Pesticide Poisoning of Animals 2000:

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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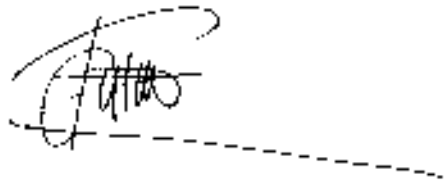
Preface

It is a little like a "finger on the pulse", in that it gives useful, but not complete feedback on the state of the system after treatment. I refer, of course, to this report that summarises results from the UK Wildlife Incident Investigation Scheme for 2000. It is useful feedback, in that it is through reported incidents that we are going to get an impression of failings in the pesticide regulation programme, either through incomplete protection arising from registered use, or from misuse or from abuse. But there are possible distortions because: not all incidents are picked up; not all incidents that are picked up are in a state that they can be properly analysed; not all species are covered; only direct poisoning is considered.

With this in mind it is, nevertheless, comforting to see no major shift upwards in incidents for 2000 as compared with the situation since 1994. Incidents due to abuse are up in 2000 compared with 1999, but fit in with the general results over previous years. Of more concern, incidents involving birds of prey are up in 2000 against 1999; probably not significantly so taking the period 1994 to 2000 as a whole, but certainly something to keep an eye on. And, in contrast, it is important that wildlife incidents attributed to anticoagulant rodenticides were not great in number and lower than last year.

Those involved in analysing these data and compiling the report are to be congratulated in providing information with clarity and care. All depends, though, on suspected incidents being reported. The public needs to be made aware that the Scheme exists and that all suspected incidents that are reported are treated as seriously and as thoroughly as this report illustrates.



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 an 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.

There were 506 suspected poisoning incidents registered by the Scheme in 2000. The causes were determined in 266 incidents of which 162 (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 16 incidents arising from the approved use of pesticides (see Figure 1) in 2000 (includes seven bee incidents). This compares with ten in 1999 (includes three bee incidents). Proportionately, this is 10% of pesticide incidents reported in 2000 compared with 7% in 1999. Although this is an increase in number and proportion of approved use incidents, it is not exceptional when compared with years prior to 1999 (see Table 24).

The number of misuse incidents (see Figure 1), often the result of the careless use of pesticides, was 23 in 2000 (includes one bee incident). There were 32 incidents in 1999 (includes one bee incident). This represents 14% of confirmed poisoning incidents in 2000, compared with 23% in 1999. The proportion of misuse incidents in 2000 has returned to a level seen in previous years, as until 1997 it was around 12% (see Table 24).

Deliberate abuse of pesticides was found in 95 incidents compared with 61 incidents in 1999. This represents 59% of the pesticide incidents (see Figure 1), compared with 44% in 1999. The proportion of abuse incidents is similar to that seen in years prior to 1999.

A further 24 poisoning incidents (15%) were attributed to unspecified use, including five bee incidents (see Figure 1). In 1999 there were 34 incidents (24%) (includes five bee incidents), where there was insufficient information available to identify the source of the poisoning.

For honeybees, there were 13 pesticide incidents involving bee deaths out of 48 incidents investigated (see Table 18), compared to 1999, where 9 pesticide incidents were confirmed out of 28 investigated.

There were four incidents where veterinary products were thought to be involved (see Figure 1).

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 taken 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 506 suspected poisoning incidents, vertebrates were involved in 394 incidents; beneficial insects in 48; suspected baits and suspicious samples, where no poisoned animals were found, in 64. These are reported in Part 2 of the report.

In England, 244 incidents were reported, of which 83 (34%) were found to be caused by pesticides; Scotland had 167 incidents registered, 57 (34%) were found to be caused by pesticides; Wales had 42 incidents registered, 11 (26%) were found to be caused by pesticides; and in Northern Ireland, 53 incidents were reported, 11 (21%) were found to be caused by pesticides (see Table 2 and Figure 3).

The number of suspected poisoning incidents registered by the Scheme in 2000 can be compared with 1999. In 1999 there were 453 incidents registered, and the causes were determined in 215 of these (47% of those registered). Therefore in 2000 the number of incidents registered has increased, so the number of incidents resulting from pesticides has also increased (see Table 3). However, the proportion of pesticide incidents has remained more or less the same, around 30%, for several years.

Thirty two agricultural chemicals were identified in the pesticide poisoning incidents (see Table 4); Twenty nine compounds were found in 1999.

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 National Assembly for Wales Agriculture Department (NAWAD) examine cases of suspected poisoning by agricultural chemicals 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 NAWAD 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 scheme 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 and 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 2000 interested Government Departments led by DEFRA, continued the long-term Campaign Against the Illegal Poisoning of Animals. The Scheme is now becoming much more widely known and there has been much press and media coverage throughout the years. 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 2000

Number of incidents in 2000

9. All incidents that were registered to WIIS, and which were investigated during 2000 are included in this report. There were 506 suspected poisoning incidents registered by the Scheme in 2000. The cause of death or illness (including pesticides and non-agricultural chemicals, trauma, starvation and disease) was determined in 266 incidents (53% of those registered). In 162 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.

10. There were 16 incidents of approved use, 23 of misuse, 95 of abuse and 24 of unspecified use, where the source of the compound remained unknown despite thorough field investigations. Additionally there were four incidents thought to involve veterinary products. Positive enforcement continued to be a priority in 2000 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 2000

	Incidents investigated	Pesticide poisoning incidents	Other cause of death found
Vertebrate wildlife	231	68 (29%)	76 (33%)
Livestock	9	0	4 (44%)
Companion animals	160	58 (36%)	18 (11%)
Other	1	0	1(100%)
Beneficial insects	48*	13* (27%)	6 (13%)
Suspected baits and suspicious substances	64	28 (44%)	not applicable
TOTAL **	**506**	**162 (32%)**	**104 (21%)**

* 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.

Part 2: Incidents in 2000 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.

12. There was one incident reported to the Scheme in England and Wales and 15 in Scotland which resulted from the approved use of a compound. This compares with 7 incidents (including 3 bee incidents) in England and Wales and 3 in Scotland in 1999. The single incident in England involved metaldehyde. Of the 15 incidents in Scotland, 7 were attributed to the anticoagulant rodenticides bromadiolone or difenacoum and involved birds of prey, a further anticoagulant rodenticide incident concerned the poisoning of a dog with coumatetralyl and 7 incidents involved bee deaths associated with the use of paraquat to destroy GM oilseed rape which was in flower. Four of these incidents are likely to have resulted from the same spray application.

13. Detailed summaries of the incidents appear below. Five different compounds representing three areas of use were identified in these incidents. The small number of incidents reported to the Scheme indicates that agricultural chemicals, if used in an approved manner, are apparently not causing major problems to wildlife or other animals. The seven incidents involving bees were all due to use of paraquat in unusual circumstances which are unlikely to re-occur. The majority of incidents, eight, involved rodenticides and once again emphasises the need for vigilance in retrieving rodent carcasses. The incident in England attributed to metaldehyde highlights the need to be scrupulous in the disposal of unused slug pellets.

Incident summaries

14. A dog became seriously ill after being walked alongside a field where slug pellets had been applied four days earlier. The symptoms displayed by the dog, including production of bright green faeces, were consistent with metaldehyde poisoning. The dog recovered with appropriate treatment. No samples from the dog were retained. However, the owner retrieved a sample of sodden blue/green pellets and partially burnt pieces of paper sack from an area of the field away from the public right of way. The pellets had been applied by a competent contractor who had burnt the waste packaging on site. It appears that every effort had been made to comply with the conditions of approval and the Code of Good Practice for the Safe Use of Pesticides on Farms and Holdings in use and disposal

of this pesticide. It is likely that an unexpected rain shower put out the fire after the contractor left the site, but before all the material was burnt. This has been considered to be an approved use incident. However, the farmer has been sent a written reminder of the need to ensure that all pesticide and its packaging is disposed of safely and completely.

15. A buzzard was submitted from the Black Isle in early January, two other buzzard carcases had been found in the same area but were largely decomposed. Post mortem examination of the submitted bird showed the presence of extensive haemorrhaging in the carcase, and no indications of traumatic injury. Analytical investigation identified a residue (0.18mg/kg) of difenacoum in the liver tissue from the buzzard. This residue, together with the evidence of haemorrhaging, was interpreted as being consistent with death having resulted from anticoagulant poisoning. A field investigation confirmed that a number of holdings in the area used rodenticides from time to time to control rats. However, only a single property had been actively using this type of product at the time of the incident, and here Neosorexa bait was being used to control rats in a potato store. Dead rats, which were often found in potato boxes, were being buried as a matter of practice.

16. Two buzzards submitted from Tayside in February and March respectively, were shown to be carrying residues of difenacoum. In the first case the magnitude of the residue was 0.03 mg/kg in liver. The post mortem findings included evidence of haemorrhaging in the lungs and within the body cavity, however this could have been associated with blunt trauma. In the second case the magnitude of the residue was 0.04 mg/kg in liver, and the immediate cause of death appeared to be trauma. In both cases the exposure was attributed to approved use.

17. A dog that died on a farm in Grampian in May showed signs of loss of appetite, then vomiting prior to death. The mucous membranes of the dog were pale. It was suspected that the animal may have been exposed to an anticoagulant rodenticide. Analysis confirmed the presence of a coumatetralyl residue in liver tissue. The magnitude of the residue was consistent with anticoagulant poisoning being the cause of death. Field investigation confirmed that a coumatetralyl formulation (Racumin) had been used on the farm for a number of years. It had been the subject of particularly active use to control a severe infestation of rats at a feed store and around a pig-rearing unit in the preceding February. The formulation appeared to have been applied in compliance with the recommendations for rodenticides, and there was no evidence to indicate that rat bodies were not being properly disposed of.

18. An adult female red kite was found dead at it's nest site near Doune in May. Post mortem examination indicated that it had died from internal haemorrhaging, possibly resulting from a ruptured ovarian follicle. A significant residue (0.24 mg/kg) of bromadiolone was identified in the liver tissue of the bird. The territory regularly hunted over by the kite was defined from RSPB observation data. Field investigation established that three of six holdings in this area were actively using rodent control measures based on bromadiolone baits. There was no evidence to indicate either a lack of care in using the formulations involved, or a direct link with a single property. The possibility of multi-point exposure from more than one site could not be excluded. A significant residue of bromadiolone had been found in another red kite that died, nearby in the Dunblane area, from chloralose poisoning in February 1999.

19. In June, a red kite chick died whilst being ringed at a site near Muir of Ord. The chick was observed to be bleeding from the beak. Post mortem examination showed the liver and other organs to be very pale, and identified free blood in the body cavity in addition to

evidence of haemorrhage into the lungs. Difenacoum (0.36mg/kg) was identified in liver tissue from the chick. Subsequently a second chick was submitted from the same nest; again difenacoum (0.38mg/kg) was identified in liver. Field investigation established that rodenticides were in use on five out of nine agricultural holdings in the area and also at a distillery site. Difenacoum baits (Neosorexa) were confirmed to be in use at four of the agricultural holdings. The source of exposure to difenacoum in this case could not be linked with a specific property. The possibility of a multi-point exposure could not be excluded.

20. Later in June, one of three red kite chicks, at a nest site on the Black Isle that was being monitored by CCTV, was observed to fall out of the nest. A post mortem examination showed that the liver was very pale, and that free blood was present in the body cavity. Blood was also present in the beak and throat, and there was evidence of subcutaneous haemorrhaging. The stomach contained the remains of a rodent, consistent with the CCTV evidence, which identified rats as frequent food items brought back to the nest by the parent birds. A residue (0.36mg/kg) of bromadiolone was detected in liver tissue from the chick; this and the evidence of extensive haemorrhaging, pointed to anticoagulant poisoning being the cause of death. Field investigation failed to provide a definite link with a single source of exposure. The two other chicks from the nest successfully fledged.

21. A significant residue (0.16mg/kg) of bromadiolone was identified in liver tissue from a red kite submitted in October from the Alness area. The bird was believed to be a road traffic casualty, and the immediate cause of death was trauma. The magnitude of the rodenticide residue is close to the range observed in birds where haemorrhagic symptoms have been expressed. Little is known about sub-lethal effects of rodenticides on birds, including any influence on their susceptibility to road traffic accidents.

22. In seven incidents involving mortalities of honeybees, there was either information pointing to a link with the spraying of an agricultural chemical on oil seed rape crops, or evidence of such a link was identified in the ensuing field investigations. In all of these cases, residues of paraquat were identified in samples of the bees. All of the incidents were associated with the use of this herbicide to destroy crops of GM contaminated Hyola oil seed rape. Four of the incidents near Nairn appeared to have resulted from the same spray event.

23. The crops, all in flower, were sprayed on dry calm days. In some cases the growers involved contacted local beekeepers, to warn of the intention to spray. However in one case a grower was unable to contact the secretary of the local beekeepers in the 2-day period prior to spraying. In most of the other cases, the presence of beekeepers in the vicinity was unknown to the grower. Finally in one case, a farmer thought that the herbicide was 'bee friendly'.

24. In all cases the beekeepers observed not only dead bees at their hives, but also a high proportion of severely affected bees. The distressing effects on bees at the hives persisted for period of up to 3 weeks. One of the beekeepers involved in the incident near Nairn had closed his colonies up for a period of 18 hours to avoid exposure during the spray application, but his hives were still seriously affected. This would seem to reflect exposure from the crop rather than direct overspraying at the time of application.

25. Despite active liaison with beekeepers in some of the cases, adverse effects on bee colonies were experienced. The use of a herbicide in this way to destroy a developing crop was somewhat unique and completely atypical of the normal pattern of use, i.e. use on a crop in full flower. Due to these incidents the product literature is being revised to avoid similar

incidents occurring. In addition, if such unlikely circumstances were to occur again, SEERAD will ensure that the danger to bees from destroying flowering crops is brought to the attention of the agricultural industry.

Misuse incidents

26. A number of incidents was reported where misuse of pesticides was identified (see Figure 1). These 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). Thus, the chemicals found in this category tend to be rodenticides, molluscicides, seed treatments and spray compounds used where honeybees are at risk. In 2000, there were 23 incidents, including one honeybee incident (14% in this category, involving 15 different compounds). In the previous year there were 32 incidents (23%, involving 14 compounds), including one honeybee incident.

27. Many of the misuse incidents involved slug pellets, primarily uncleared spillages. There were six incidents involving metaldehyde and one with methiocarb. All these incidents involved dogs, except one metaldehyde incident which was a spillage of pellets with no casualties found. Potentially wild animals such as badgers and foxes, which are likely to find the pellets palatable, are equally at risk in such circumstances. Unfortunately 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.

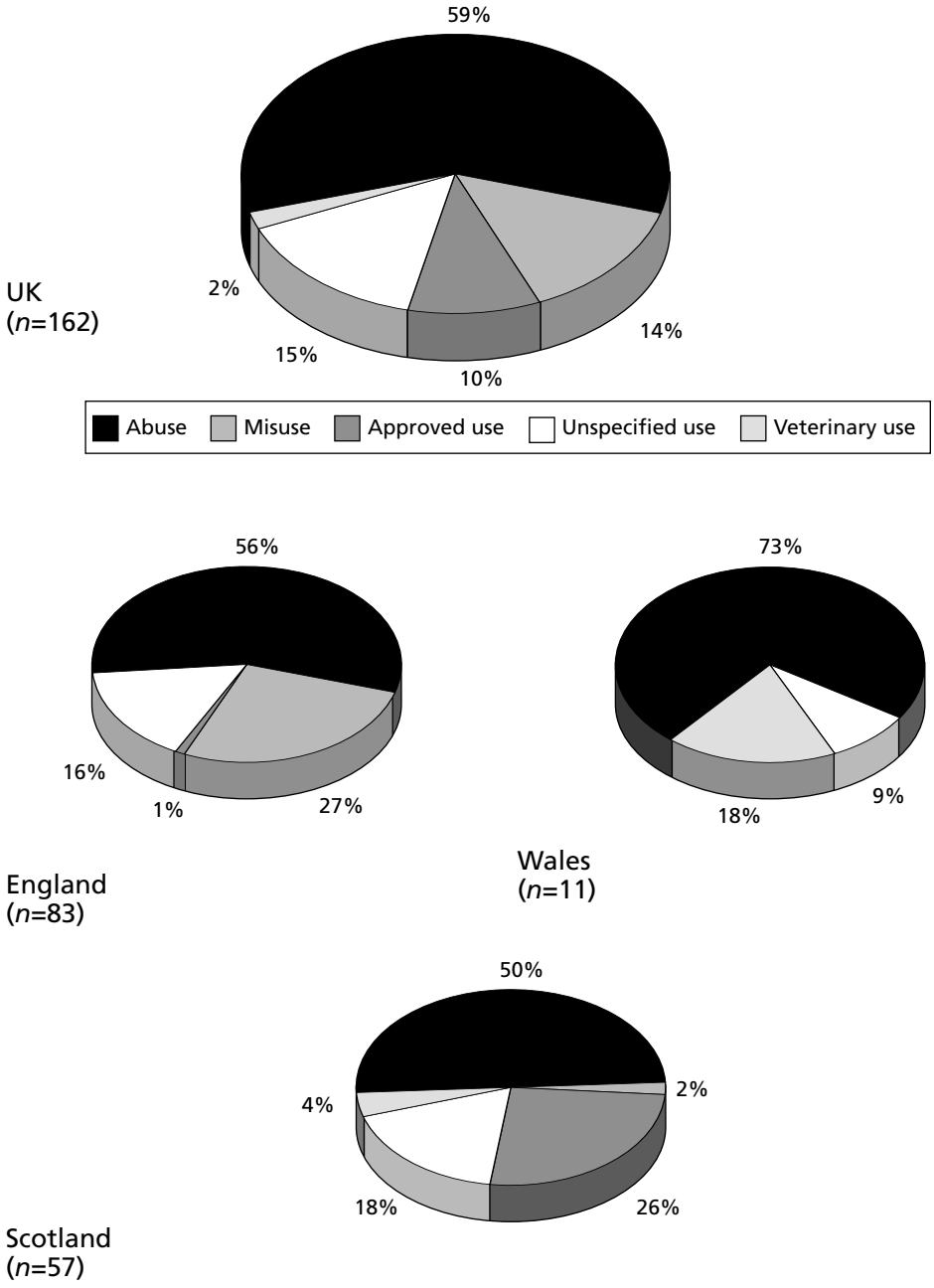
28. Uncovered rodenticide baits were found in ten misuse incidents, involving seven different compounds. Three of the incidents involved dogs and in the other incidents, exposed grain only was found. There were two misuse incidents involving bromadiolone, one incident involving chlorophacinone, one difenacoum, one warfarin and one where no samples were available to identify the rodenticide involved. There were four incidents involving more than one rodenticide, with single incidents involving: bromadiolone and difenacoum; bromadiolone, difenacoum and warfarin; brodifacoum, coumatetralyl and difenacoum; difenacoum and flocoumafen.

29. There were five single incidents of misuse of bendiocarb, sodium cyanide, aluminium phosphide, dimethoate and jeyes fluid.

30. 1,4-dichlorobenzene was involved in one honeybee misuse incident.

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

Figure 1: Proportion of all incidents by category of pesticide involvement in 2000 (All pesticide incidents in Northern Ireland were abuse).



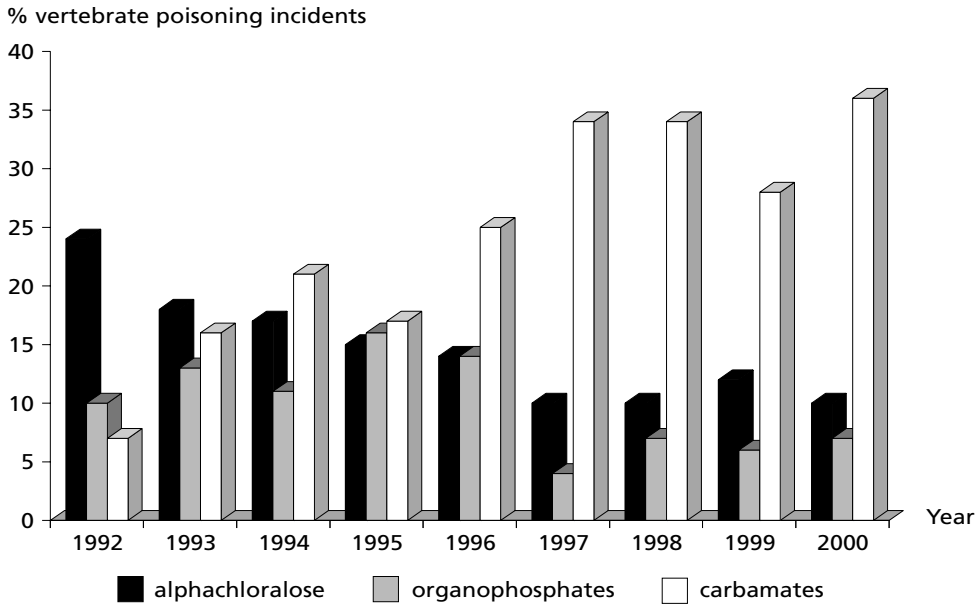
Abuse incidents

32. As in previous years, a large number of incidents involved deliberate abuse of pesticides (see Figure 1, no incidents involving beneficial insects in this category). The number of poisoning incidents attributed to abuse was 95 (59% of pesticide incidents); 61 were found in 1999, which represented 45% of pesticide incidents. Although this is an increase in number and proportion of pesticide incidents, the numbers in 1999 were lower than in previous years.

33. Nineteen different compounds were involved in these incidents, compared with 15 in the previous year. The three compounds found to be most abused were, carbofuran (24; 25% of abuse incidents), aldicarb (16; 17% of abuse incidents) and alphachloralose (15; 16% of abuse incidents). Five of these incidents involved more than one compound: carbofuran and aldicarb; carbofuran, sodium cyanide and strychnine; carbofuran and mevinphos; carbofuran and paraquat; alphachloralose and strychnine. Carbofuran and alphachloralose were the compounds most found in abuse incidents in the previous year. In 1999, carbofuran was involved in 17 (28%) abuse incidents, alphachloralose 14 (23%) and aldicarb in 12 (20%). Birds, particulary raptors, are involved in the alphachloralose incidents and with aldicarb and carbofuran the species affected include birds, cats, dogs and foxes.

34. There were 12 incidents (13%) involving the abuse of slug pellet formulations (8 incidents, metaldehyde and 4 incidents, methiocarb), with foxes, feral pigeons, cats, dogs and a badger sett affected. The abuse of mevinphos has increased by one incident, compared to 1999, with 5 incidents attributed to the abuse of this compound and involving birds, mainly raptors (1999, 4 incidents, 1998, 1 incident, 1997, 3 incidents, 1996, 11 incidents) (see Figure 2). One of these incidents also involved carbofuran. There was also a cat poisoning incident involving phorate.

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



35. The strychnine incidents reported has increased to eight (8%) (one incident in 1999) and they mainly involve dogs, except for an incident with two peregrines. There were other compounds identified in two of these incidents (see paragraph 33). There were three incidents involving vertebrate gassing agents, where in two incidents (one sodium cyanide and one aluminium phosphide) it was used to illegally gas badger setts. In the other incident sodium cyanide was retrieved during follow-up action in an abuse incident (see paragraph 33).

36. Carbamate abuse incidents, other than aldicarb and carbofuran mentioned above, were associated with three separate incidents where cats were poisoned with bendiocarb and an incident where oxamyl was used on a bait.

37. There was an increase in the number of anticoagulant rodenticide abuse incidents, from four in 1999, to ten in 2000. These incidents involved companion animals or just baits. Bromadiolone was identified in four incidents (one incident also included warfarin), brodifacoum in two incidents, difenacoum in two incidents and single incidents with coumatetralyl and one with warfarin.

38. There were three paraquat abuse incidents in 2000, two involved dogs and the other a seized sample where carbofuran was also found.

Unspecified use incidents

39. In every year there is 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 2000, there were 24 incidents of unspecified use (15% of pesticide poisoning incidents), including five bee incidents; there were 34 in 1999 (24%), including five bee incidents. There were 15 different compounds detected in these incidents and there were 16 in the previous year.

40. Dogs and slug pellets were implicated in four unspecified use incidents, three involving metaldehyde and one methiocarb. In addition there was also a badger incident which involved metaldehyde and anticoagulant rodenticides (see paragraph 43). Most are likely to have arisen from 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.

41. Other unspecified use incidents involved: three incidents with DDE (two involving sparrowhawks, a residue of dieldrin was also found in one of these, and one involving a peregrine, where dieldrin and HCB were also found); two incidents with carbofuran (one involving a red kite and the other a buzzard); one incident with paraquat (dog); and one incident with bendiocarb (red kite).

42. There were five incidents involving honeybees where the source of the residues detected could not be determined. There were three incidents involving bendiocarb, but in two of these incidents other compounds were also found, paraquat in one and pirimiphos-methyl in the other. The remaining two incidents involved cypermethrin and demeton-S-methyl.

Anticoagulant rodenticides

43. 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. From previous WIIS data, it is very unlikely that these incidents are occurring due to abuse, so although they are classified as unspecified use, it is likely that rodent control operations, particularly those where label instructions are not strictly adhered to, are the cause. 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 via secondary poisoning ie. eating poisoned rodents and this emphasizes 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. There were eight incidents involving these compounds (there were 18 in 1999) during 2000. Two of these incidents involved red kites (bromadiolone and difenacoum), two involved foxes (bromadiolone and coumatetralyl/difenacoum) and another two were associated with badgers (both bromadiolone/difenacoum, but one incident also involved metaldehyde). The remaining two incidents involved a pheasant (bromadiolone) and a dog (brodifacoum). In 1999, there were seven unspecified use anticoagulant rodenticide incidents involving birds of prey. In 1999, there were two incidents involving red kites where death was due to the abuse of a pesticide, but anticoagulant rodenticide residues were also detected in the livers of these birds. In 2000, there were eight incidents where raptor deaths were attributed to abused pesticides, but exposure to anticoagulant rodenticides had also occurred (six incidents bromadiolone, one incident bromadiolone/difenacoum and one brodifacoum/difencoum). Five of these incidents involved red kites and three incidents buzzards.

44. Regionally there was one incident from Wales, one from Scotland, and the rest were in England. In the eight incidents where abused compounds were also found, six of the incidents were in Scotland and two in England. Rodent control operations were known of in many of these incidents, but it is difficult to establish all sources of rodenticide use in an area, which is why these incidents have been classified as unspecified use.

Enforcement action

45. 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.

46. 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.

47. In England, a total of four incidents were referred to DEFRA Investigation Officers for further investigation, as well as eleven cases where inquiries had been carried forward from 1999. In seven of these cases, inquiries were completed in 2000 and it was concluded that there was insufficient evidence for prosecution. Enquiries into the remaining eight cases continued into 2001.

48. In Wales one incident was referred to The National Assembly for Wales with a recommendation to forward it to DEFRA Investigations Branch, but to date no report from them has been received. Three incidents involved the deliberate poisoning of peregrines in South Wales. In each case, the results of analysis were passed to the police who were investigating the cases. In an incident in North Wales a peregrine falcon and two suspected pigeon baits were found to contain residues of alphachloralose. The results were passed on to RSPB Investigations Branch who are hoping to set up surveillance equipment in 2001.

49. In Scotland positive enforcement action continues to be a priority as a measure to counteract pesticide abuse. SEERAD officials frequently work in partnership with wildlife liaison officers from the various police forces in Scotland, 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.

50. Charges were prepared in respect of three cases arising from incidents accepted for investigation during 2000. Only one case, in which a gamekeeper has been charged with breaches under the Wildlife and Countryside Act and the Control of Pesticides Regulations, will proceed to a court hearing. In one of the other cases charges were not pursued because of the death of the accused. In the other, charges were dropped because of a technical issue concerning licenses for bird traps. A prosecution arising from incidents in 1998 and 1999 was withdrawn by the Fiscal Service at a hearing in Perth Sheriff Court in December 2000.

51. There were three cases where it was recommended that SEERAD Policy Branch should issue advisory letters. One was in relation to the poisoning of a red kite with bromadiolone near Doune and the other two involved the poisoning of buzzards with carbofuran at sites in Grampian.

52. SEERAD Agricultural Staff carried out 40 field investigations during 2000. Many of these were joint operations with the police, and some also involved RSPB Investigation Officers. The police pursued three incidents, either independently or with assistance from the SSPCA.

Part 3: Incidents in 2000: Species/Samples and the agricultural chemicals involved

Species/Samples involved

53. A total of 506 incidents was investigated during 2000. 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. 394 incidents involved vertebrates; 48 involved beneficial insects; 9 involved livestock; 64 were suspected baits and/or seized samples. The cause of death or illness (including pesticides and non-agricultural chemicals, trauma, starvation and disease) was established in 53% of all incidents. A further 36 (7%) 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 162 (32%) of the incidents (compared with 139 (31%) in 1999); 29% of incidents involving vertebrate wildlife, 27% of incidents involving bees, 36% of companion animal incidents and 44% of suspected bait incidents. A geographical breakdown of the data is shown in Table 2.

Table 2: Incidents investigated by country in 2000 (% pesticide as cause)

	England	Wales	Scotland	N.Ireland
Vertebrate wildlife	86 (31%)	28 (29%)	99 (30%)	18 (17%)
Livestock	3 (0%)	1 (0%)	3 (0%)	2 (0%)
Companion animals	77 (44%)	9 (33%)	46 (33%)	28 (21%)
Other	1 (0%)	0	0	0
Beneficial insects	32 (13%)	3 (0%)	13* (69%)	0
Suspected baits and suspicious substances	50 (46%)	1 (0%)	8 (38%)	5 (40%)
TOTAL**	**244 (34%)**	**42 (26%)**	**167 (34%)**	**53 (21%)**

* 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.

54. A comparison of the number of poisoning incidents for each category of animal from 1994 to 2000 is shown in Table 3.

Table 3: Number of incidents in which pesticides were identified as a likely cause of poisoning 1994-2000

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

* 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.

55. 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 2000 and species and/or bait involved

Organochlorine compounds		
DDT and metabolites	3	peregrine, sparrowhawk.
dieldrin	2	peregrine, sparrowhawk.
HCB	1	peregrine.
Organophosphorus compounds		
demeton-S-methyl	1	honeybee.
dichlorvos	1	gull.
dimethoate	1	cat.
fenthion (veterinary product)	2	buzzard, red kite.
mevinphos	5	buzzard, jackdaw, peregrine, red kite, starling, bait, sample.
phorate	1	cat, sample.
pirimiphos-methyl	1	honeybee.
propetamphos	1	dog.
Carbamate compounds		
aldicarb	16	buzzard, crow, peregrine, red kite, tawny owl, fox, cat, dog, bait.
bendiocarb	9	red kite, cat, honeybee, maize, sample.
carbofuran	26	buzzard, crow, golden eagle, peregrine, red kite, tawny owl, fox, cat, dog, bait, sample.
methiocarb	6	feral pigeon, cat, dog, bait, pellets.
oxamyl	1	bait, sample.
Rodenticides		
brodifacoum	4	dog, horse, bait, grain.
bromadiolone	16	buzzard, pheasant, red kite, badger, fox, dog, bait, grain.
chlorophacinone	1	bait.
coumatetralyl	4	fox, cat, dog, grain.
difenacoum	15	buzzard, red kite, badger, fox, cat, dog, bait, grain.
flocoumafen	1	bait.
warfarin	4	dog, bait, grain.
rodenticide	1	dog.

In addition to the above, some residues of these compounds were detected and were considered to be background levels, eg. brodifacoum, bromadiolone and difenacoum residues in incidents involving red kites.

Pyrethroid compounds		
cypermethrin	1	honeybee.

In addition small residues of fluvalinate were detected in nine honeybee incidents. These were probably associated with varroa mite treatments. One incident also had a small residue of permethrin.

Table 4: Numbers of incidents* involving individual pesticides in 2000 and species and/or bait involved (continued)

Herbicides			
paraquat	12**	honeybee, dog, sample.	
Other compounds			
alphachloralose	15	buzzard, golden eagle, magpie, partridge, peregrine, pheasant, red kite, swan, bait.	
cyanide	3	badger sett, powder.	
metaldehyde	19	badger, badger sett, fox, cat, dog, bait, pellets.	
phosphide	2	badger sett, sample.	
strychnine	8	peregrine, dog, bait, sample.	
Jeyes fluid	1	sample.	
1,4 dichlorobenzene	1	honeybee.	
Causes of death other than pesticides			
disease	40	acorn poisoning	1
starvation	16	ethylene glycol	3
trauma	45		
unknown	204	not applicable	36

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

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

56. Appendix 2 lists all the incidents involving agricultural chemicals from throughout the United Kingdom where poisoning was confirmed.

Vertebrate wildlife: Mammals

57. A total of 56 incidents involving wild mammals was investigated and the cause of incident established in 33 (59%) of which 9 (16%) involved pesticides (see Table 5). Table 6 shows the number and percentage of pesticide poisonings for the past seven years.

Table 5: Numbers of incidents involving wild mammals in 2000

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Badger	England	13	2(15%)	7 (54%)
	Wales	1	0	0
	N. Ireland	1	0	0
		15	**2 (13%)**	**7 (47%)**
Fox	England	23	7 (30%)	12 (52%)
	Scotland	3	0	0
	N. Ireland	2	0	0
		28	**7 (25%)**	**12 (43%)**

Table 5: Numbers of incidents involving wild mammals in 2000 (continued)

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Otter	Scotland	3	0	1 (33%)
	N. Ireland	2	0	2 (100%)
		5	**0**	**3 (60%)**
Hedgehog	England	1	0	0
	N. Ireland	1	0	0
		2	**0**	**0**
Squirrel	England	1	0	0
	Scotland	1	0	0
		2	**0**	**0**
Hare and rabbit	England	1	0	1 (100%)
	Scotland	2	0	0
		3	**0**	**1 (33%)**
Deer	England	**1**	**0**	**1 (100%)**
Rat	England	**1**	**0**	**0**
Shrew	England	**1**	**0**	**1 (100%)**
TOTAL *	England	40	9 (23%)	21 (53%)
	Wales	1	0	0
	Scotland	9	0	1 (11%)
	N. Ireland	6	0	2 (33%)
		56	**9 (16%)**	**24 (43%)**

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

Table 6: Incidents involving wild mammals 1994-2000

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

Badger

58. There were 15 incidents involving badgers submitted to the Scheme and the cause of death was established in 60% of these incidents, with pesticide poisoning confirmed in two incidents. A badger was poisoned with metaldehyde, bromadiolone and difenacoum, but no source for these chemicals was established. In the other incident a badger was poisoned following exposure to bromadiolone and difenacoum.

59. As in previous years, there were some incidents that involved the laying of poisoned baits outside badger setts (see other sections).

Fox

60. 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 seven years.

Table 7: Incidents involving foxes 1994-2000

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

61. There were 28 incidents involving foxes investigated in 2000. The cause of the incident was established in 19 (68%) incidents with agricultural chemicals found to be involved in 7 (25%). Five of these incidents occurred following the abuse of pesticides: three incidents involved aldicarb; one incident carbofuran; and one metaldehyde. The remaining two incidents involved anticoagulant rodenticides (bromadiolone in one and coumatetralyl/difenacoum in the other) and the source of the pesticides was not established.

Other mammals

62. The other mammal incidents reported include: five otter incidents; two hedgehog incidents; two squirrel incidents; two hare incidents, one wild rabbit incident, one sika deer incident, one rat incident; and one shrew incident. Pesticides were not identified as a cause of death in all these incidents. However, three otter incidents, a rabbit incident and a shrew incident, where due to traumatic injuries and the sika deer died from acorn poisoning.

Vertebrate wildlife: Birds

63. A total of 178 incidents involving wild birds was notified to the Scheme in 2000. The cause of the incident was established in 112 (63%) and pesticides were involved in 59 (33%) (see Table 8). Table 9 shows the number and percentage of pesticide poisonings for the past seven years.

Table 8: Number of incidents involving wild birds in 2000

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Birds of prey including owls	England	36	16 (44%)	9 (25%)
	Wales	22	8 (36%)	5 (23%)
	Scotland	76	28 (37%)	23 (30%)
	N. Ireland	2	0	1 (50%)
		136	**52 (38%)**	**38 (28%)**
Wildfowl and waterbirds	England	3	0	0
	Scotland	2	0	1 (50%)
	N. Ireland	3	1 (33%)	2 (67%)
		8	**1 (13%)**	**3 (38%)**
Gulls and waders	England	1	0	0
	Wales	1	0	1 (100%)
	Scotland	3	1 (33%)	0
	N. Ireland	5	0	2 (40%)
		10	**1 (10%)**	**3 (30%)**
Pigeon and doves	England	3	1 (33%)	0
	Wales	2	0	2 (100%)
	Scotland	1	0	1 (100%)
		6	**1 (17%)**	**3 (50%)**
Corvids	England	4	1 (25%)	0
	Wales	2	0	2 (100%)
	Scotland	6	2 (33%)	1 (17%)
	N. Ireland	1	1 (100%)	0
		13	**4 (31%)**	**3 (23%)**
Gamebirds	England	1	1 (100%)	0
	N. Ireland	1	1 (100%)	0
		2	**2 (100%)**	**0**
Other birds	England	6	0	2 (33%)
	Scotland	5	1 (20%)	1 (20%)
		11	**1 (9%)**	**3 (27%)**
TOTAL*	England	49	18 (37%)	11 (22%)
	Wales	27	8 (30%)	10 (37%)
	Scotland	90	30 (33%)	27 (30%)
	N. Ireland	12	3 (25%)	5 (38%)
		178	**59 (33%)**	**53 (30%)**

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

Table 9: Incidents involving wild birds 1994-2000

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

Birds of prey (including owls)

64. There were 136 incidents involving birds of prey (see Table 8 and 10) investigated and of these the cause of the incident was established in 90 (66%); 52 incidents (38%) were identified as involving pesticide poisoning. Table 11 shows the number and percentage of pesticide poisonings for the past seven years.

Table 10: Number of incidents involving birds of prey (excluding owls) in 2000

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Buzzard	England	13	5 (38%)	3 (23%)
	Wales	9	3 (33%)	2 (22%)
	Scotland	42	14 (33%)	12 (29%)
		64	**22 (34%)**	**17 (27%)**
Red kite	England	8	6 (75%)	0
	Wales	7	2 (29%)	2 (29%)
	Scotland	9	8 (89%)	0
		24	**16 (67%)**	**2 (8%)**
Eagle	Scotland	**8**	**3 (38%)**	**2 (25%)**
Peregrine	England	6	4 (67%)	1 (17%)
	Wales	5	4 (80%)	0
	Scotland	5	1 (20%)	2 (40%)
	N. Ireland	2	0	1 (50%)
		18	**9 (50%)**	**4 (22%)**
Sparrowhawk	England	1	0	1 (100%)
	Scotland	5	2 (40%)	2 (40%)
		6	**2 (33%)**	**3 (50%)**
Kestrel	England	2	0	1 (50%)
	Wales	1	0	1 (100%)
		3	**0**	**2 (67%)**
Goshawk	Wales	1	0	0
	Scotland	1	0	0
		2	**0**	**0**
Merlin	England	**1**	**0**	**0**
Osprey	Scotland	**1**	**0**	**1 (100%)**

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

Table 11: Incidents involving birds of prey (including owls) 1994-2000

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

Common buzzard

65. There were 64 reported incidents involving common buzzards in 2000 and of these the cause of the incident was established in 39 (61%), with 22 (34%) being attributed to pesticide poisoning.

66. There were 17 abuse incidents, the chemicals involved were: carbofuran (eight incidents), alphachloralose (six incidents), aldicarb (three incidents) and mevinphos (one incident). One of the abuse incidents involved carbofuran and aldicarb. Of the remaining five pesticide incidents, three were associated with the approved use of difenacoum and one incident was attributed to the unspecified use of carbofuran. The other incident involved the veterinary compound, fenthion.

Red kite

67. There were 24 incidents involving red kites reported to the Scheme, some of which were introduced birds. The causes of the incidents were identified in 18 of these incidents (75%), with 16 (67%) involving pesticide poisoning. The abuse of agricultural chemicals was found to be involved in seven incidents: three carborfuran, two mevinphos, one alphachloralose and one aldicarb. In addition to residues of carbofuran and mevinphos, these birds had been exposed to anticoagulant rodenticides, mainly bromadiolone. The abuse of the veterinary pesticide fenthion was suspected in one incident from Wales involving two red kites. There was one incident involving carbofuran and one bendiocarb, where the sources of the compounds was uncertain.

68. Anticoagulant rodenticide poisoning was confirmed as the primary cause of death in six separate incidents involving red kites. In two of these incidents the source of the anticoagulant rodenticides (bromadiolone and difenacoum) involved was uncertain. The remaining four incidents from Scotland, involving bromadiolone (three incidents) and difenacoum (one incident), were attributed to approved use. It should also be noted that there was at least one other incident where bromadiolone was detected in liver tissue, but the cause of death was uncertain.

Eagle

69. Eight incidents involving eagles were submitted and five of these involved golden eagles and the other three were white-tailed eagles. The cause of death was established in five incidents, with three of these incidents golden eagles died as a result of pesticide poisoning from the abuse of carbofuran (two incidents) and alphachloralose (one incident).

Peregrine falcon

70. Eighteen incidents involving peregrine falcons were reported to the Scheme during 2000. The cause of death was established in 13 incidents (72%), with nine (50%) of these incidents attributable to pesticide poisoning. The abuse of aldicarb accounted for five of these incidents (one also involved a buzzard). Three more abuse incidents involved: alphachloralose (one incident), carbofuran/mevinphos (one incident) and strychnine (one incident). There was one unspecified use incident involving DDE, dieldrin and HCB.

Other raptor species

71. Other species of raptor were submitted as possible pesticide poisoning victims. These included: sparrowhawks (six), kestrels (three), goshawks (two), merlin (one) and an osprey. The cause of death was determined in five of the sparrowhawk incidents, two of the kestrel incidents and the osprey incident. However, only two of the sparrowhawk incidents involved pesticide poisoning following the unspecified use of organochlorine insecticides. Residues of DDE and DDE/dieldrin were found.

Owls

72. Eleven incidents involving owls were notified in 2000, five from England (two involving barn owls, two tawny owls and one little owl) and six from Scotland (four involving barn owls and two tawny owls). The cause of death of the birds was identified in eight (73%) of the incidents, with two (18%) tawny owl incidents due to pesticide poisoning. Both these poisoning incidents involved other birds (buzzards in one and a crow in the other) and were due to the abuse of the carbamate compounds, aldicarb and carbofuran.

Wildfowl and water birds

73. In 2000 there were eight incidents investigated by the Scheme that involved wildfowl and water birds. The cause was identified in four (50%) of these incidents, one of which involved pesticide poisoning. Three swans were poisoned following the abuse of alphachloralose.

Gulls and waders

74. There were ten incidents involving gulls and waders in 2000. The cause was established in four incidents, with one of these incidents attributable to pesticide poisoning. The poisoning of over 30 gulls by the organophosphorus insecticide, dichlorvos, occurred and it was suspected that this was due to abuse of this veterinary medicine.

Pigeons and doves

75. There were six incidents involving pigeons and doves reported in 2000; the cause of the incidents was found in four with one being attributed to pesticide poisoning. This incident involved the abuse of methiocarb.

Corvids

76. This group of birds is often the target of deliberate pesticide poisoning as they are considered by some to be pests. In 2000 there were thirteen incidents reported; the cause of incidents was found in seven (54%), with four of these attributed to pesticide poisoning. All the incidents were attributed to abuse of the compound and three of the incidents involved other birds (buzzard, starling and tawny owl). Table 12 shows the number and percentage of pesticide poisonings for the past seven years.

Table 12: Incidents involving corvids 1994-2000

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

77. Aldicarb was implicated in an incident involving a crow and tawny owl in England. Carbofuran (crow, six buzzards) and mevinphos (jackdaw, twelve starlings) were found in the Scottish incidents. In Ireland, two magpies died following exposure to alphachloralose.

Gamebirds

78. There were two incidents notified in this category in 2000 and they were both due to pesticide poisoning. In England a pheasant was poisoned from the unspecified use of bromadiolone and in Ireland a partridge and three pheasants died following the abuse of alphachloralose.

Other birds

79. This category includes passerines (mainly garden birds) and other birds not dealt with in earlier sections. There were eleven incidents reported and the cause of the incident was determined in four (36%), with just one of these incidents resulting from pesticide poisoning. A jackdaw and twelve starlings died following the abuse of mevinphos.

Livestock

80. 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 nine incidents involving livestock reported to the Scheme in 2000 (see Table 13). The cause was determined in two incidents and neither involved pesticides.

Table 13: Number of incidents involving livestock in 2000

		Number of incidents investigated	Number in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Cattle	Scotland	3	0	0
Goat	England	1	0	1 (100%)
Pig	Wales	1	0	1 (100%)
Poultry	England	2	0	1 (50%)
Alpaca	N. Ireland	2	0	1 (50%)
TOTAL	England	**3**	**0**	**0**
	Wales	**1**	**0**	**1 (100%)**
	Scotland	**3**	**0**	**0**
	N. Ireland	**2**	**0**	**1 (50%)**
		9	**0**	**2 (22%)**

Companion animals

81. There were 160 incidents involving companion animals reported to the Scheme in 2000 (see Table 14). The cause of the incident was established in 76 (48%), with pesticides implicated in 58 (36%). Table 15 shows the number and percentage of pesticide poisonings for the past seven years.

Table 14: Number of incidents involving companion and other animals in 2000

		Number of incidents investigated*	Number (%) in which pesticide poisoning was identified	Number (%) in which an other cause of death was identified
Cat	England	33	11 (33%)	7 (21%)
	Wales	4	2 (50%)	1 (25%)
	Scotland	19	6 (32%)	0
	N. Ireland	7	0	3 (43%)
		63	**19 (30%)**	**11 (17%)**
Dog	England	45	23 (51%)	3 (7%)
	Wales	5	1 (20%)	1 (20%)
	Scotland	29	10 (34%)	1 (3%)
	N. Ireland	19	6 (32%)	2 (11%)
		98	**40 (41%)**	**7 (7%)**
Horse	England	1	1 (100%)	0
	N. Ireland	1	0	0
		2	**1 (50%)**	**0**
Rabbit	N. Ireland	**1**	**0**	**0**
TOTAL*	England	77	34 (44%)	10 (13%)
	Wales	9	3 (33%)	2 (22%)
	Scotland	46	15 (33%)	1 (2%)
	N. Ireland	28	6 (21%)	5 (18%)
		160	**58 (36%)**	**18 (11%)**
Frog	England	**1**	**0**	**1 (100%)**

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

Table 15: Incidents involving companion animals 1994-2000

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

Cat

82. There were 63 incidents involving cats investigated by the Scheme. The cause of the incident was established in 30 (48%). Pesticides were implicated in 19 (30%), with over 28 individuals being poisoned. Table 16 shows the number and percentage of pesticide poisonings for the past seven years.

Table 16: Incidents involving cats 1994-2000

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

83. Pesticide abuse accounted for 17 incidents: four incidents involved aldicarb; four carbofuran; three bendiocarb; three slug pellets (two metaldehyde and one methiocarb); two anticoagulant rodenticides (one coumatetralyl and one difenacoum); and one phorate. In several of these incidents baits were also found.

84. Two incidents were attributed to misuse. One occurred in June 1998, where a cat was affected by a dimethoate spray treatment (this was not reported until January 2000). The other involved a house flea treatment with bendiocarb which affected two cats.

85. Ethylene glycol (anti-freeze) poisoning was found in three incidents.

Dog

86. The Scheme registered 98 incidents involving dogs during 2000. The cause of the incident was determined in 47 (48%), with pesticides implicated in 40 (41%). Over 56 dogs were found to have been poisoned. Table 17 shows the number and percentage of pesticide poisonings for the past seven years.

Table 17: Incidents involving dogs 1994-2000

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

87. The abuse of pesticides was found in 22 incidents: strychnine in six incidents (alphachloralose also found in one of these incidents); aldicarb in four incidents; metaldehyde in four incidents; carbofuran in three incidents; anticoagulant rodenticides in three incidents (bromadiolone two incidents and warfarin one incident); and paraquat in two incidents.

88. The misuse of pesticides accounted for nine incidents. The spillage or poor storage of slug pellets accounted for six misuse incidents, five involving metaldehyde and one methiocarb. Anticoagulant rodenticide bait which was accessible to the dogs accounted for three incidents: one where no samples were available to identify the rodenticide involved, one bromadiolone and one brodifacoum, difenacoum and coumatetralyl.

89. There were two incidents thought to have arisen from approved use, one from metaldehyde and one from the anticoagulant rodenticide, coumatetralyl. In addition to the above there were a further six incidents where the sources of the compounds were not apparent. Four involved poisoning with slug pellets (three metaldehyde incidents and one methiocarb incident) and one with paraquat and one with brodifacoum. An incident in Scotland involved the veterinary compound, propetamphos.

Other companion animals

90. There were three incidents involving other companion animals. Two involved horses and one a rabbit. Pesticide poisoning was found to be the cause of death in one incident involving two horses and the abuse of brodifacoum.

Wildlife: Others

91. In 2000 there was one incident involving a frog which had died from traumatic injuries.

Beneficial insects

92. There were 48 suspected beneficial insect poisoning incidents investigated during 2000 (see Table 18), with 32 incidents reported from England, 3 incidents reported from Wales and 13 incidents reported from Scotland. All of the incidents involved honeybees. Pesticides were implicated in thirteen (27%) of these incidents, nine from Scotland and four from England. However four of the incidents from Scotland may be related to one pesticide application.

Table 18: Number of incidents involving beneficical insects in the UK during 2000

Number of incidents investigated:	**48***
Number of incidents attributed to pesticides:	**13***
Number of incidents where bee diseases were detected:	**13**
Number of incidents attributed to disease:	**6**

Pesticide detected**	Number of incidents	Number of colonies affected
Organophosphate compounds		
demeton-S-methyl	1	5
pirimiphos-methyl	1	14
Carbamate compounds		
bendiocarb	3	19
Pyrethroid compounds		
cypermethrin	1	1
Herbicide compounds		
paraquat	8	26
Other compounds		
1,4-dichlorobenzene	1	1
TOTAL* **	**13**	**51**

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

**There were also nine incidents where small residues of fluvalinate were detected, but the incidents were not attributed to pesticide poisoning.

***In one incident paraquat and bendiocarb were detected and in another incident pirimiphos-methyl and bendiocarb were detected.

93. Diseased bees were found in thirteen incidents investigated and in six 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 nine incidents this year where small residues 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.

94. Six different pesticides have been detected and confirmed in the thirteen incidents attributed to pesticides (see Table 18). This year the majority of incidents has involved paraquat, where it has been sprayed on genetically modified (GM) flowering oilseed rape. For reviews of bee poisoning incidents refer to: Barnett *et al*., 1997; Fletcher *et al*., 1994a and Greig-Smith *et al*., 1994. For the number of incidents investigated and the percentage of pesticide poisonings for the past seven years refer to Table 19, and for a summary of the 2000 incidents where pesticides were involved refer to Table 20.

Table 19: Incidents involving beneficial insects 1994-2000

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

Table 20: Pesticides detected in beneficial insect incidents in the UK during 2000

Month	Location	Number of colonies in apiary	Number of colonies affected	Pesticide involved	Level detected (µg/bee)
March	Essex	6	1	1,4-dichlorobenzene	0.47
June	Middlesex	3	1	cypermethrin	0.015
June	Fife	7	7	paraquat	1.4, 1.7, 1.9
June	Fife	3	3	paraquat	0.48
June	Highland*	10	10	paraquat	0.28
June	Highland*	2	2	paraquat	0.18
June	Highland*	1	1	paraquat	0.78
July	East Sussex	14	14	pirimiphos-methyl	0.048
				bendiocarb	0.013
July	Highland*	3	1	paraquat	0.30
June	Highland	Feral		paraquat	1.4
July	Tayside	5	1	bendiocarb	0.63
				paraquat	0.17
August	East Sussex	4	4	bendiocarb	0.19
September	Lothian	9	5	demeton-S-methyl	0.009

* These Highland incidents are likely to be associated with one spray application.

95. The incidents where pesticides were detected and confirmed are also summarised in Appendix two. There were seven approved use incidents, but four of these incidents are likely to be associated with one pesticide application. There was one misuse incident involving 1,4-dichlorobenzene. In five incidents the source of the pesticides identified

has not been established despite thorough field investigations. However, it is likely that bendiocarb residues in three of these incidents were due to honeybees robbing bendiocarb treated comb, which had not been sealed off adequately during a feral bee control treatment.

96. An incident in Pencaitland, Lothian affected five out of nine colonies in an apiary, with one of the colonies being seriously affected. Analysis detected a residue of 0.009 micrograms demeton-S-methyl per bee, so it is possible that these honeybees died from pesticide poisoning. To date no source for this compound has been found.

97. A beekeeper in East Sussex, with 14 colonies in his apiary, became aware of a problem when an estimated loss of 20,000 bees per colony was noted. The dead honeybees were on the ground outside of the hives and their tongues were protruding. No pesticide use was known off in the area, but residues of 0.048 micrograms pirimiphos-methyl per bee and 0.013 micrograms bendiocarb per bee were found. Therefore it is likely that these bees died from pesticide poisoning.

98. Two apiaries in East Sussex, with a total of 18 colonies, suffered honeybee deaths from all colonies. The dead honeybees were found on the ground around the hives and they all had their proboscis extended. In one incident 0.19 micrograms bendiocarb per bee was detected, so these bees have died from pesticide poisoning. In the other incident 0.013 micrograms bendiocarb per bee and 0.048 micrograms pirimiphos-methyl per bee were found, so given this combined exposure it is likely that the bees died from pesticide poisoning. An apiary in Tayside had one colony out of five affected. The honeybees were found lying on their backs and unable to fly and many were dying. A residue of 0.63 micrograms bendiocarb per bee was detected, so these bees have died from pesticide poisoning. There was also a low level exposure (0.17 μg per bee) of paraquat noted on the bees. The source of all these pesticides has not been established, as the beekeepers were 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.

99. A beekeeper in Middlesex found about one hundred dead bees outside one colony, there are two other colonies in the apiary which were not affected. Many of the bees had their proboscis protruding and some were seen staggering and then keeling over and dying. The beekeeper thought the bees were foraging on field beans and was not aware of any spraying operations in the area. Analysis detected a residue of 0.015 micrograms cypermethrin per bee, so these bees have died from pesticide poisoning. At present the source of the pesticide is uncertain.

100. A beekeeper in Fife found large numbers of bees were unable to fly and others were dead at all seven of his colonies. There was a GM oilseed rape crop which was in full flower nearby and this was destroyed using Gramoxone 100. The beekeeper was not informed of the intention to spray. Analysis has detected residues of paraquat ranging from 1.4 to 1.9 micrograms per bee, which would be consistent with sub-lethal effects and possibly some mortality. Another beekeeper in Fife observed large numbers of bees that were unable to fly and others which were dead in all three colonies at his apiary. A GM contaminated oilseed rape crop was believed to have been destroyed in the area. Analysis detected 0.48 micrograms paraquat per bee, which may account for sub-lethal effects and the limited mortality observed at the apiary. Field information revealed a spray application of Gramoxone, between 10:00hrs and 18:00hrs on 22 June, to a GM contaminated oilseed rape crop which was in full flower. The farmer was unable to contact the local beekeepers secretary prior to the spray application. In Nairn four incidents are all believed to be

associated with a single spray application involving the destruction of a GM contaminated oilseed rape crop which was in flower. Gramoxone 100, at 5 litres/hectare, and Reglone were sprayed at Wester Delnies, Nairn on Sunday 25th June between 13.52hrs and 17.35hrs. The beekeepers were informed of the intention to spray. One beekeeper has confirmed that his bees were in their hives for 18 hours from midnight on the Saturday evening. Symptoms displayed by the bees ranged from crawling around in the grass and unable to fly or crawling around in little groups in front of the hives. Paraquat residues were detected on the bees analysed and these were between 0.18 to 0.78 micrograms per bee and this would be consistent with sub-lethal effects and possibly some mortality. The final paraquat incident involved a feral bee colony in a chimney which suffered large-scale mortality for no apparent reason. The field investigation has confirmed that GM contaminated oilseed rape was destroyed on 23rd June between 6:00hrs and 10:00hrs. The contractor used Agriguard Paraquat at 200g/litre and the crop was in full flower. A residue of 1.4 micrograms paraquat per bee was detected which would be consistent with the mortality observed.

101. A beekeeper in Essex found all the bees in one colony dead, the day after a new super had been placed in the hive. The super had been in storage over winter and was stacked on newspaper with PDB crystals present. The super was "aired" for about thirty minutes before placing it in the affected colony. A residue of 0.47 micrograms 1,4-dichlorobenzene per bee was confirmed in the sample analysed. It appears that this exposure to PDB on the super has caused the death of the bees.

Suspected poisoned baits and suspicious samples

102. 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 64 such samples notified to the Scheme in 2000. Pesticides were detected in 28 of these (44%). Table 21 shows the number of possible baits and suspicious samples submitted and the percentage in which pesticides were detected for the past seven years. There were 17 incidents of abuse and 11 incidents of misuse. Badger setts were involved in four of these incidents and in one misuse incident, a badger sett was accidentally gassed during a rabbit control treatment. In the three abuse incidents, bait laced with metaldehyde was left outside badger setts and two setts were intentionally gassed.

Table 21: Incidents involving possible baits and suspicious samples 1994-2000

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

103. Of the remaining 14 deliberate abuse incidents: anticoagulant rodenticides were confirmed in four incidents (one brodifacoum, one bromadiolone, one difenacoum and one warfarin/bromadiolone); carbofuran in four incidents (one also involved paraquat and one sodium cyanide/strychnine); alphachloralose in two incidents; methiocarb in two incidents; metaldehyde in one incident; and oxamyl in one incident.

104. The misuse of compounds included seven incidents with exposed rodenticide baits. There were three incidents involving bromadiolone (one also involved difenacoum and the other difenacoum and warfarin), one incident involving chlorophacinone, one difenacoum and one warfarin. There was another incident involving flocoumafen and difenacoum. The three remaining misuse incidents involved, jeyes fluid, metaldehyde and tubes of aluminium phosphide which had not been disposed of correctly.

Agricultural chemicals

105. The chemicals found in the 149 vertebrate and bait incidents are listed in Table 4. Details of these incidents are also given in Appendix 2. Agricultural chemicals involved in beneficial insect incidents can also be found in Table 4 and Appendix 2 and above in the section involving this category.

106. A total of 29 different compounds was implicated from all incidents (except beneficial insect incidents) submitted during 2000 (27 in 1999). There were 22 different chemicals from England (21 in 1999), 17 from Scotland (17 in 1999), 6 from Wales (4 in 1999) and 5 from Northern Ireland (4 in 1999). In addition, some small non-significant residues were also detected. Table 22 shows the number of different pesticides implicated in all incidents (except beneficial insect incidents) in the past seven years.

Table 22: The number of different pesticides implicated in all incidents (excludes beneficial insects) 1994-2000

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

Other causes of death

107. There were 98 vertebrate incidents where the cause was determined as other than pesticide poisoning. This represents 25% of vertebrate incidents (excluding those just involving baits). This compares with 75 (21%) 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

108. In 2000, of the 506 incidents registered, pesticide involvement was found in 162 (32%) and other causes of death (non-agricultural chemicals, disease, starvation, etc.) were identified in 104 (21%) (see Table 1, Figure 3). In addition, there were 36 (7%) incidents reported that were found to be not applicable (baits which were not laced with a pesticide and no dead animals found). Since 1995 there has been a general decline in the numbers of incidents reported (see Table 23). However, 2000 has seen 50 more incidents reported and so there has been a proportionate increase in the number of pesticide incidents. The figures confirm that there has been little change in the proportion of pesticide incidents over the years. This emphasises the importance of raising the profile of the Wildlife Incident Investigation Scheme and reporting suspected poisoning incidents, as the more incidents that are reported, it appears that more pesticide incidents are detected.

Table 23: Number of incidents reported to the Scheme 1995-2000 and number (%) pesticide incidents identified

Year	1995	1996	1997	1998	1999	2000
England						
No. of incidents reported	433	354	333	334	232	244
No. pesticide incidents (%)	151 (35%)	128 (36%)	118 (35%)	108 (32%)	84 (36%)	83 (34%)
Scotland						
No. of incidents reported	160	160	144	167	135	167
No. pesticide incidents (%)	33 (20%)	34 (21%)	36 (25%)	52 (31%)	40 (30%)	57 (34%)
Wales						
No. of incidents reported	58	58	51	32	41	42
No. pesticide incidents (%)	5 (9%)	24 (41%)	13 (25%)	9 (28%)	9 (22%)	11 (26%)
Northern Ireland						
No. of incidents reported	84	79	79	79	45	53
No. pesticide incidents (%)	19 (23%)	18 (23%)	19 (24%)	16 (20%)	6 (13%)	11 (21%)
Total						
No. of incidents reported	735	651	607	612	453	506
No. pesticide incidents (%)	208 (28%)	204 (31%)	185 (30%)	185 (30%)	139 (31%)	162 (32%)

109. Regionally, the number of incidents accepted in England in 2000 has increased by twelve, but the number of pesticide incidents has gone down by one. However, 1999 saw a decline of 100 incidents and 24 pesticide incidents compared to the previous year. However, the proportion of pesticide incidents has always remained about the same, between 32% and 36%. In Wales the number of incidents accepted is about the same as 1999. However, again the trend since 1995 is a decline in the number of incidents accepted. The number and proportion of pesticide incidents from Wales is variable, but since 1997 has been more consistent with an average of 10 (25%) pesticide incidents. Incidents accepted from Scotland have remained consistent since 1995, apart from declines in 1997 and 1999. The proportion of pesticide incidents has increased from 20-25% during 1995-1997 to 30-34% during 1998-2000. In Northern Ireland the number of incidents accepted nearly halved in

1999, but 2000 has seen a small increase in incidents accepted and so also in the number of pesticide incidents. The proportion of pesticide incidents was low in 1999, at 13%, but in 2000 it has returned to around 20%.

110. The percentages of categories of pesticide use resulting in poisoning are shown in Figure 1. There were 16 incidents involving the approved use of pesticides. This represents 10% of pesticide incidents reported. In 1999 there were 10 (7%) approved use incidents. Although this is an increase 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, agricultural chemicals 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.

Table 24: Numbers of vertebrate related incidents and category of use 1994-2000

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

111. There were 23 incidents arising from the misuse of agricultural chemicals (14% of pesticide poisoning incidents). During 1998 and 1999 there had been a significant increase on previous years in the number and proportion of these incidents, as the average figure was 38 (25%) misuse incidents. However, 2000 has seen a return to a more usual proportion of between 10% and 12% (see Table 24). These incidents have resulted from poor storage, spillage, chemicals not being used in the approved manner or compounds being disposed of in an inappropriate way.

112. As in previous years, incidents involving deliberate abuse account for the major proportion of those in which pesticides are implicated. In 2000 there were 95 incidents arising from abuse (59%). The number of abuse incidents dropped by nearly a half when 1999 data is compared to 1997 (see Table 24), so 2000 has seen an increase in number and proportion of abuse incidents. However, it is a return to a more usual number of abuse incidents which has averaged at about 122 (67%), during 1994-1997. Additionally there were 24 (15%) incidents where the cause of the poisoning could not be identified. This is a decrease in number and proportion when compared to 1999, but it is within the range seen in previous years. In 2000, there were four incidents reported that probably arose from veterinary compounds. All these poisoning incidents can be found in Appendix 2. Regulatory and/or enforcement action was taken as appropriate (see earlier sections).

Vertebrate incidents

113. Of the 458 vertebrate related incidents reported, 149 involved agricultural chemicals (33%). There were 9 incidents (6%) arising from approved use (see Table 24). Incidents arising from misuse, amounted to 22 (15%) and abuse of pesticides, 95 (63%) incidents. Unspecified use incidents were 19 (13%). There were four incidents involving pesticides formulated as veterinary medicine products during 2000. These were found as our multi-residue methods will also detect veterinary organophosphate or carbamate compounds.

114. Figure 2 shows the relative percentages of alphachloralose, carbamate and organophosphorus compounds found to be involved in incidents 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. The majority of the carbamate incidents arise from the abuse of these compounds. This year has seen the highest percentage to date of vertebrate poisoning incidents involving carbamate compounds. Since 1997, incidents involving an organophosphate or alphachloralose, have fluctuated around a similar level which is generally a lower percentage than seen in years prior to 1997.

115. In 2000, the proportion of pesticide incidents involving mammals has returned to a level seen in previous years (see Table 6). The proportion of pesticide incidents involving wild birds in 2000 has increased by 5% and is at the highest level recorded since 1994 (see Table 9). Most of this increase is due to poisonings involving gamebirds and birds of prey. For birds of prey, the peregrine has seen the largest increase in the number of incidents reported, with six incidents reported in 1999 and eighteen incidents reported in 2000. However, there has also been an increase in the numbers of buzzards, eagles and red kites reported compared to 1999. The proportion of pesticide poisoning has increased most significantly for the peregrine, from 17% in 1999, to 50% in 2000. The red kite has the highest proportion of pesticide poisoning incidents at 67% in 2000, compared to 43% in 1999. The proportion of pesticide poisoning for buzzards and eagles has decreased when compared to 1999.

Beneficial insect incidents

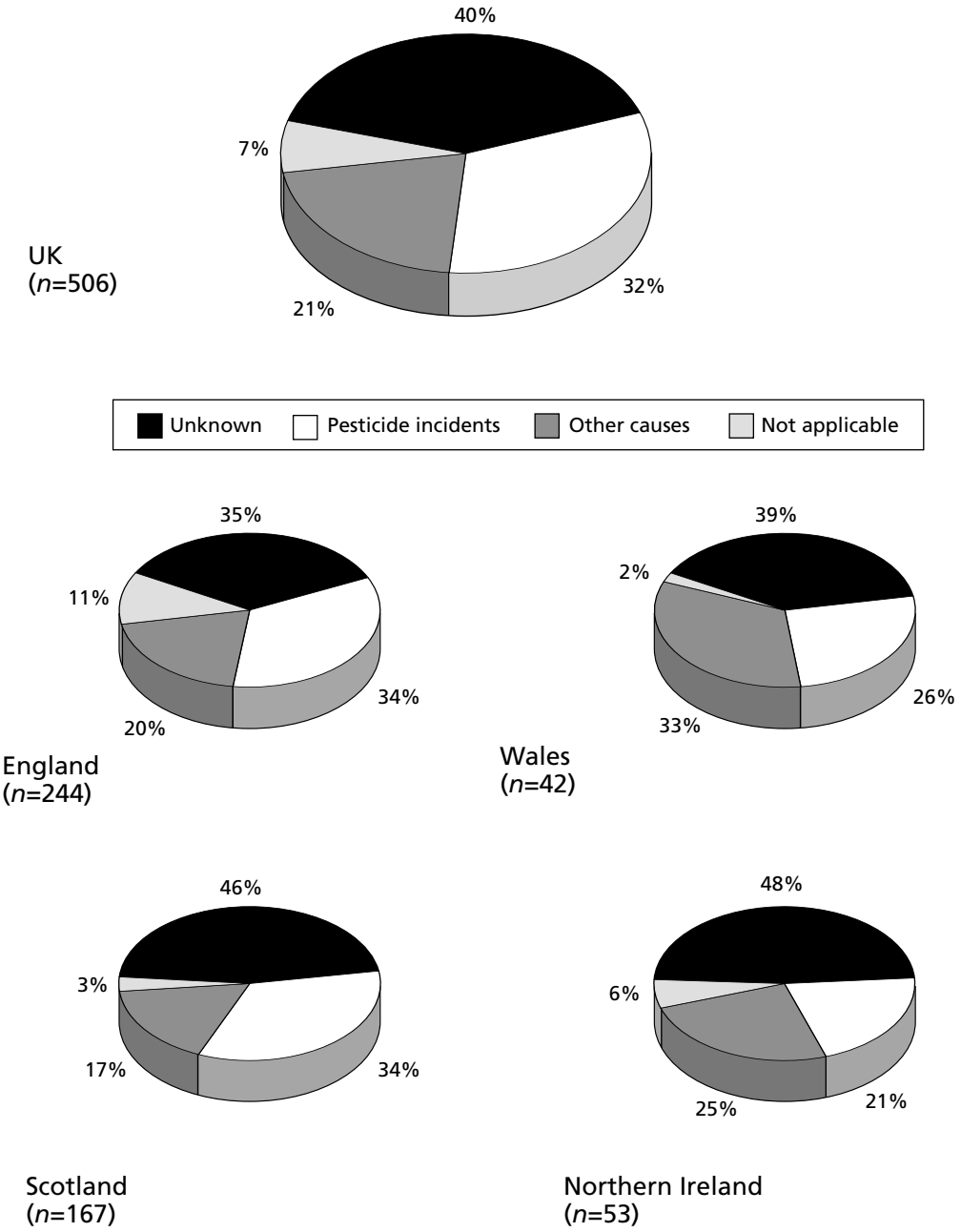
116. At 48, there were more incidents reported in 2000 than any previous year from 1994, except in 1995, when there were 56 incidents reported (see Table 19). The proportion of pesticide poisoning has decreased slightly in 2000 compared to 1999, but it is within the range seen to date. There were seven incidents arising from approved use, one misuse incident and five 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 incidents involving paraquat and an incident involving the pyerthroid, cypermethrin, where the source of the compound could not be found.

117. The number of colonies found to be affected by pesticides during 2000 was 51 (see Table 18). This is a decrease on the previous year, when 69 colonies were affected and from less (nine) poisoning incidents. 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

118. 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 non-agricultural chemicals, or the absence of the appropriate analytical method for a particular compound. In 204 (40%) of incidents reported, the cause of the incident was not established (see Figure 3). This compares with 194 (42%) in 1999.

Figure 3: Proportion of reported incidents in 2000 by cause of incident.



119. In addition, there were 36 incidents (7%) which were classified as not applicable (see Figure 3), a small decrease when compared with 44 (10%) 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.

Seasonal distribution

120. 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 December and a maximum of thirteen incidents in March. The other noticeable trend is the nine incidents of approved use in June, with the other seven incidents spread out between January to May and September and October. Most of this trend is due to the spraying of GM oilseed rape with paraquat (seven incidents).

Regional distribution

121. The distribution of abuse incidents is found throughout counties and regions of the UK with certain areas having proportionately more incidents of abuse than are found elsewhere (see Appendix 2).

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 and Wales, 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 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 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 non-agricultural 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 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 Royal Ulster Constabulary (RUC) 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 wildlife officers. SEERAD staff in Scotland and the RUC, 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 anti-coagulant rodenticides. These are supplemented by specific analyses for strychnine, alpha-chloralose, metaldehyde, paraquat and some other compounds.

Appendix 2

Pesticide incidents occurring in 2000

Month	County	Number and Species	Chemical	Cause	Comments
February 98	Highland	buzzard	carbofuran	abuse	
June 98	Suffolk	cat	dimethoate	misuse	*Spray drift into garden may have affected a cat.
May 99	Highland	buzzard	alphachloralose	abuse	Related to another incident in 1999.
January	Cleveland	2 horses, grain	brodifacoum	abuse	Bait found in the paddock.
January	Gloucestershire	dog, fox, bait	metaldehyde	abuse	Bait left on a badger track.
January	Leicestershire	cat	methiocarb	abuse	Source of bait unknown.
January	Lincolnshire	pheasant, grain	bromadiolone	unspecified	Source of rodenticide uncertain.
January	Norfolk	grain	bromadiolone/difenacoum/warfarin	misuse	Exposed baits.
January	North Yorkshire	4 dogs	strychnine	abuse	Source of bait unknown.
January	Northamptonshire	dog	paraquat	unspecified	
January	Wiltshire	dog	rodenticide	misuse	*Accessed rodenticide block in house, no samples available.
January	Grampian	2 buzzards	carbofuran	abuse	Bromadiolone also detected.
January	Highland	buzzard	difenacoum	approved	Significant haemorrhaging.
January	Tayside	dog	strychnine/alphachloralose	abuse	Chemicals recovered, improper storage.
January	Antrim	dog	bromadiolone	abuse	
January	Antrim	dog	bromadiolone	abuse	
February	Berkshire	red kite	mevinphos/brodifacoum/difenacoum	abuse	Source of chemicals unknown.
February	Derbyshire	grain	bromadiolone/difenacoum	misuse	Exposed baits.
February	Norfolk	cat, 3 dogs, 4 foxes	aldicarb	abuse	Source of bait unknown.
February	Norfolk	dog	carbofuran	abuse	Rabbit bait may have been used.
February	Northumberland	2 dogs, 9 foxes	carbofuran	abuse	*Samples tested by SASA.
February	Suffolk	badger sett	sodium cyanide	misuse	*Rabbit control operation, no obvious signs of badger activity.

Month	County	Number and Species	Chemical	Cause	Comments
February	Dumfries & Galloway	cat	carbofuran	abuse	
February	Dumfries & Galloway	tawny owl, 2 buzzards, bait	carbofuran	abuse	Bromadiolone and difenacoum also detected.
February	Highland	red kite	carbofuran	unspecified	
February	Strathclyde	dog	strychnine	abuse	Dog survived.
February	Tayside	buzzard	difenacoum	approved	Sub-lethal residue, no haemorrhaging.
February	Tayside	crow, 6 buzzards, 5 baits	carbofuran	abuse	Bromadiolone also detected.
March	Cheshire	2 dogs, sample	metaldehyde	misuse	Slug pellet spillage on a bridleway.
March	Cumbria	2 cats	carbofuran	abuse	Source of bait unknown.
March	Essex	honeybee	1,4-dichlorobenzene	misuse	Supers were not aired for sufficient time.
March	Essex	honeybee	fluvalinate	unknown	Small residue, not the cause of death.
March	Hereford and Worcester	meat/blue pellets	difenacoum	abuse	Bait may have been laid for cats.
March	Lancashire	2 peregrines	carbofuran/mevinphos	abuse	Carbofuran in one bird and mevinphos in the other.
March	Norfolk	fox	coumatetralyl/difenacoum	unspecified	
March	Norfolk	bait	chlorophacinone	misuse	Exposed baits.
March	Northumberland	2 buzzards	carbofuran	abuse	Source of bait unknown.
March	Nottinghamshire	tawny owl, crow, bait	aldicarb	abuse	Pheasant used as bait.
March	Warwickshire	pigeon carcase	alphachloralose	abuse	Used as a poison bait.
March	Gwent	buzzard	aldicarb	abuse	Source of bait unknown.
March	Gwent	buzzard, 3 peregrines, bait	aldicarb	abuse	Pigeon bait placed at peregrine nesting site.
March	Mid Glamorgan	2 peregrines	strychnine	abuse	Source of bait unknown.
March	Mid Glamorgan	4 dogs	strychnine	abuse	Source of bait unknown.
March	Highland	golden eagle	carbofuran	abuse	Police & SEERAD investigation.
March	Lothian	peregrine	DDE/dieldrin/HCB	unspecified	
March	Strathclyde	sparrowhawk	DDE	unspecified	
March	Strathclyde	cat, dog, baits	carbofuran	abuse	
March	Tayside	golden eagle	alphachloralose	abuse	
March	Tayside	sparrowhawk	DDE/dieldrin	unspecified	
March	Tayside	buzzard	difenacoum	approved	No haemorrhaging.
April	Derbyshire	cat	aldicarb	abuse	Source of bait unknown.

Month	County	Number and Species	Chemical	Cause	Comments
April	Derbyshire	badger sett	sodium cyanide	abuse	*Field tests confirmed presence of hydrogen cyanide.
April	Lincolnshire	badger sett	aluminium phosphide	abuse	* Field tests confirmed presence of hydrogen phosphide.
April	Norfolk	cat	coumatetralyl	abuse	Source of bait unknown.
April	Norfolk	honeybee	fluvalinate/permethrin	unknown	Small residue, not the cause of death.
April	North Yorkshire	red kite	alphachloralose	abuse	Source of bait unknown.
April	Northumberland	buzzard	alphachloralose	abuse	Source of bait unknown.
April	Suffolk	cat	metaldehyde	abuse	Residential area, source of bait unknown.
April	West Midlands	meat baits	bromadiolone	abuse	Found in a dog owners garden.
April	Mid Glamorgan	2 peregrines	aldicarb	abuse	Source of bait unknown.
April	Grampian	dog	coumatetralyl	approved	Baiting operation in farm feed store.
April	Lothian	buzzard	alphachloralose	abuse	
April	Strathclyde	several cats	bendiocarb	abuse	
April	Antrim	3 swans	alphachloralose	abuse	About a dozen other swans also affected.
May	Cheshire	maize	methiocarb	abuse	Possibly laid to target squirrels.
May	Humberside	honeybee	fluvalinate	unknown	Small residue, not the cause of death.
May	Humberside	honeybee	fluvalinate	unknown	Small residue, not the cause of death.
May	Kent	cat, 6 foxes	aldicarb	abuse	Source of bait unknown.
May	Lincolnshire	sample	bromadiolone	misuse	Exposed baits.
May	Norfolk	dog, grain	brodifacoum/difenacoum/coumatetralyl	misuse	Exposed baits and bait from old treatments not cleared away.
May	Norfolk	baits, sample	oxamyl	abuse	Rabbit and three egg baits and a jar containing oxamyl.
May	Northamptonshire	red kite, maize	bendiocarb	unspecified	Chick in the nest with remains of a wood pigeon which had fed on bendiocarb treated maize seed.
May	North Yorkshire	honeybee	fluvalinate	disease	Small residue, not the cause of death.
May	Oxfordshire	buzzard	alphachloralose	abuse	Source of bait unknown.
May	Somerset	2 badger setts, bait	metaldehyde	abuse	Bread and peanuts used as bait.
May	South Yorkshire	6 feral/racing pigeons, maize	methiocarb	abuse	Suspected that methiocarb treated maize fed to pigeons.

Month	County	Number and Species	Chemical	Cause	Comments
May	Dyfed	buzzard	fenthion	veterinary	Police enquiries at a house revealed this dead buzzard.
May	Powys	2 red kites	fenthion	veterinary	A pair which appeared to have been feeding on sheep carcase.
May	Central	red kite	bromadiolone	approved	Advisory letters issued by SEERAD.
May	Highland	red kite	carbofuran	abuse	Bromadiolone also detected.
May	Strathclyde	3 cats	bendiocarb	abuse	
June	Devon	2 peregrines, bait, sample	aldicarb	abuse	Pigeon tethered to a cliff top and a pot containing aldicarb nearby.
June	Devon	samples	carbofuran/paraquat	abuse	Paraquat and carbofuran stored in unlabelled containers, and many syringes found.
June	Essex	bait	flocoumafen/difenacoum	misuse	Exposed baits.
June	Humberside	dog	aldicarb	abuse	Dog ill after picking up a rabbit carcase.
June	Kent	sample	jeyes fluid	misuse	*Jeyes fluid being used as a vertebrate repellant.
June	Lincolnshire	dog, fox	aldicarb	abuse	Source of bait unknown.
June	Middlesex	honeybee	cypermethrin	unspecified	Source unknown, but probably spray application.
June	North Yorkshire	2 red kites	aldicarb	abuse	Source of bait unknown.
June	Oxfordshire	sample	metaldehyde	misuse	Pellets in piles and under guttering.
June	Shropshire	honeybee	fluvalinate	unknown	Small residue, not the cause of death.
June	Shropshire	honeybee	fluvalinate	unknown	Small residue, not the cause of death.
June	Staffordshire	honeybee	fluvalinate	unknown	Small residue, not the cause of death.
June	Gwynedd	peregrine, baits	alphachloralose	abuse	Two tethered pigeon carcases at a peregrine nesting site.
June	Fife	honeybee	paraquat	approved	
June	Fife	honeybee	paraquat	approved	
June	Highland	2 red kite chicks	difenacoum	approved	
June	Highland	honeybee	paraquat	approved	
June	Highland	honeybee	paraquat	approved	
June	Highland	honeybee	paraquat	approved	

Month	County	Number and Species	Chemical	Cause	Comments
June	Highland	honeybee	paraquat	approved	
June	Highland	honeybee	paraquat	approved	
June	Highland	golden eagle	carbofuran	abuse	
June	Highland	red kite chick	bromadiolone	approved	Significant haemorrhaging.
June	Isle of Lewis	37 gulls	dichlorvos	veterinary	
June	Lothian	cat	carbofuran	abuse	
June	Tayside	dog	strychnine	abuse	
June	Tayside	dog	metaldehyde	unspecified	
June	Down	3 baits	alphachloralose	abuse	Pigeon carcases probably targeting peregrines.
June	Down	dog	paraquat	abuse	
July	Cornwall	badger	bromadiolone/difenacoum	unspecified	
July	Cornwall	badger	bromadiolone/difenacoum/metaldehyde	unspecified	Stomach contained green "porridge" and slugs.
July	Devon	4 dogs	metaldehyde	abuse	Source of bait unknown.
July	Devon	peregrine, bait	aldicarb	abuse	Pigeon carcase used as a bait.
July	Dorset	2 foxes	bromadiolone	unspecified	
July	East Sussex	honeybee	pirimiphos-methyl/bendiocarb	unspecified	
July	Lincolnshire	honeybee	fluvalinate	disease	Small residue, not the cause of death.
July	Norfolk	sample	aluminium phosphide	misuse	*Old tubes of phostoxin, with some tablets in, found along a railway track.
July	Northamptonshire	3 red kites	bromadiolone	unspecified	Three red kite chicks found dead near their nest.
July	Nottinghamshire	buzzard	mevinphos	abuse	Source of bait unknown.
July	Somerset	dog, bait	metaldehyde	abuse	Bags of meat and pellets left in a woodland.
July	Warwickshire	2 cats, sample	bendiocarb	misuse	House treatment for fleas.
July	Border	jackdaw, 12 starlings	mevinphos	abuse	Town centre location.
July	Strathclyde	3 cats	aldicarb	abuse	
July	Tayside	honeybee	bendiocarb/paraquat	unspecified	
August	Devon	peregrine	aldicarb	abuse	Source of bait unknown.
August	Devon	buzzard, bait	aldicarb/carbofuran	abuse	Pigeons, with clipped wings, used as bait.

Month	County	Number and Species	Chemical	Cause	Comments
August	East Sussex	honeybee	bendiocarb	unspecified	
August	Lincolnshire	dog, bait	aldicarb	abuse	Pheasant carcase used as a bait.
August	Norfolk	pellets	metaldehyde	abuse	Pellets thrown in a garden, presumably to target dogs.
August	Northamptonshire	3 red kite, bait, samples	mevinphos	abuse	Hare and leveret used as bait, bottle of mevinphos also found. Bromadiolone also detected.
August	Somerset	dog	methiocarb	unspecified	
August	Dyfed	red kite	difenacoum	unspecified	
August	Dumfries & Galloway	rabbit bait	carbofuran	abuse	
August	Fife	dog	brodifacoum	unspecified	Residue identified in rat, tissues from dog not submitted.
August	Highland	50-100 egg baits	carbofuran	abuse	Anti-abuse Campaign Hot-line call.
August	Highland	red kite	carbofuran	abuse	Source not established. Bromadiolone also detected.
August	Down	dog	paraquat	abuse	
September	Greater London	meat/blue pellets	brodifacoum	abuse	Laced sausages found in a garden, foxes may have been intended victims.
September	Norfolk	sample	warfarin	misuse	*Purchased a product which is no longer approved.
September	Somerset	dog, bait	metaldehyde	abuse	Cereal and pellets.
September	West Yorkshire	cat	metaldehyde	abuse	Urban area with allotments nearby.
September	Dumfries & Galloway	dog	metaldehyde	unspecified	
September	Grampian	dog	propetamphos	veterinary	
September	Grampian	dog	metaldehyde	misuse	Dog owner compensated for loss.
September	Highland	red kite	bromadiolone	approved	
September	Strathclyde	samples	carbofuran/sodium cyanide/strychnine	abuse	
October	Buckinghamshire	dog, sample	metaldehyde	misuse	Spillage of pellets on a footpath.
October	Lincolnshire	dog, sample	metaldehyde	approved	Pellets reportedly contained a repellant.
October	Central	buzzard	alphachloralose	abuse	
October	Grampian	2 buzzards, baits	carbofuran	abuse	Rabbits used as bait. Advisory letter to Estate Factor recommended.

Month	County	Number and Species	Chemical	Cause	Comments
October	Highland	red kite	carbofuran	abuse	Bromadiolone also detected.
October	Lothian	honeybee	demeton-s-methyl	unspecified	
October	Armagh	dog	warfarin	abuse	
October	Down	partridge, 3 pheasants	alphachloralose	abuse	Gamekeeper found several hundred pheasants and partridges affected by alphachloralose.
October	Tyrone	bait	warfarin/bromadiolone	abuse	
November	Cambridgeshire	2 dogs, sample	metaldehyde	misuse	Large spillage of pellets.
November	Hereford and Worcester	2 dogs	metaldehyde	unspecified	
November	Northumberland	dog, sample	methiocarb	misuse	Spillage of pellets.
November	Somerset	bait	methiocarb	abuse	Bait left in a field.
November	Dyfed	2 cats	bendiocarb	abuse	Urban area, source of bait unknown.
November	Powys	cat, bait	difenacoum	abuse	Adulterated meat bait.
November	Border	buzzard	carbofuran	unspecified	
November	Tayside	buzzard	alphachloralose	abuse	
November	Down	2 magpies	alphachloralose	abuse	
November	Tyrone	dog	strychnine	abuse	
December	Gloucestershire	grain	difenacoum	misuse	Exposed baits.
December	Northamptonshire	dog, bait	bromadiolone	misuse	Exposed baits.
December	Nottinghamshire	2 cats, sample	phorate	abuse	Residential area, exposed brodifacoum and difenacoum bait also found.
December	Wiltshire	2 dogs	metaldehyde	misuse	Suspected spillage occurred when vehicle entered field.
December	Grampian	4 buzzards, bait	carbofuran	abuse	Deer used as bait. Advisory letter to farmer recommended.

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

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.

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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.

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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.

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

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