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## Research on calving environments for farmed red deer: a review

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### ABSTRACT

This review describes past research on suitable calving environments for farmed red deer and presents ideas on future topics for research. Neonatal mortality on deer farms is common, claiming 10-12 % of calves born on average. Research carried out in the 1970s and observations of wild red deer identified three factors that were required to minimise behavioural problems and subsequent mortality of young calves: isolation of the hind from other deer, vegetative cover for the calves to hide in, and lack of disturbance by people. Subsequent studies have substantiated these observations but the needs for isolation and lack of disturbance cannot be readily fulfilled on intensive deer farms. Selection for deer that are tolerant of other deer and humans at calving time, and taming deer so that disturbance by humans is lessened, are areas in which future research may prove worthwhile.

**Keywords:** red deer; calving; maternal behaviour; farming.

### INTRODUCTION

Research into suitable calving environments for farmed red deer began in the 1970s. Several observational studies established basic recommendations for successful calving. Nevertheless deer farmers today experience (on average) 10-12 % losses of neonatal calves (Asher, 2000), with autopsy studies attributing these deaths to starvation/exposure, dystocia, and mismothering (Asher & Adam, 1985; Gill, 1985; Audige, 1995; Hill *et al.*, 2002). Hinds can also suffer at calving, not just through loss of their offspring, but they also commonly experience stress that is evident in persistent, sometimes frantic pacing along fence lines (Pollard *et al.*, 1998; Wass *et al.*, 2003).

This review examines past research on calving environments, and discusses where future efforts in this area might be applied effectively. A brief background on the behaviour of wild deer at calving is provided at the outset to identify their likely environmental needs.

#### The behaviour of wild deer at calving

Observations of wild deer in Scotland (Darling, 1937; Clutton-Brock & Guinness, 1975; Guinness *et al.*, 1979) have shown that calving hinds seek isolation from other deer and potential predators, as well as vegetative cover. In these studies, the hind left its matriarchal group (consisting of hinds plus male offspring aged up to 2-3 years) during the day or so before giving birth, often moving to higher altitudes outside of the hind's normal range. Hinds chose long heather and sheltered areas for calving. After giving birth the hinds licked and suckled the calves, remaining within 50 m of the neonate for the first few hours, but thereafter spent most of their time much further away (often over 1 km), only returning to suckle 2-4 times a day. Following suckling, the calf moved away from its dam and selected a hiding site within long vegetation. Calf hiding sites tended to be raised above the surrounding ground and sheltered from sight on at least one side, and were often within a gully or dip on a hillside. Calves that were marked by observers were normally moved to a higher altitude level during the next 24 hours. After a few days of intensive hiding the calves started to accompany the hinds, and both mother and

offspring joined other hinds by about three weeks following birth.

A study on red deer in English parks provided further information on the selection of calving sites. Low vegetation such as ragwort or rushes was favoured, while open grassland, and in one park woodland, was avoided (it was thought that the woodland may have been avoided because of the hinds' need to monitor disturbance by humans (Birtles *et al.*, 1998)). In a study and review of calving habitats for wild elk in North America, it was concluded that, in general, calving habitats provided trees or shrubs for cover, and that an essential component was a hidden bedding site for the calf, such as rocks, logs, vegetation, hollows and fallen branches (Wallace & Krausman, 1990).

#### Past research on calving environments in farmed deer 1970s

Early in the development of pastoral farming systems for deer, Kelly & Whateley (1975) observed hinds that had been introduced recently from a more extensive farm, calving at a relatively high stocking density of 22 hinds per hectare. Of 67 live calves born, 16 died within four days of birth, 11 of them from beatings (biting and kicking) by several of the hinds. Young calves sought cover and were found in weeds, long grass, or against fence posts, and individuals hid repeatedly in the same sites. Interference by humans resulted in some calves being beaten as they subsequently ran to the mob of hinds. It was concluded that likely factors contributing to the mortality observed were lack of familiarity of the hinds with the calving area and management, lack of cover for calves and the high stocking density (Kelly & Whateley, 1975).

The following year, Kelly & Drew (1976) observed hinds calving in three paddocks with different stocking densities (22 and 3 hinds/ha) and different forms of cover (pasture with some clumps of grass, hides made of pine branches, and manuka scrub with little understory). The hinds were more habituated to the intensive farm environment than the previous year and calf beatings, and

multiple sucklings observed during human disturbance the previous year, were not seen. Young calves that were approached by people were less easily disturbed from hiding if they were hidden in the pine branches, than if they were in the manuka or grass paddocks. Calves aged up to one day were not always found hidden but thereafter found covered sites, often close to the camping site of the mob. It was concluded that for a successful calving human interference should be minimised, the hinds should be familiarised with the paddocks, stocking rates should be low and cover should be provided for the calves (Kelly & Drew, 1976).

A study on tame red deer calving in largish paddocks (2-8 ha) was carried out in Scottish hill country in the early 1970s (Arman *et al.*, 1978). Pre-parturient hinds were often seen pacing along fence lines and some hinds were described as aggressive. Some, but not all, gave birth in isolation from the rest of the herd. Of 24 births observed, one rejection of a calf was seen (following disturbance by a person), and one adoption of a second calf was seen, five days after the adoptive hind gave birth. A particular attraction of parturient hinds for birth (amniotic) fluids, and calving difficulties in primipara, were noted (Arman *et al.*, 1978).

### 1980s

Extensive observations of the deer calving under intensive farm conditions were made at Invermay and a thorough account of behaviour was provided (Cowie *et al.*, 1985). The first observed pre-parturient behaviour of the hinds was fence pacing, which occurred at relatively low levels during the week or so before parturition. Two days before parturition, pacing increased markedly, and peaked on the day the hind gave birth. While pacing normally ceased during parturition itself, it was sometimes resumed by hinds that were disturbed from the birth site. Pacing was thought to arise from the hinds' need for isolation (Cowie *et al.*, 1985).

Hinds showed some degree of isolation from the rest of the herd prior to and during parturition. Calving sites away from the normal resting area of the herd, and human disturbance, were favoured. Some sites provided cover for calves while others were on open hillsides. It was suggested that, similar to other ungulates, bonding of the hind to the calf occurred when the dam licked it immediately following birth, but the calf only slowly learnt to recognise its dam. Hinds attempted to lead their calves away from the birth site after the first suckling (which usually began  $\frac{1}{2}$  to  $\frac{3}{4}$  hour after parturition), then the calf would move away and hide, with the hind resting and grazing close to the calf for the next four or five hours (Cowie *et al.*, 1985).

Calves with little cover available walked along fence lines and pushed through fences in search of a hiding place. It was thought that lack of cover contributed to calf mortality through entanglement in fences, and separation from the hind in calves that ended up in the wrong paddocks. Hiding behaviour of the calf began to diminish when it was three to four days old. Calves joined the herd by the time they were 7-12 days old (Cowie *et al.*, 1985).

Alien hinds were sometimes intolerant of calves and attacked them. For example, calves seeking cover, or mistakenly approaching an unrelated hind, were sometimes attacked, or frightened into pushing through the fence. Aggression between hinds was observed when alien hinds approached newborn calves and were vigorously repelled by the mother, and when hinds were searching for hidden calves. Some adoption and cross-suckling was observed (Cowie *et al.*, 1985).

Disturbance of calving hinds was sometimes observed to cause the hinds to abandon the site where the amniotic sac had burst, and rejoin the herd or resume pacing (Cowie *et al.*, 1985). This could lead to loss of contact with the calf if it was born away from the original site. Human interference with newborn calves (for instance for tagging) could also lead to problems, with the calf subsequently following the person or vehicle, or being deserted by the hind (Cowie *et al.*, 1985).

Management suggestions for successful calving were minimising human interference, having large paddocks with low stocking densities, avoiding concentrated calving times, and having familiar group structures and environments (Cowie *et al.*, 1985).

### 1990s

The frequency, intensity and location of pacing along fence lines were investigated in four groups of six calving hinds each in 0.5 ha paddocks (Pollard *et al.*, 1998). Pacing was recorded in 14% of observations during the period 2-4 days before calving, increasing to 28% on the day before birth then declining to 4.6% for the period 0-03 days after calving. There were graded increases in pacing depending on the degree of human presence (not present < within deer yards < human visible < in paddock) and the deer paced in the areas most distant from human presence (Pollard *et al.*, 1998).

Deighton (unpubl.) quantified isolation at parturition and pacing in groups of 12 hinds in one small (0.8 ha) paddock underneath a hide containing a human observer and one larger (4.2 ha) paddock more remote from humans. Greater spatial separation between hinds at calving, and less frequent pacing were seen in the larger, more remote paddock (18% of observations in the 24 hours pre-parturition) than in the smaller paddock under the hide (40% of observations) (Deighton unpubl.).

### Current decade

The possibility that increasing fenceline security could decrease neonatal mortality of calves was investigated by Beatson *et al.* (2000). Adding extra netting to fences was successful in some paddocks, but appeared to increase mortality in others (Beatson *et al.*, 2000). This was possibly because calves were unable to escape attacks from alien hinds, or managed to get through the fences in search of cover but not back again. An evaluation of weaning percentages (calves weaned/hinds mated) showed that hinds were more likely to rear calf in calf-proof paddocks, or when trees or scrub were in the paddocks (Beatson *et al.*, 2000). In another study assessing calf survival to weaning there was a positive relationship between sunny weather and survival, and a

negative relationship between high temperatures and survival (Audige *et al.*, 2000).

The use of artificial shelters by young calves was investigated by Hodgetts *et al.*, (2002). Sixteen shelters of various designs (all 1 m<sup>3</sup>) were placed in a small (0.3 ha) paddock containing 19 calving hinds. As in the study by Kelly & Drew (1976), few calves used the shelters on their first day of life, but shelter use increased rapidly thereafter. No consistent preference for any particular shelter configuration was observed (Hodgetts *et al.*, 2002).

Intensive observations of calving behaviour were carried out in 2001 to quantify activities around the birth period and to compare the behaviour of primiparous (16-month-old "yearlings") and older hinds (Wass *et al.*, 2003). Pacing activity rose during the days prior to parturition and at peaked at 43% of observations over the 0-24 h prior to birth. Adult hinds showed an earlier onset and longer duration of pacing than yearlings. Hinds were often isolated (>20m) from the rest of the herd during the two days prior to parturition, and isolation was also observed earlier in the adults than in the yearlings. Forty-four percent of adult hinds and 60% of yearlings experienced interference from other hinds during parturition. Among hinds that were interfered with, yearlings had a higher number of incidences of this than adults. Calves born to yearling hinds took longer to suckle for the first time (mean=44 min) than calves born to adult hinds (33 min). Hinds and calves left the birth site between 1 and 1.5 hours following birth. It was thought that the higher number of interferences, and longer time to suckle increased the risk of mortality in yearling calves. The need for providing opportunities for hinds, especially yearlings, to become isolated during the birth period was highlighted (Wass *et al.*, 2003).

Last calving season (2002), observations at Invermay focused on hiding behaviour in neonatal calves (Wass *et al.*, 2003.). Calves aged 0-3 days were observed in paddocks with either short or long pasture, with pine branch hides scattered within the paddocks. Calves in the paddocks with short pasture were much more likely to hide in alternative cover to grass (specifically, pine branches, ditches or hollows) than calves in paddocks with long pasture. Many calves walked along fence lines prior to hiding. Attempting to get through the fence occurred in 16 and 13% of observations in the short- and long-pasture treatments, respectively. Some newborn calves travelled 50 m or more before encountering cover, and dams returned repeatedly to poorly hidden offspring. Calves approached/followed, were sniffed, licked or beaten, by another hind in 25, 34, 5 and 14% of observations respectively. Some dominant hinds prevented others' access to their calves, and calves venturing near other hinds were sometimes beaten severely. Human presence was particularly disturbing to hinds when their calf was in the open. Calves with dams that paced were often seen following them up and down fences rather than hiding. It was concluded that cover was highly desirable in calving paddocks and that long grass was particularly suitable. The desirability of isolation and minimising disturbance, was also highlighted again.

### Conclusions from past work, and future needs

The early work on farmed deer and the literature on wild deer provided guidelines on the environmental needs for successful calving in deer: cover, isolation and minimal disruption. These messages were strengthened by subsequent work, and observations that some extensive properties consistently achieve weaning rates of 93-98% (Hill *et al.*, 2002). Thus, the challenge is for intensive farms to re-create this type of environment or to alter the nature of deer so that these requirements are lessened.

Providing ample cover should be achievable on intensive farms and may reduce the need for costly calf-proof fences (especially if long grass is removed from the outside of the fence). However, consideration of how this is best achieved in tick-prone areas, and how to minimise effects of loss in pasture quality if grass is left to grow long in calving paddocks, is required. It would be valuable to determine the effect of paddock size on isolation, interactions and pacing (i.e., a comparison between small paddocks with a few hinds or larger paddocks with more hinds). Selection for "tolerance" of humans and other deer at calving time may be the next step in domesticating deer (Hill *et al.*, 2002). Thus, fruitful research might be carried out on the heritability of permissiveness towards alien calves, aggression at calving, and the propensity to pace at calving. Research could also determine whether taming hinds (e.g., by feeding) reduced pacing, and whether social composition of hind groups affected interactions at calving time.

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