

## Note by Dr G Hartley & S Campbell, SASA

### (1) What is the level of damage inflicted on livestock by foxes?

There are three main livestock areas that may be affected by fox predation, namely free-range or outdoor poultry, pigs and lamb production. Overall, the direct cost to UK agriculture from fox predation has been estimated at £12 million annually (£9.4 M to the sheep sector; £0.7M egg producers; £0.2M and £0.4m to turkey and goose producers respectively; and £1M to pig producers) (cited in Harris and Yalden, 2008). However, there have been relatively few empirical studies other than on lamb losses, with the majority relying on questionnaires of farmers. Nonetheless, in virtually all cases where fox damage has been estimated, figures are provided against a backdrop of widescale fox control either on-site or on neighbouring land. There are no reliable data from the UK on the extent of damage, where some level of fox control is not exercised.

Information from specific livestock areas includes the following.

(a) Poultry. It is widely recognised that foxes may cause significant damage to small-scale poultry producers as a result of the behavioural phenomenon of surplus killing (Kruuk, 1972). Over three contrasting areas of England and Wales, average losses to foxes were reported as between 0-18%, although in some cases, 100% of birds were lost. These losses occurred to flocks of median sizes of 17-30 birds, but all flocks were less than 200 birds (Heydon and Reynolds, 2000).

By definition, free-range chickens must be provided with continuous daytime 'access to open-air runs' that are 'mainly covered with vegetation' (Soil Association, un-dated), which increases their vulnerability to fox attack. There are approximately 10 million free-range hens in the UK, accounting for around one third of all hens (Defra, 2007). In contrast, the free-range broiler chicken production sector remains relatively small when compared to the industry overall (Sheppard, 2004). In addition to direct losses, foxes can cause stress in chickens, which can result in smothering and feather pecking, all of which may lead to production losses (Moberly *et al.*, 2004). A total of 321 questionnaires, with an average response rate of 57%, were sent to free-range egg, chicken, turkey and goose producers in England and Wales. Average reported losses to foxes were 0.02% of chickens, 0.7% of turkeys and 1.43% of geese (Moberly *et al.*, 2004).

(b) Pigs. An estimated 40% of sows are managed in outdoor systems in the UK; specific details are not available for Scotland (FAWC, 2008). Estimated losses of young piglets to foxes vary quite widely from approximately 3% (Paling, 2007) to as high as 25% (Burns *et al.*, 2000). Feedback from within the industry suggests that losses can be high, but often localised, and may affect a proportionally larger number of 'hobby' farmers or specialised pig breeders, the vast majority of which rear pigs outdoors (J. Robertson, University of Aberdeen, *pers. comm.*)

(c) Lambs. Numerous questionnaire studies report perceived losses of lambs to foxes. These are summarised in White *et al.* (2000) in which the average percentage of lamb losses to foxes in relation to flock size were reported as between 0.4% and 2.0%. However, reported losses were highly variable between farms. Heydon and Reynolds (2000) stated that pre-weaning lamb predation to foxes averaged 0 to 0.6% of the lambs born, but could in some instances reach 28.6%.

There are several studies in Scotland and elsewhere that have attempted to quantify the actual numbers of lambs lost to foxes.

On two study areas in west Scotland, Hewson (1984) found that the percentage of “definite” or “probable” fox kills were a minimum of 1.3, 1.8, 0.8 and 0.6% of the lambs estimated to be born between 1976-79 respectively. This compares with overall estimated mortality (loss of lambs at June marking) of 49, 26, 26 and 26% respectively for the four years. Details of causes of lamb loss were not reported. Foxes tended to select lambs less than 5 days old, although were known to attack a lamb up to 10Kg in weight. “Predated lambs were larger and in better condition than those dying from other causes,” although predated lambs may have been vulnerable due to other causes, such as poor defence by the mother or in the early stages of succumbing to disease. Fox control took place at both sites.

White and co-workers (2000) examined ewe-lamb characteristics and predation losses from two hill farm sites in Scotland between 1993 and 1996. Confirmed fox predation was found to be responsible for losses of 0.6% and 0.2% of the lamb crop respectively; total losses to all causes was 10.2% and 9.3%, and 5.8% and 6.9% of lambs went missing respectively. Lambs were vulnerable to predation during the first two to three weeks of life. Fox control took place at both sites.

A study at Eriboll, where no fox control took place, although a Fox Club operated nearby, found only four predated lamb carcasses over four lambing seasons (1987-1990), which was <1% of the lamb crop. However, lambing was exclusively in-bye, possibly with the “presence of shepherds and their dogs active through the night” (Hewson, 1990). This is unlikely to be representative of the majority of lambing in the West and North of Scotland. Macdonald and co-workers (2000) stated that this work is “scientifically weak”, and should probably be treated with some caution.

In a small study on a Scottish hill farm in 2007, the shepherds were asked to carefully monitor causes of death. Total reported losses up to the time of June marking were 6.9%, of which 0.6% of lambs were predated, and 1.5% went missing (SASA, unpublished data).

Studies from Australia (Greentree *et al.*, 2000) have shown that fox predation was the probable cause of death for a minimum of 0.8% and maximum of 5.3% of lambs. Successive levels of fox control resulted in significant reductions in lambs lost to foxes, but this did not result in increased levels of lamb productivity overall.

Other Australian studies have suggested that fox predation could be widely unreported once other factors, such as removal of lambs immediately at birth by foxes, is accounted for. These studies have estimated fox predation to be up to 7%, and even as high as 20 to 30% of lambs (cited in Saunders *et al.*, 1995 and Greentree *et al.*, 2000). To what extent these low intensity sheep production systems compare to Scottish hill farms is however unknown.

## **(2) What scientific evidence is there that foxes predate live lambs?**

By far the bulk of evidence lies in the discovery of lamb carcasses which have clearly been killed, as opposed to scavenged once dead. Providing the carcass is relatively fresh and not too dissected or consumed, it is reasonably straightforward to distinguish between a predated or scavenged carcass. Predated animals will have been alive during the attack, and typically show bruising (subcutaneous bleeding) and surface bleeding/haemorrhaging (presence of relatively fresh blood) around the attack wound site (Rowley, 1970; Hewson, 1984). Animals that have been scavenged post-mortem will not show external signs of bleeding and bruising.

Evidence employed to identify the specific predator can vary between bite wound characteristics, such as the specifics of the wounding pattern, intercanine distances of bite wounds, scent marking of prey, DNA analysis of saliva around the bite mark, or simply the probable elimination of other predators, such as dogs or raptors, according to the circumstances prevailing during the study (Hewson, 1984; Thirgood *et al.*, 1998; Allen *et al.*, 2000; Lyver, 2000; Blejwas, *et al.*, 2006;). Much of the evidence available on fox predation of livestock cited above relies on several distinctive bite wound characteristics, scent marking and the elimination of other possible predators due to specifics of the study site and wounding patterns.

Foxes are predominantly nocturnal hunters and as such, eye-witness accounts of attacks are rare. There are some photographs and video clips available from the world wide web which show a fox either attempting to attack a relatively large lamb (<http://www.flickr.com/photos/zoot42/3513913968/in/set-72157603808634034/>), or in one case, a wallaby (<http://www.youtube.com/watch?v=MiTWwcfhrNI>). While these images lend no support for the scale of such attacks, they do at least provide conclusive evidence that foxes are willing to attack live, apparently healthy animals of greater or equivalent size and weight to their own.

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