RSPCA
for all creatures great & small

27 November 2018

Mr Steve McCutcheon
Chair, Technical Advisory Committee
Review of the Australian Standards for the Export of Livestock

By email: TACsecretariat@agriculture.gov.au

Dear Mr McCutcheon

Comments on Stage 2 Draft Report and Literature Review

Thank you for the opportunity to comment on the Stage 2 Draft Report and accompanying literature review.

This review provides a long overdue opportunity to shift Australia's standards for the export of livestock from a model based largely on mortality and survival-based measures to one that is focused on animal welfare outcomes utilising more sophisticated, science-based measures of welfare. It marks an important juncture in the history of Australia's live export trade and the Australian Government's approach to regulating it.

The current Australian Standards for the Export of Animals (ASEL) are not fit for purpose. They have demonstrably failed to adequately protect animals and maintain their health and welfare. This has also placed the regulator in the precarious legal position of possibly breaching its regulatory duty under the *Export Control (Animals) Order 2004* to ensure "travel arrangements for the live-stock are adequate for their health and welfare" prior to granting an export permit.

The ASEL must be reviewed with a clear focus on ensuring they meet the animals' welfare needs as informed by the latest scientific evidence. Recommendation 1 of the Moss Review calls on the Australian Government to ensure "the Australian Standards for the Export of Livestock are reviewed on a regular basis to reflect industry, scientific and regulatory developments and community expectations concerning live animal exports." The Government has accepted this recommendation in full.

We acknowledge there are some important improvements recommended in the Draft Report however we remain concerned that current scientific evidence has not been adequately reflected in some of the key recommendations including those with respect to on-board stocking densities. We have taken the liberty to provide an additional supplementary literature review relating to the relationship between space allowance and lying behaviour of sheep (**attached**). We trust the Technical Advisory Committee will take this literature into account in determining its final recommendations on stocking densities.

Another major limitation in the Draft Report is the decision not to require the individual identification of sheep (and goats). The lack of traceability of sheep makes many of the provisions of the ASEL (and ESCAS) redundant as they cannot be enforced without traceability.

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We would also like to raise a number of concerns regarding the review process and literature review. The accelerated timeline for the review did not just affect the scope of the review, but the process itself. Consultation with the Stakeholder Reference Group has been truncated to exclude the opportunity for feedback prior to the draft standards being publicly released. In effect, the consultation amounted to little more than a briefing on decisions that had already made by the Technical Committee and Department of Agriculture and Water Resources. We understand the accelerated timeframes were set by the Minister but it is important the Technical Committee and Department do all that is necessary to ensure that proper consultation with the Stakeholder Reference Group can be facilitated moving forward.

These changes also meant that the literature review was not available prior to the development of the draft standards, thus it could not be used to inform submissions to the Stage 2 Issues Paper. The timing of the process also meant that the Reference Group had no opportunity to comment on the terms of reference for the literature review, the tender process, any conflicts of interest or the final review document prior to the release of the draft standards.

We hold a number of concerns over the way in which the literature review was conducted, including:

- the lack of transparency over the tender process for the review;
- that the review was the responsibility of researchers who have received, and continue to receive funding under the industry Live Export Program;
- that any potential or actual conflicts of interest held by the review authors are not declared in the review document or in the profiles of the Technical Committee members;
- that there was no independent peer review of the document (this would have been easier had the animal welfare representative on the Committee not been a co-author of the review); and
- that the review specifically excluded international studies that may have contributed to the available body of evidence, even when no relevant Australian research was available.

Finally, we are also concerned about the lack of engagement with the Departmental Observers who have had recent experience travelling on-board live export vessels. We understand the Committee had access to some of the Observer reports but that it did not speak directly with the Observers. We feel this was a missed opportunity for the Committee to gain valuable insights into the on-board conditions relevant to the review. We have also previously requested the Department to encourage the Observers to make submissions to the review, and importantly, to provide the Observers with confidence that their submissions can be, and will remain, anonymous, and be treated with utmost confidentiality.

We trust that our submission will be of assistance to the Committee in its deliberations. We look forward to continuing to participate in the Stakeholder Reference Group and being consulted on the development of the final report and recommendations.

Yours sincerely,

Dr Bidda Jones
Chief Science and Strategy Officer
RSPCA Australia

RSPCA Australia submission

Stage 2: Draft Report - Review of the Australian Standards for the Export of Livestock

1	**INTRODUCTION**
1.2	**This review**
Para 1	In commenting on the previous 2012-13 ASEL review, the report states: *The steering committee provided its final report in May 2013, recommending improvements to both the content and format of the standards and providing an incomplete draft version of the standard. There were 13 unresolved issues and the draft standard was not implemented.* This not an accurate representation of the 2012-13 review process. While there were unresolved issues in the draft version of the AAWSEL, it was not incomplete. These issues were dealt with through options that were to be presented as part of the public consultation process. The recommendation of the DAFF Livestock Export Reform Program Implementation Board at the time was that they sought the Minister for Agriculture, Fisheries and Forestry's policy approval to legally draft the standards for public consultation. The reason the draft standard was not implemented was because it never went out for public consultation due to the change of government at the time. **This should be clarified in the report**.
1.2.1	**Conduct of the review**
Para 3	It should be noted here that the accelerated timeline did not just affect the scope of the review, but the process itself. Consultation with the Reference Group has been truncated to exclude the opportunity for feedback prior to the draft standards being publicly released. The changes also meant that the literature review was not available prior to the development of the standards, thus it could not be used to inform submissions to the Stage 2 issues paper. The timing of the process also meant that the Reference Group had no opportunity to comment on the terms of reference for the literature review, the tender process, any conflicts of interest or the final review document prior to the release of the draft standards.
Table 1	The table outlining the review process makes no mention of the commissioning or receipt of the Murdoch Review.
1.2.2	**Out of scope**
	Noting that the review of the Australian Position Statement on the Export of Livestock is out of scope for the review, can we assume that this statement no longer forms part of the ASEL?
1.3	**This report**
Para 1	*The standards must, to the maximum extent possible, be evidence-based and, where available, supported by contemporary science relevant to Australian systems and the conditions faced during voyages from Australia. They also need to be enforceable.* This statement needs to be adjusted in the light of the cover letter which says that, where there were no contemporary or directly relevant scientific studies available in the submissions and literature review, the committee '*formed its own views based on the available information and its own assessments*'.

	In terms of the Murdoch Review, where no directly relevant studies relating to Australian livestock were available, in our view the review should have reported on the most relevant international studies to fill those gaps. We have provided further information in a supplementary literature review attached to this submission to assist with this in relation to space allowances for sheep.
1.3.2	**Matters for monitoring**
	This section highlights several significant issues relating to the use of research that is in progress (under the Livecorp/MLA R&D program) or needs to be progressed. Yet at the moment there is no formal process to encourage R&D conducted under this program to reflect regulatory needs. For example, there is a research project looking at space allowance effects, but we do not know if the space allowance treatments in this research will include what is required under the new ASEL, yet this research will be what informs the ongoing review. **We therefore strongly support the establishment of a regular process** for ensuring that ongoing R&D under the Live Export Program compliments the review process and that the Department encourages the LEP to improve their transparency and independent scrutiny of R&D projects.
2	**SOURCING AND PREPARATION**
2.1	**Sourcing *Bos taurus* cattle**
	Draft recommendation: **1.** That the standards prevent *Bos taurus* cattle from an area of Australia south of latitude 26° south being sourced for export on voyages that will cross the equator between 1 May to 31 October (inclusive) unless an agreed livestock heat stress risk assessment indicates the risk is manageable.
	We support the expansion of this clause to all voyages that cross the equator. However, we do not support the provision to allow such exports under the current heat stress risk assessment model. Best animal welfare practice would be for no *Bos Taurus* cattle to be sourced during May-October regardless of the location of breeding. At this stage there is no guarantee that revisions of the HSRA model will be implemented in a timeframe that matches the implementation of the new ASEL. Application of the HSRA model in its current form does not adequately remove the risk to these animals.
	Draft recommendation: **2.** That the standards prevent pregnant *Bos taurus* cattle being sourced for export on voyages that cross the equator from 1 May to 31 October (inclusive).
	We strongly support this recommendation. As per our previous submission, pregnant *Bos taurus* cattle must not be shipped into the Northern hemisphere from anywhere in Australia during May to October (see LIVE.208).
	Draft recommendation: **3.** That the standard prevent *Bos taurus* cattle with a body condition score of four (4) or more being sourced for export from, or exported through, any area of Australia north of latitude 26° south from 1 October to 31 December (inclusive).*
	We strongly support this recommendation. As per our previous submission, animals with fat cover of 20 mm at the P8 site should not be selected for export (see SMBR.003). This equates to a body condition score of 4.5 or over. Cross-bred cattle – clause should include cross-breeds with more that 50% *Bos taurus*.

	Appendices should be updated to provide body condition score diagrams equivalent to the standard shown for buffalo for all species.
2.2	**Shearing sheep and hair sheep**
2.2.3	**Discussion**
Para 3	The report states: *In relation to stresses associated with shearing, the literature review discussed a study performed by Murdoch University which examined feeding and watering behaviours of sheep after shearing. That study found minimal behavioural change in terms of time spent at the feed or water trough post-shearing (Collins et al, 2018, pp65-66). The literature review, and several submissions, referred to studies on the stress of shearing. One demonstrated that the use of cognitive bias may indicate shearing was an acute stressor (Sanger 2011). Another concluded there was no difference in observed feed and water behaviour of sheep shorn over a six day period in a registered premises (Aguilar Gainza 2015).* It seems that two studies referred to here are in fact the same study reported in two different papers. This should be corrected. On the basis of this study, the Murdoch Review (p66) states: *There are concerns that pre-embarkation shearing may contribute to increased stress, and inappetence. To address these concerns, an experiment was performed whereby 600 sheep were fitted with Radio Frequency Identification tags, and subsets were shorn each day (days 1, 2, 3, 4 or 5) and time and frequency of feed and water trough attendance were determined [80,82]. There was no difference in time spent at feed or water troughs between any treatment groups on any day, and minimal behavioural changes were observed. This suggests that shearing may occur on any day during the pre-embarkation feedlot period, and that current management practices regarding shearing do not disrupt time spent feeding.* However, in the reported study, the behavioural observations conducted were only for a 10-minute window of time after shearing, only of 20 individuals from each treatment group (120 in total) from the same line/farm and there was doubt over the accuracy of tracking individual sheep during the 10-minute window. These study limitations are clearly stated in the original paper but not here. The study did find significant differences between shorn and unshorn sheep in terms of time spent at the water trough and time spent lying down but again, this is not mentioned here. The Aguilar Gainza (2015) thesis makes it clear that there is a body of evidence which indicates that shearing is stressful: *However there are a combination of factors that are involved with shearing, rather than just wool removal, including sheep being approached by a human, moved along a race, penned, caught, upended and then dragged to the shearing station to be shorn (Devlin et al., 1989), as well as the risk of skin injury (Hargreaves & Hutson, 1990a). All these factors cause a physiological response in the sheep, including increases in heart rate (Hargreaves & Hutson, 1990c) and cortisol (Kilgour & DeLangen, 1970), and could cause sheep to become susceptible to Salmonella and inanition, which are major causes of mortality in the live export industry (Norris & Richards, 1989b).* Aguilar Gainza (2015) did not consider physiological measures of stress such as heart rate or cortisol, and did not record behaviour for sufficient time to draw conclusions other than on time spent at the feed trough. We do not think it is appropriate for the report to make general statements on the basis of this single study which looked at such a short time period post-shearing. Sanger et al. 2011 also indicates that there is a body of literature that demonstrates both behavioural and physiological signs of stress as a result of shearing. This entire section should be amended to more accurately reflect the current body of research.
2.2.4	Committee view

	Based on the above information, the words '*contrary to some concerns presented to the committee, sheep have been shown to recover quickly from shearing-related stress*' should be removed from the Report. The study reported in Collins 2016 and Aguilar Gainza 2015 does not show that sheep recover quickly from shearing-related stress. It also makes no comment on skin injuries or healing time post-shearing.
	Draft recommendation: **4.** That the standards require that sheep to be exported by sea have no more than 25mm of wool, with hair sheep excluded from that requirement given their natural tolerance for heat and lack of information on the stresses associated with shearing those animals.
	We support the first part of this recommendation relating to wool sheep, but we are concerned about the export of 'hair' sheep that have more than 25mm of coat fibre during periods of high temperatures and high humidity. **We maintain that the requirement for no more than 25mm 'hair' should also apply to hair sheep. Where hair sheep do not have a coat this thick, they will not need to be shorn.** The standards do not currently provide a definition of hair sheep and it is not clear where some exotic breeds (Awassi, Damara, Dorper etc) fit in terms of the ratio of hair fibres to wool fibres in their coat. **Unless there is a clear definition of hair sheep, we are concerned that wool sheep may be wrongly classified as hair sheep and loaded with wool or part-wool coats >25mm.** Management of the coat varies across breeds/cross-breeds. For example, while some 'hair' or hair/wool breeds are not shorn in Australia, this may not be the case overseas. Awassi sheep have a coat that is 45% hair and 39% wool (Duddy 2002). In Jordan, it is common practice for farmers to shear Awassi sheep (Al-Rawashdeh & Al-Qudah 2000). Unshorn Awassi sheep retain more heat when temperatures fall at night and during high humidity than unshorn Awassi sheep, which would increase their risk of heat stress during voyages in the May-October period (Eyal et al 1963). Dorper sheep are shorn in registered premises in preparation for live export (Barnes et al 2017). Sheep with a hair coat >25mm are also more likely than shorn sheep to become weighed and bogged down in slurry when the manure pad does not dry out in periods of high humidity.
	Draft recommendation: **6**. That for sheep held in sheds at the registered premises, the standard require they be given at least one 'clear day' between shearing and loading for export.
	Given that there is a recognised body of evidence that shearing is stressful based on both behavioural and physiological measures, and the requirement in the standards to ensure sheep have no 'significant lacerations' (1A3.1) when selected for export, we do not believe that one clear day is sufficient to protect the welfare of exported sheep. We recommend that sheep are given at least 2 clear days post-shearing prior to export.
	We repeat from our previous submission that record keeping must include dates and details of shearing. To ensure this is carried through, Standard 4E.1 should be amended to include shearing as an example for the term 'husbandry procedure'. The term 'husbandry procedure' should also be added to the glossary and the definition should include all procedures for which a record must be kept.
2.3	**Threshold weights for cattle and buffalo**
	Draft recommendation: **8**. That existing weight thresholds for cattle and buffalo be retained, but with outcomes for animals over 500kg monitored over the coming 12 months to assess whether the upper

	threshold weight should be reduced from 650kg, and whether an absolute upper weight limit is necessary.
	We note that the committee agrees that cattle between 500 and 650kg are at increased risk during export. We also note that AAVs have reported that heavy cattle can have more problems, including foot and leg trauma, and need appropriate management to be successfully exported. Our view remains that cattle over 500kg should not be exported. However, if the standards do allow the export of cattle over 500kg, then they must at the very least recognise these risks and ensure these animals are provided with additional care and attention. Surely this is the purpose of the heavy cattle management plan currently required for cattle over 650kg? Given the comments from AAVs it is clear that veterinary care should be a key requirement of this plan – so the presence of an AAV on all voyages of cattle over 500kg should be a requirement of the standards. This is also the only way to ensure that outcomes for animals over 500kg can be monitored over the coming 12 months to feed into the future review of this clause. Making a recommendation for monitoring will have no effect unless it is a requirement of the standards.
2.4	**Minimum time at registered premises**
P18	**Sheep**
	We note that the committee took particular notice of one project in determining that a minimum holding period of 5 clear days was required between arrival and load out for all classes of sheep. The reference cited for this study is Barnes et al 2018 (Journal of Animal Science), however the study referred to in the text is the MLA/Livecorp industry report Barnes et al 2017. **This should be corrected.** We note that this study tracked the time spent at the feeder for over 8,000 sheep which passed through a shed in one Fremantle, WA feedlot. The study tracked 4 consignments prepared over the 2011-12 period. All but one consignment of sheep were monitored for 7 or more days in the feedlot. The threshold for whether sheep had 'transitioned to the pelletised ration' (no longer showing inappetance) was defined as sheep spending less time at the feed troughs than 2 standard deviations below the mean daily time for the whole group (28m 5s). The report states that: '*Based on the definition of less than 2SD below the mean, it took until day six in the feedlot for less than 5% of animals to be inappetent'*. (p41) *'It took until day 6 in the feedlot for more than 95% of sheep to be spending more than the minimum time at the feed trough per day'*. (p47) The data shows that, on average, the percentage of sheep attending the feed troughs for more than 28m 5s per day was still increasing at Day 5 but began to plateau on Day 6. **If the standard is to be based on these results we suggest the standard should be set at 6 clear days rather than 5.**
	Draft recommendation **9**. That the term 'clear day' be defined in the standard as a full day (midnight to midnight) during which livestock are not subject to any feed or water curfew, and are not handled, treated (including shearing) or moved from their holding pens or paddocks.
	We support this definition of a clear day. **We also support the comment made on p20 (Related considerations) in relation to the topping up of consignments.** The reworded standards should make it absolutely clear that all animals must be prepared for the full period required. This requires full RFID traceability of individual animals throughout the supply chain.
	Draft recommendation

	10. That the standards require sheep and goats to be held at the registered premises for five clear days, irrespective of the location and design of the registered premises, the time of year, or the length of the export voyage.
	See above – we believe that the evidence supports sheep being held for a minimum of 6 clear days. **We do not support any resumption of the export of feral goats by sea.**
	Draft recommendation **11.** That the standards require all classes of cattle travelling on short and long haul voyages to be held at the registered premises for a minimum of two clear days, irrespective of the location of the premises and the number of loading/discharge ports on the voyage. Three clear days should be required for all classes of cattle travelling on extended long haul voyages.
	We support an increase in the minimum time at registered premises for cattle, but believe the evidence indicates that 3 clear days should be the minimum time for all journeys. Mortality investigations have found that movement of cattle between registered premises and reduced time in holding have contributed to onboard mortalities in multiple cases (Consignments 3,5,10,11,12,13,14,35). These investigation reports have all recommended a minimum of 3 clear days at registered premises for cattle. The concerns raised by the committee with regard to the long, harsh journeys endured by cattle exported from northern Australia underscore the need for sufficient time for cattle to recover from these journeys before being loaded.
	Draft recommendation **12.** That the standards require buffalo to be held at the registered premises for a minimum of five clear days, irrespective of location of the premises, length of intended voyage or number of loading/discharge ports.
	See our comments under Section 3.2 on the export of feral buffalo.
2.5	**Management of shy feeders and inanition in sheep**
	The Report notes that there is insufficient evidence to support the exclusion of saleyard sheep from live export consignments. However there is best practice advice (Barnes et al 2017) which includes on-farm preparation to minimise the incidence of inanition/salmonella. So while it is unfortunate that researchers have not tracked the outcomes of sheep in relation to their source, it is clear that saleyard sheep that have not been prepared specifically for live export are highly likely to be at higher risk of developing problems. This is another example where RFID tagging of sheep is required so that data can be collected on the outcome of sheep from difference sources throughout the supply chain. R&D reports have identified a number of criteria which could be applied to reduce the risk of mortality, including implementing a uniform information management system to track sheep performance. Consideration must be given to a system of compulsory feedback to ensure that individual animals can be tracked and monitored and how high risk animals can be excluded from selection.
	Draft recommendation: **13.** That the standards require that, of the five clear days for which sheep and goats are held at the registered premises (refer Recommendation 10), they are fed *ad libitum* on pelletised feed equivalent to the shipboard ration for at least the final three clear days. (*Note: refer definition of 'clear day' at Recommendation 9*).
	We are confused by this recommendation and how it interrelates to Recommendation 10.

	The research into inanition of sheep in registered premises (Barnes et al 2017) was based on sheep being fed *ad libitum* pelletised diet for the entire monitoring period. So any conclusions based on this study require that sheep should be fed the shipboard ration *ad lib* for at least 6 clear days (ie the entire time they are in the feedlot). The best practice guidelines suggested by Barnes et al (2017) state that: *Animals which appear not to be feeding well or which are noted from entry to be quiet or depressed can be supplemented immediately on entry with chaff (oaten or Lucerne) spread around on top of the pellets, and scattered nearby the troughs. This may enhance their initial approaches to the troughs. Daily application of chaff to the feed troughs for at least 2-3 days is recommended for such groups.* Based on this research, **the standard should require that sheep in registered premises are fed *ad libitum* on pelletised feed equivalent to the shipboard ration for at least the final six clear days in registered premises, with daily provision of chaff for the first 2-3 days for sheep identified as shy feeders.** The standard should not be worded to prevent animals from being supplemented with chaff at any point during their time in the registered premises as this may result in animals failing to eat.
	Draft recommendation: **14**. That the standards continue to require pelletised feed to be fed in troughs at the registered premises, and that feeders/troughs be of a design that prevents spoilage of feed, particularly during inclement weather. For sheep and goats held at registered premises in southern parts of Australia the standards should require they be fed from fully sheltered troughs, regardless of the time of year.
	We support this recommendation but question why the standard is not worded to require troughs to be fully sheltered regardless of the location of the registered premises.
2.6	**Pregnancy testing**
	Sheep – our view remains that lay pregnancy testing of sheep should only be permitted where the tester is accredited and has demonstrable current experience in sheep pregnancy diagnosis, and where all sheep are individually identified and the pregnancy status is linked to the RFID number. **We note the committee's support for the individual identification of sheep (and goats). However we strongly disagree with the committee's decision not to require this in the current standards.** The lack of traceability of sheep makes many of the provisions of the ASEL (and ESCAS) redundant as they cannot be enforced without traceability. Submissions to the 2012 ASEL review indicated that it is impossible for the certifying officer to confirm the pregnancy status of the animals presented for export when they are not individually identified. The research project on inanition (Barnes et al 2017) indicates that there is already a system in place to fit individual sheep with RFID tags on entry into the feedlot. Individual identification of ALL animals is necessary to verify that animals presented for export have had a negative pregnancy test. All documentation relating to pregnancy status must identify individual RFID codes.
	Draft recommendation: **15.** That the existing pregnancy-related rejection criteria and pregnancy testing criteria be retained in the standards, other than: a. the testing criteria relating to 'maximum days pregnant' for all livestock exported by sea, which should be amended to apply at the scheduled date of discharge, rather than the scheduled date of departure, to ensure that livestock cannot be exported in the third trimester; and

	b. the provision relating to Damara female sheep, which should be extended to apply to all female fat tailed sheep.
	We support the recommendation that 'maximum days pregnant' should apply to the scheduled date of discharge. We note that there is no definition of the 'scheduled date of discharge' in the standards and suggest that this is added. **We support the recommendation that pregnancy testing requirements be extended to all female fat-tailed sheep.**
	Draft recommendation: **17.** That the standards allow the department to extend the validity of a pregnancy test beyond 30 days only where necessitated by circumstances outside the exporters control and where the exporter can demonstrate that the extension will not impact on animal welfare outcomes. That decision should be delegated to regional veterinarians, rather than requiring a formal dispensation from the Canberra office.
	We support this recommendation in principle but reiterate our previous statement that there must be a valid animal welfare reason to avoid re-testing and this should only be considered in cases where animals have been pregnancy tested by an accredited vet, are individually identified and their RFID code is linked with the record of their pregnancy status. Whether this decision is made by regional veterinarians or the Canberra office, decision makers should be provided with clear guidance on the circumstances when an extension may be granted.
3	**STOCKING DENSITIES**
3.1	**Registered premises stocking densities**
3.1.2	**Discussion**
	The Report states that "*No significant data was provided to indicate a significant mortality problem exists at registered premises*". We note that mortality data at registered premises are not publicly available and therefore are not subject to independent analysis, and, as highlighted by the McCarthy Review recommendations, mortality is the most blunt indicator of animal welfare. There is no auditing or inspection system for registered premises other than those made with DAWR under approved arrangements to assess welfare standards at registered premises. In short, the fact that data are not available does not mean there is no problem. In fact, there are data available relating to sheep mortality. The inanition research project reported by Barnes et al (2017) provides an indication of the mortality rate for sheep in a pre-export feedlot in WA. The average mortality rate for sheep held in the feedlot for between 6 and 31 days was 0.85%. Viewed as an annual mortality rate, this ranges from 10% to 51.5%, significantly higher than would be expected on-farm for adult sheep.
3.1.3	**Committee consideration**
	We remain of the view that all animals housed in registered premises or onboard vessels should be provided with sufficient space to be able to lie down comfortably at the same time and easily access feed and water and that when using allometric principles this requires a k-value of 0.047. We support the committee's view that: *Adequate space allocation for livestock held at registered premises is important to ensure stock are rested, and have unfettered access to feed and water during a period when adaption to shipboard fodder is of critical importance to minimising welfare risks during voyages.* We note the committee's view that: *For livestock at a registered premises, the committee's view is that an allometric space allocation using a k value of 0.033 is appropriate.*

Notwithstanding our view that a k-value of 0.047 is necessary, we make the point that ensuring that animals are rested and have unfettered access to feed and water is critically important on board live export vessel as much as it is in registered premises. We also note that animals spend more time on board ship than they do in registered premises, often significantly more time, and during this period are subjected to additional stressors associated with sea transport. Thus there is no valid argument to support the idea that animals need less space on board than they do in registered premises.

Draft recommendation:

18. That the standards require that sheep and goats held at a registered premises for any period of time and in any group size be given a minimum space allocation of 0.5m2 per head, with an additional 0.006m2 for each 1kg increase in bodyweight above 54kg (as the threshold already specified in the standard).

We support the consolidation of standards for space allowances at registered premises for sheep, however we believe the standard should be set using a k-value of 0.047.

The recommended base standard of 0.500m^2 for a 54kg sheep is equivalent to a k-value of 0.036, which is an improvement on previous standards. However, it does not provide sufficient space for sheep to meet their basic needs.

The space allowances provided by an increase of 0.006m2 for each kg above 54kg is shown in the table below together with those provided by a k-value of 0.047.

Proposed standard

Space m^2	Weight kg	W$^{0.66}$	k-value
0.500	54	13.912	0.036
0.506	55	14.081	0.036
0.536	60	14.914	0.036
0.566	65	15.723	0.036
0.596	70	16.511	0.036
0.626	75	17.280	0.036
0.656	80	18.032	0.036
0.686	85	18.768	0.037
0.716	90	19.489	0.037

RSPCA recommended standard

Space m^2	Weight kg	W$^{0.66}$	k-value
0.654	54	13.912	0.047
0.662	55	14.081	0.047
0.701	60	14.914	0.047
0.739	65	15.723	0.047
0.776	70	16.511	0.047
0.812	75	17.280	0.047
0.847	80	18.032	0.047

0.882	85	18.768	0.047	
0.916	90	19.489	0.047	

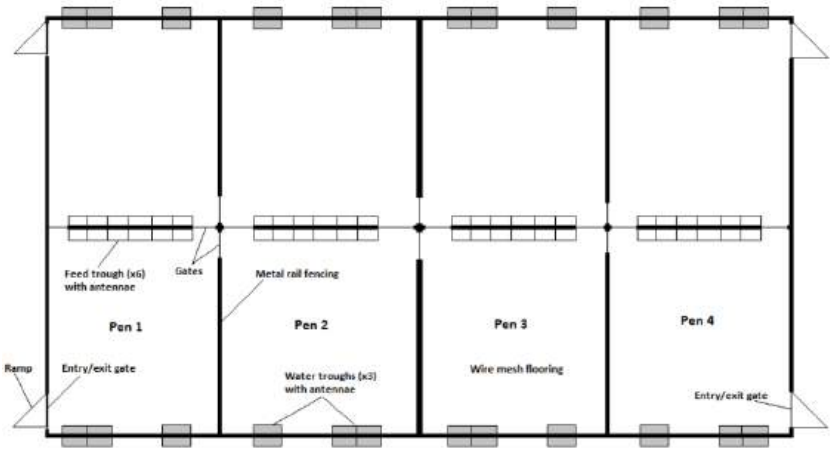
Trough length

We also reiterate the need for minimum standards for trough length in registered premises and on board vessels using the allometic formula (Broom and Fraser 2007) of Length (m) = 0.112 x $W^{0.33}$ equivalent to 4cm of trough length per a 50kg sheep.

Shed design

We reiterate our concern that sheds in registered premises must allow for the inspection of individual animals and the removal of animals that become ill, injured or otherwise unfit for export to be treated and/or transferred to a hospital paddock as soon as they are identified. This means setting a maximum group size for pens and paddocks and providing laneways to enable animals to be removed from the group without having to move them through other pens or paddocks. Mesh flooring in sheds must allow sheep to lie down and get up comfortably.

Figure 1 from Barnes et al (2018) shows a typical shed layout. Note that there is no laneway and there are only 4 external exits from the shed, with no external exits for the 4 middle pens. Each of these pens would typically hold 2,500 sheep.



Draft recommendation:

19. That the standards for stocking density in registered premises remain unchanged for cattle and buffalo.

We recognise that the current space allowance of $4m^2$ for cattle and buffalo held at registered premises for less than 30 days is significantly higher than that required by a k-value of 0.047. The fact that the standards recognise that this amount of space proportional to their size and weight is required for cattle seriously begs the question why more proportional space is not also considered necessary for sheep?

3.2 Onboard stocking densities

3.2.3 Discussion

The Report states that submissions supported an allometric approach to determining space allowances and agreed that it was important for animals to be able to lie down simultaneously.

It is worth reiterating the committee's view that for livestock held in registered premises adequate space allowance '*is important to ensure stock are rested, and have unfettered access to feed and water during a period when adaption to shipboard fodder is of critical importance to minimising welfare risks during voyages*'.

	The need to ensure livestock are rested and have unfettered access to feed and water does not stop when they board a live export vessel, in fact, given many animals will spend more time on board vessel than in the registered premise, it is even more important that sufficient space is provided. The Report notes that submissions generally separated the discussion on base stocking densities from decisions on space required to avoid heat stress. This is because there is a threshold minimum space allowance needed to perform basic behaviours irrespective of other environmental factors. A significant deficiency of the Murdoch literature review is its failure to recognise this distinction.
3.2.4	**Committee consideration**
	Sheep and cattle The report states that: *'Determining an appropriate amount of space for penned livestock on a sea voyage is challenging. More is required than for typical long-distance road transport (where stock largely remain standing), yet less than required for long term confinement such as a typical feedlot or indoor housing system.'* We question the logic of this statement, which runs counter to the argument made in support of increase space allowances in registered premises. We agree that more space is required on board vessels than during road transport. There are several reasons for this: during road transport sheep and cattle generally prefer to stand, at least for the initial stage of the journey; they are not provided with food or water and therefore have no requirement to move around the pen/crate to access these resources, and they are generally confined for less than 48 hours. However there is no evidence to indicate that the needs of animals on board live export vessels are significantly different to those in a feedlot or indoor housing system. In both situations, animals need to perform all normal behaviours including moving around the pen to access feed and water, moving from a standing to a lying position. In both situations they are held for sufficient time that denying access to sufficient space to perform these behaviours will adversely affect their welfare. We note that the committee found a '*paucity of evidence regarding appropriate stocking densities for the unique environmental conditions that impact livestock on-board vessels'*. This is indeed a serious problem and exposes the extreme reluctance of the live export industry to support research that might shed light on the effects of more generous space allowances on the welfare of exported animals. The only research project that has manipulated space allowances on board Australian live export vessels is Ferguson & Lea (2013). This industry-funded study was limited to an upper treatment space allowance with a k-value of 0.027 - only 10% more space than ASEL requirements. Other (international peer-reviewed) studies of the effect of increasing space on welfare or productivity measures have also used treatment groups that set a much higher space allowance, to validate those indicated by allometric principles, for example, k-values of 0.043, 0.049, 0.052 and 0.065 have variously been used (see Petherick & Phillips 2009). The limitations of the Ferguson & Lea study and the problem of industry control of research design are covered in detail by Phillips and Petherick (2014). In the absence of directly relevant research and evidence to support current ASEL requirements, it is incumbent on those involved in the ASEL review to seek the best available information. In the short time available, we have attempted to summarise some of the international literature relating to the behaviour of sheep in indoor housing systems with reference to space allowance. This is presented in an attachment to this submission. This literature review demonstrates that providing sufficient space allowance to enable confined sheep to lie down is essential to ensure their welfare. When space allowance is unrestricted, most sheep lie down for between 50-80% of the time in a 24-hour period and between 45 and 56% of sheep lie down at the same time a majority of the time. When lying space is restricted:

	• lower ranking sheep spend less time lying down (and more time standing) than higher ranking sheep; • sheep will spend much less time in simultaneous lying behaviour; • the number of displacements from lying to standing increases; and • a proportion of sheep will not lie down at all in the early stages of confinement. The point at which space allowance prevents normal lying behaviour is difficult to pinpoint, but k-values of 0.022-0.029 have been found to reduce lying behaviour in confined sheep, whereas lying behaviour at k-values of 0.053, 0.088 is closer to that in unrestricted environments. In light of this evidence, we strongly urge the ASEL review committee to review the recommended on board stocking densities for sheep with a view to increasing space allowance to that necessary meet the welfare needs of sheep as per our recommendations below.
P32	**Buffalo** The Draft Report indicates there are significant and serious animal welfare and mortality issues with the mustering, road transport, confinement and export of feral buffalo. Feral buffalo are completely unused to human contact and clearly do not tolerate handling and transport without serious welfare compromise. These problems carry over into importing countries to the point of slaughter. It appears that many of the problems picked up by the committee have gone unidentified and unaddressed because of the absence of any independent or veterinary oversight or reporting of this trade. There is no reporting of injuries or mortalities during mustering, transport or holding prior to export. Because feral buffalo are generally exported on voyages of less than 10 days there is no requirement for an AAV to travel with them on the vessel. Because of the absence of veterinary supervision, there are no post-mortem or other veterinary data from mortalities or other health/welfare issues during these voyages. Feral buffalo are not covered by the MLA/Livecorp live export R&D program which explains the lack of relevant scientific studies involving buffalo. There is unlikely to be any R&D in the future to support necessary animal welfare improvements in this industry. **On this basis we believe the standards should prohibit the export of feral buffalo by sea.**
	Draft recommendations: **20**. That the standard adopt an allometric approach for calculating on-board stocking densities for **shee**p, with a k-value of 0.030 to be applied to the voyages during November to April, and a k-value of 0.033 for voyages during May to October. **21**. That the standard adopt an allometric approach for calculating on-board stocking densities for **cattle**, with a k-value of 0.03. Where this approach determines a space allowance that is lower than the current ASEL requirement for a given liveweight and voyage, the higher space allowance will apply.
	We support the use of an allometric approach to calculating on-board space allowances but believe that the standard should be set using a k-value of 0.047. **We do not support there being a difference in the base space allowance requirements for different times of year.** The threshold minimum space allowance needed to perform the basic behaviours of standing, lying and moving to access feed and water resources exists irrespective of other environmental factors such as temperature and humidity. **We can find no evidence in the Report or the Murdoch Review to support a base space allowance based on a k-value of 0.030.** This value is below k=0.033, identified by Petherick & Phillips (2009) as the threshold below which there are adverse effects on welfare in intensive housing systems and used by the committee as the benchmark for space allowances in registered premises.

	Draft recommendation: **22**. That in relation to special categories of livestock, the following approach should apply to on-board stocking densities: a. Buffalo: 10 per cent more space than required for cattle. b. Cattle and buffalo with horns: 30 per cent more space than otherwise required for cattle and buffalo without horns. c. Cattle and buffalo from 650kg and above: additional space allowance as determined by an approved heavy cattle/buffalo management plan. d. All pregnant cattle and buffalo: a minimum of 15 per cent more space than otherwise required for cattle and buffalo for a given liveweight and voyage. e. Rams and goats with horns: 10 per cent more space than otherwise required for sheep and goats.
	Notwithstanding our previously stated opposition to the export of feral buffalo and feral goats by sea, we support these additional space requirements provided that they reflect a minimum base space allowance using a k-value of 0.047.
4	**HEAT STRESS RISK ASSESSMENT**
	Draft recommendations: **23**. That the standards be revised to require the application of an agreed heat stress risk assessment for all livestock voyages that cross the equator, at all times of the year, from all Australian ports. **24**. That once the (separate) review of the heat stress risk assessment model is completed, the testing criteria in the standards should be revised to support the new model. **25**. That the period 1 May to 31 October continue to be applied as defining the 'northern summer' in the relevant sections of the revised standard.
	We support the recommendations requiring the application of an agreed HSRA for all voyages that cross the equator and the future revision of the standards to support the new model. **We recommend that a deadline is set to ensure implementation of the new model within a set timeframe.** **We support retaining the definition of 'northern summer' as 1 May to 31 October.**
5	**VOYAGE REPORTING**
5.1	**Reportable mortality**
	The report states: *The committee noted that, for sheep, the average mortality rate for all voyages over the past three years was approximately 0.75 per cent, while the current RMR is 2 per cent, close to three times the three-year average. Similarly, for cattle the current RMR for short voyages (0.5 per cent) is some six times the three-year average of 0.08 per cent, and the RMR for long haul voyages (1 per cent) is also about 6 times the three-year average for such voyages (0.16 per cent).* We note that the committee believes on this basis that there is a clear case for reducing the reportable mortality rates.
	Draft recommendation: **26**. That the reportable mortality level for sheep and goats should be reduced to 1 per cent, or three animals, whichever is the greater; and that an average daily mortality rate of greater than 0.05 per cent be added to the list of events that would qualify as a 'notifiable incident'.

	We support this recommendation including the addition of a specific ADM as a notifiable incident. The department should carefully consider at what point consecutive ADM rates above the threshold level should trigger an investigation. **We also recommend that this definition of a notifiable incident should be extended to include ADM rate throughout the live export supply chain including at registered premises.**
	Draft recommendation: **27**. That the reportable mortality level for cattle and buffalo should be set at 0.5 per cent, or three animals, whichever is the greater; and that an average daily mortality rate of greater than 0.025 per cent be added to the list of events that would qualify as a 'notifiable incident'.
	We support setting the reportable mortality level for cattle on long-haul voyages at 0.5%. However we believe the committee has made the case for a reportable mortality level for voyages less than 10 days of 0.25%. This rate is the equivalent of an accumulated ADM of 0.025% over a 10-day period, however unless the reportable mortality level is lowered, under the current proposal this would not trigger a notifiable incident or a reportable mortality level. **We support the addition of a specific ADM as a notifiable incident.** The department should carefully consider at what point consecutive ADM rates above the threshold level should trigger an investigation. **We also recommend that this definition of a notifiable incident should be extended to include ADM rate throughout the live export supply chain including at registered premises.**
	Camelids and Deer We note that in the proposed version of the standards the reportable mortality rate for camelids and deer for export by sea (and by air) has been retained at 2%. This has not been discussed in the Draft Report. Notwithstanding our view that camelids and deer should not be exported by sea, we are extremely concerned that this level has been retained in the standard. Given the lack of recent experience of handling camels or deer and the associated risk of animal welfare and mortality issues, should such journeys occur, **we support the removal of reportable mortality rates for camelids, deer and goats to be replaced by additional reporting requirements as part of a consignment specific management plan.**
5.2	**Other voyage reporting requirements**
5.2.4	**Committee consideration**
	We are encouraged by the Committee's view that: > *Ideally reports should include daily measures on animal welfare and morbidity and mortality data, including animal identification. This data, combined with an end of voyage report, should be analysed post-voyage with an epidemiological approach. The analysis should involve discussion with the AAV, an exporter representative and the department.* We note and support the need for individual identification of all animals is a pre-requisite for this to be implemented. We note and support the need for a dedicated veterinary epidemiologist within the Department's Live Export Division to ensure that post-voyage data is adequately examined. A similar recommendation was made in the Moss Review. We note the committee's consideration of the need for detailed animal welfare indicators and associated data, environmental data and the need for improvements to data collection and data storage. However we are concerned that the comment made in the Draft Report will have absolutely no impact on actual voyage outcomes unless there is a fundamental shift in the way industry R&D is conducted, the speed at which it is progressed, and the

	requirement for results to be taken up by industry. Suggestions and comments on the way things 'could' be done have zero effect unless they are translated into regulated standards. We support the suggestion that the Veterinary toolbox includes at least one handheld device capable of measuring WBGT and humidity. It should also include a similar device for measuring ammonia levels (see later comments). All AAVs and Accredited stockpersons should be trained in the use of these devices. While we appreciate that it may not be a decision for the committee, it remains our view that all voyage reports should be publicly available (minus any personal information subject to privacy requirements). Transparency around voyage outcomes is crucial if the live export industry wishes to regain community support. The Report does not mention the potential for the installation and use of CCTV cameras on vessels. We support the use of CCTV in animal areas, observable from the bridge, kept for the entire voyage and the content made available to the regulator. Specific guidance should also be developed (and made public) for the video recording of voyages by Departmental Observers.
	Draft recommendation: **28**. That the requirements for daily reports and end of journey reports be updated as per Appendix A and Appendix B in this report including: a. Inclusion of more detailed welfare monitoring in daily reports based on an assessment of at least 1–2 pens of sheep, cattle, buffalo and goats representative of each class or line, per deck, as well as a welfare assessment for any 'at high risk pens' or 'pens of concern'.
	We support the updated Daily and End of Journey Reports in principle but have concerns about the potential for bias in sampling choice and assessment of pens. For example: • Who will make the decision which pens to assess as 'representative', and which pens enter the 'high risk' or 'concern' category? • Where and when will the daily environmental recordings be taken? These need to be representative of actual min and max readings across all decks and all high risk areas? **We maintain that daily reports must be provided for all voyages regardless of their length.** This issue has not been adequately addressed by the committee. We also believe it is necessary to expand the scope of notifiable incidents in line with the new HSRA model. Voyages that exceed the revised HSRA output of 5 per cent of livestock experiencing heat stress, however defined, should trigger an investigation by the Department.
6	**ONBOARD RESOURCES AND MANAGEMENT**
6.1	**Management of bedding and ammonia levels**
	Ammonia levels We concur with the committee's view that the standards should include a new requirement that ammonia levels must not exceed 25ppm, and that ammonia reduction measures must be implemented if levels exceed or appear likely to exceed this level. We also share the view that recording of ammonia levels should be incorporated into the daily and end-of-voyage reports. However we disagree that that practical measurement of ammonia gas levels as a routine, regular measure is problematic. While there may be no automated means of measuring ammonia, there are handheld devices that can and should be used for animal and human welfare reasons to ensure that critical levels are not exceeded. RSPCA on-farm assessors currently use a small handheld portable device (GasAlert Extreme NH_3, BW Technologies). It is designed as a personal alarm device for use when working in

	confined spaces. It measures NH_3 by diffusion in 1ppm increments. There are many such devices on the market, they typically range from $600-$800. They do require regular calibration (3-6 monthly) and sensor replacement (1-2 years). The cost of calibration is $150-$200 and a new sensor is $400-$500). Ammonia tape is another option, if basic in nature. It costs around $10 per roll (https://www.microessentiallab.com/) and is exceptionally portable, cheap and easy to use. Colour shades are green through darker green which means it determines ammonia levels in bands e.g. 0-10ppm, 10-20ppm, 20-30ppm etc. rather than a single figure e.g. 21ppm. As such it is most useful for indicating the presence of high ammonia levels. There is at least one option used in the poultry industry for continuous monitoring (www.bigdutchmanusa.com/en/poultry-production/poultry-production/environmental/ammonia-sensor/).
	Draft recommendations: **29**. That the standard require bedding management, including deck wash downs and replacement of bedding materials, to be sufficient to ensure good welfare outcomes for livestock, in particular, minimising slipping and abrasions, lameness, pugging and faecal coating. **30**. That the standard require the consistency and depth of bedding material to be routinely monitored. **31**. That the sheep manure pad continue to be used as the preferred bedding approach for sheep, but that the standards require a sufficient amount of sawdust, rice hulls or similar material be carried to manage moisture in the sheep manure pad, avoid slippage during loading and unloading, and manage incidents such as pen flooding. The necessity and adequacy of the amounts carried should be tested over the next 12 months, with adjustments to this requirement made on the basis of evidence obtained through daily and end of voyage reporting. **32**. That the standards require that cattle and buffalo on all voyages are provided with sufficient sawdust, rice hulls or similar material to be used for bedding at a minimum rate of 4 tonnes per 1000m^2 per application, with a minimum of 4 tonnes per 1000m^2 provided after each washdown. **33**. That bedding requirements for extended long haul voyages be agreed in the long haul management plan.
	In the absence of further evidence, we support the bedding provisions outlined in these recommendations. However, it is crucial that a formal and transparent process is instigated for the monitoring, reporting and analysis of bedding use and voyage outcomes so that the review of these standards in 12 months' time is based on accurate and reliable evidence. Details of the research commissioned under the live export program on the relationship between bedding, ammonia and animal welfare also needs to be made transparent and tailored to meet the expectations of this review.
	Draft recommendations: **34.** That once the variables affecting ammonia levels are better, and practical measurement devices are available (noting the current Livestock Export Program project underway), a requirement be inserted into the standards that: (i) ammonia levels in livestock spaces must not exceed 25ppm, and (ii) that ammonia reduction measures must be implemented if levels exceed 25ppm in any given area of a vessel.
	As explained above, the technology is available now to require a standard that ammonia levels do not exceed 25ppm. For animal welfare and worker safety reasons, this standard should be immediately implemented and a requirement for recording of ammonia levels at the pen level should be added to the Daily reporting requirements.
6.2	**Water, fodder and chaff requirements**

6.2.4	**Committee consideration**
	We note that in regard to the implementation of the McCarthy Review recommendation that all ships carrying sheep to the Middle East have automated watering systems, the committee '*found no evidence to support recommending to the department that this be extended to cattle watering systems on all vessels.*' While the design of vessels may be out of the committee's scope, this is an extraordinary statement to make. The fact that no evidence was directly provided to support this change is most likely because the principle of providing ad libitum water to cattle confined for days to weeks is so widely accepted. **We request that this statement is withdrawn or corrected.**
	Draft recommendation: **35.** That the standards require that all livestock be offered feed and water as soon as possible after being loaded on the vessel, and at the very least within 12 hours.
	The provision of water on arrival at registered premises and after loading onto the vessel was discussed at length during the 2012-12 ASEL review process. The Draft AAWSEL had recommended that in both circumstances the standard be amended to ensure that animals were provided with water within 6 hours of loading. This may have been overlooked by the committee but it is an important point and was agreed by all stakeholders at the time. **We request that this standard is amended to require water to be provided within 6 hours and a similar standard is required at registered premises.**
	Draft recommendations: **36**. That the standards require water to be provided ad libitum throughout the voyage (including days of loading and discharge). The standards should also prevent any water curfew prior to unloading in the northern hemisphere summer in Middle East ports. **37**. That the standards require that for voyages of 30 days or less, at least 1 per cent of the fodder required for cattle must be chaff and/or hay. For voyages of 31 days or more, at least 2 per cent of the required fodder must be chaff and/or hay. **38**. That in relation to 3A.3.2, the 'anticipated needs of the animals' must include expected days of loading and discharge, rather than applying from the time of departure. **39**. That in relation to 3A.3.2, the statutory reserve should be increased to 4 days for all voyages longer than 10 days, regardless of species (while maintaining the current requirement for a 7 day fodder reserve for all voyages travelling through the Suez Canal). **40**. That the standards are further reviewed without delay once current studies into fodder quality, quantity and pellet specifications are completed.
	In the absence of further evidence, we support the provisions outlined in these recommendations. However, it is crucial that a formal and transparent process is instigated for the monitoring, reporting and analysis of fodder quality, quantity and pellet specifications so that the review of these standards in 12 months' time is based on accurate and reliable evidence. Details of the research commissioned under the live export program on fodder quality, quantity and pellet specifications also needs to be made transparent and tailored to meet the expectations of this review.
7	**ONBOARD PERSONNEL**
	Draft recommendation: **41**. That the standards continue to require an accredited stockperson to accompany each consignment of livestock.
	We support this recommendation, noting that all stock handlers should receive appropriate training in the management of the species and class of Australian livestock onboard the vessel

	Draft recommendation: **42**. That the standards require one competent stock handler (as defined in the reformatted standards) per 3,000 (or part thereof) cattle and buffalo, and/or one per 30,000 (or part thereof) sheep. The standards should allow the accredited stockperson to count towards this requirement.
	We support the recommendation that the number of livestock handlers should be in proportion to the number of animals loaded, but the requirement should be for least one accredited stockperson per 2,500 head of cattle and 10,000 head of sheep (not 3,000 cattle and 30,000 sheep), to facilitate more effective monitoring of livestock.
	Draft recommendation: **43**. That the standards require an AAV to accompany any export consignment where required by the department. Notwithstanding that, an AAV must accompany each consignment on long haul voyages, extended long haul voyages and voyages with pregnant livestock, unless otherwise agreed by the department.
	Veterinary supervision is necessary on every live export voyage, no matter its duration. Only AAVs are trained to diagnose disease and other health problems and implement appropriate treatment. The standards should require an independently appointed AAV to accompany all live export consignments. **All journeys should also include an independent auditor with ultimate responsibility for reporting requirements.**
	Draft recommendation: **44**. That the standard not allow the same person to be both the AAV and the accredited stockperson for any given voyage.
	We support this recommendation.
8	**OTHER RECOMMENDATIONS**
	Export of feral goats, camelids and deer
	None of these species have been exported by sea in the past three years or more. Previous extreme mortality events have indicated that goats cope poorly at sea and similar concerns exist for deer and feral camels. There is insufficient expertise and infrastructure in the live export supply chain to manage these species at sea and such export is unnecessary when air transport is available as a safer cost-effective option. **On this basis we believe the standards should prohibit the export of feral goats, camelids and deer by sea.**
	Export of feral buffalo
	As previously outlined, the Draft Report indicates there are significant and serious animal welfare and mortality issues with the mustering, road transport, confinement and export of feral buffalo. Feral buffalo are completely unused to human contact and clearly do not tolerate handling and transport without serious welfare compromise. These problems carry over into importing countries to the point of slaughter. It appears that many of the problems picked up by the committee have gone unidentified and unaddressed because of the absence of any independent or veterinary oversight or reporting of this trade. There is no reporting of injuries or mortalities during mustering, transport or holding prior to export. Because feral buffalo are generally exported on voyages of less than 10 days there is no requirement for an AAV to travel with them on the vessel. Because of the absence of veterinary supervision, there are no post-mortem or other veterinary data from mortalities or other health/welfare issues during these voyages.

	Feral buffalo are not covered by the MLA/Livecorp live export R&D program which explains the lack of relevant scientific studies involving buffalo. There is unlikely to be any R&D in the future to support necessary animal welfare improvements in this industry. **On this basis we believe the standards should prohibit the export of feral buffalo by sea.**

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Attachment.

Literature Review: the relationship between space allowance and lying behaviour of sheep

The Murdoch University Literature Review (the Murdoch Review), published alongside the Draft Report and Reformatted ASEL, took the form of a systematic review of the literature. However, the approach taken to selecting literature drew only on studies relating to the live export of Australian animals. On the key topic of space allowance (stocking density) this brought up two peer-reviewed papers (Petherick 2007; Petherick & Phillips 2009) and one non-peer-reviewed industry report (Ferguson and Lea 2013). There was no further examination of the relationship between space allowance and animal welfare in confined livestock on non-Australian animals or in contexts unrelated to live export.

Furthermore, the Murdoch Review only examined the effect of space allowance on animal welfare in the context of heat stress. However, the amount and complexity of space animals are provided with has profound effects on their behaviour and welfare irrespective of other environmental factors.

Given the importance of this topic, we offer the following supplementary literature review which focuses on the topic of space allowance in relation to the lying behaviour of sheep. Due to the limited time available we have only been able to examine the literature for sheep, but the principles outlined here are likely to be similar for cattle.

Search terms and search process

We used a similar approach as the Murdoch Review to conduct a systematic review of the literature. We used two electronic databases (Google Scholar and Web of Science) to identify relevant papers in English. Our searches all were limited to sheep (*Ovis aries*) and the terms 'allometry', 'space allowance' and 'lying behaviour/behavior'. We then combined these iteratively with the terms 'transport' and 'confinement' and 'animal welfare'. We also searched for papers which had cited the three studies referenced in the Murdoch Review. All papers were then examined and included in the analysis if they examined lying behaviour and observed sheep in confinement (housing or lairage) for at least 24 hours.

The objective of this exercise was to locate studies that would assist in determining an appropriate minimum space allowance for sheep confined in pens on board a live export vessel. In order to make comparisons of space allowances between studies of sheep with different weights, we used the allometric equation described in the Murdoch Review (p67-68) taken from Petherick and Phillips (2009) to identify the k-value for each treatment:

Area (m^2) = k x $W^{0.66}$

We sought to answer two questions in our examination of the literature:

1. What proportion of time do sheep spend lying down when space is not restricted?
2. What are the effects of difference space allowances on the behaviour of sheep?

We feel that these questions are crucial to determining how much space confined sheep need. If sheep normally spend a significant proportion of their time lying down, then stocking densities which require animals to time-share space will likely have a significantly negative impact on lying behaviour or the overall amount of time spent lying down. The majority of the papers examined here acknowledged that lying behaviour is important in terms of ensuring that sheep can rest and ruminate, thus restricting lying behaviour will have a negative impact on welfare.

We noted that in several papers where lying behaviour was recorded, observations were only carried out during daytime hours. These studies should be regarded as providing a conservative estimate of total lying time in a 24-hour period.

1. What proportion of time do sheep spend lying down when space is not restricted?

Teixeira et al 2013

This study examined the effect of providing straw bedding on the behaviour of 24 entire male lambs (17 kg, approximately 60 days old) fattened for 28 days in two replicate trials. The space allowance was equivalent to a **k-value of 0.143** per sheep. The pens were videoed from 0800 to 2000 and scan sampling conducted to determine the behaviour of focal animals. **On average, lambs housed at this stocking density spent 50-56% of the time lying down during daytime hours.**

Teixeira et al 2014

This similar study looked at the effect of different types of bedding on the behaviour of 96 entire male lambs (19 kg, approximately 80 days old) fattened for 14 days on straw, cellulose, rice husk, and sawdust in two replicate trials. The space allowance was equivalent to a **k-value of 0.129** per sheep. **Lambs spent between 75% and 79% of their time lying down during daytime hours**, depending on the flooring substrate.

Wolf et al 2010

This study examined the behaviour of 128 growing lambs (35 kg) housed in pens of 4 animals for 18 days on straw or woodchip bedding. Lambs were observed over a 24-hour period on days 7 and 14 of housing. Space allowance per lamb in each 4.84m^2 pen was equivalent to a **k-value of 0.116**. **The overall percentage of observations when lambs were observed lying over 24 hours was 69%.**

Cuhna Leme et al. 2013

This study of the influence of stocking density on weight gain and behaviour examined the behaviour of 86 recently weaned lambs of 20kg (+-2.3kg) housed in feedlot pens in pairs or groups of 10 animals. Pens had a solid floor bedded with woodchips. The space allowance provided in both treatments was 2.4m^2 per lamb, equivalent to a **k-value of 0.332.**

Observations were conducted at half-hour intervals during daytime hours from 6am to 6pm over an 80-day period. Lying was observed more (ruminating or idling) in the early morning and at the hottest times of the day, and standing was observed more in the hours following the provision of food (at 8am and 4pm each day).

The percentage of lambs observed lying down during daytime hours varied between 5% and 92% over the course of the day. More than 50% of lambs in group pens were observed to be lying down during 56% of these observations. **More than 70% of lambs were observed to be lying down in 36% of observations.**

2. What are the effects of difference space allowances on the behaviour of sheep?

Bøe et al. 2006

This study examined the effects of reduced lying space on the behaviours of 24 pregnant ewes (80–85 kg). Pens had a lying area with a space allowance per ewe of 0.5m^2 (**k=0.027**; small), 0.75m^2 (**k=0.040**; medium) or 1.0 m^2 (**k=0.053**; large). The laying area had a solid floor with a thin layer of sawdust: each pen also had additional space for activity and feeding but was made uncomfortable for lying down by

placing wooden beams at intervals on the floor. Ewes were housed in groups of 4 for 7 days in each treatment. Sheep were individually marked and video-recorded for the last 48 hours of each treatment.

Sheep in the large and medium lying areas spent 67% of their time lying down, significantly more than sheep in the small lying area (63%). The most striking treatment effect was on synchronised lying behaviour (all four sheep in a group lying down together). The proportion of time all 4 sheep lay down together was 45% in the large pens, 38% in the medium pens and only 6% in the small pens (P<0.001). The number of displacements of lying ewes (per ewe and 24 h) increased from 6.4 to 28.9 (P< 0.001) as the lying area was reduced.

Individual lying time varied between 41% and 81%, with some of this variation explained by social rank in the group. When sheep were given a small lying area, the lowest ranked ewes were observed lying significantly less than the higher ranked ewes.

Reducing the lying space from a k-value of 0.053 to 0.027 resulted in a reduction in lying time, less synchronised lying and a large increase in the number of displacements.

This study also noted that sheep showed a strong preference for lying close to a wall.

Ferguson & Lea (2013)

This Australian report examined lying behaviour of wethers during two live export voyages from Fremantle to the Middle East. Sheep were housed in groups of varying sizes with four animals in each pen fitted with activity monitors to record the amount of time spent lying down (n=180 for each voyage). There were three space allowance treatment groups for each voyage, equivalent to **k-values of 0.022, 0.024 and 0.027** for voyage 1 and **k=0.022, 0.025 and 0.027** for voyage 2. Lying behaviour was determined from the activity logger; there was no validation of these data against video or direct observation.

Sheep in the lowest space treatment group spent less time lying than the higher space allowances; this was significant during the first 6 days of the voyage for voyage 1. In the 24 hours prior to loading (space allowance undisclosed), sheep spent an approximate average of 10 hours lying down, but only spent 5 hours (k=0.022) and 8 hours (k=0.27) lying down the day after loading. It took until day 5 for lying behaviour to increase to pre-loading levels. This study did not report on individual differences, displacement or synchronicity of lying behaviour.

Several limitations in this study were identified by Phillips and Petherick (2015) including differences in group sizes, the lack of biological relevance of the space allowances tested, and the small differences between treatment groups.

It is noted that all treatment groups in this study had a space allowance described as ‘small’ in comparison to the other studies in the current review and data on the proportion of spent lying down was not provided.

Black et al 2001

This paper reports on observations of the behaviour of male lambs (35kg) in two pens on a single live export voyage from New Zealand to the Middle East. Space allowance was reported as approximately 0.3m^2 per sheep (**k=0.029**). The study methodology did not measure total lying time, but did allow for some comparison of lying behaviour over the course of the voyage during daytime hours. Lying behaviour as a percentage of all activities was comparatively low for the first two weeks of the journey but increased dramatically by the end of the 24-day voyage, from 10% to 54% in pen A and 5% to 34% in pen B). Lying activity increased most sharply from day 16 of the voyage when average daily temperature began to exceed 26 degrees Celsius and relative humidity increased from around 75% to 85%.

Jongman et al 2008

This Australia study examined the effects of four different space allowances in an abattoir lairage in the 24 hours following transport. Adult sheep (35-45kg) were allocated in groups of 60, 40, 30 and 18 to pens measuring 18m^2 pens, providing space allowances per sheep of 0.3, 0.45, 0.6 and 1.0m^2 respectively. For ease of comparison with other studies, k-values were calculated using the mid-point of 40kg and were, in increasing order: **k=0.026, 0.039, 0.053** and **0.088**. Eight focal sheep in each pen were identified and continuously recorded on video using low light cameras for 24 hours. Five replicates of all treatments were conducted over a 3-week period. In the first 8 hours between 50-100% of sheep lay down at least once.

The percentage of time spent lying in the k=0.026 space allowance (12.6%) was significantly lower than all other treatments (22%, 25% and 29%). A space allowance of 0.3m^2 (k=0.026) also reduced the proportion of sheep that lay down at least once, compared with greater space allowances. Nine percent sheep in the k=0.026 group and 7.5% in the k=0.039 group did not lie down at all in the entire 24 hours. The authors concluded that, based on lying behaviour, the optimal space allowance may be greater than 1m^2 (k=0.088). Drinking behaviour was not affected by space allowance, although overall 20% of sheep were not observed to drink after 24 hour in lairage.

Averós et al 2014a and b

This study examined the effect of three difference space allowances 1m^2 (**k=0.071**), 2m^2 (**k=0.142**), and 3m^2 (**k=0.213**) on the behaviour of 54 pregnant ewes (55kg) confined in groups of 6 for 11 weeks. Straw was provided as bedding in each pen and regularly changed. Sheep were observed using a combination of focal animal and scan sampling techniques during daytime hours only.

The study focused on the patterns of movement of sheep and their use of the available space.

Ewes housed at k=0.071 showed reduced movement and higher frequencies of social interactions than those at larger space allowances. On the other hand, lower space allowances resulted in longer and more frequent visits to the feeders. Total distance travelled, maximum step length, and nearest and furthest neighbour distances were significantly shorter when space was restricted to k=0.071 as compared to k=0.142 and k=0.213.

Conversely, movement activity was higher at the lowest space allowance, indicating more frequent changes in location within the enclosure which may have reflected more disturbances during the resting periods and increased restlessness.

The authors concluded that behavioural differences found in this study suggest that reducing space availability to 1m^2 per ewe (k=0.071) has a potential negative impact in welfare.

Conclusions

Providing sufficient space allowance to enable confined sheep to lie down is considered essential to ensure their welfare.

When space allowance is unrestricted, most sheep lie down for between 50-80% of the time in a 24-hour period and between 45 and 56% of sheep lie down at the same time a majority of the time.

When lying space is restricted:

- lower ranking sheep spend less time lying down (and more time standing) than higher ranking sheep
- sheep will spend much less time in simultaneous lying behaviour
- the number of displacements from lying to standing increases

- a proportion of sheep will not lie down at all in the early stages of confinement.

The point at which space allowance prevents normal lying behaviour is difficult to pinpoint, but k-values of 0.022-0.029 have been found to reduce lying behaviour in confined sheep, whereas lying behaviour at k-values of 0.053, 0.088 is closer to that in unrestricted environments. Studies of pregnant ewes that have examined the movement of sheep within the pen have found reduced activity but no significant reduction in lying behaviour at k=0.071.

On live export journeys where space allowances are below k=0.029, lying behaviour is lower than in unrestricted environments, especially in the first stages of the journey.

Some authors have concluded that, based on lying behaviour, the optimal space allowance for adult sheep may be greater than $1m^2$ (k=0.088).

Further studies are needed to evaluate the effect of restricting lying behaviour on other measures of animal welfare and such research must cover the entire 24-hour period. Regardless, this gap in research should not prevent improvements to current standards based on the available evidence.

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