

FENCE LINE PACING IN FARMED RED DEER HINDS AT CALVING

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Abstract

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The frequency, intensity and location of fence line pacing were observed daily, in four groups of six farmed red deer hinds, over a 3-week period at calving. The groups were confined in neighbouring paddocks (5000m² in area; two containing a wooden shelter) adjacent to deer yards containing an observation hide. At 1100h, a person entered each paddock to weigh, sex and tag newborn calves.

Pacing (moving parallel to and within 0.5m of a fence line) was mainly at walking speed, and its frequency differed according to the time relative to parturition. It was recorded in 13.6 (± 1.09) per cent of observations during the period 2-4 to days before calving, increased to 27.6 (± 1.9) per cent on the day before birth and then declined to 4.6 (± 0.39) per cent for the period of 0-3 days after calving. Pacing relative to total movement was greater before (65.7%) than after (43.5%) parturition (SED 3.7%; P < 0.001), indicating that it was not just a consequence of greater activity before birth. The hinds were observed to be grouped together rather than distributed randomly, but when some of the hinds were pacing, groups were spread out over more quarters of the paddock than when none were pacing (P < 0.001). However, there was no definite suggestion of avoidance of other deer. Within each group, most pacing occurred along certain fence lines, but no general pattern was observed. Regardless of whether hinds had given birth or not, there were graded increases in pacing depending on the degree of human presence (not present < within deer yards < visible < in paddock; P < 0.05); and deer favoured areas distant from human presence (P < 0.01). The findings in relation to fence line pacing and location support suggestions that human interference at calving should be minimized, but did not indicate which environmental features were responsible for this motivational drive.

Keywords: *animal welfare, farming, fence line pacing, parturition, red deer*

Introduction

On intensive red deer farms, animals are typically grazed at high densities on featureless paddocks of permanent ryegrass-clover pasture (Moore *et al* 1985). The animals are

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frequently observed pacing along fence lines, and it has been suggested that this behaviour reflects motivation to gain access to resources such as food, water, shelter, or the company of other deer (Moore *et al* 1985). Fence line pacing is particularly prevalent at calving time (Blaxter *et al* 1979; Yerex 1982; Moore *et al* 1985). This may possibly be related to the discomfort of imminent parturition, or it may reflect motivation to gain access to a specific environment for calving.

Studies of wild deer indicate that farmed hinds may be motivated to seek isolation for calving. Both Darling (1937) and Clutton-Brock and Guinness (1975) observed that hinds moved away from their matriarchal groups to calve. Details of isolation-seeking behaviour were provided by Clutton-Brock and Guinness (1975) who observed that hinds moved out of their usual ranges to higher altitudes, where there were fewer deer, on the day(s) prior to parturition, and remained in isolation until the calf was at least 2 weeks old. Darling (1937) also observed that hinds calved at higher altitudes, in their upper winter territories, and sought sheltered sites covered in long heather for calving. Although opportunities to provide spatial isolation for parturient hinds are limited in the intensive farming environment, there may be ways in which farmers can minimize fence line pacing at calving. The following study aimed to document the frequency and intensity at which hinds pace along fence lines during the calving period, and to investigate any patterns in pacing behaviour which might indicate environmental needs.

Methods

Animals and study site

The study was conducted at Invermay Agricultural Centre, Otago, New Zealand (45°52'S, 170°23'E) during November–December 1994. Four groups, each of six multiparous red deer hinds (aged 4–9 years), wearing coloured collars for individual identification, were confined in four, adjacent 5000m² paddocks surrounded by deer fencing (Figure 1). In two of the paddocks there was an open-sided shelter (4x6 m) constructed of plywood timber. Daily observations were made from a hide within a deer handling facility adjacent to the paddocks over the 3-week period during which the hinds were due to give birth. The deer were observed on weekdays from 0630–0930h by one person, and from 0930–1230h and 1345–1545h by a second. At weekends only the first morning observation was carried out (with afternoons represented as missing values in subsequent analyses). At approximately 1100h every day a third person entered each paddock in turn, to weigh, sex and tag newborn calves. This took approximately 30min.

During observation periods, the deer in each paddock in turn were observed in a predetermined order, every 15min. For each deer the following details were recorded:

i) activity, as walking; pacing – moving parallel to and within 0.5m of a fence – at a walk; pacing at a trot; pacing at a run; standing; grazing; sternal recumbency ('sitting'); or 'other' (including trotting and running not associated with pacing); ii) location within the paddock (with respect to the four quarters [A–D] and the four fence lines [1–4]; see Figure 1); iii) any human presence (human in the handling facility and not visible, human visible, or human in the same paddock as the deer currently being observed); and iv) which quarter of the paddock any human was in or nearest to.

Statistical analyses

The percentage of observations within morning and afternoon sessions for each activity (and for pacing as a percentage of pacing plus walking) around the time of parturition, was analysed using data from the 4 days before, the day of (day 0), and the 4 days after calf tagging. This was analysed as a binomial GLM (McCullagh & Nelder 1989), fitting terms for the individual followed by pre- or post-calf tagging phase, time of day (morning or afternoon), and their interaction.

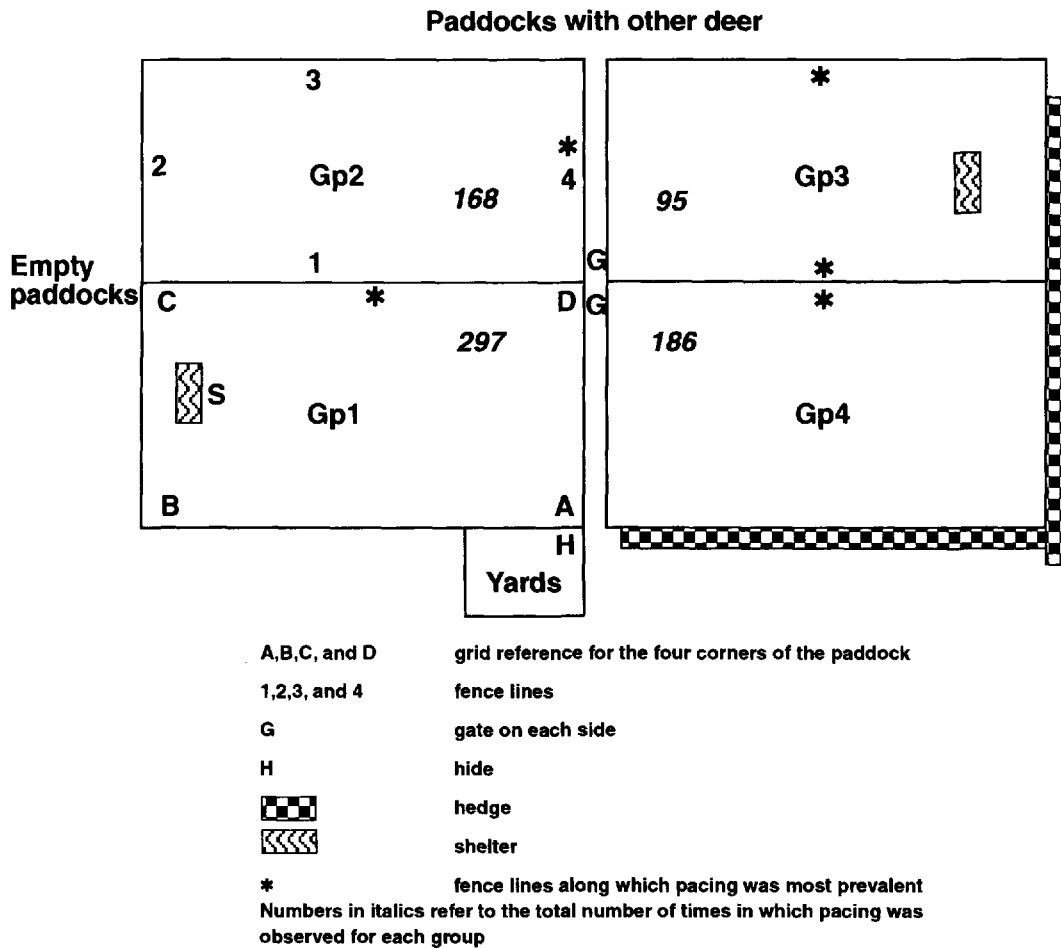


Figure 1 Study area, showing frequency and location of pacing for each group.

Pacing was further analysed as above, except that the pre-calf tagging term was subdivided into the day before (day -1) and 2-4 days before calf tagging. From this analysis, the pacing percentage was obtained for each individual. This was then regressed on hind age, calf birth weight and calf sex, and its interaction with these terms.

Each pacing observation was classified as either walking, trotting, or running and as to whether or not it was in the 4-day period before parturition. The resulting contingency table was analysed as a Poisson GLM.

The number of times each activity was observed for each individual over the whole trial was calculated for each of four types of exposure to human presence (no human present, human present but not visible, human visible, human in the same paddock as the deer being observed). Each activity was analysed as a binomial GLM, adjusting for the individual and fitting terms for human presence and phase (pre- or post-calf tagging).

The location of each hind, relative to human presence outside the paddock, was classified as close, even or opposite. For example, if a hind was in paddock quarter A, (B or D), or C respectively, while the human was closest to A, the relative classifications would have been close, even and opposite respectively. The number of deer falling into each of these categories was analysed as a Poisson GLM with an identity link, fitting (1,2,1) for the respective levels of 'hind relative to human' as the expected random proportions. These data were further classified by whether or not a human was visible and whether or not the hind was pacing. They were then analysed by a proportional-odds ordinal logistic model, fitting these terms.

The 2x2 contingency table, classified by whether or not all the hinds were in the same paddock quarter and whether or not there was pacing, was analysed using a Poisson GLM. The theoretical probability of all hinds being in the same paddock quarter if they were randomly distributed was calculated. Using the Poisson approximation to the binomial, the number of occasions in which all hinds were in the same paddock quarter and there was pacing, was tested as a Poisson random variable.

Finally, the number of times pacing was observed along each fence line for each group was analysed as a Poisson GLM, fitting for group.

Results

Sixteen hinds gave birth during week 1, four during week 2, and three in week 3. The hinds were most frequently observed sitting, regardless of whether or not they had given birth (Table 1). The overall frequency of pacing was 18.6¹ per cent on days 1-4 before parturition compared with 4.6 per cent for hinds on days 0-3 after parturition (SED 1.11; $P < 0.001$). Walking was more frequent in pre-parturient hinds than in hinds which had given birth ($P < 0.01$; Table 1). After calving, time spent grazing and standing idle increased ($P < 0.01$; Table 1).

Most pacing was at walking speed, rather than at the trot or run (Table 1). Time spent pacing was greater in the morning than in the afternoon (11.1% versus 4.4% respectively, SED 0.82%; $P < 0.001$. See Figure 2). It also differed according to the time relative to parturition ($P < 0.001$), being recorded in 13.6 (± 1.09) per cent of observations during the period 2-4 days before birth, increasing to 27.6 (± 1.90) per cent on day -1 and then declining to 4.6 (± 0.39) per cent after calving.

¹ Values may differ marginally from those in Table 1 as an artefact of the statistical transformations.

Table 1 Mean frequency (and SED between means) at which different activities were observed, as a percentage of total activities, before (days -4 to -1) and after (days 0-3) parturition. (Back-transformed estimates of percentages do not necessarily sum to 100; ns - not significant; ** $P < 0.01$, *** $P < 0.001$.)

Activity	Pre-parturition	Post-parturition	SED	Significance
<i>Sitting</i>	47.3	48.7	3.70	ns
<i>Standing</i>	9.7	15.7	1.81	**
<i>Walking</i>	9.2	5.3	1.09	**
<i>Grazing</i>	12.8	19.3	1.95	**
<i>Pacing-walk</i>	15.9	4.2	1.04	***
<i>Pacing-trot</i>	2.8	0.4	0.51	***
<i>Pacing-run</i>	0.05	0.04	0.06	ns
<i>Other</i>	3.8	4.4	0.83	ns

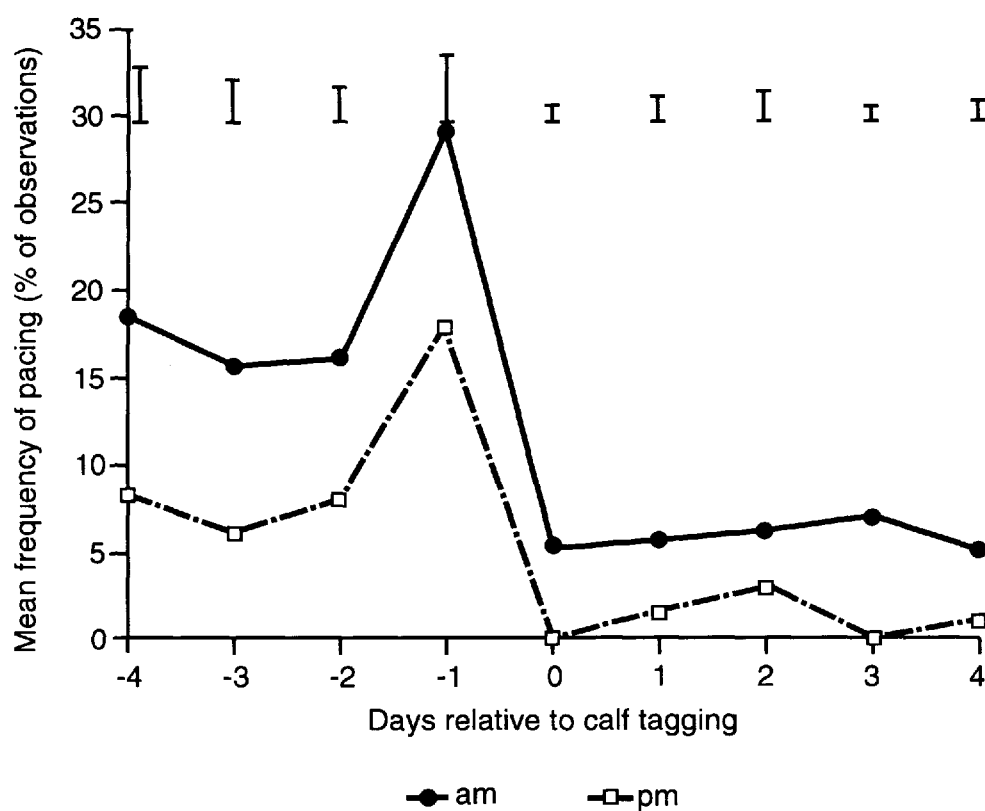


Figure 2 Mean frequency of pacing (% of observations) relative to day of calf tagging (day 0), for morning and afternoon periods. Vertical lines indicate the SEDs between means for morning and afternoon periods.

Pacing relative to total movement (pacing plus walking) was greater before (65.7%) than after (43.5%) parturition (SED 3.70%; $P < 0.001$); and greater in the morning than the afternoon (60.1% versus 36.8% respectively; SED 4.55%; $P < 0.001$. See Figure 3). No significant relationship was found between calf sex or weight, or hind age, and the frequency of pacing behaviour.

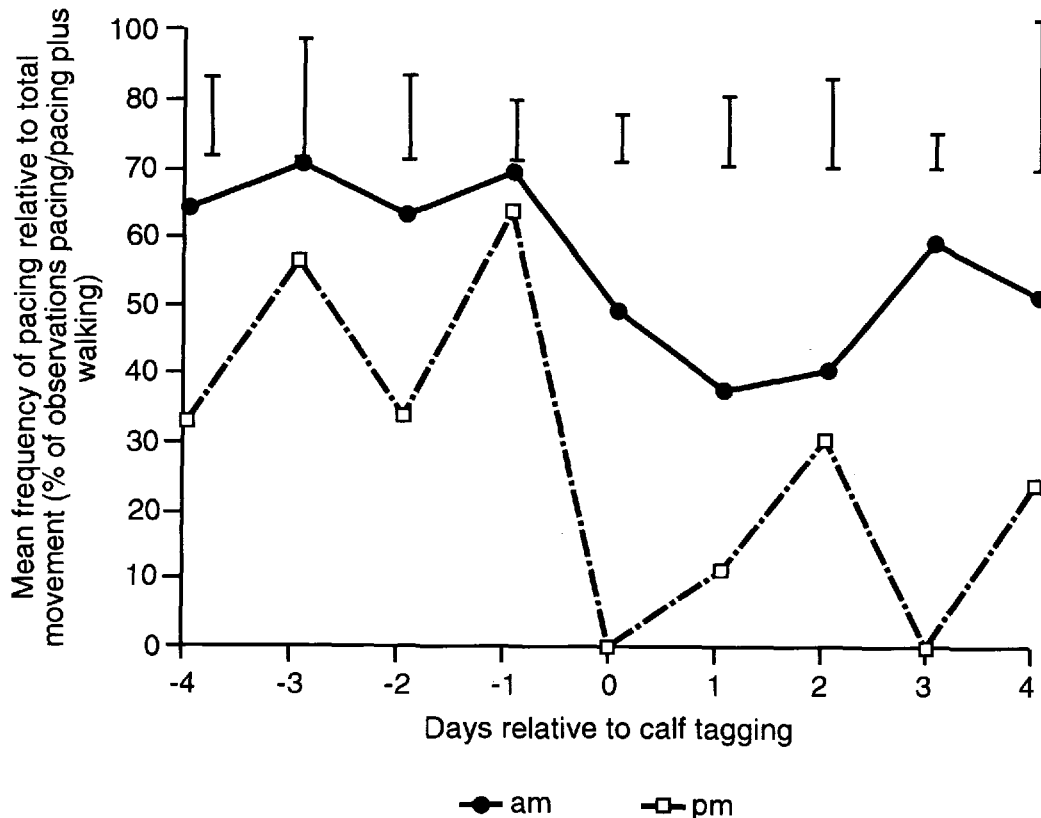


Figure 3 Mean frequency of pacing as a percentage of total movement (relative to frequency on day of calf tagging – day 0), for morning and afternoon periods. Vertical lines indicate the SEDs between means for morning and afternoon periods.

The behaviour of the hinds was related to the degree of human presence, an effect which did not differ according to whether or not the hinds had calved. As the degree of human presence increased, there were significant increases in standing, walking, and pacing, and decreases in sitting and grazing (Table 2).

There were fewer deer (18.9%) in the paddock quarter nearest the human disturbance and more deer (33%) in the quarter of the paddock opposite the disturbance, than the 25 per cent which would be expected in each quarter if the deer were randomly distributed ($P < 0.001$). This effect was maintained regardless of whether or not the human was visible, or the hinds were pacing.

Table 2 Mean frequency (and SED between means) at which different activities were observed, as a percentage of total activities, with varying degrees of human presence. (Back-transformed estimates of percentages do not necessarily sum to 100; ns- not significant; * $P < 0.05$, *** $P < 0.001$.)

Activity	No human	Human in yards	Human visible	Human in paddock	SED	Sig.
<i>Sitting</i>	51.2	34.8	17.7	11.3	2.13	***
<i>Standing</i>	12.4	20.4	45.5	31.5	2.55	***
<i>Walking</i>	4.0	7.7	12.4	32.3	1.58	***
<i>Grazing</i>	22.9	25.6	5.8	4.4	1.35	***
<i>Pacing</i>	4.6	6.4	8.7	16.1	1.43	*
<i>Other</i>	3.6	4.5	7.3	4.3	1.39	ns

The hinds tended to be grouped together, with all hinds within the same quarter of the paddock 8.9 per cent of the time. This differed significantly ($P < 0.001$) from the figure of 3.1 per cent predicted under the null hypothesis of a random distribution. Within paddocks where there was some pacing, the deer were all in the same quarter 4.5 per cent of the time, but within paddocks where there was no pacing, the deer were all in the same quarter 10.3 per cent of the time (SED 1.46%; $P < 0.001$).

Within each group, certain fence lines were paced along more often than others (Figure 1; Table 3). No general pattern or relationship with environmental features was observed, although there was an indication that pacing was related to the proximity of the group to the yards (with Group 1 pacing the most frequently and Group 3 pacing the least). Group 1 also showed a marked degree of pacing along the fence line furthest from the yards (Table 3).

Hinds were not observed using the shelters for parturition (although newborn calves were frequently observed inside them).

Table 3 Number of times pacing was observed along each fence line, for each group.

Group	Fence line number				Total
	1	2	3	4	
1	12	18	236	31	297
2	17	13	46	92	168
3	49	9	36	1	95
4	66	20	93	7	186

Discussion

Pacing and walking increased prior to parturition, but the increase in pacing was over and above than that seen in walking at this time. While the hinds may have moved around more before giving birth because they were uncomfortable, they spent a relatively greater amount of time pacing along fence lines. This suggests that they were motivated to find a specific

environment for calving. Pacing was most pronounced on the day before birth, the time when hinds in the wild state are most likely to isolate themselves from others (Clutton-Brock & Guinness 1975).

The observation that pacing occurred at moderate levels 2-4 days before calving, and peaked on the day before calving, is consistent with the contention of Cowie *et al* (1985) that pre-parturient pacing has two phases of intensity. Pacing was more prevalent in the morning than the afternoon in the present study. Diurnal effects on activities have been observed in farmed red deer (Semiadi *et al* 1993; Pollard & Littlejohn unpublished data), but the difference in the present study could be related to the daily disturbance at 1100h for tagging new calves.

Pacing was related to human presence. The deer seemed particularly sensitive to this, as movement in general increased even when the people were within the deer yards and not visible. However, there was a graded effect of the degree of disturbance depending on the visibility and proximity of the human. The deer also favoured those areas of the paddock most distant from humans (even when they were inside the deer yards); in Group 1, closest to the yards, there was a marked degree of pacing along the fence line furthest from the yards. Group 3, most distant from the yards, tended to pace least (although the experimental design did not allow a formal test of this). The disruptive effects of humans on behaviour supports the suggestion that interference at calving should be minimized (Cowie *et al* 1985; Moore *et al* 1985). The effects of human presence did not differ according to whether or not hinds had calved, suggesting that an additional factor was contributing to pacing in the pre-parturient phase.

Apart from the effects of humans, there were no clear patterns in pacing behaviour indicative of environmental needs. There was some indication that the hinds were more spread out when they were pacing than when engaged in other activities, but no evidence of definite avoidance of other deer. Similarly, Kelly and Drew (1976) and Kelly and Whateley (1975) did not observe clear isolation of parturient hinds on deer farms, although Cowie *et al* (1985) considered that hinds tended to distance themselves from other herd members. An interesting observation was reported by Yerex (1982) when a gate was opened for a distressed hind, part-way through giving birth: the hind went through the gate to the far corner of the next paddock and then completed parturition. Providing more space and topographical variation for calving could be useful in future research aimed at determining hinds' environmental needs although their spatial needs may prove to be greater than can be practically achieved on an intensive farm. In a study by Arman *et al* (1978), hinds calved in varied terrain and paddocks measuring 0.024 to 0.088 km². These researchers frequently observed pacing, and the hinds did not show any definite avoidance of each other.

In this study, the deer did not utilize the artificial shelters for calving. The shelters would have afforded some visual isolation from other deer (but at the expense of the parturient hind's own visual range).

Animal welfare implications

Fence line pacing in calving hinds occurred at moderate levels during the pre-birth days, peaked on the day before birth and then declined. The increase in pacing was over and above the increase in walking seen prior to parturition, indicating that it may be related to a motivational need for a specific environment. The literature on wild hinds suggests that this

need could be isolation from other deer, but farmed deer have shown little tendency to avoid others at calving. Pacing (and moving generally) was also related to human presence, indicating that this should be minimized at calving time (providing good husbandry can be maintained), but no clear relationship with other environmental features was observed.

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