Final report

Collection of animal welfare indicators on board live export vessels

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Contents

Executive summary

This report contains recommendations of the Shipboard Animal Welfare Surveillance (SAWS) Committee, a committee comprising animal welfare experts, veterinary epidemiologists, statistical experts, industry participants and those with practical knowledge of the on-board environment. The SAWS committee was established by the live export industry to advise on:

- A set of on-board animal welfare indicators that meet the needs of the regulator and any additional needs of industry
- Consistent, standardised procedures for collecting these data.

The need for industry to develop a meaningful set of animal welfare indicators was raised in a series of major reports on industry reform, commissioned by the Australian Livestock Exporters' Council (ALEC), and published between 2013 and 2016. The Department of Agriculture, Water and the Environment (hereinafter referred to as the Department) have also recently recognised the need for an improved set of animal welfare indicator data to be collected on board vessels. A review of the Australian Standards for the Export of Livestock (ASEL), completed in 2018 (the 'ASEL Review'), recommended, amongst other things, that shipboard daily reports to the Department include additional animal welfare measures.

In defining a system for monitoring on-board animal welfare, establishing the animal welfare indicators to be used and details of how to apply each indicator at a given point in time is essential but is also only part of the task. There are three further major components of such a system.

Firstly, indicator data are of minimal use unless repeatedly and consistently collected in a standardised way at the best timepoints from an appropriate sample of (or all) animals, pens or decks, or for the entire vessel.

Secondly, the system requires standardised methods for indicator data entry and storage. Finally, methods are required for data retrieval, analyses, interpretation and reporting. In summary, in defining a system for monitoring on-board animal welfare, four major components must be defined:

- the animal welfare indicators to be used and details of how to apply each indicator at a given point in time
- the required time(s) of day, frequencies and animals to which each indicator is to be applied
- required methods for data entry and storage
- required methods for data retrieval, analyses, interpretation and reporting.

The SAWS Committee focussed largely on components 1 and 2, but made some limited comments on component 3 (specifically, recommending continual refinement of the LIVEXCollect data collection software). The SAWS Committee did not define interpretation processes to be applied to indicator data (component 4) but made some suggestions on possible approaches (see the Conclusions section of this report).

In addressing the tasks assigned to it, the SAWS Committee identified a number of objectives for the collection of on-board animal welfare indicator data, including the following three regarded as most important:

- to enable the industry to collect robust, reliable and credible data on animal welfare outcomes on board live export vessels for transparent reporting to the community

- to allow the regulator to access robust, reliable and credible data to verify that requirements for animal welfare outcomes on board live export voyages, as prescribed in regulation, were met; and to conduct appropriate investigations in circumstances where prescribed outcomes were not met
- to identify factors contributing to on-board animal welfare outcomes enabling progressive development and implementation of improved risk mitigation procedures over time.

During the Committee's work, new reporting standards were regulated for the Australian live export industry (referred to as the ASEL 3.0 reporting standards).

Before these new standards were finalised, the Committee's work involved:

- considering recommendations made on reporting standards and animal welfare indicators in the 2018 ASEL Review and commenting on these recommendations
- providing detailed advice on measurement procedures associated with each indicator recommended in the ASEL Review. This advice comprised designing measurement scales, constructing measurement processes and using photographs / videos to demonstrate various points on the measurement scales.

Advice on measurement procedures was regarded as vital. If these procedures are not precisely defined, inconsistent data will be produced. Data collected that is inconsistent can be worse than useless, especially when being used in a regulatory setting. The absence of well-defined measurement procedures represents a substantial weakness with data collected under regulation in previous versions of ASEL – this data contains many inconsistencies.

The advice of the Committee was included in a draft report, produced in June and provided to all Committee members, including representatives from ALEC and LiveCorp. LiveCorp used the draft report in their discussions with the Department on the implementation of ASEL 3.0 reporting standards.

Most of the advice provided by the Committee on indicator measurement, as contained in the June draft report, was incorporated into the implemented ASEL 3.0 reporting standards between June and October 2020. Through the incorporation in ASEL 3.0 of the Committee's advice, many recommendations made by the Committee had already been adopted by industry by November 2020.

Following finalisation of the ASEL 3.0 reporting standards, the work of the Committee involved:

- commenting on each of the indicators included in the ASEL 3.0 reporting standards
- mapping the ASEL 3.0 reporting standards indicators against defined objectives (as stated in this report) to determine whether gaps existed. The presence of significant gaps would suggest that industry, to meet its objective of transparent reporting of animal welfare outcomes to the community, should develop indicators additional to those required by the regulator
- recommending further work to be undertaken to ensure that indicator data is collected effectively and efficiently.

The Committee concluded that the set of indicators collected under ASEL 3.0 were very comprehensive. Nevertheless, the Committee recommended that ASEL 3.0 reporting standards could be enhanced by industry in three areas (stated in order of importance):

- collect / collate more detailed livestock class information than is required in ASEL 3.0. In the view of the Committee the very aggregated livestock classes used in ASEL 3.0, comprising of four classes, 'slaughter', 'feeder', 'breeder' and 'productive (breeder)', greatly reduces the usefulness of this data for future risk mitigation analysis. This is because welfare risk is not only strongly associated with environmental conditions but also with the specific livestock classes being shipped. It is stressed that the more detailed classes, if implemented, are for industry use only – they are not for use by the regulator. They have been designed to allow industry to better meet its objective of industry monitoring and improvement, including addressing risks in the trade
- collect data on a limited number of indicators twice per day: panting, general demeanour, sailing conditions and posture. ASEL 3.0 requires the collection of indicator data on every deck of the vessel, but only once per day (except temperature and humidity data). However, if livestock classes and environmental conditions are similar across decks, collecting data on key indicators twice per day from pre-selected pens or decks may be more efficient and informative than collecting data on every deck[1]
- collect data on two additional indicators: posture and fleece / coat cleanliness. These indicators have been supported in the work on animal welfare indicators for the live export trade, commissioned by industry and undertaken by Murdoch University[2].

The Committee in this report makes three further recommendations:

- that the Livestock Export Program (LEP) develop an on-board animal welfare indicator training program, including reference materials and either face-to-face or video instruction, for LiveCorp Accredited Stockpersons (LAS). Furthermore, it is recommended that the LEP liaise with the Department on extensions of this program to Australian Government Accredited Veterinarians (AAVs) and Independent Observers (IOs)
- that the LIVEXCollect data collection software continues to be refined. In particular the Committee foresaw significant advantages in a design of a data entry system that allows use of mobile devices. Such a system would result in improvements in data collection efficiency and data accuracy, as data can be inputted simultaneously with observations are being made
- that in early 2022, a joint industry / government review of the ASEL 3.0 reporting standards be conducted examining systems being employed for monitoring on-board animal welfare under ASEL 3.0, including the following:
  - The use being made of data collected under the ASEL 3.0 reporting standards.
  - The extent of reporting burden imposed by these standards.
  - The usefulness of individual indicators - indicators should always be open to challenge, discussion and modification to reflect changing objectives, the emergence of new issues and improvement in measurement techniques.
  - Any need for additional indicators, and / or for modification to existing indicators, to better monitor on-board animal welfare.
  - The efficiency of the systems being employed for collection of on-board animal welfare indicator data where:

[1] Collins, T., Dunston-Clarke, E., Willis, R., Miller, D., Barnes, A., Fleming, T., 2019, *Animal Welfare Indicators Pilot for the Livestock Export Industry Supply Chain*, Meat & Livestock Australia, Project W.LIV.3047, Milestone Report 6, November, pp.56-58.
[2] Ibid., p.43.

- system includes both the IT systems used as well as sampling / observational protocols (frequency of assessments, selection of animals to be observed, numbers of livestock assessed for each indicator, etc), and
- efficiency describes the usefulness of the indicator in monitoring on-board animal welfare relative to the time inputs required to implement the indicator.

This report brings together the totality of the Committee's work – both before the implementation of the ASEL 3.0 reporting standards and work completed since then.

The SAWS Committee believes that, in this report, it has thoroughly addressed the terms of reference provided to it. It commends the report for industry consideration.

1 Introduction

This report represents the final report of the Shipboard Animal Welfare Surveillance (SAWS) Committee, established in 2020 by the Livestock Export Program (LEP), operated jointly by Meat & Livestock Australia (MLA) and LiveCorp, to assist industry in designing systems to collect animal welfare data on board live export vessels.

The Committee comprised animal welfare experts, veterinary epidemiologists, statistical experts, industry participants and those with practical knowledge of the on-board environment. Terms of reference for the SAWS Committee can be found in Appendix A and information on Committee members can be found in Appendix B. Meetings held by the full SAWS Committee, and a smaller Working Group, in reaching recommendations contained in this report, are described in Appendix C.

The SAWS Committee's activities commenced in March 2020 and concluded in December 2020. The period of the Committee's work spanned the date when new regulations were implemented by the Australian Government applying to the care of animals on board live export vessels. These regulations, referred to as the Australian Standards for the Export of Livestock, Version 3.0 (ASEL 3.0), replace the previous version of the standards, ASEL 2.3. A part of these regulations establish on-board animal welfare reporting requirements from exporters to the Department.

A draft version of the SAWS Committee report was produced prior to the finalisation of the ASEL 3.0 reporting requirements and indirectly contributed to the implementation of these requirements. This report represents the culmination of the SAWS Committee's work and takes into account finalisation by the Department of ASEL 3.0 reporting requirements.

The need for a meaningful, comprehensive, set of indicators to be developed to measure animal welfare outcomes on board live export vessels has been recognised for some time by both industry and the Department. The need was raised in series of major reports on industry reform, commissioned by the Australian Livestock Exporters' Council (ALEC), and published between 2013 and 2016. One of the key recommendations in those reports was for industry to "*identify a set of indicators by which to evaluate progress*"[3].

In pursuit of this recommendation, since August 2017 industry has funded a project (W.LIV 3047) to identify and quantify a comprehensive set of indicators to measure animal welfare outcomes on board livestock export vessels. Through an extensive literature review this project identified over 75 possible indicators for sheep, and a similar number for cattle, that relate to welfare outcomes on board livestock export vessels[4].

The need has also been recognised in Department commissioned reviews. For instance, a review of ASEL regulations completed in 2018, referred to throughout this report as the 'ASEL Review'[5], amongst other things, recommended that on-board reports be expanded to include additional morbidity and welfare measures.

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[3] See, for example, Futureye, 2013, *Future Proofing for Profitability: Live Export Industry Reform*, Melbourne, October.

[4] Collins, T., Dunston-Clarke, E., Willis, R., Miller, D., Barnes, A., Fleming, T., 2019, *Animal Welfare Indicators Pilot for the Livestock Export Industry Supply Chain*, Meat & Livestock Australia, Project W.LIV.3047, Milestone Report 6, November. See also Fleming, P.A.; Wickham, S.L.; Dunston-Clarke, E.J.; Willis, R.S.; Barnes, A.L.; Miller, D.W.; Collins, T., 2020, "Review of livestock welfare indicators relevant for the Australian live export industry", *Animals*, Vol 10, 1236.

[5] 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.

In defining an animal welfare surveillance system, the following are essential:

1. the objectives for collecting animal welfare indicator data must be specified
2. the indicators must be defined (what must be measured to achieve the objectives)
3. methods of using each indicator must be defined (how is it to be measured)
4. where (e.g. which pens, decks) and when each indicator should be measured should be defined (where and when should it be measured)
5. training must occur with those involved in collecting indicator data and "case definitions" developed ("case definitions" represent a set of criteria for classifying whether a certain set of observations falls into one category or another)
6. how the resulting data are to be collected and stored should be defined
7. how the resulting data are to be analysed and interpreted should be defined.

Items 1 to 3 above, form part of the Terms of Reference for the SAWS Committee. The development of full training manuals and case definitions (item 5 above) was outside the scope of the SAWS Committee as was items 5 and 6. Item 6 is the subject of another project being undertaken for LiveCorp. For comments on item 7, see chapter 11.

In determining a list of animal welfare indicators to use on board live export vessels, part of the SAWS Committee's terms of reference were to retain all the indicators recommended by the ASEL Review Committee unless there were sound reasons for rejecting some of these indicators. This aspect of the terms of reference reflects the fact that the final set of indicators chosen had to encompass both the needs of the regulator and those of industry. In 2019 the Department had endorsed the voyage reporting recommendations of the ASEL Review[6], signifying that these indicators met the needs of the regulator. Lending weight to this conclusion, the set of indicators regulated in the final implementation of ASEL 3.0 largely followed the ASEL Review recommendations.

Given the above, activities of the SAWS Committee were focused on:

- Determining indicators additional to those recommended by the ASEL Review that are critical for industry in terms of meeting its objectives.
- Developing a set of operational procedures for measuring each indicator including the frequency and timing of measurement, order of measurement, scoring systems to be used and measurement processes.

Although, the ASEL Review had touched on some aspects of operationalising indicator measurement (such as specifying scoring systems), it was the view of the Committee that these needed to be specified in more detail and, in some cases, revised for consistency to be achieved and for the indicators to be useful in practice.

[6] See Department of Agriculture and Water Resources, 2019, *Regulator's response to the final report on the review of the Australian Standards for the Export of Livestock: Sea Transport*, https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/animal/department-response-asel-review.pdf. Note that in this document the Department states: "*This* [the requirements for daily reports and end of voyage reports as per Appendix A and Appendix B of the ASEL Review Report] *will be implemented through the ASEL version 3. The proposed templates included in the committee's report will be adopted into the ASEL updates*".

This report is organised as follows:

- First, the objectives for collecting animal welfare indicator data, as defined by the SAWS Committee, are presented.
- Second, criteria used by the Committee to guide (a) the selection of indicators and (b) the measurement approach are provided.
- Third, the issue of standardisation of classes of livestock is considered – livestock classes are important in indicator measurement and analysis.
- Fourth, the measurement of indicators using decks as the sample unit, rather than 'representative' pens is considered – this was a point of difference between recommendations made in the ASEL Review and ASEL 3.0 as implemented.
- Fifth, the set of indicators used in ASEL 3.0, and additional indicators recommended by the Committee, are provided in summary form, categorised by welfare principle, criteria and type.
- Sixth, recommendations are made on the time/s of day to measure each indicator and the order of measurement.
- Seventh, details are provided on each recommended indicator. These details include:
- The research justification for the indicator.
- The measurement scale to be used for the indicator.
- Brief instructions of how measurement is to occur.
- Whether the indicator recommended by the SAWS Committee differs from that recommended in the ASEL Review and, if so, reasons for the differences.
- Eighth, reporting burden and the value of data collected in qualitatively assessed.
- Finally, some recommendations are made on training and steps involved in further development of a set of animal welfare indicators.

2 Objectives of on-board welfare indicators

The following objectives were identified by the SAWS Committee for the collection of animal welfare indicator data on board livestock export vessels:

a) COMMUNITY INFORMATION OBJECTIVE: To enable the industry to collect robust, reliable and credible data of critical animal welfare outcomes on board live export vessels for transparent reporting to the community.

b) REGULATORY OBJECTIVE: To allow the regulator:
   a. to access robust, reliable and credible data to verify that animal welfare outcomes on board live export voyages, as prescribed in regulation, were met and to conduct appropriate investigations in circumstances where prescribed outcomes were not met
   b. to determine if the existing regulatory framework is sufficient to prevent poor welfare outcomes.

c) WITHIN-VOYAGE CORRECTIVE ACTION OBJECTIVE: To monitor animal or environmental conditions on board to allow proactive decision-making and corrective action to be taken during a voyage, and to assess effects of corrective actions on animal welfare indicators.

d) RISK MITIGATION IMPROVEMENT OBJECTIVE: Through indicator measurement, to identify factors contributing to livestock animal welfare outcomes, to enable implementation of improved risk mitigation procedures for future consignments.

The above objectives represent a refinement and expansion of objectives for on-board collection of data and reporting found in the ASEL Review[7].

In presenting the above objectives it is noted that under ASEL 3.0 regulations a statutory obligation imposed on Australian Government Accredited Veterinarians (AAVs) and LiveCorp Accredited Stockpersons (LAS) to rapidly report to the regulator any incident that "*that has the potential to cause a serious adverse effect on animal health or welfare*". This suggests that the main roles of a data collection system for on-board animal welfare indicators is not to ensure any adverse welfare outcomes are captured (since this is achieved under other regulations), but rather:

- To facilitate investigation of any *serious adverse animal health or welfare* incident.
- To identify, and allow analyses to be undertaken on, systemic conditions and management practices that impact on on-board animal welfare outcomes, but do not fall into the category of causing "*a serious adverse effect on animal health or welfare"* (since these are already reported and investigated). Enabling data to be collected, and analyses to occur, on conditions and management practices generally that may impact on animal welfare, provides an opportunity for the industry to further improve on-board welfare outcomes.

[7] The following objectives can be found in the ASEL Review for on-board collecting and reporting of animal welfare data:

- to promote increased transparency;
- to allow the early detection of subtle changes in animal or environmental conditions on board and allow proactive decision-making and corrective action to reduce risk of poor welfare outcomes.
- to identify factors contributing to livestock outcomes, and enable improved risk mitigation for future consignments;
- to provide industry with the means of demonstrating continual improvement.

See 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 and p40.

- To create a body of evidence of satisfactory animal welfare outcomes on livestock voyages (noting that the more general surveillance system has a heavy emphasis on detection and reporting of unsatisfactory outcomes).

In specifying the above objectives, the SAWS Committee also noted that achieving objective c), at the present time, is challenging.

- It is suggested that to fully meet objective c) a high degree of automation in data collection and analysis would be necessary (to constantly monitor for subtle changes across a range of variables). Automation in data collection on board live export vessels is a very recent development and is currently confined to a narrow range of data (weather data). To fully meet objective c), much more extensive employment of automated equipment would be necessary.
- Given the current state of technology, it is highly likely that trained staff (AAVs and LAS), through expert observation, would be able to detect subtle changes in conditions and animal welfare, predict risk of adverse welfare outcomes, and arrange for corrective action (where possible) more efficiently and quickly than any system of indicator data collection.

This is not to suggest that objective c) should be abandoned. It is to suggest, however, that this objective may not be achievable in the short to medium term.

3 Basis for selection of indicators

In assessing the indicators recommended in the ASEL Review, those implemented in ASEL 3.0, in recommending additional indicators for industry to collect, and in determining the approach to measuring each indicator, SAWS Committee decisions were based on several considerations. These considerations are outlined below.

3.1. Credible / Based on research

By far the most important consideration was that each indicator had to be credible and firmly based on animal welfare research.

Despite animal welfare being a difficult concept to pin down, general agreement exists within the scientific community about what represents good animal welfare. This consensus is elegantly expressed in the 'Five Freedoms' model[8]:

a) freedom from hunger and thirst
b) freedom from discomfort
c) freedom from pain, injury and disease
d) freedom to express normal behaviours
e) freedom from fear and distress.

Despite being ground-breaking at the time, and still largely relevant, the 'freedoms' concept is now considered not to incorporate the full breadth and depth of animal welfare and to be overly focused on avoiding or preventing negative events. The five freedoms model has now largely been replaced with the five domains model as follows:

1. nutrition
2. environment
3. health
4. behaviour.

The above four domains then combine to influence a fifth domain relating to the mental state of the animal.

5. Mental state [affective experiences (of above)].

The above definition of welfare was adapted by the Welfare Quality® project to produce a framework from which to measure and assess animal welfare[9]. From the first four domains four welfare principles were developed:

1. good feeding
2. good housing
3. good health

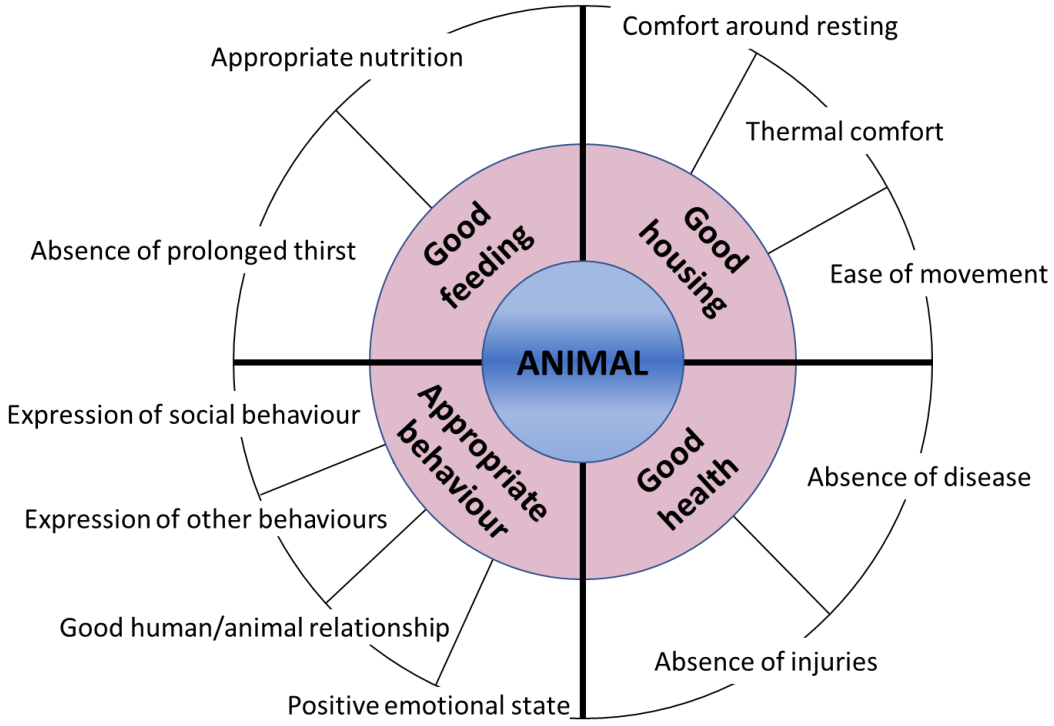
[8] Farm Animal Welfare Council, 1979, Press Statement, https://webarchive.nationalarchives.gov.uk/20121010012428/http://www.fawc.org.uk/pdf/fivefreedoms1979.pdf

[9] Welfare Quality® was an EU funded project designed to developed standardised ways of assessing animal welfare and a standardised way of integrating this information to enable farms and slaughterhouses to be assigned to one of four categories (from poor, to good, animal welfare). Numerous publications and reports emerged from this project – see, example, Winckler, C., Algers, B., van Reenen, K., Leruste, H., Veissier, I., Keeling, L., 2009, *Welfare Quality® Assessment protocol for cattle*, http://www.welfarequalitynetwork.net/media/1088/cattle_protocol_without_veal_calves.pdf. Also see Blokhuis, H., Veissier, I., Miele, M., 2010, The welfare quality project and beyond: safeguarding farm animal well-being, *Acta Agriculturae Scandinavica Section A – Animal Science*, Vol. 60, pp. 129-140.

4. appropriate behaviour.

Then each principle was broken down into different aspects of welfare to produce 12 measurable welfare criteria. The criteria reflect what is meaningful to animals as understood by animal welfare science (see Figure 3.1).

Figure 3.1: Animal welfare principles and criteria



Previous research undertaken by Murdoch University had classified potential animal welfare indicators for the live export industry (as revealed by an extensive literature review) into the principles / criteria shown in Figure 3.1[10].

In the view of the SAWS Committee, it was important that each of the principles and most of the criteria shown in Figure 3.1 be assessed by at least one indicator (recognising that while good human/animal relationship is listed as a specific criterion, the effects of such relationships would be reflected in a number of indicators).

3.2. ASEL Review recommendations

Another large consideration taken into account by the SAWS Committee in assessing and recommending a set of animal welfare indicators was the conclusions on indicators reached by the ASEL Review. Given the Department's endorsement of this review, the brief to the Committee was that there had to be very solid grounds to reject an indicator recommended by the ASEL Review. After consideration, the SAWS Committee only questioned three of the indicators recommended by the ASEL Review (relative humidity, faeces type and duration of panting). Two of these indicators (relative humidity and faeces type) have been included in the ASEL 3.0 standards. Reasons for questioned these indicators are to be found in Chapter 8 of this report.

[10] Collins, T., et al, 2019, op cit., especially pp 32-40.

While questioning only three of the ASEL Review indicators, in its draft report refinements were recommended by the SAWS Committee to many others. The SAWS Committee was able to give particular attention to the details of collection of indicator data, unlike the ASEL Review Committee which had to complete a substantially wider set of tasks. Predominantly, the recommendations made by the SAWS Committee in its draft report have been implemented in the ASEL 3.0 reporting standards.

3.3. A preference for animal based measures or resource / environmental measures closely associated with welfare outcomes

In addition to being classified by welfare principle and criteria, animal welfare indicators can be categorised by type as follows [11]:

a) ANIMAL-BASED MEASURES: Direct measures of animal health and behavioural outcomes (e.g. panting score, evidence of disease or injury).
b) RESOURCE-BASED MEASURES: Measures that describe details about resources available to livestock that can influence welfare outcomes (e.g. provision of water and feed).
c) ENVIRONMENT-BASED MEASURES: Measures of the environment conditions that impact animal welfare outcomes (e.g. air temperature).

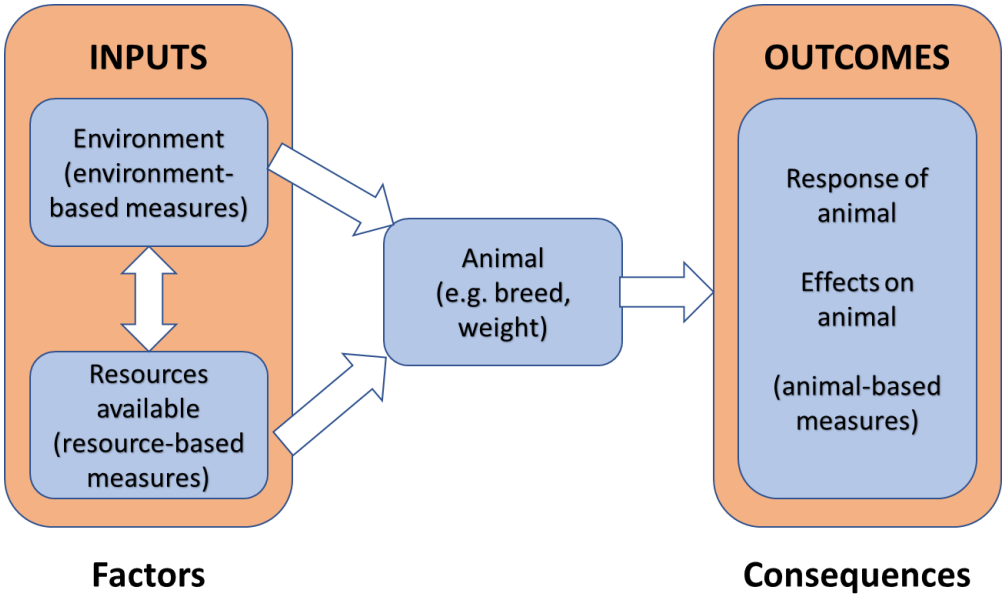
One of the innovations of modern animal welfare assessment systems is that they focus more on animal-based measures (e.g. directly related to animal body condition, health aspects, injuries, behaviour).

Previously, welfare systems concentrated almost exclusively on resource or environment-based characteristics. Of course, these risk factor-focused resource and environment measures should not be ignored; indeed, many of these measures are justifiably included in the ASEL 3.0 indicators. However, where possible, direct animal-based measures are preferable to indirect risk factor-based measures.

A particular attraction of animal-based measures is that they show the 'outcome' of the interaction between the animal and its environment. Animal-based measures aim to measure the actual welfare of the animal and thus include the collective effects of multiple input factors (see Figure 3.2). Animal-based measures may identify compromised welfare even though inputs seem appropriate and conversely, animal-based measures may indicate good welfare even though some inputs may seem suboptimal.

[11] See Fleming, P.A. et al, 2020, op cit., pp 9-10.

Figure 3.2: Animal welfare input factors and outcomes



Notwithstanding the above, the Committee recognised that each type of indicator had both advantages and disadvantages. For example:

- direct measures of animal behaviour may be more likely to provide information about the 'true' welfare status of the animal. However, most direct measures use ordinal scales (which can be problematic in interpretation) and they only describe animal attributes at the point in time when the observation was made[12]:
  - furthermore, due to the variable nature of animal behaviour, problems can arise in ensuring that an indicator is adequately reflecting the underlying phenomenon it is intended to measure. For instance, it has been suggested that panting score (the indicator) can measure heat stress in sheep (the underlying phenomenon), however, it has been noted that some sheep can open mouth pant even when body temperatures are normal. This does not necessarily exclude use of panting as an indicator of heat stress – it still may be an appropriate indicator if aggregation and calibration accounts for individual aberrations. The challenge then becomes setting an 'appropriate' proportion of animals so affected.
  - direct animal measures can give an indication of positive welfare states rather than being limited to defining only negative states of welfare, or the absence of environment or resource conditions that are known to negatively impact welfare.
- on the other hand, resource level indicators may be more easily measured, but may provide no information about the effectiveness of the resource at increasing/decreasing animal welfare risk
- similarly, different environmental conditions have varying effects on different animals in terms of welfare impact. For this reason, environmental indicators may bear an imprecise relationship with

[12] Animal-based 'point in time' estimates are particularly problematic for audit type approaches to welfare (e.g. QA program farm assessments) where the animals may be observed officially only once per year - hence the greater reliance on resource-based measures in these programs. However, on live export vessels regular daily repeated animal measures will occur, providing a great advantage.

animal welfare. It is well known, for instance, that Awassi sheep cope better with heat than Merino sheep - and even within Merino sheep, differences can be considerable.

3.4. Inter- and intra rater repeatability

Inter-rater repeatability is the closeness of agreement of measurements taken by different people when the underlying factor being measured is the same. Intra-rater repeatability is the closeness of agreement of measurements taken by the same person at different times and/or in different conditions when the underlying value being measured is the same. Low inter and intra repeatability has been found to be significant problems with some animal welfare indicators.

Low or unknown repeatability is often sufficient grounds in itself for rejection of a possible indicator.
For high repeatability, an indicator must be clearly and precisely defined. Ideally, the scoring system is clear, so it is easy to train raters in how to correctly classify their observations.

The measurement scales and procedures for each animal welfare indicator, as recommended by the SAWS Committee, have been designed to achieve high levels of inter- and intra-rater repeatability.

3.5. Communicability

One of the listed objectives for on-board animal welfare indicators (see Chapter 2) relates to communicability – *"to enable the industry to collect robust, reliable and credible data of critical animal welfare outcomes on board live export vessels for transparent reporting to the community"*. A key criterion in the selection of any indicator is that it is intelligible and easily interpreted – ideally, indicators should be simple to interpret in practice and intuitive in the sense that it is obvious what the indicator is measuring. Ideally, also, the indicator should resonate with the intended audience.

3.6. Cost

Cost of data collection is a consistent theme evident in the literature on selection of indicators. Selection of an indicator should be influenced by an understanding of the resources needed to both collect and analyse the data. Because the collection, management, and analysis of data is costly both in human and financial terms, the set of animal welfare indicators should be as simple as possible while achieving the objectives set. Similarly, it will be important to employ highly efficient mechanisms to collect indicator data. In this regard design of data entry systems that use mobile devices offer significant advantages, in both efficiency and data accuracy, as data can be inputted at the time observations are being made.

3.7. Coherence / balance

In addition to assessing the merits of an individual indicator, care should be taken to assess the value of each possible indicator within a set of indicators. Duplication or redundancies across the set of indicators should be identified and this may result in use of a more manageable, smaller number of highly useful indicators. Sometimes more than one indicator may be needed to represent the underlying phenomenon. Where this is necessary, the method by which indicators are to be combined should be specified.

For animal welfare assessments, balance should also be considered. Balance is the mix of resource- / environment-based indicators and those directly measuring some aspect of animal behaviour given that each has

advantages and disadvantages as discussed above. For example, it may be appropriate for a welfare audit system to measure a limited number of key animal outcomes to produce a pass or fail result. However, an assessment protocol designed to evaluate welfare, inform risk mitigation strategies and encourage ongoing improvements, must measure animal outcomes as well as the environment- and resource-based factors that influence them.

3.8. Field testing and ongoing review

Difficulties associated with identifying appropriate indicators, evident in Sections 3.1 – 3.7, suggest that indicators should be subject to extensive field testing. Because extensive field testing has not yet been conducted, industry and regulatory flexibility may be required in adjusting indicators and measurement procedures over time. The frequency of both false negative and false positive indicator alarms and the timeliness of detection should be considered when refining, removing or replacing an indicator from the suite of indicators used. An indicator that identifies worsening welfare early and reliably is of greater value than an indicator that provides late alarms and/or excessive false positives.

As a general rule it is widely recognised that indicators should always be subject to ongoing assessment - they should be open to challenge, discussion and modification to reflect changing objectives, the emergence of new issues and improvement in measurement techniques and data availability.

4 Classes of livestock

Livestock class is a key sub-component in some indicators and is extremely useful when analysing welfare outcomes for all animal-based indicators:

- several indicator measures, recommended by the ASEL Review and implemented in ASEL 3.0, directly require classes of livestock to be inputted. For example, if a mortality or morbidity occurs, the class of the livestock involved must be recorded
- more generally, however, knowledge of livestock class significantly increases the usefulness of all welfare indicator data collected. Welfare risk is closely related to environmental conditions, resource access and livestock class. To adequately analyse risk and the welfare outcomes achieved, therefore, it is important to not only collect information on environmental conditions (especially, wet bulb temperature) and resource access, but also livestock class. Knowledge of livestock class is vital to addressing the risk mitigation improvement objective stated in Chapter 2.

The need to enter livestock class directly in some indicators, and the more general use of this data, means that a system must be developed for categorising livestock into classes.

4.1. ASEL, industry and exporter livestock classes

Currently, each exporter uses their own proprietary schemes for classifying animals, tailored to their own commercial needs. These classification schemes normally use livestock categories that are reasonably finely defined (based on species, sex, weight, age, etc). Although different criteria and cut-off points are used in these schemes, a number of common elements are evident, dictated by shared commercial criteria and the need to calculate loading densities, to use HSRA for certain shipments and to report to the Department. As a result, all exporter classification systems refer to breed and weight, and sheep are split into adult sheep and lambs.

The primary livestock classes used in ASEL 3.0 are ‘slaughter’, ‘feeder’, ‘breeder’ and ‘productive (breeder)’ – the latter being a particular class exported to Indonesia. In ASEL 3.0 these classes are recorded against each mortality and morbidity. Additionally, under ASEL 3.0, if morbidities or mortalities involve animals requiring a special management plan (e.g. due to weight), this must also be recorded – essentially, these animals form a separate livestock class.

The SAWS Committee, however, has concluded that, for welfare indicators to be of substantial use more detailed class information is required than the ASEL 3.0 categories of ‘slaughter’, ‘feeder’, ‘breeder’ and ‘productive (breeder)’. A wide variety of livestock fall under each of these ASEL 3.0 categories. To meaningfully analyse welfare outcomes, and to understand risks, finer categories are required that are standard across industry.

Categories used by each exporter need to be converted into standard industry categories that are broader than the detailed exporter categories, but finer than the four categories used in ASEL 3.0. Converting exporter livestock classes into industry classes that are more detailed than ‘slaughter’, ‘feeder’, ‘breeder’ and ‘productive (breeder)’ would allow industry wide analyses to be conducted aligning welfare outcomes with particular characteristics of the livestock being exported.

If detailed exporter-based livestock classes are to be aligned with more common (and more aggregated) industry classes, this poses the question of how to define the industry livestock classes.

In order to determine the livestock classes that should be used at an industry level ('industry classes'), the SAWS Committee:

- utilised the HSRA model to investigate how heat stress thresholds (HST) vary across livestock characteristics – in order to determine the sensitivity of various types of livestock to heat stress
- examined the livestock classes used in past industry reporting of mortalities – e.g. see, for example, W.LIV.0297[13].

The conclusions drawn from the HRSA analysis were that:

- for sheep, the greatest sensitivity in terms of heat stress is related to the animal's age (adult sheep, lambs). On the other hand, HST estimates were relatively invariant to an animal's weight
- for cattle, the greatest sensitivity in terms of heat stress is related to breed / type. In contrast, again, the HST estimate is relatively invariant to weight.

Past mortality reports published by the industry have classified sheep based on age (lambs, hoggets, adult sheep) and sex (rams, ewes, wethers) and cattle based on sex (heifers / cows, steers / bulls) and type (dairy / beef).

In light of the analysis done using the HSRA model, the review of categories used in the mortalities report and consideration of other uses of animal welfare indicators, apart from the regulatory need to segment animals shipped into 'slaughter', 'feeder', 'breeder' and 'breeder (productive)', the following system is recommended for sheep in defining classes of animals:

- Wethers – Wool sheep
- Wethers – Hair sheep
- Ewes - Wool sheep
- Ewes – Hair sheep
- Rams – Wool sheep
- Rams – Hair sheep
- Hoggets – Wool sheep
- Hoggets – Hair sheep
- Lambs – Wool sheep
- Lambs – Hair sheep

Similarly, apart from the regulatory need to segment animals shipped into slaughter, breeder and feeder, the following system is recommended for cattle/buffalo in defining classes of animals:

- Steers – Bos taurus
- Steers – Low Bos Indicus content (25%-50% Bos indicus)
- Steers – High Bos Indicus content (> 50% Bos indicus)
- Heifers - dairy
- Heifers – beef – Bos taurus
- Heifers – beef – Low Bos Indicus content (25%-50% Bos indicus)
- Heifers – beef – High Bos Indicus content (> 50% Bos indicus)

[13] WA Department of Primary Industries and Regional Development (prepared by Norman, G.J.), 2018, *National livestock export industry sheep, cattle and goat transport performance report 2018*, Final Report for Project W.LIV.0297, Meat & Livestock Australia, Sydney.

- Cows – dairy
- Cows – beef – Bos taurus
- Cows – beef – Low Bos Indicus content (25%-50% Bos indicus)
- Cows – beef - High Bos Indicus content (> 50% Bos indicus)
- Bulls – beef – Bos taurus
- Bulls – beef – Low Bos Indicus content (25%-50% Bos indicus)
- Bulls – beef – High Bos Indicus content (> 50% Bos indicus)
- Buffalo

It is stressed that the more detailed classes, if implemented, should be for industry use only – they should not be provided to the regulator. They have been designed to allow industry to better meet its objective of industry monitoring and improvement, including addressing risks in the trade.

4.2. Programming may allow detailed livestock class information to be included with minimal cost to exporters

The SAWS Committee is cognisant of the time and effort the live export community will be allocating to on-board data collection and reporting under the ASEL 3.0 requirements and does not wish to unduly add to these. The Committee, however, is of the view that more detailed livestock class information, than that contained within the ASEL 3.0 regulations, would be beneficial to the industry in risk mitigation and reporting on animal welfare outcomes.

It is possible that, with appropriate standardisation and programming, additional time and effort involved by exporters in supplying more detailed livestock class information can be reduced to minor levels. It is noted that detailed exporter class information already exists (e.g. on load plans, on HSRA documents and against cattle ID tags), but in non-standardised formats – what is required is to implement a degree of standardisation in how this information is stored by exporters and then for tables to be included in the LIVEXCollect database that translate the exporter classes into industry classes.

It is not advocated that this task be completed immediately – this task should only be initiated once the new data collection system has been 'bedded in'. In the view of the SAWS Committee, however, this should represent an important objective for the industry over the intermediate future.

5 Collection of data by deck

The SAWS Committee notes that, for many animal welfare indicators, measurement in ASEL 3.0 involves recording a single value (or a small number of values) for each deck of the vessel at each assessment time (e.g. a measurement taken at a single point on the deck, an estimated single value aiming to represent the deck as a whole)[14]. In this respect the ASEL 3.0 indicator measurement procedures continue practices evident in ASEL 2.3. The ASEL 3.0 and 2.3 practice of recording a single indicator value considered representative of an entire deck, however, contrasts with recommendations made in the ASEL Review to measure many indicators using two sample pens per deck[15].

5.1. Indicator measurement using deck values vs sample pens

The SAWS Committee notes that there are both advantages and disadvantages in using a single indicator value to represent an entire deck at each assessment timepoint compared to using two values, one from each of two sample pens per deck.

The major advantages of using a single indicator value per deck are as follows:

- the deck values are an attempt to reflect the status of the entire population of animals on the deck. In contrast, measurements taken using only two sample pens may, on occasions, differ from the status for the entire population of animals on the deck e.g. due to unobservable differences between the animals contained in the two sample pens compared to the entire population of animals on the deck.
  - across many voyages, if appropriate sampling procedures are used, data collected in two sample pens will accurately measure welfare outcomes achieved on the deck, but this is not guaranteed on particular decks or for every assessment timepoint within a deck
  - differences between the animals contained in the two sample pens compared to the entire population of animals on the deck would generally be more common and more extreme if the sample pens are not representative of all pens on the deck, and if few sample pens are used per voyage.
- recording one value for each indicator per deck, rather than two (i.e. one for each of two pens per deck, as was required under the ASEL Review's sample pen recommendation) reduces reporting workload and complexity.

The major advantages of using sample pens for recording indicator values are as follows:

- data can be collected more accurately:
  - for instance, to collect some indicator data accurately it is theoretically necessary to view all animals simultaneously – this can be achieved when the sample unit is a pen, but not when it is a deck

[14] The SAWS Committee notes that, although being pivotal to reporting requirements under ASEL 3.0, a "deck" is never defined. Normally a deck on a vessel refers to the entire flat floor area, built between the sides of a vessel at the same level (decks can be thought of as floor levels of a vessel in a similar manner to floor levels in a multistorey building). From an examination of AAV reports, discussions with AAVs and from other material, however, it is apparent that "deck" for ASEL reporting purposes has been understood to refer not just to the floor level of a vessel, but in some circumstances to a floor level / cargo hold combination. Specifically, from the examination conducted, it seems that different cargo holds on the same level of the vessel may be regarded as different "decks" for ASEL reporting purposes, if there is no common airflow between them, creating an expectation that different microclimates may exist across these areas. Where there are open doors between different cargo holds on the same level of the vessel, creating a common airflow, they are regarded as the same deck.

[15] Why the ASEL Review Committee recommended the sampling of two pens per deck (rather than one or three or some other number) is unclear. The sampling of two pens per deck, rather than one pen, would provide a modest increase in voyage level precision and also provide some indication of between-pen variation within decks. There would be further benefits from a larger number of sample pens per deck but also greater reporting burden and it is possible that this why a larger number was not recommended.

- accuracy of single values for an indicator per deck would be higher where there is little variation between animals and between pens within the deck. Conversely, accuracy is very likely to be low where there is large variation between animals and/or between pens within the deck

- Use of sample pens means that data is collected at a finer level of granularity and this may uncover particular issues to be addressed:
    - for instance, it is possible that a values for a welfare indicator for each deck and across many voyages, are always at acceptable levels; but this is not the case for all pens on each deck. Using a pen as the sampling unit provides the opportunity to detect patterns of unacceptable welfare outcomes within a deck – and, over time, to make changes which improve these outcomes.

Given the uncertainties about benefits and disadvantages of recording a single indicator value considered representative of an entire deck, compared to measuring values using two sample pens per deck, it is the view of the SAWS Committee that this question should form part of a review of the new data collection standards recommended for early 2022 (see Section 9.3). In addressing this question it would be beneficial to collect some data using multiple sample pens on each deck at the same time as (and blinded to) assessments are recorded using the ASEL 3.0 single value per deck.

5.2. summarising animal- and pen level values for a deck

No guidance has been provided in ASEL 3.0 on the single point on the deck to take some indicator measurements (e.g. temperature data) nor on how to summarise animal and pen level values for a deck. For indicators that are summaries for the deck of animal- or pen level categorical variables (e.g. general demeanour and feeding behaviour, respectively), modal category name could be recorded (i.e. the name of the most common category e.g. for general demeanour, the demeanour category with the most animals). The IT system currently used by AAVs is designed for recording in this way, and in Chapter 8, this is the assumed method. (In contrast, the SAWS Committee is aware that under ASEL 2.3, some AAVs were recording average values for some indicators.)

The problem in recording just the most common category is that it may be insensitive to assessing welfare on a deck. For example, for feeding behaviour, suppose for a given deck, 90% of pens have mild jostling, 5% climbing / smothering / lunging in pen, and 5% no or minimal interest in feeding by majority of animals in pen. Under the protocol of recording just the name of the most common category, 'mild jostling' would be recorded even though there are 10% of pens on that deck with modestly or maybe substantially compromised feeding.

To demonstrate the insensitivity of this approach, one of the other categories will only be recorded when at least 34% of the pens are in that category, and typically a higher percentage would be required before that category is recorded. If both of the other categories are pooled, the pooled category would be recorded only when over 50% of the pens are in either of those two categories.

It is desirable that instead, the approximate percentage of animals in the most extreme category or the approximate percentages in the more extreme categories are recorded. To summarise pen-level values for a deck (e.g. feeding behaviour), the approximate percentages of pens should be recorded. In the interim, the recording system will be insensitive for indicators that are summaries for the deck of animal- or pen level categorical variables. The SAWS Committee have recommended a review of the animal welfare monitoring system in early 2022 (item 9.3) and this item is a priority for that review.

5.3. Are there merits in stratifying data collection by deck?

Despite differences, the implementation of indicator reporting under ASEL 3.0, using a single value per deck, and the ASEL Review recommendations, using two sample pens per deck, share a fundamental feature – under both measurement procedures, effectively sample stratification is occurring by deck.

Stratified data collection techniques are generally used when the population is heterogeneous, or dissimilar, and where certain homogeneous, or similar, sub-populations can be isolated (strata).

If the environment and classes of animals are relatively homogeneous within a deck, collection of one indicator value for the deck will be reasonably representative for the deck as a whole. Furthermore, if the environment and classes of animals are heterogeneous between decks, differences in indicator measurements will be expected, and it will be important to record a value for every deck.

There will be many situations on live export vessels where this situation applies – that is, homogeneity exists within a deck, but heterogeneity exists between decks. In these situations, stratification by deck is appropriate. Circumstances where this applies include:

- when only one class of animal is loaded on each deck, but different classes are loaded on different decks
- where ventilation, feeding, watering systems, etc. operate uniformly across a deck, but differently between decks
- where no hot spots exist on a deck.

Equally, however, there may be situations where these pre-conditions do not exist:

- within the *same deck* there may be *heterogeneous* elements that impact on animal welfare (e.g. the existence of "hot spots") and conversely
- two or more *different decks* may be relatively *homogeneous* in factors known to affect animal welfare.

The main factors known to have the potential to significantly impact on animal welfare are those related to the environment (e.g. wet bulb temperature), the provision of critical resources (e.g. feed and water) and the class of the animal (due to varying levels of susceptibility to unfavourable environmental conditions or resource access).

Given these factors are known, it may be preferable to develop a stratification scheme using these factors directly, rather than using "deck" (however defined) as a proxy for these factors. Supporting this, research completed for Project W.LIV.3047[16] has shown that animal welfare indicator measurements taken at the same time from different pens, even if on different decks, but with similar climatic conditions and classes of animals, do not vary substantially (i.e. there is homogeneity between strata, an undesirable design element in maximising data collection efficiency).

The SAWS Committee understands the underlying factors that resulted in the ASEL 3.0 reporting procedures involving indicator measurement by deck. However, the above suggests more tailored stratification procedures may be worthy of investigation - with environmental, resource provision and livestock class factors used directly to define the strata for on-board animal indicator welfare data collection:

[16] See Collins, T., Dunston-Clarke, E., Willis, R., Miller, D., Barnes, A., Fleming, T., 2019, *Animal Welfare Indicators Pilot for the Livestock Export Industry Supply Chain*, Meat & Livestock Australia, Project W.LIV.3047, Milestone Report 6, November, especially Appendix 2.

- where there is important heterogeneity within deck (e.g. because different classes of animals have been loaded onto the deck), measurement of more than one value (e.g. one for each class of animals) may be needed for the deck
- conversely, where there is homogeneity within and between decks, one value may be sufficient to describe outcomes across two or more of those homogenous decks.

6 The set of indicators recommended by the SAWS Committee

As noted in the introduction to this report, a key task of the SAWS Committee was to determine whether industry should collect on-board animal welfare indicators additional to those required by the regulator. This involved having regard to the objectives specified in Chapter 2 and mapping the regulated indicators against welfare principles and criteria to determine if gaps existed.

In Table 6.1 the set of indicators recommended by the SAWS Committee are presented, categorised by welfare principle and criteria[17]. The same set of indicators are recommended for cattle and sheep. Only the starred (*) indicators are recommended by the SAWS Committee as additional to those required by the regulator. Those indicators marked with a '^' are required by the regulator, but questioned by the SAWS Committee. It is clear from Table 6.1 that regulated indicators are very comprehensive, covering all welfare principles and almost all welfare criteria.

Table 6.1: Recommended indicators categorised by welfare principle, criteria and type

Welfare principle	Welfare criteria	Welfare indicator	Section of the report addressing the indicator
Good feeding	Appropriate nutrition	Feed remaining on board	8.5
		Fed to ASEL requirements	8.6
		Feed quality	8.7
		Feeding behaviour	8.8
	Absence of prolonged thirst	Water consumption	8.9
		Water quality / supply issues	8.10
Good housing	Comfort around resting	Manure pad score	8.15
		Fleece / coat cleanliness*	8.23
	Ease of movement	Sailing conditions	?
	Thermal comfort	Panting score / hot spots	8.13, 8.14
		Wet bulb temperature	8.12
		Dry bulb temperature	8.12
		Relative humidity^	8.12
		Ventilation monitoring	0
Appropriate behaviour	Expression of social behaviour / positive emotional state	General demeanour	8.17
	Expression of other behaviours	Posture*	8.22
Good health	Absence of injuries	Mortalities / Morbidities reports (various indicators)	8.18 ,8.19, 8.20
	Absence of disease	Mortalities / Morbidities reports (various indicators)	8.18 ,8.19, 8.20
		Incidence of scabby mouth~	
		Cattle faeces type^	8.16
	Other	Births / abortions report	8.21

Note: '*' denotes indicators recommended by the SAWS Committee additional to those required by the regulator.
'^' denotes indicators required by the regulator, but questioned by the SAWS Committee.

[17] The classification by welfare principle, welfare criteria and type was greatly assisted by work completed under W.LIV.3047.

'~' denotes that the indicator has only a minor relationship with animal welfare and its inclusion appears to be for other reasons and is not covered in this report.

It should be noted that a number of the indicators above are multidimensional i.e. they involve recording values for multiple variables at the same assessment timepoint, as distinct from recording a single value at that timepoint (examples of multidimensional indicators are ventilation monitoring, the mortalities and morbidities reports and panting).

As well as categorising indicators by welfare principle and criteria, it is also possible to apply a categorisation by type of indicator (resource based, environment based, animal based), level of reporting (vessel, deck, pen, individual animal, etc) and the level at which measurement / observation occurs. This categorisation of the recommended indicators is shown in Table 6.2.

Table 6.2: Recommended indicators categorised by type of indicator, and levels of measurement under ASEL 3.0 reporting standards

Type of indicator	Welfare indicator	Level of reporting (and level of measurement / observation)
Resource based	Feed remaining on board	Vessel (vessel)
	Fed to ASEL requirements	Pen (each pen to be assessed)
	Feed quality	Vessel (each pen to be assessed)
	Water consumption	Vessel (all animals pooled)
	Water quality / supply issues	Pen (each pen to be assessed)
	Ventilation monitoring	Area of vessel (all areas of vessel to be assessed)
Environment based	Wet bulb temperature	Deck (each deck to be assessed)
	Dry bulb temperature	Deck (each deck to be assessed)
	Relative humidity^	Deck (each deck to be assessed)
	Manure pad score	Deck (each deck to be assessed)
Animal based	General demeanour	Deck (each pen to be observed)
	Feeding behaviour	Deck (each pen to be observed)
	Fleece / coat cleanliness*	Deck (each deck to be assessed)
	Sailing conditions	Vessel (based on observations of all animals)
	Panting scores / hot spots	Deck (based on observations of all animals)
	Posture*	Deck (based on observations of all animals)
	Mortalities/Morbidities reports	Individual animal (all animals assessed)
	Births/abortions report	Individual animal (all animals assessed)
	Incidence of scabby mouth~	Deck (based on observations of all animals)
	Cattle faeces type^	Deck (each deck to be assessed)

Note: * denotes indicators recommended by the SAWS Committee additional to those required by the regulator.
'^' denotes indicators required by the regulator, but questioned by the SAWS Committee.
'~' denotes that the indicator has only a minor relationship with animal welfare and its inclusion appears to be for other reasons and is not covered in this report.

7 Frequency of indicator assessment and order of measurement

This chapter briefly addresses the frequency of taking indicator measurements, the timing of these measurements and the order of measurement.

7.1. Frequency and timing of indicator assessment

The Committee noted that, on board livestock vessels, a meeting of the vessel's officers and livestock personnel is held once per day, as per ASEL requirements, typically mid-morning. Prior to that meeting there is merit in the AAV / LAS thoroughly checking livestock and taking measurements, noting any issues with water supply, feeding behaviour on different decks, the health of livestock, etc. In the past, observations had been validated with cohorts at the daily meeting prior to the report being sent off with the shipboard daily report at noon. The Committee supports the continuation of morning measurements: the collection of data in the morning, which is then reviewed and validated (with corrective actions put in place to maintain the welfare of livestock), followed by dispatch of the daily report, represents a logical sequence.

Measuring indicators only in the morning, however, is limiting. More frequent assessments will have better scope to capture how animal behaviour varies across the day due to normal diurnal patterns and in response to changing environmental conditions.

The SAWS Committee is of the view that, once the new data collection system has been "bedded in", the industry should trial twice daily data collection for a select number of indicators (see below for these indicators). The twice daily trial should continue for sufficient a period to allow an evaluation to be made of the gains and costs from twice daily measurement of indicators, compared to morning only assessments.
The advantages of twice daily measurement include the following:

- animal behaviour has been shown to vary by time of day, including for some of the animal welfare indicators to be measured under ASEL 3.0 requirements (e.g. general demeanour)
- environmental factors that represent known risks to animal welfare outcomes also vary by time of day (e.g. temperature).

In the view of the Committee, the time imposition of taking afternoon measurements, in addition to morning measurements, may be small relative to the value of additional information gained. The Committee noted that:

- AAVs / LAS should be checking all livestock at least twice per day in the normal discharge of their duties
- the time taken for afternoon inspections would be significantly quicker than the morning inspections (and livestock would typically be more settled in the afternoon):
    - the afternoon inspections should not involve the same extent of checks as the morning inspections – the afternoon inspections, for instance, would not normally involve standing all animals up to inspect for health issues
        - rather, the afternoon inspections would simply involve the AAV / LAS surveilling the deck to record a number of key behavioural indicators and gathering temperature data (where automated devices are not being used).
    - collection of twice daily data may become more feasible as improvements are made to data collection software. The current version of LIVEXCollect, being spreadsheet based, has not been designed to facilitate data entry at the time observations are made. To maximise the efficiency of data collection, the development of software for mobile devices is needed, so that data input can occur

simultaneously with observations being made. If data collection software is improved, twice daily recording becomes more practicable.

The SAWS Committee believed that the industry should give significant consideration to collecting information on the following indicators in the afternoon as well as morning:

- panting
- general demeanour
- sailing conditions
- posture
- wet and dry bulb temperatures.

It is noted that the ASEL 3.0 reporting standards require wet and dry bulb temperatures, as well as relative humidity, to be taken twice per day (since minimum and maximum values must be recorded for these indicator – see Section 8.12).

A fallback position may be for the industry to require collection of some data in the afternoons when certain triggers are exceeded (e.g. if temperatures were above a certain level). Such 'trigger' observations, if implemented, should be clearly identified as such, so they are not misinterpreted as reflecting the population at all times. In addition, if indicators are only measured when trigger values are exceeded, this would remove the opportunity to assess patterns of animal behaviour etc on board vessels when trigger vales are not exceeded.

7.2. Measurement procedures and order of measurement

Animal behaviour will be affected by the presence of the AAV / LAS. To obtain consistent data, therefore, it will be important for each AAV / LAS to adopt the same procedures to measurement.

The Committee suggests the following (see W.LIV 3047 Milestone 4 Appendix 3):

- approach the deck calmly / quietly
- select a location on the deck where most animals on the deck can easily be observed
- give the animals some time to become used to your presence, 30 seconds or so, before taking any measurements
- take your animal behavioural scores (feeding behaviour, general demeanour, panting)
- take temperature data
- undertake health inspections, etc (as these may involve entering some pens).

Order of indicator measurement is particularly important as some indicators may be influenced by the collection of other indicators. Anything that may require walking into pens (e.g. to check for feed and water contamination or possibly manure pad conditions) should be done toward the end of the process.

8 Recommendations on indicators

This chapter contains details on each indicator as presented in Table 6.1. For each indicator a description of the indicator is provided, as is the type of indicator, the level at which measurement occurs, the frequency of measurement, the research justification and the measurement process. Additionally, any modifications made to the ASEL Review recommendations are noted, as well as the reasons for these modifications.

With the exception of two indicators ('posture' and 'fleece / coat cleanliness'), all indicators listed in this chapter are those specified by the Department in the final ASEL 3.0 reporting standards. As well as specifying indicators to be used, the Department in these standards also specified the scale to be used for measuring the indicator (often adopting changes to the ASEL Review scale included in the SAWS draft report) and frequency of measurement (and these are listed in this chapter). Beyond this, however, the ASEL 3.0 reporting standards are mostly silent. The material in this chapter on research justification and measurement processes is, therefore, the work of the SAWS Committee.

It is proposed that all indicator data collected be stored in the LIVEXCollect database (being developed under a separate project). All data required under regulation should be provided to the Department. Data collected by the industry, above that required by regulation, should be stored on the database, but made available only for authorised industry purposes (including to the exporter).

8.1. Administrative data at the beginning of each voyage

Certain administrative data to be entered at the start of each voyage under the ASEL 3.0 reporting standards are:

- exporter name
- vessel name
- livestock consignment number (LNC) number
- final destination port
- approved management plans for the consignment (if any)
- Australian Government Accredited Veterinarian (AAV) names and numbers (if on board)
- LiveCorp Accredited Stockperson (LAS) names
- competent stock handler names
- name of reporting AAV or LAS
- departure port
- date and time loading commenced at first port
- date and time loading completed at first port
- date and time of vessel departure at first port
- number of animals loaded by class and species
- amount of suitable feed by type (pellets, grains, roughage) remaining on board from a previous voyage
- amount of feed by type (pellets, grains, roughage) loaded at each load port.

8.2. Shipboard daily assessments – administrative data

Similarly, under the ASEL 3.0 reporting standards, some administrative data is associated with the input of each daily report:

- reporting day of voyage

- vessel position
- date and time when position was recorded
- next port of arrival
- estimated date and time of arrival at next port.

8.3. Bridge temperature / humidity information

As specified in the ASEL 3.0 reporting standards, bridge temperature / humidity information is to be taken on a twice daily basis, to measure minimum and maximum weather-related values (see Section 8.12). Information to be collected is:

- maximum bridge wet bulb temperature
- minimum bridge wet bulb temperature
- maximum bridge dry bulb temperature
- minimum bridge dry bulb temperature
- maximum bridge relative humidity
- minimum bridge relative humidity.

8.4. Sailing Conditions

8.4.1 Description of indicator

The 'sailing conditions' indicator, as specified in the ASEL 3.0 reporting standards, measures the impact of sea swell on animal behaviour. It is measured based on a three-point animal level scale:

1 = Calm: slight or no impact of sea swell on the ability of an animal to stand or rest
2 = Moderate: animal is stepping and has some stance problems, but minimal balance problems
3 = Rough: animal has marked problems maintaining their balance.

The AAV / LAS should select the score that best describes the most common category of livestock (the category with most animals) pooled across all animals on the vessel.

8.4.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Sea swell was an indicator recommended by the ASEL Review. In its draft report the SAWS Committee made refinements to the indicator recommended by the ASEL Review, converting the indicator from being environmentally based to being animal based. The indicator, as refined by the SAWS Committee, has been incorporated by the regulator in the ASEL 3.0 reporting standards.

8.4.3 Type of animal welfare indicator

Animal based.

8.4.4 Level of measurement

Vessel level – the value selected should be that which describes the majority of animals on the vessel.

8.4.5 Frequency of measurement

Morning assessments as per the ASEL 3.0 reporting standards. The SAWS Committee recommends that the industry consider collecting this indicator twice daily – see Section 7.1.

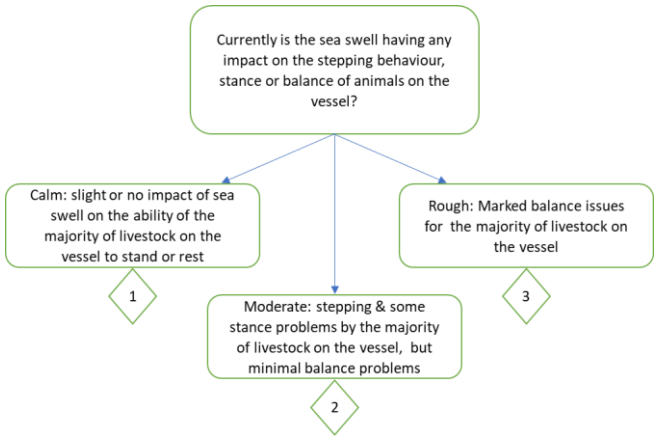
8.4.6 Research justification

Many papers by Phillips and others propose that sea swell impacts adversely on animal welfare[18] [19] There have also been concerns expressed by animal activist groups about the potential adverse welfare implications of sea swell[20] - although this seems to be primarily focussed on the effects of abnormally rough seas, which are very infrequently encountered:

- the work of Phillips and others has not involved directly correlating sea swell with animal welfare. Rather the work has created artificial environments, removed from the pen environments on board livestock vessels, and has employed limited numbers of animals on a rocking platform (designed to simulate sea swell, but imperfectly)
- to the knowledge of the Committee, the impact of sea swell (or road roughness) has not been included in any other welfare standards, guidelines or protocols, but was recommended by the ASEL Review and has been implemented in the ASEL 3.0 reporting standards.

8.4.7 Measurement process

The measurement process is outlined in the diagram below:



8.4.8 Details of changes made to the indicator that was recommended by the ASEL Review

The ASEL Review recommended the following 3-point scale for 'sailing conditions', apparently measuring the AAV / LAS's perception of sea swell:

1 = calm
2 = moderate
3 = rough

[18] Phillips argues that ships exert up to six motion forces at any one time in three directions, compared to two primary forces in trucks – see Phillips, C., 2015, *The Animal Trade*, CABI Wallingford, Oxfordshire, UK; Boston, MA. See also Phillips, C., 2020, "Sheep farmers urged to heed live export heat stress research", *Sheep Central*, https://www.sheepcentral.com/sheep-farmers-urged-to-heed-live-export-heat-stress-research/; and Navarro, G.; Col, R.; Phillips, C.J., 2020, Effects of Doubling the Standard Space Allowance on Behavioural and Physiological Responses of Sheep Experiencing Regular and Irregular Floor Motion during Simulated Sea Transport, *Animals*, Vol. 10, 476.

[19] There is certainly evidence that transport of animals on unpaved roads (compared to paved roads) can have a significant impact on stress levels – see, for example, Martínez-Rodríguez, P. et al, 2015, and Miranda-de la Lama, G.C, 2011. It is noted that The Australian Animal Welfare Standards and Guidelines: Land Transport of Livestock contain no provisions in this area.

[20] See, for example, Animals Australia, undated, *Live Sheep Exports to the Middle East: Breaches of Australian and International Standards*, AnimalsAustralia.org.

The SAWS Committee questioned the ASEL Review's recommended scale for 'sailing conditions' for the following reasons:

- considerable differences may exist between AAVs and LAS on what represent calm, moderate and rough sea swells – inter-rater repeatability of this measure would almost certainly be an issue
- in order to improve repeatability firm guidance was desirable in terms of quantitatively describing sea swell. However, it was difficult to define sea swell in quantitative terms by reference to a single factor (e.g. wave height), since the impact of sea swell on welfare may be represented by a combination of factors (e.g. wave height, wave direction, wave regularity, wave length)
- the ASEL Review recommended indicator was environmentally based. It would be preferable to design an animal-based indicator for 'sailing conditions'.

In light of the above, the SAWS Committee recommended the adoption of a new 'sailing conditions' scale that directly measures the impact of sea swell on animal behaviour.

The 'sailing conditions' indicator, as refined by the SAWS Committee in its draft report, has been incorporated by the regulator in the ASEL 3.0 reporting standards.

In a final review of the 'sailing conditions' indicator, the SAWS Committee suggested a slight re-wording of the indicator for point 2 that could occur in the next version of LIVEXCollect. Rather than 'livestock are stepping and some stance problems, but minimal balance problems' the Committee suggested 'livestock are stepping and making some stance adjustments but minimal balance problems'.

8.5. Feed remaining on board

8.5.1 Description of indicator

The indicator, as specified in the ASEL 3.0 reporting standards, requires information to be maintained on feed remaining on board each day by type (pellets, grains, roughage) in tonnes:

- feed remaining on board – pellets (tonnes)
- feed remaining on board – grain (tonnes)
- feed remaining on board – roughage (tonnes).

8.5.2 Inclusion of indicator in the ASEL Review and subsequent modifications

'Feed remaining on board'' was not recommended in the ASEL Review, nor in the draft SAWS report, but has been included by the regulator in the final ASEL 3.0 reporting standards. 'Feed remaining on board' and 'Fed to ASEL requirements' (see Section 8.6) seem to have replaced the ASEL Review indicator of 'Average feed consumption per head'. Daily feed consumption per head (perhaps more accurately referred to as feed disappearance per head) could be calculated from changes in daily recordings of feed remaining on board.

8.5.3 Type of animal welfare indicator

Resource based.

8.5.4 Level of measurement

Vessel level – amounts of feed remaining.

8.5.5 Frequency of measurement

Once daily.

8.5.6 Research justification

W.LIV.3047 notes that for housed cattle and sheep, feed supply and access to feed are critical[21]. Feed is especially important on export vessels because it needs to be carefully managed throughout a voyage. While ASEL 3.0 requires export vessels to carry additional feed supplies in case of unforeseen extensions to the voyage and to account for loading / unloading operations, daily monitoring of these resources continues to be important. Currently little information is available related to the amount of feed on board vessels (including amounts of feed remaining at the end of a voyage). Under ASEL 3.0 amounts of feed loaded on board live export vessels have substantially increased.

8.5.7 Measurement process[22]

The measurement process will involve making visual estimates of amounts of feed remaining each day.
It is noted that feed storage systems vary by vessel and feed type. Some vessels store pellets in the lower parts of the vessel, others store pellets above the water line. Some vessels will have multiple silos placed both forward and aft. Others will only have silos forward. The capacity to move pellets either forward to aft (or aft to forward) can be important for stability and providing trim for washing. On smaller vessels some fodder is often carried in bulka-bags and stored on the cover deck.

It is noted that visually assessing fodder remaining on board can be difficult due to the distribution of fodder and the asymmetry of the shape of fodder tanks, and requires a practiced eye.

8.5.8 Details of changes made to the indicator that was recommended by the ASEL Review

No significant changes have been made to the indicator recommended in the ASEL Review.

8.6. Fed to ASEL requirements

8.6.1 Description of indicator

The indicator, under the ASEL 3.0 reporting standards, measures whether feed was provided in accord with minimum ASEL feed requirements for the type of livestock being exported. If feed was not provided in accord with these requirements, reasons must be provided.

8.6.2 Inclusion of indicator in the ASEL Review and subsequent modifications

'Fed to ASEL requirements' was not recommended in the ASEL Review, nor in the draft SAWS report, but has been included by the regulator in the final ASEL 3.0 reporting standards.

8.6.3 Type of animal welfare indicator

Resource based.

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[21] Collins, T. et al, 2019, p 42.
[22] The section draws on material to be found in McCarthy, M., 2018, *Identifying opportunities for continued improvements to the onboard live export feed ration*, Report for Project W.LIV.0298, Meat & Livestock Australia, Sydney, December.

8.6.4 Level of measurement

Pen level – a record should be made of any pen on the vessel in which livestock were not provided with feed equal to or greater than ASEL minimum daily requirements.

8.6.5 Frequency of measurement

Once daily – information recorded each morning for the previous 24 hours.

8.6.6 Research justification

ASEL 3.0 specifies minimum daily feed allowances that vary by class of livestock. The ASEL 3.0 allowances are of sufficient quantity and quality to allow basic nutritional needs to be met and the animal's weight maintained (in fact, weight gains should occur if animals eat to the extent of feed provided).

Freedom from hunger and provision of an appropriate diet is considered a basic welfare criterion. For example, the Welfare Quality Assessment Framework states:

> *Animals should not suffer from prolonged hunger, i.e. they should have a sufficient and appropriate diet.*[23]

Sometimes feed rationing will need to occur on live export vessels due to unforeseen circumstances arising (e.g. vessel delays). As an occasional event this is not contrary to the welfare criteria stated above, if hunger is not prolonged – feed curfews are common, for instance, in domestic transport of livestock.

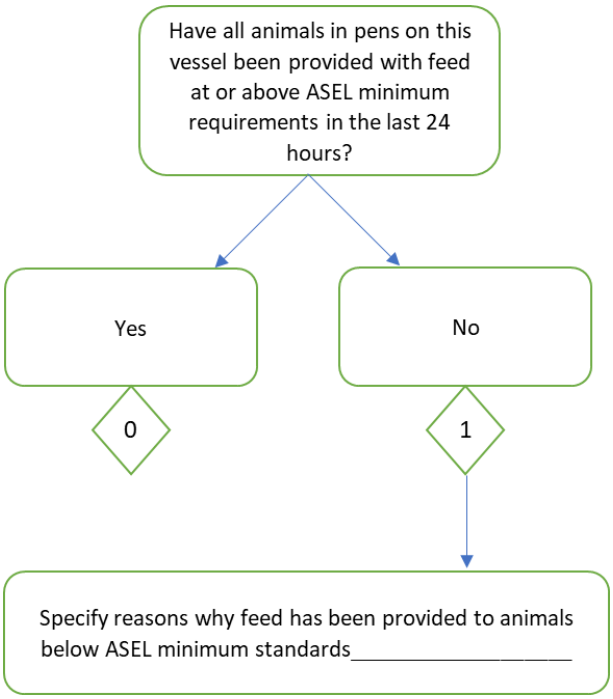
It is important, however, to record any situation in which livestock are provided with feed in quantities below the ASEL minimum standards. This indicator requires any periods of feed rationing to be recorded – and to record any other reason why livestock were not provided feed in accordance with ASEL 3.0 standards.

8.6.7 Measurement process

Stockpersons should be familiar with ASEL daily feed allowances, the amount of feed being supplied to each pen (whether through automatic or manual distribution systems – see section 8.5), whether feed is not being supplied at ASEL specified daily quantities and reasons for this. Feed is a major item discussed in the daily meetings.

Steps involved with the measurement of the feed quality indicator are shown in the figure below.

[23] Veissier, I. and Evans, A., undated, Principles and criteria of good animal welfare, http://www.welfarequalitynetwork.net/media/1084/wq___factsheet_10_07_eng2.pdf. Also see Blokuis, H., Veissier, I., Miele, M., 2010, "The Welfare Quality Project and beyond: safeguarding farm animal well-being", *Acta Agriculturae Scandinavica A*, Vol. 60, September. Similar statements with respect to feed exist in many other animal welfare frameworks.



8.6.8 Details of changes made to the indicator that was recommended by the ASEL Review

'Fed to ASEL requirements' was not recommended in the ASEL Review, nor in the draft SAWS report, but has been included by the regulator as an indicator in the ASEL 3.0 reporting standards.

8.7. Feed quality

8.7.1 Description of indicator

The 'feed quality' indicator measures whether the feed provided to livestock in all pens on the vessel is of satisfactory quality or if minor or major issues exist. Under the ASEL 3.0 reporting standards 'feed quality' is measured on a three-point scale:

0 = satisfactory feed quality (no feed abnormality obvious)
1 = minor feed quality issues (due to dust, reduced palatability, etc.)
2 = major feed quality issues (due to dust, reduced palatability, substantial contamination, etc.)

If a "1" or a "2" is entered the AAV / LAS is required to provide reasons why the feed was considered to be of unsatisfactory quality in a free text comment field.

8.7.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Feed quality was not recommended by the ASEL Review. It was, however, recommended as an additional indicator by the SAWS Committee in its draft report. This indicator has now been included by the regulator in the ASEL 3.0 reporting standards.

8.7.3 Type of animal welfare indicator

Resource based.

8.7.4 Level of measurement

Vessel – the indicator should be measured having regard to feed quality provided across all pens on the vessel. An additional free text field allows the AAV / LAS to specify the feed quality issues encountered – for instance, the type of feed quality issue and the extent it existed across pens on the vessel.

8.7.5 Frequency of measurement

Morning assessments.

8.7.6 Research justification

The Australian Animal Welfare Standards and Guidelines for both Cattle and Sheep[24] refer to the need to regularly assess the needs of livestock in relation to the quality of feed and that contaminated or spoilt feed should be avoided.

For cattle:

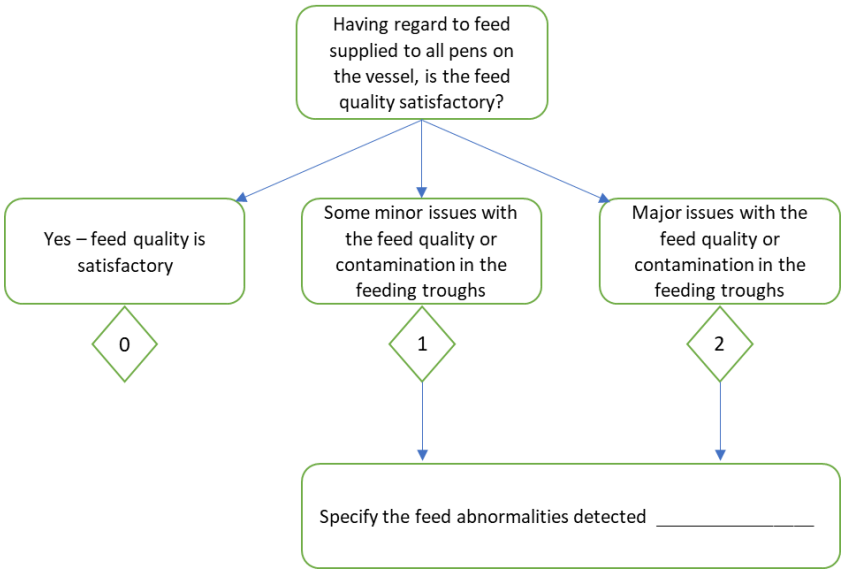
- guideline G2.2 is that "Regular assessment should be made of the needs of the cattle in relation to the quantity and *quality* of feed" (our emphasis)
- guideline G2.7 is that "cattle access to contaminated and spoilt feed, toxic plants and harmful substances should be avoided or managed".

Similar provisions exist for sheep (see G2.5 and G2.7 of the sheep standards and guidelines).
In livestock exports, an issue that has received prominence in terms of feed quality is pellets breaking into 'fines' when put through mechanised pellet distribution systems on ships. The generation of "fines" and dustiness can depress feed intakes and predispose to respiratory illness and pink eye on board.
Contamination of feed on livestock export vessels is also an issue that has occasionally been noted.

[24] Animal Health Australia, 2016a, Australian Animal Welfare Standards and Guidelines for Cattle, Version: 1.0, January, Cattle-Standards-and-Guidelines-Endorsed-Jan-2016-061017_.pdf (animalwelfarestandards.net.au) and Animal Health Australia, 2016b, Australian Animal Welfare Standards and Guidelines for Sheep, Version: 1.0, January, Sheep-Standards-and-Guidelines-for-Endorsed-Jan-2016-061017.pdf (animalwelfarestandards.net.au).

8.7.7 Measurement process

Steps involved with the measurement of the feed quality indicator are shown in the figure below:



The free text field should provide (a) information on the type of feed abnormalities detected, such as excessive fines (see photograph below) or excessive contamination, and (b) the extent that the feed issue exists across pens in the vessel.

Satisfactory feed quality

Excessive fines

8.7.8 Details of changes made to the indicator that was recommended by the ASEL Review

This was an indicator recommended by the SAWS Committee in its draft report – it was not recommended for collection in the ASEL Review. The indicator has been included by the regulator in the ASEL 3.0 reporting standards.

8.8. Feeding behaviour

8.8.1 Description of indicator

The 'feeding behaviour' indicator is designed to measure the level of hunger and social competition for food. In the ASEL 3.0 reporting standards 'feeding behaviour' is measured based on a three-point pen level scale:

1 = Mild jostling
2 = Climbing / smothering / lunging
3 = No or minimal interest in feeding

The indicator should describe the behaviour observed in the majority of pens on the deck. The indicator is to be measured separately for cattle and sheep if both species are accommodated on a deck.

8.8.2 Inclusion of indicator in the ASEL Review and subsequent modifications

'Feeding behaviour' was recommended as an indicator by the ASEL Review. However, the SAWS Committee in its draft report suggested changes to this indicator. The changes suggested by the SAWS Committee in its draft report have been incorporated by the regulator in the ASEL 3.0 reporting standards.

8.8.3 Type of animal welfare indicator

Animal based.

8.8.4 Level of measurement

Deck level (modal value estimate – i.e. the most common pen category - for pens on each deck).

8.8.5 Frequency of measurement

Morning assessments.

8.8.6 Research justification

'Feeding behaviour' is not a widely used animal welfare indicator.

- It is not included as an indicator in Welfare Quality©[25], AWIN[26] or AssureWel[27] welfare protocols, referenced throughout this report.[28]
- Neither is a performance measure on feeding behaviour included in the National Feedlot Accreditation Scheme[29].
- The Australian Animal Welfare Standards and Guidelines for Cattle[30] and Sheep[31] only specify that cattle and sheep "have access to feed and water to minimise the risk to their welfare".

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[25] See Winckler, C. et al, 2009, op cit.
[26] See European Animal Welfare Indicators Project (AWIN), 2014, AWIN Welfare Assessment Protocol for Sheep, https://air.unimi.it/handle/2434/269114#.Xsxj9WgzbD5.
[27] AssureWel was a 6 year (2010-2016) collaborative project led by the RSPCA, Soil Association and University of Bristol, supported by the Tubney Charitable Trust. Its main aim was to develop a practical system of welfare outcome assessment for the major farm animal species, which can be used in farm assurance schemes. It embodies a much less extensive range of measures than many other welfare assessment systems – see http://www.assurewel.org/index.html.
[28] It is noted that the Welfare Quality©, AWIN and AssureWel protocols were mostly developed for an on-farm setting, with assessment of animal welfare outcomes over a longer period being the focus.
[29] AUSMeat Ltd, 2017, National Feedlot Accreditation Scheme: Rules and Standards of Accreditation, AUSMeat, Queensland.
[30] Animal Health Australia, 2016a, op cit.
[31] Animal Health Australia, 2016b, op cit.

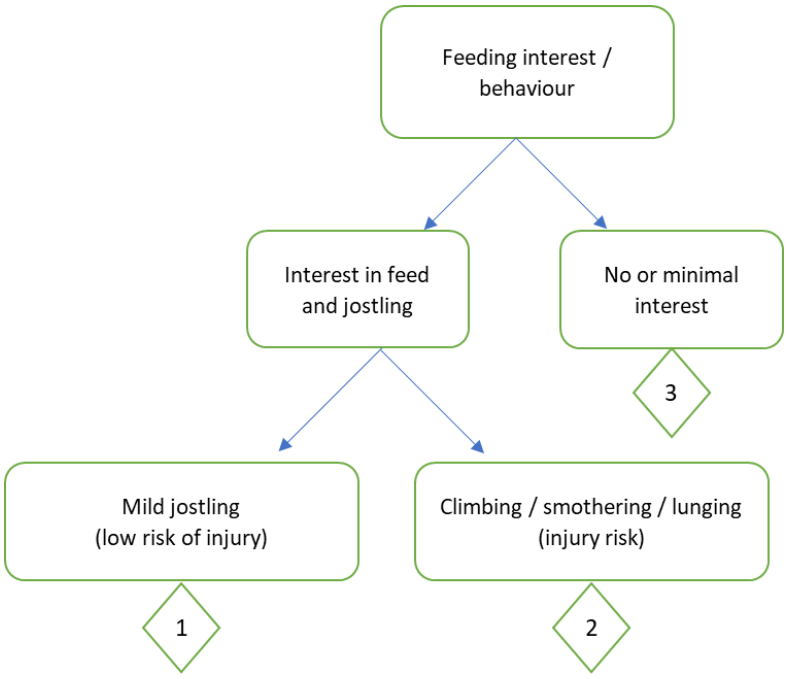
The inclusion of 'feeding behaviour' as an indicator, however, was strongly recommended in the industry commissioned project W.LIV.3047[32]. The Murdoch University researchers, who undertook this project, stated:

> *Body Condition Score (BCS) is considered an important measure … and is regarded as a robust, accepted and preferred measure for evaluating medium to long-term good feeding. ….. The reviewed protocols do not include an animal-based measure to quantify feed intake; therefore, we developed a measure described as Feed Behaviour Score, because feeding behaviour is particularly important as it is informative about the immediate level of hunger, social competition for feed, and appetitive response to climatic challenges"[33].*

Although the usefulness of this indicator has yet to be verified (with no verification existing for the way this indicator is measured under the ASEL 3.0 reporting standards), the SAWS Committee has noted that collection of feeding behaviour scores was a strong recommendation of the Murdoch researchers and in the ASEL Review.

8.8.7 Measurement process

The indicator should describe the most common behaviour category observed for pens on the deck. The indicator is to be measured separately for cattle and sheep if both species are accommodated on the deck. Steps involved with measurement are shown in the figure below:



Videos have been selected of sheep and cattle at all feeding behaviour scores.

Pictures of sheep and cattle at feeding behaviour score 2 are shown below.

[32] Collins, T. et al, 2019, op cit., p42.
[33] Dunston-Clarke, E., Willis, R.S., Fleming, P.A., Barnes, A.L., Miller, D.W., Collins, T., 2020, Developing an animal welfare assessment protocol for livestock transported by sea, Animals, 10, 705; doi:10.3390/ani10040705.

Sheep
FBS = 2 'Climbing / smothering / lunging (injury risk)'.

Cattle
FBS = 2 'Climbing / smothering / lunging (injury risk)'.

The SAWS Committee recommends that the value recorded for 'feeding behaviour' refers to the behaviour of livestock when fresh feed has been delivered to the troughs at the most recent pellet feeding time prior to the AAV / LAS recording daily observations. The time period referenced for feeding behaviour is, therefore, conceptually distinct from the time period used for other assessments and, as a result, feeding behaviour may not be observed by the person undertaking the other assessments. However, management of feed is an important activity on board vessels. Walking around pens at feeding time, to observe how animals are feeding, is a high priority task for stockpersons – either a stockperson or a vet would be observing animals at feeding time. The AAV / accredited stockperson should be aware, from information provided by other stockpersons, of behaviour exhibited at feeding time. As a result, it should be possible to accurately record feeding behaviour at the time when feed is freshly delivered, irrespective of when other measurements are taken.

It is further noted by the SAWS Committee that rarely, if ever, will all animals be climbing/jumping/ pushing simultaneously – it is really only the animals that are 2-3 back from the trough that push/jump/climb. Thus, pens

where some animals are climbing and jumping (representing evidence that they are highly motivated to access feed, but with access to feed being obstructed by others) should be noted, and if this is the most common pen-level category across the pens on the deck, a feeding behaviour score of 2 should be recorded for the deck.

8.8.8 Details of changes made to the indicator that was recommended by the ASEL Review

The SAWS Committee in its draft report suggested a number of refinements to the 'feeding behaviour' indicator recommended in the ASEL Review.

- The implication from the ASEL Review is that the feeding behaviour measure should be the recorded observation at the time of other indicator assessments by the AAV / LAS, regardless of whether or not feed had been freshly delivered. The SAWS Committee expressed the view that measurement in this way, without regard for when feed had been delivered, would result in very inconsistent feeding behaviour scores. As a consequence, the SAWS Committee recommended that the feeding behaviour score refer to the behaviour of livestock when fresh feed had been delivered to the troughs at the most recent pellet feeding time prior to the AAV / LAS recording daily observations.
- The measurement scale recommended also represents an adjustment on that recommended in the ASEL Review. The scale recommended in the ASEL Review was:

  1 = Mild to no jostling
  2 = most jostling/lunging
  3 = aggressive/smothering
- The SAWS Committee questioned the grouping of 'mild and no jostling' in the ASEL Review scale based on the following reasons:
  - There is never enough room on a live export vessel for all animals to feed simultaneously.
  - 'Mild jostling' signifies an interest in food, but not substantial hunger. Because of this 'mild jostling' may be regarded as a preferred welfare outcome.
  - In contrast, 'no jostling' signifies disinterest in the food and, as a result, may signify a non-preferred welfare outcome.
  - Thus, in the 'feeding behaviour' measurement scale recommended in the ASEL Review, a preferred welfare outcome and a non-preferred welfare outcome have been included in the same point on the scale – this will result in problems in interpretation and analysis.
- For this reason, the scale recommended by the SAWS Committee adjusted the scale recommended by the ASEL Review as follows:
  - mild jostling (preferred behaviour as it shows interest in feeding, but not excessive interest)
  - climbing / smothering / lunging (non-preferred behaviour as it may indicate hunger – refer to the Murdoch research discussed in section 8.8.6)
  - no or minimal interest in feeding (non-preferred behaviour as it shows disinterest in feeding).

The SAWS Committee notes that the final ASEL 3.0 reporting standards incorporate the above suggestions made by the SAWS Committee in its draft report. Despite this, the SAWS Committee continues to maintain concerns that the 'feeding behaviour' indicator, as implemented, is unverified – it has never been tested for usefulness or as a valid animal welfare indicator. As a result, the 'feeding behaviour' indicator should be kept under close review.

8.9. Average water consumption

8.9.1 Description of indicator

The indicator measures average water consumption per head (average litres / head / day). The indicator, under the ASEL 3.0 reporting standards, is an average for all animals on a vessel.

8.9.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Average water consumption was recommended as an indicator by the ASEL Review and was included by the regulator in the ASEL 3.0 reporting standards.

8.9.3 Type of animal welfare indicator

Resource based.

8.9.4 Level of measurement

Vessel level – average for all animals on a vessel.

8.9.5 Frequency of measurement

Once daily – calculated in the morning for the previous 24 hours.

8.9.6 Research justification

The Committee observed that it is a requirement to maintain daily records of water consumption in both ASEL 2.3 (the old version) and ASEL 3.0. In addition, an AAV reported to the Committee that water consumption was an indicator used by exporters and stockpersons – they would want to see this indicator continued.

Notwithstanding the above, for the following reasons, the Committee noted that 'average water consumption' is of limited value as an animal welfare indicator, even if collected on a species basis:

- it is a very broad indicator – welfare issues could still exist amongst particular species or classes of livestock even if average water consumption across all livestock on the vessel was at good levels. The Committee noted that in the ASEL 3.0 reporting standards no separation occurs for water consumption by species
- the water consumption estimate for livestock includes all uses for water produced from the reverse osmosis plant. No deductions, for instance, are made for other uses of water on a vessel or wastage of water – e.g. due to trough leakages or water being thrown out
- water consumption is not used as an indicator in some other important animal welfare protocols (e.g. the AWIN system34)
- if its main use was considered to be to detect early signs of heat stress, other indicators are already measuring this, probably more sensitively
- the above does not deny that absence of prolonged thirst is a key animal welfare requirement. However, this is different to water consumption and is measured directly through the 'water quality / supply issues' indicator (see Section 8.10).

[34] AWIN, 2014, op cit.

8.9.7 Measurement process

- total water consumption can be estimated from information provided by the Chief Officer based on output from reverse osmosis machinery
- per head values can be calculated by dividing by the total number of livestock being carried on the vessel.

8.9.8 Details of changes made to the indicator that was recommended by the ASEL Review

No significant changes have been made to the indicator recommended in the ASEL Review.

8.10. Water quality and supply issues

8.10.1 Description of indicator

In the final implementation of the ASEL 3.0 reporting standards a free text field has been included in the daily report for the AAV / LAS to record any 'water quality and supply issues' occurring anywhere on the vessel.

8.10.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Collection of information on water quality and supply issues was recommended by the ASEL Review, but only in sampled pens. In its draft report the SAWS Committee recommended that issues with water supply (which included availability and contamination) be recorded if they occurred anywhere on the vessel, not just in sampled pens (the SAWS Committee termed this indicator 'availability of potable water'). The ASEL 3.0 reporting requirements also require water quality and supply issues to be noted if they occur anywhere on the vessel.

8.10.3 Type of animal welfare indicator

Resource based.

8.10.4 Level of measurement

Pen level - any issue with water supply in any pen of the vessel should be noted. Problems with water supply should be recorded if they occur in any pen on the vessel.

8.10.5 Frequency of measurement

Once daily – recorded in the morning for the previous 24 hours.

8.10.6 Research justification

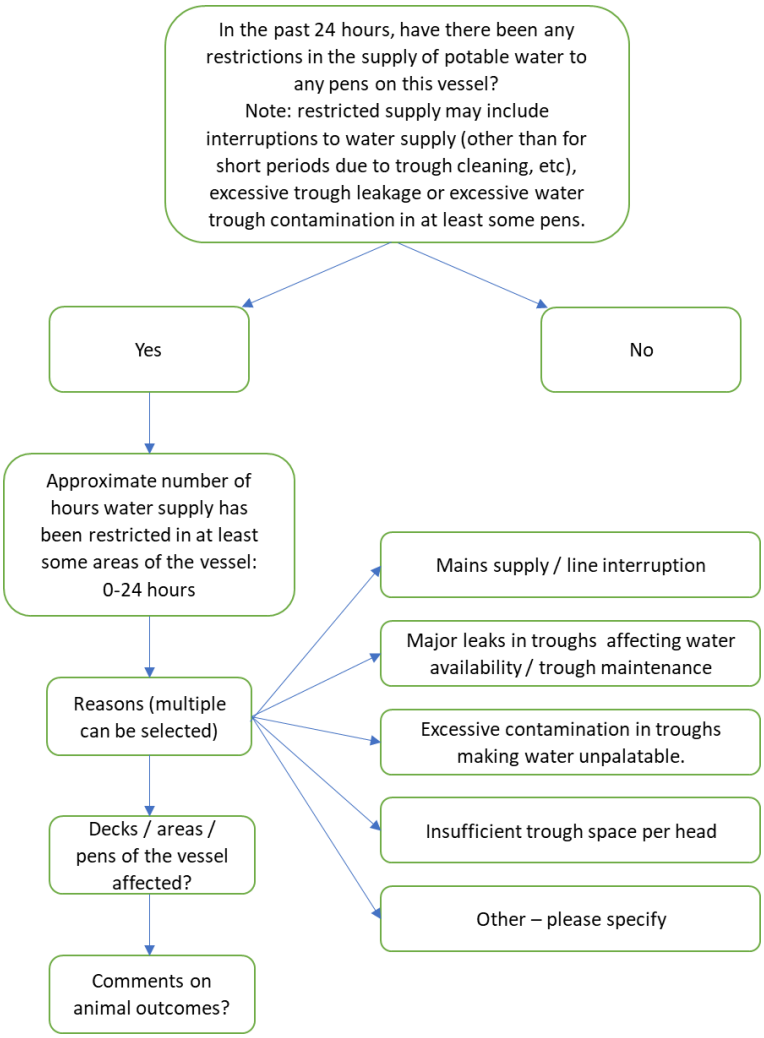
One of the five basic freedoms for good animal welfare is freedom from thirst. To ensure freedom from thirst, animals should not be without access to a potable water supply for prolonged periods.

Many animal welfare protocols (e.g. the Welfare Quality® protocol[35]) focus not only on water supply, but also cleanliness. For exported livestock, access to potable water is critical especially when being shipped through hotter areas.

[35] Winckler, C. et al, 2009, op cit., p.24.

8.10.7 Measurement process

In its draft report the SAWS Committee developed a structured approach to recording any issues with water quality and supply. This approach is shown in the figure below:



Even though just one free form text field is included in the implementation of ASEL 3.0 reporting requirements for water quality and supply issues, it is suggested that the above diagram remains relevant for determining the factors to be noted in the free text field. In particular, it is suggested that the free text field contain the following information if any issue with water quality or availability is encountered:

- the type of issues observed (e.g. mains supply / line interruption)
- the extent of the problem (decks / pens involved)
- how long the problem lasted (hours)
- any observed impact on animals.

Management of water is a critical task on board livestock vessels and should be regularly monitored by stockpersons. The AAV / LAS should be aware from their own inspections, and information provided by other stockpersons, of any issues with water supply and contamination. As a result, it is possible to accurately record data for the 'water quality / supply issues' indicator. The 'water quality / supply issues' indicator should be filled

in on a shipboard basis, with reference to the previous 24-hour period, after consultation between the AAV/LAS and other stockpersons, the Chief Officer and Bosun at the daily meeting.
Examples of trough contamination are shown below.

Trough contamination

Clean – either water points and water clean or water points show some dirt, but water fresh and clean.

Dirty[36] – Contains non-potable water. May be due to faecal or urine contamination, or marked contamination with feed, soiled bedding and/or saliva.

8.10.8 Details of changes made to the indicator that was recommended by the ASEL Review

The ASEL Review recommended the inclusion of two water supply / contamination indicators in the daily report:

- Water quality:
  1. Clean
  2. Moderately clean
  3. Dirty
- Any water supply issues (no further guidance was provided on this).

These two indicators were to be measured only using the sample pens.

Additionally, the ASEL Review recommended that the End of Voyage report should contain information on any water issue surrounding supply, availability / accessibility and quality.

[36] The picture of the dirty cement trough is sourced from Davis, R., *Feedlot Design and Construction: 5. Water quality*, https://www.mla.com.au/globalassets/mla-corporate/research-and-development/program-areas/feeding-finishing-and-nutrition/feedlot-design-manual/05-water-quality-2016_04_01.pdf. Other photographs are from W.LIV.3047.

In applying the ASEL Review water quality / supply indicators the SAWS Committee foresaw two issues:

- firstly, the focus of the ASEL Review indicators for the daily reports was on measurement in sample pens. The view of the Committee was that water supply is an absolutely vital factor in ensuring satisfactory animal welfare outcomes. As a result, it was the view of the Committee, that ANY issue / problems with water supply or contamination in any area of the vessel (not merely in sample pens) should be noted in the daily reports. This shifts focus, in terms of measuring water supply / contamination, from sample pens (as recommended in the ASEL Review) to noting any issues in any pen for the vessel as a whole
  - this view of the Committee was informed by the fact that issues with water supply represented a notifiable incident
  - the final implementation of ASEL 3.0 reporting conforms to the reasoning of the SAWS Committee, as expressed in its draft report, that this indicator should not just be confined to sampled pens
- second, the ASEL Review measure is very time of day dependent. Water may be uncontaminated and supplied in sufficient quantities when the AAV/LAS is taking measurements at sample pens, but not at other times. It is especially important to regularly monitor any issues with the provision of potable water and record any extended period when potable water is not available. The indicator should, therefore, refer to issues / problems over the previous 24-hour period, not just when the sample pens were being observed
- the Committee understands that the ASEL 3.0 reporting standards make the reference period for this indicator the previous 24 hours. However, this should be made explicit.

8.11. Ventilation monitoring

8.11.1 Description of indicator

Ventilation monitoring, under the ASEL 3.0 reporting standards, consists of five sub-indicators:

a) Were any fans on this vessel non-operational during all or part of the past 24 hours?
   - yes
   - no.

b) If "yes" to a): Specify the reason why fans were non-operational – reason to be selected from the following:
   - power interruption
   - maintenance issue
   - other – please specify.

c) If "yes" to a): Approximately for what period (hours) were there ventilation issues?
   - 0-24 hours)

d) If "yes" to a): Specify the decks or areas affected (free text field).

e) If "yes" to a): Comment on impact on animals (free text field).

8.11.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Ventilation monitoring was recommended by the ASEL Review as an indicator. Certain modifications to the specification of the ASEL Review indicator were suggested by the SAWS Committee in its draft report. The final implementation of this indicator in the ASEL 3.0 reporting standards reflects a number of suggestions made by the SAWS Committee.

8.11.3 Type of animal welfare indicator

Resource based.

8.11.4 Level of measurement

Assessed at a vessel level; any issue with ventilation in any area of the vessel should be noted.

8.11.5 Frequency of measurement

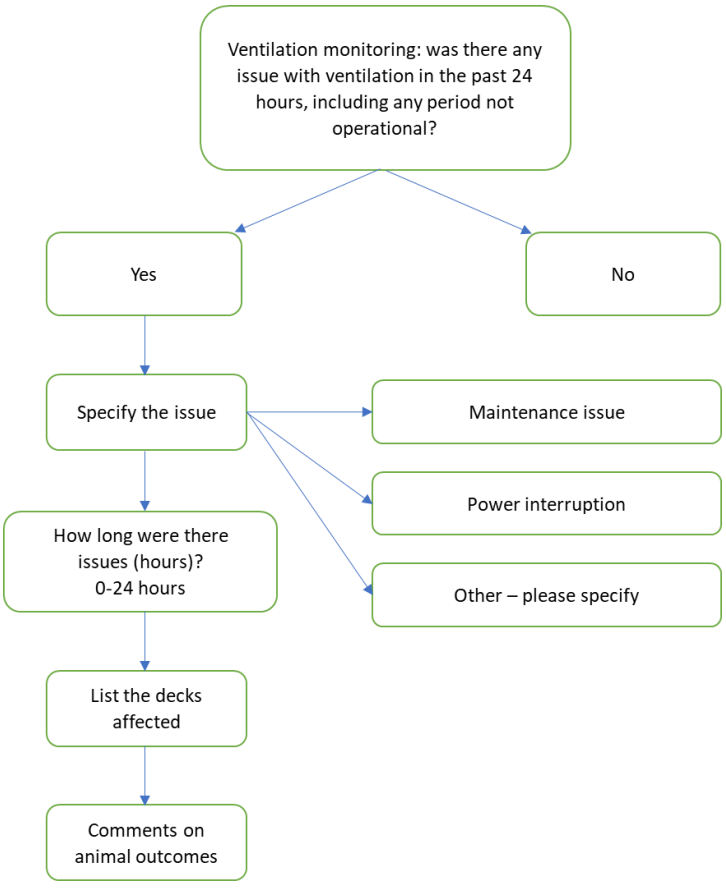
Once daily – recorded in the morning for the previous 24 hours.

8.11.6 Research justification

It has been shown that ventilation plays a crucial role in removing the heat generated by animals, reducing the risks of heat stress in hot weather[37]. Ventilation also has a role in reducing air ammonia concentrations.

8.11.7 Measurement process

Steps involved with measurement are shown in the figure below:



[37] See, for example, MAMIC Pty Ltd, 2002, *Practical Ventilation Measures for Livestock Vessels*, Final Report Project LIVE.211, Meat & Livestock Australia, Sydney; Maunsell Australia Pty Ltd, 2004, *Investigation of Ventilation Efficacy on Live Sheep Vessels*, Final Report Project LIVE.211, Meat & Livestock Australia, Sydney; McCarthy, M., 2018, *Independent Review of Conditions for the Export of Sheep to the Middle East during the Northern Hemisphere Summer*, Department of Agriculture, Water and the Environment, May. Dr Michael McCarthy stated in his report that "the central issues relevant to sheep health and welfare during shipping …. are stocking density, ventilation and thermoregulation in the sheep" (our emphasis).

The ventilation monitoring indicator has been made vessel wide, since often an operational issue with ventilation mechanisms affects multiple decks.

Comments on animal outcomes could include observations on panting scores or the impact on the manure pad, etc.

It is noted that the 'ventilation monitoring' indicator refers to issues that have arisen during the past 24-hour period. Operation of ventilation equipment is critical on board livestock vessels and should be regularly monitored. The AAV / LAS should be aware from their own inspections and information provided by other stockpersons and the ship's crew of any issues with ventilation equipment. As a result, it is possible to accurately record data for the 'ventilation monitoring' indicator. It is proposed that the ventilation monitoring indicator would be filled in on a shipboard basis with the daily report after consultation between the AAV/LAS, other stockpersons and the Chief Officer at the daily meeting.

8.11.8 Details of changes made to the indicator that was recommended by the ASEL Review

No major changes are recommended to the indicator contained in the ASEL Review. However, detailed operational measurement procedures have been developed by the SAWS Committee. Also, a field has been added: 'comments on animal outcomes'. These enhancements, which were included in the SAWS Committee's draft report, have been incorporated in the ASEL 3.0 reporting standards.

8.12. Temperature / humidity information on each deck

8.12.1 Description of indicator

The ASEL 3.0 reporting standards require a range of weather information to be collected on each deck of the vessel; namely:

- wet bulb temperature (°C)
- dry bulb temperature (°C)
- relative humidity (%).

8.12.2 Inclusion of indicator in the ASEL Review and subsequent modifications

The temperature / humidity indicators are considered critical environmental risk measures by industry and Government, were part of the reporting requirements in ASEL 2.3, were recommended in the ASEL Review for retention and have been included in the final ASEL 3.0 reporting requirements. Note, however, whereas the ASEL Review recommended that in many circumstances temperature and humidity readings be taken only once per day, ASEL 3.0 requires both minimum and maximum values to be recorded (implying readings be taken at least twice daily).

8.12.3 Type of animal welfare indicator

Environment based.

8.12.4 Level of measurement

Each deck on the vessel.

8.12.5 Frequency of measurement

Twice daily, or more regularly, to record maximum and minimum values.

8.12.6 Research justification

Wet bulb temperature (WBT) is a central component in the industry's Heat Stress Risk Assessment (HSRA) model and has been used in numerous studies to assess heat load on livestock in live export. WBT represents a convenient way to combine dry bulb temperature and relative humidity, to indicate the capacity of livestock to lose heat. Severe health issues, and even death, may result if excessively high WBTs are encountered on a voyage.

Dry bulb temperature (DBT) is also important. When the DBT is at or above body temperature, the only method for heat loss will be via evaporation.

Beyond live export, in many animal welfare systems, temperature information is considered a vital indicator of heat stress risk. For example, the National Feedlot Accreditation Scheme[38] requires feedlots to demonstrate the ability and resources to calculate and monitor the Heat Load Index (HLI) and Accumulated Heat Load Units (AHLU) – both of these indicators contain a variety of weather information, such as DBT, relative humidity and wind speed, that are combined in a way that is correlated with feedlot heat stress risk.

8.12.7 Measurement process

The SAWS Committee noted that in implementing ASEL 3.0 reporting requirements, the Department has specified that maximum and minimum values be recorded for each weather-related indicator (dry bulb temperature, wet bulb temperature, relative humidity). It is not clear from written material from the Department what minimum and maximum temperatures and relative humidity data refers to - it could refer to minimum and maximum values for different parts of the same deck at a similar point in time or it could refer to minimum and maximum values across a 24-hour period. However, LiveCorp reported that it was their understanding that the Department was referring to the latter.

In requiring that maximum and minimum values of weather-related indicators be recorded, the Department diverged from recommendations made in the ASEL Review. The ASEL Review recommendations were that only *average* dry bulb and wet bulb temperatures, as well as relative humidity, be recorded, except in specific circumstances [39].

Collection of minimum and maximum weather data, as specified by the Department in the final implementation of ASEL 3.0 reports, has both advantages and disadvantages.
In terms of advantages, maximum and minimum data can be more relevant to welfare than average weather data.

However, there are several problems recording minimum and maximum values:

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[38] AUSMeat, 2017, op cit., p19.
[39] The ASEL Review also recommended that "*if a panting score of 3 or 4 is observed, wet and dry bulb readings should be taken twice per day*".

- the time-of-day at which maximum / minimum values occur may not coincide for relative humidity, dry bulb temperature and wet bulb temperature (e.g. for a particular day, the time at which the maximum value of dry bulb temperature occurs may be different from the time at which the maximum value for wet bulb temperature occurs)
- an assessment will need to be made by the AAV / LAS of the time each day maximum / minimum values occur. This assessment may be inaccurate – the time at which the AAV / LAS chooses to take minimum and maximum readings may not coincide with the true minimum and maximum values
- the time-of-day for minimum and maximum values may be different across different decks of the vessel
- the Department has stated that they do not expect the AAV/LAS to collect data during normal sleeping hours, but this is when minimum values are most likely to occur.

In its draft report the SAWS Committee was ambivalent about whether automated loggers or handheld devices were used to collect temperature / humidity data[40]. However, considering the problems above, if the requirement to record maximum and minimum values for weather related data is to remain, there may be advantages in using automated logging devices. Automated temperature / humidity loggers allow weather data to be periodically recorded at set intervals.

In this context the SAWS Committee notes that for sheep voyages to or through the Middle East between 1 May and 31 October, current regulations require that relative humidity and wet bulb temperature be automatically recorded every 20 minutes in at least either 2 or 3 representative pens (depending on the vessel's length) on each deck.

In view of the requirement to record minimum and maximum values, the SAWS Committee recommends that industry consider the merit of using automated logging devices on all voyages.

8.12.8 Details of changes made to the indicator that was recommended by the ASEL Review

By requiring minimum and maximum temperature / humidity information to be recorded the Department has made changes to the recommendations contained in the ASEL Review.

[40] In stating in its draft report that it was relatively ambivalent about whether automated loggers or handheld devices were used to collect this weather-related information, the Committee noted the following advantages and disadvantages associated with use of either technology:

- Problems can exist with the automated devices, including failure to upload temperature data or machine faults. Because the handheld devices involve human checking and recording, problems are more likely to either not exist or be identified at the time of measurement – in this respect handheld devices may be considered more reliable.
- Difficulties can sometimes be encountered aligning the time on automated devices with the timing of other assessments (as travel on ships occurs across time zones).
- Handheld devices can be more freely positioned for temperature / humidity readings. In contrast automated loggers must be affixed to, or hung from, a vessel structure.
- The use of handheld devices would seem necessary under the ASEL 3.0 requirements, to note any "hot spots".

8.13. Panting behaviour (sheep)

8.13.1 Description of indicator

Panting behaviour (sheep) is a multidimensional indicator. Under the ASEL 3.0 reporting standards, sheep on the deck are observed for a short period of time and the following are recorded:

- The maximum percentage of sheep on the deck either intermittently or constantly open mouth panting and exhibiting the following characteristics (which the Department has termed Type 1 panting):
  - jaws separated
  - tongue in mouth
  - head up.
- The maximum percentage of sheep on the deck either intermittently or constantly open mouth panting and exhibiting the following characteristics (which the Department has termed Type 2 panting):
  - tongue out
  - head down
  - distressed appearance.
- list of any "hot spots" on the deck.

8.13.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Use of a multidimensional panting score indicator for sheep was recommended in the ASEL Review. However, the indicator recommended in the ASEL Review was different to that finally implemented in the ASEL 3.0 reporting standards. The SAWS Committee in its draft report questioned several features of the ASEL Review recommended indicator and suggested simplification. Some of the suggestions made by the SAWS Committee in its draft report align with changes made in the final ASEL 3.0 reporting standards.

8.13.3 Type of animal welfare indicator

Animal based.

8.13.4 Level of measurement

Deck level.

8.13.5 Frequency of measurement

Morning assessments as per the ASEL 3.0 reporting standards. The SAWS Committee recommends that the industry consider collecting this indicator twice daily – see Section 7.1.

8.13.6 Research justification

The research justification for using panting as an animal welfare indicator is strong. Panting is an important heat loss mechanism for sheep, indicative of an animal's response to increased temperatures, and sustained panting in the face of a heat challenge indicates a continued need for the animal to remove heat. Because of this, panting has been widely used as a measure of thermal comfort – and the ability of the animal to cope with its thermal environment. Panting score is used, for instance, in the AWIN protocol for sheep[41].

[41] AWIN, 2014, op cit., p27.

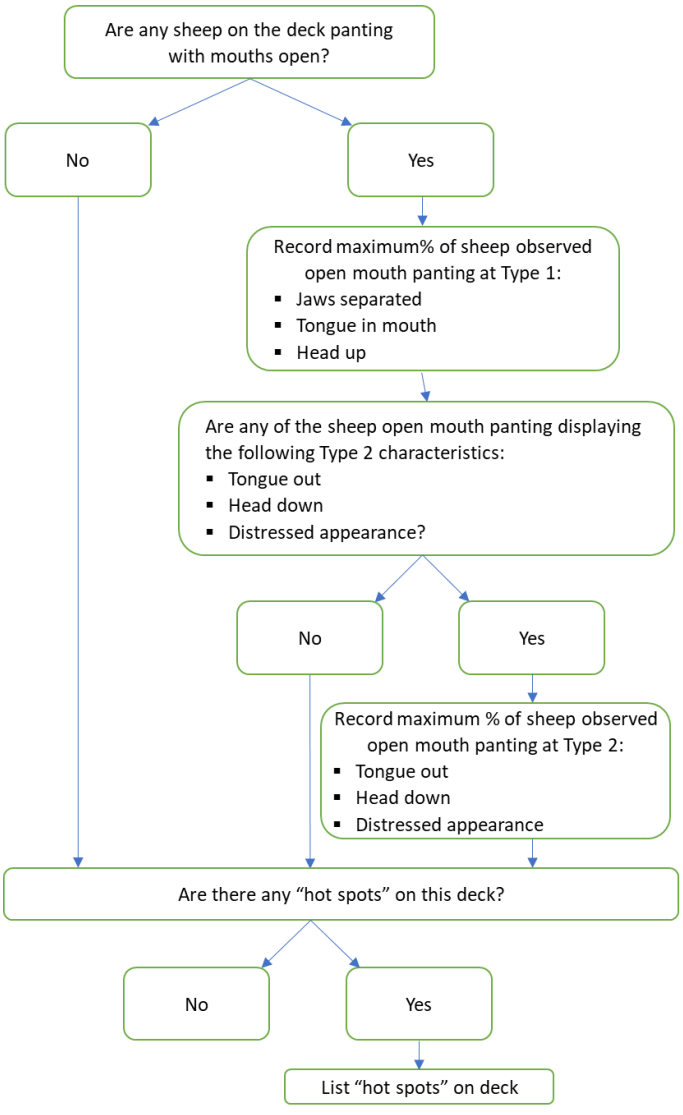
It is to be noted that monitoring of panting is not required under the Australian Animal Welfare Standards and Guidelines for Sheep. There are, however, a number of related provisions including:

- a standard that a person in charge must take reasonable actions to ensure the welfare of sheep from threats, including extremes of weather
- a guideline for contingency plans to be developed to minimise risks to sheep welfare from …. "*conditions that predispose sheep to heat or cold stress*"
- a guideline stating that in sheep feedlots shade and shelter should be provided to prevent heat and cold stress, and all ventilation equipment should be checked regularly to ensure it is fully operational (including daily inspection for indoor systems)
- the Standards and Guidelines define heat stress as "*when the response by animals to hot conditions above their thermo-neutral limit exceeds the ability of their behavioural, physiological or psychological coping mechanisms*" – and lists it as a risk in Australia.

8.13.7 Measurement process

Panting measurement

The process for measuring the portfolio of panting score measures is described in the figure below.



Videos have been selected of sheep panting at Type 1 and Type 2 and photographs of both panting scores are shown below.

Type 1: 'Mouth open, tongue in mouth, head up'.

Type 2: 'Mouth open, tongue out, head down, distressed appearance'.

Hot spot measurement

A definition of "hot spots" has not been provided in the ASEL 3.0 reporting standards, but can be regarded as areas of a deck where temperatures are significantly above those for the deck generally. Typically, some spots are "hot" because structures within these locations are subject to direct solar radiation or to some other heat source (e.g. engine room bulkheads). A method listed in the Veterinary Handbook for detecting hot spots is by monitoring the level of panting across different areas[42].

Problems with measurement and data interpretation

Despite a process for measuring panting being described above, the SAWS Committee envisages a number of problems with measurement of the multidimensional panting indicator. These include the following:

- it will be difficult to accurately measure the number of sheep type 1 and type 2 panting across a deck
- the number of sheep intermittently panting will be related to the length of time used by the AAV / LAS to take the measurements. No guidance is provided by the Department on this issue.
  - The SAWS Committee suggested a short time should be used – essentially the time taken by the AAV / LAS to scan the deck and record the measurement
- it is unclear whether 'maximum' refers to the highest percentage at any single point in time during the period in which the animals on the deck are observed, or the cumulative percentage seen exhibiting that type of panting for at least some of the period
- Type 1 and Type 2 panting are each described using three signs, but it is unclear whether all three signs are required or whether just one of the signs is sufficient to allocate that category to that sheep
- assuming all three signs are required within each of Type 1 and Type 2 panting, there are no categories for some combinations. It is not clear, for instance, whether a sheep that has its head up and does not appear to be in a distressed state, but has its tongue out, should be classified at Type 1 or Type 2
  - The SAWS Committee suggests simplifying the scale to a single characteristic based on the position of the tongue: 'open-mouth panting tongue-in', 'open-mouth panting, tongue-out'.
- As noted, hot spots are never even defined, let alone guidance being provided on how measurement should occur.

[42] http://www.veterinaryhandbook.com.au/Diseases.aspx?id=46&diseasenameid=118&speciesid=1&syndromeid=.

As well as measurement difficulties, problems will arise in interpreting data collected. Research indicates that panting duration is critical when determining the degree an animal is being affected by heat. The Heat Stress Risk Assessment (HSRA) Technical Reference Panel (TRP) drew attention to the importance of duration:

> *"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"[43].***

By including intermittent panting in its measurement process, the Department will include sheep that are panting for only very short periods of time.

8.13.8 Details of changes made to the indicator that was recommended by the ASEL Review

In its draft report the SAWS Committee was critical of the detailed implementation of a panting score indicator for sheep, as recommended by the ASEL Review, and made several suggestions on how the indicator could be changed. Some of the changes made by the regulator in the final ASEL reporting standards align with suggestions made in the SAWS Committee's draft report. Nevertheless, the SAWS Committee continues to be critical of the way in which this indicator has been implemented (see Section 0).

It is of significant concern that, while panting is universally regarded as a critical indicator, views on how it should be measured have constantly altered. Since early 2018 many different ways of measuring panting have been included in Government regulations or recommended in Government reports. The fact that yet another way of measuring panting has been included in the ASEL 3.0 standard, which is different from all preceding Government regulations and reports, is a commentary on the difficulty in measuring this vital aspect of animal welfare and the state of veterinary research in this area.

8.14. Panting behaviour (cattle)

8.14.1 Description of indicator

Panting behaviour (cattle) is a multidimensional indicator. Under the ASEL 3.0 reporting standards, cattle on the deck are observed for a period of time and the following are recorded:

- The maximum percentage of cattle observed on the deck observed either panting at points 2 or 2.5 on the Veterinary Handbook cattle panting scale:
  - 2 = Fast panting, drool or foam present. No open mouth panting.
  - 2.5 = As for 2 but with occasional open mouth[44]. Tongue not protruding.
- The maximum percentage of cattle observed on the deck observed either panting at points 3 or 3.5 on the Veterinary Handbook cattle panting scale:
  - 3 = Open mouth and some drooling. Neck extended and head usually up.
  - 3.5 = As for 3 but with tongue out slightly and occasionally fully extended for short periods.

[43] HSRA Technical Reference Panel 2019, Final report by the Heat Stress Risk Assessment Technical Reference Panel, Department of Agriculture and Water Resources, Canberra, May, p 11.

[44] It was noted by the SAWS Committee that score 2.5 is described in the Veterinary Handbook as *"As for 2 but without occasional open mouth. Tongue not protruding"* (see http://www.veterinaryhandbook.com.au/Diseases.aspx?speciesid=1&syndromeid=9&diseasenameid=116&id=46). The SAWS Committee presumes this should have read: *"As for 2 but with occasional open mouth. Tongue not protruding".*

- The maximum percentage of cattle observed on the deck observed either panting at points 4 or 4.5 on the Veterinary Handbook cattle panting scale:
    - 4 = Open mouth with tongue fully extended for prolonged periods and excessive drooling. Neck extended and head up.
    - 4.5 = As for 4 but with head held down. Cattle 'breath' from flank, drooling may cease.

8.14.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Use of a multidimensional panting score indicator for cattle was recommended in the ASEL Review. However, the indicator recommended in the ASEL Review was different to that finally implemented in the ASEL 3.0 reporting standards. The SAWS Committee in its draft report questioned several features of the ASEL Review recommended indicator and suggested simplification. Some of the suggestions made by the SAWS Committee in its draft report align with changes made in the final ASEL 3.0 reporting standards.

8.14.3 Type of animal welfare indicator

Animal based.

8.14.4 Level of measurement

Deck level.

8.14.5 Frequency of measurement

Morning assessments as per the ASEL 3.0 reporting standards. The SAWS Committee recommends that the industry consider collecting this indicator twice daily – see Section 7.1.

8.14.6 Research justification

The research justification for using panting score as an animal welfare indicator is strong. Panting is an important heat loss mechanism for cattle, indicating the animal's response to increased environmental temperatures, and sustained panting may indicate a continued need for the animal to remove heat[45]. Because of this, panting has been widely used as a measure of thermal comfort – and the ability of the animal to cope with its thermal environment.

It is to be noted that monitoring of panting is not required under the Australian Animal Welfare Standards and Guidelines for Cattle, but there are a number of related provisions including:

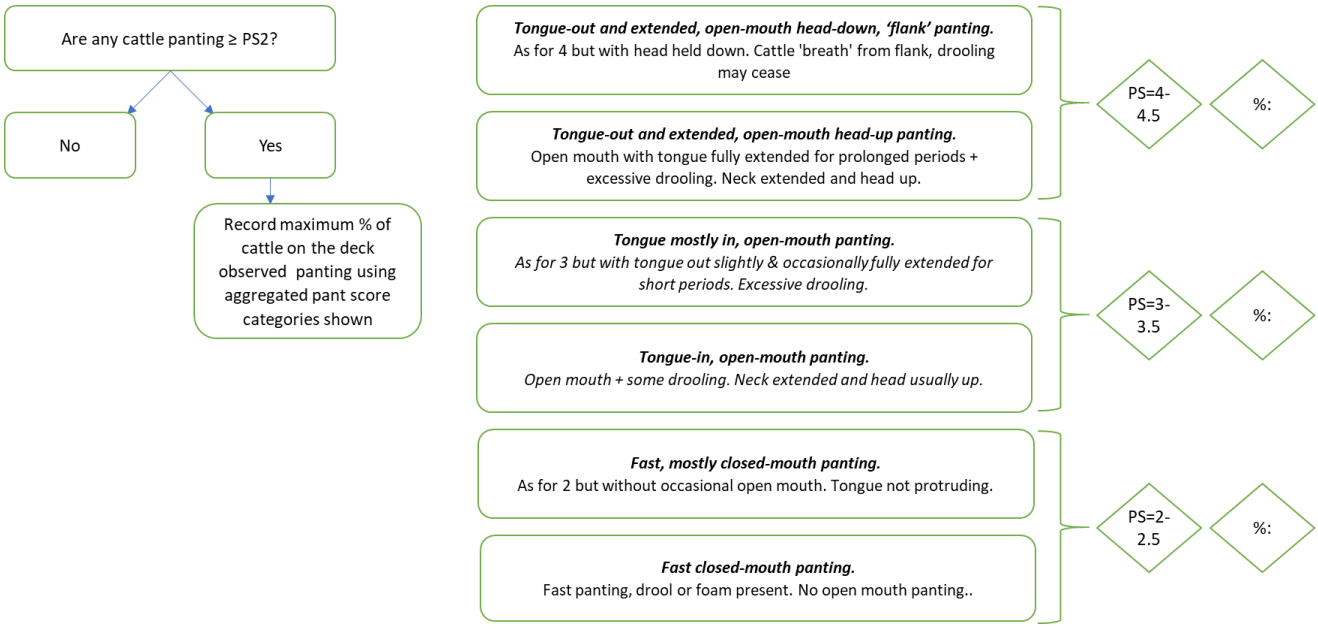
- a standard that a person in charge must take reasonable actions to ensure the welfare of cattle from threats, including extremes of weather
- a standard that, for dairy cattle, a person in charge must implement appropriate actions to minimise heat stress
- a standard that, for cattle feedlots, a person in charge must:
    - do a risk assessment each year for the heat load risk at the feedlot and implement appropriate actions to manage ongoing heat load risk
    - have a documented Excessive Heat Load Action Plan and implement appropriate actions in the event of a heat load emergency.

[45] It may also indicate a respiratory disease.

- a guideline for feedlots is that operators should develop, document and implement routine management procedures to reduce the excessive heat load risks identified before they occur.
- Similarly, monitoring of panting is not required under the National Feedlot Accreditation Scheme, but feedlots are required to:
- calculate and monitor the Heat Load Index (HLI) and Accumulated Heat Load Units (AHLU) (as live export vessels are required to monitor wet bulb temperatures on each deck)
- conduct a Risk Assessment Program (RAP) for the various classes of cattle in the feedlot
- document an Excessive Heat Load Action Plan46.

8.14.7 Measurement process

The process for measuring the portfolio of panting score measures is described in the figure below.



8.14.8 Details of changes made to the indicator that was recommended by the ASEL Review

In its draft report the SAWS Committee was critical of the detailed implementation of a panting score indicator for cattle, as recommended by the ASEL Review, and made several suggestions on how the indicator could be changed. Some of the changes made by the regulator in the final ASEL reporting standards align with suggestions made in the SAWS Committee's draft report.

In its draft report the SAWS Committee particularly questioned the following aspects of the ASEL Review's recommendations on a multidimensional panting score indicator for cattle.

Scale was too complex

The SAWS Committee noted in its draft report that the ASEL Review recommended use of the Veterinary Handbook 8-point scale for cattle panting.

[46] AUSMeat, 2017, op cit., p 19.

- the SAWS Committee was concerned over the repeatability of measurements taken with an eight-point scale. Experienced AAVs confirmed that the scale was difficult to use in that it was impossible to retain in memory the descriptors for various points on the scale
- from the perspective of ensuring animal welfare a number of points on the scale were of relatively minor relevance. In the view of the SAWS Committee, as expressed in its draft report, points on the scale should be consolidated to those with a clear connection to animal welfare (rather than, for example, trying to distinguish whether the animals were slight panting or fast panting).

The SAWS Committee notes that this simplification of the cattle panting scale has occurred in the final ASEL 3.0 reporting standards.

Cattle can pant for reasons other than heat stress

The SAWS Committee noted in its draft report that, whereas in sheep, panting is almost always associated with heat stress, this is not the case with cattle. In particular, a small number of cattle can be panting on a deck due to illness factors (usually associated with respiratory disease).

The Committee suggested in its draft report that panting score assessment requirements could be combined with temperature threshold values to address the confounding factor of BRD.

The Committee notes that in the final ASEL 3.0 reporting standards, panting scores need only be recorded if the wet bulb temperature is ≥ 25°C.

Duration

The SAWS Committee noted in its draft report that the ASEL Review recommended the collection of panting duration data. The universal view of the SAWS Committee was that forcing recording of panting duration, using methods implied by the ASEL Review, would result in spurious data being collected.

The Committee notes that in the final ASEL 3.0 reporting standards, the requirement to record panting duration has been dropped.

Debatable aspects of the cattle panting score indicator remain

Despite improvements being made to the specification of the cattle panting indicator in the final ASEL 3.0 reporting standards, some questionable features remain.

The Committee notes that for sheep, panting scores are only to be recorded once open mouth panting occurs. For cattle, however, recording occurs once the following is observed: 'Fast panting, drool or foam present. No open mouth panting'. Justification for using a lower panting threshold for cattle has not been provided.

It is the view of the SAWS Committee that the welfare of cattle may become compromised once open mouth panting is observed for a significant period of time – i.e. panting at score 3 or above is observed. Panting observed at score 2 represents evidence of some discomfort being experienced by the animals, but not the animals being in distress. If a point is to be set for the recording of panting this should be the point (i.e. ≥ PS 3, not ≥ PS 2).

The SAWS Committee is also puzzled by the inclusion of 'hot spots' in the sheep indicator, but not in the cattle indicator.

Finally, the SAWS Committee notes potential issues with interpretation of the cattle panting indicator and recommends caution in this area. As noted, cattle panting can be caused by confounding factors. Also, of relevance, are results from panting found in Australian feedlots:

- MLA Project FLOT.330, "Validation of the Heat Load Index for use in the feedlot industry"[47], used a heat load index to describe temperatures ranging from thermoneutral conditions (TNC) to "very hot". The project found that, depending on genotype, up to 1% of cattle could be panting at score 2 when temperatures (using the HLI) were only described as "thermoneutral" and 12% when they were described as "warm". Note that, using the HLI scale, temperature conditions ranging from "thermoneutral" to "very hot" could be found in Australian feedlots
- similarly, using a slightly different index for heat load (based on accumulated heat load), MLA Project FLOT.330 found that, depending on genotype, up to 4% of cattle could be panting at score 2 in conditions described as "thermoneutral", 34% when they were described as "mild", and 39% when they were described as "warm".

Indicator measurement issues

Some comments, in terms of measurement issues, made by the SAWS Committee for the sheep panting score indicator also apply to the cattle panting score indicator. In particular:

- it is unclear whether 'maximum' refers to the highest percentage at any single point in time during the period in which the animals on the deck are observed, or the cumulative percentage seen exhibiting that type of panting for at least some of the period
- panting scores are each described using multiple signs, but it is unclear whether all signs are required or whether just one of the signs is sufficient to allocate that category to that animal
- assuming all signs are required within each panting score, there are no categories for some combinations.

8.15. Manure pad score

8.15.1 Description of indicator

The 'manure pad score' under the ASEL 3.0 reporting standards is a measure of the moisture content of the manure pad for the majority of the pen floor area on the deck. It is measured using a four-point scale:

0 = Pad absent.
1 = Pad present, dry, hooves don't sink.
2 = Pad present, moist, hooves sink.
3 = Pad present, sloppy, hooves sink.

The indicator is to be measured separately for cattle and sheep if both species are accommodated on a deck. The SAWS Committee interpret this as the category with the greatest proportion of the pen floor area on the deck.

8.15.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Manure pad score was an indicator recommended by the ASEL Review. Refinements to the specification of the ASEL Review indicator were recommended by the SAWS Committee in its draft report. The final implementation

[47] Byrne, T., Lott, S., Gaughan, J., 2005, *Validation of the Heat Load Index for use in the feedlot industry*, Final Report for Project FLOT.330, Meat & Livestock Australia, Sydney.

of this indicator in the ASEL 3.0 reporting standards reflects a number of suggestions made by the SAWS Committee.

8.15.3 Type of animal welfare indicator

Environment based.

8.15.4 Level of measurement

Deck level (the category with the greatest proportion of the pen floor area on the deck).

8.15.5 Frequency of measurement

Morning assessments.

8.15.6 Research justification

Manure pad indicator for sheep

Dr McCarthy has noted that "*For the most part, the sheep pad makes for excellent bedding. There is no need for additional sawdust or any other bedding additive under normal circumstances*".[48] However, the sheep manure pad must be managed to:

- lower moisture in the air and reduce the pen wet bulb temperature
- minimise the amount of skin and fleece contamination
- improve the comfort and ease of standing, walking, lying down and standing up by minimising pugging
- maintain low levels of ammonia in the pen environment.

Ideally the manure pad should be relatively firm. If excessive moisture is contained in the pad, the animal's comfort when lying down can be affected, as can the ability of the animal to thermoregulate and potentially the health of the animal (which may suffer from a build-up of ammonia). Moreover, W.LIV.3047 found that as manure pad moisture increased, sheep were less likely to be described as 'settled' and more likely to be 'uncomfortable', 'lethargic' or have higher panting scores[49].

On board ships, moisture from manure and urine can impact the integrity of the manure pad. Monitoring the pad becomes particularly important during a heat stress event which leads to increased drinking and therefore, more urine output, subsequently impacting the integrity of the manure pad and leading to increased local humidity. Furthermore, as environmental wet bulb temperatures increase outside the vessel, the capacity of the ventilation system to remove moisture from the manure pad is reduced.

Because of these reasons manure pad score is regarded as an important indicator of animal welfare.

Manure pad indicator for cattle

Similar comments to those included above for sheep, also apply to the welfare impacts of the manure pad in cattle pens. Faecal contamination of coats can particularly be an issue for winter coated *Bos taurus* breeds.

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[48] McCarthy, M., 2018, op cit., p 23.
[49] Collins, T. et al, 2019, op cit., p 56.

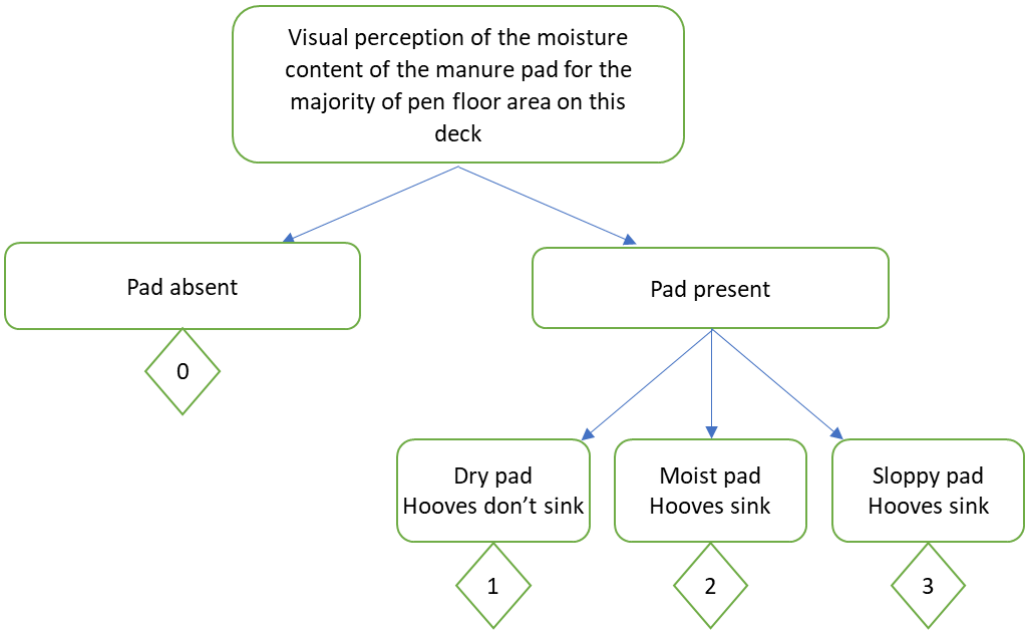
The method of management of the cattle manure pad, however, is quite different to the sheep manure pad. The manure from cattle, being more liquid than that from sheep, generally means that the cattle pens require more regular cleaning during long haul voyages, although this might not be necessary during short haul voyages. Whereas for sheep, the manure pad remains in place and makes for excellent bedding even over a long voyage, for cattle Banney et al. (2009) concluded that regular washing of pens was paramount – in fact, more important than applying fresh bedding.

Manure pad management is an integral part of livestock management during long haul cattle voyages, with manure pad affecting wet bulb temperatures, air quality, the resting surface available to livestock and faecal contamination of coats[50].

Following the first wash, a beneficial welfare management measure for cattle, the manure pad for cattle will nearly always be wet – either 'pad absent' shortly after washing or 'moist pad, hooves sink' or 'sloppy pad, hooves sink'[51]. The SAWS Committee noted that by observing the pattern in the collected data it may be possible to draw inferences about when pens had been washed.

8.15.7 Measurement process

Steps involved with measurement for sheep and cattle are shown in the figure below:



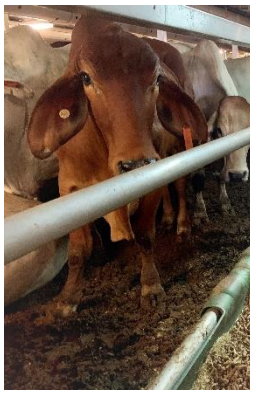
[50] McCarthy, M., Banhazi, T., 2016, *Bedding management and air quality on livestock vessels – a literature review*, Final Report Project W.LIV.0290, Meat & Livestock Australia, Sydney.
[51] See Banney, S., Henderson, A., Caston, K., 2009, Management of Bedding during the Livestock Export Process, Final Report for Project W.LIV.0254, Meat & Livestock Australia, North Sydney, March.

MPS = 1 ‘Pad present, hooves don’t sink’

MPS = 2 ‘Pad present, moist, hooves sink’

MPS = 3 ‘Pad present, sloppy, hooves sink’. A wet slop may occur if there is an issue with leaking pipes or drainage. In this case the sheep need to be moved and the problem fixed.

MPS = 1 ‘Pad present, dry, hooves don’t sink’



MPS = 2 ‘Pad present, moist, hooves sink’

MPS = 3 'Pad present, hooves sink' (Note: the pad is excessively sloppy and deep.)

8.15.8 Details of changes made to the indicator that was recommended by the ASEL Review

The ASEL Review recommended a 3-point scale for manure pad score:

1 = dry
2 = tacky
3 = sloppy.

The SAWS Committee in its draft report recommended a similar scale, but added 0 (pad absent) and endeavoured to define the cut points between levels of the scale with greater clarity to improve the repeatability of the measure. The recommendations in the draft report of the SAWS Committee have been adopted by the regulator in the final ASEL 3.0 reporting standards.

8.16. Faeces type

8.16.1 Description of indicator

The 'cattle faeces type' indicator is used to describe the consistency of faeces across a deck. Under the ASEL 3.0 reporting standards, 'cattle faeces type' is to be measured on a four-point scale that describes the majority consistency across the deck:

1 = Normal
2 = Sloppy
3 = Runny diarrhoea
4 = Firm pellets.

The SAWS Committee interpret this as the category with the greatest proportion of the pen floor area on the deck.

8.16.2 Inclusion of indicator in the ASEL Review and subsequent modifications

'Faeces type' was an indicator recommended by the ASEL Review. It has been included by the regulator in the ASEL 3.0 reporting standards in the exact form recommended by the ASEL Review.

8.16.3 Type of animal welfare indicator

Animal based.

8.16.4 Level of measurement

Deck level (the category with the greatest proportion of the pen floor area on the deck – cattle only).

8.16.5 Frequency of measurement

Morning assessments.

8.16.6 Research justification

'Faeces type' may affect several outcomes important to animal welfare including:

- consistency of the manure pad
- the degree of fleece / coat contamination
- it may be a sign of disease or dietary problems.

However, all, or the majority, of these measures are assessed by other indicators.[52] As a result, the research justification of including 'faeces type' as an indicator would appear minimal. The regulator has not stated the reasons for its inclusion as an indicator, neither were such reasons provided in the ASEL Review.

'Faecal type' is not an indicator that is used in the Welfare Quality®[53] or AssureWel[54] protocols, nor did it appear as a potential measure to be used in an industry commissioned project by Murdoch University (even though many potential measures were listed in this project)[55].

8.16.7 Measurement process

The score recorded should represent the most common category (the most common consistency of faeces type) for the pens on the deck as assessed by the AAV / LAS.

8.16.8 Details of changes made to the indicator that was recommended by the ASEL Review

The SAWS Committee in its draft report suggested that 'faeces type' not be used in the ASEL 3.0 reporting standards as an indicator, because it was redundant.

In terms of the ASEL 3.0 reporting standards, the SAWS Committee notes:

- the modal value on a deck for 'faeces type' is likely to be closely correlated with the modal value for 'manure pad score'
- faeces type is particularly important in diagnosing health problems with individual animals. For instance, diarrhoea (or scours) in cattle and sheep may be a sign of worms, listeriosis, salmonellosis or various viruses (e.g. bovine viral diarrhoea virus), amongst other conditions. Again, however, illnesses are measured directly. 'Faeces type' may be used by an AAV / LAS as an input into a diagnosis that they may make, but is not required as a separate indicator.

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[52] In the case of the SAWS recommendations, all of these outcomes are measured by other indicators, as the SAWS Committee recommends that industry collect data on 'fleece / coat cleanliness' – see Section 8.23. In effect the SAWS Committee would drop 'faeces type' as an indicator, but add 'fleece / coat cleanliness'.

[53] Winckler, C., 2009, op cit.

[54] ASSUREWEL. 2019a. Beef cattle [Online]. AssureWel. Available: http://www.assurewel.org/beefcattle.

[55] Collins, T. et al, 2019, op cit., pp35-38.

The SAWS Committee continues to hold the view that 'faeces type' should not be an indicator required by the ASEL 3.0 reporting standards.

8.17. General demeanour

8.17.1 Description of indicator

General demeanour is an indicator that is meant to summarise the emotions of animals as reflected in observed behaviour. In the ASEL 3.0 reporting standards the following seven-point ordinal scale is used to describe the most common "demeanour" category for animals on the deck:

1 = Anxious
2 = Alert
3 = Active
4 = Settled
5 = Content
6 = Uncomfortable
7 = Dull

The indicator is to be measured separately for cattle and sheep if both species are accommodated on a deck.

8.17.2 Inclusion of indicator in the ASEL Review and subsequent modifications

General demeanour was an indicator recommended by the ASEL Review. Refinements to this indicator were recommended by the SAWS Committee in its draft report. The final implementation of this indicator in the ASEL 3.0 reporting standards reflects several suggestions made by the SAWS Committee in its draft report.

8.17.3 Type of animal welfare indicator

Animal based.

8.17.4 Level of measurement

Deck level (the value selected should be that which describes the most common category for animals on the deck).

8.17.5 Frequency of measurement

Morning assessments as per the ASEL 3.0 reporting standards. The SAWS Committee recommends that the industry consider collecting this indicator twice daily – see Section 7.1.

8.17.6 Research justification

General demeanour is an attempt to develop a simple indicator to describe how animals behave and interact with each other and their environment, i.e. their 'body language'. Describing how animals behave and interact with each other and their environment is a relatively new area of welfare assessment, mostly involving more complex measurement techniques, such as qualitative behavioural assessment (QBA). Research has shown QBA to be a meaningful indicator for animal welfare and, with adequate instruction, people's assessments of animal expressivity can be reliable and valid.

An advantage of QBA is that it offers the ability to measure positive aspects of animal behaviour (e.g. that animals that are positively engaged with their environment, playfulness) and not just avoidance of problems. In contrast, most other indicators of animal welfare measure 'problems' (e.g. incidence of lameness or injury), so the best welfare results that can be recorded is that these problems are avoided.

Both the Welfare Quality and AWIN protocols[56] use QBA via a list of approximately 20 terms.

General demeanour represents an attempt to devise an indicator that measures similar aspects of animal welfare to those captured by QBA, but is simpler to apply. Apart from its association with QBA, the 'General demeanour' indicator has limited research justification as the measure is newly devised and only trialled on a small number of occasions.

A concern of the SAWS Committee with the General Demeanour measure was the prospect for outside factors to bias scoring. At least two research studies have shown the potential for environmental factors to bias scoring with QBA. For instance, it may be likely that when the WBT is high more animals will be scored "dull" rather than "active" and "alert" – this may be due to actual changes in the demeanour of animals, but it may also be due (at least, in part) to observer bias.

8.17.7 Measurement process

The measurement process simply involves selecting one value from the list provided that, in the view of the AAV / LAS, best describes the most common 'demeanour' category for animals on the deck[57].
The indicator is to be measured separately for cattle and sheep if both species are accommodated on the deck.

Videos have been selected of sheep at all General Demeanour scores.

8.17.8 Details of changes made to the indicator that was recommended by the ASEL Review

The ASEL Review recommended the following scale for General Demeanour:

1 = Alert
2 = Active
3 = Lethargic
4 = Anxious
5 = Dull
6 = Other.

In its draft report the SAWS Committee recommended several adjustments to the above list:

- four of the six terms in the ASEL Review General Demeanour scale were repeated in the SAWS Committee recommended list ('Alert', 'Anxious', 'Active', 'Dull')
- from the ASEL Review list, the SAWS Group deleted category 'other' and also 'lethargic' (which was viewed as along the same continuum as 'dull' which was already included in the list)

[56] See, for example, Winckler, C.et al, 2009, op cit., p38 and AWIN, 2014, op cit., p46.
[57] See Dunston-Clarke, E., Collins, T., Gallen, B., 2019, LIVEXCOLLECT: Industry Welfare Data Collection Project (IWDC), Milestone 6 Part B Report, Project W.LIV.3047, Meat & Livestock Australia, Sydney, November.

- the SAWS Committee added the terms ‘settled’, ‘content’ and ‘uncomfortable’. There were no terms in the original ASEL list to describe a pen of livestock that were ‘settled’ and ‘content’. Similarly, in the view of the Committee, livestock can appear as ‘uncomfortable’ without being ‘anxious’.

The adjustments recommended by the SAWS Committee in its draft report were implemented in the ASEL 3.0 reporting standards.

Another recommendation of the SAWS Committee, that a maximum of two terms from the list of terms provided could be selected by the AAV / LAS to describe livestock on the deck, was not implemented in the ASEL 3.0 reporting standards. It was the view of the Committee that the behaviour of a group of animals could be described more accurately using a maximum of two terms, rather than enforcing the selection of one term only.

8.18. Health report – Morbidities - Cattle

8.18.1 Description of indicator

The health report for cattle clinical diseases or injuries (‘morbidities - cattle’) is multidimensional. Under the ASEL 3.0 reporting standards, if a health condition or injury is observed, the following must be recorded for each affected animal:

a) date / reporting day of voyage
b) deck ID
c) pen ID
d) tag type and ID
e) species / class of animal
f) health condition or injury
g) medications / treatments administered / other actions taken
h) whether the animals were prepared or exported under an Approved Management Plan.

8.18.2 Inclusion of indicator in the ASEL Review and subsequent modifications

The ‘Health report – morbidities – cattle’ was recommended by the ASEL Review as an indicator and an outline was provided of information to be included in this indicator. The Review, however, was silent on operational measurement procedures for this indicator.

In its draft report the SAWS Committee provided information on operational procedures developed by the Committee for the ‘Health report – morbidities – cattle’ indicator, that conformed to the general outline provided in the ASEL Review.

The final implementation of this indicator in the ASEL 3.0 reporting standards reflects the operational procedures developed by the SAWS Committee.

8.18.3 Type of animal welfare indicator

Animal based.

8.18.4 Level of measurement

Assessed at animal level for all animals on the vessel - it involves a summary description of all animals on the vessel displaying significant clinical diseases or injury (particularly those transferred to a hospital pen) at that assessment timepoint.

8.18.5 Frequency of measurement

Should be recorded as morbidities are observed and animals transferred to the hospital pen and reported daily.

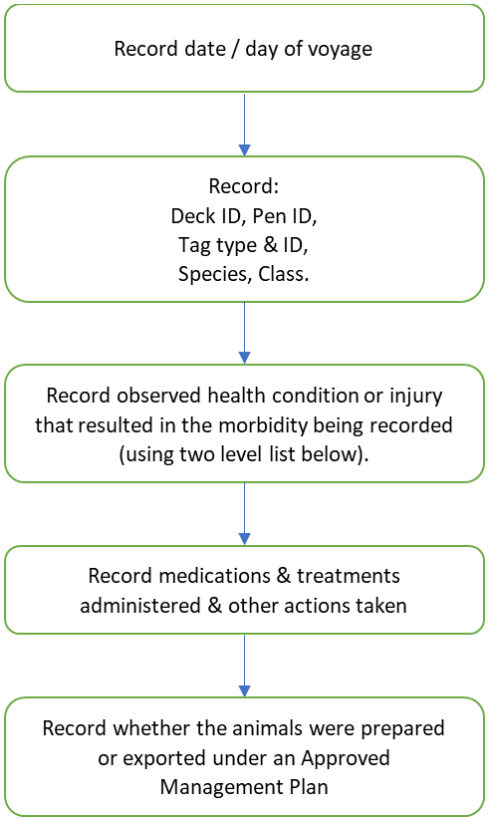
8.18.6 Research justification

Health is one of the pillars in the 5 domains model for animal welfare. Similarly, one of the pillars in the 5 freedoms model is 'freedom from pain, injury and disease'. Because of the centrality of health to animal welfare, absence / prevention of disease and injuries is an integral part of many animal welfare quality assurance systems or standards (e.g. see the Welfare Quality® protocol[58], the Australian Animal Welfare Standards and Guidelines: Cattle[59]).

8.18.7 Measurement process

Morbidities would be observed by the AAV / LAS during the twice daily inspections or, at other times, by stockpersons and referred to the AAV / LAS.

Steps involved with measurement are shown in the figure below:



[58] See Winckler, C., 2009, op cit., pp 27-33.
[59] Animal Health Australia, 2016a, op cit, pp 13, 14.

List of observed disorders

For recording observations of body systems affected and observed disorders for morbidities the following two-level list was developed by the SAWS Committee and included in its draft report.

Level 1 -Body System	**Level 2 - Clinical signs, syndromes. Select all that apply:**
Cardiovascular/ blood	Bleeding Pallor/ anaemia
Eyes/ ears	Pink eye/ eye injury/ eye foreign body Eye discharge/ conjunctivitis Blindness in both eyes Ear infection/ discharge/ swollen/ lesion
Gastrointestinal/ gut	Ill-thrift/ poor body condition/ emaciated Shy feeder/ inanition/ not eating/ inappetence/ anorexia Scours/ diarrhoea/ dysentery Bloat / abdominal distension Scabs or lesions around mouth, lips and or nose Excessive salivation
Muscle/ bone/ joints/ lame/ downer	Lameness or abnormal gait Foot abscess/ injury/ infection/ swelling/ soft sole Limb or joint injury/ infection/ swelling/ fracture
Nervous system/ staggers/ paralysis	Staggers/ uncoordinated/ weak gait Depressed/ head tilt/ circling Excited
Respiratory/ breathing	Laboured breathing/ difficulty breathing/ respiratory distress Nasal discharge Coughing Smother /strangulation / suffocation
Skin/ coat/ horns/ wounds	Wound/ significant laceration Abscess/ infection/ cellulitis Haematoma / bruising or fluid swelling under skin Flystrike Generalised skin lesions and/or hair loss or wool break (including ringworm, papillomatosis, dermatophilosis, buffalo fly lesions) Unhealed dehorning or tipping wounds
Urogenital / reproductive	Difficulty urinating/ urinary tract obstruction Urine abnormal Penile trauma/ infection/ swelling/ pizzle rot Rectal prolapse Mastitis or lactating Blood/ discharge/ retained membranes from reproductive tract Calving/ Abortion/ Dystocia Vaginal/ uterine prolapse

Level 1 -Body System	Level 2 - Clinical signs, syndromes. Select all that apply:
Whole body	Heat stress/ heat stroke/ hyperthermia Downer/ collapsed Sunken eyes/ dehydrated Fever/ elevated body temperature Low body temperature/ hypothermia Bottle jaw/ submandibular oedema
Other	Misadventure in pen Abnormal or aggressive behaviour/ intractable or violent Other causes: (please specify)
Unknown	Unknown

Treatments applied / actions taken

In the view of the SAWS Committee, the list of treatments (see item g) in 8.18.1) should reflect the list of antibiotics on the vessel and other actions that can be taken to treat livestock. The SAWS Committee understands a separate project is being conducted on this topic. The final list developed should reflect the outputs from this other project.

Threshold for a morbidity to be recorded

A question exists over the threshold that must be passed before a cattle morbidity is recorded. The ASEL 3.0 reporting standards provide no guidance in this area. Three potential thresholds are available:

- when any treatments are applied, or actions taken, by the AAV / LAS to address a health issue or injury
- the application of a treatment involving a withholding period
- when an animal is transferred to a hospital pen.

The SAWS Committee is concerned over the level of reporting burden if the first of these thresholds is applied – that time may be taken up recording minor issues when the AAV / LAS may better allocate the time to other more important tasks. The SAWS Committee, therefore, recommends that the threshold set is when a treatment is applied involving a withholding period or when an animal is transferred to a hospital pen.

8.18.8 Details of changes made to the indicator that was recommended by the ASEL Review

The health report was only outlined in general terms in the ASEL Review. The processes recommended by the SAWS Committee for inputting morbidity information into the health report conforms to that outline, but involves implementation of structured recording procedures. These processes were described in the draft report of the SAWS Committee and have been included by the regulator in the ASEL 3.0 reporting standards.

The SAWS Committee noted in its draft report that the ASEL Review asked for successive treatments to be recorded against individual animals and days in hospital pens and observed that this would significantly add to the complexity of the recording system. This requirement has not been included in the ASEL 3.0 reporting standards.

Notwithstanding considerable effort by the SAWS Committee in designing structured recording procedures, thereby, hopefully, increasing the value of data collected and easing the reporting task, the reporting burden of the 'health report – morbidities – cattle' remains considerable. The SAWS Committee expressed concerns regarding reporting burden in its draft report and continues to hold these concerns.

8.19. Health report – Morbidities – Sheep

8.19.1 Description of indicator

The health report for sheep clinical diseases or injuries ('morbidities – sheep') is multidimensional. Under the ASEL 3.0 reporting standards, if a health condition or injury is observed, the following must be recorded:

a) date / reporting day of voyage
b) deck ID
c) pen ID
d) tag type and ID (if available)
e) species / class of animal
f) for each health condition or injury, the count of number of sheep affected by the condition / injury
g) specification of the health condition or injury
h) medications / treatments administered / other actions taken
i) whether the animals were prepared or exported under an Approved Management Plan.

8.19.2 Inclusion of indicator in the ASEL Review and subsequent modifications

The 'Health report – morbidities – sheep' was recommended by the ASEL Review as an indicator and an outline was provided of information to be included in this indicator. The Review, however, was silent on operational measurement procedures for this indicator.

In its draft report the SAWS Committee provided information on operational procedures developed by the Committee for the 'Health report – morbidities – sheep' indicator, that conformed to the general outline provided in the ASEL Review.

The final implementation of this indicator in the ASEL 3.0 reporting standards reflects the operational procedures developed by the SAWS Committee.

8.19.3 Type of animal welfare indicator

Animal based.

8.19.4 Level of measurement

Assessed at animal level for all animals on the vessel - it involves a summary description for all animals on the vessel displaying significant clinical diseases or injury (particularly those transferred to a hospital pen) at that assessment time.

8.19.5 Frequency of measurement

Should be recorded as morbidities are observed and animals are transferred to the hospital pen and reported daily.

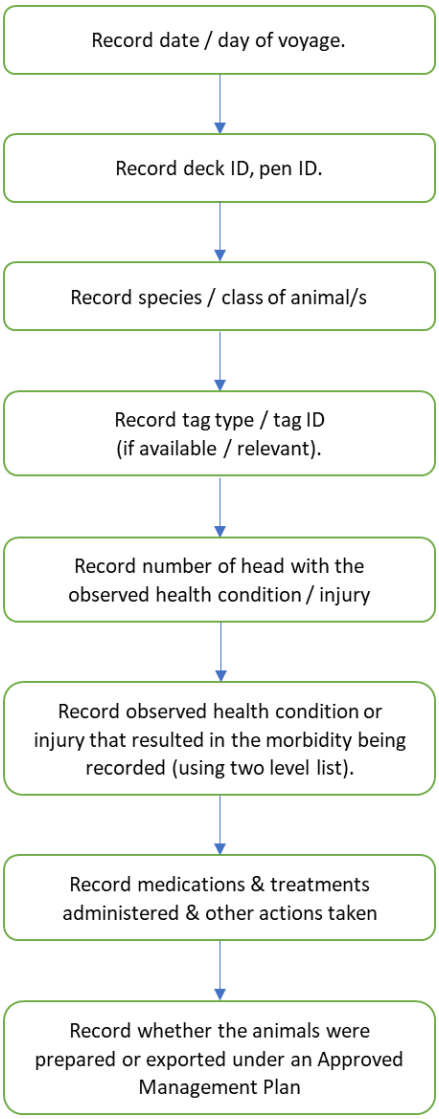
8.19.6 Research justification

Health is one of the pillars in the 5 domains model for animal welfare. Similarly, one of the pillars in the 5 freedoms model is 'freedom from pain, injury and disease'. Because of the centrality of health to animal welfare, absence / prevention of disease and injuries is an integral part of animal welfare quality assurance systems or standards (e.g. AWIN Welfare Assessment Protocol for Sheep[60], the Australian Animal Welfare Standards and Guidelines: Sheep[61]).

8.19.7 Measurement process

Morbidities would be observed by the AAV / LAS during the twice daily inspections or, at other times, by stockpersons and referred to the AAV / LAS.

Steps involved with measurement are shown in the figure below:



[60] AWIN, 2014, op cit., pp 31-39.
[61] Animal Health Australia, 2016b, op cit., pp 12-14.

Tag ID / number of head

The SAWS Committee notes that the software developed for the ASEL 3.0 reporting standards includes a facility to enter in tag numbers or number of head for sheep recorded as morbid. Recording individual tag numbers may be relevant when individual sheep are being treated / transferred to a hospital pen. When groups of sheep are affected, number of head is often a more practical recording mechanism (see Section 8.18.8).

List of observed disorders

For recording observations of body systems affected and observed disorders for morbidities the same lists to be found under Section 8.18, 'Health Report – Morbidities – Cattle', are suggested for use.

Treatments applied / actions taken

In the view of the SAWS Committee, the list of treatments (see item g) in 8.19.1) should reflect the list of antibiotics on the vessel and other actions that can be taken to treat livestock. The SAWS Committee understands a separate project is being conducted on this topic. The final list developed should reflect the outputs from this other project.

Threshold for a morbidity to be recorded

A question exists over the threshold that must be passed before a sheep morbidity is recorded. The ASEL 3.0 reporting standards provide no guidance in this area. Two potential thresholds are available:

- when any treatments are applied, or actions taken, by the AAV / LAS to address the health issue or injury
- when an animal is transferred to a hospital pen.

The SAWS Committee is concerned over the level of reporting burden If the former threshold is applied – that time may be taken up recording minor issues when the AAV / LAS may better allocate the time to other more important tasks. The SAWS Committee, therefore, recommends that the threshold set is when an animal is transferred to a hospital pen.

8.19.8 Details of changes made to the indicator that was recommended by the ASEL Review

The health report was only outlined in general terms in the ASEL Review, but required morbidity records to be maintained for individual sheep. For three primary reasons the SAWS Committee formed the view that it was preferable to only keep records of the number of sheep experiencing morbidities (but classifying these into various categories):

- the handling of sheep tends to be group based even when treating animals. For example, multiple shy feeders are occasionally moved to hospital pens
- catching individual sheep to record animal IDs may be stressful to the animals and far outweigh the welfare benefit obtained from recording this information
- it is not uncommon for 100 or more sheep to be transferred to hospital pens during a voyage. A requirement to keep morbidity records for individual sheep would significantly add to reporting burden.

Supporting points made above, an AAV on a recent voyage involving sheep to the Middle East trialled the collection of individual tag information. The AAV reported that in his observation the collection of this information was stressful to the animals. He also found the collection too onerous when accompanied by the other duties, such as twice daily pen inspections and treating sick animals.

In the view of the SAWS Committee a strong case had neither been made, nor did a strong case exist, for maintaining individual sheep morbidity records. The welfare and reporting burden costs were potentially high. Neither was the SAWS Committee convinced that the data would be used at an individual animal level.

It was noted that the collection of individual animal treatment information was advocated by some on the grounds of application of withholding periods for veterinary medicines. However, it is possible to spray mark sheep placed in hospital pens or, when drug treatments are applied, to use the longest withholding period for the entire hospital pen group (passing this information to the buyer in the overseas market).

The above information was included in the draft report of the SAWS Committee. The SAWS Committee notes that the ASEL 3.0 reporting standards include a facility to record numbers of sheep with a morbidity condition, rather than requiring tag numbers for to be recorded for every morbid sheep.

8.20. Health report – Mortalities

8.20.1 Description of indicator

The health report for mortalities is multidimensional. Under the ASEL 3.0 reporting standards, for every mortality the following must be recorded:

a) date / day of voyage
b) deck ID
c) pen ID
d) species / class of animal
e) either the Tag type and ID of each animal that died (must be recorded for cattle) or the number of animals (can be used for sheep)
f) whether euthanised or found dead
g) euthanised
h) found dead
i) whether a necropsy was performed:
    i. yes
    ii. no.
j) if “no” to h) specify the reasons for not performing a necropsy
k) specify post-mortem findings for body systems with abnormalities that may have caused the mortality and diagnosis (using a two-level list)
l) specify further information or other diagnosis
m) specify other factors that may have led to the mortality
n) whether the animals were prepared or exported under an Approved Management Plan.

8.20.2 Inclusion of indicator in the ASEL Review and subsequent modifications

The ‘Health report – mortalities’ was recommended by the ASEL Review as an indicator and an outline was provided of information to be included in this indicator.

In the SAWS Committee's draft report, a series of operational procedures that had been developed by the Committee, conforming to the general outline provided in the ASEL Review, were reported upon. The final implementation of this indicator in the ASEL 3.0 reporting standards reflects the operational procedures developed by the SAWS Committee.

In the ASEL 3.0 reporting standards the regulator specified collection of an additional item of information, recommended neither by the ASEL Review nor the SAWS Committee – 'specify other factors that may have led to the mortality'.

8.20.3 Type of animal welfare indicator

Animal based.

8.20.4 Level of measurement

Assessed at animal level for all affected animals on the vessel – it involves a census of all animals on the vessel that have died.

8.20.5 Frequency of measurement

Should be recorded as mortalities are observed and addressed and reported daily.

8.20.6 Research justification

Health is one of the pillars in the 5 domains model for animal welfare, and 'good health' is one of the four principles put forward by the Welfare Quality® protocol. Because of the centrality of health to animal welfare, recording mortalities is an integral part of animal welfare quality assurance systems generally (e.g. see the Welfare Quality® protocol, the National Feedlot Accreditation Scheme or the OIE[62]).

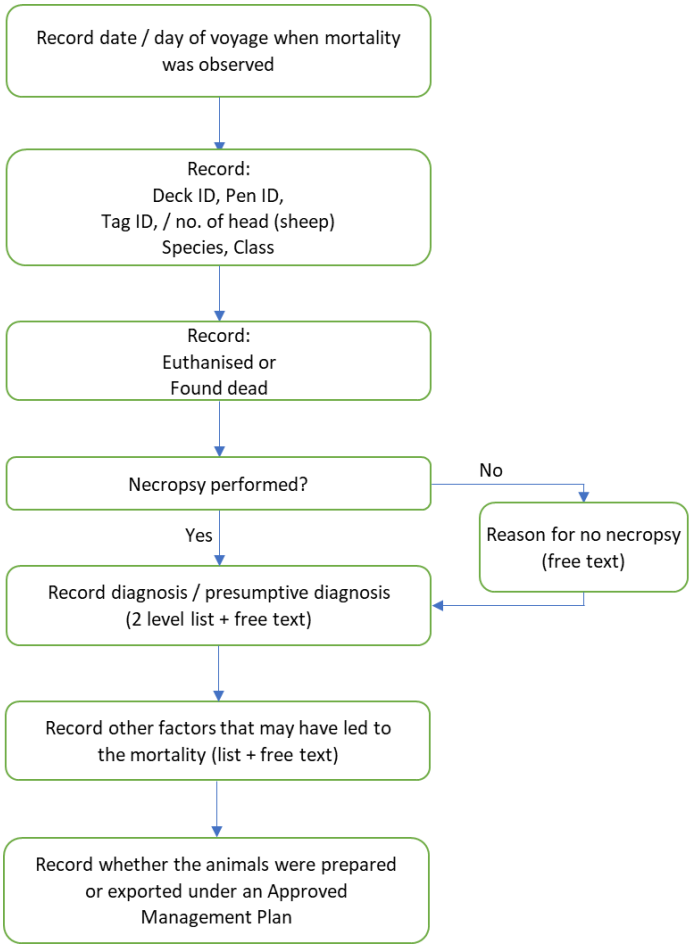
Moreover, measuring mortalities represents an extremely reliable animal welfare indicator as mortalities are easily recognisable. Mortalities continue to represent the main sentinel animal welfare measure prescribed by Australian regulations.

8.20.7 Measurement process

Mortalities would be observed by the AAV / LAS during the twice daily inspections or, at other times, by stockpersons and referred to the AAV / LAS.

[62] See AWIN, 2014, op cit., pp AWIN p22 & pi; Winckler, 2009, op cit. p 33, ASSUREWEL, 2019, op cit., OIE, 2018, Terrestrial Animal Health Code, Section 7 – Animal Welfare, https://www.oie.int/fileadmin/Home/eng/Health_standards/tahc/2018/en_sommaire.htm; AUSMeat Ltd, 2017, op cit., p22..

Steps involved with measurement are shown in the figure below:



For recording observations of body systems affected and observed disorders for morbidities the following two-level list was developed by the SAWS Committee and included in its draft report. Also to be found below are examples of differential diagnoses that could be entered into the free text field labelled 'Further information or other diagnosis (if applicable)' in LIVEXCollect.

Level 1 -Body System that a disorder is observed that may have led to the mortality. Select all that apply:	**Level 2 – Diagnosis / Presumptive diagnosis – clinical signs, syndromes, necropsy findings, gross pathology of: Select all that apply:**	**Level 3 - Differential diagnoses or further details (free text) Examples:**
Cardiovascular/ blood	Heart tissue or pericardium abnormal Major vessels abnormal Peripheral vasculature abnormal Bleeding (excluding bleeding out during euthanasia) Pallor/ anaemia Other: (please give detail) Unknown	Traumatic Reticuloperitonitis
Eyes/ ears	Pink eye/ eye injury/ eye foreign body Eye discharge/ conjunctivitis Ear infection/ discharge/ swollen/ lesion Other: (please give detail) Unknown	

Level 1 -Body System that a disorder is observed that may have led to the mortality. Select all that apply:	Level 2 – Diagnosis / Presumptive diagnosis – clinical signs, syndromes, necropsy findings, gross pathology of: Select all that apply:	Level 3 - Differential diagnoses or further details (free text) Examples:
Gastrointestinal/ gut	Ill-thrift/ poor body condition/ emaciated	E. coli
	Scabs or lesions around mouth, lips and or nose	Salmonella
	Mouth, tongue or oesophagus abnormal	Clostridial enterotoxaemia
	No gut fill/ anorexia (inanition)	Acidosis/ rumen acidosis
	Reticulum, rumen, omasum or abomasum abnormal	Vagal indigestion
	Small intestine abnormal/ enteritis	
	Large intestine or caecum abnormal	
	Scours/ diarrhoea/ dysentery	
	Peritoneum abnormal/ peritonitis	
	Liver abnormal	
	Gall Bladder/ bile duct enlarged or abnormal	
	Lymph nodes enlarged or abnormal	
	Obvious substantial levels of fat	
	Other: (please give detail)	
	Unknown	
Muscle/ bone/ joints/ lame/ downer	Hoof or claw/ injury/ infection/ swelling/ foot abscess/ soft sole	
	Limb, bone or joint injury/ infection/ swelling/ fracture	Erysipelas arthritis
	Skeletal muscle, tendon, ligament, fascia abnormal	White muscle disease, black leg
	Other: (please give detail)	
	Unknown	
Nervous system/ staggers/ paralysis	Brain tissue abnormal (excluding trauma from euthanasia)	Listeriosis
	Brain stem and spinal cord abnormal (excluding trauma from euthanasia)	PEM
	Meninges abnormal (excluding trauma from euthanasia)	
	Other: (please give detail)	
	Unknown	
Respiratory/ breathing	Nasal discharge	
	Upper respiratory tract and/or trachea abnormal	
	Lung tissue and or bronchi - infection, abscess, consolidation	
	Lung tissue and or bronchi - congestion/oedema	
	Pleura abnormal/ pleural effusion/ pleurisy	
	Smother /strangulation / suffocation	
	Other: (please give detail)	
	Unknown	

Level 1 -Body System that a disorder is observed that may have led to the mortality. Select all that apply:	Level 2 – Diagnosis / Presumptive diagnosis – clinical signs, syndromes, necropsy findings, gross pathology of: Select all that apply:	Level 3 - Differential diagnoses or further details (free text) Examples:
Skin/ coat/ horns/ wounds	Wound/ significant laceration Abscess/ infection/ cellulitis Haematoma / bruising or fluid swelling under skin Flystrike Generalised skin lesions and/or hair loss or wool break (including ringworm, papillomatosis, dermatophilosis, buffalo fly lesions) Unhealed dehorning or tipping wounds Other: (please give detail) Unknown	
Urogenital / reproductive	External genitalia/ infection/ swelling/ penile trauma, pizzle rot Bladder, urethra and/or urine abnormal Kidney or ureters abnormal Uterus, ovaries or testes abnormal Udder and/or teats/ mastitis or lactating Rectal prolapse Blood/ discharge/ retained membranes from reproductive tract Vaginal/ uterine prolapse Calving/ Abortion/ Dystocia Other: (please give detail) Unknown	Urolithiasis
Whole body	Heat stress signs: see lungs, heart and muscle. Check all that apply Sunken eyes/ dehydrated Elevated body temperature Bottle jaw/ submandibular oedema Other: (please give detail) Unknown	
Other	Misadventure in pen Other: (please give detail)	
No abnormalities detected on post mortem examination		
Unknown		

The SAWS Committee notes that, in the current version of LIVEXCollect, only one item can be selected for Level 1 and Level 2. Depending on feedback from AAVs / LAS it may be useful to allow multiple items to be selected in future versions. Currently the AAV / LAS can supply further information in the free text field.

The list agreed between LiveCorp and the regulator for “Other factors that may have led to the mortality” is as follows:

"Other factors that may have led to the mortality"
Dominance / aggression
Feed Issues
Water Issues
Shy feeder
Weather conditions
Ventilation issues
Other factors

The SAWS Committee did not design or contribute to the above list.
The SAWS Committee notes that, in the current version of LIVEXCollect, the field for recording the reasons for no necropsy being performed has been included as free text. The SAWS Committee in its draft report provided the following list:

Reason for necropsy not being performed
Autolysis
Pre-mortem diagnosis
Other reason (please specify)

Depending on feedback from AAVs / LAS it may be useful to include this list (or a modified version of it) in future versions of LIVEXCollect.

8.20.8 Details of changes made to the indicator that was recommended by the ASEL Review

The health – mortalities report was only outlined in general terms in the ASEL Review. In its draft report the SAWS Committee provided information on processes for recording mortality information that conformed to the outline contained in the ASEL Review. These processes have been incorporated by the regulator in the ASEL 3.0 reporting standards.

Notwithstanding considerable effort by the SAWS Committee in designing structured recording processes for mortalities, thereby, hopefully, increasing the value of data collected and easing the reporting task, the reporting burden of the 'health report – mortalities' remains considerable. The SAWS Committee expressed concerns regarding reporting burden in its draft report and continues to hold these concerns.

8.21. Health report – Births / abortions

8.21.1 Description of indicator

The health report for births / abortions is multidimensional. Under the ASEL 3.0 reporting standards, for every birth and abortion, the following must be recorded:

a) date / day of voyage
b) deck ID
c) pen ID
d) tag type and ID (of dam)
e) species / class of animal
f) whether a birth or abortion is being recorded

g) if birth, the immediate outcome for the young
h) if abortion: estimated age of the young
i) whether the dam was prepared or exported under an Approved Management Plan.

8.21.2 Inclusion of indicator in the ASEL Review and subsequent modifications

The 'Health report – births / abortions' was recommended by the ASEL Review as an indicator and an outline was provided of information to be included in this indicator. In the SAWS Committee's draft report, a series of operational procedures that had been developed by the Committee, conforming to the general outline provided in the ASEL Review, were reported upon. The final implementation of this indicator in the ASEL 3.0 reporting standards reflects the operational procedures developed by the SAWS Committee.

In the ASEL 3.0 reporting standards the regulator specified collection of an additional item of information, recommended neither by the ASEL Review nor the SAWS Committee – 'if birth, the outcome for the young'.

8.21.3 Type of animal welfare indicator

Animal based.

8.21.4 Level of measurement

Animal level for all animals on the vessel; involves a summary description of all animals on the vessel that have given birth or aborted.

8.21.5 Frequency of measurement

Should be recorded as births / abortions are observed and addressed and reported daily.

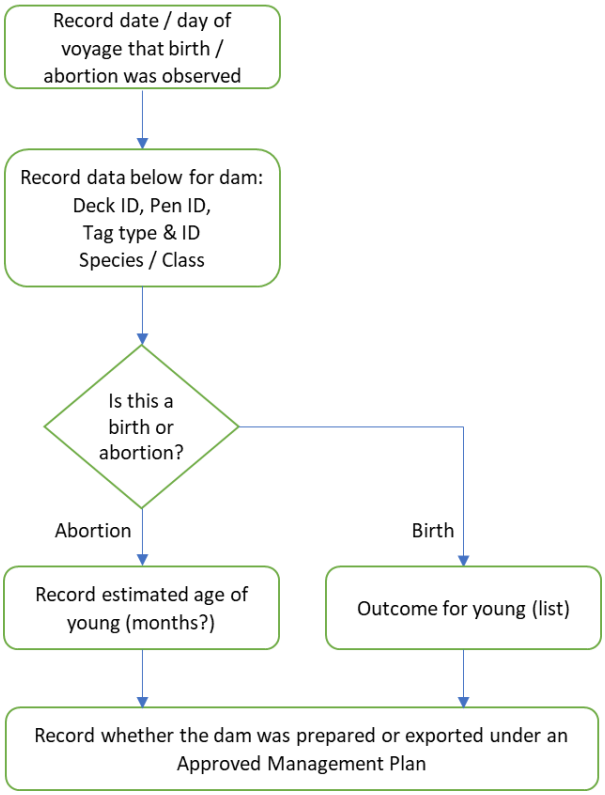
8.21.6 Research justification

Regulations are calibrated to prevent births occurring on board vessels - e.g. female cattle (if not declared as spayed) and sheep (≥ 40kgs and all fat tail sheep) sourced for export as feeder or slaughter livestock must be certified as not detectably pregnant. If births or abortions do occur on board, the certification arrangements may have been deficient, or the animal incorrectly drafted. It is, therefore, important to monitor any births or abortions on board vessels.

8.21.7 Measurement process

Births / abortions would be observed by the AAV / LAS during the twice daily inspections or, at other times, by stockpersons and referred to the AAV / LAS.

Steps involved with measurement are shown in the figure below:



Tag ID

It is noted the mother of an aborted foetus may not always be known. For this and other reasons it may not always be possible to record Tag ID.

Outcome for young

The list agreed between LiveCorp and the regulator for "Outcome for young" is as follows:

"Outcome for young"
Alive
Euthanised
Still born
Other mortality

The SAWS Committee did not design or contribute to the above list.

8.21.8 Details of changes made to the indicator that was recommended by the ASEL Review

The health – births / abortions report was only outlined in general terms in the ASEL Review. In its draft report the SAWS Committee provided information on processes for recording births / abortions that conformed to the outline contained in the ASEL Review. These processes have been incorporated by the regulator in the ASEL 3.0 reporting standards. Further, the regulator has added to the data items to be collected.

8.22. Posture (lying / standing)

8.22.1 Description of indicator

This indicator has been recommended by the SAWS Committee and measures the percentage of animals on a deck standing up (and, conversely, the percentage of animals not standing up i.e. lying down, in sternal or lateral recumbency)

- % of animals on the deck standing on four feet.

8.22.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Posture is an additional indicator recommended by the SAWS Committee. It has not been included in the ASEL 3.0 reporting standards, nor was it recommended in the ASEL Review. It was recommended, however, in the industry commissioned project on animal welfare indicators by Murdoch University[63].

8.22.3 Type of animal welfare indicator

Animal based.

8.22.4 Level of measurement

Deck level – the % of animals on the deck standing on four feet.

8.22.5 Frequency of measurement

Not to be undertaken unless industry chooses to conduct some afternoon assessments (see comments on this in Section 7.1). It would then be measured in morning and afternoon assessments.

8.22.6 Research justification

Posture is an indicator that has been added by the SAWS Committee, based on preliminary findings of W.LIV.3047 – it was not recommended in the ASEL Review.

In the view of the SAWS Committee, measurement of this indicator would demonstrate that animals on livestock export vessels have:

- the inclination to rest
- the space to rest
- the ability to rest during different sea conditions
- an appropriate surface to rest on
- will also show that animals are on their feet in the morning and they lie down in the afternoon.

[63] Collins, T., et al, 2019, op cit., p 43.

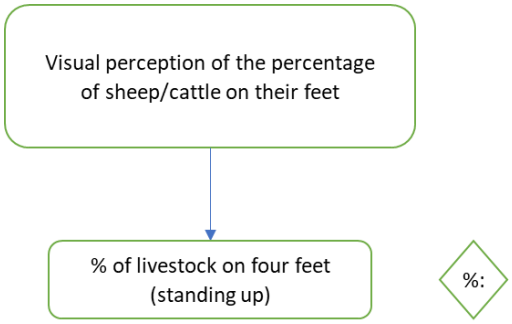
The authors of the Milestone 6 report for project W.LIV.3047 noted:

> *A measure of body posture is required, because it may provide information about stocking density and the effects on the animals, as to whether they can assume a normal or preferred body posture. As social species, cattle and sheep in extensive systems synchronise their feeding and resting behaviours, with synchrony being previously proposed as a welfare measure in other livestock systems. Sheep reduced the time they spent lying when the resting area was uncomfortable and insufficient in space. Therefore, a reduction in time spent lying and ruminating can be an indicator of reduced welfare, while observing cattle in different lying positions, such as sternal vs lateral recumbency, could be used to indicate thermal comfort or discomfort.*[64]

This indicator, however, will only be useful if measurements are taken twice per day. Taken twice daily, the indicator will detect diurnal changes in animal behaviour, with animals typically standing in the morning and lying in the afternoon.

8.22.7 Measurement process

The measurement process is simple, involving a visual estimation of the percentage of animals in the sample pen standing up at the time measurements are taken.



8.22.8 Details of changes made to the indicator that was recommended by the ASEL Review

This is an indicator that has been recommended for industry to collect by the SAWS Committee.
If this indicator is collected, data should be held by the industry for monitoring and reporting purposes and not as a provision to the regulator.

[64] Ibid, p43.

8.23. Fleece / coat cleanliness

8.23.1 Description of indicator

This indicator has been recommended by the SAWS Committee and measures the most common degree of contamination (a) on the fleece for sheep on a deck, or (b) on the coats for cattle on the deck, using a four-point animal level scale:

1 = Clean and dry.
2 = Legs up to thighs contaminated.
3 = Bellies also contaminated.
4 = Upper body also contaminated.

8.23.2 Inclusion of indicator in the ASEL Review and subsequent modifications

Fleece / coat cleanliness is an additional indicator recommended by the SAWS Committee.

8.23.3 Type of animal welfare indicator

Animal based.

8.23.4 Level of measurement

Deck level – the most common category across all animals on deck; to be recorded separately for sheep and cattle where both are present on deck.

8.23.5 Frequency of measurement

Morning assessments.

8.23.6 Research justification

Fleece / coat cleanliness was an indicator that has been added by the SAWS Committee – it was not recommended in the ASEL Review.

W.LIV.3047 noted that fleece / coat cleanliness, and extent of manure coverage of the hind, lower legs and flank are assessed as an ***important*** measure for housed animals, indicating the cleanliness of the floor and bedding. The measure is ***especially important during heat stress events***, as a faecal contamination of the fleece / coat can impede an animal's ability to thermoregulate and lead to health issues[65].

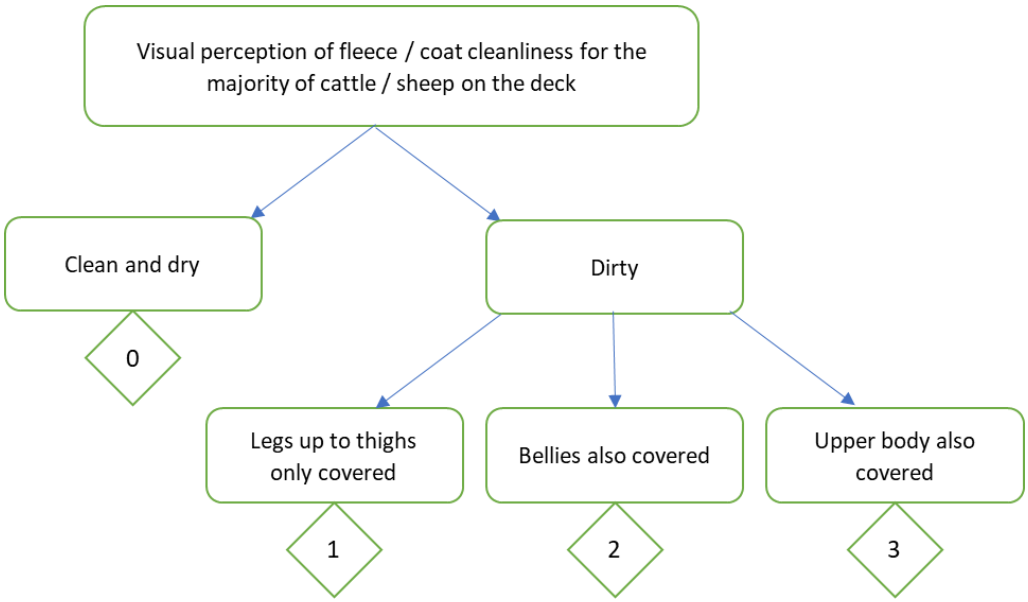
Similarly, the AWIN project noted that assessment of the condition of the fleece can provide information on whether sheep have been able to lie down in comfort[66]. Munoz et al, 2018, using a slightly different scale to that recommended by the SAWS Committee, found it to be a highly repeatable measure[67].

[65] Collins, T., et al, 2019, op cit., p 42.
[66] AWIN, 2015, op cit., p 25.
[67] Munoz, C., Campbell, A., Hemsworth, P., Doyle R., 2018, Animal-Based Measures to Assess the Welfare of Extensively Managed Ewes, Animals, 8, 2; doi:10.3390/ani8010002.

The SAWS Committee noted that with sheep, the degree of fleece contamination within pens is, almost always, quite uniform. The same does not hold true for cattle, however – within pens there may be some animals covered with faeces whereas others can have quite clean coats.

8.23.7 Measurement process

Steps involved with measurement are shown in the figure below:



Photographs of some points on the scale are shown below.

Legs up to thighs only covered

Upper body also covered.

8.23.8 Changes from that recommended by the ASEL Review

This is an indicator that has been recommended for industry to collect by the SAWS Committee. It was not recommended in the ASEL Review and has not been included in the ASEL 3.0 reporting standards.

If this indicator is collected, data should be held by the industry for monitoring and reporting purposes and not as a provision to the regulator.

9 Reporting burden and value of data collected

At several points throughout this report attention has been drawn to the extent of reporting burden created by the ASEL 3.0 reporting standards. As noted previously, reporting burden will be influenced by both the amount and type of data collected and the tools applied to collect this data. This chapter briefly qualitatively considers costs and benefits from regulated collection of animal welfare data on board live export vessels.

9.1. Costs of collecting animal welfare data on board live export vessels.

Assuming that the regulator does not require that additional personnel are employed on board live export vessels to collect welfare data, the costs of collecting additional welfare indicator data are unlikely to be economic (in the narrow sense of the word). An AAV or LAS is employed on every vessel and collection of more animal welfare data merely represents an expansion of that part of their role.

An expansion of the data collection part of their role, however, means that other parts will be squeezed (assuming no spare capacity) and may have other flow-on effects. Because of this the cost of collecting additional welfare indicator data is likely to arise in three areas:

- Distraction of the AAV / LAS from other important duties - gathering and recording data, although a key task of AAVs / LAS, is by no means their only task:
  - The AAVs / LAS carry ultimate responsibility for the management of all the livestock on board vessels, including maintaining an overview of the provision of adequate livestock services (fodder, water and ventilation) in keeping with statutory and exporter requirements.
  - The primary role of AAVs / LAS is providing care and husbandry to livestock within consignments, including the provision of appropriate treatment to sick or injured animals. This task is significant in itself and is *directly* related to ensuring good levels of animal welfare (with collection of indicator data being *indirectly* related to ensuring good welfare). Some Committee members have already received AAV / LAS feedback that the data gathering role is detrimentally impinging on their other roles. This needs to be kept under review.
- Attracting less committed personnel to AAV / LAS roles:
  AAVs / LAS are passionate to the task of providing care and husbandry to livestock. Generally, they regard record keeping, particularly at the level now required by the ASEL 3.0 reporting standards, as significantly less satisfying – an administrative burden.
- Quality of data deteriorates:
  Most relevant to the Terms of Reference of the SAWS Committee, known trade-offs exist between data quality and data quantity. Require too much by way of quantity (unless automated measurement techniques are used) and quality will suffer. The phrase “less is more” is particularly applicable to data gathering. One of the key principles of survey design is to keep the length of the survey short. The concern is, with the amount of data now required, AAVs / LAS will pay less attention to individual data items.

9.2. Value of data collected

The costs above need to be weighed against the value of data collected.
The primary interest of the regulator should be to protect animal welfare. In assessing the value of data collected against this objective, it is important to recognise that the formal animal welfare indicator data

collection system that is contained in ASEL 3.0 represents only one part of a more general animal welfare surveillance system that exists on board livestock export vessels.

The more general surveillance system not only imposes statutory reporting obligations on AAVs and LAS to rapidly report to the Department any incident that "*that has the potential to cause a serious adverse effect on animal health or welfare*", but also involves, on a number of voyages, a completely separate system of reporting on welfare outcomes by Government appointed Independent Observers (IOs). As a result, the added value of the formal data collection system in detecting and reporting adverse animal welfare instances is small.

Rather, the value of the formal data collection system mostly arises in three areas:

- Providing information on the conditions operating at the time of, and leading up to, an adverse animal welfare event, providing valuable information for an investigation of that event.
- Enabling systematic analyses to occur, identifying combinations of livestock classes, environmental conditions and management practices that result in more, or less, favourable on-board animal welfare outcomes. Data mining of this nature will reveal practices that result in the best welfare outcomes – enabling these practices to be adopted generally by industry in a continuous improvement framework.
- Creating a body of evidence of satisfactory animal welfare outcomes on livestock voyages (noting that the more general surveillance system has a heavy emphasis on detection and reporting of unsatisfactory outcomes).

Another relevant observation to be made in assessing the data collection cost / value equation is that in the ASEL 3.0 reporting standards all data collected is by census – data is collected across all vessel decks or across all animals on the vessel. Vessel decks on a live export voyage, however, can be relatively homogeneous, both in the classes of livestock carried and the environmental conditions applying. Work by Murdoch University has shown that where such homogeneity exists, welfare outcomes are highly likely to be very similar. The question arises: does the census approach adopted in the ASEL 3.0 reporting standards meet the cost / value test – or would lower cost regulation provide similar results?

9.3. On-board animal welfare monitoring should be reviewed

A missing piece in the implementation of ASEL 3.0 reporting standards has been a quantitative assessment of the *net* value of additional data being collected – indeed, even an in-depth consideration of this issue has been absent:

- It is now too late to do this prior to the implementation of new reporting standards – as the new standards have already been implemented. The Committee recommends, however, that a joint government / industry review of the new standards occur in early 2022, with this review addressing at least the following points:
  - The use being made of data collected under the ASEL 3.0 standards to that point.
  - Steps being applied for data analyses, interpretation and reporting and any identified need for further development of these steps.
  - The efficiency of methods being employed to collect the data. This should include evaluation of observational protocols (frequency of assessments, number of livestock associated with each observation, etc), and IT methods for data entry and storage.

- The extent of reporting burden imposed by these standards.
- The usefulness of individual indicators - indicators should always be open to challenge, discussion and modification to reflect changing objectives, the emergence of new issues and improvement in measurement techniques.
- The validity and precision of aggregated voyage-level variables based on deck level measurements versus measures from sample pens within decks.
- Methods for summarising animal- and pen-level values for a deck, to maximise sensitivity of detection of adverse welfare.

10 Recommendations on training procedures

As has been emphasised throughout this report, if animal welfare indicator information is to be useful, high inter- and intra-rater repeatability is critical.

To assist in achieving high inter- and intra-rater repeatability, the SAWS Committee in its draft report endeavoured to define measurement scales that are clear and easy to apply. Many of these have now been incorporated into the ASEL 3.0 reporting standards. Furthermore, the SAWS Committee has gathered photographs and videos to demonstrate points along a number of these scales.

To achieve high levels of inter- and intra-rater repeatability, however, it will be critical that all those collecting animal welfare indicator information (AAVs, LAS and Independent Observers - IOs) receive uniform training. In this respect, the SAWS Committee notes that current practice involves:

- LiveCorp being responsible for training LAS.
- The Department of Agriculture / Animal Health Australia (AHA) being responsible for training AAVs.
- The Department of Agriculture / Animal Health Australia (AHA) being responsible for training IOs.

With respect to training on the collection and reporting of animal welfare indicator data, the SAWS Committee is of the view that:

- Training should be undertaken by a single organisation; or
- The training courses should be very closely coordinated so that they contain the same material and teaching elements.

If high repeatability of data collection on animal welfare indicators is not achieved, the data collected will be worse than useless. Coordinated and well-developed training courses and materials for AAVs, LAS and IOs is vital to ensure that this does not occur.

Training instructions should include clear case definitions. A case definition is a set of standard criteria for classifying whether a certain set of observations falls into one category or another. Some guidelines on case definitions have been included in this report, but this may be an area where further work is needed.

Additionally, over time, it is suggested that inter and intra-rater repeatability be monitored. Monitoring will allow training on animal welfare indicators to proactively address areas where repeatability is problematic and will allow faults with the system to be identified and corrected.

It is recommended that the LEP develop an on-board animal welfare indicator measurement training program, including reference materials and either face-to-face or video instruction, for LAS. Furthermore, it is recommended that the LEP liaise with the Department on extensions of this program to AAVs and IOs.

11 Conclusions

The work of the SAWS commenced in March 2020 and concluded in December 2020. As such, this work spanned the introduction of the new ASEL 3.0 on-board animal welfare reporting standards for the Australian live export industry.

The work of the Committee can, therefore, be regarded as occurring in two phases.

- First, before the ASEL 3.0 reporting standard was introduced, the SAWS Committee produced a draft report. This draft report considered the recommendations of the ASEL Review related to on-board animal welfare reporting and suggested a significant number of refinements to recommendations contained in that Review. Of particular importance was the Committee's work on measurement scales and processes for each indicator and how improvements could be made in the codification of morbidities and mortalities.
  - It is this work on measurement scales and processes that represents the greatest contribution made by the SAWS Committee. This work has involved redefining many indicator scales, to maximise intra- and inter-rater repeatability, constructing flow diagrams for measurement processes, as well as using photographs / videos to demonstrate various points on the measurement scales.
  - It is a lack of guidance in data collection methodology that represented the greatest weakness with the collection of voyage data under ASEL 2.3. Lack of guidance greatly diminishes the value of data collected, since incorporated within the data are significant inconsistencies. Simply recommending that more welfare indicator data be collected will not solve this problem: it will only exacerbate the problem.
  - By designing well-structured indicator recording procedures, the work of the Committee should not only ease the reporting task (by presenting a series of choices from which the AAV/LAS can select), but also increase the value of the data gathered (by reducing inconsistencies). Most of this work on structure recording procedures has been included in the ASEL 3.0 reporting standards and, as a result, will automatically be adopted by industry.
- Second, following publication of the ASEL 3.0 reporting standards, the final report of the Committee has been produced. This final report has aimed to achieve the following:
  - Define a set of objectives for industry and the regulator for the collection of animal welfare indicator data.
  - Categorise each indicator by welfare principle and criteria, outlining the research justification for each indicator.
  - Map the ASEL 3.0 indicators against the defined objectives and welfare principles and criteria to determine whether gaps exist. Significant gaps would suggest that industry, to meet its objective of transparent reporting of animal welfare outcomes to the community, should develop indicators additional to those required by the regulator.
  - Repeat material from the draft report relevant to measurement processes for indicators included in the ASEL 3.0 reporting standards.
  - Comment on the ASEL 3.0 reporting standards, noting any Committee concerns.

The Committee concluded that the set of indicators collected under the ASEL 3.0 were very comprehensive. Nevertheless, the Committee recommends that the ASEL 3.0 reporting standards could be enhanced by industry in three areas (stated in order of importance):

- Collect / collate more detailed livestock class information than is required in ASEL 3.0. In the view of the Committee the very aggregated livestock classes used in ASEL 3.0 greatly reduce the usefulness of this data for future risk mitigation analysis. This is because welfare risk is not only strongly associated with environmental conditions, but also the livestock classes being shipped.
- Collect data on a limited number of indicators twice per day: panting, general demeanour, sailing condition and posture. Evidence suggests that collecting data on key indicators twice per day may be more important than collecting data on every deck (as is required in the ASEL 3.0 standards).
- Collect data on two additional indicators: posture and fleece / coat cleanliness. These indicators have been strongly supported in the work on animal welfare indicators for the live export trade, commissioned by industry and undertaken by Murdoch University[68].

As well as the above recommendations, the SAWS Committee made three further important recommendations:

- That the LEP develop an on-board animal welfare indicator training program, including reference materials and either face-to-face or video instruction, for LAS. Furthermore, it is recommended that the LEP liaise with the Department on extensions of this program to AAVs and IOs. The methodical approach of the SAWS Committee to indicator measurement and the visual material the Committee has gathered to demonstrate different points on a number of the indicator measurement scales should greatly assist in the development of training manuals and courses.
- That the LIVEXCollect data collection software continues to be refined. In particular the Committee foresaw significant advantages in a design of a data entry system that allows use of mobile devices. Such a system would result in improvements in data collection efficiency and data accuracy, as data can be inputted simultaneously with observations are being made.
- That a joint industry / government review be conducted of the new standards in early 2022. This review should include an assessment of the use being made of data collected, the efficacy of systems being employed to collect the data, the extent of reporting burden created by the new standards and the performance and usefulness of individual indicators.

Finally, the SAWS Committee notes that, given the embryonic nature of collection of animal welfare indicator monitoring on board livestock export vessels, it was not within its remit to define interpretation processes to be applied to indicator data. However, the animal welfare surveillance system will be of limited use until interpretation processes are defined and applied on an ongoing basis. At least two possible approaches exist for the development of interpretation algorithms:

- Synthesising the collective views of a panel of animal welfare experts.
- Developing benchmarks using indicator data from voyages.

Both approaches have limitations and a combination may be optimal. There are likely to be advantages if the regulator and community representatives are involved. It is critical, however, that a start be made in this area.

[68] Collins, T., et al, 2019, op cit.

The system for monitoring on-board animal welfare would be most useful if valid credible thresholds can be defined between acceptable and unacceptable welfare outcomes on live export voyages.

Appendix A: Terms of reference

The Terms of Reference for the SAWS Committee are to be found below.

Background

Both industry and government have agreed that a need exists to develop more meaningful indicators of animal welfare on board livestock export vessels.

In support of this aim since August 2017 industry has funded a project to identify and quantify a comprehensive set of indicators to measure animal welfare outcomes on board livestock export vessels. Through an extensive literature review this study has identified over 75 possible indicators for sheep, and a similar number for cattle, that relate, to varying extents, to welfare outcomes on board livestock export vessels.

During the conduct of the industry animal welfare indicators project, a review of the Australian Standards for the Export of Livestock also occurred. Amongst other things the ASEL review committee recommended that on-board reports be expanded to include additional morbidity and welfare measures.

Research on measuring animal welfare outcomes will continue; however, there is a need to develop an agreed list of measures that can be practically and immediately applied on board vessels and adopted by all exporters to show the welfare status of animals exported. The regulated requirements for on-board reporting (from the ASEL review) obviously form a baseline for selection of animal welfare measures; however, reasons may exist for the industry to collect additional welfare information to that required by the regulator. A further, and greater, task is to determine standardised procedures for data collection for all agreed indicators. Historically a range of non-standardised procedures have been used across the industry to collect animal welfare indicator data.

To make recommendations on both these major tasks, MLA and LiveCorp have established the Shipboard Animal Welfare Surveillance (SAWS) Committee, comprising animal welfare experts, statistical experts, industry participants and those with practical knowledge of the on-board environment.

The SAWS Committee will initially report to MLA and LiveCorp, but ultimately the report of the Committee will be considered by the Australian Livestock Exporters' Council (ALEC) with a view to partial or full implementation of the Committee's recommendations. Terms of reference for the SAWS Committee are shown below.

Work completed by the SAWS Committee will feed into a larger initiative on animal welfare surveillance. This larger initiative involves using standard templates to store animal welfare indicator data collected in a central database and developing summary information reports / dashboards from this database (see attached outline of the 'Live Export Welfare Surveillance System'.

Committee Terms of Reference

1. Using the recently concluded review of ASEL, interim results from Project W.LIV.3047 and the combined expertise of the working group, to identify a targeted, practical set of indicators that reflect critical aspects of animal welfare on board live export vessels and that will meet the requirements of industry and the regulator. These indicators should represent either direct measures of animal welfare or important resource or environmental correlates with animal welfare.

- From the recommended ASEL review indicators, the working group should note any notable omissions in terms of the industry or regulator obtaining an accurate picture of vital animal welfare outcomes on board the vessel.
- Equally, the working group should note any indicators included in the ASEL Review list that may not be required to obtain an accurate picture of vital animal welfare outcomes on board the vessel.
- The working group should have regard to the value and practicality of each recommended indicator as well as the complete set of indicators. The group should also recognise that it is planned that agreed indicators will be adopted by all exporters, placing further importance on demonstrating practicality and value.
- Recommended indicators need to be described in detail and individually justified as well as justified as a set of indicators.

2. For each identified indicator, to determine practical standardised procedures for ensuring consistency of measurement and, to the extent possible, statistically meaningful results. It is recognised that procedures initially recommended by the committee may be modified in the future as data is collected. Standardised procedures should include the following elements:
    - Whether measurement of the item is to be by census or sampling.
    - If sampling is to be used, recommending sampling protocols (how the sample is to be selected, etc).
    - Frequency of recording each measure.
    - Recommending refined scoring scales for pen-level (ordinal) assessments to provide best combination of sensitivity, specificity, and repeatability (inter- and intra-rater repeatability).
    - Recommending precisely how measurements should be undertaken.

3. Apart from the above the working group is also initially tasked with recommending training procedures for those undertaking the recommended set of animal welfare measurements.

4. The working group's role may be expanded in the future:
    - To provide recommendations on how surveillance data might be analysed and monitored as the voyage progresses to detect changes in animal welfare risk.
    - As measurements are obtained, to provide recommendations on the adequacy, of the complete set of measures collected.
    - To provide recommendations on reporting voyage animal welfare outcomes to the regulator and community.

The work of the working group represents part of the work being completed under the live export welfare surveillance system (see below objectives for this wider set of work).

Objectives of the live export welfare surveillance system

The objectives of the proposed live export welfare surveillance system are:

1. To identify a set of indicators that reflect critical aspects of animal welfare on board live export vessels and that will meet the requirements of the regulator. These indicators should represent measures of animal welfare in themselves or important resource or environmental correlates with animal welfare.
2. For each of the identified animal welfare indicators, to develop standardised measurement procedures that are also practical, to ensure measurement consistency.
3. To develop efficient procedures, including use of standard templates, for ease of uploading identified animal welfare indicators onto a central database.
4. To store indicator measures for each voyage onto a central database for regulatory and exporter use.
5. To provide summary information to the regulator and to the exporter / relevant ship staff on animal welfare indicator measurements taken during a voyage.
    - Where certain triggers are exceeded (notifiable incidents occur), information must be provided immediately to the exporter and regulator.
    - The system should provide end of voyage summaries of animal welfare results achieved during each voyage.
    - Ideally, to provide ship staff and the exporter in a timely fashion during voyages with indicators of emerging animal welfare issues.
6. Over time, to generate summary information of the animal welfare results achieved by the industry, including identifying any emerging issues or challenges.
7. To allow the system to be readily expanded to incorporate additional animal welfare indicators that may be required in the future.

Appendix B: SAWS Committee membership

The composition of the SAWS Committee is shown below.

David Beggs	BVSc, MVS, PhD, FAVA. Experience in Animal Welfare, research and policy development. Senior lecturer in cattle medicine at the University of Melbourne; PhD in animal welfare of cattle; Member of Victorian Government Animal Welfare Advisory Committee; Editor-in-chief of Australian Veterinary Journal.
Patrick Cass	Senior Veterinary Officer, Live Animal Export Branch, Department of Agriculture, Water and the Environment.
Wayne Collier	General Manager, Programs, LiveCorp.
Sharon Dundon	Project Manager - Live Export Research & Development, Meat & Livestock Australia.
Alastair James	Deputy Chief Executive Officer, Australian Livestock Exporters' Council.
Holly Ludeman	B.Sc. (Agr.), DVM, Managing Director at The Livestock Collective, senior professional in livestock exports working in compliance and welfare roles.
John Morton	BVS (Hons), PhD. Veterinary Epidemiological Consultant, Jemora Pty Ltd., past Senior Lecturer in Veterinary Epidemiology and Biometry, University of Queensland.
Richard Shephard	BVSc, MVS, PhD. Managing Director of Herd Health. Veterinary consultant and epidemiologist with special interest in animal health information systems. Independent Scientist, Live Export Research and Development Advisory Committee.
Renee Willis	PhD candidate at Murdoch University, researching animal welfare surveillance for the livestock export industry. Australian Government Accredited Veterinarian (Shipboard).
Peter Barnard	BEc (Hons), PhD. Director, Oliver & Doam, Past General Manager, Meat & Livestock Australia, including for live exports, acting as Secretariat.

Appendix C: Meetings of the SAWS Committee and Working Group

Meetings of the SAWS Committee and Working Group were held as follows:

Meeting date	Committee / Working Group
4 March	SAWS Committee
2 April	SAWS Working Group
22 April	SAWS Working Group
29 April	SAWS Working Group
9 May	SAWS Working Group
18 May	SAWS Working Group
30 June	SAWS Committee