

# A pack of dogs is more effective at flushing red foxes (*Vulpes vulpes*) to guns than a pair

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## Abstract

Legislation passed in Scotland in 2002 and England and Wales in 2004 banned the hunting of wild mammals with dogs with specific exemptions that allow red foxes (*Vulpes vulpes*) to be flushed from areas of terrain (“coverts”) to be shot as a means of pest control. In England and Wales there is a limit of two dogs whereas in Scotland there is no limit. It has been suggested that this difference may have important implications for the efficacy of pest control and on potential welfare indices of hunted foxes in the former as compared to the latter. This study addressed these questions by using a pack and a pair of foxhounds to flush foxes to guns from the same 80 coverts (in Scotland) on separate occasions in a balanced randomised crossover design, and comparing the numbers of foxes flushed, the time taken for them to be flushed and the time of active pursuit (time from hounds starting to vocalise (“speaking”) to the fox being flushed). When a pack of hounds was used as compared to a pair, more foxes were flushed ( $0.89 \pm 0.13$  versus  $0.44 \pm 0.08$  (mean  $\pm$  se) foxes/covert, respectively,  $p < 0.001$ ), it took less time to flush the first fox ( $9.4 \pm 1.9$  min versus  $21.7 \pm 1.8$  (mean  $\pm$  se) min, respectively,  $p < 0.001$ ) and considerably less time from hounds starting to speak to a fox being flushed ( $2.7 \pm 0.3$  min versus  $13.0 \pm 1.8$  (mean  $\pm$  se) min, respectively,  $p < 0.001$ ). These findings provide support to the contentions that the use of a pair rather than a pack of hounds a) is less effective in flushing foxes to guns and b) imposes a longer duration of pursuit on foxes that might be associated with welfare compromise.

## Introduction

Legislation was passed in the United Kingdom in 2002 and 2004 to prohibit the hunting of wild mammals with dogs. The Protection of Wild Mammals (Scotland) Act 2002 came into effect on 1 August 2002 in Scotland, whereas The Hunting Act 2004 came into force on 18 February 2005 in England and Wales prohibiting all hunting of wild mammals with dogs, except where it is carried out in accordance with the conditions of the exceptions or exemptions set out in the Acts. The provisions of the Acts are largely similar in that they make it an offence for a person to “hunt” a wild mammal with a dog, where “hunting” includes searching for, chasing or pursuing the mammal for the purpose of catching or killing it.

A number of exceptions (Scotland) or exemptions (England and Wales) were written into the Acts, including those to allow for flushing a quarry species from cover to be shot in order to facilitate

among other issues the protection of livestock and game birds. As such these exemptions allow for the control of red fox numbers where they are considered to be a pest.

However there is a fundamental difference in the exception in the Protection of Wild Mammals (Scotland) Act 2002 and the Schedule 1 flushing exemption in the Hunting Act 2004 in that in the former there is no limit on the number of dogs that can be used whereas in the latter there is a limit of two dogs. The current limit of two dogs in England and Wales is arbitrary and it has been suggested that it renders the use of dogs to flush foxes to be shot ineffective and inhumane in some circumstances. For instance, two dogs as compared to a pack of dogs may be less likely to find foxes when drawing (searching for foxes) in large forestry blocks and if two dogs do find a fox the pursuit before it is flushed out and shot may be more protracted than would be the case if a greater number of dogs were used. These considerations may be particularly relevant to the control of fox numbers in upland areas of Wales and England where lamb predation by foxes is a significant problem and other forms of fox control may be less effective (Burns 2000, Heydon 2000).

The current study was undertaken to investigate whether there are any differences in terms of effectiveness and potential welfare indices between the use of two dogs and a pack of dogs to flush foxes. We hypothesised that, when using a pack versus a pair of foxhounds, a greater number of foxes is flushed and the time taken to flush foxes is less. In order to test these hypotheses the objectives of the study were to draw the same areas of terrain ("coverts") using a pair and a pack of hounds on separate occasions, to record the number of foxes flushed from coverts when drawn with a pair versus a pack of hounds and to record the time from sending hounds in, to the time pursuit commences (when hounds start to vocalise intently ("speak")), to the time a fox is seen to emerge (flushed) from the covert.

## Materials and Methods

The study was conducted in Scotland where the use of an unlimited number of dogs to flush remains legal. The study was undertaken from early December 2012 to late March 2013 with the cooperation of five foxhound packs in Berwickshire and Roxburghshire in the Scottish Borders. In total observations were made on 60 separate hunting days and 80 individual coverts.

Hounds were used either as a pair or a pack to attempt to flush foxes from the same 80 coverts in a randomised balanced crossover design ordered such that the pair or pack were used first in 40 coverts each. This design was used in order to control for a potential ordering effect of the pack or pair when used first to draw the covert through possible effects on fox behaviour or disruption of fox numbers in the environment. The time between the same coverts being drawn by the pack and the pair was targeted as a minimum of 21 days in order to minimise any effects on disruption of fox behaviour and numbers and to allow the completion of the study within the time available during the hunting season (November to March).

Coverts were selected in discussion with the huntsmen (those individuals responsible in each foxhound pack for the management of the hounds) in order that well delineated blocks of terrain were used where it was possible to have observers clearly positioned in order to detect when foxes were "flushed" as they were seen to break cover such that they were in a position to be shot when

safe to do so. The observers, many of whom were armed with shotguns or rifles, were positioned at a number of locations around the coverts including those considered most likely for foxes to emerge. The mean ( $\pm$  sd) number of observers on pair hunting days was 5.0 ( $\pm$  1.6). Covert size was determined using the “Magic” web-based interactive map service (Defra 2013) and a photographic record was made of each covert.

On all occasions when a pack of hounds was used to flush foxes, observations were made on days in the normal calendar of activity of the hunts whereas when a pair of hounds was used this was undertaken on non-hunting days. When the pack was used the number of hounds was determined by the huntsman (mean  $\pm$  sd 29.1  $\pm$  6.5), whereas when a pair of hounds was used individuals were selected by the huntsman for proven hunting and “speaking” (vocalising) ability.

The huntsman was instructed to conduct the normal protocol for “drawing” each covert. This starts with the hounds being introduced into the block of terrain, controlled by vocal and auditory signals made with a hunting horn. The hounds were accompanied by the huntsman either on horseback, on a quad bike/trials bike or on foot through or around the covert depending on the terrain, ground cover and climatic conditions. Progress was made systematically with hounds ranging through the covert providing them the opportunity to pick up the scent trails of foxes. The investigators were in radio contact with the huntsman and the observers. Timing was started when the hounds were introduced into the covert and times recorded when/if hounds started to speak which would indicate their detection of and following a scent trail, and when a fox was seen by observers to emerge from the covert in such a position where it could be shot. The numbers and timing of any sighting of foxes was recorded. Statistical comparisons were made using paired and unpaired t-tests where appropriate.

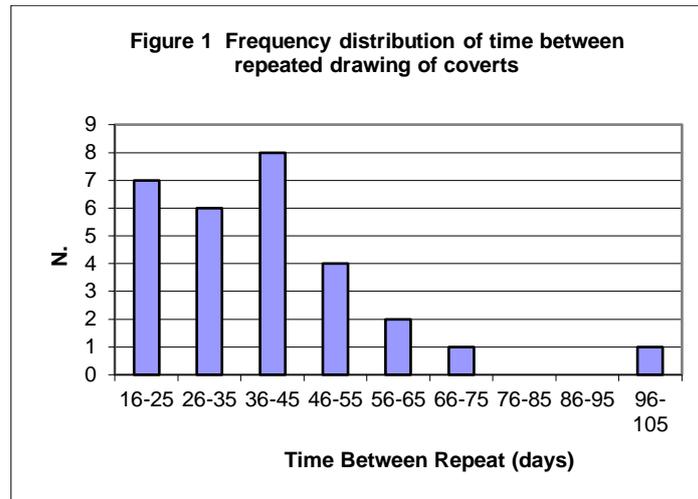
## Results

Five different hunts provided experimental observations for the study and their relative contributions are summarised in Table 1.

Table 1: distribution of hunting days between the five hunts of the study.

Hunt	Pack-First days completed (No. of Coverts)	Pair-First Days completed (No. of Coverts)
1	3 (7)	4 (20)
2	5 (12)	8 (15)
3	2 (2)	1 (1)
4	3 (14)	3 (4)
5	1 (5)	-
<b>Total</b>	<b>14 (40)</b>	<b>16 (40)</b>

The mean ( $\pm$  sd) number of days between pair then pack or pack then pair drawing the same coverts was 39.2 ( $\pm$  18.0) days, median 38 and range 19-103. The frequency distribution of timing between the repeated drawing of coverts with pack or pair is shown in Figure 1.



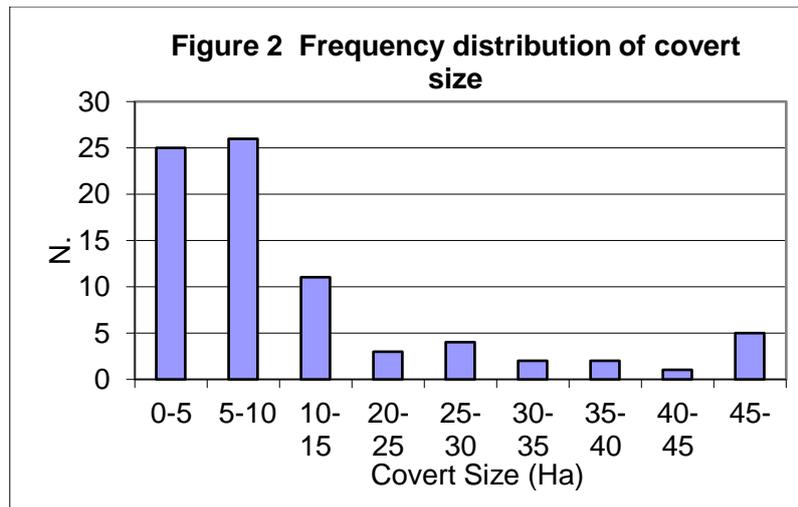
## Coverts

The study incorporated a range of types of covert, with blocks of conifer plantation and mixed conifer/deciduous being the highest proportions (Table 2).

Table 2: Summary of types of covert

Covert Type	% of coverts	% of foxes found in the covert types
Mixed Plantation	23.8	33.0
Conifer Plantation	45.0	43.4
Deciduous Plantation	3.8	1.9
Shrub and Bog	3.6	0
Gorse	17.5	17.0
Other	6.3	5.7

The coverts used ranged in size from 0.4 to >330 Ha, with the greatest proportion being up to 15 Ha in size (Figure 2).



The types of ground cover, classified as high, medium and low were relatively evenly distributed, at 26.3%, 40% and 33.7%, respectively.

When all coverts were included (with and without foxes flushed) where timings were available (n=79), it took longer for the pair of hounds than the pack of hounds to draw the coverts (pair  $3.89 \pm 0.49$  min/Ha (mean  $\pm$  se) versus pack  $2.34 \pm 0.31$ ,  $p < 0.001$ ), whereas when considering those coverts where no foxes were found, the difference between pair and pack in time taken to clear the coverts was not significant (pair  $3.51 \pm 0.68$ , pack  $2.53 \pm 0.65$ ,  $p=0.092$  n=26).

### Number of foxes flushed

From the 80 coverts drawn in total by the pack and pair of hounds, one or more foxes were flushed from 61.3% of the coverts (n=49). The pack flushed a fox from 53.8% (n=43) of the coverts, whereas the pair flushed a fox from 32.5% (n=26) of the coverts. The pair flushed a fox in 7.5% (n=6) of the coverts where the pack did not, whereas the pack flushed a fox in 28.8% (n=23) of the coverts where the pair did not. Both pack and pair flushed a fox in 25.0% of the coverts (n=20).

From the 80 coverts drawn by both pack and pair of hounds, there was a greater total number flushed by the pack than by the pair ( $0.89 \pm 0.13$  (mean  $\pm$  se) and  $0.44 \pm 0.08$  foxes /covert, respectively,  $p < 0.001$ , (totals of 71 and 35 foxes with pack and pair, respectively)).

In eight coverts there were two or more foxes flushed by a pair of hounds as compared to in 16 coverts when drawn by the pack.

## Timing of foxes found and flushed

When a pack of hounds was used, hounds were heard to speak in 29 coverts with a time to start speaking of  $7.9 \pm 1.6$  min (mean  $\pm$  se), whereas when a pair was used speaking was heard in 35 coverts with a time to start of  $12.9 \pm 2.7$  min, with the difference approaching significance ( $p=0.067$ ).

When a pack of hounds was used, at least one fox was flushed in 43 coverts with the time to flush the first fox being  $9.4 \pm 1.9$  min (mean  $\pm$  se,  $n=42$ , due to timing of one covert not taken), whereas when a pair was used at least one fox was flushed in 25 coverts with the time to flush the first fox being  $21.7 \pm 1.8$  min, which was significantly longer than that for the pack ( $p<0.001$ ). When considering only those 18 coverts where a fox was flushed on separate occasions by both a pair and a pack of hounds, the time to flush the first fox was longer with the pair ( $23.5 \pm 2.2$  min (mean  $\pm$  se)) than with the pack ( $12.4 \pm 4.2$  min) ( $p<0.01$ ).

The time taken between hounds starting to speak and a fox being flushed was longer when the coverts were drawn with a pair ( $13.0 \pm 1.8$  min (mean  $\pm$  se),  $n=19$ ) than when drawn with a pack ( $2.7 \pm 0.3$  min,  $n=32$ ) ( $p<0.001$ ). When considering only those seven coverts where a fox was flushed after hounds were heard speaking on separate occasions when drawn by both a pair and a pack of hounds, the time between speaking starting and the fox flushed was longer with the pair ( $14.7 \pm 3.8$  min (mean  $\pm$  se)) than with the pack ( $2.3 \pm 0.4$  min) ( $p<0.01$ ).

Of the 35 foxes to be flushed by a pair of hounds 19 were associated with hounds speaking (54.3%). Of the 71 foxes that were flushed by the pack 32 were associated with hounds speaking (45.1%). When a pair of hounds was used, in 16 coverts hounds were heard to speak but speaking was not followed by a fox being flushed whereas this only occurred in one covert when a pack was used.

## Discussion

There has been little scientific study of the hunting (used here in the broad sense of the word) of wild mammals by dogs in the United Kingdom. Although some studies have been conducted on the hunting by hounds of red deer (Bateson 1997, Harris 1999), there have been few objective reports of the activity of hunting of red foxes by hounds. While one study reported heart rate and temperature responses of captive foxes to being chased by dogs, the data likely have little direct relevance to the pursuit of foxes in the wild by hounds (Kreeger 1989); several other studies have commented on aspects of hunting foxes by hounds, although these have relied principally on responses to questionnaires (McDonald 1996, Heydon 2000, White 2003) or indirect indices of fox numbers (Baker 2002, 2006). While there has been reference made to the practice, as far as we are aware there has been no prior detailed description of the activity of dogs used to flush foxes to guns (Burns 1999, Heydon 2000).

The coverts used in the study are representative of the range of types of ground cover and foliage found in upland areas of the UK (Tables 1 and 2, Figure 2) and the timing of the study was appropriate in that observations were made throughout the main period of the hunting season (Figure 1) (Burns, 1999). It has been reported that before the hunting bans were enacted a pack

would typically kill 0.6 to 0.8 (McDonald 1996) or 0.8 to 1.2 (Burns 2000) foxes per day. While our data cannot be compared directly with those numbers because in this study hounds were used to flush foxes from cover rather than to hunt them to a kill, the total number of foxes flushed on 30 hunting days by a pack was 71, or 2.4 foxes per day. This is not dissimilar to McDonald's figure of approximately 3 foxes per day hunted (pursued) to yield the 0.6 to 0.8 killed (McDonald 1996).

In a study of this nature it is important to consider potential areas that could have led to biasing of the data. One such area was the time taken by the pack versus the pair to draw the coverts. While the time taken to draw the coverts appeared to be longer for the pair than the pack of hounds when all coverts drawn were considered, irrespective of whether or not foxes were found and/or flushed (pair  $3.89 \pm 0.49$  min/Ha (mean  $\pm$  se) vs pack  $2.34 \pm 0.31$ ,  $p < 0.001$ ), it is more appropriate to make this particular comparison with those coverts where no foxes were found and/or flushed. This provides an indication of the time taken for the hounds under the direction of the huntsman to range systematically through the covert seeking out scent trails. There was no difference between time taken by pack and pair to draw the coverts (pair  $3.51 \pm 0.68$  min/Ha, pack  $2.53 \pm 0.65$ ,  $p = 0.092$ ), suggesting that there was no bias in terms of the huntsman's action in how the coverts were drawn.

When considering the question of any difference in numbers of foxes flushed, when the same coverts were drawn there were more than twice as many foxes flushed by the pack than the pair ( $0.89 \pm 0.13$  (mean  $\pm$  se) and  $0.44 \pm 0.08$  foxes /covert,  $p < 0.001$ ) and two or more foxes were flushed on twice as many occasions with a pack than with a pair. This indicates that a pack of hounds was considerably more effective than a pair when considering the number of foxes flushed to guns.

When considering the question of any difference in timing between a pair or pack of hounds from being sent in to when foxes were flushed, it took over twice as long for foxes to be flushed by the pair than the pack ( $21.7 \pm 1.8$  min (mean  $\pm$  se) vs  $9.4 \pm 1.9$  min,  $p < 0.001$ ) in coverts where one or more foxes were flushed. Further, this conclusion is reinforced by the comparison made from only those coverts where at least one fox was flushed by both pair and pack, where there was similarly an approximately two-fold greater time taken by the pair to flush the first fox ( $23.5 \pm 2.2$  min (mean  $\pm$  se) vs  $12.4 \pm 4.2$  min, respectively,  $p < 0.01$ ). These findings reinforce those discussed above for number of foxes flushed in suggesting that the pack provides a more effective means for flushing foxes than a pair of hounds by achieving the result in a shorter period of time.

It is not unreasonable to consider that the time from hounds starting to speak to a fox being flushed is an index of the time during which a fox is actively pursued by hounds. This time was approximately five-fold greater with the pair than the pack ( $13.0 \pm 1.8$  min vs  $2.7 \pm 0.3$  min (mean  $\pm$  se), respectively,  $p < 0.001$ ). Similarly, this finding was reinforced by a more than six-fold greater time for pair than pack in speaking to flush when considering only those coverts where both pair and pack flushed foxes after speaking ( $14.7 \pm 3.8$  min vs  $2.3 \pm 0.4$  min (mean  $\pm$  se), respectively,  $p < 0.01$ ). The Burns Enquiry considered that the duration of "the chase" was one of the key indices that might reflect compromise of fox welfare during hunting (Burns 2000). However the report acknowledged that opinions differed as to what extent a pursued quarry animal's welfare was compromised during the pursuit and that there was little scientific evidence to support opinions on either side of the argument. Here, while we have been able to provide objective data on the duration of pursuit, no firm conclusion can be drawn as to the impact of duration of pursuit on fox welfare.

While it is possible that hounds on some occasions may have spoken when following the scent of a mammalian species other than the fox, it is very likely that in the majority of occasions speaking was associated with fox pursuit. There is little published evidence with which to compare our data for timing of pursuit of foxes by hounds. McDonald reported that in 17 hunts to a kill the pursuit lasted from 4 to 64 minutes (McDonald 1996), but these data are of little relevance to ours where the pursuit was considerably shorter when a pack was employed to flush foxes from a discrete area of cover.

There were 16 occurrences for the pair but only one for the pack when hounds were heard to speak but no fox was flushed. This could be accounted for either by the pair engaging in pursuit of a fox within a covert but failing to flush it out, or by a failure to observe the fox being flushed. While it is impossible to rule out that the latter might have occurred on some occasions, the former is more likely, especially in view of the prolonged times recorded for hounds speaking on a number of those occasions. This is an important finding since it provides further evidence that the use of a pair rather than a pack can result in a more prolonged period of pursuit (that might be associated with compromise of fox welfare) and for lower efficacy in regard to successful flushing to guns.

It was interesting to note that a considerable proportion of foxes was flushed from cover without hounds being heard to speak when both pack and pair were used (54.9% and 45.7%, respectively). One possible explanation for this is that in those instances the foxes may not have been pursued by hounds but were disturbed by the activity of the hounds and huntsman. In these cases it is likely that there was less compromise to fox welfare if the foxes were not actually pursued by hounds even when successful flushing occurred. However these data would suggest that the pack were again more effective in flushing foxes even when there was no actual pursuit. This contention is supported by comment in the report of the Burns Enquiry in relation to Welsh gun packs, where it stated that "the foxes will often move out quite slowly, perhaps having been merely disturbed by the noise of the hounds some distance away in the wood" (Burns 2000).

In the report of the Burns Enquiry, it was stated that "in upland areas, where the fox population causes more damage to sheep-rearing and game management interests, and where there is a greater perceived need for control, fewer alternatives are available to the use of dogs, either to flush out to guns or for digging-out" (Burns 2000). The data presented here provide evidence that in such areas a pack versus a pair of hounds used to flush foxes to guns is considerably more effective as a measure in controlling fox numbers and provide information on the duration of pursuit of foxes by hounds that might be used for informing opinion as to possible compromise of fox welfare.

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