews of bee poisoning incidents refer to: Barnett E.A. *et al.,* 1997; Fletcher M.R. *et al.,* 1994; and Greig-Smith P.W. *et al.,* 1994. For the number of incidents investigated and the percentage of pesticide poisonings for the past eight years refer to Table 19, and for a summary of the 2001 incidents, where pesticides were involved, refer to Table 20.

Table 19: Incidents involving beneficial insects 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	45	56	40	40	43	28	48	23
Pesticide incidents	44%	59%	20%	40%	28%	32%	27%	22%

Table 20: Pesticides detected in beneficial insect incidents in the UK during 2001

Month	Location	Number of colonies in apiary	Number of colonies affected	Pesticide involved	Level detected (µg/bee)
May	Essex	16	1	permethrin	0.86
May	Cumbria	3	1	bendiocarb	0.12
May	South Croydon	4	4	dichlorvos	0.006
June	West Glamorgan	1	1	dichlorvos	0.004
July	Suffolk	39	2	dimethoate	0.045

86. The incidents where pesticides were detected and confirmed are also summarised in Appendix 2. There was one approved use incident, involving a crop of beans which had been treated with dimethoate. The beans were well past flowering at the time of the incident. An incident involving dichlorvos has been assigned to misuse, as a Vapona unit is unlikely to be labelled for the control of wax moth. In three incidents, despite thorough field investigations, the source of the pesticides identified has not been established. However, it is likely that the bendiocarb residue was due to honeybees robbing bendiocarb treated comb, which had not been sealed off adequately during a feral bee control treatment.

87. In Suffolk, two hives at separate apiaries had very high numbers of dead bees and the remaining bees were far more aggressive than usual. The beekeeper believed this to be a sign that the bees had been poisoned with pesticides. A nearby crop of beans, which was well into pod formation, was heavily infested with black bean aphid. It had been sprayed earlier in the month with lambda-cyhalothrin and after seeking advice had been sprayed again with Danadim - dimethoate and Folicur - tebuconazole. According to the spray records this application had taken place between 15:00 and 17:00, three days before the dead bees were found. Analysis has confirmed a residue of 0.045 micrograms dimethoate per bee, so it is likely that these bees have died from pesticide poisoning. This incident has been attributed to approved use and similar incidents to this have been reported before by WIIS.

88. Two incidents, one in Wales and one in England, probably arose through the use of dichlorvos. The beekeeper in England had colonies at two locations and within a week many dead bees were found in the hives at both apiaries. In discussion with the local bee inspector, it became apparent that the deaths might be linked to the addition of new supers. Given residue losses before and during analysis, the residue of 0.006 micrograms dichlorvos per bee detected may be significant and probably indicates the cause of the mortality. In the incident in Wales, only a handful of bees were found alive and there was a huge pile of dead bees outside the hive. A residue of 0.004 micrograms dichlorvos per bee was confirmed. Again exposure to dichlorvos may be the cause of the mortality. The source of the dichlorvos in the Welsh incident is uncertain, but the beekeeper in England had reportedly used naphthalene and an old Vapona unit to control wax moth. This incident has been classified as a misuse as it is unlikely that this is a label use for the dichlorvos product.

89. An apiary in Cumbria, with a total of three colonies, had one colony affected with many dead bees found around the hive. The dying bees seemed sluggish and were lying on their backs. A residue confirmed of 0.12 micrograms bendiocarb per bee was identified, indicating that these bees have died from pesticide poisoning. The source of this pesticide has not been established, the beekeeper was not aware of any pesticide applications in the area. However, it is likely that the bendiocarb was from a feral bee or wasp treatment, which had not been adequately sealed off.

90. A large apiary in Essex with 16 colonies had one colony affected and several hundred bees were found dead. The bees were said to be aggressive after the deaths had occurred. There was oilseed rape in full flower in the immediate vicinity, but it was reported that this had been sprayed a few days after the incident. The analyses have detected and confirmed 0.86 micrograms per bee of permethrin, so clearly these bees have died from pesticide poisoning. The source of the compound is uncertain at present, but the size of the residue suggests that it may not be associated with an approved use of the compound.

Suspected poisoned baits and suspicious samples

91. Each year a number of suspected baits and suspicious samples are submitted for pesticide residue investigation, even though no dead animals have been found nor poisoning known to have occurred. There were 35 such samples notified to the Scheme in 2001. Pesticides were detected in 16 of these (46%). Table 21 shows the number of possible baits and suspicious samples submitted and the percentage in which pesticides were detected for the past eight years. There were thirteen incidents of abuse and three incidents of misuse. There were no incidents involving badger setts during 2001. However, some of the baits were intended for cats, or were indiscriminate attempts at pest control, where no mortalities were found. In at least one incident, the intended target for this activity was peregrine falcons.

Table 21: Incidents involving possible baits and suspicious samples 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Incidents investigated	57	72	63	66	62	67	64	35
Pesticide incidents	28%	39%	46%	48%	47%	33%	44%	46%

92. Metaldehyde was the single most often abused compound and was identified in four incidents. Vertebrate control products were used in five abuse incidents, two of these involved difenacoum, and one incident each involved strychnine, bromadiolone and brodifacoum. In the remaining four deliberate abuse incidents, there was an incident with carbofuran, one with paraquat and two with aldicarb. One of the aldicarb incidents also involved benfuracarb and were samples seized as part of a "poisoning kit". The other aldicarb incident was a pigeon bait under a peregrine nest, where the bait also had bendiocarb present and samples of bendiocarb and permethrin formulations were also seized.

93. The three misuse incidents, involved two incidents where spillages of metaldehyde had occurred and an incident with exposed, anticoagulant rodenticide, chlorophacinone bait.

Pesticides

94. The chemicals found in the 105 vertebrate and bait incidents are listed in Table 4. Details of these incidents are also given in Appendix 2. Pesticides involved in beneficial insect incidents can also be found in Table 4 and Appendix 2 and above in the section involving this category.

95. A total of 23 different compounds were implicated from all incidents (except beneficial insect incidents) submitted during 2001 (29 in 2000). There were 19 different chemicals from England (22 in 2000), 6 from Scotland (17 in 2000), 7 from Wales (6 in 2000) and 6 from Northern Ireland (5 in 2000). In addition, some small non-significant residues were also detected eg. flocoumafen, DDE and dieldrin. Table 22 shows the number of different pesticides implicated in all incidents (except beneficial insect incidents) in the past eight years.

Table 22: The number of different pesticides implicated in all incidents (excludes beneficial insects) 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Number of compounds	35	36	29	26	34	27	29	23

Other causes of death

96. There were 63 vertebrate incidents where the cause was determined as other than pesticide poisoning. This represents 22% of vertebrate incidents (excluding those just involving baits). This compares with 98 (25%) in the previous year. It should be noted that disease, starvation or trauma victims are not usually sent for analyses (see Appendix 1). However, it is possible that a sub-lethal exposure to a pesticide contributed to death, apparently by natural causes. Within the remit of the Scheme it is not possible to monitor sub-lethal effects, but if pesticides are strongly implicated in an incident, tissues may still be sent for analyses.

Part 4: Conclusions

Number of incidents

97. In 2001, of the 346 incidents registered, pesticide involvement was found in 109 (32%) and other causes of death (other chemicals, disease, starvation, etc.) were identified in 64 (18%) (see Table 1, Figure 3). In addition, there were 19 (5%) incidents reported that were classified as "not applicable" (alleged bait materials where no pesticides were identified and where no dead animals were found). Since 1996 there has been a general decline in the numbers of incidents reported, although 2000 saw 53 more incidents reported than in 1999 and also a proportionate increase in the number of pesticide incidents (see Table 23). The figures confirm that there has been little change in the overall proportion of pesticide incidents over the years. This emphasises the importance of raising the profile of the Wildlife Incident Investigation Scheme and encourage reporting of suspected poisoning incidents.

Table 23: Number of incidents reported to the Scheme 1996-2001 and number (%) pesticide incidents identified

Year	1996	1997	1998	1999	2000	2001
England						
No. of incidents reported	354	333	334	232	244	133
No. pesticide incidents (%)	128 (36%)	118 (35%)	108 (32%)	84 (36%)	83 (34%)	51 (38%)
Wales						
No. of incidents reported	58	51	32	41	42	34
No. pesticide incidents (%)	24 (41%)	13 (25%)	9 (28%)	9 (22%)	11 (26%)	6 (18%)
Scotland						
No. of incidents reported	160	144	167	135	167	127
No. pesticide incidents (%)	34 (21%)	36 (25%)	52 (31%)	40 (30%)	57 (34%)	35 (28%)
Northern Ireland						
No. of incidents reported	79	79	79	45	53	52
No. pesticide incidents (%)	18 (23%)	19 (24%)	16 (20%)	6 (13%)	11 (21%)	17 (33%)
Total						
No. of incidents reported	651	607	612	453	506	346
No. pesticide incidents (%)	204 (31%)	185 (30%)	185 (30%)	139 (31%)	162 (32%)	109 (32%)

98. It is difficult to assess the impact that FMD has had on the figures for 2001, but it is clear that far fewer incidents have been investigated than in any previous year reported by WIIS. Comparing the average total number of incidents reported in 1999 and 2000 with that of 2001, shows that the reporting of incidents was down by nearly 30%. Similar regional comparisons showed that reporting of incidents in England was down by 44%, in Wales it was down by 19% and in Scotland it was down by 16%. In Northern Ireland, the number of incidents reported is within the usual variation from year to year. As might be expected, FMD has affected reporting of incidents in some regions more than others.

99. The number of incidents reported in England in 2001 has decreased by over 100, compared to the previous year, and the number of pesticide incidents has gone down by over 30. However, the proportion of pesticide incidents is the highest reported to date, at 38%. In

Wales, the number of incidents reported is less than in 2000, but in 1998, only 32 incidents were reported (see Table 23). However, the number and proportion of pesticide incidents in Wales is the lowest reported since 1996. In Scotland, there is clearly a reduction in the number of incidents reported, the number of pesticide incidents and the proportion of these incidents, compared to 2000. However, the number and proportion of pesticide incidents, is within the variation seen in previous years. In Northern Ireland the number of incidents accepted is about the same as 2000, but there has been a notable increase in the number of pesticide incidents. This is the highest proportion of pesticide incidents reported since 1996 (see Table 23).

100. The percentages of poisoning incidents in the various categories of pesticide use are shown in Figure 1. There were three incidents involving the approved use of pesticides, representing 3% of pesticide incidents reported. In 2000, there were 16 (10%) approved use incidents. Although this is an apparent decrease in number and proportion of approved use incidents, it is within the range seen for vertebrate incidents in years prior to this (see Table 24). This small proportion of approved use incidents indicates that when label instructions are followed, pesticides are apparently not causing major problems to wildlife and other animals. However, the Scheme relies on the incidents being found and reported and it is possible that incidents, particularly those involving small vertebrates, are not reported fully. The Scheme also only monitors acute, lethal effects and it is possible that sublethal, or chronic, effects may not be identified.

Table 24: Numbers of vertebrate related incidents and category of use 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Number of pesticide poisoning incidents	**191**	**175**	**196**	**170**	**173**	**130**	**149**	**104**
Abuse	115 (60%)	112 (64%)	136 (69%)	125 (74%)	95 (55%)	61 (47%)	95 (63%)	81 (78%)
Misuse	21 (11%)	21 (12%)	19 (10%)	21 (12%)	45 (26%)	31 (24%)	22 (15%)	6 (6%)
Approved use	12 (6%)	5 (3%)	11 (6%)	3 (2%)	4 (2%)	7 (5%)	9 (6%)	2 (2%)
Unspecified use	39 (20%)	32 (18%)	26 (13%)	21 (12%)	22 (13%)	29 (22%)	19 (13%)	14 (13%)
Veterinary compounds	4 (2%)	5 (3%)	4 (2%)	0 (0)	7 (4%)	2 (2%)	4 (3%)	1 (1%)

101. There were seven incidents arising from the misuse of pesticides (6% of pesticide poisoning incidents). The number and proportion of misuse incidents in 2001 is the lowest reported by WIIS since 1994 (see Table 24). However, this is probably attributable to the impacts of FMD on the countryside, rather than a real reduction in pesticide misuse. Misuse incidents are often associated with poor storage, exposed grain or pellet spillages on farms. Many of these areas would have had restricted access during the FMD outbreak, so opportunities to find and report incidents would have been limited, and on some occasions investigations could not be pursued due to FMD restrictions.

102. As in previous years, deliberate abuse incidents account for the major proportion of those in which pesticides are implicated. In 2001, the number of abuse incidents, at 81, is less than

in 2000 (95), but the proportion of abuse incidents (see Figure 1) is the highest reported since 1994 (see Table 24). However, the proportion of vertebrate abuse incidents has been variable and has ranged from 47%, in 1999, to 74%, in 1997. Additionally there were 17 (16%) incidents where the cause of the poisoning could not be identified. This is a decrease in number, but the same proportion when compared to 1999 and it is within the range seen in previous years. In 2001, there was only one incident reported that was due to poisoning by a veterinary compound. Details of all these poisoning incidents can be found in Appendix 2. Regulatory and/or enforcement action was taken as appropriate (see earlier sections).

Vertebrate incidents

103. Of the 323 vertebrate related incidents reported, 104 involved pesticides (32%). There were two incidents (2%) arising from approved use (see Table 24). Incidents arising from misuse, amounted to 6 (6%) and abuse of pesticides, 81 (78%) incidents. There were 14 (13%) unspecified use incidents. During 2001, there was one incident involving a pesticide formulated as a veterinary medicine product. This was identified as the multi-residue methods employed will also detect various veterinary compounds.

104. Figure 2 shows the relative proportion of incidents involving alphachloralose, carbamate and organophosphorus compounds over several years. Since 1996, carbamate compounds have consistently been involved in a much larger percentage of vertebrate poisoning incidents than either organophosphates or alphachloralose and there is no sign of this trend changing. Since 1997, incidents involving either an organophosphate or alphachloralose, have fluctuated around a level that is generally lower than that seen in years prior to 1997. However, 2001 has seen an increase in the proportion of alphachloralose incidents, to a level not observed for nearly ten years. The Environmental Panel of the Advisory Committee on Pesticides has considered the inclusion of alphachloralose in the Poison Rules 1982 and has recommended that it be classified under Part One. All of the alphachloralose incidents were attributable to abuse and most of the carbamate incidents also arose from abuse of these compounds.

105. Apart from the obvious decline in the number of incidents investigated in all areas during 2001, there are no striking differences for the proportion of pesticide incidents compared to last year. An increase in the percentage of mammals poisoned, was mainly due to an increase number of foxes. However, there are differences for particular species. For example, only three incidents involving peregrines were reported in 2001 and none were attributed to poisoning. In 2000, 18 peregrine incidents were reported and half of these involved poisoning. Red kite incidents were reported in similar numbers in both 2000 and 2001, and in both years high proportions involved pesticide poisoning.

Beneficial insect incidents

106. The 23 beneficial insect incidents were far fewer than the number reported in 2000 (see Table 19), but FMD will have had an uncertain impact on this. The proportion of pesticide poisoning has decreased again, compared to 2000, but it is within the range seen to date. There was one approved use incident, one misuse incident and three where the origin of the pesticides was not established. These incidents have been detailed in previous sections, but of note this year is the approved use incident, where honeybees died following exposure to dimethoate in an aphid infested field bean crop. There was also an incident with permethrin, but the size of the residue suggests that this may have been an illegal use of the compound.

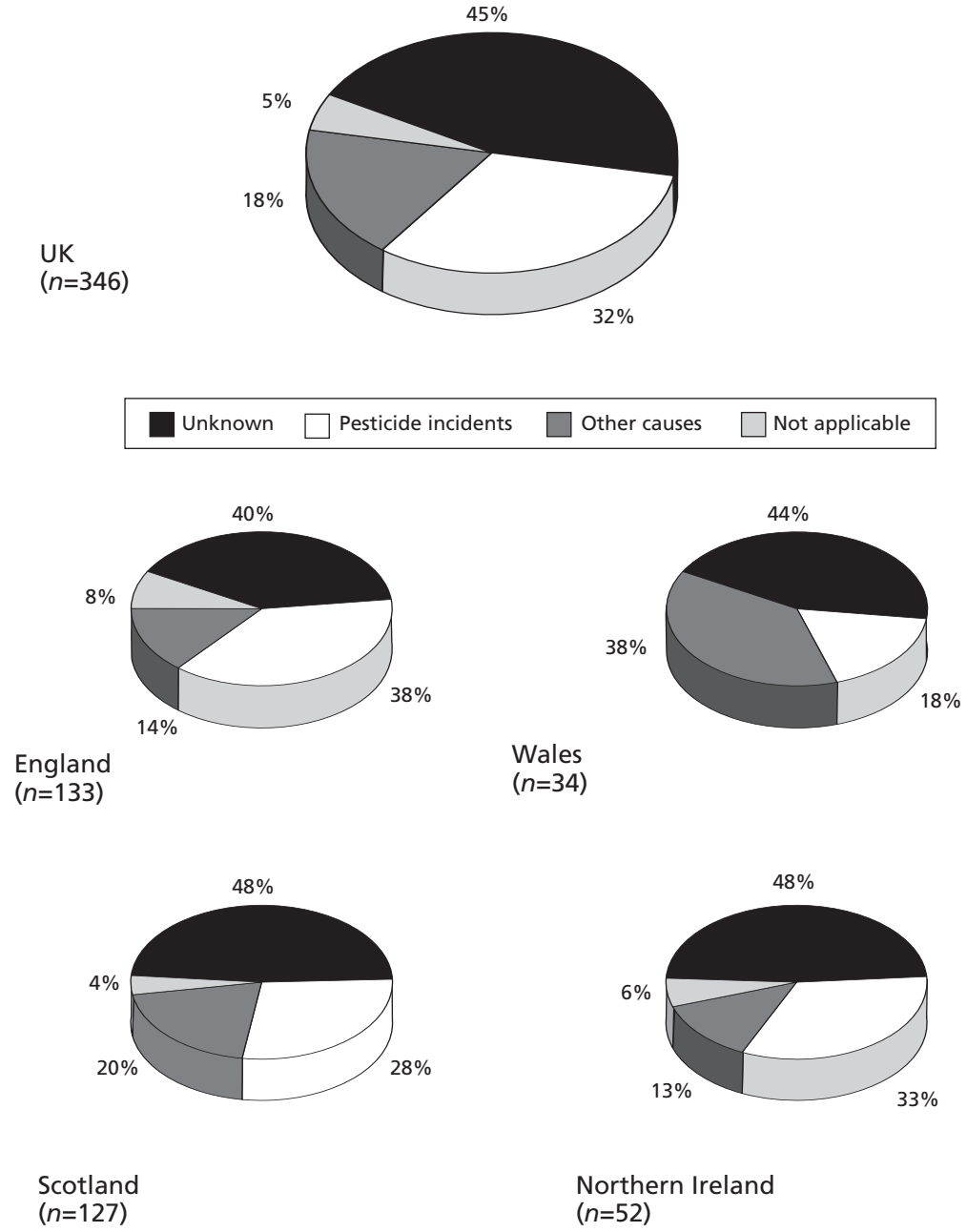
107. The number of colonies found to be affected by pesticides during 2001 was only nine (see Table 18). This is a notable decrease on the previous year, when 51 colonies were affected. Reviews of pesticide poisoning of beneficial insects over past years can be found in: Barnett *et al*., 1997; Fletcher *et al*., 1994a; and Greig-Smith *et al*., 1994.

Unknown causes of incidents

108. There is always a number of incidents reported where the cause remains unknown. This may be due to several factors, such as, insufficient or inappropriate tissues for analysis, an absence of disease diagnosis, poisoning by other chemicals, or the absence of the appropriate analytical method for a particular compound. In 154 (45%) incidents reported, the cause of the incident was not established (see Figure 3). This compares with 204 (40%) in 2000.

109. In addition, there were 19 incidents (5%) which were classified as not applicable (see Figure 3), a small decrease when compared with 36 (7%) in the previous year. These are suspected baits or suspicious substances where there are no dead or poisoned animals found. Often these are just food placed for animals or birds, or discarded food items.

Figure 3: Proportion of reported incidents in 2001 by cause of incident.



Seasonal distribution

110. The seasonal distribution of incidents can be seen in Appendix 2. Incidents of abuse occur throughout the year, with a minimum of two incidents in October and a maximum of eleven incidents in April. More than half (six) of the incidents in April involved red kites. Whereas in June, when there were nine abuse incidents, five of the incidents involved cats or dogs or were in an urban situation. Therefore, the spring peak in abuse is likely to be illegal, indiscriminate, methods of pest control by some farmers or gamekeepers, and in June neighbour disputes and nuisance bird populations become the target for pesticide abuse. Unspecified use is reported throughout the year, except in January and August and the only other notable trend is two, misuse, slug pellet incidents in October.

Regional distribution

111. The distribution of abuse incidents extends throughout counties and regions of the UK. However, there is a bias in some counties (three or more abuse incidents) towards particular chemicals. For example, in England, aldicarb incidents occur in South Yorkshire and Humberside, alphachloralose in North Yorkshire and carbofuran in Northumberland. In Scotland, alphachloralose incidents occur in Tayside and carbofuran more frequently in Highland and Tayside. In Northern Ireland, paraquat is the poison of choice in County Down.

Publications

Appendix 3 gives a list of publications that have arisen from work carried out by the Scheme and its findings. In addition to these, the results of the Scheme have been widely used in several publications.

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Appendix 1

Investigation procedures

The investigation of potential wildlife poisoning incidents depends on a scheme, which allows members of the public and interested organisations, to submit carcases or suspected baits for pesticide analysis. In England, this is organised on a regional basis with the relevant Rural Development Service (RDS) wildlife officer deciding, in consultation with others if necessary, whether an investigation should be started. This permits the screening-out of incidents which may not involve pesticides. In Wales, investigations are similarly initiated by wildlife officers from ARAD.

In England and Wales, after acceptance of an incident, the carcases are taken to a local Veterinary Laboratories Agency where a post-mortem examination is undertaken. This may result in bacteriological or virological tests to determine whether disease contributed to the deaths.

A field visit may be made by an RDS or ARAD wildlife officer to gather information to help in identifying the cause of the incident. A further visit may be required in non-abuse incidents in order to obtain more information, for example to interview relevant contacts not previously available or to follow up the results of analyses.

Incidents may be rejected if they are outside the remit of the Scheme, for example if poisoning is thought to have involved other chemicals or pollutants. If the field inquiry or the post-mortem identifies the cause of death as other than possible pesticide involvement, then tissues are not sent for analysis.

The field inquiry report, post-mortem findings and relevant tissues from casualties are forwarded to the Wildlife Incident & Diagnostic Unit (WIDU) at the Central Science Laboratory, Sand Hutton, York, where chemical and other analyses of the tissues are carried out.

The results are collated and interpreted by WIDU to assess the probable cause of the incident and whether any residues detected contributed to the death or illness of the animal. Mortality is generally attributed to a pesticide if residues of a chemical or its derivatives are found above levels considered to represent lethal exposure. In some cases, the presence of residues in association with typical post-mortem findings may be used to determine mortality. Wherever possible, residues found are confirmed using an alternative analytical technique.

Honeybee deaths in England and Wales are investigated in a similar way. Samples of dead bees are passed by beekeepers to the National Bee Unit of the Central Science Laboratory at Sand Hutton, York to enable disease screening and other investigations to be carried out. Field visits are made by RDS or ARAD wildlife officers to gather relevant information. Bee samples are forwarded for residue analysis to the WIDU, where reports of the incidents are also collated. There are experimental data, resulting from laboratory dosing of honeybees with pesticides, which can be used to assist in assessing the significance of residues in the insects.

The Scottish scheme is similar to those in England and Wales and covers wildlife, companion animals, livestock and beneficial insects. Samples are sent to the Scottish Agricultural Science Agency (SASA) in Edinburgh for investigation. Veterinary support is provided by the Veterinary Investigation Laboratories of the Scottish Agricultural College and by Lasswade Veterinary Laboratory. Field investigations by Scottish Executive Environment and Rural Affairs Department (SEERAD) staff are normally only undertaken when pesticide poisoning has been confirmed unless there is clear evidence of deliberate abuse or misuse of a pesticide.

The Northern Ireland scheme is similar to the Scottish scheme. Samples are sent to specified analytical and veterinary laboratories in Northern Ireland. As with the Scottish scheme field investigations are normally only carried out when pesticide poisoning has been found. Investigations are usually carried out by the Health and Safety Executive Northern Ireland. The abuse and misuse of pesticides affecting wildlife may also contravene the provisions of the Wildlife (Northern Ireland) Order 1985 which is enforced by the Police Service of Northern Ireland (PSNI, formerly the Royal Ulster Constabulary) supported by the Countryside and Wildlife Branch of the Department of the Environment (Northern Ireland).

Where an incident is to be investigated for use in legal proceedings, evidence is gathered by the Defra Investigation Branch, in collaboration with the Pesticides Safety Directorate, who rely on information collected by the RDS and ARAD wildlife officers. SEERAD staff in Scotland and the PSNI, DARD staff and others in Northern Ireland carry out a similar role. Veterinary and analytical findings may also be used in evidence. The HSE and local authorities also have a regulatory role under FEPA and local liaison takes place between the departments to co-ordinate enforcement action. The police may also investigate cases.

All the schemes make use of analytical techniques and equipment capable of identifying low levels of residues of approved pesticides that are considered to present a possible hazard to vertebrates or beneficial insects. Multi-residue methods are used for the detection of organochlorine, organophosphate, some carbamate and pyrethroid compounds and for anticoagulant rodenticides. These are supplemented by specific analyses for strychnine, alphachloralose, metaldehyde, paraquat and some other compounds.

Appendix 2

Pesticide incidents occurring in 2001

Month	County	Number and Species	Chemical	Cause	Comments
January	East Yorkshire	grain	chlorophacinone	misuse	Exposed bait.
January	Hampshire	3 cats	aldicarb	abuse	
January	Hampshire	cat	alphachloralose	abuse	
January	Norfolk	20 fish, 10 frogs	Jeyes fluid	abuse	* Jeyes fluid poured into fish pond.
January	South Yorkshire	cat	aldicarb	abuse	
January	Suffolk	dog, grain	coumatetralyl	misuse	Dog also had small residue of bromadiolone.
January	Antrim	fox	bromadiolone	abuse	One of 15 found in a dump.
February	Cheshire	2 cats	dichlobenil	approved	*Illness in kittens possibly associated with dichlobenil use.
February	Derbyshire	2 dogs, pellets	metaldehyde	abuse	Pellets left in an area where there was no legitimate use.
February	Greater London	pellets	metaldehyde	abuse	Pellets probably intended for feral pigeons.
February	Humberside	2 dogs	aldicarb	abuse	
February	North Yorkshire	buzzard, tawny owl	alphachloralose	abuse	
February	Oxfordshire	dog	metaldehyde	unspecified	
February	South Yorkshire	bait	brodifacoum	abuse	Tuna laced with treated grain.
February	Surrey	2 dogs	methomyl	abuse	
February	Highland	red kite	carbofuran	abuse	
March	Cheshire	2 crows, 3 magpies	bendiocarb	abuse	
March	North Yorkshire	bait	metaldehyde	abuse	Tuna laced with metaldehyde.
March	South Yorkshire	cat	aldicarb	abuse	
March	Border	barn owl	bromadiolone	unspecified	Background residue.
March	Tayside	buzzard	carbofuran	abuse	SEERAD, RSPB & Police investigation.
March	Tayside	numerous ducks	bromadiolone	approved	SEERAD investigation.
March	Tayside	tawny owl	bromadiolone	unspecified	

Month	County	Number and Species	Chemical	Cause	Comments
March	Armagh	dog	warfarin	abuse	Parvovirus also noted.
March	Armagh	bait sample	paraquat	abuse	
March	Down	dog	paraquat	abuse	
April	Devon	honeybee	fluvalinate**	unknown	Small residue, not cause of death and probably from varroa treatment.
April	Essex	cat	alphachloralose	abuse	
April	North Yorkshire	red kite	alphachloralose	abuse	Bromadiolone also found.
April	North Yorkshire	dog, bait	aldicarb	abuse	Feral pigeon carcase used as a bait.
April	Oxfordshire	buzzard	alphachloralose	abuse	Difenacoum also found.
April	Shropshire	honeybee	fluvalinate**	unknown	Small residue, not cause of death and probably from varroa treatment.
April	Suffolk	fox	bromadiolone	unspecified	
April	West Midlands	bait	difenacoum	abuse	Meat laced with difenacoum.
April	Dyfed	red kite	alphachloralose	abuse	Bromadiolone also found.
April	Central	red kite	carbofuran/difenacoum	abuse	SEERAD, RSPB & Police investigation.
April	Highland	red kite, crow	carbofuran	abuse	SEERAD, RSPB & Police investigation.
April	Highland	red kite, baits	carbofuran	abuse	Three pigeon, a hare and a rabbit bait found.
April	Lothian	dog	bromadiolone	unspecified	
April	Tayside	cat	alphachloralose	abuse	
April	Tayside	red kite	alphachloralose	abuse	SEERAD, RSPB & Police investigation.
May	Cumbria	honeybee	bendiocarb	unspecified	Source unknown, but probably feral bee or wasp control.
May	Essex	honeybee	permethrin	unspecified	Source of permethrin not known at present.
May	Norfolk	buzzard, samples	carbofuran	abuse	Strychnine and mevinphos in seized samples, difenacoum also found in buzzard.
May	North Yorkshire	18 jackdaws, bait	alphachloralose	abuse	Bread used as poison bait.
May	South Croydon	honeybee	dichlorvos	misuse	Possibly from the use of Vapona to control wax moth.
May	West Glamorgan	pigeon bait, samples	aldicarb/bendiocarb	abuse	Bait under peregrine nest. Samples submitted also contained permethrin and bendiocarb.
May	Border	buzzard	carbofuran	abuse	Police investigation.
May	Tayside	buzzard	alphachloralose/bromadiolone	abuse	SEERAD & Police investigation.

Month	County	Number and Species	Chemical	Cause	Comments
June	Hampshire	3 badgers	methiocarb	abuse	
June	Hertfordshire	bait	metaldehyde	abuse	Chicken laced with pellets, probably intended for a dog.
June	North Yorkshire	honeybee	fluvalinate**	unknown	Small residue, not cause of death and probably from varroa treatment.
June	Northumberland	4 cats	carbofuran	abuse	
June	Surrey	3 foxes, bait	methomyl	abuse	Chicken used as bait, continuation of incident in February.
June	Gwent	11 dogs, bait	strychnine	abuse	Strychnine found in liver bait.
June	West Glamorgan	blackbird, 20 feral pigeons	fenthion	veterinary	Inner city area, abuse suspected.
June	West Glamorgan	honeybee	dichlorvos	unspecified	Small residue and the source unknown.
June	Strathclyde	magpie	carbofuran	abuse	Starling, pigeon and crow also reported, but not submitted for analysis.
June	Fermanagh	cat	alphachloralose	abuse	
June	Tyrone	cat	alphachloralose	abuse	
July	Avon	badger	difenacoum	unspecified	Blue coloured vomit near badger also contained difenacoum.
July	East Sussex	badger, bait, dog, sample	mevinphos/phosphine	abuse	Pheasant bait, badger - mevinphos: dog, seized sample - phosphine.
July	Hereford & Worcester	goshawk	alphachloralose	abuse	
July	Norfolk	grain	difenacoum	abuse	Grain left in an area, probably for birds.
July	Suffolk	honeybee	dimethoate	approved	Beans, infested with black bean aphid, were sprayed.
July	Tyne & Wear	honeybee	fluvalinate**	unknown	Small residue, not cause of death and probably from varroa treatment.
July	Border	cat	carbofuran	abuse	SEERAD & Police investigation.
July	Highland	red kite	carbofuran	abuse	Related to incidents occurring in April 2001.
July	Strathclyde	buzzard	alphachloralose	abuse	SEERAD investigation.
July	Antrim	2 dogs	metaldehyde	abuse	
August	Highland	golden eagle	carbofuran	abuse	SEERAD, Police & RSPB investigation.
August	Strathclyde	bait	strychnine	abuse	Reported to PF but no proceedings taken – possibly due to age of the accused.
August	Down	dog	paraquat	abuse	
August	Down	dog	paraquat	abuse	

Month	County	Number and Species	Chemical	Cause	Comments
August	Londonderry	golden eagle	warfarin/bromadiolone/ brodifacoum	abuse	
September	Cumbria	partridge bait	carbofuran	abuse	
September	Greater Manchester	40 feral pigeons, bait	bendiocarb	abuse	Seed laced with bendiocarb.
September	Lincolnshire	honeybee	fluvalinate**	unknown	Small residue, not cause of death and probably from varroa treatment.
September	Northumberland	dog	metaldehyde	unspecified	
September	Dyfed	4 dogs	paraquat	abuse	
September	Border	red kite	carbofuran/bromadiolone	abuse	SEERAD & Police investigation.
September	Highland	red kite	carbofuran/bromadiolone	abuse	Police & RSPB investigation.
September	Highland	red kite	difenacoum	unspecified	
September	Strathclyde	pigeon	carbofuran	abuse	Police & RSPB investigation. Related to incident in June.
September	Tayside	buzzard	carbofuran	abuse	SEERAD, Police & RSPB investigation.
September	Antrim	cat	paraquat	abuse	
September	Down	buzzard	alphachloralose	abuse	
October	Norfolk	12 racing pigeons	imidacloprid	unspecified	Birds were very ill after eating imidacloprid treated grain.
October	Suffolk	pellets	metaldehyde	misuse	*Spillage of pellets on a road following application to a field.
October	Wiltshire	dog, pellets	metaldehyde	misuse	Spillage of pellets.
October	Dumfries & Galloway	red kite	carbofuran/bromadiolone	abuse	SEERAD, Police & RSPB investigation.
October	Strathclyde	buzzard	bromadiolone	unspecified	
October	Tayside	dog	brodifacoum	misuse	SEERAD investigation.
October	Antrim	bait	bromadiolone	abuse	Sausages laced with blue pellets.
November		4 samples	aldicarb/benfuracarb	abuse	One jar had poisoning instructions on the label.
November	Bedfordshire	red kite	bromadiolone/brodifacoum/ difenacoum	unspecified	Trichomoniasis also noted in bird.
November	County Durham	buzzard	alphachloralose	abuse	
November	Dorset	red kite	carbofuran	abuse	Bromadiolone and difenacoum also found.
November	Northumberland	pellets	metaldehyde	abuse	Slug pellets mixed with bread and fruit, possibly for birds.
November	Suffolk	pellets	metaldehyde	misuse	Spillage near a path.

Month	County	Number and Species	Chemical	Cause	Comments
November	South Glamorgan	honeybee	fluvalinate**	unknown	Small residue, not cause of death and probably from varroa treatment.
November	Dumfries & Galloway	red kite	carbofuran	abuse	SEERAD, Police & RSPB investigation.
November	Tayside	buzzard	carbofuran	abuse	Police investigation.
November	Western Isles	buzzard	difenacoum/brodifacoum	unspecified	
November	Antrim	buzzard	alphachloralose	abuse	Found injured below tree where it roosted, dead the next day.
November	Rathlin Island	buzzard	alphachloralose	abuse	
November	Tyrone	dog	warfarin/bromadiolone	abuse	
December	Gloucestershire	dog	metaldehyde	abuse	
December	Northumberland	buzzard, bait	carbofuran	abuse	Rabbit used as a bait.
December	Tayside	buzzard	alphachloralose	abuse	SEERAD, Police & RSPB investigation.
December	Tayside	buzzard	alphachloralose	abuse	SEERAD, Police & RSPB investigation.
December	Western Isles	buzzard	difenacoum	unspecified	
December	Tyrone	dog	bromadiolone	abuse	
Unknown	Grampian	buzzard	bromadiolone	unspecified	
Unknown	Tayside	buzzard, pine marten	alphachloralose/bromadiolone/ difenacoum	abuse	SSPCA investigation.

* Incidents where samples were not available for analysis, but information gathered during enquiries into the incident suggests the involvement of the pesticide.

**Residue not confirmed, but reported here to show the frequency that residues of this compound are noted.

Appendix 3

Major WIIS publications

(in chronological order since 1976)

Hamilton, G.A., Hunter, K., Ritchie, A.S., Ruthven, A.D., Brown, P.M. and Stanley, P.I. (1976). Poisoning of wild geese by carbophenothion-treated winter wheat. *Pestic. Sci.* **7:**175-183.

Brown, P.M., Bunyan, P.J. and Stanley, P.I. (1977). The investigation and pattern of occurrence of animal poisoning resulting from the misuse of agricultural chemicals. *J. Forens. Sci.* Soc. **17:** 211-221.

Stanley, P.I. and St Joseph, A.K.M. (1979). Poisoning of Dark-bellied Brent Geese in Essex, February 1979. *Wildfowl.* **30:**154.

Felton, C.L., Brown, P.M., Fletcher, M.R., Stanley, P.I., Quick, M.P. and Machin, A.F. (1981). Bird poisoning following the use of warble fly treatments containing famphur. *Veterinary Record,* **108:** 440.

Keymer, I.F., Fletcher, M.R. and Stanley, P.I. (1981). Causes of mortality in British Kestrels (Falco tinnunculus). In: *Recent Advances in Study of Raptor Diseases.* Cooper, J.E. and Greenwood, A.G. (Eds.), Chiron Publications, Keighley. pp. 143-151.

Hamilton, G.A., Ruthven, A.D., Findlay, E., Hunter, K. and Lindsay, D.A. (1981). Wildlife deaths in Scotland resulting from misuse of agricultural chemicals. *Biological Conservation*, **21:** 315-326.

Fletcher, M.R. and Hardy, A.R. (1983). Wildlife poisoning incidents from agricultural pesticides in England and Wales. *Proceedings 10th International Congress Plant Protection,* **2:** 725.

Hardy, A.R., Fletcher, M.R. and Stanley, P.I. (1986). Pesticides and wildlife: Twenty years of vertebrate wildlife incidents investigated by MAFF. *State Veterinary Journal,* **40:** 182-192.

Hardy, A.R., Greig-Smith, P.W. and Stanley, P.I. (1987). Birds as indicators of the intensity of use of agricultural pesticides in the UK. In *The Value of Birds.* Diamond, A.W. and Filion, J. (Eds.), ICBP Technical Publication no.6. pp. 119-132.

Brown, R.A., Hardy, A.R., Greig-Smith, P.W. and Edwards, P.J. (1988). Assessing the impact of rodenticides on the environment. *OEPP/EPPO Bull*., **18:** 283-292.

Greig-Smith, P.W. (1988). Wildlife hazards from the use, misuse and abuse of pesticides. *Aspects of Appl. Biol*., **17:** 247-256.

Greig-Smith, P.W. (1988). Hazards to wildlife from pesticide seed treatments. In *Application to seed and soil*. Martin, T.J. (Ed.). Monograph no.39, BCPC. pp. 127-134.

Greig-Smith, P.W. (1989). Tracking the safety of pesticides for wildlife. *British Sugar Beet Review*. **57:** 23-27.

Greig-Smith, P.W. (1990). Understanding the impact of pesticides on wild birds by monitoring incidents of poisoning. In *Wildlife Toxicology and Population Modelling: integrated studies of agroecosystems*. Kendall, R.J. and Lacher, T.E. (Eds.), Lewis Publishers, Boca Raton. pp. 301-319.

Greig-Smith, P.W. (1990). Investigations of honeybee poisoning by pesticides in the UK, 1981-1989. *Proceedings*, Fourth International Symposium on Harmonisation of Methods for Testing the Toxicity of Pesticides to Bees. Research Institute of Apiculture, Dol, Czechoslovakia 1990, pp 29-34.

Greig-Smith, P.W. (1991). Use of cholinesterase measurements in the surveillance of wildlife poisoning in farmland. In *Cholinesterase-inhibiting insecticides*. Mineau, P. (Ed.). Elsevier. pp. 127-150.

Fletcher, M.R. and Grave, R.C. (1992). Post-registration surveillance to detect wildlife problems arising from approved pesticides. *Proceedings British Crop Protection Council – Pests and Diseases 1992*, **2:** 793-798.

Hart, A.D.M. and Greig-Smith, P.W. (1992). Validation of environmental risk assessment procedures for pesticides. *Proceedings British Crop Protection Council –- Pests and Diseases 1992*, **2:** 799-804.

Fletcher, M.R., Greig-Smith, P.W. and Stevenson, J.H. (1994). The Scheme to investigate the suspected poisoning of honeybees by agricultural chemicals in England and Wales. In: *Proceedings 5th International Symposium on the Hazards of Pesticides to Bees*. Appendix 18, pp.139-145: Plant Protection Service, Wageningen, The Netherlands.

Fletcher, M.R. (1994). Pesticide poisoning of wildfowl in England and Wales. *Wildfowl*, **45:** 255-259.

Greig-Smith, P.W., Thompson, H.M., Hardy, A.R., Bew, M.H., Findlay, E. and Stevenson, J.H. (1994). Incidents of poisoning of honeybees (*Apis mellifera*) by agricultural pesticides in Great Britain 1981-1991. *Crop Protection*. **13:** 567-581.

Hunter, K. (1995). The poisoning of non-target animals. In: *Pesticides – Development, Impacts, and Controls*. Best, G.A. and Ruthven, A.D. (Eds.) RSC publications pp 74-86.

Brown, P., Charlton, A., Cuthbert, M., Barnett, E., Ross, L., Green, M., Gillies, E., Shaw, K. and Fletcher, M. (1996). Identification of pesticide poisoning in wildlife. *J. Chromatogr. A.*, **753:** 463-478.

Barnett, E.A., Fletcher, M.R., Brown, P.M. and Charlton, A. J. (1997). Changing patterns of pesticide poisoning incidents of bees in England and Wales in recent years. In: *Proceedings 6th International Symposium on the Hazards of Pesticides to Bees*. Appendix 21, 1-9: Federal Biological Research Centre for Agriculture and Forestry, Braunschweig, Germany.

Barnett, E.A. and Fletcher, M.R. (1998). The poisoning of animals from the negligent use of pesticides. *Proceedings British Crop Protection Council – Pests and Diseases 1998*, **1:** 279-284.

Mineau, P., Fletcher, M.R., Glaser, L.C., Thomas, N.J., Brassard, C., Wilson, L.K., Elliott, J.E., Lyon, L.A., Henny, C.J., Bollinger, T. and Porter, S.L. (1999). Poisoning of raptors with organophosphorus and carbamate pesticides with emphasis on Canada, U.S. and U.K. *J. Raptor Res.*, **33:** 1-37.

Edwards, P.J., Fletcher, M.R. and Berny, P. (2000). Review of the factors affecting the decline of the European brown hare, *Lepus europaeus* (Pallas, 1778) and the use of wildlife incident data to evaluate the significance of paraquat. *Agriculture, Ecosystems and Environment*, **79:** 95-103.

In addition to the above, the results of the Scheme have been widely used in several publications.