Wounding rates in shooting foxes (Vulpes vulpes)

Animal Welfare 2005, 14: 93-102 has published this study, which has been peer reviewed. Abstracts are available online at the UFAW website; https://www.ufaw.org.uk/.
Copies as published are available free from International Wildlife Consultants, PO Box 19, Carmarthen SA33 5YL, UK. Joint authors: NC Fox, N Blay, AG Greenwood, D Wise and E Potapov.

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GENERAL INTRODUCTION

The All Party Parliamentary Middle Way Group on Hunting with Dogs has been tackling this thorny issue for several years.

Our concerns are wider than the immediate issues of hunting with dogs. First of all, we are concerned that wildlife should be managed on a sound scientific basis, not on ill-informed and often prejudiced opinion. Therefore, we have undertaken research into these issues ourselves because neither side of the debate seems eager to seek out the truth.

Secondly there are clearly many ways of killing wildlife, with implications both for populations and for individual animal welfare. These methods, such as shooting, poisoning, snaring, trapping and hunting with dogs, should ALL be subject to scientific scrutiny for their relative merits and disadvantages. There are already welfare benchmarks in existence for some of these methods, such as trapping, and we think these standards should be applied evenly across the board, if welfare is not to be compromised.

Therefore, not only have we undertaken research into these methods, especially shooting, and made a film of the research, and published the research in the leading peer-reviewed scientific Journal of Animal Welfare, we have also proposed solutions for drafting legislation and licensing so that these welfare benchmarks can be achieved.

Details of this work are shown in this website.

For more on the Middle Way Group, see www.themiddlewaygroup.org.uk

PUBLIC HEARING 3.D

How to ensure that any activity which may be permitted is effectively regulated.
Dr Nick Fox

Introduction
What I am going to say summarises a more detailed draft document entitled A Legal Solution to Hunting with Dogs, building on the Middle Way Group position. When we have collated any new information arising from the public hearings, we plan to finalise this document for release next week.

1. The police have already stated that they would have great difficulty in enforcing a hunting ban forced on an unwilling public. Regulation can only work if the legislation is seen to be fair, is understood clearly, and if the public are willing to comply.

2. A ban on hunting with dogs will not be seen to be fair unless alternative ways of killing wildlife, particularly for those species that are also hunted with dogs, are subject to the same scrutiny and welfare criteria using scientific methods. Some methods, such as humane traps, are already subject to testing for welfare standards and these standards should be applied across the board to all methods of killing or capturing wildlife. Methods that meet those standards may be licensed, those that fail should be banned.

3. The issue of any licence to kill wildlife should be based on two key criteria:
a. Wise and sustainable use of the species.
b. Individual animal welfare.

4. In assessing the issue of individual animal welfare, the criterion 'unnecessary cruelty' is too ambiguous and subjective to be useful in law. The term 'undue suffering' is more helpful and can be applied more objectively to proper tests of welfare standards as already in use.

5. The legal definition of 'hunting with dogs' has so far been elusive. I suggest we divide it into two simple categories: hunting with dogs above ground, and hunting with dogs below ground. The first category encompasses any situation in which a dog chases any mammal above ground, whether at an MFHA Hunt, a shooting syndicate, someone out with a lurcher, or someone out with the family dog in the park. I suggest that this is banned, but that a General Licence is issued by the Secretary of State making it legal to be done for certain Statutory Purposes (including sport), subject to the two key criteria already mentioned. I suggest that the person who is actually in charge of the dog at the time of the incident is the person legally responsible under this General Licence. I suggest that all hunting with dogs below ground be banned, but that certain approved persons may be authorised by Individual Licences to use this method for certain Statutory Purposes, (not including sport hunting).

6. I suggest that the shooting of foxes is banned, but subject to a General Licence entailing the two key criteria. In order to pass the welfare criterion, the General Licence could be expected to limit shooting of foxes to shot sizes of BB or larger and to rifles of calibre larger than .22.

7. I suggest that snaring of foxes is banned, but authorised for Individually Licensed approved Pest Control Operatives.

8. The legal framework under which the killing of wildlife is currently regulated is a shambles. The Wildlife and Countryside Act 1981 is currently under review and this could be a suitable vehicle for pulling together all the loose ends in a coherent, science-based, comprehensible manner.

9. I propose that a Wildlife Management Authority is formed through the powers already in place in Part 1, Section 23 of the WCA, to regulate wildlife management activities, primarily through a licence system, as now, but expanded.

10. I propose that the licences issued by the Secretary of State, on the advice of the Wildlife Management Authority, on the basis of the two key criteria, continue as now in three main types, namely General Licences, Individual Licences, and Product Licences, that they be issued for a number of possible Statutory Purposes, and that they allow a number of approved Methods that satisfy the welfare criterion.

11. I suggest that a Handbook of Wildlife Regulations be issued by the WMA, listing in full the different licences that are current, with their conditions for use, and that this Handbook be widely available to both users and enforcers, and on the Web. Compliance is dependent on clear understanding.

12. I suggest that sport or recreational use of wildlife – be it of foxes, pheasants or coarse fish – continue as a valid Statutory Purpose for a General Licence, provided that the two key criteria are met.

13. The first condition on any licence would be permission from the land-owner or manager to enter land for the purpose of the licensed activity. I suggest that organised Hunts or Syndicates prepare for themselves a standardised form of Hunting Permit that satisfies the licence requirements, and keep the signed forms on file. Only if a Hunt has sufficient permitted country on file would hunting with hounds be viable.

14. Spectators of a licensed activity, who are not actually controlling the dogs, or shooting the guns, are still subject to the laws of trespass. I suggest that organised Hunts and syndicates make proper access provision for spectators on the Hunting Permit and take clearer steps than now to identify them and control them.

WELFARE ASPECTS OF SHOOTING FOXES

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SUMMARY

Although large numbers of foxes (Vulpes vulpes) are shot in Britain each year, little is known of the welfare implications of this. When foxes are shot at and escape it is impossible to discern what proportion are wounded or to investigate the nature of those wounds.

Both shotguns and rifles are used to shoot foxes and we observed and filmed foxes shot at by all the main methods. We obtained data from the Scottish gun packs for the 2002-2003 season documenting the outcomes of 574 shots fired at 386 live foxes. This revealed an average kill rate of 55% (range 20-79%) for all shots fired, but did not permit exact calculations of wounding rates because some foxes escaped.

We undertook target fox shooting and examined 51 different shooting regimes: 35 shotgun regimes including .410 and 12 bore shotguns using No 6, BB or AAA shot sizes at 25, 40 and 60 yards, using open choke and full choke barrels, and shooters that were skilled, semi-skilled or unskilled. We undertook 16 rifle regimes using both rimfire and centrefire rifles at 50, 100 and 150 yards from both supported and unsupported positions and by day and by night. Shoots took place in England, Wales and Scotland and involved 199 shooters, of which those in the skilled categories frequently shoot real foxes and used their usual fox guns for the tests.

The targets were life size colour paper sheets, cut to the silhouette of a trotting fox, traced from a frozen longitudinal section of a real fox and mapped with the internal anatomy. For shotgun trials the targets moved both right and left across an 8 or 10 yard gap taking 3 or 3.5 seconds to cross. For rifle trials the targets were static and exposed for 4 seconds.

15 dead foxes shot with the same ammunition, range and angle were supplied to independent pathologists for them to assess internal injuries caused by each shooting regime. Penetration of ammunition was also tested in comparative card penetration tests.

1283 shotgun shots and 885 rifle shots were fired during the trials and the outcome of these shots was scored by two independent pathologists as killed, two or three grades of wounding, or missed. The shotgun results showed a trend; as shooter skill increased the kill rate increased, missing decreased but wounding stayed much the same at around 60%. No 6 shot was a major source of wounding, even at 25 yards because of poor penetration, at 40 yards wounding reached 97%. AAA suffered from poor pattern density beyond 40 yards, even well-centred shots having insufficient pellets to ensure that a vital organ is hit. Up to 40 yards both AAA and BB performed well, BB being the shot size of choice tested. We did not trial No 3 or No 4 shot. .410 shotguns with No 6 shot are totally unsuitable for foxes, wounding but seldom killing.

Rifles killed considerably more than shotguns and wounded less. High-powered rifles in skilled hands were accurate, even at 150 yards (the furthest we trialled) both by night as well as by day. Poor marksmanship due to inexperience or lack of a gun support lowered this standard. A bullet from a high-powered rifle causes death or fatal injury quickly when hitting almost anywhere on the thorax, skilled shooters under good conditions scoring about 97%.

The welfare consequences of this wounding and mitigating factors such as the use of second shots or dogs are discussed. Ways in which welfare can be assessed and compared across different methods are outlined.

PREFACE

This research was commissioned independently by the All Party Parliamentary Middle Way Group in response to the obvious void in scientific evidence revealed by the Burns Report and the Public Hearings on Hunting with Dogs. Others (George 2003) considered there is plenty of evidence, but on closer scrutiny little of it is useable. Our report is an interim document and is accompanied by a film of the study. Our full scientific report is currently in preparation for submission to a scientific journal. We would like to thank all those who participated in the study. Participation does not imply agreement with any statements made herein. No foxes were killed or wounded specifically for this study.

This report is broken up into four sections. Sections one and four were written by Dr Fox, Section Two was written by the International Zoo Veterinary Group, and Section Three was written by Dr Wise.

SECTION ONE

The Design of the Study
Dr Nick Fox

1.1. Introduction

With the current controversy over hunting with dogs, shooting is seen by some as the panacea. But despite repeated calls for scientific evidence on the relative welfare merits of the two methods, none has so far been available.

This study set out to quantify the physical injuries incurred when foxes are shot at. The results allow at least an informed opinion of the suffering foxes are likely to experience and provide some quantitative data (percent wounded and a basic scale of injuries) that allow comparisons with other methods and with ISO Standards for assessing other methods.

When foxes are shot at, some are killed stone dead (group 'k') and some are completely missed (group 'm'). There is no major welfare problem with these two groups. The third group ('w') is the foxes that are wounded but not killed stone dead and either die or recover later, suffering pain and stress in the process. This is the group that this study investigated.

Some of these wounded foxes may be recovered by means of a second shot, or by dogs, and dispatched. Others will escape, and there is no reliable way to differentiate between them and the foxes that have been missed completely.

Thus, number of shots fired $S = k + (m + w)$

1.2. Kill rates

Many hours, even days, are expended in getting a shot at a fox. We could not provide enough observers to document sufficient fox shooting to determine the kill rate ourselves. We observed foxes shot both by shotguns and by rifles, by day and by night, and we saw foxes killed and foxes wounded by all these methods. However, we did manage to obtain the Hunt Returns for the Scottish Gunpacks 2002-2003 that are being submitted in evidence for their court case (see 1.5.). Their average kill rate was 54.9% (range 20% - 79.3%). The Welsh Gun packs estimated their kill rates at

around 33% (Aled Jones pers comm.). The kill rate is clearly a very variable figure, depending on circumstances. In general, from what we saw, and from questioning the shooters who participated in the trials, we estimate that the kill rate of real foxes with shotguns with BB or AAA (see 1.5) is around 35% and with high powered rifles, 80-95%.

1.3. The missed and the wounded rates

As we cannot use captive live foxes for this research, we must use artificial targets to simulate as closely as possible the same conditions as found in real life situations. By shooting at a lot of dummy targets one can easily see which ones are hit (k + w) and which ones are missed (m).

The theory is simple. In practice there are many variables and confounding factors. These need to be assessed, both so that we can assess the accuracy of our estimates and so that we can understand the variation. Cadavers from fox shoots were examined to assess injuries caused by the different shooting regimes. This information was then applied to score the target fox sheets. We can thus estimate what percentage of target foxes are 'wounded' (w) and assess what shooting parameters cause more or less wounding. There is no standard way to quantify suffering, and probably never will be, and therefore we have not attempted to assess the welfare implications of these wounds.

1.4. The variables

Shooting foxes is not a single, standard activity; rather it is a multi-faceted activity with a host of variables. The only common denominator is that all shooting of free-living foxes inevitably entails some wounding. Variables include type of weapon (rifle or shotgun), calibre, choke, size and number of shot and load, range, ability of the shooter, movement and direction of the fox, and exposure time. These are the most obvious variables. When looking at welfare it is not just the welfare of the target that needs to be considered. The fox may be a vixen with dependent cubs that will starve (Macdonald et al.2000). The fox may be misidentified and be a non-target species such as a dog or small deer. A human may be injured accidentally during the attempt to shoot the fox. By failing to kill the fox, it may inflict suffering on further prey animals, or if injured, it may be unable to forage normally and may become a rogue 'killer' fox specialising on easily-caught domestic animals, and thus cause further economic loss. The list is elastic and we will confine the study to the most immediate variables. It is possible that by studying some of these we may be able to identify shooting regimes that cause more suffering than other regimes and this could lead to regulations or codes of practice that might confer some practical welfare benefit, as is already done for deer.

1.5. Data from Fox Shoots

The wounding rate is based on the outcome of a single shot. It either kills, wounds or misses. An individual fox can be missed or wounded by multiple shots before finally escaping or being killed by a last shot. Thus, while a fox can be scored as more than one outcome, a shot can be scored as only one outcome. This is well illustrated by the data from the Scottish Gun packs 2002-2003 season, compiled by the Master of Foxhounds Association from the Hunt Returns from the Masters of eight Scottish packs (Table 1).

In the table Total foxes shot at (T), Foxes shot dead (K), Foxes escaping (E), Shots fired (S) and Escaped wounded foxes killed by dogs (WD) are all knowns. What is impossible to establish is the exact ratio of wounds to misses. When a fox is shot at and runs off it is often possible to see if it is wounded, but it is impossible to see if it is clean missed. The highest-killing packs were under instructions not to shoot at more than 30 metres. Most of the packs used AAA shot. It was believed that most, if not all, the foxes that escaped had been hit. Thus, there is a degree of uncertainty in the minimum wounding figure.

Foxes seen escaping probably wounded (E) = 71.
The probable minimum wounding rate = E/S = 71/574 = 12.4%.
If there were no misses, M = 0, the maximum possible wounded = 259.
The maximum possible wounding rate = 259/574 = 45.1%.
Therefore the wounding rate was in the range 12.4% - 45.1%.
The missed rate was 0% - 32.7%.
The kill rate was 54.9% (range 20% - 79.3%).

Table 1. SCOTTISH GUN PACKS 2002-2003, source: Hunt returns via MFHA

Pack	Total Foxes shot at	Foxes shot dead	Foxes escaping	Total shots fired	% shots that killed	Shots that did not kill outright	Foxes escaping status unknown	Escaping wounded foxes caught by dogs	% Foxes escaping perhaps wounded
	T	K	E	S	K/S%	W+M+ EU+WD	EU	WD	E/T%
A	79	70	9	120	58.3	50	0	9	11.4
B	43	18	25	70	25.7	52	20	5	58.1
C	64	57	7	80	71.2	23	0	7	10.9
D	31	20	11	60	33.3	40	9	2	35.5
E	48	46	2	58	79.3	12	0	2	4.2
F	18	8	10	40	20	32	3	7	55.5
G	83	78	5	120	65	42	0	5	6
H	20	18	2	26	69.2	8	0	2	10
TOTAL	386	315	71	574	54.9	259	32	39	18.4

The percentage of foxes escaping from the guns varied tremendously (4.2% - 58.1%) between the different Hunts. On overall average, 18.4% of foxes fired at escaped the guns and were thought to be wounded. The other wounded foxes were killed by additional shots and did not escape the guns.

Of the shots that did not kill outright (259) = W (unknown wounded) and M (unknown missed) + EU (32) and WD (39).

Therefore 279-71 = 188 shots were neither kills nor escapes and must have been repeat shots. 188/574 = 32.7% of all shots were repeat shots. Roughly speaking, half of the foxes were shot at once, half were shot at twice.

1.6. Fox target shooting trials

Very few foxes present themselves to the shooter at exactly the same speed, direction, angle, distance, lighting and with the same amount of warning and of obscuring vegetation. We therefore used a design that was as close as possible to a common shooting situation in the field, but was standardised to ensure comparability of data.

The target fox was based on an adult vixen weighing 5.0 kg and selected from a group of 14 foxes as being intermediate between the large males and the smaller sub-adults. It was frozen in a trotting position and the silhouette traced out exactly onto clear acetate. The specimen and the silhouette were used to produce a life-size full colour image of the fox, side-view. The specimen was then sawn longitudinally, the longitudinal section was overlaid with clear acetate and the major organs and skin outline were traced in. Exact outlines were thus obtained for the abdominal and thoracic cavities, the brain and spinal cord, and the heart, trachea and buccal cavity. Dissection of the limbs, spine and pelvic and thoracic regions were used to trace in the exact outlines of the bones when viewed from the side. All the acetate overlays were then combined to produce a target that from a few metres looked like a normal fox, but at close quarters was clearly mapped with anatomical details. A data sheet for the shooting regime was printed under the target between the legs. We thus had an anatomically accurate standard fox target and this was scanned and printed in both right and left-facing positions.

The broad-side position is the most vulnerable position for the fox. The vulnerable organs: brain, heart, liver, great veins etc are fully exposed with the minimum of protective bone and muscle mass to absorb shot penetration. There is also a considerable area of the body exposed that is made up of tissue, such as gut, haunches and legs, that if hit would lead to wounding rather than immediate death. The head-on view, on the other hand, presents a relatively compact target that may be a little harder to kill, but is also less likely to be wounded. The tail-on view presents little that is vulnerable. Most of the vital organs are well protected by the lumbar mass and gut which absorbs the penetration of all but the most powerful of shot and leads to a high risk of wounding (Bucknell 2001).

Clearly one can design a shooting trial where k = 100%, for example where all shots are at point blank range. Similarly, one could design a trial where k = 0% by placing the target beyond the range of the gun. Thus, it is important to calibrate the degree of difficulty of the trial so that k is within the same range as that found in shooting live foxes. The trials themselves include a range of degrees of difficulty so it is not critical at this stage that for any specific regime the results of the artificial trials exactly mirror those from shooting live foxes. The nature of shotgun shooting is such that wounding tends to be somewhat random, depending exactly on where each pellet strikes.

1.7. The target

The printed paper targets were held onto two renewable ¾ inch plywood sledges using rubber bands. The sledge had curved runners so that there was a tendency for the target to rock as it was towed. At each end of the sledge was a 50-yard rope, adjusted so that it pulled the sledge along a straight track. The target track line was 3 yards behind a screen, to prevent the sledge colliding with the screen. A person at each side was designated to run, pulling the sledge past a gap in the screen. The gap was 8 yards for the 25 yard range, and 10 yards for the 40 and 60 yard ranges. The fox took approximately 3 seconds to cross at 25 yards and 3.5 seconds at the two longer ranges.

1.8. Shooter classification

199 shooters participated in the trials and shoots were held in England, Scotland and Wales according to a standardised protocol. As far as possible we used shooters who normally shoot foxes and they used their own normal guns. Unskilled shooters used borrowed guns and we did notice a fall off in performance where unfamiliar guns were used by any participants. We assessed three categories:

Skilled - People who shoot significant numbers of mammals or birds each year in field situations.
Semi-skilled. People who possess a gun and shoot a few times per year but do not consider themselves to be above average shots.

Unskilled - People who have seldom or never fired a gun before and need teaching how to manage it. Anyone who was legally eligible to fire a gun was eligible to participate in the trials. We came across shooters who attended fox shoots and who were, to all intents and purposes, unskilled. Several did not know the choke ratings for their guns.
These categories are somewhat arbitrary; shooter ability is, after all, a cline or spectrum, rather than discrete groupings. In the .410 regime the skill levels were lumped together but the sample was still in the same ratio as for the 12 bore regimes i.e. approximately 25% unskilled, 50% semi-skilled and 25% skilled. The reason for testing these skill levels was to investigate how performance improves with increasing skill and whether or not all parameters, such as kill rate and wounding rate, improve equally.

1.9. Choke
The guns were the same ones that are normally used for shooting foxes and had a variety of chokes. Therefore, we divided choke into two regime categories. The first included true cylinder (zero choke) and improved cylinder (equivalent to ¼ choke), normally the 'open' barrel. The second is the 'choke' barrel, including ¾ and full choke. With the .410 it was difficult to find a gun with less than ½ choke, therefore the open regime included 0 - 1/2 choke.

1.10. Range
The regimes covered three ranges: 25 yards, 40 yards and 60 yards for shotguns and 50, 100 and 150 yards for rifles. We used yards instead of metres to make it easier for the shooters to judge range.

1.11. Rifles
For the rifle trials the sledge was not used. Instead, the target hinged up and was exposed, static for 4 seconds before going down again. At 50 yards one regime was shot with no support or rest for the rifle and another with a support, resting on a vehicle, beanbag or bipod. For lamping all procedures were the same except that the shooter had an assistant to manage the lamp.

1.12. Ammunition
Ammunition and guns of supposedly the same specification can vary according to manufacturer, brand name and even batch (Di Maio 1999). The cartridges we used differed slightly from those of the same specification detailed by Bucknell (2001). We therefore tried as far as possible to use the same guns as are actually used for shooting foxes and we purchased standardised ammunition.

The shotgun ammunition used was:

- .410 Eley Fourlong No 6 containing 111 pellets weighing 12 grams.
- 12 bore Eley Grand Prix No 6 containing 307 pellets weighing 30 grams.
- 12 bore Lyalvale Express BB containing 103 pellets weighing 36 grams.
- 12 bore Lyalvale Express AAA containing 43 pellets weighing 36 grams.

The 12 bore cartridges were chosen as representing those used at a driven pheasant shoot (No 6) and those used on fox shoots (BB and AAA). It is worth noting that many game guns are not proofed for these 36 gram heavy fox loads and therefore at a pheasant shoot it may not be possible to change cartridges for a 36g fox load. Conversely it is possible to obtain heavier shotgun loads, up to 57g, provided that the gun is proofed for it.

For the rifles the shooters provided their own ammunition, zeroed specifically for each rifle and range by their owners. Unskilled shooters were provided with zeroed rifles and basic instructions in

their use. Rifle calibres included .22 rimfire (up to 50 yards) and .222, .22-250, .223, .243, 6mm PPC, .25-06 and .308 in centrefire.

1283 target foxes were shot at in the shotgun trials and 885 in the rifle trials.

1.13. Penetration tests

Relative penetration tests were carried out on the shotgun ammunition using 20 x 21 cm sheets of standard artists mounting board in slots spaced at 1 cm centres up to 20 sheets and 5mm centres above 20 sheets. This provided a standardised, repeatable, sensitive, comparison of penetration (Table 2).

Table 2.

PENETRATION TESTS					
SHOTGUNS	RANGE	SHOT	Minimum	Maximum	Mean
	(yards)	SIZE			
Fourten	40	6	3	11	7
12 bore	40	6	5	11	8
Four ten	25	6	7	11	9
12 bore	25	6	8	12	10
12 bore	40	BB	17	20	18.5
12 bore	60	AAA	17	22	19.5
12 bore	25	BB	16	27	21.5
12 bore	40	AAA	25	34	29.5
12 bore	25	AAA	30	32	31
0.22 subsonic	100		35	41+	41+
0.22 subsonic	50		41+	41+	41+
Units are in sheets of mounting board.					

Units are in sheets of mounting board.

Penetration depends on a host of factors, such as shot size, hardness, deformation, clumping, powder charge, range and so on. Pellets of all sizes, being round and hardened, penetrate making a hole about the same diameter the whole way unless they hit bone. Hollow nose .22 bullets expand or tumble by about a third of their penetration, making a hole 3-4 time their entry diameter. Penetration tests were not done on the high velocity rifles because it is already known that their performance is more than adequate on foxes.

1.14. Analysis of fox carcasses

Penetration also depends on what tissues the pellet meets. This is more difficult to assess. Rabbits

shot with both .22 subsonic or HV LR in the chest frequently have the bullet still in the body. Similarly, rabbits shot with No 6 usually have a lot of pellets still present. We know this from having shot several hundreds of rabbits with this ammunition.

The shooters provided x fox carcasses for post mortem analysis to assess the penetration and damage caused by projectiles shot in the same regimes as in the target trials. Foxes were either shot directly according to one of the regimes, or in most cases were re-shot. The fox, having originally been killed either by a humane killer shot to the head or by snaring, was suspended in a broad-side position similar to the fox target and shot with the appropriate regime of ammunition and range. Dissection of each carcass provided information on the effects of the shot.

Scoring of the shot targets was done independently by the International Zoo Vet Group and by Dr Douglas Wise. Inevitably there is an element of subjectivity in this process, and a risk of bias. By using two independent scorers we hoped to see the variation in this aspect. Additionally, all targets have been retained and are available for further examination should the need arise.

The results are shown in the next two sections. Just because a regime is included it does not mean that it is suitable for foxes, but the regimes are all legal in Britain. In discussions with shooters during the trials, some claimed to have shot foxes with .410s and several claimed to have shot at foxes at 80-120 yards with intent to slow them down sufficiently for dogs to get them or for them to die later. Therefore, we decided to explore the performance potential of all these regimes in the hope that some at least could be positively identified as suitable for foxes from the welfare point of view.

SECTION TWO

Study of shot wounds in foxes and scoring of fox targets by the International Zoo Veterinary Group (IZVG).

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2.1. Objectives

To assess the likely effects of shooting foxes in different situations, by scoring life-size targets shot by specific regimes, and by using radiographs and necropsies of shot foxes in order to assess penetration of, and damage caused by, shot and bullets, using differing shooting regimes.

2.2. Introduction

The International Zoo Veterinary Group (IZVG) were commissioned by Dr. Nick Fox, Scientific Advisor to the All Party Parliamentary Middle Way Group to quantify rates of wounding, missing or killing of foxes through shooting. The experimental procedure, targets and fox carcasses were provided by him. The study was commissioned to provide scientific evidence on a subject that is generally the subject of anecdotal analysis.

The different shooting regimes used in the study were designed to allow comparison of both accuracy and penetrative power between gun and barrel types, ammunition types, skill of shooter, and distance from the target. The conclusions reached in this study are based solely on the data collected, and cannot be expected to cover all possibilities. The data can however give an indication of the variation inherent in shooting.

2.3. Methods and Materials

Fifteen fox carcasses were supplied which had originally been killed by gun packs or snared. The carcasses had been suspended and re-shot with one of the cartridges used in the regimes from one

of the distances assessed, and labelled with the shot weight, distance and gun type. Method of death was also detailed.

They were delivered to IZVG frozen and were subsequently thawed for examination. All Carcasses were radiographed and then necropsied in order to assess penetration of, and lesions caused by, shot. Dorsoventral and lateral radiographs were taken of each animal using standard dog positioning and exposure. Radiographs were examined to determine the location of shotgun pellets or rifle bullet fragments within the carcass. As complete a necropsy as possible, including skinning of the entire carcass and examination of all organ systems was performed on each animal. However full post mortem assessment and interpretation of lesions was not possible in all cases due to autolysis and freeze/thaw artefact.

Paper targets were also delivered to us having previously been shot in various shoots throughout UK. We scored each paper target based on the presence and pattern of holes made by the ammunition. These data were combined with the data on penetration and damage determined from the examinations, so that the predicted effect of each shooting regime on a live animal could be classified. The targets were scored into one of the following four categories:

Kill: targets in the AAA and BB regimes where pellets have hit within the outline of the brain, the heart, the spinal cord or major blood vessels drawn on the target. In the 6 shot regimes a cluster of at least 3 pellets must hit the target areas. The post-mortem examinations of fox bodies shot with .410 shotguns did not indicate that pellets would penetrate the body cavity; therefore, there are no kill scores for the .410 regimes. In the rifle regimes, if the bullet has hit the outline of the brain, the heart, the spinal cord or major blood vessels drawn on the target, or fell within these outlines the shot is scored as a kill.

Serious wound: targets in the AA and BB regimes where pellets have hit the abdomen or thorax of the target. For the No 6 shot regimes, a cluster of pellets must be present in this area. For the rifle regimes, bullets that hit the head (excluding brain) thorax, abdomen, or leg bones.

Wound: targets where pellets have hit the limbs, or other areas not defined above. For the No 6 shot regimes this includes single pellets anywhere on the body of the target. For the rifle regimes, bullets that hit areas not defined above within the body outline area.

Missed: targets where no shot or bullet has struck the body shape outlined in the target. Each rifle target should have 5 bullet holes; where there were fewer than 5 holes, the number missing were scored as a miss.

2.4. Results

Each different shooting regime was sorted by percentage into the kill, serious wound, wound and miss categories to standardise the data. The relationships between the skill categories, shot size, distance and choke variables were compared using the chi-squared test (?2) for difference. A chi-squared value of above 3.84 for these tests shows that there is a significant difference between values compared.

Table 3. Scores for shotgun regimes

GUN	CHOKE	RANGE	SHOT	SKILL	Number	Kill	Serious wound	Wound	Miss
		(yards)	SIZE	of shots	%	%	%	%	
Four ten	0-1/2	25	6	All	54	0	0	61.11	38.89
Four ten	3/4-Full	25	6	All	62	0	6.45	72.58	20.97
12 bore	0-1/4	25	6	Unskilled	25	12	28	24	36
	0-1/4	25	6	Semi-skilled	42	30.95	42.86	16.67	9.52
	0-1/4	25	6	Skilled	26	26.92	46.15	26.92	0.00
	0-1/4	25	AAA	Unskilled	25	40	20	12	28
	0-1/4	25	AAA	Semi-skilled	54	33.33	31.48	27.78	7.41
	0-1/4	25	AAA	Skilled	28	28.57	46.43	17.86	7.14
	0-1/4	40	6	Unskilled	25	4	12	72	12
	0-1/4	40	6	Semi-skilled	42	4.76	23.81	64.29	7.14
	0-1/4	40	6	Skilled	28	3.57	28.57	67.86	0
	0-1/4	40	AAA	Unskilled	25	8	36	28	28
	0-1/4	40	AAA	Semi-skilled	41	17.07	39.02	29.27	14.63
	0-1/4	40	AAA	Skilled	23	56.52	30.43	8.7	4.35
	3/4-Full	25	6	Unskilled	27	22.22	29.63	11.11	37.04
	3/4-Full	25	6	Semi-skilled	53	24.53	43.40	30.19	1.89
	3/4-Full	25	6	Skilled	35	34.29	28.57	37.14	0
	3/4-Full	25	AAA	Unskilled	25	36	24	8	32
	3/4-Full	25	AAA	Semi-skilled	53	43.4	22.64	5.66	28.30
	3/4-Full	25	AAA	Skilled	28	57.14	17.86	14.29	10.71
	3/4-Full	40	6	Unskilled	24	8.33	12.5	58.33	20.83
	3/4-Full	40	6	Semi-skilled	43	2.33	25.58	62.79	9.3
	3/4-Full	40	6	Skilled	36	5.56	36.11	58.33	0
	3/4-Full	40	AAA	Unskilled	25	24	32	8	36
	3/4-Full	40	AAA	Semi-skilled	53	15.09	37.74	32.08	15.09
	3/4-Full	40	AAA	Skilled	32	21.88	34.38	31.25	12.5
	3/4-Full	60	AAA	Unskilled	27	3.7	14.81	29.63	51.85

	3/4-Full	60	AAA	Semi-skilled	51	7.84	29.41	37.25	25.49
	3/4-Full	60	AAA	Skilled	25	20	44	28	8
	0-1/4	40	BB	Unskilled	26	26.92	34.62	23.08	15.38
	0-1/4	40	BB	Semi-skilled	67	52.24	32.84	11.94	2.99
	0-1/4	40	BB	Skilled	31	45.16	32.26	9.68	12.9
	3/4-Full	40	BB	Unskilled	28	42.86	35.71	17.86	3.57
	3/4-Full	40	BB	Semi-skilled	65	52.31	30.77	12.31	4.62
	3/4-Full	40	BB	Skilled	29	55.17	27.59	13.79	3.45

Table 4. Scores for Rifle Regimes

Rifle	Range	Supported	Time	Skill	Number of shots	Kill %	Serious wound %	Wound %	Miss %
0.22	50 Yards	Supported	Day	Unskilled	50	48	48	4	0
0.22	50 Yards	Supported	Day	Skilled	45	46.67	53.33	0.00	0.00
0.22	50 Yards	Supported	Night	Unskilled	70	50.00	38.57	10.00	1.43
0.22	50 Yards	Supported	Night	Skilled	60	70.00	26.67	3.33	0.00
0.22	50 Yards	Unsupported	Day	Unskilled	50	28	26	28	18
0.22	50 Yards	Unsupported	Day	Skilled	65	41.54	24.62	7.69	26.15
0.22	50 Yards	Unsupported	Night	Unskilled	50	8	30	36	26
0.22	50 Yards	Unsupported	Night	Skilled	50	44	32	12	12
Heavy	100 Yards	Supported	Day	Unskilled	60	56.67	33.33	1.67	8.33
Heavy	100 Yards	Supported	Day	Skilled	55	65.45	23.64	9.09	1.82
Heavy	100 Yards	Supported	Night	Unskilled	60	31.67	40.00	10.00	18.33
Heavy	100 Yards	Supported	Night	Skilled	50	44	50	6	0
Heavy	150 Yards	Supported	Day	Unskilled	65	21.54	38.46	18.46	21.54

Heavy	150 Yards	Supported	Day	Skilled	50	52	44	4	0
Heavy	150 Yards	Supported	Night	Unskilled	55	29.09	30.91	21.82	18.18
Heavy	150 Yards	Supported	Night	Skilled	50	44	44	12	0

To look at the effects of the different variables, we have calculated the mean and standard deviation value for each shot category. It is important to note that the standard deviation (sd) values are quite large. Large standard deviation scores indicate wide variation within the sample.

2.5. Marksmanship results for skilled, semi-skilled and unskilled shotgun regimes

Table 5.

	Kill %	Serious wound %	Wound %	Miss %
Unskilled	20.73 sd=14.52	25.39 sd=9.28	26.55 sd=20.78	27.33 sd=13.61
Semi-skilled	25.80 sd=18.17	32.69 sd=7.28	30.02 sd=19.29	11.49 sd=8.70
Skilled	32.25 sd=19.34	33.85 sd=8.85	28.53 sd=19.50	5.37 sd=5.16

Shooter rating themselves unskilled missed significantly more than those rated semi-skilled (?2 =21.8), or skilled (?2 =8.15). However, there are no other significant differences between categories.

2.6. Shot size, Shotgun regimes

Table 6.

	Kill %	Serious wound %	Wound %	Miss %
No 6	15.56 sd=10.36	31.33 sd=2.89	42.85 sd=4.89	10.26 sd=5.50
BB	45.78 sd=12.34	32.30 sd=10.07	14.78 sd=22.51	7.15 sd=13.73
AAA	27.50 sd=16.76	30.68 sd=9.37	21.18 sd=10.82	20.63 sd=13.48

There are significantly more ‘kills’ using BB shot (?2 =7.29, versus AAA, ?2 =58.69 versus 6 shot), and there are significantly more kills with AAA than with No 6 shot (?2 =9.17). There are significantly more misses with AAA than with the BB (?2 =25.42) or the No 6 shot (?2 =10.49). However, this does not take into account the fact that AAA regimes were shot from 60 yards and 40 yards, whereas the BB and the No 6 shot regimes were not further away than 40 yards. The ‘serious wound’ score does not differ significantly for any of the 3 shot weights, which seems to indicate that there is a 30%

likelihood of seriously wounding whichever shot size is used.

2.7. Range: Shotgun Regimes

Table 7.

Kill %	Serious wound %	Wound %	Miss %	
25 yards	32.45 sd=11.43	31.75 sd=10.38	19.30 sd=9.80	16.50 sd=14.54
40 yards	24.77 sd=20.38	30.11 sd=7.68	33.86 sd=23.32	11.26 sd=9.66
60 yards	10.52 sd=22.07	29.41 sd=4.94	31.63 sd=14.59	28.45 sd=8.47

The distance effect is very clear for the shotgun regimes. Comparing the 25 and 60 yard regimes, there are significantly more 'misses' at 60 yards (?2 =5.03) and significantly more 'kills' at 25 yards (?2 =45.75). The difference between 25 and 40 yards is not as strong, with the only significant difference being in the wound category. Wounding is significantly more likely at 40 yards (?2 =6.26), but this is a consequence of a higher kill rate at 25 yards. There are significantly more 'misses' at 60 yards than at 40 (?2 =26.2) and more 'kills' at 40 than at 60 yards (?2 =8.20).

2.8. Choke effect, shotgun regimes

Table 8.

	Kill %	Serious wound %	Wound %	Miss %
0-1/4	26.00 sd=17.54	32.30 sd=9.41	29.34 sd=21.23	12.36 sd=10.72
¾ - full	26.48 sd=18.11	29.26 sd=8.82	27.56 sd=18.11	16.70 sd=15.23

There is no significant difference between the choke regimes.

2.9. Fourten shotgun regimes

Table 9.

.410 regimes	Kill %	Serious wound %	Wound %	Miss %
Regime S2 (25 yards, 6 shot, unmodified barrel)	0	0	61.11	38.89
Regime S8 (25 yards, 6 shot, choke)	0	0	79.03	20.97

The difference between the .410 regimes is significant (?2 =19.38, df=3). As the only difference between the two regimes is choke, it would seem to indicate that using a ¾ to full choke is linked to hitting the target area more often. This may simply be because the gun was unfamiliar and the open barrel was fired first. The improvement in the choke barrel may thus simply be the result of practice.

2.10. Marksmanship results for skilled and unskilled rifle regimes

Table 10.

	Kill %	Serious wound %	Wound %	Miss %
Unskilled	34.12 sd=16.31	35.66 sd=6.98	16.24 sd=11.98	13.98 sd=9.56
Skilled	50.96 sd=10.86	37.28 sd=11.93	6.76 sd=4.26	5.00 sd=9.50

Skilled shooters hit the 'kill' area significantly more than unskilled shooters (?2 =8.31). Unskilled shooters missed significantly more than skilled shooters (?2 =5.77).

2.11. Night and Day, Rifle Regimes

Table 11.

	Kill %	Serious wound %	Wound %	Miss %
Day	44.98 sd=14.48	36.42 sd=11.36	9.11 sd=9.54	9.48 sd=10.86
Night	40.09 sd=17.97	36.52 sd=7.98	13.89 sd=10.44	9.49 sd=10.47

There is no significant difference between the night and day regimes.

2.12. Supported and Unsupported shooting, rifles, 50 yards

Table 12.

	Kill %	Serious wound %	Wound %	Miss %
Supported	53.67 sd=10.97	41.64 sd=11.70	4.33 sd=4.16	0.36 sd=0.71
Unsupported	30.38 sd=16.50	28.15 sd=3.43	20.92 sd=13.32	20.54 sd=6.85

There is a significant difference between these regimes. There are significantly more 'kills' (?2 =17.84) and 'serious wounds' (?2 =6.46) for the supported regimes, and significantly more 'wounds' (?2 =13.15) and 'miss' (?2 =19.83) for the unsupported regimes.

2.13. Range: Rifle Regimes

Table 13.

	Kill %	Serious wound %	Wound %	Miss %
50 yards	42.03 sd=17.98	34.90 sd=10.76	12.63 sd=12.73	10.45 sd=11.69
100 yards	49.45 sd=14.77	36.74 sd=11.10	6.69 sd=3.76	7.12 sd=8.29
150 yards	36.66 sd=11.99	39.34 sd=5.37	14.07 sd=6.80	9.93 sd=10.00

The distance effect is more confused with the rifle regimes. There is no significant difference between the 50 and 150 yard regimes. From 100 yards there are significantly more 'kills' than there are at 150 (?2 =4.46). There are significantly more 'wounds' at 150 than at 100 (?2 =3.87). There are significantly more 'wounds' at 50 yards than at 100 (?2 =5.27).

2.14. Summary

Fifty-nine percent of all 12 bore targets shot with 12 bore guns fit into the 'wound' or 'serious wound' categories, with only 26 percent fitting into the 'kill' category.

Figure 1 shows the total percentages for the combined 12 bore regimes.

Figure 2 shows the total percentages for the combined rifle regimes. Forty-eight percent of the rifle targets fit into the 'Serious

wound' or 'wound' category.

Fig2. Total Percentages for Rifle regimes

The skill of the shooter, the range they are shooting from, the size of ammunition, and whether the guns are supported all affect the result. The large standard deviations indicate that the results vary widely.

Unskilled shooters missed more often than semi-skilled or skilled shooters.
There were significantly more 'kills' using BB shot than AAA or No. 6 shot.
AAA shot regimes had significantly more 'kills' than the No. 6 shot regimes.
AAA shots missed significantly more than BB and No. 6 shot regimes.
There were significantly more 'misses' at 60 yards.
There were significantly more 'kills' at 25 yards.
There were no 'kills' or 'serious wounds' in either .410 regime.
There are significantly more kills with a supported rifle.

2.15. Conclusions and Discussion

The analysis of the targets and carcasses provided to IZVG by the Middle Way Group showed that the effects of shooting are variable. However, certain factors were significant in the data.

The results confirm what common sense tells us: shooters further away 'miss' more often, whereas shooters closer to the targets 'kill' more; more experienced shooters are more accurate; heavier shot weight has more penetrative power, and is therefore more likely to 'kill'.

In the examination of the carcasses, radiography was of most value as it allowed us to create a three-dimensional picture from the shot targets. Although a number of 'live shot' foxes were sent, the majority had been killed and re-shot, some foxes having been frozen or dead for a significant length of time before re-shooting. Factors such as skin contraction, change in tissue density and elasticity, and disruption of the protective hair coat may have affected penetration, especially by lighter shot, and the lack of movement in the target will have reduced deflection of pellets. Clearly, however, it could be determined that shot from a .410 weapon failed to penetrate to vital organs. Whereas the heavier shot from the 12 bore weapons penetrated the bodies, either stopping in organs or against bones, exiting on the opposite side, or for the most part, being caught and held by the elasticity of the skin on the opposite side. Round shot, as in shotgun pellets, create relatively small projectile tracks through tissue and are individually difficult to follow. Pellets that are distorted or flattened by hitting bones may produce more severe local damage, although their energy is easily dissipated. Pellets that pass straight through a body impart less energy to the tissues than those that lodge there. As shotgun pellets produce little shockwave effect individually, except in brain or spinal cord, their damage is usually limited to the direct penetration or tearing of tissues. Consequently, their killing and wounding effect is very dependent on a substantial number of hits to one or more vital areas.

The different variables investigated were not independent of each other. The interaction of skill, ammunition choice and distance from the target is crucial and should be investigated further. It should be possible to do this statistically using a software package for multivariate analysis.

The rifle data contained significantly more kills than the shotgun data. However, the variation within rifle groups was large and shows that a high kill rate is not guaranteed merely by using a rifle. The higher kill rate in the rifle regimes may be due in part to targets being stationary for 4 seconds, as opposed to the moving shotgun targets.

The same data was analysed by Dr Wise (in Section 3), who came to similar conclusions despite using different scoring categories. His total percentages for 12 bore shotgun regimes are presented in Figure 3.

Fig 3. Total Percentages for shotgun 12-bore regimes from Dr Wise (scored by independent)

Sixty-three percent of the targets fit into the 'wound' 'serious wound retrievable' and 'serious wound irretrievable' categories. The overall conclusions from Dr Wise are as follows: Skill level is very important to both efficiency and humaneness. (With shotguns, efficiency improved with skill level but humaneness was less affected.) Unsupported shooting is a lot less efficient and humane. Target distance over the range tested is not a major influence on the results of the skilled marksmen but is for the unskilled.

SECTION THREE

SECOND INDEPENDENT SCORING OF TARGETS

Dr Douglas Wise, MA Vet MB PhD MRCVS, Dept Clinical Veterinary Medicine, University of Cambridge.

3.1. Introduction

The first part of this section deals with how I came to my conclusions with regard to scoring the targets. In part, I based my judgement both on my veterinary knowledge and on my considerable

experience of shooting with shotguns and very limited experience of rifle shooting at live targets. I was also greatly assisted by being given access by IZVG to the post mortem reports relating to the shot foxes. The results of the shot penetration tests, using card, supplied to me by Dr Fox, also formed part of the background to the scoring process. The scores that I ascribed to each target were mine alone and not the result of prior discussion with other scorers.

Inevitably, the interpretations that I have made are subjective and I have therefore attempted to explain the criteria I used in scoring the targets. There may well be others with greater expertise who would have used different criteria and come to somewhat different conclusions. Having gone into the background to the scoring process, I go on to present the scores for the different shooting regimes. These are raw data and difficult to assimilate.

3.2. Criteria for scoring targets shot with No 6 shot
Kill (near-instant) (1): 20 pellets in head adjudged sufficient to kill by hydraulic shock or 70 in head and thorax combined or 100plus if abdomen included. A cluster of tightly grouped pellets striking in more or less the same place over the brain area (3-4) or a similar cluster (2-3) passing between ribs through intercostals space allowing access to heart chamber or great vessel.

Severely injured, probably retrievable (2a): Large numbers of pellets striking front end (head, neck and thorax) but not satisfying criteria above.

Severely injured, probably not retrievable (2b): Greater than 10 pellets striking the body at 25 yards or greater than 15 at 40 yards but insufficient for criteria above. Also, if direct hit, even with a single pellet, in eye, adjudged in this category.

Lightly wounded (3): Hit but with fewer pellets than above

Missed (4): No pellets within green bodyline

Comment: I am speculating a lot here though basing my judgement both on personal experience and the PM reports. I really don't know enough about hydraulic shock. Further, the depth of shot penetration seems to vary depending upon tissue to a much greater extent than with heavier shot sizes. I have assumed that it would never be sufficient to collapse more than one lung. I have never seen a fox killed cleanly at 40 yards and few at 25 with a shotgun and light loads. They are easy to kill with a 12 bore and No 6 shot up to 15 yards.

3.3. Criteria for scoring targets with AAA and BB shot
Near-instant kills (1): One or more pellets in brain or hitting vertebral bodies squarely high in neck. One or more pellets through chamber of heart (not just muscle) or through dorsal aorta anywhere proximal to kidneys.

Severely wounded and probably retrievable (2a): One or more pellets through lungs, which, on a broadside shot with good penetration should collapse both lungs. One or more pellets hitting vertebral bodies (not spinous processes) from middle cervical vertebrae to last thoracic vertebrae. A combination of pellets hitting the bones of more than one leg squarely. (depending upon pellet numbers and pellet position vis a vis ribs, I allowed myself a little latitude to place an animal in a higher or lower category. It would only have been higher if many pellets at relatively close range had done severe damage without satisfying precisely the criteria laid down for the definition of near-instant kills above).

Severely wounded but probably not retrievable without canine assistance (2b): Any animal not falling into the above categories but which has taken one or more pellets through the abdominal

cavity or to bone (excluding tips of spinous processes, bone in tail or very glancing blows to limb bones). One or more pellets through pharynx, trachea or buccal cavity without taking bone.

Lightly wounded (3): Pellet(s) penetrating muscular tissue and, at worst, only shaving edges of limb bones, hitting tips of spinous processes or passing through tail bone.

Missed (4): No pellets on target or pellets on target that only pass outside body outline through fur or through pinna of ear (only one of the targets had a pellet through an ear pinna and none elsewhere in the body. This was classed as missed)

Comment: I am making the assumption that both AAA and BB shot will normally be sufficiently penetrative over the ranges tested to pass from the entry side to the far side of the target's body.

3.4. Criteria for scoring rifle targets

Any hit from a heavy rifle, unless extremely peripheral, will cause death (1) or serious wounding (2a or 2b). Anything hitting scapula, ribs, vertebral bodies or low on spinal processes or passing through chest has been assumed to kill quickly (1). It has been assumed that hits to limb bones, to tips of spinous processes, through abdomen or through significant amounts of musculature will generally cause severe injuries but will not allow an easy retrieval of the body (2b). Exceptions have been made when point of entry is very adjacent to but not penetrating rib cage, possibly allowing easy retrieval (2a). Essentially similar scoring has been used for the .22 targets but muscle injuries are more likely to have been recorded as light wounding (3). Misses were designated to score column (4).

3.5. Scores

Table 14. Scores for shotgun regimes

GUN	CHOKE	RANGE	SHOT	SKILL	Number	Kill %	Serious wound	Serious wound	Wound	Miss
(yards)	SIZE	of shots	Retrievable %	Not retrievable%	%	%				
Four ten	0-1/2	25	6	All	57	1.75	0.00	15.79	57.89	24.56
Four ten	3/4-Full	25	6	All	62	0.00	0.00	38.71	50.00	11.29
12 bore	0-1/4	25	6	Unskilled	25	8.00	0.00	44.00	8.00	40.00
"	0-1/4	25	6	Semi-skilled	51	13.73	5.88	64.71	9.80	5.88
"	0-1/4	25	6	Skilled	24	12.50	4.17	79.17	4.17	0.00
"	0-1/4	25	AAA	Unskilled	24	29.17	20.83	12.50	4.17	33.33
"	0-1/4	25	AAA	Semi-skilled	42	28.57	19.05	26.19	2.38	23.81

“	0-1/4	25	AAA	Skilled	25	28.00	20.00	36.00	8.00	8.00
“	0-1/4	40	6	Unskilled	24	0.00	0.00	33.33	45.83	20.83
“	0-1/4	40	6	Semi-skilled	43	0.00	0.00	48.84	46.51	4.65
“	0-1/4	40	6	Skilled	27	0.00	0.00	29.63	70.37	0.00
“	0-1/4	40	AAA	Unskilled	25	8.00	24.00	40.00	8.00	20.00
“	0-1/4	40	AAA	Semi-skilled	41	12.20	21.95	34.15	7.32	24.39
“	0-1/4	40	AAA	Skilled	24	37.50	29.17	16.67	8.33	8.33
“	3/4-Full	25	6	Unskilled	28	14.29	7.14	46.43	3.57	28.57
“	3/4-Full	25	6	Semi-skilled	53	9.43	5.66	73.58	9.43	1.89
“	3/4-Full	25	6	Skilled	36	8.33	19.44	58.33	8.33	5.56
“	3/4-Full	25	AAA	Unskilled	25	24.00	24.00	16.00	4.00	32.00
“	3/4-Full	25	AAA	Semi-skilled	49	30.61	30.61	14.29	2.04	22.45
“	3/4-Full	25	AAA	Skilled	27	44.44	25.93	14.81	3.70	11.11
“	3/4-Full	40	6	Unskilled	24	0.00	0.00	54.17	25.00	20.83
“	3/4-Full	40	6	Semi-skilled	43	0.00	0.00	51.16	39.53	9.30
“	3/4-Full	40	6	Skilled	35	0.00	0.00	65.71	31.43	2.86
“	3/4-Full	40	AAA	Unskilled	25	24.00	16.00	16.00	8.00	36.00
“	3/4-Full	40	AAA	Semi-skilled	48	14.58	31.25	22.92	4.17	27.08
“	3/4-Full	40	AAA	Skilled	31	16.13	29.03	35.48	6.45	12.90

"	3/4-Full	60	AAA	Unskilled	26	3.85	11.54	15.38	15.38	53.85
"	3/4-Full	60	AAA	Semi-skilled	50	8.00	12.00	38.00	14.00	28.00
"	3/4-Full	60	AAA	Skilled	24	8.33	33.33	41.67	4.17	12.50
"	0-1/4	40	BB	Unskilled	27	11.11	37.04	33.33	3.70	14.81
"	0-1/4	40	BB	Semi-skilled	69	43.48	31.88	18.84	2.90	2.90
"	0-1/4	40	BB	Skilled	32	31.25	40.63	12.50	6.25	9.38
"	3/4-Full	40	BB	Unskilled	27	33.33	33.33	18.52	7.41	7.41
"	3/4-Full	40	BB	Semi-skilled	60	60.00	16.67	11.67	1.67	10.00
"	3/4-Full	40	BB	Skilled	28	42.86	32.14	17.86	3.57	3.57

3.6. Scores for Rifle Regimes

Table 15.

RIFLE REGIMES

Range/Choke	Unskilled		Semiskilled		Skilled	
	% eff.	% wel.	% eff.	% wel.	% eff.	% wel.
25 open	62.9	75.0	73.8	62.5	84.0	52.2
25 choked	64.0	70.6	75.5	78.9	85.2	79.2
40 open	72.0	40.0	68.3	45.2	83.3	72.7
40 choked	56.0	62.5	68.8	62.9	80.6	51.9
60 choked	30.8	33.3	58.0	27.8	83.3	47.6
Mean	57.1	56.3	68.9	55.5	83.3	60.7

Table 18.

BB targets all at 40 yards

Choke	Unskilled		Semiskilled		Skilled	
	% eff.	% wel.	% eff.	% wel.	% eff.	% wel.
Open	83.3	47.6	81.5	56.5	84.4	79.3
Choked	85.2	72.0	88.3	85.2	92.9	77.8

Table 19.

Range/Choke	Unskilled		Semiskilled		Skilled	
	% eff.	% wel.	% eff.	% wel.	% eff.	% wel.
25 open	52.0	13.3	84.3	20.8	95.8	16.7
25 choked	67.9	30.0	88.7	15.4	86.1	29.4
40 open	33.3	0.0	48.8	0.0	40.4	0.0
40 choked	54.2	0.0	51.2	0.0	65.7	0.0
Mean	51.9	10.8	68.3	9.1	72.0	11.5

Table 20. Rifle targets

	Unskilled			Skilled	
		% eff.	% wel.	% eff.	% wel.
Supported					
Range					
150	Day	69	58	98	94
	Night	73	63	96	82
100	Day	88	98	94	92
	Night	77	67	98	94
50	Day	90	84	98	92
	Night	95	83	96	98
All supported					
	Night and Day	81.9	77.1	96.8	91.8
Unsupported					
50	Day	74	51	73	74
	Night	53	30	75	79

3.8. Conclusions

Efficiency, expressed as the percentage of foxes seriously wounded as a total of those aimed at, increases with skill level of marksman.

The welfare index, expressed as the proportion of hit animals likely to be brought to hand, is not greatly influenced by skill level in the case shotgun users but is strongly influenced by marksmanship ability in the case of rifle users. Thus, training could be expected to enhance animal welfare in the case of rifle users but would have little or no effect in the case of shotgun users.

The use of the .410 to shoot foxes at 25 yards range is both inefficient and inhumane.

In the hands of skilled or semi-skilled marksmen, the 12 bore, loaded with No 6 shot, gives levels of efficiency at 25 yards that are equivalent to those obtainable with heavier shot sizes and loads. However, the welfare scores are very poor even at this range, with the likelihood of approximately three quarters of hit foxes escaping wounded. Both efficiency and welfare levels are low when the range is 40 yards.

Skilled marksmen maintained their levels of efficiency (> 80%) at all ranges from 25 to 60 yards when using AAA or BB ammunition. However, efficiency tended to drop with increasing range at lower skill

levels and this was particularly evident at 60 yards. Welfare tended to fall with range across all skill levels but only at 60 yards in the skilled group.

The use of choked barrels markedly improved welfare scores for all skill levels and had little effect on efficiency levels.

At 40 yards range, BB ammunition appeared to be superior to AAA, both with respect to efficiency and welfare. This result may or may not be an artefact of the scoring method. (It was assumed that both shot sizes were sufficiently penetrative at this range to pass from the entry to the far side of the body. Given that there are substantially more shot in BB than in AAA cartridges, the current result was inevitable.)

Over the shotgun regimes tested, the best results give levels of efficiency of somewhat over 80% with 20-25% of animals escaping wounded to the first shot.

Efficiency levels were maintained over all ranges tested by skilled rifle shooters but dropped with range for inexperienced marksmen. The same applied to welfare scores but these only fell at 150 yards for the unskilled group.

There were no marked differences in scores between night and day rifle regimes.

When rifles were unsupported, all scores deteriorated markedly

In the case of skilled riflemen, shooting at ranges up to 150 yards with supported rifles, one can expect efficiency levels of approximately 95% with some 8% of hit foxes escaping wounded.

SECTION FOUR

DISCUSSION
Dr Nick Fox

4.1. A comparison of scoring rates
Sections two and three show how scoring can be done in different ways. Do not get dragged into the numbers game and attempt to use these figures to prove or disprove your own preconceived opinion! Let's draw an analogy to help us understand what we are looking at here:

Imagine there is a multiple pile-up on the motorway. A lucky few of the cars were actually untouched and, after giving their details to the police ('missed') drove home. The remainder are all damaged in some way and several repair shops are invited to tender estimates to repair them. For some of the cars the bill to repair them is greater than their book value and they are 'written off' ('dead'). But not all of these cars are actually written off by all the estimators, some repair shops think that some of the cars are repairable. The rest of the cars ('wounded') are deemed repairable but the estimates to repair them vary. Some repair shops seem to be more expensive than others. But when you get the estimates for all the cars from all the repair shops you can see that, despite their somewhat differing levels of charges, most of the damaged cars are in fact pretty much in the same price ranking order. The lightly damaged vehicles cost less on average to repair than the more heavily damaged vehicles. The extent of the damage is a continuum, there are no definite categories. So. if you asked the estimators simply to categorise them as three categories: write-offs, heavily damaged and lightly damaged there would be indecision and arguments about which category some of the marginal vehicles should go in. Clearly, they are all damaged, and clearly some at least are write-offs.

This is the position we are in with these data sets. We know what proportion of foxes have been hit, and we know some of these would have died instantly. We know that some would not have died instantly, but they would have died certainly. For example, a AAA pellet through the liver would not kill the fox instantly, but there would have been massive internal bleeding and the fox would certainly have died, and sooner rather than later. Or perhaps the shot had struck further back and gone through the intestine without hitting any major blood vessels. The fox is doomed, but how long will it take to die? It is certainly mortally wounded, and surely a mortal wound should be described as 'heavy'? But for the time being at least it has run off apparently unscathed showing no sign of the fatal injury ticking away inside it.

Thus, it is very hard to score consistently the injuries we are seeing. We cannot easily predict whether or not the fox would have recovered from its wounds. We cannot say how many hours it would have taken to die or to recover. And we cannot say what levels of pain or suffering it might have experienced in the process. Our estimators have scored as they see fit and their scores, although different, can all provide valid conclusions.

So, I have cautioned you not to pin too much precision on any individual figures. And I have given caveats about what we are unable to predict or assume from the information. After all that, have we actually learned anything at all from this study? The answer is: yes, a great deal. First, we have measured the miss rates for all these regimes, and hence the variations in miss rates, and of hit rates. Our estimators have individually scored the foxes as consistently as they can. Some may be 'expensive repair shops' and some may be 'cheaper', but they will both show some consistency and it is this consistency that enables us validly to assess the trends that have appeared. Also, between the two of them there are differences in scoring. Seldom do they exactly match. These differences serve to caution us, to highlight the variation that exists between scorers. If we can get more experts to score the data, they too would vary somewhat; but gradually we would come to a consensus of opinion.

It is important to keep in mind the large variation not just in the scoring, but probably actually in the results; this was actually clearer for us when doing the trials. For example, in the unskilled groups we came across individuals who had never fired a gun but had good eye-to-hand co-ordination. Some of these, at their very first attempts, produced scores that could have placed them in the skilled bracket. Other individuals, supposedly at least semi-skilled, produced results comparable with the unskilled. This portrays the difference between people who are genuinely unskilled, and those who are simply beginners. There are pointers here in prioritising training programmes, and in the way one could improve welfare by placing emphasis on reducing wounding, rather than just increasing hitting.

The IZVG had the 15 fox carcasses to guide them in assessing injury effects. This method is not ideal, for example a dead body that has been frozen and thawed probably reacts differently to a live one, particularly in aspects such as hydraulic shock. But even so, we think it is better to make assessments as directly as we possibly can, using the same ammunition and fox carcasses, rather than trying to construct indirect scenarios using tables of muzzle velocities and gel flesh simulation blocks that could just introduce additional unknowns.

Dr Wise has the benefit of considerable first-hand experience of shooting in its various forms, as I do myself. Experience of shooting, and of skinning carcasses, while not strictly scientific, is not to be belied.

We have given some at-a-glance pie charts to aid quick reviewing of the data. Treat these as guides to trends only. Look at Section Two for a fuller portrayal of the variation, standard deviations and statistical significance of the findings, in particular tables 5 – 13 based on the IZVG scores.

There are many aspects that we have not tested in these trials. How would No 3 shot perform, or BB at 25 yards? There are many unanswered questions. Perhaps some of these will be tackled in the future by those interested in them. If any organisation is interested in scoring our targets for themselves, we have stored all the targets and are happy to make them available to bona fide pathologists.

4.2. Marksmanship

The kill rate with shotguns was very variable. The Scottish Gunpacks ranged from 20% - 79.3% and averaged 54.9%. The better shooters, using BB and AAA in the shooting trials, had similar results. Some of this is due to marksmanship and some must be to discipline in not taking shots that are out of killing range or are too difficult. The shooting rules in the Danish Law on Wildlife Administration say: 'If the cartridge consumption is not on a suitable scale with the amount of retrieved game, the shooting distance should be decreased and/or training provided on clay pigeons. A suitable cartridge consumption is considered by the Danes to be 3 cartridges per flying game and 2 cartridges per running game. Thus, a good fox shooter, with suitable ammunition, and restricting himself to the most certain shots can achieve this level of performance. In real life it is clear that many shooters do not achieve it, nor is there any way to enforce it.

Of course, the kill rate is not a measure of wounding rates, although for the sake of simplicity the Danes are using it as a predictor of wounding. When the kill rate is less than 50% the wounding rate tends to exceed 50%. When the kill rate exceeds 50% the wounding rate inevitably falls below 50%.

If the shooter attempts long shots using a heavy load such as AAA, the pattern fails, and the way in which it fails is often dependent on the characteristics of each individual gun barrel. It is a worthwhile exercise for each shooter to plate shoot his gun and ammunition at different ranges so that he is fully aware of the limiting capabilities of his gun, regardless of his own marksmanship.

Training might be the answer. At present the British Association for Shooting and Conservation has about 130,000 members; it has Codes of Practice for shooting, as well as for lamping and snaring. But there are 577,171 shotgun certificate holders and 119,560 firearms certificate holders (Secretary of State's reply to Lembit Opik 2003). Allowing for dual certificate holders and for those who shoot only targets, BASC is reaching only perhaps a quarter of the shooters, probably the keener and better ones. There is no route at present to reach the majority of shooters for education or training purposes.

4.3. A comparison of wounding rates

Reports on wounding rates have been based on different aspects that are not directly comparable. For example, Ericsson and von Essen (1998) recorded the fates of 1746 elk that were shot at in Sweden. Of these, 1312 (75%) died on the spot. A further 11% fell after 100 metres, another 9.3% were tracked, found and killed, mostly the same day, a further 1.1% were hit but never found, there was no information on the fate of a further 1.7%, and another 1.6% were presumed to be missed. They concluded that 2.8% were shot at and not retrieved. Actually, from their data, only 95.3% of the elk that were shot at were in fact retrieved, the remaining 4.7% being unaccounted for. From the wounding point of view, 75% died on the spot, 20.3% were heavily wounded, ran some distance but were found and killed within hours, and 4.7% were unaccounted for and could have been lightly wounded. Therefore, the wounding rate was between 20.3% and 25%. Thus, retrieval rates and

wounding rates are not comparable and even these calculations are uncertain because they are animal-based, rather than shot-based (see 1.5.).

Others, such as Bertsden et al. (1999) examined 143 foxes from rural Denmark and found that 25% carried shotgun pellets from previous injuries. That they had survived indicates that they had been only 'lightly wounded'. Further shot animals may have survived with no pellets present in their bodies. If such a high percentage had been lightly wounded, how many others had been heavily wounded and died?

In contrast, in the same study, Bertsden et al. found that only 4% of 48 foxes from urban areas of Denmark carried shotgun pellets, which could indicate that urban foxes are less likely to be shot at than rural ones.

Although this type of information may be interesting, it is impossible to draw many conclusions from it. How many foxes had originally been shot at? How many had recovered from their injuries? How old were they when they were shot? How long could they have expected to live even if healthy?

Records from Wildlife Hospital admissions face similar problems. Between 1993 to present, 2020 foxes were admitted to three RSPCA Wildlife Hospitals (Dr A. Lindley pers comm.). Of these only three foxes were admitted because they had been shot. Some of these admissions data have been used by Harris (1997) and Swann (2000) to indicate that shot wounding is not a problem for foxes. The examination on admission to the hospitals is undertaken to diagnose the immediate problem and does not normally include the whole-body X-rays and so on required to determine old shot wounds, as was undertaken by Bertsden on the Danish foxes. There are many imponderables, such as what proportion of the original sample had ever been shot, and how many of those had survived. How long and how likely is a wounded fox to be badly enough incapacitated to be able to be caught alive by humans but yet be alive at all, or be only lightly wounded and thus able to elude humans? Brash (in Mullineaux et al. 2003) considered that 'most adult foxes presented to the surgery have traumatic injuries, usually from gunshot wounds, road traffic injuries or snare injuries', and 'many foxes will tolerate minor gunshot injuries, particularly 'scatter' from shotgun pellets, without any clinical signs'.

Other studies, such as Bradshaw and Bateson (2000) and Urquhart and McKendrick (2003) relied on reports from shooters or studies of butchered carcasses at game dealers, rather than making direct observations, methods that are inherently flawed because lightly wounded animals may never be retrieved. The starting point of any wounding study should be the shot fired. Percentages should be based on this, not the number of animals fired at, nor the animals retrieved, nor the animals surviving old wounds, nor the carcasses of dead animals. These observations, while being of interest, can be misleading indices of total wounding. Similarly, comparisons between species, or between circumstances, can be misleading. Large ungulates are slower, more predictable and have a larger vulnerable area than a fox. They are normally shot with a rifle while static (Gladfelter 1985, Green 1992, and Morrison 1979). Smaller mammals and birds, being shot mainly with shotguns while moving, usually require 3-4 shots per retrieved animal (Bertsden et al. 1999), some of these being still alive, and some of those escaping being lightly wounded. The fox, being intermediate in size, is shot at with both rifles and shotguns and tends to meet the limitations of each method. It can be rather quick and unpredictable to allow a measured rifle shot, and yet is rather large to kill cleanly with a shotgun unless a balanced load, pattern and range is used.

Baker and Harris (1997) assessed the different known causes of mortality of British foxes, such as road deaths, shooting, terriers, snares, lurchers and hounds. They concluded that 80,000 foxes were shot and retrieved each year and that a theoretical further 115,000 fox deaths remained

unaccounted for. Some of these may be foxes that have been shot and died later without being retrieved.

4.4. The second shot

It should not be assumed that the wounding rates seen in our study would all result in continued suffering in the field. What we have shown are the baseline figures, and it is essential to emphasise that in the real world many of these wounded foxes will not suffer long. If a fox is shot at but not killed, especially with a shotgun, it may be possible to take a second shot or even more. Unless the fox is physically impaired, the chances of a kill with subsequent shots is the same or less than the first because the fox will be alarmed and moving faster, probably away from the shooter and at a longer range. The data from the Scottish Gunpacks showed that 32.7% of their shots were repeat shots. Assuming that their kill rates were about the same as for first shots (55%), the second shots will kill a quarter of the wounded foxes within seconds.

The strategy of using second shots depends on the priorities of the shooter. The fox has no meat or fur value and it is not important if the carcass is retrieved. Fox control aims to remove and reduce foxes and their effects on livestock, game and wildlife (Reynolds 2000). Fox welfare is not a first priority. Bertsden et al. (1999) examined the use of the second shot in shooting flying mallard. They concluded that if the shooter reserved the second shot for use only on ducks wounded by the first shot, ie a 'damage repair' strategy, then overall crippling was reduced. On the other hand, if the shooter used the second shot on an apparently uninjured duck, then injury rates increased. They found that of 341 shots fired at an average range of 23 metres, 29% were killed, 16% wounded and 55% missed. The shooters averaged 3.44 cartridges per bagged mallard. But the skilled shooters, who averaged less than 3 shots per retrieved duck, wounded only 0.32 additional ducks for each duck killed whereas poorer shots, averaging over 3 shots per duck, wounded 0.86 further ducks for each duck killed.

In fox shooting, shooters tend to keep firing for as long as they have shots available and the fox in range. Although a 'damage repair strategy' might reduce wounding, it is not the primary priority in fox shooting, and the obvious way to minimise suffering is not to fire the first shot either, if welfare was the priority.

When an animal is a pest the priority is to put it out of action. Shooters in our study claimed to have shot at foxes with shotguns at up to 120 yards. Several shots (up to 11) were fired at one fox. When the priority is to put the fox out of action, and the carcass is not required, it is logical to fire at extreme ranges on the off chance that a lucky pellet might hit a vital spot. In this logic, a long shot has at least a slim chance, whereas a withheld shot has no chance at all.

The rifle shooters who shot foxes as a sport took pride in their accuracy and kill rate. With time no object they could afford to pick their shots. In pest control situations cost effectiveness becomes a priority over welfare. When the immediate task is to shoot the fox, riskier chances are taken. Reynolds (2000) found that 0.2-0.6 foxes per hour could be killed by lamping in autumn and winter but that this figure dwindles as fox density decreases. If one searches for several hours at night and just gets a glimpse of one fox, there is a temptation to take a chance and shoot. Thus, by spring many foxes are 'lamp-shy' having survived previous attempts to shoot them. Additionally, in pest control the aim is to kill the most for least effort, and cubbing time in February to May is the main season for fox lamping. This is when the population is at its lowest ebb and when pregnant or lactating vixens can be shot, thus negating their whole breeding effort. In these circumstance dogs are indispensable for finding and disposing of the cubs.

Keepers in mixed or arable country lamp foxes with rifles because they pose a threat to ground-nesting game birds that nest in April or so. They have another peak of fox shooting in August and September, between harvest and the pheasant poults being released. In sheep-rearing districts there is less game-rearing and foxes are controlled more because they are a pest to sheep that tend to lamb earlier – from January to March. The gun-packs in Wales concentrate their efforts on this period, using hounds and shotguns in daylight. The terrain they cover is often steep and densely wooded, with high densities of foxes.

Thus, different methods suit different situations and fox welfare is not always the prime criterion.

4.5. Dogs

When shotguns are used it is common to use dogs to flush the foxes so that they come within shooting range of waiting people with guns. If the shooter shoots but fails to kill the fox, the fox may return to cover or get beyond shooting range. The dogs can be used to pick up the scent line quickly and have a chance to catch the fox, especially if it is wounded. In the Scottish Gunpack returns, 54.9% of the escaping foxes were killed by the hounds. In the film accompanying this study we show a fox shot at five times and running off wounded, to be eventually overtaken and killed by the hounds.

Dogs are less commonly used in conjunction with rifles. To use a rifle the fox must be stationary and is usually not fully aware of the shooter's presence. A dog is liable to make a noise or movement at the critical moment and scare the fox. Dogs are often used with the lamp, without a rifle. These are large lurchers, capable of coursing and killing a fox within the length of the field.

If the wounded fox goes to ground, terriers are the last hope of catching it. Terrier work, if carried out competently, is capable of performing this task. But there are potential welfare issues for the fox, the terrier and sometimes even for badgers, and therefore the Middle Way Group believes that terrier work should only be undertaken by licensed operators under strict controls.

All this begs the question – why wound the fox in the first place? Why not just use hounds and thus ensure that wounding is zero? The IFAW submission to the Burns Inquiry quoted the work of Kreeger et al. (1989 ,90) as indicating that being chased by a dog was as stressful for a fox as being in a leghold trap. But this was carried out in a confined 10 acre enclosure and Kreeger himself has since commented that such a comparison is not a valid one. Most of the 'chase' phase of a 'hunt' is not pursuit of the fox but the following of the fox's scent trail. It is only in the final phase that the hounds actually see the fox and give chase. Further research is needed to assess physical or mental distress during the hunt, or as a result of it. Most fox hunts are of relatively short duration. Foxes are seldom exhausted to the point that they are unable to run away. When hounds catch a fox, their relative strength is overwhelming and death must occur in seconds (Thomas and Allen 2002).

4.6. Assessing suffering

We have not attempted to assess suffering in this research. We have attempted to measure what proportion of foxes are wounded by various types of shooting. We have shown how this wounding varies with the different shooting regimes and between the different proficiencies of marksmanship. We have loosely categorised the extent of the wounding. We have not attempted to say how long an animal will be wounded for before it dies or recovers. A second shot may kill it almost immediately, a dog may find it and kill it, or it may linger on for weeks. What we do know is that wounding is inevitable in shooting and some individuals are liable to be in pain for a long time. What this pain is like in terms of physical or mental suffering we do not know.

Attempts have been made, for lack of any better option, to formulate a welfare equation. This is outside the scope of this study. However, it might be worth pointing out that if one takes a wounded fox as a standard unit, with a standard expectation of suffering, then the use of dogs by the Scottish Gunpacks to catch wounded foxes halved the suffering caused by the shooting. Thus, although we cannot actually assess suffering itself, we can still make valid calculations relating to it.

4.7. Assessing welfare standards

There are three ways of looking at welfare standards in this context:

Species specific. The fox, as a species, can be killed by several legal methods, such as a variety of shooting methods, snares, cage traps, dogs and (theoretically at least) gassing. If sufficient scientific evidence is forthcoming, one can rank these in order according to the welfare criteria chosen.

Method specific. Each individual method can be used to kill several species. Rifles or dogs can be used on many species from rats to red deer. The welfare performance of each method may vary from species to species (Sainsbury et al. 1995).

Against agreed standards. The alternative that combines the benefits of both the above methods is to assess against agreed standards. This is already used for some of the methods, such as traps, poisons and gasses (Fox and MacDonald 1997). Specific welfare criteria (such as the catch-to-kill interval) are used to assess the method against internationally recognised (ISO) standards. DEFRA then issues appropriate licences for their use, or does not permit their use. For example, DEFRA tests on the poison bait T3327 MRM showed that the caged foxes convulsed, retched and showed obvious signs of distress before death occurred (Health and Safety Executive 2003). The foxes responded to stimuli during these seizures. T3327 was considered more humane than strychnine which causes bone-breaking convulsions, haematomas and (in humans) an ‘overwhelming fear or hysteria’ and yet is still licensed for use on moles. Some of these poisons easily affect non-target organisms, T3327 for example being classed as ‘potentially extremely dangerous to fish or other aquatic life’ and also children, birds and pets.

From the scientific point of view, standardised criteria are the only supportable route to follow. The first two ad hoc methods inevitably lead to inconsistency and controversy. One wonders why DEFRA is prepared to assess certain methods scientifically and yet leave others, such as hunting with dogs and shooting, to the ravages of public opinion.

At the time of going to press we have been unable to obtain exact information on the criteria being applied by DEFRA when licensing traps and poisons. Therefore, it is impossible to compare the shot wounding rates we have assessed in this study with those criteria. This remains to be done.

DEFRA’s licensing system is by no means comprehensive or all-embracing. The common break-back mouse trap does not meet the EU protocol on ISO trapping standards and DEFRA, in its Assessment of Humaneness of Fully Approved Vertebrate Control Agents (DEFRA 1997), noted ‘As severe discomfort, which can last for several days, occurs in a large proportion of all the reported studies, anticoagulant rodenticides must be regarded as being markedly inhumane’. Welfare standards are at present context-dependent. In pest control, welfare is treated as a secondary priority over efficiency in many cases, and the application of standards and controls is clearly unbalanced.

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Appendix A

Findings from examination of red fox (Vulpes vulpes) carcasses submitted by the All Parliamentary Middle Way Group to IZVG.

Method

Fox carcasses were presented frozen and subsequently thawed. They were radiographed and then necropsied in order to assess penetration of, and lesions caused by various shot, using differing shooting regimes. Dorsoventral and lateral radiographs were taken of each animal, using standard dog positioning and exposure. Radiographs were examined to determine the location of rifle bullet fragments and / or shotgun pellets (shot) within the carcass. As complete a necropsy as possible, including skinning of the entire carcass and examination of all organ systems was performed on each animal. Descriptions were divided into head, neck, thorax, abdomen and limbs to facilitate ease of comparison with paper targets. However, in all of the specimens full assessment and interpretation of lesions present were impossible due to autolysis and freeze/thaw artefact.

Specimen ID: FOX D 03-0010

Shooting regime: History submitted with Carcass states: Summer cub. Killed instantaneously from 25 yards by .22 rimfire high velocity rifle. Shot from right side.

Radiography: Multiple 1-4 mm fragments of radio dense material (presumed fragments of rifle bullet) in soft tissues surrounding the left scapula.

Necropsy findings: Date of necropsy: 12th March 2003.

Juvenile female. Weight 3.3kg. Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head: No abnormalities discovered.

Neck and thorax: Skin immediately cranial to the right scapulohumeral joint contains an approximately 9 mm diameter, perforation (presumed bullet entry site). Underlying subcutis and skeletal muscle of the cranio-lateral aspect of the scapula and ventral aspect of the neck, contains extensive haemorrhage. Contiguous with the skin perforation, an approximately 7 mm diameter

tract (presumed path of bullet) extends dorsally through the neck of the fox culminating in the subcutis immediately cranial to the spine of the left scapula. The path of the tract is as follows:

From skin perforation dorsally through the musculature of the right lateral aspect of the neck to the 7th cervical vertebra. From right to left lateral aspect of the 7th cervical vertebra, passing through the spinal canal. The spinal cord is completely transected. The vertebra is fractured into two halves by a complete dorsoventrally aligned fracture contiguous with the tract. The tract continues through the left 1st rib approximately 3 cm dorsal to the sternum. The rib is completely fractured transversely by the tract. Through the supraspinous process and overlying musculature of the left scapula, immediately cranial to the scapula spine and approximately 2 cm dorsal to the glenoid cavity. The scapula spine contains a complete dorsoventrally aligned fracture extending from the ventral aspect of the tract to the acromion process. The tract culminates in an approximately 10mm diameter region of subcutaneous haemorrhage immediately overlying the scapula. Thorax contains approximately 5ml of watery, dark red fluid.

Abdomen and limbs: No abnormalities discovered.

Specimen ID: FOX A 03-0014

Shooting regime: Shot from left side.

History submitted with Carcass states: Originally killed by headshot with humane killer. 24hours later shot with open barrel No.6 Eley GP shot from 25 yards left side.

Radiography: A large number of 2-3 mm diameter pieces of round, radio dense material (shot) are scattered throughout the Carcass with the majority located as follows:

Head: Multiple pieces in soft tissues surrounding dorsocaudal aspect of skull.

Neck: Multiple pieces in soft tissues of dorsal and ventral aspect of neck.

Thorax: Multiple pieces in right caudodorsal area of thoracic cavity and three pieces in soft tissues of right thoracic wall.

Abdomen: Multiple pieces scattered throughout right side of abdominal cavity. Small number of pieces in soft tissue of right lateral abdominal wall.

Limbs: Multiple pieces around fracture in midshaft of left humerus. Lesser number of pieces in soft tissues of right humerus.

Necropsy findings: Date of necropsy: 14th March 2003

Adult male. Weight 6.4 kg. Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head: Subcutis caudal to the left pinna contains three, approximately 2-3 mm diameter pieces of shot. Caudoventral aspect of the left temporalis muscle contains four, approximately 2-3 mm diameter pieces of shot. Skin immediately cranial to the medial aspect of the right ear contains an approximately 4 mm diameter perforation surrounded by a small amount of haemorrhage (presumed site of humane killer application). The caudal aspect of the right parietal bone contains a jagged, approximately 3 cm long fracture surrounded by extensive haemorrhage. An irregular tract

extends from this through the caudal aspect of the brain, the right occipital condyle, the ventral aspect of the occipital bone and the ventral aspect of the trachea at the level of the 2nd and 3rd tracheal ring. There is extensive intramuscular and intracranial haemorrhage surrounding the tract and the right caudal aspect of the brain is macerated.

Neck: No abnormalities discovered.

Thorax: Subcutis of the right lateral aspect of the thorax contains three, approximately 3 mm diameter pieces of shot located as follows:

One piece at the ventral aspect of the sternum at the level of the 4th rib.

One piece approximately, 4 cm dorsal to the sternum at the level of the 9th rib.

One piece approximately, 10 cm dorsal to the sternum at the level of the 12th rib.

Subcutis of the dorsal midline contains two, approximately 2 mm diameter pieces of shot located as follows:

One piece at the midpoint of cervical vertebral column.

One piece at midpoint of thoracic vertebral column.

The thoracic cavity contains approximately 10 ml of watery, dark red fluid. The ventrolateral surface of the left cranial lung lobe contains two, approximately 2 mm diameter punctures, which do not extend completely through the lobe. The pleural surface of the cranial aspect of the left 4th rib, approximately 5cm dorsal to the sternum contains an approximately 3 mm diameter cortical fracture. The marrow cavity is exposed.

There are single, approximately 3 mm diameter indentations in the pleural surface of the intercostal musculature cranial to left 7th, 8th, and 9th ribs immediately adjacent to the vertebral articulations.

Left 10th rib contains a complete transverse fracture approximately 4 cm ventral to the vertebral column.

Abdomen: Subcutis of the right ventrolateral abdomen contains a single, approximately 3 mm diameter piece of shot, located approximately 5 cm caudal and 10 cm dorsal to the xiphoid process. Left sternal part of the diaphragm contains a full thickness, 2 mm diameter puncture wound that directly overlies a similar puncture wound in the ventral surface of the greater curvature of the stomach. The caudal tip of the left lateral lobe of the liver contains a transverse tear that extends approximately 3-4 mm into the parenchyma. The ventral surface of the left kidney contains two, approximately 3-4 mm diameter, puncture wounds: one in the cranial pole and the other located approximately 2 cm caudal to the first. A tract within the renal cortex unites the wounds.

Limbs: The midshaft of the left humerus is fractured.

Shot is retained.

Specimen ID: FOX 3 O3-0030

Shooting regime: Shot from left side, after death. Duct tape around left hind leg states: 40 yards, No. 6, 12 bore.

Radiography: A large number of 2-3 mm diameter pieces of round, radiodense material (shot) are scattered throughout the Carcass with the majority located as follows:

Head: multiple pieces in soft tissue surrounding left mandible.

Neck: one piece in midline immediately dorsal to the trachea.

Thorax: multiple pieces in mid thoracic cavity, and two pieces in the soft tissues of the right lateral thoracic wall.

Abdomen: multiple pieces in the right side of the abdominal cavity and one piece in the soft tissues of the right lateral abdominal wall.

Limbs: multiple pieces in the soft tissues surrounding right and left humerus and radius.

Necropsy findings: Date of necropsy 28th March 2003

Adult female. Weight 5.2 kg. Good skeletal musculature, scant subcutaneous and visceral adipose reserves.

Head: The following are attributed to humane killer injury: The dorsal and ventral aspects of the calvaria are fractured into multiple fragments. The brain is macerated. The skin and skeletal muscle of the lower jaw at the level of the mandibular rami contains an approximately 1 cm diameter laceration.

Neck: Three, approximately 2 mm diameter pieces of shot are embedded in the oesophageal wall.

Thorax: Pleural space of the left cranial thoracic cavity contains one, approximately 2mm diameter piece of shot. One, approximately 2 mm diameter piece of shot is embedded in the dorsal pleural surface of right caudal lung lobe. The left 3rd rib, approximately 4 cm dorsal to the sternum contains a complete transverse fracture.

Abdomen: The uterus contains 2 foetuses (crown rump 2.5 cm) in each horn. An approximately, 1 mm diameter, full thickness puncture in the wall of left uterine horn, 11 cm cranial to the bifurcation, directly overlies one foetus. One, approximately 2 mm diameter piece of shot is embedded in the cortex of the dorsal aspect of the right kidney.

Limbs: No abnormalities discovered.

Shot is retained.

Specimen ID: FOX 2 03-0035

Shooting regime: Shot from left side.

Yellow tape around left hind leg states: 5.0 kg snared 16.1.98 Paxton

Duct tape around left hind leg states: 40yds 12 bore AAA

Radiography: The majority of round, radiodense material (shot) is located as follows: Three, approximately 5 mm diameter pieces in soft tissues of the dorsum to the right of midline. One 2-3 mm diameter piece in the left thoracic cavity. Multiple 2-3 mm diameter pieces scattered throughout soft tissues of hindquarters extending ventrally to surround both stifles. Lesser number of 2-3 mm diameter pieces in soft tissues surrounding right and left radius and ulna.

Necropsy findings: Date of necropsy: 1st April 2003 Adult male. Weight 5.0 kg. Carcass is too autolysed to examine fully.

Thorax: Left lateral thoracic wall contains two, approximately 5mm diameter lacerations that extend through skin, skeletal muscle and scapular bone – one immediately caudal to the midpoint of the scapula spine and the other at the cranial aspect of the glenoid cavity - to enter the thoracic cavity caudal to the 6th rib, approximately 4 cm dorsal to the sternum and caudal to the 8th rib, approximately 7 cm dorsal to the sternum.

The left ventricular wall at the heart base contains an approximately 3mm diameter, full thickness, puncture wound that extends into the left ventricular lumen.

Specimen ID: FOX 11 03-0038

Shooting regime: Originally shot at 80 yards with .243 90g soft point. Shot at 25 yards from left side with .410 shotgun, after death.

Tag on left hind leg states: Berwickshire 27/2/03.

Radioraphy: Multiple pinpoint to 4 mm diameter, irregular fragments of radiodense material (presumed fragments of rifle bullet) scattered throughout the thoracic cavity, with the majority in the left side. Extends into the soft tissues of right and left thoracic wall. Small number of pieces of round 3 mm diameter radiodense material (presumed shotgun pellets) in right side of thoracic cavity and skeletal musculature dorsal to abdomen.

Necropsy findings: Date of necropsy: 11th April 2003

Adult female. Weight 6.8 kg. Carcass is in an advanced state of autolysis.

Good skeletal musculature, scant subcutaneous and visceral adipose reserves.

Head: One, approximately 2 mm diameter piece of shot is embedded in the subcutis at the angle of the right mandible. One, approximately 2 mm diameter piece of shot is embedded in the subcutis overlying the right parietal bone, immediately lateral to the external sagittal crest.

Neck: No abnormalities discovered.

Thorax: The left lateral thoracic wall contains a gaping, approximately 5 x 3 cm full thickness laceration, located approximately 5 cm ventral to the dorsum and 4 cm caudal to the dorsal border of the scapula. Laceration extends fully through skin, muscle, ribs (left 2nd, 3rd, 4th, 5th, 7th, 8th and 9th ribs contain complete transverse fractures) and pleura exposing the thoracic cavity. Trachea and oesophagus are completely transected transversely at the level of the thoracic inlet. All of the left lung lobes and the right cranial lung lobe are macerated.

Right 2nd, 3rd, and 4th ribs contain complete transverse fractures located approximately 5-6 cm dorsal to the sternum. The intercostal musculature and pleura between these is lacerated. The overlying wing of the right scapula is fractured into multiple fragments. The overlying skin is not penetrated. Thoracic vertebrae articulating with the 1st, 2nd, 3rd, 4th and 5th ribs contain complete longitudinal fractures aligned parallel to the dorsal plane. The ventral surface of the spinal cord is exposed.

Abdomen: The right uterine horn contains two, approximately 2 cm diameter dilations located approximately 3 cm and 12 cm cranial to the uterine bifurcation. The left uterine horn contains one, approximately 2 cm diameter dilation located approximately 4 cm cranial to the uterine bifurcation.

Limbs: No abnormalities discovered.

Shot is retained.

Specimen ID: Fox 13 03-0039

Shooting Regime: Shot from left side, after death.

Duct tape around left hind leg states: AAA 25 yds

Radiography: One piece of round 5mm diameter, radiodense material (shot) in soft tissue lateral to the right scapula. Multiple pinpoint to 5 mm irregular fragments of radiodense material (shot) in soft tissue caudal to right humeral fracture.

Necropsy findings: Date of necropsy: 11th April 2003

Adult female. Weight 6.1 kg.

Good skeletal musculature, scant subcutaneous and visceral adipose tissue.

Head: Skin craniomedial to the base of the left ear contains an approximately 3 mm diameter puncture wound. A tract extends from this through skeletal muscle, left parietal bone, brain and occipital bone. The left parietal bone and the occipital bone are fractured into multiple fragments.

Neck and Thorax: Skin overlying the caudal angle of the left scapula contains an approximately 2 mm diameter entrance wound. A tract extends from this wound through skeletal muscle, bone of the infraspinous fossa at the caudal angle of the left scapula (approximately 5mm diameter full thickness puncture), through skeletal muscle of the dorsum between the spines of the 5th and 6th thoracic vertebrae, to exit through the bone of the infraspinous fossa at the caudal aspect of the right scapula (approximately 4 mm diameter full thickness puncture). There is no exit wound in the skin overlying the right scapula. Skin approximately 3 cm dorsal and 3 cm cranial to the left scapulohumeral joint contains an approximately 2 mm diameter entrance wound. A tract extends from this wound through skeletal muscle dorsal to the cervical vertebrae but does not penetrate the skin of the right side of the neck.

Abdomen: Left and right uterine horns each contain three, 3.5 cm crown rump length foetuses.

Limbs: The distal right humerus contains a complete, transverse fracture.

The distal left tibia contains a complete, open transverse fracture.

Specimen ID: FOX 14 03-0050

Shooting Regime: Shot from unknown side.

Tag on bag states: Shot with 12G. at 41 yds, using 36 gram BB, 1/4 choke, then again at 32 yds with 1/2 choke, running from left to right. (this animal was immobilised but not killed outright) (Cameron I. Bruce) (11-3-03)

Radiography: Multiple pieces of round, approximately 4-5 mm diameter, radiodense material (shot) are present throughout the Carcass with the majority located as follows:

Head: one piece in fracture of sagittal crest.

Neck: two pieces in soft tissues of dorsal aspect of the neck.

Thorax: one piece in left cranial thoracic cavity. One piece in soft tissues of dorsum.

Abdomen; one piece in soft tissues at junction of left thorax and abdomen.

Limbs: one piece in fracture of left olecranon. One piece in fracture of left humerus. One piece in the soft tissues caudal to the right femur.

Necropsy findings: Date of necropsy: 24th April 2003

Adult female. Weight 6.4 kg. Carcass is in an advanced state of autolysis.

Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head: Sagittal crest contains an irregular approximately 1 x 0.5 cm fracture.

Neck: No abnormalities discovered.

Thorax: One, approximately 3 mm diameter piece of shot is embedded in the subcutis of the left lateral thorax at level of 8th rib. Thoracic cavity contains approximately 200ml of watery dark red fluid.

ABDOMEN: No significant lesions.

Limbs: Left elbow is fractured into multiple fragments: left olecranon process is macerated and an approximately 3 x 5 x 1 mm flattened piece of shot is embedded in the macerated bone. Left distal humerus contains a complete transverse fracture approximately 4 cm dorsal to the elbow joint.

Shot is retained.

Specimen ID: FOX 16 03-0051

Shooting Regime: Shot from right side at 25 yards with No. 6 shot using .410 shotgun, after death.

Originally killed: Tag on bag states: 10-3-03 Shot with .22 - 250, 53 gr (NORMA) at 97 yds (Cameron I. Bruce).

Radiography: Multiple pinpoint to 1 mm, irregular fragments of radiodense material (presumed remains of rifle bullet) are scattered throughout soft tissues surrounding laceration in dorsum. A small number of pieces of approximately 3 mm diameter, round, radiodense material (shot) are scattered throughout the Carcass with the majority present as follows:

Head: one 3 mm diameter piece in the soft tissues surrounding the ventral aspect of angle of the right jaw.

Abdomen: small number within right side of abdomen.

Limbs: one piece in soft tissue surrounding the right humerus and two pieces in soft tissue surrounding the right elbow. Three pieces in soft tissue of right hind leg.

Necropsy findings: Date of necropsy: 24th April 2003

Adult male. Weight 7.2 kg. Carcass is in an advanced state of autolysis.

Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head and Neck: No abnormalities discovered.

Thorax: There is a gaping, approximately 8 cm long x 6 cm wide, laceration in the dorsum, commencing immediately caudal to the caudal angle of the scapulae. Laceration extends through skin, underlying skeletal muscle and spines of the 4th, 5th, 6th, and 7th thoracic vertebrae. Exposed skeletal muscle and vertebral spines are macerated. The left 9th and 10th ribs contain complete transverse fractures located at the angle of each rib. The fractured ends protrude marginally into the dorsal aspect of the thoracic cavity. The thoracic cavity contains an approximately 10 ml blood clot.

Abdomen: No abnormalities discovered.

Limbs: One, approximately 2 mm diameter piece of shot is embedded in the subcutis immediately dorsal to the caudal aspect of the right elbow. One, approximately 2 mm diameter piece of shot is embedded in the subcutis of the medial aspect of the right inguinal region.

Shot is retained.

THE FOLLOWING CARCASSES: 03-0007, 03-0011, 03-0012, 03-0031, 03-0034, 03-0049, 03-0 052 PROVIDED LIMITED INFORMATION FOR THE STUDY, AS IT WAS NOT KNOWN WHICH SIDE THE ANIMAL WAS SHOT FROM AND / OR THE SHOOTING REGIME USED:

Specimen ID: FOX PH2 03-0007

Shooting Regime: Shot from unknown side.

History submitted with states: Shot by Paxton Foxhounds with BB or No.4 shot. Questionably mauled by hounds once dead.

Radiography: Multiple pieces of 3-4 mm diameter, round, radiodense material (shot) are scattered throughout the Carcass with the majority located in soft tissues of both hindquarters and left thoracic and abdominal walls.

Necropsy findings: Date of necropsy: 12th March 2003

Adult male. Weight 5.3 kg. Extensive freezer burn of head neck and hindquarters and in an advanced state of autolysis. Good skeletal musculature and good subcutaneous and visceral adipose reserves.

Head: No abnormalities discovered.

Neck, Thorax and Abdomen: Subcutis of thorax and right ventrolateral aspect of the trachea extending to the larynx is diffusely brown to black. Thorax contains approximately 2 ml of watery, red to black fluid. Cranial mediastinal tissue is macerated and diffusely, dark red to black.The oesophagus contains a single approximately 7 cm long, 1-2 mm diameter, white, nematode consistent with an ascarid. Gastric pylorus contains three similar though smaller nematodes.

Limbs: The shaft of the right femur is fractured into three pieces.

Specimen ID: FOX PFH1 03-0011

Shooting regime: Shot from unknown side.

History submitted with carcass states: Shot by Paxton Foxhounds with BB or No 4 shot. Questionably mauled by hounds once shot.

Radiography: Multiple pieces of 4-5 mm diameter, round, radiodense material (shot) are scattered throughout the Carcass with the majority located in soft tissues of the head, neck, forelimbs, and thoracic wall. Lesser numbers are present within the thorax, abdomen and soft tissues of abdominal wall and hind legs.

Necropsy findings: Date of necropsy: 13th March 2003

Adult male. Weight 5.5 kg. There is severe freezer burn of head, neck and hindquarters. Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head: The skull is fractured into multiple fragments as follows:

The occipital bone contains two, irregular, approximately 2-3 cm long fractures, which extend dorsocranially from the occipital condyles, to meet in the dorsal midline aspect of the parietal bone. Left occipital condyle contains a complete, midline, transverse fracture, which continues into the ventrocaudal aspect of the occipital bone, creating an approximately 1 x 1 x 1 cm irregular fragment. The caudal aspect of right parietal bone contains a triangular, approximately 1 x 2 x 2 cm fragment. There is an approximately 5 cm long, irregular, dorsal midline fracture between left and right frontal and parietal bones. This fracture is contiguous cranially with 1) an approximately 3 cm long fracture that extends ventrally into the right frontal bone, and then caudally into ventral aspect of right parietal bone, to create an approximately rectangular fragment composed of right frontal and parietal bones, 2) an irregular fracture extending approximately 0.5 cm cranially, then approximately 2 cm ventrally, then approximately 0.5 cm caudally, to create a fragment composed of right frontal bone. The right tympanic bulla is fractured into multiple pieces and contains blood.

The ventral aspect of the calvaria contains two, irregular fractures extending from the ventral aspect of the occipital condyles craniomedially, to unite immediately caudal to the pituitary fossa.

Neck: No abnormalities discovered.

Thorax: Skeletal muscle immediately medial to the left scapulohumeral joint contains an approximately 3 mm diameter piece of shot. Skeletal muscle immediately medial to cranial angle of the left scapula contains an approximately 3 mm diameter piece of shot. The entire right lateral aspect of the thorax contains extensive subcutaneous and intramuscular haemorrhage, which extends cranially into the ventral aspect of the neck, to the larynx.

The following ribs contain complete transverse fractures:

Right 2nd rib approximately 1 cm ventral to vertebral articulation.

Right 5th rib approximately 7cm ventral to vertebral articulation.

Right 11th rib approximately 2cm ventral to vertebral articulation.

Left 1st and 2nd ribs approximately 1cm dorsal to sternum.

The right side of the thoracic cavity contains an approximately 5ml blood clot and approximately 10ml of watery, dark red fluid. The left ventricular myocardium approximately 1.5 cm dorsal to the apex of the heart and 1 cm caudal to cardiac groove, contains an approximately 3 mm diameter puncture wound. A tract extends from this, through the ventricular wall to enter the lumen of the right ventricle.

Abdomen: No abnormalities discovered.

Limbs: The shaft of the left humerus and head and proximal shaft of the right humerus contain multiple fractures.

Shot is retained.

Specimen ID: FOX PFH3 03-0012

Shooting regime: Shot from unknown side.

History submitted with carcass states: Shot by Paxton Foxhounds with BB or No. 4 shot. Questionably mauled by hounds once shot.

Radiography: Multiple pieces of approximately 4-5 mm diameter, round, radiodense material (shot) mainly within the left side of thorax and soft tissues of left thoracic wall.

Necropsy findings: Date of necropsy: 13th March 2003

Adult male. Weight 5.6 kg. There is severe freezer burn of head, neck and hindquarters. Carcass is in an advanced state of autolysis. Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head and Neck: No abnormalities discovered.

Thorax: Subcutis and skeletal musculature of entire right lateral aspect of thorax, and left lateral aspect between the 9th and 11th ribs is diffusely, brown to black.

Supraspinous fossa of the right scapula, immediately cranial to the scapula spine and approximately 4 cm dorsal to the scapulohumeral joint contains an approximately 4 mm diameter, full thickness, puncture wound. Cranial angle of the supraspinous fossa of the left scapula, immediately cranial to the scapular spine contains a similar full thickness puncture wound. The punctures are united by a tract that extends through the skeletal musculature between the spines of the 1st and 2nd thoracic vertebrae, immediately dorsal to the vertebral bodies. There are no lacerations in the overlying skin.

Intercostal musculature between left 9th and 10th rib contains an approximately 4 mm diameter laceration. Intercostal musculature between left 10th and 11th rib contains an approximately 4 mm

laceration. Embedded in the intercostal musculature at the junction of the left 10th rib with the sternum is an approximately 3 mm diameter piece of shot. Left 10th rib contains a complete transverse fracture approximately 5 cm ventral to the vertebral articulation.

Right 7th rib contains a complete transverse fracture approximately 3 cm ventral to the vertebral articulation. Intercostal musculature contiguous with the fracture contains an approximately 5 cm long laceration. Skeletal muscle overlying the sternum at the level of right 3rd rib contains an approximately 3 mm diameter blind-ending tract, which extends into the overlying subcutis of the right side, but does not penetrate the skin. The thoracic cavity contains an approximately 15 ml blood clot.

The pericardium contains multiple lacerations. Right ventricular myocardium immediately ventral to the tip of the right auricular appendage contains a 1-2 mm diameter puncture wound that extends into the right ventricular lumen. Right ventricular myocardium at the cardiac groove approximately 4 cm ventral to the heart base contains a similar 1-2 mm diameter puncture wound, that extends into the right ventricular lumen. Left ventricular myocardium contains an approximately 4 cm long, 2-3 mm diameter laceration, that extends from the apex of the heart, to enter the right ventricular lumen at the base of the papillary muscle in the right ventricular free wall. The laceration does not enter the lumen of the left ventricle. The ventral aspect of the left ventricular myocardium approximately 2 cm from the apex of the heart contains a 4 mm diameter laceration, which extends dorsally through the myocardium to enter the left ventricular lumen immediately proximal to the papillary muscle in the left ventricular free wall.

Dorsal surface of the cranial portion of the right cranial lung lobe contains two, approximately 3 mm diameter lacerations that do not extend completely through the lobe. Dorsal surface of the cranial aspect of the right caudal lung lobe contains one, approximately 4 mm diameter and 1 approximately 2 mm diameter lacerations that do not extend completely through the lobe. Sternal part of the diaphragm contains two midline, approximately 4 mm diameter lacerations, and another similar laceration located approximately 4 cm to the right of midline.

Abdomen: The right medial liver lobe is diffusely macerated. Left medial liver lobe approximately 2 cm cranial to the caudal margin of the lobe contains a jagged, transversely aligned fissure that extends partially into the hepatic parenchyma. Left lateral liver lobe contains two, similar transverse fissures located approximately 2 and 4 cm cranial to the caudal margin of the lobe. The right ventral aspect of the spleen contains a gaping fissure located approximately 3 cm cranial to the caudal margin.

Limbs: No abnormalities discovered.

Shot is retained.

Specimen ID: FOX 4 03-0031

Shooting regime: Shot from unknown side.

Tag on right hind leg states: Berwickshire 3-3-03.

Shot originally with .243 90g rifle at 96 yds, re-shot with 12 bore AAA at 40 yards

Radiography: Multiple pinpoint to 4 mm, irregular, fragments of radiodense material (presumed remains of rifle bullet) are scattered throughout right side of thorax and abdomen. One piece of approximately 5-6 mm diameter, round, radiodense material (shot) in soft tissue at the ventrolateral aspect of the angle of the right jaw.

Necropsy: Date of necropsy: 28th March 2003

Adult male. Weight: 5.4 kg. Carcass is in an advanced state of autolysis.

Good skeletal musculature, adequate subcutaneous and visceral adipose reserves.

Head and Neck: No abnormalities discovered.

Thorax: Right lateral thoracic wall contains a gaping, approximately 6 x 8 cm full thickness laceration, located approximately 2 cm caudal and 2 cm ventral to caudal angle of scapula. Laceration extends fully through skeletal muscle and ribs (5th, 6th, 7th, 8th, and 9th ribs contain complete transverse fractures) to expose the thoracic cavity and is surrounded by extensive haemorrhage. All of the right lung lobes and the tip of left cranial lung lobe are macerated. The right atrium of the heart is macerated. The right sternal aspect of the diaphragm contains an approximately 4 cm diameter laceration. The tip of the right medial lobe of liver and a 10cm long portion of the duodenum extend through this hole into the thoracic cavity.

Abdomen: The right kidney contains an irregular, jagged laceration commencing at the cranial pole and extending approximately 4 cm caudally through cortex and medulla.

Limbs: No abnormalities discovered.

Specimen ID: FOX 1 03-0034

Shooting regime: Shot from unknown side.

Tag on left hind leg states: Bucheck fox 20/2/03.

Originally shot with .243 rifle at 150 yds. Carcass re-shot with .410 shotgun at 40 yds

Radiography: Multiple pieces of approximately 3-5 mm diameter, round, radiodense material (shot) are scattered throughout the Carcass but predominantly in tissues of the right side of thorax, abdomen and hindquarters.

Necropsy: Date of necropsy: 1st April 2003

Adult female. Weight 5.2 kg. Carcass is autolysed.

Good skeletal musculature and adequate subcutaneous and visceral adipose reserves.

Head and neck: No abnormalities discovered.

Thorax: One, approximately 3 mm diameter piece of shot is embedded in musculature medial to left scapula. One, approximately 3 mm diameter piece of shot is embedded in the parietal pleura between right 11th and 12th rib. There is an approximately 2 cm diameter, gaping laceration in the right lateral thoracic wall immediately caudal to shoulder joint. Laceration extends through skin, muscle and ribs into the thoracic cavity. There are complete transverse fractures of the following ribs:

Right 5th rib approximately 6cm dorsal to sternum.

Right 6th rib approximately 8 cm dorsal to sternum.

Right 9th rib approximately 10 cm dorsal to sternum.

The intercostal musculature between these ribs is lacerated.

The dorsal pleural surface of the right caudal lung lobe contains an approximately 6 cm long, jagged laceration that does not extend fully through lobe.

There are complete transverse fractures of the following ribs in the left side of the thorax:

Left 5th rib approximately 7 cm dorsal to sternum.

Left 6th rib approximately 5 cm dorsal to sternum.

Left 7th rib approximately 6 cm dorsal to sternum.

The intercostal musculature between these ribs is lacerated.

The apex of the left cardiac ventricle contains two, approximately 1mm diameter puncture wounds that extend fully through the myocardium into the left ventricular lumen. There is an approximately 0.5 cm diameter laceration in the right costal part of the diaphragm.

Abdomen: One, approximately 3 mm diameter piece of shot lies within the small intestinal mesentery. An approximately 10 cm diameter area of the left dorsal peritoneal wall immediately dorsal to left kidney is macerated.

Limbs: One, approximately 2 mm diameter piece of shot is embedded in the subcutis ventral to the right patella.

Shot is retained.

Specimen ID: FOX 15 03-0049

Shooting regime: Shot from unknown side.
Tag on bag states: Shot with 12G. at 26yds using 36 gram BB, 1/4 choke, running away. (Cameron I. Bruce) (11-3-03)

Radiography: Multiple pieces of approximately 5 mm diameter, round, radiodense material (shot) predominantly in soft tissues of dorsal aspect of the thorax, abdomen and head. A small number of similar pieces of shot within thorax and abdomen.

Necropsy findings: Date of necropsy: 24th April 2003

Adult male. Weight 7.4 kg. Carcass is in an advanced state of autolysis.

Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head: One, approximately 4 mm diameter piece of shot is embedded in the subcutis, immediately caudal to the left eye. Two approximately 4mm diameter pieces of shot are embedded in the subcutis overlying surface of the temporalis muscle, caudal to the left ear. One, approximately 4 mm diameter piece of shot is embedded in the caudal aspect of the right temporalis muscle.

Neck: Two, approximately 4 mm diameter pieces of shot are embedded in the subcutis of the left ventral aspect of the neck at the level of the thoracic inlet.

Three, approximately 4 mm diameter pieces of shot are embedded in the subcutis of the right ventral aspect of the neck.

Abdomen: One, approximately 4 mm diameter piece of shot is embedded in the subcutis of the right inguinal region.

Thorax: Thoracic cavity contains approximately 200ml of watery dark red fluid and an approximately 50 ml blood clot. The right cranial lung lobe contains an irregular, approximately 2 cm long, full thickness laceration that extends medially from the lateral margin.

Limbs: The left forepaw contains one, approximately 4 mm diameter piece of shot, embedded between the medial tendons of the superficial digital flexor.

The right ulna contains a complete fracture that extends from the ventral aspect of the trochlear notch to the caudal aspect of the ulna, approximately 5 cm ventral to the olecranon.

Shot is retained.

Specimen ID: FOX 17 03-0052

Shooting Regime: Shot from unknown side.

Masking tape around right hind leg states: Shot in head only OK to reshoot.

Reshot No 6, 40yds (R to L)

Radiography: Multiple, pinpoint to approximately 3 mm fragments of radiodense material are scattered in a line from the base of the left ear to the trachea, and a single approximately 1 x 0.5 cm irregular piece of radiodense material is present in the soft tissues at left cranioventral aspect of the neck (presumed remains of original head shot). Small number of 2-3 mm diameter pieces of round, radiodense material (shot) are present. The majority are located in the soft tissues of the head, right foreleg and right thoracic and abdominal wall.

Necropsy findings: Date of necropsy: 25th April 2003

Adult male. Weight 6.4 kg. Carcass is in an advanced state of autolysis.

Good skeletal musculature and scant subcutaneous and visceral adipose reserves.

Head: An approximately 6 cm diameter region of subcutaneous and intramuscular haemorrhage extends ventrally from the base of the left ear to the angle of the jaw.

The left parietal bone is fractured into multiple fragments. A 0.5 x 0.5 cm fragment of parietal bone is depressed into the left cerebral hemisphere.

Neck: No abnormalities discovered.

Thorax: Thoracic cavity contains approximately 20 ml of watery, dark red fluid.

Abdomen and Limbs: No abnormalities discovered.

WOUNDING RATES

A Legal Solution to the issue of Hunting with Dogs
Dr. Nick Fox BSc (Hons) CEd PhD


Dr. Nick Fox BSc (Hons) CEd PhD
with a foreword by
The All Party Parliamentary Middle Way Group

Foreword

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1. A middle way position

1.1 Hunting with dogs is only one of a number of alternative methods for killing, or taking, wild mammals and does not exist, or operate, in isolation. This middle way solution to the issue of hunting with dogs allows for this and seeks, wherever possible, to meet the genuine concerns of both pro and anti-hunting viewpoints. This document presents some ideas and concepts towards the genesis of a lasting resolution that is both practical and robust, without addressing other field sports in any detail.

1.2 Without doubt there are genuine welfare issues in current wildlife management practices. However, the welfare priorities are not those held by Countdown to a Ban: namely, that of sport or recreational hunting. Nor is hunting with dogs without difficulty in terms of animal welfare, as held by the Campaign for Hunting. Furthermore, wildlife management, in its relation to conservation and biodiversity, is too complex an issue to be decided on the single criterion of the welfare of individual animals.

1.3 Existing legislation has developed over many years and is difficult for practitioners, and the Police alike, to access, and interpret, in a straightforward comprehensible manner. In this respect, hunting with dogs should properly be considered alongside other methods of killing or taking wild mammals, with all methods being subject to a comprehensive review or rationalisation. Such an approach would result in a fair, science-based system that is:

- readily comprehensible
- affordable
- enforceable
- non-discriminatory
- flexible enough to allow for changes in wildlife status
- flexible enough to reflect changes in the developing understanding of welfare issues

At the recent Hunting Hearings there was a general consensus that these welfare issues appeared in several different areas and should be addressed to achieve at least a minimum standard of welfare across the board.

2. Legal Framework

2.1 The Wildlife and Countryside Act 1981 (WCA) is currently under review. Given that part of its remit is '... to prohibit certain methods of killing or taking wild mammals; to amend the law relating to protection of certain mammals ...' it would seem a suitable and timely vehicle for a lasting resolution. The WCA already makes considerable provision for the protection of certain mammals that cannot be killed or taken except under licence. The Act also prohibits, or controls, certain methods of killing or taking except under licence. DEFRA's European Wildlife Division (EWD), including its Wildlife Management Branch (WMB), already has responsibility for policy toward the conservation and enhancement of wildlife in England, and responsibility for all issues involving wild animals [for instance, Control of Vertebrate Pests and Game Licensing (1)]. This includes much of the key legislation relevant to the issue of hunting with dogs, as well as wider issues (2). EWD and the Wildlife Management Team already oversees applications for, and the issue of, licences under the

WCA, and other legislation such as The Protection of Badgers Act 1992(3). Considerable technical advice regarding wild vertebrates and their management/control is already offered and could reasonably be expanded to include the issue of hunting with dogs (4). In addition, certain of EWD's units could assist in an ongoing assessment of any licensing system allowing for changes in wildlife status, and our developing understanding of control methods including related welfare issues.

2.2 Alternatively, a new Wildlife Management Act could offer the opportunity for a strategic long-term solution. This would be a more complex approach than building on to the existing Wildlife and Countryside Act.

2.3 Such a legal framework to wildlife management issues could:

- take as its basic premise that all wild, or free-living, mammals are protected and then specify exemptions to this blanket protection
- replace all obsolete and confusing legislation concerning game animals (5)
- provide framework legislation for a governmental Wildlife Management Authority
- include welfare of individual wild mammals as an integral, and science-based, part of all aspects of wildlife management

3. The Wildlife Management Authority

3.1 Wildlife Management Authority

- Area of responsibility could include all wildlife management issues as specified in the relevant sections of the new Wildlife Management Act
- In particular it could include involvement in the current Wildlife and Countryside Act, Part 1, Sections 2-8, 10-12, 16-17, 22-23 and 26.
- The legislative framework for the formation of this body in an advisory role is already in place in Part1, Section 23 of the WCA.
- The role would include advising the Secretary of State in the issuing of licences for certain aspects of wildlife management.
- Its role could link up, but not replace, the current role of the Joint Nature Conservation Committee (JNCC).
- Could be an expanded version of the newly-formed Wildlife Branch.
- Could include, and possibly expand, the current DEFRA Wildlife Inspectorate.
- Could have working links with the Partnership for Action Against Wildlife Crime (PAW)
- Could be a department, or unit, of DEFRA and consist of experts in various aspects of wildlife management combined with administrative support
- Could have the ability to consult with, or contract, specialist individuals/organisations as required
- Could be paid for under DEFRA central budget

- Could be designed to minimise administrative costs (see below)
- Could be provided with specific powers of entry and inspection for authorised persons
- Could undertake most of the role currently provided by ISAH

3.2 Tasks of the Wildlife Management Authority

- Prepare licences for activities involving the killing, or capturing, of wildlife otherwise prohibited by the new Act. This could include all methods of intentionally killing/capturing wildlife.
- Collate existing data, initiate scientific research to obtain new data, and consult with others as needed in order to clarify licences or conditions thereon.
- Collate data from licencees in the form of annual reports where appropriate.
- Provide an expanded Wildlife Inspectorate of suitably specialised persons to ensure that the new Act is being complied with, but not to enforce the Act.
- Enforcement would be provided by the Police, assisted by the Wildlife Inspectorate as is currently the case.

3.3 Costs

Ideally the costs of administration and enforcement should be minimised in the original design of the system. In this proposal it is achieved by the use of General Licences that do not require significant administration. The concept that 'user pays' is useful but requires identifying who the 'users' of some aspect of a General Licence might be. In many countries the revenue of game licensing is ploughed back towards wildlife, but in UK it goes into central funds and barely covers the levy costs. Individual Licences under this proposal could be easily self-funding. Any fund-raising should be proportional to the activity; the person who mainly catches rabbits with his lurcher, but maybe takes two or three hares per year as well, will simply ignore any level of control that is too onerous.

4. Licences

4.1 Types of Licence at present (no new types are proposed)

- General - renewed annually to cover one or more species, and one or more methods of killing or capturing (6).
- Individual - issued to approved individuals such as pest control operatives to perform certain specialised tasks involving killing, or capturing, wildlife.
- Product - issued to manufacturers to produce and sell, and for certain buyers to use, certain products, such as traps (Spring Traps Approval Order 1995) or chemicals/poisons (in conjunction with the Pesticide Safety Directorate), that are deemed humane (7).

4.2 All licences would have to comply with existing legislation including:

- EU protocols/conventions/directives (8,9)
- International Standards Organisation (ISO) standards (see Appendix II.b.)

4.3 Utility: Statutory Purposes to be licensed
Licences to hunt, catch or kill mammals may be issued for one or more Statutory Purposes, such as:

- Population control (see 4.13 below)
- Nuisance animals (see 4.13 below)
- Food or body parts
- Public health and safety
- Health and safety of domestic or wild animals
- Sport or recreation (see 4.14 below)
- Habitat management (see 4.13 below)
- Scientific research
- Relocation
- Sale (alive)
- Sale (dead)

4.4 Approved Methods to be licensed
Licences may be issued for one or more approved methods that meet welfare standards.

- Dogs (above ground) (see 5.1 below, and Appendix I.g.)
- Dogs (below ground) (see 5.6 below)
- Ferrets
- Birds of Prey
- Smooth bore shotguns (see 6.1 below)
- Rifles (see 6.1 below)
- Dead traps (see 6.2 below)
- Live traps (see 6.2. below)
- Nets
- Snares (see 6.2 below)

Poison and Poison Gas (note: By way of example the use of Hydrocyanic gas [Cymag] against foxes is illegal as this is not one of the approved uses, which are, to destroy rabbits, rats and ants. The poisoning of foxes is also illegal. The poisoning, or gassing, of other species [eg. squirrels, rabbits] is permitted under certain conditions and subject to licence.) (see 6.2 below)

4.5 Key Criteria for licences
All licences must comply with two key criteria:

- The principles of wise and sustainable use of wildlife resources.
- The welfare of individual animals.

4.6 The principles of sustainable use are well understood in conservation policy, and decisions would be based on advice from the JNCC. In simple terms it covers our global responsibility for species and the welfare of their regional populations. As part of this, in respect to licensing, legal and natural selectivity are included:

- Legal selectivity: the extent to which non-target species are affected.
- Natural selectivity: the extent to which the strongest and fittest tend to survive. This includes aspects of maintaining a suitable sex ratio and age structure in wild mammal populations.

At the Hunting Hearings it was agreed that the populations of the prey species hunted by dogs were not impacted unduly by hunting and that this was a sustainable use of a wildlife resource.

4.7 The welfare of individual animals is still a young science. The welfare criteria currently being used by DEFRA to licence traps need reviewing, and new criteria need to be established on the basis of current or future research. These criteria must be achievable in most instances, and must be capable of being applied evenly across the Approved Methods. In particular, all licensed methods should comply with the welfare standards and methods of testing them as laid down in Annex 1 to the Agreement on International Humane Trapping Standards (Appendix II b.)

4.8 More research, especially using radio-tracked mammals during, and after, the hunt or shoot is needed to clarify scientifically a subject where there is more opinion than evidence. Overlaying this, it must be recognised that in a small percentage of cases unusual suffering may occur (eg. a badly placed shot, an unduly long pursuit phase, being held by a limb in a killing trap). Appropriate means must be sought to reduce such instances through improved operator/hunter training or education and through improved trap design. Whilst accepting that suffering takes many forms, both physical and mental, and is unquantifiable, it is considered that the following aspects, in this order of precedence, are of priority:

- Escaping wounded or maimed (Non-fatal wounding)
- Time intervals between capture and insensibility or death (Catch-to-kill interval)
- Extent of direct human supervision
- Period of direct pursuit

- At the Hunting Hearings some of the expert witnesses opined that a kind of welfare equation is useful in making a basic assessment of suffering, based on the assessment of the amount of suffering, the duration, and the numbers of animals. In this context it was agreed that escaping wounded, although important in shooting, was not a factor in hunting with dogs.

4.9 Conditions on Licences

- Each licence would have a number of conditions such as:
- outlining what legislation it is providing exemption to
- who it is issued by
- the Statutory Purposes being licensed
- persons authorised
- species affected
- Approved Methods being licensed
- conditions on how methods must be conducted
- places, dates for which licence is valid
- bag limit of animals to be killed or captured
- treatment of animals post capture

4.10 Before any licence is valid, the licencee must first obtain permission from the land-owner or equivalent; the DEFRA licence is not an access permit (see 5.5 below). Further, one of the conditions of the licence would be adherence to a mandatory minimum code of conduct laid down by the governing body responsible for each method. These codes of conduct would be designed to enable each method to satisfy the two key criteria above. The WMA could require all holders of Individual Licences to maintain accurate records and request/inspect a representative sample on an annual basis in order to enable adequate monitoring.

4.11 Phasing in of Licences

All currently legal activities are already licensed, or permitted, by one route or another. In line with the government's commitment not to address shooting or fishing, the current situation would remain the same with the permitting system being clarified and made more coherent. Apart from the immediate issue of hunting with dogs, the other methods would remain unaffected. However, in the course of time, the Wildlife Management Authority would undertake research, and seek specialist advice, in order to establish whether each licence was properly fulfilling the two key criteria of welfare and wise use. If, after consultation with the governing body of a particular method, it became clear that certain aspects of that method were incapable of satisfying the key criteria, that aspect of the method would be deleted from the General Licence. It may, however, be subjected to an Individual Licence in order that the method could be carried out by certain licensed, and approved, individuals.

4.12 Handbook of Wildlife Regulations

At present licences are issued by a variety of bodies through a number of routes. It is difficult for the end-user to be fully aware of their existence or conditions (10). Thus, misdemeanours occur through ignorance. A clear checklist chart showing which species can be hunted or killed (including species recognition section), for what Statutory Purposes, and by which Approved Methods, would be of considerable benefit in this respect (Appendix I.i.). All licences, with relevant codes of conduct, should also be available under one cover and made readily available to all concerned parties. This annual Handbook of Wildlife Regulations could be disseminated through relevant organisations and available via internet. This would be helpful in crime prevention and useful for enforcement agencies, many of whom are not wildlife experts and do not have the resources to become so.

4.13 Pest control, population management, and nuisance animals

'Pest control' is a loose term that can entail a variety of management approaches. For example, it can include reducing a population of rats to an acceptable level, and maintaining it there. It can involve harvesting a surplus of red deer to maintain a healthy static population in balance with its food supply and habitat, and with a balanced age and sex ratio. It can mean depressing a population of predators immediately prior to a sensitive period for its prey, such as the breeding season. It can mean activities that deter predators or prevent them from preying heavily at key periods (e.g. diversionary feeding). It can mean finding and killing a particular individual such as an old fox specializing in lambs. Whether these activities are carried out commercially, or by paid operatives, or free of charge as part of a leisure activity, is irrelevant.

At the Hunting Hearings there was some confusion about what is meant by pest control. Clearly the 20,000 or more foxes that are killed during hunting are controlled, death is the ultimate control. The combined killings by man-made agencies (that totalled about 70% of mortality in the Bristol area) were sufficient to stabilise or even depress the population below its potential maximum. This too is a form of control. But nationally there remains a healthy population sufficiently large for there to be no concern over sustainability.

4.14 There are many situations in hunting, shooting and fishing where the activity is carried out entirely, or in part, as a means of recreation or sport. In these circumstances 'efficiency' implies maximising the number of man-hours of sport whilst minimising the impact upon populations and individual animals. Therefore, when an activity is undertaken primarily, or solely, for sport the licensed hunting season would include only the non-breeding season, and the numbers of animals killed may be restricted by a bag limit. Where an activity is conducted entirely, or primarily, for pest control reasons 'efficiency' implies minimising the number of man-hours and maximising impact. The two approaches are not necessarily inconsistent or incompatible, and can be self-balancing. For example, the sport-hunting of foxes in the east of England conserves populations that would otherwise be killed as pests by gamekeepers. In Wales, where foxes can reach high densities and become agricultural pests, hunting is more a matter of pest control carried out as a leisure activity free of charge. Whatever the Statutory Purpose of the Licence, the activity would have to comply with the two key criteria above.

5. Practical application of Licences

5.1 General Licence for Hunting with Dogs (above ground)

4.8 million households own a dog in the UK, with 21.5% of that total owning two or more dogs (11). A number of these will, at one time or another, chase or catch wild mammals. In July 2000, the NFU estimated that 24,000 sheep had been killed, or injured, by dogs that previous year (12,13); this is on

par with the number of foxes killed by Hunts. Dogs include individuals on a country walk, gundogs seeking other quarry, lurchers and hounds belonging to registered packs. Legislation must not make criminals out of ordinary dog owners. As such, a General Licence (Appendix I.g.) would be the most appropriate, and workable proposal. Although, individual owners would not have to apply for a personalised licence they would have to comply with the conditions of a General Licence. This further illustrates why the Handbook of Wildlife Regulations should be widely circulated in order that individuals are aware of their responsibilities.

At the Hunting Hearings the issue of how you identify in legal terms a dog that is hunting was not addressed. A recognised pack of foxhounds, or a pair of greyhounds in an organised meet are easily identifiable. But any type of dog is capable of chasing a hare, or hunting out a mink. A General Licence addresses this difficulty directly.

5.2 Individual Licence for Pest Control (below ground)
Hunting with dogs below ground would become illegal. If the fox goes to ground, the General Licence for Hunting with Dogs (above ground) is no longer applicable and the fox must be given best. If, for pest control reasons, it is desired to kill the fox by means of terriers, this may only be done by a person holding an Individual Licence as a Pest Control Operative (terriers), who will perform the task expeditiously according to the strict conditions on his licence. This licensed person will be solely responsible for his actions. He may, in his own judgement, accede to a request from the Master, but is not under orders of the Master. If he fails in his duties, it is his own responsibility and he can lose his licence. Conversely, his activities are separate from those of the Hunt Staff acting under the General Licence for Hunting with Dogs (above ground). No licence, whether Individual or General, permits access onto private property without the owner's consent.

5.3 Who is licensed
In the course of a hunting activity the human involved shall be the person responsible for the animal at the time the activity took place. This may or may not be the keeper, owner or land-owner. In the case of an organised fox Hunt, it shall be the Huntsman who carries the horn. There may be occasions in which the Whippers-in may also be temporarily responsible for a part of the pack while undertaking their tasks of whipping them in. In the event that saboteurs attempt to control the hounds by blowing horns or laying scent trails, then they also will be deemed the responsible persons for any resulting misdemeanour. These Hunt Staff who are directly responsible for the actions of the hounds may also be acting under instructions from the Master. In this case their legal situation shall be the same as that of the game-keeper and his employer. If the Huntsman can show that he acted on the explicit instructions of the Master (rather than on his own initiative), then both shall be responsible and liable.

This issue was not addressed at the Hunting Hearings, but is a crucial part of a workable solution.

5.4 Intent
When hunting with an animal, such as a dog, it is the dog that actually does the catching and it is obviously not possible to prosecute the dog. At the same time the person in charge of the dog cannot be as responsible for the dog's actions to the same extent that he can be for a mechanical device, such as a gun or trap. Therefore in all cases it shall be a defence to show that it was not an intent of the human to commit an offence and that all reasonable steps were taken to prevent it.

5.5 The Hunting Permit
The Master, or person in charge of the gunpack or Shoot Manager, would be the person responsible for ensuring that the basic conditions of the General Licence are covered before the start of the

day's activities. The first condition is to obtain written permission from the land-owner or occupier, together with a boundary map. Only when the Master has sufficient adjacent farms signed up will he be able to organise a Meet there. A sample of a standard Hunting Permit is enclosed (Appendix IV.e). The file of Hunting Permits must be retained by the Master and may be inspected at any time by the Wildlife Management Authority, either routinely, or in connection with an incident. In order for the Huntsman and Whippers-in to control the hounds within the permitted hunting area the Master must provide them with a Map clearly showing the limits of the day's hunting area. Their task is to stop hounds if they are approaching the edge of the permitted area. It is understood that if the hounds are in direct hot pursuit and despite the best endeavours of the Hunt staff to stop them, they cross the boundary of the permitted area, then this is 'hot pursuit' and unintentional. If on the other hand, hounds were simply working out a line and not speaking and the staff allowed them to draw on over the boundary, this would be deemed negligent. If staff deliberately cast hounds to draw outside the permitted area, this would be an intentional offence. As part of his responsibility, the Master must ensure that the Hunt Staff have adequate means of communication and that there is adequate access around the permitted area for them to carry out their responsibilities (14).

This issue was not addressed at the Hunting Hearings but is a crucial part of a workable solution. In the case of illegal coursing of hares, it would bring into effect a new offence on which to base a prosecution.

5.6 Spectators

Any person present at any type of activity involving catching or killing wildlife, who is not the person or persons actually responsible for the killing 'agent' (be it dog, gun or whatever) is not actually hunting, but is only a spectator. He is not therefore acting under any licence to kill or capture an animal. This person may be present under a formal arrangement with the Master or Manager. He may be a Member, Subscriber or Guest to the Hunt and therefore tacitly agrees to obey the orders of the Master or Manager, or his representative, such as the Field-Master. This is necessary for the organised management of the day. When obtaining a Hunting Permit, the Master will have clarified with the land-owner, whether or not Spectators are welcome on the land. He has thus obtained joint access permission for the whole group. It is up to him to ensure that either the spectators know the limits of their permitted access, or that he controls them within those limits for currently existing Agreements and Permissions relating to Forestry Commission land see Appendix IV.

5.7 Access Agreements

Thus the Hunting Permit has two roles: to permit access for the purpose of Hunt Staff to hunt with dogs under the conditions of the General Licence, and to permit access for spectators under the organisation of the Hunt. The Hunt Permit is thus a Voluntary Access Agreement. It can cover followers on foot, on horse or in vehicles according to the exact agreement with each land-owner. At present the MFHA Hunts have by far the largest voluntary access system for horse-riders in UK. The Hunting Permit, whether entered into for some kind of remuneration or not, is a legal access document, enabling the Hunt to comply with the terms of the General Licence, and enabling spectators to comply with the laws of trespass. BUT spectators are at all times responsible for their own actions and may be liable for trespass if they fail to follow the instructions of the Hunt Master. Similarly, spectators who are not under the organisation of the Hunt are not covered by the Hunt's access agreement. Where any participants are on public land such as roads or rights of way, they are fully liable to all regulation pertaining to those places (14).

5.8 Wildlife Inspectors

Authorised card-bearing Inspectors from the Wildlife Management Authority should be permitted entry on to any land (except dwellings) in order to inspect any activity being carried out under any type of licence issued by the Wildlife Management Authority. Inspections shall only be carried out under instruction from the WMA. Any enforcement should be undertaken by police. The inspector may advise the police but does not have an enforcement role. Given that some licence holders may keep hunting dogs within their dwellings, the WMA may wish to secure an additional power of 'presentation for examination' such as contained in Section 19ZA (6) of the WCA 1981 (as amended by Schedule 12 of Countryside and Rights of Way Act 2000).

5.9 The issue of inspection was raised at the Hunting Hearings, with a proposal that members of the public should be allowed to follow hunts for the purpose of verification. This is not a practical proposition given that most hunting of wild mammals by dogs takes place in a wide variety of individual and spontaneous situations. Whilst not advocating increased use of scarce police resources, the use of the general public or NGO's in policing the law should be confined to providing police with information or evidence, not with powers of entry or seizure. If an activity is not of sufficient significance to be worth policing, then it must be considered whether or not it is worth legislating at all. In reality, in the countryside, for matters such as game seasons, or shot sizes etc to be adhered to, it is up to the individual and the social pressure put on him. This is why it is essential that practitioners believe in the worthiness and fairness of proposed legislation.

6. Shooting, snaring, trapping and poisoning of foxes

6.1 Foxes may be shot under a variety of circumstances often on an opportunistic basis. Farmers might shoot only one fox per year. A General Licence is thus the most appropriate catch-all way to govern the shooting of foxes. The General Licence, to cover the welfare criterion, would specify the types of guns and ammunition permissible (15). It would also specify conditions to minimise animals escaping wounded. Owners of private land that is subject to 24-hour public access under the CROW Act should take into consideration the question of public safety before giving permits for shooting, particularly with high-powered rifles, or at night.

At the Hunting Hearings there seemed to be a general agreement that there are aspects of legal shooting that cause unnecessary suffering, such as small shot sizes. It seems to be an appropriate moment to improve this aspect of animal welfare.

6.2 Snaring, trapping and poisoning of foxes would be illegal; no General Licence would be issued. Only approved operatives possessing an Individual Licence would be able to use these methods (16). These Individual Licences would carry tight conditions to fulfil the welfare criterion. The snares, traps and chemicals would themselves be subject to Product Licences, as now. The Burns report cites Macdonald et al (17) assertion that about 50% of animals caught in snares are of non-target species. As such, snares would not satisfy the ISO standards 1.3.3.(c) and should not be in general use, nor do snares meet the welfare indicators stipulated by ISO 2.3 and 2.4 (Appendix 2b).

6.3 The Wild Mammals (Protection) Bill 1995, supported by the League Against Cruel Sports, sought to prohibit the general use of snares (S.3) but allowed for the setting of snares under licence granted, for the purpose of pest control, by the Secretary of State (S.8).

7. Killing other species with dogs

Hunting of rats, squirrels, rabbits, hares, mink, and red deer with dogs would all be subject to General Licences with appropriate conditions to meet the Key Criteria. Some species may also be killed by other methods, such as approved snares, traps and poisons. Some of these, such as household rat poison and traps, could be subject to General Licences. Methods which require specialist use, and that require careful application to fulfil welfare criteria, could be subject to Individual Licences.

8. Summary

What is proposed here is a legal framework for tackling the issue of hunting with dogs and the further issues that arise from this. It is based as far as possible on existing legislation and licensing. Clearly in rural areas enforcement is impossible unless the constituents both understand and are prepared to comply with legislation. There are many details, such as shot sizes, that will no doubt be debated further by those more expert in these matters. It is hoped that this document will provide some pointers and help the government in its difficult task of 'resolving the issue'.

References

(1) See Appendix I for sample of Full Game Licence (Red). Licences are issued under the Game Act 1831 and Game Licences Act 1860. For a discussion and overview of relevant Game Licence legislation see 'Fair Game: The Law of Country Sports and Wildlife Protection'. Parkes, C. and Thornley, J. (Pelham: London, 1997) pp60-65.

(2) Visit http://www.defra.gov.uk/wildlife-countryside/ewd/index.htm for Department for Environment, Food and Rural Affairs, English and European Wildlife Issues

(3)See Appendix I or http://www.defra.gov.uk/wildlife-countryside/vertebrates/forms.htm and http://www.defra.gov.uk/wildlife-countryside/vertebrates/gen-licence.htm

(4) Visit http://www.defra.gov.uk/wildlife-countryside/ewd/index.htm for examples.

(5) See 'Fair Game: The Law of Country Sports and the Protection of Wildlife'. Parkes, C. and Thornley, J. (Pelham: London, 1997). Also, for an online version of 'A Guide to Wildlife Law Enforcement'. Bradley Taylor, M. (1998) visit http://www.defra.gov.uk/paw/publications/law/%20

(6) See example of General Licence contained in Appendix I

(7) All Spring Traps have to be approved before being placed on the Spring Traps (Approval) Order 1995 (See Appendix II). Legislation places severe restrictions on the use of pesticides. It is illegal, with certain exemptions, to poison any mammal or bird (See Appendix III)

(8) Notably, the Convention on the Conservation of European Wildlife and Natural Habitats (Berne Convention) for its prohibition of indiscriminate capture methods as an animal welfare provision. Also, Article 8(1) of The Council Directive on the Conservation of Wild Birds 79/409/EEC

(9) See Appendix II: Agreement on international humane trapping standards between the European Community, Canada and the Russian Federation 1997. For background, critique and texts see Harrop, S. 1(3) Journal of International Wildlife Law & Policy 387-394 (1998)

(10) See for instance the above example contained in footnote 1

(11) Pet Ownership: Demographics. The Pet Food Manufacturers' Association.
Visit http://www.pfma.com/petownership.htm

(12) NFU praises new initiative to prevent worrying of sheep. Visit http://nfu.org.uk

(13) See Dogs (Protection of Livestock) Act 1953

(14) For currently existing Agreements and Permissions relating to Forestry Commission land see Appendix IV

(15) For firearms and ammunition permitted for killing deer see Appendix I relating to Section 4(2) Deer Act 1991. Note no similar legislation concerning permitted and prohibited weaponry and ammunition exists for foxes for example.

(16) The Wild Mammals (Protection) Bill 1995, supported by the League Against Cruel Sports, sought to prohibit the general use of snares (S.3) but allowed for the setting of snares under licence granted for the purpose of pest control by the Secretary of State (S.8).

(17) See Management and Control of Populations of Foxes, Deer, Hares, and Mink in England and Wales, and the Impact of Hunting with Dogs. Macdonald et al cited in Report Of The Committee Of Inquiry Into Hunting With Dogs In England And Wales (HMSO: London, 2000) pp88

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EXAMPLE OF GENERAL LICENCE FOR FOXES:

DEFRA
Wildlife and Countryside Act 1981, as amended

General Licence to Kill or Take the Red Fox, Vulpes vulpes in England and Wales

Licence Number G-017

The Secretary of State for Environment, Food and Rural Affairs, in exercise of the powers conferred on him by Section xyz of the Wildlife and Countryside Act 1981, after consultation with the Wildlife

Management Authority, hereby grants the following licence:
Area: All counties of England and Wales.
Period of licence : 1 January 2003- 31 December 2003.
Persons: All persons authorised in writing by the person responsible for the land on which this licence will be used.
Purposes: Population control, nuisance animals, food or derivatives, public health or safety, health or safety of other wild or domestic animals, sport, sale (dead).
Methods: Dogs above ground only, smooth bore shotgun, rifle.
Terms: The terms used in this licence are explicitly defined in the Handbook.
Special conditions:

1. If a fox escapes to ground or any confined space where dogs cannot reach it, it must not be bolted and pursued again by dogs above ground.
2. It is illegal to use a dog to pursue a fox below ground unless the operator has an Individual Licence I-017.
3. Smooth bore shotguns are restricted to 12 bore or larger loaded with shot size BB or larger.
4. Rifles are restricted to .222 calibre or larger.
5. Foxes may be shot at only when a dog capable of finding and stopping a wounded fox is immediately available for use.
6. Seasons: For the purposes of population control, nuisance animals, public health or safety, and health or safety of other wild or domestic animals, this licence is valid at all times. For the purposes of food or derivatives, sport or sale (dead), this licence is not valid from 15 March – 20 August.

Note:

1. This licence does not confer any right to enter land or to kill for any purpose or by any method not listed here.
2. Persons wishing to kill or capture foxes for the purposes of scientific research or for re-location, or to do so by the methods of dogs below ground, live traps, snares, gasses or poisons, must first obtain specific individual licences. General Licence G-017 does NOT cover these purposes or methods.