

3 December 2021

Re: Draft report - Heat and cold stress in *Bos taurus* cattle from southern Australia during long haul export by sea

The Australian Livestock Export Corporation Limited (LiveCorp) welcomes the opportunity to provide comment on the Draft report: *Heat and cold stress in Bos taurus cattle from southern Australia during long haul export by sea* ("the Draft Report"), released for consultation by the Department of Agriculture, Water and the Environment (DAWE).

LiveCorp is a not-for-profit industry body funded through statutory levies collected on the live export of sheep, goats, beef cattle, and dairy cattle. LiveCorp is one of the 15 Australian Rural Research and Development Corporations (RDCs), being the only RDC focused solely on the livestock export industry.

LiveCorp endorses the major finding contained in the Draft Report

LiveCorp agrees with the major finding contained in the Draft Report, that although "*increased heat load can occur during long-haul Bos taurus voyages from southern Australia in all classes of cattle (breeder, feeder or slaughter), Bos taurus slaughter cattle voyages have a significantly greater risk of increased heat load compared to voyages of feeder cattle and breeder cattle*".

Based on extensive confidential information provided by exporters, LiveCorp in a preliminary submission to the Bos Taurus Inquiry drew a similar conclusion. In particular LiveCorp noted that increased risk of heat stress was associated with the following factors:

- "consignment of heavy [slaughter] cattle (average weight > 500kgs),
- consignment of grainfed cattle,
- consignment of Bos taurus cattle,
- departures from southern ports during autumn and winter, especially May to July".

The above risk factors identified by LiveCorp were evident both from a detailed analysis of voyage data and a review of research addressing heat stress risks in cattle (this research having mainly been conducted in the feedlot and dairy sectors).

LiveCorp notes that this major finding of the Bos Taurus Review was based on analysis of data from actual live export voyages (as were the LiveCorp findings), rather than experimental data. Although the quality of voyage data can vary, analysis of this data will provide more dependable and defensible insights into factors influencing voyage outcomes than experimental data.

It is a limitation of land-based experiments, including those conducted to date in relation to live exports, that they cannot fully, or even largely, replicate conditions on-board live export vessels. In fact, environments and situations created in these experiments can be and often are significantly removed from actual voyage conditions and, therefore, cannot be fully relied upon to draw

inferences about voyage outcomes. Incorrect use of or overreliance on experimental results, when these experiments have not replicated conditions on live export vessels, has been a concern in some past heat stress analyses.

LiveCorp accepts that the major finding contained in the Draft Report supports the major recommendation in the Report

Flowing from the major finding contained in the Draft Report is the major recommendation, namely, that *“a suitable HSRA [Heat Stress Risk Assessment] should be employed all year round for Bos taurus slaughter cattle to all destinations”*.

LiveCorp notes that this recommendation differs from the recommendation of the ASEL Review that *“the standards be revised over time to require the application of an agreed HSRA to all livestock voyages that cross the equator, at all times of the year, from all Australian ports”* (ASEL Review Recommendation 27).

The ASEL Review did not point to any evidence supporting its Recommendation 27 and the regulatory burden in developing and applying such a HSRA is high. The lack of supporting evidence for ASEL Review Recommendation 27 has now been addressed through the extensive heat stress analysis completed under the Bos Taurus Review.

This extensive analysis shows that, although *“increased heat load can occur during long-haul Bos taurus voyages from southern Australia in all classes of cattle (breeder, feeder or slaughter), Bos taurus slaughter cattle voyages have a significantly greater risk of increased heat load compared to voyages of feeder cattle and breeder cattle”*.

LiveCorp in its preliminary submission reached a similar conclusion. An extensive analysis of voyages with mortality rates > 0.5% and of Independent Observer (IO) reports by LiveCorp showed no well-founded association between breeder and feeder voyages and heat stress. Moreover, based on extensive voyage analysis and comparisons with other areas of livestock production, LiveCorp demonstrated that Bos taurus breeder and feeder cattle voyages had an excellent welfare record, comparable with, or better than, welfare results achieved throughout the livestock production chain. LiveCorp also pointed to wider research evidence that breeder and feeder cattle differed from slaughter cattle in heat stress risk thresholds due to factors such as size, feeding regimes and fat scores.

The narrower application of the HSRA model, based on the analysis completed under the Bos Taurus Review, is especially justified given the regulatory burden involved in the development and application of the HSRA model.

- The ASEL Review itself noted the regulatory burden involved in development of the model, stating *“this requirement will require significant model development”*. LiveCorp is of the view that the development of an *“agreed HSRA to all livestock voyages that cross the equator, at all times of the year”* would have involved extensive research and taken a considerable time to complete and validate. Limiting the use of a HSRA model to where it is required greatly simplifies the development process and will expedite finalisation of the work.
- In terms of application, the use of the HSRA model requires considerable additional exporter resources for data collection, data input, livestock management and completion of HSRA related documentation when preparing a shipment. LiveCorp also notes that any use of a HSRA model requires additional departmental resources and adds to regulatory costs, as the

HSRA creates a new regulatory touchpoint in terms of core documents and information that need to be vetted and accepted.

- For the above reasons, the use of the HSRA model should be confined to particular circumstances that are well justified and for which a need for its use has been firmly established.

Given the considerable regulatory burden associated with the development and application of HSRA, the excellent welfare outcomes achieved on Bos taurus breeder voyages and the lack of evidence that the application of HSRA would further improve these outcomes or be a proportionate response, it is appropriate to limit HSRA to Bos Taurus slaughter cattle. Confining HSRA to these voyages has the additional advantage of considerably simplifying the redevelopment of the model, allowing the model to be applied sooner than would otherwise be the case.

Other recommendations made in the Draft Report

Apart from the HSRA recommendation discussed above there are 17 other recommendations made in the Bos taurus Review. Eight (8) of these recommendations have implications for regulation while the remaining nine suggest further research / investigation.

The eight recommendations, apart from the HSRA recommendation, with regulatory implications are:

- Consideration should be given to providing additional pen space to Bos taurus slaughter cattle exported from southern Australian ports during the northern hemisphere summer (Recommendation 2).
- Vaccination against bovine respiratory disease may be valuable in decreasing its incidence and should be considered for voyages of Bos taurus slaughter cattle departing Australia from southern ports between 1 May and 31 October (Recommendation 3).
- Hot spots on vessels should be identified and monitored using standardised and well-maintained data loggers to support the management of cattle in these areas (Recommendation 8).
- Exporters should implement proactive pad management during voyages. These should include specific contingencies for addressing sloppy pads in hot, humid conditions (Recommendation 9).
- In addition to reporting on abortions and births, daily reports should also require reporting on premature lactation (Recommendation 11).
- On board data loggers should be used to improve the monitoring of deck temperatures (Recommendation 12).
- Measures to mitigate the risk of cold stress on board vessels should be incorporated into exporters' 'adverse weather contingency plan' (Recommendation 17).
- The 'cold climate destination checklist' for cattle should be completed prior to the export of cattle to cold climate destinations (Recommendation 18).

Despite the major findings of the Bos Taurus Review being narrow in scope (confined to increased heat stress risk associated with Bos taurus slaughter cattle from southern Australia exported during the northern hemisphere summer), the above eight recommendations imply the introduction of

substantial new regulation. Moreover, much of this new regulation is not confined only to shipments of *Bos taurus* slaughter cattle from southern Australia exported during the northern hemisphere summer, but has wider ramifications. Any new regulation has the effect of stifling commercial innovation, impeding the economic competitiveness of the industry and adding costs and burden for the regulated and the regulator – it therefore must be soundly justified as being warranted and necessary.

Principles of good regulation

Among other things, good regulation should exhibit the following characteristics:

- **Clear objective/s:** At the centrepiece of any regulation must be a clearly defined regulatory objective. In other words, definitively, what is it that the regulator is trying to achieve? In framing clearly defined objectives, if reducing risk is an objective – as it appears to be in much live export regulation – risk levels should be explicitly stated. What is an acceptable level of risk, recognising that few achievements in life (or commerce) are risk free?
- **Effectiveness:** Regulation must be focussed on the problem to be solved and achieve its intended policy objectives with minimal side-effects and cost. Regulation should be tightly targeted at the objective.
- **Outcome focussed:** To maximise effectiveness, regulations need to focus on outcomes rather than inputs or details about how to achieve the outcomes.
- **Proportionality:** Regulatory measures must be proportionate to the problem they seek to address. A proportionate system allocates controls based on risk of not meeting the most important objectives, while those with few or insignificant risks or objectives of lower importance receive less attention. Proportionality also implies that regulatory standards are similar when addressing the same issues (e.g. animal welfare) across industries or industry sectors – to ensure that one industry or sector is not being singled out for disproportionate treatment.

Despite recommending substantial new regulation, the Draft Report does not systematically analyse whether recommended new regulations meet the criteria listed above for best practice regulations. As emphasised by LiveCorp in the ASEL Review, it is critical that any new regulation meets the tests of good regulation. A gap in the Draft Report is that these tests have not been explicitly applied.

LiveCorp recommends that in the final report a checklist be developed for testing recommended new regulations against best practice criteria and each piece of new regulation recommended be tested against this checklist. This checklist should clearly cover benefits and costs.

As noted, a particularly important task in specifying regulatory objectives is defining acceptable levels of risk. In this regard, contextual setting can be helpful – such as comparing animal welfare risks in live exports against those in livestock production generally. LiveCorp provided some contextual information in its confidential submission, concluding that welfare risks in live exports are comparable to, or less than, those elsewhere in livestock production. An independent assessment of risks across a range of settings would have been an important addition to the Draft Report, assisting in an assessment of regulatory proportionality. Placing live export risks in the context of risks elsewhere in livestock production would provide guidance on when regulatory intervention may be warranted and justified.

As an example of the above, the Bos Taurus Review stated that cattle experienced cold conditions when temperatures fell to 5°C or less, when other physical signs existed of cold conditions (e.g. frozen pipes) or when animals showed physiological or behavioural signs of coldness. It found that under this definition 20 of 214 voyages involved cold conditions. Further, on the basis of the findings, the Draft Report included five recommendations on counteracting / investigating cold stress, three of which involve additional research and two of which involve increased regulation (both input-based, rather than outcome focussed).

- LiveCorp notes that on the basis of the department's definition of cold conditions, a significant proportion of the Australian herd would experience these conditions at certain times of the year.
- LiveCorp further notes that just as the Review concludes that climatic conditions can affect welfare outcomes on live export voyages to all destinations, from all departure ports at any time of year, so too can temperature stress affect the welfare of cattle in Australia at any time of year – as was evidenced by the conditions in Queensland in early 2019, resulting in many deaths due to temperature stress.

Against the background provided above on the principles of good regulation, comments are now made on a number of recommendations contained in the Draft Report.

Recommendation 2: Consideration of additional pen space for Bos taurus slaughter cattle exported from southern Australian ports during the northern hemisphere summer.

A general increase in base space allowances for Bos taurus slaughter cattle, as considered by Recommendation 2 in the Draft Report, is not justified against the principles of good regulation.

Three major reasons exist for this conclusion.

- First, if additional space allowances are necessary to address the potential for heat stress in heavy slaughter cattle, these should be determined through application of the HSRA. In effect, through the implementation of Recommendation 1 of the Draft Report there should be no need for Recommendation 2.
- Second, application of a HSRA to determining space allowances, additional to those that generally apply, addresses many of the factors listed on p22 of the Draft Report as relevant to determining space allowances. Specifically, the HSRA model considers departure and discharge ports, time of year, breed and weight, all of which are listed on p22 as relevant factors. Other factors listed on p22, namely, pregnancy status, horn length and exporter performance are relevant in very discrete circumstances, are already explicitly addressed in ASEL and Approved Arrangements, and do not justify a general increase in space allowances for Bos taurus slaughter cattle.
- Third, if it is accepted that any increase in space allowances due to heat stress (and associated factors such as departure and discharge ports, time of year, breed and weight) is already taken into account through use of a HSRA, the question then arises as to whether a further general increase in space allowances for Bos Taurus slaughter cattle leaving southern Australia during the northern summer is needed.

Such a regulatory change is contemplated under Recommendation 2 - i.e. this Recommendation seems to be proposing an increase in space allowances for Bos Taurus slaughter cattle departing southern Australia in the northern winter, above those provided

for under ASEL 3 and through the use of HSRA. However, the Draft Report contains no evidence to support this regulatory change.

We note that an extensive review has only recently been completed into live export shipping regulations, including appropriate stocking densities. The review findings have been implemented through ASEL 3.0 and Approved Arrangements (including heavy cattle management plans).

The ASEL review concluded that the “*science-based approach*” for calculating stocking densities was to use the allometric equation. The review further concluded that for cattle the default k-value to use in this equation was 0.030.

We further note that for heavier animals (i.e. the animals captured by Recommendation 2) a decision was made to continue to apply the ASEL v2.3 space allocations, rather than the allometric equation using a k value of 0.030 (which would have allowed higher stocking densities at heavier weights). For a 700kg animal, for instance, under penning space guidelines published in the Approved Arrangements Guidelines, the implied k-value is 0.038, substantially greater than the 0.030 value advocated by the ASEL review’s allometric approach.

If there is to be a departure from the ASEL v3.0 stocking density recommendations, and above those required through the application of HSRA, strong supporting evidence is needed. None is provided in the Draft Report and cannot be provided until the impact of applying a HSRA is known.

Reviewers of the DAWE Bos Taurus paper (the Technical Expert Group – TEG) made two comments of relevance to Recommendation 2. The TEG stated that:

- *“In some cases it was not clear how recommendations were developed out of the findings”;* and
- *“The timing and nature of the introduction of ASEL 3 made it difficult to determine how many factors may change or improve through ASEL 3 alone”.*

For the reasons listed above, it is not clear how Recommendation 2 was developed out of the findings and there does not appear to be a basis for recommending a general increase in space allowances for Bos taurus slaughter cattle.

Recommendation 3: BRD vaccination for Bos taurus slaughter cattle departing from southern ports between 1 May and 31 October

Bovine Respiratory Disease (BRD) is a major cause of morbidity and mortality in feedlot cattle and has been identified as an important cause of death in live export cattle¹. As noted in the LEP Veterinary Handbook, infectious agents associated with BRD are likely to be ubiquitous and it is probable that all shipments will be exposed at varying levels to some or all of the BRD pathogens.

Vaccines specifically targeting BRD pathogens may reduce morbidity and mortality. There is, therefore, merit in vaccinating for BRD in situations where BRD risks are high.

¹ Perkins, N, 2008, Respiratory disease of export cattle, Final Report Project B.LIV.0248, Meat & Livestock Australia, December.

LiveCorp notes that BRD vaccination is already required for extended long haul voyages². LiveCorp further notes that BRD is currently a consideration for the department when approving a heavy cattle or buffalo management plan (noting that such plans are a requirement when exporting cattle of more than 500 kgs – i.e. slaughter cattle)³.

LiveCorp, therefore, questions the need for further regulation in this area, since the department already has the regulatory tools at its disposal to address any concerns regarding vaccination.

While there is no need for further regulation, there is a continuing role for industry bodies in promoting the benefits BRD vaccination to commercial players. LiveCorp is open to working with ALEC and the department on effective promotional strategies and programs.

Recommendations 8 and 12 on identification and monitoring of hot spots and use of data loggers onboard vessels.

There is considerable regulatory burden associated with the use of data loggers to collect on-board environment data, potentially more than is realised by the department. For an 8-deck vessel, with one data logger on each deck and additional loggers in hot spots, it is not unreasonable to assume that 15 loggers would be required⁴. While the cost of the loggers themselves is relatively small, extensive resources can be expended in their use.

It is a mistake to believe that the entire process of collecting and transferring weather data from loggers occurs automatically or with little time and effort. Live export vessels currently lack ship-wide connectivity. Available technology to create ship-wide connectivity has been tested by LiveCorp – however, this was a discrete trial and further pressure testing is needed to prove its capabilities and capacity for wider application. Ensuring that additional data logging can be automated through a connectivity solution needs to be a prerequisite before additional regulatory requirements are imposed. The cost of creating this connectivity has been estimated at about \$45,000-\$70,000 per vessel, which we note is also a significant increase in regulatory burden that would need to be justified as necessary and proportionate.

In the absence of ship wide connectivity, data from each logger needs to be separately, and through partly manual processes, downloaded at the end of each voyage. Downloads are generally completed through a Bluetooth connection, while near the logger, and take time (depending on the file size and logger type). LiveCorp estimates that the time taken to collect data at the completion of the voyage, sort through this data, and then send it to the appropriate parties is about 15-20 minutes for each logger. For 15 loggers, the total elapsed time for data download is, therefore, more than four hours.

The above practices of gathering data from loggers, contrasts with the current approach used, with the Australian Accredited Veterinary (AAV)/LiveCorp Accredited Stockperson (AS) taking deck

² Department of Agriculture, Water and Environment, 2021, Approved arrangement guidelines for the export of livestock: Version 4.4, <https://www.awe.gov.au/sites/default/files/documents/aa-guidelines-export-livestock.pdf>, April and Department of Agriculture, Water and Environment, 2016, “The export of Livestock on ‘extended voyages’”, Export Advisory Notice, 2016-15, April, p31.

³ Department of Agriculture, Water and Environment, 2021, op cit., p33.

⁴ Although 15 data loggers has been assumed for an 8 deck vessel, it is noted that the number of loggers will depend crucially on the definition of a “hotspot” and how the Department intends to identify these. No guidance is provided in the draft Report on this matter.

temperatures while undertaking other necessary daily tasks associated with inspecting livestock and equipment on each deck.

It is clear from the above, that considerable additional resources are entailed with the use of loggers. It is, therefore, critical that the regulatory objective is clearly defined, that it is proportionate and necessary, and that tests are applied to ensure that the measure proposed meets this objective with the least possible cost.

In this context, it is recognised that the use of data loggers is a requirement on sheep shipments. However, Recommendations 8 and 12 of the Draft Report represent a very significant expansion of those existing requirements and, given the regulatory burden involved, requires the presentation of considerably more evidence on the need for loggers than is contained in the Draft Report – in particular a demonstration is required that benefits exceed costs. These benefits must be clear as to why the regulator needs such detailed temperature data (noting it is an input-based measure, not an outcomes-based welfare measure) to perform its functions and why the benefits of continuous logger data substantively outweigh the current manual measurement (or improvements to the current manual measurement). If this demonstration is possible, then a purposeful and phased in implementation plan is needed and should be referred to in any recommendation.

In this regard, it is noted that industry is working towards automated data collection, viewing this as the way of the future. LiveCorp has been undertaking a range of work to overcome the barriers and identify solutions to move forward in this space. Components of this work have involved conducting connectivity and technology trials (including identifying and bringing the original loggers into the industry) and developing LIVEXCollect.

However, at this stage automated data collection processes are not currently in widespread use because these processes are in an embryonic stage of development in a live export environment and require additional resources compared to current practice. To force the use of data logging processes through regulation prematurely – particularly prior to resolving central teething issues, such as connectivity and establishing the platforms for standardised data and ingestion – will impose costs on the industry and create inconsistency and disruption. It is also worth noting that if these processes (the use of loggers) were currently more efficient than the existing manual approach, they would already have been adopted by exporters.

An alternative to Recommendations 8 and 12 would be to support the expeditious finalisation of the ongoing work of LiveCorp in resolving the challenges for connectivity and automated environmental data collection in a live export environment with a view to universal collection of data using these methods.

Recommendation 9: Exporters should implement proactive pad management during voyages.

Recommendation 9 of the Draft report would require exporters to implement proactive pad management during voyages. However, as McCarthy and Banhazi note:

“It is difficult (if not impossible) to be prescriptive about bedding management and that management strategies are modified and amended in response to the interplay of a large number of factors. It is strongly influenced by the way in which events unfold during the course of a voyage”.

Since a close relationship exists between the management of bedding and the pad, the statement of McCarthy and Banhazi equally applies to management of the pad.

It is difficult to know precisely what is meant by a recommendation that exporters should implement proactive pad management during voyages. If this recommendation suggests that the strategies of the AAV / AS in pad management should be prescribed or constrained, this does not appear supported by research or the findings of the Bos Taurus Review.

It must be recognised that AAVs and ASs are highly professional and pad management represents one of their major tasks during a voyage. Simply because, on a limited number of occasions, an IO has observed that the pad has been inadequately managed, does not necessarily invalidate the management that has applied. Professionals sometimes come to different viewpoints on strategies adopted or the IO may not have been aware of all the factors that influenced management decisions (recognising that AAVs/ASs are largely more experienced in the practical management and care of livestock, particularly in an on-board environment).

Rather than unduly prescribing or constraining the strategies of the AAV / AS in pad management, additional training in this area may be useful. In this regard LiveCorp at a future meeting of AAVs/ASs would be willing to conduct a session on pad management strategies and research findings and through this session ascertain the need for further training activities.

Recommendation 11: Reporting on premature lactation

Premature lactation has been a recognised problem in some dairy heifers exported from Australia by long-haul sea voyages. Exported heifers showing udder development and initiation of lactation *en route* represent a potential loss for exporters, predominantly due to devaluation or rejection of consigned animals as unfit for purpose by importers in destination countries⁵.

Although premature lactation may be related to stress, it is acknowledged that risk factors that result in premature lactation are poorly understood. A number of theories exist as to the cause, however none have been substantiated and methods to control the incidence of the condition have not been established⁶. For example, a cause identified as the most likely in a 2012 LiveCorp/MLA LEP project was later shown as not a likely cause⁷.

In the view of LiveCorp, causes of premature lactation remain in the realm of research and it would seem premature and potentially inconsistent with the principles of good regulation to mandate the collection of specific items of data in this regard.

Recommendations 17 and 18: Cold climate mitigation contingency plans and checklist

The Review classified twenty voyages (9.3%) as experiencing “cold conditions” where ambient temperatures of $\leq 5^{\circ}\text{C}$ dry bulb temperature (DBT) were experienced or behavioural, physiological or environmental signs existed of cold conditions.

For 13 of the 20 voyages cold conditions were classified by reference to DBTs only without regard to other factors (i.e. DBTs fell to 5°C or below, but there were no other reported signs of coldness).

For the remaining seven voyages:

⁵ Mansell, P.D., Jubb, T.F. and Wilson, S., 2015, Zearalenone and Premature Lactation in Exported Dairy Cattle, Final Report, Project W.LIV.0286, Meat & Livestock Australia, March.

⁶ Mansell, P.D., Beggs, D.S., Jubb, T.F., Pyman, M.F.S. and Fisher, A.D., 2012, Premature Lactation in Exported Dairy Cattle, Final Report, Project W.LIV.0280, Meat & Livestock Australia, July.

⁷ Ibid and Mansell et al, 2015.

- On 3 voyages there were *environmental* signs of cold conditions, such as frozen pipes.
- On 1 voyage decreased water consumption was reported when the DBT was 10°C.
- On 1 voyage cattle were reported to be ‘cold, wet and windblown’, due to heavy seas despite DBTs being 16-17°C⁸.
- On 1 voyage cattle were reported as shivering when ambient DBT was -1°C.
- On 1 voyage cattle were euthanized as their Body Condition Score (BCS) was too low to support the environment they were entering.

The Review states that: *“There were no recorded primary mortalities due to cold stress”*.

LiveCorp notes that based on the above classification, there are many times and locations in Australia where conditions would be classified as “cold”. LiveCorp further notes that it is important that deck temperatures, rather than ambient temperatures, be used as a reference point for cold conditions.

Despite the following results being found:

- No primary mortalities being attributed to cold stress;
- For only 3 (1.4%) voyages did behavioural or physiological signs exist of cold conditions (including one where DBTs were 16-17°C); and
- Conditions being defined as “cold” often existing within Australia (a LiveCorp observation, rather than a Review finding);

the Review made five recommendations related to cold stress, two of which have regulatory implications.

For the reasons outlined, the two cold stress regulatory related recommendations do not meet the conditions of good regulation and should be removed from the final version of the report – they are not proportionate and a demonstrated need has not been established.

Other recommendations

As previously noted, 9 of the 17 recommendations made in the Review require further research / investigation. To the extent industry research is required, LiveCorp will consider the research / investigatory recommendations contained in the final report through the joint LiveCorp/MLA LEP RD&E Program and in the context of available budgets and the full range of priorities.

⁸ It was apparently on this voyage that the IO recorded the following comments:

- *“The AAV was particularly conscientious in his duties preferring to move sick or injured cattle to hospital pens rather than treat in-pen”.*
- *“Sick or injured animals were provided care in a timely and appropriate way, and humanely euthanised when required”.*
- *“Overall, the cattle were delivered in good condition with their health and welfare taken into account by the AAV, stockmen, officers and crew throughout the voyage”.*
- *“The voyage encountered rough sea conditions in the Great Australian Bight and hot and humid conditions in the Indian Ocean. These events mildly impacted the health and welfare of some cattle on the voyage. Water logging from this event and wet decks from repeated wash downs without sawdust application contributed to a number of cattle with sore or tender feet” (our emphasis).*

Conclusions

DAWE is to be congratulated for its heat stress analysis conducted as part of this Review. The analytical work is superior to work previously undertaken on heat stress, assisted by the fact that the heat stress findings in the Draft Report are based on the analysis of real voyage data rather than experimental findings.

The major conclusion reached by the Draft Report, that *“Bos taurus slaughter cattle voyages have a significantly greater risk of increased heat load compared to voyages of feeder cattle and breeder cattle”* was also a conclusion reached by LiveCorp’s extensive data analysis.

The major recommendation from the report that *“a suitable HSRA should be employed all year round for Bos taurus slaughter cattle to all destinations”* is sound and supported by the Review’s analysis.

A number of other regulatory recommendations, however, are not sufficiently supported by the data analysis, do not fully take into account changes implemented under ASEL v3.0, and/or do not represent best practice. The department should consider removing, or in some cases altering, these recommendations from the final report.