

Wednesday, 19th April 2000

(10.30 am)

THE CHAIRMAN: Good morning and welcome to the second seminar in this series. We had a good discussion yesterday and I hope we will be able to have another good discussion today. We are grateful for both the draft reports.

I would like to follow the same pattern as yesterday which is to invite both teams to introduce their papers. Then we will have a brief period for questions of fact and clarification. I will then invite other people sitting at the table to make any introductory remarks on both papers that they want to make. Hopefully, out of that process a number of issues will present themselves for further discussion and to provide our agenda for the rest of the day.

If I could just give one reminder to everyone: our remit is to focus on facts and analysis. We do not have to make a recommendation about whether or not hunting should be banned. Our focus is, therefore, very much upon the evidence and what it can tell us. If the evidence is inconclusive, it is also helpful to know that. I mention it merely because in a session when there is going to be a great deal to discuss, we should be wanting to try and focus as much as possible on what it is that we can say and what it is that we cannot say about this very complicated subject.

I think, David, you are going to do the first presentation and then Stephen Harris will do the second presentation. Thank you very much.

PROFESSOR MACDONALD: Can I check that I am audible. My Lords, ladies and gentlemen, speakers obviously are always enthusiastic to win the sympathy of those to whom they are speaking and I am no exception, so let me begin by telling you that you have, Committee, posed to us a series of questions. I think there is about six of them for four groups of species and it concerned at least four interest groups, which means you are expecting in the course of this morning 96 answers, at the very least, and by my calculation that gives me 12 and a half seconds per answer or 4 seconds per page of the report. The good news is that I do not have to climb that mountain alone because I have with me the team of people that helped compile the report and so my intention is to provide this overview myself, but when it comes to questions we will be sharing the load amongst us. I should also add that the matrix of questions and species and interest groups with which we have to deal is made yet more complicated and multidimensional by the fact that the answers to many of the questions have a regional basis and many of the interest groups contain more than one faction, adding to the complexity. For that reason, I am going to try and make sure that the talk focuses on the sort of data we have been able to uncover rather than providing you with abundant background information of actually what happens when hunting is going on, because I rather assume people know about that.

Let me begin by summarising for you the questions -- I hope with the light dimmed this is legible to

everybody -- that we extracted from those that you posed to us.

They are listed here but before I tackle them, I should say something about the scope of what we have tried to do. As you said, Lord Burns, the two presentations you will hear this morning are both from scientists and we have tried to restrict ourselves to scientific enquiries, so clearly there are questions about hunting that are beyond our remit.

Another difficulty that we face is that many of the things we are measuring and might like to compare are what we might call "incommensurable" in the sense that they are measured in such different units that deciding how one should be traded off against the other is extremely difficult. For example, we might find ourselves trading off metres of hedgerow preserved against units of suffering and there is no easy metric for that in science as yet, it is a problem that besets all of conservation and biology. There is one third caveat which is, in a sense, more prosaic but, nonetheless, impeding that is -- at least in our report -- we discovered that in many instances the data that are crucial to resolve any questions you formulated for us are simply not available, or only fragmentary available so we are not going to be able to provide many glib, short and simple summaries.

Nonetheless, what I am going to do now is to try and work through the answers that we have formulated to the six questions that you see on the board, beginning with, "Why seek to control foxes?". Why do people seek

to do so? But taking up this point I have made that there is often a shortage of information with which to answer these questions, I thought it would be helpful to begin rather than to end with a list of things in which we found data to be lacking, or open to widely different interpretations.

For example, we find that estimates of damage caused by the species in question are often somewhat unsubstantiated. Data on basic population biology of the species concerned are often rudimentary, that makes predictions very difficult to make. We find that the relationship between different sorts of mortalities are generally completely unknown, so we would find it hard often to predict what the compensation for the change of one mortality might be amongst others.

We find that actually, with the exception of hunting in its various forms, estimates of the culls made by different methods are largely speculative. When it comes to measuring humaneness, which was the topic of yesterday's seminar, our judgement is that this is a very, very important science but one that is in its infancy, also making interpretation far from easy.

So why do these different interest groups -- we have listed five here -- seek to undertake control of the species groups that we have illustrated on this table, which is a brief summary of the main motivation? The first thing to make clear to you is, amongst the list of caveats, that each of these types of people, farm managers, foresters and so forth, are not necessarily exclusive; they are often the same person,

different days of the week.

Also I want to point out that this is about why people say they seek to control populations and the species and I point out to you that seeking is very different to achieving population control. It is also important that the actions and the decision to seek to control these species is based on people's perceptions, but later we will ask something about the quality of the evidence that leads them to have a perception that motivates them to seek to control these different species.

It is important also to remember that the complexity in this is that each of the species concerned may have a multiple personality, if I can put it that way. I might, for example, see a red fox soon after sunrise trotting across the horizon and think of it as a splendid aesthetic element of our biodiversity. That same fox might be seen by a sheep farmer who believes it to be an agricultural pest, or a poultry farmer, or by a game manager. It might be seen by somebody who is interested in the fur trade. It might be seen by a sportsman who sees it as quarry. In some places a public health official might see that same individual as a vector of disease. On the list goes, so there is no one dimensionality to any of the measures and perceptions that we have here.

By the way, this little table of the principal motives for people seeking control excludes sport as a motive, because we do not see sport as a motive for seeking control. We see that as a different motivational

basis.

Why then, for example, do farmers seek to control foxes? That has been the subject of many questionnaires of which we report on just one here. It compares the answers for three different areas: Wales, Midlands, East Anglia, and you will see that this produces a ranking of why farmers say they are concerned to control foxes in this instance.

Now, there is a number of points to take from this picture, further adding to this tedious multidimensionality that the problem has. One is that most of those farmers had more than one motive, and the figures now shown at the bottom as percentages are those that say they have more than one reason for trying to kill foxes in the area. Another point is that there is regional variation which we see as rather important, so, for example, you see that preserving game stock is different, differently ranked in different places. Similarly, livestock differently ranked in different places and sport differently ranked in different places, so it is hard to come up with a uniform answer to even a rather simple question.

Also, beneath these tables there is a difficult other tier of variation. For example, the foxes that were shot in this particular study, or rather the foxes killed in this particular study, were killed by different means. In Wales 73 per cent of those that were killed involved dogs in some way in their death, whereas in Norfolk 64 per cent involved a spot lamp and a rifle, so everything is essentially different.

"Why do people seek to control deer?" Well, there have been ADAS surveys, of which a recent one in 1999 asked four different interest groups -- each of them displayed on this slide -- what percentage of the land or estate owners or managers in each of the categories, forestry, agriculture, conservation or recreation, believe they suffered significant damage from deer and you will see the percentages given here. Forestry is, without doubt, the arena within which deer damage is most widely perceived and most widely accepted. In the agricultural context there has been a series of surveys summarised in our report which tend to suggest that on a regional basis or widescale basis deer damage is not so significant. However, on a local basis, even one field or two fields within one farm, it may be so.

"Why do people seek to control mink?" Well, it is mainly conservationists who seek to control mink, at least at the moment, and the reason why is illustrated by these two maps here which show a study -- in fact my own group was involved -- in the Thames catchment where we compare the distribution of mink, on the squiggly lines which are part of the Thames catchment river bed, and we compare the distribution of mink with water voles in 1975. You will see that over successive years the relative distribution of these two species has been reversed. There is now rather compelling data that one of the factors leading to the demise of the water vole is indeed the influence of this imported alien species, the American mink.

Again, however, there are subtleties and many

preconceptions and prejudices. For example, in the same area, we have looked at the relationship between the mink and various water birds, for example, the coot and the moorhen, which you might have thought are superficially similar, but it turns out that the impact of the mink on the coot is rather significant; on the moorhen not very significant because of differences in the life history of these two prey.

Moving on to the next question which was, "How do people seek to control these different species?" You can see another horrible matrix. Life would be simple for your Committee if every aspect of control of any of these species fitted cleanly into one or other of these categories. However, the difficulty that we have faced is that many activities involved in attempted population control defy ready classification within this sort of matrix. For example, you might consider the operation of gun clubs in part of upland Wales where hounds, terriers, guns, and everything that can be mustered, in fact, is all brought together in an attempt to control foxes, so classifying some of these activities is a bit difficult. Nonetheless, obviously the legal options at the moment are shooting, hunting with dogs, trapping and snaring.

There are regional differences regarding the use of dogs in the control of foxes and that is just summarised briefly here. Again, of the three areas I mentioned to you before, a study undertaken by Jonathan Reynolds, who is with me today from the Game Conservancy, which shows different categories of

dogs, mounted hunts, by which we mean the traditional classic sort of hunting that most people have in mind when they talk of fox hunting: foot packs, gun packs, which are dogs used to bolt foxes on to guns, and going to ground with the terriers.

You will see again that between the different regions the proportion of these activities varies widely and many of the farmers who reported these percentages of activities on their farms actually are involved with several of them. 92 per cent of Welsh farms involve some sort of use of dogs, for example in the control of foxes.

Turning to stag hunting, this is the distribution of red deer in this country and the little red area in the south-west, which I hope is visible to you, is the area where hunting with hounds occurs. A recent survey, which involved Jochen Langbein, also with us here today, showed that 73 per cent of Quantocks farmers permit or encourage hunting with hounds, 31 per cent of them also use shooting to control their red deer.

Well, the next question is, "What is effective in terms of control of these different species?". It is terribly important that we get this straight because there is a beguiling misconception lurking in much of what is written, and that is that simply killing a lot of something is somehow effective. Numbers killed, catch per unit effort you might say, is actually not a terribly good measure of whether something is effective because you have to take into account how many were there in the first place. That point is illustrated

rather vividly by this comparison between the efforts of two gamekeepers on two comparable estates; one in south-east England and one in east England.

What the top pair of graphs shows of these two blokes is that when they went out, about twice a week, spot lamping with a rifle to try and shoot foxes, the chap in the south-east was seeing about three foxes an hour, whereas the chap in Norfolk was seeing under half a fox an hour trundling around, there were fewer foxes there. They took pot shots at these foxes whenever they got the opportunity and, therefore, accumulated a cumulative tally throughout the seasons from August to March that you can see shown on the lower graph. The point of this parable, if you like, is to show that while the chap in the south-east was seeing more foxes and was shooting many more of them -- in fact he clocked up 60 -- he made no observable difference to the number of foxes he was seeing because other foxes were dispersing into the area from which he was shooting that abundant supply, whereas the fellow in the east of England shot only 20 foxes, but by doing so effectively wiped them out.

When we come to talk about effectiveness, we must bear in mind it is quite a difficult thing to measure and involves careful consideration of efficiency, which is also different to measure.

We have reviewed in our report, as some of you will have seen, as much as we could of the evidence on effectiveness. I realise it is a crucial question to your Committee and we come with the generalisation in

terms of hunting with hounds and dogs, and that is that if reducing numbers with the intention of protecting a game or agricultural fisheries interest is the prominent aim of the whole exercise, then the various strands of the data that we have evaluated suggest that hunting with hounds is generally less effective than alternative methods that are available for all the species in question.

Well, one of the things we have done is ask whether simulation models can help us. Let me explain to those of you who are unfamiliar with this sort of computer technique what its function is. Often in life there are inadequate opportunities, inadequate time and inadequate data to study complicated questions, and one way of tackling those questions is to set up a computer simulation. It mimics, in a virtual world, things that cannot currently be studied fully in the real world and there is some advantage to that because it is perhaps better to make mistakes in the virtual world rather than the real one.

We have undertaken -- and the guys who did the work are here today -- three different modelling approaches, the details of which I am not going to go into very much other than to provide you with a flavour of the sort of results that they produced. The first of these is matrix population modelling. The idea there was simply to explore whether the differences in the life history of the different species with which we are concerned had some impact, as of course biologists know it would, on their response to given levels of culling.

The output of these models summarised in this table here simply shows that the life histories of these species are so different that on a national level -- this is a widescale coarse grain modelling -- different levels of control are required, pointed at different age groups, to inflict some population control on the population. So, for example, proportionally much higher levels of control are required to induce control in hare and mink populations, according to this model, than would be the case in, say, deer populations and that is due to the reproductive biology of the species and in that sense, unsurprisingly, that reveals another layer of complexity that has to be taken into account.

Individual based models are rather different. They involve setting up in the computer, with the aid of what is called a geographic information system, a real landscape within which animals are programmed to behave on the basis of what they are known to do in reality and from that behaviour a population develops that has certain characteristics. This allows us to model different control strategies in real landscapes.

Now that revealed -- to cut a long story short -- for foxes that, as far as we could gather from the data we had available, mounted hunting with hounds in the traditional lowland sense has no effect on fox population radio control in these models. However, different strategies which we explored in this virtual reality, and remember these models are only as good as the assumptions that they make and the data with which they are fed, but we found that, for example, strategies

that involved culling at the earth, culling vixens and cubs at the earth, and shooting did have the potential to control these populations.

These sorts of models also allow one to uncover what is really important, or at least what may be really important in reality, and in this case with foxes the model suggests that a better understanding of dispersal is a process that is really vital to understand if one is to see how culling does impact on populations. Of course, dispersal is particularly difficult to study and particularly poorly understood, which is a pity.

Similarly, the results for mink are along the same lines. The model suggested to us that hunting with hounds as currently practised, as we understand it, was not affecting the dynamics of the mink population.

Trapping and hunting were capable of doing so within this model.

How many red deer, and I would consider how many animals, are actually killed by each of the methods that we have exposed to you before? I am going to present the species in order, because the quality of the data varies as we go through them. So we have good data for hunting with hounds in terms of number of deer that are killed. You can see that one of the activities of the hounds is also to mop up additional casualties, which we spoke about in the seminar yesterday quite extensively, some 35 to 95 a year. There are estimates for the number of deer shot throughout the UK in this case, including the Red Deer Commission in Scotland, and 1,000 or so being shot in the counties where hunting takes place.

Data for hares: a little bit less easy to deal with. The yellow bar here suggests data that seem to be reasonably firmly based, and those data come from beagle packs and regulated coursing, but we were able to find nothing to give us any clue about the numbers of hares that were killed by unregulated coursing and other activities.

Mink: terrible paucity of data. You will see there is no yellow on here. Hunting with hounds somewhere between 400 and 1400. Trapping, we really have no idea, the more than 1,000 is just one survey which reveals that at least 1,000 are trapped, but that must just be a tiny drop in the ocean.

Now foxes are a little bit different and I want to spend just a couple more minutes on the fox example. The yellow data shows that the better data has come from the surveys of mounted hunting, the records kept by fell packs, Welsh packs. There is some difficulty with the Welsh packs because the data, while good, have been under different collecting umbrellas as the structure of the hunting associations has changed, but we also have data for the number of terriers that are used outside hunts. It is hard to estimate, however, on the other hand, the number of foxes killed by trapping, snaring and shooting. This turns out to be fiendishly difficult and the figures that we have put down there are estimates based on a survey of gamekeepers who were asked how many foxes they killed and what proportion of the foxes they killed were killed by each method, snaring or trapping for example.

So it turns out that gamekeepers say they trap -- live trap that is -- about one per cent of the foxes they kill. Surveys of how many foxes are killed by gamekeepers in total give estimates between 37,000 and 80,000, so one per cent of those would be between 350 and more than 800. So you will see the way these guesstimates were arrived at and you would be missing the point if you were to take these numbers too seriously, but I am just trying to show you the way we that try to stick together on these things.

Similarly, with the shooting figure, that is quite an interesting one because what happened there was, first of all, there was a gamekeeper survey that said somewhere between 46 and 68 per cent of the foxes killed by gamekeepers are shot. So, again, using the total figure one can get a notion of how many they are shooting, but that must be a drop in the ocean in comparison to the numbers shot by non-gamekeepers.

One way of looking at that, which we have done here, is to say from our surveys of farmers throughout the country, it has turned out that an average sort of figure for the number of foxes killed by farmers is about 2 per kilometre squared. We know that the sum of 340,000 square kilometres of England and Wales, of which about 70 per cent is farm land, and therefore in terms of orders of magnitude about 470,000 foxes might be shot, might be killed, I should say, on farms, but they are not all shot; some of them are killed by hounds, some of them by terriers and other things.

If we deduct the figures we have for those sources

of mortality we come out with this tentative thought that a bit over 400,000 foxes might be killed on farm land. We know that the estimate of foxes in England and Wales at the moment is about 200,000 or so. They will have about 400,000 cubs each year, which will have to die to keep the population stable, and so these estimates are broadly in the same sort of ballpark. But I make no more of it than that to show the way that we have tried to stick together figures in the absence of data.

Moving on swiftly, this is a plot that simply shows that the more times hunts -- traditional mounted fox hunts meet, the greater the number of foxes they kill per kilometre squared. So kill is related to effort in a very linear near way for mounted fox hunts. We asked the question because I thought it was one you had posed in a sense by implication to us, about could they do more as well as less? So, for example, proportion of the foxes that hunts chase go to ground and a proportion of those are left.

Could the hunt be more effective than it currently is? Well, if we multiply the mean number of foxes killed per kilometre squared by 2.5, that might take into account how many they could kill. The ones they leave have gone to ground and that would increase the effectiveness in the way that you have seen here. There is all sorts of possibilities there, most of them impractical for weather, equestrian and other reasons. An important regional variable to keep in mind is that there is a profound difference between the upland

packs in Wales and the lowland mounted packs elsewhere in the UK, and you can see here the difference in the mean density of foxes killed per kilometre squared, as reported by those two different sorts of enterprise. Note that the Welsh packs are killing about ten times as many foxes, and they are killing them from an area where one might expect the population density to be lower, so the difference is more marked.

We have tried, although I know you have economists on the team, to depart fairly gently into the water of the cost effectiveness of some of this, and I want just to make three brief points to you.

We have looked at the cost of hunting in Wales and made estimates of the lamb losses that result to ask whether the cost of hunting is balanced by the loss of lambs that are incurred, and what might happen if we made simple projections as to the likely increase in fox numbers if hunting were banned. It is important to mention -- and vitally important to mention -- that all these estimates of losses are based on the farmers' perceptions, so the data are unverified as to the extent of fox predation in the first place. So this whole thing is based on, well, technically upon a castle built on sand. Also there is the assumption that there is a linear relationship between the number of foxes and the amount of damage they do, which is entirely unvalidated. These assumptions are crucial. Nonetheless, they show that in Wales, at the moment, and under those improbable assumptions, it could be profitable in terms of sheep farming to kill foxes in a way that they currently are.

The answers are rather different for Midlands stock farms, but the point I wanted to make mainly here was concerning arable farms where the foxes are not causing any damage to the arable farmer in terms of its agricultural operation, but they are eating rabbits which cost him a lot of money. We have tried to calculate what they are worth and this is the graph here which shows that because the rabbits that are eaten by foxes breed, or would have bred had they not been eaten by foxes, the advantage of the fox eating those rabbits accumulates over successive years as the descendants of rabbits that have been eaten by foxes are not born as a consequence of that.

"How effective are control methods?" -- I am going to wrap up very shortly, Chairman.

As typically practised, the result of our review is that organised hunting by methods involving dogs for all these species, does not appear effective for any non-recreational aim in terms of population control, with the possible exception from the data we have seen of fox control in mid-Wales and sheep farming areas, and remembering the proviso that the data on lamb losses are largely unverified.

Shooting, according to our evaluation, generally contributes most to effective population control. An exception is the trapping which appears to be the most effective way to deal with mink. If you need to answer questions about effectiveness, by the way, ultimately you need to do an experiment which is almost never done. An exception is the often reported Salisbury Plain

experiment where the world was divided into a series of grids -- pictured here in different colours -- where two areas were over a series of years successively subjected to intensive predator control, or no predator control, and the consequences of those things are then measured. But this sort of experiment has rarely been done.

"How acceptable are control methods" was largely the topic of your meeting yesterday, and so

I do not propose to go into it, other than we have listed the topics which seem to be relevant. And also I just simply put here the graph which illustrates that farmers, at different times in history, have held contrasting opinions about the acceptability in terms of humaneness of different killing methods. This is one sample you can see that somewhere approaching 16 per cent of them felt hunting was humane. The answers are different from different surveys in different places.

The final point is: "What are the wider impacts of hunting on the countryside?" Not strictly part of our brief, but something on which we have touched. These data here summarised for 1981 and 1998, the length of hedgerow, or the density of hedgerow, removed by farmers whose main recreational interest was hunting, shooting, or both, or neither. Interestingly, and I think relevant to your considerations, is that the answers in 1981 were different to the answers in 1998 because the world was a different place, especially for the farmer. So, in 1981 it was the case that hunting farmers had removed significantly less hedgerow in the previous decade than

other classes of farmers. There is no such difference in 1998 where the world of farming and subsidy is unrecognisably changed. Although, in the 1998 sample there is a significant increase in the number of hunting farmers who say they have retained the hedges they have retained because of an interest in hunting as a motivating factor.

So to conclude: what is the likely impact for a ban on hunting with dogs? Three questions appear to arise out of our consideration of the original six that you put to us. But before putting those questions to you, I must say again that much of what we have discussed and considered is evidence for the effectiveness of, or other things to do with population control. Population control, however, needs to have an aim and so we must be sure that if we are undertaking population control, that it is the appropriate action to deal with a particular problem, i.e. the problem indeed exists in the first place. We must remember when posing that question the answer may be very different regionally.

But the three descending questions appear to be: can the contribution to the cull, currently made by hunting with dogs, be provided satisfactorily by other means? This is a numerical question when I say "satisfactorily". The answer for mink and for deer is straightforwardly "yes", as it probably is for hares. For foxes, the answer is probably "yes", for mounted packs, but less clear cut for the combination of terriers and gun packs that operate in upland Wales.

The second question descending from that is: will a ban on hunting make landowners less willing to tolerate the quarry and hence, to then cause a decline in the species because of that loss of tolerance? We are unaware of any hard data on this sort of compensatory action, but there are plenty of bits of circumstantial evidence from questionnaires of what people say they would do, be it in the case of deer and hares and foxes -- there are no data for mink -- there is a suggestion on behalf of people, farmers in particular, that they would take action, tolerating less, animals that they have previously tolerated for being available for hunting.

A paradox, of course, of hunting is that while on the one hand it may be interested in controlling species, on the other hand it may be interested in having an abundance of it to hunt.

The final question is: would any such change that could result from question two be detrimental if, for example, people shot more foxes because they hunted fewer, would it be a bad thing? We can only speculate on the answer and point out to you that it is essential in all aspects of conservation biology and wildlife management to be clear about what you want. At the moment, people are not. So if people want more or less foxes, that will be important to knowing whether it is detrimental or not to have more or less, and how to arrive at those decisions is difficult. But a final point, that I imagine may be shared by all of the biologists on this table, is that whatever happens it is

important to monitor carefully what goes on, and at the moment in this country, there is no adequate system for doing that and so whatever course of action is followed, it should be accompanied by a detailed monitoring system so that future generations of people do not have to struggle with such fragmentary data as we have all had to here. Thank you very much.

THE CHAIRMAN: Thank you very much.

PROFESSOR HARRIS: Thank you, Lord Burns. Well, I have decided I would be cautious and use overheads in case my computer crashed, so I hope they are legible.

I am not sure, Lord Burns, whether you asked us both to do this contract because you had faith in neither of us, but I think you should be reassured to discover that we have actually come to very broadly exactly the same conclusions. So, from that point of view, it means that I think my talk will be curtailed a bit and I will therefore try and catch up the timetable for you.

We did the same with a different team, looked at the same two contracts, and obviously exactly the same objectives, and those are the objectives we tackled. I am not going to go through them again, you know the objectives. Clearly, we have both had quite extensive data sets. I am not going to talk on all those objectives today. What we have tried to do is summarise a number of the key points we wanted to discuss today in the form of comparative tables, in the hope that these are easy for you to assimilate. They will be mainly in the form of ticks and crosses, rather than hard figures

because we think that is easiest to assimilate in this sort of seminar.

Our approach was much the same: we have done a literary review; we have done some computer modelling; we have actually done quite a lot of survey of organisations, practitioners and general public, during the course of this month. This was mainly by telephone and postal surveys. We have asked people about the perceived pest status of these animals. The effectiveness and acceptability of control methods; we have quantified data and control practices. We have asked people their opinions on what would be the future changes in control if hunting with dogs was banned, and what the crucial aspects of the data we collected was not just simply to ask them "yes" or "no", but to rank these data, so actually in the report you will see there is a more sophisticated analysis than what we are presenting here.

Obviously, Lord Burns, you set us a timescale and we have worked to it. We sent out --

THE CHAIRMAN: Can I just say that somebody else set us a timetable.

PROFESSOR HARRIS: I understand that, Lord Burns. I should say the powers on high set you a tight timescale and you passed on the grievance to us.

We have contacted 105 organisations. At the time, at the end, we only got a reply to 31, so we are not going to talk about the response in fact to organisations. We are going to talk about responses we have had from practitioners and also the general

public. We had 89 responses from the general public. From the practitioners, there is 198 at the time we did the analysis. By "practitioners", we mean farmers, foresters, fish farmers, gamekeepers, nature reserves, managers. We have defined a number of regions, seven in total, which we think reflected different patterns of hunting and different attitudes to the species in question. In the final report there will be slightly more data in there as well.

So what I am going to do is run through the reasons people cite for control, the prevalence and the perceived effectiveness of control, the evidence for effectiveness of control, the acceptability of control, the hunting with dogs and, finally, the areas of agreement and disagreement, and some comment on future research. I will do that very tentatively, simply because scientists are famed for always saying we need more data. I do not think we do need more data; I think the evidence is fairly clear, but there are areas where, clearly, it would be nice to know more. So, okay, people cited reasons for culling, and you will see there are two columns for each reason: one is in black; one is in red. The black lines are from the literature; the red is from our questionnaire surveys. For foxes, people wanted to cull mainly for perceptions of predation on livestock, game, and so on. Also for conservation values; also to reduce abundance -- this widespread perception there are too many foxes. David said: "We would like to know how many foxes you want in Britain or how many foxes we should

have in Britain". None of us know, but there is a perception that we have to cull them because there are too many. For deer the reasons are much more focused: mainly to conserve damage; also public health concerns, in some way for that cull to reduce numbers of road accidents and factors like that.

For hares, it is mainly damage to forestry, agriculture, to reduce poaching. For mink, it is mainly predation conservation interests.

What we have tried to do is look at the prevalence of methods of control and, again, this is just a brief summary, looking from very common through to moderately common, uncommon and restricted in use, and, again, comparing the information from the literature and the information provided from our polls of practitioners. As you can see, there are differences in approaches to different animals. For foxes it is mainly control in the forms of culling, or the other forms of controlling problems, things like habitat management and things like that require (inaudible) repellents, and so on.

For deer, again, it is mainly culling, but there is quite a regular use of (inaudible) and tree guards as a form of controlling of damage; more so for hares and rarely for mink. It is mainly a culling practice.

If you go on and actually look at the way people perceive the effectiveness of control, this is actually quite interesting. Again, there were regional differences in the way people perceived the effectiveness of control, but, again, looking at it: very effective, moderately effective or ineffective,

shooting was deemed to be moderately to very effective, though quite a few practitioners actually expressed the view that night shooting was not particularly effective. Generally, if you look at hunting with packs; practitioners view hunting with packs as being effective, the same for foot packs, the same for digging out foxes, and so on.

So we have some idea of the relative effectiveness of these different forms of control, as perceived by practitioners and I do say that is simply perception data.

Now the big question we have to say is: okay, is culling effective? The problem is it is impossible for us to actually tell you whether culling is effective, because nowhere can we find anyone who gives us a very clear idea of what they are trying to achieve in a culling programme. There is no clear yardstick against which to measure the effectiveness of what they are doing. David has alluded to that; we have the same problem. So any idea of whether culling is effective, it is very hard to make a very sound or rational judgement on that issue.

But, generally, people believe that culling foxes to reduce predation of livestock is not particularly effective. Predation of game, possibly; the problem is predation of game, many of the game species are also suffering from serious habitat degradation and, for instance, things like grey partridge, culling foxes does benefit grey partridge, but the fundamental problems facing grey partridge is a habitat one and clearly

habitat was better. It is not clear whether the impact of foxes will be anything like it may be at the moment. So trying to unravel all these issues is very difficult, and also some of them are actually very muddled in people's minds. Particularly the idea of predation game and conservation, it is often argued, for instance, for foxes that culling is important to conserve hares. Well, actually to conserve hares in the densities we probably want them recorded by the diversity action plan, culling foxes probably is not necessary. If you want very large numbers of hares to shoot, then, okay, that is where fox predation appears to have an impact.

So there is a perception muddle in there as well that makes it very hard to identify and separate out all these problems.

I should also say, by the way, there is a lot of perception around that many of these species have been culled to prevent transmission of disease. It is very hard to actually know in many of them what disease people are concerned about, but it is regularly said they are being culled to reduce disease.

We then went on to try and look at the wider acceptability of the different methods of control and here we compared information we had gathered from the practitioners and the general public for each of the species and each of the methods of control. The first thing that should be pointed out is that things are more acceptable to practitioners than they are to the general public in an overall pattern. For most of the general

public the only method of culling that seems to be acceptable is shooting and it is actually quite interesting if you look, many forms of culling are actually even unacceptable to practitioners; snaring of foxes is unacceptable by the practitioners and the members of the public. Digging out of foxes is also unacceptable to the practitioners and the public, as is the use of lurchers. Hounds are unacceptable for deer as far as practitioners and public -- for hares, they are unacceptable to the public only marginally acceptable to hunt hares with hounds from practitioners, and so on. There is a general pattern there of the public being less tolerant than the practitioners. Surprisingly, the practitioners themselves are very unhappy about a variety of methods of culling currently used. Perhaps that is actually not too surprising. In the final report there will be details of how we compare with Europe and actually we compare rather badly with Europe. If you look at all the Member States of the EU Council for Europe we are actually the only country that has no closed season for hares. They usually have restricted hunting seasons across Europe, normally it is just October to the end of December and some countries also have strict bag limits as well. Even for foxes, all Member States of the EU Council for Europe, except Austria, Hungary, Ireland, the Netherlands, Slovenia, UK and parts of Belgium have a closed season for foxes. It is generally a closed season to protect vixens and dependent cubs, but for five countries it is actually a very limited hunting

season and they are given the same status as other game animals and they have a short hunting season and that is all.

That is actually quite interesting, because certainly in the rest of Europe they do have a disease perception for foxes. Rabies was, until recently, very widespread and yet still they give them these closed seasons.

The other point in Europe is that stocks and free running snares are largely illegal in Europe. There are only five EU states that allow the use of snares and we are one of them. So clearly we do not perhaps compare very well.

We tried to look again at the culling intensity for each species by region and method and the problem we hit with these data is that clearly there is very little information. What we have produced here are some figures for the various regions looking at the number of foxes killed per square kilometre per annum by different means and basically exactly the same as David concluded from a different approach, very low density of animals killed with hounds, most have been killed by shooting. We put "other" there because also within that it is hard for the numbers being killed by farmers to separate out shooting and snaring. The only exception perhaps is in Wales where there is quite a high density of animals killed with gun packs and, again, that is the same conclusion.

The problem we have though is that I am very unhappy about figures on digging out simply because the

number of terriers I believe that David used is grossly underestimated. There is a larger number of terriers out there used by perhaps a less controlled element of society and they are killing very large numbers of foxes each year and trying to get a handle on the number they are killing is actually proving very difficult.

So I would view a lot of question marks under digging out and that is simply because it is very hard to actually try and work out exactly what is happening in our countryside at the moment.

The other species became even more nebulous so I have not even bothered to put those figures up yet.

We then did some modelling and, again, I am not going to bore you with the modelling or the details of it. We put in a lot of factors into this model, looking at time of culls, different patterns of mortality, different forms of cull, patterns of aid structure, patterns of immigration, which is dispersal but from the other end, and, exactly as David pointed out in his models from the different approach, the factors most affect the effectiveness of your culling operation is basically the level of immigration. Timing of culls are also important and methods of culling that way, but also time of culls with respect to non-anthropogenic mortality.

The basic conclusion is that the hunting with hounds had very little effect on fox numbers and overall it is very hard to be quite sure what impact the current levels of culling are having on fox numbers overall.

For the hare model we actually had some quite nice

data from East Anglia where we got a lot of data on hare population dynamics and so what we did was model the impact of different levels of culling, the impact of closed season and the pattern of culling from both shooting and through the year hunting with lurchers and others to try and see the impact on hares.

One of the things that is easily apparent in the way our hare population is at the moment is that the level of production, particularly level of survivorship, is critically down on what we believe it was in the recent past and this has a big impact on the effects of any form of culling and basically it does not appear that recruitment is large enough to support the level of culling that occurs in one large shooting. Shooting sessions were held in the autumn and also the low levels of culling coursing during the bulk of the year, that again causes hare populations to decline. Closed seasons themselves will not actually prevent a population decline unless culling levels are quite low even during the open season.

So hare populations are very vulnerable, they are very vulnerable to immigration rates and also rates of level of survival and they do not seem at the moment to be able to buffer themselves from difficult patterns of culling, and perhaps it is not too surprising that hare numbers are continuing to decline. We have not produced a model for mink yet and I explain why from this. We have talked briefly about animals numbers in Britain; this is mainly in Britain. I have not split it down for England and Wales. We do not use the same estimate for

the number of adult foxes in Britain.

Two points I would make about that: the pre-breeding population is around 240 adults, there is about 400,000 cubs being born each year. They are estimates we produced a few years back -- obviously you have to lose 400,000 foxes a year if the population of Britain is going to stay stable. I think I would take difference with David in his estimates, particularly in the impact of shooting. It is very hard to know how many are being killed by different forms of culling, but in his total he did not include 100,000 odd animals run over on the open roads each year and clearly, when you look at these sort of figures, it is very hard then to try and work out exactly how many animals are being killed by each means, particularly when a lot of it has been done clandestinely, so at the moment we have not produced a final figure for you, Lord Burns, on the number of figures killed by each means, but my figures, I think, are going to differ from David's.

The other thing I point out, is that of that total 14 per cent of them live in suburban areas and they are effectively outside your remit anyway because they are not really affected by those patterns of mortality. I know in recent evidence you were told the estimate of the number of foxes in urban areas is an underestimate, I will actually advise you the estimate for the number foxes in suburban areas is the best of the two. It is the number of foxes in rural areas we are much more foggy about and, therefore, I would say the estimate for urban populations is more precise of the two, it is

about 14 per cent.

At the moment hares, again, are still declining.

We have just had a new population completed. Britain as a whole is about 750,000 now, 10 per cent down on the start of the century as part of the decade and, again, that is perhaps not too surprising given the problems they face.

Perhaps the most interesting one is mink and this is why we did not try to model the mink population dynamics. Mink have actually undergone a major population crash in the last eight years. Eight years ago the estimate was 110,000 mink as a minimum estimate in Britain. Using exactly the same technique based on recent data that has just come in, the person who produced the first estimate has now said that mink have disappeared from 50 per cent of the sites he looked at eight years ago and the population is only one-third of what it was eight years ago. The estimate now for the Britain as a whole is about 39,000 adult mink and that is a staggering decline, because not only have you lost about 10,000 adults per annum from our mink population, eight years ago they were producing roughly 272,000 kids so you have lost that number of kids plus the adults each year and the productivity is now quite a lot lower. That is almost exclusively due to competition with otters. There is actually no evidence it is due to any form of hunting pressure, or culling pressure or anthropogenic factor. Why we have not tried to model it is because no one actually knows how this competition in effect works. You do not know how the otters are

actually competing with the mink and how the mortality pressures are appearing on the mink. All we know is that the population has gone down dramatically. What we do not also know is whether actually the population will continue to decline or whether it will bounce back once they have stabilised and you get a balanced position where otters recolonised much of their former range. So we leave it that their numbers are down dramatically.

Okay, we were asked to look at the estimated impact on a ban on hunting with dogs and basically I think we come to much the same conclusions as David in his team. In lowland areas we think there will be no impact on foxes. Only about 6 per cent of all the foxes killed are killed by packs of hounds and we do not think in the lowland areas, a ban will have any impact. Again, in the upland areas we come to the same imponderable. No one is quite sure what impact gun packs are having and so we say in upland areas, i.e. in this case Wales, it is possible that it will have an impact and it will possibly lead to an increase in fox numbers but, again, that is speculative. We do not actually know whether the fox numbers in upland Wales are significantly below the numbers the environment can carry anyway. It is speculative; it could do.

For deer we do not see any reason to suspect the increase. In the small number of hunts operating you only account for 2 to 5 per cent of the population compared to 8 to 13 per cent by other means, and we think it is quite easy for any form of culling to compensate for that, as it is, already culling is

involved in the population in check.

For hares we see a possible population increase and we think that should be good news, simply because biodiversity action plans featured, the aim of which is to double the hare population by the end of this decade, and that at the moment they are still going down so an increase would be good news. That would be partly because a lot of landowners are killing hares to keep lurchers and poachers off their land. In the absence of use of lurchers, particularly that problem may go away. For mink we do not see any effect and we do not have a clear idea where the mink population is going to go in the next few years.

So if you are looking at levels of damage, then we come to exactly the problem David has already pointed out to you. There is no relationship between the numbers of foxes, deer or hares as far as we can see and levels of damage. We cannot find any simple linear relationship. Damage levels can be very patchy. David has already told you this: sometimes it can be a particular field or two, or one farm or whatever. It is a very localised problem. It is not related to population density so even if population densities go up or down following a ban on hunting, no one can actually tell you whether that is going to have any significant impact on levels of damage.

For foxes we said no obvious change in lowland areas simply because we do not believe that there will be any impact on fox numbers following a ban on hunting. So for deer, deer numbers are already increasing.

It is very unclear to us at the moment whether levels of deer damage are going up significantly following that population increase.

For hares, well in parts of East Anglia clearly they do cause economic damage but, again, it is hard to quantify; we cannot get a good figure on it. We are not quite sure why in some situations there is damage and why in others there is not. If you look at the attitudes of practitioners to the perceived changes in levels of control they would undertake following a ban on hunting, actually this is quite interesting, in that most of them will actually show no change in the levels of culling foxes, or no change in the levels of culling deer and no change in the levels of culling hares and surprisingly really only 50:50 for mink.

If you look at the different types of pattern of culling that they would use they is certainly not going to be a mass rush to use more snares, or anything like that. But also, perhaps more dishearteningly, there is actually not much evidence people might even at the moment start to contemplate looking at means of controlling damage rather than numbers and actually take up methods of looking at habitat change, greater use of tree guards, things like that. Most people still say, "No, we are not looking to use alternatives to culling". Overall, there is no evidence from practitioners to actually convince us that there would actually be a significant change in the pattern of these populations of culls following a ban on hunting. Very quickly, we listed areas of agreement and

disagreement for you which will end up in your final table, but generally we did not find that too difficult to achieve. The control of foxes is widespread, undertaken for a number of perceived reasons. It is widespread rather than focused on specific problems. It lacks clear objectives on methods for assessing success. There is large regional variation in prevalence and culling intensity of different methods and hunting with hounds has low culling in comparison with other means and there is large variance in acceptability of different forms of culling.

The areas of disagreement I think between various interest groups -- first of all it is unclear whether fox control is either warranted for the reasons commonly cited, there is no evidence of population density in relation to the ecological or economic impacts, and the other issues relating to a ban on hunting I have already discussed. They seem to be the main areas of disagreement, but I think our data at least answered the last two questions for you.

For deer, again, there is many areas of agreement. Most of the deer in Britain, and there is at least 1.25 million -- that is probably an underestimate -- are managed by means which do not involve dogs. Hunting with dogs is very confined to a particular region and it has not been effective in controlling deer numbers. We do not know whether it has been effective in limiting deer damage to any significant extent.

The one point of course that we have to bear in mind is that in the future there may be greater access

to the countryside. Many deer practitioners have expressed the concern that if people had more access to the countryside, culling deer with rifles with traditional means would no longer be a practical option for them because the countryside would be too disturbed. We would actually want to do more driven shooting where they use dogs under control; one or two dogs working for a man to slowly move deer out of cover to be shot, and that may be a practice that would increase in frequency in time to come.

Again, for deer it is unclear what impact hunting has with hounds on the greater population in terms of damage caused by deer and it is unclear whether a ban on hunting with dogs would have any significant impact on landowner attitudes. We could not make up our mind whether the data really convinced us that landowners would change their use of deer in the South-west, and so we put that down to the area of disagreement.

For hares, again there are large areas of agreement in much of what we see. Hare numbers have declined; there are species of conservation concern. For most of the country there is little evidence of economic damage. What there is, is largely confined to one place, like East Anglia.

It is also clear the impact of hunting with lurchers is probably considerable, but we find it impossible to quantify the figures of numbers of hares killed by lurchers entirely speculative and it is almost certain the current levels of culling have a major population impact.

Areas of disagreement is that the impact of hunting with hounds and beagles, we are not actually quite clear whether they have any significant impact on hare numbers overall. We are not sure we could find much evidence the role of hunting with dogs in conserving hares. There is also disagreement over the reason for hare population declines and also methods of trying to improve hare numbers.

Just a footnote I should say also, all the modelling work we did was based on hare populations in the east of England where they are doing better than in the west of England and whether that data is typical we just do not know.

Areas of agreement for mink, again, are fairly general. There is a lot -- including introduced species detrimental to livestock, game and wildlife. Hunting with dogs, there is no significant mode of controlling numbers or their ecological impact. There is no evidence that hunting with -- that the mink numbers can be eradicated by anthropogenic means except (inaudible). Also quite important, there is no evidence that mink numbers are actually related to their ecological impact, and I go back to the point that mink numbers have crashed by two-thirds in eight years. Their main impact, as David said, was on water vole numbers. During that same period water vole numbers have continued to crash at an accelerating rate, so whilst mink have gone down, there is no sign yet water vole numbers have benefited from it, and it brings us back to this very basic point: there is no simple correlation between population trends

in a predator and population trends in their prey. There is a lot of conflicting factors in there that make interpretation extremely difficult.

The other point generally agreed is that hunting mink with dogs is a summer activity and is probably detrimental to repairing habitats and also species of conservation concern. There is no real areas of disagreement with mink.

As a final point, you asked us to suggest future research. Much again, as David has said -- send me the cheque later please -- population dynamics of managed species. It is very hard to give you clear ideas of what is going on, because we still know remarkably little, even about species like foxes.

Going on to the presence of cost and control practices in Britain: what is the real cost effectiveness of these different control operations?

The appropriate behaviour of foxes is rather actually poorly understood and also, again, the point that David made, good experimental manipulations, look at single species of carnivore so you actually see how individual species interact on their prey rather than predators in general.

So that is my brief overview. I think I say, Lord Burns, there is a large area of agreement there. We might argue a bit over numbers of animals in different of things, but overall, I think the conclusion is very much in concordance. Thank you.

THE CHAIRMAN: Thank you very much to both teams. I would now like to give people the opportunity of raising

points of fact or clarification. I would ask people if they would, please, not to comment on the substance of the presentations at this stage. I would like to save that until we have had a first round of questions about facts and clarification. Obviously we are very happy for each team to raise points about facts and clarification about the presentation and paper of the other team.

PROFESSOR HARRIS: You did not expect us to fight it out?

THE CHAIRMAN: No, it is not a question of fighting it out, but I think clarification. But maybe we will give the first opportunities for this to others.

MR SWANN: Thank you, Lord Burns. Two points of clarification, please, for Professor Macdonald. The first one is that you talked about lamb mortality data and you said you had used farmers' figures. I would like to know, if possible, just exactly what figure you worked with. The Sheep Veterinary Society and MAFF have used figures of total lamb mortality attributable to foxes between 2 and 5 per cent in the worst areas and farmers' figures have often been as high as 50 per cent, that is their perception. I wondered if you could clarify the exact figure you worked with.

The second point of clarification is some years ago I had the misfortune to have to prepare the rabies contingencies for one of Britain's offshore islands. One thing we looked at was control sinks, and we worked out that in intensive killing in control sinks, because there are maintained kill rates there must be an imponderable figure of immigration. I wondered if you could tell us if you put a figure for immigration into

your population modelling, please?

PROFESSOR MACDONALD: The first one concerns lamb losses and I hope I was careful to point out that most of the data on lamb losses, of which we are aware, are those reported by the farmers and, therefore, in some technical sense are circumstantial. In the written report you will find a review of all the evidence we could find on this and, as you rightly point out, the percentages of pre-weaning lamb losses vary between the surveys of different sorts, as does the evidence for them. For example, I myself was involved in a survey some years ago where we did ask sheep farmers for the evidence that they had invoked when concluding that a fox had killed a lamb and a proportion of them stated they had seen the kill; a different proportion -- and I cannot remember the figures now -- said they had found dead lambs, fox earthers; a different proportion said they had seen foxes in the vicinity of the lambs and so forth, so you will immediately see the quality of those lines of evidence differs radically.

In the particular calculations that we made, that I presented in summary here, the data came from a study in mid-Wales, which Jonathan Reynolds may choose to help me over, but I will tell you, since he was involved in it, that the summary of the situation is that the farmers in that particular area recorded a 6 per cent lamb mortality pre-weaning of which their estimate was 0.6 per cent of pre-weaning mortality was due to foxes. That was the figure we used in the little linear calculation I made for you. May I just pause and ask

Jonathan if I have remembered those figures correctly? I have, good.

The source sink business. You are quite right, this touches on the issue which I think both Stephen and his team and ourselves have diagnosed as a crucial consideration in the population dynamics of foxes and that is the biological factors involved in dispersal. I think I said dispersal is frustratingly a rather poorly understood, poorly measured phenomenon in all of these species, foxes included. The reason, just for those of you who may wonder why it has not been studied, is that to understand how dispersal works you have to operate over a rather large spatial scale because the fox starts in the territory within which it was born, which may vary widely in size between different parts of the country, and then may travel a distance which might average anywhere between three or four kilometres to extensive movements of 20, 30, 40 kilometres.

To understand what has gone on, you not only need to know the circumstances from which the fox departed but the circumstances into which it arrived, which is so far a task that has defeated almost everybody and, indeed, throughout the whole class of mammals has rarely been studied effectively.

So your question was: have we taken that into account in our modelling, I believe? While I can call on the modellers to help me out, again I would say that the answer is: yes, we have explored, in each of the types of models, the consequences of there being a sink, or a reservoir from which animals could disperse into

the controlled population and in each of the type of models, so far as I have understood them, dispersal emerges as crucially important.

The category of model that most allowed us to explore the importance of this phenomenon were the individual based models, those which occur in a real world landscape set up in the computer and that within these exercises one can undertake what is called sensitivity analysis. The meaning is intuitively obvious I think. You change each of the variables, for example the number of cubs that are born, the death rate, dispersal rates and distances, and find which of these changes has the biggest effect on the outcome and that sensitivity analysis in the individually based models revealed dispersal was one of the variables that had the greatest outcome on the population dynamics of the species and, therefore, your proposal that sources and sinks were likely to be important, is I think correct. Stephen, did I get that correct?

PROFESSOR HARRIS: Absolutely.

MR SWANN: Thank you very much, Lord Burns. If I could just ask to clarify the figure on lamb mortality you worked on was about 10 per cent for fox mortality, if my figures are correct?

PROFESSOR MACDONALD: 0.6.

MR SWANN: 0.6 of 6 per cent?

PROFESSOR MACDONALD: No, 6 per cent was lamb mortality.

MR SWANN: 6 per cent was lamb mortality?

PROFESSOR MACDONALD: Pre-weaning, as reported by the farmers --

MR SWANN: The overall mortality of --

PROFESSOR DAVID MACDONALD: Yes, and 0.6 of overall pre-weaning mortality in that calculation.

MR SWANN: Was due to?

PROFESSOR MACDONALD: 0.6 of all lambs, 0.6 per cent of all lambs.

MR SWANN: Was down to fox?

PROFESSOR MACDONALD: Yes. Just under 1 in 100 lambs were said by the farmers to be killed pre-weaning by foxes on evidence that was not reported.

MR SWANN: I still was not clear how that last percentage --

PROFESSOR DAVID MACDONALD: I am sorry if I was --

MR SWANN: No that is okay. Could I just ask another quick one on the sensitivities: on the sensitivity analysis, did you use a median figure from the sensitivity analysis or did you weight it one way or the other?

PROFESSOR MACDONALD: I will pass that to Steven Rushton.

DR RUSHTON: A uniform distribution between 1 and 38 kilometres dispersal distance, which are the published ranges from David's own work, from 1984. It was a uniform distribution because we did not have any knowledge of the statistical distribution itself. One might expect some sort of normal distribution around a mean -- or a skewed one with a median, but we used uniform distributions, largely.

MR SWANN: Okay. Thank you.

MR HART: Three points of clarification for each of the contractors, if I may. These are really layman's questions. First of all to Professor Macdonald, you talked about effectiveness and efficiency of hunting methods and I wondered if there was any way you could just go into a little bit more detail at some stage on the targeted control that certain types of hunting are able

to afford, i.e. the specific rogue fox scenario which has been referred to at various other stages in the evidence?

The second question, both contractors referred to mounted hunting having no visible effect on fox population levels. I am quite interested to know if you mean both ways because there have obviously been comments made about population levels being maintained as a result of hunting, perhaps at a level which would be higher than normal and that has not really been addressed, as far as I am aware, in the comments you have made.

Thirdly, a very simple question really, when you refer to "control", do you actually mean a reduction in the overall population or do you mean a reduction in predation or in perceptions of predation?

There are similar questions, if I may, for Professor Harris. First of all, you referred quite strongly to certain, or practitioners of certain activities, namely terrier work and lurcher work, as being unacceptable to the practitioners themselves.

I think I know what you mean, but I would quite like to know exactly how they find it unacceptable and the basis for your comment. I am not trying to challenge, I am just trying to get a better understanding of exactly what you meant by that.

Secondly, you referred in some detail to hare populations and the effect of culling or otherwise.

Obviously, evidence submitted by the coursing fraternity and, indeed, the hare hunting fraternity generally has

actually focused not on hare control but on hare management and I wondered if in any of your calculations you have taken into account the conservation benefits and the conservation efforts made by those two sporting fraternities in reaching the conclusions you put to us just now.

You have also quite strongly put there was likely to be no change in the attitudes to culling by a majority -- I think 58 per cent or something -- of farmers or landholders that you had questioned. What I want to know, if you can explain, is if predictions that you have made earlier in your report about population levels either going up or going down, how long that view of actually not changing the status quo is likely to last, i.e. if you were wrong in your earlier assertions and actually the population then does rise or fall suddenly, will that 58 per cent of people actually suddenly think: heck, we have this wrong, we have to change. I just wonder how much you might have taken that into account. Thank you.

PROFESSOR MACDONALD: I will see if I can get my three straight. The first one I think was about the distinction I would try to draw about effectiveness, of which efficiency is a component, and whether that related, or what I can say about how targeted control including the rogue fox phenomenon might work. Effectiveness just to recap is something we believe must be measured against a goal and is not simply a matter of how many of something one kills. Efficiency within effectiveness is a measure of the effort expended to kill foxes that you know are

there, that was the point I tried to make, or anything else you might know, contrasting the chap in the south-east with the chap in the east with quite different numbers of foxes, so we are clear, I hope, on some yardstick of effectiveness is achieving a stated aim or goal.

Now, is there effectiveness in hunting with any of the species concerned, considering rogue individuals? And while others around the table may know of data or remind me of data that I am unaware of, I do not know of any data which could be used to evaluate the claims, for example that on-call hunting during the lambing season is or is not particularly effective in catching rogue foxes.

Indeed, and frustratingly, I am not sure that biologists have any very good evidence that rogue foxes are a real phenomenon. There is an intuition that there may well be so and there is evidence, and I think this is strong evidence, that in the case of lamb worrying that most foxes are not lamb killers at all, and that only very, very few foxes, I could not hazard a guess what proportion, are significant lamb killers and the evidence for that is entirely straightforward insofar as that if even one fox -- if every fox killed even just one lamb, then lamb losses attributed to foxes would be staggeringly larger than those that are currently attributed. So we can see that most foxes do not kill any lambs at all and I agree with you that a possible construction, well you may be suggesting a possible construction from that, is that there are rogue foxes

who kill very many. Biologists to the best of my knowledge do not have data on that and to the best of my knowledge there are no scientific data on the efficacy of hunting dealing with that problem.

Another topic which you may also have had in mind -- I do not want to put words in your mouth -- which we have not been able to deal with because there were no data with which we could, is that part of the rationale, as I understand it, in the context of population control and traditional mounted hunting, with its both cull hunting and main hunting periods, is not only concerned with attempted population control, but also with the spatial dispersion of the foxes that survive. The notion being, if I understand it correctly, that the dispersal of young foxes from their natal range from the territory in which they are born might be encouraged or accelerated by hunting activities. To the best of my knowledge, again, there are simply no data on which one could evaluate that proposal or go on from there to evaluate the likely consequences for whatever the yardstick of effectiveness might be, so that is the first one.

The second question was about effectiveness where we had, both teams had tended to the conclusion that traditional mounted hunting as practised in the lowlands was unlikely to, in general, have an impact on fox population dynamics, unlikely to single-handedly be responsible for controlling fox populations, but you asked the question: is there a possibility that it is beneficial in terms of increasing fox numbers as an

alternative scenario? Have I correctly recollected the question? We do not have any data on that, I believe, but it was in a topic on which we had implied judgements when we posed the second of at least our final questions, resonated in Stephen's questions as well, about whether people might take some sort of compensatory, even retaliatory action, you might say, against certain of these species of hunting was banned because of the hunting paradox, that one not only may have an aspiration to control but also to have sufficient therefore for recreation or sport.

There are groups of people in previous questionnaires, some of whom say: if there were not hunting, yes, we farmers or we game sportsmen would shoot more foxes and therefore there might be less. That possibility was a possibility to which we alluded in the second of our summary points but we cannot say what would happen, Stephen may chip in, or he has his own three questions to worry about, because his results, if I remember, showed that some people were proposing that view and others were not. So I think the answer is it is a hypothesis that we do not know the answer. The third one was something about control but I cannot quite remember what.

MR HART: Basically it was whether your definition of control was about reducing the overall population number or whether it was a reduction actually in predation levels or, which I think is significant, perception of predation levels.

PROFESSOR MACDONALD: It is kind of you in a way to ask that

question because it is at the very heart of what both of us and our teams have been trying to say. So much of the technical goings on that we have tried to summarise for you this morning is about whether we believe in terms of population control any of these methods of attempted control are effective. By population control we mean that natural populations have a level which is set in some sense by the carrying capacity of the environment that they occupy, we might often attribute that maximum ceiling on the population to food availability, but it might be something else, like water supply or disease or something else. Anyway there is a maximum.

When we talk about population control we are talking about population control by people, that is that the activities of people reduce the population to a level below that maximum at which it would otherwise achieve. So if the yardstick of success here is to reduce a population then so be it, population control would be achieving that yardstick. However, we would say, I think all of us would say strongly, that you could not legitimately have that measure of success unless you had some reason for wanting to do it, so you have to have all the steps in the chain completed. There is perceived damage. That perception is verified.

You then say what course of action would reduce that damage and you have to verify the course of action does in fact deliver the goal that you have set, and that is why I was at such pains, I hope, to say that you cannot talk of effectiveness unless you have aims and I think both of us have said the aims are sometimes a bit

hazy in all of this. So no, for me the answer to your question is: if you ask is achieving population control a measure of effectiveness? I would say no, the measure of effectiveness is reducing whatever damage it is that you are seeking to reduce by undertaking population control, which opens up the issue of whether there are alternatives and it may well be that something, nothing at all to do with controlling numbers but with controlling behaviour, for example fencing or repellents would be an alternative. Did I get the three?

MR HART: I will read the transcript, but yes, I think so.

PROFESSOR HARRIS: I have made the sad mistake of not starting to write your questions down because I did not realise it was going to be quite so long, so I apologise. I hope I get them right, but stop me if I get them wrong.

The first two seem to relate to the information we put forward on perception of practitioners and how we scored them. In the actual report you will see that practitioners were asked to score their perception of acceptability on a scale of 0 to 10. Basically we have given in the report mean scores and a standard deviation, I do not know whether that is going to be particularly helpful, but anyway you have these mean scores, and for the slide I simply tried to rank them as unacceptable, moderately acceptable or very acceptable. So, for instance if you asked as to the mean scores of, I think you asked about snares, the only score, the mean score of acceptability of 2.29 compared to 7.17 for shooting at night with rifles and 6.40 for shooting at

day with rifles.

MR HART: I actually asked about terrier work and lurcher works specifically not snares.

PROFESSOR HARRIS: Okay, again, terrier work only scored 3.22, lurcher work scored 2.13 less than snares. That is what the figures were, so all we are doing is reporting what practitioners told us. The second question I understood it to relate to what would happen if a population of these animals changed and whether people's perception of their attitudes to culling would change? Simply we could not really ask that because there is no way we could really ask people what would be an acceptable number of foxes or deer or hares in Britain because really there is no yardstick for people to measure that. So really we only asked them for their perception at the current situation. Clearly over time things may change but there is just no way we could assess that.

Could you remind me of the third question.

MR HART: I can, it was whether you had taken into account conservation measures of the hare hunting fraternity?

PROFESSOR HARRIS: No, again we found that very hard because it is very hard to actually put any quantification onto the conservation measures; simply in terms of how it would benefit hare numbers which is what we were looking at, simply all we did was look at the effects of culling pressure at different levels of culling on the population environments of the species. That really is the only question we are trying to answer because you could equally well apply some measure to all the other

species where it was impossible to quantify in the modelling prey, in the modelling scenario, so all we are trying to do is actually model the impact of culling on numbers. Does that help you?

MR HART: It raises a number of important issues. Thank you.

DR LINDLEY: I do not know whether I should introduce myself, I am new to the circle here. My name is Dr Arthur Lindley. I am Director of Science at the RSPCA. There were two questions, if I may. One related to what Professor Harris called "non-anthropogenic mortality", it might have been perhaps better to call it perhaps "non-targeted mortality", since what he was really talking about was road traffic accidents which are certainly anthropogenic.

PROFESSOR HARRIS: I was not talking about road accidents I was talking about natural mortality.

DR LINDLEY: Sorry, I thought you did mention road casualties.

PROFESSOR HARRIS: I also said there are road factors as well, but actually non-anthropogenic, I just meant natural mortality.

DR LINDLEY: The question really was between the two, Professor Harris, again I hope I did not get you wrong you indicated that you believe that those non-anthropogenic causes of mortality were a significant part of the total mortality of the fox population in a year, and yet it seems from Dr McDonald's presentation, certainly in a table that you showed of numbers of animals killed, foxes killed, the total numbers of foxes killed in a year, by hunting, shooting, trapping and

snaring actually seemed to exceed the annual production of cubs, without any non-anthropogenic mortality at all, and I wondered whether that was my misperception or whether there were some provisions in there?

PROFESSOR HARRIS: Perhaps this is one area we might usefully put our heads together to see if we can come up with some meaningful figures because it is exceedingly hard. Let David answer.

PROFESSOR MACDONALD: I remember clearly the slide to which you are referring. I hope I introduced it by saying that what I was trying to illustrate to you was the sort of logic we could pursue to try and get some guess at the numbers of foxes killed by different mortality factors in the absence of adequate data.

The particular exercise you have in mind is one where we started, exactly as Stephen's team did, with an approximate estimate of the number of foxes that exist in England and Wales and pointed out that if they breed at a conventional rate, then a certain number, we both said about 400,000 I think, will have to die by the following year if the population is to stay approximately stable.

We were considering then what evidence there was for the contribution to that mortality made by different sources of human intervention. I made the point that, perhaps surprisingly, there are really no data on which we can readily call, regarding shooting. So, I said let us try the back-of-an-envelope calculation whereby we say roughly how many foxes are killed on farm land. We happen to know approximately from questionnaire

data that it turns out to be 2 per square kilometre as a rough figure from the 800 or so farmers we asked in different regions of Britain. I said, let us imagine how much farm land there is, let us imagine from that how many foxes are killed on farm land and deduct from that figure the numbers known to be killed by other sources like hounds. That led me to the figure of about 400,000 again; foxes being killed on farm land.

Stephen made the absolutely correct point that we already know there are other things killing foxes, like motor cars, and in fact, happily, there will be no difference between us on that. I was simply following through a particular progression saying if this, then that, if that, then the next thing. So all I am saying at the moment is, firstly and most importantly, I believe there is nobody who can tell us how many foxes are shot in Britain or in England and Wales at the moment, and that seems to be an important and regrettable omission.

There are various ways of trying to deduce how many are shot and one really back-of-the-envelope progression leads us to believe that the answer is several hundred thousand. It may be less. We know that it is more than quite a few tens because there are fragmentary data, for example of surveys of gamekeepers, of which we know how many there are and how many foxes they shoot, largely. So we know that the number is going to be, say, more than 50,000 and less than the number of foxes there are. The figure I gave has no more status than that.

DR LINDLEY: Could I then just finally clarify. In terms of developing models, was there a provision for non-anthropogenic, if we can call it that, mortality, and how did you arrive at that as an estimate?

PROFESSOR MACDONALD: I will quickly answer and then pass to Steve Rushton to give you a more technical answer. The answer is yes, one of the beauties of functioning in a model is that you can alter anything you like, even in the absence of any data. Its capacity, we had in the model, to ask what would happen if levels of mortality were such and such, and so we could cover these options and, Steve, I think you could elaborate.

DR RUSHTON: We managed to get one estimate of non-anthropogenic mortality, and that was from the Game Conservancy and it was 14 per cent, which really Jonathan Reynolds could elaborate on. Essentially, what we did was to estimate confidence limits around that value, assuming it was a proportion which meant that we could simulate our non-anthropogenic mortality as lying between 5 and 32 per cent. In other words the confidence limits on that 14 per cent are 5 and 32, which is quite a high range in mortality.

I would also stress that the other mortality factors were additive in the sense that they were treated as independent although they are probably not. Again, as I stressed in the report, there is little if any information on mortality itself. Although we know how many were killed approximately but we do not know the population size from which they were killed. Is that clear?

DR LINDLEY: Yes, I think that is clear so far, we may need to discuss this further.

PROFESSOR HARRIS: Do you want me to answer that point as well because you address some of the question to me?

What I meant by non-anthropogenic mortality? I think there probably is a very high level of natural mortality out there -- the data we collected in Bristol. You could be looking at 25 per cent per annum of mortalities from a variety of natural causes and misadventures, which I am sure are likely to be replicated in the countryside as well.

I guess we probably underestimate the level of natural mortality largely because we cannot monitor it and I would put it nearer 25 per cent. That is a back-of-an-envelope calculation but there is certainly a lot of natural mortality out there through a variety of causes.

PROFESSOR MACDONALD: Just to round off that same point or a related one, we all have several times and in the written report many more times, put in the caveat that we have made explorations based on the data that were available. Many of those data come from people's perceptions.

When I was making that back-of-the-envelope remark that farmers recorded approximately, as an average, 2 foxes per square kilometre are killed on their land, I should point out to you that the quality of that data is open to question. For example, we did recently an intensive survey of the farmers' opinions in Wiltshire and asked the farmers the same question: how many foxes

are killed on your land. They came up with an answer. We asked how many foxes were killed by hounds, by the hunt on your land and we asked the Master of Foxhounds the same question. The farmers believed that five times the number of foxes were killed by the hounds than the Master of Foxhounds did.

So there are always reasons to question the data which I think in the written report, where we have more time to elaborate, we have been rather careful to put in the caveats.

DR REYNOLDS: I would just like to make the point that in doing ecology and studying these kind of systems, there is a general trade-off between being accurate and being general. So if you are looking for general answers that apply to the whole of the UK, you will not get accurate answers.

As the members of our team will have learned by now, I have a personal dislike of what I call telephone numbers, which are so very speculative. I do not believe they teach you very much at all, although it is a great temptation to have such data about how many foxes are killed in Britain and how many die under the wheels of cars and so on. But I much prefer to stress the benefits of doing specific field studies which are targeted at a particular problem, or a particular region and come up with more accurate, not necessarily precise, but more accurate data.

So that was the general point. If I may just respond to an earlier question as well, about the evidence of a positive influence of hunting on fox

numbers. It is impossible to keep all the elements of this argument in one's head, and I am afraid David has omitted one.

We did find evidence in the Game Conservancy's Three Regions Study, which you will have read about, in the sense that the hunt in the East Midlands had a restraining influence on gamekeepers and others on local shoots, to the extent that the number of foxes killed by those local interests on their estates was about the same as the number killed in mid-Wales or in West Norfolk. This was despite the fact that the population of foxes in the East Midlands was about twice what you find in mid-Wales, and about four times what you find in Norfolk. So there is evidence there that the hunt actually has an influence on other landowners.

THE CHAIRMAN: Could I ask a general question about population modelling? Just so that I can be clear. Given the shortage of data, presumably it is very difficult to actually verify the models and it is not possible to build a model which then simulates the behaviour of some area where the data is known. Or is it possible to build a model which will simulate what happens in particular areas?

DR RUSHTON: In theory one should and in fact in most of the published work that I have been associated with, one takes a separate set of data to validate your model and show that your model actually does simulate reality. In this particular instance we do not have sufficiently good data, either in the sense of populations against which to compare what is going on or

the mortality data to go into the models in the first place. This is why we used the particular strategy for sensitivity analysis that we did.

We took upper and lower bounds on each of our input parameters which we knew were logical. We knew for instance that the dispersal distance was somewhere between 1 and 38 kilometres for foxes moving around. Similarly the confidence limits that I suggested on the anthropogenic mortality were abstracted in a similar sort of way, given an upper and lower bound.

If you can imagine all the different parameters that you are modelling, between a minimum and maximum, you do know that you are overestimating what is actually going on in the population, in terms of those underlying parameters but you do know that reality is somewhere in there.

What we really ought to be doing is to try and focus down on the true nature of those distributions, so that we can get closer and closer and our universe of nonsense narrows to a focus point of reality. That is what all modelling is about.

Although I should also add here, we did use these models didactically, in that we were trying to investigate how the system functioned in relation to variations in these parameters. I think the dispersal issue have both studies have highlighted is a key one here.

DR WISE: Lord Burns, could I follow up on this modelling because I have never been very mathematically astute but it occurred to me, I believe that Professor Harris

suggested that hare numbers were very sensitive in his model to low levels of culling and that appeared to be different from the McDonald model. I might have missed the point, but could the contractors clarify whether they are in dispute over this or not.

PROFESSOR HARRIS: Are we in dispute, David?

PROFESSOR MACDONALD: I do not think so. Well, okay, Mark, would you like to say something here?

We have, as you recall, three different modelling approaches and Stephen and Kieron have others. It is the case with models as with all other tools, which is simply what they are, that you can use different tools to explore different issues. I suspect that if there is any incongruity between what we said, it is to do with using different tools, with different assumptions, to explore the same question. The model that we were talking about which mentioned hares, Dr Shirley constructed and so you might like to say a word.

DR SHIRLEY: David has just covered basically what I was going to say. The two models differ quite dramatically, mainly because of their intent, the data that we were trying to produce out of them and the purpose behind the modelling. We were looking at a very general model, which would look at populations as a whole across a wide area, perhaps on a regional scale, whereas the models in the other contract were very specific to a particular location and that is something that Professor Harris said in his talk. This is one of the main reasons why there is such a big difference.

There are faults in both approaches but, as we have tried to stress, we are trying to look at the

sensitivity; we are only looking at the responses of what could happen when applying a cull. Particularly in the hare, because the populations can in theory grow so very quickly, it is quite hard, with the generic modelling approach that we use, to distinguish what is actually going on and to approximate the actual processes there. Perhaps Jonathan has got something more to say.

DR REYNOLDS: I just wanted to say that the essential difference, I think, between the two models is the amount of productivity that is built into the models. So, whereas Mark's model was based on quite optimistic productivity data from the Handbook of British Mammals, Stephen's model was built on rather gloomy data about the productivity of hares culled from a population in Norfolk.

We have been discussing within our group about the hare model and I have to say we are a little bit puzzled at the moment because we have not seen all the details of how the model was constructed. So I would like to ask, if I may, just how the productivity data and the survival data for leverets that went into that model were derived?

PROFESSOR HARRIS: I think that is the crux of the problem. The data on hare productivity in the Handbook of British Mammals is very old. It is 1974, I believe. There is the Lincoln data and the data from about that period. I think that is the data you used, is it?

DR REYNOLDS: Yes.

PROFESSOR HARRIS: Since then there has been dramatic

changes in the British landscape. One of the big problems has been this change, particularly in East Anglia, from the use of spring slide and seals to winter slide and seals. That had a big impact on the productivity and survivorship of hares throughout the summer and our data collected in recent years from a number of estates, spread not just in Norfolk, but Suffolk around East Anglia, all show exactly the same: because of the changing farming practice, leverets survive and productivity is actually much lower in the summer now. So we use those data in the modelling. I did stress that we do not know whether there is something similar going on in the west of England, where clearly there is not so much cereal crop, we just do not know. It is the only good data we have in recent years, and those are the data we used.

DR REYNOLDS: The thing that is really puzzling, if I may, is that the estates in Norfolk particularly, and also in the north of Suffolk that we know about, have the highest hare densities of any in Britain that we know of, and appear to be doing extremely well. These are particularly the estates on which they do hold shoots in order to decrease hare numbers. So it seems odd to have such poor productivity on the estates where hare populations are doing so very well; the field data and the model do not seem to match up.

I would suggest that what is happening here is that we are looking at a very high density population in which density dependent effects are already taking place, and that the productivity of these animals is low

in the summer because the populations are so high. I think that may well be a key difference between the models here.

PROFESSOR HARRIS: I think, Lord Burns, perhaps we are going down the line of speculation; I think that is completely wrong. I am not sure it is relevant, but I will answer it. The point is that many of these estates in Norfolk and Suffolk do not have high densities any more, and not all of them that we have hares from actually cull hares each year. Three of the ones we sampled also admitted that they can cull hares on their land in February as they do, and within two or three months they have got hares back and solely by immigration. Their populations have been maintained by immigration, not by productivity.

Again, the density dependent factor is not in there because densities of hares on those estates are a lot lower than they used to be in the recent past. What is happening is that productivity is very low for a specific period of the year, and then productivity goes up again towards the end of the year before numbers have been culled, so it is not a density dependent effect in there; it is a habitat effect. We have got the data, and we have proved that. I think the data we have used are as realistic as we can, and they are a reasonable data set to use, and we have compared them with the data for the 1970s and we have actually gone back to the original source for those data, Dr Lincoln's data, and got his own data and compared them because they are from the same estates in many cases. The situation today is

very different, and that is why we think it is valid to use those data.

THE CHAIRMAN: Could I suggest that, on this point, we do not seek to take it any further at this stage. I think we have raised an issue where there are differences. I think it is something that we would hope that the two

teams might be able to sort out between themselves a little more, as we move to the next stage.

I would like -- if there are no more points of what I would call fact and clarification --

MR HOBSON: Thank you, Lord Burns. Could I pick up on a point made by Professor Harris. In his presentation he said, I quote: "Hare numbers are continuing to decline". However, in a recent report published earlier this year called The National Hare Survey, by Bristol University, written under Professor Harris' name, he said, I quote: "There is no evidence to suggest that there has been a significant change in hare numbers nationally since the first survey in 1991 to 1993."

There seems to be some divergence in the figures.

PROFESSOR HARRIS: Actually, there is not a divergence, I think you are quoting out of context. They have produced a number of figures in that report. It is not a published report, it is actually a newsletter sent for the volunteers who helped and it is the draft analysis. You say that the statistics nationally in Britain, in the few years and the decade, there has been a 10 per cent decline in hare numbers. What it then goes on to say is that that decline is not significant nationally, because actually the declines in some areas have been counteracted by, in some areas, small increases;

particularly upland areas where hares are becoming more abundant in some upland areas.

What it then goes on to say is that if you break the country down into regions, in many of the regions decline is statistically significant, and particularly in many of the arable areas of Britain and southern Scotland. So I think it is quoting a phrase out of context.

MR SWIFT: I too was going to raise a point about hare numbers, but I shall leave it to the two contractors to sort that out between themselves, if I may.

There are, however, large chunks of Stephen Harris' report which are not there. That creates problems for us in making rational judgements about some of the opinions that he is expressing about hares and about other animals. The point I would like to clarify is on the practitioner and general public survey, the responses were given, but some of the sampled numbers were extremely small; I am talking about seven gamekeepers -- and probably analysed as being representative, I do not know -- and 83 members of the general public, and is that satisfactory, and how far can you take those sample sizes?

PROFESSOR HARRIS: No, it is not satisfactory. If you go back to the point that we did have a timescale, more responses are coming and in the final report we will have more information and, of course, to actually get contact with gamekeepers in the specific regions was proving problematic. That is why we gave your organisation a large numbers of forms and asked them to

circulate to gamekeepers in that area. So we hope that we will get those back promptly, and we can add those to the sample sizes. All we can do is get people to see if they can fill the forms in and get them back to us.

MR SWIFT: Will we, through you, have an opportunity to comment on that before it goes into the final report?

DR WHITE: Can I make a comment in response to that question in the small sample sizes? Although the questionnaires we were asking are actually quite detailed; in the report it says that each questionnaire of practitioners actually took 20 minutes to complete, so we actually got 198 practitioners in total, which means a lot of hours spent on the phone.

Because they were a lot more detailed than previous questionnaires, one of the comments about accuracy that you made, it is useful to compare them with previously published studies, such as the one that David did earlier. When you look at the general attitudes of practitioners such as farmers, then when there are questions in common, the results from our surveys do actually seem to bear out the results from his, which gives us some confidence in their credibility.

On the point of the small sample sizes for gamekeepers in particular; because we had small sample sizes only for gamekeepers and most of the practitioners were farmers, that is why in the analysis we have decided to pool the practitioners as one lump of practitioners, rather than to subdivide them. We were also trying to concentrate on subdividing by region as

well, so that is where the emphasis of the research was.

PROFESSOR MACDONALD: Regarding these questionnaire data, I think in our report we have deployed quite a lot of accumulated questionnaire data of one sort or another, much of it concerned with the opinions of people whose opinions are to be valued; people who are farmers or gamekeepers or whatever, who have first hand experience of many of the issues we are talking about.

So I do not for a moment want to give the impression of being dismissive of those opinions but, irrespective of the sample sizes that lie behind them, I think there is a more important general point that we must be terribly careful not to lose sight of; that is, as both Stephen and I have mentioned in our presentations, have to be terribly cautious about what are perceptions, rather than demonstrable facts. I, for example, have participated in questionnaires where I have asked people opinion and I think they have answered me, so far as I know, honestly and on the basis of sound experience. But life is often not intuitive and things are often not as they appear to be. That is especially true in biological systems which are complicated, so when we sit here saying 73 per cent of farmers think this and 45 per cent of urban people think that, that is precisely what it says; nothing more and nothing less and please can we bear that in mind.

MR OLIVER-BELLASIS: Lord Burns, Hugh Oliver-Bellasis, representing the National Farmers' Union.

Could I address a question to both contractors and then a question to Professor Harris. To both of the

contractors: when talking about livestock, you have focused quite specifically on lambs, and I wonder whether you took into account piglets.

The question specifically to Professor Harris: have you taken into account the changes over the last maybe four or five years to more extensive systems? You make a comment that in some of the cases of damage done by predators, that it could be avoided by better husbandry, and in one case you specifically mention housing and fencing. The extensive systems and the move to extensive systems with, particularly, pigs and poultry, puts a particular pressure onto that method of husbandry, both in terms of cost and other matters. I would be interested to know if, in fact, that was part of your calculations.

PROFESSOR HARRIS: Perhaps to address the question specifically to me first.

Yes, clearly, it is an interesting question. Will the drive for more extensive systems in farming lead to greater problems? We did a survey, I think, three years ago of free range pig farmers, free range poultry farmers, and so on. At that time they all reported that basically their economic losses to foxes were actually very small, and most of them solved it simply by good husbandry, good fencing, and so on.

So we conclude, at that stage, there was no real evidence to believe that more extensive systems would lead to greater problems. It may be that there will be greater costs and so on in the extensive systems, but not actually greater problems in terms of losses of

foxes.

PROFESSOR MACDONALD: On the general one, you are absolutely right, of course, that at least I spoke in the agricultural context this morning mainly about lambs, that is purely an after-effect of how much time was available. But it is also the case, as you will see reflected to you in our report, that most of the evidence that we could gather, dismal though they are in quality, concerns lambs and lambing and we were unable to dig up very much on pig farming, although we would welcome, if somebody could offer them. I am fully aware, mind you, that in farming circles fox predation, at least on a localised basis on farrowing sows in the open, is widely talked about as being locally financially punishing to given pig farmers. I am unaware that -- though fully prepared to stand corrected -- of any data we could draw on there... But we do have at least a sentence in the report to reassure you, saying that pigs are an issue on which we think more data are needed, and the other thing that I did not talk about this morning is poultry, free-range poultry and again, other than noting that, for people that have free-range poultry on a small basis, foxes are undeniably and always have been a considerable nuisance and could become so, if market forces required there to be more free-range poultry; other than noting that, I was not aware of anything very useful we could say but I fully take your point.

DR VICTORIA EDWARDS: I have a very quick one on the mink population. Professor Harris, you said that there is evidence that the mink population is declining and I

took that to mean the entire population nationally, and I believe -- I am sorry if I got it wrong -- I believe you said therefore we cannot deduce that there is a threat on the water vole population and yet I thought the study of the indirect relationship between the mink and the water vole was actually a site-specific study and it strikes me that it has got us back to Dr Reynolds' comment about looking at specific field studies and trying to draw conclusions nationally from that. Can you clarify? If we are looking at a national population in one case and a specific field study in the other we cannot actually draw conclusions, can we?

PROFESSOR HARRIS: I obviously did not make the point very clearly that the decline in mink numbers is national, and on the notepad I just gave the national figure. In the report -- in the final report -- you will actually get a regional breakdown of that, so that in a regional pattern, declines are greatest in areas where there has been dramatic otter population recovery. In some regions the mink decline has been as high as 80 per cent but nationally the average is something like two thirds. What I actually said was that nationally the mink population has gone down substantially and at the same time nationally because there are two parallel surveys there. The water vole populations also continue to go down substantially and, in fact, the data on mink and water voles are actually collected at one and the same time, so I think they are directly comparable. David referred to a specific study he had done. No one denies that mink are having a dramatic impact on

water vole populations. The only point I made was that here was one example where we could clearly see that there was not a simple relationship between the number of predators and the impact on their prey. I made no other deduction other than that.

DR LINDLEY: Could I just come in on that, it is really a question to David. Am I right, because David has done all the work, that there is evidence in that localised study that the impact that mink were having on the water vole was an integral part of the impact of constrained habitat, particularly with the narrow corridors of modern waterways and that there was some suggestion that the effect the mink were having was only in the context of depleted and reduced habitat quality.

PROFESSOR MACDONALD: I have been involved with the work, but only in the sense as part of a team of a lot of other people. As Stephen says, there is no conflict between the two sets of results on which we chose to draw. There are two phenomena taking place which are simultaneously true and can be integrated. On the one hand, there really is very abundant evidence -- I think more than this committee wants to hear right now -- that, locally, the arrival of American mink had introduced alien species into river systems from which they were formerly absent and where water voles are present, leads to a rapid and dramatic decline and often local extinction of water voles and I do not think there is anybody that would dissent from that view. The mechanism that is involved is one that is rather interesting because, while there are some places -- many places -- where the arrival of

mink is detrimental, indeed terminal to water voles, there are some places where you get those species together and there has been a line of inquiry which I have been interested in which asks whether loss of habitat, in fact what were once swathes of riparian habitat, now narrowed through riparian engineering and intensification of agriculture to a single ribbon, causes such a thin fragmented sliver of habitat that, even if mink were not there, water voles might be in serious difficulty. And Stephen also, I think, mentioned habitat restoration as one of the possible tools open to us now to solve wildlife management problems and it is exactly in that context that he might well have been thinking of habitat restoration.

There is some debate about the extent to which, if we control mink now, water voles might recover because of the habitat uncertainties. There is no debate about the fact that mink are detrimental to water voles, almost irrespective of habitat. There is no debate about the fact that mink numbers, very interestingly, are declining, as Stephen says, on a national basis, partly, possibly explicable, as he says, by specifically competition with otters, so these things are actually all simultaneously true and leave us with some interesting practical and moral dilemmas. On the one hand, the practical dilemma is how to restore habitat whatever; on the other hand, one might ask, if mink numbers are going down, will that be sufficient for water voles to recover. Maybe the answer is no, because maybe the habitat is so shot to pieces and the water

voles now so rare anyway, that the natural recovery in some areas is already a lost cause. The moral aspect of this, by the way, perhaps not today's conversation but for another day in your seminars comes about in the attitudes people take from a welfare point of view towards the control of introduced species as distinct to species which are native.

THE CHAIRMAN: I think that takes us probably as far as we should sensibly go this morning. We should break now for an hour for lunch. What I propose to do when we come back is to go through the subject species by species and basically look at three headings: one is what is happening to population levels; the second is the reasons for population management; the third is the effectiveness of different methods. I will invite other members of the seminar to comment on each of those areas in relation to the reports and then get your responses. It is going to have to be a bit of a quick chase through them in the time that we have. But if people could, over lunch, try to concentrate their questions under those headings, if possible. By that I do not just mean questions, I mean alternative views. If people wish to put them forward and challenge the views that have been set out in the reports we will give you all an opportunity to respond. So we are missing out, in a sense, the stage of general response to what we have seen. I think, given the amount of time that we have taken, we need to now focus in under the headings that I have mentioned when we come back after lunch. Thank you all very much.

(Adjourned for lunch)

(1.30 pm).

THE CHAIRMAN: Good afternoon and welcome back -- impressive time keeping from all concerned.

Could I issue one request, please, which is that people should not speak too fast. I realise that there is a lot to be said, but the people who are talking should have some sympathy for the people who are taking the record of the meeting. If you could also, for the benefit of the people who are further back in the room, get as close to your microphone as possible when speaking. I think that it would help everyone.

The order that I propose to do things in this afternoon is first fox, then hare, then deer, then mink. We will begin with fox. I mentioned, however, before lunch that I would like to break it up first of all into questions about population; secondly, reasons for population management; and, third, effectiveness of different methods. So if I could begin with general issues of population and ask if any of the people at the seminar would like to make any comments on the paper or presentations.

MR HART: Lord Burns, just to really start things off; it appears we have talked quite a lot about what are acceptable levels, what are optimum levels, what are minimum levels of fox populations, but one point seems to have escaped most of the conversation this morning and that is there was really only one section of the rural community who are in a proper position to judge what is an acceptable level or otherwise and that is the farming community upon whose land these foxes reside.

Now, we are all conscious, I think, that that might vary from one place to another, from one farm to another, but the judgement ultimately is not on whether two foxes per square kilometre or ten foxes per square kilometre is an acceptable level; it is the level of foxes which causes the minimum acceptable damage to farmers which is the significant factor and therefore it is their judgement to a great extent as to what cocktail of control methods they employ to retain that level on their holdings.

I think what I want to attempt to say is that there are some practical applications of the extremely interesting science we have heard which I think from the Alliance's point of view I would like to really inject.

THE CHAIRMAN: I am sorry to do this, I think you are actually on the second topic I had on my list. I have to rule you out of order at this point in time.

I think that does get us into the questions of the reasons for population management. I wanted to deal, first of all, if I could -- and it may be there are no questions about this - what the numbers are; the alternative ways in which they meet their end; and other issues to do with the population dynamics. That is what I wanted to have under the first question. Then we will move on to the second question about population management.

MR SWANN: Thank you, Lord Burns. I wanted to make two brief points, if I could. The one I was concerned about is the two foxes per square kilometre killed per annum. I believe that was the estimate that was used in talking to farmers to try and get some sort of idea of the

average numbers of foxes killed on farms. Please correct me if I am wrong in that understanding.

One of the points that I wanted to make on this is the great difficulties in using data which are just acquired empirically from farmers in this way because there is a culture here that if a farmer is asked -- I must break there and I apologise to the transcript writers and say, with the knowledge of my own farming background, I know that people do this. If you ask how many foxes you shoot, they will not say, "We do not shoot any". There is a culture if you are not shooting foxes you are not a very good farmer. I would just question that figure as to how reliable that figure is and whether it is possible to make that as a statement. The second thing on population I am still not convinced on is in the upland areas that the population is in any way below that of the carrying capacity of the environment, even given the level of killing by the hunting packs, the dog packs, because the numbers killed each year do seem to maintain a degree of consistency. It comes back to this modelling on the amount of migration inwards and I just feel there is an awful lot more information needed on this migration topic, because I am still not convinced that the population is actually being controlled. I think a lot of foxes are being killed but I think the population may well be, I think there is a good reason to believe it may well be at its actual carrying capacity in those areas. Just those two points, thank you, Chairman.

PROFESSOR HARRIS: Perhaps I should just say I tend to agree

with that. We had to assume for our modelling work the foxes in upland areas were not at carrying capacity. That may be a false assumption, we just do not know. All we can say at the moment we are not even 100 per cent sure how many foxes there are in many parts of rural Britain. Our estimates are at the moment at best provisional. We are producing a more refined population estimate at the moment, in a year or two we might our estimates grossly underestimate how many foxes there are in certain areas; we just do not know at the moment.

PROFESSOR MACDONALD: You make two points, and the first one is about the extent to which we can rely on the estimates that farmers, or anybody else for that matter, give us regarding the number of foxes killed or anything else, and I am happy that you are in fact endorsing them or re-emphasising the point I have made, that these data are exactly what they say they are; they are the answers that people have given to questionnaires. The status of the evidence we have not explored.

I would just say to you though, since this figure of two foxes per square kilometre being killed average on farm lands has a larger life than I would originally expected it to have, having mentioned it that if people are interested in that figure, and they will find this retreating to the written version of the report, that comes from a survey that we originally did in the early 1980s which involved ten agricultural regions, 891 farmers who made their estimates. They made a number of other estimates, like the number of cubs they believe were born on their farm, the number of breeding earths

and other things, all of which were published.

We repeated that survey in 1998 and there is a publication we can make available to you, although it only exists in proof at the moment with updated data. This month in the Journal of Rural Studies you will find we have published a similar questionnaire for farmers in Wiltshire which, to my astonishment, comes up with the same estimates. Farmers at least agree, that is not to say they are right.

The second point you raised was about upland areas and whether they are or are not at capacity. My own personal experience on that is to have worked on fox biology in the uplands of northern England. I want to make a proviso, a caveat, that we may have slipped past earlier. There has been a lot of talk today about mid-Wales as a paradigm of upland areas. That is solely because the data that we have been discussing happens to come from there, but I hope in our report where we have mentioned Wales we have always been careful to say something along the lines of, "upland sheep farming areas as typified by Wales", so were there comparable data from the north of England or from Cumbria where I have worked myself on foxes, I would imagine that similar sorts of things might apply there. The data from Wales was gathered largely from Jonathan Reynolds, who is here. I think it would be better for him to comment on this population carrying capacity issue that you raise.

DR REYNOLDS: There are a number of interconnected issues here. First, let me deal with the reliability of

farmers' perceptions of how many foxes are killed on their reports of how many foxes are killed. In both the work done in Wiltshire and in the work that we did at the Game Conservancy Trust, Matthew Heydon and myself, we found over-reporting of the hunt culls by farmers. It seems to be intrinsic to the nature of reporting culls and I think there is experience from many other species too that if you just ask people how many animals they cull, you get an inflated figure. I think that is inevitable.

The second thing is to do with how that reported cull might be compared with the population that is there at all, and I would thoroughly endorse Stephen's point that we have rather imprecise figures about how many foxes there are in different parts of Britain and, therefore, by implication how many foxes there are in the whole of Britain.

However, there are three regions in which we worked intensively where we have much more precise estimates of numbers of foxes present, partly by doing line-transect surveys with a methodology known as distance sampling which gives us a good handle on how to reconstruct the population from the transect survey data, but also this is backed up by two other sources of information. One is a survey of cubbing earths and the other was an index of fox abundance from gamekeeper observations.

So we have quite good data on fox abundance in three regions. We did not want to fall into the trap of simply comparing over-reported culls with good estimates

of fox abundance. So what we did in order to assess the status of the fox populations in those regions was to look at their productivity, their reproductive success. Now, it is a widely held paradigm amongst fox biologists that reproductive success is related to the density of the population relative to its resources. So crowded population, lower reproductive success; and a less crowded population, higher reproductive success. What I am going to say is a relative measure between the three regions that we studied. We are not talking about absolute measure, but in relative terms, the Midlands area that we studied showed heavy suppression of reproduction in the population to the extent that about 20 per cent of vixens did not even produce any cubs at all, but the mean litter size was also reduced there.

By contrast the mid-Wales and the west Norfolk areas had no evidence of reproductive suppression at all. We interpreted that as meaning that the population itself was not close to carrying capacity because if it were we would expect to see reproductive suppression. The fact that the reported cull was very high in those two regions and relatively low or moderate in the Midlands region also led us to postulate that the cull was the thing that was responsible for this population suppression.

DR LINDLEY: If I could, I do think, although there is a slight risk of labouring the point, this question of unreliability of evidence and lack of knowledge is really crucial to a lot of these discussions. Just to

emphasise the point, the study that Jonathan Reynolds is talking about, the estimates of game bags in one region at the higher end of the estimates, went up to something like, am I right, 540 per cent of the annual production, which is clearly absurd? Unless there is an astonishing level of immigration. Elsewhere I think in both studies the authors have been able to compare estimates from farmers and landowners and gamekeepers of population numbers, estimates of cull levels, etc. with more objective data gathered in other means. By my reading of the reports, the estimates there are exaggerations of between 5 and 18 times, depending on which study has been looked at. So I do think it is important that everyone is aware that the reporting by -- well, by everyone who has been asked to provide information, is no more than people's opinions and has to be treated as such. It is unreliable. Which brings me to the other point I just wanted to put into the arena. We discussed briefly before lunch the main anthropogenic mortality levels and I just wondered whether it would help if around the table it is possible to get any kind of more accurate handle on what those levels might be, because on the whole neither of the reports addressed that in any detail. I notice that Professor Macdonald's paper made reference to some RSPCA information from wildlife hospitals but dismissed it on the grounds it might come from urban areas and so should not be considered further.

I just wonder whether it would be helpful to try and get other people's views on what the likely levels

of non-cull, if you like, mortalities are going to be in fox populations, so that we can begin to have a feel for whether that is having as much of an effect or more of an effect than various forms of culling activity.

Just from my own figures, just to put on the table, the RSPCA runs wildlife hospitals which receive casualties of all sorts. Of the foxes, of the adult foxes taken in, between 25 per cent and 35 per cent are known road traffic accident victims, and a further 25 to 40 per cent -- these ranges are between hospitals -- 25 to 40 per cent were classified as injured but cause unknown, but certainly not shot.

I think there is an indication there at least of casualty foxes of a very large proportion suffering, certainly anthropogenic but non-targeted, non-culled related injury, which may have resulted in deer having to be taken for treatment.

I do not know whether Professor Harris would want to refer to a study which his team did some years ago on rehabilitated foxes, foxes taken in for care and treatment and then released. Obviously not necessarily completely representative, but I think that study found that something like 55 per cent of foxes that were released back into the wild suffered death from road traffic accidents.

So, to my mind, clearly, these non-cull mortalities are a very significant proportion of the population and I think it might be helpful to get some kind of view of how that relates to culling activities of various sorts.

THE CHAIRMAN: Could I ask a supplementary, very much on the same lines. And it may be that I am trying to be more specific than we possibly can be. We have heard that there is a stable population of about 240,000. There is then a number that die each year, about 400,000 to 500,000. We can then split that in four parts: one is vehicles; second is natural causes; third is shooting and the fourth is all manner of deaths in association with dogs.

Is there any consensus about any of those figures, other than the 240,000?

PROFESSOR HARRIS: Should I try and answer? I think the simple answer is frankly "no". As stated the earlier figures based on the studies we have done in Bristol which, again, is not prime fox hunting country, but I think it has some relevance in that we could at least have a very clear handle on the population, something like 25 per cent of our foxes who die each year were dying from what I would loosely call misadventure, injuries, to gathering day-to-day life, disease. Quite a lot were dying in fights between foxes; a whole variety of factors, which I am sure are replicated in the rural environment, people cannot monitor the population as close as we did that in population in Bristol. So I guess it is probably quite high, and I will get the exact figure for you.

Beyond that there is an estimate based on some quite reasonable samples of known road mortality of 100,000 foxes bowled over on the roads each year and I guess it is probably in that order of magnitude. I would

not go much further than that. Beyond that you can start speculating. 14,000 killed by packs of hounds last year, and that is the last figure I can even try and put a number on, frankly. Beyond that the numbers shot, particular numbers taken by lurchers, by poaching, the numbers taken by terriers are particularly problematic because there are just so many people out wandering around with two or three dogs randomly hunting foxes, no permission, no right of access to the wider countryside. I think the numbers are entirely speculative.

I go back to the point we would not like to lay our life on the line; it is 240,000 plus 425,000 cubs a year. In a year or two we might do that, but beyond that I think you are asking a lot in trying to get those figures. We can give you a ballpark figure, but I would not base too much credence on it.

If I could come back to my other point that Jonathan made in relation to his study. He said there is a widely accepted paradigm in relation to density and productivity and numbers. I am not sure I believe that paradigm and we have been in a position in Bristol where our population crashed with 33 adults per square kilometre to currently under 2 adults per square kilometre. That is a fairly massive population change in the same habitat, but at the same time the proportion of vixens breeding each year has stayed the same, the number of cubs they are producing has stayed the same. You cannot automatically expect you are going to see these differences the paradigm predicts. You can look at animals who seem to be in the populations producing a

lot of cubs in the high reproductive output they can still be very close to rhythmical culling capacity if there is such thing, it is a very complex issue.

PROFESSOR MACDONALD: I think this section of the conversation illustrates that the answer to your question is no, that we do not have the data to provide specific answers exactly as Stephen says.

LORD SOULSBY: Can I just take up the question of migration of foxes. One area that has received no attention whatsoever is the urban fox, and it may be that that is not part of the total equation, but is there any movement between the urban fox population and the rural fox population, in either direction, and could this be a factor in the immigration and the invasion of the territory that may be depleted by hunting from urban foxes? That is the first question.

The second question is when we have been going around we have met anecdotal comments -- only anecdotal -- that urban foxes have been dumped in rural areas because they have been collected by the dog catchers, the vermin catchers. That may not be true, but I just wonder if you would like to comment on the immigration.

PROFESSOR HARRIS: I will deal with that because I have the data. Well, the question was basically: is there movement in and out of the city? And, yes, there is a low level of movement. If we take the large number of foxes in Bristol and, yes, we had some born in the centre of the city that dispersed out of the city 20 kilometres and then spent the rest of their lives living as adults in the top of the Mendip hills. That

is a pretty dramatic change in habitat in that dispersal period and dispersal is a very swift process.

Really the movement in and out was surprisingly small. I think, if I have the figure right from memory, it was a few years ago we published it, there was only a 6 per cent movement out and we have estimated roughly the same movement in. It was a very small movement and around the edges of the town and very foxes. Frankly, the distance they moved, they were not moving far enough to get into hunting country and we had to cut all the hunts around Bristol trying to get tagged foxes. I do not think a hunt ever returned the tag to us and we tagged 2.5 thousand foxes. I think the movement out of the urban area into hunting country is virtually non-existent.

As for the old myth about people catching foxes in urban areas and raising them in the countryside, I have heard these people driving out with vans full of them, I wish I could catch vans full of foxes, it is not that easy. Where do you keep them when you have these van loads of foxes? I am afraid it is a myth, I think the RSPCA still has a reward out for anyone who can prove any evidence of this ever happening.

Back in the early 1970s when I worked in London, it was then the practice of some of the local authorities to catch foxes in cave traps and take them out, release them in the countryside rather than to shoot them because they did not have a gun. Now I do not think even they do that and I think if any release is done it is the odd animal.

DR REYNOLDS: About ten days ago I met a young chap from Switzerland who had just completed a PhD study on urban foxes in Geneva. Basically they were looking at genetic differences between the urban population and the rural population and came to the conclusion that there is almost no interchange between them. In fact there are two sub-populations in Geneva separated by a river and the next nearest related population is in another town about 40 kilometres away. So, although there may be movement of individuals from one habitat to the others, as Stephen has described, it probably has no lasting impact and that is perhaps understandable if you think about the extremely different selective environments that exist within an urban area and outside. If you are afraid of man in an urban area, you are not going to get anything to eat, whereas in a rural area if you are not afraid of man, you are probably going to get killed, so I think there is very little voluntary exchange of blood, if you like, between rural and urban areas. The other thing concerns the dumping of foxes. We do have some handle on the total number of foxes handled by wildlife hospitals in the course of a year and it amounts to some few thousand. Now, if all of those were dumped in the countryside it would have a really trivial impact on the total population in the countryside. However, if those few thousand were dumped on one estate of course it would be rather a headache for the gamekeeper or whoever was living there, but in national terms it is not a big deal.

PROFESSOR HARRIS: Would you mind if I come back, because I

do not think Geneva foxes have much relevance to what I know of British foxes, we have had ours -- the city of Bristol have been quite happy living out on the Mendips for a number of years and breeding before they get killed, so certainly I would just say that that is the evidence from Britain and I would stay with it.

MR HART: I just want to come back to the comments about incomplete data on mortality of foxes just really to add another factor which will further muddy the waters. That is, of course, a substantial proportion of foxes that are either injured as a result of shooting or injured as a result of road traffic accidents, are either tracked and dispatched by the person who shot them or, indeed, by hunts or keepers in that vicinity who find them, locate them, either underground or above ground, and deal with them accordingly.

Perhaps one of the reasons why there are not too many of these foxes appearing in wildlife hospitals is that is a route which is taken by people who actually live out there and deal with the problem as and when they find it.

MR OLIVER-BELLASIS: Lord Burns, could I come back to the subject of urban foxes because in 1997 the NFU conducted a survey of a large number of their members because we were keen to establish what was happening in a range of pest species and certainly the perception was -- and I stress the word "perception" which has been used a number of times this morning -- was that foxes were coming out of big urban conurbations and foraging on farms which were next door to those conurbations. I actually live in that situation, and because we

control foxes for conservation reasons for wild game,
I can state categorically that they do come out and they
do get killed.

PROFESSOR MACDONALD: Perhaps this one has been exhausted, but
I think often today, in this debate, we find ourselves
dealing with things that at first seem contradictory but
are actually simultaneously true, and this is one of
those many things. It depends again on the scale at
which you look at the issue -- at least that is how.

I understand the answers that colleagues around
the table have been giving. I have personal experience,
as does Stephen and I think others, in radio tracking
individual foxes and can say that I have known
individuals -- in fact whole communities of
individuals -- who have behaved in the way that you are
describing, often at the interface between the suburban
environment and the rural environment, which is actually
a very happy interface for foxes. It is a habitat that
suits them well, at least judged in terms of their
population densities, so I do not think anybody is
arguing that individual foxes may have territories that
span that interface and may on a day-to-day basis find
themselves moving from a piece of habitat which is
suburban or urban into a piece of habitat which is in
itself rural although juxtaposed close to a town.

The other issue though is on a different scale and
that is whether there is large-scale movements, which
I think is behind your question, between urban and rural
circumstances and actually I felt that although it is
slightly misunderstanding, perhaps, in the answers, that

Stephen's answer and Jonathan's were trying to make the same point, namely that while individuals may come and go on some basis, making excursions from one habitat to the next, broadly speaking there is not a huge flux of urban foxes into the countryside or vice versa.

I think, Stephen, is that your point as well? I know it is the one Jonathan was trying to make too, so actually it is purely a matter of scale.

THE CHAIRMAN: I think we probably should move on. It has been my experience since I have been reviewing the subject over the last six months that most people wish to talk to me about urban foxes. I keep saying that we are dealing with the issue of hunting with dogs and how does this impinge on the issue of urban foxes?

I suppose, given that there is not any hunting in urban areas, it is the other direction that maybe might have some relevance, if there was a notion that there was going to be more foxes in the countryside then even more may start coming into towns. It is a terribly interesting issue, but I think we have gone as far on this as is relevant to this study, or to our inquiry, unless you can advise me differently.

PROFESSOR HARRIS: Perhaps I can say there is actually some hunting with dogs in urban areas. We have problems with people running lurchers at foxes on open playing fields in city and terriers are used in some parts of cities and moderately commonly, so hunting with dogs does occur in urban areas, but clearly it is not the bulk of your remit.

THE CHAIRMAN: Shall we move on to the next subheading we have about the reasons for population management. And maybe, Simon, you would like to restate your question again?

MR HART: Thank you, Lord Burns. It was purely really to inject a slightly practical comment into the debate, which was that the only people who appear in a perfect position to judge what is an acceptable population level of foxes, whatever that might be, are the people upon whose land or within whose control they actually live; by that I mean landholders or keepers, or in some cases both. It would, therefore, to me seem to be a dangerous road to go down to suggest that there is an optimum level or a maximum or minimum level which is deemed acceptable. That level has to be deemed acceptable by the people who actually have to derive some form of livelihood or living from the land.

One farmer on one side of the road may have a completely different view than that which lives the other and the consequence of this is that fox control, in its various forms and its various legal forms, can be tailored to suit the individual requirements, parish by parish, farm by farm, to some extent, even field by field. What I am suggesting is that whilst we are talking very much of the scientific analysis of fox populations, it actually is what happens practically out there which is what is important. What people actually believe to be the case, what they perceive to be the dangers and what they ultimately deem to be the acceptable population level.

Now, I am not commenting about whether their judgement is necessarily right. I am simply saying that in the absence of any conclusive evidence that they are wrong, and I have not heard much of that so far, then I think these are questions which need to be addressed and hopefully by both contractors.

PROFESSOR HARRIS: Perhaps I could start, Lord Burns. I have to say I do not disagree with a word you have said, Simon. I think it is entirely up to people to decide what foxes they want on their land and manage them with the numbers they find acceptable. That is entirely up to them and that actually has many advantages; you have a variety of fox densities in different pieces of land. I do not see any problem with that. I think the problems are that obviously if you are trying to manage a piece of land in isolation, then you are going to have a lot of problems with immigration from other areas where they are not managed to the same level and that is just the point David and I made in our submissions.

I think also it is difficult to actually then determine why people -- the problem we had, I think, in trying to draw our reports together, if I read what David said correctly, is that we just have trouble understanding why people chose to decide that they wanted this number of foxes or that number of foxes, but, yes, there is no problem with people managing the numbers they perceive they want. It might be nice if we had some way of actually trying to understand what they were trying to achieve and then we could see whether they are actually achieving it, but that is a problem we

just could not find a way to do that.

MR HART: In which case you do agree with what I was saying, because the point I made was it was the individual landholder who had to decide and was the best person qualified to make that judgement, which from what you have said --

THE CHAIRMAN: I understood Stephen to say he did agree with you.

MR HART: I thought he said "did not".

THE CHAIRMAN: He did.

MR HART: I beg your pardon, from where I was it sounded like "did not".

THE CHAIRMAN: It may be very unusual for people to agree with you!

MR HART: It is the first time for some time, I have to say.

PROFESSOR MACDONALD: I actually also do not dissent from anything that has been said, except that I would say we were given a rather clear brief by the Committee and it was, as I understood it, to report on entirely scientific aspects, as far as we could discipline ourselves to do so, and there are elements of the question you raised which would go beyond the remit we were trying to address. I am, first of all, keen not to be lured off what was our remit, but not necessarily the entire remit of the Committee. But I would take you up on just one phrase you used -- it is always awkward when people catch a couple of words -- but you said: farmers were perfectly positioned to make these judgements, and insofar as that phrase captures the thought, that of

course is the farmer's property and the farmer has, I think, the great wisdom from a professional, it brings him or her into contact with the countryside. Nobody could dissent from the view the farmer is, as you said, perfectly positioned to make judgements.

However, I would say that there are things we are talking about today which turn out not to be very easy to measure, and wildlife biologists, also with some training and some experience, struggle for a lifetime to measure really rather simple things, apparently rather simple things that have been relevant to this conversation, and find it difficult to do so, so the farmer may be well-positioned to see and form opinions about many things, but a lot of the stuff we are debating about cannot easily be assessed by the farmer nor, indeed, anybody else.

As a point of evidence in favour of that view, which is in no sense demeaning or diminishing the farmer's insights, is to say that in the early 1970s when both Stephen and myself started our careers, much of the accepted literature on the creatures we are talking about today, and particularly foxes, described an animal that appears to behave quite differently to one that science has now revealed to be the reality. There are many aspects of fox behaviour that were not apparent to any community previously until new technology and new ideas came on stream, so I just want to make it clear that I do not want to dismiss rural insight, but there is a lot that science has to contribute to the understanding of these creatures.

DR LINDLEY: Thank you, Chairman. I wanted to make something of the same point David has just made. To suggest that a particular individual or a group of individuals is perfectly positioned to make decisions about levels of acceptability for their populations or whatever, presupposes that that individual, or group of individuals, has, if they are perfectly positioned, perfect knowledge of population levels, of the impact of those populations on their financial interests, on the likely effect of particular culling activities on those population levels. I think the one thing that it seems we have established today is that farmers and landowners, no more than anyone else, is anything like perfectly positioned to make those judgements. It is quite apparent, I think, that many of the estimates made by the farming community of all those factors are significantly off the truth.

DR REYNOLDS: I think it is almost self-evident that the farmer has very little handle on the fox population which is either on his land or on the surrounding land and, given the caveats that David has been making about how difficult it is for even biologists to determine these numbers, I think that is bound to be true. However, it is also the case that if you have a lot of people individually culling foxes on one piece of ground -- sorry, on their own patch of ground -- then together those will add up to a regional cull. There is no escaping this. They are a part of the total mortality of the fox population in that region, and if there are enough of them, as we found in mid-Wales and in

west-Norfolk, then that total cull can be very substantial, probably the most substantial cause of mortality in the fox population in those regions.

As Stephen already mentioned, the task that faces somebody doing local control on an individual estate, is quite a major task if the background fox population

is very big because of immigration. You have seen earlier when David made his initial presentation the task that faced a gamekeeper in South-east England when he had a terrific influx of foxes from the surrounding areas. Now his task would have been a lot easier had he been in west Norfolk where there is a very high density of gamekeepers and where the fox population as a consequence is very low.

I am not saying that this is therefore a desirable system to have in the whole of the UK. What I am saying is that if you want to understand the position of the individual landowner and why he makes the decisions that he does, then you have to understand that there is a very long history of fox culling in each of these regions and it is peculiar to each region. So the landowner faced with his aims of wishing to conserve game or wishing to protect his livestock, or whatever, makes his decisions based to a large extent on cultural inheritance - I think we should really describe it in those terms. He is not making his decisions based on his current or even his recent experience. He is making his decisions based on perhaps a lifetime or several generations of experience. I am not saying, again, whether he is right or wrong; that is the way the world is operating at the moment.

THE CHAIRMAN: To a degree that would explain this phrase about people saying that there are just too many foxes, which is one of the replies that you get in your surveys.

DR REYNOLDS: Perhaps it is also the occasion to raise that, because another thing you must bear in mind historically is that man has had a lot of influences on the fox population in this country, starting with the creation of suitable habitat from an originally forested island and ending up with the introduction of a number of very significant prey species, like the hare back in the Iron Ages and the rabbit more recently, and the pheasant of course -- one must not forget that -- released in huge numbers around the country and it is a substantial source of food for foxes.

So the ultimate carrying capacity, if we can use that term for convenience, for the whole country is going to be pretty big and it may be a level which we have never yet seen, which is unprecedented. We just have no concept of where a fox population could end up if you took off all the constraints.

Can I just add to that, that the desirability of that level, whatever it might be, is something we must also consider, not just from the point of view of each landowner, but also from the point of view of the native wildlife which has been here all along, because the rate of predation by foxes on some minor prey species -- like, for instance, avocets, or terns, or whatever -- is not going to be related to the density of those species specifically; it is going to be related to the

density of much more common prey species like rabbits.

THE CHAIRMAN: You were looking like you might want to say something, Stephen?

PROFESSOR HARRIS: I think that is largely the position we have come to and I think the cultural inheritance is the problem with fox culling at the moment. People cull foxes -- and this was the problem we had, we tried produce our understanding of why people cull foxes and the benefits of culling foxes. They are free to do it and that is the position but we have no understanding of why they do it, what they are hoping to achieve and it is the fact that it is a cultural inheritance they are acting under, rather than perhaps moving towards a point where we understand the costs and benefits of culling foxes?

MR OLIVER-BELLASIS: Lord Burns, whether we, as farmers, are perfectly positioned, or whether it is cultural inheritance I am not quite sure, but I think I must point out that farmers make local decisions on their farms when they perceive a threat, and they relate their position to their stock to the threat, which may be a fox, and they, under those circumstances, make a decision whether to kill a fox or not.

I think we must be very clear that this happens on lots and lots of holdings all the way round the country. There are 80,000 working farmers, covering over 70 per cent of the United Kingdom land mass, and there are pockets exclusive to Wales and the uplands where there are sheep which are under threat, or piglets which are under threat, or poultry, and the farmer under those

circumstances sees the fox as a threat and deals with it on an opportunistic basis, which is the basis upon which the fox attacks his stock. He sees it as a financial threat and therefore deals with it. But it is local, it is human and it is natural forces.

THE CHAIRMAN: We need to come, I think, to the end of this section quite soon. Normally in conversations on this subject, one would be having more interchange about particular issues about predation on lambs, on pigs, on game, et cetera. Does anyone want to question any of the views that have been put to us about the significance of that? We seem to be moving to a position which says that some of these other non-measurable factors seem, in many cases, to have more significance than do the particular economics of predation of particular farm or game animals.

Before moving off this topic, I would like just to be sure that people have said what they wanted to say on those issues as well.

MR OLIVER-BELLASIS: Lord Burns, could I make one very quick point on the economics? The percentage has been raised by Professor Macdonald of 0.6 of numbers of lambs that are killed. In a sense, to me as a stock farmer, that is the percentage of failure. I think we have to recognise that if I allow one of my lambs to be taken by a fox I fail. I have to raise the question what would have happened if I had not have made the effort to kill foxes in relation to the remaining lambs, the remaining piglets, or the remaining poultry. In a sense that too is very difficult to judge, but I think one has to raise it,

particularly since the loss of a lamb in today's circumstances is a serious issue.

MR SWANN: Sorry, Chairman, I just went slightly off-track there.

The data that we had presented to us this morning, I am still trying to get my head round, and I am not going to waste your time in this Committee, but I feel that the estimates are too high. I think that they are based on farmers' perceptions I think we will have to talk about this, but I think what you are actually saying is that the figures are as high as 10 per cent of lamb losses, and I think that would be far, far too high.

THE CHAIRMAN: No, absolutely not.

MR SWANN: I am not sure if that is what you said this morning. We have been trying to get our heads round this and we cannot work out your figures.

PROFESSOR MACDONALD: It would be helpful if I said that we are talking about 0.6 per cent which is six lambs in 1,000.

Does that put it in a way that is helpful?

MR SWANN: That is of all lambs or of lambs --

PROFESSOR MACDONALD: Pre-weaning mortality and the estimate of farmers in one hunting country in Wales.

MR SWANN: Thank you, that does clarify it. I am sorry to bring that up, it is a crucial point and I just, this morning, thought there was some confusion about it.

I would like to just make another quick point on culture. I think this has been covered by others and we have made this point previously in the oral submissions, in that there is undoubtedly a culture among farmers about wanting to kill foxes, and particularly in the

upland areas, and because they think that they do kill lambs -- and I do not think anybody has ever denied this cultural aspect of it and this needs keeping in perspective, because I think it is primarily a cultural point. I do not think it is, in any way, an actual definite point in terms of lamb predation.

Arthur is desperate to speak.

DR LINDLEY: Thank you. It was really in response particularly to the point that Mr Oliver-Bellasis just made. Clearly a farmer perceives a loss if he loses a lamb, but I see, for example, there is a section in David Macdonald's paper which addresses the cost of culling in Wales -- specifically in mid-Wales -- whereas I understand the figures here it comes out quite clearly, the cost of culling as undertaken in mid-Wales, more or less exactly matches the cost of the perceived losses of lambs to foxes. So there is no net benefit to the farmer in engaging in those practices.

PROFESSOR MACDONALD: Maybe I could just clarify that and if we need to go into greater depth, I will pass to Jonathan, but I suspect we may not need to go into greater depth. First of all, I think that Hugh raises a very interesting point and that is that many of the measures that are currently taken of all sorts of things we have discussed today, are taken under the current situation, the current circumstances. So, for example, the loss of lambs perceived by farmers in this now much talked about area of Wales, is under circumstances where they have pulled out all the stops already to do what they can to kill foxes. So you quite rightly phrased the question:

"What would happen if that level of culling were to change?"

That is precisely the sort of question which I believe can only be answered properly and technically by the sort of experiment I commended to you earlier on. Although many of the questions we are tackling today are probably not feasible, politically or logistically, in terms of experimentation, the lamb loss is one I believe is. So if we wanted to know what would happen if there were no fox control in that area, or half the amount, or twice the amount, we could actually find out by experiment. But until we do find out we maybe are not going to benefit greatly from pursuing the detail in terms of minutiae, other than to say that Arthur is also right that in our calculation we looked at very loosely estimated costs to the -- and the basis of that calculation is set out in our report, if you want to look at the detail -- of killing the foxes in question in this area in mid-Wales and the value of the lambs lost, as based on the farmers' judgements of how many lambs they lost and they more or less balanced as things are.

We then went on, as Hugh had in mind, to ask the question of what would happen if the fox killing finished, and we took as an opening gambit an exploration which said, "Let us imagine the fox numbers double and if they do, then the cost benefit analysis -- not surprisingly -- shifts in favour of the farmer's position".

Since we do not know what would happen and nobody

has done the experiment, other than illustrating to you the principle, I am not sure that it is very helpful to your Committee for us to go a lot further into the detail.

THE CHAIRMAN: Could I have two supplementaries on that. One we heard when we were in Wales, again this famous part of the country, where it was suggested that part of the problem in terms of lambs was of twins. Is this an issue? It certainly was a point that came up several times.

The second point I just make by way of exploration on this issue of cost benefit analysis. It is, of course, the way that culling is currently organised, certainly in Wales. There is a recreational element to this, which is used to subsidise the cost to individual farmers. Therefore, when you are looking at it from the point of view of an individual farmer, the economics of this can look rather better than it does if you look at the total amount of resources that are put into it. Some people are willing to subsidise this because they actually want to do it.

PROFESSOR MACDONALD: Absolutely. I can make a quick comment on both of those points.

When you raise the issue -- it is a question really -- as to whether second lambs of twins are more susceptible to fox predation than others, that opens up a fascinating, but poorly studied, arena of debate of all the different aspects of sheep farming that may affect susceptibility to predation. And also opens up, by the way, a wider literature on carnivore behaviour

and how carnivores select their prey and the extent to which they select disadvantaged prey or whatever.

It is certainly the case that sheep breeds differ in relation to their tendency to twin. It is certainly the case that their maternal capacities differ, and if farmers take this sort of thing into account in choosing their stock and in shepherding -- we talked this morning about how many of the animals we consider have different jobs, as it were, different perceptions. I, for my part, have to confess to you I have a little sheep farm and I was lambing before I came here this morning. I can tell you of the four breeds of sheep I have. I doubt if any shepherds in the audience will dissent from this view: each has a different maternal behaviour and each has a different tendency to twin and so forth.

So these are all factors that are probably extremely relevant to this debate, but nobody to the best of my knowledge has explored these ethological, these behavioural issues, in the sort of depth that would allow you to put a great deal of flesh on these bones, other than to say: yes, twins are harder to defend, there is a singleton and on a hill farm twins are less likely to be viable than singletons anyway, depending on how hard the ground is.

You also make the point about the recreational element of this, which we were keen to, in a sense, keep out of our motivation for attempted population control because we saw it as a different kettle of fish. But, nonetheless, when we were exploring the cost benefit analysis to Midlands farmers of hunting, something we

did involve in that very tentative calculation was that to non-hunting farmers the loss of those foxes to the extent that it is a benefit is entirely free and paid for by the people who pay for the hunt. So you, I think, are quite right in picking up that asymmetry in the economics.

DR WHITE: Just to add a bit of hard information on the instance of twinning and likelihood of losses of lambs to foxes. A couple of studies that we have been involved with: one on a couple of farms in Scotland; one in the Penderland Hills in Mid-Lothian and one in Crianlarich; it was possible to actually follow flocks and lambs throughout their life history. There, we found that there was a correlation between likelihood of sheep losing lambs to foxes and the instance of twinning or multiple births.

However, it does appear to be quite common, as David alluded to, with different breeds having different maternal behaviour and that sort of thing, in that a wider survey of about 450 to 500 sheep farmers has actually shown that the instance of multiple births is not that strongly correlated with the incidence of loss. In other words, if we get multiple births it does not mean that you are more likely to lose your lambs. So it does appear, again, to be a question of scale. If you are looking at one particular flock, it might be the lambs which are going to be lost, the ones with multiple litters. But if you are looking across lots of different flocks, it might not be quite so obvious.

PROFESSOR HARRIS: One final point on sheep: there was a

question of whether we should do experiments on them. To some extent some of those experiments have already been done. Do not forget Ray Hewson back in the 70s and 80s looked at this problem in Scotland, and he compared lamb losses on two flocks on adjacent bits of land, one on an island without foxes, one on the adjacent mainland, the lamb losses were identical in both of them. Then he went up to Eriboll in the north of Scotland, actually did an operation where they stopped fox culling for three years and to lamb losses we could see no detectable impact.

So there are some data that have moved towards that experiment with (inaudible) already.

DR REYNOLDS: May I just say that the subject of Ray Hewson's study at Eriboll I think is going to be one of those areas where we have to agree to disagree, because I am afraid it is a seriously flawed piece of work -- and I say that with the greatest respect to Ray Houston who I know personally -- but as evidence that ceasing to cull foxes has no impact on lamb losses, I am afraid it is a very poor piece of evidence.

THE CHAIRMAN: I think I would rather not get into this debate, unless you really think there is going to be merit in it. It seems to me this should be sorted out outside of this seminar.

Could I move on to my third heading, which was "Effectiveness of Different Methods". Is there anything anyone wishes to say under this third heading, as far as foxes are concerned?

MR WISE: I think it is very important, Lord Burns, that there is a variety of methods available to control foxes

according to different times of year and different people's needs to control. There are very few legal methods left, if you discount live trapping, which is not really practical for anything other than the urban fox. One has snaring, shooting, or use of dogs in one way or another. Shooting tends to be most efficient if one is talking about shooting at night with rifles after harvest in sort of arable areas certainly -- I do not know about grassland areas. If you are concerned with controlling foxes by day with guns, one is going to be reliant on driving shotguns, and then you will inevitably need dogs to sweep up the wounded foxes that will be produced. So night shooting is not appropriate for most times of year and one is, therefore, only left with snaring, or hounds, or terrier work, or something, and terrier work is the only legal method to deal with the problems of cubs which may be often left to starve underground otherwise, unless dog work remains.

MR OLIVER-BELLASIS: Lord Burns, could I support that. I do think it is very necessary to understand that different circumstances that farmers find themselves in demand different solutions, as between the uplands and the lowlands, as between close to urban conurbations or footpaths, or whatever. I think it is very important that we do not fail to recognise or that we should recognise the need for a range of control methods. In a sense, the efficacy of those control methods is something that the farmer will judge in relation to his local circumstances and his knowledge of his own farm and the threat.

DR LINDLEY: Firstly, if I may, Lord Burns, just to follow on that, it seems to me a little disingenuous to argue that a landowner must have a range of methods available, regardless of the effectiveness or acceptability of those methods. I thought, at least, if nothing else, this seminar had established that hunting with dogs was an ineffective mechanism for culling foxes, if culling of foxes was seen to be necessary. So I cannot see really much of an advantage in landowners having access to a mechanism which is ineffective.

Could I raise two other points briefly on different issues within this arena. The first related to condition taste aversion work and other forms of non-lethal control. I am just interested to hear a little more about that, because it was my understanding both of the work that David McDonald and his team were doing and that the Game Conservancy were involved in, until recently that that was looking quite promising, and potentially quite a fruitful new method to explore. But all of a sudden it seems, though it does not seem to have much information to back that up, that it is now regarded as a bit of a no-hoper. I just wondered why there had been a switch in attitudes to that.

The other point, which is, again, completely different -- I am not sure whether it relates to this element of the discussion -- but, if we are looking at the impact of hunting and the impact of the potential of a hunting ban, I was slightly surprised that neither of the studies addressed the question of the direct physical impact of a hunt on conservation of species and

conservation of habitat. Although there was some information in the studies about the tendency of landowners to conserve habitat features if they did or did not support hunting, but neither addressed the potential impacts of trampling and of disturbance on particularly sensitive habitats, ground nesting species and the like.

I did note that in David Macdonald's study he mentioned that the RSPB does not allow hunting on its land, but did not explain why. I am aware that certainly a number, if not most of the County Wildlife Conservation Trusts, do not allow hunting on their land. In that case, from my own previous experience, I know that one of the principal reasons there is concern over disturbance of is damage to natural habitats. It seems to me that was a whole issue that had not really been addressed.

PROFESSOR MACDONALD: There has been a lot of, some big and some small, comments made there and I hope I can hold them all in my head. Going through them briefly, at some point early perhaps in your remarks there was mention about what is important to farmers in terms of taking decisions. It occurred to me that while we have spoken a lot about lambs, for which there are rather few data, that farmers are amongst people who wear several hats in this debate, and I suspect a lot of the motivation -- and Hugh will correct me if I am wrong -- from farmers being concerned to control foxes, is to do with game management, rather than agricultural stock.

It may be helpful for people to have in mind that

distinction which has not hitherto been emphasised.

Then another point about linguistics. We were talking about hunting with dogs, Arthur made a point, and I think it is generally unhelpful that we have fallen into using English in that way, because there is all sorts of different sorts dogs involved here, and many of the remarks that came out of Stephen's report and mine, I think I am right in saying, where we were using that number of 14,000, or whatever it is, killed a year by traditional hunting refers to hunting with hounds in the traditional mounted sense. When Hugh was talking about things open to farmers, I believe he had in mind a whole suite of things that included not just hounds, but a spaniel putting up a fox in front of a row of guns and things.

So the word "dog" covers such a miscellany of different things that we must be very careful there, and I sensed a confusion growing up amongst us.

Arthur asked about non-lethal control -- of which I personally am a huge fan -- whether non-lethal control is going to have advanced as far as we would all like by the end of May when you have to report is a different issue, but --

THE CHAIRMAN: I have a very lot to do.

PROFESSOR MACDONALD: -- at least in principle, I think it is morally, philosophically and, indeed, scientifically proper that people should be looking very, very hard indeed in all sorts of wildlife management arenas for novel ways of solving problems.

Remember all this should be aim driven -- there

should be an aim that people are trying to achieve, and if it is stopping a problem, then just killing the animal is a rather unimaginative sort of solution.

Arthur Lindley is right in saying that there is work going on of all sorts in this arena. In my own group we are working on condition taste aversion, as you say, both with foxes and with corvettes and we are working on repellents of all sorts. There is other work going on with regard to habitat restoration and Stephen was saying fencing -- other things that are to do with this whole basket of possibilities.

My own feeling, at the moment, is the repellents are looking rather good. The corvid work with condition taste aversion is also looking rather good. Jonathan recently has had some practical difficulties in the field which led to the remark in the report here that condition taste aversion with foxes was proving logistically awkward. Part of the reason for that, if I can stumble through this and Jonathan will then help me out, is that some of the compounds that might be used in this would require the PSD registration. It would be a difficult hurdle to get over, so there is logistical as well as technical issues.

While there may be advances at different speeds in different arenas here, I think Arthur is right to say that non-lethal control is a hopeful arena, but one which has not been anything like fully explored.

DR REYNOLDS: I would just like to briefly talk about CTA and then come back to the range of methods issue.

On the subject of CTA, disappointingly, the things

that made condition taste aversion ultimately look unpromising for use against foxes to control their predation on game birds, were exactly the same kind of issues that dog lethal control methods, issues of ethics and of non-target involvement and of logistics as well. Going back through those in reverse order, the logistical problem is it is simply extremely hard to target every fox in a population using baits.

Stephen Harris has had the same experience in Bristol. There is a proportion of foxes which never come and take the bait, so you must always reckon with having a proportion of uneducated foxes who continue to take game.

The ethical question is that the most promising, existing candidate chemical for engineering conditioned taste aversion in a wild animal, is actually an oral oestrogen and because of that, it has side effects. It is a strong chemical. One sniff of it would probably change me considerably! One has to be very careful handling it. It comes under Pesticides Safety Directorate jurisdiction and they made it clear to us that no way would they ever countenance licensing this chemical for widespread environmental use. We were examining it as a model system only.

The last thing is non-target involvement.

Whatever we did out there in the field -- this was not just a logistical problem of research; this is a serious logistical problem of applying this method, or this proposed method in the field. Whatever we did, we involved badgers, we could not exclude them from our

work, and so they too -- well, arguably if they involved themselves -- are a partridge predator and, therefore, should perhaps be addressed. But the fact is, they are heavily protected by legislation and it would be deemed unethical, I think, in most circumstances to include them in the population of animals addressed.

The other issue is the range of methods and I think it is quite significant to note here that there is a general agreement around the table here, that shooting is a jolly effective and jolly humane method of despatching foxes and other animals. But the people who practice shooting with a rifle most in this country are professional gamekeepers, and amongst professional gamekeepers it is not the case that every fox is killed using a rifle and a spot lamp, or even just using a rifle. In fact, only about 50 per cent are killed using a rifle, 25 per cent with snares, and a further 25 per cent or so is actually taken at the earth, at the culling earth. We therefore do not know by what method it is taken; it could be partially using shotguns, partially using rifles, partially using terriers. At any rate, at a minimum estimate something like 30 per cent of gamekeepers' cull is taken using methods other than the single most acceptable method.

THE CHAIRMAN: I know that Simon wanted to speak, but I have a supplementary on that.

One of the issues we clearly have to address is that if there was to be a ban on hunting, what are the methods that people would actually use in order to manage the problem. Then we have to assess whether they are better or worse than hunting. It

is not a question of saying what method they should use; we have to ask ourselves in part, what is the method that is going to be used?

The comments you have just been making have some relevance to that question. But I would like to ask others if they would also address that question. It takes us on to the issue of not only the effectiveness that we would choose if we were looking at this in an academic way and saying what is the best way of dealing with foxes that have to be culled, but what we believe would be the consequences of it in terms of the methods that would be used.

Then I think we must try to move to wrap this up and move on to the next.

MR HART: Could I come back to a comment made about the effectiveness or otherwise of hunting with hounds? It was suggested on my left that we were all agreed that hunting was an ineffective method of control and I want to come back to that, because it was mentioned this morning.

First of all, clearly within the agricultural industry there is not necessarily an agreement with that statement. It may be statistically the case here, but it is certainly not the case if you see the evidence which has been submitted to the Inquiry from the major land use bodies.

We never really covered, I do not think, in sufficient detail on that particular point, targeted control which can be afforded by hunts, can be afforded by lamping, can be afforded by terrier work, can be

afforded by shooting in connection with those particular specialities, nor does it really address the regular nature of hunting over a particular area of land properly conducted over a period of time, i.e. the season, its consistency, its ability to increase or decrease its intensity according to landowners' particular wishes or particular fox populations or trends, and it does not really address the fact that this form of fox control is relatively evenly spread over the whole sort of land mass of the UK. It did not really, as far as I understand, address the dispersal qualities that hunting can or cannot afford. We touched on it with Professor Macdonald, but I do not think we ever came to a particular conclusion.

I think one thing, Chairman, that you mentioned -- of course we have not really addressed either -- the fact that in the absence, take that particular aspect of fox control out of the equation, and you automatically increase the likelihood of pressure on the other remaining methods of control to replace it. As yet, I have not heard anything which -- I think this is what Lord Burns has said -- actually indicates which of the three remaining methods would be the preferred choice and the welfare implications that that might actually throw up.

The other point is this. That is all of the figures we talked about; predation, and the debated figures which we talked about, almost all, and I think almost without exception, and even in the case of Hewson in Eriboll, all of those figures must be taken in

the context of the fact that the existing methods of control were practised, either in that region, or in the very close proximity of that region, which may have affected the results.

So my point, basically, is that we have still not, I do not think, satisfied the question of whether we are moving from a position where we vaguely know what is going on to one where we almost certainly do not know what is going to happen.

PROFESSOR HARRIS: Perhaps I could just come back to that point and also perhaps the first point that was made. Looking at the claim that there needs to be a plethora of control techniques available to the landowner, I think in the table you have, because I gave a copy of it to Brian, you will actually see, if you look at the one: "Culling tends to be our regional method", there is very heavily reliance on one or two methods.

Okay, farmers, landowners, gamekeepers can at the moment take X per cent of their foxes by a means other than shooting, but it does not mean they have to use those means if those means are not available to them. It does not mean so far -- and you can see no data that can convince us -- that that would cause them any problems in actually trying to achieve their management goals if they did not have those techniques available to them.

I think that is also reflected in the further table we gave you later on, which was simply the one type of procedure change in the levels of control. Most

practitioners said if they were not allowed to use dogs; that included both terriers and hunting with hounds, for fox control, would they include shooting, snaring, trapping and so on? Naturally, most of them said they probably would not. Their perception at the moment is they do not actually need those techniques available to them; that is what the survey seemed to show.

PROFESSOR MACDONALD: Taking Simon's points, to repeat the thought that what we in our reports have been trying to do is to evaluate the scientific evidence. I would just like to draw a rather frustrating circle around what we are capable of, because we cannot produce scientifically evidence that does not exist. That really is the nub of your point, so I can only agree with you that it is a pity there is no evidence, but it means we cannot say a hell of a lot about it.

As I mentioned earlier, that I believe that applies, unless somebody can help us out by providing the data in any systematic way to studying the effect of targeted hunting, for example on-call lambing and so forth. I guess we have all watched that; I certainly have quite often, but that does not enable me to form a view scientifically and so no evidence.

Similarly, about the consequences of the ban.

There are various questionnaires we have heard about and some of them differ in their conclusion, as to what sort of actions, if any, people would take if there was a ban. These are what people say they would do, but since it has not happened yet, we cannot tell you what they really would do and we raised the technical issue,

I think it is an important technical issue, that we are unable, at the moment -- it was one of our important missing understandings in the first part of my talk -- to talk about the compensatory relationship insofar as it exists between all sorts of different types of fox mortality. We just do not know and therefore we cannot come up with, frustrating though it may be, a technical answer to your question. I guess you can assume one of two things will happen, both of which split in half: either people will increase their onslaught on foxes or they will not and if they do either, they will do so using existing methods in the same proportion that they always have, or they will not.

THE CHAIRMAN: I am not sure that I could use that as a final paragraph.

PROFESSOR MACDONALD: Just trying to be helpful.

MR OLIVER-BELLASIS: John I think was before me, Lord Burns.

MR SWIFT: I think I would like to come back on the principle that there should be a range of different techniques available and decisions on those different techniques should be made at the local level, or that the decision should be made at the local level. I think I would encourage people not to have a problem with that principle and to accept what Professor Macdonald said. If I got it right, it was that contradictory things may be said and they may be simultaneously true, to paraphrase what he said, because although the gross figures may indicate that hunting has a relatively low cull, in fact in certain circumstances it may be highly appropriate, and if you look at the diverse nature of landscaping and

social situations that apply, then techniques which would be inappropriate in certain circumstances become appropriate, and those decisions need to be taken locally and with all the different options available. I think that if we are looking at the future and what might happen, would there be additional fox control activity if there were a ban? Perhaps there is an assumption that there would be additional control. There may well, I would ask this panel about it, are there circumstances where the hunts have reduced their activity for one reason or another? Has that resulted -- there must be circumstances where that has happened locally -- and has there been an outcry in those areas because of additional fox control activity which has affected the public conscience and, if so, I have not heard about it.

I think once you start to speculate in this area, you have to look at the forms of control which take place on certain types of land and would it be the land in relation to game managed areas, or not game managed areas, to try and assess what would happen. In game managed areas, for example, you would have professional and competent gamekeepers to have access to section one firearms, and in non-game managed areas you would tend not to, but as soon as we get into this area we are into the realms of fantasy and speculation and I think that it is likely to be rather unproductive.

The important thing that I was saying yesterday is that we should have high standards of practice and that we should be disseminating those and promoting them

publicly by every means, so that whatever option, whatever the future holds for store, we put ourselves in the best place to address it.

THE CHAIRMAN: Thank you very much. We are planning to have a short break at 3.00 pm for a cup of tea. I would like to move on to the next topic, unless that is going to create umbrage and to start this section about hares.

MR OLIVER-BELLASIS: I am happy to move on.

THE CHAIRMAN: Okay. I think we have had a good discussion and I think we have covered a lot. We have covered most of the topics we wanted to. I think some of them have been general points which actually apply to some of the other species as well.

I think we must go through them. I would like to, just before we break, begin to deal with the first heading: population, as far as hares are concerned. That takes us, in fact, really to this morning's discussion where there seems to be much greater disagreement about the whole question of hare population and modelling than with regard to foxes. Or have I got that wrong?

If I can be more specific: I am still trying to get a feel of the extent to which there are differences of views. Are those differences of views wider when it comes to the question of the hare population and its behaviour et cetera than there is with regard to the fox population? Or are you going to tell me you do not know much about any of them?

PROFESSOR MACDONALD: Probably. Let me try to summarise my take on our discussion this morning. Between us, between the two

teams, we produced two completely different sorts of model and therefore, as Mark Shirley was explaining this morning, some of the sorts of conclusions we could draw from them were rather different. That is no source of awkwardness or embarrassment or rightness or wrongness between us, it is just a different scale of resolution, a different approach, so I do not think there is any issue to be further explored there.

Also this morning we were talking about interpretation of the mechanisms involved in the work that has come from Stephen's study area in East Anglia. Jonathan and Stephen had different interpretations. That is also scientifically not a particularly surprising state of affairs, and nor do I think it has great ramifications for our conclusions in this report from either of us about the impact of hunting with dogs which, so far as I recall, were rather similar between the two reports. So it seems to me that while you are right that there may be a topic for scientific debate about the mechanisms involved in attempting one study, I do not think there is a great issue in terms of our respective conclusions in terms of the impact of hunting with dogs on hares.

Jonathan, do you want to?

DR REYNOLDS: I think it is only fair to mention there has been a fairly longstanding difference in interpretation about the trends in hares during the last few decades. That difference has been, on the one hand, Professor Harris suggesting that there has been a significant decline in recent years and, on the other hand, my boss,

Dr Stephen Tapper, suggesting that although there was a significant decline in the early 1970s and perhaps through to the 1980s, due to the intensification of farming, currently hare populations appear to be stable. Now, the difference arises here really through differences in approach, I think. On the one hand we have the National Hare Survey which Stephen set up and oversaw, which has been repeated twice now. So we have two pretty good measures of the hare population in Britain at a space of eight years, but those are only two points.

The point of disagreement is whether or not you can infer a trend from the two points and it is a fact that the only data which is repeated on an annual basis, for what it is worth, is sighting data from the Master of Harriers and Beagles Association, which basically records the number of hares seen each time they go out to meet. That is widespread data; it is available for most of the country and it is repeated on an annual basis.

On the other hand, it is not an estimated population density but it does not show any trend in it either. I think that has really explained the difference of opinion.

PROFESSOR HARRIS: I think the difference between our interpretations are actually very small. Mine says there are 10 per cent less hares in a decade and Steve Tappers's data suggests there is no change. There is a difference in the way we collect our data though. I think Steve and I both agree that this is

probably a major contributing factor to why we get different results. We are trying to write our data up jointly, for a joint paper, to actually put it together. The Game Conservancy data are based on data from hunting estates and data where people go to hunt hares. You do not go to areas where there are few or no hares to hunt, because you are wasting your time.

My data actually stratified across the wider countryside and I include a lot of sampling areas where there are very few or no hares. I think common sense alone suggests you might see slightly different results from that. They may not be widely different, but there are areas when you are looking, areas that manage the benefit of game comparing with the countryside generally, you might get slightly different results and the two results are slightly different; I do not see a great surprise in that. All I can say is that ours are based on the countryside generally not on specific habitat types.

MR OLIVER-BELLASIS: Lord Burns, can I make a personal comment because my farm actually has had hares and I have records that go back to 1897 and in fact Professor Harris is correct that our numbers have declined about 5 per cent in that period of time.

I think the difference though, which is underplayed very often, is that the loss of mixed farms and the loss of spring cropping, that has had a very dramatic effect on habitat available for hares at different times of the year. We happen to have a mixed farm and we happen to have some spring cropping and we

have maintained our hares. It must be against the background the fox's favourite food is leverets and we kill our foxes.

DR LINDLEY: Just a quick question: is Mr Oliver-Bellasis in possession of any data to support leverets being the fox's favourite food?

MR OLIVER-BELLASIS: It is the observation of my keepers who see it happening.

THE CHAIRMAN: Are you questioning this, Dr Lindley?

DR LINDLEY: All the data that I have ever seen in relation to fox diet does not suggest leverets as being a high component.

MR OLIVER-BELLASIS: Could that be there are not very many leverets where the foxes are being looked at!

DR REYNOLDS: In 1985 and 1987, we did a very interesting study on fox diet in relation to densities of game species of prey in north-east Dorset. What we found was that if you work out the density of foxes and you work out the bio-mass of each individual prey species eaten by those foxes, for the hares, it worked out to a very considerable bio-mass, even though on that site the hares were only 11 per cent of total fox diet.

I think the point to take home here is that foxes have a very broad diet and in an area like rural north-east Dorset there are a lot of prey species there for them to depend on. So the fox population is sustained by a pretty broad base of prey species. That does not mean to say that a prey species which is minor for the fox is not severely affected by the amount of predation on it. What we seem to be seeing

with the hares was a very substantial predation and when we modelled this out, and you have heard a lot this morning about the perils of doing modelling, they apply to us as much as to everybody else, that when we modelled this out, it appeared that this was in the same sort of order of magnitude as the total annual productivity of the hare population.

What we argued in the paper, and it since has been questioned by Professor Harris, is that what we were looking at there was a perfectly ordinary density of hares and a perfectly ordinary density of foxes and in the light of experience -- I would still stand by that -- although, again this is a matter of some debate.

THE CHAIRMAN: Any other questions or points to be made on population?

PROFESSOR HARRIS: Could I just say, if I interpreted Hugh's statement correctly, he kills all the foxes on his estate, but the hare numbers have still gone down by 5 per cent, so clearly -- is that what you said?

MR OLIVER-BELLASIS: Lord Burns, what I said was that since 1897 the hare numbers have declined by something around 5 per cent. I made the point about changing agricultural practice which I believe has been responsible for a part of, if not all of, that decline and I merely made the comment that we do kill foxes and they do eat hares and somewhere in there is the answer. But I still have a very substantial number of hares, probably rather more than my farming director would like.

THE CHAIRMAN: I can hear the tinkling of tea cups and that

is the point at which to stop. We will break for, shall we say 10 minutes but we really must start in 15 minutes and I hope for everyone in the audience as well.

(Short break).

THE CHAIRMAN: Thank you very much for getting back so quickly. Shall we move on to the question of population management of hares and, in particular, we might deal with the question of the contribution of hunting with dogs to the numbers of hares?

We had a discussion earlier about foxes, about the extent of death through natural causes, of shooting and of hunting with dogs. To what extent can we come to any similar conclusions or non-conclusions in relation to hare. And, in particular, deal with the question of the significance of hunting towards the numbers. To what extent is there a problem in terms of hare numbers and is hunting contributing to that? Or, as it is sometimes argued, is the fact that there is hunting there leading to possibly more hares than otherwise would be the case?

MR OLIVER-BELLASIS: Lord Burns, again a personal comment: Traditionally we have had two packs of beagles which hunt over our land and I think there is absolutely no question but that the relationship between my family and the people who work for me and the people who manage and run those packs of beagles have encouraged us probably to be conscious of the needs of the hare, which is actually differing management in agricultural terms. I think there is an indefinable human piece in there which I cannot precisely put my finger on, but we are happy to

have them come and hunt and there are hares for them to hunt. They do kill one or two. They undoubtedly do not kill as many as we do later on, either to go through my butcher's shop or to be sold on the open market.

MR HOBSON: Lord Burns, could I refer to some figures from areas where legal coursing takes place and I make the distinction between legal coursing and poaching? I know that research found that -- this was Hutchings' and

Harris' data, reported in the Game Conservancy Trust' submission, that -- arable districts on average supported

7.1 hares per 100 hectares and this compares unfavourably with areas where coursing takes place where 30.4 hares per 100 hectares were recorded at Altcar and 13.8 hares per 100 hectares at another area where coursing took place, Chippenham.

So I would contend that areas where legal coursing is practised have higher hare numbers because farmers take steps to conserve and manage hare populations on that land.

I would also like to perhaps respond to a comment that Professor Harris made this morning, when he was saying that due to coursing hare numbers fall in coursing areas. I think that -- and I may be wrong -- he is referring to poaching, so where people are going on to land and they are undertaking an activity which is already illegal and, yes, in those cases then farmers are forced to respond in the only way they can to stop these violent gangs from going on to their land, but as this is already illegal, I wonder how a ban on hunting with dogs would actually solve the situation.

PROFESSOR HARRIS: Could I respond to that? I think we

always have the problem of misquoting figures out of context. I do not think it is relevant to quote a mean figure for a large area of land with two examples which you deem to have high densities. That mean figure was based on densities, including both with and without coursing and was simply a means that landscape across the whole of Britain, so I think the comparison made was meaningless.

I think it is also a problem that we have trying to use the word "legal" and "illegal coursing". There is certainly organised coursing at a number of meets and the number of these clubs is in some ways difficult to define. There are 23 in the National coursing Club, but there are others who actually are not affiliated but still have comparable organised coursing meets.

In addition, according to the Cobham Report, there are 70,000 people with lurchers used for hunting hares. They are not all poachers. They can go and use those lurchers for coursing quite legally on the land. It is only an illegal activity if they are trespassing or poaching. I do not think there is evidence to suggest those 70,000 people are not behaving illegally. So there is a lot of unquantified and unestimatable legal coursing of hares by people other than organised meets, and I think it should not be said that there are organised meets dealing with coursing. That is just not the state of the evidence.

THE CHAIRMAN: If I interpret it right, what you are saying is that there may be those two categories. But there are a number of other categories as well which fall

somewhere between. I mean, you have official, you have unofficial and it may be illegal in some cases because trespass is involved. But it may well also be legal.

PROFESSOR HARRIS: That is absolutely correct. Nowhere can we find anywhere assessing the relative contribution to each one of those forms of coursing of hares.

MR WISE: Could I just add to that? I think that the damage to hares is done by illegal coursers, not by the dogs themselves; it is the sort of armed trespass which provokes keepers in those areas for reasons of self-defence or protection of the estate to wipe out by guns all hares on that estate, and quite a lot of areas in our part of the world hares are deliberately obliterated because of the degradations of illegal coursers, so I think there is possibly some misconception here.

I would agree with Professor Harris. Obviously there are authorised lurchers which he cannot get detailed figures on, but there is a lot of also mass extermination of hares just because of this -- what I would call organised illegal hunt coursing.

PROFESSOR HARRIS: Again, can I respond? I am not sure even I necessarily agree with that. It is true in some areas there is extensive culling of hares by landowners to keep coursing gangs off their land. If you look at the distribution of that in England, it is certainly focused particularly on the eastern side of the country. If you go to the western side of the country, we do not seem to see that as such as a problem, but there is extensive impact on low density hare populations by people

coursing hares with lurchers, part legally, with the landowner's permission and I just do not see how we can actually separate out all those effects and compartmentalise them in the way that appears to be said.

THE CHAIRMAN: Would it be right, however, to say that we do not have any reliable figures at all for any of these categories? Once one gets out of the world of official coursing where records are kept, then we are basically in the dark about the numbers concerned. There may be a view that it is happening but, as far as I can see, no one has been able to provide us with any idea of the scale.

DR REYNOLDS: Can I just comment that we are into dangerous ground if we speculate from the numbers of people estimated to hold lurchers and infer from those the impact on the hare population. It is rather like trying to infer the cull of ducks from the number of people who have shotguns. A lot of those lurchers will actually be used for perfectly legitimate rabbit control activities. Some of them are actually used for fox culling, but we cannot guess how many hares are killed by the national ownership of lurchers, even if we could estimate it.

PROFESSOR HARRIS: Could I just clarify the figure I gave you? What Cobham says is these are lurchers -- these are people -- he does not say "lurchers", he actually says "people" -- who own lurchers used for coursing hares. You can argue whether he has his figures right or wrong, but basically that is about as far as we can go in giving you that data. I wish I could work out how many

hares were killed each year by the average run coarser. There is no way I can find any data that would tell you that. The numbers of hares killed by coursers each year is entirely speculative as far as I can see.

MR SCULL: Lord Burns, I am not able to offer any evidence, but I can give an observation on how serious in some parts of the country illegal hare coursing is.

In Cambridgeshire there is a dedicated police operation, Operation Tortoise. Similarly, in Suffolk and in Norfolk there are dedicated police initiatives to tackle this. In certain areas, particularly the eastern parts of the country, it is extremely serious.

THE CHAIRMAN: I think the other question which I have on this phase of the discussion is related to shooting of hares. To what extent are hare shoots recreational activities and to what extent are they meant to be pest control activities? Do you have any view as to the balance of these? It may well be that like much of this activity there is always a combination of motive that is involved. But I do not think anybody suggests, for example, that coursing takes place in order to control hares. As we have heard, nor, I think, really does beagling take place as far as I can gather in order to cull hares.

To what extent does shooting take place similarly as recreation?

MR OLIVER-BELLASIS: Lord Burns, maybe I can help. I think one is the function of the other. If you have hares there is a need to control them because there is no doubt that too many hares does quite a lot of damage in

cereal crops, and other crops for that matter, as well as in forestry.

I think there are two ways in which there is a recreational value. There are people who enjoy hare shooting and who are prepared to pay for hare shooting and, therefore, there is quite definitely the ability for the landowner to make some money from laying on a day's hare shooting. Equally, there is the other side of it, which is that one's beaters and estate staff and farm staff, and so on, actually enjoy hare shooting, and in my case that is part of our thank you for them for being who they are and doing what they do that they shoot the hares with their friends.

The last thing is that the hare is a very valuable product into a butcher's shop in that a hare will sell between 4 pounds and 4.50 pounds prior to 1st December and there are a lot of people that like eating them and, therefore, it seems a shame not to be able to crop them, harvest them and use them because people wish to eat them.

THE CHAIRMAN: Are there any more questions on the subject of hares? I propose to move on.

The next topic I have down is deer. As we spent all day yesterday discussing deer I suspect we have done the bulk of the work here. But I would like to give the seminar the opportunity of raising any points that they would like to raise, both from the presentations and from the papers that have been done by the researchers.

MR YOUNGSON: Thank you, Lord Burns. There is a common theme running through today's debate concerning all

quarry species and this relates to the implications of perhaps stopping hunting or how we are going to advocate control. We are all conscious of the fact that -- we do not understand what the interests of the different groups are. Although we are able to model and we are able to think in terms of strategies, we still do not really know what the interests of farming and forestry, welfare, conservation groups are. We are conscious of this in Scotland and we are trying to make headway by drawing all the interests together and drawing up management plans or guidelines for the future and really getting everybody together to voice their main interests and finding a common pathway. It is really quite interesting because we have brought community councils into it and local authorities and planners, and we have managed to find out the interests of main players and even some of the smaller players. It has allowed us, therefore, to form a management plan for the future, to be able to make decisions on real information, the data, which the two contractors have brought up-to-date and it is something which we all have to consider.

We have published a guideline to collaborative planning which is being taken up just about by every interest and area in Scotland. Really all woodland owners and Woodland Grant Scheme applicants are having to produce a management plan like that. These plans could apply to all quarry species.

If you would allow me to move on, Jochen

Langbein at lunch suggested that we have not really tackled the costs yet. The Deer Commission and Forest

Enterprise have been looking in some detail over the last six years at the costs of deer control in different habitats, especially woodland habitats and there are some frightening figures coming up. Although you are perhaps going to make recommendations for deer control, or control of other quarry species, some of the results of effort and cost are going to be difficult to impose in the field. For instance, we have been looking at Sika deer in the worst scenario areas in Scotland, in different woodland habitats. At worst it will take 30 hours to control one Sika hind.

So, therefore, the annual control, say, for 1000 hectare block would take about 450 hours with a Sika population at about 20 deer per hundred hectares. Really you cannot impose that on the Forest Enterprise or any private forest company. So really the normal methods are not perhaps going to be cost probable or cost effective. We also looked at red deer and woodland control Finny Forest, and at best we are talking about a control effort and achievement of about three deer per man day, three deer per eight hours at best, or at worst as population densities dropped down to a success rate of about 0.7 deer per man day. So really the effort terms of deer control in woodland areas have been quantified, some of the data has been published and can be available. Thank you very much.

PROFESSOR HARRIS: I think this to some extent also deals with the point I alluded to briefly in our presentation, which was that a number of deer managers are becoming

aware of this now and more and more, I think in England, they are talking about wishing to actually move away from some of the stalking approaches to actually moving deer to guns in a controlled way, partly to reduce that cost of management without necessarily any welfare implications or selectivity implications. I think once people are aware of the cost implications, some effort to deer control management practice are likely to involve change and hopefully improve as well.

DR LINDLEY: Thank you Lord Burns. A different issue, but one which has been raised in relation to all the species but I just wanted to clarify if I was right in my reading of David Macdonald's report as it has been very difficult to absorb in a short space of time, but I think there is a bit of information in there that answers to a degree the question of the effect of a ban in terms of what we call "landowner tolerance", and the often alleged likelihood of landowners being less tolerant of the animals if hunting was banned and, therefore, killing large numbers or larger numbers by other means.

Am I right that in, I think, some data from Jochen Langbein that in the areas where there has been effectively a ban on hunting through National Trust and Forestry Commission decisions in the south-west the subsequent population census counts have indicated no change in deer populations?

DR LANGBEIN: Yes. If we refer specifically to the Holnicote Estate, which is the largest area of National Trust land where the hunting has been banned, certainly in those

areas, within the estate itself, the deer population has remained fairly stable as determined from the visual censuses over the three years since the ban. For those data I would say that about 20 per cent of the Exmoor deer population is actually within that National Trust estate, so it is quite a substantial area, but it is just based on the visual count and just on that one area. I have not really got similar information on the other National Trust estates where hunting has also been banned which are much smaller and often surrounded by hunted land.

LORD SOULSBY: Thank you. I wonder whether probably Dr Macdonald could bring us up-to-date with some of the non-lethal control methods in deer, for example the use of fertility control or the control of pregnancy that has been practised in Australia and, I believe, may well be within your sights in Oxford too.

PROFESSOR MACDONALD: Two points: First, on fertility control, my Lord. My understanding of the data -- and I suspect Jochen Langbein will be able to answer in more depths than I -- is that that is not immediately a feasible option in this country. The developments still have a long way to go regarding deer and fertility control. Is that an adequate summary of it?

DR LANGBEIN: Yes, but I would say that certainly it has been attempted in a number of populations in especially the United States, and there usually it has been confined to island populations, and the main problem has been actually getting sufficient numbers of animals treated. It has been shown to work, immuno-contraception - by various teams, but actually delivering the drug to a sufficient number of animals is a major

problem and it does not seem really to have potential for widespread use for general population control of the million or more deer that we have in this country.

PROFESSOR HARRIS: I think the other problem you have to bear in mind when we are just talking about the cost effectiveness is the current culling strategies. The time involved in actually trying to apply fertility control technique is massive and it is only used in very specific circumstances. Even then a number of the American studies have found it has not been very effective. There are also considerable welfare implications because deer that do not breed tend to live longer and they start showing a variety of degenerative diseases typical to what we experience and there is a welfare cost there; it is not necessarily good welfare. Another thing is if we start using contraceptives on deer in Britain, clearly there may be part of a big change in current culling strategies anyway, because this may hamper quite what you do with a carcass that may or may not have a fertility control agent in it, so I think overall it is perhaps not a strategy going to have a wide applicability for free-living deer in Britain.

PROFESSOR MACDONALD: If I could just add one thought to some comments that were made earlier? I think each of the species with which we are dealing brings with it its own particular problems and in some cases, at least, some glimmer of clear cut results and deer perhaps are one of the easier ones in terms of the perception of damage. It seems, taking up the remarks you were making

about forestry, there have been surveys and there seems to be abundant data that when one asks the question, "Is there a problem?", then the answer from forestry and deer is quite clearly "yes", and that is a straightforwardness that we have not had at hand in some other respects. Similarly, as we presented this morning of summary data, there are at least circumstances where people in agricultural situations, if very localised rather than wider scale, and people in conservation situations, do face a definite need to do something about deer. So the question is rather different in this case. The question is about whether hunting with hounds is an appropriate solution to that, rather than whether there is a problem in the first place that needs to be dealt with.

MR OLIVER-BELLASIS: Lord Burns, could I pick up a point that Professor Harris made? He, I think, said that there was a likelihood that deer would be moved through woodland. That begs the question what weapon would be used and how the deer would be moved. As I am sure we are all aware only in very rare cases where landowners/farmers/foresters are prepared to certify serious damage, can shotguns be used, and only then with cartridges with specific shot size - otherwise one is restricted to rifles. The use of a rifle when a deer is moving is an extremely skilled business. I would profess, having shot for the army and having had to shoot at moving things, that one's hit rate is actually probably quite small in relation to the number of rounds fired. The difference is that then one would have been on a range, not in the open countryside. Where one

has footpaths, and so on, you begin to get into shark infested waters and I would suggest that at that point the ability to use hounds is extraordinarily important.

PROFESSOR HARRIS: I think perhaps you are misunderstanding how proponents of deer stalking are thinking about moving deer to waiting guns. They are actually looking to move them to waiting rifles and they are not actually looking to shoot at moving targets, they are looking to move deer slowly out of cover, and if you do it slowly and carefully the deer are not particularly running away and moving at speed, they will move out of cover slowly, often stop and look back, and that is where they want to shoot.

That is what the British Deer Society is saying to me. I report it simply as their perception because they are the experts on the subject.

MR OLIVER-BELLASIS: Having, my Lord, Chairman, been a past Chairman of the British Deer Society and also having some experience of this particular matter, the length of time referred to by Dick Youngson would be multiplied by 2, because the majority of deer are not so accommodating as either to move slowly or stop when you wish to take a shot.

THE CHAIRMAN: Could I raise this question about population numbers in the event of a ban which has been mentioned? Dr Lindley quoted the case of the National Trust where maybe the numbers have not fallen. However, my understanding of the argument is that it relates to small estates where you have small farms and where there may be competitive culling in the absence of a ban. That may put the numbers in the south-west under threat.

May I just raise the question to what extent would the information from the National Trust be relevant in order to predict that? Because you are looking at completely different circumstances where they are, presumably, managing the estate themselves. Therefore it is more akin to the situation in Scotland, as it is argued, where the ownership is in very large estates. I simply raise the question as to whether or not that evidence really does tell us anything about what would happen in the event of a ban when one is looking at the smaller estates which are typical, as I understand it, of the south-west.

DR LANGBEIN: Lord Burns, to confirm, first of all, the National Trust estate I referred to is actually the largest single landownership on Exmoor, but obviously there are some other large estates as well which may change their current deer management or stay as before, or try to conserve more deer in the event of a ban because of the perceived reduction in the numbers elsewhere.

It has certainly been recommended, following my study, that deer management groups as they are practised in Scotland, should be set up in a lot of these areas, whether there is hunting or not, because hunting in the way it is organised at present is largely ineffective because some farmers do shoot, others do not shoot, a lot of them do allow hunting, but in general the lack of co-ordination is why it is so difficult to predict the impact of a hunting ban, because a lot of typical landowners will take quite different actions following a ban. Overall the average landownership in

the south-west of England is actually much smaller even than in Scotland where they do have deer management groups and so the need for deer management groups is even greater in the south-west because we have tiny landownership there, with every Red deer readily ranging over five to ten, if not more, landowners' land.

MR HART: I just really want to agree with what Dr Langbein says, but also to just refer to the concept of deer management groups and just refer you to one point which was made in a submission by the deer hunting representatives in the south-west. That is that approximately 800 different landholders currently welcome hunting on their land as part of the deer management process. If that is not an excellent example of a deer management process actually at work and functioning, I do not know what is. I suspect to get a similar one in place, which would attract that level of general support, which also has an awful lot of other spin-off effects as well, is something which needs serious addressing before we move from the current position.

MR SWANN: Thank you, Lord Burns. You mentioned the Scottish situation and I think it might just be of interest that in a lot of the large Scottish estates there is not a uniform pattern of deer over them, that deer do live in very small groups and do not move off the home territory to any great extent.

It is also worth pointing out that many of the larger estates, and particularly those in my part of the

world, are sub-tenanted to a considerable degree and so you will have tenanted farms and you will have crofting areas. The difference is that the management of deer is co-ordinated and I think this is an important point, is that the significance of the large estates is that you do get co-ordination over a large area. I do not think the problems are that different from the south of England, but it is this level of co-ordination which is perhaps a significant difference.

THE CHAIRMAN: Any more points on deer, otherwise I propose to move forward looking at the tired faces around me? Can we move on to the question of mink and can I put together my questions as a group so that if anyone wishes to raise any aspect of the question of mink, if they would do so now.

DR LINDLEY: I do not know whether this would be a perhaps more appropriate point to go back to a question which I raised in relation to foxes that was not addressed, which was the question, when one is looking at whether or not a ban should be considered, of the direct impact of hunting activity on habitat and conservation of species through trampling, through disturbance, dogs going through wild habitat and followers, foot followers, horse followers, vehicle followers, and all the rest, and the fact that the RSPB, as noted by David Macdonald, does not allow hunting with hounds on its land, wildlife trusts do not allow hunting on their land. There is some suggestion there that hunting does have a direct adverse impact on wildlife conservation in some ways in some areas and I would have thought that

was perhaps particularly noticeable in the case of mink and disturbance of waterways and riparian habitats.

PROFESSOR MACDONALD: Shall I have a go at that? I agree. I think in our report we actually raised the point that, having analysed in a numerical way the likely impact of mink hunting on mink populations and drawn the conclusion that it strikes us as improbable that mink hunting with hounds could contribute in a substantial way to limiting mink populations, we go on to say that another consideration is that the activities involved in mink hunting with hounds are likely to -- at least it is plausible that they would cause disturbance to riparian habitat, and one can think of all sorts of circumstances in which that might be the case. The very obvious example that will spring to mind is possible disturbance to otters in the same habitat as mink, even though the two species do have -- as Stephen was saying earlier -- a somewhat hostile relationship as it emerges at the moment, so it would be hard to control that disturbance, I would imagine. However, I am unaware of any data that we could draw on to quantify that view. It seems entirely plausible to me.

MR HOBSON: I would like to respond to that. Really what evidence is there that mink hunting does disturb otters? I am not aware of any evidence it does. The mink hunts are bound by strict rules to ensure that they do not disturb otters and if they do come across otters they have to withdraw their hounds from the river.

I also note that in the areas where mink hunting is practised most intensively, in the south-west of

England and west Wales, otter numbers are actually the highest. I note also from your report that you say that otters have expanded their range where mink hunting with hounds takes place, so to me that does not suggest that there is any evidence at all that mink hunting does adversely affect otters.

PROFESSOR MACDONALD: I would agree with you that I too am unaware of any firm data to evaluate that which I hope I said. I just said that I thought it struck me as plausible that hunting along the riparian corridor could be disturbing to wildlife in general, but I am unaware of any data. I do, however, understand there is evidence of mink and otters, at least locally, occurring in the same area and I just thought it was practically difficult as an operational activity to control which species was disturbed at a given moment, but I have no scientific data to offer on that at all.

PROFESSOR HARRIS: I was just going to say I did not address that further because obviously Lord Burns has had submissions from a number of the otter project officers working for the wildlife trusts and they do describe situations where otters are hunted by minkhounds and the disturbance problem, so they do describe it, but it is hard to quantify and it is hard to know how regular it is, but it is described.

MR HOBSON: Could I respond to that because I know Professor Harris was not at the sessions last week? With regard to those four cases which were submitted by the wildlife trusts in their submission, I have spoken to each of the hunts concerned and they all deny categorically that they have ever

hunted otters. The one hunt -- I think it was the Pembrokeshire hunt which was accused of hunting otters 10 or 20 years ago, asked why the police were not involved 10 or 20 years ago and why were they not prosecuted for this, if they were indeed hunting otters. The police never contacted them and they were unaware of the allegations until they were submitted to the Inquiry as a report written by the anonymous friend of the anonymous observer of this alleged incident.

DR LINDLEY: Since I raised the subject, I was not myself specifically concentrating on otters, but the discussion seems to have done so. What I was raising was the suggestion, the possibility which I think David Macdonald in broad terms agreed with as a possibility, that the passage of a hunt with dogs and followers and huntsmen and the rest might, or could, cause disturbance to wildlife generally, not specifically to otters alone. It seems to me that perhaps this brief discussion raises a problem for the panel which is going to maybe affect you in a number of issues, which is that of burden of proof. Here we have a case where there is some supposition that there might -- the grounds for the possibility of some disturbance and no scientific evidence to quantify that or indicate its validity or not. On whom does the burden of proof lie? Do activities continue until there is proof that they are damaging, or do you take the precautionary approach and require the burden of proof on the other side?

THE CHAIRMAN: Could I say that I have been tending to be asking the questions today rather than answering them. And that is just one of the many issues that we have yet to resolve. But we do have a long time to do that -- we have all of five weeks.

PROFESSOR HARRIS: Luxury, pure luxury!

THE CHAIRMAN: We heard this morning that numbers of mink are falling and have fallen very sharply over the last ten years. Those are firm figures, are they? Is there any dispute about that, or is this something that we can ignore silently?

PROFESSOR HARRIS: Perhaps I should defend that since I presented them. They are actually supplied courtesy of the Vincent Wildlife Trust. They have said that I am in the final submission to mark them as professional and they will play around with them a little bit, but they are not going to change by very much and what is quite clear is that there has been a substantial decline of roughly two-thirds and they are quite happy that that is now made public. They will actually publish the data in full themselves sometime next year.

MR OLIVER-BELLASIS: Lord Burns, could I refer to a comment I made earlier that in a sense the decline in numbers is interesting and is relevant at a national level. The individual farmer looking after a river which has a problem with mink is not affected by the fact that the population is either larger or smaller. What he is affected by is the problem that is being posed to that river or to his poultry or whatever, and I think we must, if we may, strengthen the resolve to look at the local level and the individual who at that particular moment is faced with the risk and, therefore, having to make a decision outside of a national figure which may be rising or falling.

PROFESSOR MACDONALD: Perhaps I might just add to that and also

endorse again what Stephen said about the fact that we all see that there is such a decline and there is no dissent on that.

What is rather interesting is the pattern of that decline and there is work which is perhaps not directly relevant to your inquiry but, nonetheless, fascinating, trying to work out what the mechanisms are. There is also the question about the extent to which the decline of mink is one in overall distribution or in numbers in particular areas, so, for example, we have people in my team at the moment working in the south-west of the country where mink have disappeared largely from river systems where they were present previously. There is other areas where they still appear to be in similar numbers to their previous density and yet other areas where they appear to be declining. While competition or interactions of some sort with otters is a hypothesis that certainly has a lot of support, there may be other factors involved as well. The details are not directly relevant with hunting with hounds but, nonetheless, this complicated process is going on.

MR HART: Can I just revert back to one comment which then leads on to what we are currently talking about and that is the disturbance element which is allegedly caused by minkhounds with particular reference to otter habitat or similar?

What has not been mentioned is the regularity with which minkhounds visit certain locations and the evidence that we have seen indicates that it is rarely ever more than twice per annum that the minkhounds visit

the specific areas and, even on those occasions, the relative areas of the river they visit are actually extremely limited.

Secondly, that they actually assist in identifying where mink populations are residing, thus enabling other methods of control sometimes to complement that particular cocktail available to the people who manage that particular part of the river. So whilst the mink hunt results might not show anything which registers on the sort of Richter Scale of mink control, what it does do is alert people to their presence so they can undertake that.

Also, clearly even if there is damage caused by mink hunts, and there is by no means any evidence which has been put forward to suggest that is in there tablets of stone, that needs to be measured against the possible damage that an infestation of mink could do ecologically to that area if they were not subjected to some form of control.

THE CHAIRMAN: I think that I for one am certainly reaching the capacity of my ability to absorb information on this subject. I am very grateful to everybody for the contributions they have made.

I would like to do the same as I did yesterday which is to go round the table to see if people have any final comments that they wish to make on any of the points that have been raised to date. And, as yesterday, I am going to start in the opposite corner to where we started this morning. But as Mr Swann was sitting in the same place, as yesterday, he therefore was no doubt

able to predict this.

MR SWANN: I have been dropped in it now, thank you, Lord Burns, because Arthur has declined to make a comment.

I would like to say that the work that these two papers have presented we have found exceedingly useful. Despite the limitations, and we have had a go at one or two of those on gathering of data and the imponderables, I think this is a subject where there always will be imponderables and I think always there is going to be a lot of reliance on local data and impressions and trying to carve a way through that to get something sensible out of it is an unenviable task and I think both researchers have had an incredibly good shot at it. I think the papers are useful; we found them enormously helpful. I think the conclusions they draw broadly support the arguments that these organisations have made throughout this presentation to the Committee that there is basically no real role for hunting with dogs in population control and that where population control may be demonstrated to be necessary, that there are alternative methods which are more effective both in terms of time and cost.

So I think today's discussions have been instructive in this respect and I do not really, Chairman, need to say any more, thank you.

MR HART: Lord Burns, if I may really make a comment which I was going to make at the beginning but I think it is even more relevant now.

The Alliance, like Deadline 2000, welcome the publication of these research documents which go some

way -- and I emphasise that, some way -- to a more informed debate on this issue. However, that should not imply that we as the Alliance necessarily agree with all the findings. It is encouraging, however, that both reports broadly concur with one another -- that is interesting -- although the authors also state their concerns quite loudly about the timescales under which they have been invited to operate. In particular, we have taken note that both reports conclude that the four subject species, deer, hare, fox and mink, can and do cause damage and that they all need control and management of some sort. That concurs quite neatly with the evidence put forward by the NFU, Farmers Union in Wales, country landowners, referred to also in the Forestry Commission and Ministry of Agriculture leaflets and, presumably, it is the reason why they appear in the 1947 Agriculture Act as a pest species.

Although Professors Harris and White do not touch on cruelty, Professor Macdonald does comment and I will just read the particular quote, which I think is of relevance:

"No scientific aspect of quantifying hunting with dogs is sufficiently vast to enable simple judgements of the complexities involved in comparing species, circumstances, duration and numbers of individuals. Therefore, any immediate judgement on the humaneness of each type of hunting with dogs can be based only on fragmentary, although interesting, evidence and common sense."

Both reports, however, agree that control methods

are likely to increase in the event of a ban on hunting. So, in summary, what the Alliance takes note is that hunting is acknowledged by both parties as one of the four existing and legal methods of control. In certain places, such as the famous mid-Wales, it appears to be the preferred and principal method of control. It is the only method for which the landholder generally pays nothing. It is the only method that guarantees death or escape and nothing in between; that there are wider issues associated with it, such as a fallen stock collection and a social and cultural contributions to rural areas; that hunting attempts to achieve balance rather than extermination; that both reports acknowledge widespread support for fox control within the farming community, confirming research by Produce Studies and the hunting organisations, contributions to your inquiry, i.e. That only two and a half per cent of farmers actually disapprove of fox control; that there would be increased hostility towards quarry species in the absence of organised hunting; the true test of whether the fox is a pest is in the attitude of the human victims of the fox predation; that additional research is required in any many areas; that non-lethal methods appear not to have much enthusiastic support from the contractors, and that there is a certain relationship which exists between the hunter and the hunted which science cannot and does not even attempt to quantify.

So in short, again, we endorse what Professor Macdonald says really, which is that science of this nature only

really informs the debate and does not necessarily provide solutions to all of the problems.

So our conclusion is it cannot necessarily be right to criminalise one activity, which has seemed to work quite well, on the basis that it might be possible to achieve the same result by some other as yet untried method.

MR WISE: I will attempt to be brief, Lord Burns. I would just like to say I do not think there is any less, or there is no more welfare friendly way of culling than with a combination of approaches in different circumstances and I am absolutely convinced that if hunting with dogs were to go, animal welfare in fox terms would be much worse. I also feel the same as with the other species we have discussed.

MR HOBSON: Lord Burns, could I say a little about conservation? I think that in response to Dr Lindley, I think that we need to recognise that hunting with dogs is compatible with conservation and that, on the contrary, many Wildlife Trusts do permit hunting with dogs to take place over their land. They often issue licences. I also note that the EU at a Natura 2000 conference two years ago did recognise that hunting (and that was in the European sense) so hunting with hounds and shooting are compatible with conservation issues.

I think also we have not looked, and it is not surprising because it is not in the brief for today, at the role that hunting plays in conservation of habitat. Professor Macdonald did refer briefly to hedgerow maintenance

and those effects are well-known, but interim results from ongoing research on woodland management shows that hunts and hunt supporters are managing about 10 per cent of the rural woodland available to them and that that is about 560 hectares in each area, so this is a very significant benefit of hunting which should be considered.

MR SWIFT: I too would like to add my congratulations on behalf of the AOC to both teams for the huge amount of work that has gone in. It has been genuinely impressive. What has struck me as being the general level of agreement that there is a need for good control, whether of foxes or of the other subjects that we are talking about, and the problems to livestock and game which have to be addressed, and there will have to be lethal methods of control. I think that I am not shifted from the view that the report, once again, supports the central contention that the method of control is best determined by the owners and occupiers of the ground and they know all the factors and can weigh one objective with another. All the matters -- all the methods are required and used to a greater or lesser extent, depending on various circumstances, including geography, time of year, the weather, economics, I guess tradition as well.

As to -- I had a slightly irreverent thought -- that the arguments about whether something is effective or not, I think that the farming community, who are notoriously economic with their effort and energy to expend so much energy in pursuing something which over the years we are being told is completely ineffective,

strikes me as just slightly implausible. Thank you very much.

DR HARRADINE: I would just like to make a point in order to make a request, if I may? I think we have been left with the impression that shooting with hares is problematic. Yet I am conscious of the fact that one of the main reports from Professor Harris' team does not address and present a case for problems, so with that in mind -- and clearly a lot more material has to be added, particularly, I think, to that report and perhaps revisions to existing material in the light of further analyses, could we please have an opportunity to comment on the final versions of the reports before they get finally get to your team?

MR OLIVER-BELLASIS: Lord Burns, may I make three points? Firstly, can I reiterate a point that I made earlier which is that the risks which a farmer faces on the farm at the local level in trying to manage a natural threat is something that he does and I believe takes that responsibility very seriously. He does not wish to see a species exterminated. He is making a response to a threat and he assesses the risk and deals with it. The second point is that in relation to foxes we have not discussed the business of disease. I believe there is some evidence that there is a correlation between urban foxes and mange and dog populations which has been drawn out by the Game Conservancy in relation to reports from vets and I believe that ought to be looked at, because I do believe it is an issue, and I do not personally know which way the thing is travelling,

whether it is travelling from dog to fox or vice versa. The last point is that when you were discussing the business of what might happen in relation to foxes with a ban on hunting, can I offer one thought and that is that if a farmer is to control the risk that he perceives and one mechanism is withdrawn, then it is logical to assume that he will resort to a proportion of the other mechanisms. In the case of using shotguns and rifles, there are already very strict rules in this country for the ownership of those weapons and it is by no means easy for individuals to be able to obtain those rifles and, therefore, be able to use them. I suggest that there are places within this country where farmers do not have currently certificates for rifles or shotgun certificates and therefore they might have to get them and there is a whole issue in there. I cannot quantify it and I do not wish to try; I merely raise it as an issue because I do believe in certain places where hounds are commonly used, that people would not have necessarily the access to some of the alternative mechanisms of control.

Can I also add my thanks to Professor Harris and Professor Macdonald and to your team for enabling us to come and discuss with you the issues which you wish to discuss today. Thank you.

MR YOUNGSON: I too would like to add my congratulations to the researchers concerned with both reports today, which I accept, and the conclusions reached.

I would also like to thank you for giving me the chance to represent the Deer Commission here in the last

few days. Thank you very much.

DR RUSHTON: I think I am sitting on the other side of the fence in the sense that we have done some of the work. I really I would like to comment from the modelling side, if you like.

I would like to say that I think we have some evidence to suggest -- however slight -- that hunting with hounds does not appear to have any effectiveness as a control, at least within the East Midlands. I think we need to know more about dispersal.

DR LANGBEIN: I just really want to, as a point of clarification, answer Simon Hart. He mentioned that our team is saying that non-lethal methods were not really of great importance, and obviously at least for deer it is of importance. I take it that really you just meant to refer to 'novel' rather than all non-lethal methods, like fertility control and condition taste aversion. Certainly for deer, non-lethal methods, such as habit manipulation, providing food and shelter within the home range are probably as important for control but that needs to be backed up also by lethal control. Certainly expenditure on fencing and tree shelters are more costly nationwide than the lethal control which often tends to pay for itself in the case of deer.

I just really wanted to make sure you are not left with the impression that we are dismissing all non-lethal forms of control. Thank you.

DR REYNOLDS: I would really like to re-emphasise a point which David Macdonald made soon after lunch and I am not entirely sure it has been taken on board, that is we have talked about hunting with hounds as being pretty

ineffectual in the great scheme of things. I think we need to be careful to distinguish between hunting with hounds, as practised in most Midlands hunts, and hunting with hounds and hunting with dogs of any kind in principle. In our report we do explore the issues of what more hunts could do to make themselves more effective and we also explore the regional variation in how effective hunting with dogs actually is.

One further thing which has not come out in our discussions today but which I think was quite a lesson for me when we started to model the -- or when we had modelled the impact of hunting, and that is that one has to be analytical here. There is an essential difference between a hunt and a lot of people shooting with rifles on individual estates and that is on any one hunt country there is only one hunt. It is acting rather like a huge predator, roving round this hunt country and, on average, in a typical Midlands hunt, it is getting one fox per day and moving on to the next place at the next meet.

By contrast, in the scheme of things that we modelled, shooting by individual landowners or their agents can take place simultaneously on many different estates. This is a qualitative difference really between the two things and almost by definition, if you had a smaller hunt country or more meets, or whatever, hunting would improve, but the essential difference remains there are many, many landowners and gamekeepers and only one hunt.

PROFESSOR MACDONALD: I am happy for a rest.

PROFESSOR HARRIS: I am strangely silent too actually.

THE CHAIRMAN: Well, I am very grateful to everyone. It has been a good discussion and I hope the researchers have not found it too much of a burden. We appreciate the terrible timetable that is involved. All I can say is that it is a pain that we share. We look forward to the final versions. We have asked for the final reports before the time that we come our report and it is our intention that when we get the final reports we will make them available. So although there is not time for another iteration in the sense of being able to comment on the researchers' reports, there will still be a few days for people to give us comments after they have seen the final versions of the reports. So I hope that answers your query. Whether we will have finished our report by then, we will see.

Once again, thank you very much. I hope that you have all found the format has worked reasonably well. From our point of view I think that it has. As you know, this is a very sensitive subject. It is a subject that often can bring forth some very strong opinions. I am very grateful to everyone for keeping the temperature down and conducting it in a very positive way.

Thank you all very much, have a good Easter and some of us will be meeting no doubt again in the subsequent seminars. Thank you very much.

(4.25 p.m.)

(The hearing adjourned)