# TRANSPORT OF DEER: A REVIEW WITH PARTICULAR RELEVANCE TO RED DEER (*CERVUS ELAPHUS*)

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**Abstract**

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*Farmed deer, of which the predominant species is the red deer (*Cervus elaphus*), are increasingly transported to abattoirs for slaughter rather than being shot at pasture. In order to satisfy meat hygiene and marketing requirements, the welfare of deer is often reduced because all farmed animals are stressed by commercial transportation. Several recent experimental studies (reviewed here) have found the magnitude of behavioural and physiological responses of deer to many aspects of handling and transport to be similar to those measured in other farm species, particularly ruminants. Thus, their welfare appears not to be unduly compromised despite their comparatively recent domestication. Deer are, however, particularly flighty and require specialized handling facilities and equipment, the key features of which are summarized.*

*Legislation covering transport of deer is already operative in many countries with the aim of safeguarding deer welfare. However, the responses of deer to commercial transportation have not yet been measured scientifically. This primary information is needed before a full assessment of the effects of transport on the welfare of deer can be made. Thermal conditions during transit are of importance for deer welfare and these have not been measured, either under experimental conditions or during commercial journeys.*

**Keywords:** *animal welfare, farmed animals, handling, legislation, red deer, transport*

## Introduction

Farmed deer are increasingly transported to abattoirs for slaughter rather than being shot at pasture. Most published scientific studies relate to the red deer (*Cervus elaphus*) which, worldwide, is the predominant species farmed in this modern way. This review therefore concentrates on red deer with mention, where relevant, of other farmed species which include wapiti or elk (*C. elaphus canadensis)*, fallow deer (*Dama dama*), reindeer/caribou (*Rangifer tarandus*), rusa (*C. timorensis*), sika (*C. nippon*), chital (*Axis axis*) and white-tailed deer (*Odocoileus virginanus*) among others. This review considers the transport of deer on and from modern farm enterprises, concentrating on its consequences for deer in terms of their welfare. Some information on handling and conditions pre- and post-transport is included, particularly where this updates the review of deer handling by Matthews (1993).

## Pre-transport handling

The deer species that are commonly farmed remain essentially wild prey animals, relying on alertness and flight (including jumping) to avoid predators, but they may also bite and kick when cornered. Like many grazing ruminants they rely on 'safety in numbers' and herding when threatened. They normally establish dominance hierarchies (Clutton-Brock *et al* 1982) which can be disrupted by close confinement (eg in pens of high stocking density) or need to be established when unfamiliar animals are encountered. These instinctive behaviour patterns are little altered in captivity although red deer and wapiti are less flighty than other species. Several studies have shown the presence and approach of humans, handling, physical restraint and social isolation to be stressful and aversive to deer (Pollard 1993; Pollard *et al* 1993, 1994; Matthews *et al* 1994; Carragher *et al* 1997; Grigor *et al* 1998c). However, deer do habituate to humans, flight distances reduce with familiarity, and the effects of most of these stressors are usually short-lived.

The principles of good handling of deer and design of handling facilities have been reviewed in detail by Matthews (1993) but are continually being refined (Hamilton 1994; Grigor *et al* 1997a, 1998d). An important consideration with deer is the marked alteration in physiology and behaviour associated with pronounced seasonality of breeding. Stags are particularly aggressive during the autumn rut when testosterone levels are high.

Seasonal differences in the basal heart rate of red deer hinds were recorded by Price *et al* (1993). The winter low of 50 beats per minute (bpm) in January when lying resting increased to 85bpm in May (when the hinds were pregnant). Standing increased these rates by 15bpm, walking by 30 and trotting by 63. Approach by humans or exposure to noise increased heart rate by about 14bpm whereas visual isolation increased heart rate by 27bpm over and above any effects of increased activity. Interestingly, the heart rate changes were similar to those reported for well-handled sheep (Baldock & Sibly 1990). Price *et al* (1993) therefore suggested that deer may find certain farming practices no more stressful than do other farm animals.

Carragher *et al* (1997) also concluded that the welfare of deer was unlikely to be compromised by typical handling procedures, as behavioural and physiological measures returned to normal levels soon after release from penning, drafting or restraint in a crush (a narrow pen designed to restrain single animals). Heart rate changes were very similar to those reported by Price *et al* (1993), with the most stressful procedure, restraint in a crush, elevating levels by about 30bpm – less than increases due to exercise.

These findings are also supported by an observational study of 18 red deer hinds which found no increase in abnormal behaviour regardless of whether the animals were: i) merely herded; ii) herded and handled; or iii) herded and subjected to restraint and a veterinary procedure (Diverio *et al* 1993). Six of these deer were given long-acting neuroleptics that did have a slight tranquilizing or calming effect during herding.

A recent study of ease of loading of farmed red deer by Grigor *et al* (1998d) found no effect of gender or of overnight housing (at either of two stocking densities). Thus no benefit of overnight housing in preparation for transport, as suggested by Fletcher (1988), was found. The experiments involved repeated loading attempts of groups of five animals on subsequent days. Deer loaded from a very wide race (4m wide), in which they could turn around, were more difficult to load the next day. However, deer entered both curved and straight races 1.5m wide faster from day 2 and also entered the trailer more readily. Grigor *et al* (1997a) had previously found that groups of six deer also moved more readily into and along races that were 1.5m wide in comparison with narrow races, 0.5m wide. This study showed that speed of movement through a race increased significantly on the second day but changed little thereafter, indicating that red deer rapidly become accustomed to moving through wide races.

### *Key points for handling deer*

Based on the published scientific evidence in this review and practical farming experience, the more important features to reduce levels of fear, stress and injury when handling deer include:

i) familiarity with the handlers and handling system (naive animals are best introduced to novel situations alongside experienced deer);
ii) high fences (at least 2m) and race sides (up to 2.5m) to reduce injury from attempted escape by leaping. Gradually increasing the visibility of fences until they become predominantly solid-sided and smooth is suggested for races approaching yards (Matthews 1993). Having the upper part of the race wall slatted reduces fear and stress, as deer can see each other and have warning of the approach of humans;
iii) wide races (5–20 m approaching fields, and about 1.5m in handling facilities) as deer prefer to move in groups. Similarly, gateways should be at least 3.5m wide;
iv) circular races should have a radius of about 2m;
v) stocking densities of $0.5m^2$ $animal^{-1}$ in holding pens for animals up to 100kg which should be increased to at least $1m^2$ for larger animals and longer time periods;
vi) the use of crushes designed specifically for deer which suspend them above the ground in padded squeeze sides to overcome their extreme flight response and reduce the potential for injury;
vii) avoiding driving deer down inclines exceeding 20°. Deer prefer to move uphill.

## Transport

### *Background and legislation*

Long-distance national or international journeys may be experienced by a few deer whose value for breeding purposes ensures the highest standards of welfare and veterinary supervision.

In the infancy of the deer farming industry, the majority of animals intended for meat were individually shot in the field and butchered locally in much the same way as venison obtained from hunting. From the point of view of the deer this was an ideal situation, provoking no fear or stress, provided the shot was accurate and resulted in instantaneous insensibility. Deer do not show distress when a conspecific is killed near them (Bracke 1992).

Modern marketing and meat hygiene requirements have resulted in increasing numbers of farmed deer being slaughtered in licensed premises with meat inspection. In consequence, they have to undergo several stressful procedures associated with pre-slaughter handling and transport.

It is well established that most farmed species find the transportation process frightening, aversive and stressful (see reviews in Grandin [1993]). As with other species farmed for meat, the welfare of deer during this time is of concern. Thus legislation and codes of recommendation or practice specifically relating to transportation are in operation in many countries (eg Farm Animal Welfare Council [FAWC 1985]; Ministry of Agriculture, Fisheries and Food [MAFF 1989a]; New Zealand Game Industry Board [1993-4]; New

Zealand Animal Welfare Advisory Committee [1994, 1996]; Canadian Agri-Food Research Council [CARC 1996]; GB Parliament [1997]).

In New Zealand, certain classes of deer are considered to be particularly prone to stress or injury during transport and their codes (New Zealand Animal Welfare Advisory Committee 1994, 1996) recommend the following are not transported: i) deer with young-at-foot less than 1 month old; ii) deer that are likely to injure other animals or people; iii) deer with bleeding antler stubs or in the first week after velveting; and iv) deer with velvet longer than 60mm (except master breeding stags).

The New Zealand codes (New Zealand Animal Welfare Advisory Committee 1994, 1996) also recommend that deer of different species; hinds/does; deer with antlers; young animals and those differing in size are separated during transit; and that newly weaned (within 10 days) deer should only be transported directly between farms and not on the same vehicle as their mothers.

UK guidelines (MAFF 1989a) are broadly similar to the New Zealand codes, with recommendations that the following classes of animals should not be transported to an abattoir and may therefore be considered unfit for other journeys: i) deer aged under 5 months; ii) deer in velvet; iii) hinds during the last month of pregnancy; iv) infirm, ill, injured or diseased animals; and v) entire males aged over 24 months during the rut.

In addition, deer with antlers should have had them removed several days prior to transport or be penned separately. It should be noted that velvet (ie soft, vascularized) antlers cannot legally be removed in Europe, save for veterinary reasons (GB Parliament 1982; MAFF 1989b).

### *Lorry design and operation*

There are few published specifications relating to the design of vehicles transporting deer: in general they are expected to conform to legislation and codes regarding welfare and safety and are similar to those used for transporting other ruminants. Deer should preferably not be transported in the same vehicle as other farm livestock nor penned adjacent to them in transit or in lairage (MAFF 1989a; Abeyesinghe *et al* 1997).

A recent experiment in New Zealand winter conditions (Waas *et al* 1997) found heart rates to be slightly elevated (by 7% to 8%) in red deer stags travelling in middle and rear pens compared with the front pen inside an aluminium crate transported for 2h on the back of a lorry. Plasma lactate levels were also lower in the front pen. Unfortunately, no variables such as temperature, humidity and wind speed were measured but it is highly likely that the mid and rear pens were more exposed, thus imposing a higher thermal demand on these animals in winter weather. This could explain the increased heart rate, possibly accompanied by shivering or increased movement that would elevate lactate levels.

There is clearly a need for thermal conditions during transit of deer to be measured as thermal comfort is an important welfare consideration.

### *Space allowances during transport*

MAFF (1989a) guidelines suggested the following minimum floor area allowances for deer: i) adult stags, 9 sq ft (approximately 1m$^2$); ii) adult hinds and yearling stags, 5–6 sq ft (0.5–0.6 m$^2$); iii) 3-month-old calves to yearling hinds, 3–5 sq ft (0.3–0.5 m$^2$).

New Zealand Animal Welfare Advisory Committee Codes (1994, 1996) allow a maximum of eight deer, each with a liveweight of 100kg, in a pen measuring 2.5x1.4 m; with detailed minimum space allowances ranging from $0.22m^2$ per 40kg fallow hind up to $0.96m^2$ per 200kg red deer stag.

A recent study by Grigor *et al* (1998a) found few effects of group size (5 versus 10 deer), sex or stocking density (0.6 or 1.2 $m^2$ per 100kg liveweight, ie similar to the minimum or double the above space allowance, respectively) on most behaviours and physiological parameters during experimental transport over 160km in straw-bedded pens. There were more losses of balance at higher space allowances, but there were no falls. These losses of balance occurred only on narrow winding roads and were associated with driving events such as braking and cornering. Deer orientated either parallel or perpendicular to the direction of travel with similar frequency. Diagonal or other orientations were seldom seen.

Similar results were found in a New Zealand study (Jago *et al* 1993) in which 16-month-old deantlered male red deer were transported in groups of six at either commercial stocking densities of $0.49m^2$ $animal^{-1}$ or a more generous $0.74m^2$ $animal^{-1}$ on floors made from steel grating. Stocking density had little effect on loss of balance, which occurred more on winding roads. There were more impacts with pen walls or other deer but fewer aggressive encounters at high stocking densities. The preferred orientation was facing forwards and parallel to the direction of travel (23% of the time) but orienting to the rear or towards the nearside was also frequently seen. It was suggested deer avoided facing passing traffic. In a subsequent study (Jago *et al* 1997) it was found that larger hinds could not easily orientate parallel to the direction of travel in pens only 1.2m long and at stocking densities of $0.42m^2$ $deer^{-1}$, and that longer pens would better meet the requirements of the animals.

High stocking densities of $0.38m^2$ per 84kg animal were found by Waas *et al* (1997) to increase the stress of red deer stags transported in groups of six for 2h, on a 160km experimental journey. Heart rates were, respectively, 10 per cent or 13 per cent higher than those of deer transported at medium ($0.62m^2$ $animal^{-1}$) or low ($0.85m^2$ $animal^{-1}$) densities. Lactate concentrations in blood of deer transported at medium or high densities were between 30 per cent and 40 per cent higher than those at low stocking densities.

These studies indicate that deer travel well with few welfare problems; thus current guidelines and practices appear satisfactory, provided care is taken on winding roads, and pen size measures at least the full body length of the deer from front to rear to provide space for orientation in the direction of travel.

### *Journey length*

Both journey distance and duration of transit have a marked effect on most species of farmed animals: eg sheep (Knowles 1998), pigs (Warriss 1995), cattle (Tarrant 1990; Knowles 1999) and broiler chickens (Warriss *et al* 1992). New Zealand codes (New Zealand Animal Welfare Advisory Committee 1994, 1996) suggest deer should not be transported for more than 12h without water and should also be fed and rested after 24h. They also recognize that deer can become stressed by being unloaded in unfamiliar surroundings; thus, journey breaks are not particularly desirable. This point was emphasized by Fletcher (1988) who stated that journeys should be accomplished with the minimum number of delays.

Waas *et al* (1997) concluded that journey times should be kept to a minimum, having measured significant increases in both plasma cortisol and sodium levels with time during a 2h journey. However, changes in several other physiological variables were small and heart rate and plasma lactate levels declined as the journey progressed.

The percentage of deer downgraded for bruising in one deer slaughter plant in New Zealand almost doubled from a mean of 6 per cent for commercial journeys under 100km, to over 11 per cent for journeys exceeding 200km (Jago *et al* 1996).

In experimental journeys of 80, 230 or 380 km to the abattoir, bruising levels were low but significantly increased on the hocks and vertebrae/back with distance (Jago *et al* 1997). Initial handling and transport increased levels of most blood constituents indicative of stress or muscle damage – but only a few of these were significantly altered by journey length and the deer did not appear to be dehydrated.

Grigor *et al* (1998b) examined the effects of road type and journey length and duration. In a factorial design, deer were transported (2h for 94km on winding roads, or 2h for 122km on straight roads; or 6h for 284km on winding roads, or 6h for 350km on straight roads). Six yearling red deer hinds were transported at a time, allowing $0.8m^2$ per animal. In the cool weather conditions and low stocking density, air temperatures in the lorry (mean 8.3°C) were similar to those in the home pens (mean 7.0°C) stocked at $2.25m^2$ per head. Liveweight losses increased significantly from 0.8 per cent to 1.7 per cent with longer journey time, but returned to pre-transport levels within 3h of transport, with access to feed and water; and thus may be attributed to feed withdrawal rather than stress. More losses of balance were observed during transit over winding roads but the incidence reduced with time suggesting some adaptation. Similarly, initial elevations in heart rate of around 12bpm declined to normal values after 1h, and initial perturbations of behaviour reduced after the first hour. There was little evidence of dehydration in the thermally comfortable conditions during 2h or 6h without water in transit. Significant rises in plasma cortisol and non-esterified fatty acids immediately post-transport indicated that deer found all these journeys stressful – but only in the short term, as concentrations returned to pre-journey levels at the end of the 2.75h recovery period. Levels of plasma creatine kinase were significantly higher in deer transported on winding roads which were probably physically demanding for the deer and whose effects continued beyond the post-transport recovery period.

Thermal exchanges during transit have not been specifically investigated for deer but adult ruminants are much more likely to experience heat than cold stress. Pending such work, New Zealand recommendations (New Zealand Animal Welfare Advisory Committee 1994, 1996) that stock should not be transported when ambient temperatures exceed 30°C, or air temperatures around the deer exceed 35°C, may be used. The New Zealand recommendations suggest that water cooling (hosing) can reduce heat stress and drinking water should be provided at least every 12h. In hot weather, stocking density could also be reduced. Obviously vehicles need a uniform and controlled supply of ventilating air for all stock carried, avoiding draughts.

***General responses to transport***

Surprisingly, there appear to have been no scientific studies conducted of responses of deer to transport during commercial journeys. This leaves an important gap in our knowledge. It is always valuable to be aware of the nature and extent of a potentially problematic situation before examining its component parts. Although it is valid to assume that transport is stressful to deer, the degree of stress and of possible compromises to welfare needs to be measured during normal commercial journeys. A fully loaded vehicle driven by a commercial driver provides a physical and social environment that can seldom be reproduced under experimental conditions. For example, the thermal conditions and the nature of vehicular vibrations are significantly altered by partial loading. Legislation should therefore initially be based on research under commercial conditions, as it is those that it addresses.

The (previously mentioned) surveys at New Zealand slaughter plants are relevant in terms of the overall response of deer to commercial transit (Selwyn & Hathaway 1990; Jago *et al* 1996). Also the measurements by Grigor *et al* (1997c) were made in a commercial abattoir. Behavioural and physiological responses measured during experimental journeys are likely to be relevant to the commercial situation in many instances (eg Jago *et al* [1997]; Waas *et al* [1997]; Grigor *et al* [1998a, b]), but similar observations during commercial journeys need to confirm this. A survey of 228 captive cervid herds in Michigan (containing white-tailed, fallow, sika, red and axis deer, elk and caribou) claiming to be the first description of cervid farming in the USA (Bruning Fann *et al* 1997) found death and illness attributed to 'stress due to handling or transport' to be among the most frequently reported categories of problems, but with only 0.7 per cent to 0.8 per cent of animals affected.

## Responses to specific aspects of transport

The focus of most research on the transport of deer has been to monitor responses to individual variables (or combinations of a few of the stimuli) which an animal could experience during handling and transport. The nature and degree of the response of the animal enables the relative magnitude of stress to be established. It may also indicate ways of reducing the adverse effects of particular stressors, for example by improving designs of handling facilities.

### *Light*

Matthews (1993) stated that practical experience has shown that reduced levels of illumination reduce the flightiness of deer during handling. He also cited evidence from Langridge (1992) that the tendency of fallow deer to move from relatively dark areas towards the light can be exploited by dimming holding pens and lighting the entrance to a race or crush. From practical experience of handling fallow deer on Danish farms, Vigh-Larsen (1988) stated that the room before a crush should be totally dark and that increasing light levels would facilitate the movement from one area to another.

Pollard and Littlejohn (1994) concluded that the welfare of red deer might be improved by darkening holding areas. However, most of the behavioural responses of the yearling hinds in their experiment appeared to be related to whether or not they could see their surroundings. It is uncertain whether the deer were frightened, and whether darkness reduced postulated levels of fear or not. Only two levels of illumination – bright (200 lux) – and dark (0–1 lux) were used. Other, less extreme, levels would need testing to be of relevance for practical deer farming.

In studying factors influencing the movement of farmed red deer through races, Grigor *et al* (1997a) measured light levels and attempted to compare brightly lit (mean 184 lux) with dimly lit (mean 97 lux) conditions. While fluctuating levels of daylight gave rise to high variability (means between 9 and 463 lux), light levels always increased towards the end of the race and there was no effect of light on latency to enter a race. Neither did light intensity affect the spacing of red deer within a race or the speed with which they traversed it.

A subsequent study examined the effect of illuminating the interior of a trailer on ease of loading of red deer (Grigor *et al* 1998d). Light levels were raised to between 111 and 176 lux inside the trailer, similar to levels of 199 lux measured at the foot of the ramp. However, the deer were no easier to load than in unlit trailers where light levels were considerably less, at under 7 lux.

### *Penning*

Confining deer in pens with a reduced space allowance is usually accompanied by changes to other factors that affect behaviour and physiology which make it difficult to interpret the effect of penning *per se.* Grigor *et al* (1997b) observed relatively minor and transient changes in both indices of welfare when castrated adult male red deer were confined without food or water in groups of five, at $0.9m^2$ $animal^{-1}$ for 3h or 6h. The deer were slightly more restless and aggressive than normal but it was concluded that confinement and withdrawal of food and water for up to 6h did not adversely affect welfare. However, these minor stressors could contribute to overall stress levels experienced in the context of transportation.

Observations of red deer experimentally penned adjacent to pigs or cattle has indicated some mild aversion to the other species (Abeyesinghe *et al* 1997). Behaviour was more normal next to a pen of unfamiliar red deer, yet cortisol levels were raised. Being next to an empty pen seemed the least stressful option. Changes were relatively minor and it is not known how relevant these findings are to commercial transport and lairage.

## Post-transport

The effects of water deprivation were examined by Hargreaves and Matthews (1995) specifically in relation to handling and transport, and also in lairage where provision of water is usually a requirement. Deer were experimentally deprived of feed and water for either 2h or 20h and then monitored for 6h in a pen with or without water in an unfamiliar trough. Only 75 per cent of the deer deprived for 2h chose to drink during the test period, whereas all but one animal deprived for 20h drank: latency to drink averaged between 40 and 50 min for both groups. The frequency and duration of drinking were greatest during the first 2h after deprivation. Empty water troughs were examined by the deer as much, or more, than full troughs.

On average, deer deprived of water for 20h drank 0.65l during the 6h test period, as compared with 0.14l for those deprived for only 2h. This appeared to be less than normal consumption, as the deer drank on return to pasture. Deer normally consume 2–4 l $day^{-1}$ at pasture (where herbage provides up to 60% of water intake; Barrell & Topp [1989]; Alexander & Segiura [1990]). Results from blood sampling indicated little change in haematocrit values which therefore, unlike the situation in cattle, are not a useful index of hydration in deer. Plasma chloride and sodium concentrations increased significantly with increased duration of water deprivation and were a more useful index of hydration than plasma potassium. This study indicates that water should be provided in lairage, and that deer will make use of it, thus improving their welfare.

Few effects on physiology and carcase quality were detected in small groups of yearling red hinds kept in lairage for up to 18h (Grigor *et al* 1997c). However, behavioural changes indicated that the deer found the novel lairage environment to be stressful, particularly during the first 3h when they were significantly more alert. Only after 8–10 h in lairage did relative incidences of standing and lying approach those observed pre-transport when the deer had also been kept in indoor pens. These findings support the MAFF (1985) codes of practice recommending that deer should be slaughtered as soon as possible after they are unloaded from the transporter.

***Meat quality***

Several factors associated with pre-slaughter handling and transport have an effect on meat quality.

Bruising has both economic and welfare implications. A 3 year survey at a single deer slaughter plant in New Zealand (Jago *et al* 1996) found an average of 6.8 per cent of carcases were downgraded owing to bruising. This was similar to earlier surveys reporting that between 1.3 per cent and 9.8 per cent of carcases showed traumatic injuries (Selwyn & Hathaway 1990, 1992), varying between plants. Their 1992 survey indicated that stags showed a higher incidence of acute injuries, with chronic injuries more often seen in hinds.

Jago *et al* (1996) also found that significantly more stags were downgraded than hinds, especially in spring and during the autumn rut, with overall strong seasonal effects that varied slightly from year to year. This latter survey found significant increases in levels of bruising and consequent downgrading (varying from 3.8% to 14.2%) to be significantly associated with increased journey length and with carrier company. Holding overnight rather than for a few hours in lairage did not, on average, affect levels of bruising. Damage was most commonly to one hindquarter. Lighter animals with less fat were more susceptible to bruising.

Early work by MacDougall *et al* (1979) found few effects on meat quality of various handling and slaughter procedures designed to be more or less stressful. The deer were not transported in that study, but all treatments had some dark-cutting carcases (ie less acid carcases with a final pH > 6). Males appeared to be more susceptible to stress and thus to have dark-cutting meat which was actually more tender than the normal pH venison.

Smith and Dobson (1990) measured lowest levels of peripheral plasma cortisol (mean < 7ng $ml^{-1}$) immediately post-slaughter; and of neck muscle pH at 24h post-slaughter (pH < 5.74) in groups of farmed red deer shot in the field. Intermediate levels were found in animals slaughtered on-farm, and highest mean levels in deer transported to a commercial abattoir where cortisol levels exceeded 20ng $ml^{-1}$ and pH was over 5.74. However, only 4 out of the 66 males which were transported recorded a muscle pH > 6.0, the value associated with dark-cutting in venison. There was, therefore, evidence of stress resulting from handling and transport of sufficient magnitude to affect meat quality from a few animals.

## Conclusion

Handling facilities need to be appropriate for deer. In most cases they need to be designed specifically for deer to incorporate such features as wide races and high-sided walls. Fallow deer may also handle better in darkened facilities with roofs. If crushes are required, these should be specialized for deer (ie of a design that suspends them above the ground in padded squeeze sides to overcome their extreme flight response and reduce the potential for injury).

Transport vehicles need not necessarily be specialized for deer, as deer may travel satisfactorily in vehicles designed for other farm ruminants. Where possible, journey breaks should be avoided. There is a need for scientific assessment of welfare during and after commercial transport journeys including measurements of thermal stress.

Current knowledge indicates that water should be provided in lairage but also that deer should be slaughtered as soon after arrival as possible.

### *Animal welfare implications*

Despite their relatively recent domestication, there is no evidence that deer need to be treated as a 'special case', nor of any aspects of particular concern for their welfare during transit. Practical experience and the scientific evidence to date indicates that deer travel comparatively well and without becoming unduly stressed. However, transport is a stressful experience for all farmed livestock and, in common with them, deer should be handled carefully and provided with a comfortable physical and thermal environment. Vehicles should be driven in a considerate manner and journey times minimized.

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