

LiveCorp Submission

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Middle East Sheep Exports Policy Options

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1 Introduction

This submission by LiveCorp is written in response to the Department's invitation to comment on the impact of possible policy options addressing sheep exports to the Middle East.

The issue of sheep exports to the Middle East has been under review since April 2018. The need for a review arose from video footage taken over five voyages in 2017 which showed some unacceptable animal welfare outcomes associated with heat stress in sheep being shipped to the Middle East. Existing policy settings, which focussed on mortalities, did not adequately capture the unacceptable welfare outcomes that occurred. It was therefore concluded that new policy settings were required.

The 18 months of review have culminated in the Department identifying four possible policy options, as summarised below (with further details to be found in the Department's discussion paper):

1. A three month prohibition on sheep exports to the Middle East during the hottest part of the northern summer.
 - The current HSRA model, or a modified model, would continue to be used on individual shipments at other times of the year.
 - The period of prohibition could be extended or reduced based on weather forecasts when these significantly differ from historical averages.
2. Continue to apply the 2019 prohibition period.
 - The need to use HSRA at other times of the year would be removed.
3. Adopt a revised HSRA model with risk settings based on heat stress thresholds or agreed animal welfare indicators.
4. Impose no prohibition period on sheep exports to the Middle East and continue to use HSRA Version 4.

The department is seeking comment on:

- The impact of each option
- Further possible policy options that might be considered.
- The data that should be collected on future live export voyages to the Middle East.

This submission attempts to meet the Department's request in these areas.

In this submission the impact of options is considered in three dimensions:

- Impact on animal welfare outcomes
- Economic impact
- Impact on importing countries and Australia's trading reputation.

These areas of impact are considered in the next three chapters of this submission.

Following this, Chapter 5 contains a consideration of the data that should be collected on future live export voyages to the Middle East and Chapter 6 proposes an additional policy option to the four included in the Department's discussion paper.

Finally, there is a chapter that outlines a possible way forward for the Department and industry in terms of regulating live sheep exports to the Middle East.

2 Impact on animal welfare

In this chapter the following conclusions are made:

- All options provided in the Department's discussion paper will result in significant improvements in animal welfare outcomes above those that have historically applied to the trade.
- It is difficult to precisely delineate the welfare outcomes that will result from the various options until further data is obtained and precise measures of animal welfare (including boundaries between acceptable and unacceptable levels) are developed.

The basis for these conclusions is provided below.

2.1 All regulatory options being considered by the Department will result in a significant shift in animal welfare outcomes.

Indisputable evidence exists that all options provided in the Department's discussion paper will result in extensive improvements to animal welfare outcomes above those which have historically applied. This statement applies equally to Option 4 as to the other options contained in the discussion paper (notwithstanding reservations expressed in the paper regarding Option 4). The improvements in animal welfare that will occur under all options reflect the impact of recently introduced regulatory measures which will continue under Options 1 to 4.

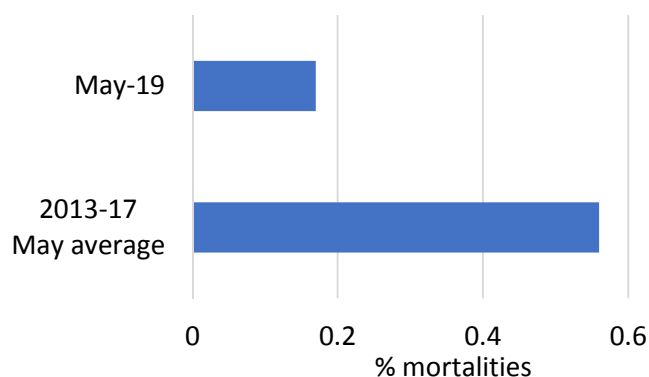
Since the Awassi incident, which was the root cause for the series of reviews that led to the Options Paper, a raft of new regulations have been applied to the trade. These regulations include the following:

- an increase in the base amount of space allocated to each sheep of more than 30% (compared to ASEL 2.3) for common weights of sheep exported;
- the placement of Independent Observers on all vessels to the Middle East;
- the halving of the notifiable mortality rate to one per cent;
- a requirement for automated watering systems;
- a requirement for automated wet bulb temperature measurement devices to be installed;
- different treatment of open decks and changes to AMSA regulations; and
- the conduct of ventilation audits.

It is evident from an examination of outcomes from May sheep voyages that the new regulations have resulted in much improved welfare outcomes. As an indication of the welfare improvements that have occurred, mortalities in May this year, after the new regulations were implemented, were less than one-third of those in previous years (see Chart 2.1). For the mortalities that did occur none were associated with heat stress¹. This is despite the fact that relatively high wet bulb temperatures were recorded on some of these voyages – these temperatures were more than the 28°C threshold defined by the Technical Reference Panel above which voyages involving standard sheep would be prohibited.

¹ Department of Agriculture, 2019, *Explanatory note – Decision to extend the prohibition of live sheep exports to, or through the Middle East until 22 September, 2019*, Canberra, July, p5.

Chart 2.1: Mortalities for May shipments in 2019 and previous years



Information from the three Independent Observer reports for May 2019 sheep shipments to the Middle East also highlights the achievement of good animal welfare outcomes, despite relatively hot conditions being encountered. In summary these reports indicate the following:

- **Adverse animal welfare outcomes were not observed.**
- Panting did occur at heat stress score three for some sheep on some days.
- Open mouth panting on one shipment occurred in conditions that would exist in Australia during summer months (i.e. when wet bulb temperatures were low, but dry bulb temperatures were high).
- On another shipment the Independent Observer noted that in some “hot spots” 30%-50% of sheep open mouth panted, but this “was transient as the sheep adapted to the rapid increase in wet bulb temperatures”.

Relevant excerpts from the Independent Observer reports are to be found below:

- Report 123, MV Al Messilah, Departing 8th May 2019

The observer did not identify any animal welfare issues. Mortalities for this voyage were the lowest in the vessel's 166 voyage history. The majority of the mortalities were attributed to enteritis and respiratory disease. ... Temperatures for the voyage below decks reached a maximum of 34°C dry bulb, and wet bulb of 31.7°C. The average heat stress score was 2, with open mouth breathing observed in several sheep per deck during the hottest part of the voyage (heat stress score 3). ... Lambs travelled well in the higher wet bulb temperatures with the least mortality rate encountered.

- Report 127, MV Maysora, Departing 19th May 2019

The most common cause of mortality in cattle was pulmonary disease, and in sheep was enteritis/inanition.

The extreme conditions were observed from Day 24 until completion of discharge with temperatures reaching 37.2 degrees Celsius dry bulb, 25.8 degrees Celsius wet bulb and relative humidity around 40%. During this period, the heat stress score for sheep generally ranged from one to two. However for a period of between 5-10 hours each day during the afternoon and early evening, there were isolated examples (<1% of sheep) of heat stress scores rising to three on the open decks before then dropping again later in the night.

Open mouth panting was rarely (<1%) observed in either sheep or cattle even on the days with the highest wet bulb temperatures (32°C).

- Report 133, MV Ocean Drover, Departing 26th May 2019

... temperature and humidity records gathered by the observer at 31 pens indicated that from day 5 when the wet bulb temperatures reached 28°C there was a mild increase in heat stress scores (between 1 and 2) and it was common that 5 – 10% of sheep per pen would show a heat stress score of 3. This pattern maintained while the wet bulb temperature gradually increased to a daily max of 30 to 31°C on about day 10 when the vessel was passing Jebel Ali for the first time in the Persian Gulf.

The wet bulb temperatures dropped very quickly on days 11 and 12 towards arrival in Kuwait. During this period of high dry bulb temperatures and low relative humidity the numbers of sheep showing a heat stress score of 3 was generally less than 5%.

After departing Kuwait and returning toward Jebel Ali, the humidity and wet bulb temperatures on decks increased rapidly from day 14 to day 15 (commonly a daily maximum around 31°C and 85%). The heat stress scores increased during this period of rapid wet bulb increase, particularly in the pens identified as potential hot spots on decks 7 and 9 where 30 – 50% of sheep per pen showed heat stress scores of 3 on day 15. However this increase in the heat stress scores was transient as the sheep adapted to the rapid increase in wet bulb temperatures. Adverse animal welfare outcomes were not observed at any of the potential hot spot locations during the voyage.

The observer determined that animal health and welfare outcomes for livestock on the voyage were satisfactory.

The new regulatory conditions that have been introduced, particularly **when combined with the shipment moratorium introduced by the industry** for the hottest months, **provides confidence that satisfactory welfare outcomes will be achieved** on live sheep voyages to the Middle East.

It is also important to note that **undue restrictions on Australian live export shipments will result in lower global welfare outcomes**. This is because undue restrictions on Australian sheep shipments will force customers in the Middle East to turn to other suppliers, which is already starting to occur in some markets. In a visit to the Middle East in May 2018, the previous Minister of Agriculture, David Littleproud, made it clear that this would be the result:

“During Minister Littleproud’s visit to the Middle East last week, Ministers from all three countries [Qatar, Kuwait and the UAE] and the government-owned livestock importer explained they want to continue importing similar amounts of live sheep to what they are now. They said they will source them from other markets such as South Africa, Sudan and Ethiopia if Australia stops supplying. The Al Mawashi Group (an arm of the Kuwaiti Livestock Transport and Trading Company, which supplies Kuwait, Qatar and the UAE with live sheep) has stated this publicly”.

The previous Minister of Agriculture also noted that this would result in a decline of global animal welfare standards:

“Australian opponents of the live sheep trade need to reflect on their ‘moral compass’ because if the local trade is ultimately banned, animals from other countries will be exported to the Middle East with fewer safeguards, according to the agriculture minister, David Littleproud.

“If it’s not our sheep and our cattle going to the Middle East, it will be another nation’s sheep and cattle, that doesn’t have the standards we do, and you know what, if we think we can bury our

head in the pillow and close our eyes and think it's all over – well I ask about the moral compass of those people because there will be animals that suffer.”²

2.2 Measurement of animal welfare still uncertain

Beyond concluding that all options in the discussion paper will result in significant improvements in animal welfare outcomes over those achieved historically, it is difficult to be more definitive. This is largely because, notwithstanding 18 months of reviews into heat stress and conditions on live export voyages, firm measures of what comprises acceptable and unacceptable animal welfare outcomes, apart from those referencing mortalities, are yet to be determined. Furthermore, even if they had been determined, widespread data on any measures has yet to be collected.

The paucity of determinations in this area is well illustrated in a statement made by the ASEL Technical Advisory Committee (TAC). In their final ASEL Review report the TAC noted the following³:

- *“Ideally, voyage reporting on the welfare of livestock would be based on a broad set of health and welfare measures (morbidity data) in addition to a mortality rate”.*
- *“However, measures of welfare are complex, requiring multiple measurements over time, and vary with many factors including livestock class and preparation and environmental context”.*
- Welfare measures other than mortalities *“have not yet been clearly identified and described ... nor adequately validated to determine thresholds to act as triggers for action”.*
- *“Thus the need to continue with notifiable mortality rates per consignments remains in the short term”.*

2.2.1 Multiple views have emerged on welfare criteria involving unacceptable heat stress

In terms of heat stress, multiple different views have emerged from the reviews conducted on the behaviour or symptoms within an animal that would signify that animal welfare outcomes are unacceptable.

The TRP based its analysis on a view that unacceptable welfare occurs when core body temperature (CBT) rises by 0.5°C (but then recognised that measurement of CBT is impractical in live shipment situations). Other researchers, however, including Professor Shane Maloney (who the TRP referenced in its report and who is considered a world expert on heat stress) and Dr McCarthy, are of the view that a CBT increase of 0.5°C, in itself, is of little consequence.

Most researchers hold the view that panting scores are useful in detecting heat load (either because of the practical difficulties in measuring CBT or as a primary measure), but here the agreement ends. The TRP made the following statements regarding panting scores and unacceptable welfare outcomes:

*“When a sheep is panting with its mouth open—score 3—it has moved away from the TNZ and is **having to work much harder** to try and lose heat from the body, and **this is considered to be beyond what is acceptable.***

² The Hon. David Littleproud MP, Fact Check: Live Export Claims; Facts and Stats, Media Release, 30 May 2018, https://parlinfo.aph.gov.au/parlInfo/download/media/pressrel/5996064/upload_binary/5996064.pdf;fileType=application%2Fpdf#search=%22media/pressrel/5996064%22

³ ASEL Review Technical Advisory Committee, 2018, *Review of the Australian Standards for the Export of Livestock: Sea Transport—final report*, Department of Agriculture and Water Resources, Canberra, December, p37.

*The panel concluded from all available scientific and anecdotal evidence that a sheep could be considered too hot when it is **open mouthed panting for a sustained period without respite***⁴.

In its draft report the TRP defined a “sustained period” as “mouth open panting, without a reduction in the panting ... through the day and night”⁵.

A number of questions arise from the TRP’s definition of an unacceptable welfare outcome from heat stress:

- If there is open mouth panting in a small proportion of animals on a vessel does this represent an unacceptable welfare outcome for the shipment?
- If open mouth panting occurs for one animal does this represent an unacceptable welfare outcome for the shipment?
- If the whole boat pants for 12 hours, and then stops with no ill effects does this represent an unacceptable welfare outcome? As the TRP notes, sheep pant on a hot day in Australia, as they do across the world.
- If there is no panting but loggers show the core body temperature rises 0.6 degrees has the regulatory objective been achieved?

Certainly other researchers have concluded that panting of itself, including open mouth panting, need not signify a welfare issue. The authority on sheep panting, Bob Hales, stated that sheep can open mouth pant when body temperatures are normal – that is, when no welfare issues exist⁶. Additionally, Professor Maloney has noted that open mouth panting does not immediately nor necessarily equate to any physiological harm. Professor Maloney states that “*Panting has gained the reputation of being unsustainable because it is energy demanding, but except perhaps in extremis, that is generally not the case*”.

2.2.2 Measurement of the main welfare indicator suggested for heat stress is problematic
Added to the above issues, in the case of panting, like CBT, the question of measurement again arises.

The TRP’s definition of an unacceptable welfare outcome pertains to individual sheep – welfare for individual sheep have been compromised if they have been open mouth panting for a “sustained period without respite” (“day and night”). Currently certain welfare measurements are undertaken periodically across pens of sheep on a vessel. Unless sheep are continually monitored AND all sheep within a pen are panting, it is impossible to know whether the sheep panting now have been panting constantly for the past 12 hours – sheep commonly pant intermittently and different sheep pant at different times. The TRP’s use of panting to determine an unacceptable welfare outcome, therefore, is as impractical as measuring CBT – since unacceptable levels of panting under the TRP’s analysis requires monitoring individual sheep which cannot be done on board a vessel.

2.2.3 Practical, precise criteria for assessing animal welfare due to heat stress are needed
Practical, precise criteria for assessing animal welfare on board a vessel are needed with the regulator defining breakpoints between acceptable and unacceptable levels. Eighteen months of

⁴ HSRA Technical Reference Panel, 2019, Final report by the Heat Stress Risk Assessment Technical Reference Panel, Department of Agriculture and Water Resources, Canberra, May, p11.

⁵ HSRA Technical Reference Panel, 2018, Heat Stress Risk Assessment: Draft Report by the Independent Heat Stress Risk Assessment Technical Reference Panel, Department of Agriculture and Water Resources, Canberra, December, p19.

⁶ Hales, J., 1973, Effects of heat stress on blood flow in respiratory and non-respiratory muscles in the sheep, *Pflügers Archiv*, Vol 345, pp 123-130.

reviews has failed to provide these. The precision needs to include at least the following three features:

- Precise definition of the behaviour / symptom to be measured. In this regard it is to be noted that differences between researchers persist on how panting should be measured.
- The percentage of the population affected before the breakpoint between acceptable and unacceptable welfare levels is crossed.
- The length of time the behaviour / symptom has to persist before the breakpoint between acceptable and unacceptable welfare levels is crossed.

2.3 Equally uncertain are the environmental conditions that give rise to this outcome

The TRP tried to circumvent the issues raised above with panting by:

- correlating panting scores / rise in core body temperature with wet bulb temperatures (WBT) – referring to data from the Stockman thesis,
- determining that this correlation coincided with WBTs contained in the heat stress threshold (HST) distribution in the HSRA model – a distribution in the HSRA model that had been dormant, never used and never tested, and
- arguing that welfare outcomes were, therefore, unacceptable when the WBTs exceeded those in the HST distribution.

After the application of conservatism, this resulted in a determination by the TRP in its draft report that voyages involving standard sheep should be prohibited if there was a 2% chance of maximum WBTs exceeding 28°C at any time during the voyage⁷.

It should be evident that the process used by the TRP was flawed: how well a certain WBT is correlated with a desired welfare outcome first requires the desired outcome to be defined. In the case of welfare involving sheep exported to the Middle East, as was pointed out in the previous section, this requires definitions around the number of animals affected and, most importantly, acceptable duration periods (as well as how, precisely, the outcome itself is to be measured). Without first defining the desired outcome, correlations with certain environmental conditions cannot be made.

The welfare criteria used by the TRP was:

*“The panel concluded from all available scientific and anecdotal evidence that a sheep could be considered too hot when it is **open mouthed panting for a sustained period without respite**”.*

but this definition is unclear and opaque. Did the TRP mean that no sheep could be open mouth panting? And what is to be understood by a *sustained* period of time?

⁷ For the standard animal, in its draft report, the TRP deducted 0.7°C off the actual HST value, apparently due to the application of conservatism. The TRP state: *“The recommended WBT limit for a standardised shipper sheep (56 kg adult Merino wether, body condition score 3, zone 3, winter acclimatised, recently shorn) is 28°C. This threshold is based on the data evaluated by the panel that consistently indicates an unrelenting challenge to homeostasis once sheep are exposed to WBTs above this value. This limit conforms closely with the heat stress threshold derived, but not currently utilised, in the industry heat stress risk assessment model.* The TRP also note: *“Recent monitoring on ship corroborates the use of 28°C WBT as the heat stress threshold for most shipped wethers travelling from the southern Australian winter (i.e. 56 kg Merino adult, zone 3, recently shorn). Beyond that environmental WBT there is an increase in body temperature indicating the animals are no longer maintaining homeostasis”.* It is unclear in the final report whether the 0.7°C deduction still applies, but it is any case marginal.

It is also correct to state that many sheep (from evidence we have gathered, the overwhelming majority) do not open mouth pant for a “sustained period” until WBTs are well in excess of those contained in the HST distribution. LiveCorp provided abundant evidence of this in submissions to the HSRA Inquiry⁸, although it did not appear to be considered by the TRP.

Again, further evidence can be found from the May 2019 voyages. The mortality measures from the May voyages, used in the last section could be criticised for being an extreme measure of animal welfare. In light of this potential criticism we have also examined panting scores from the May voyages.

The May 2019 voyages provide further evidence that the overwhelming majority of sheep do not open mouth pant until WBTs are well in excess of 28°C. The maximum panting scores recorded for the majority of sheep on any deck and WBTs from each of the three May 2019 shipments are to be found in Figures 2.2 to 2.5.

Before examining information contained in Figures 2.2 to 2.5, it is necessary first to provide additional information on the panting score data shown in these figures. Livestock vessels have many decks on which sheep are carried and on each of these decks, at any point in time, sheep display a number of panting scores. It is common practice amongst AAVs to record one representative pant score per deck, equating to the pant score displayed by the majority of animals on that deck⁹. Also typically pant scores differ by deck. These differences reflect the type of animals carried on each deck and / or the environmental conditions applying to that deck. The pant score data shown in Figures 2.2 to 2.5 is the highest representative pant score recorded on any deck for that day of the voyage (days of the voyage are shown on the x-axis).

It can be seen from these Figures 2.2 to 2.5 that although WBTs peaked at almost 34°C the maximum representative pant score on any deck on any day during any of the three shipments did not exceed 2. In noting this, LiveCorp also recognises that some sheep may have been panting at above score 2 (indeed the Independent Observer reports note this) – but the vast majority did not. If panting by the majority of sheep is not to be used at the point of reference, but a proportion lower than the majority, this simply points to the importance of defining the number of animals that can be affected and the duration of panting – a task that, despite a number of reviews, still has not been undertaken. In the absence of such definitions LiveCorp has chosen to reference the modal pant score in Figures 2.2-2.5.

⁸ LiveCorp, 2019, Heat Stress Risk Assessment for the Export of Sheep to the Middle East, Response to the draft HSRA Report and recommendations by the Independent Heat Stress Risk Assessment Technical Reference Panel, Sydney, March.

⁹ For one of the three May voyages LiveCorp was provided with more detailed pant score data containing the estimated proportion of animals on each deck displaying a certain pant score. For this more detailed data the pant score was selected which pertained to the greatest number of animals on each deck. Through this process the more detailed data was rendered compatible with data more typically collected.

Figure 2.2: Voyage 1 of 3 Voyages in May 2019: Temperature and Pant Score Information

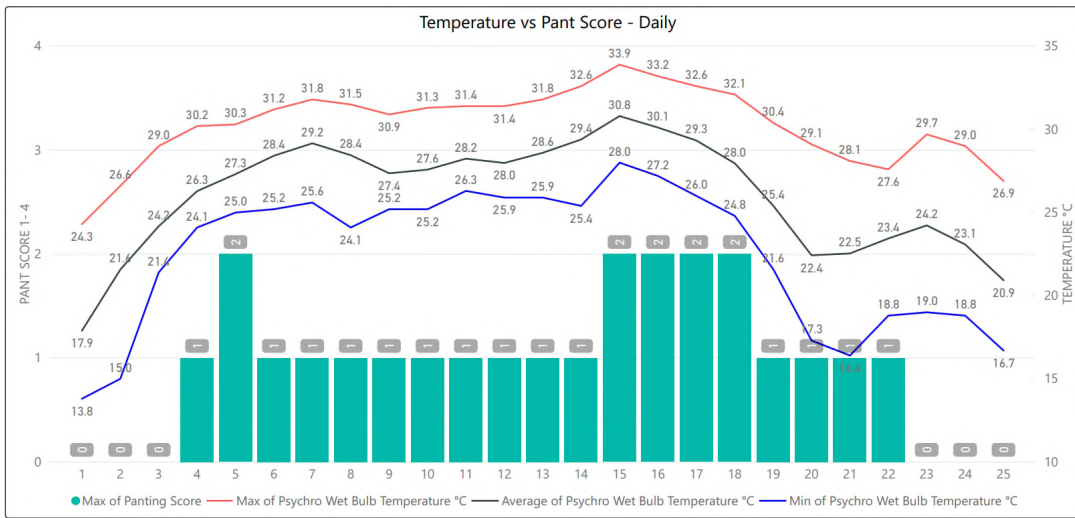


Figure 2.3: Voyage 2 of 3 Voyages in May 2019: Temperature and Pant Score Information

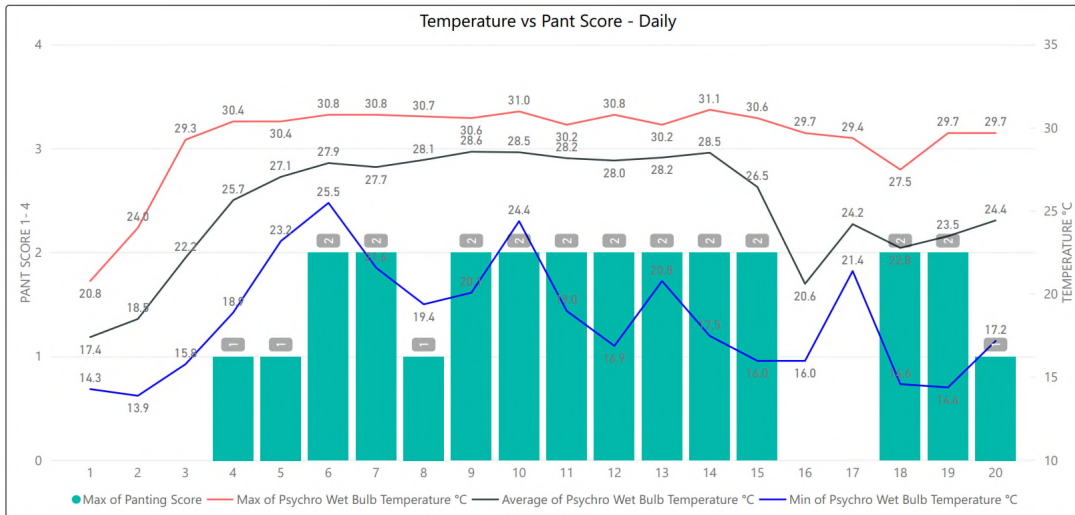
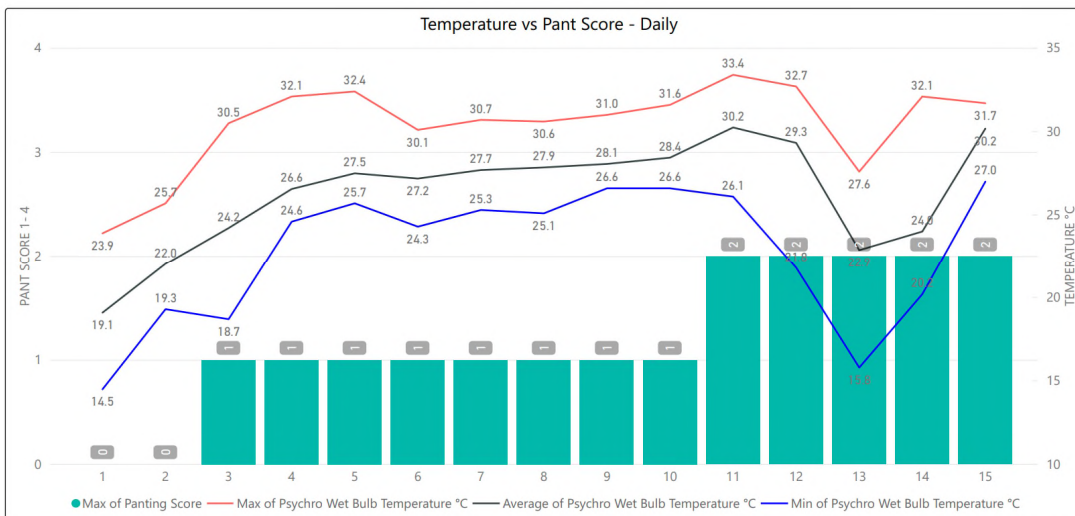


Figure 2.5: Voyage 3 of 3 Voyages in May 2019: Temperature and Pant Score Information



2.4 The work of Professor Shane Maloney which explicitly accounts for duration

Professor Shane Maloney in work commissioned by LiveCorp devised a more sophisticated relationship between WBT and possible implications for animal welfare, than that produced by the TRP, taking into account duration. Professor Maloney is regarded as one of Australia’s pre-eminent authorities on heat stress in animals.

The main figure in Professor Maloney’s analysis is reproduced below as Figure 2.6 in the hope that it will support the Department in further work and that if it is not considered useful at least an explanation may be given of why.

In Figure 2.6:

- Green coding indicates a combination of WBT and time that presents no adverse welfare outcomes
- Orange coding indicates a combination of WBT and time that begins to present adverse welfare outcomes
- Red coding indicates a combination of WBT and time that presents adverse welfare outcomes.

Figure 2.6: Analysis by Professor Maloney on impact on wet bulb temperature on panting (phase II) taking into account duration

		Time of exposure (h)						
		12	24	36	48	60	72	84
Wet-bulb temperature (°C)	27	Green	Green	Green	Green	Green	Green	Green
	28	Green	Green	Green	Green	Green	Green	Green
	29	Green	Green	Green	Green	Green	Green	Green
	30	Green	Green	Green	Green	Orange	Orange	Red
	31	Green	Green	Green	Orange	Orange	Red	Red
	32	Green	Green	Orange	Orange	Red	Red	Red
	33	Green	Orange	Orange	Red	Red	Red	Red
	34	Orange	Orange	Red	Red	Red	Red	Red
	35	Red	Red	Red	Red	Red	Red	Red
	36	Red	Red	Red	Red	Red	Red	Red

It is the observation of Professor Maloney that animal welfare (as measured by panting) is not compromised unless the wet bulb temperature is in excess of 33°C for 12 hours, 32°C for 24 hours, or 30°C for 48 hours. Professor Maloney openly concedes that these values are based on incomplete evidence and should be subject to further testing.

LiveCorp in submissions to the TRP also showed how duration could conceptually be incorporated into a revised HSRA model, but again this work did not appear to be considered by the TRP.

The more sophisticated representation of the possible impact of WBTs on welfare by Professor Maloney, with the incorporation of duration, is useful when considering the impact of higher temperatures which may be encountered for a short period – e.g. when vessels are passing through the Straits of Hormuz or the Bab-el-Mandeb Strait.

2.5 Conclusion

It has been shown in this chapter that all options under consideration for regulating heat stress in sheep exported to the Middle East, including option 4, will result in significant improvements in animal welfare.

To be definitive beyond this requires the regulator to provide clarity and precision around measures to be used to define welfare (CBT, pant score or some other measure/s), including setting breakpoints between acceptable and unacceptable levels. Precision in defining acceptable animal welfare outcomes necessarily involves referencing duration. Such clarity and precision will allow analysis to be undertaken of the environmental conditions that may give rise to unacceptable welfare outcomes. This would result in a solid, scientific approach being used to analyse the relationship between environmental conditions and animal welfare outcomes. Further suggestions using this approach are contained in Chapter 6.

3 Economic impact

In this chapter the economic impact of each of the options contained in the Department's discussion paper will be examined.

The relative economic impact of each option will be closely related to the length of time the trade in sheep to the Middle East will be fully or partially closed. In this chapter we examine the length of time the trade will be closed under each of the options as well as the impact on the live export supply chain in Western Australia.

3.1 Length of trade closure under each option

The length of time the trade is closed under Options 1 and 2 is evident from the specification of the option: under Option 1 the closure is for three months and for Option 2 the closure is for 3¾ months.

3.1.1 Analysis of length of trade closure under Option 3

For Option 3 the length of closure is uncertain, due to two factors:

- The option, as expressed, contains flexibility in final construction. The option refers to “*a revised HSRA model based on HSTs or an approach based on agreed animal welfare indicators*” without the exact form of the revisions being specified.
- As the option does not specify a period of closure this must be calculated using assumptions of the form the HSRA model will take.

The approach taken by LiveCorp was the following:

- To assume that the revisions to the HSRA model involve using the HST distribution as per the TRP's recommendations¹⁰. In accordance with the TRP's recommendations, the HST distributions have been used to calculate threshold wet bulb temperatures for each animal type. These threshold temperatures as well as being variant across animal types are also different across months of the year due to different acclimatisation.
- Calculating the 98th percentile highest environmental wet bulb temperatures for voyages to Aqaba and Kuwait using information from the HSRA model.
- Calculating heat generated by the animals themselves based on the new ASEL allometric loading densities. This was done across a range of Pen Air Turnover (PAT) values – from a PAT of 125 to a PAT of 200. Equations from the HSRA model (and available in the HSRA reports) were used in these calculations.
- Adding the heat generated by the animals themselves to the environmental temperatures to derive the 98th percentile deck temperatures (this represents the wet bulb temperatures that would exist on the deck of a livestock carrying vessel at the 98th percentile level). The heat generated by the animals themselves was small relative to the level of environmental heat – resulting in a rise of about 1.2°C to 2.1°C, depending on the animal type and PAT value.
- Comparing the threshold wet bulb temperature with the deck wet bulb temperature. If the deck temperature exceeds the threshold temperature, the voyage would not be permitted.

¹⁰ As noted in a previous footnote, the TRP in their draft report deducted 0.7°C off the actual HST value for the standard, apparently due to the application of conservatism. It is unclear in the final report whether the 0.7°C deduction still applies. It has been assumed in the analysis contained in this chapter that the deduction does not occur. The period of trade closure would be longer if the TRP's draft report recommendations were to apply.

These calculations were done for three animal types:

- The TRP’s standard animal – a 56kg, body condition score 3, recently shorn Merino wether, sourced from zone 3. Instead of this illustrative wether being winter acclimatised (as in the TRP’s draft report) we have designated acclimatisation to the month in which shipment occurs.
- A Merino shipper – a 45kg, body condition score 3, recently shorn (i.e. with a coat of under 10mm) wether, sourced from zone 3, acclimatised to the month in which shipment occurs.
- A Standard Merino lamb – specified here with a weight of 40kg, body condition score of 3, recently shorn (i.e. with a coat of under 10mm), sourced from zone 3 and acclimatised as above.

Results from the process outlined above, as applied to voyage to Aqaba, is shown in Table 3.1. The colour coding in this table is as follows:

- Red = Shipments cannot occur for all PAT values examined.
- Amber = Shipments can occur for some PAT values examined.
- Green = Shipments can occur for any PAT value examined.

Table 3.1: Trade impact of application of TRP’s recommendations across animal types for voyages to Aqaba.

Animal Type	Month of shipment											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TRP standard animal	Green	Amber	Amber	Red	Red	Red	Red	Red	Red	Red	Red	Green
Merino shipper	Green	Green	Green	Amber	Red	Red	Red	Red	Red	Red	Amber	Green
Merino lamb	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red

It can be seen from Table 3.1 that adjusting the HSRA model, using the TRP’s recommendations, would result in the following outcomes across the PAT values tested:

- Lambs could not be shipped at any time during the year¹¹.
- Exports of “Merino shippers” would be prohibited for six months of the year and partially restricted for another two months (for some PAT values tested).
- Exports of the TRP’s standard animal would be prohibited during eight months of the year, would be partially restricted for February and March, but would be allowed in December and January.

¹¹ We note that one of the TRP’s recommendations in their final report was that “*The definition of lamb and the appropriate associated heat stress thresholds (HSTs) in the heat stress risk assessment (HSRA) model should be revised to reflect the animal’s capacity to thermoregulate. The lower HSTs in the HSRA model for lambs would be biologically more appropriate for immature animals aged less than 12 months of age, rather than the marketing-based definition of a lamb. Further refinement of the age at which mature thermal tolerance is reached should be undertaken*”. In making this statement effectively the TRP determined that the HST distribution in HSRA model for lambs was incorrect. This gives rise to an obvious question: how much confidence can be placed by the TRP on the HST distributions for all classes of animals other than the “standard” animal (which is no longer representative of the trade)? An issue of the TRP was that it based its examination of the HSRA model almost entirely on the standard animal. This was a small portion of the task the TRP was assigned – the TRP was meant to examine the HSRA model as a whole. No adjustment for lambs from the values provided by the model has been made in the analysis reported above – since the TRP made no recommendation on precisely what this adjustment should be.

Table 3.2 repeats the information in Table 3.1 but for voyages to Kuwait.

Table 3.2: Trade impact of application of TRP’s recommendations across animal types for voyages to Kuwait.

Animal Type	Month of shipment											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TRP standard animal	Green	Green	Green	Orange	Red	Red	Red	Red	Red	Red	Green	Green
Merino shipper	Green	Green	Green	Green	Red	Red	Red	Red	Red	Red	Green	Green
Merino lamb	Orange	Orange	Red	Red	Red	Red	Red	Red	Red	Red	Red	Orange

The situation for Kuwait is slightly better than for Aqaba, but shipments would be prohibited for much of the year.

3.1.2 Summary of the length of trade closure under each option

Table 3.3 summarises the length of trade closure under each option for the merino shipper category of animal. In this table the green shading signifies the trade is open, the orange shading signifies the trade is partially closed (either to some destinations e.g. Red Sea Vs Gulf and / or across some PAT values examined) and red shows the trade is closed (across all PAT values examined).

Table 3.3: Trade impact of each option using the ‘merino shipper’ category of animal.

DAWR option	Month of shipment											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Option 1	Green	Green	Green	Green	Green	Red	Red	Red	Green	Green	Green	Green
Option 2	Green	Green	Green	Green	Green	Red	Red	Red	Orange	Green	Green	Green
Option 3	Green	Green	Green	Orange	Red	Red	Red	Red	Red	Red	Orange	Green
Option 4*	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

* Additional space would be allocated under the current HSRA model for the hotter months.

It can be seen from Table 3 that Option 4 has the least impact on the trade, whereas under Option 3 the trade is either fully or partially closed for 8 months of the year.

The situation is, in fact, potentially worse than that shown in Table 3.3 once total shipments, including lambs, are considered (and not just shipments consisting entirely of Merino shippers). According to the TRP, lambs represent the majority of shipments. Depending on the HST modifications made for lambs (and these are unclear from the TRP’s recommendations) the trade may be uneconomic for almost all of the year.

3.2 Impact on the Western Australian live export supply chain

LiveCorp has recently commissioned Mercado to undertake analyses into the economic importance of the live sheep trade to participants, including producers, in the Western Australia live export supply chain and to assess the impact of the three-month industry moratorium on sheep exports to the Middle East. It is to be noted that two of the options contained in the Department’s discussion paper involve a prohibition on shipments for more than 3 months and, therefore, will have an impact greater than indicated by Mercado. The conclusions of the Mercado work will be reported separately to the Department – most likely as part of the following RIS process – however, an abridged version of the relevant section in the report is provided below.

3.2.1 Importance to Western Australian sheep producers

- The live export trade is one of the most important risk management tools in the arsenal of Western Australian sheep farmers. The highly seasonal nature of production in key sheep

regions of WA, means that many farmers rely on the live export trade as their 'relief valve' when conditions are poor.

- In seasons of low rainfall in autumn or persisting dry, producers will turn-off wethers to manage their stocking density based on the limited available feed and/or water.
- Light Merino wethers are not in a condition suitable for local processing markets but are well suited to the live export market. Lack of pastures in more marginal areas inhibits wethers from gaining enough weight to be sold to processors.
- The live export market provides a stable price floor in the sheep market. Fewer buyers are present in WA sheep markets compared to eastern markets. Thus, competition is heavily reliant on the presence of buying activity for the live export trade to improve competitiveness and prices received for stock. Analysis undertaken by Mecardo demonstrates that during the moratorium period, the normal price discount in WA compared to eastern markets, widened further due to lack of competition. On resumption of the live export trade, WA prices returned to the average discount.

3.2.2 Importance to Western Australian road transport operators

- Road transport operators in Western Australia are highly dependent on the live export trade compared to many other participants in the value chain (averaging 25-50% of business revenue, and an upper range of 85%).
- The movement of livestock on road requires specialist skills and bespoke vehicles, facilities and loading equipment. Stock trucks are not designed to carry any bulk loads other than livestock which restricts the transportation work available to these operators.
- For most livestock transport operators in WA, the moratorium has had severe consequences for their business. On average, the sale of sheep from farm to the live export trade requires 3.5 movements. In comparison, sheep sold to a WA abattoir would be moved just 1.5 times. This is a significant reduction in available work which was fiercely competed for by an influx of operators.
- Most transport operators experienced a drastic reduction in their turnover as a result of the industry moratorium. In high-cost businesses, this caused strain on cash flow. Some larger operators requested that staff access annual leave entitlements or reduced contracted staff hours during the moratorium period.
- The worst findings amongst the Mercado consultations were some single truck operators that experienced a collapse in their business model.
- Transport operators reported a significant flow on effect to their suppliers in regional towns as a result of having trucks sidelined.

3.2.3 Shearing services

- Shearing services are another important part of the live export supply chain, with the requirement that all sheep must be shorn before export.
- In WA, shearing ewes and crutching lambs occurs between September and April, avoiding the wettest months of the year. The shearing of wethers intended for the live export trade fills in what would otherwise be a gap in the work calendar for shearing service providers through the May to July period (off season).
- The impact of the industry moratorium for shearing service providers is a major distortion to the distribution of their workload.
- Concerns were also expressed for the social and mental health issues in regional communities, caused by the imbalance between demanding and strenuous work periods (shearers working long days and weekends in peak season) and no work. *"There is a noticeable (negative social) effect in regional towns when people are off work".*

3.2.4 Agents and saleyards

- In WA, the live export trade underpins 35% of the agency business. The agent's role is to find the best marketing option for his customers stock and for many, the live export trade is the best option.
- While the financial implication of the moratorium is not as significant for livestock agents as for other participants in the supply chain, they have still experienced consequences. *"The moratorium has disrupted the marketing system that we've had in place for decades"*.
- The impact of the live export moratorium on individual livestock agents is highly dependent on their region. In key live export supply regions, some agents noted that 30-40% of their revenue was reliant on the live sheep export trade.
- Most agents reported that without the live trade, alternative buyers were difficult to find.

3.2.5 Fodder manufacturers and growers

- The live export trade is not only an important marketing destination for livestock in Western Australia but acts as a significant end customer of feed and grain products.
- There are a number of feed manufacture businesses based in regional WA that supply feed products to exporters. The proportion of product sold to domestic markets versus live export varies from business to business. For some manufacturers that have focused their business on supplying to live export, more than 90% of their revenue comes from the trade.
- The moratorium on the live sheep trade significantly impacted the operations of fodder manufacturers that rely heavily on this market. Planning for fodder manufacture begins 12 months prior to sale, therefore the shipping standstills and moratorium experienced in 2018 and 2019 left fodder manufacturers with no capacity to prepare and adapt to the significantly lower demand for product. Even the three-week extension was problematic for manufacturers as live export fodder cannot be stored.
- Fodder manufacturers are an important source of employment in WA, providing work for manufacturing staff directly, and contract bailers and straw suppliers. One manufacturer reported that during the moratorium, they had to reduce their operational capacity to 65-70%. As a result, one third of their casual staff were not required for this time.

3.2.6 Exporters

- The impact on exporters of the moratorium is twofold. Firstly, there is the economic cost of carrying non income producing assets through the moratorium period and the reputational cost due to exporters inability to provide reliable supply to markets where we have a long history of trade and business relationships maintained over decades. Secondly, there is the cost borne by contract staff that are engaged directly by exporters (and occasionally importers) only when live export vessels are scheduled to operate. These include veterinarians and other down chain participants, such as onboard stock handlers, sheep buyers and quality control staff, etc.
- In relation to economic costs, exporters consulted have noted between a 10-25% reduction in revenue during the suspension in the trade during 2018 and a 5%-15% reduction in revenue during the 2019 moratorium period. Some exporters were able to re-direct their business focus during the 2019 season as there was increased lead time with which to plan.

3.2.7 Veterinarians

- Veterinarians involved in the live sheep export are specialised to practice at one of a number of possible points in the supply chain. These include on-farm animal health services, Australian Government Accredited Veterinarians (AAVs) in preparation of animals prior to voyage or onboard AAV.

- AAV's that are contracted by exporters are completely reliant on the trade's operation. The role of an AAV in live export is specialised hence there is little opportunity to supplement or replace with other contract work in WA.

3.2.8 Associated down chain participants

- Several diverse services in Australia are owned, employed or contracted by exporters and importers to fulfil each shipment. They include registered premises staff, sheep buyers, shipping services, stevedores, AAV's, stockmen, quality control specialists, ship owners and port authorities.
- Many of the individuals consulted for this research found no alternate revenue streams within their field of skills during the moratorium period.

3.3 Conclusion

The work of Mercado shows that even the three-month industry moratorium severely impacts a wide range of businesses in Western Australia. Ideally, to minimise suffering by these businesses, any trade suspension would be substantially less than three months. However, Option 2 (somewhat) and 3 (significantly) increase the level of trade suspension. Implementation of Option 3 (using the TRP's interpretation of this option) would have a devastating economic impact on a number of businesses in Western Australia.

4 Impact on importing countries and Australia's trading reputation

In this chapter the impact of each option on importing countries and Australia's trading reputations will be examined.

The impact of each option for importing countries and Australia's trading reputation will be closely related to the length of trade closure, that was analysed in the previous chapter.

4.1 Impact on importing countries

Bill Farmer noted in his 2011 review: "... food security concerns, a preference for freshly slaughtered meat, infrastructure constraints and religious and cultural factors all play a role in driving demand for Australian livestock exports". Focussing on Middle East markets, ABARES have noted that the preference for fresh meat stems primarily from religious and cultural factors¹². Halal and Kosher traditions place strict requirements on how an animal must be slaughtered, and on treatment before and after slaughter. While there is a valuable export trade in meat which is slaughtered and prepared in line with religious requirements, there is still a preference within Middle Eastern countries to slaughter animals under the auspices of local religious officials, in order to maintain control over the process.

In a trip made by the previous Minister for Agriculture, David Littleproud, to the Middle East in May 2018, Government representatives from Kuwait, Qatar and the United Arab Emirates (UAE) emphasized the importance of their citizens having access to freshly slaughtered meat.

Some Middle East countries, including Kuwait, have been involved in importing sheep from Australia for more than half a century. Although Kuwait, Qatar and the UAE are able to source sheep from other countries, they have a significant preference for Australian sheep due to inherent characteristics such as Australia's status as a supplier free from major diseases and customer preference.

Minister Littleproud's trip to the Middle East in 2018 was made to assure customers that Australia would continue to trade to the region¹³. The Minister later urged Australian exporters to ship through the northern summer:

"Exporters who value the trade know we need to show Qatar, Kuwait and the UAE we can give them supply through their summer.

We also need to show Australians the trade can be done properly through the Middle Eastern summer and rebuild public support for this industry' he [Minister Littleproud] said".¹⁴

A relevant question is whether a complete trade ban lasting six to eight months, as would occur from implementation of the TRP's recommendations (one interpretation of Option 3), is in accord with commitments made in 2018. A similar comment applies to Option 2 which would place a trade ban for almost one-third of the year.

¹² Drum, F. and Gunning-Trant, C., 2008, "Live animal exports: a profile of the Australian industry", *ABARE Research Report 08.1*, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

¹³ See AAP, 2018, Australia's agriculture minister will assure Kuwait and Qatar the live sheep trade is going to continue, 19 May 2018, amongst numerous other similar press reports.

¹⁴ Sim, T., 2018, "Agriculture Minister Littleproud urged to meet WA live sheep exporters", *Sheep Central*, 31 July 2018, <https://www.sheepcentral.com/agriculture-minister-littleproud-urged-to-meet-wa-live-sheep-exporters/>.

4.2 Impact on Australia's trading reputation

The above matters also have a bearing on Australia's reputation as a reliable trading partner particularly in goods associated with food security.

From information available to LiveCorp there is no doubt that the constant changes in live export regulations over the past eight years, including trade bans in two regions, has damaged Australia's reputation as a reliable supplier of livestock – with some effect on Australia's reputation overall.

Further major changes in regulations, particularly if these lack a firm scientific base, will only inflict further damage on our reputation.

5 Data to be collected on future live export voyages

The Department requested that submissions contain comment on the data to be collected on future voyages to the Middle East. LiveCorp has recently made a submission to the Inspector General of Live Animal Exports (IGLAE) on data collection for live export voyages generally. This part of the current submission is largely drawn from that work.

5.1 Data currently collected on livestock export voyages and that proposed in the ASEL Review

Table 5.1 lists data to be reported by the AAV / accredited stockperson for voyages of 10 days or more (i) under current ASEL 2.3 arrangements and (ii) under changes to ASEL proposed from the most recent review. It can be seen that very extensive data is collected and reported to the Government.

The amount of data that is reported by the AAV / accredited stockperson varies by the length of the voyage and other voyage, vessel and livestock characteristics. However, for a voyage to the Middle East with the following characteristics:

- 15 days duration;
- using a vessel with 12 decks (with fore and aft sections being considered separate “decks”, as reflected in current practice);
- carrying sheep and cattle; and
- with mortalities well below the notifiable rate

over 1,000 separate data items currently need to be reported to Government. Under proposed changes to ASEL, the number of separate data items to be reported would increase to about 7,000 for this voyage – a seven-fold increase.¹⁵

Table 5.1 Current data collection requirements under ASEL and proposed requirements

Information item	ASEL 2.3	Data proposed
1. Veterinarian's name / AAV accreditation #	✓	✓
2. Stockman's name	✓	✓
3. Vessel name	✓	✓
4. Voyage number	✓	✓
5. Planned voyage duration, including load and discharge days		✓
6. Departure port(s)	✓	✓
7. No of animals loaded by port and species	✓	✓
8. Date of report	Daily	Daily
9. Day of voyage (must be consistent with day used by vessel Master)	Daily	Daily
10. Vessel position	Daily	Daily
11. Vessel ETA at next port	Daily	Daily

¹⁵ The 7,000 calculation includes taking measurements from two pens per deck for a number of animal welfare attributes (although variations in animal classes could require more than two pens per deck to be monitored).

Table 5.1 (cont.)

12. Daily environmental & other recordings – per deck or bridge		
▪ Average dry bulb temperature for each deck	Daily	Daily ^a
▪ Average wet bulb temperature for each deck	Daily	Daily ^a
▪ Relative humidity for each deck	Daily	Daily
▪ Respiratory character / pant score for each deck	Daily	See 13.
▪ Time in last 24 hours that fans were operational		Daily
▪ If above <24 reason for fans not being operational		Daily
▪ Bridge dry bulb temperature	Daily	Daily
▪ Bridge wet bulb temperature	Daily	Daily
▪ Bridge relative humidity	Daily	Daily
▪ Conditions e.g. Sea swell (1) calm, (2) moderate, (3) rough		Daily ^b
▪ Faeces - average for each cattle deck: (1) normal, (2) sloppy, (3) runny diarrhoea, (4) like sheep pellets	Daily	See 13.
▪ Feed consumption - average per head	Daily	Daily
▪ Water consumption - average per head	Daily	Daily
▪ Issues with feed & water (including sufficiency & maintenance issues)	✓	✓ See 13.
13. Detailed animal health & welfare measures - 2 representative pens for each species per deck		
▪ Pen ID		Daily
▪ Breed / line in pen		Daily
▪ General pen demeanour - (1) alert, (2) active, (3) lethargic, (4) anxious, (5) dull, (6) other		Daily
▪ Fodder type - (1) pellets only / (2) pellets mixed with chaff		Daily
▪ Feeding behaviour - (1) mild to no jostling, (2) most jostling/lunging, (3) aggressive/smothering		Daily
▪ Comment on trough space (1) adequate, (2) inadequate		Daily
▪ Water quality (1) clean, (2) moderately clean (3) dirty		Daily
▪ Comment on any water supply issue		Daily
▪ Faeces type - (1) normal, (2) sloppy, (3) runny diarrhoea, (4) firm pellets		Daily
▪ Manure pad score - (1) dry, (2) tacky (3) sloppy		Daily
▪ Panting score – scale 0 to 4		Daily
▪ If panting >= PS2, % panting at each score		Daily
14. Basic health related information		
▪ Number euthanised per day by species	Daily	See 16
▪ Number dying by natural causes per day by species	Daily	See 16
▪ Comment on causes of mortality	Daily	See 16
▪ Sick pen report, including medications and treatments	✓	See 16
▪ Number of births	✓	See 17
▪ Number of abortions	✓	See 17
15. Detailed health related information		
▪ Deck ID		Daily
▪ Pen ID		Daily
▪ Animal tag ID		Daily
▪ Species / class (e.g. sheep / slaughter)		Daily
▪ Clinical sign		Daily
▪ Treatment / actions taken		Daily
▪ For sheep to Middle East # of sheep showing clinical signs of scabby mouth		Daily
16. Detailed mortalities report		
▪ Deck ID		Daily
▪ Pen ID		Daily
▪ Animal tag ID		Daily
▪ Species / class (e.g. sheep / slaughter)		Daily
▪ Number euthanised		Daily
▪ Number found dead		Daily

Table 5.1 (cont.)

17. Detailed births / abortions report		
▪ Deck ID		Daily
▪ Pen ID		Daily
▪ Animal tag ID		Daily
▪ Births by day		Daily
▪ Abortions by day		Daily
▪ For each abortion estimated stage of pregnancy		Daily
18. Comments, including issues from daily meeting, general conditions, including deck conditions	Daily	Daily
19. Relationships with master/crew/accredited stock person/accredited veterinarian	✓	✓
20. Discharge port(s)	✓	✓
21. No of animals unloaded by port and species	✓	✓
22. Comments on discharge operations	✓	✓
23. Actual voyage duration, including load and discharge days		✓
24. Average daily mortality rate		✓

Notes:

^a If panting of score 3 or 4 is recorded wet and dry bulb temperatures must be taken twice daily near those pens.

^b In the proposed changes to ASEL sea conditions are presented just as an example – comments are to be made on further unspecified environmental conditions.

5.2 Outcomes based reporting required

It has been the consistent view of LiveCorp that regulation of the livestock export trade should be on an outcomes basis and this includes how compliance is monitored. Data collection, therefore, should be directed at measuring the welfare outcomes achieved, rather than the means used to achieve these outcomes.

An outcomes-based approach to live export voyage regulation would rely on several essential elements, including:

- Agreed outcomes, as they relate to animal health and welfare to be achieved on the livestock export voyage;
- Defined performance targets, as they relate to the agreed outcomes; and
- A compliance monitoring and management framework that provides an accurate picture of performance against those defined targets and agreed outcomes, and sets appropriate incentives and remedial / punitive mechanisms.

As pointed out in Chapter 2, the challenge for the regulator is to define the welfare outcomes it wants from voyages to the Middle East. Once these outcomes have been determined it will be possible to be more definitive about the data that should be collected.

5.3 Suggestions on data to be collected

In the absence of clearly defined statements from the regulator on the welfare outcomes to be achieved during livestock export voyages, it is difficult to be definitive about the data to be collected and included in reports to Government.

Until further research is conducted and animal welfare outcomes are clearly defined, given the expense involved in data collection, there is merit in limiting the number of items that must be measured. In this regard, the ASEL Technical Advisory Committee in requiring over 7,000 pieces of data be collected on a 15 day voyage, may have placed an imposition on the industry that cannot be justified in terms of compliance monitoring and the costs / benefits.

A data collection and reporting framework predicated on an outcomes-based framework is likely to be much more closely aligned with the original ASEL daily and EOVR reports than those suggested in the ASEL Review recommendations, focussing on key factors such as:

- mortalities;
- respiratory character / pant scores per deck;
- feed consumption - average per head;
- water consumption - average per head;
- issues with feed & water (including sufficiency & maintenance issues); and
- important environmental correlates used in industry tools.

In addition to creating an outcomes-based data collection and reporting framework, as outlined above, LiveCorp recognises that in the short term some additional data collection may be necessary to inform the development of a new HSRA model. The collection of additional data, however, should be time bound and with the research purposes clearly articulated.

6 Defining an Option 5

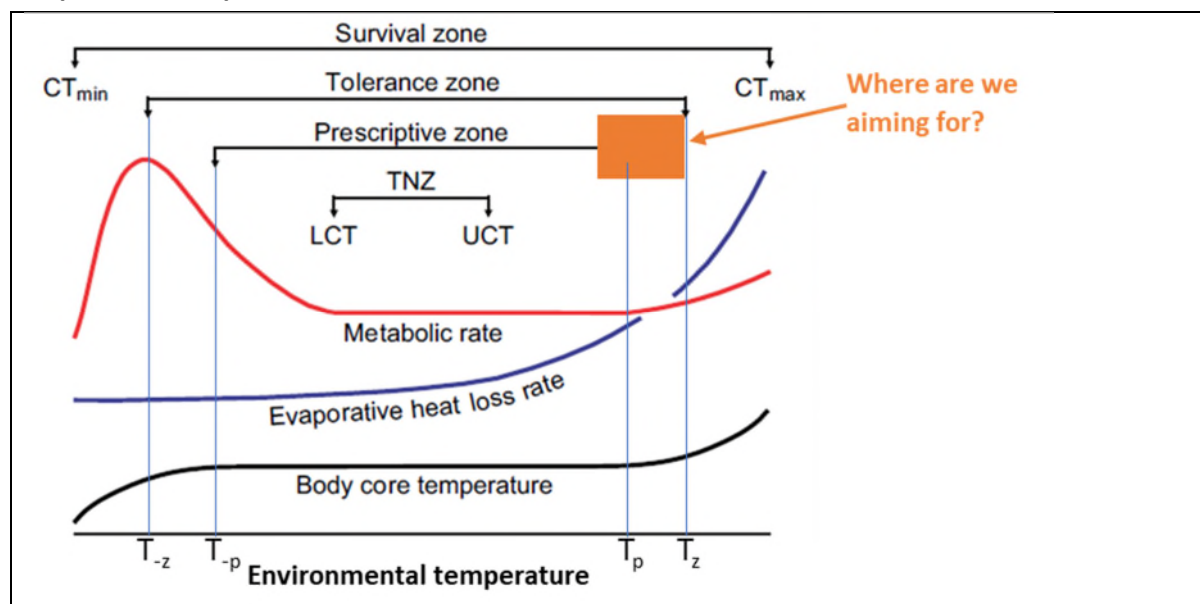
The department invited submissions on the discussion paper to include information on new options that could be considered. The purpose of this short chapter is to identify a new option that reflects major elements of both the TRP and McCarthy reviews. A conceptual framework for the new option is presented below; further work would be necessary to operationalise the new option, but this work could be prioritised by LiveCorp.

6.1 The relationship between environmental temperature and heat stress

The new option can be explained by reference to Figure 6.1. Figure 6.1 contains a framework used to depict the impact of heat stress on an animal (Figure 6.1 below closely mirrors Figure 1 in the TRP's final report).

Figure 6.1 depicts the relationship between environmental temperature, core body temperature, evaporative heat loss rate, and metabolic rate of mammals. In the case of live exports, the relevant environmental temperature is taken to be represented by wet bulb temperature.

Figure 6.1: The relationship between the environmental temperature and the core body temperature, evaporative heat loss rate, and metabolic rate of mammals.



Shown in Figure 6.1 are four zones of thermal safety:

- The Thermoneutral Zone (TNZ) is the range of environmental temperatures which are perfect for the animal in terms of maintaining core body temperature, so the animal does not have to use energy to either increase or decrease body temperature. As Mitchell et al. point out, free-living mammals spend very little of their lives within the TNZ.¹⁶
- In the Prescriptive zone, outside the TNZ, stable body temperatures are maintained by increasing metabolic rate and evaporative heat loss (water loss). Animals can live within the prescriptive zone over the long term.

¹⁶ Mitchell, D., Snelling, E.P., Hetem, R.S., Maloney, S.K., Strauss, W.M. and Fuller, A., 2018, "Revisiting concepts of thermal physiology: Predicting responses of mammals to climate change", *Journal of Animal Ecology*, Vol. 87, pp956-73 – see, especially, p959 and p963.

- In the Tolerance zone, outside the prescriptive zone, core body temperatures rise, but the animal employs mechanisms to stabilize core body temperatures – survival of individuals is not threatened.
- In the Survival zone, outside the tolerance zone, individual lives are at risk (e.g. from heatstroke or cold injury).

It has been agreed by government, the livestock export industry and animal groups that the current HSRA model for assessing heat stress risk in sheep shipments to the Middle East is no longer appropriate. This model sets a WBT threshold slightly greater than T_z (for some animals). It has now been agreed that the WBT threshold should be less than T_z .

6.2 HST distribution does not equate to heat stress or open mouth panting

The TRP advocated that the HST distribution be used to determine the WBT threshold to be applied. As the original authors of the HSRA model observed, the HST distribution defines the WBT when the animal is on the **verge** of becoming heat stressed:

*“When the local air wet bulb temperature reaches any animal’s HST, the animal is on the verge of becoming stressed”.*¹⁷

The TRP recognized this when it stated:

*“Using the heat stress threshold as the cut off WBT may alleviate concerns about duration of exposure, because it appears that the animals are able to make physiological adjustment over time because they are within their ‘prescriptive zone’ as defined above”.*¹⁸

That is, the HST distribution is formed at a point around T_p and, according to the TRP, may even be less than T_p (since the animal is within its prescriptive zone).

There is evidence, however, that open mouth panting for a sustained period is defined by a point greater than T_p and less than T_z . A new distribution is required to define this point across a group of animals. It is neither defined by the HST distribution (which is around or slightly less than T_p), nor by the mortality limit distribution used in the current HSRA model (which is greater than T_z for some animals).

This new distribution would be defined in the area where there is some rise in CBT but the animal uses mechanisms to stabilise these. As Shane Maloney notes:

“Within the tolerance zone, and particularly towards the lower end, the animal remains able to thermoregulate (that is, to establish heat balance) via normal physiological mechanisms, but reaches heat balance at a slightly higher core temperature. ... This does not immediately or necessarily equate to physiological harm. Heart rate, peripheral perfusion, respiratory rate, and some behaviours, all change within the prescriptive zone, and continue to change within the tolerance zone”.

Shane Maloney places the transitions to Phase II panting as consistent with a rise in core temperature of between 0.5 to 1.0°C (for the average animal).

¹⁷ Maunsell Australia 2003, Development of a heat stress risk management model, project code LIVE.116, Meat & Livestock Australia, North Sydney, p24.

¹⁸ HSRA Technical Reference Panel 2019, Final report by the Heat Stress Risk Assessment Technical Reference Panel, Department of Agriculture and Water Resources, Canberra, May, p13.

Within the ecological focus of their research, Mitchell et al. are quite clear that when the welfare focus is on individual animals the upper environmental temperature threshold should be placed at T_z :

“If it is the welfare of individual animals that are of concern, then it [the safe thermal limits] should be the lower and upper ends of the tolerance zone”.

This placement by Mitchell et al. of the upper environmental temperature threshold at T_z is based on the following observations:

- Survival of individuals is not threatened at temperatures up to T_z .
- Large mammals, such as sheep and cattle, spend a significant amount of time in a state of heterothermy – that is, between ambient temperatures of T_{-z} to T_p and T_p to T_z .
- Animals (including humans) will only maintain homeothermy if the following conditions are met: they are healthy, at rest, well-resourced and not facing demands from competing homeostatic mechanisms.
- If these conditions are not met, animals will be in the tolerance zone and this will often be the case.

It is, therefore, proposed that if an animal welfare based HSRA model is to be used that the model be modified by defining a new distribution that identifies the WBT threshold at which open mouth panting for a sustained period occurs (or another agreed welfare measure). Following the lead of the TRP, the modal point on this distribution should be used to define conditions at which shipments involving particular categories of animals can occur. The exact position of the new distribution will be determined by matters considered in the next chapter.

7 Suggestions on a way forward

Previous chapters in this submission have examined the animal welfare, economic and trade and reputational implications of options contained in the Department's discussion paper for regulating the live sheep trade to the Middle East. Data needed to support ongoing analysis and improvements to live animal export regulation was also discussed.

A key theme running through these previous chapters, particularly Chapter 2, was that all the reviews conducted to date had been unable to provide a clear, precise statement of the welfare outcome required – although this should have been the starting point for any analysis.

The failure to start with a clear, precise statement of the welfare outcome/s required means that it is impossible to define the environmental conditions that might result in unacceptable animal welfare outcomes. (How can it be possible when the outcome itself is undefined?)

While critical that ongoing reviews have avoided defining a clear, precise statement of the welfare outcome required, LiveCorp is also cognisant of the complexities of changing from a mortalities basis for regulating the trade to an animal welfare basis. A methodical approach needs to be adopted that will provide certainty both to the regulator and the regulated.

This chapter, therefore, sets out what needs to be done and a work program for completing identified tasks.

7.1 The form of a new welfare objective on which to regulate the trade

Any regulatory objective needs to contain two primary elements: (i) the target to be aimed for and (ii) the degree of certainty with which the target must be achieved.

In the context of regulating animal welfare outcomes associated with heat stress, defining the target involves:

1. Precisely defining what is to be measured as an indicator or indicators of heat stress (including, in the case of the latter, how aggregation is to occur);
2. Using the measure established under (1), defining the proportion of animals displaying signs of heat stress before welfare outcomes are determined to be unacceptable for the shipment (recognising genetic differences occur and that any observed measure of heat stress will be imperfect);
3. Using the measure established under (1), defining the period of time (duration) for which signs of heat stress can occur before welfare outcomes are determined to be unacceptably compromised.

Using open mouth panting as an example of the welfare measure used, the regulatory objective then is defined as:

“To ensure that there is less than a X% probability of Y% of sheep in a shipment open mouth panting for more than Z hours”.

Where values for X, Y and Z need to be specified.

7.1.1 Precisely defining what is to be measured

As noted in Chapter 2, an indicator of heat stress that has been proposed in both the McCarthy and TRP Reviews has been panting score, but there is disagreement on how precisely this should be

measured. Both reviews proposed a 4 point ordinal scale for measuring panting but the specification of the scales differs considerably (see Appendix B).

It may also be that rather than measuring heat stress using a single measurement (pant score) a portfolio of measurements may be preferable with these being aggregated using defined procedures. Such an approach would be more reflective of the differences that exist between various scientists on the relevance of using panting alone as an indicator of welfare (e.g. is welfare compromised if an animal is panting, but its demeanour content or putting on weight?).

7.1.2 Proportion of animals affected

The second step is to set a threshold in terms of the number of animals affected before the indicator of heat stress is determined to reach an unacceptable level.

Some might argue that even if one animal is affected by heat stress this is unacceptable. But this ignores the following considerations:

- Animals pant in Australia. As the TRP itself noted, it is not uncommon for sheep to open mouth pant on a hot afternoon in Australia.
- Any indicator of heat stress will be imperfect. As pointed out in Chapter 2, panting can occur at low WBTs and when CBT has not risen at all.

The TRP in its final report suggested that the modal value of the probability distribution defined by point (1) (refer to Section 7.1) be used. As highlighted in LiveCorp's submission to the TRP's draft report there are sound reasons for this selection. It is proposed, therefore, that the modal value of the distribution be used.

7.1.3 Duration of panting

Any move to animal welfare of necessity must include the capacity to deal with **duration**. This is because welfare impact is clearly tied to duration. This is true of many areas of animal welfare. For instance, water deprivation is not considered an animal welfare issue unless it exceeds a certain amount of time (e.g. 48 hours for certain circumstances in the Land Transport Standards). Similar considerations apply to the provision of feed. And it is certainly the case with heat load.

As the TRP have noted:

"Duration of effect is an important aspect in considering the effects of high heat loads".

McCarthy is even more explicit:

*"Duration of exposure is an important dynamic in the development of heat stress. Without respite, sheep will take on heat load, and if this becomes excessive they may succumb to heat stress. On this basis, sustained exposure to heat may become just as intolerable as a short burst of severe heat stress, and this is important when the risk is being simply compared to a wet bulb temperature. The industry HSRA model does not factor the duration of exposure in its current form. **It is recommended that duration of exposure be included in the HSRA model in any future version...**"*

The department also considers that there is a duration component to heat stress. In explanatory notes on the decision to extend the prohibition of live sheep exports to, or through, the Middle East until 22 September the department stated: *"Based on limited research on duration of exposure, it is*

not the department's view that short periods of open mouth panting constitutes compromised welfare"¹⁹.

If heat load, as measured by rise in CBT and the presence of open mouth panting, were to be used as a criterion for animal welfare, without reference to duration, this would have profound implications for sheep farming in many areas of Australia.

In the view of LiveCorp, the 'Z' in the regulatory objective previously outlined must be explicitly stated. To do otherwise would imply that the regulator is acting in a manner that is not fully transparent and direct.

Furthermore, the 'Z' needs to be considered in conjunction with the 'Y' given that it will be impossible to measure responses in individual sheep – rather sheep pens in their entirety should be the subject of measurement.

7.1.4 Degree of certainty

Finally, the welfare impacts of heat load on a voyage is subject to a number of uncertainties. There are uncertainties over weather conditions, the genetic disposition of the sheep to cope with heat and uncertainty in measurement. Given risks exist, the regulator needs to specify the degree of certainty that will be required in meeting the regulated target.

7.2 A stepwise process to defining the regulatory objective and to developing the industry tools to meet this objective

In the view of LiveCorp it is unrealistic to immediately:

- implement a new animal welfare based regulatory objective designed to address the potential for heat stress on sheep shipments to the Middle East
- establish new industry tools to meet the new regulatory objective.

Both these tasks will take time and will require the analysis of data that is only now beginning to become available.

Because of this LiveCorp believes that a stepwise process for regulating the trade will be needed. This process is set out in the following subsections of this submission.

7.2.1 Industry moratorium / regulated prohibition.

A regulated prohibition on trade in sheep to the Middle East is currently in place to address the highest heat stress risk period. This moratorium was led by exporters for the months of June, July and August and later industry agreed to extend this period to the 14th of September for Persian/Arabian Gulf destinations.

We suggest that the industry specified moratorium period remain in place until a new regulatory objective has been defined and a revised HSRA model has been developed. LiveCorp will give priority to liaising with the regulator on a new regulatory objective and, particularly, developing a revised HSRA model.

7.2.2 Defining a new regulatory objective and redevelopment of the HSRA model.

Moratoriums or regulatory imposed prohibitions, however, are blunt regulatory tools and, at most, should only be implemented in the short term while more appropriate approaches are developed.

¹⁹ Department of Agriculture, 2019, *Explanatory note – Decision to extend the prohibition of live sheep exports to, or through the Middle East until 22 September, 2019*, Canberra, July.

Good regulatory practice involves the regulator defining the regulatory outcome to be met and then allowing individual companies or an industry to apply mechanisms to meet this outcome.

The regulatory outcome to be met should directly reference the welfare measures that needs to be achieved, not the environmental, shipboard and animal category conditions under which these measures may arise (of which there will be numerous combinations which may change over time with the introduction of new technologies or genetics). The latter is a task for the tools that industry needs to develop to meet the specified regulatory outcome.

The regulatory outcome to be met until recently was clear: *less than a 2% risk of 5% mortality*. This objective was evaluated for particular environmental, shipboard and animal category conditions using the industry's HSRA model.

An analogous process now needs to be developed for a new regulatory objective involving welfare – the objective has to be defined and then industry has to develop science-based tools to meet the objective.

In contrast to the structured, methodical approach outlined above, the various reviews to date have tried to take unjustified shortcuts by applying the existing industry tool for a task it was never designed to achieve. Given this, not surprisingly, the reviews have been critical of one another. For example, the TRP noted:

“McCarthy’s suggestion that the mortality limit (WBT) be lowered appears a relatively straightforward method by which the HSRA could be adapted to predict whether animals will be exposed to environmental heat conditions which compromise their welfare. However, there is currently no objective method to determine the percentage of the mortality limit that is appropriate to use, based on the welfare responses of the sheep”.

The TRP, instead focussed on the heat stress threshold (HST) distribution, associating this with panting and rise in CBT. The HST distribution is just one component of the existing HSRA model that has been dormant since the model was first developed and has never been tested. McCarthy, describes the HST distribution as “contentious”:

*“Inherent in the model is the heat stress threshold. This is a contentious measure and there are several definitions in the literature. In the construct of the HSRA model it is the point at which animals go from shedding heat by passive means to utilising more active means to remove heat from their body (i.e. raising their respiratory rate and or sweating in the case of cattle). **It is not the point at which animals are heat stressed.**”*

The TRP itself even dismissed the HST distribution in the case of lambs – concluding it was not a reliable indicator of heat stress. The TRP also noted that “*consultation with industry ...[had] ... indicated that the majority of sheep exports are lambs*” – the TRP, therefore, indicated that the HSRA HST distribution was not appropriate for the majority of the trade.

LiveCorp urges the regulator to adopt a methodical, structured approach to the inclusion of welfare in heat stress regulations for sheep voyages to the Middle East. Shortcuts should not be taken. Even the definition of a new regulatory objective may take some time as new data becomes available and is assessed. For instance, there is already practical and real-world evidence the HST fails to equate reliably to open mouthed panting or poor welfare.

7.3 Conclusion

If the regulator and the industry want to move to an animal welfare based model then it is integral that the complexity inherent in welfare measures is embraced and not dismissed in favour of simple approaches that do not represent reality, are not objective, are not clearly connected to welfare, are not measurable or that cannot be regulated. Continuing to apply the dichotomous mortality type thinking will not achieve the transformation in regulatory and industry approaches required.

Rather than shy away from the complexity of moving to welfare, LiveCorp's submissions have embraced it. In a series of submissions LiveCorp has suggested:

- Implementing outcomes based regulatory objectives – based on verifiable and objective measures directly related to welfare and then using the HSRA model or other tools to delineate the conditions under which the regulatory objective will be met.
- Proposing a framework from Professor Shane Maloney essentially providing a guide for how to incorporate level of exposure and duration into a framework.
- Putting forward a statistical model – based on the available VOS data (while also identifying the availability of newer, more granular weather data) – to assess duration (within the short timeframes of putting forward a submission).

ALEC has indicated in its policy that it should be a matter for LiveCorp to develop a solution by March 2020 or else the moratorium should apply.

It is important that we note that LiveCorp does not have the data to develop an animal welfare approach.

The stepped process, therefore, suggested by LiveCorp for developing and implementing a welfare approach to regulating sheep voyages to the Middle East entails the following:

- Applying the industry moratorium as a short-term measure until better tools are developed.
- Consider adjusting the regulated trade prohibition for certain destinations. The adjustment would involve (i) a deeper consideration of the interrelationship between heat stress and duration of exposure and (ii) markedly different environmental conditions that apply to destinations even within the same spatial region – for instance, within the Gulf, different environments that operate in Kuwait and Doha. There may be justification for applying a more limited or adjusted / shifted moratorium for some destinations.
- As a matter of urgency, use data currently being collected and further analysis to arrive at a quantitative, precise regulatory objective that directly addresses the welfare outcome required.
- As a matter of urgency, explore permutations of the HSRA model to incorporate a welfare objective. This would involve LiveCorp liaising with the department on methods and results.
- As a matter of urgency, once a new regulatory objective becomes available, finalise redevelopment of the HSRA model.

LiveCorp would propose working closely with the department on the above, under appropriate arrangements to protect potentially confidential information and ensure government privacy obligations are met, to define and determine how the data can be used to verify assumptions etc. LiveCorp wants to embrace an animal welfare approach for risk assessment for sheep voyages to the Middle East, has identified several options for doing this and offers to work cooperatively and expeditiously with the department to this end.

Appendix A: Major shifts in temperatures are not needed to significantly reduce mortalities and improve welfare generally

As noted in Chapter 2, May 2019 shipments showed dramatic improvements in welfare outcomes as measured by mortalities. Many regulatory changes no doubt contributed to the large reduction in mortalities, but amongst them was an increased space allocation to each sheep. Space allocations were first increased by 17.5% and then were further increased through the use of allometry with a k-value of 0.033. The application of a k-value of 0.033 resulted in space allocations per sheep increasing by 30-40% for typical shipments to the Middle East (over those that originally applied under ASEL).

It is important to note that:

- although the increase in space allocations was large (30-40%) and
- the effect on heat stress outcomes seemed to be significant (as measured by mortalities),
- the impact of these increased space allocations on actual deck temperatures is very small.

Part of the heat on the deck of a sheep carrier is due to heat being generated by the sheep themselves – less sheep means less heat generated. However, the increased space afforded to each sheep during the May 2019 shipments only caused deck WBTs to drop less than 0.5°C compared to the temperatures that would have applied under ASEL space allocation. That is, the space allocations in May 2019 only caused deck temperatures to drop by small amounts, to those that would have historically applied, yet the mortalities due to heat stress were reduced to zero²⁰.

This leads to one of three conclusions - either:

- mortalities recorded for the May 2019 shipments were an aberration, caused by small sample sizes – we think this is unlikely, but can be tested with the collection of more data over time; or
- heat stress is not a primary factor causing mortalities and the reductions in mortalities was brought about by the regulatory changes working through other mechanisms – if this is the case then higher temperatures are likely to be consistent with good welfare outcomes; or
- very small reductions in deck temperatures can result in significant reductions in deaths from heat stress (and, we suggest, improvements in welfare generally).

Support for the third conclusion listed above is found in the HSRA model. In the HSRA model for a 40kg sheep (body condition score 3, recently shorn, year average acclimatisation) mortalities are estimated to be 50% at a WBT of 35.5°C but only 2% at a WBT of 34.2°C – a drop in temperature of 1.3°C reduces mortalities from 50% to 2%. This feature of the HSRA model has been verified by other researchers.

An inference from the above is that very large reductions in temperatures, such as those proposed by the TRP, are not needed to reduce mortalities and, we suggest, improve welfare significantly in other areas as well.

The WBT conditions under which shipments of a 40kg sheep (body condition score 3, recently shorn, year average acclimatisation) are prohibited under the current HSRA model and under the TRP's recommendations are shown in Table 2.1. Compared to the current HSRA model the TRP's recommendations involve dramatically lower WBTs for the shipment to be approved. We accept

²⁰ The figures have been calculated using equations in the HSRA model for a 45kg sheep and a PAT value of 175 - but similar conclusions could be drawn using other values.

that some reductions in threshold WBTs may be necessary; however, the dramatic reductions advocated by the TRP are not supported by the evidence.

**Table 2.2 WBTs above which shipments are prohibited: current HSRA Vs TRP recommendations
Sheep 40kg, body score condition 3, recently shorn, 15°C acclimatisation**

Model	Threshold WBT
Current HSRA model	34.2°C
TRP model	30.6°C

Appendix B: Pant score measurement differences between the McCarthy and TRP reviews

Both Dr Michael McCarthy and the TRP proposed that pant scores be used as an indicator of heat stress and both proposed use of a four-point ordinal scale, but there are very significant differences between the two scales – see Table B.1.

Table B.1 Panting scores as defined in the McCarthy and TRP reviews

Panting score	Description*	Respiratory Rates	
		McCarthy Review	TRP Review
0	Normal	25-80	Up to 60
1	Elevated respiratory rate	80-100	61 to 80
2	Mild panting	100-160	81-120
3	Open mouth panting	160-220	121-192
4	Open mouth panting with tongue out	Usually second stage	Above 192

* The McCarthy descriptions have been used in this table – there were even some differences between the McCarthy and TRP panting descriptions, although at the lower (score 0) and upper ends (scores 3 and 4) the descriptions were almost exactly the same.

Differences between the McCarthy and TRP scales would seem to deserve further testing. For instance, what band of respiratory rates are most associated with open mouth panting – is the 160-200 breaths per minute used by McCarthy or the 121-192 breaths per minute suggested by the TRP most closely aligned with observational evidence?

The TRP certainly seemed to indicate that there should be further investigation into how to measure panting:

*McCarthy and now others have indicated **several versions of panting and heat stress scores**, which primarily use respiratory responses for sheep, based on those described by Gaughan et al. (2008) for cattle.....The choice of table of panting scores and respiratory rates will be **a continued matter of debate**. The panel believes rather than adding more detail and description, a useful panting score that could be used by all parties throughout the live export chain would be less detailed. **Once there is agreement** about the scores, a series of videos/photos could be developed to ensure everyone is using the same system.*