

# ROYAL SOCIETY OPEN SCIENCE

## **Are regulations addressing farm animal welfare issues during live transportation fit for purpose? A multi-country jurisdictional check.**

Journal:	<i>Royal Society Open Science</i>
Manuscript ID	RSOS-231072
Article Type:	Science, Society and Policy
Date Submitted by the Author:	27-Jul-2023
Complete List of Authors:	Duval, Eugénie; Essex Law School; The University of British Columbia Faculty of Land and Food Systems, Animal Welfare Program Lecorps, Benjamin; University of Bristol Veterinary School; The University of British Columbia Faculty of Land and Food Systems, Animal Welfare Program von Keyserlingk, Marina; The University of British Columbia Faculty of Land and Food Systems, Animal Welfare Program
Subject:	behaviour < BIOLOGY
Keywords:	animal transport, welfare, law, policy
Subject Category:	Science, Society and Policy

SCHOLARONE™  
Manuscripts

1  
2  
3 **Author-supplied statements**  
4

5 Relevant information will appear here if provided.  
6

7  
8 ***Ethics***  
9

10 *Does your article include research that required ethical approval or permits?:*

11 This article does not present research with ethical considerations  
12

13 *Statement (if applicable):*

14 CUST\_IF\_YES\_ETHICS :No data available.  
15

16  
17 ***Data***  
18

19 *It is a condition of publication that data, code and materials supporting your paper are made publicly*  
20 *available. Does your paper present new data?:*

21 Yes  
22

23 *Statement (if applicable):*

24 All data are available in the main text, in the tables (Tables 1-5) and in the supplementary materials  
25 (list of regulatory materials/legislations used in the paper).  
26

27  
28 ***Conflict of interest***  
29

30 I/We declare we have no competing interests  
31

32 *Statement (if applicable):*

33 CUST\_STATE\_CONFLICT :No data available.  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

---

# **Are regulations addressing farm animal welfare issues during live transportation fit for purpose? A multi-country jurisdictional check.**

**Eugénie Duval<sup>1,2,†\*</sup>, Benjamin Lecorps<sup>2,3,†</sup>, Marina A.G. von Keyserlingk<sup>2</sup>**

*1 Essex Law School, University of Essex, Colchester, United Kingdom.*

*2 Animal Welfare Program, Faculty of Land and Food Systems, The University of British Columbia, Vancouver, British Columbia, Canada.*

*3 Centre for Behavioural Biology, School of Veterinary Science, University of Bristol, Bristol, United Kingdom.*

*†These authors contributed equally to this work and share first authorship.*

**Keywords:** animal transport, welfare, policies, law

---

## **1. Summary**

Growing animal welfare concerns have pushed some jurisdictions to strengthen regulations addressing live farm animal transportation, but whether they provide satisfactory levels of protection for animals remains to be shown. Using recent peer-reviewed literature, we identified 4 major risk factors associated with live animal transportation (fitness for transport, journey duration, climatic conditions and space allowances) and explored how regulations were structured to prevent animal welfare issues in 5 English-speaking Western jurisdictions (Australia, Canada, New Zealand, the EU and the US). All legally binding federal regulations were systematically reviewed and compared. Whether these rules were fit for purpose was assessed using the relevant peer-reviewed scientific literature. Our findings indicate that most regulations in most jurisdictions are often insufficient or too vague to be deemed fit for purpose. All 5 jurisdictions fall short in guaranteeing adequate protection to livestock during transport, but recent changes as well as future policy proposals currently in discussion may largely improve the welfare of farm animals during transportation.

## **2. Introduction**

Agricultural practices are under increased scrutiny given their major contribution to climate change [1], biodiversity loss [2] and the increased awareness of animal welfare issues by the public [3]. The latter is one of the key barriers hindering the social sustainability of the livestock industries [4] with some food animal products or practices being phased out in some jurisdictions due to animal welfare concerns. For example, foie gras, which is produced by force-feeding ducks or geese, has been banned in several countries including Israel, Turkey, Argentina, and most EU Member States due to concerns of animal cruelty [6]. The European Union has also banned the practice of housing sows in gestation stalls for the duration of their pregnancy, with the exception of the first 4 weeks [7], for animal welfare reasons. The transport of live farm animals is another practice that affects most farm animals at some point during their lifetime, and has attracted growing criticism due to animal welfare concerns.

Farm animals are typically subjected to transport at least once in their lifetime (e.g., from the farm to the abattoir) but in some industries transport may also occur when different parts of the production cycle coincide

\*Author for correspondence (eugenie.duval@essex.ac.uk).

†Present address: Essex Law School, University of Essex, Colchester, United Kingdom.

1 with a change in ownership. For instance, pigs are frequently transported at different phases of their  
2 development in the US, and some pigs may be transported long distances across the country [8].  
3 Transportation is a stressful experience for animals (e.g., for cattle, (9)); in most cases, animals are prevented  
4 from drinking, eating and resting during transport which can be very long in some jurisdictions. For example,  
5 in Canada some animals (e.g., cattle) can be transported for 36 hours without feed, water and rest. Live  
6 transportation is often associated with animals being exposed to additional stressors such as comingling with  
7 unknown animals, human handling and extreme temperatures. Live transportation is therefore especially  
8 challenging for vulnerable animals [e.g., cull sows, (10); cull cows, (11)]; classes of animals that are usually not  
9 exempt from long journeys in some jurisdictions (e.g., the EU).

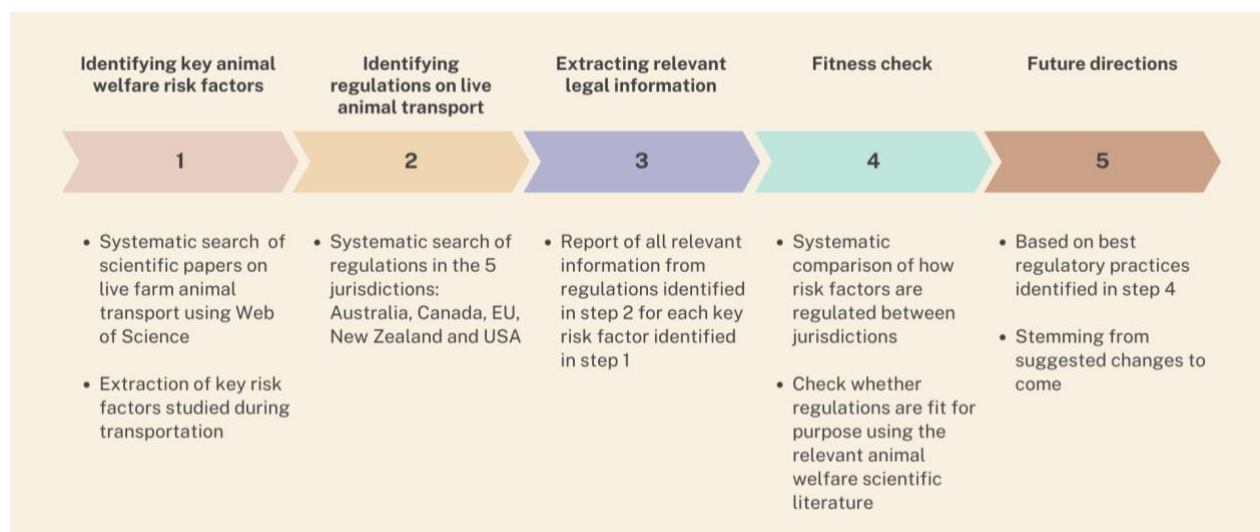
10  
11 Most jurisdictions have put regulations in place to protect animals from harm. However, there is an increasing  
12 number of public reports citing catastrophic and systemic failures in protecting animals during live  
13 transportation. Challenges associated with live animal export to third countries (non-EU members) have been  
14 highlighted in the EU [12] and New Zealand banned the export of livestock by sea effective on 30 April 2023  
15 following the sinking of a ship departing from New Zealand with 43 crew members and 6,000 cattle on board  
16 [13]. These events strengthened views amongst the public that livestock are not effectively protected from  
17 harm during transport [see review [14]; Europe, [15]; Australia, [16]; Canada, [17]]. This view is also shared by  
18 some institutions; members of the EU Parliament have repeatedly called for improved enforcement of existing  
19 regulations and for new, more protective regulations during farm animal transport [18–20].

21  
22 Global trade agreements between countries put additional pressure on jurisdictions to adopt regulations that  
23 are efficient and harmonized between jurisdictions. Trade restrictions based on animal welfare concerns have  
24 been implemented based on World Trade Organization rules [21,22]. Bilateral trade agreements in the future  
25 may involve more discussions on how the animals were cared for in the country of origin, including how they  
26 were transported and the degree to which the regulations protected the animals. In the context of the EU  
27 “Farm to Fork Strategy”, the introduction of “mirror clauses” (i.e., clauses that would require imports from  
28 third countries to adhere to the same welfare standards than the EU’s) in trade agreements with non-EU  
29 countries has been called by some stakeholders and several EU ministers [23]. Such clauses could potentially  
30 improve the welfare of farm animals beyond the EU borders [24]. However, if global trade agreements are  
31 based on harmonized rules, these rules first have to demonstrate that they are fit for purpose.

32  
33 Here we aim to provide the first comprehensive multi-country jurisdictional scan – or fitness check – of live  
34 animal transportation regulations in five English-speaking Western jurisdictions (i.e., Australia, Canada, New  
35 Zealand, the EU and the US). Fitness checks are defined by the European Commission “as a comprehensive  
36 policy evaluation to assess whether the regulatory framework for a policy sector is fit for purpose” [25]. This type of  
37 scan can help jurisdictions draw conclusions on potential future regulatory changes. Our analysis is intended  
38 to enrich this process by evaluating five jurisdictions rather than one [e.g., [26]]. This multi-jurisdiction  
39 approach provides a broader perspective on the different regulatory tools available to address similar issues.

40  
41 We explored how these jurisdictions have approached the issues associated with live animal transportation  
42 with a focus on binding regulations. We did not explore non-binding recommendations and guidelines (also  
43 known as soft laws). In some circumstances, soft laws can be useful [27,28] notably to disseminate new rules  
44 more quickly between stakeholders [e.g., in Canada, Appendix L, “Should this pig be loaded?” Decision Tree,  
45 [29]], but they suffer important limitations, especially if they are not officially adopted as complementary to an  
46 already comprehensive set of binding rules [e.g., [30,31]]. Hence the first step is to document how different  
47 jurisdictions set up comprehensive, binding regulations to protect animals during live transportation.

48  
49 To assess how the five different jurisdictions address live farm animal transportation, we aimed to (i) identify  
50 major risk factors during transport using a systematic search of the relevant peer-reviewed scientific literature;  
51 (ii) identify and screen all relevant legal texts in the five different jurisdictions addressing each of the different  
52 risk factors identified previously, (iii) systematically check and compare how the five jurisdictions address risk  
53 factors in accordance with the scientific literature to highlight major gaps in current policies and areas where  
54 regulations appear fit for purpose. Finally (iv), we draw future policy directions inspired by the most  
55 comprehensive regulations identified in the comparative analysis and from plans highlighted by different  
56 countries for future regulations (Figure 1).



**Figure 1.** Methodological diagram representing the different steps of the analysis.

### 3. Materials and Methods

#### Identification of main risk factors

To identify main risk factors leading to animal welfare issues during live transportation of farm animals, we first conducted a rapid systematic search. Using Web of Science, we searched the peer-reviewed literature published between January 2021 and December 2022 using the following Boolean search terms in the web of knowledge database: livestock OR calf OR calves OR cow\* OR pig OR piglet OR chick\* OR “laying hen” OR lamb OR sheep OR sow OR goat\* OR rabbit\* OR cattle OR horse\* OR turkey, AND lairage OR transport OR transportation OR “Live animal transport\*”, AND “animal welfare” OR “animal wellbeing” OR “animal well-being” OR stress. Our assumption was that the recent scientific literature would have largely focused its efforts on the most pressing issues.

We included papers published in peer-reviewed, refereed journals. We sorted articles related to “dairy and veterinary sciences” and excluded reviews and conferences abstracts. This led to 214 published papers. Titles and abstracts were read and only papers focusing on live animal transportation welfare were included. To be included, papers had to explore risk factors for reduced farm animal welfare during transportation (studies looking at what happens before transportation or after it ends were not considered). We extracted the aim of each study to identify which key risk factors were investigated. Aspects related to the journey such as length, breaks, and distance covered were grouped as ‘journey duration’. Aspects related to trailer type, ventilation, heat zones, temperature, humidity and CO<sub>2</sub>, season or time of the day were grouped as ‘climatic conditions’. Factors related to space allowances and density were grouped as ‘stocking density’. Pre-transport referred to studies looking at different animal management practices (e.g., fasting) before transportation, which can affect an animal’s response to transportation.

#### Jurisdictions examined

This study is based on a comparative analysis of the rules that govern livestock transport in five Western English-speaking jurisdictions: Australia, Canada, New-Zealand, the EU and the US. Our analysis also covers the United Kingdom (UK) as farm animal transportation is still under the EU Transport Regulation. Billions of animals are transported each year in these jurisdictions [e.g., over 1.6 billion live animals transported in the EU and beyond its borders in 2019, (154); Canada: over 700 million animals transported each year, [34]]. We focused on these five jurisdictions because they display comparable levels of development [35] and have some similarities in their farm animal industries. However, the same issues may not have been addressed similarly in the different jurisdictions given differing geographical constraints, legal frameworks or timelines in

adopting transportation regulations. The comparison between these five jurisdictions not only covers different parts of the globe, but also provides opportunities to understand the different ways in which countries regulate live animal transportation.

We focused our analysis on current mandatory rules and excluded 'soft' instruments such as non-binding recommendations and guidelines. We used the term 'regulations' throughout this paper, but in some jurisdictions, rules applying to the transport of farm animals are written in codes of practice but not included in legislations per se. We only included codes of practice for jurisdictions where they are binding legal instruments. A full list of law materials used for this paper can be found in the Supplementary Material.

We also limited our investigation to regulations adopted at the national or federal level. For example, in the US, this meant that our investigation was mostly limited to the so-called federal "Twenty-Eight-Hour Law" and in the EU, we used the Transport Regulation that is applied to each EU Member State. Lastly, in the case of Australia, Canada and New Zealand (NZ), we used national legislation or mandatory standards. However, there may be variations within a jurisdiction. For example, although we used the national standards for land transport as a basis of comparison in Australia, there are minor differences between states. Member states, provinces or territories may also adopt additional regulations, depending on the legal framework.

We identified main policy texts legislating live farm animal transportation in each jurisdiction. Each regulation/policy document was then screened for any relevant information regarding the 4 animal welfare risk factors (e.g., any mention of regulated journey duration of live farm animal). This allowed us to compare jurisdictions based on the type of regulations that have been implemented to protect farm animals during transport. Data were extracted from these regulations that related to the four key animal welfare topics. Data extraction included reviewing all relevant sections within the legal texts. If additional regulatory guidance existed to help stakeholders implement the legislation, this was used in addition to the regulations. In Canada, the Interpretive Guidance Document helps stakeholders to interpret the regulations, especially when the wording is vague [36]. For example, the guidance document provides transporters with examples of signs of 'mammary engorgement'; whereas the legislation only requires lactating animals to be transported without their suckling offspring "*at intervals that are sufficient to prevent mammary engorgement*".

### Fitness check

After summarizing and comparing the regulations in the five jurisdictions, we reviewed animal welfare scientific literature for each of the four risk factors to assess and compare whether the different jurisdictions adopted regulations that are fit for purpose. The legal information was checked against the available scientific literature, specifically looking for convergence (when a legal text applies current scientific consensus) and divergence (when a legal text does not apply current scientific consensus) on each topic. Lastly, using different sources such as the recent EFSA reports [37–41] and the Inception Impact Assessment "*Revision of the EU legislation on animal welfare*" [42], we considered both recent and proposed changes to the regulations. In the latter case, this refers to reviewed changes that have been announced but not yet been translated into legislation or to different options that are being considered.

## 4. Results and Discussion

After summarizing and comparing the regulations in the five jurisdictions, we reviewed animal welfare scientific literature for each of the four risk factors to assess and compare whether the different jurisdictions adopted regulations that are fit for purpose. The legal information was checked against the available scientific literature, specifically looking for convergence (when a legal text applies current scientific consensus) and divergence (when a legal text does not apply current scientific consensus) on each topic. Lastly, using different sources such as the recent EFSA reports [37–41] and the Inception Impact Assessment "*Revision of the EU legislation on animal welfare*" [42], we considered both recent and proposed changes to the regulations. In the latter case, this refers to reviewed changes that have been announced but not yet been translated into legislation or to different options that are being considered.

Among the 214 papers published between January 2021 and December 2022 on the welfare of farm animals during transport, 58 (27%) met our inclusion criterion. Our results indicate that the most researched topics included studies that focused on climatic conditions (n=28), journey duration (n=28), stocking density (n=14) and fitness for transport (n=4). Other factors (e.g., motion stress, environmental enrichment or species transported) were explored in only 1 or 2 studies. We retained four main risk factors: climatic conditions, journey duration, stocking densities and fitness for transport as these studies all had at least 4 studies that had addressed this specific factor. That said, we do recognize that other potential animal welfare risks including challenges associated with loading (e.g., handling; ramp design), mixing animals, pre-transport management (e.g., fasting) or driving conditions [43] are also important and warrant future work.

## Fitness for transport

*A comparative analysis of the regulations in the five jurisdictions can be found in Table 1.*

The transport of unfit animals has been cited as the “*the single most important [animal welfare] issue*” during transport [44] as it can impose undue suffering, particularly when the animal’s condition deteriorates during transport [45]. Reasons contributing to poor fitness for transport may include young age, advanced pregnancy or the presence of one or more health conditions [e.g., in pigs see [46]]. In dairy cattle production systems, culling (removal from the herd) of sick (e.g., mastitis, metritis) or lame [47] cattle increase the risk that transportation can further compromise the animal, inducing additional pain and suffering and leading to higher risk of mortality over long journeys [48]. Compromised animals may also become ‘downers’ during transport, a term commonly used to describe animals unable to stand [e.g., [49]].

The federal legislation in the US, adopted more than a century ago (i.e., 1873), does not have regulations on fitness for domestic transport apart from a ban on the slaughter of non-ambulatory cattle [50]. The US does, however, have some limited requirements on fitness for transport in regulations governing live animal exportation (Table 1). In contrast, the other four jurisdictions have all adopted more comprehensive regulations and generally prohibit transportation of unfit animals. For example, in Canada, the revised animal transport regulations now state “*no person shall load, confine or transport an animal that is unfit*” unless certain conditions (e.g., if the animal is to receive care) are met. However, there is some evidence that education about the regulatory specifications about fitness for transport is lagging for some key stakeholders [e.g., in Canada: Atlantic Canada, dairy farmers: [51]; British Columbia, livestock haulers and dairy farmers: [52]; Ontario, dairy farmers: [53,54]; Ontario, veterinarians: [55]].

Regulations tend to prioritize aspects of what makes an animal ‘unfit’ and rarely include attributes of what makes an animal fit for transport [46], though Australia does include some elements defining an animal fit for transport. However, the list of ‘unfit’ signs ranges greatly across jurisdictions. For instance, EU regulations only include two clinical-related signs (i.e., animals “*unable to move independently without pain or to walk unassisted*”; animals presenting “*a severe open wound, or prolapse*”). In contrast, the newly revised Canadian legislation provides an extensive list (e.g., “*non-ambulatory*”; “*in shock or dying*”; “*has a severe open wound or a severe laceration*”). Australia, likely because this country has a long history of live transport by sea, appears to have higher expectations regarding fitness for transport of exported live animals compared to inland transport and to the other jurisdictions (see Table 1).

The legislative requirements in most jurisdictions are often written in ambiguous language. While conditions that make an animal unfit for transport are explicitly described in the regulations of some jurisdictions, such as forbidding transportation of animals that are in late pregnancy (e.g., last 10% of the gestation period, Canada and the EU), have recently given birth (e.g., during the preceding 48h in Canada; during the preceding week in the EU) or if they are too young, other jurisdictions use language that is broad and subject to interpretation [56]. For example, an animal that is “*extremely thin*” (Canada) or “*unable to move independently without pain or to walk unassisted*” (EU) is subjective and thus open to interpretation by those involved in making the decision of whether the animal is fit or not for transport.

1 In Denmark, approximately one third of dairy farmers who responded to a questionnaire (119 out of 2500  
2 Danish dairy farmers) reported experiencing doubts about fitness for transport, especially around lameness  
3 [57]. Also in Denmark, 35% of cattle truck drivers surveyed (~55 % of all registered Danish livestock drivers)  
4 reported being regularly in doubt when assessing fitness for transport [58]; doubts that may come from a lack  
5 of training or knowledge about the regulations. For instance, despite 94% of Danish livestock drivers declaring  
6 that they were knowledgeable about the EU legislation on fitness for transport, only 52% of the participants  
7 were able to correctly answer two questions on the legislation [58]. In Canada, fever is one of the signs  
8 mentioned in the definition of unfit animals and animals in peak lactation are considered compromised;  
9 however, a recent survey of Ontario farmers (7.4% response rate) showed that lactation status and fever were  
10 considered by some farmers (i.e., 28% and 15%, respectively) as “*unimportant or of little importance*” when  
11 assessing if a cow is fit before transport [53].  
12

13 The line between a compromised animal (can be transported) and an unfit animal (cannot be transported, with  
14 exceptions) is often thin. In the EU, “*slightly injured or ill*” animals may be considered fit for transport.  
15 However, the word “*slightly*” is vague and is open to interpretation [11]. To our knowledge, Canadian  
16 lawmakers are unique in including a specific section entitled “*Compromised animals*” that is accompanied by a  
17 list of clinical signs (e.g., an animal that “*has acute frostbite*” or “*is blind in both eyes*”) (see Table 1 for additional  
18 descriptions on the physical characteristics that define animals as uncompromised). Additional and specific  
19 conditions must be met before transporting these animals (e.g., animals must be transported to the nearest  
20 place, other than an assembly centre). Although little is known about whether these mitigation measures are  
21 effective in limiting the suffering of the animals during transport [45], adjusting transport rules for animals  
22 with disabilities or conditions likely to make them especially vulnerable is an improvement.  
23  
24

25 In some jurisdictions, veterinarians are asked to provide a certificate to attest if the animal is fit for transport.  
26 For example, in New Zealand a lame animal must not be subjected to transport unless accompanied by a  
27 veterinary certificate that states otherwise. However, this approach should be viewed with caution given that  
28 the provision of a certificate does not guarantee that the animal is indeed fit for transport. Hundreds of unfit  
29 animals were transported in one EU Member State with veterinary certificates that failed to report health and  
30 welfare issues [59]. Challenges may come from the absence of clear guidance about fitness for transport, which  
31 may result in variation between veterinarians when assessing an animal’s fitness for transport. When  
32 investigating differences in assessments of fitness for transport between Danish farmers, veterinarians and  
33 livestock drivers, authors reported that the level of agreement within and between each of these groups was at  
34 best “*moderate*” [11]. A recent survey of veterinarians’ practices and attitudes around cull cow management in  
35 the Canadian province of Ontario may also indicate a lack of education and training [55]. Although a large  
36 majority of the participants (i.e., 82,5%) reported being familiar with the new transport legislation adopted in  
37 February 2020, some respondents reported being interested in learning more about the regulations (i.e., 37%)  
38 and fitness for transport assessment (i.e., 30%).  
39  
40  
41

42 Overall, with the exception of Canada, the other reviewed jurisdictions have limited regulations on fitness for  
43 transport. Most regulations provide some information on signs of what makes an animal unfit, but continue to  
44 allow vulnerable animals (e.g., cull animals; “*slightly injured or ill*” animals, EU) to be transported in the same  
45 way as fit animals.  
46  
47

## 48 Journey duration

49 *A comparative analysis of the regulations in the five jurisdictions can be found in Tables 2 and 3.*

50  
51  
52  
53 Journey duration is an important issue that can have a profound impact on animal welfare. Any journey,  
54 whether it is long or short, likely affects the welfare of animals [e.g., in pigs: [60]], but long journeys can  
55 exacerbate the negative effects associated with transportation, such as food deprivation or exposure to  
56 extreme temperatures. It is well established that animals transported during long journeys are at greater risks  
57 for compromised welfare [43]. Increased travel duration has been associated with increased mortality in cattle  
58 [[61]; for contrasting results, see [62]], calves [63], pigs [(53, 54); especially when associated with elevated  
59 temperatures: [66]; for contrasting results, see [67]; for a review, see [68]] and poultry (58, 59, 60, 61, 62). An  
60 increase in stress biomarkers following transport has been reported, for example in pigs [74], horses [75] and  
61 cattle [76]. Long journeys can also cause dehydration [e.g., in horses: [77]] and increased body weight loss



[e.g., in cattle: [48]]. Some animals, such as cull dairy cows, are more vulnerable to long transport [48] but may be subjected to long transit times in some jurisdictions [e.g., some cows are in some cases reported to be in transport for 7 to 10 days according to Canadian stakeholders [78]].

Regulations either provide a maximum total duration (i.e., animals must arrive at their final destination within a certain time) or a maximum duration without feed, water and rest. In the latter case animals can be transported indefinitely if some requirements, such as rest stops, are met. In four of the five jurisdictions examined (exception being the US), maximum durations for the entire journey have been adopted, but only for some species or some animal categories. For example, in Canada, calves aged 8 days or less, and in New Zealand calves aged 14 days or less, can only be transported once for a maximum duration of 12 h (Table 2). The changes in New Zealand were driven by public outcry after the release of animal cruelty footage on a dairy farm in 2015 [79,80]. Although an improvement, there are concerns that the 12 h maximum duration is still too long [79]. In Australia, the maximum duration of transport for calves aged 5 days or less when transported directly to a calf-rearing facility is 6 h. In the EU, maximum durations are provided for chicks (24 h) and poultry and rabbits (12 h) but only for journeys without food and water. In the EU, unless livestock are transported less than 100 km, there are requirements based on a minimum age (e.g., calves must be at least 10 days old for journeys less than 8 h; 14 days old for journeys over 8 h). Newborns are especially vulnerable to transport in part because they require more frequent meals [81]. In 2022, a panel of scientists recommended that the minimum age of transport for calves be increased from 14 to 35 days [37].

Except for the specific cases outlined above, none of the jurisdictions have adopted a maximum total (or 'absolute') duration of transport before arriving at final destination. Instead, guidance is often provided regarding maximum intervals that animals can go without feed, water and/or rest (Table 3). However, the language can be interpreted in ways that allows animals to be transported for an unlimited time if some requirements are met (e.g., rest periods). Most jurisdictions have adopted regulations for a broad range of species. In contrast, New Zealand does not have regulations on transport duration, meaning there are currently no rules requiring livestock transporters to stop and provide water or feed along the journey for any livestock species except young calves. Sea transport is generally dealt with separately as journey durations do not apply to this form of transport, with the exception of Canada for 'roll-on-roll-off vessels' (i.e., animals transported on 'roll-on-roll-off vessels' are not unloaded from the trucks).

For the purposes of this discussion, we assume that all journeys start when animals last had access to feed, water and rest; the definition used in Canada. For additional context, note that the EU uses the time when the first animal is loaded onto the vehicle as the journey's start and there is no specification in US regulations. In Australia, only a maximum time without access to water is mentioned in regulations. From the animals' perspective, the time since their last meal or drink is most relevant given the negative effects associated with food and water deprivation [e.g., [43,82]]. These effects are also likely exacerbated when animals are fasted before transport, a common practice for pigs [e.g., [83]].

Jurisdictions differ greatly in terms of maximum intervals that an animal can be transported without access to feed, water and rest (Table 2). Australia, Canada and the EU state that adult cattle, sheep and goats must not be transported longer than 48, 36 and 29 h, respectively. In the EU, the 29 h rule can only be used if the animals are provided a mandatory 1 h stop after 14 h, during which they must be rested, watered and (if necessary) fed. There is no mandatory unloading during this time.

In the EU, livestock transporters must follow specified maximum durations and unload animals so that they can be fed, watered and rested for a certain period of time. In contrast, in Australia, Canada and the US, lawmakers give more leeway to transporters if trailers meet specific requirements (e.g., allowing animals to be fed, watered and rested onboard). In Australia, livestock does not have to be unloaded during the time of the break, but the vehicle must be stationary. A similar provision exists in the US, suggesting that the animals should be unloaded "unless there is ample room in the car for all of the animals to lie down at the same time". However, in the US, journey breaks are not mandatory for animals if they can eat, drink and rest during transport. Canadian transporters also have three options regarding duration times when it comes to transporting livestock. First, they are exempt from rules on maximum journey durations without food, water,

1 and rest if the vehicle is fully equipped with drinkers, feeders, resting space and environmental control and  
2 recording systems (i.e., no mandatory stop). Second, if the vehicle is not fully equipped but meets some  
3 requirements, journey durations apply (i.e., the truck must stop) but animals may stay onboard for the time of  
4 the rest period. Third, animals may be unloaded in an approved lairage facility.

5 The benefits of rest stops to animal welfare are unclear. Some have argued that a mandatory rest stop extends  
6 an already long journey duration [43,84–86] and that the benefits of providing a rest period for calves may be  
7 limited [87–89]. However, other work provides contrary evidence. For example, cattle provided a rest period  
8 of 24 h after transportation for long periods experienced improved recovery [90,91]. Although some  
9 jurisdictions allow transporters to keep cattle loaded during the rest period when certain conditions are met,  
10 few studies have compared on-trailer versus off-trailer lairage [92]. While unloading may allow animals to  
11 access feed and water and eventually recover from the journey, it does come with additional stress associated  
12 with handling and potential comingling with unfamiliar animals in unfamiliar environments [93]. In contrast,  
13 not unloading the animals often prevents the animals from eating, drinking and resting; even if water is  
14 provided in the truck, animals may either be reluctant to drink while the vehicle is moving or unable to access  
15 the drinker due to other animals blocking access [94]. The lack of clarity in the scientific literature on whether  
16 rest stops benefit animal welfare and how long animals need to recover is reflected by differences in the  
17 regulations (Table 3). In sheep, studies indicate that providing a longer rest stop may be preferable when  
18 compared to a short one [95,96]. Messori et al. [97] suggested that a 16h rest may be enough to allow sheep to  
19 recover from the journey. These results raise questions regarding the adequacy of the short rest stop durations  
20 in place in Canada (8 h) and in the US (5 h). Finally, the benefits of providing a short mid-journey break are  
21 also unclear. In an EU study involving cattle, providing a single 1 h on-trailer break following 14 h of  
22 transport (adhering to EU legislation) did not serve its purpose as many animals did not drink during the stop  
23 [90]. Overall, despite no clear evidence in support of having rest stops, or whether unloading benefits welfare,  
24 it does seem reasonable to ensure that all animals have access to key resources such as water after a certain  
25 time in transport, particularly in cases of elevated temperatures.

26 Some regulations may also be difficult to apply in practice. For example, in the EU, after 9 h of transport,  
27 unweaned animals must be provided a minimum rest stop of 1 h, be given liquid and if necessary, fed.  
28 However, regulations do not specifically state that the animals must be unloaded during that time, which  
29 means the journey may be up to 19 h long before unloading. Questions regarding this process have been  
30 raised. For instance, during a public hearing for the European Parliament Committee on animal transportation  
31 in 2021, arguments were made that the majority of 56 trucks that were observed were not equipped with an  
32 adequate drinking system for unweaned animals. When haulers were asked why they do not feed animals,  
33 *“the drivers laughed and they asked [...] how they should do it. In fact, if you ever stand in front of a truck loaded with*  
34 *220 calves on 3 decks, or 800 lambs on 4 decks, you understand why it’s clearly impossible”* [personal communication  
35 Iris Baumgärtner, [98]]. These findings and reports put into question whether the EU regulation of providing a  
36 mandatory short break during the journey is in fact effective in protecting animal welfare.

37 Driving times by the transporters are also regulated [26,99]. In the EU, during the 29 h of maximum travel  
38 time before a mandatory rest stop is needed for adult sheep, cattle and goats, the driver must stop 4 times (for  
39 45 min; ‘drivers’ legislation). Long journeys may require several drivers being in the truck at the same time as  
40 each individual driver cannot exceed the maximum daily driving time of 9 h. In addition, the EU requires that  
41 there must be one 1 h break after 14 h of transport (‘animals’ legislation). The combined effect of these two  
42 pieces of legislation increases the time that animals spend in transport and the time they are left in a stationary  
43 vehicle, which can prolong exposure to extreme temperatures due to a lack of proper ventilation. Thodberg et  
44 al. [100] reported that the temperature inside Danish trucks transporting cull sows increased when the vehicle  
45 was stationary. Similar results were reported in cattle [Canada: [101]], sheep [New Zealand: [102]] and poultry  
46 [Canada: [103]]. This is more problematic for trailers that are only passively ventilated (i.e., through  
47 perforations in the walls), the norm for most livestock trailers used in North America [68,104].

48 Overall, all jurisdictions investigated in the current study allow animals to be transported for long periods (>  
49 to 8 hours) without feed, water and rest. Whilst the available evidence fails to provide information on how  
50 long is too long, there is agreement that deprivation of water, feed and rest during long journeys is  
51 detrimental for the welfare of the animals and should thus be reduced as much as possible. As mentioned  
52 above, Canadian and US regulations allow transporters to be exempt from maximum durations if their

vehicles meet specific requirements despite that animals cannot properly drink, eat and rest onboard, especially when considering the typically low space allowances during transport (see below).

## Climatic conditions

*A comparative analysis of the regulations in the five jurisdictions can be found in Table 4.*

Although the importance of protecting animals from adverse weather conditions is recognized in most legislations, the majority have adopted vague rules on the topic, resulting in animals being exposed to extreme climatic conditions during transport (Table 4). For example, according to the federal standards for land transport in Australia, “a person in charge must take reasonable steps to minimize the impact of extreme weather conditions on the welfare of livestock during the transport process”. What “reasonable steps” and “extreme weather” mean is open to interpretation, although the standards provide some guidance on what is meant by “extremes of weather” (i.e., “Temperature and climatic conditions (e.g. rain, hail, snow, wind, humidity and heat) that — individually or in combination — are likely to predispose livestock to heat or cold stress”). In particular, the absence of specific thresholds in most jurisdictions (Australia, Canada, New Zealand and the US) makes it difficult to implement the requirement that animals must be protected from severe environmental conditions [49].

In contrast, the EU has adopted minimum and maximum temperatures inside the vehicles; ventilation systems “must be capable of maintaining a range of temperatures from 5°C to 30°C within the means of transport, for all animals, with a +/- 5°C tolerance”. Although this is more ambitious than other jurisdictions, it is far from perfect. For instance, these specific thresholds only apply to journeys longer than 8 h by road. Although the text states that this applies to “all animals”, the placement of this regulation within the full text is specific to horses, cattle, sheep, goats and swine and thus it is not clear whether other animals, such as rabbits and poultry [e.g., for rabbits: [105]; for poultry, [106]], are included despite evidence that they too can experience cold and heat stress during transport [defined as the situations in which “the animal experiences stress and/or negative affective states such as discomfort and/or distress when exposed to low [or high] effective temperature”, [107]]. There is also no guidance regarding age, injuries or sickness despite that these factors have a profound effect on how an animal is impacted when exposed to extreme temperatures [43]. There are also important species-specific differences in thermal comfort zone. For example, studies have found that the upper threshold of the thermal comfort zone is 20°C for sows and 25°C for sheep [38,107]. However, these numbers are only estimates as most studies on this topic have not been done under realistic transport conditions. Pigs, poultry and rabbits are all highly sensitive to the effects of heat stress [68] whilst sheep appear to be less vulnerable than cattle [108]. Breed differences exist [e.g., in cattle: [62]] and production stage may also play a role [e.g., lactating versus non-lactating: [109]].

As stated by Mitchell and Kettlewell [110], “It is not certain that the thermal limits prescribed in such legislation are entirely appropriate for all livestock”. The stated thresholds in the EU allow animals to be transported when temperatures are outside the thermal comfort zone of most species, and for extended periods of time. According to the EU legislation, pigs can be transported during long journeys at temperatures as low as 0°C and as high as 35°C; extremes well outside of animals’ thermal comfort zone. A Danish study reported that temperatures inside the vehicles, especially during summer and autumn, were outside of the thermal comfort zone of sows [100] despite only one of the 39 journeys taking place when outside temperatures were above 25°C. Several studies highlighted increased mortality rates with increased temperatures [111–114]. In addition, the comfort zone of sows was established decades ago and may not be relevant to the modern breed given changes in genetics [100,115]. Recent studies reported that the upper threshold of the thermal comfort zone of sows may be lower than 20°C [e.g., late-gestation sows: [115]; lactating sows: [116]].

Lastly, the current regulations only refer to temperatures and do not mention other factors such as air humidity, despite the importance of this factor on the temperature felt by the animals. Ambient temperature (outside and inside the vehicle) and relative humidity should be considered, given that the latter can clearly exacerbate the effects of heat stress [117]. Scientific evidence shows that with a 30°C limit (dry bulb temperature), the felt temperature ranges from 29 to 44°C with increasing humidity [118]. Dairy cows experience negative affective states associated with heat stress when a THI of 72 is reached (albeit a

conservative threshold), which can be reached in temperature as low as 22°C when humidity is high [119]. However, in the EU, it is legal to transport cows when the dry bulb temperature is 30°C (and up to 35°C, given the 5°C tolerance). The European Food Safety Authority (EFSA) panel recently suggested other methods of calculation for heat stress that consider additional environmental factors [38].

Although limited, the EU legislation still provides a greater degree of protection compared to other jurisdictions that chose not to adopt specific thresholds. González et al. [49] reported that cattle transported to or from the Canadian province of Alberta were sometimes exposed to temperatures as low as -42°C and as high as 45°C. In Australia, several studies reported that cattle and sheep are especially at risk for heat stress when exported by sea to the Middle East during the Northern Hemisphere summer [120,121]. Following the airing of undercover videos showing deadly conditions during sea transport, an independent review commissioned by the Australian Government [122] led to the adoption of a ban of sheep exports to the Middle East between June and September in 2020 [a temporary ban was adopted in 2019, [123]]. However, this ban has been partially lifted as sheep can now be exported to or via the Red Sea during the first two weeks of June [124]. Similarly, cattle cannot be transported south of latitude 26°C to the Middle East during the Northern Hemisphere summer months, a limitation that existed before the adoption of temporary bans for sheep [108]. However, caveats remain that could still make it possible to export cattle during that time such as if the heat stress risk is deemed “manageable” (i.e., less than 2% risk of a 5% mortality).

Lastly, most jurisdictions require adequate ventilation to limit thermal stress. However, in the case of road transport for example, regulations remain vague regarding the type of ventilation needed inside vehicles (i.e., passive/natural ventilation; or active/mechanical/forced-ventilation). In Australia, New Zealand and the US, although recommended, forced-ventilation systems are not mandatory for road transport. Stricter rules exist in the EU and in Canada but only in a limited number of cases and species (i.e., in the EU: for long journeys by road for horses, cattle, sheep, goats and pigs; in Canada: for journeys exempted on meeting the maximum intervals). Both jurisdictions require mechanical ventilation systems that must be maintained, as well as systems to monitor and record temperatures (and humidity, in Canada) inside vehicles. A warning system must be installed to alert the driver when temperatures reach a set temperature. Lastly, adequate ventilation must be provided “at all times” according to Canadian legislation, which upon review also appears to include stationary periods, something that is also clearly specified in the EU Regulation. Mechanical ventilation, if adequately provided, may aid in limiting temperatures inside vehicles [110,125]. However, mechanical ventilation is not a panacea as it can fail to decrease the temperature of the animals inside the truck [pigs: [126]].

Overall, these results raise questions regarding the adequacy of the regulations in the five jurisdictions. While most jurisdictions have only vague regulations on ventilation, EU regulations are more specific but do not reflect the latest scientific evidence.

## Space allowances

*A comparative analysis of the regulations in the five jurisdictions can be found in Table 5.*

Stocking density can affect the welfare of animals during transport [94]. However, optimal space allowances are not easily determined, as both too little or too much space per animal can have negative impacts [e.g., cattle: [127]]. For example, some have discussed whether cattle benefit from lower space allowances in some situations (e.g., poor driving conditions) to maintain their balance [128]. However, two studies also suggest that the lower the space allowance the greater the risk of stress and injuries [129,130].

The current regulations across all jurisdictions on stocking density mention that animals should be provided with enough space (Table 5). For example, New Zealand requirements state that “stocking density must be sufficient to allow animals to adopt a natural posture during the journey without injuring their heads or backs if they stand, and to allow animals to rest, if this is necessary during the journey”. In Canada, there is also explicit language stating that overcrowding the animals is forbidden, making specific reference to the animals’ position within the truck (e.g., “the animal cannot maintain its preferred position or adjust its body position in order to protect itself from injuries or avoid being crushed or trampled”). In Australia (land transport) and the US, specific space allowances are not written in laws (or in national standards in Australia), but are written in codes of practice

or guidelines as non-binding recommendations. Minimum space allowances exist in Australia as binding regulations but only for export by sea or by air and for a limited number of species. In contrast, the EU has provided transporters with specific and mandatory minimum space allowances for different species depending on the type of transport (i.e., rail, road, air, sea) and the animals' weight. With the exception of the Australian standards for export, the EU minimum space allowances are either equivalent or have higher expectations than the recommendations and guidelines on space allowances in Australia (land transport) and the US.

The EU regulations, although strict compared to the other jurisdictions, lack precision and, given that they were adopted in 2005, fail to reflect the latest scientific evidence. Although providing adequate space above the animal within the truck may be important, no jurisdiction provides specific height requirements (except the EU for horses), potentially due to the lack of scientific literature on this topic [131].

In terms of minimum floor space allowances for animals transported by road transport, recommendations are almost always based on weight and not body size, which can vary greatly [132]. To that end, the use of allometric equations for cattle, sheep and pigs "to estimate the volume of space an animal occupies as a function of its mass" [133–135] may help. In the case of horses, stocking density (i.e., m<sup>2</sup>/kg) may be a more appropriate measure than the current reference to space allowance (i.e., m<sup>2</sup>/animal), especially if their weights and body conditions differ [[133]; for untamed ponies, [136]].

Absolute space allowances may also fail to efficiently protect animals during transport. Although cattle prefer to stand during transport [137,138], lying down may be necessary during a long journey [138]. However, the lower limit of the EU space allowance fails to provide sufficient lying space and for movement between lying and standing and vice versa [133]. For instance, heavy cattle (i.e., 550-700kg) need more than 3 m<sup>2</sup> to move between lying and standing, which falls outside of the range stated by the EU Regulation for minimum space allowance [i.e., between 1.30 and 1.60 m<sup>2</sup>; [131]]. Based on a comparison between the minimum space allowances recommended for cattle to lie down and the lower limit of the minimum space allowance of the Regulation, the lower range of the minimum space appears to consistently fall under the minimum spaces recommended by the available scientific literature for cattle to lie down [131,133]. Recent reports from animal advocacy groups have used this argument to highlight animal welfare concerns associated with transport in crowded vehicles, even if the transporter is in compliance with the legal space allowance [e.g., see [139]].

Similarly, minimum space allowances specified by the EU Regulation are insufficient to allow sheep to adopt their preferred positions [see [134]]. This was also highlighted as "unacceptable" by the EFSA Panel on Animal Health and Welfare [133]. As the Regulation only specifies a minimum space for lambs above 26 kg (i.e., 0,20 to 0,30 m<sup>2</sup>), young lambs < 26 kg are often provided less than 0,20 m<sup>2</sup> per animal. Menchetti et al. [140] reports that 0,27 m<sup>2</sup> is required to transport smaller lambs, suggesting that the current recommendations are insufficient to protect their welfare during transport.

Similar findings of insufficient space were also found for pigs [141], especially at high ambient temperatures and when pigs need to access water inside the truck [117]. As noted by Arndt et al. [141], "the minimal floor area offered on animal transportation vehicles, according to European legislation, is not sufficient to grant finishing pigs of modern genetic origin enough static space in the fully recumbent body position". Another issue is the lack of specific densities for pigs that are less than 100 kg as the Regulation does not specify space requirements for smaller pigs. According to the EU Regulation, "the loading density for pigs of around 100kg should not exceed 235kg/m<sup>2</sup>". However, this was recently criticized by Bracke et al. [117] as "this loading density is obviously wrong for the smaller weight ranges. You cannot physically keep 8 pigs of 30 kg each on one m<sup>2</sup>, without stacking them on top of each other". Finally, there are also no recommendations regarding the minimum space allowances for rabbits during transport; some also argue that the prescribed weight ranges are too broad [142].

Overall, regulations remain vague on space allowances during transport and although the EU stands out from the other four jurisdictions, current space allowances allowed in the legislation are not in line with the latest scientific evidence.

## Future directions/considerations

To our knowledge, this paper is the first to provide an up-to-date evaluation and comparison of the regulations on live farm animal transport in several jurisdictions, highlighting similarities and differences but also trends for improvement and remaining gaps. Although variations between jurisdictions exist, our results show that all regulations, including the most recently revised ones, may not guarantee adequate protection to animals during transport. Whilst some jurisdictions have made substantive advances on some issues, others do not address some issues, use vague language or do not reflect the latest scientific evidence. This comparative fitness check also highlighted areas where some jurisdictions provide clearer guidance than others (Figure 2). Using these examples and new changes to come announced in several countries, we drew key future directions for regulatory changes.



**Figure 2.** Mapping of the regulatory elements present in the federal regulations of the 5 jurisdictions for domestic journeys. Coloured segments indicate whether the issue is being regulated with different levels of regulatory efforts. Animal welfare regulated include: 1. Set a list of health signs defining unfit animals, 2. Considerations for pregnant animals, 3. Transport ban for unfit animals, 4. Transport ban without exceptions for unfit animals (unless required for veterinary care), 5. Set a list of signs for compromised animals, 6. Adapted conditions of transport for compromised animals, 7. Maximum journey durations (absolute/for the entire trip), 8. Maximum intervals without food, water and rest, 9. Rest stop with mandatory unloading, 10. Export ban, 11. Minimum temperatures, 12. Maximum temperatures, 13. Adopt temperature/humidity indexes, 14. Mandatory mechanical or forced-ventilation systems, 15. Mandatory monitoring, recording and alarm system, 16. Minimum space allowances, 17. Height requirements.

**Unfit animals.** Not all jurisdictions explicitly ban the transport of unfit animals nor provide clear definitions of unfit animals. Clear definitions of what makes an animal unfit (exemplified by the recent Canadian regulations) is needed to help decision-making of whether the animal is fit for transport. One way forward could be to establish a comprehensive list of clinical signs for each species. It might also be useful to make additional materials including recommendations and decision trees that can help stakeholders' appropriate decisions about fitness for transport [45]. Some of the animal-based measures identified in the EFSA scientific opinion (e.g., lameness score, wounds, abscess, body condition score) could serve as a basis for future regulatory improvements [37–41]. We do, however, acknowledge that this is challenging as there is also a general lack of scientific agreement (EFSA Panel on Animal Health and Welfare [37–40,107]). Even with clearer legislations, assessing fitness for transport will likely remain a subjective task.

**Compromised and vulnerable animals.** 'Compromised' and 'vulnerable' animals are more likely to experience negative effects associated with transportation. Again, drawing from the Canadian example, a first step could be to clearly identify signs (e.g., young, pregnant, lactating and end-of-career animals) that an animal is unfit for transport, 'compromised' or 'vulnerable'. Vulnerable animals require additional protection during transport such as "increased contingency planning, reducing journey duration, adjusting ventilation, increasing bedding, avoiding extreme weather conditions, avoiding loading via steep ramps, loading last and unloading first, providing space to lie down, increasing monitoring frequency, providing feed, water and rest more frequently and use of analgesics or other applicable medication" [37]. The adoption of a maximum duration for the entire trip (rather than a maximum duration without rest) would limit the time animals are exposed to the negative effects associated with transport and prevent unnecessary loadings and unloadings. Banning long journeys (i.e., over 8 h) for "unweaned and other vulnerable animals" is specifically mentioned by the European Commission in its impact assessment for the future revision of the legislation [42].

**Maximum durations.** The EU 2005 Regulation states that “for reasons of animal welfare the transport of animals over long journeys, including animals for slaughter, should be limited as far as possible”. This language is, however, insufficient in limiting journey durations. In fact between 2005 and 2015, the number of long journeys has increased [143]. Reduced journey times are currently under consideration in the EU [(122, 124); see also EFSA recommendations, [37–41]] where some Member States already limit journey durations taking place within their borders to 8 hours [e.g., cull sows in Denmark and Sweden: [10,144]]. For species other than poultry and rabbits for which EFSA recommends a maximum journey duration of 12 h, the EFSA report only highlights the importance of keeping journey durations to a minimum, without providing specific limits. Following recent public consultations in the UK [145], the UK and Welsh governments committed to introduce ‘absolute’ maximum journey times, including: 4 h for broiler chicken, 9 h for calves up to 9 months old, 12 h for horses and newly weaned pigs, 18 h for pigs, 21 h for cattle, sheep and all other animals and 24 h for recently hatched chicks. Whether this will translate into laws, and if so when, remains unknown. Revisiting the absolute maximum durations for the entire journey should be considered given that in some situations it appears that not all animals are able properly eat, drink and rest during transport; a situation that compromises the welfare of some individuals being transported.

**Live animal export.** The issue of live animal transportation is further complicated when animals are sold live and exported to another country, as the country of origin loses its capacity to ensure animal welfare beyond its borders. To be exported outside the EU’s borders, the journey must, in theory, comply with EU regulations even when outside EU’s borders [146]. However, as noted by the European Parliament, “there is no control system currently in place for transport to third countries, leading to situations where animal exports to third countries often do not respect Regulation (EC) No 1/2005 and are often in violation of the Court of Justice ruling C-424/13 on this matter” [20]. The New Zealand government was the first to announce a ban on live farm animal exports by sea as of April 2023; a change followed by similar announcements by the UK and Welsh governments, although the adoption of the relevant legislation is still pending and under discussion. In the EU, Germany has recently restricted the export of cattle, sheep and goats to third countries (i.e., non-EU countries). Veterinary certificates which are required for export will no longer be issued for fattening and slaughtering, and breeding as of July 2023; a step that effectively prevents the animal from being exported. However, as noted by the German Federal Ministry of Food and Agriculture, these changes do not prevent German transporters from moving animals to another country and exporting them from there [147]. To that end, five EU Member states (i.e., Belgium, Denmark, Germany, the Netherlands, and Sweden) called for an EU ban “on certain long journey exports of live animals to third countries by road and sea” [148]. Banning the export of “certain categories of animals” is one of the options mentioned by the EU Commission in its impact assessment for the revision of the Transport Regulation [42]. However, other options including implementing assurance schemes or requiring the presence of a veterinarian on-board are also under discussion. Despite the adoption of several reforms aimed at improving animal welfare during export [see [120]], it remains to be seen what Australia does given that a large proportion of live sheep are exported annually. Although the current Australian government is committed to ban live sheep export (but not cattle), to our knowledge no timeline accompanied this announcement [149]. If confirmed, the current trend towards a ban on live animal export by some jurisdictions may lead other countries to adopt similar legislation. Although this may not necessarily result in other countries adopting similar legislation [150], the increasing number of international bilateral trade agreements that include animal welfare considerations [e.g., the EU-Chile Free Trade Agreement, described by von Keyserlingk and Hötzel, [22]] may push countries to seek greater alignment in their respective regulations in order to remain competitive. This could include, among other considerations, the question of whether live animal export is allowed.

**Climatic conditions.** Potential pathways moving forward for all jurisdictions would be to provide clear species/age/condition-specific thresholds for the temperature-humidity index inside vehicles (and not the outside or bulb temperature). There are some indications that lower climatic thresholds may be adopted in the UK [145] but also in the EU in line with the EFSA recommendations. According to EFSA, animals should be transported at temperatures within their thermal comfort zone and the temperature inside vehicles should not exceed their upper critical temperature (UCT) (i.e., the UCT is 25°C, for cattle, pigs and horses [37,38,40]). The adoption of adapted climatic thresholds would require trucks to be equipped with climate-control and mechanical ventilation systems. Some trucks already allow animals to be transported under temperature-

1 controlled conditions (e.g., with air conditioning). Equipping vehicles with monitoring and recording systems  
2 for temperature and humidity (as is now the case for some journeys in Canada) could also allow the  
3 authorities to check the temperatures and humidity inside vehicles at any time, including after the end of the  
4 journey [for an example of a climate monitoring equipment allowing to automatically calculate the  
5 temperature-humidity index, see [151]].

6 **Space allowances.** Space allowances should allow animals to adopt their preferred postures but also to rest  
7 and access drinkers inside vehicles (assuming that they have previous experience with the type of drinker,  
8 which is uncertain). One way forward would be for all jurisdictions to begin by establishing  
9 species/age/condition-specific minimum horizontal (i.e., floor space) and vertical (i.e., deck height) space  
10 allowances as a binding requirement in law. In the EU, updating the requirements in accordance with new  
11 scientific evidence on space allowances is mentioned as one of the future potential changes by the EU  
12 Commission [42]. EFSA has recommended to increase space allowances as well, though it is unclear if the EU  
13 Commission will take EFSA's recommendations into account. In the UK, changes are limited to new  
14 headroom allowances. Again, it remains unclear whether these announcements will be translated into laws.  
15  
16

17 **Enforcement.** Beyond the adoption of new rules, it is crucial that regulations are enforced. All jurisdictions  
18 studied share, to some extent, issues in enforcing current transport regulations and more generally animal  
19 welfare legislations [see examples – Canada: [152]; Australia: [123]; New Zealand: [153]; EU: [26]]. This can  
20 cause important discrepancies between what regulations state and what animals experience. In the US, the  
21 Twenty-Eight-Hour Law appears either rarely or never enforced [50, 154]. Non-compliances are regularly  
22 reported by animal welfare organizations and in some cases by scientists [e.g., in the EU: [155,156]; in Canada:  
23 [75]]. Critics within the European Parliament have urged Member States to do a better job in enforcing the  
24 regulations [18–20]. Ways to improve compliance and enforcement may include increased and improved  
25 inspections [26,156], increased penalties but also economic incentives [154], as well as trainings and  
26 educational tools [58]. To ensure that regulations are complied with, regular comprehensive mandatory  
27 trainings should be adopted. Improving drivers' working conditions may also be an important factor to  
28 improve animal welfare during transport as poor working conditions are likely to negatively affect the welfare  
29 of the animals [157,158].  
30  
31  
32

33 If implemented across jurisdictions, these policy changes could lead to substantive improvements in the  
34 welfare of transported animals. However, some of these may require profound transformational changes in  
35 our food production systems in line with the "Farm to Fork" ambition of the EU aiming to promote a more  
36 sustainable food production system. Whenever possible, transportation of meat should be preferred over  
37 transportation of live animals [see for example: [18,26,159,160]] and alternatives to live animal transport must  
38 be further explored. For example, on farm slaughter may mitigate some of the issues associated with  
39 transportation, especially of vulnerable animals [161,162].  
40  
41

42 Finally, in some areas, the scientific literature is unclear. As noted by Herskin and Duffield [163], "*scientific*  
43 *focus on animal transport is relatively new*"; thus, there are numerous gaps within this body of research that  
44 require attention. For instance, there is limited information regarding deck height and varying results  
45 regarding the benefits of unloading animals during a rest stop [37,38,40,41,134]. In addition, it is difficult to  
46 use science to determine specific thresholds (e.g., when does a journey become too long?) because depending  
47 on the animal welfare metrics used, very different conclusions might be drawn. Ultimately, the development  
48 of measures that better reflect the animals' perspective [see [164]] may help determine an appropriate  
49 maximum transportation time. Based on precautionary reasoning about animal sentience by Birch [165], we  
50 suggest that where doubts exist or if there is a lack of scientific evidence, lawmakers should strive to adopt  
51 solutions that are most likely to protect the animals.  
52  
53  
54  
55  
56  
57  
58  
59  
60



## Acknowledgments

The authors wish to thank the Humane Slaughter Association for their financial contribution.

## Funding Statement

Humane Slaughter Association grant 01-21/22 (ED, MAGvK)  
Hans Sigrist Stiftung (MAGvK)

## Data Accessibility

All data are available in the main text or the supplementary materials.

## Competing Interests

Authors declare that they have no competing interests.

## Authors' Contributions

Conceptualization: ED, BL, MAGvK  
Investigation and writing—original draft preparation: ED, BL  
Writing—review and editing, ED, BL, MAGvK

## References

1. Clark MA, Domingo NGG, Colgan K, Thakrar SK, Tilman D, Lynch J, Azevedo IL, Hill JD. 2020 Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets. *Science* **370**, 705–708. (doi:10.1126/science.aba7357)
2. Rigal S *et al.* 2023 Farmland practices are driving bird population decline across Europe. *Proceedings of the National Academy of Sciences* **120**, e2216573120. (doi:10.1073/pnas.2216573120)
3. Alonso ME, Lomillos JM. 2020 Consumers' Concerns and Perceptions of Farm Animal Welfare. , 1–13.
4. Sinclair M *et al.* 2022 International perceptions of animals and the importance of their welfare. *Frontiers in Animal Science* **3**. (doi:10.3389/fanim.2022.960379)
5. Hild S, Bachelard N, *Le foie gras* 2019 ([https://www.fondation-droit-animal.org/documents/Livret\\_Foie\\_gras\\_LFDA\\_2019.pdf](https://www.fondation-droit-animal.org/documents/Livret_Foie_gras_LFDA_2019.pdf)).
6. Rochlitz I, Broom D. 2017 The welfare of ducks during foie gras production. *Anim. welf.* **26**, 135–149. (doi:10.7120/09627286.26.2.135)
7. Council Directive 2008/120/EC of 18 December 2008 laying down minimum standards for the protection of pigs (Codified version) OJ L 47, 18.2.2009, p. 5–13.
8. Engebretson M. 2008 North america. *Long Distance Transport and Welfare of Farm Animals* , 218–260. (doi:10.1079/9781845934033.0218)
9. Knowles TG. 1999 A review of the road transport of cattle. *Veterinary Record* **144**, 197–201. (doi:10.1136/vr.144.8.197)
10. Thodberg K, Fogsgaard KK, Herskin MS. 2019 Transportation of cull sows—Deterioration of clinical condition from departure and until arrival at the slaughter plant. *Frontiers in Veterinary Science* **6**, 1–17. (doi:10.3389/fvets.2019.00028)
11. Dahl-Pedersen K, Foldager L, Herskin MS, Houe H, Thomsen PT. 2018 Lameness scoring and assessment of fitness for transport in dairy cows: Agreement among and between farmers, veterinarians and livestock drivers. *Research in Veterinary Science* **119**, 162–166. (doi:10.1016/j.rvsc.2018.06.017)
12. Marahrens M, Kernberger-Fischer I. 2021 Research for ANIT Committee – The practices of animal welfare during transport in third countries: an overview.
13. Cargo ship with 43 crew and nearly 6,000 cattle sank off Japan, survivor says | Japan | The Guardian. See <https://www.theguardian.com/world/2020/sep/03/typhoon-maysak-ship-with-43-crew-and-nearly-6000-cattle-missing-off-japan> (accessed on 2 July 2023).
14. Clark B, Stewart GB, Panzone LA, Frewer IJL. 2016 A Systematic Review of Public Attitudes, Perceptions and Behaviours Towards Production Diseases Associated with Farm Animal Welfare. *Journal of Agricultural and Environmental Ethics* **29**, 455–478. (doi:10.1007/s10806-016-9615-x)
15. Vanhonacker F, Van Poucke E, Tuytens F, Verbeke W. 2010 Citizens' Views on Farm Animal Welfare and Related Information Provision: Exploratory Insights from Flanders, Belgium. *J Agric Environ Ethics* **23**, 551–569. (doi:10.1007/s10806-010-9235-9)
16. Buddle EA, Bray HJ, Ankeny RA. 2018 “ I Feel Sorry for Them ”: Australian Meat Consumers' Cattle Transportation. , 1–13. (doi:10.3390/ani8100171)
17. Spooner JM, Schuppli CA, Fraser D. 2014 Attitudes of Canadian citizens toward farm animal welfare : A qualitative study. *Livestock Science* **163**, 150–158. (doi:10.1016/j.livsci.2014.02.011)
18. 2019 European Parliament resolution of 14 February 2019 on the implementation of Council Regulation (EC) No 1/2005 on the protection of animals during transport within and outside the EU (2018/2110(INI)).
19. 2020 European Parliament decision of 19 June 2020 on setting up a committee of inquiry to investigate alleged contraventions and maladministration in the application of Union law in relation to the protection of animals during transport within and outside the Union, and defining its responsibilities, numerical strength and term of office (2020/2690(RSO)).
20. 2022 European Parliament recommendation of 20 January 2022 to the Council and the Commission following the investigation of alleged contraventions and maladministration in the application of Union law in relation to the protection of animals during transport within and outside the Union (2021/2736(RSP)).
21. Howse R, Langille J, Sykes K. 2015 Pluralism in practice: moral legislation and the Law of the WTO after seal products. *Geo Wash Int'l L Rev* **48**, pp. 81-150, *NYU School of Law, Public Law Research Paper No. 15-05*.
22. Von Keyserlingk MAG, Hötzel MJ. 2015 The Ticking Clock: Addressing Farm Animal Welfare in Emerging Countries. *J Agric Environ Ethics* **28**, 179–195. (doi:10.1007/s10806-014-9518-7)
23. Times TB. Animal welfare: The case for mirror clauses in trade agreements. See <https://www.brusselstimes.com/212560/animal-welfare-the-case-for-mirror-clauses-in-trade-agreements> (accessed on 9 June 2023).
24. Di Concetto A. The Double-Edged Sword: International Law and Its Effects on EU Farm Animal Welfare Legislation | *Global Journal of Animal Law*. See <https://ojs.abo.fi/ojs/index.php/gjal/article/view/1756> (accessed on 2 July 2023).
25. OECD. 2021 *Competitiveness and Private Sector Development Competitiveness in South East Europe 2021 A Policy Outlook: A Policy Outlook*. OECD Publishing.
26. Bachelard N. 2022 Animal transport as regulated in Europe: a work in progress as viewed by an NGO. *Animal Frontiers* **12**, 16–24. (doi:10.1093/af/vfac010)
27. Fraser D. 2015 Turning science into policy: The case of farm animal welfare in Canada. *Animal Frontiers* **5**, 23–27.

- (doi:10.2527/af.2015-0027)
28. Broom, D.M. 2002. Does present legislation help animal welfare? *Landbauforschung Völknerode* **227**, 63–69.
29. NFACC. Code of practice.
30. Coglianese C. 2020. Environmental Soft Law as a Governance Strategy. *Faculty Scholarship at Penn Carey Law*. **61**.
31. Koutalakis C, Buzogany A, Börzel TA. 2010 When soft regulation is not enough: The integrated pollution prevention and control directive of the European Union. *Regulation & Governance* **4**, 329–344. (doi:10.1111/j.1748-5991.2010.01084.x)
32. European Parliamentary Research Service. 2021 Protection of animals during transport: Data on live animal transport.
33. Government of Canada PW and GSC. 2016 Canada Gazette – Regulations Amending the Health of Animals Regulations. See <https://gazette.gc.ca/rp-pr/p1/2016/2016-12-03/html/reg2-eng.html> (accessed on 4 July 2023).
34. Government of Canada PW and GSC. 2016 Canada Gazette – Regulations Amending the Health of Animals Regulations. See <https://gazette.gc.ca/rp-pr/p1/2016/2016-12-03/html/reg2-eng.html> (accessed on 3 June 2023).
35. United Nations Development Programme. 2022 The 2021/2022 Human Development Report.
36. Government of Canada CFIA. 2020 Health of Animals Regulations: Part XII: Transport of Animals-Regulatory Amendment/Interpretive Guidance for Regulated Parties. See <https://inspection.canada.ca/animal-health/terrestrial-animals/humane-transport/health-of-animals-regulations-part-xii/eng/1582126008181/1582126616914> (accessed on 16 February 2023).
37. EFSA Panel on Animal Health and Welfare (AHAW) *et al.* 2022 Welfare of cattle during transport. *EFSA Journal* **20**, e07442. (doi:10.2903/j.efsa.2022.7442)
38. EFSA Panel on Animal Health and Welfare (AHAW) *et al.* 2022 Welfare of pigs during transport. *EFSA Journal* **20**, e07445. (doi:10.2903/j.efsa.2022.7445)
39. EFSA Panel on Animal Health and Welfare (AHAW) *et al.* 2022 Welfare of domestic birds and rabbits transported in containers. *EFSA Journal* **20**, e07441. (doi:10.2903/j.efsa.2022.7441)
40. EFSA Panel on Animal Health and Welfare (AHAW) *et al.* 2022 Welfare of equidae during transport. *EFSA Journal* **20**, e07444. (doi:10.2903/j.efsa.2022.7444)
41. EFSA Panel on Animal Health and Welfare (AHAW) *et al.* 2022 Welfare of small ruminants during transport. *EFSA Journal* **20**, e07404. (doi:10.2903/j.efsa.2022.7404)
42. European Commission. 2021 INCEPTION IMPACT ASSESSMENT - Ares(2020)6081753. , 6–9.
43. Nielsen BL, Dybkj L, Herskin MS. 2011 Road transport of farm animals: Effects of journey duration on animal welfare. *Animal* **5**, 415–427. (doi:10.1017/S1751731110001989)
44. Grandin T. 2001 Perspectives on transportation issues: The importance of having physically fit cattle and pigs. *Journal of Animal Science* **79**, E201. (doi:10.2527/jas2001.79e-suppl201x)
45. Cockram MS. 2019 Fitness of animals for transport to slaughter. *Canadian Veterinary Journal* **60**, 423–429.
46. Herskin MS, Gerritzen MA, Marahrens Michael, Bracke MBM, Spoolder HAM. 2021 Review of fitness for transport of pigs. *European Union Reference Centre for Animal Welfare Pigs (EURCAW-Pigs)* , 23.
47. Stojkov J, von Keyserlingk MAG, Duffield T, Fraser D. 2020 Management of cull dairy cows: Culling decisions, duration of transport, and effect on cow condition. *Journal of Dairy Science* **103**, 2636–2649. (doi:10.3168/jds.2019-17435)
48. González LA, Schwartzkopf-Genswein KS, Bryan M, Silasi R, Brown F. 2012 Relationships between transport conditions and welfare outcomes during commercial long haul transport of cattle in North America. *Journal of animal science* **90**, 3640–3651. (doi:10.2527/jas.2011-4796)
49. González LA, Schwartzkopf-Genswein KS, Bryan M, Silasi R, Brown F. 2012 Benchmarking study of industry practices during commercial long haul transport of cattle in Alberta, Canada. *Journal of Animal Science* **90**, 3606–3617. (doi:10.2527/jas.2011-4770)
50. Animal Welfare Institute. 2020 Legal Protections for Farm Animals During Transport. , 1–5.
51. Hendricks J, Roche S, Proudfoot KL, von Keyserlingk MAG. 2023 Livestock haulers' views about dairy cattle transport in Atlantic Canada. *Journal of Dairy Science* **106**, 3548–3558. (doi:10.3168/jds.2022-22752)
52. Kuo C, Keyserlingk MA von. 2023 Livestock hauler and dairy farmer perspectives about cull dairy cattle transport and cattle transport regulations in British Columbia, Canada. *Animal Welfare* **32**, e42. (doi:10.1017/awf.2023.36)
53. Marshall J, Haley D, Levison L, Kelton DF, Miltenburg C, Roche S, Duffield TF. 2022 A survey of dairy cattle farmers' management practices for cull cows in Ontario, Canada. *Frontiers in Veterinary Science* **9**.
54. Marshall J, Haley DB, Kelton D, Miltenburg C, Roche S, Duffield T. 2023 A focus group study exploring dairy farmers' perspectives of cull cow management in Ontario, Canada. *Frontiers in Veterinary Science* **10**.
55. Marshall J, Haley D, Levison L, Kelton DF, Miltenburg C, Roche S, Duffield TF. 2022 A survey of practices and attitudes around cull cow management by bovine veterinarians in Ontario, Canada. *Journal of Dairy Science* **106**, 302–311. (doi:10.3168/jds.2022-22005)
56. Grandin T. 2016 Transport fitness of cull sows and boars: A comparison of different guidelines on fitness for transport. *Animals* **6**. (doi:10.3390/ani6120077)
57. Dahl-Pedersen K. 2022 Danish Cattle Farmers' Experience With Fitness for Transport – A Questionnaire Survey. *Frontiers in Veterinary Science* **9**, 1–8. (doi:10.3389/fvets.2022.797149)
58. Herskin MS, Hels A, Anneberg I, Thomsen PT. 2017 Livestock drivers' knowledge about dairy cow fitness for transport – A Danish questionnaire survey. *Research in Veterinary Science* **113**, 62–66. (doi:10.1016/j.rvsc.2017.09.008)
59. European Commission, Food Safety. 2015 Overview report Systems to Prevent the Transport of Unfit Animals in the EU. (doi:10.2875/45032)
60. Werner C, Reiners K, Wicke M. 2007 Short as well as long transport duration can affect the welfare of slaughter pigs. *Animal Welfare* **16**, 385–389. (doi:10.1017/S0962728600027202)
61. Malena M, Voslařová E, Tomanová P, Lepková R, Bedaňová I, Večerek V. 2006 Influence of travel distance and the season upon transport-induced mortality in fattened cattle. *Acta Veterinaria Brno* **75**, 619–624. (doi:10.2754/avb200675040619)
62. Simova V, Voslarova E, Vecerek V, Passantino A, Bedanova I. 2017 Effects of travel distance and season of the year on transport-related mortality in cattle. *Animal Science Journal* **88**, 526–532. (doi:10.1111/asj.12658)
63. Cave JG, Callinan APL, Wootton WK. 2005 Mortalities in bobby calves associated with long distance transport. *Australian Veterinary Journal* **83**, 82–84. (doi:10.1111/j.1751-0813.2005.tb12203.x)
64. Voslarova E, Vecerek V, Passantino A, Chloupek P, Bedanova I. 2017 Transport losses in finisher pigs: Impact of transport distance and season of the year. *Asian-Australasian Journal of Animal Sciences* **30**, 119–124. (doi:10.5713/ajas.16.0265)
65. Malena M, Voslařová E, Kozák A, Bělobrádek P, Bedaňová I, Steinhäuser L, Večerek V. 2007 Comparison of Mortality Rates in Different Categories of Pigs and Cattle during Transport for Slaughter. *Acta Vet. Brno* **76**, S109–S116. (doi:10.2754/avb200776S85109)
66. Vecerek V, Malena M, Malena M, Voslarova E, Chloupek P. 2006 The impact of the transport distance and season on losses of fattened pigs during transport to the slaughterhouse in the Czech Republic in the period from 1997 to 2004. *Vet. Med.* **51**, 21–28. (doi:10.17221/5513-VETMED)
67. Dewey CE, Haley C, Widowski T, Poljak Z, Friendship RM. 2009 Factors associated with in-transit losses of fattening pigs. *Animal Welfare* **18**, 355–361. (doi:10.1017/S0962728600000750)
68. Rioja-Lang FC, Brown JA, Brockhoff EJ, Faucitano L. 2019 A review of swine transportation research on priority welfare issues: A Canadian perspective. *Frontiers in Veterinary Science* **6**, 1–12. (doi:10.3389/fvets.2019.00036)
69. Nijdam E, Arens P, Lambooij E, Decuyper E, Stegeman JA. 2004 Factors influencing bruises and mortality of broilers during catching, transport, and lairage. *Poultry Science* **83**, 1610–1615. (doi:10.1093/ps/83.9.1610)
70. Vecerek V, Grbalova S, Voslarova E, Janackova B, Malena M. 2006 Effects of Travel Distance and the Season of the Year on Death Rates of Broilers Transported to Poultry Processing Plants. *Poultry Science* **85**, 1881–1884. (doi:10.1093/ps/85.11.1881)
71. Voslarova E, Janackova B, Vitula F, Kozak A, Vecerek V. 2007 Effects of transport distance and the season of the year on death rates among hens and roosters in transport to poultry processing plants in the Czech Republic in the period from 1997 to 2004. *Vet. Med.* **52**, 262–266. (doi:10.17221/1881-VETMED)
72. Oba A, Almeida M de, Pinheiro JW, Ida EI, Marchi DF, Soares AL, Shimokomaki M. 2009 The effect of management of transport and lairage conditions on broiler chicken breast meat quality and DOA (Death on Arrival). *Braz. arch. biol. technol.* **52**, 205–211. (doi:10.1590/S1516-89132009000700026)
73. Di Martino G *et al.* 2017 Factors associated with pre-slaughter mortality in turkeys and end of lay hens. *Animal* **11**, 2295–2300. (doi:10.1017/S1751731117000970)
74. Somavilla R *et al.* 2017 Season, Transport Duration and Trailer Compartment Effects on Blood Stress Indicators in Pigs: Relationship to Environmental, Behavioral and Other Physiological Factors, and Pork Quality Traits. *Animals* **7**, 8. (doi:10.3390/ani7020008)
75. Roy RC, Cockram MS, Dohoo IR. 2015 Welfare of horses transported to slaughter in Canada: Assessment of welfare and journey risk factors affecting welfare. *Can. J. Anim. Sci.* **95**, 509–522. (doi:10.4141/cjas-2015-031)
76. Chulayo AY, Bradley G, Muchenje

- V. 2016 Effects of transport distance, lairage time and stunning efficiency on cortisol, glucose, HSPA1A and how they relate with meat quality in cattle. *Meat Science* **117**, 89–96. (doi:10.1016/j.meatsci.2016.03.001)
77. Friend TH. 2000 Dehydration, stress, and water consumption of horses during long-distance commercial transport. *J Anim Sci* **78**, 2568–2580. (doi:10.2527/2000.78102568x)
78. Stojkov J, Bowers G, Draper M, Duffield T, Duivenvoorden P, Groleau M, Hauptstein D. 2018 Hot topic : Management of cull dairy cows — Consensus of an expert consultation in Canada. *Journal of Dairy Science* **101**, 11170–11174. (doi:10.3168/jds.2018-14919)
79. van Dyke R, Connor M, Miele A. 2021 An investigation into the perceptions of veterinarians towards perioperative pain management in calves. *Animals* **11**, 1–17. (doi:10.3390/ani11071882)
80. Bolton SE, von Keyserlingk MAG. 2021 The Dispensable Surplus Dairy Calf: Is This Issue a “Wicked Problem” and Where Do We Go From Here? *Frontiers in Veterinary Science* **8**, 1–12. (doi:10.3389/fvets.2021.660934)
81. Roadknight N, Mansell P, Jongman E, Courtman N, Fisher A. 2021 Invited review: The welfare of young calves transported by road. *Journal of Dairy Science* **104**, 6343–6357. (doi:10.3168/jds.2020-19346)
82. Appleby MC, editor. 2008 *Long distance transport and welfare of farm animals*. Wallingford, UK ; Cambridge, MA: CABI.
83. Driessen B, Freson L, Buyse J. 2020 Fasting finisher pigs before slaughter influences pork safety, pork quality and animal welfare. *Animals* **10**, 1–10. (doi:10.3390/ani10122206)
84. Fisher AD, Colditz IG, Lee C, Ferguson DM. 2009 The influence of land transport on animal welfare in extensive farming systems. *Journal of Veterinary Behavior: Clinical Applications and Research* **4**, 157–162. (doi:10.1016/j.jveb.2009.03.002)
85. Cockram MS, Mitchell MA. 1999 Rôle of research in the formulation of ‘rules’ to protect the welfare of farm animals during road transportation. *BSAP Occasional Publication* **23**, 43–64. (doi:10.1017/S0263967X00033243)
86. Cockram MS. 2007 Criteria and potential reasons for maximum journey times for farm animals destined for slaughter. *Applied Animal Behaviour Science* **106**, 234–243. (doi:10.1016/j.applanim.2007.01.006)
87. Marti S, Wilde RE, Moya D, Heuston CEM, Brown F, Schwartzkopf-Genswein KS. 2017 Effect of rest stop duration during Long-Distance transport on welfare indicators in recently weaned beef calves. *Journal of Animal Science* **95**, 636–644. (doi:10.2527/jas2016.0739)
88. Meléndez DM, Marti S, Haley DB, Schwinghamer TD, Schwartzkopf-Genswein KS. 2020 Effect of transport and rest stop duration on the welfare of conditioned cattle transported by road. *PLoS ONE* **15**, 1–22. (doi:10.1371/journal.pone.0228492)
89. Meléndez DM, Marti S, Haley DB, Schwinghamer TD, Schwartzkopf-Genswein KS. 2021 Effects of conditioning, source, and rest on indicators of stress in beef cattle transported by road. *PLoS ONE* **16**, 1–25. (doi:10.1371/journal.pone.0244854)
90. Knowles G, Warriss PD, Brown SN, Edwards JE. 1999 Effects on cattle of transportation by road for up to 31 hours. *Veterinary Record* **145**, 575–582. (doi:10.1136/vr.145.20.575)
91. Earley B, Drennan M, O’Riordan EG. 2013 The effect of road transport in comparison to a novel environment on the physiological, metabolic and behavioural responses of bulls. *Research in Veterinary Science* **95**, 811–818. (doi:10.1016/j.rvsc.2013.04.027)
92. Messori S, Pedernera-Romano C, Magnani D, Rodriguez P, Barnard S, Dalmau A, Velarde A, Dalla Villa P. 2015 Unloading or not unloading? Sheep welfare implication of rest stop at control post after a 29h transport. *Small Ruminant Research* **130**, 221–228. (doi:10.1016/j.smallrumres.2015.07.012)
93. Cockram MS et al. 2000 Behavioural and Physiological Responses of Sheep to 16 h Transport and a Novel Environment Post-transport. *The Veterinary Journal* **159**, 139–146. (doi:10.1053/tvjl.1999.0411)
94. Broom DM. 2008 The welfare of livestock during road transport. In *Long distance transport and welfare of farm animals*, pp. 157–181. CABI Wallingford UK.
95. Parrott R, Hall S, Lloyd D, Goode J, Broom D. 1998 Effects of a maximum permissible journey time (31 h) on physiological responses of fleeced and shorn sheep to transport, with observations on behaviour during a short (1 h) rest-stop. *Animal Science* **66**, 197–207. (doi:10.1017/S135772980008961)
96. Cockram MS et al. 1997 Effect of lairage during 24 h of transport on the behavioural and physiological responses of sheep. *Animal Science* **65**, 391–402. (doi:10.1017/S135772980008596)
97. Messori S, Pedernera-Romano C, Rodriguez P, Barnard S, Giansante D, Magnani D, Dalmau A, Velarde A, Dalla Villa P. 2017 Effetto dei diversi tempi di sosta al posto di controllo durante il lungo viaggio sul benessere delle pecore. *Veterinaria Italiana* **53**, 121–129. (doi:10.12834/Vettit.316.1483.3)
98. Doyle R, Roest H-J, Sultana P, Tullio D, Baumgärtner I, Velarde A. Public hearing on long distance transports of live animals within the European Union.
99. Duthoit S. 2017 Le transport « longue durée » de bovins vivants : les incohérences de la réglementation européenne régulièrement pointées du doigt par la Cour de justice de l’Union européenne. *Европейски правен преглед*. See <https://evropeiskipravenpregled.eu/t188/> (accessed on 8 February 2023).
100. Thodberg K, Foldager L, Fogsgaard KK, Gaillard C, Herskin MS. 2022 Temperature conditions during commercial transportation of cull sows to slaughter. *Computers and Electronics in Agriculture* **192**, 106626. (doi:10.1016/j.compag.2021.106626)
101. Goldhawk C, Janzen C, González LA, Crowe T, Kastelic J, Kehler C, Siemens M, Schwartzkopf-Genswein FM, Pajor FM. 2015 Trailer temperature and humidity during winter transport of cattle in Canada and evaluation of indicators used to assess the welfare of cull beef cows before and after transport. *Journal of Animal Science* **93**, 3639–3653. (doi:10.2527/jas.2014-8390)
102. Fisher AD, Stewart M, Duganzich DM, Tacon J, Matthews LR. 2004 The effects of stationary periods and external temperature and humidity on thermal stress conditions within sheep transport vehicles. *New Zealand Veterinary Journal* **53**, 6–9. (doi:10.1080/00480169.2005.36461)
103. Knezacek TD, Olkowski AA, Kettlewell PJ, Mitchell MA, Classen HL. 2010 Temperature gradients in trailers and changes in broiler rectal and core body temperature during winter transportation in Saskatchewan. *Canadian Journal of Animal Science* **90**, 321–330. (doi:10.4141/cjas09083)
104. Schwartzkopf-Genswein K, Ahola J, Edwards-Callaway L, Hale D, Paterson J. 2016 SYMPOSIUM PAPER: Transportation issues affecting cattle well-being and considerations for the future. *Professional Animal Scientist* **32**, 707–716. (doi:10.15232/pas.2016-01517)
105. De la Fuente J, Díaz MT, Ibáñez M, González de Chavarri E. 2007 Physiological response of rabbits to heat, cold, noise and mixing in the context of transport. *Animal Welfare* **16**, 41–47.
106. Mitchell MA, Kettlewell PJ. 2009 Welfare of poultry during transport – a review.
107. Nielsen SS et al. 2022 Methodological guidance for the development of animal welfare mandates in the context of the Farm to Fork Strategy. *EFSA J* **20**, e07403. (doi:10.2903/j.efsa.2022.7403)
108. Caulfield MP, Cambridge H, Foster SF, McGreevy PD. 2014 Heat stress: A major contributor to poor animal welfare associated with long-haul live export voyages. *Veterinary Journal* **199**, 223–228. (doi:10.1016/j.tvjl.2013.09.018)
109. Purwanto BP, Abo Y, Sakamoto R, Yamamoto S, Furumoto F. 1990 Diurnal patterns of heat production and heart rate under thermoneutral conditions in Holstein Friesian cows differing in milk production. *The Journal of Agricultural Science* **114**, 139–142. (doi:10.1017/S0021859600072117)
110. Mitchell MA, Kettlewell PJ. 2008 Engineering and design of vehicles for long distance road transport of livestock (ruminants, pigs and poultry). *Veterinaria italiana* **44**, 201–13.
111. Sutherland MA, McDonald A, McGlone JJ. 2009 Effects of variations in the environment, length of journey and type of trailer on the mortality and morbidity of pigs being transported to slaughter. *Veterinary Record* **165**, 13–18. (doi:10.1136/vetrec.165.1.13)
112. Haley C, Dewey CE, Widowski T, Poljak Z, Friendship R. 2008 Factors associated with in-transit losses of market hogs in Ontario in 2001. *Can J Vet Res* **72**, 377–384.
113. Gade PB, Christensen L, Baltzer M, Petersen JV. 2007 Causes of pre-slaughter mortality in Danish slaughter pigs with special emphasis on transport. *Animal Welfare* **16**, 459–470. (doi:10.1017/S0962728600027391)
114. Warriss PD. 1998 The Welfare of Slaughter Pigs During Transport. *Animal Welfare* **7**, 365–381. (doi:10.1017/S0962728600020923)
115. Robbins LA, Green-Miller AR, Lay DC, Schinckel AP, Johnson JS, Gaskill BN. 2021 Evaluation of sow thermal preference across three stages of reproduction. *Journal of Animal Science* **99**, 1–10. (doi:10.1093/jas/skab202)
116. Bjerg B, Brandt P, Pedersen P, Zhang G. 2020 Sows’ responses to increased heat load – A review. *Journal of Thermal Biology* **94**, 102758. (doi:10.1016/j.jtherbio.2020.102758)
117. Bracke MBM, Herskin MS, Marahrens M, Gerritzen MA, Spoodler HAM. 2020 Review of climate control and space allowance during transport of pigs (version 1.0). *EURCAW Pigs* , 1–34.
118. US Department of Commerce N. What is the heat index? See

- <https://www.weather.gov/ama/heatindex> (accessed on 4 July 2023).
119. Habeeb AA, Gad AE, Atta MA. 2018 Temperature-Humidity Indices as Indicators to Heat Stress of Climatic Conditions with Relation to Production and Reproduction of Farm Animals. *International Journal of Biotechnology and Recent Advances* **1**, 35–50. (doi:10.18689/ijbr-1000107)
  120. Collins T, Hampton JO, Barnes AL. 2018 A systematic review of heat load in australian livestock transported by sea. *Animals* **8**, 1–16. (doi:10.3390/ani8100164)
  121. Carnovale F, Phillips CJC. 2020 The effects of heat stress on sheep welfare during live export voyages from Australia to the middle east. *Animals* **10**. (doi:10.3390/ani10040694)
  122. McCarthy M. 2018 Independent review of conditions for the export of sheep to the Middle East during the northern hemisphere summer.
  123. Ellis E. 2022 *Australian Animal Law: Context and Critique*. Sydney University Press.
  124. Australian Government, Department of Agriculture, Fisheries and Forestry. 2022 Review of live sheep exports by sea to, or through, the Middle East during the Northern Hemisphere summer.
  125. Miranda-de la Lama GC, Villarroel M, María GA. 2014 Livestock transport from the perspective of the pre-slaughter logistic chain: A review. *Meat Science* **98**, 9–20. (doi:10.1016/j.meatsci.2014.04.005)
  126. Warriss PD, Brown SN, Knowles TG, Wilkins LJ, Pope SJ, Chadd SA, Kettlewell PJ, Green NR. 2006 Comparison of the effects of fan-assisted and natural ventilation of vehicles on the welfare of pigs being transported to slaughter. *Veterinary Record* **158**, 585–588. (doi:10.1136/vr.158.17.585)
  127. Schwartzkopf-Genswein K, Grandin T. 2014 *Cattle transport by road*. (doi:10.1079/9781780643212.0143)
  128. Scientific Committee on Animal Health and Animal Welfare. 2002 The welfare of animals during transport (details for horses, pigs, sheep and cattle). *Anim. welf.* **11**, 354–355. (doi:10.1017/S0962728600024982)
  129. Tarrant PV, Kenny FJ, Harrington D. 1988 The effect of stocking density during 4 hour transport to slaughter on behaviour, blood constituents and carcass bruising in Friesian steers. *Meat Science* **24**, 209–222. (doi:10.1016/0309-1740(88)90079-4)
  130. Tarrant PV, Kenny FJ, Harrington D, Murphy M. 1992 Long distance transportation of steers to slaughter: effect of stocking density on physiology, behaviour and carcass quality. *Livestock Production Science* **30**, 223–238. (doi:10.1016/S0301-6226(06)80012-6)
  131. Visser K. 2014 Note on minimum space allowance and compartment height for cattle and pigs during transport. *Livestock Research*
  132. Consortium of the Animal Transport Guides. 2018 Guide to good practices for the transport of cattle.
  133. EFSA Panel on Animal Health and Welfare (AHAW). 2011 Scientific Opinion Concerning the Welfare of Animals during Transport. *EFSA Journal* **9**, 1966. (doi:10.2903/j.efsa.2011.1966)
  134. FAWC. 2019 The welfare of animals during transport. *Gov*, 1–30.
  135. Petherick JC, Phillips CJC. 2009 Space allowances for confined livestock and their determination from allometric principles. *Applied Animal Behaviour Science* **117**, 1–12. (doi:10.1016/j.applanim.2008.09.008)
  136. Knowles TG, Brown SN, Pope SJ, Nicol CJ, Warriss PD, Weeks CA. 2010 The response of untamed (unbroken) ponies to conditions of road transport. *Animal Welfare* **19**, 1–15.
  137. Warriss PD, Brown SN, Knowles TG, Kestin SC, Edwards JE, Dolan SK, Phillips AJ. 1995 Effects on cattle of transport by road for up to 15 hours. *The Veterinary record* **136**, 319–323. (doi:10.1136/vr.136.13.319)
  138. Visser. 2014 Behaviour of heifers during long distance transport Behaviour of heifers during long distance transport.
  139. Animals' Angels. 2021 *100 Reasons to Revise Council Regulation EC 1/2005 on the Protection of Animals during Transport*.
  140. Menchetti L, Costa LN, Zappaterra M, Padalino B. 2021 Effects of reduced space allowance and heat stress on behavior and eye temperature in unweaned lambs: A pilot study. *Animals* **11**, 1–19. (doi:10.3390/ani1123464)
  141. Arndt H, Volkman N, Spindler B, Hartung J, Kemper N. 2019 Do pigs have adequate space in animal transportation vehicles? Planimetric measurement of the floor area covered by finishing pigs in various body positions. *Frontiers in Veterinary Science* **5**. (doi:10.3389/fvets.2018.00330)
  142. FAWC. 2013 FAWC advice on space and headroom allowances for transport of farm animals FAWC advice on space and headroom allowances for transport of farm animals.
  143. European Parliament. Directorate General for Parliamentary Research Services. 2018 *Regulation (EC) No 1/2005 on the protection of animals during transport and related operations: European implementation assessment*. LU: Publications Office. See <https://data.europa.eu/doi/10.2861/15227>.
  144. Wilhelmsson S. 2022 *There's no time to rush!: pigs' and transport drivers' welfare and interactions during slaughter transport*.
  145. Defra WG. 2021 Improvements to animal welfare in transport: summary of responses and government response.
  146. 2015 Zuchtvieh-Export GmbH v Stadt Kempten.
  147. 2022 Tiertransporte aus Deutschland werden deutlich eingeschränkt. *BMEI*. See <https://www.bmel.de/SharedDocs/Pressemitteilungen/DE/2022/148-tiertransporte.html> (accessed on 12 February 2023).
  148. Council of the European Union, General Secretariat of the Council. 2022 Updating legislation on the transport of animals in the EU Information from the Belgian, Danish, Dutch, German and Swedish delegations.
  149. 2022 Live sheep trade ban won't happen in this term, PM says. *ABC News*, 3 June. See <https://www.abc.net.au/news/2022-06-03/sheep-live-export-ban-labor-agriculture-minister-confirms/101119752>.
  150. Offor I. 2020 Animals and the Impact of Trade Law and Policy: A Global Animal Law Question. *Transnational Environmental Law* **9**, 239–262. (doi:10.1017/S2047102519000402)
  151. Consortium of the Animal Transport Guides. 2018 Guide to good practices for the transport of sheep.
  152. Shroff V. 2021 *Canadian Animal Law Book written by V. Victoria Shroff, published Sept. 2021 by LexisNexis*.
  153. Rodriguez Ferrere M, King M, Larsen LM. 2019 Animal Welfare in New Zealand: Oversight, Compliance and Enforcement.
  154. Schwartzkopf-Genswein K, Grandin T. 2019 *Cattle transport in North America. Livestock handling and transport*, 153–183. (doi:10.1079/9781786399151.0153)
  155. Marlin D, Kettlewell P, Parkin T, Kennedy M, Broom D, Wood J. 2011 Welfare and health of horses transported for slaughter within the European Union Part 1: Methodology and descriptive data. *Equine Veterinary Journal* **43**, 78–87. (doi:10.1111/j.2042-3306.2010.00124.x)
  156. Padalino B, Menchetti L, Mininni V, Tullio D, Nanni Costa L. 2021 Transport certifications of cattle moved from France to Southern Italy and Greece: do they comply with Reg. EC 1/2005? *Italian Journal of Animal Science* **20**, 1870–1881. (doi:10.1080/1828051X.2021.1971573)
  157. Anneberg I, Sandøe P. 2019 When the Working Environment is Bad, you Take it out on the Animals – How Employees on Danish Farms Perceive Animal Welfare. *Food ethics* **4**, 21–34. (doi:10.1007/s41055-019-00044-6)
  158. Wilhelmsson S, Andersson M, Arvidsson I, Dahlqvist C, Hemsworth PH, Yngvesson J, Hultgren J. 2021 Physical workload and psychosocial working conditions in Swedish pig transport drivers. *International Journal of Industrial Ergonomics* **83**, 103124. (doi:10.1016/j.ergon.2021.103124)
  159. Federation of Veterinarians of Europe. 2016 FVE calls to end suffering of animals during long distance transports. **1**, 1–2.
  160. Baltussen WHM, Spoolder H a. M, Lambooi E, Backus GBC. 2009 Sustainable production: transporting animals or meat?
  161. Hultgren J. 2018 Is livestock transport a necessary practice? Mobile slaughter and on-farm stunning and killing before transport to slaughter. (doi:10.1079/PAVSNR201813054)
  162. Eriksen MS, Rødibotten R, Grøndahl AM, Friestad M, Andersen IL, Mejdell CM. 2013 Mobile abattoir versus conventional slaughterhouse—Impact on stress parameters and meat quality characteristics in Norwegian lambs. *Applied Animal Behaviour Science* **149**, 21–29. (doi:10.1016/j.applanim.2013.09.007)
  163. Herskin MS, Duffield TF. 2020 Editorial: Animal transport related management. *Journal of Dairy Science* **101**, 11170–11174. (doi:10.3168/jds.2018-14919)
  164. Creutzinger KC, Broadfoot K, Goetz HM, Proudfoot KL, Costa JHC, Meagher RK, Renaud DL. 2022 Assessing dairy calf response to long-distance transportation using conditioned place aversion. *JDS Communications* **3**, 275–279. (doi:10.3168/jdsc.2022-0209)
  165. Birch J. 2017 Animal sentience and the precautionary principle. *Animal Sentience* **2**. (doi:10.51291/2377-7478.1200)

## Tables

# Are regulations addressing farm animal welfare issues during live transportation fit for purpose? A multi-country jurisdictional check.

Eugénie Duval<sup>1,2,†\*</sup>, Benjamin Lecorps<sup>2,3,†</sup>, Marina A.G. von Keyserlingk<sup>2</sup>

\* Correspondence: Corresponding Author: [eugenie.duval@essex.ac.uk](mailto:eugenie.duval@essex.ac.uk)

**Table 1. Comparison of the legislations on fitness for transport.**

	Australia	Canada	EU	New Zealand	US
<b>Relevant legislation</b>	<p>Australian Animal Welfare Standards and Guidelines, Land transport of livestock, Edition One, Version 1.1, 21 September 2012, Part A, 4 and Part B (for specific rules by species), Glossary</p> <p>Australian Standards for the Export of Livestock 3.2, Standards 1 and 6</p> <p>Exporter Supply Chain Assurance System (ESCAS) version 1.3., April 2016</p>	<p>Health of Animals Regulations, Part XII – Transport of Animals (last amendments published in 2019 and came into force in 2020), Sections 139 and 140</p>	<p>Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport, Annex I, Chapter I</p>	<p>Animal Welfare (Care and Procedures) Regulations 2018, Part 1, Sections 21, 31-43</p> <p>Code of Welfare: Transport within New Zealand, 2018, Minimum standard n°6</p>	<p>The United States Code, Title 49, §80502. Transportation of animals</p> <p>The Code of Federal Regulations, Title 9, Chapter I, Subchapter C</p>
<b>Unfit animals: Signs – Age</b>	<p>Export:</p> <ul style="list-style-type: none"> <li>• Cattle weaned &lt; 14d prior to sourcing for export</li> <li>• Goats weaned &lt; 14d prior to sourcing for export</li> <li>• Sheep &lt; 14d</li> </ul>	<p>Newborn with unhealed navel</p>	<ul style="list-style-type: none"> <li>• Newborn with an unhealed navel</li> <li>• pigs &lt; 3w, lambs &lt; 1w, calves &lt; 10d (unless transported &lt; 100km)</li> </ul>	<ul style="list-style-type: none"> <li>• Calves &lt; 4d (96h)</li> <li>• + additional requirements: the calf must be free from signs of any injury, disease, disability; the calf is alert; the calf's hooves are firm/worn flat/not bulbous; the calf's navel cord is shrivelled and not pink or red coloured, raw, or fleshy.</li> </ul>	<p>Export:</p> <p>Newborn livestock with an unhealed navel (for export)</p>

<p><b>Unfit animals: Signs – Health</b></p>	<p>Land transport:</p> <ul style="list-style-type: none"> <li>• For all animals: <ul style="list-style-type: none"> <li>○ Unable to walk on its own by bearing weight on all legs</li> <li>○ Severely emaciated</li> <li>○ Visibly dehydrated</li> <li>○ Showing visible signs of severe injury or distress</li> <li>○ Suffering from conditions that are likely to cause increased pain or distress during transport</li> <li>○ Blind in both eyes</li> </ul> </li> <li>• Horses: lameness score 4 and 5</li> <li>• Poultry: broken legs or unable to walk</li> </ul> <p>Export:</p> <p>- A fit animal:</p> <ul style="list-style-type: none"> <li>• Can walk on its own by evenly bearing weight on all 4 legs</li> <li>• Is free from visible signs of injury or distress or conditions likely to further compromise its health or welfare during transport</li> <li>• Is strong enough to make the journey and is not dehydrated or emaciated</li> <li>• Is not blind in either eye and can see well enough to walk, load and travel without impairment or distress</li> <li>• Has had adequate access to water prior to loading</li> </ul> <p>- Rejection criteria:</p> <ul style="list-style-type: none"> <li>• Lactating animals</li> <li>• Viral diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Non-ambulatory</li> <li>• Fracture impeding mobility or causing pain/suffering</li> <li>• Lameness in one or more limbs causing pain/suffering and halting movements or reluctance to walk</li> <li>• Lameness to the extent it cannot walk on all its legs</li> <li>• In shock or dying</li> <li>• Prolapse uterus/severe rectal or vaginal prolapse</li> <li>• Signs of a generalized nervous system disorder</li> <li>• Porcine: trembling, difficulty breathing, discolored skin</li> <li>• Laboured breathing</li> <li>• Severe open wound or laceration</li> <li>• Has sustained an injury and is hobbled to aid in treatment</li> <li>• Extremely thin</li> <li>• Dehydration</li> <li>• Hypothermia or hyperthermia</li> <li>• Fever</li> <li>• Hernia (impeding its movements; causing pain/suffering; touches the ground when the animal is standing; open wound, ulceration or obvious infection)</li> <li>• Gangrenous udder</li> <li>• Severe squamous cell carcinoma of the eye</li> <li>• Bloating (discomfort/weakness)</li> </ul>	<ul style="list-style-type: none"> <li>• Severe open wound or prolapse</li> <li>• Unable to move independently without pain or to walk unassisted</li> </ul>	<ul style="list-style-type: none"> <li>• Animals not fit enough to withstand the entire journey without suffering unreasonable or unnecessary pain or distress.</li> <li>• Animals displaying any injuries, signs of disease, abnormal behaviour or physical abnormalities that could compromise their welfare during the journey</li> <li>• Animals with horns if the animals can seriously injure itself or another animal</li> <li>• Animals with ingrown horns (involving part of the horn – other than the base – piercing or inflaming any part of the animal's body or causing a skin abrasion)</li> <li>• Animals with injured horns</li> <li>• Animals with a bleeding, discharging, or broken (and unhealed) horn, or pedicle</li> <li>• Lame animals: <ul style="list-style-type: none"> <li>○ Animals not able to stand and to bear weight on all limbs.</li> <li>○ Lame cattle or pig: the animal is not weight bearing on 1 or more limbs when moving/standing; or animal with a definite limp. If the cause of the limp is a non-painful condition and if the animal is able to bear weight on all 4 limbs: not lame</li> <li>○ Lame sheep or goat: the animal is not weight bearing on 1 or more limbs when moving/standing; or</li> </ul> </li> </ul>	<p>Export:</p> <ul style="list-style-type: none"> <li>• Sick, injured, weak, disabled or fatigued</li> <li>• Unable to stand unaided or bear weight on each leg</li> <li>• Blind in both eyes</li> <li>• Cannot be moved without causing additional suffering</li> <li>• Unhealed wounds from surgical procedures such as dehorning</li> </ul>
---	--	---	--	--	--

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

	<ul style="list-style-type: none"> <li>• Displaying clinical signs of infectious or contagious disease or external parasites</li> <li>• Showing signs of injury (e.g., fractures, swelling)</li> <li>• Body condition score not appropriate for export (such as emaciated or over-fat)</li> <li>• Anorexia (inappetence or 'shy feeders')</li> <li>• Uncoordinated, collapsed, weak</li> <li>• Unwell, lethargic, dehydrated</li> <li>• Ill-thrift</li> <li>• Dysentery or profuse diarrhea</li> <li>• Bloat</li> <li>• Abnormal gait or lameness of any kind</li> <li>• Abnormal soft tissue or bony swellings</li> <li>• Nervous symptoms such as head tilt, circling, incoordination</li> <li>• Abnormal or aggressive behaviour/intractable or violent</li> <li>• Generalized papillomatosis or generalized ringworm or dermatophilosis</li> <li>• Generalized and extensive buffalo fly lesions</li> <li>• Generalized skin disease or infection</li> <li>• External skin cancer</li> <li>• Lacerations that penetrate the full thickness of the dermis or are likely to affect the health or welfare of the animal</li> <li>• Discharging wounds or abscesses</li> <li>• Cutaneous myiasis (flystrike)</li> <li>• Balanitis (pizzle rot in sheep)</li> <li>• Blood/abnormal discharge from reproductive tract (vulva/prepuce)</li> <li>• Visible external parasites</li> </ul>	<ul style="list-style-type: none"> <li>• Exhaustion</li> <li>• Newborn with infected navel</li> <li>• Any other signs of infirmity, illness, injury or condition that indicates that the animal cannot be transported without suffering</li> </ul>		<p style="text-align: center;">difficulty walking and holds head below backline almost continuously</p> <ul style="list-style-type: none"> <li>• Animals with injured or diseased udders (e.g., necrotic, discharge other than milk)</li> <li>• Animals with eye cancer (e.g., bleeding, discharge)</li> <li>• Animals within 7d of being castrated or tail docked</li> <li>• Animals displaying injuries/signs of disease/abnormal behaviour/physical abnormalities that would compromise their welfare</li> </ul>	
--	--	--	--	---	--

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

	<ul style="list-style-type: none"> <li>• Blindness in 1 or both eyes</li> <li>• Cancer eye</li> <li>• Keratoconjunctivitis (pink eye)</li> <li>• Excessive salivation</li> <li>• Nasal discharge consistent with signs of a contagious or infectious disease</li> <li>• Coughing consistent with signs of a contagious or infectious disease</li> <li>• Respiratory distress or difficulty breathing</li> <li>• Sharp horns</li> <li>• Horns causing damage to the head or eyes</li> <li>• Bleeding horn stumps or broken antlers</li> <li>• Horns longer than appropriate for export</li> <li>• Scabby mouth</li> <li>• Groups of animals with unusual mortalities</li> <li>• Disparities in sex, size, weight or age that could cause an issue with the health or welfare of the animals (redraft animals in this case)</li> <li>• More specific rules on body condition scores and liveweight apply (see the Australian Standards for the Export of Livestock 3.2)</li> </ul> <p>Transport in the importing country:</p> <ul style="list-style-type: none"> <li>• Animals include, but may not be limited to: those that are sick, injured, weak, disabled or fatigued; those that are unable to stand unaided and bear weight on each leg; those that are blind in both eyes; those that cannot be moved without causing them</li> </ul>				
--	--	--	--	--	--



	<p>additional suffering; newborn with an unhealed navel; pregnant animals which would be in the final 10% of their gestation period at the planned time of unloading; females travelling without young which have given birth within the previous 48 hours; and those whose body condition would result in poor welfare because of the expected climatic conditions.</p>				
<p><b>Unfit animals: Signs – Reproductive status</b></p>	<p>Land transport:</p> <ul style="list-style-type: none"> <li>• Cattle in the last 4 weeks of pregnancy (can only be transported under veterinary advice unless the journey is less than 4h)</li> <li>• Goats in the last 2 weeks of pregnancy</li> <li>• Mares in the last 4 weeks of pregnancy (can only be transported under veterinary advice unless the journey is less than 4h)</li> <li>• Ewes in the last 2 weeks of pregnancy</li> </ul> <p>Export:</p> <p>- Export by sea:</p> <ul style="list-style-type: none"> <li>• Cattle more than 190 days pregnant</li> <li>• Pregnant female goats source for export as feeder or slaughter animals; female goats more than 100 days pregnant sourced for export as breeder animals</li> <li>• Pregnant females source for export as feeder or slaughter; female sheep more than 100 days pregnant source for breeder animals</li> </ul> <p>- Export by air:</p> <ul style="list-style-type: none"> <li>• Pregnant animals (unless veterinary certificate)</li> </ul>	<ul style="list-style-type: none"> <li>• Pregnant females in the last 10% of the expected gestation period</li> <li>• Females who gave birth in the last 48h</li> </ul>	<ul style="list-style-type: none"> <li>• Pregnant females in the last 10% of the expected gestation period</li> <li>• Females who gave birth in the previous week</li> </ul>	<ul style="list-style-type: none"> <li>• Animals in late pregnancy</li> <li>• Animals must not be transported if they are likely to give birth during the journey or be affected by metabolic complications of late pregnancy as a result of the journey.</li> </ul>	<p>Export:</p> <ul style="list-style-type: none"> <li>• Females who gave birth within the last 48h and are travelling without their offspring</li> <li>• Final 10% of the pregnancy at the planned time of unloading in the importing country</li> </ul>

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

	<ul style="list-style-type: none"> <li>• Imminent parturition</li> <li>• Animals that are within 5d or giving birth</li> <li>• Animals that are more than 5d but less than 15d of giving birth (unless stated otherwise)</li> <li>• Similar specific rules stated above for export by sea also apply here</li> </ul> <p>Export – transport in the importing country:</p> <ul style="list-style-type: none"> <li>• OIE definition of unfit animals: include, but may not be limited to: those that are sick, injured, weak, disabled or fatigued; those that are unable to stand unaided and bear weight on each leg; those that are blind in both eyes; those that cannot be moved without causing them additional suffering; newborn with an unhealed navel; pregnant animals which would be in the final 10% of their gestation period at the planned time of unloading; females travelling without young which have given birth within the previous 48 hours; and those whose body condition would result in poor welfare because of the expected climatic conditions.</li> <li>• Downer animals (cannot stand or walk)</li> <li>• Injured/sick animals that are reluctant to stand or walk (e.g. animals with a broken limb or other serious injury)</li> </ul>				
<p><b>Unfit animals – transport: yes/no?</b></p>	<p>No unless veterinary advice (road transport)</p>	<p>No unless veterinary certificate and for treatment purposes</p>	<p>No unless under veterinary supervision and for or following treatment/diagnostic purposes</p>	<p>No unless veterinary certificate</p>	<p>Export: No</p>

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28</p> <p><b>Compromised animals – signs</b></p>	<p>--</p>	<ul style="list-style-type: none"> <li>• Bloating but no discomfort/weakness</li> <li>• Acute frostbite</li> <li>• Blind in both eyes</li> <li>• Not fully healed after a procedure (including dehorning, detusking, castration)</li> <li>• Lameness other than in a way described for unfit animals (see above)</li> <li>• Deformity or fully healed amputation without pain</li> <li>• Peak lactation</li> <li>• Unhealed or acutely injured penis</li> <li>• Minor rectal or vaginal prolapse</li> <li>• Mobility limited by a device (including hobbles that are not applied to aid in treatment)</li> <li>• Wet bird</li> <li>• Any other signs of infirmity, illness, injury or condition that indicates that the animal has a reduced capacity to withstand transport.</li> </ul>	<p>Slightly injured or ill animals (when transport would not cause additional suffering)</p>	<p>--</p>	<p>--</p>
<p>29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46</p> <p><b>Compromised animals – transport: yes/no?</b></p>	<p>--</p>	<p>Yes, if:</p> <ul style="list-style-type: none"> <li>• Specific requirements (individually loaded/unloaded; no ramps inside; measures preventing suffering/injury/death)</li> <li>• Animal transported directly to the nearest place other than an assembly centre</li> <li>• Max 12h without FWR</li> </ul>	<p>Yes, no specific conditions</p>	<p>--</p>	<p>--</p>

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

<b>Other</b>	Livestock are of sufficient health, vigour and condition if they can withstand the intended journey. Following the intended journey, they can recover their normal biological state in a reasonable time.				<p>Slaughter-ante-mortem inspection (The United States Code, Title 9, Part 309, §309.2):</p> <ul style="list-style-type: none"> <li>• All seriously crippled animals and non-ambulatory disabled livestock: must be identified as U.S. Suspects and disposed of unless they are required to be classed as condemned</li> <li>• Non-ambulatory disabled cattle: must be condemned and promptly disposed</li> </ul>
--------------	---	--	--	--	---

**Table 2. Table summarizing specific regulations for journey durations by road for young calves in five different jurisdictions.**

Jurisdiction	Age range for specific regulations (in days)	Maximum duration/distance applied
Australia	≤ 5	6h
Canada	≤ 8	12h
EU	< 10	100km
	between 10 and 14	8h
New Zealand	≤ 14	12h
US	--	--

**Table 3. Comparison of the legislations on journey durations for road transport.**

\* *In Australia, more specific durations may apply (e.g., calves between 30 days and 6 months old).*

	Australia*	Canada	EU	New Zealand	US
<b>Relevant legislation</b>	<p>Australian Animal Welfare Standards and Guidelines, Land transport of livestock, Edition One, Version 1.1, 21 September 2012, Part B, B4, B7-11, Glossary</p> <p>Export Control (Animals) Rules 2021, Chapter 6</p>	<p>Health of Animals Regulations, Part XII – Transport of Animals (last amendments published in 2019 and came into force in 2020), Section 152</p>	<p>Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport, pt 18, Annex I, Chapter V</p>	<p>Animal Welfare (Care and Procedures) Regulations 2018, Section 34</p> <p>Animal Welfare Act 1999, Section 41</p> <p>Animal Welfare (Export of Livestock for Slaughter) Regulations 2016</p>	<p>The United States Code, Title 49, §80502. Transportation of animals</p> <p>The Code of Federal Regulations, Title 9, Chapter I, Subchapter C</p>

	Australian Standards for the Export of Livestock 3.2, 1.4.3, 1.4.4, 3.7.8				
<b>Maximum durations (for the entire trip)</b>	Calves only: <ul style="list-style-type: none"> <li>• ≤ 5 days old transported directly to a calf-rearing facility: 6h</li> <li>• 5-30 days old: 18h</li> </ul>	<ul style="list-style-type: none"> <li>• Ruminants too young to be fed exclusively on hay and grain + livestock ≤ 8 days old: 12h (prohibition to transport these animals to an assembly centre)</li> <li>• Compromised animals: 12h (transport to the nearest place; prohibition to transport these animals to an assembly centre)</li> </ul>	Poultry and rabbits when transported without food and water: 12h	Calves ≤ 14 days old only: 12h	--
<b>Maximum durations (intervals; for intervals durations, see below) (yes/no)</b>	yes	yes	yes	no (except for young calves)	yes
<b>Durations (intervals for sheep, cattle, goats, swine, horses, poultry and rabbits)</b>	<ul style="list-style-type: none"> <li>• Sheep, cattle and goats: 48h</li> <li>• Swine: 24h or 72h (with water and feed every 24h)</li> <li>• Horses: 24h or 36h (with water and feed every 5h)</li> <li>• Poultry: 24h</li> <li>• Rabbits: no maximum duration</li> </ul>	<ul style="list-style-type: none"> <li>• Sheep, cattle and goats: 36h</li> <li>• Swine: 28h</li> <li>• Horses: 28h</li> <li>• Poultry and rabbits: 28h (24h without water)</li> </ul>	<ul style="list-style-type: none"> <li>• Sheep, cattle and goats: 29h (rest period of 1h with water and feed after 14h), followed by 24h rest</li> <li>• Swine: 24h (with continuous access to water during the journey)</li> <li>• Horses: 24h (rest period of 1h with water and feed every 8h)</li> <li>• Poultry and rabbits: 12h without feed and water</li> </ul>	Young calves (≤ 14 d): 12h	<ul style="list-style-type: none"> <li>• Cattle, sheep, goats, swine, horses: 28h</li> <li>• Poultry and rabbits: unclear scope; no maximum duration</li> </ul>

<b>When does the interval start?</b>	When the animal had last access to water	When the animal had last access to the resource	When the first animal is loaded onto the vehicle	When the animal is loaded onto the vehicle	When the animal is loaded onto the vehicle (loading/unloading not included)
<b>Resting time after maximum intervals</b>	<ul style="list-style-type: none"> <li>• Sheep, cattle and goats: 36h</li> <li>• Swine: 12h (for 24h journeys) or 24h (for 72h journeys)</li> <li>• Horses: 12h (for 24h journeys) or 24h (for 36h journeys)</li> </ul>	8h	24h	--	5h
<b>Rest location</b>	No mandatory unloading – but stationary vehicle	No mandatory unloading – for equipped vehicles only	Mandatory unloading – resting station	--	No mandatory unloading
<b>Possibility to lift the maximum durations?</b>	Yes for poultry: no maximum duration if water and food are provided	Yes if animals have access to feed, water and rest during transport	Yes for poultry and rabbits: no maximum duration if water and food are provided	--	Yes: <ul style="list-style-type: none"> <li>• if animals have access to feed, water and rest during transport</li> <li>• if the confinement ends at night (for sheep; additional 8h)</li> <li>• if accidental or unavoidable causes</li> <li>• if the owner or person having custody of animals being transported requests it in writing (up to 36h)</li> </ul>
<b>Export ban</b>				<ul style="list-style-type: none"> <li>• Ban on live animal export by sea (for cattle, deer, goats, or sheep)</li> <li>• Livestock exported for slaughter by air: need prior approval of the Director-General of the Ministry for Primary Industries (MPI).</li> </ul>	

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

<p><b>Seasonal export restrictions/ban</b></p>	<p>Seasonal export bans or restrictions exist for sheep and cattle – for more information, see: Export Control (Animals) Rules 2021, Chapter 6; Australian Standards for the Export of Livestock 3.2, 1.4.3, 1.4.4, 3.7.8; Australian Government, Review of live sheep exports by sea to, or through, the Middle East during the Northern Hemisphere summer, September 2022.</p>				
<p><b>Other</b></p>			<ul style="list-style-type: none"> <li>• Horses, cattle, sheep, goat and pigs : max 8h but this time can be extended if some requirements are met (see Chapter VI)</li> <li>• Long journeys (i.e., &gt; 8h) are likely to have more detrimental effects on the welfare of animals than short ones.</li> </ul>		



**Table 4. Comparison of the legislations on climatic conditions during transport.**

	<b>Australia</b>	<b>Canada</b>	<b>EU</b>	<b>New Zealand</b>	<b>US</b>
<b>Relevant legislation</b>	Australian Standards for the Export of Livestock 3.2, 1.4.3, 1.7.3, 5.1.19, 6.1.30  Australian Standards for the Export of Livestock 3.2, Standard 13	Health of Animals Regulations, Part XII – Transport of Animals (last amendments published in 2019 and came into force in 2020), Sections 146, 152  Health of Animals Regulations: Part XII: Transport of Animals-Regulatory Amendment Interpretive Guidance for Regulated Parties, Part 19	Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport, Annex I, Chapter II, Paragraph 3.1, Chapter III, Paragraph 2.6, Chapter IV, Section 1, Paragraph 2, Chapter VI, Paragraph 3	Animal Welfare (Care and Procedures) Regulations 2018, Part 1, Section 10  Code of Welfare: Transport within New Zealand, 2018, Part 3.1	The Code of Federal Regulations, Title 9, Chapter I, Subchapter C, §89.1, Subchapter D., §91.12
<b>Minimum/maximum temperatures</b>	no but sheep and cattle cannot be transported during certain times of the year in some areas (export only)	no	no except for journeys > 8h by road for horses, cattle, sheep, goats and pigs: from 5°C to 30°C within the means of transport, with a +/- 5°C tolerance	no	no
<b>Mandatory mechanical or forced-ventilation systems</b>	no except for animals transported on vessels with enclosed decks (export only)	no except for journeys exempted on meeting the maximum intervals	no except for: <ul style="list-style-type: none"> <li>Journeys &gt; 8h by road for horses, cattle, sheep, goats and pigs</li> <li>Livestock vessels and roll-on-on-roll-off vessels</li> </ul>	no	no except for export by sea
<b>Ventilation/temperature monitoring, recording and alarm systems</b>	no	no except for journeys exempted on meeting the maximum intervals	no except for: <ul style="list-style-type: none"> <li>Journeys &gt; 8h by road for horses, cattle, sheep, goats and pigs</li> </ul>	no	no

		(temperature and humidity only)	<ul style="list-style-type: none"> <li>Livestock vessels and roll-on-on-roll-off vessels (ventilation only; no mandatory recording)</li> </ul>		
<b>Other</b>	<ul style="list-style-type: none"> <li>Road transport: A person in charge must take reasonable steps to minimise the impact of extreme weather conditions on the welfare of livestock during the transport process. Extremes of weather: Temperature and climatic conditions (e.g. rain, hail, snow, wind, humidity and heat) that — individually or in combination — are likely to predispose livestock to heat or cold stress.</li> <li>Export (by air): The ventilation and temperature in the livestock hold must be adequate to maintain the health and welfare of the livestock at all times while livestock are in the aircraft.</li> <li>Export (in the importing country): Animals must be protected from exposure to adverse weather conditions or alternative arrangements must be made to alleviate heat/cold stress. Animals are provided with shade/shelter or there are alternative arrangements in place to prevent or alleviate heat/cold stress. Animals show no signs of heat/cold stress.</li> </ul>	No person shall load, confine or transport an animal in or unload an animal from a conveyance or container, or cause one to be so loaded, confined, transported or unloaded, if the animal is likely to suffer, sustain an injury or die due to inadequate ventilation or by being exposed to meteorological or environmental conditions.	<ul style="list-style-type: none"> <li>Animals must be protected from inclement weather, extreme temperatures and adverse changes in climatic conditions</li> <li>Transport by air: Animals shall be transported only in conditions where air quality, temperature and pressure can be maintained within an appropriate range during the entire journey, having regard to the species of animals.</li> <li>Sufficient ventilation shall be provided to ensure that the needs of the animals are fully met taking into account in particular the number and type of the animals to be transported and the expected weather conditions during the journey. Containers shall be stored in a way which does not impede their ventilation.</li> </ul>	<ul style="list-style-type: none"> <li>Conveyances and containers must be designed to provide protection from adverse weather that may be a risk to the animal's health and welfare.</li> <li>For calves: the vehicle must provide protection from adverse weather, including precipitation and extremes of heat and cold</li> </ul>	<p>Road transport:</p> <p>When emergency conditions arise, such as severe changes in the weather, which increase the rigors of transportation, the livestock should receive additional amounts of feed, sufficient to sustain them until they arrive at the next feeding station or destination.</p> <p>Export (ocean vessels):</p> <ul style="list-style-type: none"> <li>Pens on exposed upper decks must protect the livestock from the weather. Pens next to engine or boiler rooms or similar sources of heat must be fitted to protect the livestock from injury due to transfer of heat to the livestock or livestock transport spaces.</li> <li>Ventilation during loading, unloading, and transport must provide fresh air and remove excessive heat, humidity, and noxious fumes (such as ammonia and carbon dioxide). Ventilation must be adequate for variations in climate and weather and to meet the</li> </ul>

					needs of the livestock being transported. Ventilation must be effective both when the vessel is stationary and when it is moving and must be turned on when the first animal is loaded.
--	--	--	--	--	---

**Table 5. Comparison of the legislations on space allowances during transport.**

	Australia	Canada	EU	New Zealand	US
<b>Relevant legislation</b>	Australian Animal Welfare Standards and Guidelines, Land transport of livestock, Edition One, Version 1.1, 21 September 2012  Australian Standards for the Export of Livestock 3.2, 5.1.11	Health of Animals Regulations, Part XII – Transport of Animals (last amendments published in 2019 and came into force in 2020), Sections 141, 147, 148, 152	Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport, Article 3 (g), Annex I, Chapter II, Paragraph 1.2, Chapter VII	Code of Welfare: Transport within New Zealand, 2018, Part 3.1	The Code of Federal Regulations, Title 9, Chapter I, Subchapter D, §91.13
<b>Regulations related to space allowances</b>	The driver (except train drivers) must assess the loading density for each pen or division in the livestock crate or each container, with the exception of poultry, emus and ostriches in containers. The assessment is based on average live weight of the intended livestock loading, and must be managed to minimise risk to the welfare of the livestock.  Determination of loading density must consider all of the following factors: species and class; size and body condition;	<ul style="list-style-type: none"> <li>• Sufficient space is provided to allow the animal to lie down without lying on top of other animals;</li> <li>• Livestock <math>\leq 8d</math>: sufficient space is provided to allow the animal to lie down without lying on top of another animal</li> <li>• Livestock: must be able to stand at all times within the conveyance or container with all feet on the floor, with head elevated, with sufficient space to permit a full range of head movement and without any part of the body coming into contact with a deck,</li> </ul>	<ul style="list-style-type: none"> <li>• Sufficient space shall be provided inside the animals' compartment and at each of its levels to ensure that there is adequate ventilation above the animals when they are in a naturally standing position, without on any account hindering their natural movement.</li> <li>• Sufficient floor area and height is provided for the animals, appropriate to their size and the intended journey.</li> </ul>	<ul style="list-style-type: none"> <li>• Stocking density must be sufficient to allow animals to adopt a natural posture during the journey without injuring their heads or backs if they stand, and to allow animals to rest, if this is necessary during the journey</li> <li>• Containers must be designed to ensure enough room to enable animals to travel in a natural posture.</li> </ul>	Export only: Cargo containers used to ship livestock must provide sufficient space for the species being transported given the duration of the trip, as determined by APHIS.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

	<p>wool or hair length; horn status; predicted climatic conditions; nature of the intended journey; vehicle design and capacity</p>	<p>roof or top of the conveyance or cover of the container</p> <ul style="list-style-type: none"> <li>• Poultry confined in a container: must be able to maintain a squatting or sitting position with sufficient space to permit a full range of head movement without coming into contact with the cover of the container</li> <li>• All other animals, and poultry that is not confined in a container: must be able to maintain its preferred position with sufficient space to permit a full range of head movement</li> <li>• Horses: cannot be transported in a conveyance that has more than one deck.</li> <li>• Transport by air: no overcrowding.</li> <li>• Overcrowding occurs when, due to the number of animals in the container or conveyance, the animal cannot maintain its preferred position or adjust its body position in order to protect itself from injuries or avoid being crushed or trampled; the animal is likely to develop a pathological condition such as hyperthermia, hypothermia or frostbite; or the animal is likely to suffer, sustain an injury or die.</li> <li>• Air transport: containers must meet the stocking density guidelines set out in the Live Animals Regulations, 44th edition, published by the International Air Transport Association</li> </ul>	<ul style="list-style-type: none"> <li>• Horses: the minimum internal height of compartment shall be at least 75 cm higher than the height of the withers of the highest animal.</li> <li>• Specific, see below</li> </ul>		
--	---	---	--	--	--

<b>Minimum/maximum space allowances</b>	no except for export for cattle, goats and sheep  (See Australian Animal Welfare Standards and Guidelines, Tables 9-12, 16, 19, 30, 34, 36)	no	yes for horses, cattle, sheep, goats, pigs and poultry  (See Council Regulation (EC) No 1/2005 of 22 December 2004, Annex I, Chapter VII)	no	no
---	---	----	---	----	----