THE WELFARE IMPLICATIONS OF SHEPHERDING DURING LAMBING IN EXTENSIVE NEW ZEALAND FARMING SYSTEMS

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Abstract *Animal Welfare 2002, 11*: 157-170

A review of the literature was undertaken to consider the possible effects of human intervention (shepherding) at around the time of parturition in extensively farmed sheep. There is little clear empirical evidence to suggest that shepherding ensures either easy births or the integrity of ewe–lamb contact — factors closely linked to the welfare of the animals at this time. There is similarly no clear support for shepherding being harmful. However, the following suggestions are made: first, human presence can inhibit or delay parturition; second, extended parturition can increase the risk of, or is associated with, dystocia; and third, disturbance at birth can compromise ewe–lamb bonding and consequently lamb survival. Furthermore, sheep populations that have undergone rigorous selection for ease of lambing and minimal shepherding in extensive environments have well-documented physical and behavioural traits underlying their predisposition for enhanced lamb survival. Although our cultural legacy may impose a duty to intensively monitor animals at lambing, it is concluded that, at least in some situations, shepherding may not be entirely beneficial. The commonly held view of the necessity for some human intervention in extensive livestock systems is perhaps overly paternalistic, and requires a more comprehensive appraisal.

Keywords: *animal welfare, disturbance, easy-care, lambing, sheep, shepherd*

Introduction

The relationship between man and sheep is an ancient one, sheep being among the earliest domesticated animals (Zeuner 1963; Protsch & Berger 1973). Similarly, the shepherd has historically been seen as the paragon of care (eg "the good shepherd giveth his life for the sheep", Christian Bible, John Chapter 10, Verse 11). Nowadays, there are many sheep farming management methods. At one extreme are the very intensive indoor systems, where lambing proceeds under constant supervision (Fell 1967) and may occur at eight-month intervals in fecund sheep (Ainsworth *et al* 1985). In contrast, there are the 'easy-care' or 'natural' systems of management, where sheep are selected for traits that require minimal or no shepherding at lambing. An easy-care sheep is defined (Kilgour & de Langen 1980) as one that can adapt and survive in adverse climatic conditions; can successfully lamb and rear at least one lamb without assistance; and is easily shepherded.

Although the origins of easy-care lambing are obscure, they are most often associated with the development, since 1935, of the Marshall Romney sheep in New Zealand's Wanganui district (Mackereth 1979). This strain of Romney sheep has a high survival rate, lower lamb

mortality and requires less shepherding at lambing than other sheep breeds (Kilgour & de Langen 1980; Knight *et al* 1988, 1989b). The first report on their breeding success indicated that lamb survival was 10–14 per cent higher in Marshall Romney sheep than in a number of other lines of Romneys (Hight 1978/79). In one experiment, control lines of Romneys showed 24.9 per cent lamb mortality, and Marshall Romneys 10.7 per cent. When control ewes or rams were mated to Marshall Romney rams or ewes, lamb mortality was intermediate (Knight *et al* 1988). Many factors have been identified as contributing to the improved lamb survival associated with Marshall Romney sheep (Knight *et al* 1988, 1989a,b; McSporran & Fielden 1979), such as: lower incidence of periparturient deaths, including those attributable to dystocia and starvation; lower incidence of cranial and spinal haemorrhage; differences in the maternal pelvis and lamb measurements, presumably facilitating the birth process; greater choice of sheltered lambing sites; a lower incidence of abandoned lambs at birth and less separation of individual twins in a steep environment, possibly related to a greater agility; and, reduced separation of lambs and ewes at tagging undertaken within 12 h of birth. The easy-care concept has since been extended to sheep other than the Marshall Romney strain, with much selection for ease of lambing undertaken in New Zealand in the 1960s and 1970s. Similarly, some strains of Merinos with heritable differences in lifetime rearing ability have been described (Haughey 1983).

The traditional relationship between man and sheep around the time at which the latter gives birth raises a dilemma. Should sheep be shepherded in order that difficult births can be assisted, vaginal prolapses treated, moribund animals destroyed, displaced ewes and lambs reunited, and orphans fostered, artificially reared or euthanased? Conversely, should shepherding be kept to an absolute minimum, so that animals can give birth in relative isolation without the contribution of human interference to difficult births and lamb mortality? In essence, the problem appears to be one of balancing the competing ideals enscribed in two of the Five Freedoms (Webster 1994) that those with responsibility for animals should aim to provide. These are the freedom from pain, injury and disease by prevention or rapid diagnosis and treatment, and the freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind.

The object of this review is to consider whether shepherding does result in freedom from pain, injury and disease, and whether it does allow the expression of normal behaviour. This is undertaken by considering factors which affect animal welfare at lambing, especially lamb survival (isolation, bonding, the birth site, disturbance during lambing and lamb mortality) based on Kilgour and Dalton's (1984) practical guide *Livestock Behaviour*, and several recent reviews (Alexander 1984; Pollard 1989; Nowak 1996). The influence of the system of management, particularly the degree of human intervention, on lamb survival is then examined.

Isolation at birth

The ewe may attempt to seek isolation prior to giving birth (Welch & Kilgour 1970), a behaviour also noted in wild populations of sheep such as the Bighorn (Geist 1971) and the Soay (Grubb & Jewel 1966; Shillito & Hoyland 1971). Isolation may reduce the risk of predation by allowing the lamb time to develop the locomotory ability to flee, and may aid exclusive bonding of dam and offspring. However, the importance of isolation among domestic sheep is unclear, as it has not always been observed (Arnold & Morgan 1975) and may differ between breeds of sheep (Alexander 1980). In addition, there are differing subjective definitions of isolation and very many farm management practices that interfere

with the opportunity for sheep to be isolated. Factors such as topography, land surface features, breed and adjacent human activity may affect birth-site selection (Kilgour *et al* 1983; Knight *et al* 1989a,b; Alexander *et al* 1990). Failure to achieve isolation is a problem inherent in some modern farming practices characterised by high stocking rates and synchronous or concentrated lambing patterns. It may result in interference from other ewes, leading to mismothering, desertion of lambs and lamb stealing, all of which have been described in some New Zealand flocks as well as in other flocks (Welch & Kilgour 1970; Winfield 1970; Kilgour 1972; Kilgour *et al* 1976; Stevens *et al* 1982; Alexander *et al* 1983a,b; Putu *et al* 1986; Crawford *et al* 1993).

Bonding of ewe and lamb

The first four hours after birth are critical for the bonding of ewe and lamb, with olfactory cues being particularly important. Newborn and older lambs may be attracted to any moving objects such as other sheep, shepherds or dogs, which inadvertently causes them to abandon the birth site, an aberrant behaviour not seen in animals giving birth in isolation (Winfield & Kilgour 1976). Attachment or bonding of dam and offspring occurs during a sensitive phase of maternal responsiveness that may begin prior to parturition and end within the 12 hours following birth (Poindron & Le Neindre 1980; Numan 1988). The most important period is the hour immediately after birth (Alexander *et al* 1986), although bonding can occur later (Smith *et al* 1966). Ewes with stronger maternal behaviour — those less likely to move away from a shepherd tagging the lamb soon after birth — have been associated with better lamb survival (O'Connor *et al* 1985).

Birth site

Bonding takes place at the birth site, with those ewes that spend longer periods at this site being less likely to be separated from their lambs than those spending shorter periods there (Alexander *et al* 1983b, 1984). Natural movement of the ewe and lamb away from the birth site shortly after birth (eg if the lamb slips down a slope and the ewe follows) may not affect ewe–lamb bonding, especially if the afterbirth is dropped at the new site. In contrast, human intervention, such as the forced movement of ewes while they are in labour, is disruptive because it eliminates the birth-site focal point. Therefore, ewes and lambs should not be displaced from the birth site. To illustrate this principle, birth site disruption was described for twin-born Merino lambs (Putu *et al* 1988) by drifting them 25 m away from their birth site (Table 1). Although animal numbers in this experiment were low (n = 60 ewes, 11–19 per group) and significant statistical comparisons were limited to contrasts between those penned at the birth site and those moved from it, the data do indicate that disruption (or a reduction in time spent at the birth site) can affect maternal behaviour, leading to lamb desertion and death. When these ewes and their lambs were separated 48–60 h after birth, 72 per cent of control ewes reunited with both of their lambs within 30 s, in comparison with only 28 per cent of the moved ewes. Thirty-five per cent of these animals reunited after more than five minutes of separation, compared with only five per cent of control ewes and lambs. A similar study comparing penning at the birth site with penning 25 m away confirms the importance of the birth site. However, the results suggest that what is important for lamb survival is not so much that the ewe is on the birth site but that she is simply together with her lambs (Murphy *et al* 1994). Ewes may not, of course, necessarily choose the most appropriate birth site (Kilgour *et al* 1983; Knight *et al* 1989a). Although the birth site is a focal point, after birth the lambs become the focus; however, there are breed- and age-related

differences in the time spent at the birth site. Ewes and possibly lambs may return to the birth site if disturbed (Kilgour 1982; Putu *et al* 1988).

Table 1 The effect of deliberate birth-site disturbance on maternal behaviour and lamb mortality in Merino ewes with twin lambs (Putu *et al* 1988).

Treatment	Maternal behaviour (%)			Mortality (%)
	Normal	Temporary disturbance	Permanent desertion	
Control:				
Penned at birth site 30 min after second lamb was born.	84	16	0	3
Left undisturbed at birth site.	62	23	16	12
Disturbance:				
Moved 30 min after second lamb was born.	35	35	30	18
Moved as above, then returned to birth site another 30 min later.	18	54	27	23

Disturbance during lambing

Disturbance during lambing can result in premature movement from the lambing site (Kilgour *et al* 1983) unless the ewes are well habituated to the source of the disturbance, be it the shepherd, dogs, horses or vehicles. The latter part of labour involving abdominal straining usually takes less than an hour, and the response to interruption during this period is dependent on prior habituation. Fear, anxiety or disturbance may inhibit uterine muscle contractions in the ewe, as in other species, and a delay in birth may impact on the lambs' survival (Haughey 1980). This inhibition is, presumably, a physiological adaptation for survival, most probably mediated via the adrenal system, and in parturient animals it may delay or prolong parturition (Naaktgeboren 1974, 1979; Bray & Wodzicka-Tomaszewska 1974; Naaktgeboren & Bontekoe 1976; Bontekoe *et al* 1977; Lederman *et al* 1978; Duffy 1981). Disturbance, which can include shepherding (Kilgour *et al* 1983), may suppress or delay the normal process of parturition, enabling the animal to flee danger and give birth at a more appropriate time or place (see Naaktgeboren 1979). This phenomenon has been graphically illustrated in the disappearance of electrical activity recordings associated with uterine contractions prior to parturition in a (albeit single) ewe subjected to human disturbance, and their continuation in a control ewe (see Naaktgeboren 1979). An artificial delay in the birth process has been linked to lowered survival rates in one study (Haughey 1980), although there were several confounding influences (eg experimental design, birth rank). Interestingly, confinement and human presence may also be associated with an increase in the frequency both of birth problems and assisted parturition in beef cattle (Duffy 1981).

The response of the ewe to disturbance may depend on the age of the ewe and on lamb birthweight, with younger ewes and those producing lighter lambs being more susceptible (Arnold & Dudzinski 1978). There are also breed-related differences in the response to the disturbance caused by a shepherd (Whateley *et al* 1974) that may lead to the permanent desertion of lambs. Interestingly, some ewes with twins may resist disturbance better than ewes with single lambs, while poor nutritional status may increase the incidence of poor maternal behaviour and lamb desertion (Arnold & Dudzinski 1978). Merino ewes that are

assisted, at least during indoor lambing, tend to show abnormal maternal behaviour and have a higher incidence of lamb desertion (Winfield *et al* 1972).

Lamb mortality

New Zealand lamb mortality rates are generally assumed to range between 5 and 25 per cent (Hight & Jury 1970; Dalton *et al* 1980; Scales *et al* 1986), a figure comparable to the 15 per cent national loss in the UK (Eales *et al* 1983). Most lamb deaths of known age occur within the first three days of birth (Dalton *et al* 1980; Hinch *et al* 1985), with placental insufficiency, dystocia and starvation/exposure implicated in nearly three-quarters of deaths (Gumbrell 1985; Mellor 1988). Few problems occur between bonding and weaning. A more recent study involving ultrasonic scanning of over 16,000 ewes (Nicoll *et al* 1999) indicated the times at which lamb losses were occurring. Out of 180 potential lambs per 100 ewes present at pregnancy diagnosis, five were lost between scanning and birth, 14 were born dead, five died within 48 h of birth and 12 died or were lost between 48 h after birth and weaning. Deaths (see Table 2) result mainly from starvation/exposure and dystocia which, in combination with a long period of labour, may reduce mothering ability and lamb survival (Wallace 1949; Alexander 1960; Shelley 1970; Bray & Wodzicka-Tomaszewska 1974; Arnold & Morgan 1975; Haughey 1980; Alexander *et al* 1983a).

Table 2 **Overall causes of lamb mortality in three major New Zealand studies. These document the survival rates of 7727, 10 049 and 5163 lambs born during 1959–1976, 1969–1976 and 1976–1981, respectively (from Hight & Jury 1970; Dalton *et al* 1980; Scales *et al* 1986).**

Cause of death	Lamb mortality (%)		
	Hight & Jury 1970	Dalton *et al* 1980	Scales *et al* 1986
Abortion/prenatal/stillborn†	10.3	7.7	8.0
Dystocia	32.2	19.3	22.1
Starvation/exposure	26.5	25.4	20.5
Infection/disease	11.6	6.6	2.8
General/other	5.1	6.1	4.4
Unknown	14.3	34.8	*

† A significant number of stillborn lambs are likely to have been alive at birth but died shortly afterwards before being counted (Mellor 1988).

* The remaining 42.2 per cent of "lamb mortality" comprised lambs that were assisted and survived which, without assistance, were assumed to have died.

Collectively, it is apparent that lambing can be associated with poor animal well-being and that the time immediately around birth is critical for lamb survival. The major strategies for improving survival during this period, therefore, are an easy birth, protection from environmental extremes, and ensuring maximum and highly specific contact between ewes and their offspring during the first 12 h after birth (Alexander 1984). Not surprisingly, a number of management systems are commonly used during lambing to optimise survival.

Lambing management systems

Strategies associated with lambing are quite varied, ranging from intensive indoor systems to extensive outdoor systems and from virtually continual supervision to minimal-to-no shepherding. The characteristics and advantages and disadvantages of the different systems vary, reflecting underlying differences in factors such as environment, climate, breed,

stocking density, economics, and shepherding skills and expectations (summarised in Table 3). The systems have been grouped as: intensively managed indoor systems (not generally undertaken in New Zealand); the more traditional outdoor lambing systems generally associated with shepherding; and unsupervised or easy-care lambing characteristic of extensive conditions. It is worth emphasising here that easy-care lambing is not an option on all farms, as the diversity in animals, environments and socio-economic influences means — indeed, demands — that traditional shepherding is also a feature of the sheep industry in New Zealand.

Table 3 A comparison of some of the features and relative advantages and disadvantages of different lambing management systems.

Intensively managed, indoor lambing	Traditional, shepherded lambing	Minimal and easy-care lambing
Lambs protected from climatic extremes minimising the risk of hypothermia. Animals confined in high-pathogen environments with greater risk of gastrointestinal and other infections in lambs and mastitis in ewes requiring treatment. Lambs protected from risk of predation.	Lambs exposed to climatic extremes and susceptible to hypothermia. Depending on environment, animals may be exposed to pathogens resulting in infections and requiring treatment. Predation of lambs possible.	Lambs exposed to climatic extremes and susceptible to hypothermia. Ewes and lambs not exposed to pathogens associated with more intensive environments. Predation of lambs possible.
Ready access to ewes and lambs ensures early intervention and treatment of animals experiencing difficult births and ill-health; and fostering or hand-rearing of orphan lambs undertaken. Welfare of ewes and lambs enhanced through early intervention and treatment.	Depending on the frequency of shepherding, some degree of assistance can be given to animals experiencing difficult births and ill-health; animals can be moved to shelter; fostering or hand-rearing of orphan lambs undertaken. Welfare of ewes and lambs enhanced through intervention and treatment, although this depends on frequency of shepherding.	Ewes selected for easy births and lamb survival, and little or no assistance given to difficult births and mismothered or ill lambs. Welfare of ewes and lambs can be compromised through little opportunity to intervene and treat.
Ewes familiar with human presence reducing handling stress. Welfare compromised by reduced opportunity to lamb without interference.	Depending on the degree of habituation to humans, intervention may cause stress. Welfare may be compromised when human presence disturbs birth and ewe–lamb bonding.	Ewes wary of the presence of shepherds, shepherd-induced problems avoided. Welfare is enhanced by avoiding moving the animals from the birth site and disturbing birth and ewe–lamb bonding.
Mortality, health and pedigrees easily recognised and recorded. Reduced opportunity to select against difficult births and weak ewe–lamb bonding.	Mortality, health and pedigrees can be recognised and recorded. Some opportunity to select against difficult births and weak ewe–lamb bonding.	Accurate records of mortality, health and pedigrees not easily obtainable. Opportunity for intensive selection for survival traits.
Capital, labour, milk-substitute and medication costs are significant.	Labour and intervention costs can be significant.	No significant capital, labour and other costs of intervention.

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Perhaps the major characteristic relevant to this study that differs between lambing management systems is the value of human supervision. In more intensive systems, the benefits of shepherding are seen as paramount whereas, in contrast, in some extensive systems the costs of shepherding are fully acknowledged. A view that is central to more extensive systems is that human interference can cause harm and that therefore it is necessary to consider what effects disturbance might have, and whether it could be detrimental to animal welfare during lambing.

The influence of shepherding

How good is shepherding at ensuring an easy birth and sufficient or appropriate ewe–lamb contact? There have been few scientific studies comparing the merits of different shepherding systems, and what has been reported should be treated with caution, if not dismissed, because of significant confounding influences. There may be a reason for this paucity of definitive studies: different systems suit different animals, environments and economic circumstances; research environments may be biased towards intensive management; and, it is difficult to monitor lambing without imposing some degree of interference.

In Australia, the effect of supervising Merinos during lambing on lamb mortality was examined over several years (Tyrrell & Giles 1974). Supervision comprised assisting ewes experiencing difficulty; 'drifting' or 'shedding' (separating and moving) unlambed ewes into the next paddock daily (Giles 1968a; Scales *et al* 1986); and marking and mulesing (surgically removing the wrinkled breech skin, which predisposes the animals to insect parasitism or flystrike) lambs at 4–6 days of age, after which they were moved to a different paddock. This system of management resulted in a mean lamb mortality rate of 14 per cent. When lambing was unsupervised, mortality averaged 21.4 per cent when marking and mulesing occurred during lambing, and 15.9 per cent when it was undertaken after lambing had ceased. In a similar experiment (Giles 1968b), 'drift lambing' was compared with unsupervised lambing. The drift lambing system involved removing unlambed ewes at least daily, assisting any ewes and lambs in difficulty, weighing, tagging, docking and mulesing the lambs, and eventually removing them to a different paddock. This system was compared with an unsupervised one, although this also involved mustering (herding) for docking and mulesing during lambing. The drift lambing system reduced lamb mortality from 43.9 per cent to 23.9 per cent, probably because of a reduction in mismothering. These experimental results must be viewed with caution. Differences between the systems are confounded by differences in stocking rates and age at mulesing. Mortality could only be estimated in the unsupervised groups, and lambing in the unsupervised groups was disturbed by mustering, docking and mulesing during lambing.

In other studies, Moore *et al* (1966) found no significant difference in lamb mortality in Merinos either drifted (21%) or 'set-stocked' (animals placed on an area of pasture for a long period rather than shifting them frequently) (27%) during lambing, although the study was primarily designed to investigate predation by foxes, with all sheep inspected twice-daily. Similarly, lamb mortality did not differ significantly between set-stocked and daily shed or drifted Romney ewes (Scales *et al* 1986).

There have been brief reports of UK studies (see Waterhouse 1996) investigating the role of shepherding. Compared with ewes that receive moderate levels of shepherding in an enclosed hill area, unshepherded ewes rear 22 fewer lambs per 100 ewes, a difference which, although apparently large, makes it difficult to justify the costs of a shepherd unless lamb

values exceed £20 per head. Similarly, a simulation study based on a 30 per cent reduction in ewe numbers and a 70 per cent reduction in farm labour, management and inputs resulted in a reduction of productivity but maintenance of profitability. However, the level of mortality associated with single pregnancies rose from 0.07 to 0.17 per ewe, suggesting that systems with lower inputs and less intensive management can lead to poorer welfare. Finally, in intensive and housed lambing systems there is evidence that the level of husbandry is related to lamb survival (Ducker & Fraser 1973; Gates 1977). It is not clear whether the sheep in these studies have or have not been selected for shepherding. The only true comparison would be if different shepherding intensities were compared using sheep selected for differing intensities of human management.

Therefore, there is apparently no clear empirical evidence indicating that shepherding ensures either easy births or the integrity of ewe–lamb contact. Although as a society we value objective or scientifically derived facts (Midgley 1992), we also value our subjective conclusions (Midgley 1994). The following anecdotal comments suggest that management practices undertaken to assist animals are perhaps not always beneficial:

"The marking procedure used in the unsupervised group — together with the mustering of very young lambs, probably caused mismothering", which may have contributed to the high levels of lamb deaths (Giles 1968b).

"Most lambs were tagged by a single observer as the presence of two people greatly increased the apparent disturbance" (Stevens *et al* 1982).

"A system in which there is no ... disturbance at any time during lambing may yet prove to be the most economical" (Tyrrell & Giles 1974).

Shepherding may interfere with lambing site behaviour — removing a ewe in which labour has started may induce dystocia (Kilgour 1982).

That "Merino ewes may move from the birth-site before their lambs are sufficiently mobile, or before the mother–offspring bond is fully established ... is supported by a lower incidence of separation after births at night, when Merinos moved little" (Alexander *et al* 1983a). Whilst this may have been due to their relative nocturnal inactivity, it might equally have been due to the lack of disturbance caused by the observers (two to four observers walking through the paddock continuously between 0830h and 1800h).

"28 per cent (15/53) of Merino twin abandonments could be attributed to human interference at tagging of lambs" (Alexander *et al* 1980).

Within the 24 hour period, the peak of lambing was associated with reduced human activity in housed sheep (Hudgens *et al* 1986) whilst there was a lull in births associated with morning and afternoon drifts in Merinos at pasture (Alexander *et al* 1993).

"The traditional tendency of shepherds to intensively manage ewes lambing for the first time could aggravate the loss of lambs through precipitating premature movement from the birth site, where bonds between mother and young are established" (Alexander *et al* 1984).

Finally, "it seems that much more shepherding is done in the industry than is necessary" (Allison 1982).

Discussion

Western civilisation has a rich historical and cultural legacy influencing what it traditionally means to be a good shepherd. The common perception of the caring shepherd and the timid sheep raises the possibility that our husbandry ideals are perhaps overly paternalistic. This is evident in the view (Kilgour 1982) that little is gained from once- or twice-daily intervention at lambing except in providing some satisfaction for the shepherds involved, and in the

question (Jones 1976) "...does supervision achieve anything, more than easing your conscience?". It is not surprising that an adequate scientific critique of the effects of shepherding is missing — it seems to have been taken for granted that shepherding is both necessary and beneficial. Using the evidence available from the scientific literature, however, it is possible to construct the following argument:

1) Human presence can inhibit or delay parturition.
2) Long parturition increases the risk of, or is associated with, dystocia.
3) Disturbance at birth compromises ewe–lamb bonding and consequently lamb survival.
4) Therefore, in some situations, shepherding may not be entirely beneficial.

Although scientific reports have identified the causes of lamb mortality — mainly dystocia and starvation/exposure/mismothering — the underlying reasons are apparently idiopathic, there being no attempt to quantify differences between different systems of management. In short, we do not know the mortality rates associated with easy-care lambing on extensive hill country. Given the popularity of pregnancy scanning as a management tool, this should not be difficult to determine. Nor do we objectively know the effects of different shepherding routines on animal welfare in such situations.

In a companion paper (Fisher 2002) covering farmers' perspectives during the development of easy-care lambing, it was suggested that shepherding was a legacy of our European descent and not the long-term solution to some of the problems associated with extensive pastoral farming in this country. The pragmatic approach was to breed stock to suit their environments, as well as to appropriately adapt stockmens' skills and farm management practices. The study was based on a subjective examination of farmers' and shepherds' views of easy-care lambing, as presented over several decades as articles in the New Zealand popular farming literature. Several themes were apparent. First, animals were bred to survive or to suit local environments or conditions, particularly steep hill country in New Zealand. This involved extensive culling of undesirable animals, regardless of how well they might perform in traits other than the ability to survive and to produce live lambs at weaning. Problem sheep were assisted, recorded or marked and then culled at an appropriate time; thus, both artificial (culling) and natural selection were used. Second, natural selection enabled the important traits to be identified and they were subsequently incorporated into artificial selection programmes. The traits indicative of survival were not necessarily the traits associated with, or commonly accepted as important in, livestock judging. Third, the practice was necessitated by the impracticality of supervising lambing in difficult terrain and the cost of skilled farm labour. Finally, it was acknowledged that disturbance at lambing created problems and, most importantly, that the easy-care approach reduced some of the problems traditionally associated with lambing.

Thus, far from merely attempting to balance the two apparently competing ideals inscribed in the Five Freedoms, some New Zealand farmers have arguably advanced both. The animals' freedom to express normal behaviour is sought by providing them with the opportunity for isolation and minimising interference around the time of lambing. More relevant though, the freedom from pain, injury and disease is sought by prevention (selection of easy-care sheep) as well as, or in some circumstances rather than, treatment (some of the skills normally associated with shepherding). This simple solution, encapsulated in the commonly held belief that "prevention is better than cure", is nevertheless one which animal welfare science has yet to fully acknowledge. The major period of development of easy-care sheep is now history, having occurred several decades ago. Modern sheep-farming practices build on the genetic legacy provided through the breeding of easy-care sheep by addressing

the well-being of mother and foetus prior to birth (see Mellor 1988; Geenty 1997), especially with regard to maternal nutrition, a significant factor affecting lamb mortality.

Finally, it is important to acknowledge some of the limitations of this study. First, there are other empirical indicators of welfare, such as measures of physiology and behaviour, reproductive success, and incidence of disease (Broom & Johnson 1993). Although acknowledging lamb mortality is far from the only or the perfect measure of welfare, it is a particularly useful one not only because it is easily quantified, but also because it is the most visible aspect of the problem both in the public arena and in scientific publications. There are, however, other important reasons for (or against) shepherding — the main reason for not addressing them in this study was a lack of information. They may range from obvious ewe welfare issues (cast, vaginal prolapses etc) to the more obscure effects of ewe distress during pregnancy affecting the learning ability of the subsequent offspring (see D'Alessio 1993). Second, there may be significant breed and environmental differences in some aspects of lambing and lamb survival (Dalton *et al* 1980; Dwyer *et al* 1996); the Merino especially may rate poorly in several aspects of lambing and lamb survival (Alexander 1984).

Animal welfare implications

Mankind has had a long association with — and dependence upon — animals, but only relatively recently have we begun to consider the influences of well-intended interactions between man and animals. Shepherding in pastoral farming is one such interaction, but the caring ideal of the shepherd and the perception of sheep being helpless raises the possibility that some of our expectations of husbandry practices are overly paternalistic. Several decades ago, New Zealand farmers responded to an outdated legacy of the cultural virtues of a "good" shepherd, the necessity of economic survival, and the requirements of adapting animals to extensive and often demanding physical environments by developing the easy-care lambing system. This resulted in the development of animals now better suited to their environment and more closely aligned with farm management practices. The major period of development of easy-care sheep is now history, and modern sheep farming practices build on the genetic legacy provided; by addressing maternal nutrition prior to birth, lamb mortality can be significantly improved. To conclude, it would appear that the development of easy-care lambing might well come to be seen as representing a significant milestone in farm animal welfare. It not only overcame the pervasive influences of our cultural legacy on the way we interact with animals, but produced a system more in keeping both with the biology of the animal in an extensive environment and with the demands placed on the animal by humans.

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