DETERMINING THE EXTENT OF USE AND HUMANENESS OF SNARES IN ENGLAND AND WALES

Report submitted to Defra

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All values quoted in the text are rounded to an appropriate number of decimal places, according to context.

EXECUTIVE SUMMARY

1. Snares are commonly used in the UK for the restraint of certain mammal species, prior to despatch. Although they can be used for restraint without injury – such as in radio-tagging animals for scientific research – neck snares are recognised as capable of causing injury and death to target and non-target animals, and for this reason are controversial.
2. In 2005, the Independent Working Group on Snares (IWGS), convened at Defra's request, developed a Code of Practice (CoP) for the use of snares which was subsequently adopted by Defra. However, the IWGS commented that there was a poor evidence base concerning several aspects of snare use, including the extent of snare use in the UK and the humaneness and selectivity of snares. They recommended that research should be carried out to obtain this knowledge. The present study results from that recommendation.
3. The objectives of the present study were: i) establish the extent of use of fox snares and rabbit snares within England and Wales, the circumstances in which the snares are used, and the extent of awareness of the Defra Code of Practice. ii) determine the degree of compliance with statutory requirements and with the Defra Code of Practice; iii) determine the consequences of key recommendations of the Code of Practice; iv) evaluate the humaneness of use of fox and rabbit snares under best practice conditions; iv) through a combination of (i)-(iv), estimate the total welfare and ecological impacts of the use of snares on target and non-target species; vi) report on the voluntary uptake of the Code of Practice, and make recommendations for its revision if appropriate.
4. Data to address the objectives of the study were collected during three work programmes: (a) pen trials, using the rabbit as a model, to investigate the welfare benefits of reduced time between inspections and use of a stopped snare; (b) field trials based on the Agreement on International Humane Trapping Standards (AIHTS) for restraining devices, but utilising Bayesian statistics to minimise animal use; (c) a telephone survey of a random and representative sample of landowners/ tenants across England and Wales, and field visits with a proportion of respondents.
5. No welfare benefits were detected in pen trials from shortening the inspection interval from 24 to 16 hours. Inspection every 24 hours is a statutory requirement, but more frequent inspections are recommended in the CoP. There was evidence that unstopped snares caused poorer welfare; the only fatality occurred in an unstopped snare, and a greater proportion of rabbits in unstopped snares had tears in thin membranous tissues in the neck. The pen trials were found to have limited utility as a substitute for field trials, as entry into the snare and the presence of predators could not be assessed.
6. Between 27 January and 31 December 2009, 2,861 telephone surveys with landowners/tenants were conducted. Snares were used on 6% of all landholdings. Further detailed questionnaires with the snare user were then completed over the telephone for 130 landholdings, and 18 operators were visited in the field, primarily to verify telephone responses. The results for fox and rabbit snares are reported separately.

7. Approximately equal numbers of gamekeepers and farmers use fox snares. The number of fox snares set by gamekeepers (median = 35, range 2 to 700) was significantly higher than the number set by farmers (median = 5, range 1 to 300).
8. Extrapolation on the basis of country, landholding size class and user suggested that, at any one time and depending on the season, between 62,800 and 188,300 fox snares were in use in England, and between 17,200 and 51,600 fox snares in Wales. In both countries, the maximum occurred in March.
9. The use of fox snares was explained by landholders mainly in relation to the utility of other methods of fox control. Where fox snares were used, the most common explanation was that other legal methods could not be used because of high vegetation cover, terrain, or fox behaviour. Conversely, where snares were not used, the reasons most commonly cited were that it was not necessary to use snares, or that other methods of control were used instead.
10. A significantly higher percentage of gamekeeper users were aware of the CoP (95%) and had formal training in the use of fox snares (38%), compared to farmers (64% and 3%, respectively).
11. A statistically robust assessment of compliance with the CoP for fox snare users could be undertaken only for a sub-set of its recommendations in the telephone survey. From the telephone survey we estimated that 87% of fox snares were set as restraining devices and 13% as killing devices. Eighty four percent of operators made efforts to avoid capture of non-target species, but 60% of operators had caught non-targets in fox snares at some time. Badgers were the non-target species most commonly mentioned i.e. by a quarter of these operators.
12. Observations made during the 16 field visits cannot be taken as representative of all fox snare users, but supported the results from the much larger telephone survey while also raising issues to note. No fox snare operator visited was fully compliant with the CoP. At the time of the study, operators were unable to buy 'off-the-shelf' any snares that were fully compliant with CoP recommendations on design. Consequently, only 3 operators visited were using any snares that met CoP recommendations; these operators were taking part in a field trial of a new design. A notable deviation from recommended operating practices was failure to avoid sites where the snare could become entangled with nearby objects, such as branches, trees or fences. The consequences of this were illustrated during field visits, in that two badgers that were caught were entangled with objects and one was severely injured as a result of entanglement. Only 2 out of 16 operators visited set 75% or more of their snares at sites where entanglement was not possible.
13. Field trials were carried out using two different fox snares. All snares in both trials were set following the CoP. A commercially available fox snare (type A), claimed by the manufacturer to be CoP-compliant and similar to that used by the majority of operators in the field, was used in the first trial. During 211 snare nights, eighteen animals of three species were captured; eight animals escaped before the snare inspection. One badger escaped after both swivels of the snare had become inoperative, allowing the cable to be broken. Because of cable fraying it was thought unlikely that the snare noose would have dropped

off this badger, and the consequence was considered likely to result in poor welfare. Of the ten animals captured and held, three hares had indicators of poor welfare (one hare was found severely injured, one was found moribund and one was found dead with no sign of predation). Of the other animals captured, three hares and two foxes were uninjured and two hares had been predated. It was predicted that in a more prolonged test this snare would have been unlikely to meet the requirements of the AIHTS for restraining devices.

14. The severe injuries and the cable break found in the trials with snare type A, were thought to be caused by poor quality and design of the snare. Mechanical tests were undertaken to simulate field conditions on four commercial types of fox snare. A fox snare (type D) that had the weakest point within the noose, and had two swivels that operated as expected in mechanical tests, was used for the second field trial.

15. The second field trial, with fox snare type D, was undertaken using the same protocol as the first trial. A total of 1704 snare nights were carried out and 44 captures of six species were recorded; 23 animals were held until the next inspection and 21 escaped. None of the animals, including 14 foxes, captured and held had any severe injuries or indicators of poor welfare. The snare broke at the predicted weak point in the noose four times, allowing two badgers, a hare and a deer to escape; no foxes escaped. Five badgers held until inspection of the snare were released unharmed. It was concluded that snare type D met the requirements of the AIHTS for restraining devices, when operated according to CoP recommendations.

16. In summary, although fox snares made with high quality components, which were of a design compliant with the CoP and used as recommended in the CoP were shown to meet the standard required by the AIHTS for a restraining trap, this is not what we observed during the survey so cannot be concluded to be commonplace practice among fox snare users. Specifically most snares in use were not CoP-compliant and snares were frequently set at sites where entanglement leading to poor welfare was a risk.

17. In the fox snare field trials, non-target species were captured despite careful adherence to the CoP by a competent and conscientious operator. The capture of non-target species highlights the need for fox snares to be of a design and quality that will facilitate rapid self-release by non-targets and minimise negative welfare impacts on all captured animals while they are held.

18. Rabbit snares are not used as extensively as fox snares. Extrapolation from the survey results suggested that rabbit snares were in use on 1,567 holdings in England and 115 in Wales; with an average of 12 snares being set at any one time on each of these holdings.

19. In telephone interviews, 53% of rabbit snare users said they took no precautions to avoid the capture of non-target species. Five out of 17 operators had caught a cat in a snare at some time. Three out of 17 operators cited public access as the main factor limiting the use of snares, one operator cited non-target risk, and one lack of suitable cover. 53% of rabbit snare users intended the snare to kill any captured animal and 59% reported that they used stopped snares.

20. There was inconsistency between the telephone survey responses and findings in the field as to the use of stopped snares for rabbits. Neither of the two rabbit

snare users visited in the field used stopped snares as recommended in the CoP, and snares were set under fence lines by one operator.

21. Humaneness of rabbit snares were assessed by accompanying three professional rabbit snare operators during morning inspections. All three operators used unstopped snares. For two operators, more than 20% of rabbits were found dead on inspection; the third operator caught only one live rabbit. Necropsies showed that these deaths had not been caused by cervical dislocation or other sudden trauma; necropsy findings were consistent with asphyxsia during strangulation, and this was considered the most likely cause of death. However, the time to irreversible unconsciousness is unknown.

22. Rabbits held alive in unstopped snares had no indicators of poor welfare and therefore unstopped snares met the requirements of the AIHTS for restraining devices. Time to irreversible unconsciousness for rabbits that were found dead in unstopped snares is unknown, and therefore we do not know whether these snares met the requirements of the AIHTS for killing traps. Comparable data for stopped snares could not be gathered because no operators were found who used this design of snare.

23. While it is conceptually possible to combine the survey and field trial results to predict the overall impact of fox and rabbit snaring on the welfare and conservation status of target and non-target species throughout England and Wales, confidence intervals would be very large, and we advise that predictions could be very misleading.

24. As a result of this study we recommend considering measures to:

    a. revise the recommendations of the CoP in line with our detailed suggestions.

    b. improve uptake of the CoP by snare-users. Targeted delivery of education to particular user groups will be required, notably within the farming sector and to those who have not been exposed to educational material since 2004.

    c. actively encourage manufacture, sale and use of CoP compliant snares and discourage the sale of snares that are not compliant with the CoP.

    d. educate snare manufacturers and users that in addition to design, using quality snare components is vital to avoid poor welfare; and disseminate simple protocols that can be used to assess whether snares are fit for purpose.

    e. promote further research into snare design to allow self-release of non-target species and to improve the welfare of captured animals.

    f. commission research into the humaneness of stopped rabbit snares, and rabbits that die in unstopped rabbit snares.

    g. incorporate into training material documentary evidence of the consequences of compliance and non-compliance with the CoP, including the results of this study.

1 Introduction

Snares are commonly used in the UK for the restraint of certain mammal species, prior to despatch. Although they can be used for restraint without injury – such as in radio-tagging animals for scientific research – neck snares are recognised to be capable of causing injury and death to target and non-target animals, and for this reason are controversial.

In 2004, Defra set up the Independent Working Group on Snares with three main objectives:

1) To seek agreement on good practice guidelines.
2) To produce a Code of Practice.
3) To advise Defra on the next steps including approximate costs of each proposal.

The Group submitted their report to Defra in 2005 and included in it a number of recommendations for research (http://www.defra.gov.uk/wildlife-countryside/vertebrates/snares/pdf/iwgs-report.pdf).

The Group identified a need to determine the extent of use of snares, levels of compliance with legislation and good practice, and their welfare consequences. Some data already existed for foxes but there was a lack of information about the use of snares for rabbits and foxes, including their impact on non-target species. Information was also lacking on the range of situations in which snares were used and the purposes of their use.

Another major gap in knowledge identified by the Group related to the welfare impact on animals through the routine use of snares. It was also unknown whether there were any differences in terms of adverse welfare impacts through the use of snares used according to the Code compared to solely legal use.

This lack of data on the welfare aspects of snaring is a serious problem in allowing a cost/benefit assessment to be made on the use of snares for wildlife management decisions. It has been argued that this is especially important where the adverse impacts on animal welfare can result in severe injuries and in such circumstances there is a greater need for formality and rigor in cost benefit analysis (IWGS). The IWGS suggested that for research or wildlife control programmes at the national level it is important that these costs and benefits are considered by a group of experts and that soundly-reasoned, ethically defensible decisions are reached.

The current study aimed to address the following six objectives:

1) By telephone survey, randomly stratified across 4 broad land-use classes, to establish the extent of use of fox snares and rabbit snares within England and Wales, the circumstances in which the snares are used, and the extent of awareness of the Defra Code of Practice.

2) By ground-truthing approximately 30 % of snare users identified in (1), to determine the degree of compliance with statutory requirements and with the Defra Code of Practice.

3) To determine the consequences of key recommendations of the Code of Practice for the welfare of animals held captive in snares, using the rabbit as a model species in pen trials.

4) To evaluate the humaneness of use of fox and rabbit snares under best practice conditions, particularly with respect to the Agreement on International Humane Trapping Standards

5) Through a combination of (1)-(4), estimate the total welfare and ecological impacts of the use of snares on target and non-target species.

6) Report on the voluntary uptake of the Code of Practice, and make recommendations for its revision if appropriate.

The use of animals in scientific procedures is regulated by the Animals (Scientific Procedures) Act 1986 which requires a three-level licensing system – personal licence, project licence and certificate of designation. The studies required to address objectives 3 and 4 were carried out under the Home Office licensing system.

2 Objectives 1 and 2: extent of use of snares and compliance with the Defra Code of Practice

2.1. Introduction

In constructing its recommendations for a Code of Practice (CoP) (Defra 2005) (Section 9.1), the Independent Working Group on Snares (IWGS) found that there was poor knowledge of even the extent to which snares were used in England and Wales. An objective assessment of the extent of snare use in England and Wales is important to inform future government policy on the use of snares. The IWGS recommended further work to remedy this lack of knowledge (IWGS 2005).

There are two approaches that can be used to estimate the extent of use of snares. One is to identify the main user groups and to survey those; the second is to sample landholdings and determine the proportion on which snares are used. Information available prior to the IWGS report was obtained using the first approach. The National Gamekeepers Organisation (NGO) (submission to the Burns Inquiry 2000) and the British Association for Shooting and Conservation (BASC; BASC 1995) carried out large scale membership surveys and found that 81% (NGO) to 86% (BASC) of gamekeepers (both professional and part-time) used snares. The Fox Control Monitoring Scheme (FCMS), conducted by the Game & Wildlife Conservation Trust (GWCT), explored the methods of fox control used by a smaller sample (n = 61) of gamekeepers (IWGS 2005). This study found that 82% of contributing gamekeepers used snares as a method of fox control, despite the deliberate selection of gamekeepers who specialised in lamping with a rifle. Estimates of the population of professional and part-time gamekeepers in England and Wales vary from approximately 2,000 (J. Ewald, pers. comm.) to 3,000 (National Gamekeepers Organisation, unpublished data). Combining these suggests that the total number of gamekeepers in England and Wales using snares may be approximately 1,620 to 1,720, but clearly this will exclude anyone who uses snares but does not belong to an association like NGO, BASC or GWCT. The IWGS believed this might be true of some people who used snares to catch rabbits, for example. Such bias toward certain groups of snare users, together with uneven coverage of England and Wales, gives an incomplete and possibly biased picture of the extent of snare use. It also gives no indication of the amount of land over which snares are used.

The second approach of sampling landholdings was used by Heydon and Reynolds (2000) in a survey of all fox control methods (including snaring) across three county-sized regions of England and Wales. In this survey, responses were obtained from 50-52% of all farmers identified in each region (n = 1,123). The use of snares was found to be strongly correlated with the employment of a gamekeeper and thus with a game-bird shooting interest, and with arable rather than pastoral land use. This was also reflected in an increase in use from west to east among the three regions (< 200 ha: Mid Wales 7%, East Midlands 10%, and West Norfolk 20%; > 200 ha: Mid Wales 3%, East Midlands 22%, and West Norfolk 41%).

This approach was also used for a more general survey of rabbit control techniques included in the Pesticide Usage Survey, with the use of snares being one of the available responses in the questionnaire (Smith et al. 2001). Landholdings were randomly selected from the Defra June Agricultural Database but the survey was restricted to arable areas of England only.

Because of their geographical restrictions, these previous landholding-based studies give restricted insight into the extent and scale of snare use across England and Wales, but demonstrate the benefits of this approach over the user-group approach. The present study aimed to quantify the extent of snare use across the whole of England and Wales using a similar approach.

The second aim of the survey was to quantify current knowledge of, and compliance with, the Defra CoP for the use of snares, which had been published in 2005 following the IWGS Report. Approaches that could be used to obtain this information were identified as either a detailed telephone survey or observation of snares set by a similar number of operators. Ensuring a non-biased population sample was also an issue for this part of the survey. To ensure that snare users from all backgrounds, land class and country were covered, the snare users identified during the survey establishing the extent of snare use would be used.

2.2. Methods

2.2.1. Survey population

Landholdings in England were randomly selected for the survey by the Defra Survey Control Unit from a database of landholdings used for the June Agricultural Survey (JAS) 2008. Landowners and tenants in Wales were randomly selected by the Agriculture and Rural Affairs statistician in the Welsh Assembly Government, from a database of landholdings that had been selected for the JAS 2008. The JAS is a postal survey which collects information on arable and horticultural cropping activities, land usage, livestock populations and agricultural labour force. The survey is conducted annually, on a random selection of landholdings listed on the farm register, with a full census carried out once every ten years. In 2008, 19% of farms in England were sampled, drawn from a random sample within five strata of size class (< 5 ha, ≥ 5 < 20 ha, ≥ 20 < 50 ha, ≥ 50 < 100 ha and ≥ 100 ha). The proportion of landholdings selected for the JAS from each size class increased with the farm size. This reduces the burden on farmers whilst maximising geographical coverage.

For the present survey, the smallest size class of the JAS 2008 (< 5 ha) was excluded. Although the most numerous size class (45% of landholdings), it was inconsequential in terms of land area (< 5% of farmed area in England). On the basis of previous work (Heydon and Reynolds 2000), it was expected to show the lowest frequency of snare use but, if included, would have vastly increased survey effort. For the remaining size classes, random sampling of English landholdings within the JAS was implemented, stratified by land class, to generate the required sample size. Distribution of landholdings in Wales by land class was not available.

Although the proportion of landholdings selected at random for this survey from the JAS 2008 was reasonably consistent across strata for England (Table 2.1), this was not the case for Wales (Table 2.2). The proportion of landholdings sampled by the JAS itself from the farm register was biased toward the larger farm sizes in England and the smaller farm sizes in Wales. These biases led to some variation in sampling rate (between 1 and 4%) among farm size categories in the present survey. This was considered to be inconsequential in terms of representativeness and later extrapolation.

Besides size class, landholdings were also stratified by land class (arable a, arable b, arable c, pastoral d, pastoral e, marginal upland, upland; Bunce et al. 1981), defined as the land class in which the postcode of the landholding fell (Table 2.3, Figure 2.1). Errors in the assignment of land class could arise if the postcode did not fall on the land class matching the majority of the landholding but, in the absence of boundary data for each landholding, this was considered the best available method.

Land class	Size class	Number of landholdings that responded in the JAS 2008*	Number of landholdings in this survey	Actual number of landowners / tenants interviewed	% of JAS 2008 selected for this survey	% of JAS 2008 actually interviewed
arable a	2	153	52	23	34	15
	3	270	88	39	33	14
	4	225	73	36	32	16
	5	944	305	144	32	15
arable b	2	514	172	80	33	16
	3	1,009	334	130	33	13
	4	1,020	334	151	33	15
	5	3,369	1,085	420	32	12
arable c	2	18	7	1	39	6
	3	52	17	4	33	8
	4	78	26	13	33	17
	5	287	92	45	32	16
pastoral d	2	511	169	93	33	18
	3	797	264	143	33	18
	4	956	307	156	32	16
	5	1,559	505	225	32	14
pastoral e	2	355	120	49	34	14
	3	702	226	110	32	16
	4	920	301	146	33	16
	5	1,598	516	219	32	14
marginal upland	2	166	58	30	35	18
	3	253	85	46	34	18
	4	302	97	52	32	17
	5	700	222	107	32	15
upland	2	5	2	0	40	0
	3	14	5	5	36	36
	4	23	7	4	30	17
	5	91	30	16	33	18
Totals		16,891	5,499	2,487		

Table 2.1 Sampling rate among landholdings in England across strata (land class and size class) expressed as percentage frequency of the June Agricultural Survey (JAS) 2008. Equivalent data were not available for Wales. Size classes: 2 (≥ 5 < 20 ha), 3 (≥ 20 < 50 ha), 4 (≥ 50 < 100 ha), 5 (≥ 100 ha).

Country	Size class	Number of landholdings on the farm register	Number of landholdings selected for and responding to the JAS 2008*	% of the farm register that was sampled in JAS 2008	Number of landholdings selected for this survey	Actual number of landowners/ tenants interviewed	% of farm register selected for this survey	% of JAS 2008 selected for this survey	% of farm register actually interviewed in this survey	% of JAS 2008 actually interviewed in this survey
England	2	40,232	1,722	4	580	276	1	34	1	16
England	3	27,399	3,097	11	1,019	477	4	33	2	15
England	4	21,237	3,524	17	1,145	558	5	32	3	16
England	5	26,568	8,548	32	2,755	1,176	10	32	4	14
Total		115,436	16,891		5,499	2,487				
Wales	2	8,178	6,849	84	271	122	3	4	1	2
Wales	3	6,618	2,870	43	174	72	3	6	1	3
Wales	4 & 5	8,987	1,464	16	355	180	4	24	2	12
Total		23,783	11,183		800	374				

Table 2.2 Sampling rate of landholdings in England and Wales across size class strata, expressed as percentage frequency of the June Agricultural Survey (JAS) 2008 and of the farm register. Size classes: 2 (≥ 5 < 20 ha), 3 (≥ 20 < 50 ha), 4 (≥ 50 < 100 ha), 5 (≥ 100 ha). *Welsh contacts included those who did not respond in the JAS 2008.

Land class type and group	Land classes included	Description of topography and land use for land class group
Arable a	2	Open gentle slopes with land at medium low or low altitude. Mainly open or wooded downland with few hedges. Varied agriculture but extensive cereals and built-up land. S England and SW Midlands.
Arable b	3, 4, 9, 11, 12	Flat mainly low altitude alluvial plains. Open, intensively farmed lowland and fenland areas with large cereal fields and little native vegetation. East Anglia, S and mid to NE England (and SE Scotland).
Arable c	14, 25, 26	Gentle sloping medium to low altitude land, often valley floors and coastal plains. Intensively farmed lowland with many fences and moorland vegetation types. N England (and S, C, and E Scotland).
Pastoral d	1, 5, 6, 7, 8	Medium to low altitude, often coastal areas. Undulating lowland farmland, intricate in comparison with small fields, many hedges and small woods. Predominantly pasture. S England, SW Midlands and Wales.
Pastoral e	10, 13, 15, 16, 27	Variable medium to low altitude valley floors with escarpments. Varied lowland landscapes with many natural features. Grassland types predominating with some moorland. Mid to N England, N Wales (and C and E Scotland).
Marginal Upland	17, 18, 19, 20, 31	Moderate slopes, medium to high altitude river valley hillsides and exposed coast. Transitional farmland with walls and fences. Mainly rough grassland and moorland vegetation, often afforested. SW and N England (and Scotland).
Upland	21, 22, 23, 24, 29, 30, 32	Steep sloping ridges, high altitude. Bleak moorland and upland bog with scattered lochs and large areas of afforestation. Mainly mountainous landscapes and rocky coasts with much bracken. N England (and Scotland including the Western Isles).

Table 2.3 Land class groupings used in this report. Based on Bunce *et al.* (1981).

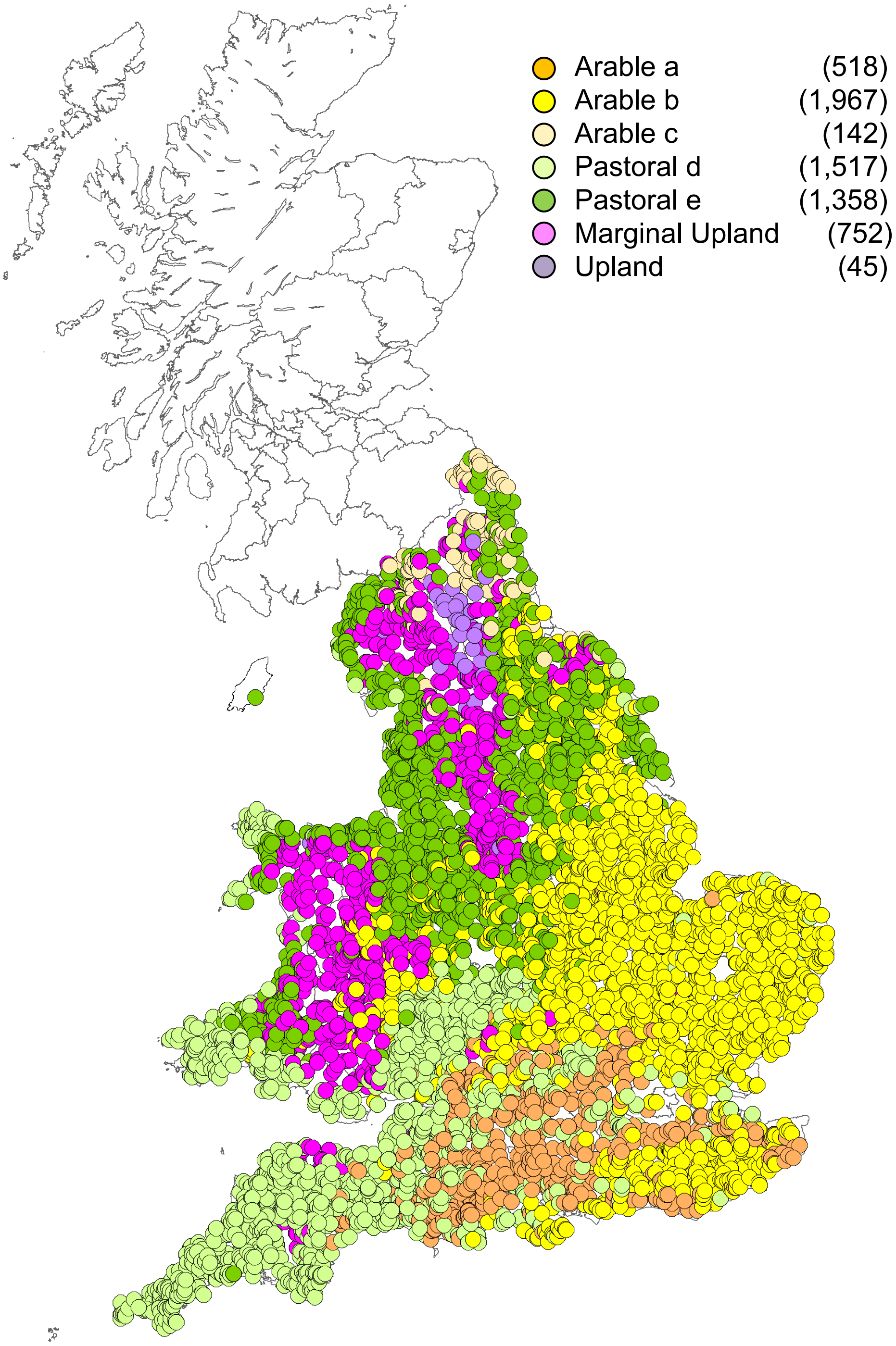

Figure 2.1 Land classes of landholdings in both England and Wales selected for the survey (n = 6,299).

2.2.2. Survey design

Survey design was developed in conjunction with stakeholders, statisticians and Defra Survey Control Unit. The survey had two aims: 1) to establish the extent of use of snares, and 2) to ascertain awareness of and compliance with the Defra CoP for Snaring.

To address the first aim, a telephone survey was undertaken to establish whether snares were used on the participant's landholding. Through a carefully planned sequence of questions, aiming to establish motivations, the interviewee was also asked if there was any shooting interest on the land; whether or not any fox or rabbit control was conducted on the land; and, if snares were used, for which species. If snares were not used on the land, the interviewee was then asked if there was any particular reason for not using snares as a method of control.

The second aim of the survey was to determine awareness of and compliance with the Defra CoP. It was acknowledged that the ideal approach would have been to obtain this information from field surveys. It was not possible to undertake field surveys with a sufficient number of snare operators to obtain robust representative results, the information was obtained from undertaking telephone surveys with snare users identified during the first aim of the survey.

There was an issue that had to be addressed to allow robust assessment of compliance with the CoP. The CoP was not written nor designed as a set of specific rules that had to be complied with but rather as a package of advice leading to 'good practice'. The authors attempted to distinguish between different levels of obligation and encouragement (using the verbs 'must', 'should' and 'may'). These are initially explained as follows:

- Requirements which 'must' be followed in order to comply with the CoP
- Best Practice advice, indicated by the verb 'should'.
- Advice which 'may' be of practical help.

These different levels of coercion are not separated within the document. For example within the section 'How to set snares to capture foxes' the CoP states that, 'Snares **should** incorporate a strong swivel…', 'The wire **must not** be ….', 'the fastenings **should** be designed…', etc.

In a telephone interview, many of these points could be approached only through the use of closed or suggestive questions. In either case, responses were not likely to give a true reflection of compliance with the code, but rather what the respondent imagined the 'correct' answer to be. For example, "Snares must not be set on or near a badger sett" is difficult to approach without asking a question like, '*Do you ever set snares close to badger setts?*' A series of detailed open questions was therefore devised which would indicate awareness and compliance with the points of the CoP highlighted in bold. These are described in the context of the full interview below (2.2.3.1).

A concern with any questionnaire-based survey, but particularly on a controversial subject, is that responses could reflect what respondents wished to suggest rather than the real situation. For this reason some element of ground-truthing to check the veracity of responses was considered essential. Ground-truthing was conducted through field visits with a random sub-sample of snare users who stated that they had snares set at the time of the survey.

2.2.3. *Survey method*

2.2.3.1. Overview

The survey was conducted in four stages:

1. Initial contact letter.
   An initial contact letter, explaining the aims of the survey, was sent to the landowner/tenant. This gave notice to expect a telephone call from survey staff within a few days, but also offered the option of not participating in the survey (Appendix 8.1).
2. Telephone interview with landowner/tenant.
   If the landowner/tenant had not opted out, a telephone call was made to the landowner/tenant approximately 5 days after the letter had been sent, to establish whether or not snares were used on the landholding, and if so, by whom.
3. Telephone interview with snare user.
   If snares were used on the landholding, a detailed telephone questionnaire was carried out with the actual snare user.
4. Field visit.
   For a random selection of landholdings where the snare user stated that they had snares set at the time of the telephone interview, field visits to check snares with the snare user were requested.

Stage 1) The initial contact letters explained the aims of the survey and the information that was being sought, how contact details had been obtained, and how to opt out of the survey if desired. The letter also guaranteed anonymity and confirmed protection of personal details under the Data Protection Act (DPA) 1998. For landholdings in Wales, English and Welsh language versions of the contact letter were sent out together. At the end of both versions it was stated that when first contacted by telephone, the landowner/tenant should inform the interviewer if they wished to conduct the survey in Welsh.

Stage 2) Contact by telephone was first attempted a minimum of 3 days after the initial contact letter had been sent. Up to five attempts were made to contact the landowner/tenant by telephone at varying times of day. The telephone questionnaire carried out with the landowner/tenant followed a scripted format (Appendix 8.2). A standardised introduction identified the caller, explained Defra’s reasons for doing the survey and protection of personal details under the DPA. If it was established during this initial survey that snares were used on the land, contact details of the operator carrying out snaring were requested. Where the operator was a third party, permission to contact him or her by telephone was requested (stage 3). If the landowner/tenant was the main snare user, the questionnaire was continued with them for stage 3 (unless they declined to participate in this part of the survey).

For landholdings in Wales, information as to whether the landowner/tenant normally preferred correspondence in Welsh had been requested with the contact details. For those landholdings where correspondence in Welsh was generally preferred, telephone contact was made by a Welsh speaking interviewer.

Stage 3) The second part of the survey was addressed to the snare operator. Where snaring was not carried out by the landowner/tenant a second telephone survey was conducted, which again followed a scripted format (Appendix 8.3). A standardised introduction explained why we were contacting the interviewee; and that we had already spoken to the landowner/tenant, who had provided their contact details. Questions first established the respondent's reasons for using snares; then addressed awareness and compliance with the Defra CoP; followed by experience and training; and finally the intensity of snare use. Specific questions that aimed to verify knowledge and compliance of the CoP included whether snares were set to kill or restrain the target species; whether fixed stops were present on their snares (the term 'stop' was explained if the operator did not understand what was meant); the time of day that snares were checked; whether there were any factors/issues that limited the use of snares; and measures taken to minimize the capture of non-target species.

Prompts were used for certain questions (methods used to dispatch the target species; when the interviewee first started using snares; the number of snares typically set during each month of the year) but not for questions seeking to establish awareness of the CoP. Finally, the respondents were asked how many snares were set at the time of the telephone survey. If the interviewee had snares set at the time of the telephone survey and had been selected for a visit, a request was made to accompany the snare operator on a check.

Stage 4) Field visits were planned for 30% of snare operators; this proportion was deemed appropriate by statisticians. The sample of operators with whom a field visit was to be requested was selected randomly from a list of all interviewees prior to any stage 3 telephone calls. The intention was to carry out the field visits on the day following the stage 3 questionnaire to minimise opportunities for the operator to re-deploy or alter their snares. The main purpose of the field visit was to support and complement the findings of the detailed survey.

2.2.3.2. Pilot survey

A pilot survey was undertaken to determine the sample size required for the main survey and to ensure that the questionnaire generated the information required. The pilot survey was conducted in England only between 27th January and 25th March 2009 (inclusive) on 200 landholdings that had been selected at random from within the seven land class and four size class strata (Figure 2.2).

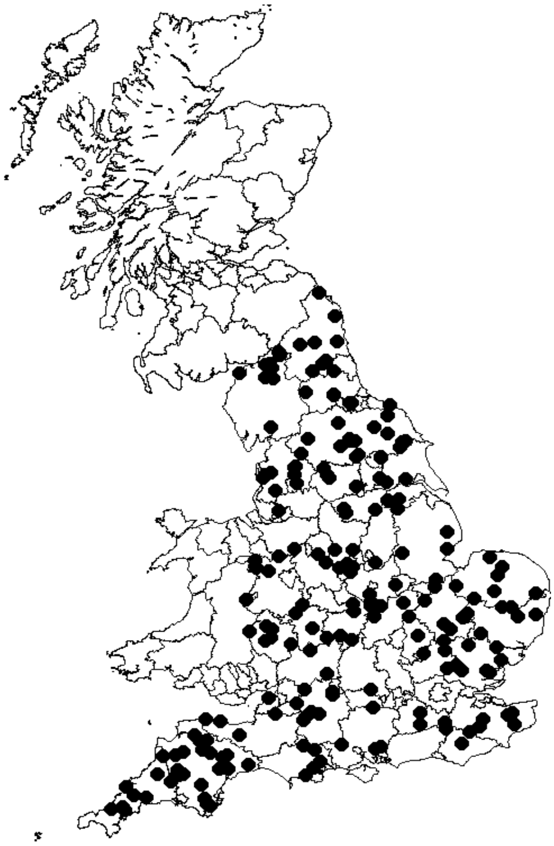

Figure 2.2 Geographical distribution of the random sample of 200 landholdings selected for the pilot survey.

2.2.3.3. Sample size calculation

In the pilot survey, from 200 contact letters (stage 1), the participation rate was 61% and initial analysis indicated that snares were used on 6% of landholdings. These results were used to predict the number of contacts required for the main study.

For questions relating to the CoP, where a Standard Error of the mean for questions with a yes/no response of under 7% was required, statistical advice predicted that 195 detailed surveys should be carried out to fulfil this requirement. If snaring was carried out on 6% of landholdings contacted, as suggested by the pilot survey, then the sample population needed to be a minimum of 5,327 landholdings to survey 195 snare users, assuming a participation rate of 61% as experienced in the pilot study. To allow for a possible lower participation rate a sample size of 6,299 landholdings was selected for the main survey.

2.2.3.4. *Main survey*

The main study was conducted from 7th May to 31st December 2009 (inclusive). Due to the large sample size required for the main survey, England and Wales were divided up into 13 regions based on administrative boundaries (Figure 2.3), so that all selected landholdings within any one region could be contacted within a short time period. This simplified the logistics of conducting field visits on the day following the telephone interview with the snare user. To minimise the extent to which region was confounded with time of year, the order in which regions were surveyed was randomised.

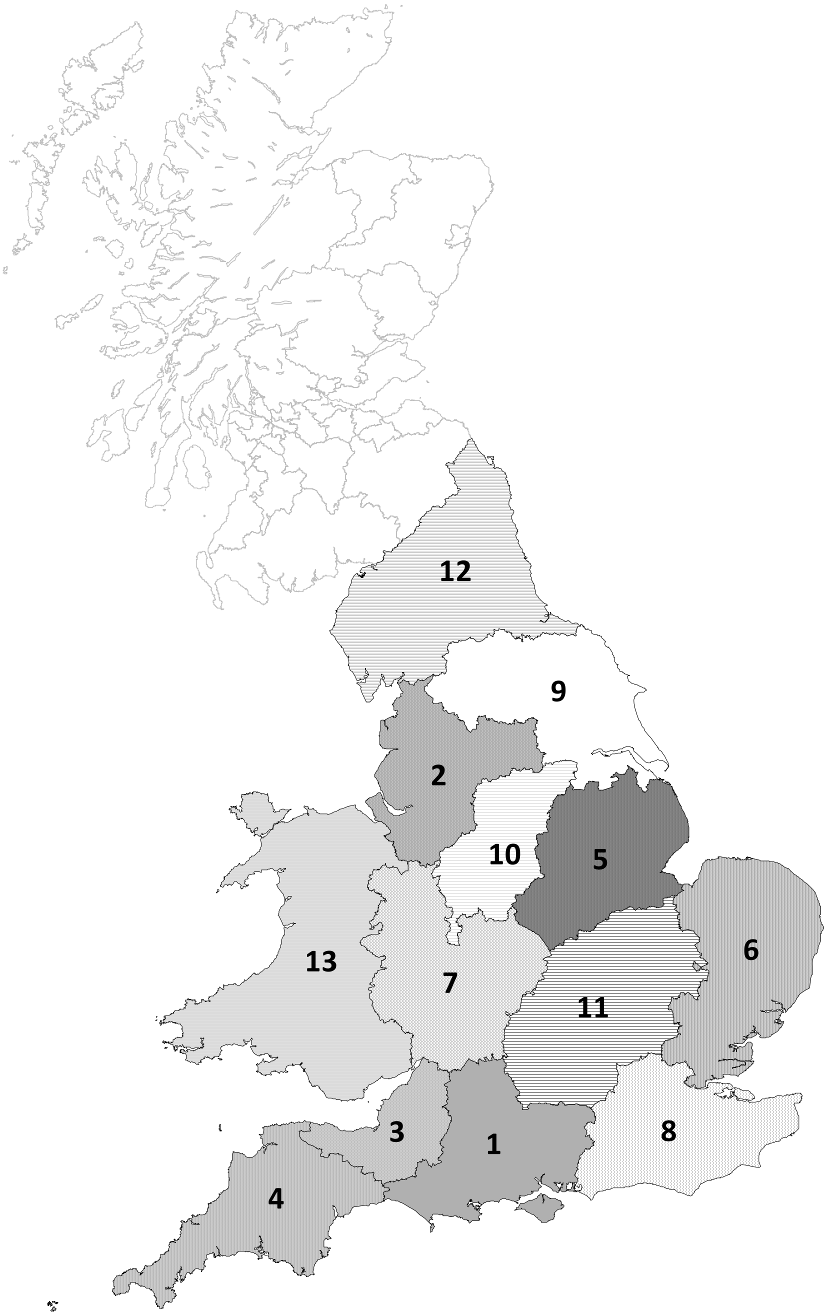

Figure 2.3 The thirteen regions used to organise survey timing.

Eleven interviewers were involved in conducting surveys in stage 2 (and stage 3 if the landowner was the principal snare user). To maintain consistency between interviewers, they were all trained prior to carrying out surveys and monitored during early calls. Within a region, landholdings were selected at random for each available interviewer to contact, in order to minimise the extent to which interviewer was confounded with region; however interviewer availability meant that it was impossible to avoid this association entirely (Figure 2.4).

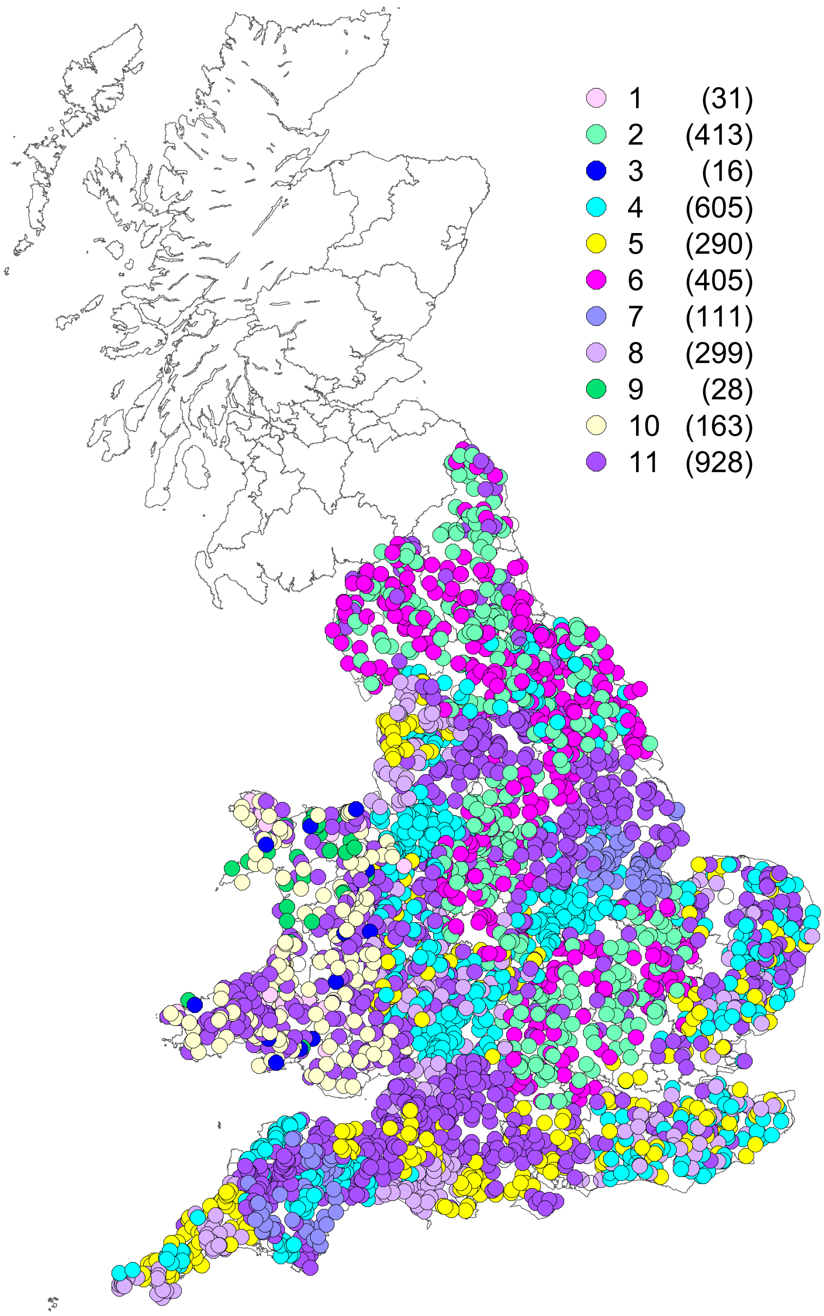

Figure 2.4 Geographical distribution of landholdings contacted by each of the eleven interviewers (n = 3,289; this excludes 124 landowners/ tenants who contacted us to either participate or opt out of the survey, and 2,886 whom we were unable to contact by telephone).

2.2.3.5.

Ground-truthing

During field visits for ground-truthing, information was recorded on a maximum of ten snares, selected at random if more than ten snares were set. If there were ten or fewer snares set, all were visited and the relevant information noted. During these field visits, data were recorded on the following: the number of snares set, the type of snares in use, the placement of the snare, any evidence of the target or non-target species, where the snare had been set, any captures, the type of anchor stakes used, and whether or not drags were used. Snare type included information on the type of wire used; whether or not stops were present and, if so, whether or not they were fixed; whether or not any swivels were present and, if so, what type; whether or not a tealer was used and, if so, what type; and finally, the type of running eye used. These features of the snare were noted without handling the snare. (Precautions to avoid contaminating the snare with human scent are advised in the CoP). Snares were photographed *in situ* against a chequered measuring board; this allowed measurements to be determined later without disturbing the set snare, all measurements were determined to the nearest cm. Snares in which the crimp (cable fastening) at the eye was identical to those used elsewhere in the snare, and in which there was no other weak-link at the eye, were deemed to be non-compliant. Stops are fixed into position by crimping. The commonest type – a metal spiral (found on 79% of all fox snares examined) – clearly shows distortion when adequately crimped and the cable itself may also be flattened. If the stop lay at the bottom of the loop and there was no evidence of distortion in either the stop or the cable, the stop was assumed not to be adequately fixed in position. Snare locations were assessed for entanglement risk and for evidence of foxes and non-target species using the run within 10 m. The information recorded on captures included where the animal was caught, e.g. around the neck, middle or leg, any injuries and whether the animal was dispatched or released.

2.2.3.6. Data analysis

All statistical analyses were performed in GENSTAT v.9. The SVSTRATIFIED procedure in GENSTAT was used to extrapolate estimates for the number of snare users, fox snare users, and rabbit snare users in each size class for all landholdings that are on the farm register in England and in Wales.

Sample sizes varied among survey questions because not all interviewees provided answers to all questions, either through lack of knowledge or an unwillingness to provide the information. The sample size for each question is therefore indicated throughout the reporting of results.

Statistical models were constructed to determine whether responses to questions were associated with known factors, such as size of the landholding, land class and management interests. Questions with only two possible answers (yes/no) were modelled as binomial probabilities and related simultaneously to several potential explanatory factors by means of logistic regression (with binomial error distribution and logit link function). In different models, the dependent binomial variable was:

- whether landowners/tenants participated in the survey;
- whether or not fox control was carried out;

- whether or not rabbit control was carried out;
- whether there was a game-bird shooting interest (which was likely to mean that there was a gamekeeper);
- whether snares were used;
- whether non-snare users had a negative perception of snaring.

Explanatory factors considered were:

- interviewer (11 individuals) (only considered for modelling participation in the survey);
- land class (7 classes);
- size class (4 classes);
- whether there was a game-bird shooting interest (except when this was the dependent variable) (yes/no);
- country (England/Wales);
- previous experience of using snares (yes/no) (only considered for modelling negative perception of snaring);
- whether any control (fox or rabbit), excluding snaring, was carried out (only for modelling negative perception of snaring).

Where country differences were significant in a model, separate models were constructed for England and Wales. Interactions of explanatory factors were considered, as appropriate. Explanatory factors or interaction terms were retained in the models if their significance (*P*-value) was ≤ 0.05.

Results from the detailed survey with the snare user are presented for all snare users, and then separately for fox snare users and rabbit snare users, allowing species-specific results to be identified.

Sample sizes for the detailed telephone survey were too small for analysis by land class, size class, game-bird shooting interest and country, but were analysed according to the type of snare user. Snare users were classified into two types on the basis of their response to the first question in the detailed survey (Appendix 8.3), because it was considered possible that snare use by professional gamekeepers or pest controllers might differ in several respects from snare use by those whose main occupation was not related to snaring or wildlife control (such as farmers).

For fox snare users only, similar binomial models were used to examine whether detailed aspects of snaring practice were related to type of snare user. The following dependent variables were modelled, again by binomial logistic regression, with type of snare user as the sole explanatory factor:

- intention in setting the snare (to restrain the fox, or directly kill the fox);
- whether they were limited in their use of snares;
- awareness of the CoP;
- training in the use of snares;
- time of the snare round (whether checked before 9 am and whether checked after dark);
- non-target captures.

Differences in the length of time that snares had been used, the amount of time spent checking snares, the number of snares set, the importance of snaring (which was also compared between fox and rabbit snare users) and level of compliance (score between 0 and 4) with the CoP were compared between farmers and gamekeepers. These were compared using Mann-Whitney U tests, as the continuous dependant variables were not normally distributed. Sample sizes for rabbit snare users were too small for statistical tests to be conducted on the details of snaring practice.

2.3. Results

2.3.1. The extent of snare use and factors determining it (stage 2)

2.3.1.1. Overview

Of the 6,299 randomly selected landholdings, 263 had inadequate contact details or were duplicates. Contact details proved to be incorrect for a further 296 landholdings, but 5,740 (91%) contact letters were assumed to have been delivered correctly. Telephone contact was made with 3,413 of these and 2,908 (46%) landowners/tenants indicated whether snaring was carried out on the holding. The initial survey was conducted with 2,861 landowners/tenants (84% of those contacted); the remaining 16% (n = 552) did not wish to participate in the survey. Whether or not respondents participated in the initial (Stage 2) telephone survey did not vary significantly by land class, size class, or whether snares were used on the landholding (Table 2.4). The percentage of contacted landowners/tenants participating in the survey differed significantly by interviewer (χ^2_{10} = 18.15, p < 0.001), but was high (at least 80%) in 10/11 interviewers. Where a reason was given for not wishing to participate in the survey (39% of 552), the reasons most commonly cited were: snares were not used on the landholding (25% of 216); no time to participate in the survey (21%); not interested in the survey (17%); company policy not to participate in surveys (9%).

Land Class	Size class	English Sample Size	% Participating English Sample	Welsh Sample Size	% Participating Welsh Sample
Arable a	2	52	44	0	-
	3	88	45	0	-
	4	73	49	0	-
	5	305	47	0	-
Arable b	2	172	46	10	60
	3	334	39	12	50
	4	334	45	11	55
	5	1,085	39	9	44
Arable c	2	7	14	0	-
	3	17	24	0	-
	4	26	52	0	-
	5	92	50	0	-
Pastoral d	2	169	56	102	38
	3	264	54	66	45
	4	307	51	63	54
	5	505	45	41	41
Pastoral e	2	120	41	77	48
	3	226	49	46	35
	4	301	49	49	49
	5	516	42	23	65
Marginal Upland	2	58	52	82	48
	3	85	55	50	40
	4	97	54	62	47
	5	222	48	96	52
Upland	2	2	0	0	-
	3	5	100	0	-
	4	7	57	0	-
	5	30	55	1	0
Total		5,499		800	

Table 2.4 Summary of the number of participants by strata (size class 2 (≥ 5 < 20 ha), 3 (≥ 20 < 50 ha), 4 (≥ 50 < 100 ha), 5 (≥ 100 ha)).

2.3.1.2. Extent of use of snares

Snares were used on 6% (±SE 0.5) of the 2,908[1] landholdings surveyed (stage 2). Figure 2.5 shows the distribution of snare use across England and Wales, by county.

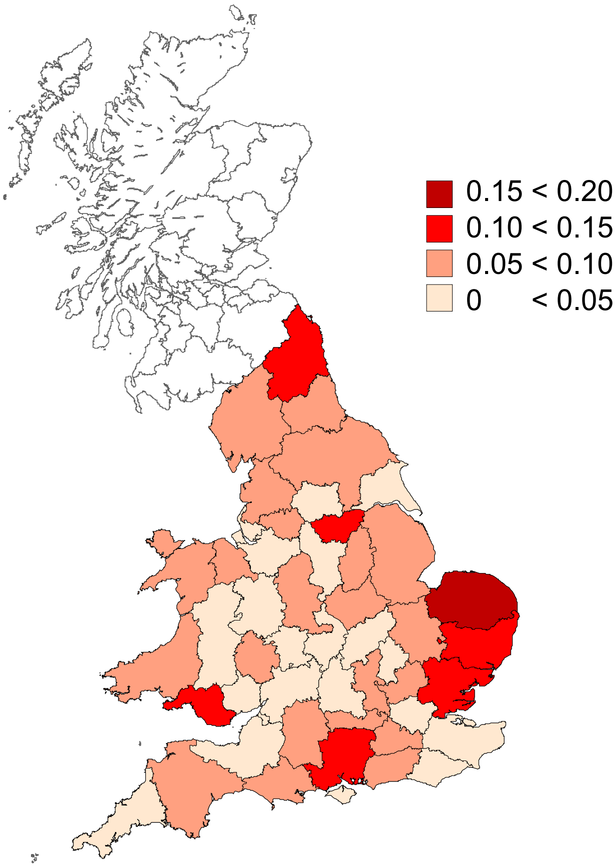

Figure 2.5 The proportion of landholding respondents within each county using fox snares or rabbit snares as a method of control (England: n = 2,530; Wales: n = 378).

In a model across landholdings in both England and Wales, the probability of snare use was determined by the interaction of three factors: game-bird shooting interest, land class and country (χ^2_3 = 8.45, p = 0.038). Landholding size class (χ^2_3 = 13.52, p = 0.004) was also a significant factor determining the probability of snare use. Because of this complex interaction between factors, we modelled England and Wales separately. Among landholdings in England, size class (χ^2_3 = 13.65, p = 0.003) and the interaction between land class and game-bird shooting interest were significant factors (χ^2_6 = 12.77, p = 0.047; Table 2.5). Snare use was more likely on landholdings in all land classes if there was a game-bird shooting interest and among these was highest in arable and upland land classes. The percentage of landholdings on which snares were used in each size class was 7% ±SE 2 (≥ 5 < 20 ha); 5% ±SE 1 (≥ 20 < 50 ha); 3% ±SE 1 (≥ 50 < 100 ha); and 7% ±SE 1 (≥ 100 ha)

[1] 2,851 landowners/tenants who participated in the survey informed us of whether or not snares were used on the landholding and 57 landowners/tenants who did not wish to participate in the survey also provided information about whether or not snares were used on the landholding.

(predictions from the regression model, averaged across all land classes and landholdings with or without game-bird shooting interest). Among landholdings in Wales, only game-bird shooting interest was a significant factor determining the use of snares (χ^2_1 = 5.99, p = 0.014): the proportion of landholdings on which snares were used was 17% ±SE 6 where there was a game-bird shooting interest compared with 5% ±SE 1 where there was no game-bird shooting interest.

Land class	No game-bird shooting interest	Game-bird shooting interest	Sample size
Arable a	2 (1)	19 (4)	225
Arable b	1 (1)	16 (2)	749
Arable c	3 (3)	15 (6)	61
Pastoral d	3 (1)	9 (2)	604
Pastoral e	1 (0.4)	10 (2)	509
Marginal Upland	4 (2)	11 (4)	230
Upland	0.1(0.4)	27 (12)	25
Sample size	1,582	821	2,403

Table 2.5 The influence of land class and game-bird shooting interest on the percentage (±SE in parenthesis) of landholdings in England on which snares were used (n =2,403 excluding 127 landholdings which did not provide information on whether or not there was a game-bird shooting interest on the land).

2.3.1.3. Motivation for and against snare use

On landholdings where fox snares were used, the most commonly cited reasons for using snares were: that other methods could not be used (e.g. when cover was too high - 15/126); terrain did not allow access of a vehicle for lamping (16/126); and foxes were lamp-shy (7/126). Twenty-two of 126 respondents cited more than one reason for using snares (Table 2.6). Seven of the seventeen landowner/tenants where rabbit snares were used, gave a reason for using snares as opposed to other methods of control. Some of the reasons stated were: snares work 24-hours a day (2/7); specific areas can be targeted (1/7); snares are more effective (1/7); snares are relatively cheap (1/7); other preferred methods are no longer available (1/7); and snares are useful at certain times of the year (1/7).

Where snares were not used, the reasons most commonly cited were that it was not necessary to use snares, and that other methods of control were used (Table 2.7).

	total	% of total
None given	32	25
Other methods cannot be used	32	25
One of several methods used to control foxes	25	20
Work 24-hours a day	25	20
More effective	21	17
More targeted	12	10
Other	8	6

Table 2.6 Reasons given as to why snares were used as a method of fox control (n = 126 landholdings in England and Wales, responses from stage 2 survey; more than one reason was given by n = 22 respondents).

	total	% of total
Not necessary	816	34
Other methods of control were used	509	21
Negative view of snares†	351	14
Inhumane	291	12
No reason	215	9
Risk to non-targets / indiscriminate	212	9
Time issues	152	6
No experience	66	3
No control effort	41	2
Other methods of control more effective	41	2
Thought they were illegal	32	1
Public access	31	1
Other	27	1
Ineffective	24	1

Table 2.7 Reasons given as to why snares were not used as a method of control (n = 2,427 landholdings in England and Wales which provided information; more than one reason was given by n = 268 respondents).

A negative view of snaring was associated with no previous experience of using snares ($\chi^2_1 = 40.24$, $p < 0.001$) and with the current use of methods other than snaring to control foxes and/or rabbits ($\chi^2_1 = 7.36$, $p = 0.007$). Twenty-six percent (±SE 1) of landowners/tenants who had no previous experience of using snares had a negative view of snares, contrasting with 13% ±SE 2 among those who did have previous experience (predictions from the regression model averaged across control/no control categories). Twenty-six percent (±SE 1) of landowners/tenants who carried out fox and/or rabbit control without the use of snares had a negative view of snaring, as did 21% ±SE 1 who carried out no control (predictions from the regression model averaged across respondents with and without previous experience of using snares).

2.3.1.4. Extrapolation to estimate snare use throughout England and Wales

Although landholding size, land class and game-bird shooting interest were all determinants of snare use in England, extrapolation was based solely on size class, because the composition of the full farm register with respect to land class and game-bird shooting interest was unknown. This imposes the assumption that within each size class, the full population of landholdings had a similar composition as the sample with respect to land class and shooting interest. To avoid this assumption we modelled England and Wales separately, recognising the different composition of land classes and game-bird shooting interests within each country (Table 2.1, Figure

2.1) and the interaction between land class, game-bird shooting interest and country in determining the proportion of landholdings which used snares.

Extrapolating from the number of landholdings where snares are used within each size class to the total number of holdings on the farm register for England gives an estimate of 5,454 (95% CI 4,363-6,545) landholdings within the total population of 115,436 landholdings; and for Wales gives an estimate of 1,288 (95% CI 764-1,811) landholdings within the population of 23,783 landholdings (Table 2.8). Considering fox and rabbit snare use separately, gives an estimate of 4,695 (95% CI 3,755-5,635) landholdings where fox snares are used in England and 1,288 (95% CI 754-1,811) landholdings where fox snares are used in Wales (Table 2.9). Rabbit snares are used on only 1,567 (95% CI 866-2,270) landholdings in England and 115 (95% CI 5-225) landholdings in Wales (Table 2.10).

Size class (ha)	England: Number of holdings where snares are used	England: Total holdings	Wales: Number of holdings where snares are used	Wales: Total holdings
≥ 5 < 20	1,417 (552-2,281)	40,232	319 (43-594)	8,178
≥ 20 < 50	852 (430-1,274)	27,399	409 (57-761)	6,618
≥ 50 < 100	562 (284-840)	21,237	330 (93-568)	5,005
≥ 100	2,623 (2,185-3,061)	26,568	230 (78-382)	3,982
Total	5,454 (4,363-6,545)	115,436	1,288 (764-1,811)	23,783

Table 2.8 The estimated total numbers of landholdings on which snares (fox or rabbit) are used in England and Wales (with 95% CI in parenthesis).

Size class (ha)	England: Number of holdings where fox snares are used	England: Total holdings	Wales: Number of holdings where fox snares are used	Wales: Total holdings
≥ 5 < 20	850 (175-1,525)	40,232	319 (43-594)	8,178
≥ 20 < 50	852 (430-1,274)	27,399	409 (57-761)	6,618
≥ 50 < 100	525 (255-793)	21,237	330 (93-568)	5,005
≥ 100	2,469 (2,043-2,895)	26,568	230 (78-382)	3,982
Total	4,695 (3,755-5,635)	115,436	1,288 (764-1,811)	23,783

Table 2.9 The estimated total numbers of landholdings on which fox snares are used in England and Wales (with 95% CI in parenthesis).

Size class (ha)	England: Number of holdings where rabbit snares are used	England: Total holdings	Wales: Number of holdings where rabbit snares are used	Wales: Total holdings
5 < 20	708 (91-1,325)	40,232	0	8,178
20 < 50	284 (38-530)	27,399	0	6,618
50 < 100	112 (0-238)	21,237	0	5,005
≥ 100	463 (271-655)	26,568	115 (5-225)	3,982
Total	1,567 (866-2,270)	115,436	115 (5-225)	23,783

Table 2.10 The estimated total numbers of landholdings on which rabbit snares are used in England and Wales (with 95% CI in parenthesis).

2.3.1.5. General control of foxes and rabbits

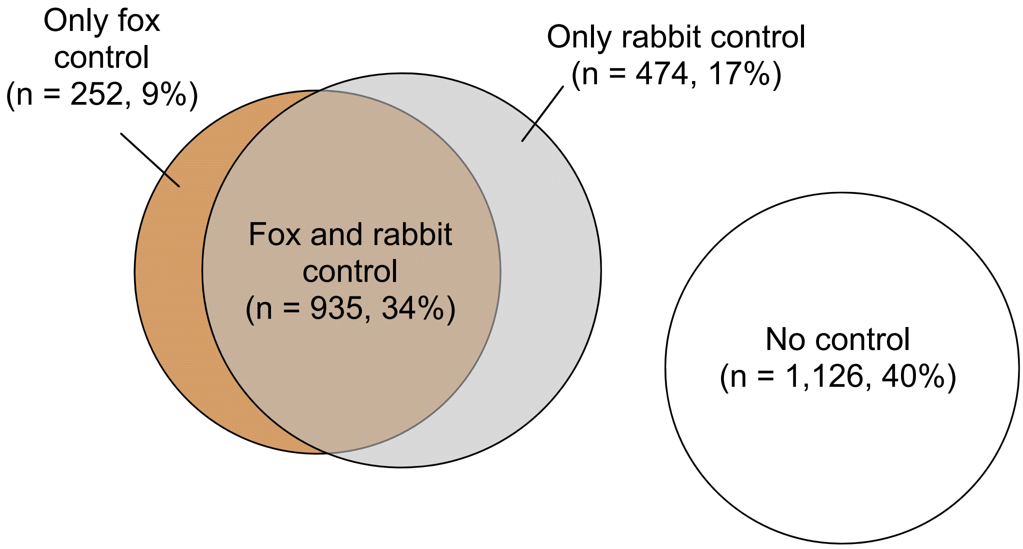

Figure 2.6 Number of landholdings where fox control, rabbit control, both or neither took place (figures in parenthesis are number of respondents and percentage of the total N = 2,787, excluding n = 74 where the control of either species was unknown).

Fox control in some form (not necessarily involving snaring) was carried out on 43% (±SE 0.9, n = 2,805[2]) of landholdings (Figure 2.6). In a model across landholdings in both England and Wales, there were significant interactions determining the probability of fox control between size class and game-bird shooting interest (χ^2_3 = 10.793, p = 0.013) and between country and land class (χ^2_3 = 9.312, p = 0.025). Fox control was commonest on landholdings where there was an interest in game-bird shooting, which was associated with landholdings in the largest size class, and fox control was more common on landholdings in arable and upland land classes than in pastoral land classes. Due to the significant interaction between country and land class, England and Wales were modelled separately. In England, land class (χ^2_6 = 26.63, p < 0.001), size class (χ^2_3 = 49.73, p < 0.001) and game-bird shooting interest (χ^2_1 = 214.38, p < 0.001) were significant factors determining the proportion of landholdings on which foxes were controlled (Section 9.4a). In Wales, size class (χ^2_3 = 29.04, p < 0.001) and game-bird shooting interest (χ^2_1 = 5.35, p = 0.021) were significant predictors of fox control (Section 9.4 b).

Rabbit control (not necessarily involving snaring) took place on 51% (±SE 0.9, n = 2,792[3]) of landholdings. The three-way interaction between land class, size class and country (χ^2_9 = 20.56, p = 0.015) and the two-way interaction between game-bird shooting and land class (χ^2_6 = 14.17, p = 0.028) were significant factors determining the proportion of landholdings on which rabbits were controlled. Among landholdings in England, the interaction between land class and size class (χ^2_{17} = 30.64, p = 0.022) and between land class and game-bird shooting interest (χ^2_6 = 15.98, p = 0.014) was significant (Appendix 8.4c). Among landholdings in Wales, the interaction

[2] 56 landowners/tenants did not provide information on whether or not fox control was conducted on the land.
[3] 69 landowners/tenants did not provide information on whether or not rabbit control was conducted on the land.

between game-bird shooting interest, land class and size class were significant (χ^2_7 = 17.60, p = 0.014) (Appendix 8.4d).

2.3.1.6. Game-bird shooting interest

Overall, there was a game-bird shooting interest on 31% (±SE 0.9) of 2,769[4] landholdings. There was a strong regional distribution of game-bird shoots, with a high proportion in the east and south of England (Figure 2.7) and very few game-bird shoots in Wales. The type of game-bird shoot (wild or reared) was also regionally distributed, with reared shoots predominately in the West (in particular in the Southwest) and wild bird shoots predominately in the East (Figure 2.8).

Land class (χ^2_6 = 41.62, p < 0.001) and the interaction between country and size class (χ^2_3 = 9.87, p = 0.020) were significant factors determining which landholdings had an interest in game-bird shooting. In England, game-bird shooting interest was less common among landholdings in the smallest size class (10% ±SE 2) and most common in the largest size class (49% ±SE 2), whereas in Wales the association of game-bird shooting with the larger size class was less pronounced (corresponding figures 8% ±SE 3 and 18% ±SE 4). Comparing England and Wales, a game-bird shooting interest was twice as likely in England (33% ±SE 1) compared to Wales (16% ±SE 2). Among landholdings in England, size class (χ^2_3 = 268.05, p < 0.001) and land class were significant factors (χ^2_6 = 41.32, p < 0.001; Appendix 8.4e) determining whether there was a game-bird shooting interest. Among landholdings in Wales there were no significant factors associated with game-bird shooting interest.

[4] 92 landholdings did not provide information on whether or not there was a game-bird shooting interest

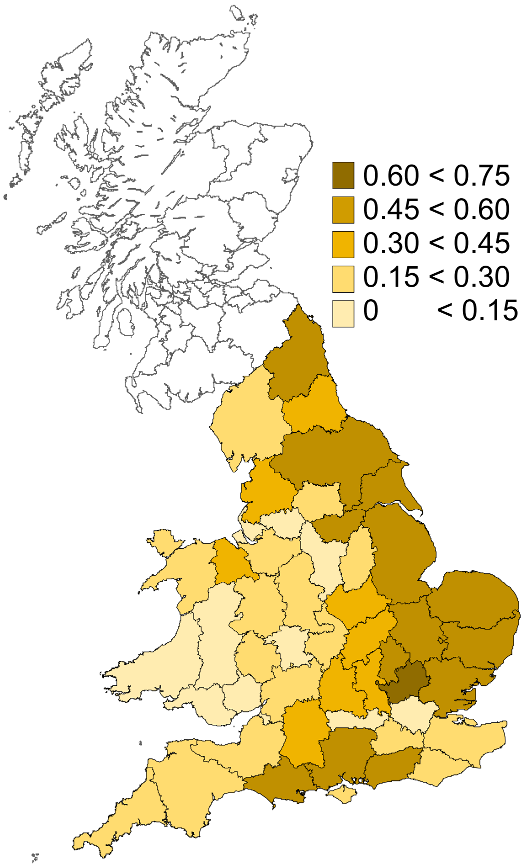

Figure 2.7 Geographical distribution of game-bird shoots (coded by the proportion of landholdings with a game-bird shooting interest within each country, n = 872).

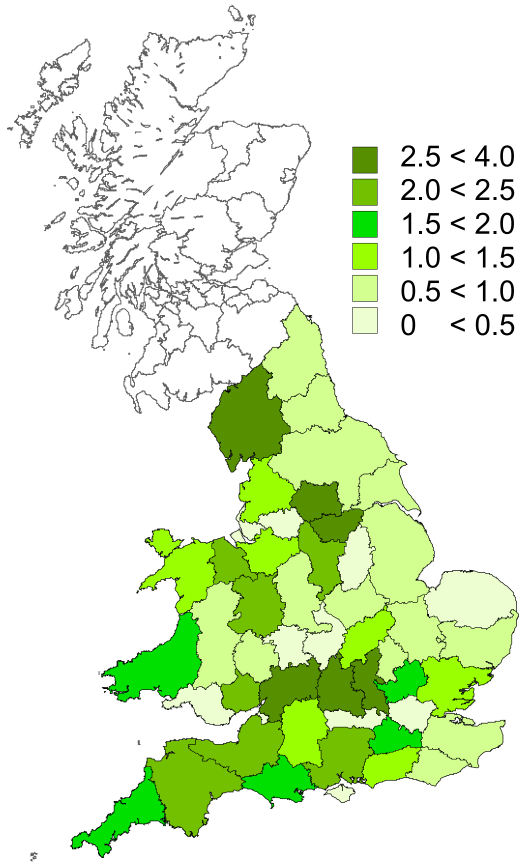

Figure 2.8 Geographical distribution of the type of game-bird shoots (coded by the proportion of reared-bird shoots to wild-bird shoots within each county, n = 848).

2.3.2. Compliance with aspects of the Defra COP

2.3.2.1. Response rate

Out of 184[5] landholdings where snares were used, a survey was conducted with 130 snare operators (71%) on snaring practices and the CoP. Thirty-nine of 184 (21%) did not wish to participate, and another 15 could not be contacted. The number of operators who participated in the detailed survey differed significantly between gamekeepers and farmers (χ^2_1 = 23.37; p < 0.001; 55% ±SE 5, 89% ±SE 3, respectively; reasons for which are discussed in section 2.4.1.1).

	Fox		Rabbit	
	Farmer	Gamekeeper	Farmer	Gamekeeper
Sample size	70	56	12	5
Awareness of CoP (%)	64%	95%	92%	80%
Had been on a training course (%)	3%	38%	0%	40%
Average number of snares set (with range)	12 (1- 300)	66 (2-700)	7 (2-25)	27 (50-55)

Table 2.11 Snare users summarised by their role and the target species for which snares were used (n = 130, 8 farmers and 5 gamekeepers used both fox and rabbit snares).

2.3.2.2. Snare users

Snare users classified themselves as gamekeeper (42%), shoot manager (1%), pest controller (1%) (hereafter combined and referred to as 'gamekeepers') or farmer (56%) (Table 2.11, Figure 2.9). Species targeted using snares (respondents to the survey: n = 130) were foxes (97%), rabbits (13%), hare (1%), stoat (1%), and weasel (1%) (some operators targeted more than one species).

Farmers had used fox snares for significantly longer (median = 27 yrs, range 1 to 73, n = 55) than gamekeepers (median = 20 yrs, range 0.6 to 54, n = 51; Mann-Whitney $U_{55,51}$ = 1058.0, p = 0.03). The length of time rabbit snares had been used did not differ significantly between farmers (median = 25 yrs, range 10 to 60, n = 10) and gamekeepers (median = 28 yrs, range 10 to 54, n = 4; Mann-Whitney $U_{10,4}$ = 4.0, p = 0.07).

[5] 6.3% of 2,908 landholdings where snaring occurred.

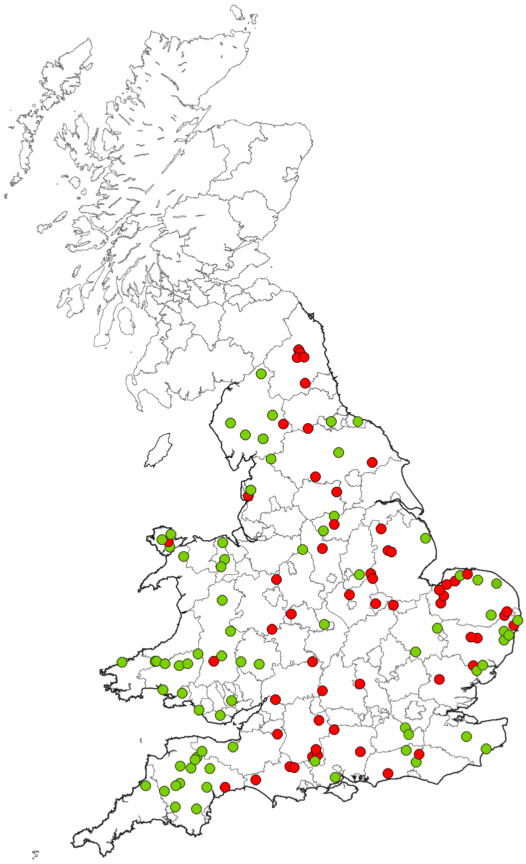

Figure 2.9 Distribution of snare users who participated in the detailed survey (stage 3); red = gamekeeper (n = 56), green = farmer (n = 74).

2.3.3. Fox snaring

2.3.3.1. Awareness of the Defra CoP

Among fox snare users (n = 126), 95% of gamekeepers were aware of the Defra CoP, significantly higher than the percentage among farmers (64%; $\chi^2_1 = 16.59$; $p < 0.001$; Table 2.12). This significant difference between the two types of snare user was consistent for each of the training and awareness questions. 'Formal' training courses attended included GWCT snare training course (11 operators); NGO snare training course (2); BASC snare training course (1); training in the use of snares during a college course (2); one-to-one tuition (1); and other/could not remember (5). A further 37 fox snare users (18 gamekeepers and 19 farmers) stated that they had received 'informal' training' from other snare users. Forty-nine farmers (70% of the 70 farmers surveyed) and 17 gamekeepers (30% of the 56 gamekeepers surveyed) were using fox snares without any formal or informal training.

	% Yes (±SE)		Chi-squared
	Gamekeeper n = 56	Farmer n = 70	
Aware of the CoP	95 (3)	64 (6)	16.59^{***}
Read the CoP	82 (5)	47 (6)	16.30^{***}
Possessed a copy of the CoP	75 (6)	27 (5)	28.53^{***}
Read any other CoP/advice leaflet	66 (6)	17 (5)	31.34^{***}
Possessed a copy of another CoP/advice leaflet	59 (7)	5 (3)	42.47^{***}
Had been on a training course	38 (7)	3 (2)	16.56^{***}
Had been trained in the use of snares[b]	70 (6)	30 (5)	19.60^{***}

Table 2.12 Responses to training and awareness questions for fox-snare users, comparing gamekeepers and farmers. The chi-squared test statistic is quoted in the right-hand column ($^{***}p < 0.001$). [b]Includes training course or informal training by other snare users.

2.3.3.2. Compliance with aspects of the Defra CoP

Overview

For those questions in the telephone survey (stage 3) where responses could be easily classified as compliant or non-complaint with the CoP, responses of fox snare users were scored to quantify compliance with the Defra CoP, enabling comparisons between the two user groups. Out of a maximum score of four (one point each for: snares used with fixed stops, snares used to restrain not kill, snares checked before 9 am, and foxes humanely dispatched when caught in a snare), the mean score was 3.1. Gamekeepers scored higher for compliance with the CoP than did farmers (median = 4 and 3 respectively; Mann-Whitney $U_{56,70} = 1102$, $p < 0.001$). English farmers scored significantly higher than Welsh farmers (median = 3 and 2 respectively; Mann-Whitney $U_{48,22} = 311$, $p = 0.003$). Gamekeepers could not be compared between countries because of the low number of gamekeeper respondents in Wales. Across all fox snare users, the highest level of compliance was in the method used to dispatch foxes (score of 113/119) and the lowest level for checking snares before 9 am (78/126).

Intention of setting snares

Most fox snare users (76% of 126) stated that they set snares with the intention of restraining the fox prior to its dispatch, while 19% intended the snare to kill the fox directly. A further 5% stated that they used both approaches in different circumstances. Among farmers, 67% (n = 70) set snares with the intention of restraining the fox, 27% intended the snare to kill the fox directly and 6% used both approaches. Equivalent figures for gamekeepers were 88%, 9% and 4% respectively, and this difference between user groups was significant ($\chi^2 = 7.55$, $p = 0.006$).

Types of snares used

Fox snares were purchased from a variety of suppliers, or in some cases were homemade (20% of gamekeepers, 9% of farmers; Table 2.13). Where snares were purchased from commercial outlets (n = 105, excluding n = 7 operators who made some of their snares), they were rarely modified before use (3% of users).

Most fox snare users operated snares with fixed stops (stopped: 82%; unstopped: 10%; mixed: 3%; didn't know 5%). For those that used snares without fixed stops, 9/13 (69%) were farmers. Snares used without fixed stops were obtained from farm suppliers (6), made their own (2), mixture of farm supplier and made their own (1), gun shop (1), mail order (1), or didn't know (2).

	Fox snares	
Category of snare supplier	Gamekeeper (n = 56)	Farmer (n = 70)
Agricultural depot	2	0
Don't know	9	9
Game fair	5	0
Game management equipment supplier	23	6
GWCT breakaway snares†	9	0
Local agricultural cooperative/store	4	2
Local farm supplier	29	60
Local gamekeeper	0	1
Local gun shop	5	9
Local hardware store	0	3
Local merchant	0	1
Mail order	14	1
Make my own	20	9

Table 2.13 Types of outlets from which fox snares were obtained. Tabulated values are percentages of the total sample of snare operators for each column. Fox snares were obtained from more than one supplier for n = 11 gamekeepers and n = 1 farmer. †These snares were not commercially available at the time of the study and were being used by operators taking part in a scientific trial with the GWCT.

Factors limiting the use of snares

Across all fox snare users, 34% stated that there were no factors or issues that limited their use of fox snares. Of those who were limited in their use of snares, public access was cited most commonly (51/126), followed by the risk of non-target captures (46/126). Every individual factor/issue was more commonly cited by gamekeepers compared to farmers. A significantly higher proportion of farmers compared to gamekeepers (44%, 21% respectively) stated that they were not limited by any factor in their use of fox snares ($\chi^2_1 = 6.25$, $p = 0.012$) and the number of reasons cited by the remainder was lower for farmers (mean 1.6 reasons) than for gamekeepers (mean 2.2 reasons) (Table 2.14).

Factors/issues	Fox snares	
	Gamekeeper (n = 56)	Farmer (n = 70)
Public access	54	30
Movement of machinery	7	0
Risk of badger captures	25	19
Non-targets (excluding badgers)	21	16
Public interference	5	3
Time	4	0
Other	5	3
None	21	44

Table 2.14 Factors limiting the use of fox snares for gamekeepers and farmers. Tabulated values are percentages of the total sample for each column. More than one factor/issue was cited by n = 19 gamekeepers and n = 9 farmers.

Timing and duration of snare round

Overall, 62% of the 126 fox snare users checked their snares first thing in the morning or before 9 am, but there was a significant difference in this respect between gamekeepers (80%) and farmers (47%; $\chi^2_1 = 15.16$, $p < 0.001$; Figure 2.10). Although we did not specifically ask how many times during the day snares were checked, most fox snare users checked their snares only once (77%), which was similar for gamekeepers and farmers (79% and 76%, respectively).

The average time spent checking fox snares on a snare round was 56 minutes (range 2 to 240 min, n = 111). The time spent checking snares differed significantly between gamekeepers (median = 90 min, range 10 to 240 min) and farmers (median = 28 min, range 2 to 240 min; Mann-Whitney $U_{50,61} = 444.5$, $p < 0.001$), though not by a factor of six as might be expected from the average number of snares used by each group (section 2.3.2.1).

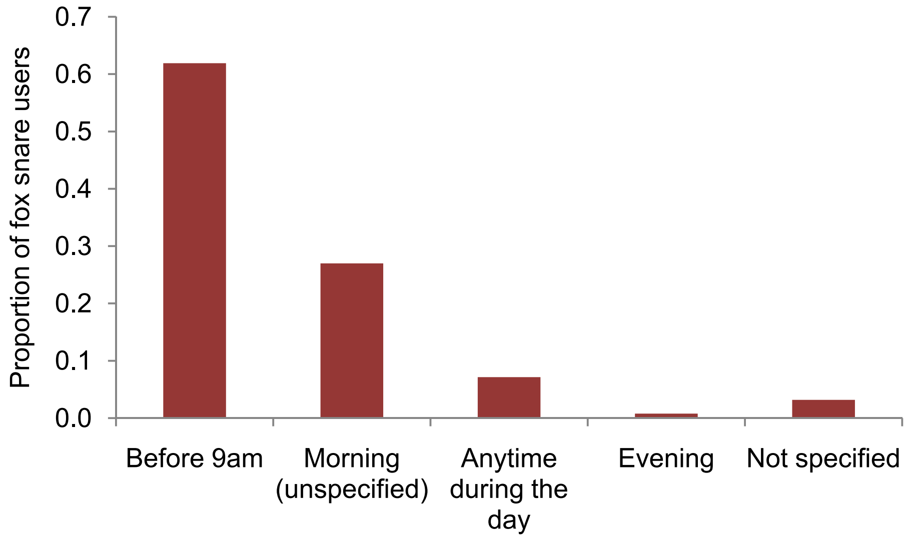

Figure 2.10 The time of day at which fox snares were first checked (n = 126 operators).

Experience of non-target captures

Among fox snare users (n = 126), 60% stated that they had caught non-targets when using fox snares. There was no time limit in this question nor investigation of numbers of non-targets caught and therefore we cannot relate capture of non-targets to any aspect of the CoP. The proportion who stated that they had never caught a non-target species was significantly higher among farmers (51%, n = 70) than among gamekeepers (27%, n = 56; $\chi^2_1 = 8.01$, $p = 0.005$). Among all those who had never caught a non-target (n = 51) the median number of snares set at one time (excluding zeros) was 5, (compared to a median of 28 who did catch non-targets), but this group of operators included one person who used a large number of snares (range 1 to 700). The non-target species most commonly stated to be caught in fox snares (n = 126) were badger (25% of operators stated they had caught a badger in a snare), brown hare (21%) and deer (16%). Each of these non-target species was more commonly cited by gamekeepers than by farmers (badger: 34%, 17%, $\chi^2_1 = 4.72$, $p = 0.03$; hare: 34%, 10%, $\chi^2_1 = 11.03$, $p < 0.001$; deer: 32%, 3%, $\chi^2_1 = 21.77$, $p < 0.001$, respectively). Three farmers (2% of 70) did not specify which non-target species they had previously caught.

Avoidance of non-target captures

Eighty four percent of fox snare users stated that they took measures to reduce the risk of capturing non-target species. Of those who took no special measures, 60% (12/20) stated they had never caught a non-target species. Measures cited as being used to reduce the capture of non-target species when snaring for foxes were: using a targeted approach (i.e. looking for fox signs, limiting the number of snares set - 39% of 126); care in setting the snare (25%) (e.g. setting the snare at an appropriate height (21%) or setting the noose large to avoid the capture of hares (2%)); avoiding badger runs (13%); avoiding areas with high densities of non-targets (13%); using deer jumps (i.e. a pole or branch is placed over the snare to encourage deer to jump over the snare; 11%); avoiding areas where public have access (6%); avoiding fence lines (5%); checking frequently (2%); and using breakaway snares (1%). These measures differed significantly between gamekeepers and farmers for: avoiding fence-lines (10% ±SE 4 and 0% ±SE 0, respectively; χ^2_1 = 10.11, p = 0.001), avoiding areas where public have access (10% ±SE 4 and 2% ±SE 2, respectively; χ^2_1 = 4.05, p = 0.044), and using deer jumps (23% ±SE 6 and 1% ±SE 1, respectively; χ^2_1 = 16.74, p < 0.001).

Methods of dispatch

The most common means of dispatching a fox caught in a snare among gamekeepers and farmers was with a firearm; slightly more operators in both groups used a rifle for this purpose than used a shotgun (Table 2.15).

	Fox snares	
Method of dispatch	Gamekeeper (n = 56)	Farmer (n = 70)
Already dead	2	7
Rifle	59	49
Shotgun	43	47
Blow to the head	4	7
Dogs	0	1
Not stated	5	1

Table 2.15 Methods of dispatch used by gamekeepers and farmers after capture of a fox in a snare. Values are percentages of totals in each column (more than one method was quoted by n = 7 gamekeepers and n = 8 farmers).

2.3.3.3. Importance of Snaring

The importance of snares as a method of fox control was rated highly by both gamekeepers and farmers who used them, but significantly higher by gamekeepers than by farmers (Mann-Whitney $U_{69,56}$ = 1451.5, p = 0.017). On average, gamekeepers rated snaring at 4.6 ±SE 0.1 (on a scale of 1 = unimportant and 5 = very important; n = 56) and farmers rated snaring at 4.1 ±SE 0.1 (n = 69). Across gamekeepers and farmers, the importance of snares was rated significantly higher by fox snare users than by rabbit snare users (mean = 4.3 and 3.8 respectively; Mann-Whitney $U_{125,17}$ = 782.5, p = 0.033).

2.3.3.4. Seasonal variation in snaring effort

Among gamekeepers, the use of fox snares was most common during spring and summer, with a peak in July (Figure 2.11). Among farmers, by contrast, use of fox snares peaked during late winter and was least common during the summer months.

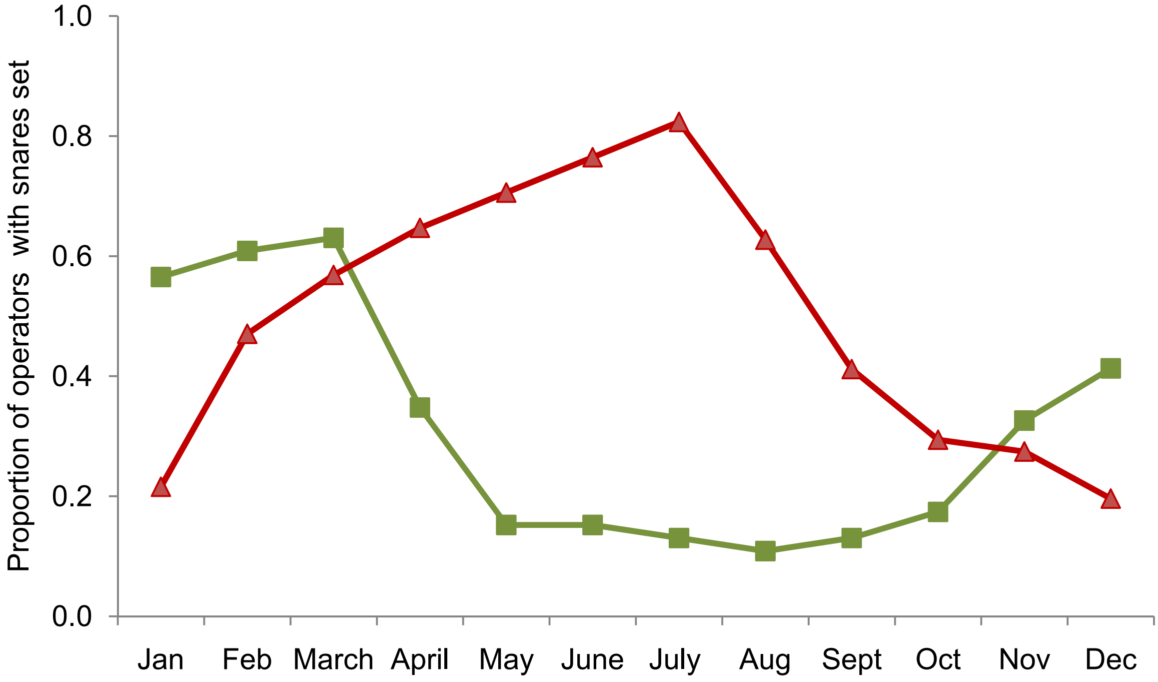

Figure 2.11 Proportion of operators with fox snares set at any one time during each month, for gamekeepers (red line, n = 51), and farmers (green line, n = 46).

At all times of year, individual gamekeepers set significantly more fox snares than did farmers (median = 35, range 2 to 700; median = 5, range 1 to 300, respectively; Mann-Whitney $U_{306,172}$ = 13.59, p < 0.001). Across the months of the year, the average number of fox snares in use at any one time in each month ranged from approximately 60 to 130 per actively snaring gamekeeper, and from approximately 1 to 18 for farmers (Figure 2.12). Taking into account the proportion of operators actually using fox snares in each month, the net result was that the number of fox snares in use at any one time peaked in March for both groups, declining rapidly after March for farmers but much more gradually to a minimum in January for gamekeepers (Figure 2.13). Taking March as a reference point, there was no significant difference between gamekeepers and farmers in the density of snares set, although the highest densities were set by gamekeepers (for farmers, median = 1.52 km^{-2}, range 0 to 247.10 km^{-2}; for gamekeepers, median = 0.05 km^{-2}, range 0 to 432.40 km^{-2}; Mann-Whitney $U_{34,44}$ = 679.5, p = 0.474). This was because, in general, farmers were operating snares on smaller landholdings than were gamekeepers (median 1.21 km^{2}, median 5.67 km^{2}, respectively; Mann-Whitney $U_{44,34}$ = 260.0, p < 0.001).

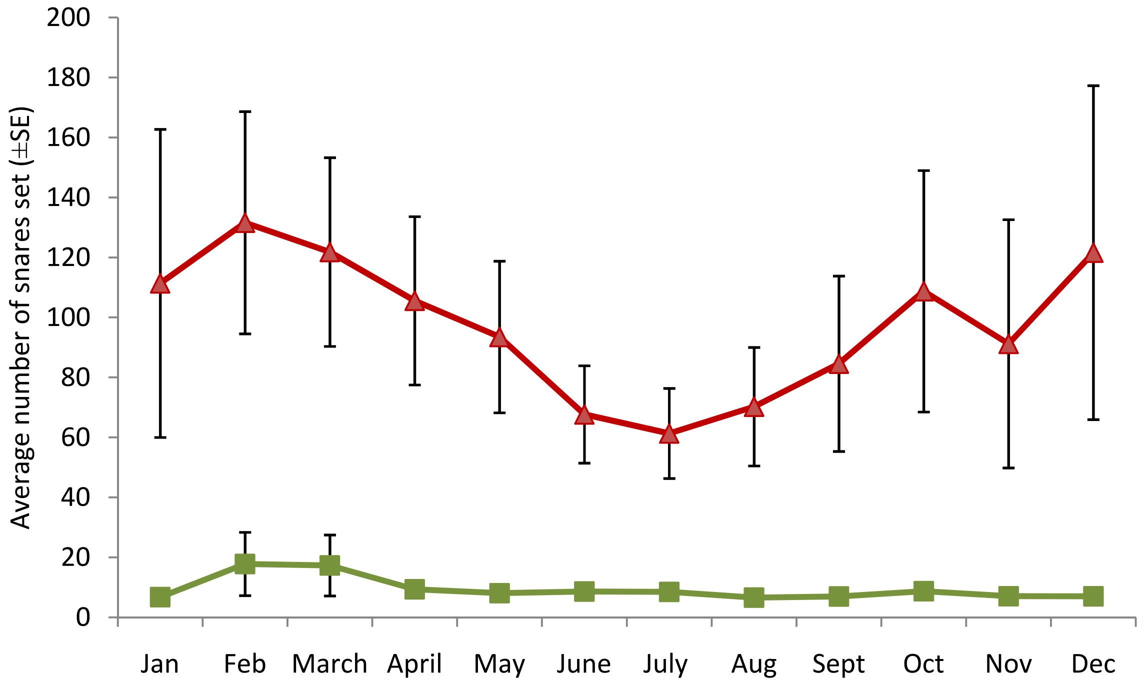

Figure 2.12 Average number of fox snares ±SE set per operator, at any one time in each month, for gamekeepers (red line, n = 51) and farmers (green line, n = 46), excluding operators without any snares set in that month.

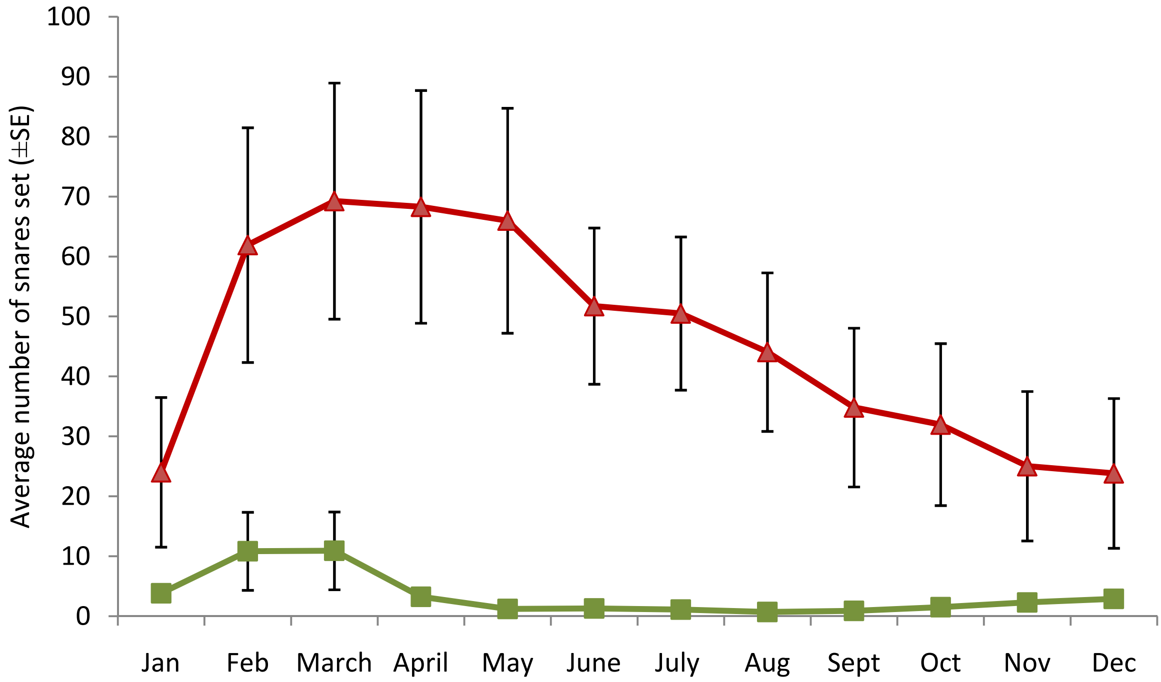

Figure 2.13 Average number of fox snares set per operator, at any one time in each month for gamekeepers (red line, n = 51) and farmers (green line, n = 46). In each case, the average includes operators with no snares set during the month in question. Bars indicate SE. In effect, these curves are the product of Figure 2.11 and Figure 2.12.

2.3.3.5. Extrapolation to estimate the number of fox snares used in England and Wales

For all landholdings on the farm register in England and Wales, the number of fox snares set at any one time, was extrapolated from survey results on the basis of landholding size class for each month of the year. In England the predicted number of fox snares in use ranged from 62,823 (±SE 7,062) in December to 188,283 (±SE 11,689) in March. In Wales the predicted number of fox snares in use ranged from 17,231 (±SE 230) in December to 51,641 (±SE 4,824) in March (Table 2.16 & Table 2.17).

Size Class	January	February	March	April	May	June	July	August	September	October	November	December
2	11,834 (3,642)	30,927 (6,029)	34,080 (6,182)	30,415 (6,096)	28,568 (5,889)	22,551 (4,200)	21,938 (4,114)	19,038 (4,107)	15,188 (3,972)	14,238 (4,008)	11,621 (3,647)	11,371 (3,643)
3	11,862 (2,768)	31,000 (4,583)	34,160 (4,699)	30,487 (4,699)	28,635 (4,476)	22,604 (3,192)	21,989 (3,127)	19,083 (3,122)	15,224 (3,019)	14,272 (3,046)	11,648 (2,772)	11,398 (2,769)
4	7,309 (1,572)	19,102 (2,602)	21,050 (2,669)	18,786 (2,631)	17,645 (2,542)	13,928 (1,813)	13,550 (1,776)	11,759 (1,773)	9,381 (1,715)	8,794 (1,730)	7,178 (1,574)	7,023 (1,572)
5	34,376 (4,830)	89,834 (7,995)	98,993 (8,199)	88,347 (8.084)	82,981 (7,810)	65,503 (5,570)	63,723 (5,456)	55,300 (5,447)	44,117 (5,267)	41,358 (5,315)	33,756 (4,837)	33,030 (4,831)
Total	65,382 (7,062)	170,863 (11,689)	188,283 (11,689)	168,034 (11,819)	157,829 (11,419)	124,586 (8,143)	121,200 (7,977)	105,181 (7,963)	83,909 (7,701)	78,663 (7,771)	64,203 (7,071)	62,823 (7,062)

Table 2.16 The estimated total number of fox snares set in England at any one time, by month and landholding size class (±SE in parenthesis). Size classes: 2 (≥ 5 < 20 ha), 3 (≥ 20 < 50 ha), 4 (≥ 50 < 100 ha), 5 (≥ 100 ha).

Size Class	January	February	March	April	May	June	July	August	September	October	November	December
2	4,441 (161)	11,607 (2,138)	12,790 (2,138)	11,415 (252)	10,721 (50)	8,463 (50)	8,233 (50)	7,145 (50)	5,700 (50)	5,344 (35)	4,361 (102)	4,268 (102)
3	5,694 (258)	14,881 (3,426)	16,399 (3,426)	14,635 (404)	13,746 (80)	10,851 (80)	10,556 (80)	9,161 (80)	7,308 (80)	6,851 (57)	5,592 (163)	5,472 (163)
4	4,595 (179)	12,007 (2,378)	13,231 (2,378)	11,808 (281)	11,091 (55)	8,755 (55)	8,517 (55)	7,391 (55)	5,897 (55)	5,528 (39)	4,512 (113)	4,415 (113)
5	3,202 (108)	8,368 (1,440)	9,222 (1,440)	8,230 (170)	7,730 (34)	6,102 (34)	5,936 (34)	5,152 (34)	4,110 (34)	3,853 (24)	3,145 (69)	3,077 (69)
Total	17,933 (363)	46,863 (4,824)	51,641 (4,824)	46,088 (569)	43,289 (113)	34,171 (113)	33,242 (113)	28,848 (113)	23,014 (113)	21,575 (80)	17,609 (230)	17,231 (230)

Table 2.17 The estimated total number of fox snares set in Wales at any one time, by month and landholding size class (±SE in parenthesis). Size classes: 2 (≥ 5 < 20 ha), 3 (≥ 20 < 50 ha), 4 (≥ 50 < 100 ha), 5 (≥ 100 ha).

2.3.4. Rabbit snaring

2.3.4.1. Awareness of the Defra CoP

The total sample of rabbit snare users interviewed was small (n = 17), and in general was insufficient to compare between gamekeepers (n = 5) and farmers (n = 12). However, the divergence in awareness of the CoP between gamekeepers and farmers that has already been noted among fox snare users was also apparent among rabbit snare users. Although the two user groups were similarly aware of the CoP on rabbit snaring (80% of gamekeepers, 93% of farmers), there were consistent non-significant differences in whether or not they had read the CoP (80% and 33% of gamekeepers and farmers, respectively) or other advice/CoP leaflets (80%, 25%) and whether they possessed copies of these (Defra CoP: 80%, 17%; other advice/CoP leaflets: 80%, 8%). Of the 17 rabbit snare users, 15 had received no training (although we are not aware of any formal training course in the use of rabbit snares).

2.3.4.2. Compliance with aspects of the Defra CoP

Intention of setting snares

Among rabbit snare users, intentions were almost equally divided: 53% (n = 17) set snares with the intention of the snare killing the rabbit on capture.

Types of snares used

Approximately 2/3 of all rabbit snare users reported that they operated snares with fixed stops (stopped: 59%; unstopped: 35%; didn't know: 6%). Rabbit snares were purchased from a variety of suppliers, or in some cases were homemade (20% of gamekeepers, 17% of farmers; Table 2.18). Where snares were purchased from commercial outlets (n = 14), they were rarely modified before use (7% of users).

Category of snare supplier	Rabbit snares	
	Gamekeeper (n = 5)	Farmer (n = 12)
Don't know	0	8
Game fair	40	0
Game management equipment supplier	0	8
Local farm supplier	40	50
Local gun shop	0	8
Mail order	0	8
Make my own	20	17

Table 2.18 Types of outlets from which rabbit snares were obtained. Tabulated values are percentages of the total sample of snare operators for each column.

Factors limiting the use of snares

Twelve out of 17 rabbit snare users cited no factors as limiting their use of snares. Of the operators which cited a factor/issue which limited their use of snares, public access was most commonly cited among farmers, all factors were cited equally by gamekeepers (Table 2.19).

	Rabbit snares	
Factors/issues	Gamekeeper (n = 5)	Farmer (n = 12)
Public access	20	17
Non-targets	20	0
Lack of cover	20	0
None	40	83

Table 2.19 Factors/issues limiting the use of rabbit snares for gamekeepers and farmers. Tabulated values are percentages of the total sample for each column.

Timing and duration of snare round

Out of 17 rabbit snare users, 8 (47%) checked their snares before 9am (Figure 2.14), and the same number checked their rabbit snares more than once a day. Six (35%) users checked their snares after dark. The average time spent checking rabbit snares on each round was 33 minutes (range 5 to 120 min, n = 13).

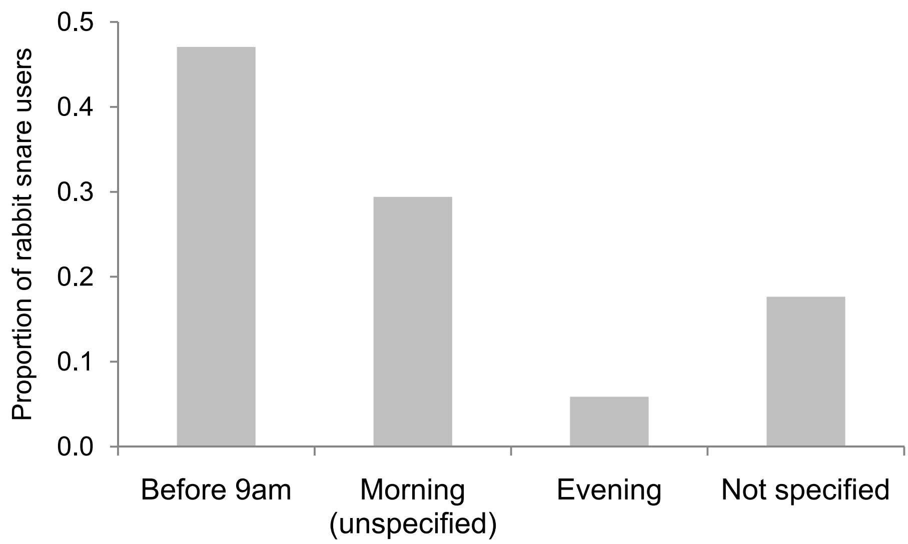

Figure 2.14 The time of day at which rabbit snares were first checked (n = 17 operators).

Experience and avoidance of non-target captures

Twenty-nine percent (5/17) of rabbit snare users cited cat as a non-target species caught in their rabbit snares; one respondent cited polecat. Of those who had caught a non-target, two (40%) stated measures taken to avoid their capture. Among all rabbit snare users measures taken to reduce the capture of non-target species included: none (53%); using a targeted approach (35%); avoiding areas where public have access (12%); avoiding areas with high densities of non-targets (6%); and setting the snare at a suitable height (6%).

Methods of dispatch

Among gamekeepers, the most common method of dispatch for rabbits held in snares was either to stretch the neck (cervical dislocation) or to use a shotgun; among farmers, cervical dislocation or a blow to the head were the preferred methods (Table 2.20).

Method of dispatch	Rabbit snares	
	Gamekeeper (n = 5)	Farmer (n = 12)
Already dead	20	8
Blow to the head	0	25
Rabbit punch	0	8
Rifle	20	17
Shotgun	40	17
Stretching the neck (cervical dislocation)	40	25

Table 2.20 Methods of dispatch used by gamekeepers and farmers after capture of a rabbit in a snare. Values are percentages of totals in each column.

2.3.4.3. Importance of Snaring

On average, rabbit snare users rated snaring at 3.8 ±SE 0.3, significantly lower than the importance rating given for fox snares (on a scale of 1 = unimportant and 5 = very important; mean for fox snare users 4.3; Mann-Whitney $U_{125,17}$ = 782.5, p = 0.033).

2.3.4.4. Seasonal variation in snaring effort

Rabbit snaring (n = 7) was most common between February and March (100% of users) and least common between April and September (43% of users). Across months and users, the number of rabbit snares set ranged between 2 and 55 (average = 12 ±SE 2)[6]. Other rabbit snare users (n = 10) stated that there was no particular time of the year that rabbit snares were set, they were set reactively whenever they had a problem.

[6] The number of rabbit snares used across England and Wales for each month of the year as could not be extrapolated as per fox snares due to low sample sizes.

2.3.5. Accompanied snare check (stage 4)

Initially field visits were requested as planned only with a previously picked random sample of snare users. However because of the low prevalence of snare use at the time of the interview it became apparent that the target number of field visits would not be achieved using this approach. Hence towards the end of the survey, requests were made to all snare users interviewed who had snares currently set. For logistic/budgetary reasons, field visits were not carried out on landholdings in Wales. Fifty-four of the 126 fox snare users who participated in the survey had snares set at the time of the survey, 44 of these in England. Visits were requested with 36 operators in England and 18 of these were granted. Two of these had to be aborted because of transport failure. The distribution of field visits corresponds to counties were snare use was most prevalent (Figure 2.15). Seven visits took place on the day following the detailed telephone survey, a further 5 within 4 days and the remainder within 10 days (average lapse = 3 days, ±SE 0.6, range 1 to 10). Reasons for the delay in field visits were: the researcher was already booked to make another visit on the following day (3); the snare user was too busy the following day to have a visitor (2); someone else was going round his snares the following day as he was out lamping that night (1); no reason given (1); not sure where he is from one day to the next (1); visit arranged when snares were set (1). Among the 18 respondents refusing visits, 9 stated that they were happy for a visit but were too busy at the time; others did not allow a visit due to lack of trust/privacy reasons (2); snares were checked on a quad bike which was safe for only one person (1); too busy (3); ‘sick of visits’ (1); and no reason given (2). Among the 17 rabbit snare users who participated in the survey, 4 had snares set at the time of the survey. The two requests for visits were both granted, one visit was made within 4 days of the survey and the other within 5 days.

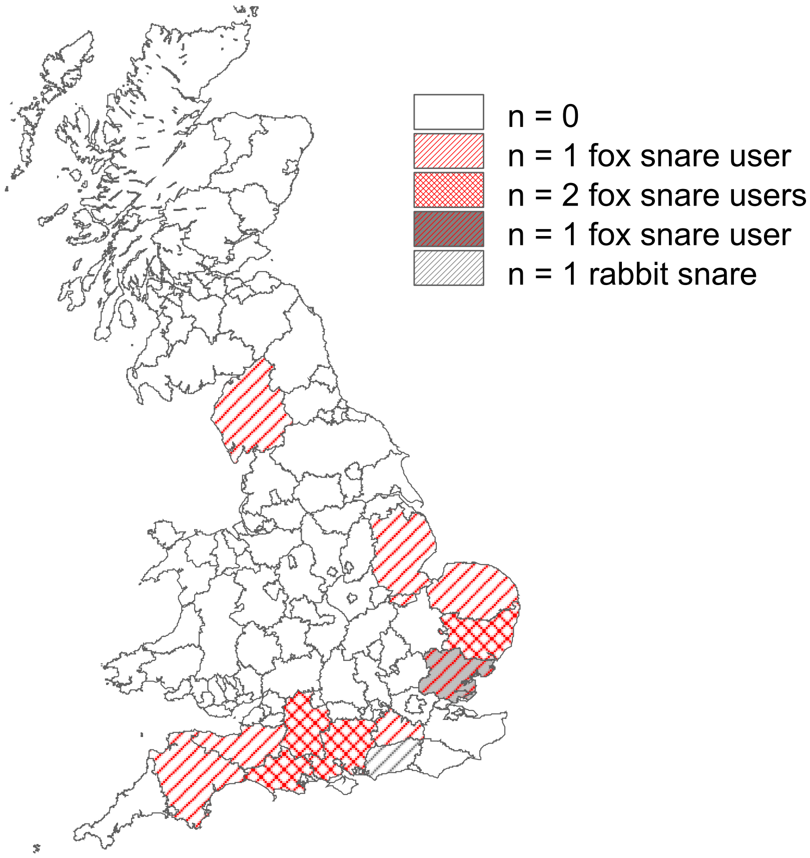

Figure 2.15 Geographical distribution of accompanied snare checks with snare users at a county scale (n = 16 fox snare users, n = 2 rabbit snare users).

Species	Land class	Size class	Gamekeeper	Farmer
Fox	Arable a	≥ 100	6	1
Fox	Arable b	≥ 100	7	0
Fox	Pastoral d	≥ 100	0	1
Fox	Upland	≥ 100	1	0
Rabbit	Arable a	≥ 5 < 20	0	1
Rabbit	Arable b	≥ 100	0	1

Table 2.21 Summary of the number of field visits for both fox and rabbit snare users by land and size class.

A disproportionate number of gamekeepers were accompanied on snare checks (78%, gamekeepers account for 51% of snare users; Table 2.21). This bias arose because gamekeepers more commonly had snares set at the time of surveying English landholdings, between May to September inclusive (57% of 56 gamekeepers, and 30% of 74 farmers).

2.3.6. Verification of telephone questionnaire statements

For the 18 snare users (fox and rabbit snare users) visited in stage 4, we compared responses to the telephone questionnaire with the situation found in the field. Twelve out of 18 snare checks were conducted at the time the operator had stated that they typically checked snares. The remainder stated that they had arranged the visit an hour or so later than they would normally check them (3/6), or had arranged the visit at a convenient time but had already gone round their snares earlier that day (3/6).

One of the 16 fox snare users visited had stated in the telephone survey that snares were set to kill rather than restrain foxes. On field visit to this operator, the snares examined were free-running by design, although a proportion (40%) were slightly misshapen around the noose of the snare. The remainder of operators visited had stated that they set snares with the intention of restraining foxes. Field visits found that these operators were using only snares that were designed to be free-running. Some snares (26 out of 181 snares checked) were old or had been misshapen by previous captures (n = 6 operators; 5 fox snare users, 1 rabbit snare user) to the extent that their free-running nature was in doubt, but in only one case did this amount to >25% of the snares set by the operator. One of these operators had set a small proportion of (free-running) snares using a lever system intended to suspend the captured fox off the ground. Captures made during accompanied snare checks (6 animals, n = 5 operators) were alive on inspection of the snare, although one injured badger had to be killed on welfare grounds. (A further hare had been killed by a predator whilst in the snare.) No captures were witnessed for the operator who stated that he set snares to kill rather than restrain.

For 2 of the 16 fox snare users, snares in use did not match telephone survey responses with respect to whether or not stops were used. One operator stated in the telephone survey that their snares did not have fixed stops, when in fact they did. The other operator stated that their snares had fixed stops when in fact 73% if those examined did not.

In the two telephone surveys with rabbit snare users, one user stated that snares were set to kill, and the other that snares were set to restrain, rabbits. One operator stated that they did not know whether stops were present, the other that stops were present. Field visits showed that both operators used free-running snares, but stops were not present in either case.

Thirteen of the 18 operators took measures to avoid non-target species as had been stated in the telephone survey. For the other 5 operators, discrepancies arose in setting the snare at the minimum height stated in the CoP. The 2 operators who stated they took no measures to avoid non-target species both caught non-target species during accompanied snare checks (badger and hare). Two out of three non-target captures caught on field visits matched species stated to have been caught previously. A third operator who caught a hare on the field visit had cited previous captures of cat, deer and badger, but not hare.

Of the 18 operators visited, 10 had the same (± 2 snares) number of snares set at the time of the visit as had been stated in the telephone survey. One operator had not been sure how many snares were set at the time of the telephone survey. Another operator had no snares set at the time of the interview but a visit was arranged for 7 days later by which time the interviewee did have snares set. Five operators had stated a higher number of snares set in the telephone survey than were observed during the field visit (51% ±SE16 more snares in survey), however another operator had 30% more snares set in the field than stated in the telephone survey.

2.3.6.1. Observations made during visits

Fox snaring

Besides verifying statements made in the detailed telephone survey, the field visits allowed us to observe compliance with some aspects of the Defra CoP. For fox snare operators, 13 aspects of the CoP were identified that could be assessed on a field visit, although some of these field measures were only indicative and could not entirely verify compliance or non-compliance (this point is expanded below). The 13 measures fall broadly into 5 issues of snare design and 8 of working practices. Each snare examined was scored as compliant or otherwise. The percentage of snares examined which complied with each of the 13 aspects of the CoP was determined (see Table 2.22). An operator was considered compliant on a particular aspect if >75% of their snares met CoP requirements.

Because of the low sample size (16 operators, 178 snares or 42% of those set) and its non-random derivation, these observations must be seen as illustrative, rather than representative of all fox snare users in England and Wales. It must also be remembered that the CoP provides advice at different levels of coercion (indicated linguistically by ‘must’, ‘should’, and ‘may’) to reflect (respectively) statutory obligations, requirements to achieve best practice and advice on beneficial working practices. The degree of obligation to follow all requirements of the CoP is therefore unclear, even for those who have been taught about it through formal training.

No operator visited complied fully with all 13 aspects of the CoP across all snares examined. In aspects of the CoP related to snare design, no snares examined were self-locking by design (which would be illegal). Although snares were not handled by the investigator (to avoid adding scent cues), most were considered likely to run freely, a few exceptions were those that were rusty or kinked. A fixed stop was present on most snares examined. The required stop distance of ‘approximately 23 cm from the eye’ is difficult to score categorically. Most snares in use did not have the weakest point at the eye of the snare and did not have two swivels incorporated (one near the anchor point and another closer to the noose) (see Figure 2.16 for example). Apart from snare design issues, other aspects of the CoP less well complied with were setting snares at sites cluttered by obstacles and setting snares at a minimum height of 15 cm above level ground (although this too is difficult to score categorically).

Figure 2.16. An example of the swivel, running eye and crimps typical of the majority of snares examined during the field visits. In this case, a wooden tealer has been used to support the snare. The checkerboard was used to measure dimensions without the need to handle the snare.

	1[gk]	5[gk]	13[gk]	7[gk]	8[gk]	4[gk]	11[gk]	3[gk]	6[gk]	9[gk]	10[gk]	12[gk]	14[gk]	15[gk]	2[f]	16[f]
Background																
Total number of snares set	*100*	*23*	*48*	*8*	*14*	*21*	*6*	*7*	*30*	*18*	*19*	*20*	*100*	*4*	*6*	*1*
Number of snares examined	*14*	*15*	*26*	*8*	*14*	*13*	*6*	*7*	*7*	*15*	*16*	*15*	*11*	*4*	*6*	*1*
Formal training in the use of snares	y[a]	y[b]	y[b]	y[a]	y[c]	n	n	n	n	n	n	n	n	n	n	n
Informal training by another snare user	n	n	n	n	n	y	y	n	n	n	n	n	n	n	y	n
Participated in the GWCT breakaway trial[d]	n	n	y	n	n	n	n	n	y	y	n	n	n	n	n	n
Snare design																
Snare is free-running	✓	✓	✓	✓	✓	✓	✓	(✓)	✓	✓	✓	✓	✓	✓	✓	✓
Stop present and fixed in position	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	(X)	✓	✓	✓
Stop distance of approx. 23 cm	✓	✓	(X)	(✓)	✓	✓	(X)	(✓)	✓	✓	✓	✓	✓	✓	-	-
The weakest point of the snare is at the eye	X	X	(X)	X	X	X	X	X	(✓)	X	X	X	X	X	X	X
Two swivels, one near the anchor and one closer to the noose	X	X	(X)	X	X	X	X	X	(✓)	X	X	X	X	X	X	X
Operating practice																
Snare supported by a tealer	✓[w]	✓[w]	✓[m]	✓[w]	✓[w]	✓[w]	✓[w]	(✓)[w]	✓[m]	✓[m]	✓	✓[w]	✓[w]	✓[w]	X	X
Snare site not cluttered by obstacles	✓	(X)	X[†]	X	(X)[†]	X	X[†]	X	(✓)	X[†]	X	✓	X	X	X	X
Snare not set along-side or through fence-lines or hedges	✓	✓	✓	✓	✓	(✓)	X	(X)	✓	✓	(✓)	✓	✓	(X)	X	X
Snare at a minimum height of 15 cm above ground	X	(✓)	✓	(X)	✓	X	X	X	(X)	✓	(X)	X	(X)	X	X	X
Snare not fastened to a moveable drag	X	X	✓	✓	(✓)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Snare not set along watercourses	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Evidence of target species using the run	X	X	X	(X)	X	X	X	X	X	X	X	X	X	X	X	X
No evidence of non-target species using the run*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 2.22 (opposite) Compliance with selected aspects of the Defra Code of Practice (CoP) by 16 fox snare users (numbered, top row) who were accompanied in the field on a routine snare check round. Operators are grouped by main profession ([gk]gamekeeper, [f]farmer) and then by training ([a]unknown course, [b]GWCT course, [c]part of college course). It is unknown whether such training pre-dated or post-dated the 2005 CoP. [d]indicates 3 operators who had participated during 2007-9 in a GWCT trial of an experimental 'breakaway' snare which was fully CoP-compliant: these operators had been issued with experimental snares to form up to 50% of those in use, and had been inducted into the experimental protocol, but had not otherwise received any special tuition about operating practices. By the time of the field visit Operator 9 had <25% of these experimental snares still in use. [m]Indicates that a metal wire tealer was used, [w]indicates a wooden tealer was used, if no symbol is given against a tick in this row both types of tealer were used. Due to snares set in fence-lines or hedgerows, stop distances could not be measured for operators 2 and 16.

In the lower two sections of the table, aspects of the CoP which could be assessed in the field at the time of inspection are considered. Symbols X, (X), (✓), and ✓ indicate that 0-24%, 25-49%, 50-74%, and 75-100% respectively of snares examined were compliant. [†]includes cases where an anchor stake protruded above the ground to the extent that entanglement of the snare with the anchor stake was possible.

[*]Although the CoP advises setting snares only where there is evidence of the presence of the target species, field signs are transient and were not necessarily expected to persist to the time of inspection. Evidence prompting snare deployment may in any case have consisted of a sighting or field signs in the general vicinity of the snare location. Similarly, absence of evidence of non-targets on the day of inspection does not indicate that such evidence was also absent when the snare was set. Conversely, fresh evidence or capture of a non-target animal on the day of inspection could have been the first evidence available that non-targets were at risk on a particular run.

This table is intended as a visual overview. We caution against calculating any summary compliance score from it, because specific aspects of the CoP differ in importance, emphasis and ease of compliance; and because only a subset of CoP recommendations lend themselves to field examination and scoring. See section 2.3.6.1 for discussion.

Several fox snare users (5/17) had snares in use that were rusty or where the cable was distorted along the part forming the noose, which could possibly have interfered with the free-running characteristics of the eye. In most instances, this would have interfered only with the drawing-up of the noose (i.e. with the catching ability of the snare; 17/21 snares), but in four instances across two operators, the distortion could have prevented the running eye from relaxing once the noose was drawn up. In addition, one operator used fox snares set in conjunction with a lever system which suspended an animal caught in the snare off the ground, and also stated that they sometimes modified snares so that they were self-locking.

All fox snare users (n = 16) set snares with stops permanently fixed on the snare, though in one case stops were fixed on only 27% of snares, and in another case stops were fixed on 94% of snares. Among 141 snares measured, stop position showed a bimodal distribution (Figure 2.17), with the higher peak at 23-25 cm from the eye of the snare. 82% of snares examined had stops positioned at 22 cm or more. For the remaining 18%, stop position varied between 15 and 21.5 cm. Eight further snares had no stops at all, and 1 had a stop fitted but not fixed in position. A further 28 snares could not be measured due to their location, set within a hedgerow. Of those snares with stop positions lower than 23 cm, the majority were used by one operator and had been home-made.

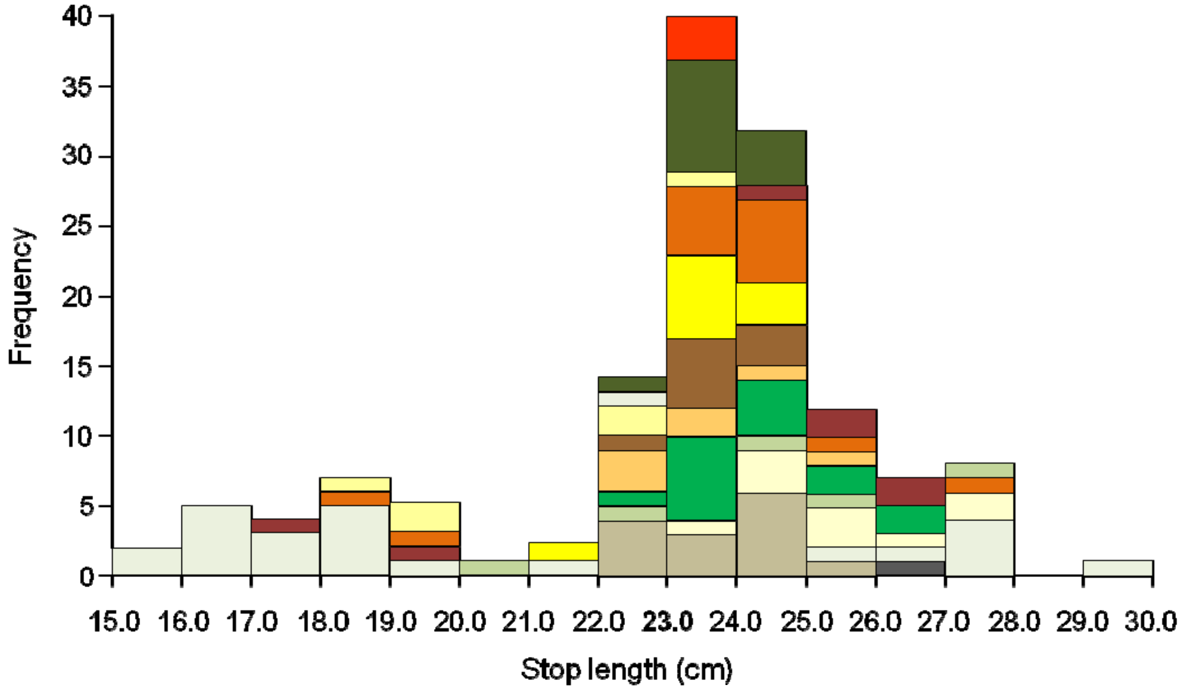

Figure 2.17 The distance between the stop and the eye of the snare for 141 fox snares used by 14 operators and checked in the field during ground-truthing. Colours represent individual operators. Stops were not present on 8 snares, the stop was not fixed on 1 snare, and measurements could not be taken for a further 28 snares

The wire used in fox snares is typically either single-twisted cable (1 bundle of 19 strands) or rope-laid cable (7 bundles, each of 7 strands). Thirteen of the 16 fox snare users used snares with single-twisted cable (1 x 19), 3/16 fox snare users set a combination of the 2 snare types (rope-laid cable: 7%, 57%, and 69%). Twelve of the operators used snares which had 1 swivel incorporated half-way between the eye of the noose and the anchor point. Two operators set snares with no swivels incorporated in the snare (though in one case swivels were present on 27% of snares). Three operators used 2 swivels incorporated in a proportion (7%, 31%, and 57%) of the snares that were observed (these were experimental breakaway snares being operated as part of a GWCT trial). Most snares examined were also constructed with identical crimps throughout. These snares are not expected to have the weakest point at the eye, because in practice crimps of the same style at other places in the snare break more easily, presumably because they receive a more direct pull.

Fox snares were anchored using metal stakes (n = 7, 40%), drags (n = 5, 21%), trees (n = 5, 18%), fence-wire (n = 4, 8%), fence-post (n = 4, 4%), wooden stakes (n = 2, 6%) and other (n = 4, 3%). Fox snares were attached to anchors by a variety of fixings (number of operators, percent frequency among snares for all operators visited): anchor plates (n = 7, 41%), D-shackles (n = 6, 11%), extra wire (n = 4, 14%), staple (n = 4, 17%), knot (n = 3, 11%), and other (n = 4, 7%).

Only 2 operators, 1 trained and the other untrained, avoided cluttered locations where entanglement was likely to arise for 75% or more of snares set. However, one of these operators used a drag which would likely result in entanglement once the captured animal moved the snare from the capture site. Fence lines were more likely to be avoided than other sources of entanglement, with 9 operators ensuring that over 75% of their snares were not placed in this position. The consequences of using cluttered sites was illustrated during the field visits, where a badger that had been caught in a fox snare set in a fence line was severely injured and was killed by the operator on welfare grounds.

Most fox snare users did not set their snares with the bottom of the loop at or above the recommended minimum height of 15 cm above ground (on level ground). Only 3/16 operators visited set at least >75% of their snares at or above this height. Among 164 snares measured, the height of snares range from 0 cm (level with the ground) to 22.5 cm, with the majority set between 10 and 20 cm (Figure 2.18). The height at which snares were set varied across operators and between snares set by the same operator. Fifteen snares could not be measured due to their location within the hedgerow (n = 6) or due to a capture in the snare or an escape from the snare (n = 9).

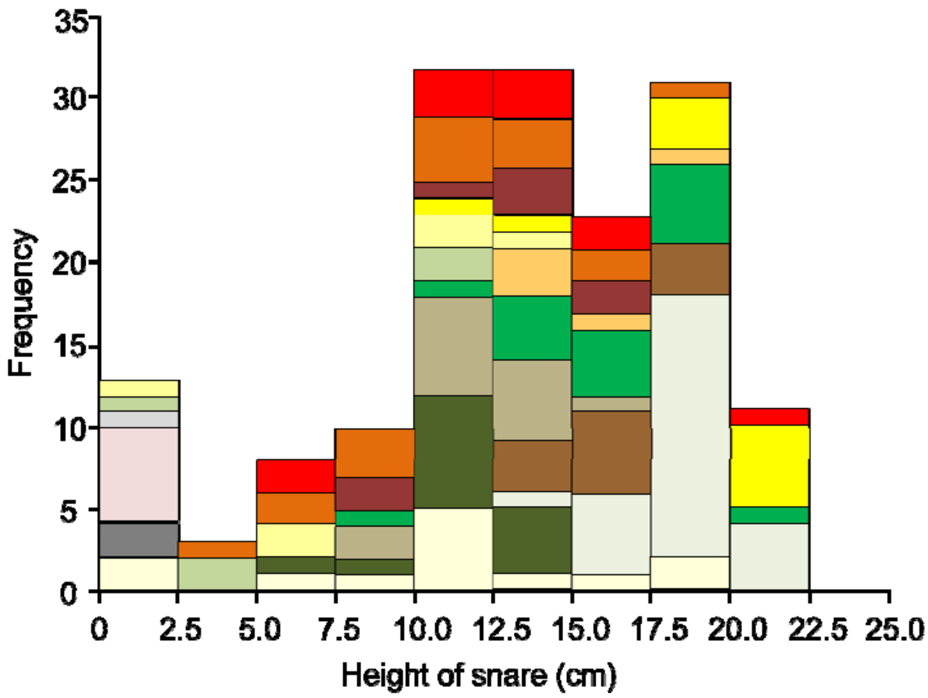

Figure 2.18 The height of the snare (bottom of loop) from ground level for 164 fox snares used by 16 operators and checked in the field during ground-truthing. Colours represent individual operators. The height of the snare could not be measured if there had been a capture (n = 7) or escape (n = 2), and measurements could not be taken for a further 6 snares.

Not all aspects of the CoP were easily assessed at the time of the visit. For instance, field signs indicating the use of a run by a target or non-target species are transient and were not expected necessarily to persist until the time of the field visit. Evidence of foxes using runs on which snares had been set, observed at the time of the field visit, comprised: fox smell (2 sites, 1 operator), fox tracks (1 site over 3 operators; 2 sites 1 operator) and fox hair on a snare from which the fox had escaped (1 site and operator). Evidence of non-target species using runs on which snares had been set comprised: hare or rabbit tracks (not distinguishable; 1 site over 2 operators), hare fur (1 site and operator), deer tracks (3 sites 1 operator) and snares set near a badger sett but not on a badger run (1 site and operator).

Seven captures were observed in the snares during visits with 5 fox snare operators. Three foxes were caught by 2 operators, the other 4 captured species were non-targets. Two hares were caught by 2 different operators and 2 badgers were caught by 1 operator. The snare was positioned around the neck of one fox; around the chest and one shoulder of one fox and a badger; and around the abdomen of the two hares and remaining fox and badger. All 3 foxes caught were alive and appeared uninjured, and were dispatched by shooting following the CoP guidelines. One of the hares was alive and appeared uninjured, and was therefore released from the snare. The other hare had been killed by a predator while in the snare; no injury was apparent from the snare itself. One of the two badgers, caught in a snare set in a fence-line at ground level, was severely injured and was killed on welfare grounds. The snare was entangled in the fence. This animal had a broken leg, and the snare wire had restricted the abdomen, though no laceration was observed. The other badger had also been caught in a snare set at ground level in a fence-line, and the snare had become entangled in the fence, but the badger appeared uninjured from a distance. The operator cut the snare wire but not within the noose, this resulted in the animal being released with the noose still attached around its chest and one shoulder. The CoP states that if the wire has to be cut to release the non-target it should only ever be cut at the noose to ensure that no part of the snare remains on the animal. This operator was aware of the CoP, but had not read it or had any training in the use of snares.

2.3.6.2. Rabbit snaring

Two visits were made to rabbit snare operators, both farmers, who had low number of snares set (2 and 3 respectively) at the time of the visit. No captures were observed during the accompanied checks.

With respect to the CoP, as with the fox snare operators, some aspects were complied with and others were not. In both cases all snares were free running at the time of the visit, but neither operator used snares with fixed stops. Snares were anchored using either a wooden stake or a metal peg, attached to the snare by a length of cord. One rabbit snare operator set snares at the entrances of rabbit burrows, though this is not specified as an area to avoid in the CoP; the other set snares on runs under fence lines. In the CoP it states that snares should be set on well used rabbit runs at sites not cluttered by obstacles (Table 2.23).

	Operator 1	Operator 2
Background		
Total number of snares set	3	2
Number of snares checked	3	2
Formal training in the use of snares	n	n
Informal training by other snare user	n	y
Snare design		
Snare is free-running	✓	✓
Stop present and fixed in position	X	X
Stop distance of approx. 14 cm	X	X
Snare constructed from 3 or 4 strand brass wire	✓	✓
Operating practice		
Snare set on well used rabbit runs	✓	✓
Snare site not cluttered by obstacles	✓	X
Snare at a min. height of 10 cm above ground	X	X
Snare securely tethered to the ground	✓	✓
No evidence of non-target species using the run	✓	✓

Table 2.23. Compliance with selected aspects of the Defra Code of Practice by 2 rabbit snare users who were accompanied in the field on a routine snare check round. Symbol ✓indicates that all snares examined were compliant, X indicates that none of the snares examined were compliant.

2.4. Discussion

2.4.1. Validity and limitations of the survey

2.4.1.1. Survey design, bias and precision

For 27% of contacted landholdings (n = 2,599) we found discrepancies between size class categories as recorded in source data from the Defra Survey Unit and Welsh Government, and the size of the landholding stated by the interviewee. These were possibly due to rounding errors (51% fell in the three smallest size classes), boundary discrepancies or changes to the size of the landholding since the June Agricultural Survey in 2008. However, these discrepancies would not have affected the outcome of the study.

Snare use was equally likely on landholdings where the landowner/tenant declined to participate in the telephone survey as on landholdings for which a full survey was completed (98% of 57 who opted out of the survey did not use snares, compared to 94% of 2,851 who participated in the survey). It therefore seems unlikely that non-participation biased the estimated extent of snare use.

In stage 3, the proportion of gamekeeper snare users for whom a detailed telephone questionnaire was completed was lower than the proportion of farmer snare users. This could in part reflect greater awareness among gamekeepers of the controversy surrounding snare use; they certainly showed greater awareness of the Defra CoP and legalities of snaring. However, 49% (19/39) of those non-participating cases arose through landowners not wishing to pass on gamekeeper contact details, rather than through non-cooperation of the gamekeepers themselves. Therefore although results are inevitably biased toward farmers who use snares, this was adjusted for when extrapolating the number of fox snare users in England and Wales for each user type.

For those using snares, questionnaire sample sizes were insufficient for analysis by land class (7 classes), size class (4 classes) and/or game-bird shooting interest (2 categories), but were sufficient for analysis with the required precision by the type of snare user (farmer or gamekeeper), which reflects aspects of the other classifications. Sample sizes of rabbit snare users were insufficient for analysis of results by the type of snare user as a smaller than anticipated number of rabbit snare users were discovered (n = 17). Sample sizes of field visits allowed only limited statistical analysis of results.

With the detailed telephone survey, there was consistency between answers on several questions however some ambiguity may have occurred in one of the questions. A minority of fox snare users claimed that they set snares with the intention of killing the fox on its capture rather than restraining it (24% of 126). When later asked what method of dispatch they used, 5% (of 126) stated that foxes were found dead so no method of dispatch was required. This disparity may be due to semantic confusion between the ultimate purpose of using fox snares i.e. to kill foxes, and whether the snare itself was intended to kill the fox. A further equally valid explanation is that snares set by those operators were not efficient at killing captured foxes, despite that intention.

2.4.1.2. Ground-truthing

As noted in the Introduction, a generic problem with questionnaires is that responses may reflect what respondents wish to suggest (or what they perceive to be the 'right' answer), rather than reflecting reality. For this reason, ground-truthing through field visits to snare operators with snares in use at the time of the telephone survey was planned before the survey began. The main intention was that some element of ground-truthing should be included in the survey, but it was recognised that under budget constraints this could not provide a robustly representative sample across all snare operators to establish current practice in the field. Ground-truthing of telephone survey data is not commonly practised, and logistically its achievement by field visits within a controversial subject area was bound to be challenging. The number of visits to be carried out could not be based on any previous study, but was determined under statistical advice using 'best-guess' estimates of the proportions of landholdings on which snares were used, and the proportion of snare-users with snares currently set. The likely degree of cooperation was completely unknown. In the event, the number of snare users who had snares set at the time of the telephone survey was much lower than anticipated, and more operators than expected declined to allow a visit. The result was that field visits were carried out on a smaller sample than had been originally proposed. Nevertheless the field visits can still be used to indicate whether the telephone survey was representative of operator practices, and as an illustration of some of the practices in current use.

A second concern with the field visits was that although every effort was made to carryout visits on the day following the telephone survey, this was actually achieved in less than half of the visits undertaken. The consideration here is whether this delay had any effect on the observations made. If snare operators were to modify their use of snares before a field visit, this would be expected to increase their apparent compliance with the CoP. In fact, compliance with aspects of the CoP was not different between operators who were visited the next day and cases where the visit was delayed. No operator complied with all aspects of the CoP.

In broad terms, ground-truthing supported information from the telephone responses, the percentage of respondents reporting having caught non-target captures (49% of 70 farmers; 73% of 56 gamekeepers) can be compared with two previous studies of gamekeepers which required daily recording of snare captures through 12 month periods (75% of 44 snare users, and 87% of 62 snare users; GWCT, unpublished data; FCMS and JST studies described in IWGS 2005).

A limitation of the field visits was that any evidence of target and non-target species present at the time of setting the snare may no longer have been present at the time of the accompanied snare check. All field signs are transient and the evidence may even have been a sighting or scent of a fox on or near a particular run. Apparent deviations from the CoP in these respects may therefore be an observational issue, rather than indicating speculative use of snares, which is discouraged in the CoP.

There was discrepancy between the results from the telephone survey and the field visits, for the use of stops on rabbit snares. In the telephone survey the majority of operators stated that they used bought snares, which they didn't modify and that these snares had a stop. However, in a trawl of internet based companies selling rabbit snares, all available models lacked stops and during the field visits neither of the operators were found to have stops on their snares.

2.4.2. Extent of snare use

Overall snares were used on 6% of landholdings surveyed. In England landholdings where there was an interest in game-bird shooting which was associated with arable and upland land classes had the highest proportion of landowners/tenants that used or allowed the use of snares on their land. In Wales the proportion of landholdings on which snares were used was similar for those with and without a game-bird shooting interest. Most snare users interviewed in Wales were farmers (22/24), with the majority not having an interest in game-bird shooting (17/24), but using snares for fox control to minimize predation on lambs (stated by 11 farmers). This could account for the peak of snare use by farmers in February and March.

Snares were used more frequently for fox control than for rabbit control (96% and 12% respectively). Circumstances preventing the use of other control methods were the reason most commonly cited for using fox snares. Responses to this question and the strong seasonal pattern of use support the interpretation that snares are used when other methods of control for foxes are inoperative or not effective (e.g. when vegetation cover is high, or where access with a vehicle is not permitted). In comparison, a much wider variety of methods is available for rabbit control (e.g. gassing, killing traps, ferreting, drop traps), so effectiveness and low cost seemed to be the main drivers for using rabbit snares.

Extrapolating from the number of landholdings on which snares were used in the present study, it was estimated that among 139,219 landholdings on the farm register in England and Wales, there are 5,983 landholdings upon which fox snares are used and 1,682 upon which rabbit snares are used (assuming none on landholdings smaller than 5 ha). Forty-five percent of fox snare users were farmers (adjusting for the significantly higher participation of farmers compared to gamekeepers in the detailed survey). Therefore, there are perhaps 3,291 gamekeepers and 2,692 farmers using fox snares in England and Wales. Previous estimates of snare users in England and Wales, based on membership of several organisations (J. Ewald, GWCT, unpublished data), suggested around 1,600 gamekeepers using snares; this now seems likely to be a considerable underestimate. However, the more significant discovery from this survey is that the gamekeeper users are matched by a similar-sized population of farmers using snares who were previously uncounted.

The estimated number of fox snares set in England in each month of the year ranged from a minimum of 62,823 (±SE 7,062) fox snares set in December to a maximum of 188,283 (±SE 11,689) during March. In Wales the number of fox snares set was also at a minimum in December at 17,231 (±SE 230) and at a maximum in March at 51,641 (±SE 4,824).

2.4.2.1. Comparison with previous surveys

Landholdings included in the present study which fell within the outline of the three county sized regions used in the Heydon and Reynolds study (2000) were identified and results between the two studies were compared. The proportion of landholdings on which snares were used did not differ significantly between the two studies in the East Midlands (Heydon and Reynolds: 31%, n = 246; this study: 27%, n = 15; χ^2_1 = 0.003, p = 0.955), in East Anglia (14%, n = 215; 6%, n = 17; χ^2_1 = 0.33, *p* = 0.568), or in mid Wales (3%, n = 39; 0%, n = 12; χ^2_1 = 0.58, *p* = 0.446). In the present study, snare use was highest among landholdings in the largest size class (≥ 100 ha). Similarly, in the study by Heydon and Reynolds (2000), a significant relationship was found between the extent of use of snares and the size of landholding, with snares used on a higher proportion of landholdings over 200 ha compared to those less than 200 ha.

2.4.3. Fox and rabbit control in general

Through an Order made under Section 1 of the Pests Act 1954, occupiers of land throughout England and Wales (except for the City of London, the Isles of Scilly and Skokholm Island) are legally obliged to control rabbit numbers on their land to prevent them causing damage (Defra 2004). This survey found that on only 51% ±SE 0.9 of landholdings in the survey was any form of control carried out. Although we did not know what proportion of landholdings had rabbits on their land, we expect it to be considerably higher than 51%. The proportion controlling rabbits was slightly increased on the larger landholdings (≥ 100 ha) or on landholdings with an interest in game-bird shooting (60% and 68%, respectively). This is perhaps because these categories are more likely to employ a professional gamekeeper. There is no legal obligation to control fox numbers, so in comparison the proportion of landholdings on which fox control was carried out was high (43% ±SE 0.9), even where there was no game-bird shooting interest (32% ±SE 1). Heydon & Reynolds (2000) found fox culling in some form took place on 70-90% of farms in three county-sized regions of England and Wales, and established the motivations for this. Given that both studies involved substantial samples, the lower estimate in the present survey of the extent of fox culling may be due to variation across the whole of England and Wales, or it may reflect the effect of the Hunting Act 2004 on a previously widespread form of fox culling.

2.4.4. Awareness and compliance with some aspects of the Defra Code of Practice

The Defra CoP is not mandatory and has no legal status. It describes Government-recommended procedures and could therefore be used to defend or criticise a given snaring practice in any legal proceedings under wildlife or animal welfare legislation, if an offence was alleged to have been committed under one of those Acts. However, compliance with the CoP is not a defence specifically recognised in law, nor does non-compliance in itself constitute an offence. Among the working practices recommended in the CoP, only one aspect is a statutory requirement (under the Wildlife and Countryside Act, 1981; WCA) namely that snares must not be self-locking. However, the term ‘self-locking’ is not defined in the WCA, and has not been clarified by case law, so even this requirement is open to interpretation. The remainder of the CoP can be revised by Defra without recourse to legislation. At the time that it was drafted, most of its content was based on expert opinion due to an acknowledged lack of empirical evidence.

2.4.4.1. *Fox snare operators*

In this survey, gamekeepers were more aware of the Defra CoP than were farmers (95%, 64%; respectively), and were more likely to have had training in the use of snares (70%, 30%, respectively had been informally trained in the use of snares, including 38%, 3%, respectively who had been on a relevant training course). This difference was consistent across responses in telephone surveys and accompanied snare checks.

Below we consider point-by-point the degree to which some recommendations of the CoP were followed in current practice, as indicated by telephone surveys and field visits. Generalisations to all fox snare operators cannot be made from observations that were solely obtained during field visits.

Every effort must be made to avoid catching non-targets.

[Snares] must not be set where there is evidence of regular usage by non-target species.

Answers to the survey question '*What factors if any limit your use of snares?'* were unprompted, but it was expected that high risk of non-target captures might be cited as a factor in at least some areas. Thirty-three percent of snare users stated that there were no factors that limited their use of fox snares. For those who did suggest limiting factors, 37% of operators cited risk of non-target capture, and 23% cited public access, which may have been to avoid the capture of domestic dogs. Other factors were associated with non-animal related issues.

Nevertheless a higher percentage of snare users (84%) stated that they made efforts to avoid capture of non-targets. Not all the measures recommended in the CoP were cited by respondents, but those most commonly cited were using a targeted approach and limiting the number of snares set. The success of these measures in reducing the occurrence of non-target captures appeared to be variable, as 60% of users had caught non-targets; however we do not know whether the measures were in place prior to any non-target captures or were implemented as a result of them. Badgers were the non-target species most commonly cited (by 25% of operators). This study gives no means to estimate the frequency of capture of non-targets.

During the field visits evidence of regular non-target use was not found at the sites where examined snares were set (0/16).

Snares must only be used as a restraining device rather than a killing device.

Self-locking snares were designed to kill by progressive tightening. The intention in making them illegal was presumably to ensure that captured animals were to be restrained alive rather than killed. It is probable that the presence of a stop is more important in reducing the risk of death, and it is also clear that even free-running snares can kill animals under certain circumstances (IWGS 2005). Killing traps may be considered humane if they consistently lead to rapid death and have an low risk of non-target capture. In the light of these considerations, the IWGS and the adopted CoP advised that snares should be used only to restrain foxes.

Most respondents to the telephone survey (76%) complied fully with this advice (19% stated that they set snares to kill, and a further 5% that they sometimes did). Because farmers were more likely to use snares as killing devices than were gamekeepers (27% and 9%, respectively), and because in general gamekeepers set many more snares than farmers, the proportion of snares set in compliance with this advice is likely to be higher (87%). On field visits, 1/16 operators had set a small proportion of snares deliberately to kill captured animals.

Snares must not be set in sites cluttered by obstacles such as saplings, hedges, walls, fences or gates.

A CoP recommendation is to avoid setting snares where there is the potential for the snare to become entangled with nearby objects (e.g. saplings, hedges, walls, fences, or gates). It is known that entanglement can lead to failure of the running eye or the swivel to operate as intended, and may also cause injury directly through contact of the captive animal with the obstruction (IWGS 2005).

Among responses to the telephone survey question '*What factors if any limit your use of snares?'* avoidance of sites cluttered by obstacles was not mentioned by any operator. This could have implied that there was no shortage of uncluttered sites. However field visits showed that this advice in the CoP was rarely complied with (2/16), and that this appeared not to be influenced by whether the operator had attended a formal training course or had been trained informally. As noted previously, it is not known whether any training received was recent enough to have included CoP advice. The consequences of disregarding this piece of advice were illustrated during the field visits, in that both badgers that were caught and held were entangled with objects and one was severely injured as a result of entanglement.

Three out of 126 respondents in the survey with the snare user stated that they set snares with the noose particularly large to avoid the capture of non-targets. Although this may reduce the risk of catching certain non-target species (e.g. hares), it may also increase the likelihood of target and other non-target animals being mis-caught (e.g. caught around the abdomen instead of the neck), which may in turn increase the risk of injury. Currently there is no guidance in the CoP on appropriate maximum noose size for fox snares, although a maximum vertical diameter of 15-18 cm is suggested in the Scottish CoP.

Free running snares must be used, and these must have a 'permanent stop' fixed approximately 9" (23cm) from the eye of the snare.

Respondents were not asked during the telephone survey whether they used free-running snares. During field visits, 5/16 operators had snares in use that were rusty or where the cable was distorted along the part forming the noose, to an extent that was thought likely to have interfered with the free-running characteristics of the eye. In most instances, this would have interfered only with the drawing-up of the noose (i.e. with the catching ability of the snare; 17/21 snares), but in 4 instances across 2 operators, the distortion might have prevented the running eye from relaxing once the noose was drawn up. One operator set a small proportion of fox snares in conjunction with a lever system intended to suspend a captured animal off the ground, and also stated that he sometimes modified snares so that they were self-locking.

Eighty-two percent of telephone respondents stated that they used only stopped snares. In field visits too, the use of stopped snares for foxes was prevalent (141/150 snares examined). Stops fixed in place at manufacture were not typical at the time of the IWGS Report (2005) but are currently, so this represents a significant change since publication of the CoP.

Among snares examined in field visits, stop position tended to err on the ‘generous’ side of the recommended 23 cm (i.e. leading to a larger minimum noose size). Variation in stop position can be attributed to several causes (a) stops that are not fixed at manufacture, and subsequently fixed by the user; (b) stops that are inadequately fixed, so that they slide along the wire when a capture is made; (c) variation in manufacture (these are essentially hand-made items); (d) vague wording in the CoP (‘approximately 9” (23 cm)’) with no guidance as to acceptable limits;

The bottom of the loop should be at least 7-7.5" (15/18cm) above level ground and up to 12” (30cm) in open ground.

This point of the CoP was not covered during the telephone survey. This aspect of the CoP tended not to be followed by operators (13/16) visited during the field visits. One of the recommendations within the CoP is to adapt procedures in the light of experience, and this could be the reason why deviation from this point was found.

Snares should incorporate a strong swivel near the anchor point and also at a position closer to the noose.

Although snares are designed to hold the target species (fox), the materials used in their manufacture can be severely challenged if a stronger or larger non-target animal is caught. The intended purpose of swivels in the snare is to safeguard against the strands of wire becoming untwisted or over-twisted by the captured animal, substantially weakening the snare. The CoP recommendation to use two swivels was based on the reasoning that a swivel was generally most effective next to the fixed anchor point, but that in this position it could become clogged or rendered inoperative through entanglement; in the event of this occurring a second mid-point swivel would become operative (IWGS 2005).

This aspect of the CoP was not covered during the telephone survey. Apart from a proportion of snares used by 3 operators which had been supplied for a separate GWCT trial, no snares examined on field visits had swivels positioned at the anchor point and at a mid point. The snares examined had a basic design of swivel, always at the midpoint of the cable.

The wire must not be less than 460lbs (208 kilos) breaking strain.

This point was not addressed during the telephone survey, but in the field visits all snares examined were made from cable of standard 2 mm thickness which would have a breaking strain in excess of the required 208 kg, irrespective of construction (both 7x7 and 1x19 constructions were seen).

To avoid animals escaping while still entangled in the snare, with potentially serious welfare consequences, the fastenings should be designed so that the weakest point is at the eye.

The CoP recommends that snares 'should' be designed to have the weakest point at the eye and two effective swivels. If a snare breaks anywhere other than the eye, the captured animal will escape with the snare noose still in place around part of its body, which can result in very poor welfare (IWGS 2005).

This aspect of the CoP was not covered by the telephone survey. Apart from a proportion of snares used by 3 operators which had been supplied for a separate GWCT trial, no snares examined on field visits incorporated a weak point at the eye.

Snares should be supported by a suitable 'tealer' or set-stick pushed firmly into the ground.

This aspect of the CoP was not covered in the telephone survey. In the field visits, most of the operators(14/16) used tealers to support their snares, but only two used metal tealers as recommended in the CoP. Wood tealers are thought to have a greater scent profile than metal tealers and are therefore more likely to be avoided by foxes (IWGS 2005).

Snares must be firmly anchored so that they can on no account become free (because of the great risk to welfare that this would cause).

Drags should not be used.

This aspect of the CoP was not covered during the telephone survey. Fourteen of the sixteen operators visited ensured that their snares were securely anchored, however two operators used drags on the majority of their snares. Both of these operators had attended a training course, although the date of this training relative to publication of the CoP was not established. Animals caught in snares that are attached to drags, may be more likely to become entangled after capture and also may not be located by the operator; both scenarios are likely to lead to poor welfare, which is why they are specifically mentioned in the CoP.

In winter snares must be inspected as soon after sunrise as practicable, in summer before 9am.

In responses to the telephone survey most (89%) operators claimed to first check their fox snares before noon, including 62% before 9 am. In field visits 14/16 were completed before noon, among which 6 were completed before 11 am and 5 before 9 am, the remainder (2/16) were conducted in the afternoon. Although the technician tried to avoid influencing the time at which snares were checked on the day of the field visit, timing was likely to have been influenced by meeting arrangements, and later times may have been proposed out of courtesy to the technician.

Foxes must be despatched quickly and humanely by a shot at close range from a rifle, shotgun or pistol.

Air weapons must not be used.

Most telephone interviewees dispatched foxes using a firearm, as recommended in the CoP. The use of other methods is not specifically unlawful, or necessarily inhumane, provided they do not unnecessarily cause suffering (which would be an offence under the Wild Mammals Protection Act 1996 and the Animal Welfare Act 2006). Seven out of 123 operators (6%) used methods other than firearms.

Summary – fox snaring and the CoP

In summary, the telephone survey – from a representative sample of operators - suggested that awareness and knowledge of the Defra CoP was good amongst gamekeepers but notably lower amongst farmers. Adoption of CoP requirements, as indicated by telephone responses, was more selective. The field visits – to a small non-random selection of operators – cannot be taken as representative in themselves, but supported the results from the much larger telephone survey while also raising issues to note. No operator visited was fully compliant with the CoP. In part, this was due to hardware availability: operators were unable to purchase fully CoP-compliant fox snares 'off-the-shelf' from British outlets at the time of this survey. However, some other aspects of the CoP that were considered to be very important by the IWGS (2005) were not followed, notably the avoidance of cluttered sites where entanglement can occur, potentially leading to very poor welfare. The consequences of disregarding this piece of advice were illustrated during the field visits themselves, in that both badgers that were caught were entangled with objects and one was severely injured as a result of entanglement.

2.4.4.2. Rabbit snare operators

Seventeen detailed telephone interviews with rabbit snare users were conducted and field visits were made with 2 operators. Among all farmer snare users, only 33% had read the CoP, and 17% possessed a copy it. Only 5/17 rabbit snare users were gamekeepers, and they also used fox snares; among all gamekeepers interviewed, 80% had both read the CoP and possessed a copy of it. However, as the entire sample of rabbit snare users was small, caution must be taken in attempting to generalise from these results.

Snares must not be set where there is evidence of regular usage by non-target species.

Every effort must be made to avoid catching non-targets.

Most rabbit snare users interviewed stated that there were no factors/issues which limited their use of snares (12/17). Among those that cited a factor public access was cited most commonly (2/17). More interviewees (8/17) stated measures that they took to minimize the capture of non-targets in response to a later question. Among these responses, the most common measure taken was to use a targeted approach (6/17), setting snares at sites where there is evidence of regular usage by rabbits and/or where rabbits are causing the damage. Despite these measures 5/17 had stated that they had caught a cat in their snares (the frequency of which is unknown) and 1/17 had caught a polecat.

Snares must not be set in sites cluttered by obstacles such as saplings, hedges, walls, fences or gates, which increase the risk of injury.

Among the factors/issues that were listed as limiting operators use of snares, sites cluttered by obstacles was not cited by any of the 17 interviewees, and 12 of these did not state any factor as limiting their use of snares. During field visits one of the two operators visited set snares on runs under fence-lines, supporting the telephone survey finding that rabbit snares are often set in sites cluttered by obstacles.

Rabbit snares should be constructed with 3 or 4 -stranded brass wire (doubled so that whilst there are 3-4 strands around the eye, there are 6-8 in the noose) with a loop of 4" (10 cm) diameter for the head of the rabbit.

The two operators who were visited during the field visits both used snares that met this recommendation of the CoP.

Snares must have a fixed stop about 5" (14 cm) from the 'eye' of the snare

Thirty-five percent of operators stated that they used snares without fixed stops in the telephone survey. Both operators visited in the field used snares without fixed stops. Rabbit snares are usually sold without a stop (IWGS 2005) and a trawl of internet based companies selling rabbit snares suggests that this is still the case. Most users (13/17) did not modify their snares before use, and therefore for this aspect of the CoP we are unsure of the real situation.

You must ensure that snares are free running.

Both rabbit snare users visited in the field used free-running snares. As the sample of field visits was so small (2) and the telephone survey did not ask this question, it is not known how many rabbit snare users would ensure that their snares are free-running. However most if not all rabbit snares sold do not have a ratchet device on them so would be free-running unless altered by the user or so placed as to act as self-locking (e.g. by lifting the rabbit off the ground and using its weight to prevent the snare from relaxing).

The loop should be positioned 3" (9cm) above the ground using a short notched stick, the 'tealer'.

Neither of the two operators visited in the field used tealers to set their snares, however it is unknown whether this represents general practice.

The free end of the wire must be securely tethered by a strong, rot proof cord attached to a peg that is driven firmly into the ground.

The two operators visited in the field both ensured that their snares were securely anchored, however we do not know if this is representative of general practice.

In winter snares must be inspected as soon after sunrise as practicable, in summer before 9am.

Just under half (8/17) of the rabbit snare users interviewed checked their snares before 9 am and the same proportion checked their snares more than once a day. The intention of checking snares soon after sunrise or before 9 am is to minimize the time an animal is held in the snare and therefore any injury caused to the animal. Only 1 operator checked their snares for the first time in the evening.

In the present survey, 6/17 rabbit snare users (35%) inspected snares after dark. Although the CoP states that 'it is desirable that animals are dealt with as soon as possible after they are caught', it does not specifically suggest that rabbit snares should be checked during the hours of darkness. Checking after dark could possibly lower capture-success through disturbance, would significantly increase workload, and could be more hazardous than daytime checks; on the other hand, it may improve welfare by limiting time spent in the snare.

Summary – rabbit snaring and the CoP

In summary, the low number of rabbit snare users surveyed by both telephone and field visits means that generalisation of the results should be done with caution. From the telephone survey awareness of the CoP was good, but gamekeepers were more likely to have read the CoP than farmers. There is uncertainty as to how prevalent the use of stops on rabbit snares is, and some other aspects of the CoP were not complied with by the operators visited in the field.

3 Objective3: Determine the significance of stops and of inspection times on the welfare of animals held captive in snares, using the rabbit as a model species in pen trials.

3.1. Introduction - background

The CoP was not written nor designed as a set of specific rules that had to be complied with but rather as a package of advice leading to 'good practice'. The authors attempted to distinguish between different levels of obligation and encouragement (using the verbs 'must', 'should' and 'may'). These were initially explained as follows:

- Requirements which 'must' be followed in order to comply with the CoP
- Best Practice advice, indicated by the verb 'should'.
- Advice which 'may' be of practical help.

In the CoP, 'must' refers to legal obligations as well as other recommendations. Although the CoP is intended to lessen or avoid some of the recognised problems of snare use, it is based on expert opinion and the benefits of adhering to its provisions have not been scientifically validated.

One approach to obtaining scientific data on the benefits of following such recommendations could have been to identify a sample of snare users, classify them according to whether they operate either according to the CoP or to the minimum statutory requirements, and collect data on the animals caught. Such an approach would have required total co-operation from participants and an expensive infrastructure to collect carcasses and data from widely spread land-holdings. The condition of individual target animals captured in snares is known to be highly variable, at least where snares are operated to minimum statutory requirements, and therefore would require a large sample size for each operator. Operators themselves are highly variable too, but operator and region would be confounded unless a regionally stratified random sample of operators could be achieved for each 'treatment'. Confounding of operator variables with the region variable would also be problematic because the likelihood of catching non-target species would be determined, in part, by their regional abundance.

An alternative approach could have been for investigators themselves to run snares using both CoP and minimal statutory requirements in a balanced design, forgoing knowledge of geographical and between-operator variation. However, sample size requirements were deemed to be too great.

Another approach could have been to repeat the 1994-5 BASC/GCT Joint Snares Trial and compare current performance with the historical data. Current performance could have reflected the investment of effort since the mid-1990s in training, advice, and the CoP. However, for several reasons this comparison would not work. Firstly, it was not possible in 1994-5 to study a 'sample' of fox snare users that was representative of general use in any sense (region, land use, non-target availability, professional/amateur, experience, training, preferred methods, season of use, scale of use) and this has not changed. Secondly, any data gathered from volunteer snare operators would be from a self-selected sample and so could not be regarded as random. Thirdly, data on target and non-target captures and their condition would be difficult to verify without a large amount of ground-truthing (which presents its own difficulties). Fourthly, for logistical reasons, it would be disproportionately expensive to carry out *post mortem* examination of carcasses from a geographically representative sample of snare users.

In view of all these issues, it was decided that the extra demands of the CoP, could best be investigated in pen trials, where most factors could be controlled. It was proposed that the rabbit could be taken as a model to explore the consequences of some aspects of the CoP. For foxes, the extra time involved in pen trials with larger animals, and the difficulties of obtaining sufficient wild-caught animals, prevented the use of what would have been extensive pen trials.

The CoP (Appendix 8.1) was examined to identify those recommendations that were most likely to improve welfare, were applicable to all species likely to be snared and could be investigated in pen trials using rabbits as a model. The two aspects of the CoP that were identified as meeting these criteria were use of a permanently fixed stop and reduction in inspection time.

Use of a fixed permanent stop is recommended for snares used to catch both foxes and rabbits. The IWGS highlighted two benefits to the use of stops, firstly to aid escape of non-target captures and secondly to prevent strangulation of the target animal. The benefits to non-target animals can not be determined in pen trials but the benefit to the target animal at preventing strangulation can. Within the CoP the recommended relative position of the stop is different for foxes than for rabbits. For foxes, the recommended stop position is approximately 23 cm and was based on the BASC (1994) Code of Practice for snaring. There is no documented evidence that this is the appropriate position of a stop for foxes. Twenty three cm is less than the average fox neck circumference of 27cm. For rabbits, the recommended stop position is 14 cm, again there is no documented evidence that this is the appropriate position of a stop for rabbits. In contrast to the fox stop position, 14 cm is greater than the average rabbit neck circumference of 11cm. It is logical to assume that to ensure that strangulation is prevented the stop should be placed at least at the same length as the circumference of the neck. For this trial, using the rabbit as a model, it was decided to set the stop at a length corresponding to the circumference of an average rabbits' neck.

At the IWGS it was suggested that the majority of animals are captured in snares either during darkness, or at dusk and dawn. For this reason the CoP recommends that in winter when the nights, and therefore the time that an animal may be held in a snare, are longest, snares are inspected as soon after sunrise as is practicable. Dusk to dawn could span sixteen hours in the middle of winter. Other widely available Codes (E.g. BASC Fox Snaring Code) stipulate checking snares at least once a day. It follows that if snares are checked once per day, animals may be held in snares for over 24 hours. However, if the CoP is followed and snares are checked at dawn, or before 9am then assuming that captures are made during darkness or not before dusk then animals would be held captive in snares for a maximum of 16 hours. We therefore looked to compare 16 and 24 hours duration of snaring using the rabbit as a model.

3.2. Methods

3.2.1. Licences

All procedures were licensed by a Home Office Project Licence under the Animals (Scientific Procedures) Act (A(SP)A) and all personnel carrying out the trials held Home Office Personal Licences, permitting them to carry out those procedures.

3.2.2. Animals

Twenty-four wild-caught rabbits were used for the trials. Rabbits were housed in single sex groups after capture and before the trials were undertaken. The ground of the holding pens consisted of grassed and concrete areas; food and water were provided *ad libitum* and each pen contained three wooden hutches for shelter. The rabbits were held in these pens for at least three weeks to acclimatise.

3.2.3. Snares

Snares, obtained from a professional snare maker were used (Figure 3.1). The snares were constructed from three strands of brass wire, twisted together to make a 6 stranded cable. The eye was made from brass, the snare was connected to the anchor by polypropylene string and the anchor peg was made from wood. The length of the snare from the anchor point to the eye was 64 cm. The stop, that was present on half the snares, was positioned 11 cm from the eye. Apart from the stop the snare design and construction was thought to be not dissimilar from snares that might be in common use.

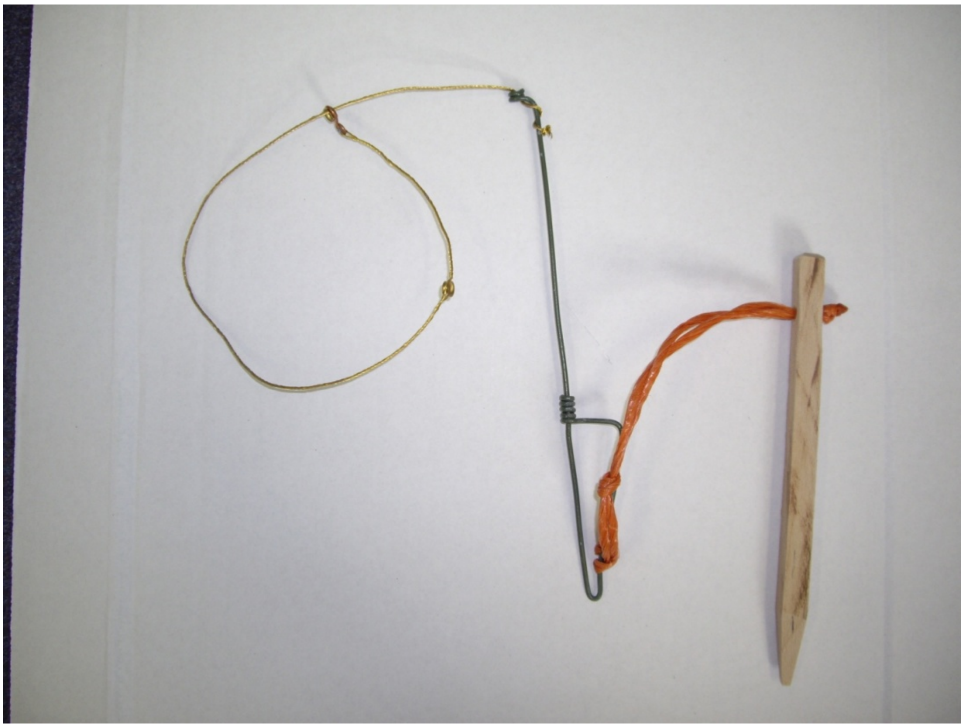

Figure 3.1 An example of the snares that were used for the rabbit pen trials. Stopped snare illustrated.

3.2.4. Trial pens

Four adjacent pens were used for the trials. Each pen contained a large area of grass in which the snares were anchored (Figure 3.2 and Figure 3.3). Low light level video cameras were suspended above the snare anchor point, such that the whole of the area within which the snared rabbits could move was in the field of view. To ensure that the behaviour of the rabbits could be seen this area was also illuminated by red lights. The behaviour of the rabbits during the trials was recorded using time lapse video recorders. The video recorders and monitors were positioned in a remote building, where the presence of the experimenters was not expected to affect the behaviour of the rabbits, but the experimenters could observe the rabbits via the video cameras.

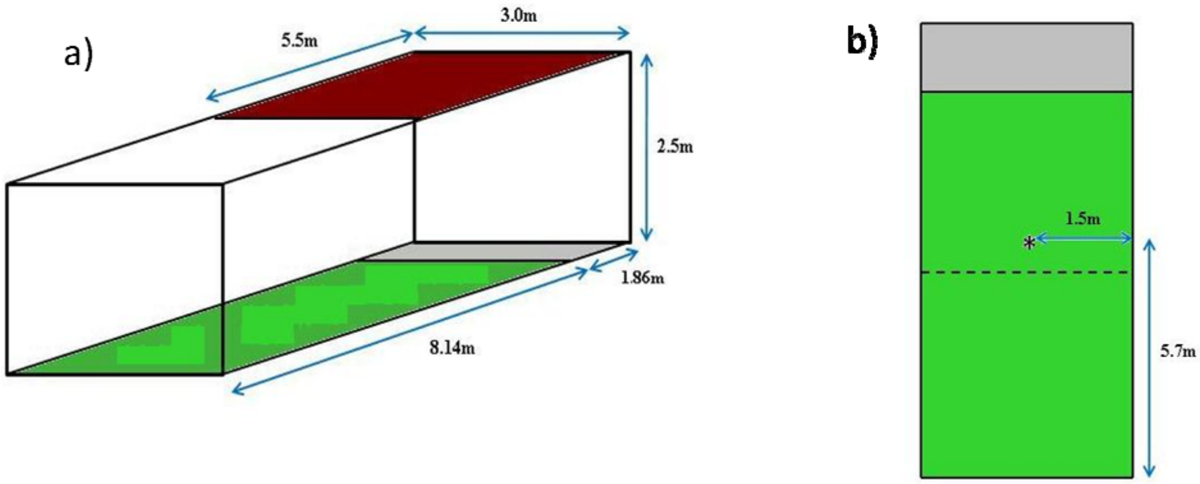

Figure 3.2 a) Dimensions of a trial pen with concreted area shaded grey, grassed area shaded green and the roofing shaded brown. b) Plan of a trial pen with the location of the snare marked by *. The dashed line represents the point at which roof cover ends, beyond the snare stake position.

Figure 3.3 One of the trial pens

3.2.5. Procedure

Trials were carried out between August 2008 and December 2008. Individual rabbits, selected at random, were moved from the holding pen to the test pen in a black bag immediately before a trial. Twelve rabbits were assigned to the 16 hour trials and 12 rabbits to the 24 hour trials. The 16 hour trials were started at approximately 16:00. Eight of the 24 hour trials were started in the morning (09:00) and four were started at approximately 16:00). When in the test pen, the rabbits were restrained within the black bag, removed from the bag and the snare noose placed over the head and positioned around the neck. The snare eye was then carefully drawn up until the noose was either up to the stop or tight around the neck. The rabbit was then positioned on the ground at the full reach of the snare and facing away from the experimenter. As soon as the rabbit was released the experimenter exited the pen as quickly and quietly as possible. This was then repeated for three further rabbits, one in each of the adjacent pens.

All the rabbits were observed using the output from the video cameras for the first hour of the trial. During the first set of four trials, observations of the rabbits using the cameras were continued at least once every two hours of the trials. This was to ensure that if any signs of unacceptable suffering occurred, rabbits could be euthanized as soon as possible. Signs of unacceptable suffering used for these trials were the indicators of poor welfare listed in the Agreement on International Humane Trapping Standards[7]. After the first four trials, due to no adverse effects being observed, rabbits were not required to be inspected overnight.

At the end of the trial, each rabbit was physically restrained, the snare wire cut and then the rabbit was moved to a nearby procedure room. Rabbits were then euthanized by administration of an overdose of anaesthetic via the ear vein. An attempt was made to collect blood from the jugular vein of two rabbits on the 16 hour trial prior to administration of the anaesthetic. This was unsuccessful. The remainder of the rabbits on the 16 hour trial had a blood sample withdrawn from the heart within 0.5 s of cessation of heart beat. The quality and quantity of the blood samples was not sufficient for analysis, and samples were not taken from rabbits during the 24 hour trial. Carcasses were frozen for storage.

3.2.6. Trial design

Within each set of four trials, two of each type of snare (i.e. stopped and unstopped) were used, balanced across all trials for pen used and order of placement. To minimise animal usage a staged design was employed. Trials of 16 hours duration were predicted to have a lower welfare cost than 24 hour trials; therefore, the first 12 trials were of 16 hours duration. No indicators of poor welfare were found in these trials and therefore it was appropriate to increase the trial duration for the subsequent 12 trials to 24 hours duration.

3.2.7. Necropsy

Rabbit carcasses were sent to an independent veterinary pathologist for examination. All carcases were defrosted prior to whole body necropsy. The pathologist necropsied carcasses by skinning and then examining the whole body for injuries. Definitions of pathologists terms are included in Table 3.1

[7] Indicators of poor welfare listed in the AIHTS are: excessive immobility, self mutilation, fracture, joint luxation proximal to the carpus or tarsus, severance of a tendon or tarsus, major periosteal abrasion, severe external haemorrhage or haemorrhage into an internal cavity, major skeletal muscle degeneration, limb ischaemia, fracture of a permanent tooth exposing pulp cavity, ocular damage including corneal laceration, spinal cord injury, severe internal organ damage, myocardial degeneration, amputation, death.

3.2.8. *Behavioural Analysis*

To allow a comparison of behavioural responses to being restrained in the two different types of snare and how the responses change over time, the video recordings of the trials were analysed using Observer XT9 software.

To allow analysis of time effects instantaneous observations, at 5 minute intervals, of the behaviour of the rabbit and tautness of the wire leading to the noose, were analysed for the whole duration of every trial. If the rabbit was active between instantaneous samples, this was recorded, but the specific behaviour performed was not noted. Proportions of time spent in different behaviours were used for subsequent analysis. Behaviours analysed were grooming, sitting, grazing, pulling on the wire, other active behaviour and inactive.

Escape behaviours had a short duration and would not have been accurately represented by instantaneous sampling. Therefore, continuous analysis of one hour of behaviour at the beginning and end of each trial was undertaken to compare escape behaviour. Behaviours that were counted as escape behaviour were flipping, jumping, biting the wire, digging, and pulling on the wire.

Any comparisons between differences in escape behaviour during the final hour of the 16 hour and 24 hour would have been confounded by time of day effects, and therefore were not carried out. It is not known if there were any differences or not.

3.2.9. *Data analyses*

Data for which both the skew and kurtosis were excessive, were treated as non-normally distributed. Other data were tested for normality using the Kolmogorov-Smirnov test. Where all data samples were normally distributed, multi-factorial analysis using two-way analysis of variance (ANOVA) was carried out. Non-normally distributed data were analysed using Friedman’s ANOVA test, with snare type explored as the main effect.

The escape behaviour data was non-parametric and therefore differences between the first and last hour of the trial were explored using the Wilcoxon signed-rank test. Differences between the stopped and unstopped snares were explored using Friedman’s ANOVA.

3.3. Results

All twenty-four trials were completed. One rabbit that was restrained in an unstopped snare died. All other rabbits appeared un-injured and showed no indicators of poor welfare at the end of the trial. It must be remembered that the aim of this particular trial was to use the rabbit as a model for examining 2 specific aspects of the CoP rather than as an overall assessment of the humaneness of rabbit snares.

3.3.1. *Necropsy*

Whole body necropsies were performed on all the rabbits from the pen trials and the results summarised (Table 3.2 and Table 3.3). Some of the injuries in the rabbits held for 16 hours were attributed to blood collection. These included the bruised rib cage, lobular haemorrhage in the lung and haemorrhage on the rib cage. None of the rabbits had dislocated necks.

External skin perforation or abrasions were not found on any of the rabbits in the vicinity of where the snare was in contact with the animal. Externally palpable indentations were found in 79% (19/24) of rabbits at the position of the snare and subcutaneous neck oedema was found in 88% (21/24) of rabbits. Indentations and oedema occurred independently of each other. Three rabbits held in stopped snares had no detectable oedema.

Rabbits in unstopped snares were significantly more likely to have tears in the subcutaneous adventitia (Mann-Whitney U test, U=30, p=0.05). Some of these tears completely encircled the neck whereas others were less than 4 cm long.

The overall neck haemorrhage score was significantly lower in the rabbits that were in the snares for 24 hours. There was no effect due to snare type (Mann-Whitney U test, U=14.5, p=0.001). Intramuscular haemorrhages were found in 7 of the rabbits.

Three out of the 24 rabbits had oedema around the URT[8] and these were all held with unstopped snares. Ninety-five per cent (23/24) of the rabbits used for the trial were found to have lung oedema or haemorrhage. All but one rabbit had some type of oedema on its head or neck above the position of the snare.

Haemorrhage: Bleeding or the abnormal flow of blood from a ruptured vessel.
Haematoma: An abnormal localized collection of blood in which the blood is usually clotted or partially clotted and is usually situated within an organ or a soft tissue space, such as within a muscle.
Extravasation: Leakage of fluid out of a vein, artery or capillary.
Compartment syndrome effect: Build up of pressure in heavily-muscled areas which are surrounded by fascia, a supportive tissue which is not very flexible. If pressure builds up in these compartments of muscle and fascia, it can cut off nerves and underlying muscle cells, causing widespread tissue death and other problems.
Oedema: An accumulation of an excessive amount of watery fluid in cells, tissues or serous cavities, extravascular.
Congestion: Presence of an abnormal amount of fluid in the vessels or passages of a part or organ, intravascular.

Table 3.1 Definition of some terms used in necropsy reports

[8] Upper respiratory tract

Trial number	Snare type	Trial duration	External Indentation	Damage to Windpipe[1]	Oedema	Subcutaneous adventitious tear	Overall neck haemorrhage score
1	S	16hr	X	✓[c]	✓	X	0.5
3	S	16hr	X	X	✓	X	2
6	S	16hr	✓	X	✓	X	1
8	S	16hr	✓	✓[c]	✓	✓	0.5
9	S	16hr	X	X	✓	X	0.5
12	S	16hr	✓	✓[c]	✓	✓	1
2	US	16hr	✓	✓[c,o]	✓	✓	1
4	US	16hr	✓	X	✓	✓	0.5
5	US	16hr	✓	✓[c,o,h]	✓	X	1.5
7	US	16hr	✓	✓[c]	✓	✓	1
10	US	16hr	✓	✓	✓	✓	1
11	US	16hr	✓	✓[c]	✓	✓	1
14	S	24hr	✓	X	✓	X	0
15	S	24hr	✓	✓[c]	✓	X	0
17	S	24hr	✓	X	X	X	0
18	S	24hr	X	X	X	X	0.5
23	S	24hr	✓	X	X	X	0
24	S	24hr	✓	X	✓	X	0
13	US	24hr	✓	✓[c]	✓	✓	0.5
16	US	24hr	✓	✓[c]	✓	X	0
19	US	24hr	✓	✓[c]	✓	X	0
20	US	24hr	✓	X	✓	✓	0
21	US	24hr	X	✓[c,o]	✓	✓	1.5
22	US	24hr	✓	X	✓	✓	0

Table 3.2 Summary of *necropsy* results for rabbits held in stopped (S) and unstopped (US) snares.[1] Damage to the windpipe interpreted as congestion (c), oedema (o) or haemorrhaging (h) of the larynx and/or pharynx and/or trachea.

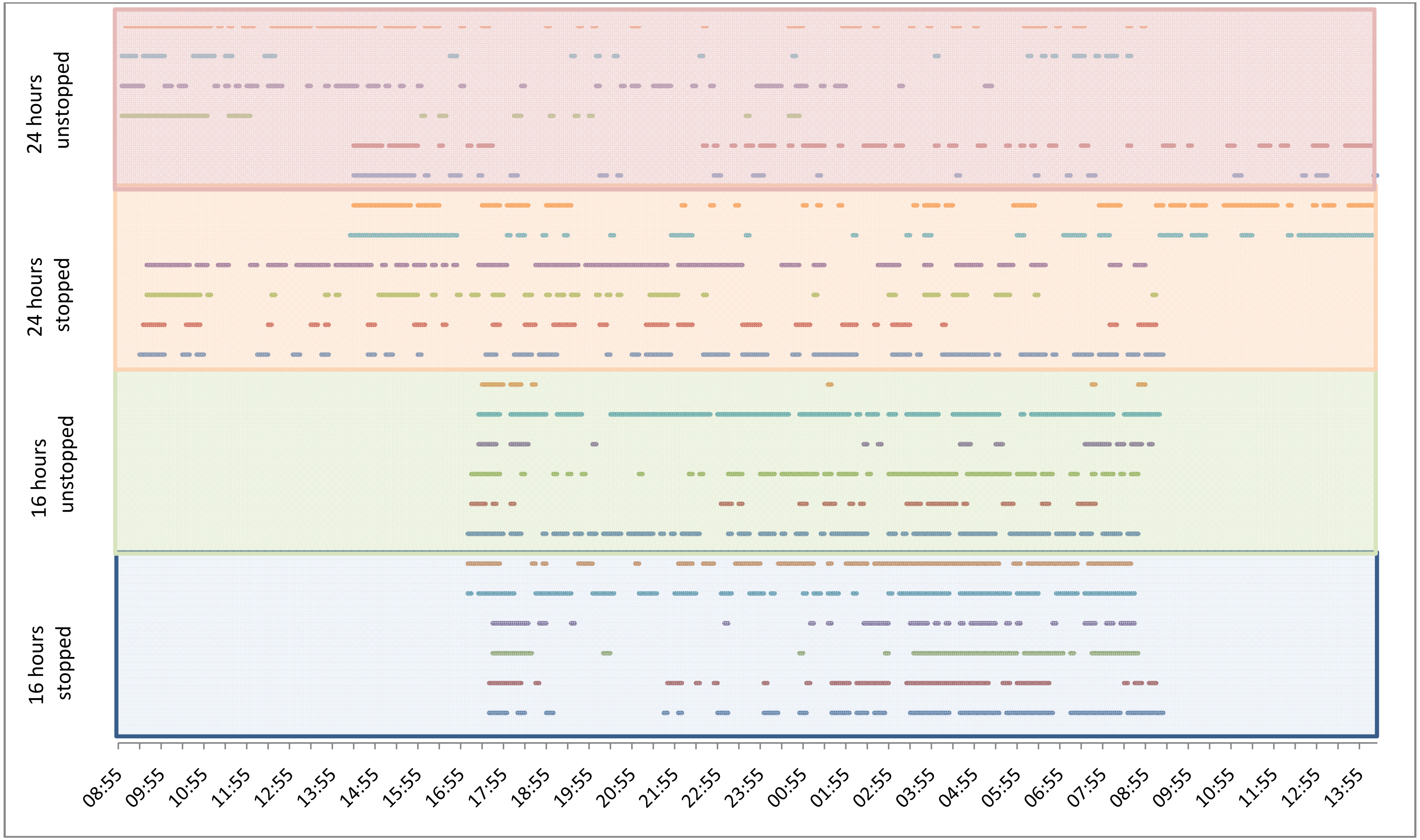

Figure 3.4 Activity pattern of 24 rabbits during restraint in a snare. Solid bars indicate periods where rabbits were seen to be active within each 5 minute period. Individual rabbits are grouped according to treatment and presented in ascending order within each group..

3.3.2. Behaviour

Behaviour data were obtained for all 24 trials.

i) Activity over whole trial

The results from the data where any movement within a 5 minute period was used to indicate activity showed that the time that rabbits were active was very variable, ranging from 17 up to 85% of the trial (Figure 3.4).

ii) Instantaneous observations over whole trial

There were significant differences between trials of different durations on the proportion of time that the snare wire was taut ($F(1, 20) = 18.42$, $p < 0.001$). This was also different between stopped and unstopped snares ($F(1, 20) = 5.81$, $p = 0.026$), but there was no interaction between these factors ($F(1, 20) = 0.01$, $p = 0.934$) (Figure 3.5). Rabbits in stopped snares spent a higher proportion of time with the wire taut. Rabbits in the 16 hour trials also spent proportionately more time with the snare wire taut.

There were no significant differences between trials of 16 hours duration and 24 hours duration for any of the behavioural categories used in the analysis. However, rabbits in stopped snares spent significantly more of their time grooming and pulling on the snare but significantly less time sitting down (Figure 3.6) (grooming; $F(1, 20) = 44.24$, $p < 0.001$, pulling; $F(1, 20) = 23.93$, $p < 0.001$, sitting down; $F(1, 20) = 22.96$, $p < 0.001$).. Sitting down was the behavioural category most commonly observed in both stopped and unstopped snare trials (64% and 80% of total trial times respectively).

3.3.3. Escape behaviour

The amount of escape behaviour performed was influenced by snare type at the start of trial but not at the end and there were significant differences between the beginning and end of the trials (Mann Whitney U test, U =3. Wilcoxon's signed ranks $z = -3.06$, $p = 0.002$) (Figure 3.7).

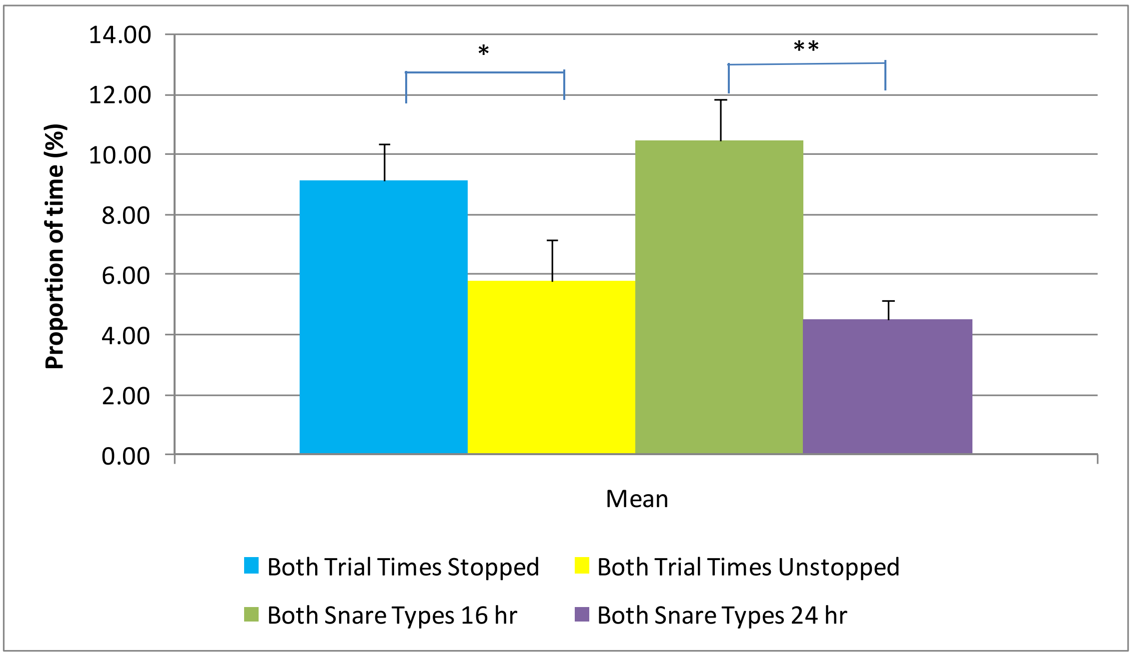

Figure 3.5 Percentage of time that the snare wire was pulled taut across snare type and trial time. *Level of significant difference between snare types: $F(1, 20) = 5.81$, $p = 0.026$. **Level of significant difference between trial times: $F(1, 20) = 18.42$, $p < 0.001$.

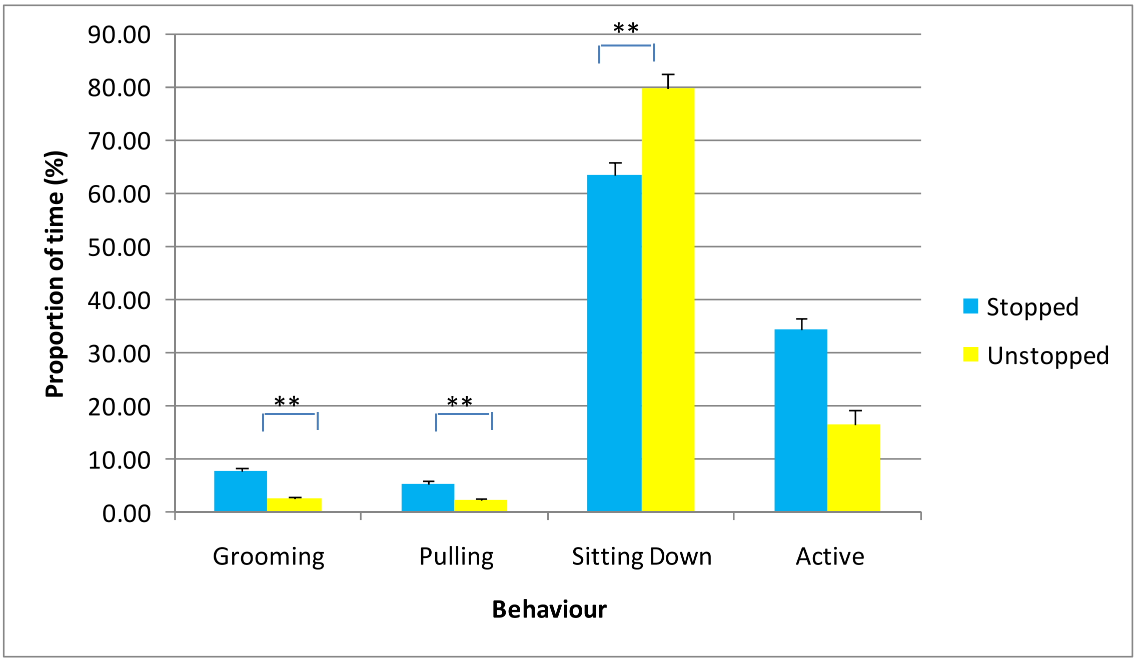

Figure 3.6 Mean proportions of time spent grooming, pulling away from the snare, sitting down not doing any other activity or being active (i.e. not sitting down, lying down or standing) according to snare type. ** indicates significant difference of p<0.001

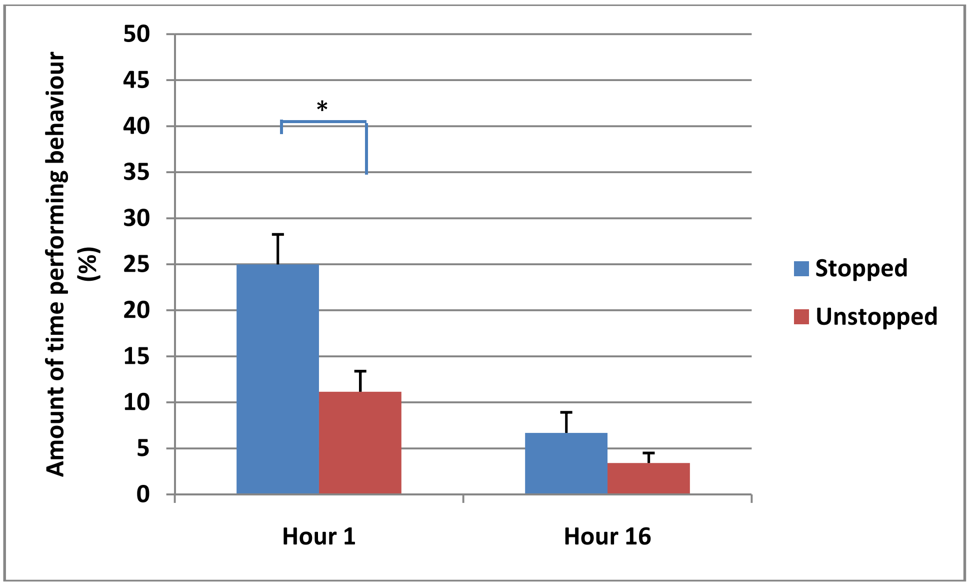

Figure 3.7 Change in escape type behaviour between the beginning and end of the 16 hour trials for rabbits held in snares (n=12). * indicates significant difference of p<0.05.

Behaviour observations leading up to cessation of movement of the rabbit that died are detailed in Section 9.6.

3.4. Discussion

The study described in this part of the report aimed to investigate the potential benefits of using a snare with a permanent stop and increasing the inspection frequency, rather than assess the humaneness of rabbit snares *per se*.

3.4.1. Presence of stop.

The presence of a stop had a significant impact on behaviour and on whether a tear was found in the adventia but not on any other injuries. Rabbits that were held in a snare that had a stop, performed more grooming, escape,and active behaviour and were observed with the snare wire taught on more occasions. Pain associated with unrestricted constriction of the neck while the rabbit is pulling on the snare could explain these differences in behaviour. A similar effect is found during use of choke chains during dog training, this is generally described as a painful stimuli that should discourage the dog from performing the pulling behaviour. The results in this study suggest that the rabbits may also learn to prevent the negative emotions, such as pain, caused by the snare by restricting their movements.

It is unknown whether tears in the adventia are definitely associated with pain, but animals with these symptoms will have lower welfare than animals without these, The outer surfaces of the dermis require a greater force before a tear occurs, the internal layers of the dermis are more delicate and break easier. This explains why internal tears can occur without any such indicators on the outer layer of the skin. On one rabbit a tear was found completely around the neck, these specific injuries suggest that the unstopped snares may be having a cheese wire effect, and this can be prevented by using stopped snares. These results suggest that rabbits inflict some level of injury upon themselves and one could reasonably assume that this would be during performance of escape behaviour. If so the level of injury caused by unstopped snares after initial capture may be propotionate to the level of motivation to escape. In pen trials the motivation may be lower than in the wild and therefore a greater difference between stopped and unstopped snares would be expected in the wild.

Although none of the rabbits had dislocated necks, as was reported by the IWGS to happen, it must be remembered that in this study they were placed gently in the snares at the full reach of the snare wire. In the wild rabbits would run or hop into the snares, probably at speed, coming to a sudden unexpected stop when the full extent of the snare was reached. This would be likely to increase the chance of neck injuries.

3.4.2. Stop placement vs neck size

The suggested stop position in the CoP for foxes is 23cm which is 4 cm less than the average circumference of fox necks. A stop position of 20 cm is suggested in North America and 20.5 cm in Spain, however it is unknown whether foxes from these areas have different sized necks. The suggested stop position for rabbits is 14cm, with rabbits having an average neck circumference of 11 cm. Notwithstanding any considerations of benefits to non-targets, the ideal place for a stop is small enough to prevent the target pulling its head out of the snare and large enough to reduce injury and improve welfare. From this it could be suggested that the absolute minimum size of noose should be equivalent to the circumference of the target animal's neck. As individual neck sizes within a species differ, a standard size for each species would need to be stipulated. If this was at the smaller end of the range the welfare benefits would be limited but the number of escapees may be minimised. Conversely, if it were at the larger end of the range the welfare benefits would be maximised, but escapes may increase. A problem with,setting the stop at the 'average' neck size is that it may benefit only half of the snared target animals.

The results from this study indicate that although the stop position was set at the average animals' neck size, the occurance of oedema was similar in both stopped and unstopped snares. It is unclear from these results whether increasing the stop position to greater than the average neck circumference would reduce this constriction of the blood vessls, and consequent formation of oedema.

3.4.3. Inspection frequency

From the results of this trial, there did not appear to be any significant welfare differences between 16 and 24 hour inspection frequencies. Injuries were not increased nor likely to be more severe in the longer trials. Nevertheless, increasing the inspection frequency would reduce the time that a captured animal was exposed to the other potential negative effects of snaring, such as starvation, dehydration, hyperthermia, hypothermia and predation. Hyperthermia and hypothermia can be controlled by the operator not setting snares during adverse weather conditions however starvation and dehydration cannot be avoided by this strategy. Starvation is most likely to be an issue for smaller rather than larger captured, mammals. Unlike cage traps, rabbits are able to eat the grass in the area where the snare is anchored, and are therefore unlikely to experience severe starvation or dehydration between 24 hour inspections. This was confirmed by observations of the rabbits in the pen trials carried out for this study, eating at various points throughout the capture period. The amount of escape behaviour (5%) displayed at the end of the 16 hour trial was relatively low and much lower than that displayed by rabbits that were held in cage traps under similar circumstances (Talling et al 2008). Although the escape behaviour at the end of the 24 hour trials was not determined, rabbits in these trials spent significantly less time active and were therefore expected to also have lower levels of escape behaviour. A low performance of escape behaviour could suggest that there may be only marginal benefits to any increase in inspection frequency. However as mentioned above, motivation to escape under field conditions could well be greater and lead to higher levels of escape behaviour than in a pen situation. How great this might be and how great any differences would be due to differing lengths of time in the snare is not known. It is likely that the chance of predation occuring would also be decreased if inspection frequencies were increased and this benefit could not be assessed in pen trials. Potential negative consequences associated with more frequent inspection times would be increases in time taken to check snares, increase in human scent associated with the site, and increased disturbance to the target population.

3.5. Conclusion

In summary, the results from this study showed that the presence of stops improves welfare, but placement of the stop at the average neck circumference is not sufficient to prevent formation of oedema. Benefits from increased inspection frequencies were not demonstrated in these trials, but this may be due to the pen trials not being a good model for investigating this aspect of the CoP (see section 4.6) rather than a lack of real benefit.

4 Objective 4: Evaluate the humaneness of use of snares under best practice conditions, particularly with respect to the Agreement on International Humane Trapping Standards -

Objective 4 is addressed by Section 4, 5 and 6. Section 4 reports the findings of a literature review to determine the most appropriate approach, section 5 reports the field trials of fox snares, and section 6 reports the field trials of rabbit snares.

4.1. Review of approach taken to assess humaneness

Humaneness is a relative term and the acceptable level of welfare is an ethical rather than a scientific decision. The role of science here is to collect suitable data that will allow subsequent robust evaluation against stated criteria. The condition of animals caught in snares is thought to depend not only on intrinsic properties of the snare itself, but also on operating rules (e.g. legal requirements, CoP), operator skills and field conditions (IWGS 2005). Several potential sources of data on snares already existed and we reviewed the suitability of these before proposing any new trials as part of this project.

4.2. Snare injuries reported to non-governmental organisations

Snares can cause severe injury and death in target and non-target animals (IWGS 2005). An appreciable number of such cases have been publicised by bodies such as the RSPCA and the Badger Trust (previously the National Federation of Badger Groups). Such cases may represent occasions when events did not follow best practice intentions as described in the CoP; alternatively it is possible that they reflected poor practice or malpractice. It was unknown how often such poor welfare cases arise when snares are operated according to the CoP, or how much the risk of poor welfare is increased by failure to observe the CoP.

4.3. Snare injuries reported to veterinary surgeries

It has been proposed previously, for instance in the original call for this project, that veterinary practitioners may hold valuable databases of domestic or wild animals treated after injury in snares. Experience of trying to utilise this data source has proved problematic. Typically, vets do not have time to search databases themselves. Data are usually indexed using drug names or treatments and if access to these databases could be gained, the lack of a search term unique to snare injuries would be a major problem. This approach has been used previously to establish prevalence of diseases, treated by only one or two specific medicines, whose drug names could therefore be used as robust search terms. By contrast, snare injuries may involve a wide range of drugs during treatment, none of which are specific. Some cases presented may not require any drugs. Data from veterinary practitioners will, by definition, consist largely of cases where things have gone wrong, as only injured animals are likely to be presented to veterinarians. This data-set is therefore likely to be a sample heavily biased towards injured animals. It is also unlikely to record details on how the snare was set or the characteristics of snares, so making it impossible to attribute injuries to malpractice or good practice. Likewise the number of animals caught in snares without injury will not be recorded, so the proportion of animals injured can not be calculated.

4.4. Data submitted from practitioners

In previous work in the UK, use has been made of practitioners themselves to record data on a voluntary basis. In the BASC/GCT Joint Snares Trial, 1994-5 (JST), 120 practitioners were enlisted from all over Britain, all of whom regarded snares as an important part of their fox control effort, were enthusiastic about the aims of the trial, and agreed to take part. Of these, only 51 operators returned usable data. During analysis, it was apparent that participants were a small, non-random sample of the user population, such that neither the original 120 participants nor those who actually returned data could be stratified by region. In statistical terms, 'operator' and 'region' were confounded variables. Data were not ground-truthed or verified in any way, but because participants were volunteers sympathetic to the research aims, and in view of the daily pro-forma records, the care taken to preserve anonymity, and the actual reporting of non-target captures and injuries, the investigators did not suspect reporting bias. However, it was believed impossible to obtain such collaboration in a genuinely random sample of operators – whether stratified by region or not – because of political sensitivities about snares.

4.5. Data collected using methods in International Standards

Since the JST, many restraining devices have been assessed under obligations to the Agreement on International Humane Trapping Standards (AIHTS) (Canada and USA). All data has been collected by government employed technicians but two approaches have been used. Either the technicians themselves were fully competent at using the capture technique under investigation or they accompanied competent practitioners (Mike O'Brian, Canada, pers. comm. & Bryant White, USA, pers. comm.). To ensure that the results of such trials were relevant for all types of habitat and environmental conditions, realistic combinations of these factors were included in the trials. The methodology used for obtaining the data to assess restraining devices is based on ISO TC/191/N 121' Methods for testing restraining traps'.

4.6. Methodology used for this project

To ensure collection of unbiased data, the methodology outlined in the AIHTS for restraining devices was used as the basis for data collection. The AIHTS prescribes pen trials followed by field trials to verify performance of the device under field conditions and optimal usage. However, since the AIHTS was signed, scientists involved in assessing commonly used traps have abandoned pen trials for the direct assessment of restraining traps (Mike O'Brian, Canada. pers. comm.). There were a number of reasons for this, including stress on the animals, different behavioural responses in captivity, logistics and economics. Pen trials are still being used in Canada to develop computer simulation models for some generic designs of restraining device, eg leg hold trap for coyote.

Previous experience with both badgers and foxes has demonstrated that captive wild animals in pen trials can be a poor model for the field situation (Defra, 2007). Wild caught animals held in natural enclosures for such trials do not adapt to the captive environment and do not behave as they would in the field, either before or after capture. Failure of the animal to adapt to the captive environment may influence both its physiological and behavioural responses to restraint. Additionally, designing a protocol to persuade the animal to voluntarily enter the restraining device within a captive environment, while replicating the setting of such a device in the field, is very difficult. The environmental setting surrounding the snare may have profound

It has previously been established that foxes in the field can be restrained in snares without visible or clinically significant injury (e.g. for radio-tagging in scientific studies; IWGS 2005). Where such information is already available for a device, pen trials are considered not to be useful or necessary.

The trial carried out to address Objective 3 (Section 3) showed that in pen trials, rabbit snares can cause indicators of poor welfare as listed in the AIHTS for restraining devices. However, the number of animals showing these indicators suggested that the stopped rabbit snare could meet the requirements of the AIHTS for restraining devices. The pen trials did not, and were not designed to, replicate how snares are used in the field. Data collected under field conditions is therefore required to allow an assessment of rabbit snares to be made.

Field conditions also determine the likelihood of non-target captures because the abundance of target species (usually fox or rabbit) and non-target species, (e.g. badger, brown hare, muntjac, roe deer, cat) varies regionally; and because previous culling of the target species (whether by snares or any other method) will itself alter the relative densities of target and non-target species. The AIHTS for restraining devices requires the welfare impact of the device under test to be assessed in non-target species that are present in the habitat, and for the device to be tested in habitats that are representative of those in which the device will be used

We therefore chose to collect data under field conditions on neck snares used to restrain foxes and rabbits.

4.7. Criteria used to assess welfare of fox and rabbit snares.

For some people, any trapping of wild animals is unacceptable. However, if it is accepted that wild animals may be trapped, many people believe that an acceptable level of welfare should be defined (Iossa et al 2007). There will be differences of opinion between stakeholders as to what level is acceptable.

Currently, there are three welfare standards that are used around the world for assessing wild animal restraining devices. An issue with all the standards described below is that devices that meet the requirements of the standards can cause poor welfare in a proportion of animals during capture. However, there is a trade off between increasing the pass rate and the number of animals that would need to be tested to prove this.

One of the standards is based on a combination of injuries and two behavioural indicators of poor welfare, whereas the other two are based solely on injuries: thus although the standards are broadly similar, they could potentially give different verdicts on the same device. The assessment of welfare in this report was predominantly based on the AIHTS, because it is the standard most likely to pass into legislation within the EU.

a) The AIHTS for restraining devices provides a list of injuries and two behaviours "recognised as indicators of poor welfare in trapped animals". No scores are assigned to the injuries but the trap is passed only if at least 80% of a sample of at least 20 animals shows none of the indicators listed. A criticism of this standard is that it does not deal with the compound welfare effects of a number of lesser injuries. This Agreement has been signed between Russia, Canada and the EU, and a similar agreement has been signed with the US. It currently applies to a list of fur-bearing species commonly trapped for their fur. Of these, only Stoat, (European) Badger, Otter and Pine Marten occur in the UK. The AIHTS has not been ratified by the EU although it is incorporated into the draft EU Humane Trapping Standards Directive COM (2004) 532 for fur-bearing animals. Fox and rabbit are not included in the AIHTS, although the EU or member states could potentially add to the species list on implementing the legislation.

b) The International Standards Organisation (ISO) draft humaneness standard for restraining traps focused on injuries thought to cause pain, and combined both an injury scale for "potentially acceptable injuries" and a list of "unacceptable injuries". Under this scheme, a captured animal that had "unacceptable" injury was always scored as being beyond the "injury threshold value". Injuries of lesser severity (the "potentially acceptable injuries") might occur singly or in a large number of combinations. Accordingly, there was a points system for potentially acceptable injuries that was both cumulative and multiplicative, with higher points assigned to those injuries considered more severe. The points were not intended to represent the degree of pain associated with any one injury - but rather to provide a system for comparing different traps. An animal would pass the required "injury threshold value" if it had i) no unacceptable injuries, and ii) a total injury score for the potentially acceptable injuries less than or equal to 75. The draft standard proposed that a restraining trap would pass welfare requirements if at least 80% of a sample of 25 or more captured animals met the injury threshold value. However, for species that were difficult to catch, a reduction in the total number of animals that are required was suggested. For such species it was suggested that the minimum number of animals tested should be 5, and no fails would be acceptable. The committee working on this standard failed to reach agreement on the performance traps must achieve and this aspect did not progress past the draft stage. Thus, the published standard (ISO 1999) defines a methodology for carrying out trap assessment but does not stipulate a performance level that traps should meet. Nevertheless, this scheme is used by the USA in development of their Best Management Practices (BMP)[9]. These BMPs list those traps that meet the standard for each target species.

c) The New Zealand National Animal Welfare Committee (NAWAC) trap approval system[10] was based on the ISO draft described above. Each injury sustained by an animal caught in a restraining trap is classified into one of four Trauma Categories, namely: mild trauma, moderate trauma, moderately severe trauma, and severe trauma. The numbers of each of these trauma categories are then combined to produce the overall Trauma Class for each animal. There are four Trauma Classes, namely: Mild, Moderate, Moderately Severe and Severe. Each of these Trauma Classes can be made up of different combinations of the various Trauma Categories,

[9] http://www.fishwildlife.org/furbearer_resources.html
[10] http://www.biosecurity.govt.nz/animal-welfare/nawac/policies/guideline09.htm

and in this manner the NAWAC Guideline deals with the problem of multiple and diverse injuries. A trap which causes any injuries or combination of injuries that fall within the Severe Trauma class, fails to meet the requirements of the standard. This approval system is a legal requirement only in New Zealand. Instances where captured animals escape are classified as fails under this system.

Although many papers have claimed that the ISO and AIHTS for restraining devices standards have unjustly neglected the use of physiology and behaviour to assess the welfare of animals in restraining traps (e.g. Harrop 2000, Iossa et al 2007, Nocturnal Research 2008), none of these papers have suggested how an absolute measure of these indicators could be incorporated into a relevant standard. Interpretation of such responses is regarded as difficult (e.g. Proulx 1999, Talling & van Driel 2009). No system has been established to integrate injury scores with behavioural and physiological responses (Proulx 1999). Whilst Warburton *et al.* (1999) accepted that any assessment of the humaneness of trapping should have physical injury at its core, they argued that data on behavioural and physiological responses could assist interpretation and should be collected if possible.

Attempts to assess welfare in practical situations was first discussed in relation to trapping wild animals and the development of International Standards; however more recently a significant body of work has been completed in this area for farm animals. Assessment of welfare in production systems rather than experimental set ups, has been the subject of the Welfare Quality project (Keeling 2009). Of the twelve criteria that underpin the assessment system that was developed for that project, five are relevant to restraining devices. These are absence of prolonged hunger, absence of prolonged thirst, thermal comfort, absence of physical injuries and avoidance of negative emotions such as fear, distress, frustration or apathy.

The Welfare Quality project came to the conclusion that the first three criteria were best assessed using a resource based measure, i.e. has the animal access to an appropriate source of food and water and are checks of this availability made at appropriate intervals. Perhaps not surprisingly, using an animal-based condition scoring protocol was found to be the most reliable indicator for assessing absence of injuries. Methodology for practical measurement of negative emotions was most problematic, and they found that the only valid test of general fear in farm animals was the novel object test.

The emotions of fear and anxiety have biological importance to wild animals in that the life expectancy of animals can be increased if danger is avoided (e.g. Boissy 1995). Fear and anxiety are thought to motivate defensive or avoidance behaviours and associated biochemical responses as a way to protect animals from potentially harmful situations. Animals can cope with fear and anxiety, but if these states are excessive in either intensity or duration, distress will occur and the welfare of the animal will be compromised (Webster, 2005). The major negative emotions, likely to be experienced by animals during restraint in a trapping device are pain, fear and anxiety.

The strength of these emotions in animals, as highlighted within the Welfare Quality project, has to be inferred from behavioural and physiological responses that can be very variable.

Although fear and anxiety have not been extensively studied in wild animals, much work has been completed using laboratory rodents and domestic animals. Yet even here there is still disagreement over the appropriate methodology for assessing levels of fear and anxiety. For rodents the plus-maze has been adopted as the standard model of anxiety despite being heavily criticised (Hogg, 1996); whilst the Welfare Quality project (Keeling 2009) has identified the novel object test as being the valid test of general fear in farm animals. Even within species kept in identical environments, a wide variation has been found among individuals in their responses to tests, ranging from extreme panic to no obvious response at all. Laboratory rodents and domestic farm animals have been bred in captivity for many generations. Domestication selectively removes genotypes that fail to prosper in captivity, or whose behaviour makes them difficult to handle (Hemmer 1989). There is likely to be a greater variation in behavioural response to fear- or anxiety-evoking stimuli in wild species, and responses may also differ among species (e.g. it may be more important for prey species to be vigilant to changes in the environment compared with predators). The level of escape behaviour (e.g. biting the bars of the cage) shown by a trapped animal has been identified in previous work as a potential welfare indicator for wild species (e.g. Inglis et al, 2001); a low level might be acceptable but excessive performance of escape behaviour could be a welfare indicator.

Cortisol (with other chemicals related through the hypothalamic-pituitary axis, the so-called ‘stress hormones’) is established as an indicator of stress, but poses interpretational difficulties (e.g. Moberg & Mench 2000). The very flexible nature of production of these hormones, and also the degree to which the stress hormones can be controlled by the central nervous system, suggests that they are unlikely to form a reliable and robust indicator of welfare (Mormede et al. 2007). In a comparative study, and under controlled experimental conditions, relatively small samples of individuals may be sufficient to demonstrate differences in cortisol production and metabolism. Where absolute levels of cortisol are to be interpreted, the number of animals sampled would need to be substantially greater and the relationship between observed cortisol levels and the maximum achievable cortisol levels would need to be established for the target species, for example, by an adreno-cortico trophin releasing hormone (ACTH) challenge. Even given a satisfactory regime for measuring relative cortisol levels, these cannot be taken to indicate the degree of suffering. In the Welfare Quality project (with domestic livestock) the conclusion was reached that, whilst physiological and biochemical measurements are useful in comparative studies, they are not a reliable measure in the context of a stand-alone assessment (Mormede et al. 2007).

Other physiological indices that could be measured in the blood relate to physical exertion. A positive relationship has previously been shown between blood parameters relating to exertion (e.g. lactate dehydrogenase) and physical injury (Powell 2005), but that study required a sample size of over 200 individuals. Blood parameters reflecting physical injury may, in fact, be more straightforward to interpret than cortisol. However, for either stress hormones or physical injury, blood samples are unlikely to provide information additional to that obtained during necropsies. For the trials reported here, it was decided to collect injury data during necropsies, and where possible collect behaviour data.

The survey of snare use (Objective 1) confirmed that foxes and rabbits are the two species that are most often targeted by snare operators in England and Wales; hence, the humaneness of snares as a restraining device was assessed in these two species. Due to a lack of knowledge and experience of rabbit snaring among technical staff, different approaches were used for collection of data in the two species.

In conclusion, due to a lack of consensus on interpretation of physiological and behavioural responses and the variability of responses in wild animals, leading to a requirement for large sample sizes, field assessments of snares (see sections 5 & 6) were based primarily on injury data and where possible escape behaviour.

5 Field trials of fox snares

During the JST referred to above (section 4.1.) the success of fox snare operators was highly variable, ranging from one to 33 foxes caught in snares per year. To obtain the 20 foxes required per operator and thus achieve a statistically robust assessment of welfare, at least four operators would need to be enlisted and be accompanied whenever snares were set for approximately 2 years. The data obtained from such a lengthy study would still not allow factors, such as habitat or environmental conditions, to be investigated statistically because (voluntary) participants could not be selected at random on a stratified basis.

The alternative approach of using a technician fully competent in the use of the device is clearly more achievable, and was therefore the preferred option to address the objective of this part of the project. Necessarily, it focuses on the device as operated according to best practice (because it is difficult and unethical to emulate bad practice). It cannot be assumed that the technician is representative of all operators, or even all best-practice operators. Also, practical and budgetry constraints meant that this approach could not cover all ranges of habitats nor all other ranges of environmental factors that might influence the welfare of animals restrained in snares. The study did not aim to assess whether snares met the requirements of the AIHTS for restraining devices for any specific non-target species, but results from non-targets would be collected.

There were three stages to the fox field trials. The first stage was to identify a suitable snare. The second stage was to validate an activity monitoring device. The final stage was to use the snare identified in stage one in combination with the activity monitoring device validated in stage two. This aimed to provide objective injury and activity data to allow assessment of the humaneness of the device.

5.1. Snare selection

Three snare suppliers were identified from an internet search and advertisements in shooting magazines. These suppliers were contacted to determine whether they supplied snares that conformed to the CoP recommendations, specifically whether the snares offered a) had a stop, b) the stop was approximately 23 cm from the eye, c) were free running, d) the breaking strain of the cable was 460 lb (208 kg) or more e) had two swivels with one of the swivels being at the anchor point, and f) the weakest point was at the eye.

Only one of the suppliers claimed to have a snare that had a breakaway device (i.e. weakest point at the eye) and two swivels as standard (snare type C). Supplier of snare type B stated that their snare had two swivels, though not necessarily at the anchor point, but that they could supply snares with extra swivels at the anchor point. Neither snare type A or B had the weakest point at the eye but their suppliers claimed they met all the other requirements of the CoP.

A sample of five snares was obtained from each of the three suppliers. Single examples of the three types of snare were then sent for independent assessment to (a) an organisation representing the British game shooting industry and (b) an animal welfare organisation. They were asked to assess which of the snares from the three suppliers, in their opinion, best met the Defra CoP. Both organisations thought that none of the snares fully met the CoP but that one of the snares was better than the others (snare type A). Snare type C had a novel design of running eye and both assessors were dubious as to whether it would perform as predicted in the field.

To check that the cable strength of the snares was sufficient for the trial, weights in multiples of 25 kg were suspended from a snare until it broke. This was undertaken with a sample of 2 snares from each supplier. All three types of snare remained intact whilst holding 75 kg, but components other than the wire broke when the weight was increased to 100 kg. It was believed, based on maximum body weights, that neither foxes nor badgers would be able to exert forces of this magnitude on the snares. The CoP specifies the breaking strain of the wire rather than the whole snare.

The type (snare type A) that was ranked highest by the two independent assessors was chosen for subsequent pen and field trials, with a second swivel fitted at the anchor point by the manufacturer to make it compliant with this aspect of the code.

5.2. Description of snare

The snare cable was 2 mm in diameter and had a stop placed at 23 to 24 cm from where the cable ran through the eye. The middle swivel was positioned 75 cm from the eye, and the length from the middle swivel to the anchor swivel was 48 cm, giving a total length of 123 cm. The snare's anchor swivel was manufactured from 2.1 mm diameter galvanized steel wire. (Figure 5.1 & Figure 5.2).

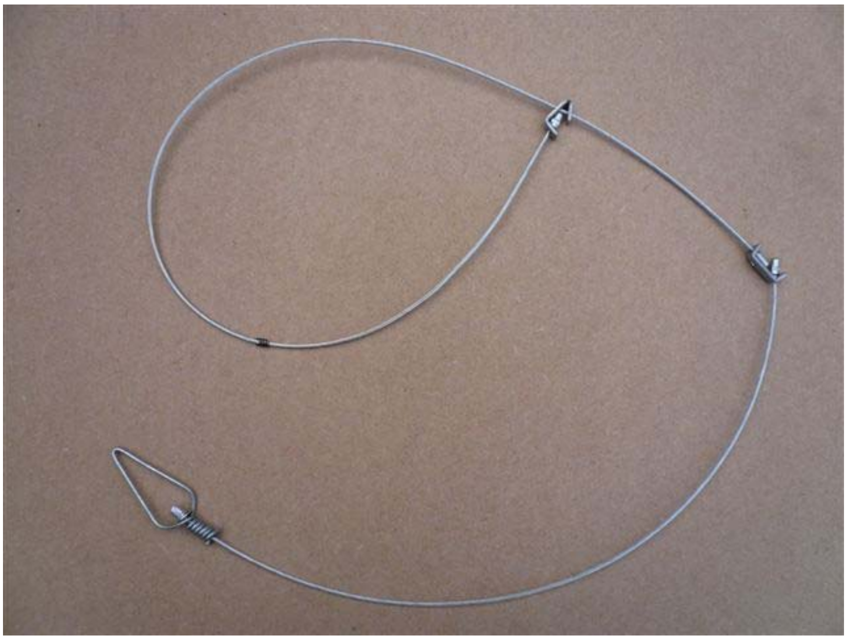

Figure 5.1. Snare type A

Figure 5.2. Components of snare type A, showing left to right: middle swivel, anchor swivel, stop and running eye.

5.3. Pen trials to validate activity monitoring devices for foxes in snares

In the field trials of the snare we aimed to collect data on behaviour during restraint alongside assessment of physical injuries during necropsy. Equipment that would work in the field and could be used in the vicinity of each snare was required to collect behaviour data. Placement of monitoring equipment in close proximity to a trap can alert animals to a change in the environment and disrupt behaviour. For snares in particular, which rely on the animal being unaware of their presence, this creates problems for the investigator. As awareness of environmental cues and subsequent behavioural responses are expected to differ among species, and among age and sex classes within a species, the addition of monitoring equipment could also affect selectivity of the trap.

To obtain information on all behaviours performed during restraint by a snare in the field would require video cameras to be used. Experience has shown that traps monitored by video cameras have a significantly reduced capture rate (CSL 2007) and, therefore, alternatives to video cameras were explored. In previous behavioural studies of animals in restraining devices (cage traps, foot snares and body snares), overall activity was positively correlated with escape motivated behaviours (e.g. Talling *et al* 2006). In such cases the proportion of time spent active may therefore provide an indication of how motivated the animal is to escape from the snare. However, this relationship may not be true for foxes or other non-target animals caught in snares, and escape behaviour may therefore be over estimated if activity alone is measured. Two techniques were identified that could measure activity but were less obtrusive than video cameras were identified. First, a shock sensor, detecting vibration either at the anchor stake or in the snare cable, and integrating it with a time code for storage in a logger. It was thought that both detector and logger could be buried in the ground close to the anchor stake to minimise visual and olfactory cues.

The second option was a digital still camera, activated by motion, and programmable to take pictures at a set interval. Pen trials were undertaken to validate these devices as activity monitors for foxes held in snares. Although these two options were chosen as offering the lowest possibility of detection by foxes, we accepted the possibility that in field use, target:non-target capture ratio might be affected by either device.

5.3.1. Methods

Licences
All procedures were licensed on a Home Office Project Licence, and all personnel carrying out the trials held Home Office Personal Licences permitting them to carry out those procedures.

Vibration Loggers
Discussions were held with an electronics engineer to determine whether any commercially available vibration sensors could record activity of foxes held in snares. Two sensors were identified as having the potential to achieve this objective. Initial tests involving a person pulling on a snare to try and replicate the behaviour of a fox demonstrated that one sensor, that incorporated a data logger – the TinyTag 0-100 g Shock Logger - met the requirements (Figure 5.3). The sensor contained an accelerometer that measured any shocks (accelerations) perpendicular to the snare cable, with the logger mounted in-line, tugs along the cable twitched the logger sideways, causing accelerations to be recorded. The logger recorded the maximum acceleration occurring in each recording interval. It was established that the output from the logger could be used to reliably indicate activity but not strength of pull. The logger was programmed to record data every 5 seconds.

Figure 5.3. Tinytag data logger used to record activity during the trials.

Trail cameras are activated by motion. When the PIR sensor of the camera is activated an image is recorded. The total number of images that can be recorded is restricted by the memory capacity of the camera. The sensitivity of the PIR sensors associated with trail cameras is not standardised and has not previously been validated. The optimum distance from the camera to the anchor point of the snare was determined prior to placement of the cameras in the pens. The camera used for this trial (Moultrie GaemSpy D-55IR; Figure 5.4) had an optimum distance of 10m. The memory capacity of this camera indicated that the minimum time between images had to be set at 5 minutes to ensure that images could potentially be obtained over the whole 16 hours of the trial. Once an image has been recorded the camera is deactivated for the next 5 minutes; following this, a movement has to be detected to trigger recording of the next image.

Figure 5.4. Trail camera used to measure activity

Animals

Two adult male wild foxes, which had been captured in cage traps in a rural area as part of a pest control operation during March 2009, were transported to the experimental facilities. On arrival at the experimental facility, they were checked for external injuries, then housed separately in outdoor concrete and mesh pens which contained wooden boxes for shelter. The foxes were kept in these pens for at least twenty-four hours after capture, to allow them time to acclimatise, before the trials took place. Each concrete pen (8 x 5 m) used to house the foxes was linked, by a closed door, to an adjacent grass paddock (20 x 5 m). The trials were carried out in the two grass paddocks.

Equipment placement

The snare anchor was positioned 2.5 m from each side wall of the grass pen and 4 m from the door separating the concrete pen from the grass paddock.

Two video cameras were used, one positioned at the end of the grass pen and a second adjacent to the point where the snare was anchored, to ensure that the behaviour of the foxes could be determined at all times. Two trail cameras were secured to the side of the pen focused on the anchor point.

The data logger was attached to the snare via a ‘D’ shackle, and the logger attached to the anchor point, again using a ‘D’ shackle.

Trial procedure
The video recorders, loggers and trail cameras were all switched on. The video recorders recorded continuously for the whole of the trial, the loggers were programmed to record data every 5 seconds and the trail cameras were programmed to record an image at a frequency of not more than once every 5 minutes. The video recorders, loggers and trail cameras were only switched off after the fox had been removed from the snare at the end of the trial.

Protocol
Each fox was restrained, using a dog-handling noose, and carried to the vicinity of where the snares were anchored. The noose of the snare was placed over the head of the fox and drawn up so that it was positioned around its neck. The dog-handling noose was then removed from the fox and the technicians quickly withdrew from the vicinity of the fox. This was an established handling procedure for foxes which was known not to cause injury.

The fox was observed, using the video camera output, for 2 hours, and then left until it had been restrained by the snare for 16 hours. At the end of the trial, the fox was again restrained by the dog-handling noose, and was then euthanized. A close external examination of the dead fox was undertaken, and a note made of any injuries found. The procedure was repeated for the second fox on the following day. The foxes were killed at the end of the trial as they could not be returned to the area from which they had been obtained.

The video records, the trail cameras and the data loggers were compared to determine the reliability of the two techniques at obtaining data on activity of foxes restrained in snares. For analysis of the video records, inactive behaviour was defined as the fox lying immobile on the floor. Active behaviour included sitting, rearing-up and all other actions while standing. For the trail cameras, a recorded image was taken to indicate that the fox was active from the time of the image until 5 minutes later.

In addition to analysing proportion of total time spent active, the number of bouts of active behaviour was analysed. An active bout was taken to have ended when intervals between recorded images were greater than 10 minutes. For the loggers, an active bout was taken to have ended when recorded forces had been zero for 10 minutes. Specific behaviour from the images recorded on the trail cameras were not analysed.

5.3.2. Results
Both foxes were successfully restrained by the snares for the duration of the trial, with no external injuries. The loggers were undamaged and did not appear to have

interfered with the operation of the snare. Both the loggers and the trail cameras recorded data over the whole duration of the trial (

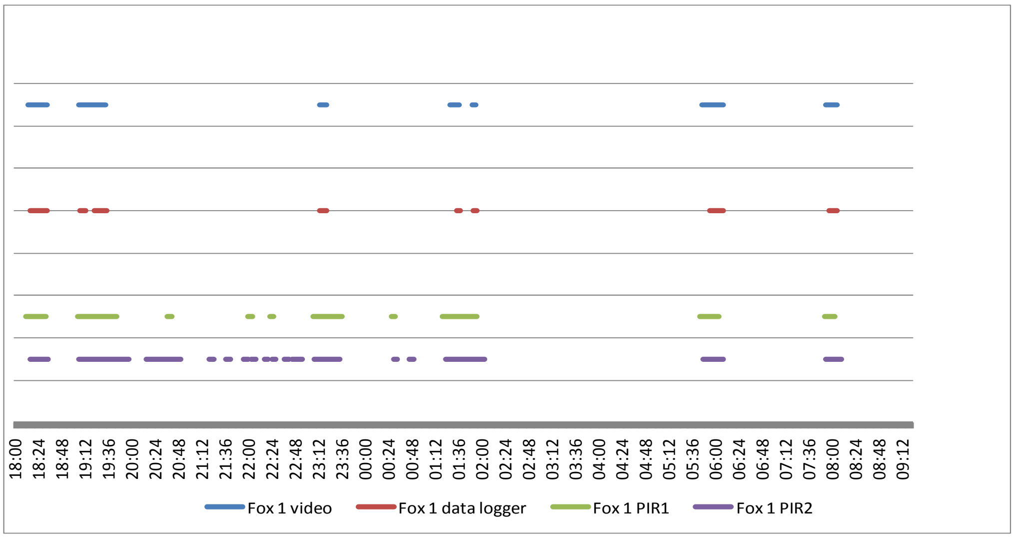

Figure 5.5. Activity pattern of fox 1 measured by 3 different methods, PIR = trail camera.

Figure 5.5 & Figure 5.6). Trail cameras were activated during dark and light and fox behaviour could be deduced from the photos (Figure 5.7 and Figure 5.8).

Insufficient trials were completed to allow any statistical comparison of the devices. Comparison of behaviour recorded from the videos with activity recorded by the data logger, showed that, for both foxes, the loggers underestimated time active by between 3 and 4%, but recorded a similar number of bouts of active behaviour (Table 5.1). There was more variation in the results obtained from the trail cameras. The percentage of time active was over-estimated by both cameras in the trial of fox 1 but under-estimated by one camera in the trial of fox 2. Over-estimation can be explained by the cameras being triggered by movement of the fox while it was laid down. However, under-estimation implies that cameras failed to detect on some occasions when the fox was active.

Both methods gave a reasonable picture of activity patterns during the whole period of restraint.

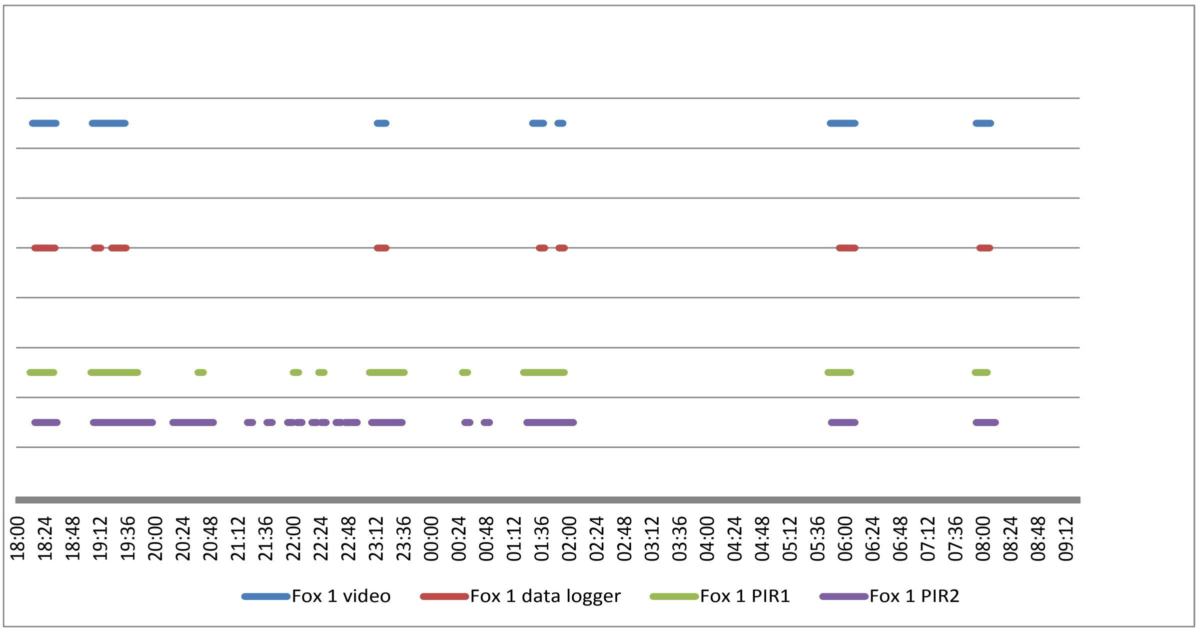

Figure 5.5. Activity pattern of fox 1 measured by 3 different methods, PIR = trail camera.

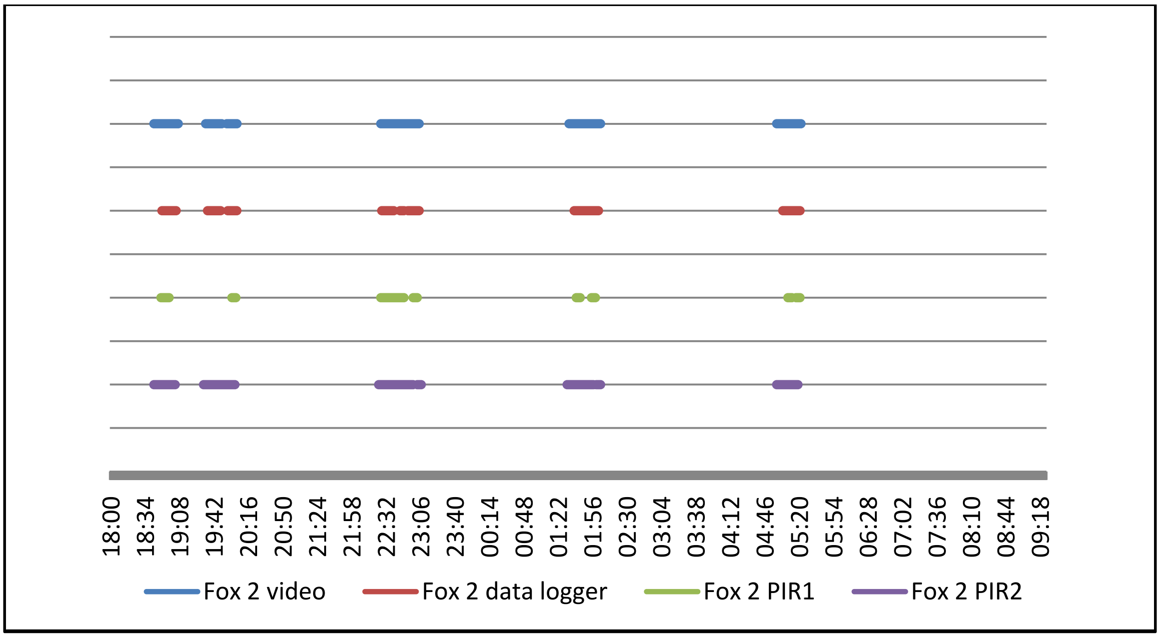

Figure 5.6. Activity pattern of fox 2 measured by 3 different methods, PIR = trail camera.

Figure 5.7. Image captured during darkness by a trail camera.

Figure 5.8. Image captured in the early morning by a trail camera.

	Fox 1		Fox 2	
	Number of bouts	Percentage of time active	Number of bouts	Percentage of time active
Video	7	12	6	16
Logger	9	8	5	12
Camera1	10	19	8	7
Camera 2	7	29	7	16

Table 5.1. Comparison of active behaviour as measured by different methods.

5.3.3. Outcome

The primary objective of this pen trial was to determine which of the two devices was likely to give the most robust data on active behaviour during the field trials. During these trials, the loggers performed most consistently. The field workers also thought that the loggers would be easier to conceal from foxes than the trail cameras.

The data logger was selected to be appropriate for use in the field and likely to provide reliable informative data about the activity of any captured animals.

5.4. Field trials of fox snares – Study 1

Having identified a suitable snare and a method for recording activity of captive animals in the field, field trials of the snares were undertaken in May 2009.

5.4.1. Methods

5.4.1.1. Snare selection

The snares used were those identified as best meeting the CoP (snare type A with an extra ground swivel, section 5.1).

5.4.1.2. Licences and ethical considerations

A Home Office Project Licence was already held by Fera covering experimental work to assess the humaneness of physical control methods for wild animals. The work for the current study was carried out under that Project Licence and was covered by one of the procedures on that Licence.

Home Office guidelines on implementation of the Animals (Scientific Procedures) Act 1986 require investigators to minimise the use of animals in experiments. However, sample sizes should be sufficiently large to allow robust conclusions to be drawn. Using this approach, Fera scientists have developed a method of continuous assessment of results-to-date, using Bayesian statistics.

The true failure rate is a binomial proportion and the Jeffreys uninformative prior for a binomial proportion is given by the *Beta(0.5,0.5)* distribution. The posterior probability density function for *p* is given by *Beta(x+0.5, n-x+0.5)* given *n* trials (captures) with *x* failures. Hence, the probability (p_S) of observing X or fewer failures in N future trials (captures), given x failures observed in n trials (captures), is given by the beta binomial distribution function:

$$p_s = \sum_{i=0}^{i=X} \binom{N}{i} \frac{B(x+0.5+i, n-x+0.5+N-i)}{B(x+0.5, n-x+0.5)}$$

Where *B(a,b)* is the Beta function which can be calculated using gamma functions:

$$B(a,b) = \frac{\Gamma(a)\Gamma(b)}{\Gamma(a+b)}$$

And

$$\binom{N}{i} = \frac{N!}{i!(N-i)!}$$

The AIHTS for restraining devices pass criteria can then be used to estimate the probability that the device tested will meet the AIHTS requirements based on results-to-date: after each capture, the probability is estimated of the device passing were the trial to be continued to 20 animals (assuming consistent performance). Decision rules established in advance can then be used to determine whether the device passes or fails based on results-to-date, or whether more captures are required in order to reach such a decision.

This approach is incorporated into the Home Office Project Licence and was used in previous trials of a badger body snare (Defra 2007).

Discussion of the procedure under the Ethical Review Process[11] (ERP) led to agreement that an appropriate probability of Type 1 error (i.e. of failing the snare on results-to-date when in fact its underlying performance was acceptable) was 5% or less (i.e. $p \leq 0.05$). Appropriate stopping points agreed on this basis are highlighted below in Table 5.2. Although one failure out of one trial should technically have stopped the trial, it was agreed that the stopping rule would not be invoked until at least two captures had occurred. In addition, it was agreed that the trial would not stop early if no failures were observed, because the benefits of having a greater number of replicates outweighed the costs to the captured foxes as long as no failures had occurred.

[11] For details on the role of the ERP see http://tna.europarchive.org/20100413151426/http://scienceandresearch.homeoffice.gov.uk/animal-research/publications-and-reference/publications/guidance/ethical-review-process/ethicalprocess.html

Trials (*n*)	Failures (*x*) 0	1	2	3	4	5
1	0.595	0.044				
2	0.740	0.160	0.006			
3	0.831	0.289	0.031	0.001		
4	0.890	0.417	0.077	0.004	0.000	
5	0.929	0.535	0.141	0.013	0.000	
6	0.956	0.640	0.220	0.030	0.001	
7	0.973	0.730	0.310	0.057	0.003	
8	0.984	0.805	0.407	0.096	0.007	
9	0.991	0.865	0.506	0.148	0.015	
10	0.995	0.911	0.604	0.213	0.027	
11	0.998	0.944	0.696	0.291	0.046	
12	0.999	0.968	0.779	0.381	0.073	
13	1.000	0.984	0.850	0.481	0.111	
14	1.000	0.993	0.907	0.586	0.164	
15	1.000	0.998	0.950	0.693	0.234	
16	1.000	0.999	0.978	0.796	0.326	
17		1.000	0.994	0.887	0.444	
18			1.000	0.959	0.591	
19				1.000	0.775	
20					1.000	

Table 5.2. Probability of a successful study (no more than 4 failures in 20 trials) given *x* failures in *n* trials. Red highlighted points indicate where the trial would stop early due to failure.

All personnel carrying out the trials held Home Office Personal Licences, permitting them to carry out the regulated procedure (i.e. capture in a snare) on the Project Licence. As the work was required to be carried out in the field, all field sites were identified as Permitted Off Designated Establishment Sites (PODES) and details were supplied to the Home Office at least 72 hours prior to use of any particular field site. A detailed procedure for action to be undertaken in the case of non-target species that were injured was agreed under the ERP prior to the trial (Appendix 8.6).

When unexpected circumstances arose out of office hours, the Project Licence Holder and Personal Licence Holder were to decide on the appropriate course of action. Any subsequent changes to the protocol were to be discussed and agreed through the ERP.

5.4.1.3. Snare operator

The technician chosen to undertake the field trials was considered to have a high level of competence. He has 20 years experience as a field-based wildlife biologist, working almost entirely on projects requiring the detection, capture, handling, tracking or humane dispatch of mammalian predator species. He has considerable experience of using snares to catch foxes for radio-tagging studies and first-hand experience of fox behaviour from the same studies. He has conducted scientific research on the use of snares by others in game management and provides input into industry recognised best practice guidelines, training and other educational material on fox snaring.

5.4.1.4. Field sites

Where possible, field sites that were familiar to the technician were selected. This approach most closely resembles snaring in the wider countryside, where operators work on familiar ground and are aware of areas and runs used by foxes and by non-targets. The field sites used were primarily lowland arable farms in central southern England, with a small proportion of pasture and woodland. During studies in the 1980s and 90s, the region had mid-range densities of fox, badger and roe deer, and hares were locally abundant (Reynolds & Tapper 1995a; 1995b); badger sett densities have increased subsequently, but this is unquantified. Written or verbal permission was obtained from all landowners for the trials and the Home Office was notified of the location of the sites at least 72 hours before any snares were set.

5.4.1.5. Protocol

Site survey

Before any snares were set, field sites were first surveyed for signs of fox activity. Fresh signs of fox activity included: scats, tracks, fur, sightings, prey remains or presence of a cubbing earth. Snares were set only in locations where there were fresh signs of fox activity. Locations with evidence of recent non-target activity were avoided.

Snare preparation and setting

Snares were de-greased and coloured following established guidelines (Defra 2005). Snares were supported with tealer sticks of 3 mm diameter copper rod. Each snare was attached to either a spiral anchor or an angle-iron anchor stake (depending on soil conditions), via an in-line data logger. All anchor stakes were driven fully into the ground to prevent their entanglement with the snare. The data logger was attached to the snare anchor swivel and the anchor with D shackles. Typically, snares were located in tramlines, field edges and grass runs and set according to the Defra CoP. The noose was set so that typically, the diameter was approximately 20 cm and the bottom of the noose was approximately 20 cm from the ground. Snares were not set in locations where captive entanglement with shrubby or woody material could occur. A maximum of 30 snares were set at any one time and the locations of all snares were recorded on a field map, which was updated daily. Snares were set on one landholding between 19th May and 29th May 2009. The data logger was activated when the snare was initially set and left running until the snares were dismantled. The loggers were set to record every 10 seconds.

Snare checking

Snares were checked twice daily, between 6.00-7:30 am and 4:00-6:00 pm. A daily diary of snaring activity, recording the number of snares set on any given day, and the times that the two snare checks were started and completed, was kept. Typically, a snaring session at any one land holding was expected to last for several consecutive days.

Snare captures

All foxes captured were killed using a 12-bore shotgun and a 30 g load of AAA shot, from a distance of 10-20 paces, dependent on how visible the fox was amongst surrounding vegetation and how it presented itself for a clear killing-shot. The aim was to keep any disturbance to a minimum. An eye-blink reflex test was used to check unconsciousness in any animals that were euthanized, and onset of rigor mortis to confirm death. All other animals held in snares were closely examined by the field worker and, if found to be uninjured, released. The protocol agreed with the ERP was followed for all non-target captures that were injured (Appendix 8.6).

For each capture (including animals that had escaped, were released, found dead or dispatched), the snare operator completed a capture sheet and assigned the capture event a unique code. Detailed field notes were written describing the capture site, the disturbance caused to the site, and anything else considered significant. Photographs were taken of the capture site. Where escapes occurred, the snare operator searched the capture site for any field signs that would indicate the species of the escaped animal. Field signs that were looked for included tracks, faecal samples, hair or body tissue samples stuck to the snare, and scents. All snares that animals escaped from were stored, and hair or tissue samples stuck to them were included. All carcasses, target and non-target, were placed in a freezer at -18^{o}C within 2 hours of discovery or humane dispatch.

Necropsies

Necropsies were carried out under contract by veterinary pathologists based in a University Pathology Department. The pathologists had at least five years experience of undertaking necropsies and were provided with fox carcasses that had been snared and killed prior to the current study to ensure they were familiar with the types of injury that could be expected. The pathologists were familiar with the AIHTS for restraining devices.

All carcases were defrosted prior to whole body necropsy. The pathologist necropsied carcasses by skinning and then examining the whole body for injuries. A report was written for the injuries, however minor and whether or not included in the AIHTS, occurring on each carcass (Table 5.3). The veterinary pathologist indicated on the reports which injuries could be attributed to the snare, which injuries could be attributed to the shot and those for which the cause could not be determined unambiguously. The pathologist was unaware of the field observations during the necropsy. All injuries that were described on the necropsy reports as attributable to the snaring event, or were ambiguous, were later cross-referenced with the technician's field observations. In addition, all injuries close to where the snare wire held the animal were considered further by the project leader and a veterinary surgeon experienced with injuries in wild foxes and badgers[12]. Where alternative causes of injuries seemed possible, these were discussed with the pathologist before a final consensus was reached on the most likely cause of each injury, if this could be determined.

Within the AIHTS for restraining devices, external haemorrhage is the only injury for which a descriptor is used to differentiate between injuries that are counted as indicators of poor welfare and those that are not. Unfortunately, a description of what constitutes a severe external haemorrhage is not provided in the AIHTS for restraining devices. The pathologist was asked to assess the severity of any haemorrhages found and provide a definition of these terms. The pathologist's definition of a severe external haemorrhage was taken as equivalent to a severe external haemorrhage as listed (but undefined) among the indicators of poor welfare in the AIHTS for restraining devices. Less severe external haemorrhages and haemorrhages that are not into a body cavity are not counted as indicators of poor welfare in the AIHTS for restraining devices. The scoring terms; mild, moderate and severe, reflected the intensity, distribution and extent of haemorrhage (Table 5.4).

Oedema: An accumulation of an excessive amount of watery fluid in cells, tissues or serous cavities, extravascular.
Congestion: Presence of an abnormal amount of fluid in the vessels or passages of a part or organ, intravascular.
Haemorrhage: Bleeding or the abnormal flow of blood.
Haematoma: An abnormal localized collection of blood in which the blood is usually clotted or partially clotted and is usually situated within an organ or a soft tissue space, such as within a muscle.
Extravasation: Leakage out of a vein, artery or capillary.
Compartment syndrome effect: Build up of pressure in heavily-muscled areas which are surrounded by fascia, a supportive tissue which is not very flexible. If pressure builds up in these compartments of muscle and fascia, it can cut off nerves and underlying muscle cells, causing widespread tissue death and other problems.

Table 5.3. Definition of some terms used in necropsy reports.

[12] The veterinary surgeon has had his own practice for over 10 years and has treated over 100 foxes and badgers brought to the surgery during this time. He is recognised as an expert in wildlife by the RSPCA.

Scoring term for haemorrhage	Definition
Severe	A haematoma would have been ranked as severe haemorrhage, provided it was large relative to the size of the area where localised. A haemorrhage would also be called severe when extending deep into multiple tissues and having a relative large size.
Moderate	Intra-tissue haemorrhages without haematoma formation would usually be classified as moderate or mild depending on intensity, size and depth within the area being described.
Mild	See above for intra-tissue haemorrhages. Blood extravasation would usually be classified as mild, except when a large area was covered, in which case it would be moderate.

Table 5.4. Definitions of the score used for haemorrhages in the necropsy reports

The tendency for a tissue in one body region to be severely affected may be greater than in another region but this may not be reflected in the suffering each provokes. For example, blood is more readily distributed in continuously active thin muscles, such as those in the abdominal wall, whereas in tightly bound muscles, such as those in the neck, a haematoma will not run so far. However, pain in the neck could be greater through a compartment syndrome effect. In other words, the pathologist's interpretation of the haemorrhage severity score is also site-specific.

Capture site disturbance scores

The site of each capture was assigned a score representing the degree of disturbance (Table 5.5). The degree of disturbance may represent the motivation of any restrained animals to escape. This assessment was made by the project leader from photographs, and field notes of the sites.

Score	**Description**
0	No visible disturbance
1	Edge of snare circle visible but majority of vegetation not flattened.
2	All vegetation within snare circle flattened but very little digging of soil
3	Excavation of soil over most of snare circle

Table 5.5. Description of disturbance scores used to assess capture sites

5.4.2. Results

Over a period of 10 days, during May 2009, a total of 211 snare nights were completed, ie the number of snares set multiplied by the number of trapping nights. Eighteen capture events[13] occurred during this time: 15 found at the morning check and three found at the afternoon/evening check (Table 5.6). Of these captures, 10 animals were still held in the snares at the time of inspection. The species caught were red fox (*Vulpes vulpes*), European badger (*Meles meles*) and brown hare (*Lepus europaeus*).

Species	Fox	Hare	Badger
Captures	3	13	2
Escapes (snare intact)	0	5	0
Escapes (component failure)	1	0	2
Captured and held	**2**	**8**	**0**
Alive, uninjured	2	3	0
Severe Injury/dead	0	3	0
Predated	0	2	0

Table 5.6. Summary of capture events from study 1 using snare type A

5.4.2.1. Escapes where the snare was intact

Examination of the snares showed very little physical impact apart from the noose being drawn towards the eye and the snare being displaced from the tealer.

5.4.2.2. Escapes due to mechanical failure of a component.

The attachment brackets on two of the data-loggers broke following the capture of a fox and a badger, identified from the field signs, allowing both animals to escape with a snare attached (see Appendix 8.7 for description). Also at this point, two hares out of three captured (excluding those where there was evidence of predation) had been injured, invoking the stopping rule agreed with the ERP (section 5.3.1.2). The trial was therefore suspended. However, after discussion with the ERP, extra snares (without loggers) and the existing snares were deployed for a further 3 days in an attempt to recapture the escaped fox and so minimise any possible adverse welfare effects. After this, all snares were equipped with an additional chain between the anchor point and snare, to ensure that if another logger bracket snapped, the captured animal could not escape with the snare around it. The snares attached to the broken data-loggers were not found near to the capture site, and an extensive and thorough search of all field boundaries within the area and leading back to the nearest badger sett did not locate the animals or snares.

During this 3 day period of additional snare deployment a second badger escaped from a snare that had a chain attached (Figure 5.9). The chain and logger bracket remained intact *in situ* but the cable broke between the middle swivel and the noose, allowing the badger to escape with the wire noose around it. A careful search of all hedgerows and field boundaries within 400 m of the snare site over the following three days did not locate the animal or the snare noose. A fox cage trap belonging to the landowner, already situated close to the capture site, was baited with maize and peanut butter, set and checked for three days. A second, new cage trap was also baited and deployed in this area. Neither trap caught any badgers. Examination of

[13] A capture event was defined as any instance where there was evidence of the snare holding an animal, even momentarily.

the snare showed that both the anchor swivel and middle swivel had been rendered inoperative after the badger had been captured. The anchor swivel was stretched, buckled, buried in soil and vegetation and, at the time of inspection, it could not function (Figure 5.10). The middle swivel too was inoperative at the time of inspection and it appeared that pulling forces on the cable by the captured badger had caused it to jam (Figure 5.11). The cable broke 2 cm back from the stop, and the ends of the cable were frayed (Figure 5.12). It seems unlikely that the eye could have passed over the frayed ends and the noose would not have been able to open much larger than the minimum size determined by the stop. After this capture, all snares were taken up and snaring was suspended. The actions taken in response to the failure of the snares were all explained to the ERP and were fully supported.

Figure 5.9. The capture site where the snare broke following capture of a badger.

Figure 5.10. The anchor-swivel of the snare that broke following capture of a badger. The anchor-swivel was distorted and the snare cable could not be rotated at this swivel.

Figure 5.11. The middle swivel of the snare that broke following capture of a badger. The two ferrules within the swivel are jammed together and the snare cable did not rotate at this point.

Figure 5.12. Fraying of the snare cable that broke following the capture of a badger

5.4.2.3. Necropsy

Necropsies of the two foxes that were captured and held, found no injuries that would be classified as being indicators of poor welfare according to the AIHTS for restraining (Table 5.7).

The injuries found on the foxes were haemorrhages in the area of the neck where the snare was positioned. These haemorrhages extended from the surface muscle into the deeper muscle .They were assessed as moderate in one case and mild in the second by the veterinary pathologist.

Three hares were found dead during inspections. In two of these cases, there was clear evidence of predation and field evidence suggested that the predator was most likely a fox. As snare injuries could not be distinguished from predator injuries, it was not possible to determine whether these hares did or did not have any indicators of poor welfare due to the snare. Exposure to predators as a result of being held in a restraint is a known but not quantified welfare cost to hares held in snares. There is no established procedure under the AIHTS for consideration of predated captures. For this study, it was decided that all captured animals, where there was evidence of predation, would be excluded from any humaneness analysis, to avoid ambiguity. Of the five hares that were alive when the snares were inspected, two were euthanized due to their condition/injuries. The first had a severe injury to its eye and the second was lying immobile but was still conscious. Although the injured eye may have been caused by a predator (e.g. carrion crow, raven, buzzard), there was no way of verifying this, so this hare was counted in the assessment.

Three hares that were captured and held were released. Before release, a thorough examination was undertaken. No injuries or swellings were found on any of these hares. The snare was positioned round the neck of two hares and the abdomen of the third. The extent of any injuries to the escaped animals could not be determined.

	Number of animals caught and held (predated animals excluded)	Number of animals with indicators of poor welfare
Fox	2	0
Hare	6	3
Total	8	3

Table 5.7. Assessment of results using AIHTS for restraining devices.

5.4.2.4. Entanglement

Although the snares had been placed so as to avoid entanglement with fences or woody shrubs, three of the snares did become entangled with non-woody vegetation. This occurred with two of the snares that held hares and the snare that broke. For the two hare captures, the vegetation entangled was oilseed rape stalks at a height of 120 cm and wheat stalks at 50 cm. The snare that broke, in which the badger had been captured, was entangled in a mixture of soil, loose vegetation that had been excavated by the badger and the safety chain which had been added to the snare.

5.4.2.5. Duration of capture

For all animals that were captured in snares with a data logger attached, the duration of restraint in the snare was determined from the loggers (Table 5.8).

Capture code	Species	Time in snare (hh:mm)	Outcome	
Dt1	Hare	00:01	Escaped	
Dt2	Hare	00:26	Escaped	
Dt4	Hare	00:00	Escaped	
Dt12	Hare	00:01	Escaped	
Dt13	Hare	02:03	Escaped	
Dt5	Hare	00:43	Held	Dead/predated
Dt6	Hare	01:07	Held	Released
Dt7	Hare	04:40	Held	Dead/predated
Dt8	Hare	06:13	Held	Dead
Dt9	Hare	08:35	Held	Killed (injured)
Dt18	Badger	05:48	Escaped	
Dt3	Fox	02:12	Held	Killed (no injury)

Table 5.8. The duration that animals were held in the snare before either being found or escaping.

Five hare captures ended in escape after periods ranging from 1 min to 2 hr 03 min. Two of these captures (dt-2 and dt-1) are believed to have been consecutive brief captures of the same hare in adjacent snares. The captured badger escaped after 5 hrs 48 min.

For the animals that were captured and held until inspection, the period of restraint ranged from approximately 43 minutes, for one hare, to 8 hours 35 minutes, for another hare. The only fox for which logger data was obtained was caught during the day and was held for just over two hours before it was killed at the afternoon snare check round.

For two hares that were predated, activity was recorded by the loggers for 43 minutes and 4 hrs 40 minutes after capture; it is unknown how much of this recorded activity was caused by the predator killing/consuming the hare.

5.4.2.6. Time spent active

Data from loggers showed that for hares, the proportion of time spent active in the first hour after capture ranged from 1% to 36% (mean for restrained hares 18.4%; Table 5.9). For hares that were held for longer periods, activity fell in successive hours. Where captured hares were predated, it is impossible to distinguish activity of the hare from activity of the predator.

Logger data for the single fox indicated that it was most active in the first hour after capture (32% of time), and progressively decreased to 11% in the third hour, after which it was killed. The badger, which escaped after 5 hrs 48 min, was active for 85% of the first hour after capture, declining to 5% in the sixth hour.

							% of logger records indicating movement in each hour after capture											
species	**id**	**time caught**	**time of snare inspection**	**time of last active recording**	**maximum period in snare**	**fate**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
hare	dt-8	19:28	06:36	06:36	11:08	recovered dead	12	1	1	0	4	0	3	0	0	0	0	0
hare	dt-5	21:12	06:46	06:46	09:34	recovered dead (predated)	15	0	0	0	0	0	0	0	0	(2)*		
hare	dt-7	00:37	06:32	06:32	05:55	recovered dead (predated)	15	8	6	4	2	0						
hare	dt-9	21:53	06:25	06:25	08:32	recovered alive but injured, dispatched	14	0	0	1	0	1	0	0	0			
hare	dt-6	05:32	06:41	06:41	01:09	recovered alive, released	36	12										
hare	dt-13	19:36	06:50	21:31	01:55	escaped	26	12										
hare	dt-12	08:05	08:08	08:06	00:01	escaped	10											
hare	dt-1	20:48	06:46	20:49	00:01	escaped	2											
hare	dt-2	20:22	06:46	20:48	00:26	escaped	6											
hare	dt-4	14:56	17:02	15:11	00:15	escaped	11											
fox	dt-3	13:58	16:12	16:12	02:14	alive, uninjured, dispatched	32	22	11									
badger	dt-18	23:14	06:30	05:02	05:48	escaped	85	40	39	36	23	5						

Table 5.9. Activity of animals captured in Snare type A, trial 1, by hour after capture. Loggers recorded peak values within consecutive 10s intervals of mechanical shocks in a direction perpendicular to the snare cable. The proportion of these records greater than zero was then determined for each hour after capture. Capture time and escape time (where appropriate) were determined from the onset and cessation of records greater than zero. * indicates movement of the logger caused by the technician.

5.4.2.7. *Disturbance to capture site*

One hare caused no visible disturbance to the capture site, whereas a second hare flattened all the vegetation within reach of the anchor point (Table 5.10). Insufficient data were obtained in this trial to explore whether the amount of disturbance to the capture site was related to the duration of restraint.

	score 0	score 1	score 2	score 3
Fox	0	0	3	0
Badger	0	0	1	1
Hare	4	6	3	0

Table 5.10. Number of capture sites of each species assigned to each disturbance score (0=no disturbance, 1= edge of snare circle visible, 2=vegetation flattened, no digging, 3= digging).

5.4.2.8. *Review of results*

The results obtained were discussed under the Ethical Review Process. At that point in time, results-to-date suggested a 74% probability (Table 5.11) that the snare (type A) would pass with respect to the target species (fox), if the trial was continued to 20 animals. The escape of a third fox was attributable to the logger bracket failing, and the condition of this animal was unknown.

	Failures (x)					
Trials (n)	0	1	2	3	4	5
1	0.595	0.044 b				
2	0.740a	0.160	0.006			
3	0.831	0.289	0.031	0.001		
4	0.890	0.417	0.077	0.004	0.000	
5	0.929	0.535	0.141	0.013	0.000	
6	0.956	0.640	0.220	0.030c	0.001	
7	0.973	0.730	0.310	0.057	0.003	
8	0.984	0.805	0.407	0.096	0.007	
9	0.991	0.865	0.506	0.148	0.015	
10	0.995	0.911	0.604	0.213	0.027	
11	0.998	0.944	0.696	0.291	0.046	
12	0.999	0.968	0.779	0.381	0.073	
13	1.000	0.984	0.850	0.481	0.111	
14	1.000	0.993	0.907	0.586	0.164	
15	1.000	0.998	0.950	0.693	0.234	
16	1.000	0.999	0.978	0.796	0.326d	e
17		1.000	0.994	0.887	0.444	
18			1.000	0.959	0.591	
19				1.000	0.775	
20					1.000	

Table 5.11. Probability of a successful study given *x* failures in *n* trials. a = probability from 0 failures out of 2 fox captures, b = probability from 1 failure out of 1 badger captures, c = probability from 3 failures out of 6 hare captures, d = probability of 9 failures out of 16 captures, e = probability of passing given 4 failures out of 16 captures.

The AIHTS for restraining devices was also used to consider any welfare issues with non-target captures.

For the purposes of assessment a precautionary approach with respect to animal welfare was taken, counting the badger which escaped due to breakage of the snare as a failure. The case where the logger broke, can not be used to assess humaneness of the snare device. These results-to-date suggested 95% probability of failing the AIHTS for restraining devices if the trial continued and 20 badgers were caught (as non-targets) with the same rate of indicators of poor welfare occurring.

Three of the six hares held had indicators of poor welfare (Table 5.7), suggesting a 97% probability that the snare would fail the AIHTS for restraining devices if the trial continued and 20 hares were caught (as non-targets) with the same rate of indicators of poor welfare occurring (Table 5.11). There was no reason to implicate the logger as a cause of poor welfare with the hares, though predation by foxes was clearly an issue.

Across all three species, and taking all escapes as cases of poor welfare, there was a worst-case interpretation of 9 cases of poor welfare out of 16 captures, implying likely failure of the device under the AIHTS for restraining devices, no matter how large a sample was gathered. Taking a best-case interpretation (in which all escaping animals, except the badger where the snare cable broke, were assumed to be in good condition), there were four cases of poor welfare out of 16 captures. These results suggested that there was a 67% probability that the device would have passed had the trial continued until 20 animals of any species had been caught.

The ERP recommended termination of the trial with this snare, based on results-to-date. The ERP decided that the trial using snare type A could have continued if a) the snare could be set in such a way as to guarantee avoidance of non-target captures or b) it was set in an environment where hares and badgers could be guaranteed not to be present.

Broken snares can allow the captured animal to escape with the noose around its neck or body. To avoid this scenario, which is suspected often to lead to poor welfare, the IWGS had recommended that all snares should have effective swivels and a designed-in weak point at the eye. Swivels were intended to prevent the cable unwinding (and so becoming more vulnerable to breaking) and the weak-eye was intended to prevent snare nooses remaining on animals strong enough to break the cable or fastenings. Claims from the manufacturer that effective stops and swivels were present had not been verified mechanically prior to this trial. The trial had shown that, despite testing intact snares for cable strength, the snare itself could be broken in use as a result of swivels becoming inoperative under field conditions which allowed the cable to unwind. This demonstrated the importance of the *quality* of the components as opposed to just their presence in the design.

Breakage of the logger connection had allowed two animals to escape with attached snares. Based on previous fox research in which video-footage showed wild foxes avoiding novel objects, the technician also expressed concern that the presence of the logger could be influencing the ratio of target:non-target captures. To avoid the possibility of the logger biasing results in any further trials, it was agreed not to use the logger should any more trials be undertaken.

It was agreed with the ERP that another field trial could be undertaken only if a snare was used that had been mechanically tested to show that it complied fully with the CoP. It was decided that if a commercially available snare could be identified that performed satisfactorily in mechanical tests designed to simulate practical conditions, a second field trial would be undertaken.

5.5. Mechanical testing of fox snares

The aim of this mechanical testing procedure was to assess whether there was a commercially available snare that could meet the CoP under practical conditions likely to be encountered during field use. For instance, a stop is effective only if it does not move when an animal is caught. Likewise, a swivel is effective only if it allows rotation under field conditions when put under strain by an animal pulling on and /or rotating it. A type of snare which passed the mechanical testing was not guaranteed to prevent poor welfare indicators occurring but one which failed was considered to have an unacceptable risk of failure in the field.

5.5.1. Methods

Mechanical testing consisted of three parts with the aim to mimic the kinds of stresses likely to occur in the field: a rotation test (to mimic an animal rolling and potentially unwinding the cable), a drop test (to mimic an animal pulling on the snare) and a second rotation test. The aim was to test 20 examples of any one snare type.

For the rotation test the snare, under tension from a weight, was rotated 10 times both clockwise and anticlockwise (20 in total), with each swivel being tested independently.

For the drop test, a weight was attached to a 7 cm diameter cylinder (to mimic the size of a fox neck), held by the noose of the snare (Figure 5.13). The weight was then dropped from a 1 m height so as to put the whole snare under strain. The test weight was 15 kg initially, as this corresponded to the weight of a heavy non-target animal (badger), and a 1 m drop height corresponded to the distance between anchor stake and the limit of the snare. If the first 5 tests all failed, subsequent snares were tested using a 10 kg weight instead of the 15 kg weight. Again, if the first 5 tests with the 10 kg weight all failed, up to 20 further snares were tested with a 5 kg weight.

The second rotation test was carried out on the same snare after it had been ‘drop tested’ as described above. At the end of the rotation test, the snares were tested to determine whether they had become self-locking. This consisted of drawing the snare noose tight around the knuckles of a clenched adult human fist, releasing the tension on the cable and flexing the fingers. The snare was described as self–locking if the eye did not shuffle back down the cable. Measurements of all components of the snare were taken prior to and after the test. The location of any break was noted.

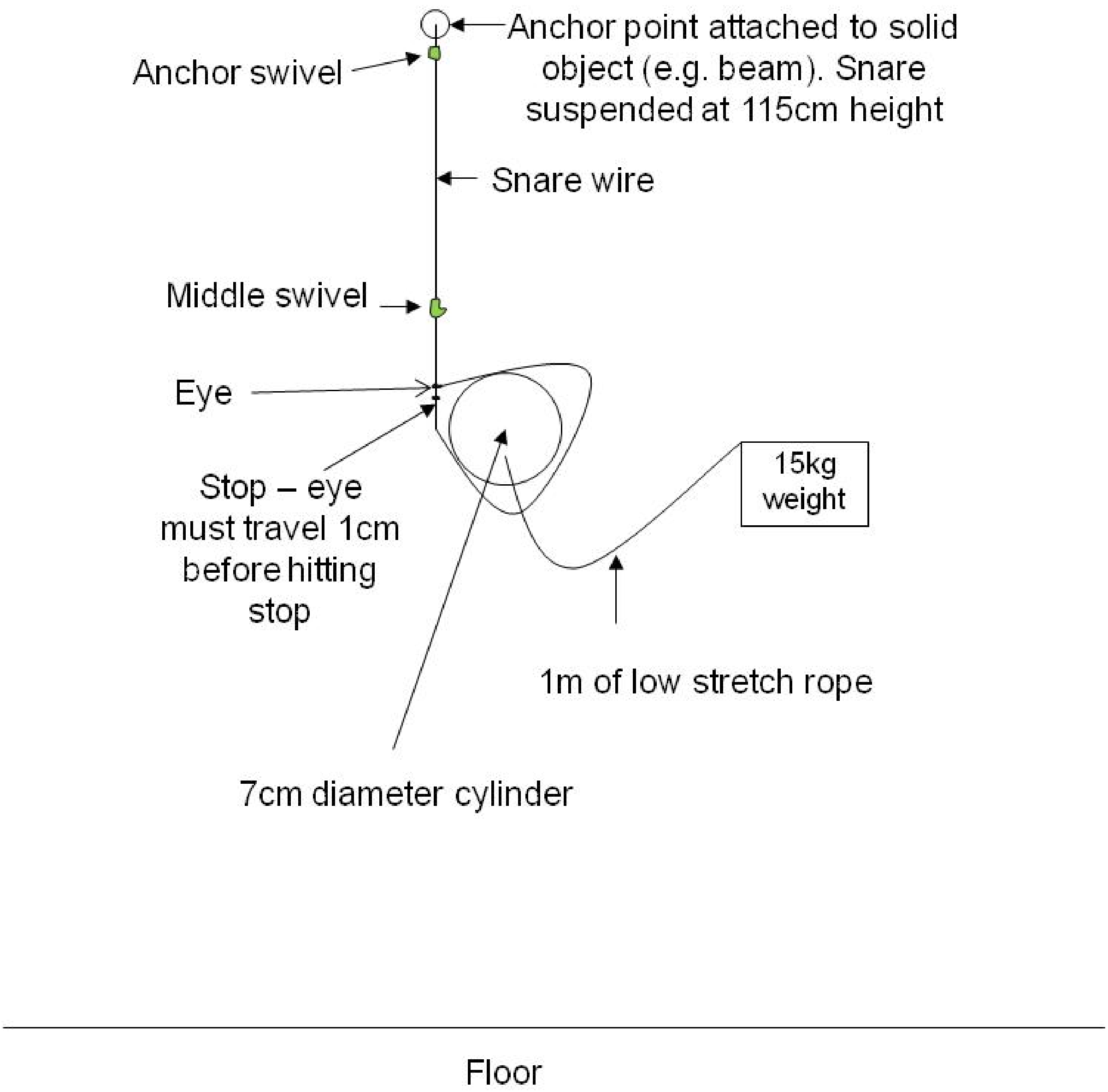

Figure 5.13. Schematic drawing of test set up with drop weight.

The following outcomes were classed as unacceptable, in that they were likely to render the snare non-compliant with the Defra CoP and could have potentially caused serious injuries if they were to have happened in the field.

1) Any snare which broke allowing the cylinder and the weight to fall to the ground and the breaking point was not the eye.

2) Any snare where the ‘stop’ had moved.

3) Any snare that was self-locking after the drop test.

The three types of snare selected prior to any field trials were tested. One type of snare (snare C) incorporated a break-away design, that was claimed to open when badgers were caught, and at a weight of approximately 5 kg. Tests on this snare started with 5 kg weights and, as the breakaway device opened on all snares at this weight, tests with heavier weights were not carried out.

5.5.2. Results and Conclusion

Snare type C was the only type of snare tested that showed none of the unacceptable outcomes (Table 5.12type). Snare type A failed for all three reasons, some broke at places other than the eye (Figure 5.14), some became non-running and on some the stop moved. With snare B all 20 failed the non-running test after the 5kg drop test (Figure 5.15). When snare type C was tested with the 5 kg drop weight, all twenty examples of this type of snare opened at the eye, and it was decided to use this snare for subsequent trials. When the manufacturer of snare type C was contacted to procure 300 snares, they could not deliver them in the time frame required. A fourth snare manufacturer, identified from a web search, was then contacted to enquire as to whether they sold a snare (snare type D) that met the CoP and that a sufficient number could be supplied. As with snares type A & B, the manufacturer did not sell the snare with an anchor swivel fitted as standard. However, the snare did contain a breakaway device within the noose. Snares of this type, but with an anchor swivel fitted by the manufacturer, were obtained and underwent the mechanical testing. Snare type D also showed none of the unacceptable outcomes and the breakaway device opened on all snares when tested with the 5kg drop weight.

Snare type	**Drop weight**	**Number tested**	**Number passed assessment**	**Number failed**	**Failure reason**		
					Snare broke other than at eye	**Non-running**	**Stop moved**
A	15	5	0	**5**	**5**	0	0
	10	10	**1**	**9**	**5**	**4**	0
	5	20	**5**	**15**	**7**	**4**	**4**
B	15	5	0	**5**	**2**	**3**	0
	10	5	0	**5**	0	**5**	0
	5	20	0	**20**	0	**20**	0
C	5*	20	**20**	0	0	0	0
D	5	20	**20**	0	0**	0	0

Table 5.12. Results from tests performed on three brands of snare. *Snare incorporated breakaway device opened when5kg weight was used, therefore heavier tests not performed. ** Breakaway device was attached to the eye, but caused a break within the noose and therefore would allow the animal to escape without the cable attached.

Figure 5.14. Illustration of end crimp failure with snare type A

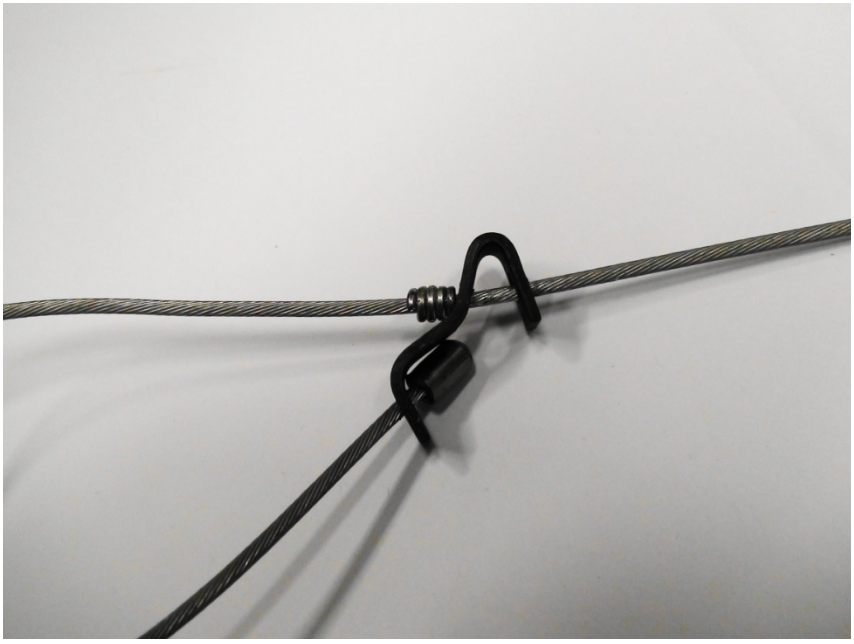

Figure 5.15. Illustration of non-running eye caused by the eye plate deforming during the 5kg test on snare B.

5.6. Field trials of fox snares – Study 2

Having identified a snare that met the mechanical testing requirements and thus increased assurance that the snare would meet CoP requirements under practical field conditions, a second field study was agreed by the ERP and undertaken using snare type d. The second field study was undertaken between 2nd November 2009 and 18th May 2010. Snares were not set continuously, and were either rendered inoperative or removed entirely during periods of adverse weather.

5.6.1. Method

Overall, the method used was similar to that described for study 1 but without the loggers and with the following changes to the protocol (see Appendix 8.8).

5.6.1.1. Snare description

Snare type D (Figure 5.16) was constructed of 2.1 mm diameter cable. The distance between the stop and eye was approximately 27.5 cm (range 27-28 cm; Figure 5.17) this was longer than in snare type A (23 cm), due to insertion of the breakaway device.. The length of the snare from the eye to where the middle swivel attached to the bottom half of the snare cable, was 80 cm and from this point to the bottom of the anchor swivel was 66.5 cm, giving the overall length of snare as 146.5 cm. A breakaway device was positioned between the eye and the snare wire. The eye hardware was a ‘Relax-a-Lock’, procured from the USA (Kaatz Bros Lures, 9986 Wacker Rd, Savanna, IL 61074) and designed as a non-tightening eye.

The data loggers were not used, to prevent the loggers contributing ambiguity to the welfare assessment.

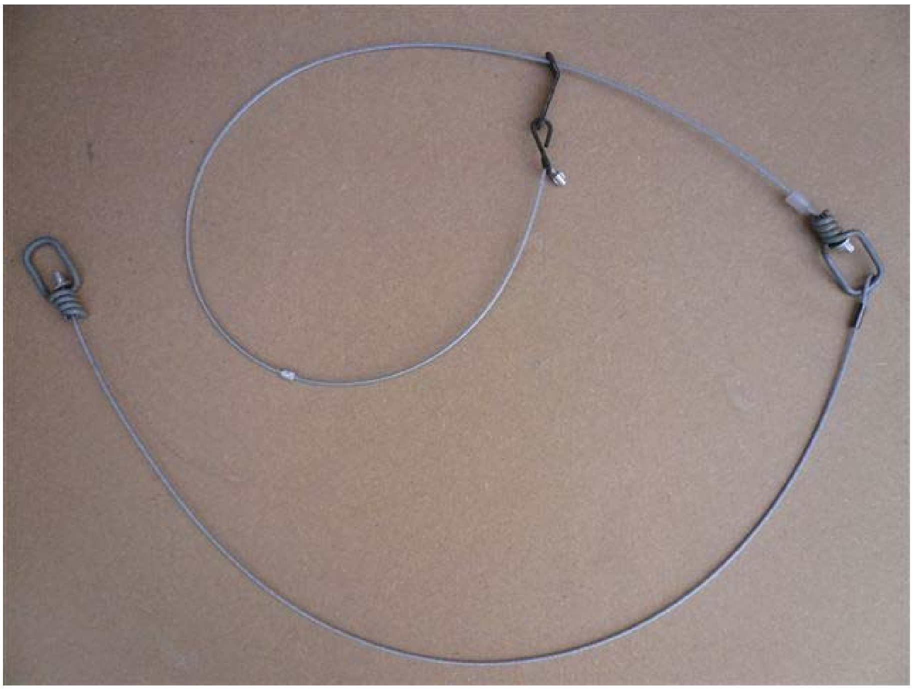

Figure 5.16. Snare type D.

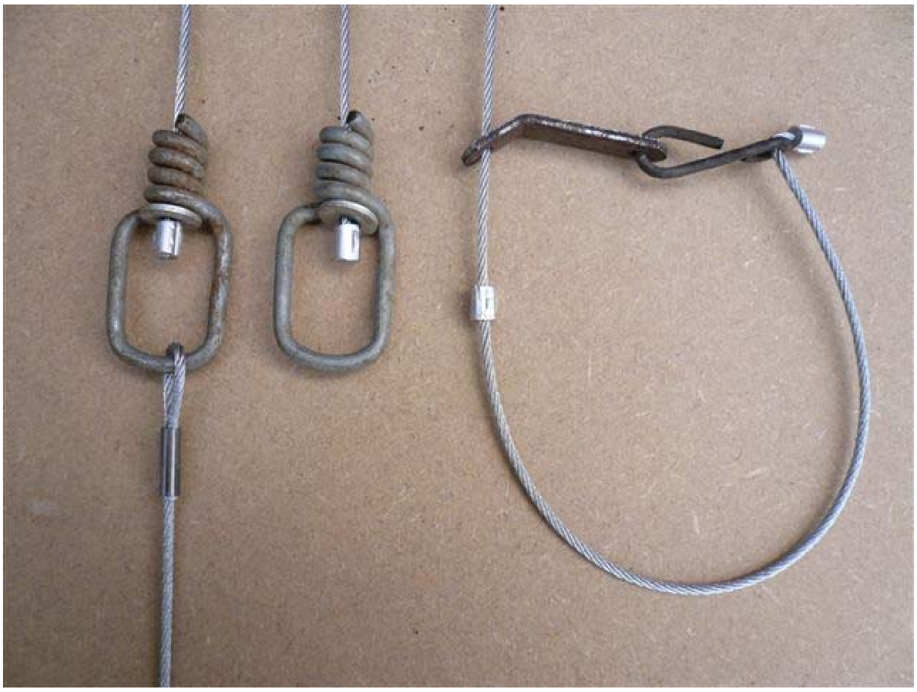

Figure 5.17. Components of snare type D, showing from left to right: middle swivel, anchor swivel, stop, running eye and break-away device.

5.6.1.2. Field sites

Site-specific factors were expected to influence outcomes. To ensure that capture events took place under a variety of environmental conditions (e.g. crop types, fox density, non-target density, etc.), a new field site was used each time a fox was caught. To maximise snaring effort, field sites were also changed if no fox had been caught after snaring had been carried out over seven separate nights. Sites where a fox was caught were not revisited for at least 3 months. Despite fresh activity being found, some sites were not used because of excessive non-target activity. These rules on changing field sites caused the snare operator to use several sites that he was not familiar with.

5.6.1.3. Snare captures

All captured hares, in addition to all foxes, were killed. The first hare captured in snare type d was killed following the protocol used in trial one (point-blank head shot from a .177 air pistol loaded with a Prometheus pellet). Compared with hares dispatched in the first trial on grounds of poor welfare, the first hare captured during trial 2 was difficult to immobilise prior to dispatch and it was apparent that this procedure might itself cause or exacerbate injuries. Thereafter, all captured hares were killed with a 12 bore shotgun using 21 grams of 7.5 shot, fired from 10-20 paces. Changes to the detailed procedure for action to be undertaken in the case of capture of a badger were agreed with the ERP prior to the trial (Annex A of Appendix 8.8).

5.6.1.4. Licences

A brief capture of a badger, even if it subsequently escaped, was interpreted as ‘taking’ under the Wildlife and Countryside Act and discussions were held with Natural England as to when and if a Licence would be required. The outcome was that badger captures that were accidental did not require a licence but captures that could be predicted would require a licence. For the purposes of this study, it was suggested by Natural England that if the proportion of badgers caught exceeded 10% then a licence should be applied for. After one badger had been caught by a snare, but subsequently escaped, a licence from Natural England was applied for and granted. The licensee was permitted to capture and kill a maximum of 10 badgers but was required to release captured badgers unless these had injuries judged likely to cause suffering in the wild or to seriously impair survival in the wild. A protocol for dealing with captured badgers was agreed with the Named Veterinary Surgeon as certified by the Home Office (Appendix 8.9). Foxes remained the sole target species and measures to avoid catching badgers were continued.

The stopping rules based on indicators of poor welfare were employed as in the first trial but the probability of Type 1 error (i.e. of failing the snare on results-to-date when in fact its underlying performance was acceptable) was reduced to 1% (i.e. $p \leq 0.01$) (Table 5.13). This was to allow for a more robust evaluation against the AIHTS for restraining devices, and also comparison with other capture devices and future assessment against other proposed standards. It was therefore proposed that using a probability level of 99% to determine stopping was more appropriate for this study than 95%, and this was agreed by the ERP.

At the start of the trial, it was agreed that if no failures had occurred, the trials could continue until data had been collected on 20 target animals. However, when the trial continued into the breeding season of foxes, discussions with the ERP concluded that the increased welfare cost to any dependent cubs must be taken into consideration, and that the probability table (Table 5.13) should be used to ensure that the trial did not continue into the breeding season any longer than necessary. It should be noted that this did not reflect normal practice where no consideration of the fox breeding season is required.

The main addition to the procedure was that welfare assessment should extend to animals that were captured but not held. The technician's field notes from such events were discussed with the project leader on a daily basis and with the ERP on a monthly basis.

Trials (n)	Failures (x) 0	1	2	3	4	5
1	0.595	0.044				
2	0.740	0.160	0.006			
3	0.831	0.289	0.031	0.001		
4	0.890	0.417	0.077	0.004	0.000	
5	0.929	0.535	0.141	0.013	0.000	
6	0.956	0.640	0.220	0.030	0.001	
7	0.973	0.730	0.310	0.057	0.003	
8	0.984	0.805	0.407	0.096	0.007	
9	0.991	0.865	0.506	0.148	0.015	
10	0.995	0.911	0.604	0.213	0.027	
11	0.998	0.944	0.696	0.291	0.046	
12	0.999	0.968	0.779	0.381	0.073	
13	1.000	0.984	0.850	0.481	0.111	
14	1.000	0.993	0.907	0.586	0.164	
15	1.000	0.998	0.950	0.693	0.234	
16	1.000	0.999	0.978	0.796	0.326	
17		1.000	0.994	0.887	0.444	
18			1.000	0.959	0.591	
19				1.000	0.775	
20					1.000	

Table 5.13. Probability of a successful study (no more than 4 failures in 20 trials) given *x* failures in *n* trials. Red highlighted points indicate where the trial would stop early due to failure and green highlighted points indicate where the trial would stop early due to meeting the requirements, using a probability criteria of 99%.

5.6.2. Results for 2nd Field Study (2 November 2009-18 May 2010)

A total of 1,704 snare-nights were completed. Forty-four capture events were recorded during this time, with 21 (48%) of these being instances where the captured animal had escaped and 23 (52%) being where animals were held until the snares were checked (Table 5.14). Excluding escapes, this gave a capture rate of one animal per 74 snare nights. The species captured (including escapees) were fox, badger, brown hare, pheasant (*Phasianus colchicus*), domestic dog (*Canis lupus familiaris*) and deer of unknown species. Both male and female foxes and badgers were caught. Two foxes and one badger were lactating. Escapes by deer (3/3), hare (5/7), pheasant (1/2) and badger (9/14) occurred but he species could not be identified for three escapes. Four escapes resulted from activation of the breakaway device. The breakaway device contributed to the escape of two badgers, one hare and one deer, and was partially opened in the case of one of the restrained hares. No snares broke during the trial but some fraying of the cable occurred in the case of one fox capture.

Species	Fox	Hare	Badger	Other
Captures	14	7	14	9
Escapes (snare intact)	0	5	9	7
Escapes (component failure)	0	0	0	0
Captured and held	**14**	**2**	**5**	**2**
Alive, uninjured	14	2	5	2
Severe Injury/dead	0	0	0	0
Predated	0	0	0	0

Table 5.14. Summary of captures made during trial 2 with snare type D

Sixty one percent (14) of the caught and held animals were of the target species (fox), if all interactions with the snare are included then 32 percent of potential captures were the target species. The numbers of non-target species caught and held were: five badgers, two hares, one pheasant and one dog. Field examination found only minor injuries, such as hair loss, on the held foxes and hares. Thirteen of the foxes and both hares were observed briefly while active before they were killed. One fox remained crouched low to the ground until shot. This fox was not initially seen due to its close proximity to a second captured fox. However, its posture indicated that it was conscious; it was crouched on its stomach, in the middle of a tramline. None of the foxes or hares displayed any behaviours to suggest that they were injured.

The behaviour of all badgers held was observed prior to approach for evidence of their condition. All five badgers were then quietly approached, restrained (using either a stick on the snare or a special animal handling pole), and closely examined. No visible injuries or swellings were observed on any of the five badgers. After examination they were released ensuring that no snare was attached to them and that they were guided away from other snares in the vicinity. All five badgers were observed as they ran away from the capture site and none showed any signs of injury or ill health.

The one pheasant that was held was also observed and checked over prior to its release. No visible signs of injury were seen and on release the pheasant flew, landed and immediately began calling and displaying.

The one dog that was held belonged to an agronomist who was walking crops on private land. The dog was released by its owner approximately 5 minutes after capture. The dog’s owner was contacted three days after the incident and reported that the dog had not suffered any physical injury or obvious distress.

5.6.2.1. Necropsy

Whole body necropsy was carried out on 14 foxes and two hares. Injuries attributed to the snare ranged from subcutaneous oedema to muscle haemorrhage (Table 5.15). 10/14 foxes had oedema associated with the location of the snare on the body; this was classified as moderate in 2 cases, mild in 8 cases. One fox (dt61) had a moderate haemorrhage in a muscle attributed to the snare and two had mild lung oedema. 4 foxes had no injuries attributed to the snare. 10/14 foxes had faeces in the rectum; 3 of the 4 foxes with no rectal contents had no injuries attributed to the snare.

One fox had a skin perforation that was attributed to the snare but this was small and was not associated with any haemorrhage (Table 5.16). Skin or muscle indentation (but not laceration) was seen in two foxes; in both these cases the snare was located around the neck and shoulder and the indentations were in the vicinity of the snare. In all foxes, the circumference of the neck was less than the circumference of the snare noose when drawn up to the stop, so the stop would have prevented the noose from tightening to a size smaller than the foxes' necks. The neck of the largest fox was 26 cm circumference, whereas the smallest snare noose was 27 cm. The most severe injury attributable to the snare was found on the one cub that was caught. A haemorrhage extended deep (pathologist's description) into the right temporal muscle (a small muscle on the head) and was associated with moderate oedema in the surrounding area.

The necropsy found an injury on one fox, not in the vicinity of the snare, that the pathologist initially attributed to the snare. This was damage to the shoulder ligaments but not dislocation of the joint. Such an injury would not be classified as an indicator of poor welfare under the AIHTS for restraining devices. The technician's field notes for this fox were examined by the project leader to determine whether such an injury had been apparent at the inspection and prior to euthanasia. This fox was observed jumping and moving with ease while approached and was shot while leaping up in the air. The fox's left shoulder was the first part of its body to hit the ground after the shot. It fell onto hard ground with no vegetative cover. Further discussion with the pathologist resulted in agreement that the probable cause of this injury was trauma occurring at death.

The snare was positioned around the abdomen in one captured hare and around the neck and shoulder of the second captured hare. The necropsy on the first hare found an area of the abdomen where the fur had been removed. There was fur loss along a 17.5 cm length of skin around the loin, at the position of the wire. At its widest point, the region without fur was 4 cm wide. The skin in the region of the wire was not perforated. Extravasation was found in the left ventral abdominal wall (5 x 2.5 cm) extending to the medial aspect of the left hind leg. This haemorrhage extended through the depth of the abdominal wall but was not present in the muscles lining the ventral aspect of the vertebral column.

The second hare had five areas of fur loss with skin reddening. The areas of skin loss were positioned in the vicinity of the snare wire on the hare's shoulder and on the upper hind leg. The largest area affected was on the hind leg and measured 5 x 3.5 cm. This hare had two teeth like perforations in the skin of one shoulder. Extensive mild to moderate haemorrhagic oedema was also found around the neck and shoulder.

ID	Date	Sex	Snare position	Skin perforation	Skin indentation	Contents in rectum	Oedema associated with snare	Haemorrhage associated with snare	Lung Oedema
Dt21	12/11/09	F	Neck	X	X	Yes	X	X	X
Dt25	22/11/09	M	Neck	X	X	Yes	Mild subcut	X	X
Dt26	22/11/09	M	R neck to L axilla	X	Y, axilla not neck.	Yes	4 mild subcut	X	X
Dt27	25/11/09	M	Neck	X	X	Yes	Mild subcut	X	X
Dt29	16/12/09	M	Neck	X	X	No	X	X	X
Dt30*[14]	16/12/09	M	L neck & R axilla	X – skin reddening R axilla	X	No	X	X	X
Dt33	20/1/10	M	Neck	X	X	No (Colon)	X	X	X
Dt39	19/3/10	M	Lumbar	X	Y	No	Mild subcut	X	X
Dt44	29/3/10	M	L neck & R axilla	X	ventral aspect of neck, but not dorsal .	Yes	Mild subcut	X	Mild
Dt48	27/4/10	M	Neck	X	X	Yes	Mild subcut	X	X
Dt49	27/4/10	F	Neck	Y, no haemorhage	X	Yes	Moderate subcut	X	X
Dt55	30/4/10	F (Lact)	Neck	X	X	Yes	Moderate subcut	X	Mild
Dt60	13/5/10	F (Lact)	Neck	X	X	Yes	Mild subcut	X	X
Dt61	18/5/10	M	Neck	X	X	Yes	Moderate subcut	Y moderate	X

Table 5.15. Summary of necropsy data from foxes for field trial 2 (subcut = subcutaneous)

[14] Not observed walking/moving prior to euthanasia.

ID	Description of injuries attributed to the snare observed during necropsy
Dt25	Mild subcutaneous oedema (7 cm x 5 cm) in the dorsal aspect of the cranial half of the neck; not associated with a shot hole. Patch of very mild congestion in the superficial layers of the muscles on the left side of the neck, not associated with a shot hole.
Dt26	Mild but extensive subcutaneous oedema on the underside of the pelt at the neck, extending to the right thorax, and measuring 26 x 13 cm. Mild subcutaneous oedema (7 x 2.5 cm) at the left shoulder extending to the axilla corresponding to the position of the wire. Moderate subcutaneous oedema (8 cm x 4 cm) on the caudal dorsal aspect of the neck corresponding to the position of the wire. Mild subcutaneous submandibular right side oedema.
Dt27	Mild subcutaneous oedema without haemorrhage in the upper half of the neck and at the base of the head in the carcass; not associated with a penetrating injury.
Dt39	Subcutaneous indentation, encircling the ventral abdomen. Superficial subcutaneous haemorrhagic oedema at midline of abdomen medial to the preputium, 5.5 cm x 3 cm. No oedema or haemorrhage on the underside of the pelt. Some hair loss, especially at site of the snare's eye and stop.
Dt44	Mild subcutaneous oedema with congestion at the right shoulder. Moderate congestion in the cranial portion of the oesophagus and tracheal mucosa, without haemorrhage. Mild lung oedema.
Dt49	Non-haemorrhagic subcutaneous oedema at C1 extending to the back of the head and the left parietal and temporal regions, 6 cm x 8.5 cm.
Dt55	Moderate superficial subcutaneous oedema over back of head and cranial part of neck (8 cm x 6 cm). Mild subcutaneous oedema with congestion in the submandibular region, extending more deeply than the neck oedema. Mild lung oedema.
Dt60	Mild subcutaneous oedema over right upper surface of neck extending to the head, 7.5 cm x 2.5 cm.
Dt61	Subcutaneous oedema over the dorsal and left aspects of the neck. Moderate subcutaneous haemorrhagic oedema at base of right ear extending towards the right eye and to the zone of non-haemorrhagic oedema at the dorsal aspect of the neck. The overall area of the neck oedema plus head haemorrhagic oedema was between 15 and 20 cm^2. The haemorrhage below the ear extended deep into the right temporal muscle. Subcutaneous oedema over the right jugular vein

Table 5.16. Pathologists' descriptions of fox injuries observed during necropsy, that were attributed to the snare.

5.6.2.2. Disturbance to the capture site.

The degree of disturbance to the capture sites ranged from 0 to 3 on a scale of 0 to 3 where 0 was no disturbance and 3 was a high level of disturbance (Table 5.17). The sites where animals had escaped had lower disturbance scores than those where the captured animal was held until the snare was inspected (Mann-Whitney U test, U = -4.31, $p < 0.0001$). Of those animals that were captured and held by the snare, badgers caused significantly more disturbance than foxes (Mann-Whitney U test, U = 15.5, $p < 0.05$) (Figure 5.18 & Figure 5.19).

		score 0	score 1	score 2	score 3
Fox	Escape	0	0	0	0
	Held	0	1	12	1
Badger	Escape	3	4	1	0
	Held	0	0	1	4
Hare	Escape	3	1	1	0
	Held	0	1	0	0

Table 5.17. Summary of disturbance scores for all fox, hare and badger capture sites

Figure 5.18. Typical level of disturbance caused by a badger caught and held in a snare (score 3 on a scale of 0 to 3). Site originally covered in oil seed rape and grass, as seen in the background. Badger released uninjured prior to the photograph being taken

Figure 5.19. Typical level of disturbance caused by a fox caught and held in a snare (score 2 on a scale of 0 to 3). Site originally covered in oil seed rape and grass, as seen in the background. The fox was killed before the photograph was taken.

5.6.2.3. Use of the stopping rules

After nine foxes had been caught, the results were examined to determine if the stopping rules agreed with the ERP should be invoked. Using the probability table, this was the first opportunity at which the trial could be stopped using a probability value of 99%.

Eight of the nine foxes had no injuries and performed no behaviours that would be classified as indicators of poor welfare. In the ninth case, the fox shot while laid in the tramline, neither the necropsy report nor field observations suggested that this animal had any indicators of poor welfare attributed to the snare. The field technician had previously seen snared foxes lie still when first approached and believed that this fox was conscious before being shot. However, the fox was not observed moving, nor checked for consciousness using an eye blink reflex before being shot. During necropsy this fox was found to have a broken rear leg, though the injury was associated with a shot hole and no haemorrhage at the site was found. These post mortem observations led the pathologist to conclude that the broken leg was caused by the method of killing (a break prior to death would have been expected to be associated with haemorrhaging). Given the residual uncertainty about the condition of this fox prior to dispatch, the ERP agreed that trials should continue, but utilising stopping rules which presumed a worst case scenario for this fox i.e. a failure.

Given one failure out of 9 cases, the stopping rule would next be invoked when 14 foxes had been caught in total. The results from the following five foxes indicated no indicators of poor welfare and therefore the trial was stopped in agreement with the ERP conditions when 14 foxes had been caught and held.

5.6.3. Discussion

5.6.3.1. Assessment with respect to international standards

As determined earlier, the AIHTS for restraining devices was to be used to assess the humaneness of fox snares. However, it is useful to provide information with respect to the other two standards discussed, so that comparisons with similar devices that have been assessed under these other standards can be made. Although environmental conditions were varied as much as practicable by using a variety of landholdings within the region, these could not be representative of all the circumstances in which snares might be set. However it is thought that all the most relevant non-target species were present where tests were carried out.

Field trials of fox snares – Snare type A (Study 1)

In the AIHTS, there are no indications as to how results from non-targets should be interpreted. In the other two schemes, specificity is considered, but it is assumed that the non-targets are uninjured and are fit for release. Discussion with researchers from Canada, New Zealand, and the USA, who were involved with development of the international schemes, and more recently with assessment of restraining traps, reached a consensus that any indicators of poor welfare found in non-targets should be included and have equivalent weight to those in a target animal. However, non-targets that had no indicators of poor welfare should not contribute towards assessment of the humaneness of the restraining device for the target species.

Although both foxes restrained during the trial with snare type A had intramuscular haemorrhages (one mild and one moderate), these would not be sufficient to count as a fail under any of the schemes. However, the results from the non-target species have to be taken into account. One hare was found dead, and the injuries of the other two hares that had to be euthanized would both have been counted as having indicators of poor welfare. The hares that were obviously predated were excluded from the analysis.

To meet the requirements of the AIHTS for restraining devices, 80% or more of a minimum of 20 animals must not show any of the poor indicators of welfare. In this study, as the failures occurred in non-target species, the proportion failed can be viewed as three out of eight captures (i.e. all captures) or three out of six captured hares. Fewer than 20 animals were captured during trials of snare type A. However, the likelihood of the snare meeting the requirements or failing if the study had continued to 20 captures can be predicted using the probability table. On this basis, it is predicted that snare type A would not have met the requirements of the AIHTS for restraining devices criteria when hares alone are counted (95% confidence).

When all species are counted, the capture event where the badger escaped with the snare around its neck must be included. We have no way of predicting the outcome of this incident. However, the worst case interpretation, which assumes the badger died or suffered unacceptably poor welfare, would increase the proportion of failures to 4/9 and therefore mean that snare type A would be predicted not to meet the requirements of the AIHTS for restraining devices (95% confidence). The best case interpretation, where the badger is assumed to have survived without severe injury, e.g. after shedding the attached snare, would change the proportion of failures to 3/9 and the predicted probability of snare type A meeting the requirement of the AIHTS for restraining devices would be low, (15% confidence).

Using the draft ISO 10990-5:1999, two of the hares would score 100 points. The behavioural indicator, excessive immobility, is not included in this standard. In the draft standard, tests scoring more than 75 points were counted as fails. More than one failure out of ten captures indicates that the restraining device would not have met the requirement of the draft standard. In this trial snare type A failed to meet the ISO standard due to the welfare scores of non-targets.

Under the NAWAC standard, behavioural indicators are not included, but the other two hares had injuries that would be described as severe. In addition under the NAWAC standard escapes are counted as failures. No severe injuries are acceptable in any of the trials for a restraining device to meet this standard. In this trial Snare type A failed to meet the NAWAC standard due to the welfare scores of non-targets.

In summary, although snare type A was predicted to meet the requirements of the AIHTS for restraining devices for captured target species (fox), it was predicted <u>not</u> to meet the AIHTS for restraining devices, for captured non-target species. Therefore in this trial, overall snare type A failed to meet the AIHTS for restraining devices, an assessment that would be supported by the draft ISO and NAWAC standards. At present, there is no method for excluding non-target species from this snare.

Field trials of fox snares – Snare type D (Study 2)

Although fewer than 20 foxes were caught, the number caught was sufficient to demonstrate, with 99% confidence, that the pass criteria for a restraining device under the AIHTS for restraining devices would have been met had the trial progressed until 20 foxes had been caught (see section 5.1.2). No visible injuries were found on any of the non-target badgers that were caught and subsequently released from snare type D. None of the captured animals in this trial had any of the indicators of poor welfare included in the AIHTS for restraining devices. Therefore the welfare indicators from non-target species did not alter the assessment that in this trial snare type D would have met the AIHTS for restraining devices had the trial progressed until 20 foxes had been caught.

The oedema and haemorrhage injuries found on the foxes would have scored five points each on the ISO trauma scale but with a maximum of 15 points from this source. The failure score of the draft standard was 75 or above and, therefore, this was not high enough to fail any of the captures. Snare type D in this trial thus also met the requirements of the ISO draft standard for a humane restraining device including both foxes and non-targets.

The NAWAC guidelines describe oedema and haemorrhage as mild. Some of the foxes had two oedemas/haemorrhages, but none had three, which would have equalled a moderate injury according to the criteria in this standard. In order for the confidence in the results to be high, a greater number of animals is required for testing in this standard. The minimum number of animals that are required for testing is 25. However, the results obtained suggest that this snare would probably meet the requirements of this standard but would be classified in the lower category, B. This predicted ranking used welfare indicators for both foxes and non-targets.

In summary, in this trial snare type D was predicted to meet the requirements of the AIHTS for restraining devices and the inclusion of welfare indicators for non-target species does not alter this. This assessment was supported by assessments made based on the draft ISO and NAWAC standards.

5.6.3.2. Welfare impact of injuries sustained by captured animals

In addition to assessing the injuries found on the animals using the above international standards, the welfare impact of all injuries found can be examined. In the absence of evidence to the contrary, it may be assumed that any stimuli or experience which produces pain and discomfort in humans, also does so in animals (LASA, 1990; RSPCA, 1983), as first proposed by the Littlewood Committee in 1965.

The injuries most commonly found during the necropsies of the foxes were oedematous swelling and haemorrhage of the head and neck. Information from human reports of pain following such injuries were used when the ISO and

NAWAC guidelines were being developed. In an annex to the NAWAC guidelines, the pain and welfare impact of all types of injury are described. The description of oedematous swelling or haemorrhage is as follows:

> ’*This occurs where there is partial impairment of venous and lymphatic return from the tissue distal to a constriction, results in plasma leakage and sometimes, red blood cell leakage from vessels. The extent is dependent on the length of time and constriction pressure. Consequently there is always a variation in the amount of oedema. Slight oedema causes no observable discomfort. Severe swelling of tissue, particularly of the distal limbs, will cause temporary disuse or cautious use of the limb. The condition is usually transient and recovery may be seen as early as half an hour after release. Persistence may indicate infection.’*

During development of the NAWAC guidelines and the AIHTS, injuries specific to neck snaring were not considered. The head and/or neck are not weight bearing and therefore any temporary pain or discomfort are unlikely to be detected by observation. The clinical significance of the oedema is therefore unclear. Oedema of the head and neck, with absence of any symptoms of pain or suffering, is commonly reported in humans and animals.

In foxes there was no indication for significant circulatory compromise in spite of the subcutaneous oedema and the pathologist did not believe this amount of oedema to have caused suffering or pain. Pulmonary (lung) oedema is a common agonal process, and is most likely to have been caused as a result of the foxes dying *after* being shot. The lung oedema cannot be attributed with any confidence to the snaring.

The question remains whether a ligature in place around the neck and exerting sufficient pressure to constrict the blood vessels, but no other injuries is in fact painful. Forensic pathologists have reported that they do not believe partial or prolonged strangulation to cause significant pain. Strangulation is defined as cutting off the blood supply to a part of the body, and does not include obstruction of the airways. Evidence from paediatricians suggest that emotions associated with strangulation in people are fear rather than pain (Friedrich and Gerber 1994) and that this fear can be overcome with experience.

In previous studies of snaring, captured non-target animals have been radio-tagged, released and followed, to determine the long term impact of being held captive in a snare on them (Muñoz-Igualada *et al.* 2010). No negative impacts were found.

5.6.3.3. Indicators of fear and distress

It is unknown whether animals caught in snares spend the whole of the capture duration attempting to escape. Such a sustained performance of escape behaviour may be likely to leave them exhausted and such effects would not necessarily be detected by standards based on injury data alone. The data loggers used during trials of snare type A showed the activity patterns of the different species caught. Accepting that the sample size was small, the degree of disturbance of the capture site did mirror differences in activity measured by the loggers.

From both the logger data for one captured badger and from site disturbance scores, badgers appeared to be the most active species when held in a snare. The logger data showed a much higher level of activity for badgers (85% in the first hour) compared to that found in previous pen trials (Defra, 2007). Badgers in pen trials when caught in body snares performed escape behaviour for approximately 40% of the first hour of capture, this then dropped to less than 15% at the end of the restraint period. However during pen trials the badgers could hide under piles of hay, which may have influenced their behaviour.

The activity of captured hares during the first hour of capture was variable (1 to 36%). This variability may have been the result of foxes being close to some of these animals. It is not known how many of the captured hares were visited by foxes, or whether they detected foxes while restrained. However, presence of predators, indicated by odour or visible cues, may have led to increased active behaviour. Two of the captured hares were thought to have been killed by predators, with field evidence suggesting fox in both instances.

Fox activity while restrained in the snare, as indicated by logger data for one fox (22% active, averaged over the whole restraint period) and the disturbance scores of fox capture sites, appeared to be much lower than badgers. In other studies, foxes captured in box traps were found to be active for 35% of the time (White *et al.* 1991), and foxes caught in foot hold traps were active for between 13 and 17% of the time (Kreeger *et al.* 1990).

Although not all the active behaviour can be assumed to be escape motivated behaviour, total activity can be used as an estimate of escape behaviour to compare against other species in restraining devices. Squirrels spend over 80% of the first hour of capture in a cage trap in escape behaviour, whereas rats and rabbits spend approximately 50% of the first hour of restraint in escape type behaviour (Talling & van Driel 2009).

The current trials and previous trials indicate that escape activity does occupy a proportion of a captured animal's time, and it can be suggested that all restrained animals are experiencing some level of fear and distress. However, although it is generally accepted that trapping *per se* does cause some fear and distress, especially for prey animals in the vicinity of their predators, as yet, there is no robust method using behavioural indicators to objectively determine what level this is and whether or not it is acceptable (Talling & van Driel 2009).

Defaecation is one physiological response that has been shown to be an indicator of fear (Rushen 2000). This response has been found predominately in farm animals that are also classified as prey species; however, it is not predicted to be any different in predator species such as fox. In the present study, 10 of the 14 captured foxes had faeces present in the rectum when they were killed, suggesting that they were not experiencing levels of fear high enough to make them defecate.

5.6.3.4. Non-target capture rate

As has previously been argued, any indicators of poor welfare found in non-target captures should be included in a humaneness assessment (Section 4.4.1.1). Non-target species that are captured, but are uninjured and released, are assumed to have no long term negative consequences from the experience. (Muñoz-Igualada *et al.* 2010).

There is no internationally agreed standard for acceptable target:non-target ratio of restraining or killing traps. The ISO and NAWAC both took the opinion that traps should be as specific as the most commonly used trap for the target species (i.e. a 'state-of-the-art' yardstick, *sensu* Reynolds 2004). This approach increases the data requirements for trap assessment and is likely to discourage consideration of selectivity during the development of new traps.

In this report, differences in the target:non-target ratio between the first and second field trials of fox snares (1:4 and 1:0.64) may simply reflect different environmental circumstances (e.g. target and non-target densities), but may also reflect differences between the two snare types. We cannot exclude the possible influence of data loggers in the first trial (e.g. by adding to the scent profile of the snare, may have influenced fox:non-target ratio).

Using a snare with the position of the stop at 27cm rather than 23 cm and incorporating a breakaway in the snare used in the second trial may have reduced the proportion of non-target species caught and held. Although, overall, there were similar proportions of non-target escapes in field trials of fox snare type A and fox snare type d, a higher proportion of hares escaped when snare type d was used, (5/13 escaped snare type A; 5/7 escaped snare type d). The low level of disturbance to the capture sites suggested that these escapes from snare type d happened relatively quickly and these may have been assisted by the larger stop position. The breakaway device of snare type d was activated by 2 badgers, 1 hare and 1 deer. No foxes (0/14) escaped from this type of snare, suggesting that there is no disadvantage to the operator from these features.

For some other restraining devices, such as leg-hold traps, selectivity has been improved through either exclusion and/or use of a species-specific lure (Vidal et al. 2003). For exclusion to be successful, the non-target species must not be of a similar size or weight as the target. Unfortunately, for fox snares in England and Wales, badgers, which are one of the non-target species most commonly caught, are a similar size as foxes and are often locally as or more numerous (especially where fox density has been reduced by successful control). An alternative to exclusion might be to use a fox-specific lure. However, this would require identification of such a lure suitable for English and Welsh conditions and non-target species and associated development of a new associated snaring strategy. Conventional (passive) snares catch only if undetected. A mechanically-propelled neck snare (Collarum) that remains hidden below the soil surface until triggered, and which uses a scent lure to attract the fox has been developed in the USA and has been approved for use in England and Wales. Currently, there are no data available to compare the relative effectiveness, efficiencies and selectivity of conventional (passive) snares (as used in this study) against Collarums using fox specific lures, in English conditions.

5.6.3.5. Capture rate

The target capture rate of fox snares, was significantly better in the two field trials completed for this study than those reported during other studies of fox snaring. A snare-night capture rate of 0.009 and 0.008, respectively, compares favourably with other studies that achieved capture rates of 0.003 (Muñoz-Igualada *et al.* 2010) or 0.001 to 0.0035 per snare night (GWCT studies of gamekeepers, reported in IWGS Report). Foxes were known to be present in the area where snares were set in the Muñoz-Igualada *et al.* (2010) study but the snares were left set in the same locations for several months. The contrasting higher capture rate obtained during the present study is thought to result from a focused strategy in which snares were set only in response to very local evidence of fox presence and removed again after a pre-defined period without capture. Another factor is thought to be the care taken in the preparation and setting of snares.

5.6.3.6. Overall welfare impact of predation

During the field trials of fox snare type A, predators were thought to have interacted with and killed two restrained hares. Although predation is not exclusively associated with the use of snares, it is a welfare cost that was identified by the IWGS (2007) and should be included in any robust risk assessment of snaring as a wildlife management method (e.g. Talling & van Driel 2008). The IWGS had identified fear of predation as an additional welfare cost during snaring. To enable an objective assessment of predation, the time taken from first interaction between the predator and death of the prey species would need to be determined. The frequency of non-lethal interactions would be an important indicator that would need to be determined. However, it was beyond the scope of this project to evaluate this important aspect of snaring in the humaneness assessment and is not included in any of the three international standards that have been used by authorities for assessment of humaneness of restraining devices.

5.6.3.7. Other indirect welfare consequences

All methods of control that target adults and are used during the breeding season are likely to leave dependent young to die from starvation if the primary carer (especially a lactating female) is caught and killed. This is a welfare cost that is common to a wide variety of wildlife capture/ killing methods that remove adults and not dependent young; it should be considered in any robust risk assessment of wildlife management methods (e.g. Talling & van Driel 2008). Unlike predation costs, welfare costs to dependent offspring can be avoided only by suspending any form of lethal control during the breeding period of target and non-target species, i.e. by having a close season.

5.7. Conclusion

In summary, although snare type A was predicted to meet the requirements of the AIHTS for restraining devices for captured target species (fox), it was predicted not to meet the standards for captured non-target species. Field trials with snare type A showed how *quality* of the snare is as important as the design. Snare type A did not comply with all the recommendations in the Defra Code of Practice for Snaring.

Field trials of snare type D showed that it met the requirements of the AIHTS for restraining devices for the target species. Indicators of poor welfare were not found in any of the non-target species captured, and there was no indication that those animals that escaped would have experienced poor welfare.

Although many species of non-target were thought to have interacted with the snares during the trials, the trials were only carried out in one habitat type. It is unknown how habitat type would influence the results. No assessment was made of fear and distress experienced by animals caught in snare type D, and too few animals were caught in snare type A, for any conclusions to be drawn. Predation of non-target captures, such as hares, is an additional welfare cost that has not been included in the welfare assessment of fox snares in this project.

6 Field trials of rabbit snares

6.1. Introduction

No project staff were competent in rabbit snaring. The AIHTS recommends that at least one person should be proficient in use of the trap (snare) and capable of trapping the target species using the device on test. The most robust approach identified to allow assessment of rabbit snares was for experimental staff, in an observational capacity, to accompany experienced and competent rabbit snaring professionals. As the snaring was being carried out anyway for the purposes of pest control, a Home Office Licence was not required for this work but it was discussed under the Ethical Review Process (ERP) of the organisation responsible for this part of the project. Any alteration to the normal procedure used by an operator would have placed the trials under the Animals Scientific Procedures Act (1986).

This approach did have some disadvantages in that the operators may not have set snares according to the CoP. Specifically, the type of snares that the operator used, where they were set, how many were set, weather conditions and the times of inspections, could not be controlled. On the other hand, the methods used might have represented a closer approximation to commonly used practices by operators and so would have provided valuable information on practices likely to be encountered.

6.2. Method

The aim was to accompany one professional snare operator while they checked their snares. All the snares that were set at the time of the visit were to be observed. Observations recorded were: the condition of the rabbit, whether the snare had a stop, the position of the snare in the environment and the state of the area around the snare.

Professional snare operators were identified from enquiries made to professional pest control companies, or through industry contacts. Seven professional rabbit snare operators were contacted; of these, only three said they were actively snaring at the time of the study and were willing to allow someone to accompany them.

Operator 1

A professional pest controller, who predominantly snares rabbits. He covers a large area controlling rabbits on mostly lowland pasture for farmers and land owners. He has over 20 years experience and trains other pest controllers in the art of snaring. He makes his own snares and was aware of the Defra Code of Practice

Operator 2

A professional pest controller, who snares rabbits occasionally as part of a wider range of pest control activities covering a smaller land area than Operator 1. He carries out fox control (including snaring) as well as urban rodent control. He is employed by farmers and landowners to control rabbits on pasture and arable land and has over 15 years of experience. He makes his own snares and was aware of the Defra Code of Practice

Operator 3

A professional pest controller who owns his own company dealing with all types of pest control covering a smaller area of land, than operator 1, involving both urban and rural environments. He was employed by farmers and land owners to carry out rabbit control, which included the use of snares, on pasture and crop fields. He has over 15 years of experience and makes his own snares, to sell in addition to his own use. He was aware of the Defra Code of Practice

When the visit with Operator 1 was undertaken it became apparent that, the landowners where the snares were set, would not permit rabbits to be killed other than by neck dislocation, so snare injuries would have been indistinguishable from injuries sustained during killing. However, such injuries would not be present on any rabbits that were found dead in the snares. Another accompanied operator, (3), killed all live rabbits by a blow to the head with a blunt metal object which meant that oedema present in the head area would be unlikely to be identified during necropsy. Operator 2 killed his captured rabbit using an air rifle shot to the head.

Accompanied visits occurred in April 2009 and November 2009

The aim was to collect twenty rabbit carcasses in total. After collection they were removed from the site and frozen for later examination. The veterinary pathologist (described in section 5) carried out whole body necropsies on the defrosted carcases.

6.3. Results

Rabbit snares have far fewer components than fox snares and apart from the use of a stop or breakaway device they are all virtually identical in design.

All the snares used by these professionals were unstopped and were therefore not CoP-compliant. All snares were made from brass wire and used brass eyelets for the running eyes. One operator (3) used a breakaway device on some of his snares but not all. Operator 1 set snares in the fence line, in hoops on open ground and at single pegs (Figure 6.1 & Figure 6.2). The operator stated that rabbits caught in snares set within stiff wire hoops should be found dead. Operators 2 and 3 used only snares set on single pegs.

Figure 6.1. Snare set within a stiff wire hoop. Snare wire is attached directly to the hoop

During the data collection visit one operator thought that some of his snares appeared to have been interfered with, and that some rabbits had been released or removed. A total of 416 snare nights were observed and in these 50 rabbits were caught (Table 6.1). Twenty three rabbits were alive at the inspection, 27 were found dead, with six of these having evidence of predation. No non-target captures were observed during accompanied visits.

Operator no.	Visit no.	No of snares set	Weather	Rabbits live	Rabbits dead	Rabbits predated	Snare-nights per capture
1	1	112	Overcast, dry	9	17	4	4
2	2	80	Heavy rain overnight, drizzly in morning	1	0	0	80
3	3	92	Clear sky	4	1	0	18
3	4	92	Mainly overcast, dry	9	3	0	8
3	5	40	Overcast, very dry	0	0	2	20

Table 6.1. Rabbit snare captures

At the inspection with operator 1, captured rabbits were found dead in all setting locations (Table 6.2). All the snares set in the fence line that had caught rabbits, had been wrapped around part of the fence by the actions of the rabbits. No rabbit had wrapped the snare to such an extent that it could not move and not all fence snared rabbits were found dead.

	Hooped snare		Single peg snare		Fence snare	
	Dead	Alive	Dead	Alive	Dead	Alive
No of rabbits	4	2	1	0	12	7

Table 6.2. Distribution of rabbit deaths by snare type for operator 1, excluding predated rabbits

Figure 6.2. Example of a snare set in a fence line, the snare wire is attached directly to the fence. The rabbit was found dead.

There was very little visible evidence of disturbance to any of the capture sites where rabbits were found either alive or dead. Unfortunately this parameter could therefore not be used to indicate whether the rabbits that were found dead had been conscious for any time after they had been caught in the snare.

6.3.1. Necropsies

Whole body examinations were carried out on 27 rabbits in total from operators 1,2 and 3 (Table 6.3). Ten rabbits that had been found dead with operator 1 and the 4 rabbits that were found dead from operator 3, were chosen for further examination. It was decided that injuries caused by the technique to kill the rabbits by operator 1 would not have been distinguishable from injuries caused by the snare and so none of the live-caught rabbits from this operator were examined. All the live rabbits caught by operator 2 and 3 (1, 13 respectively) were examined.

No rabbits had any broken or fractured bones or dislocated joints. Twenty out of twenty seven rabbits (74%) had oedema and/or congestion in the region of the neck or head. Nine out of 27 rabbits (33%) had one or more haemorrhage. The majority of haemorrhages found were subcutaneous and described as mild, but 2 of the rabbits, found alive, had intramuscular haemorrhages. One snared rabbit that was found alive had a tear in the adventitia[15] of the neck, and five of the rabbits that were found dead had palpable indentations in either the skin or muscle in the area where the snare held the rabbit.

Twenty one out of 27 rabbits (78%), had lung oedema. Lung oedema was also found in the two cage trapped animals. Foam was found in the airways of eight rabbits, with seven of these being rabbits that had been found dead during the trial.

[15] The outermost fibrous coat of a vessel or of an organ that is derived from the surrounding connective tissue.

Rabbit id	Found	Snare placement	Indentation	Head/neck condition	Fractures/ dislocations	Snare related injury	Airway	Foam	Other
1-21	Dead	Neck	Ys	o,c	X		o,h	Y	
2-22	Dead	Neck	Ys,m	O	X	Bruise thorax	o,h	Y	
3-23	Dead	Neck	X	o,c,h	X		o,h	X	
4-24	Dead	?	X	c,o,h	X		o,h	Y	
5-25	Dead	Neck	Ys	c,o,h	X	Eye enucleated	o,h	Y	
6-26	Dead	Neck	X	c,o	X		o,h	Y	
7-27	Dead	Neck	X	H	X	Lumbar oedema	h	X	Pleuropneumonia, pleuritis, pericarditis
8-28	Dead	Neck	Ys,m	o,c	X	Bruise at the eye	o,h,c	X	
9-29	Dead	?	X	o,c,h	X	Submandibular bruising	h,o	Y	
10-30	Dead	Neck	X	O	X		h,o,c	y	
11-32	Dead		X	o,c	X		h	x	
12-43	Dead	Neck	X	X	X		h	X	Predated
13-46	Dead	?	X	O	X	Marked bruise thorax	h,o	x	
14-47	Dead	?	Y m	O	X		h,o	X	
15-31	Alive	?	X	O	X		o	x	
16-33	Alive	?	X	X	X		x	X	
17-34	Alive	?	X	h,c,o	X		H,o	X	
18-35	Alive	?	Tear adventitia	h,o	X		Congested mucosa trachea	X	
19-36	Alive	Abdomen	X	X	X	Subcut haem oedema abdomen	ho	x	
20=37	Alive	Abdomen	X	X	X		o	X	
21-38	Alive	Abdomen	X	X	X		Mod o	X	
22-39	Alive	Shoulder	X	Subcut o	X		h, o	X	
23-40	Alive	Thorax	X	X	X	Effusion of blood from jugular	o, congested tracheal mucosa	x	
24-41	Alive	Neck	X	X	X		o	y	
25-42	Alive	Neck	X	Intramus h	X	Leg congestion	o,h	x	
26-44	Alive	?	X	c, deep muscle h	X		Larynx congested	X	
27-45	Alive	?	X	Moderate to marked subcut o	X		o, trach congested, lung oedema	X	

Table 6.3. Necropsy results for rabbits caught in snares. S=skin, m=muscle,c=congestion, o = oedema, h=haemorrhage

6.4. Discussion

All three of the operators were aware of the Defra CoP, but nevertheless used unstopped snares that were not Code compliant. Their reasons for not following the CoP were that they thought stops were present solely to prevent non-target captures rather than being of a benefit for the target animal. They reported that both hares and deer can break rabbit snares if they do become caught in them. As no operator used stopped snares, we were able to obtain field data only for unstopped snares. The design of the snares used by operator 1 and 3 were very similar and, unlike fox snares, there are much fewer components in rabbit snares. We therefore decided that it was appropriate to treat the rabbit snares used by these two operators as equivalent and representative of a generic ‘rabbit snare’.

The number of rabbits found dead in the field trials was 17/26 (63%) with operator 1 and 4/17 (24%) with operator 3. Operator 1 claimed to set some snares to kill, and therefore it is valid to differentiate between these two sub-sets of snares. In snares set to kill 4/6 (66%) of rabbits were found dead, whereas in snares set to restrain, 13/20 (65%) of rabbits were found dead. These results indicate that the method of setting snares does not influence the proportion of animals that are killed, as reported by some operators to the IWGS (2005). Although there is considerable difference between operators, neither of them had lower than 20% rabbits dead at the inspection.

6.4.1. Assessment with respect to welfare standards

As determined earlier, the AIHTS for restraining devices was to be used to assess the humaneness of rabbit snares. During development of the separate standards for restraining and killing traps within the AIHTS, problems were encountered with regard to snares. The delegations discussing the standards, accepted that snares could be both killing and restraining devices, but decided not to deal with this issue within the standards.

The unstopped snares in this trial did not meet the requirements of the AIHTS for restraining devices, as 47% of rabbits had an indicator of poor welfare. However, the only indicator of poor welfare in the AIHTS found was death. It is possible that these rabbits that were killed by the snare, were killed quickly and therefore it would be appropriate to assess this subset of rabbit captures using the AIHTS for killing traps.

When assessing any killing method it has been widely accepted (eg Farm Animal Welfare Council) that the critical duration is the time from the onset of pain until irreversible unconsciousness, rather than time until death. Indeed the time from onset of unconsciousness until death may be several hours under some methods of killing, however as welfare is determined by the emotional state of the animal, it is generally accepted that animals are similar to humans in that they do not feel pain while unconscious.

In order to meet the requirements of the AIHTS for killing traps, at least 80% of a minimum of 12 animals (e.g. at least 10 animals out of 12) must reach irreversible unconsciousness within 300 seconds. This study of rabbit snares did not directly measure the time to irreversible unconsciousness (TIU) and the exact TIU cannot be determined from necropsy; however, the likely mechanism of death could be established from the necropsies and it may be possible to predict the likely TIU from data on other species.

It is claimed by professional rabbit snare operators that in those rabbits which are found dead, death is caused by cervical dislocation and that this happens relatively quickly. In the current trial, cervical dislocation was not found in any of the rabbits that were found dead in snares. Twelve of the fourteen rabbits that were found dead had oedema of the head or neck and seven of these also had foam in their lungs. One of the two rabbits without oedema had signs of predation and the necropsy results, pleuropneumonia, indicated that it was unwell when captured.

Oedema of the head and neck is a common finding during necropsy of humans that have died from strangulation where the time to death was prolonged (Iserson 1984). Such oedema is thought to arise where the pressure around the neck is sufficient to cause partial occlusion of the jugular veins but not the carotid arteries. In humans the carotid arteries are much deeper within the neck and are protected by layers of muscle. Partial occlusion of the jugular veins is also thought to be the most common mechanism of death during strangulation. This occlusion causes a reduction in venous return, which leads to passive congestion of the blood vessels of the brain and reduction of blood supply to the brain. The victim then becomes unconscious and dies. The time taken for unconsciousness and death are dependant on many factors and can’t be predicted with any accuracy. Oedema of the head and neck is only found where time to death during strangulation was prolonged, but, absence of oedema does not indicate a short time to death.

Foam in the respiratory tract is a common *post mortem* finding, that is often accompanied by oedema in the lungs and pulmonary haemorrhage. Foam is created when an animal is breathing through a liquid covering the inside of the airways. This has been found in animals after anaesthetic overdose and slaughter without stunning (Gregory et al 2009). The foam indicates that the animal was still breathing after the onset of oedema, but can’t be used to establish time of onset of unconsciousness. In addition, absence of such foam does not indicate sudden death, as in some animals foam does not appear even though breathing is observed during the dying process. In most cases the foam is blood tinged and this is thought to arise from rupture of the alveolar-blood capillary barrier. However, in the present trial, the blood-tingeing could be an artefact of freezing and thawing, or *post mortem* autolysis.

The necropsy results in the rabbits that died in the field trials are consistent with the cause of death being strangulation, and the mechanism being partial jugular occlusion.

During trials to determine the TIU in kill traps, it was found that traps that caused cranial or cervical fractures tended to kill animals in under 30 seconds (M. Hiltz, Fur Institute of Canada, pers.comm). In possums, jaw positions of traps that put sufficient pressure to cause full or partial occlusion of both carotid arteries, tended to cause TIU within 180 seconds (Warburton et al 2000), but with occlusion of neither carotid artery TIU occurred within 140 s.

Differences in taxonomy may influence the neck pressure required to cause TIU in different species. However, such studies can give an indication as to whether it is likely for snares to cause unconsciousness by strangulation within such time frames. Self-locking snares were classified as killing devices in Canada (Fur Institute of Canada) but were unable to kill red foxes within 300 seconds (Neave, 1981). Following on from this, power snares were examined to determine if they could be modified to kill within 5 minutes (Proulx & Barret 1990). Power snares have a ratchet device that tightens the noose around the animal's neck as soon as it is caught. Trials with this device showed that, although it was possible to get unconsciousness within 5 minutes, it was not always achieved.

One of the rabbits in the pen trials described in this report died and its behaviour was recorded on video. From the video it is impossible to determine the onset of unconsciousness. The first signs of gasping behaviour, taken to be the first signs of distress, were observed several hours after the rabbit was placed into the snare (Section 9.6). Behaviours indicative of distress, including gasping, fits and lying immobile were then observed intermittently over a period of 6 hours. In between these behaviours the rabbit appeared no different than other rabbits undergoing the trial. The total time from the onset of gasping until final movements were observed was determined to be >6 hours, however it was not known at what time, the rabbit became unconscious.

Results from the field trial of rabbit snares show that operators cannot predict which snares will result in rabbits dying. Therefore, the only way to obtain precise data on time to irreversible unconsciousness in snared rabbits would be to monitor snares continuously in the field.

Taken together, the necropsy results and previous studies outlined above suggest that unstopped snares do cause death by strangulation in a significant proportion of rabbits but the time to TIU could not be estimated. Further trials would be needed to directly measure the TIU in rabbits that die after being caught in unstopped snares, if they are to be assessed against the AIHTS for kill traps.

6.4.2. Overall welfare impact of predation

During the field trials of rabbit snares, predators were thought to have interacted with and killed six restrained rabbits. Although predation is not exclusively associated with the use of snares, it is a welfare cost that was identified by the IWGS (2007) and should be included in any robust risk assessment of snaring as a wildlife management method (e.g. Talling & van Driel 2008). The IWGS had identified fear of predation as an additional welfare cost during snaring. To enable an objective assessment of predation, the time taken from first interaction between the predator and death of the prey species would need to be determined. The frequency of non-lethal interactions would be an important indicator that would need to be determined. However, it was beyond the scope of this project to evaluate this important aspect of snaring in the humaneness assessment and is not included in any of the three international standards that have been used by authorities for assessment of humaneness of restraining devices.

6.4.3. *Other indirect welfare consequences*

All methods of control that target adults and are used during the breeding season are likely to leave dependent young to die from starvation if the primary carer (especially a lactating female) is caught and killed. This is a welfare cost that is common to a wide variety of wildlife capture/ killing methods that remove adults and not dependent young; it should be considered in any robust risk assessment of wildlife management methods (e.g. Talling & van Driel 2008). Unlike predation costs, welfare costs to dependent offspring can be minimised by not carrying out snaring during the breeding period of the target species. However, rabbits have an extended breeding season, and dependent young can be found at all times of the year, therefore this would not be a viable option for rabbit snares.

6.5. Conclusions

In summary, rabbits held alive in unstopped snares, had no indicators of poor welfare and therefore met the requirements of the AIHTS for restraining devices. A significant number of rabbits were found dead in snares (47%), and the necropsy suggested that they died from strangulation through vascular occlusion. Time to unconsciousness for rabbits that were found dead in unstopped snares is unknown, and therefore we do not know if these snares do or do not meet the requirements of the AIHTS for killing traps. If all the unstopped rabbit snare captures in these field trials are assessed solely against the AIHTS for restraining traps, they would not meet the requirements due to the high number of deaths. Comparable data for stopped snares could not be gathered because no operators were found who used this design of snare.

7 Estimation of total welfare and ecological impacts of the use of snares and recommendations for changes to the CoP.

7.1. Objective 5: Through a combination of (1)-(4), estimate the total welfare and ecological impacts of the use of snares on target and non-target species.

7.1.1. Estimating total welfare impacts

In principle, data relating to Objectives 1 (snare use) 2 (compliance with CoP) and 4 (welfare impacts) can be combined to estimate the total welfare impact of snares on target and non-target species throughout England and Wales. However the likely reliability of such an estimate must be carefully considered.

Objectives 1, 2 and 4 produced very different kinds of information. The telephone survey was designed specifically to sample landholdings in an unbiased manner and provide a robust basis for extrapolation to the whole of England and Wales. The welfare assessment, by contrast, was constrained by the ethics of animal experiment, so that the sample size (of animals used) was the smallest that allowed comparison of snare performance against the AIHTS.

The telephone survey provided the intended basis for extrapolation. A large amount of variability was expected because the use of snares was affected by unmeasured factors such as public access, non-target abundances, personal preference or competence. However, the use of snares was found to be significantly related to interactions among country, land class, size class and game management interest. Extrapolation based on this range of explanatory factors was not possible here, because land class and game management interest were not known for all landholdings in the Defra farm database. (This could be done in the future if such information became available.) Instead, extrapolation to estimate use of fox snares was made on the basis of landholding size class only, using separate models for England and Wales. Confidence limits on the resulting estimates are broad, reflecting all the variability in survey responses that is not explained by size class. No estimate of the extent of use of rabbit snares across England and Wales was possible because of small number of users encountered during the telephone survey.

The limited scale of the welfare assessment – designed to minimise animal use – makes it fit only for its single purpose: namely to assess the snare, used by a single competent operator following CoP guidelines, using the AIHTS. This requires less data than would be required to estimate the underlying risk of poor welfare with precision. Hence the estimate from this sample, of the underlying risk of poor welfare has broad confidence limits.

For instance, with snare D, 14/14 captured foxes had no indicators of poor welfare. The probability that this type of snare operated in this way would have passed a full trial as required by the AIHTS (i.e. at least 16 passes out of 20 captured foxes) was calculated to be >99%. 95% confidence limits for the underlying probability of an adverse event for each trapping were 0 to 19%. In other words, there was a 5% chance that the underlying risk of poor welfare was in fact greater than 19%. 99% confidence limits were 0 to 28%.

Precision is lower for non-target species, such as badger and hare, where the number of captured animals was small. No attempt was made to increase the sample size of these species by deliberately targeting them, although clearly that could be done. A sample of five badgers with no observed poor welfare gives 95% confidence that the underlying probability of poor welfare per trapping event lies somewhere between 0 and 45%. Two hares with no observed poor welfare gives 95% confidence that the underlying probability of poor welfare per trapping event lies between 0 and 78%. In the case of Snare A, where six hares were caught with three observed poor welfare incidents, the probability of passing the AIHTS trial was low (3%). The 95% confidence interval for the underlying probability of an adverse outcome per trapping event lay between 17 and 83%. Overall, the sample sizes for the non-target species caught are so small that the results are meaningless.

Furthermore, the confidence limits quoted above reflect an assumption that performance does not vary in different environmental conditions. The conditions under which the field trials were carried out were varied as much as was possible within the study area, but some habitat types where snares are known to be used were not included (e.g. pastoral habitats and uplands). The telephone survey showed that fox snares are used in all land classes of England and Wales, including pastoral landscapes and upland, which is predominantly heather moorland and bog. It is possible that performance will vary between habitats, but the extent of this variation is at present unknown and therefore would not be adequately reflected by the confidence limits outlined above.

The use of snares also requires significant operator input and it is likely that performance will vary between operators. The field trials of the fox snares in this project were undertaken by a single operator and therefore the true rate of occurrence of poor welfare again may not be adequately characterised by the confidence intervals outlined above.

Given the performance differences found between Snare A and Snare D, estimation should also reflect the type of snare being used by practitioners in the field. Field visits found that very few practitioners were using snares that had similar components or component quality as in snare D; most were using snares more similar to snares A and B.

In summary, while it is conceptually possible to combine the survey and field trial results to predict the overall impact of fox and rabbit snaring on the welfare of target and non-target species throughout England and Wales, confidence intervals would be very large, and we advise that predictions could be very misleading.

7.1.2. Ecological impacts on non-target species

The target species, fox and rabbit, are both widespread and common, and their ecological status is not at risk. Where snares are used as part of an effort to control numbers, the intention is clearly to have an impact of ecological significance. In this section we focus on the possibility of unintended ecological impacts on non-target species.

The species most commonly cited by snare users as non-target captures in fox snares were badger, brown hare and deer. This corresponds with earlier studies which followed the capture histories of operators over periods of 12 months (IWGS 2005) and in which badger, brown hare and roe deer were the non-target species most commonly caught. Of these species, badger and roe deer are both increasing in Britain (JNCC: www.jncc.gov.uk/page-3744). Brown hare is a BAP species which suffered a substantial decline in the mid 20th century, attributed principally to intensification of agriculture (Tapper & Parsons 1984; Tapper & Barnes 1986; Tapper 1999).

The brown hare has a capacity for rapid population increase in favourable circumstances, and exceptional densities can be sustained where habitat is favourable and control of common predators is practised (Reynolds *et al.* 2010). Of the predators commonly controlled on estates managed for game, the fox is believed to be the most significant for hares (Reynolds *et al.* op.cit.). In two studies reviewed by Reynolds *et al.*, snares contributed significantly to fox control in spring and summer. These studies showed that where fox numbers were effectively controlled by methods which including the use of snares, and where good habitat was available, hare densities increased – despite non-target hare captures – because the benefit of reduced fox predation outweighed the direct impact of snares on hare numbers. Hare densities averaged 52 and 67 /km^2 and exceeded 80/km^2 in some years, despite deliberate harvests when hare densities reached levels that were believed to have an economic impact on agriculture.

One recommendation of the CoP is to avoid setting snares close to water courses, the intention being to avoid the accidental capture of otters, which sometimes follow trails in these habitats. The otter is recovering strongly from the pesticide issues of the mid-20th century (JNCC: www.jncc.gov.uk/page-3744), and there is no evidence that the use of snares to catch foxes or rabbits has any impact on their ecological status. However, instructional material is available in english on how to catch mink using snares (e.g. http://www.thewarrenersden.co.uk/snares_snaring.html), and this practice is not specifically unlawful. In this study we did not encounter any operators who used snares to catch mink, but a trawl of discussion forums on the web suggests the practice is not uncommon.

To summarise, although we can reliably estimate the extent of snare use, the data do not allow a reliable estimate of the total welfare impacts of snare use at a national level. Results from other studies (IWGS 2005) suggest that capture of non-target species in snares is not currently a cause of deteriorating conservation status.

7.2. Objective 6; Report on the voluntary uptake of the Code of Practice, and make recommendations for its revision if appropriate.

7.2.1. Uptake of the Code of Practice

Uptake of the Code of Practice has already been reported within the survey results (Section 2). In summary, the survey showed that the majority of snares used in England and Wales are targeted at foxes and that most of this snaring is carried out by professional gamekeepers. Most professional gamekeepers using snares had received at least some form of formal or informal training and were aware of the CoP. However, there was also a similar-sized population of snare users whose principal occupation was farming. This user group typically operated fewer snares, but the majority of them had received no formal training. Because of small sample sizes we were unable to test whether training *per se* led to greater compliance with the CoP; in addition it was not possible to determine whether formal training courses included CoP advice at the time they were attended.

There were two main areas of non-compliance: hardware (snare design) and operating practices. With the exception of a few gamekeepers who had been supplied with CoP-compliant snares by the GWCT for a separate trial, the fox snares in use were mostly commercial models which were non-compliant. A few snares in use were home-made and were also non-compliant. At the time of this study, CoP-compliant fox snares were not, as far as we could ascertain, available to be purchased “off-the-shelf”. They could be obtained by special commission, though this option was not advertised. Towards the end of 2010, the Type D snare tested in this study, and another CoP-compliant breakaway snare, both became available for sale.

Non-compliance was also evident in working practices, although few aspects of the code lent themselves to categorical evaluation. Of particular concern was the persistent use of cluttered sites where entanglement of the snare with nearby fixed objects poses an increased risk of injury or death of the captured animal. In the CoP the recommendation to avoid such sites was associated with a whole package of advice (e.g. use of wire tealers, careful preparation to reduce scent contamination), which together aimed to allow snares to be used successfully in open locations devoid of cover.

For rabbit snare users, awareness of the CoP did not appear to translate into uptake of the CoP, the most notable deviation being the failure to use stopped snares.

Several reasons can be suggested for the limited uptake of the CoP. Firstly, since the publication of the Defra Code of Practice in 2005, promotion of the Code has been left entirely to the voluntary sector. The training courses offered by the GWCT and NGO have been advertised exclusively within the professional and part-time gamekeeper community, which was believed to be the main user group. The reasons for attending such a course are thought to be either personal interest or career development. The present study has identified a similar-sized group of users in the farming community and indicates a need to promote training within that sector also.

We think it likely that the subtle distinctions between different levels of advice are unclear to the average operator. The different levels of advice reflect the fact that the CoP was based on expert opinion - and furthermore a defence for other working practices is acknowledged in the CoP. Several recommendations of the CoP have proved controversial with existing snare users (J.Reynolds, GWCT, pers comm.). Consequently, on points of advice described as 'should' and 'may', training in good practice can consist only of rehearsal of the different arguments, and exercises in cost-benefit analysis. As a result of the present study we now have better evidence to support future advice. Training should be updated to incorporate any fresh evidence. The Code itself should also be reviewed in the light of this new evidence.

7.2.2. Extending uptake of the CoP and training

Uptake of the CoP could be extended through pro-active extension of specific snare training to all snare-users. To some extent this could be done through organisations representing particular interest groups (e.g. gamekeepers, farmers, pest controllers), but there is likely to be a particular problem accessing those who do not belong to any such umbrella organisation and it may be necessary to use the public media to access such people. It may be that a significant improvement in reach of the CoP could only be achieved through making formal training mandatory for those using snares, e.g. through an accreditation and licensing process.

If this training were to be delivered within a reasonably short time-frame, training capacity would probably need to be increased. The survey suggests that in England and Wales approximately 4500 operators are currently using fox snares without formal training. It is believed that there is no formal training currently available for rabbit snare users. Existing training material would also need to be brought up to date to reflect the findings of this study.

7.2.3. Improving the influence of CoP recommendations and training on everyday practice

There is no guarantee that recommendations made during training will be put into everyday practice. Snares are used on private land, generally away from public access in England and Wales, where poor practice or even malpractice can pass un-noticed. Strengthening the legal status of the CoP would be one way to promote uptake of CoP recommendations, while still allowing easy revision in the light of fresh evidence. Promotion of the CoP by enforcement officers, would be another way of increasing the voluntary uptake of of the CoP.

To promote the responsible use of snares, it is important that operators (and their employers, where appropriate) appreciate how CoP recommendations lead to greater target capture efficiency at the same time as avoiding non-target captures and poor welfare. It should be highlighted that employers and landowners, also have a responsibility to ensure that any snaring being carried out under their authority meets the CoP recommendations. A video demonstrating how to set snares following the CoP, may be more appropriate than a written document.

Training material would be improved by inclusion of photographic documentation where available, to illustrate the consequences of non-compliance with the CoP.

A major flaw in the current CoP is that operators are reliant on their own interpretation of the recommendations as to whether a snare meets the CoP. In light of the results in this study, it appears that most makes of commercially available snare would fail to meet the requirements of simple mechanical tests. Protocols for these simple tests could be included in the CoP, giving manufacturers a clear bench-mark and the means to assess their own products, besides allowing operators to assess the products on offer and ensure they used only those that met the CoP. Alternatively regulation could be passed that only permitted snares approved by a competent authority such, as Defra, to be sold or used. This would be similar to the current regulation of spring-traps. It would however require new primary legislation.

7.2.4. Recommended changes to the CoP

It was believed by the experts that wrote the first CoP that adherence to the recommendations would improve welfare and non-target aspects of snare use. Development of a CoP was the primary purpose of the IWGS (2005). Little published evidence was available to the IWGS in 2004, but earlier unpublished studies of fox-snaring by gamekeepers, carried out by GWCT and BASC, were made available and were published within the IWGS Report. These confirmed that while foxes were the species most often caught in snares set for foxes, non-target captures occurred commonly in general practice, and injury and death occurred among both target and non-target animals. Both snare hardware and operator practices clearly affected these outcomes, but there was insufficient evidence to compare systematically among snare types and operator practices, and the evidence was 10-15 years old at the time of the IWGS Report. Consequently, CoP recommendations were based on a combination of first-hand experience among IWGS members and expert interpretation of the available evidence.

Evidence obtained during the current project clearly helps to clarify specific aspects of the CoP, and we have used it wherever possible to consider how the CoP might now be improved. Evidence has not been obtained for all recommendations but those for which it has are emphasized in bold in Section 9.1 and are elaborated below.

<u>How to set fox snares</u>

They must not be set in sites cluttered by obstacles such as saplings, hedges, walls, fences or gates.

Although the IWGS had no documentary evidence available, there was a strong belief based on experience that entanglement of the snare with nearby fixed objects (e.g. trees, bushes or fencelines) after the animal was caught was a major cause of injury and/or death. No injuries or death occurred when catching foxes for radio-tagging, when careful avoidance of such sites was part of the approach.

On field visits to practising snare users, only 2/16 users visited in the field followed this recommendation totally, and for 11/16 operators the level of compliance was low (<25% of snares).

In trials undertaken with Snares A and D, all snares were set on locations free of obvious obstacles. This demonstrates how foxes can be caught in very open locations without the need for physical cover.

Snares must have a permanent stop fixed approx 23cm from the eye of the snare.

The presence of a stop to limit the minimum size of the noose is not a statutory requirement. The CoP recommendation to use a permanently fixed stop is supported by findings in the pen trials, using rabbits as a model species, where the extent of injuries was greater in the unstopped snares (although severe injury occurred in only one out of 12 cases).

Further work is required on the appropriate position of the stop for different species. The stop position of 23 cm for fox snares recommended by the IWGS was already incorporated in the BASC (1994) Code of Practice for snaring, although there was no documented evidence to support this choice. Stop positions varied among snares considered for trial in the present study, and an interpretational difficulty was how much deviation from the recommended stop position was acceptable, as it was on field visits. Snare D had stops set at an average of 27.5 cm. This noose size allowed 4 hare escapes, 7 badger escapes and 2 deer escapes, but held foxes having an average neck circumference of 26 cm. Further work to determine the largest noose size consistent with retention of the target species would be beneficial. Conceptually, a larger noose circumference might also reduce the risk of injury in animals of any species that are held with the wire across the shoulder or around the abdomen, where the body circumference is greater than around the neck.

Snares should incorporate a strong swivel near the anchor point and also at a position closer to the noose.

The aim of swivels is to prevent unwinding or overwinding of the snare cable, both of which reduce the breaking strain of the cable to that of its component strands, and can also allow the captive to chew through the separated strands. The comparison between field trials with snare A and snare D illustrates the importance of good quality swivels that work as intended in the field. When a badger was caught in snare A, both the anchor swivel and the middle swivel jammed, for different reasons but in both cases due to poor swivel quality. The higher quality middle swivels incorporated in Snare D were observed by the technician to be operating as intended when 5 captured badgers were released. In some cases, the ground swivel had become inoperative, highlighting the importance of the middle swivel as a back up to the ground swivel.

In the CoP, illustrations of what are considered to be good quality and unsatisfactory swivels would improve clarity.

The fastenings should be designed so that the weakest point is at the eye.

This point was illustrated by the differences in field performance between snare A and snare D. Where the swivels had jammed on snare A after capture of the badger, the snare cable unwound, and the individual wires broke. As the breakage happened outside the noose, the snare wire was still attached to the badger when it escaped.

With snare D, two badgers escaped from the snare by opening the breakaway device, demonstrating that this was the weakest part of the snare. An ideal breakaway device would not permit foxes to escape but would allow the majority of badgers and deer to escape. To determine the ideal operating strain, further work to determine how hard different species pull when caught in snares (e.g. using strain gauges) would be beneficial.

<u>**How to set rabbit snares**</u>

They must not be set in sites cluttered by obstacles such as saplings, hedges, walls, fences or gates, which increase the risk of injury and death.

Data obtained to determine the humaneness of rabbit snares gave no indication whether avoidance of cluttered sites decreased the risk of injury and death. Nor was there any evidence that use of cluttered sites increased the risk of injury or death to rabbits. None of the rabbits that were still alive at the inspections had severe injuries. In fact fence lines are preferred setting sites for rabbits as the operator can predict with greater accuracy where the rabbit will place its feet. If further trials with stopped rabbit snares are undertaken, the welfare impact of setting snares in fence lines for rabbits should also be assessed more fully.

The snare must have a fixed stop about 5” (14 cm) from the ‘eye’ of the snare.

The presence of a stop to limit the minimum size of the noose is not a statutory requirement. The unstopped snares that were used by two/three operators that were accompanied in the field resulted in more than 20% of rabbits being found dead. Unstopped rabbit snares did not meet the requirements of the AIHTS for restraining devices. However, no data was obtained for stopped rabbit snares; therefore we can’t comment on whether this recommendation decreases the risk of death.

<u>**Avoidance of non-targets**</u>

Every effort must be made to avoid catching non-targets.

Field trials confirmed that certain non-target species are at risk of capture even where the CoP is followed (Section 5.4). The technician was arguably handicapped by the need to include a range of sites and therefore to operate on unfamiliar ground. A typical operator would be extremely familiar with his ground and would have more detailed knowledge of the movements of non-target animals within it. Nevertheless, a snare user operating where badgers, hares or deer are present must recognise that these species are at risk of capture. The use of snares which maximise the opportunities for rapid self-release of non-targets, and operating practices which apply CoP recommendations, clearly help to reduce welfare and demographic impacts on non-target species. Although this study found no severe injuries resulting from capture in snare D, further research would be required to determine the long-term impacts of restraint in a snare for non-target species that self-release or are released at inspection.

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9 APPENDICES

9.1. Appendix A

The Defra Code of Practice presented as specific points of advice. Advice that was assessed during the telephone survey is highlighted in bold, and the level of advice associated with each point is also highlighted in bold.

Snaring foxes

1. In order to comply with this Code of Practice, snares **must** be set only at sites likely to be used by foxes.
2. **Snares must not be set where there is evidence of regular usage by non-target species.**
3. **Snares must only be used as a restraining rather than a killing device.**
4. Snares **should** be set in open sites such as field edges, tramlines, along runs, trails or tracks, such as vehicle tracks, where foxes are likely to travel through.
5. **They must not be set in sites cluttered by obstacles such as saplings, hedges, walls, fences or gates, which increase the risk of injury as a result of the snares becoming entangled.**

Preparing snares for use

6. To this end efforts **should** be made to reduce the chances of their detection by target species.
7. The greater the number of snares in operation the greater the chances of capturing foxes but this **should** be weighed against the greater time necessary to inspect, maintain and set the snares, and the increased risk of non-target captures.

How to set snares to capture foxes

8. **Free running snares must be used,** and **these must have a 'permanent stop'** fixed approximately 9" (23cm) from the eye of the snare.
9. The bottom of the loop **should** be at least 7-7.5" (15/18cm) above level ground and up to 12” (30cm) in open ground.
10. In other situations the height may be modified to reduce non-target captures.
11. Snares **should** incorporate a strong swivel near the anchor point and also at a position closer to the noose.
12. The wire **must** not be less than 460lbs (208 kilos) breaking strain.
13. To avoid animals escaping while still entangled in the snare, with potentially serious welfare consequences, the fastenings **should** be designed so that the weakest point is at the eye.
14. Snares **should** be supported by a suitable 'tealer' or set-stick pushed firmly into the ground.
15. Snares **must** be firmly anchored so that they can on no account become free (because of the great risk to welfare that this would cause).
16. Drags **should** not be used.
17. You **must** ensure that snares are free running at the time they are set and remain so during their use.
18. Snares that are frayed or damaged **must** be disposed of safely.
19. You **must** adapt your procedures for setting snares in the light of experience, particularly to minimise the risks to non-target species (see below).

Snaring rabbits

20. In order to comply with this Code of Practice, snares **must** be set at the time and place that maximises the chances of catching a rabbit and minimises risks to non-target species.
21. **Snares must not be set where there is evidence of regular usage by non-target species.**
22. Rabbit snares **should** be set on well-used rabbit runs, in short vegetation, close to the harbourage from which rabbits gain access to crops.
23. **They must not be set in sites cluttered by obstacles such as saplings, hedges, walls, fences or gates, which increase the risk of injury.**
24. Sites that pose the risk of fatal entanglement **should** be avoided.

How to set snares to capture rabbits

25. Rabbit snares **should** be constructed with 3 or 4 -stranded brass wire (doubled so that whilst there are 3-4 strands around the eye, there are 6-8 in the noose) with a loop of 4” (10 cm) diameter for the head of the rabbit.
26. **The snare must have a fixed stop about 5” (14 cm) from the ‘eye’ of the snare.**
27. **You must ensure that snares are free running at the time they are set and remain so during their use.**
28. Snares that are frayed or damaged **must** be safely disposed of.
29. The loop **should** be positioned 3” (9cm) above the ground using a short notched stick, the ‘tealer’.
30. The free end of the wire **must** be securely tethered by a strong, rotproof cord attached to a peg that is driven firmly into the ground.

31. It **must** not be possible for the snare to become free because of the serious welfare consequences that could ensue.
32. You **must** adapt your procedures for setting snares in the light of experience, particularly to minimise the risks to non-target species (see below).

How to avoid capture of non-target animals

33. When setting snares every effort must be made to avoid the capture of nontarget and protected species.

34. Knowledge of the tracks, trails and signs of both target and non-target species is essential. If there is evidence of other species regularly using a site then snares **must** not be set.

Badgers:

35. Snares **must** not be set on or near to a badger sett, or on the runs radiating from a sett.

Domestic pets:

36. Snares **must** not be set on or near public footpaths, rights of way, near housing and areas regularly used for exercising domestic animals to avoid capturing pets.

Deer:

37. Snares **should** not be set in holes through or under fence lines, in gaps through hedges or under gateways, particularly where roe or muntjac are present.
38. Snares **should** not be set along-side fence lines, particularly when they pass through woodland, where deer may travel alongside them.
39. Snares **should** not be attached to fences, as this increases the risk of entanglement and injury.

Livestock:

40. Snares **must** not be set where livestock are grazing.
41. Snares **should** not be set along side fence lines because cattle and other livestock often lean over or push through to graze the grass on the opposite side.
42. You **should** agree with farmers and landowners when and where snares are to be set to avoid contact with livestock and horses.

Otters:

43. Snares **should** not be set on tracks along the side of watercourses of any size.
44. Snares **should** not be set on or under footbridges, fallen trees or logs spanning watercourses.
45. Where snares are used for mink control particular care **should** be taken and, if necessary, other methods used.

Hares:

46. Where hares are present particular attention **should** be given to site selection and, if necessary, other methods of fox or rabbit control used.

Inspection of snares

47. During the winter, in order to comply with Best Practice, snares must be inspected as soon after sunrise as is practicable, and should again be inspected near dusk.

48. In summer snares must be inspected before 9 am, and a further inspection should be conducted in the evening.

Humane killing of foxes

49. Snared foxes must be killed quickly and humanely by a shot at close range from a rifle, shotgun or pistol.

50. Air weapons must not be used, as they are not sufficiently powerful.

51. The shot **should** be aimed to the head because this maximises the chance of immediate and irreversible loss of consciousness.
52. Due care **must** be taken to avoid the risk of ricochet.
53. Insensibility and death **should** be confirmed by absence of corneal reflex (failure to blink when the surface of the eye is touched), and absence of breathing.
54. The body **must** be disposed of responsibly, e.g. by deep burying (more than a metre).

Humane killing of rabbits

55. Once removed from the snare, a rabbit may be humanely killed by holding it firmly and giving a strong blow to the head with a heavy stick.
56. This **must** always be followed by a second blow and death confirmed by the absence of breathing and/or the eye-blink reflex.

Release of non-targets from snares

57. Unless the animal is badly injured and has to be killed on humane grounds, it **must** be released immediately.
58. It **should** be remembered that if humane despatch is deemed to be appropriate then the snare user may be called upon to justify their actions in a court of law.
59. The animal's struggles **should** be limited by shortening the wire so that it can then be cut at the noose in order to ensure that no part of the snare remains on the animal. The wire **must** never be cut anywhere else in the hope that the noose will fall off later.

60. Great care **must** be taken to avoid injuring the animal and to avoid being bitten.
61. If the captured animal has been seriously injured it **must** be humanely despatched using a firearm, as described above.

Further development of knowledge and skills

62. All those using snares **should** maintain awareness (by reading, attending training courses etc.) of developments in the field, for example of any improvements in snare design and/or methods of use.

9.2. APPENDIX B – Initial contact letter

Game & Wildlife CONSERVATION TRUST

Burgate Manor, Fordingbridge
Hampshire, SP6 1EF
t: 01425 652381 f: 01425 655848
info@gwct.org.uk
www.gwct.org.uk

Address Line 1
Address Line 2
Address Line 3
Address Line 4
Address Line 5

Reference: ####

1 January 2009

Dear Sir/Madam

Re: DEFRA SURVEY ON EXTENT OF USE OF SNARES IN ENGLAND
We are carrying out a survey under contract from the Department for Environment, Food and Rural Affairs (Defra) to determine the extent to which snares are used for pest control in England. We are interested to record responses from both snare users and those who do not use snares. This Survey is voluntary – however your participation would help to develop Defra Government Policy on Snares for England. Briefly, we would like to know whether pest control using snares is carried out on your land, as well as your reasons for using or not using snares. If snares are used on your land, we would like to ask the snare operator (whether this is yourself or someone else) a number of more detailed questions.
Your address has been selected at random from a list maintained by the Defra division responsible for the June Agricultural Survey. This letter is to let you know that we will be giving you a ring in the near future to ask what contribution (if any) snaring makes to pest control on your land. If the operator is someone other than yourself, please could you ask them if they are willing to be involved in this survey and, if so, have their details to hand. If you **do not** want to be involved, please contact ……….. on the number below.
All information supplied will be treated in complete confidence and individuals will not be identifiable in any output of this project. All personal information is protected under the Data Protection Act 1998. We take full responsibility for the security of the data you supply and it will be deleted once the project has been completed.
The telephone interview should only take between 5 and 15 minutes, depending on your answers.
Thank you for your co-operation.
Yours sincerely

Research Scientist

9.3. APPENDIX C – Transcript of telephone survey on snare use

Initial Survey

Good morning/afternoon/evening my name is …….. from the Game and Wildlife Conservation Trust. I am ringing to follow-up the letter I sent you recently about a snaring survey. Is now a good time? It will take about 5 minutes, depending on your answers.

If yes, but not now: what would be a convenient time for me to ring back?

Just to repeat and emphasize, we are carrying out this survey under a contract from DEFRA, to gather baseline information on the extent to which snares are used for pest control in England, variation in working practices with snares, and the factors that influence these. It is a fact-finding exercise. Any information given to us during this survey is protected under the Data Protection Act, consequently, the information we pass to Defra will consist of an anonymous analysis and summary. We will treat individual responses in strictest confidence. Information you supply will be properly protected and personal identifiers will be deleted once the report is complete.

1. DEFRA have supplied me simply with a list of tenants and landowners, so first I need to establish if you are the landowner or tenant?
2. How large is your landholding?
3. Are foxes controlled on your land?
4. Are rabbits controlled on your land?
5. a. Is there a game-bird shooting interest on your land?

- **Yes (if no proceed to question 6):**

   b. Is it predominantly wild or reared birds?

   c. Is any of the shooting let or sold?

6. As you know, this survey is particularly concerned with the use of snares, to the best of your knowledge are snares used on the property to control these *or any other species?*

- **No (if yes proceed to question 9):**

7. Is there a particular reason that snares are not used?
8. Do you have any personal experience of using snares?

Thank you very much for your participation and time. Is there anything you would like to add with regard to snaring? End of survey.

- **Yes:**

9. Can you tell me which species?
10. How important is snare use currently for control of these species on your land, on a scale from 1-5, with 1 being unimportant and 5 being very important? (Answer for each species controlled by snares.)
11. Do you have any personal experience of using snares?

I would now like to ask some more specific questions relating to snare use.
<Depending on whether they have personal experience of snaring>, who carries out most of the snaring on your land?
Can you give me the contact details (telephone number) of the person who snares so I can ring them with a view to asking them some questions about the details of their snaring? Thank you very much for your participation.
If self = snare operator, carry on: Is this a convenient time to run through some more detailed questions? This will take around 15 minutes.

- **No:** when would be a convenient time for me to ring back? (get a date and time)
- **Yes:** continue from *(missing out question 2 in Appendix II).

9.4. APPENDIX D – Transcript of detailed telephone survey about snare use

Detailed Survey

Good morning/afternoon/evening my name is Suzanne Richardson and I am calling from the Game and Wildlife Conservation Trust. I have been given your phone number by (name of landowner), as I understand you carry out pest control on (name of farm). (Name of landowner) may already have told you that we are carrying out a survey to gather baseline information on the importance and extent of the use of snares in England. Defra has contracted us to do this survey, but I want to stress the confidentiality arrangements. Any information given to us during this survey is protected under the Data Protection Act. Consequently, the information we pass to Defra will consist of an anonymous analysis and summary. We will treat individual responses in strict confidence. Information you supply will be properly protected and destroyed once the work is complete.

Is this a convenient time to ask you some questions? It will take around 15 minutes.

- **Yes, but not now:** arrange suitable time and call back later.
- **Yes:** thank you.

* When you give me your answers, please bear in mind that these questions relate only to (name of farm).

Snare operator questions:

General snare questions:

1. Can I just check on what basis you operate (gamekeeper/pest controller/other) and that you are the main user of snares (as opposed to overseeing the staff that do the actual snaring) on (name of farm)? If no – contact name and number – is it ok to contact them …….(reasons as above)
2. What species do you use snares for on (name of farm)?

If more than one species, then repeat Q3-Q12 for each species.

Species specific snare questions, repeat for each species:

3. Do you set the snares to kill or restrain (species)?
4. What is your main reason for using snares (as opposed to other methods) against (species)?
5. Where do you get your (species) snares from (no prompt – e.g. SCATS/make my own/gun shop)? If a mixture of sources, check proportions.
6. Do you modify them before use, use as purchased or do you have a mixture of both?
7. Are the (species) snares that you use unstopped, stopped, or mixed. (Allow option of 'what do you mean?' Reply 'i.e. does it have a stop/crimp to prevent the noose closing down beyond a certain diameter')?
8. Are there any factors/issues which limit your use of snares for (species)?
9. A. When snares are set for (species), approximately what time or times of the day do you check them?
   B. Are snares checked after dark?
   C. How long does it take to carry out your snare round?
10. Which methods do you use to dispatch any (species) which are caught in the snare (prompt - shotgun/rifle/blow to head/rabbit punch/stretching neck)?
11. Only if snare operator is not the land owner: How important is snare use for the control of (species) on a scale of 1 to 5 with 1 being unimportant and 5 being very important?

Training and awareness questions:

12. Are you aware of the DEFRA CoP?
13. Have you read it?
14. Do you possess a copy?
15. Have you read any other CoP/advice leaflet - If so which?
16. Do you possess a copy?

<u>Repeat questions 17 to 22 for each species:</u>

17. Have you caught non-targets – if so which?
18. What measures do you take to minimize non-target captures?
19. When did you first start using snares (with prompts – <5/10/20 years etc)?
20. Have you had any training (no, on the job training, attended a course) – if a course, which?
21. To try and establish the extent of snare use, I want to ask how many snares you would typically have 'set' at any one time – I appreciate that this probably changes through the year so if I run through the months can you give me an approximate number of snares you would expect to be running?
22. How many snares do you have 'set' at present?

That is the end of the telephone survey:

23a...but we do have a further request. To ensure that this study is accepted by everyone as a fair picture of the current use of snares in England, it's important that we actually visit a proportion of the farms included in the survey. We have chosen a sub-sample of farms at random, and your farm (Name of farm) turns out to be one of those. So would it be possible for me to come with you tomorrow when you check your snares?

9.5. APPENDIX E – Additional data obtained during survey

Table E.1 ***The percentage (±SE in parenthesis) of landholdings in England (n = 2,404) on which some form of fox control (not necessarily involving snaring) was carried out. Predictions from the regression model, classified by land class, size class (2 (>=5 <20), 3 (>=20 <50), 4 (>=50 <100), 5 (>=100)) and game-bird shooting interest.***

Land class	Size class	No game-bird shooting interest	Game-bird shooting interest	Sample size
Arable a	2	23 (4)	54 (5)	22
	3	28 (4)	61 (5)	36
	4	31 (4)	65 (4)	32
	5	42 (4)	75 (3)	138
Arable b	2	21 (3)	52 (5)	77
	3	26 (3)	59 (4)	124
	4	29 (3)	62 (3)	148
	5	40 (3)	73 (2)	398
Arable c	2	13 (4)	39 (8)	1
	3	17 (4)	45 (8)	4
	4	19 (5)	49 (7)	13
	5	28 (6)	61 (7)	43
Pastoral d	2	25 (3)	57 (5)	92
	3	30 (3)	64 (4)	139
	4	33 (3)	67 (3)	154
	5	45 (3)	77 (2)	220
Pastoral e	2	15 (2)	42 (5)	47
	3	19 (2)	49 (4)	108
	4	21 (2)	53 (4)	143
	5	31 (3)	64 (3)	211
Marginal Upland	2	24 (4)	56 (5)	27
	3	29 (4)	63 (4)	46
	4	33 (4)	66 (4)	51
	5	44 (4)	76 (3)	105
Upland	3	25 (9)	58 (11)	5
	4	28 (9)	62 (11)	4
	5	39 (11)	73 (9)	16
Sample size		1,579	825	2,404

Table E.2 The percentage (±SE in parenthesis) of landholdings in Wales (n = 355) on which some form of fox control (not necessarily involving snaring) was carried out. Predictions from the regression model, classified by size class (2 (>=5 <20), 3 (>=20 <50), 4 (>=50 <100), 5 (>=100)) and game-bird shooting interest.

Size class	No game-bird shooting interest	Game-bird shooting interest	Sample size
2	20 (4)	36 (9)	115
3	30 (6)	49 (10)	68
4	48 (5)	68 (8)	88
5	54 (6)	73 (7)	84
Sample size	313	42	355

Table E.3. The percentage (±SE in parenthesis) of landholdings in England (n = 2,404) on which some form of rabbit control (not necessarily involving snaring) was carried out. Predictions from the regression model, classified by land class, size class (2 (>=5 <20), 3 (>=20 <50), 4 (>=50 <100), 5 (>=100)) and interest in game-bird shooting.

Land class	Size class	No game-bird shooting interest	Game-bird shooting interest	Sample size
Arable a	2	51 (11)	90 (5)	22
	3	52 (9)	90 (5)	36
	4	32 (9)	80 (8)	32
	5	54 (6)	91 (3)	138
Arable b	2	44 (6)	75 (5)	77
	3	42 (5)	73 (5)	124
	4	51 (5)	80 (4)	148
	5	64 (3)	87 (2)	398
Arable c	2	0.1 (2)	0 (4)	1
	3	0.1 (1)	0 (2)	4
	4	48 (15)	61 (15)	13
	5	45 (11)	58 (10)	43
Pastoral d	2	28 (5)	43 (8)	92
	3	40 (4)	57 (6)	139
	4	41 (4)	58 (6)	154
	5	54 (4)	70 (4)	220
Pastoral e	2	18 (6)	35 (10)	47
	3	27 (4)	47 (7)	108
	4	42 (4)	64 (5)	143
	5	52 (4)	73 (4)	211
Marginal Upland	2	10 (6)	21 (11)	27
	3	44 (8)	65 (9)	46
	4	41 (7)	62 (9)	51
	5	48 (6)	69 (6)	105
Upland	3	32 (19)	58 (18)	5
	4	35 (22)	61 (29)	4
	5	99 (3)	100 (1)	16
Sample size		1,579	825	2,404

Table E.4. The percentage (±SE in parenthesis) of landholdings in Wales (n = 355) on which some form of rabbit control (not necessarily involving snaring) was carried out. Predictions from the regression model, classified by land class, size class (2 (>=5 <20), 3 (>=20 <50), 4 (>=50 <100), 5 (>=100)) and interest in game-bird shooting.

Land class	Size class	No game-bird shooting interest	Game-bird shooting interest	Sample size
Arable b	2	40 (22)	74 (19)	5
	3	12 (12)	38 (27)	6
	4	62 (21)	88 (10)	6
	5	0.1 (1)	1 (5)	4
Pastoral d	2	6 (3)	21 (11)	40
	3	23 (8)	56 (14)	29
	4	16 (6)	45 (14)	32
	5	33 (11)	68 (14)	17
Pastoral e	2	14 (6)	41 (15)	34
	3	11 (8)	35 (19)	16
	4	8 (5)	28 (14)	24
	5	28 (12)	62 (15)	13
Marginal Upland	2	17 (6)	47 (14)	36
	3	3 (3)	12 (11)	17
	4	18 (7)	49 (14)	26
	5	25 (6)	58 (11)	50
Sample size		313	42	355

Table E.5. The percentage (±SE in parenthesis) of landholdings in England (n = 2,412) on which there was a game-bird shooting interest. Predictions from the regression model, by land class and size class.

	Land class							
Size class	Arable a	Arable b	Arable c	Pastoral d	Pastoral e	Marginal Upland	Upland	Sample size
>=5<20	12 (3)	13 (2)	13 (4)	7 (1)	9 (2)	8 (2)	16 (6)	266
>=20<50	22 (3)	23 (2)	23 (5)	13 (2)	18 (2)	14 (2)	27 (9)	464
>=50<100	32 (4)	33 (3)	33 (6)	19 (2)	26 (2)	22 (3)	38 (10)	545
>=100	56 (4)	57 (2)	57 (7)	39 (3)	49 (3)	43 (4)	63 (10)	1,137
Sample size	228	752	61	605	511	230	25	2,412

9.6. Appendix F - Description of snare pen trial where rabbit died during trial 19.

The rabbit in trial 19 died whilst still held in an unstopped snare and during its set trial time of 24 hours. The rabbit was put into the snare at 14:19:25 on 11/12/08 and the weather was dry with temperatures at approximately 3°C. The rabbits in this run of trials were not checked for the first 18 hours due to the lack of any significant injuries in previous trials, but were then checked every 2 hours thereafter. The video recording of the trial was therefore used to decipher what had occurred prior to the death of the rabbit.

The rabbit could be seen to be panting quite heavily during the first half hour of the trial, especially during pauses from pulling away from the snare, but then appeared to be breathing more normally. The extent of pulling calmed down and smaller, calmer movements were noted. At 18:00 the rabbit began to gasp, heavily for 19 minutes and then less pronounced until 18:35. At approximately 20:00, the rabbit began to move about again and the snare wire became wrapped around the right hind leg. It may have become further entangled at 20:26 and 20:50, but this was unclear from the video footage as the rabbit was moving about, often in small circles.

At 21:22, the rabbit began to move about again, after having sat still and got its right hind leg free from the snare wire. It then began a bout of pulling, which was followed by some shallow panting at 21:25 for approximately one minute. The rabbit became entangled in the snare wire once again at 22:30, getting the wire caught around its left hind leg and a few serious bouts of pulling away from the snare wire resulted in gasping for several minutes afterwards. The rabbit was then still again until 22.45 when, for approximately 20 seconds, there was lots of pulling away from the snare and flipping as the end of the snare wire was reached. This was followed by 2 minutes of shallow gasping and the rabbit being mostly sat down with occasional, small movements.

The rabbit had another bout of pulling at 23:40, when the snare wire could be more clearly seen to be wrapped around the left hind leg. More gasping followed for approximately 6 minutes and the next movement noted was at 00:14, when the rabbit may have become further entangled. This was, again, followed by gasping for 2 minutes and very little general movement until 01:01.

At 01:01, the rabbit can be clearly seen to have the snare wire also caught up around its front left paw as a result of more pulling away from the snare and crossing over the wire when doing so. More movement and crossing over the snare wire at 01:18 is likely to have untangled the front left paw but this cannot be seen for certain. The hind left leg became more entangled at 01:35 as the rabbit did several turns, almost on the spot. Another serious bout of pulling away from the snare at 01:48 causes the rabbit to fit whilst lying on its side. The fitting slowed after 40 seconds and the rabbit sat back up a minute later, although still gasping for breath.

The gasping became much deeper at 01:55 and the tongue seemed to be protruding from the rabbit's mouth. The gasping became shallower at 02:00 but with moments of deeper gasping after any movements the rabbit made, mostly small and calm movements, until 04:55. At this point, another stint of pulling resulted in a fitting episode for 90 seconds and the rabbit remained lying on its side for a further 6 minutes. Another fitting episode followed at 05:04 lasting 25 seconds and was followed by the rabbit lying on its side gasping for 3 minutes. The rabbit collapsed onto its side from a standing position at 06:13, continuing to breathe very heavily. It had been showing very little activity throughout its time in the snare between these fitting episodes, as movements resulted in its breathing becoming more laboured.

It is likely that the rabbit spent some time eating prior to 04:55, as only three of the six pieces of carrot provided were recovered at the end of the trial, but it was not evident when this feeding occurred exactly. The onset of the fitting restricted the movements of the rabbit to sitting or lying still or bouts of pulling away from the snare and there were no periods of time that could be interpreted as feeding, either on carrot or grass.

The following hour contained a series of further fitting episodes at the following times: 06:27 for 40 seconds; 06:32 for 10 seconds; 06:39 for 30 seconds; 06:43 for 15 seconds; 06:48 for 25 seconds; 06:53 for 10 seconds; 06:54 for 5 seconds and 06:59 for 2 minutes intermittently. The rabbit was then twitching intermittently from 07:08 until 07:11, when it experienced another fit for 10 seconds. This was again followed by intermittent twitching, with the last twitch recorded at 07:15:10 and no further movements recorded. The rabbit therefore died at 07:15 and a technician entered the pen to confirm death at 07:50 and to confirm that its body was not frozen.

9.7. Appendix G - Procedure for dealing with non-target captures in Fox snare field trial – study 1.

Hares
Hares will be released unless the snare operator decides a captive is unfit for release. Reasons for not releasing hares might include extreme lethargy or an obvious snare-related injury. Hares will be euthanized with a shot to the head using a .177 air pistol and a Prometheus air pellet. This is the same methodology that GWCT scientists use to dispatch live mink and grey squirrels.

Badgers
Badgers will be released unless the snare operator decides a captive is unfit for release. In the unlikely event that a badger needs to be dispatched, it will be shot in the chest using a 12 bore shotgun and 30 gram AAA or BB load.

Deer
Deer will be released unless the snare operator decides a captive is unfit for release. In the unlikely event that a deer needs to be dispatched, it will be shot in the back of the head using a 12 bore shotgun and 30 gram AAA or BB load. However, any muntjac deer that are caught will be shot (muntjac may only be released into one of 12 listed counties, deemed to be their “core area”.)

Other non-targets
All other non-targets will be released unless the snare operator decides they are unfit for release. If a non-target needs to be dispatched, it will be shot using a 12 bore shotgun and 30 gram AAA or BB load. If the non-target capture is a domestic animal, and is deemed unfit for release, the landowner will be consulted prior to dispatch.

9.8. Appendix F - Description of capture site for fox and badger where the logger bracket failed.

Fox, 25/5/09, capture code dt10: Caught on a tramline in a field of wheat. The capture circle was very typical of a fox and I found a ginger-coloured guard hair stuck to the top of the anchor post (the only equipment that remained intact). I have kept this for analysis if needs be. I could not detect a smell at the capture site, there were no droppings, and I found no tracks as the tramlines were too compacted and unreceptive to tracks at the time of capture. The fox I caught the following day (capture code dt14), was caught approximately 40 yards away, in the same field.

Badger, 25/5/09, capture code dt11: Caught on a tramline in the same field of wheat described above. The capture circle included a number of shallow excavations. There was an extremely strong smell of a badger at the capture site. I found no fur or droppings and could not find any tracks (due to the reasons described above). This capture was approximately 30 yards away from capture dt10, on a tramline in the same field of wheat.

9.9. Appendix H. Protocol for Fox snare field trial – study 2.

Field trials to test the humaneness of fox snares: welfare and protected animal safeguards

Background
The objective of these trials is part of a wider objective in the SID 3, namely: *to evaluate the humaneness of use of fox and rabbit snares under best practice conditions, particularly with respect to the Agreement on International Humane Trapping Standards* (Objective 4).

Data will be primarily obtained from post mortem and two behavioural categories that can be obtained in the field. The aim is to obtain data on twenty target animals (foxes) captured during field trials.

Procedure
See Annex B

Ethics
The field trials will be carried out under a Home Office Project Licence, with field workers having personal licences permitting them to carry out the work. The protocol for the trials has been approved by the Ethical Review Process (ERP) in both Fera and GWCT (the Certificate Holder being legally responsible for all decisions made by the ERP

Welfare safe-guard
In order to prevent avoidable suffering, the condition of each successive captured animal will be scored. The cumulative score will be used to trigger suspension of the trial and review of the protocol.
Condition scoring will be based on the indicators of poor welfare listed in 'The Agreement on International Humane Trapping Standards' for assessing restraining traps (Annex A). For the special circumstances of this trial, additional events listed in Annex A would also contribute to the score. The trial would be suspended if the total score reaches 5. During the running of the trial any events that could potentially be assigned a lower score will be discussed with the ERP on a regular basis, to prevent them causing unnecessary suspension of the trial. If the welfare safe-guard score reaches 5 the data gathered to date would be examined and continuation of the trial would be discussed with the ERP.

Post mortems
All captured foxes and hares will be euthanised at the site of capture and post mortems carried out. This is to collect data for the research, but the findings will also be used to inform review of the trial as described above. The size, type and extent of all injuries will be fully recorded, and those that can be attributed to the snare identified.

Examination of badger captures.
Initial observations on any badger caught alive will be undertaken by field personnel. If a badger is considered so seriously injured that to kill it would be an act of mercy, then this will be done immediately under the provisions of the Protection of Badgers Act 1992. Any badger killed or found dead in snares will be examined post-mortem

by a vet. Any badger that is displaying normal behaviour and on closer inspection is not injured will be released. The appropriate course of action for all other badgers, i.e. those with minor injuries, will be under veterinary direction.

As with other species, full exploration of the condition of a snared badger could only be achieved post-mortem. However, it is not proposed to kill badgers in order to gain this information. Examination under anaesthesia has also been rejected because of the increased welfare risks associated with anaesthesia and taking a wild animal into care, which outweigh the extra information that would be obtained.

<u>Numbers of non-targets</u>
Non-target captures are expected in the normal course of snaring, and uninjured non-targets would not normally suspend the trials. However, a licence is required under the Wildlife and Countryside Act 1981 to take certain protected animals by snares.[16] As soon as 2 protected animals are caught all trials will be suspended and a licence applied for.

[16] Protected animals are hereby defined for the purposes of this protocol as: all wild birds (including game birds), all deer, and all animals on Schedules 5 and 6 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation (Natural Habitats & c.) Regulations 1994 (as amended), A licence is required to use a snare to capture animals on Schedule 6 of the WCA.

Annex A – welfare indicators

Several methodologies have been previously used to assess injuries during live capture trapping; however, few of these have been discussed and achieved consensus approval. The indicators of poor welfare listed in the Agreement on International Humane Trapping Standards (AIHTS) do at least represent a consensus between many scientists. The AIHTS sets out a list of indicators that, if observed, are unacceptable.

Poor welfare Indicators in the AIHTS

Behaviours:
a) self-mutilation and
b) excessive immobility and unresponsiveness.

Injuries:
(a) fracture,
(b) joint luxation proximal to the carpus or tarsus;
(c) severance of a tendon or ligament;
(d) major periosteal abraison;
(e) severe external haemorrhage or haemorrhage into an internal cavity;
(f) major skeletal muscle degeneration;
(g) limb ischaemia;
(h) fracture of a permanent tooth exposing pulp cavity;
(i) ocular damage including corneal laceration;
(j) spinal cord injury;
(k) severe internal organ damage;
(l) myocardial degeneration;
(m) amputation;
(n) death.

In the present trial, the above indicators would contribute towards a cumulative score, in combination with other events, as follows:

Trial scoring

- An animal (target or non-target) displaying any of the indicators listed in AIHTS (above) would count as 1.0.
- Signs that an animal was captured but later escaped, (snare remains on-site) will score 0.5. This is because it is unknown whether the animal would have had any of the indicators or not. During previous pen trials of snares, animals were observed to escape from snares within 3 minutes. These escapes left no disturbance to the surrounding vegetation and no damage to the snare, apart from the noose being drawn tight. These types of escape never resulted in any injuries. It is probable that similar short duration captures occur in the field with a low likelihood of injury. Escapes where there is no disturbance to the surrounding vegetation and no disfigurement of the snare, would suggest a similar short duration of capture in the field. Cases where an animal escapes and takes the snare, or part of it, with it, will be assessed on a case by case basis using evidence provided by the field worker. If the snare is considered likely to come

loose and drop off the animal this will score 0.5. If the snare is considered likely to stay on the animal this will score 1. The final decision on assigning the lower score to such an event will rest with the ERP.

- Cases where a captured animal has been predated will be scored 0.5 where it is not possible to differentiate injuries caused by the predator from those, if any, caused by the snare.

The maximum that any individual animal can score is 1.0

Annex B

Field protocol

Abbreviations:

PL Project leader
PFW Primary field worker
FTL Field trial leader

Field sites

Initially, field sites that are well known through prior fox snaring research will be selected. This approach will most closely resemble the advantage of a snare operator "knowing his ground". The advantage of knowing one's own ground is that it is possible to more easily predict where fox activity will occur, and that non-targets can more easily be avoided. Another advantage is these landowners are more likely to support the research and accept a site inspection by a Home Office inspector. To ensure that the results of the study are robust to a wide range of habitats and environments, the field sites should be as varied as possible. Snares will be set in each location for a maximum of 7 snare nights (not necessarily consecutive). Similarly, if a fox is captured, that field site will be abandoned. Field sites may be revisted after a period of 3 months has elapsed.

Site survey

Field sites will be surveyed for signs of fox activity prior to any snares being set. If snares are to be set, the snare operator will inform FTL and/or PL immediately. Snares will be set only in locations where there are fresh signs of fox activity. Typically, these signs might include presence of a cubbing earth, scats, tracks, fur, prey remains or sightings. Speculative snaring will be avoided.

Abandoning snaring at a site

Whilst every effort will be made to avoid non-targets, it should be noted that badgers and brown hares are locally abundant throughout the region in which the study will take place. If an unacceptably high number of these non-target species is being caught, snaring effort at that site will be terminated following discussion with FTL and PL.

Snare preparation and setting

New snares will be de-greased and coloured using established guidelines. Snares will be supported with copper teeler rods, noose size and height above the ground will follow The Defra Code of Practice Guidelines. Each snare will be attached to either a spiral ground anchor or an angle-iron anchor stake (dependant on substrate). Typically, snares will be sited in tramlines, field edges, grass runs and farm tracks. Snares will not be set in locations where captive entanglement with shrubby or woody material might occur. The locations of snares will be recorded on a field map, which will be updated daily.

Snare checking

Snares will be checked twice daily, early morning and late afternoon. A daily diary will be kept of snaring activity, recording the number of snares set on any given day, and the times that the two snare checks were started and completed.

Daily report
A daily report on number and species of all captures will be made to FTL and PL. This will also include information as to whether escapes have occurred. Field assessment will be made to identify any injuries that are included on the AIHTS indicator list.

Snare captures
For each capture (including animals that have escaped, are released, found dead or are dispatched), the snare operator will assign the capture event a unique code, complete a capture sheet (for details, see below), write a detailed description of the capture site, and take photographs of the site. Where an escape has occurred a detailed examination of the snare, and description of the site will be completed. Any animal remains found will be collected and stored. Particular note will be made of the degree of disturbance both to the surrounding vegetation and the snare, and the presence of any odour of an animal. Animals that are dispatched will be tested for unconsciousness by an eye-reflex test, and death by rigor mortis. Euthanized animals and animals that are found dead, will have a label attached by wire and will be placed in labelled plastic sacks (with the snare attached), and placed in a freezer as soon as is practicable. Accumulated carcasses will undergo post-mortem examination. Details for captures and dispatch of different species are detailed below.

Foxes
All captive foxes will be dispatched using a 12 bore shotgun and a 30g load of AAA or BB shot. It is likely that most foxes will be shot from 10-20 metres, depending on snare site constraints and captive behaviour. Shooting the fox as quickly as possible will be a priority, to minimise stress to the fox and to reduce snare related injuries that might occur only when the fox becomes aware of the snare operator. When possible, the shot will be directed towards the chest area and taken when the captive is static. On occasions, through necessity, the fox might be head shot - if it were lying in high vegetation for example. Some foxes may behave erratically when approached, in which case two shots might be required to dispatch the animal.
If a fox is captured and it has a radio-collar attached, it will not be included in the study. If a fox is euthanized by anyone other than an approved snare operator, it will not be included in the study.

Hares
All captive hares will be euthanized. Prior to December 2009 hares were euthanised with a shot to the head using a .177 air pistol and a Prometheus air pellet . After December 2009 hares were euthanised from a distance with a 12g shotgun using either a 1oz or 7/8 oz load of No 7 shot. The landowner’s permission to kill hares will be required in advance.

Badgers
If a badger needs to be dispatched, it will be shot in the chest using a 12 bore shotgun and 30 gram AAA or BB load.

Deer

Deer will be released unless the PFW decides that a captive is unfit for release. In the event that a deer needs to be dispatched, it will be shot in the back of the head using a 12 bore shotgun and 30 gram AAA or BB load. However, any muntjac deer that are caught will be shot (muntjac may only be released into one of 12 listed counties, deemed to be their “core area”.)

Domestic animal captures.
In the event of any domestic dogs or cats being caught alive or dead in a snare, if the owner can’t be contacted, they will be taken to the nearest veterinary surgery as soon as is practical. The results of examinations will be recorded and the owners contacted, if they can be identified. Owner permission will be sought before any post-mortem.

Other non-targets
Other non-targets will be released, unless the PFW decides that a captive is unfit for release.

Photographs
The following photographs will be taken with a digital camera. Relevant files will be sent to Fera:
All capture sites (caught and held or escaped).
Evidence of digging, droppings or blood spotting (excluding blood from the killing shot).
For animals that are dispatched with a shotgun, a photograph of the animal in its terminal position, showing its position relative to the capture site.
Any obvious snare related external injuries.

Termination of field work
Once a sample of 20 foxes has been accrued, all remaining snares will be pulled and PL will be notified.
On the trials extending into the breeding season for foxes, the ERP has recommended continuing the trials only until sufficient trials have been completed to ensure that confidence in the results is 99%, i.e. 99% confident that if 20 foxes had been caught less than 20% would have had the poor welfare indicators included in the AIHTS.

9.10. Appendix I. Procedure for dealing with badger captures as agreed with the named veterinary surgeon during Fox snare field trial – study 2.

On first confirming that a badger has been caught the primary field worker (PFW) will approach and the following action will be taken:

a) If badger is <u>obviously</u> uninjured and fit for release it will be released immediately.

b) If the badger has severe injuries it must be euthanised immediately. Severe injuries are defined as those that would hinder the subsequent survival of the animal, these are likely to be either laceration of a limb and/or a visible deep wound on the body that penetrates the skin. These are the most likely severe injuries to occur, but others may occur and the PFW must make a judgement on these. Dental injuries, tend to cause significant bleeding but rarely hinder survival of the animal. Therefore dental injuries would not normally be counted as severe, but if the snare is located through the mouth and around the back of the head this would most likely cause severe injuries.

c) If the PFW believes that the badger may escape then he must immediately examine the badger and either release it if it has no visible injuries or euthanise it if the injuries look like they would hinder the subsequent survival of the animal.

d) If there are any concerns in the PFW’s mind he will immediately withdraw having checked that the animal is secure and unlikely to injure itself or escape. The PFW will then contact the secondary field worker (SFW) to assist in examination of the badger. While waiting for the SFW to arrive the rest of the snares will be checked and any captured animals dealt with as outlined in the main protocol.

When the SFW arrives and the rest of the snares have been checked the badger will be restrained for a closer examination. To restrain the badger a forked stick will be run down the snare wire up to the eye of the noose, and the head of the badger restrained. A dog noose will then be placed around the badgers neck, avoiding the site where the snare is. A sack will be placed over the badgers head to try and keep it calm. The two field workers will then examine the badger as closely as possible. If there are no visible injuries the badger will be released. If there are minor injuries the badger will be given long acting antibiotics and a vet will be consulted as to the appropriate course of action to take. (Badgers will only either be released or euthanised). The GWCT vet will be the primary vet for consultation but in instances when he is unavailable, the Fera named veterinary surgeon or his deputy will be consulted. When the vet is not the SFW, the badger will be placed into a cage trap prior to the consultation. If the field workers have to move to obtain telephone contact with the vet the badger will be left in the covered cage trap at the site of capture. All badgers that are euthanised will be frozen and post mortem examinations undertaken. Full field notes of all events will be recorded.

All badger captures will be reported as soon as possible to the Fera NVS (or his deputy) and the project leader.