# Exploring calf loss behaviour: what can we learn from wildlife?

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Calf mortality reduces productivity, profitability, and animal welfare outcomes. In northern Australia, numerous challenges exist that preclude the detection and management of calf mortality, such as vast property size and minimal human-animal interaction. With rapid advancements occurring in on-animal sensing technologies, it might be possible to use such devices to detect a calf loss event. One potential method of achieving this involves monitoring the cow and inferring the status of the calf from her behaviour. Detecting maternal behaviours associated with calf loss may provide a practical and affordable solution to enable researchers and producers to explore exactly when, where, and why calves might be lost. For accurate and successful detection of calf mortality, a greater understanding of the dam's behavioural response to a calf loss event must first be determined. We hypothesised that a) several behaviours could be monitored to identify the loss of offspring and b) the behaviour of a dam with young at foot would differ from a female without young at foot.

A systematic literature review was conducted to find scientific literature pertaining to the behavioural changes of *Ruminantia* dams in response to the death of their offspring and/or identifying the behavioural differences between females with and without young at foot. Articles were included if they complied with the following criteria: (i) were written in English, (ii) identified animals of the *Ruminantia* taxon as the primary subject, and (iii) investigated the behavioural changes associated with the loss of offspring and/or identified the behavioural differences between females with and without young at foot. The whole *Ruminantia* taxon was used given the absence of papers pertaining to this topic in domestic cattle.

A total of 3,322 articles were searched and 13 articles met the relevant criteria. Ten papers related to comparative maternal/non-maternal behaviours and three papers pertained to the behavioural changes associated with neonate loss. Two behaviours were identified across the ten comparative maternal behaviour papers – foraging time (n = 4 papers) and vigilance (n = 9 papers). Vigilance was, on average, greater in mothers compared to non-mothers, while foraging times were higher in non-mothers compared to mothers.

Neonate loss related behaviours that were identified included ambulatory pattern, distance to conspecifics, feeding, step length, and vigilance (n = 1 for all behaviours). Ozoga et al. (1982) identified that the pattern of ambulation in white-tailed deer changed following the loss a fawn. The doe initailly established a home range, and later was observed wandering extensively. Similarly, DeMars et al. (2013) noted a significant increase in the step length in caribou following the loss of the calf. Another study in cattle, conducted by Kluever et al. (2008), identified a transition period following the loss of a calf. Feeding initially decreased, while vigilance increased in the three days following the loss of the calf, before returning to baseline levels after 10 days.

Numerous on-animal sensing devices exist that could be utilised to detect the identified behaviours. Accelerometers measure the acceleration of an object along the x-, y-, and z- axes, and can be used to identify distinctive behaviours (Barwick et al., 2018). Previous studies have used accelerometers to detect grazing in cattle, which is comparable to the foraging in wildlife (Nielsen, 2013). Vigilance was considered an upright head position, with side-to-side scanning movements. Although no papers have formally utilised accelerometers to measure vigilance, it is theoretically possible. A global navigation satellite system (GNSS) estimates an animal's location by triangulating signals from orbiting satellites (Fogarty et al., 2015). Visualisation of GNSS data could reveal changes in ambulatory pattern, distance to conspecifics, and step length.

As hypothesised, the literature review identified several behavioural changes observed in *Ruminantia* dams that had lost their young and when comparing females with and without young at foot. It is difficult to ascertain whether a species effect exists, and whether this will have implications for the development of an autonomous sensing device in domesticated cattle. Further research is required to investigate the maternal responses to calf mortality in domestic cattle, such that an accurate device can be developed.

## References

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