



final report

Project code: W.LIV.0284
Prepared by: K.Shiell, N.Perkins, L.Hewitt

Date published: April 2013
ISBN: 9781925045024

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Review of ASEL Scoping Study

Export of sheep from southern ports to the Middle East in winter months

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

This publication is published by Meat & Livestock Australia Limited ABN 39 081 678 364 (MLA). Care is taken to ensure the accuracy of the information contained in this publication. However MLA cannot accept responsibility for the accuracy or completeness of the information or opinions contained in the publication. You should make your own enquiries before making decisions concerning your interests. Reproduction in whole or in part of this publication is prohibited without prior written consent of MLA.

Abstract

This report provides a review of the current ASEL and regulatory framework with a particular focus on preparation of sheep for export from southern ports in the Australian winter months. It also incorporates assessment of government reports from investigations of reportable mortality events since 2006. The report makes recommendations concerning areas where the current standards may be changed to improve clarity and purpose and suggestions where further research may be implemented to both identify risk mitigation strategies for major risks and inform further refinement of standards.

Executive Summary

This report provides a review of the current ASEL and regulatory framework with a particular focus on preparation of sheep for export from southern ports in the Australian winter months. It also incorporates assessment of government reports from investigations of reportable mortality events since 2006 and identifies areas in the current ASEL that may benefit from review.

There have been 13 reportable mortality investigations involving sheep voyages since 2006. These reports involved voyages that included sheep loaded from all three major ports (Fremantle, Portland and Adelaide) and there were two major drivers of mortality identified in the investigations: enteritis or more broadly salmonella-inanition, and heat stress.

There has been a decline in voyage and annual mortality rates over the years since the period from 2000-2002 and this is attributed in part to the decline in total numbers of sheep being prepared for export as well as to the implementation of the current ASEL and associated improvements in standards of preparation of sheep for export and management of the export supply chain.

In the period since 2004 when the initial Standards were implemented there have been no major changes in the way sheep are prepared for export and little evidence for continued decline in annual mortality rates for export sheep.

Many of the issues identified in the report will require targeted research projects to deliver results that can then contribute to improvements in the regulatory framework.

Caution is urged to avoid making additional prescriptive changes to the ASEL and also to avoid making changes unless there is unequivocal evidence to support a view that the changes are both warranted and likely to result in measurable benefit. As can be seen in some of the discussion in this report, there are existing requirements in the ASEL that may not be warranted when assessed for science-based justification and that may not necessarily be having measurable beneficial impacts on welfare outcomes, but are nonetheless difficult to change, largely because they are already incorporated into the Standards.

One option may be to consider some changes as interim changes until such time as further research is conducted or evidence accumulated to warrant implementing change into the standards. An example may be implementing measures as export advisory notices with a defined timeline in conjunction with further research.

Options for further research include:

1. That a framework be developed that will allow appropriately justified research findings to inform modifications to Standards over time. There is a sense of frustration within the industry that it is difficult to modify sections of the Standards once they are written even when there is a body of accumulating evidence to justify change.

2. That consideration be given to removing the term *pastoral and station sheep* from the Standards and replacing it with a clear definition of any restrictions that may be placed on sheep sourced for export during winter months. It is suggested that the definition be linked to the geographic locations of the origins of sheep that have been shown to be at elevated risk of mortality during winter months.
3. That the land transport components of the Standards be simplified by referring to the National Land Transport Standards without additional criteria that must be met or checked. This change is likely to simplify issues relating to responsibilities and compliance and means that everyone has to refer to a single set of Land Transport Standards.
4. That consideration be given to implementing research to test whether there is a benefit in allowing a shorter minimum time on feed for sheep being prepared in registered premises. There have been a number of occasions where reviews have suggested that shortened feedlot time may be beneficial in terms of reducing exposure risk to *Salmonella* organisms in the registered premise.
5. That further research be conducted to assess options for risk mitigation against Salmonellosis including in particular oral vaccination and management of sheep in registered premises during winter months. There are ongoing questions about the benefit of sheds vs paddocks (in both the west and the east) as well as how best to manage sheep in paddocks to minimise exposure risk and also whether it may be possible to monitor environmental loads and mob level shedding.
6. That appropriate research be conducted or expert opinion sought on the benefits of shearing sheep in the days before loading onto ships as a preventive measure against possible heat stress. It is understood to be a common practice in sheep prepared in sheds in Western Australia but the benefits do not appear to be documented.
7. It was not possible to identify definite suggestions concerning options to mitigate risk of heat stress in sheep prepared in southern ports during winter months. There has been a new version of HotStuff implemented recently and there is also ongoing work validating the application of HotStuff in managing heat stress risk.
 - a. It is suggested that the findings of ongoing work aimed at validating HotStuff and HSRA models be considered in developing further recommendations for refining and improving HSRA.
 - b. It is suggested that industry consider reviewing the strategic objective for HotStuff (lower than 2% probability of a 5% mortality event) during this process.
8. That industry consider developing and implementing an integrated monitoring and surveillance capacity that can underpin QA systems and provide important benefits to the industry in terms of documenting good performance, early identification of problems and underpin and inform industry R&D.

Export of sheep from southern ports to the Middle East in winter months

Abbreviation	Explanation
APS	Australian Position Statement (on the Export of Livestock)
AAV	AQIS accredited veterinarian
AEP	Approved Export Plan
AHCPLL	Application for Health Certificate and Permission to Leave for Loading
ALEC	Australian Livestock Exporters' Council
ALES	Australian Livestock Export Standards
AMLI	Australian Meat and Live-stock Industry Act 1997
AMSA	Australian Maritime Safety Authority
AO	Officer of the Order of Australia
AQIS	Australian Quarantine and Inspection Service
ASEL	Australian Standards for the Export of Livestock
AWC	Animal Welfare Committee
AWI	Australian Wool Innovation
CRMP	Consignment Risk Management Plan
DAFF	Department of Agriculture, Fisheries and Forestry
DAFWA	Department of Agriculture and Food Western Australia
DPI	Department of Primary Industries
ESCAS	Exporter Supply Chain Assurance System
HSRA	Heat Stress Risk Assessment
IATA	International Air Transport Association
IRG	Independent Reference Group
LEAP	Livestock Export Accreditation Program
LEAP	Livestock Export Program
LEICC	Livestock Export Industry Consultative Committee
LESAC	Livestock Export Standards Advisory Committee
LESAG	Livestock Export Standards Advisory Group
LHPA	Livestock Health and Pest Authorities
ME	Middle East
MLA	Meat and Livestock Australia
MT	Metric tons
NCCAW	National Consultative Committee on Animal Welfare
NLIS	National Livestock Identification System
NOI	Notice of Intention
NSW	New South Wales
NVD	National Vendor Declaration
PAT	Pen air turnover
PIC	Property Identificaiton Code
PIMC	Primary Industries Ministerial Council
PIRSA	Department of Primary Industries and Resources of South Australia
PISC	Primary Industries Standing Committee
QA	Quality Assurance
QLD	Queensland
R&D	Research and Development

RLPB	Rural Lands Protection Boards
RP	Registered Premise
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SA	South Australia
SLEP	Saudi Live Export Program
TWG	Technical Working Group
VICT	Victoria
WA	Western Australia

Contents

	Page
1	Background 10
2	Objectives 10
3	Introduction 10
4	Review of relevant literature 13
4.1	Overview of the export chain 13
4.2	State legislation and requirements..... 16
4.3	Australian Position Statement on the Export of Livestock 17
4.4	Australian Standards for the Export of Livestock (ASEL)..... 18
4.4.1	Standard 1: Sourcing and on-farm preparation of livestock..... 18
4.4.2	Standard 2: Land transport of livestock..... 22
4.4.3	Standard 3: Management of livestock in registered premises..... 23
4.4.4	Standard 4: Vessel preparation and loading 29
4.4.5	Standards 5 and 6: Onboard management of livestock and air transport of livestock..... 31
4.5	Australian Meat and Livestock Industry (Export Licensing) Regulations 1998..... 32
4.6	Export Control (Animals) Order 2004 32
4.7	Independent Reference Group reviews..... 33
4.8	Livestock Export Review 2003 - Keniry Review 34
4.9	Independent Review of Australia’s Livestock Export Trade 36
4.9.1	Section 1.6: Past reviews 36
4.9.2	Section 3: Current Regulatory Arrangements 36
4.9.3	Section 4: Australian Standards for the Export of Livestock..... 40
4.9.4	Section 5: Suitability of livestock for export 43
4.9.5	Section 7: Post-arrival monitoring and risk management..... 46

4.9.6	Government response to the Farmer Review	48
4.10	Exporter Supply Chain Assurance System (ESCAS).....	49
4.11	Australian Senate inquiry into animal welfare standards in live export markets	51
5	National livestock export performance reports.....	53
5.1	Summary of sheep numbers	53
5.2	Summary statistics for mortalities	55
	Mortality investigations	63
5.3	Strategies identified in mortality investigation reports to manage risks 75	
5.3.1	Actions	75
5.3.2	Recommendations	77
6	Analysis of industry data.....	78
6.1	Voyage mortality rate.....	79
6.2	Odds of reportable mortality events.....	89
6.3	Results of statistical analyses in context	92
6.4	Origins of ASEL requirements	94
6.5	Southern ports.....	96
6.6	Pastoral and station sheep.....	97
6.7	Paddock vs shed.....	104
6.8	Age of sheep.....	105
6.9	Transport distance.....	105
6.10	Full mouth wethers, broken mouth sheep and pregnant ewes	106
6.11	Time on feed	107
6.12	Sheltered feed troughs	108
6.13	Wool length.....	109
7	Heat stress risk assessment (HSRA)	110
	Findings	

7.1	Current problems	114
7.2	Why are the problems occurring	114
7.2.1	Salmonellosis-inanition	114
7.2.2	Heat stress	115
7.3	Changes in preparation practice for various classes of sheep	116
7.4	Assessment of the current standards for sheep being prepared in southern ports.....	117
7.5	Gaps in the current standards	118
8	Options for further industry research	120
9	References	123
10	Appendix 1: Recommendations arising from the Independent Reference Group reviews.....	125
11	Appendix 2: Principles and recommendations from the Keniry Review	129
12	Appendix 3: Recommendations from the Farmer Review.....	133

1 Background

This report is part of a broader project that will provide a scoping study of the regulatory framework for livestock export. The project started in August 2012 and is scheduled to be completed in April 2013.

This report is intended to deliver against Objective 3 from the broader project objectives.

2 Objectives

Objective 3: Export process – sheep exported to the Middle East from southern ports

- a) Review of current standards that are relevant to export of sheep from southern ports, including consideration of winter vs summer months.
- b) Description of preparation practices for various classes of sheep being prepared in southern ports for export to the Middle East and other destinations, in winter and summer.
- c) Review of DAFF investigations relating to export of sheep from southern ports. The review will summarise issues identified in the reports and recommendations for any changes to procedures arising from the investigations. The review will identify areas where standards and/or monitoring and reporting may be changed to improve animal welfare outcomes.

3 Introduction

It is relevant to consider a brief overview of recent events to place this review into a broader context.

The Australian Livestock Export Standards (ALES) were developed in the 1990s by a committee with representation from the Australian Livestock Exporters' Council (ALEC), AQIS, DAFF, the National Consultative Committee on Animal Welfare (NCCAW) and Meat and Livestock Australia. The ALES were managed by LiveCorp in association with a quality assurance scheme called the Livestock Export Accreditation Program (LEAP), that was intended to ensure that exporters complied with ALES, relevant legislative requirements for export and other animal welfare legislation and codes of practice.

In 1999 and 2002, there were reviews of the livestock export trade by an Independent Reference Group (IRG) convened by the Australian Government Minister for Agriculture, Fisheries and Forestry. Both reviews were convened in response to concerns over incidents relating to live exports and whether there were appropriate controls in place to prevent such incidents in the future. These reviews will be described separately.

In 2003, the Keniry Livestock Export Review was initiated in response to welfare concerns arising in particular from issues associated with the MV *Cormo Express*, an export vessel carrying sheep to Saudi Arabia that was forced to spend 80 days on the vessel following the rejection of the consignment by Saudi authorities, while the vessel was at sea.

Significant reforms were made to industry regulation following the Keniry Livestock Export Review, including in particular the development of the Australian Standards for the Export of Livestock (ASEL). The ASEL initially came into effect in July 2005 and since then there have been several revisions. The current version 2.3 of ASEL was endorsed in April 2011.

In May 2011, the Four Corners program aired evidence of animal welfare mistreatment of cattle in Indonesian facilities.

This was followed in early June 2011 by prohibition of Australian cattle exports to Indonesia, initially to specified facilities and then of all live cattle exports to Indonesia until further notice.

The Australian Government commissioned an independent review into Australia's livestock export trade (the *Farmer Review*)¹ also in June 2011. This review was tasked with delivering an interim report on 29 July 2011 and a final report on 31 August 2011.

Two industry-government working groups were established in June 2011 (one for live sheep and goat exports and one for live cattle).

The Industry Government Working Group on Live Cattle Exports² was advised at its initial meeting on 10 June 2011 of safeguards the government were requiring before the Indonesian trade could be resumed and the role of the Working Group was to focus on operational issues to establish these safeguards and subsequently to include exports to all markets.

The Industry Government Working Group on Live Sheep and Goats Exports³ was established in early July 2011 to develop supply chain assurance systems to protect the welfare of sheep and goats exported from Australia.

¹ <http://www.livestockexportreview.gov.au/>

²

http://www.daff.gov.au/liveexports/government_action/industry_government_working_groups/industry_government_working_group_on_live_cattle_exports_terms_of_reference

³

http://www.daff.gov.au/liveexports/government_action/industry_government_working_groups/igwg-sheep-goats-tor

In July 2011, the Government announced that cattle exports to Indonesia could be resumed provided that exporters met new conditions concerning animal welfare requirements. The conditions were outlined under the Livestock Export Supply Chain Regulatory Approach⁴. It was expected that there would be a progressive resumption of trade depending on demonstration of compliance with requirements. It is understood that the first ship carrying Australian cattle to Indonesia following this resumption, arrived in Indonesia in mid-August 2011⁵.

The *Farmer Review* report was delivered in August 2011⁶ and reports were also provided by the two industry-government Working Groups in August 2011.

In October 2011, the Government outlined the future of regulation in Australia's live export industry, which incorporated the Government's response to the recommendations of the *Farmer Review* as well as separate responses to the findings of the two industry-government Working Groups⁷.

Information about the detail of the new regulatory frameworks is outlined through the DAFF web pages on the Exporter Supply Chain Assurance System (ESCAS)⁸. The new supply chain assurance framework will be applied to all markets that take Australian livestock by early 2013.

There are a range of additional activities that are flowing out of the commitment to the recommendations from the *Farmer Review*. The government has initiated a comprehensive review of the Australian Standards for the Export of Livestock (ASEL)⁹, and this is currently under way.

In early June 2011, the Senate had also initiated a formal inquiry by the Senate Rural Affairs and Transport References Committee into Australia's live export markets and referred two private Senator's bills into the scope of the Senate inquiry.

⁴ http://www.daff.gov.au/_data/assets/pdf_file/0005/1955624/supply-chain-assurance-and-welfare-standards-080711.pdf

⁵ <http://www.abc.net.au/pm/content/2011/s3294864.htm>

⁶ <http://www.livestockexportreview.gov.au/>

⁷ http://www.daff.gov.au/ludwig/media_office/media_releases/media_releases/2011/october/gillard-government-reforms-live-export-trade

⁸ <http://www.daff.gov.au/aqis/export/live-animals/livestock/escas>

⁹ http://www.daff.gov.au/animal-plant-health/terms_of_reference_for_a_review_of_the_australian_standards_for_the_export_of_livestock_and_the_live_stock_export_standards_advisory_group

The final report from this inquiry was delivered in November 2011¹⁰, and the Government response to the Senate recommendations can be found on the DAFF website¹¹.

This project forms part of an industry funded initiative aimed at completing an independent review of the ASEL and ESCAS¹².

4 Review of relevant literature

Livestock export operates under a number of government legislative and regulatory mechanisms that operate mainly at the state and commonwealth levels. These have been most recently described in the Independent Review of Australia's Livestock Export Trade which also provides a review of the export chain and the component activities and responsibilities.

This review focuses on those activities and regulations or requirements that are most relevant to the preparation of sheep from southern ports.

4.1 Overview of the export chain

The parts of the export chain that culminate in the loaded vessel departing an Australian port is summarised in the following section. The information is specifically focused on sheep exports from southern Australian ports. More detailed information may be found on the DAFF website.

1. Annual export licence

Only licensed exporters are allowed to export livestock from Australia. Information on the application and assessment process and requirements for a licence may be found on the DAFF website.

2. Notice of Intention (NOI) and Consignment Risk Management Plan (CRMP) and evidence of compliance with the Exporter Supply Chain Assurance System (ESCAS) requirements

The exporter submits a completed NOI & CRMP form that describes the proposed export plan including details of exporter, importer(s), details of livestock (species, class, breed, age, quantity) proposed for each registered premise and port of loading.

¹⁰

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=rat_ctte/live_exports_2011/report/index.htm

¹¹ <http://www.daff.gov.au/animal-plant-health/welfare/export-trade/government-response-to-senate-inquiry-into-animal-welfare-standards-in-live-export-markets>

¹² www.mla.com.au/files/96cb897d.../Review-ASEL-and-ESCAS.pdf

The NOI also provides details of the ship, relevant dates for the voyage, destination ports, and names of the AQIS Accredited Veterinarian (AAV) and LiveCorp accredited stock person.

AAVs were originally referred to as third party veterinarians and this term appears occasionally in documentation. They are not government employees but they do have to complete an accreditation process and meet various requirements in order to be accredited by AQIS. AAVs may be involved in either pre-export preparation (the focus of this review), or may travel on a ship to provide shipboard services under an Approved Export Program.

The CRMP component of the application describes the importing country requirements, how the exporter plans to meet relevant standards described in the ASEL and any other relevant risk management considered necessary for the export. This information includes a description of how any importing country requirements (pre-export quarantine, isolation, health certification or testing etc) will be met. The ESCAS component (if relevant) requires the exporter to describe how they will ensure control of the supply chain in accordance with ESCAS requirements.

Approval of the NOI & CRMP by AQIS is required before the exporter can begin to prepare the specified livestock for export. All subsequent activities in relation to livestock preparation must be in accordance with the NOI & CRMP.

AQIS will also provide one or more Approved Export Plans (AEP) when an NOI is approved. The AEP defines any tasks to be undertaken by the AAV as part of the pre-export preparation of livestock (quarantine, treatments, testing, health certification).

3. Pre-export preparation of livestock

The exporter then sources livestock and proceeds through any treatment or testing and certification requirements as stipulated in the NOI and AEP.

All livestock intended for export from Australia by sea must be assembled at an AQIS registered premise for pre-export quarantine and preparation. Registration must be renewed annually and requires preparation of a detailed operations manual documenting how the premise will operate and in particular meeting requirements in relevant legislation and the ASEL.

Livestock sourced on-farm for export must meet requirements in ASEL, any importer specifications and any importing country requirements that relate to on-farm treatment, testing or examination. On-farm procedures may or may not be included in the AEP.

Livestock that meet the relevant criteria are then assembled at the registered premise for preparation in accordance with requirements that may be defined in ASEL, NOI, AEP or importer/importing country specifications.

When pre-export preparations have been completed at the registered premises the exporter submits a completed Application for Health Certificate and Permission for Leave for Loading (AHCPLL) form to AQIS. The AHCPL form is signed by an AAV and the exporter. The AAV will complete an inspection of the livestock in the registered premise before signing the declaration. Inspection procedures are variable and may include mob level inspection or individual animal inspections if deemed to be required.

Following submission of the completed AHCPLL, an AQIS officer will then inspect the consignment at the registered premise. This inspection is generally a mob-level inspection but may involve any inspection activity at the discretion of the AQIS officer. If all requirements have been met, AQIS will issue a permission to leave for loading and this authorises the exporter to transport the livestock from the registered premise to the wharf for loading onto the export vessel. An AQIS officer may request animals be removed from the export process if they have any concerns about their suitability for export.

4. Loading

Transport vehicles carry livestock to the wharf and unload them in preparation for loading onto the export vessel.

There is a requirement for animals to be inspected by an AAV prior to loading and for the exporter to complete an Application for Livestock Export Permits. The authorising AQIS officer then reviews all relevant documents and issues certificate(s) of health and export permit(s). At this point the responsibility for the sea consignment passes to the ship's master and the voyage can commence.

5. Voyage

During each voyage either an AAV or an accredited stockperson (if there is no AAV on the voyage) must provide reports on health and welfare of livestock. For voyages of 10 or more days, a daily report must also be provided by the AAV to the exporter and AQIS.

If consignment specific, shipboard mortality rates exceed thresholds defined in the ASEL as the notifiable level (>2% for sheep and goats), then this triggers an AQIS investigation and the results of all investigations are published on the DAFF website¹³.

6. Sheep are unloaded at port of destination

¹³ <http://www.daff.gov.au/aqis/export/live-animals/livestock/aqis-mortality-investigations>

4.2 State legislation and requirements

With respect to movement of sheep from a property to the assembly feedlot, there must be compliance with state / territory legislation and codes of practice concerning health, welfare and traceability of animals. The national Land Transport Standards have been approved by several states including WA and SA and it is understood that these states are currently preparing to develop regulations to allow full implementation of the national standards within state legislative frameworks. State inspectors may then be assessing animal welfare using a combination of current state legislation, regulations and codes of practice, as well as referencing the national standards.

Officers from the relevant state departments (DAFWA, PIRSA, DPI Victoria etc) have responsibility for ensuring compliance with state legislation or codes concerning animal welfare, identification, traceability and transport of livestock within each state.

There is some variation between states with respect to livestock requirements.

All sheep in WA must be earmarked with the registered earmark for the property of birth (by 6 months of age or before they leave the property), and they must have a visual NLIS eartag inserted. In WA, NLIS eartags are colour coded by year of birth in an 8-year repeating cycle (2009=white, 2010=orange, 2011=green, 2012=purple), and also must contain the NLIS logo and the registered brand for the owner. Sheep that are not on the property of birth (purchased and moved to another property) must have a pink post-breeder NLIS tag inserted that is imprinted with the new owner's brand.

All sheep that are being transported from one property to another in WA (such as from property to the assembly feedlot), must travel with an NVD/waybill providing details of the owner/vendor (name, address of property, PIC, brand) as well as information describing the destination and declarations concerning various treatments. Copies of the NVD/waybill are kept by the vendor, transporter and purchaser.

In South Australia, there is no legislated requirement for sheep to be earmarked though some producers still do use earmarks. All sheep in SA must have a visual NLIS eartag inserted and SA uses the same colour coding scheme indicating year of birth and post-breeder tags as are used in WA. Sheep movements within SA must be accompanied by an NVD/waybill.

In Victoria, sheep must be identified with either a visual or an electronic NLIS eartag. Visual tags are colour coded by year of birth using the same colour coding system but electronic tags are yellow. All sheep movements involving movement to a property or location with a different PIC must be accompanied by an NVD/waybill.

In New South Wales, there is a general requirement for all sheep to be earmarked with a registered ear mark as in WA, and all sheep should have NLIS ear tags inserted before movements from one PIC to another.

NSW encourages but does not require the use of colour coded tags in accordance with the national standard for year of birth. Animal movements must be accompanied by an approved document (NVD, transported stock statement or post-sale summary document).

In Queensland, the use of ear marks and brands in sheep is not mandatory but where they are used they must be registered. All sheep should have NLIS ear tags inserted before movements from one PIC to another. QLD encourages but does not require the use of colour coded tags in accordance with the national standard for year of birth. Animal movements must be accompanied by an approved document (NVD).

There is generally a common requirement for all livestock movements to be registered on the NLIS movements database.

4.3 Australian Position Statement on the Export of Livestock

The Australian Position Statement on the Export of Livestock (APS) is a separate document at the front of the ASEL. The APS has been endorsed by the Primary Industries Ministerial Council (PIMC) but is not enforceable by law.

The development of the ASEL and the APS was managed by the Livestock Export Standards Advisory Committee (LESAG) which included representation from many stakeholder groups associated with livestock export. There is also a technical working group (TWG) of LESAG that may be tasked with addressing queries of a technical nature that may arise from discussions within LESAG. Recommendations from LESAG are then considered by the Australian Government Minister for Agriculture, Fisheries and Forestry who makes all final decisions concerning the ASEL. Approval of ASEL by the Minister is then followed by endorsement by relevant state and territory Ministers through the Standing Committee on Primary Industries (previously known as PIMC).

The APS provides a brief overview of the export chain and the various roles and responsibilities.

Guiding principles for the export of Australian livestock from Australia (reproduced from the Australian Position Statement on the Export of Livestock).

- The health and welfare of animals is a primary consideration at all stages of the livestock export chain.
- All participants throughout the livestock export chain are responsible for the health and welfare of animals in their care.
- The operation and regulation of the livestock export industry is conducted in a transparent manner, in which accountabilities, roles and responsibilities are clearly defined and met.

- Animal health and welfare requirements that apply to the livestock export industry are consistent with those applying to other livestock industries in Australia.
- Participants in the livestock export industry are demonstrably competent and operate in accordance with the national animal health and welfare system in an environment that encourages sustainable improvement.
- Livestock export consignments from Australia meet the requirements of the national animal health and welfare system and importing country requirements.
- The export of livestock requires a risk-based approach throughout the export chain and development of appropriate risk minimisation strategies.
- The Australian Government and the Australian livestock export industry remain committed to furthering improvements in the health and welfare of livestock in the live export chain in Australia, including by supporting relevant research and development initiatives.
- The Australian Government and the Australian livestock export industry remain committed to furthering the health and welfare of livestock in importing countries by fostering cooperation and goodwill, sharing Australian technical expertise, providing educational and training opportunities, and supporting infrastructure.

4.4 Australian Standards for the Export of Livestock (ASEL)

The Australian Standards for the Export of Livestock (ASEL) – *the Standards* - provide defined welfare outcomes that must be achieved at critical steps along the export chain. The current ASEL (Version 2.3) came into effect in April 2011.

There are several areas of ASEL that are directly relevant to preparation of southern sheep. These are summarised briefly here. Please note that the material presented in this review is a brief summary of relevant points and readers are directed to the ASEL for additional detail.

It is important to note that compliance with the requirements as outlined in the ASEL will require compliance with a range of defined procedures and standards that may be derived from state or territory legislation (including codes of practice), as well as commonwealth legislation and regulations.

4.4.1 Standard 1: Sourcing and on-farm preparation of livestock

The required outcomes are defined in Section 1.2 and reproduced here:

(1) *Livestock sourced for export must meet any requirement under a law of a state or territory relating to the sourcing of livestock. State and territory governments are responsible for ensuring that these requirements are met.*

(2) *Livestock sourced for export must meet these Standards and importing country requirements.*

(3) *Livestock sourced for export that become sick or injured during on-farm preparation must be excluded from export, and arrangements must be made for their prompt and humane handling and care.*

(4) *AQIS must be satisfied that these Standards and importing country requirements are met before issuing a health certificate and export permit.*

Division 2 of Standard 1 of the ASEL then defines various standards for sourcing and on-farm preparation of livestock. These standards include general criteria relevant to state or territory legislation (requirements concerning animal health, welfare, identification and traceability), reference to the need to meet importing country requirements as defined in a separate agreement or protocol, and reference to Australian food safety requirements for livestock intended for human consumption.

The Standards then define various specific requirements that must be met including the following.

Standard number S1.6 states that sheep must not be sourced for export from or through the ports of Darwin, Weipa or Wyndham from 1 November to 31 May in the following year (inclusive).

Standard number S1.7 states that:

Livestock sourced for export must be fit to enter the export chain. Livestock sourced for export must be inspected on-farm and any animal showing signs consistent with the rejection criteria below, or any other condition that could cause the animal's health and welfare to decline during transport or export preparation, must not be prepared for export.

A list of rejection criteria is then specified under S1.7 that allows identification of animals that must be rejected. This is reproduced below.

Table 4.1: Rejection criteria reproduced from Section S1.7 of the ASEL

Category	Rejection criteria
<i>General requirements</i>	<i>Fail to meet requirements of protocol/import permit, such as sex, type, breed, tag number</i>
	<i>Lactating animals with young at foot (but this does not apply to livestock being exported by air)</i>
	<i>Lactating animals</i>
	<i>Pregnancy status not confirmed as appropriate for journey</i>
<i>Systemic conditions</i>	<i>Emaciated or over fat</i>
	<i>Anorexia (inappetence)</i>

Export of sheep from southern ports to the Middle East in winter months

	<i>Uncoordinated, collapsed, weak</i>
	<i>Unwell, lethargic, dehydrated</i>
	<i>Ill-thrift</i>
<i>Gastrointestinal system</i>	<i>Dysentery or profuse diarrhoea</i>
	<i>Bloat</i>
<i>Nervous system</i>	<i>Nervous symptoms (head tilt, circling, incoordination)</i>
	<i>Abnormal or aggressive behaviour/intractable or violent</i>
<i>External/skin</i>	<i>Generalised papillomatosis or generalised ringworm, dermatophilosis</i>
	<i>Generalised and extensive buffalo fly lesions</i>
	<i>Generalised skin disease</i>
	<i>Visible external parasites</i>
	<i>Significant lacerations</i>
	<i>Discharging wounds or abscesses</i>
	<i>Cutaneous myiasis (flystrike)</i>
	<i>Ballanitis (pizzle rot in sheep)</i>
	<i>Blood/discharge from reproductive tract (vulva/prepuce)</i>
<i>Head</i>	<i>Blindness in one or both eyes</i>
	<i>Cancer eye</i>
	<i>Keratoconjunctivitis (pink eye)</i>
	<i>Excessive salivation</i>
	<i>Nasal discharge</i>
	<i>Coughing</i>
	<i>Respiratory distress — difficulty breathing</i>
	<i>Untipped sharp horns</i>
	<i>Sheep: long horns greater than one curl, except in approved NOI and CRMP</i>

Export of sheep from southern ports to the Middle East in winter months

	<i>Horns causing damage to head or eyes</i>
	<i>Bleeding horn/antler stumps</i>
	<i>Scabby mouth</i>
<i>Other</i>	<i>Mobs with unusual mortalities over the whole period of pre-export isolation</i>
	<i>Large disparities in size or age (redraft animals in this case)</i>

There are then a number of additional standard criteria concerning sheep:

- S1.8 (c): Sheep, goats and deer must be from condition scores 2 to 4 (on a 1 to 5 point scale).
- S1.11: Ewes with a weight of 40 kg or more and all does (goats) must only be sourced for export as slaughter and feeder animals if they have been pregnancy tested by ultrasound within 30 days of export and certified not to be pregnant, by written documentation, by a person able to demonstrate a suitable level of experience and skill.
 - (a) all female Damara sheep breeds sourced as feeder or slaughter must be pregnancy tested within 30 days of export by ultrasound and certified not to be pregnant, by written documentation, by a person able to demonstrate a suitable level of experience and skill.
- S1.12: lambs must be 14+ days post-weaning and >28kg liveweight.
- S1.13: breeder sheep must be not more than 100 days pregnant at departure.
- S1.16: acceptable horn criteria for export sheep
- S1.19: defines acceptable criteria for wool length and time off shears.
- S1.25: requirement for recording of all treatments administered to animals.
- S1.26: defines acceptable use of prostaglandin drugs in female livestock relative to export
- S1.27: animals that become sick or injured during preparation must be excluded from export and treated appropriately.

4.4.2 Standard 2: Land transport of livestock

The required outcomes are defined in Section 2.2 and reproduced here:

- (1) *Only livestock fit to travel are presented for loading.*
- (2) *Livestock are loaded in a manner that prevents injury and minimises stress.*
- (3) *Transport of livestock is undertaken in a manner that meets these Standards, any requirements of a state or territory relating to the transport of livestock, and importing country requirements.*
- (4) *Livestock are unloaded in a manner that prevents injury and minimises stress.*

The national standards for Land Transport of Livestock form an important source of information governing practices for land transport and these standards are in the process of being enacted in most Australian states. The national standards for Land Transport of Livestock specifically state that information should be considered in conjunction with other requirements such as the ASEL and that in general where different sources may vary, the higher standard will apply and that the governing principle is the welfare of livestock.

Animals must only be loaded for transport to the registered premise if they meet standards outlined in Standard 2 of the ASEL. Under the ASEL responsibility for ensuring that all sheep that are loaded meet the relevant requirements outlined in the ASEL rests with the exporter. The vehicle driver then accepts responsibility for livestock on his or her vehicle from the point of loading until they are unloaded at the registered premise.

Under Divisions 2 and 3 of Standard 2 of the ASEL there are a number of standards that are relevant for land transport of sheep. These include:

- S2.1: land transport of livestock must meet any relevant requirement under state or territory legislation or national codes of practice.
- S2.2: land transport of livestock must meet any importing country requirements.
- S2.3: need for a detailed travel plan for interstate journeys greater than 2 hours and any journey greater than 8 hours
- S2.4: on-farm preparation of livestock for transport, vehicle requirements and loading facilities
- S2.8: feed and water curfews
- S2.9: limits for water deprivation

- S2.10: requirements for loading including separation of animals by species, class, young from old, size, and horned vs polled.
- S2.11: Livestock must be inspected prior to loading and animals with any condition specified in Standard S1.7 or that has any condition that could cause the animal's health and welfare to decline during transport or export preparation, must not be transported.
- S2.12: travel plan and journey log.
- S2.13: livestock must be loaded in a manner that prevents injury and minimises stress.
- S2.14: loading density and penning arrangements
- S2.15: at loading the person responsible for the vehicle is responsible for livestock.
- S2.16: defines intervals when livestock must be checked.
- S2.17: working dogs must not be in the same pen as livestock.
- S2.18: defines when livestock must be unloaded and rested and provided with feed and water during journeys.
- S2.19: at unloading, livestock become the responsibility of the designated person at the registered premises.
- S2.20: livestock that are distressed or injured at unloading must be given immediate assistance and if euthanasia is required it must be carried out humanely.
- S2.21: livestock must be unloaded for a rest period if the journey was longer than 14 hours.
- S2.22: unloading must involve competent stock handlers, minimisation of injury and stress and in appropriately designed facilities.
- S2.24: all relevant standards for land transport of livestock should also be applied for transport from registered premises to the port of export.

4.4.3 Standard 3: Management of livestock in registered premises

The required outcomes are defined in Section 3.2 and reproduced here:

- (1) *Facilities at registered premises are appropriate for the type and species of livestock to be held.*
- (2) *The health and welfare needs of the livestock are appropriately catered for in a secure environment.*

(3) *Livestock leaving the premises are fit for the export voyage and meet importing country requirements.*

(4) *Livestock rejected for export are managed humanely.*

It is also noted under Section 3.4 (Linkages) that only livestock fit to travel, which meet importing country requirements, can be loaded for transport to the port of embarkation.

Under Divisions 2 and 3 of Standard 3 of the ASEL there are a number of standards that are relevant for management of sheep in registered premises. These include:

- S3.0: registered premises must not be more than 8 hours journey time from the port.
- S3.1: operator must employ appropriate numbers of trained staff for effective operation and management of livestock.
- S3.2: construction and design of sheds and facilities at the registered premises.
- S3.3: registered premises must be constructed to allow quarantine and isolation of livestock as required.
- S3.4: management of surface water, drainage and livestock effluent.
- S3.5: provision of protection from extreme climatic conditions (shade, shelter, windbreaks).
- S3.6: fencing at the registered premises.
- S3.7: provision of adequate feed and water.
 - during any or all of May, June, July, August, September and October feeding must occur from fully sheltered feed troughs, with the exception of areas of Australia north of latitude 26° south.
- S3.8: special conditions for preparation of sheep and goats in southern premises (south of latitude 26 degrees south) at different times of the year. Fremantle, Adelaide and Portland are all south of this line.

For preparation of sheep and goats in premises south of latitude 26° south that are held:

(a) in paddocks during any or all of May, June, July, August, September and October, premises must have procedures to ensure that:

(i) sheep and goats to be exported by sea are held at the premises for 5 clear days (excluding the days of arrival and departure) before export;

- (ii) livestock are fed *ad libitum* during that period; and
 - (iii) during the last 3 days of that period, livestock are fed *ad libitum*, but only on pelletised feed equivalent to that normally used during an export journey.
 - (b) in paddocks during any or all of November, December, January, February, March and April, premises must have procedures to ensure that:
 - (i) sheep and goats to be exported by sea are held at the premises for 3 clear days (excluding the days of arrival and departure) before export; and
 - (ii) livestock are fed *ad libitum* during that period and only on pelletised feed equivalent to that normally used during an export journey.
 - (c) in sheds during any or all months of the year, premises must have procedures to ensure that:
 - (i) sheep and goats to be exported by sea are held at the premises for 3 clear days (excluding the days of arrival and departure) before export; and
 - (ii) livestock are fed *ad libitum* during that period and only on pelletised feed equivalent to that normally used during an export journey.
- S3.9: special conditions on sheep that can be exported to the Middle East during the period from May to October.

Export to the Middle East:

- (a) The operator of the registered premises must not prepare the following classes of sheep for export to the Middle East by sea during the period from May to October,:
 - (i) For livestock held in paddocks:
 - pastoral and station sheep;
 - lambs (less than 34 kg and no permanent incisors); and
 - sheep and goats that have been held on trucks for more than 14 hours.
 - (ii) For livestock held in paddocks or sheds:
 - full mouth wethers with a body condition score greater than 4;
 - broken mouth sheep; and

- pregnant ewes.
- (b) All sheep for export to the Middle East by ship during the period from May to October held in paddocks in the registered premises must have wool not more than 25 mm in length, unless approved by the relevant Australian Government agency based on an agreed heat stress risk assessment model and must be at least 10 days off shears on arrival at the premises.
- S3.10: security at registered premises.
- S3.11: stocking densities at registered premises.
- (c) for sheep and goats held in sheds for 10 days or more, based on an individual liveweight of 54 kg:
 - (i) penned in groups of less than 8 animals, a minimum of 0.9 m²
 - (ii) penned in groups of 9–15 animals, a minimum of 0.8 m²
 - (iii) penned in groups of 16–30 animals, a minimum of 0.6 m²
 - (iv) penned in groups of thirty-one (31) or more animals, a minimum of 0.5 m²
- (d) for sheep and goats held in sheds for less than 10 days, based on an individual liveweight of 54 kg:
 - (i) penned in groups of less than 8 animals, a minimum of 0.6 m²
 - (ii) penned in groups of 9–15 animals, a minimum of 0.53 m²
 - (iii) penned in groups of 16–30 animals, a minimum of 0.4 m²
 - (iv) penned in groups of 31 or more animals, a minimum of 0.33 m²
- S3.12: operator of registered premises must obtain copies of vendor declarations concerning property of origin and health and welfare of livestock.
- S3.13: livestock must be unloaded as soon as possible after arrival at the premises and **individually inspected** to determine whether they are suitable for export.
- S3.14: livestock must be offered feed and water as soon as possible after arrival at the premises.
- S3.15: requirements for penning livestock including separation of animals by species, class, young from old, and size.
- S3.16: daily monitoring of health, welfare and mortality including:

- all livestock must be inspected daily
- all sick and injured livestock must be given immediate treatment and veterinary advice sought if the cause is not obvious or treatment/prevention is ineffective.
- investigation must be conducted by a registered veterinarian if mortalities in one paddock or shed and on one day exceed 0.25% or 3 deaths.
- dead livestock must be collected and disposed of daily.
- records must be kept of each consignment.
- S3.17: at unloading, livestock that are distressed, injured or otherwise unsuitable for export must be marked using a permanent method and isolated from the rest of the consignment. Records must be kept of the identity, treatment and disposal of all rejected animals. Criteria for rejection of livestock are provided in the following Division of Standard 3.

Section 3.1.2 of Division 3 of Standard 3 provides a definition of rejection criteria for sheep. These are reproduced below.

Sheep or goats found with any of the signs shown in Table A3.1.2 must be rejected from the proposed export consignment. Any other condition that could be defined as an infectious or contagious disease, or would mean that the animal's health or welfare would decline or that the animal would suffer significant distress during transport, also requires the animal's rejection from export.

Table 4.2: Sheep and goat rejection criteria reproduced from S3.1.2 of the ASEL

Category	Rejection criteria
General requirements	Fail to meet requirements of protocol/import permit, such as sex, type, breed, tag number
	Lactating animals with young at foot (but this does not apply to livestock being exported by air)
	Lactating ewes and does
	Pregnancy status not confirmed as appropriate for journey
Systemic conditions	Emaciated or overfat
	Anorexia (inappetence)
	Uncoordinated, collapsed, weak
	Unwell, lethargic, dehydrated
	Ill-thrift
Musculoskeletal system	Lameness — footrot, foot abscess, arthritis, fractures etc or abnormal gait
	Abnormal soft tissue or bony swellings
Gastrointestinal system	Dysentery or profuse diarrhoea
	Bloat
Nervous system	Nervous signs (eg head tilt, circling, incoordination)
	Abnormal or aggressive behaviour/intractable or violent
External/skin	Generalised skin disease
	Visible external parasites
	Cutaneous myiasis (flystrike)
	Significant lacerations
	Discharging wounds or abscesses
	For sheep: wool longer than 25 mm, unless approved by the relevant Australian Government agency based on an agreed heat stress risk assessment model or it has been included in an

Export of sheep from southern ports to the Middle East in winter months

	approved NOI and CRMP
	External skin cancer
	Ballanitis (pizzle rot in sheep)
	Blood/discharge from reproductive tract (vulva/prepuce)
Head	Cancer eye
	Keratoconjunctivitis (pink eye)
	Excessive salivation
	Nasal discharge
	Blindness in one or both eyes
	Long horns greater than one curl, except in approved NOI and CRMP
	Horns causing damage to head or eyes
	Bleeding horn stumps
	Coughing
	Respiratory distress – difficulty breathing
Other	Mobs with unusual mortalities or mortalities of more than 0.5% over the whole period of pre-export preparation
	Large disparities in size or age (redraft animals in this case)

4.4.4 Standard 4: Vessel preparation and loading

The required outcomes are defined in Section 4.2 and reproduced here:

(1) *Livestock are healthy, fit to travel and comply with importing country requirements.*

(2) *The vessel meets Australian requirements for the safe carriage of livestock.*

(3) *Sufficient personnel must be available both at loading and during the voyage to ensure that livestock husbandry and welfare needs are addressed.*

(4) *Livestock are handled and loaded in a manner that prevents injury and minimises stress.*

(5) *The travel and loading plans adequately address the health and welfare of the livestock.*

(6) *A health certificate and an export permit are issued by AQIS.*

It is also noted under Section 4.4 (Linkages) that only fit animals (fit to travel), which meet these Standards and importing country requirements, can be transported to the port of loading for export.

Under Divisions 2 and 3 of Standard 4 of the ASEL there are a number of standards that are relevant to this review. These include:

- S4.3: requirement for a loading plan before loading begins.
- S4.5: accredited stock person must be appointed by the exporter to accompany each consignment.
- S4.6: sufficient personnel must be available at loading and during the voyage to ensure livestock husbandry and welfare needs are met.
- S4.7: on arrival at the port, responsibility for the livestock must be transferred to a competent person nominated by the exporter.
- S4.8: To ensure that only fit and healthy livestock are transported and are loaded on board:
 - a) the exporter must arrange for the livestock to be inspected for health and welfare and fitness to travel, immediately before they are loaded onto the vessel;
 - b) only livestock that are healthy and fit to travel can be loaded;
 - c) any livestock rejected for export must be distinctively identified, and humane and effective arrangements must be made for their removal from the port;
 - d) if euthanasia is necessary, it must be carried out humanely and promptly; and
 - e) dead livestock must be removed from the port, and carcasses must be disposed of in compliance with all relevant health and environmental legislation.

- S4.10: livestock must be loaded onto the vessel by competent stock handlers in a manner that prevents injury and minimises stress
- S4.11: livestock must be presented for loading and penned on the vessel in lines segregated by species, class, age, weight and presence or length of horns.
- S4.12: livestock densities must be in accordance with defined specifications and heat stress risk assessment.

There are additional standards and information in the ASEL that relate to management of animals once they are loaded onto the vessel and these are not considered further in this review.

4.4.5 Standards 5 and 6: Onboard management of livestock and air transport of livestock

These sections of the ASEL are not directly relevant to this review and are not considered further.

4.5 Australian Meat and Livestock Industry (Export Licensing) Regulations 1998

The Regulations exist as subordinate legislation under the Australian Meat and Livestock Industry Act 1997 and set out the requirements that an exporter must meet in order to obtain an export licence.

4.6 Export Control (Animals) Order 2004

The Export Control (Animals) Order 2004 – the Animals Order - exists as subordinate legislation under the Export Control Act 1982. The Animals Order provides the regulatory control for export of live animals and animal reproductive material.

Earlier descriptions of the live export chain and the processes which must be adhered to for export to occur, are outlined in the Animals Order.

Part 2 of the Animals Order relates to export of livestock by sea and there are specific divisions of the Animals Order that deal with topics of direct relevance to this review:

- Division 2.2 outlines the requirements for registration of premises for holding and assembling livestock for export.
- Division 2.4 outlines the Notice of Intent (NOI) to export and related matters including the CRMP and ESCAS requirements.
- Division 2.5 relates to inspection of livestock before export and grant of export permit

Part 4A of the Animal Orders relate to accreditation of veterinarians for livestock export and Part 5 to auditing processes.

There are some specific sections of Division 2.5 that are worthy of note.

Part 2, Division 2.5, Section 2.53 (Health Certificates)

(1) A health certificate in relation to livestock is a certificate, issued by an authorised officer, that the livestock meet the requirements of a specified importing country relating to the health of the livestock.

(2) Before issuing a health certificate for livestock, an authorised officer:

(a) must inspect the livestock before they leave the registered premises at which they are held and assembled for export

Section 2.54 outlines requirements for granting of permission to leave for loading. Amongst other things it states the following.

Part 2, Division 2, Section 2.54 (Grant of permission to leave for loading)

(3) If an authorised officer is satisfied that:

...

(g) each of the livestock is fit to undertake the proposed export voyage without any significant impairment of its health

...

(3B) For paragraph (3) (g), an authorised officer may be satisfied livestock are fit to undertake a proposed export voyage without needing to be assured of the fitness of every animal in a herd.

(6) To assess whether the animals are fit to undertake a proposed export voyage without any significant impairment of their health, an authorised officer must have regard to the following matters:

(a) the animals' general condition;

(b) the risk of them being injured by the enclosures or ramps used for loading them onto the ship, aircraft, train or other vehicle on which they are to be carried to the place of export;

(c) the nature of the accommodation for them on the ship on which they are to be transported overseas;

(d) the numbers, species, health and general condition of any other animal to be carried on the same ship;

(e) the conditions that the animals are likely to encounter during the export voyage.

4.7 Independent Reference Group reviews

In July 1999, the Independent Reference Group (IRG) was convened by the Minister for Agriculture, Fisheries and Forestry as a result of incidents in live cattle exports.

The IRG reported in Feb 2000 and identified concerns related to a lack of integration of activities across the whole chain, limitations in legislation and regulations between the Commonwealth and the states, problems with third party systems and with the regulator (AQIS), lack of clarity about responsibilities of government and industry in setting and administering standards, and gaps in emergency management.

In October 2002, the Minister reconvened the IRG following further export incidents, including in particular the deaths of several hundred cattle on the *MV Becrux*, attributed to heat stress.

A working group was then formed to develop an action plan and subsequently an industry consultative committee was formed to coordinate implementation of the action plan. There were six strategies identified, each of which was intended to be actioned through separate projects.

The major achievement of these processes as identified by the subsequent Keniry review, was the implementation of the Heat Stress model that required exporters in southern Australia to submit consignment management plans to AQIS for approval prior to export. Exporters were required to use a computer generated heat stress assessment model (HotStuff) to determine loading densities of livestock.

Other actions progressed more slowly and activities were still ongoing when the *Cormo Express* incident occurred and the Keniry review was initiated.

Recommendations from the IRG reviews are presented in Appendix 1 to this report.

4.8 Livestock Export Review 2003 - Keniry Review

An independent review into the livestock export industry was announced by the Minister for Agriculture, Fisheries and Forestry in October 2003 with the review team to be led by Dr John Keniry.

The *Keniry Review* was tasked with examining the welfare standards applying to export, regulatory arrangements, types of livestock suitable for export, the need for supervision of each export voyage and any specific factors associated with the *Cormo Express* incident.

The *Keniry Review* determined that continuation of the export trade was dependent on recognition by governments and industry that animal welfare concerns expressed by the community were legitimate and needed to be addressed. The review identified five principles on which it based conclusions and recommendations.

The review also highlighted a number of concerns relating to standards and regulatory arrangements:

- It outlined the need for a comprehensive national standard for health and welfare of animals during export;
- recommended that government be solely responsible for granting export licences and permits and enforcing compliance against the standard, and that industry should be responsible for QA systems to support its members in developing best practice standards;
- recommended that third party veterinarians (accredited veterinarians) be employed by AQIS and not by industry;

- recommended that a suitably trained and qualified veterinarian should be on all export voyages that take over 10 days and some other voyages, and that these veterinarians should report directly to AQIS as well as to industry;
- recognised that there are factors associated with livestock, preparation and voyage that may make some voyages have higher risk of adverse welfare outcomes than others and that risk assessments and further research should be used to identify these factors and either manage them or ban exports when such factors may be present;
- recommended the development of agreements with importing countries to manage emergency situations such as the *Cormo Express* including the development of quarantine facilities in the Middle East;
- development of an emergency response plan for future export incidents.

As identified in the *Farmer Review*, several of the recommendations from the *Keniry Review* were subsequently implemented, some were applied in a modified form and some were not supported. The principles and recommendations arising from the *Keniry Review* are presented in Appendix 2.

The following comments summarise actions that have occurred against recommendations of the *Keniry Review*:

- Development of the Australian Standards for the Export of Livestock (ASEL) which were implemented in 2005.
 - consistent with Recommendation 1.
- Government took over sole responsibility for granting of export licences and permits to export.
 - consistent with Recommendation 2.
- Legislation was introduced to support the roles and responsibilities, sanctions and training of AQIS Accredited Veterinarians (AAVs). However, AAVs were not employed by AQIS and continue to be employed by the exporters.
 - partly consistent with Recommendations 3 and 4.
- Government developed a risk management approach where AAVs were required to accompany consignments on all voyages to the Middle East and any other voyage that was identified as a higher risk voyage. AAVs were required to produce daily and end-of-voyage reports, but these reports were to be provided by the AAV to the exporter and the exporter then assumed responsibility for reporting to the Government.
 - partly consistent with Recommendation 5.

- Restrictions were placed on the export of livestock from southern ports in the Australian winter.
 - partly consistent with Recommendation 6.
- Recommendations to establish an operational quarantine holding facility for markets in the Middle East and to develop an emergency management plan were accepted and implemented by the Government.

4.9 Independent Review of Australia's Livestock Export Trade

In June 2011, the Australian Government Minister for Agriculture, Fisheries and Forestry commissioned Mr Bill Farmer AO to undertake a review of the Australian livestock export trade. The *Farmer Review* made a number of observations, findings and recommendations that are related to the objective as described in this document.

Where text is directly reproduced from the *Farmer Review* (quotation) it is presented here in italics and indented. Where the text is left justified and not in italics it represents the writing of the author.

The recommendations arising from the *Farmer Review* are presented in Appendix 3.

4.9.1 Section 1.6: Past reviews

The *Farmer Review* identified two major historical review activities that have resulted in significant changes in the way the export industry is managed.

The first of these were the review activities of an **Independent Reference Group** (IRG) relating to cattle exports that was established in 1999 and recalled in 2002. Amongst the outcomes resulting from activities of this group was the development of the Heat Stress Risk Assessment (HSRA) heat stress model that has subsequently been refined as Hot Stuff and version 4 of which is currently being applied

The second of these were review activities of the **Keniry Review** which was established following the adverse outcomes for livestock being transported on the MV *Cormo Express* in 2003. The Keniry Review built on the recommendations of the earlier IRGs and led to the Australian Government establishing the Australian livestock export code which has subsequently become the ASEL.

4.9.2 Section 3: Current Regulatory Arrangements

There is a lack of clear, or clearly appreciated, roles and responsibilities under the regulatory framework, and in particular the welfare of livestock destined for, or in, the export supply chain. (Farmer 2011, p27).

The *Farmer Review* highlights the fact that state and territory legislation underpin animal welfare up to the point of loading on to a vessel and that there may be

confusion over where responsibilities may lie for either monitoring or enforcing of compliance with animal welfare requirements at different steps along the supply chain. There are opportunities for better communication between states/territories and the Commonwealth to ensure efficient monitoring and reporting of animal welfare outcomes and to support more effective responses when problems are identified.

There may also be difficulties associated with the lack of nationally consistent and enforceable Australian standards for animal welfare (the land transport standards are the first such nationally agreed standard but are still being incorporated into state and territory legislation). Variability between states and territories with respect to animal welfare legislation and codes of practice may mean that there are difficulties with enforcement and that future compliance with national standards is likely to be based largely on industry driven QA programs.

Responsibility for compliance with specific aspects of ASEL shifts at each stage of the supply chain. For example, the primary producer/vendor is responsible for selecting only fit stock for sale; the transporter is responsible for loading only fit stock; the registered premises operator is responsible for receiving only fit stock. (Farmer 2011, p29).

The responsibility ultimately lies with exporters for ensuring that only fit and healthy livestock, meeting the requirements of ASEL, are presented for export.

Finding

The domestic elements of the export supply chain are working substantially better now than before the Keniry Review. A number of concerns persist, including the lack of nationally consistent and enforceable standards for animal welfare and, at an operational level, some failure to comply with ASEL requirements.

Finding

Greater clarity about, and shared understandings on, responsibilities and regulatory powers in the respective jurisdictions would assist the Australian Government and the states and territories to identify and address gaps and areas of discontinuity. This is necessary to ensure more effective government dealings with animal welfare matters throughout the livestock export supply chain.

Recommendation

The Review recommends that the Australian Government urge the states and territories to develop and implement, as a priority, enforceable standards of welfare to replace Codes of Practice, incorporate the standards into legislation and prepare and implement compliance programs to monitor and enforce the regulations in the domestic phase of the livestock export trade.

Cattle, sheep and goat welfare standards should be produced as a priority for incorporation into state and territory legislation.

(Farmer 2011, p30)

A number of respondents including the Australian Livestock Exporters' Council (ALEC), WA Beef Council, Australian Livestock and Rural Transporters Association, state governments and individual exporters, proposed and/or supported the concept of an independently audited, through-chain quality system incorporating formal contracts involving exporters, producers, agents, registered premises operators and transporters (including shipping companies where relevant). The exporters would assume responsibility, with contract specifications including livestock type and quality specifications as well as compliance with enterprise-level QA programs and welfare standards at each stage in the export chain. (Farmer 2011, p31)

Such a system, it was proposed, would:

- establish clear lines of accountability and benchmarks in the domestic part of the chain*
- establish a feedback mechanism in the domestic chain to support improvements and performance*
- specify what should/must be recorded, to whom it should be reported and what must be done with the reports*
- enable demonstration of compliance with animal welfare standards at all stages and enable audit of outcomes, not inputs or paperwork only. (Farmer 2011, p31)*

After a successful establishment period such a quality system could, in the view of a number of submissions, largely replace the current prescriptive regimen. AQIS would then be responsible to audit the quality system itself – that is, AQIS would retain an 'audit the auditor' function. (Farmer 2011, p31)

While the Review sees potential in development of through-chain QA, it does not consider the time is right to reduce government regulation. If industry were to introduce such a system and demonstrable animal welfare assurance improvements resulted, there might be scope in the future to examine options for reducing government regulation. (Farmer 2011, p31)

Recommendation

The Review recommends that in line with ASEL, industry develop and implement a through-chain QA system to complement government regulatory compliance programs. (Farmer 2011, p31)

The *Farmer Review* noted that the shipboard mortality rate for sheep has not declined significantly since the introduction of ASEL at the end of 2004, and then went on to suggest that a lack of ongoing declines in mortality rate indicated that causes of ongoing mortality are not adequately addressed in ASEL, not managed adequately by exporters, not effectively monitored and addressed in regulatory programs or not currently preventable.

This observation by the *Farmer Review* seems to encapsulate some of the major issues currently challenging the industry. Since 2003, annual mortality rates (expressed as a percentage) have consistently remained under 1% (fluctuating between 0.74% and 0.99%). As shown in Figure 1, over the longer term, annual mortality rates in sheep have declined considerably. However, in the period since implementation of the ASEL, mortality rates have not continued to decline further.

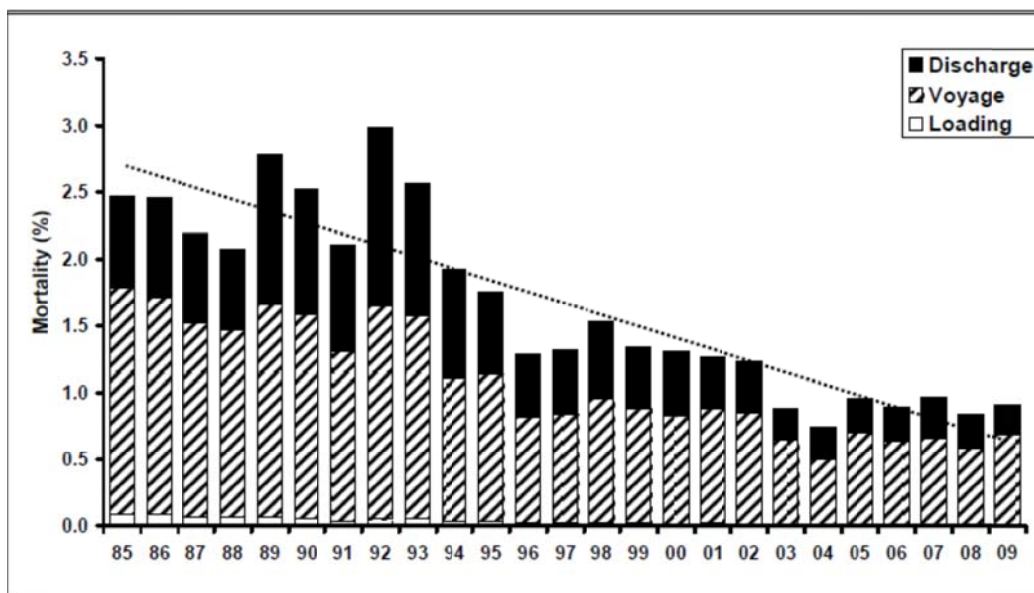


Figure 4.1: Annual mortality of sheep exported by sea from Australia to all destinations since 1985. Reproduced from Norris and Norman (2010).

There have also been substantial changes in the total numbers of sheep exported and the destination countries over time. The total number of sheep exported by sea from Australia to all destinations peaked at 6 million in 2001 (24% rise from 2000). This was followed by substantial declines to between 3 and 4 million for most of the subsequent years.

These and other factors are likely to influence morbidity and mortality risk and are considered in more detail later in this review.

The *Farmer Review* referred to recommendations from investigations into reportable sheep mortalities on sea voyages where sheep had been loaded from southern ports in the Australian winter. The *Farmer Review* highlighted a recommendation for two veterinary inspections of sheep during the preparation period prior to loading onto the ship. There have been a number of recommendations made in recent investigation reports that cover a range of areas relating to sourcing and preparing sheep from southern ports. These will be covered in more detail later in this review.

The *Farmer Review* made general comments about out of specifications sheep being presented at different stages along the supply chain and a specific finding about inspection procedures at the Fremantle wharf.

These issues have been the subject of a different report (W.LIV.0171) that has reviewed pre-embarkation inspection procedures for sheep.

The *Farmer Review* provided useful comments on differing perspectives concerning AQIS operations that were presented as understandable given the regulatory role that AQIS fulfils (See Sections 3.4.7 to 3.4.10 of the *Farmer Review*).

Comments were made about the potential for improvement in the regulation of export (including potentially interaction between separate Commonwealth legislation as well as between the Commonwealth and States or Territories). There was also comment on the potential for improved management of non-compliance with current regulatory requirements and mention that currently it seems that breaches of the ASEL may be followed mainly by additional conditions being imposed on future consignments.

There were observations made on the potential for conflict of interest with respect to the role of the shipboard AAV and this was followed by recommendations concerning contracting, auditing and training programs for AAVs (and stockpersons) and systems to ensure that daily and end-of-voyage reports are forwarded to AQIS and the exporter and not just to the exporter.

It is noted that under Export Advisory Notice 2012-06, AAVs are required to submit daily and end-of-voyage reports simultaneously to DAFF and the exporter¹⁴.

4.9.3 Section 4: Australian Standards for the Export of Livestock

This section of the *Farmer Review* begins with a brief summary of criticisms raised by respondents arguing that the ASEL are inadequate. These included:

- ASEL lack jurisdiction outside Australia
- standards are unenforceable under current legislation
- ASEL require actions that are not measurable or easily enforced
- there is a lack of transparency, monitoring, enforcement, reporting and feedback in the export process
- there is no process for public feedback on animal welfare
- ASEL do not make responsibilities clear
- there are unacceptable welfare standards
- the heat stress model is inadequate
- there are inappropriate mortality and welfare measures on board ship

¹⁴ <http://www.daff.gov.au/aqis/export/live-animals/advice-notice/2012/2012-06>

- export permits are issued and export licences renewed despite non-compliance with ASEL
- standards and codes are voluntary
- there are problems with self-reporting and self-regulation.

The *Farmer Review* also noted submissions that described the ASEL as a comprehensive and detailed source of standards on the sourcing, preparation, management and transportation of livestock through the supply chain, while also providing guidance for those with responsibility for animal welfare within the livestock chain.

There were comments about the commitment of livestock producers to meeting husbandry needs of livestock, and compliance with requisite standards, about improvements in the industry over the past decade, the general view through the entire supply chain that it is in everyone's interests to have stock in excellent condition before they travel and during transport, and the importance of commercial pressures in that vendors will be penalised by buyers if animals do not meet specifications.

It is clear, for reasons outlined below, that a full review of ASEL remains a priority. Standards need to be clear, essential (causally related with mortality or otherwise scientifically based), consistent and verifiable. Ongoing feedback and review processes need to be clarified and strengthened and roles and responsibilities of bodies engaged in monitoring and enforcement of ASEL and related welfare standards need to be clarified and formalised. In addition, accountability for shipboard welfare needs to be better defined.

(Farmer 2011, p46)

There were comments on page 47 that ASEL could have a stronger focus on outcomes rather than inputs, potential roles of audits and key performance indicators and that in some sections of ASEL the wording is unclear and may lead to inconsistent advice or difficulty in enforcing standards.

On page 48, Farmer (2011) noted some comments suggesting that ASEL was thought too prescriptive, not allowing enough flexibility to assess situations and make decisions based on animal welfare.

Flexibility of both Standards and associated Work Instructions is a key issue for regional AQIS veterinarians and a full review of ASEL should include consideration of issues of discretion and delegation.

(Farmer 2011, p48)

Whatever the merits or otherwise of ASEL, on several occasions in the domestic supply chain the Review observed livestock that clearly did not meet the Standards. Under Standard 1, livestock sourced for export must be inspected on-farm and any

animal meeting rejection criteria must not be prepared for export. However, livestock that should have been rejected under Standard 1 were seen by the Review to have been transported and accepted into registered premises. On one occasion, livestock meeting the rejection criteria were observed at ship loading and on board, having been through the requirements of Standard 4 without rejection.

(Farmer 2011, p48)

Several comments were made, principally by welfare groups, about the inadequacy of sanctions and penalties in the face of non-compliance with ASEL. They referred to offences at unloading and embarking at the port, involving individuals or small groups of animals (usually sheep), without regulatory action.

There is no statement in ASEL about the consequences of breaching the standards. Leaving aside the penalties for conviction under state or territory welfare legislation (a rare and unlikely event in these circumstances), the penalties able to be applied by AQIS for breaches of ASEL are imposition of changes in conditions for future consignments or, in serious cases of non-conformance, suspension or cancellation of an export licence.

There has been evolution of practices in recent years in relation to investigation of mortalities and other welfare issues, as well as in the publishing of mortality investigation reports. The Review has seen evidence of some untidiness in procedures during this evolutionary process. As noted in Section 3.4.9 above, the Review sees merit in issues relating to reporting and sanctions being examined as part of the DAFF/AQIS review of service delivery issues recommended by the Review.

(Farmer 2011, p49)

Finding

- *Since the introduction of ASEL, there have been improvements in many domestic elements of the supply chain.*
- *ASEL need to continue to evolve, in relation both to persistent issues like mortality in sheep exported from southern ports in winter months and to the results of scientific research.*
- *There needs to be closer examination of a range of issues relating to ASEL, including issues of scope, clarity and accountability, flexibility, sanctions and review procedures.*

Recommendation

The Review recommends that a comprehensive review of ASEL be undertaken.

- *The review should inter alia examine the policy on export of sheep from southern ports to the Middle East in winter months, with a view to:*

- *mitigate feedlot and shipboard losses in adverse weather conditions*
- *mitigate losses from heat stress and inanition during the voyage.*
- *The review should also consider additional specific criteria, identified in recent industry-funded research, for selection of suitable livestock for export.*

(Farmer 2011, p50)

4.9.4 Section 5: Suitability of livestock for export

The *Farmer Review* refers to the Keniry Review in identifying that multiple causal factors may interact in a complex and dynamic way to influence morbidity and mortality risk.

Some of these factors may in turn be used to develop practices designed to reduce risk and this risk management approach is a major driver behind the development of the ASEL in the first place.

Risk management strategies already in use at some level include selection of certain types of sheep and practices for transporting and preparing these animals for export.

There are specific issues identified with respect to pastoral and station sheep and sheep that are prepared in southern ports in the Australian winter. The *Farmer Review* notes that there is no definition in ASEL of the terms *pastoral* or *station* sheep.

The *Farmer Review* uses the term **suitability** to refer to animal characteristics that are assessed at the initial selection process which generally is expected to take place on a vendor property or farm to determine whether the animals will both meet purchaser specifications and any local/state/national requirements including those concerning health and welfare.

It is important to note that some suitability characteristics will not be altered by the export preparation process. These are characteristics that will not change once the animals have been selected for export and include things such as: species, age, breed, sex, treatment history and origin. The *Farmer Review* refers to these as **basic suitability** attributes.

There are other characteristics that may play a role in selection of animals for export (body weight, body condition and health status) but that may then change during the preparation of animals for export depending on health and disease in individuals or groups of animals. These characteristics influence the animal's fitness to load at any given point in time and may change over time, therefore requiring multiple opportunities for assessment.

The *Farmer Review* notes that suitability of livestock can be assessed at four stages in the export chain:

1. On-farm selection involving assessment by the vendor and the exporter (or more typically a buyer acting as an agent for the exporter). The NVD provides a vendor declaration of the health of the animals. There are ASEL standards requiring that livestock sourced for export must be inspected on farm and any animal with signs consistent with ASEL rejection criteria must not be prepared for export.
2. Before removal from the property the transport operator must confirm that each animal is fit for export under ASEL and animals that do not meet these criteria must be removed.
3. Inspection at the registered premises which must occur immediately following unloading and also prior to loading out on completion of the feedlot period.
4. A final inspection is then performed immediately before loading on to the international transport vessel.

The *Farmer Review* notes the importance at selection of a range of different characteristics, some of which may be more closely related to managing potential for adverse risks during export while others may be related to market specifications:

- Animal characteristics such as species, breed, body condition score, health status, weight, age, gender.
- Source and origin characteristics such as pastoral sheep
- Experience with feed types
- Temperament
- Handling and transport experience
- Transport distance to port
- Experience with pathogens (prior exposure to disease and parasites)

Under normal supply and demand forces it may be reasonable to expect that when supply of potentially suitable animals is high, there is an opportunity for selection pressure to ensure that exported animals are of high quality. Conversely when supply is low (particularly lower than demand) then market pressures may favour attempts to export animals that are of more variable and lower quality. Through chain quality assurance systems have the potential to ensure adherence to specifications and therefore ensure quality regardless of the supply side of the market.

The *Farmer Review* identified the contrast between southern Australian conditions in the Australian winter and northern hemisphere conditions as animals approach the destination countries where climatic conditions in the northern summer may be very different. This is widely recognised as contributing to issues for sheep prepared in southern ports.

There was specific reference to mortality incidents in sheep from southern ports (and cattle) between 2006 and 2010 that indicated mortalities related to suitability criteria including heat stress and enteritis in sheep (particularly fat wethers and pastoral or rangeland sheep).

The Review noted from AQIS mortality reports that despite closer attention to risk factors and introduction of routine veterinary surveillance, export of sheep from southern ports during the Australian winter still results in a significant number of high mortality incidents.

AQIS has made the point that split voyages from southern ports, for example involving loading at Portland or Adelaide and Fremantle, often strike extreme weather conditions in the Great Australian Bight and the rough trip and longer port time can result in higher shipboard losses.

The Review has not been able, in the time available, to do a thorough study of the research and other data bearing on mortality out of southern ports. Such a study is needed and should inform the recommended review of ASEL.

(Farmer Review 2011, p59)

Finding

- *There has been significant progress in improving the suitability of cattle for export.*
- *Some livestock are not suitable, or suitably prepared for export. Selection and certification of suitable livestock remains an important and sometimes poorly conducted operation, especially from southern ports.*

Recommendation

The Review recommends that the ASEL review should examine the policy on export of sheep from southern ports to the Middle East in winter months, with a view to:

- *mitigate feedlot and shipboard losses in adverse weather conditions*
- *mitigate losses from heat stress and inanition during the voyage.*

(Farmer Review 2011, p59)

The *Farmer Review* specifically referred to findings from recent research projects relating to causal factors involved in sheep morbidity and mortality. These will be addressed in more detail in subsequent sections.

Recommendation

The Review recommends that the proposed review of ASEL should also consider additional specific criteria, identified in recent industry-funded research, for selection of suitable livestock for export.

(Farmer Review 2011, p61)

The *Farmer Review* provides specific discussion of pregnancy as a suitability characteristic, mainly because inadvertent inclusion of heavily pregnant females in export consignments may result in parturition and delivery of neonates either during a voyage or at the destination port when conditions may not be conducive to good welfare outcomes for the neonate or the dam.

There was concern about the possible accuracy of pregnancy testing which may result in animals entering the export supply chain following a misclassification (calling an animal non-pregnant when in fact she is pregnant).

There was also discussion of the ASEL stipulation that pregnancy testing (if conducted) must be conducted within 30 days of export. An example had been given of a situation where departure of an export vessel was delayed by some days and went over the 30 day limit for a consignment of cattle, meaning that a literal interpretation of the ASEL requirement would have resulted in several thousand cattle being re-pregnancy tested (Farmer 2011, p48). The *Farmer Review* concludes on page 62, that the 30-day limit should be subject to discretion by AQIS where the risk of pregnancy is low.

The *Farmer Review* acknowledges the difficulties with respect to traceability in sheep. All sheep in Australia must be identified with an NLIS compliant ear tag before they can be moved from the property to another location associated with a different property identification code (PIC). However, there is no requirement for individual animal identification in sheep as there is in cattle, radio frequency identification devices (RFID) are not required in sheep and appear to be used only by early adopters of this technology. In addition, while some states require sheep movements (mob movements only) to be recorded on the national movements (NLIS) database, Queensland and Victoria do not require such recording.

There are well recognised difficulties in recording accurate counts of sheep at different steps along the supply chain since it is easy for counts to differ even when stringent attempts are made to record accurate counts.

4.9.5 Section 7: Post-arrival monitoring and risk management

This review focuses on those sections of the *Farmer Review* that are considered directly relevant to the objectives of this review.

Animal identification and traceability are identified as key elements of providing assurance on animal welfare outcomes for Australian livestock.

The current national policy for sheep and goats requires that animals be identified with a visual NLIS compliant eartag (RFID tags are available and can be used but are voluntary), and that animal movements be accompanied by a completed NVD/waybill. Only three states (New South Wales, South Australia and Western Australia) currently require recording of sheep and goat movement on the national

movements (NLIS) database. Other states (such as Queensland and Victoria) indicate that compulsory recording will become mandatory in the near future but that it remains voluntary for now.

Mob based identification and tracing systems mean that it is not possible to provide individual animal accounting in all cases for sheep.

There are additional traceability requirements for some markets such as those requiring sheep exported to Saudi Arabia to be identified with a numbered ear tag documenting that they have been vaccinated against scabby mouth and aged based on tooth eruption.

The *Farmer Review* presents discussion on using attributes of the approach to resuming Indonesian cattle exports as a coherent framework for animal welfare for all Australian livestock exports (which have subsequently been developed in the ESCAS system).

There was additional discussion on identification options for sheep and whether effective accountability could be developed in the absence of individual animal identification methods. The *Farmer Review* suggested that *accountability for sheep (and goats) could in principle be achieved without individual identification, provided that the exporter is able to report that a given number of animals left the farm gate and that the total number of animals which died in transit, in feedlots and the slaughter point equalled that original number. Nonetheless, individual animal identification is likely to provide the greatest level of assurance that animals are kept within a defined supply chain. This would be achieved at a greater cost to industry and for it to be practicable the domestic system would need to be developed first.*

(Farmer Review 2011, p87)

The *Farmer Review* highlights the fact that current methods of sheep and goat identification and movement recording do not meet standards defined in the National Traceability Performance Standards that underpin disease preparedness and contribute to market access.

It seems likely that if this issue is not able to be addressed effectively then it may contribute to increasing support for adoption of individual animal identification methods such as the RFID technology already being used in cattle. This decision appears to have already largely been made in some jurisdictions with Victoria appearing to be further progressed towards a move to EID in sheep¹⁵.

¹⁵ <http://www.dpi.vic.gov.au/agriculture/beef-and-sheep/dpi-services-to-beef-and-sheep-producers/evaluation-of-2010-plan>

Recommendation

The Review recommends that the Australian Government should work with states and territories and industry to implement individual identification of all sheep and goats as soon as practicable.

As a priority, current exemptions applying to export cattle from the Northern Territory and Western Australia should be removed.

(Farmer 2011, p88).

Finding

Overall, there is considerable support for an approach to all exports of feeder and slaughter livestock, which has the following elements: all elements of the supply chain must meet OIE standards as a minimum; animals entering a supply chain must be accounted for; there should be independent third party assessment of each supply chain; and the exporter must demonstrate whole of supply chain control enabling accounting for animals and ensuring treatment according to OIE standards. There are species-by-species and market-by-market circumstances which will affect the means of achieving that assurance for animals from the farm gate to the point of slaughter.

(Farmer 2011, p90)

Much of the remainder of the *Farmer Review* is focused on the international parts of the supply chain and these are not reviewed here.

It is noted that implementation of the recommendations in the *Farmer Review* will require examination by DAFF of resourcing and operations as new arrangements are implemented, both in the domestic elements of the supply chain as well as internationally.

4.9.6 Government response to the Farmer Review

The Government has agreed in principle to all recommendations of the *Farmer Review*, recognising that some recommendations will require actions by the Commonwealth, State and Territory Governments and industry¹⁶.

Under recommendation 10, the ESCAS system that had already been implemented for the cattle trade to Indonesia, would be extended with appropriate modification to all markets and all livestock species intended for feeder and slaughter.

¹⁶ http://www.daff.gov.au/_data/assets/pdf_file/0020/2030366/australian-government-response-LAE-reports.pdf

4.10 Exporter Supply Chain Assurance System (ESCAS)

In 2011, the Australian Government announced that all exports of livestock for slaughter would be required to supply evidence of an acceptable ESCAS before an exporter can be issued with an approval to export. The legislative control of these procedures was implemented as an amendment to the Export Control (Animal) Orders 2004 in February 2012

The ESCAS is based around the following four principles:

1. evidence of compliance with international (World Organisation for Animal Health) standards for animal welfare;
2. evidence of effective traceability of animals within a supply chain through to slaughter;
3. meet reporting and accountability requirements;
4. incorporate independent auditing.

The ESCAS process has a managed transition period depending on livestock type and destination and the dates by which systems must be in place for each of these combinations, are displayed on the DAFF website¹⁷.

With respect to sheep exports, ESCAS procedures had to be in place by 1 March 2012 for sheep being exported to Kuwait, Bahrain, Qatar and Turkey.

Exports of sheep to several additional countries (Israel, Jordan, Malaysia, Oman, Saudi Arabia, Singapore and United Arab Emirates) must have ESCAS procedures in place by 1 September 2012 and then there are additional countries that must have ESCAS procedures in place by January 2013.

Accountability for performance in the ESCAS system is applied to Australian exporters.

The exporter's supply chain assurance system must include adequate records that account for:

- the numbers loaded onto and unloaded from the ship;
- the number of animals that enter and exit each facility within the approved supply chain;
- the number of non-slaughter mortalities within the approved supply chain;
- the number of animals slaughtered within the approved supply chain; and

¹⁷ <http://www.daff.gov.au/aqis/export/live-animals/livestock/escas>

- the number of animals on–sold as breeders (the regulatory framework does not apply to breeder animals)

The ESCAS auditing requirement is expected to check supply chain traceability/accounting records to identify whether the system can account for the sheep in the supply chain. Independent audit reports will be completed every two months for the first six months of a new supply chain, and then at a frequency determined by a risk–based approach involving a minimum of three audits per year.

The ESCAS will be expected to provide complete accounting for all animals in an export supply chain until natural death or slaughter. There is recognition that QA systems have to recognise the inherent variability associated with human error but in general there is no acceptable level of leakage of animals from the whole-of-chain system for animals that cannot be accounted for.

While ESCAS has a whole-of-chain application, the area where most procedures need to be developed and implemented is in the period from discharge to slaughter in the destination country or countries. At the time this report was prepared information available on the DAFF website indicated that ESCAS audits would focus primarily on the part of the supply chain beginning with discharge of animals from the ship.

With respect to the scope and objectives of this review the relevant requirements arising from ESCAS are:

- As animals move from the export depot, exporters must verify/ensure that all animals have an NLIS ear tag.
- All animals must be counted onto the ship/aircraft.

These two requirements lay the foundations for the whole-of-chain QA system that is fundamental to the ESCAS.

4.11 Australian Senate inquiry into animal welfare standards in live export markets

The Senate Rural Affairs and Transport References Committee initiated an inquiry in June 2011 that included consideration of animal welfare standards in Australia's live export markets, and that also included consideration of two private Senator's bills.

The final report from this Committee was delivered in November 2011.

The Senate Committee was able to consider in its inquiry the findings of the *Farmer Review* and the development of the supply chain quality assurance framework which had been announced by the Government in July as a condition of resumption of any export trade to Indonesia.

The Senate Committee report incorporated a total of nine recommendations and also included additional recommendations in two dissenting reports: two recommendations in a dissenting report from the Australian Greens and five in a dissenting report from Senator Xenophon.

The Government's response to all of these recommendations can be observed on the DAFF website¹⁸.

For the purposes of this review, brief comments are made on those sections of the Senate Committee report that are considered most relevant. Some of the recommendations related to topic areas that were not directly relevant to this review such as Mark IV restraint boxes used for cattle.

Many of the recommendations appeared to be aligned with information and issues already covered in the *Farmer Review* and therefore the Government response involved reference to initiatives that had been outlined already either as part of the initiatives implemented to allow Indonesian cattle exports to resume or broader initiatives identified in responses to the *Farmer Review*.

Recommendation 4 of the Senate Committee report concerned information that might be made public about compliance with supply chain assurance systems. The Government response indicated that there was already a commitment to make independent auditor reports public.

Recommendation 5 outlined the Senate Committee's support for a mandatory national permanent livestock traceability system and the Government indicated that it will continue to work closely with industry in the development of a mandatory national traceability system for livestock.

¹⁸ <http://www.daff.gov.au/animal-plant-health/welfare/export-trade/government-response-to-senate-inquiry-into-animal-welfare-standards-in-live-export-markets>

Recommendation 6 concerned the clarification of responsibilities of peak bodies that act and speak on behalf of the industry with a view to clarifying the lines of authority and communication within industry. The Government response was to agree in principle and to support the notion of clarification of lines of authority and communication within peak industry bodies.

Recommendation 7 concerned establishment of inter-governmental dialogue with the governments of each of our live export trading partners and that agreements reached as a result of this dialogue are clearly communicated to Australian Government officials and Australian industry representatives. The Government agreed in principle with this and referred to both the existing dialogues with trading partners and the recognition that export reforms announced in 2011 clearly stipulate that Australian exporters have the responsibility to put in place the new arrangements. It is the exporter's responsibility to work with industry in importing countries to develop supply chains that meet the new standards.

5 National livestock export performance reports

Each year Richard Norris and Greg Norman produce a summary report of livestock export performance as a separate MLA/LiveCorp report that details summary statistics for livestock exported and mortality rates. The reports provide a valuable chronology of performance and include some breakdown by various characteristics. These reports were assessed to develop summary statistics for sheep exports.

5.1 Summary of sheep numbers

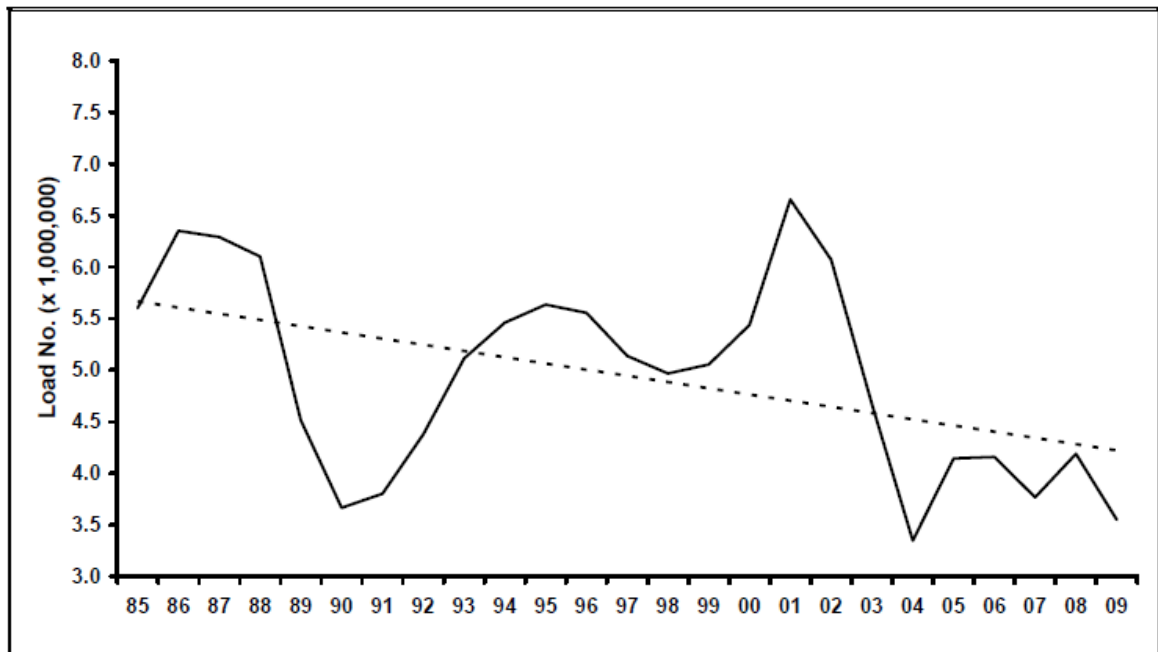


Figure 5.1: Number of sheep exported by sea from Australia to all destinations since 1985. From Norris and Norman (2010).

Historical data indicates that the live export trade in sheep from Australia peaked in the 1980s when the annual total number of sheep exported from Australia ranged between 7 and 8 million.

This review will focus on the more recent period from the late 1980s and particularly from the late 1990s since this coincides with availability of more detailed data on risk factors associated with mortality.

Since the late 1980s, the long term trend in sheep exports shows a gradual decline with large fluctuations over shorter periods (see Figure 5.1). The major fluctuations and particularly the large declines in 1990-1991 and 2003-2004 are due mainly to cessation of trade to Saudi Arabia with other factors such as drought and sheep availability and changes in market forces playing additional roles.

Export of sheep from southern ports to the Middle East in winter months

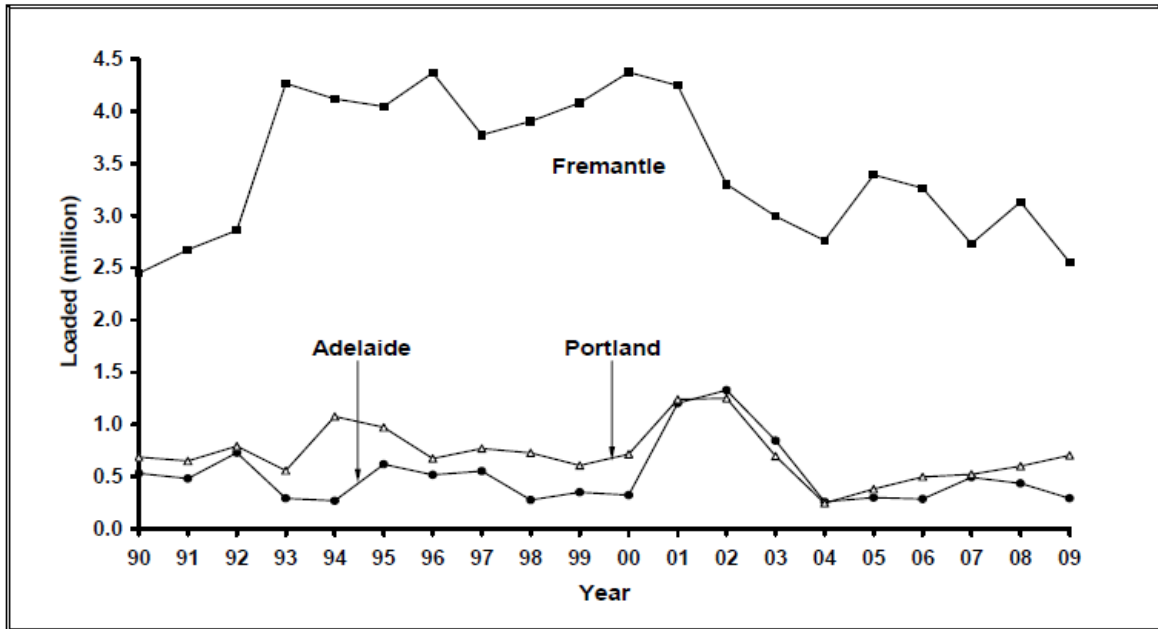


Figure 5.2: Number of sheep exported by sea to the Middle East from Fremantle, Portland and Adelaide since 1990. From Norris and Norman (2010).

The highest total number of sheep exported by sea in a single year in the period since 1990 was in 2001 with more than 6.5 million sheep exported. The annual total for 2001 represented a 24% increase from 2000 but the relative increase by port of loading was much larger for Adelaide (273% increase over 2000) and Portland (74% increase over 2000) than at Fremantle (decline by 3% compared with 2000), as shown in Figure 5.2.

It is important to recognise that while Western Australia consistently accounts for the majority of sheep exported from Australia, there are significant variations in the numbers of sheep exported at different times from the other two ports (Adelaide and Portland).

There was a 12% decline in total sheep exported from 2001 to 2002. However, when broken down by port of loading there was a substantial decline in sheep loaded at Fremantle (26% drop from 2001), a 12% rise at Adelaide and a 1% rise at Portland.

There was a further 24% decline in total sheep exported from Australia in 2003 (45% drop at Portland, 37% drop at Adelaide and 11% drop at Fremantle), and an additional 27% decline from 2003 to 2004.

The cessation of the Saudi trade in August 2003 was a major contributor to the decline in sheep exports in this period but there were additional factors operating including a major drought across much of Australia in 2002-2003 with reductions in sheep numbers and upward pressure on prices as well as uncertainty in Middle East markets associated with the Iraq war and with concerns in other countries over the suspension of live exports to Saudi Arabia.

Exports to Saudi Arabia re-commenced in July 2005 and contributed to the increase in total sheep numbers exported for the 2005 year and particularly to an increase in numbers for the second half of that year.

The age of sheep exported has also consistently fallen through the late 1990s and early 2000s and this has been attributed to general reductions in sheep numbers as well as changing flock structures to favour lamb production rather than wool production.

Since 2005, there has been less large scale fluctuation in total sheep numbers exported.

5.2 Summary statistics for mortalities

When summarised over all ports, older wethers appeared to have higher mortality rates than younger wethers (hoggets and lambs) and rams appeared to have higher mortality rates than wethers with an age associated decline (adult rams > hogget rams > ram lambs).

There was also a seasonal pattern to mortality reports with voyage mortality rates being higher in the second half of the year compared to the first half of the year. Depending on particular years when summary data were presented the pattern appeared more or less marked in different locations (Fremantle, Portland, Adelaide) and this is presumably related to seasonal conditions and sheep characteristics.

There was an increase in mortality rates from 2000 to 2001 for Adelaide and Portland with the increase appearing in loading and voyage phases.

Norris and Norman (2003) indicated that there were elevated deaths in Portland in July and August 2002 in association with salmonellosis outbreaks.

There was a major reduction in mortality rates for Portland in 2003 & 2004 compared to 2002 and a smaller reduction for Adelaide. These reductions coincided with a major drop in sheep exported through these ports.

Export of sheep from southern ports to the Middle East in winter months

Table 5.1: Summary statistics for sheep exports from 2001-2009. Compiled from annual reports produced for MLA.

Port	Variable	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fremantle										
	No. of sheep	4,279,734	3,359,463	3,007,980	2,821,304	3,450,944	3,295,235	2,975,179	3,150,885	2,558,183
	No. of voyages	76	96	65	44	48	47	43	50	42
	No. voyages >2% death	5	3	0	1	2	0	2	1	1
	Mortality rate (%)									
	voyage only	0.65	0.61	0.56	0.46	0.73	0.63	0.66	0.61	0.68
	all shipboard deaths	0.96	0.88	0.77#	0.71	0.97	0.86	0.96	0.87	0.91
Adelaide										
	No. of sheep	1,203,991	1,329,176	843,283	258,175	301,648	289,745	450,726	447,161	291,665
	No. of voyages	24	25	21	9	6	5	10	9	7
	No. voyages >2% death	0	2	2	0	0	0	2	0	0
	Mortality rate (%)									

Export of sheep from southern ports to the Middle East in winter months

voyage only	1.11	1.01	0.93	0.89	0.54	0.54	0.74	0.67	0.76
all shipboard deaths	1.48	1.32	1.2	1.15	1	1	1.03	0.97	1.01
<hr/>									
Portland									
No. of sheep	1,238,373	1,256,324	694,948	246,960	311,031	497,831	513,677	599,141	696,498
No. of voyages	19	25	18	8	9	11	13	14	16
No. voyages >2% death	3	6	1	0	0	0	1	0	0
Mortality rate (%)									
voyage only	1.36	1.27	0.72	0.49	0.51	0.57	0.6	0.36	0.61
all shipboard deaths	2.1	2.09	1.01	0.78	0.83	0.92	0.99	0.64	0.86

excludes mortalities that occurred on the *Cormo Express* after it was rejected at Saudi Arabia

Export of sheep from southern ports to the Middle East in winter months

Table 5.2: Relative risk estimates and associated p-values comparing mortality rates

Comparison	2001	2002	2003	2004	2005	2006	2007	2008	2009
Adelaide compared to Fremantle									
Relative risk	1.54	1.50	1.56	1.62	1.03	1.16	1.07	1.11	1.11
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Portland compared to Fremantle									
Relative risk	2.19	2.38	1.31	1.10	0.86	1.07	1.03	0.74	0.94
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.022	<0.001	<0.001
Portland compared to Adelaide									
Relative risk	1.42	1.58	0.84	0.68	0.83	0.92	0.96	0.66	0.85
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.026	<0.001	<0.001

The total counts of sheep exported and of deaths derived from Table 5.1 were used to generate relative risks to compare mortality rates.

For all years between 2001 and 2009, annual mortality rates for sheep exported from Adelaide were significantly higher than mortality rates for sheep exported from Fremantle. Relative risk estimates ranged from 1.03 to 1.62.

Export of sheep from southern ports to the Middle East in winter months

For sheep exported from Portland, mortality rates were significantly higher than Fremantle for years from 2001 to 2004. Since 2004, mortality rates for sheep exported from Portland were significantly lower than for Fremantle for three years (2005, 2008 and 2009) and were significantly higher for the other two years (2006 and 2007). For sheep exported from Portland, mortality rates were higher than for sheep exported from Adelaide in 2001 and 2002 but they have been consistently lower than Adelaide since that time.

Export of sheep from southern ports to the Middle East in winter months

Table 5.3: Relative risks comparing annual shipboard mortality rates over time within Ports. Annual mortality rates for each year from 2004 or 2005 onward were compared to three base rates: annual rate for 2003, annual rate for 2004 and the overall rate based on combined data for 2001-2003.

Adelaide	Comparison to:	2004	2005	2006	2007	2008	2009
	2003	0.96	0.83	0.83	0.86	0.81	0.84
	2001-03 combined	0.85	0.74	0.74	0.76	0.72	0.75
	2004		0.87	0.87	0.90	0.84	0.88
Portland	Comparison to:	2004	2005	2006	2007	2008	2009
	2003	0.77	0.82	0.91	0.98#	0.63	0.85
	2001-03 combined	0.42	0.45	0.50	0.53	0.34	0.46
	2004		1.06	1.18	1.27	0.82	1.10

p=0.14

All comparisons were statistically significant with the exception of one. The annual mortality rate for sheep exported from Portland in 2007 was not different to the rate for sheep exported from Portland in 2003 (p=0.14). All other comparisons were associated with p<0.05.

Export of sheep from southern ports to the Middle East in winter months

The 1985 Senate Inquiry into animal welfare in live export identified the winter months in Portland as a problem period associated with elevated risk of mortality, both as a result of conditions at the assembly feedlot as well as the dramatic shift in climatic conditions to the heat of the northern summer as export vessels approached destination ports in the Middle East. There was acknowledgement of the need to provide adequate shelter for animals in the feedlot during the assembly period and to avoid assembling animals directly off shears when they may be exposed to inclement weather. At that stage, the committee appeared to consider a ban on exports during the Australian winter but chose not to.

Annual reports compiled by Norris and Norman for MLA/LiveCorp began to report on monthly mortalities and also on the period from May to October for each year from 2005, though the initial report covered the period from 2000 onwards.

The results demonstrate that there had been relatively large elevations in mortality rates for sheep exported from Portland in particular during the May to October period in 2000 and 2001 and 2002. Mortalities continued to be elevated during this period for 2003 but then reduced. It is believed that salmonellosis in particular may have been a major contributor to these mortalities.

Table 5.4: Mortality percentage by month for all sheep exported from Fremantle, Adelaide and Portland. From Norris and Norman (2006, 2008).

Port	Month	2000	2001	2002	2003	2004	2005	2006	2007	2008
Fremantle	J	0.8	0.7	0.9	0.5	0.8	0.7	0.9	0.4	0.7
	F	0.8	0.5	0.7	0.5	0.5	0.6	0.8	0.5	0.5
	M	1	0.5	0.5	0.4	0.5	0.5	0.7	0.6	0.4
	A	1	0.6	0.7	0.6	0.4	0.7	0.5	0.4	0.4
	M	1.1	0.7	0.7+	0.6	0.5	0.5	0.7	0.9	0.6
	J	2.2	1.3	0.9	0.8	0.9	0.9	0.8	0.5	0.6
	J	2.4	1.4	1.4	0.9	0.6	0.5	0.9	1	1
	A	1.3	1.6	1.1	1	0.9	1.4	1.1	1.4	1.5
	S	1.8	1.7	0.9	1	1	1.3	1.1	1.3	1
	O	1.1	1.1	1.1	1.1	0.8	1.4	0.9	1.4	0.9
	N	1	1.1	0.9	1.2	0.7	0.7	0.7	1.3	1.1
	D	0.9	0.8	0.6	0.7	0.6	1	0.8	0.8	1.1
	M-O	1.6	1.3	1	0.9	0.8	1.2	0.9	1.1	1
	N-A	0.9	0.7	0.78	0.58	0.68	0.63	0.77	0.57	0.68

Export of sheep from southern ports to the Middle East in winter months

Adelaide	J	0.2		1.7	0.9	1.2			0.6	
	F		1.5	0.8	1	1.3				0.6
	M		1.3	0.8	0.9			0.7	0.5	
	A	0.6		1.2	0.6		0.5	0.9	0.7	0.5
	M	0.5	1.1	0.7	1.2	0.5	0.9		0.6	0.7
	J	2.4		1.8	2.3	1.1			2.1	0.4
	J	1.3	1.5	1.7	1.2	0.7	1.4		0.5	1.2
	A		2.4	0.9	1	1.3	1	1.1	2.1	1.6
	S	0.5	1.7	1.5	1.7	1.3			1	
	O	0.7	1	1.9	1.1			1.2	1.2	
	N		1.8	1.1			1.1	0.9		1.2
	D	2.3	1.4	1.4	1.8				0.8	1.1
		M-O	1.3	1.5	1.5	1.4	1.1	1.1	1	1.3
	N-A	0.4	1.7	1.28	0.98	1.43	0.50	0.90	0.68	0.63
Portland	J	1.3	1.9	1.3	0.6		1		1.2	0.8
	F		2.4	1		0.8	0.4		0.8	0.6
	M	0.9	0.7	0.7	0.6	1		0.9	0.6	0.5
	A	0.7	1	1.1	0.6	0.8		0.6		0.6
	M		1.8	1	0.7	0.5		0.7	1.8	0.4
	J		4	1.8	1	1	0.5	1.4	0.7	
	J		1.6	5.5	1.7	0.7	1.1		2.5	1.4
	A		2.2	7.5	1.4			1.2	0.7	0.6
	S	2.8	2.1	2.1	1.8		0.7	1.1	0.6	
	O	2.2	3.2		1.4		1.5	1.2	0.8	0.4
	N	1.6	2.4			0.9	1	0.6	0.7	
	D	5.3	2.1	1.3	0.7		0.6	0.3	0.6	0.3
		M-O	2.5	2.7	3	1.3	0.6	0.9	1.1	1.1
	N-A	0.97	2.15	1.43	0.78	0.83	0.77	0.78	0.70	0.63

Mortality investigations

A Government investigation is conducted whenever there is a consignment with a reportable mortality event (>2% mortality for sheep voyages). Reports from mortality investigations conducted since 2006 are available for download from the DAFF website¹⁹. The material summarised here was drawn from those mortality investigation reports that dealt with reportable death events in sheep.

There were 13 investigation reports involving deaths in sheep exported by sea from southern ports between 2006 and 2011.

All of these incidents involved voyages with departure dates between June and October.

All reports indicated that sheep were loaded onto the ships in accordance with ASEL requirements with one exception. The exception was noted in Report 21 where sheep that were not in accordance with ASEL requirements (pastoral sheep between May and October that were prepared in paddocks at a registered premise in South Australia) were loaded onto the ship. In this case the sheep were part of a research project (LIVE.123) in operation at that time that was investigating causes of mortality in live sheep exports and also risks associated with pastoral sheep. The sheep formed part of a LESAG agreed trial that involved placing pastoral sheep onto ships under experimental control and following those sheep to determine mortality outcomes.

There were 10 voyages where sheep had been loaded at an eastern port (Portland or Adelaide) and on eight of these additional sheep had been loaded at Fremantle. Of these 10 voyages with eastern loading, nine involved Portland and three involved Adelaide.

There were three voyages where sheep had only been loaded at Fremantle.

The reports did not all contain the same level of detail. More recent reports contain more detail including for example details on breakdown of mortality rates by port of loading for voyages where sheep were loaded from more than one port, and more detail on conditions during the assembly period and on board the ship. In some cases the additional detail allows an appreciation of the potential involvement of different risk factors including factors associated with sheep, preparation period, voyage, climatic conditions and the ship.

The two major causes of deaths involved in all 13 voyages that had reportable levels of sheep mortality were heat stress and enteritis.

¹⁹ <http://www.daff.gov.au/aqis/export/live-animals/livestock/aqis-mortality-investigations>

Export of sheep from southern ports to the Middle East in winter months

In most cases where enteritis occurred it was often associated with deaths that were attributed to enteritis alone, enteritis in combination with inanition and inanition alone.

In some cases the voyage reports indicated that deaths due to enteritis (and sometimes inanition) occurred in the early part of the voyage and that deaths due to heat stress occurred in the latter parts of the voyage. Comments indicated that those decks and pens where deaths had occurred from enteritis were then hard hit by heat stress. However, there were instances where deaths due to heat stress were not preceded by any evidence of prior illness or deaths from other causes.

Inspection of the patterns of daily counts of mortalities can be used to make inference about epidemiology and exposure risks.

With respect to enteritis there appeared to be two broad patterns, as illustrated by the following plot of daily mortality counts.

In one case peak mortality occurred very early in the voyage (day 4) and then mortality counts declined over time. In the other case mortality counts remained low until day 9 and then rose rapidly to a peak on day 11 and then declined.

These patterns are likely to be related to a combination of exposure and susceptibility and this is discussed in more detail in the literature review section of this report.

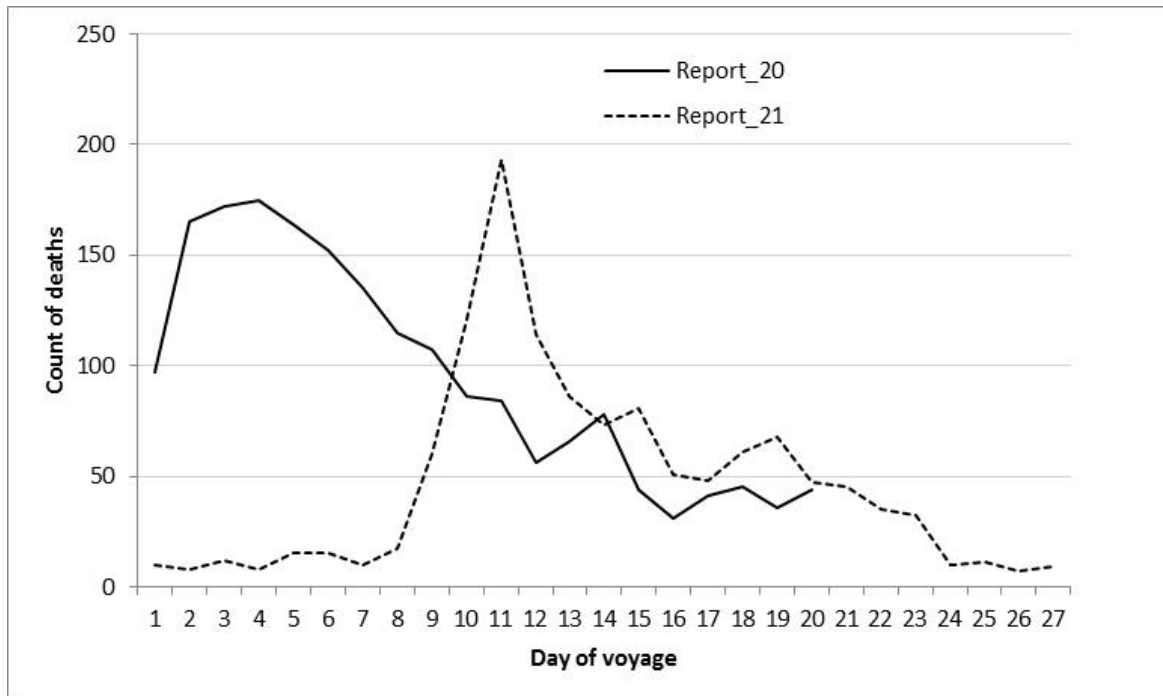


Figure 0.1: Count of mortalities by voyage day for two voyages where enteritis was the major cause of death

Importantly, the earlier onset pattern is likely to reflect increased exposure of animals in the registered premise such that animals were already heavily exposed at the time that they were loaded onto the ship. There was no evidence of problems in the registered premise for this voyage and no suggestion that rejects in the period immediately prior to loading were displaying signs of enteritis.

The second pattern (from report number 21) is very strongly suggestive of heavy exposure of sheep to enteritis causing organisms (*Salmonella*) on board the ship. The daily reports from that voyage indicated moderate to rough seas in the first five days of this voyage. Whether these conditions contributed to the exposure risk is unknown but it is certainly plausible that there was a low level of shedding of infectious organisms at the time of loading the ship and that subsequent events favoured the development of disease and high levels of shedding in some animals. Under conditions of high density stocking, stress and susceptible animals, this can create the very rapid increase in disease and deaths as is displayed in Figure 0.1.

There were some voyages where reports described adverse climatic conditions (particularly prolonged and severe wet weather) while sheep were being prepared in paddocks at the registered premise, and where these conditions were then followed by development of enteritis in the early stages of the voyage.

It is also worth noting that there may have been some clustering in time for voyages with enteritis as a major contributor to mortality for those voyages in mid-2007 (15, 17, 19, 20, 21, 23). These voyages involved sheep prepared in registered premises linked to all three major ports (Portland, Adelaide and Fremantle). As discussed in the literature review section of this report, if conditions in the registered premise lead to heavy environmental exposure with salmonella organisms then this may create a situation where subsequent consignments entering the same premise may be exposed to high levels of organisms. There may also be similar environmental conditions operating on properties of origin that increase the risk of enteritis in sheep during a wet winter for example.

The reports associated with enteritis as the major cause of deaths during the voyage, all described low or typical levels of mortality during the assembly period. This information suggested that there was not an outbreak of severe salmonellosis and elevated mortality in sheep during the assembly period. It suggested that the assembly period was most likely producing higher levels of exposure of sheep to salmonella organisms such that sheep were then predisposed to develop clinical disease and elevated mortality rates once they were loaded onto the ship. The epidemic curves suggest two different broad patterns of exposure of sheep to both infectious organisms and stressors that may increase the risk of disease.

Deaths due to heat stress appeared to follow cumulative exposure over time to very hot conditions (often several days in a row), around the period when vessels are in the Gulf region and in some cases associated with unloading.

In some cases (report 15) there was a suggestion that open decks were associated with a higher mortality risk, attributable to a combination of extreme climatic conditions and reduced air flow in open decks if the vessel is stationary or moving very slowly and there is little wind.

In other cases (report 37 & 38) there were higher mortality rates reported for lower (closed) decks, in association with elevated wet bulb temperatures in these decks. There was also information in some reports to suggest that either upper or lower tiers of sheep pens may have higher mortality risks in decks with two tiers of pens. There is also acknowledgement that different breeds and classes (age, sex, weight) of animals may be located in different parts of the ship and that there may be apparent differences in mortality rate associated with sheep factors as well as ship factors.

Report 38 states that: *There is insufficient information available to determine if the differences in mortality percentages was due to sheep or deck factors or both* (page 8, report 38).

In one case the onboard AAV indicated that while the loading of the ship had been completed in accordance with ASEL requirements concerning loading density, the AAV felt that minimum stocking densities outlined in the ASEL for sheep exported to the Middle East in July and August may be insufficient to allow adaptation to the northern heat and that there should be a review of ASEL minimum stocking densities for sheep exported to the Middle East at this time.

Export of sheep from southern ports to the Middle East in winter months

Table 0.1: Summary of 13 sea voyages with reportable sheep mortality between 2006 and 2011

Report No.	Port of loading	Origin of worst affected sheep	Major cause of death	Load date	Duration (days)	Sheep numbers			Consignment		
						loaded	died	%	loaded	died	%
7	Portland / Fremantle	Unknown	Heat stress	Jun-2006	26	72,210	1,425	1.97	20,701	449	2.17
8	Portland / Fremantle	Portland	Enteritis	Sep-2006	29	111,788	1,626	1.45	17,999	373	2.07
15	Portland / Fremantle	Fremantle	Heat stress preceded by inanition/enteritis	May-2007	31	109,035	2,051	1.88	14,854	622	4.19
17	Portland / Fremantle	Portland	Heat stress preceded by enteritis	Jul-2007	27	77,464	1,330	1.72	25,872	653	2.52
19	Adelaide / Fremantle	Adelaide	Enteritis & heat stress	Jun-2007	32	105,242	1,659	1.58	27,626	593	2.15
20	Fremantle	Fremantle	Enteritis	Aug-2007	21	76,149	1,923	2.53			
21	Portland / Adelaide	Adelaide	Enteritis	Aug-2007	30	92,398	1,493	1.62	59,865	1,251	2.09
23	Fremantle	Fremantle	Enteritis	Oct-2007	16	55,520	1,142	2.06			

Export of sheep from southern ports to the Middle East in winter months

33	Portland / Fremantle	Fremantle	Enteritis. Secondary causes - inanition & heat stress.	Aug-2009	28	78,421	1,516	1.93	34,535	756	2.19
36	Portland / Fremantle	Portland	Enteritis & heat stress	Jun-2010	26	70,726	1,023	1.45	36,518	913	2.50
37	Portland / Adelaide	Portland	Heat stress	Aug-2010	26	77,523	2,572	3.32	52,213	1,914	3.67
		Adelaide	Heat stress						25,310	527	2.08
38	Fremantle	Fremantle	Heat stress	Aug-2010	22	69,024	1,407	2.04			2.04
40	Portland / Fremantle	Portland	Enteritis & inanition	Jun-2011	27	65,203	1,006	1.54	28,607	703	2.46

Export of sheep from southern ports to the Middle East in winter months

Table 0.2: Summary of findings from reports of investigations into reportable sheep mortality on sea voyages from Australian ports

Report No.	Year	Major causes of mortality	Comment	Recommendations	Actions
7	2006	Heat stress			Conducted audit of voyage against ASEL
8	2006	Enteritis		<p>1. RP inspection must be able to detect diarrhoea in sheep</p> <p>2. Industry to assess procedures for managing salmonellosis during voyage.</p>	Sheep on open decks must be loaded with 10% extra space.
15	2007	Heat stress. Inanition & enteritis	severe conditions, worse on open decks	<p>climatic deaths</p> <p>Sheep exported to ME between May-Oct loaded at lower stocking rate based on mechanical pen area turnover in HSRA or ASEL + 10% additional space. Ensure sheep are clean shorn.</p> <p>Government to negotiate dispensation for Oman Govt as first port of call between May-Oct because of heat stress risk</p>	Sheep on open decks must be loaded with 10% extra space.

Export of sheep from southern ports to the Middle East in winter months

17	2007	Heat stress. Enteritis	Enteritis early in voyage. Heat stress later in voyage.	Industry to consider stocking density for sheep to ME during May-Oct to manage risk of heat stress	Next voyage to have 10% extra space on board over ASEL & HSRA
19	2007	Enteritis & heat stress	Wet conditions in RP (SA), followed by hot conditions in the ME. Ran short of fodder. Voyage went longer than expected.	Industry to consider stocking density for sheep to ME during May-Oct or other methods to manage heat stress in open decks. Consider whether ASEL fodder requirements are adequate for multi-port discharges. Consider moving from 3 extra days of fodder to 7.	Following consignments to have 10% extra space on board over ASEL & HSRA
20	2007	Enteritis	High death rates very early in voyage that declined over time.	Consider R&D to determine whether ASEL is appropriate for sheep from July-Dec to allow adaptation to onboard ration & detection of enteritis.	Next consignments at 10% (15% in one voyage) extra space on top of ASEL.

Export of sheep from southern ports to the Middle East in winter months

21	2007	Enteritis	Pastoral sheep onboard as part of trial. Also ran short of fodder towards end of voyage.	<p>Conduct further R&D into on-board management of enteritis.</p> <p>R&D to assess preparation to determine if appropriate to adjust to onboard ration & detect enteritis.</p> <p>Consider whether ASEL fodder contingency is adequate.</p>	Next voyage to have 10% extra space on board over ASEL & HSRA
23	2007	Enteritis	Outbreak of enteritis on 2 decks.	R&D to assess preparation to determine if appropriate to adjust to onboard ration & detect enteritis.	Following consignments to have extra space on board over ASEL & HSRA

Export of sheep from southern ports to the Middle East in winter months

33	2009	Enteritis. Inanition & heat stress.	Severe wet weather during preparation. Sheep shorn close to departure. Some enteritis in RP.	<p>LiveCorp Technical Working Group to determine if shearing within 48hrs of export is acceptable.</p> <p>LiveCorp Technical Working Group to determine if ASEL adequately addresses risks for export of rams on long haul voyages in Australian winter.</p> <p>Avoid exporting pastoral sheep between May-Oct.</p> <p>Industry to complete revised HotStuff software to better manage heat stress, particularly in open two-tiered decks in northern summer.</p> <p>Industry to consider R&D to investigate management strategies to reduce stress in assembly period, particularly during inclement weather.</p> <p>Industry to consider a program to allow collection of post-mortem samples on voyages and return to Australia for diagnosis in the event of a reportable mortality investigation or other health issue.</p>	AQIS imposed a condition of no shearing of sheep within 48 hrs of export on subsequent voyage.
----	------	-------------------------------------	--	--	--

Export of sheep from southern ports to the Middle East in winter months

36	2010	Enteritis. Heat stress.	Wet weather in assembly (Vict). Horned rams and B&C wethers were worst affected. Worst affected sheep appeared to be from one property.	<p>Industry to progress revised HotStuff HSRA modelling to better manage risk of heat stress.</p> <p>Industry to consider R&D to investigate management strategies to reduce stress in assembly period, particularly during inclement weather.</p> <p>Industry to consider a program to allow collection of post-mortem samples on voyages and return to Australia for diagnosis in the event of a reportable mortality investigation or other health issue.</p>	<p>Conditions imposed on subsequent consignment including avoiding preparation of pastoral and station sheep for export, and sheep to be fed <i>ad libitum</i> during last 3 days in assembly with onboard pellet ration only.</p>
37	2010	Heat stress. Enteritis	Very hot conditions nearing first ME port. Over half of all deaths occurred in a 3 day period near the end of a very hot week.	<p>Review ASEL for space requirements for sheep exported into northern summer.</p> <p>Industry to progress revised HotStuff (HSRA) modelling to better manage risk of heat stress. If not available then impose additional space for sheep in northern summer.</p> <p>AQIS to consider more rigorous pre-export inspection for sheep assembled in paddocks from May-Oct to reduce risk of loading sheep with diarrhoea.</p>	<p>Conditions for subsequent shipment(s) including no pastoral sheep, no rams, extra space, additional antibiotic to be loaded onto ship, 3-6 tons of chaff to be loaded onto ship, and two vet inspections during assembly period.</p>

Export of sheep from southern ports to the Middle East in winter months

38	2010	Heat stress	Severe climatic conditions for a week at end of voyage with very high mortalities.	Industry to progress revised HotStuff (HSRA) modelling to better manage risk of heat stress. If not available then impose additional space for sheep in northern summer.	Next consignments at 10% extra space on top of ASEL. Exporter must provide updated load plan and HSRA prior to issuance of export permit.
40	2011	Enteritis & inanition	Wet weather during assembly.	Industry to consider a program to allow collection of post-mortem samples on voyages and return to Australia for diagnosis in the event of a reportable mortality investigation or other health issue (based on a current project in cattle – W.LIV.0252).	Additional drugs & chaff loaded for next consignment from Portland to ME.

RP=Registered premise, ME=Middle East

5.3 Strategies identified in mortality investigation reports to manage risks

The reports described practices employed by the onboard AAV to manage animal health.

For infectious diseases such as enteritis (likely caused by *Salmonella* organisms), the measures included:

- prompt removal of dead animals from pens;
- isolation of sick animals by moving them to hospital pens;
- regular cleaning of feed and water troughs;
- clinically affected animals were provided with chaff ratio to promote feed and water consumption;
- administration of antibiotic (oxytetracycline) to affected animals either in the water or by injection.

With respect to heat stress, reports indicated that onboard management may include moving sheep to utilise as much space as possible onboard the ship.

A number of the reports also include recommendations and actions.

5.3.1 Actions

Actions appear to relate to activities conducted by DAFF in response to the findings of the report or requirements imposed by DAFF on the exporter for subsequent voyages. The conduct of the investigation itself is an action triggered by the reported mortality for any consignment exceeding the reportable threshold. The investigation involves collection of a range of data and information from the exporter and possibly other sources about the management of the sheep through the supply chain. Part of this assessment involves auditing the actions of the exporter against the requirements in the ASEL.

In several cases and most notably when heat stress was considered to be a cause of mortalities, the actions included requiring the exporter to assign additional space to sheep on the next consignment (reports 15, 17, 20, 21, 23, 37, 38).. Generally this involved estimating space requirements based on the ASEL and the HSRA and increasing the space requirement by 10%. Sometimes this was limited to open decks (report 15) and on other occasions the additional space appeared to be imposed across the whole ship (report 17). In some cases these conditions were imposed on multiple future consignments and later reports provided addenda with details of the overall mortality rates for those subsequent voyages. In one case (report 37) there was an additional 20% of space requirement imposed on rams and 15% on all other stock for a subsequent consignment leaving in the following month. This was revised to 10% additional space for a further consignment leaving in October.

There were a number of reports where the actions were not related to space or did not only relate to space.

Report 33 described imposing a prohibition of shearing of sheep within 48 hours of departure of sheep from the registered premises. This action arose from the finding that the inspection of sheep in the registered premise prior to loadout suggested the sheep may have been stressed during the assembly period by a combination of severe wet weather and the fact that some sheep had been shorn close to the time of loading.

Report 36 described two conditions that were imposed on a subsequent consignment in August 2010 to ensure that high risk groups of sheep were not prepared for that consignment:

- pastoral and station sheep were not to be prepared for export;
- during the last three clear days in the registered premises, sheep must be fed *ad libitum* but only on pelletised feed equivalent to that normally used during the export journey.

It is not clear what impact these conditions might have, given that both conditions are already defined in the ASEL for preparation of sheep in southern premises for the period between May and October. It is understood that sheep originating from pastoral zone in Australia may have been managed in preparation for export in the period from May to October by transporting them to areas outside the pastoral zone (into the wheat sheep or the high rainfall zones) for a period of 30 days or more. It is not clear whether this approach may be used to prepare such sheep for export and available information from these reports does not provide this level of detail concerning origins of sheep. However, the condition above may have been intended to expressly prevent this from happening in an attempt to eliminate pastoral sheep completely from the export supply chain during the period from May to October.

Report 37 described conditions that were imposed on a subsequent consignment in August 2010, including:

- declaration that pastoral and station sheep have not been prepared for the consignment;
- provision of an updated load plan and HSRA prior to issuance of an export permit;
- sheep to be loaded with extra space above ASEL requirements (rams – 20% extra, all other sheep – 15% extra);
- onboard veterinary supplies to include an additional 100kg of oxytetracycline;
- 6 metric tons (MT) of chaff to be loaded;
- AQIS officers to inspect the sheep twice during the assembly period.

Report 37 then described conditions that were imposed on a subsequent consignments of sheep exported from Adelaide and Portland to the Gulf by this exporter in October 2010, including:

- declaration that pastoral and station sheep have not been prepared for the consignment;
- provision of an updated load plan and HSRA prior to issuance of an export permit;
- sheep to be loaded with 10% extra space above ASEL requirements;
- no rams to be loaded;
- onboard veterinary supplies to include an additional 100kg of oxytetracycline;
- the exporter must load 3 metric tons (MT) of chaff to be loaded;
- AQIS officers to inspect the sheep twice during the assembly period.

In Report 40, the exporter loaded additional antibiotics and chaff for the following consignment of sheep exporter from Portland to the Middle East in the event of a similar outbreak of enteritis.

5.3.2 Recommendations

Most but not all reports from mortality investigations contain recommendations.

Recommendations appeared to relate to desired future activities and included activities related to the preparation and management of sheep for future voyages and identification of suggestions for future research or review of existing ASEL requirements.

Many of the recommendations appeared to relate to heat stress and enteritis and reflect the fact that reportable mortalities tend to be attributed to the same causes over time.

The only other issue identified in the recommendations was the topic of fodder contingency which related to how much additional fodder (over anticipated actual needs) might be loaded to deal with voyages that take longer than expected or where additional fodder is required.

A summary of recommendations is presented here by general topic area:

- Selection of sheep including:
 - avoid exporting pastoral and station sheep between May-October
 - consideration of whether the ASEL adequately addresses risks for export of rams on long haul voyages in the Australian winter.
- Preparation in the registered premise including:

- management of sheep to ensure they adjusted to the onboard ration. This is presumably related to the association between inappetence in sheep and subsequent risk of salmonellosis as has been identified in earlier research on morbidity and mortality in export sheep (Norris and Norman, 2003).
- management in general of sheep in the assembly period to reduce stress, particularly in inclement weather.
- consideration of inspection procedures in the registered premise in an attempt to improve detection (and presumably removal) of animals that may be shedding infectious organisms and posing a risk of exposure to other animals.
- Management of sheep during the voyage including:
 - review of procedures for managing cases of clinical disease due to enteritis during the voyage.
 - review of stocking density including consideration of modification to heat stress risk assessments (HSRA) and ASEL requirements, or imposing additional space requirements in the Australian winter to reduce risks of heat stress.
 - ensuring sheep are clean shorn when exporting into the northern summer (modified in later recommendations to require that sheep not be shorn within 48 hrs of departing the registered premise).
 - consideration of whether ASEL requirements with respect to fodder contingency are adequate.
 - consideration of a program to allow collection of post-mortem samples on voyages and return to Australia for diagnosis in the event of a reportable mortality investigation or other health issue.

6 Analysis of industry data

Data on counts of sheep exported by voyage and numbers of deaths were obtained from reports available on the DAFF website that relate to the 6-monthly reports on livestock mortalities that are tabled in each House of Parliament²⁰. These reports provide details of port of loading, date of loading, duration of voyage, total animals loaded and numbers of deaths.

²⁰ <http://www.daff.gov.au/animal-plant-health/welfare/export-trade/mortalities#reports>

It is important to note that the data do not contain details by port of loading (number of sheep loaded and deaths). They only contain the total sheep on the ship and an indication of which ports sheep were loaded from.

Data for all voyages containing sheep from 2006 to 2011 were compiled. Data relating to voyages with very small consignments of sheep, that were loaded at ports other than Portland, Adelaide or Fremantle, or that were going to ports other than the Middle East, were removed.

The resulting dataset contained one row per export voyage and included a total of 277 voyages over the 6 year period.

Port of loading was coded as 1 if any sheep were loaded at Portland (regardless of whether additional sheep were loaded at other ports), 2 if sheep were loaded at Adelaide (including voyages where sheep were loaded at Adelaide and Fremantle), and 3 if sheep were loaded at Fremantle only.

Voyage duration was recorded in days.

Month of loading was coded as 1 to 12 and year was coded as 2006 to 2011.

A numeric variable was used to code for exporter with those exporters associated with very few voyages aggregated into a single category.

6.1 Voyage mortality rate

A negative binomial statistical model was then applied to these data using the count of deaths as the outcome and the total number of sheep loaded onto the ship as an offset or estimate of animal time at risk. The model included fixed effects coding for exporter, port and month and year of loading, and duration of voyage. The model included an interaction between port and month of loading to account for possible differences between ports.

There was interest in determining whether there might be an interaction between year and month. The statistical modelling was being run with a particular focus on the question of whether there was a season pattern that may differ for different ports. Figure 6 is a plot of the means derived from the port*month interaction from the main statistical model. It seemed plausible that this could be dependent on year. For example, if there was one year that was markedly different to all other years then this unusual year could influence the pattern of the month*port interaction.

This was investigated in a separate preliminary model that just included year and month and the year*month interaction. The results from this model are not shown. There was variability between years for example the mean mortality rates for any given month between years did vary. However, there was a very clear overall pattern that remained evident in all years – lower mortality in the first four months of the year, followed by a rise to a peak in August and then a decline towards the end of

the year. This provided confidence that the overall seasonal pattern (change by month within any given year) was very similar in each year.

This finding provided confidence that the main statistical model could then be fitted as follows:

- outcome = count of deaths on each voyage adjusted by the total number of sheep on the voyage (mortality rate per voyage expressed as deaths per 100 sheep per voyage)
- fixed effects coding for:
 - year (2006, 2007, 2008, 2009, 2010, 2011)
 - port of loading (Portland, Adelaide, Fremantle)
 - month of loading (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)
 - duration of voyage (days)
 - exporter (1, 2, 3, 4, 5)
 - interaction between port and month of loading

Notice that a variable coding for exporter was included in the model because we expected that there would be some variability between exporters in how voyages are managed. Part of this will include unmeasured effects associated with ships that may be operated by only one exporter. This variable is therefore included in the model to provide adjustment for unmeasured factors at the exporter level and as a result is expected to produce more accurate estimates for other fixed effects in the model. It is the other fixed effects that are of primary interest and particularly the effects of port and month of loading.

The model was then used to generate estimates of mortality incidence rate for various fixed effects.

Export of sheep from southern ports to the Middle East in winter months

Table 6.1: Summary count of voyages listed by port of loading

Month	Portland				Adelaide			Total
	Alone	+Adel	+Freo	+ Adel+Freo	Alone	+Freo	+Freo	
1			9			1	11	21
2	1		5			2	13	21
3	1		8		2	1	13	25
4	1		8			3	10	22
5			4	1		2	10	17
6			8			4	5	17
7			6			5	15	26
8		5	5		1	3	15	29
9			4		1	4	10	19
10	1	1	3		3		21	29
11	1	2	2		2	1	19	27
12	1		6		2		15	24
Total	6	8	68	1	11	26	157	277

The above table demonstrates that on almost all occasions when sheep were loaded at either Portland or Adelaide, the ships then took on additional sheep at Fremantle.

There was a single voyage where sheep were loaded at all three ports.

Export of sheep from southern ports to the Middle East in winter months

The following table shows how the port of loading was coded for analysis.

Table 6.2: Count of the number of voyages for each combination of port and month in the dataset

Month	Portland	Adelaide	Fremantle	Total
1	9	1	11	21
2	6	2	13	21
3	9	3	13	25
4	9	3	10	22
5	5	2	10	17
6	8	4	5	17
7	6	5	15	26
8	10	4	15	29
9	4	5	10	19
10	5	3	21	29
11	5	3	19	27
12	7	2	15	24
Total	83	37	157	277

The main reason for coding port in this way was to try and produce a coding where all months of the year were represented and that provide some measure of effect of each port. When considering an effect of Portland, it is important to realise that the measure of effect will incorporate a component due to Fremantle (and a very small component due to Adelaide) but that any differences between this port level and other levels should be able to be attributed to an effect of Portland.

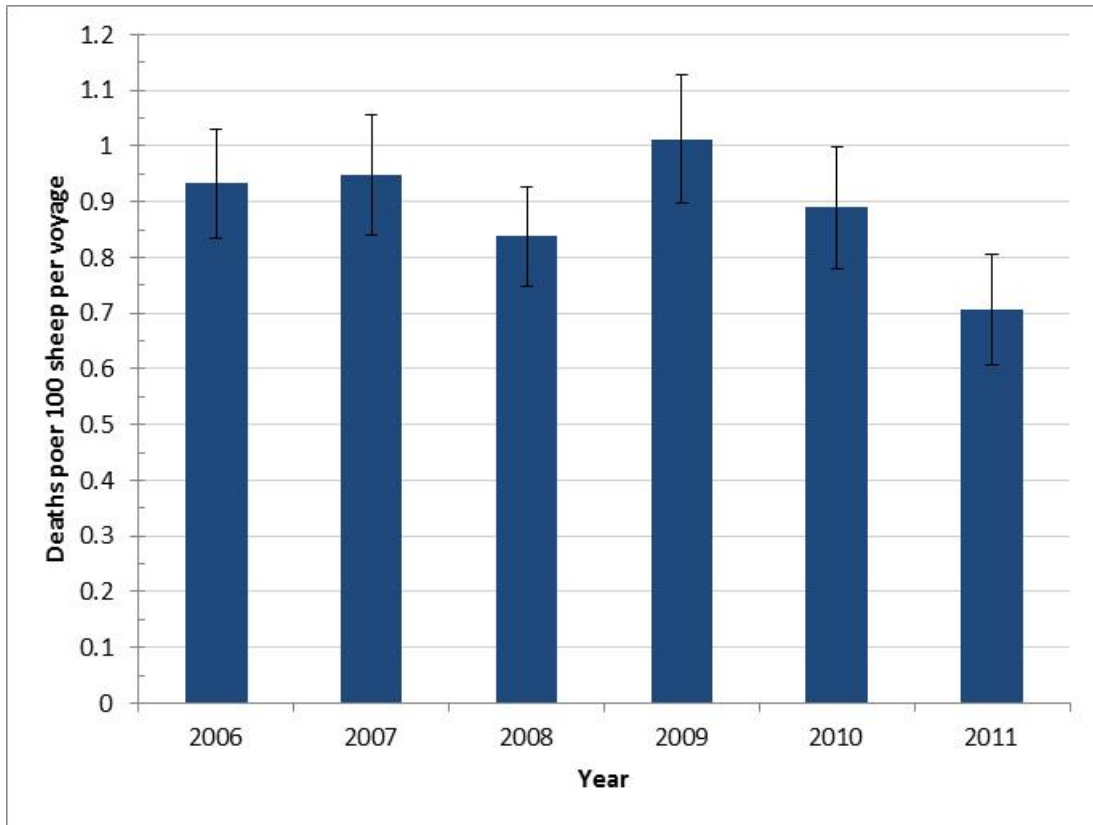


Figure 6.1: Mean overall mortality rate (deaths per 100 sheep per voyage) averaged over all exporters, months and ports. Bars represent 95% confidence interval either side of the mean.

There was no difference between the first three years, then there was a significant rise from 2008 to 2009 ($p=0.02$) followed by a decline over the following years to the lowest level in 2011.

The overall mortality rate for 2011 (0.71 deaths per 100 sheep) was lower than in any of the previous years. The difference was statistically significant when compared to all of the previous years ($p<0.05$) except 2008 when the comparison produced a tendency to significance ($p=0.06$).

Export of sheep from southern ports to the Middle East in winter months

Table 6.3: Mortality rate expressed as deaths per 100 sheep for export voyages, by month of year. Estimates derived from a regression model applied to 6 years of voyages. Se=standard error, CI=confidence interval.

Month	Deaths		95% CI	
	per sheep	100 se	lower	upper
1	0.759	0.065	0.631	0.887
2	0.735	0.063	0.613	0.858
3	0.584	0.044	0.497	0.671
4	0.635	0.052	0.532	0.737
5	0.873	0.083	0.711	1.036
6	0.836	0.081	0.678	0.994
7	1.091	0.090	0.914	1.268
8	1.330	0.094	1.145	1.515
9	1.064	0.099	0.870	1.259
10	1.003	0.074	0.857	1.149
11	0.913	0.068	0.779	1.046
12	0.781	0.063	0.657	0.906

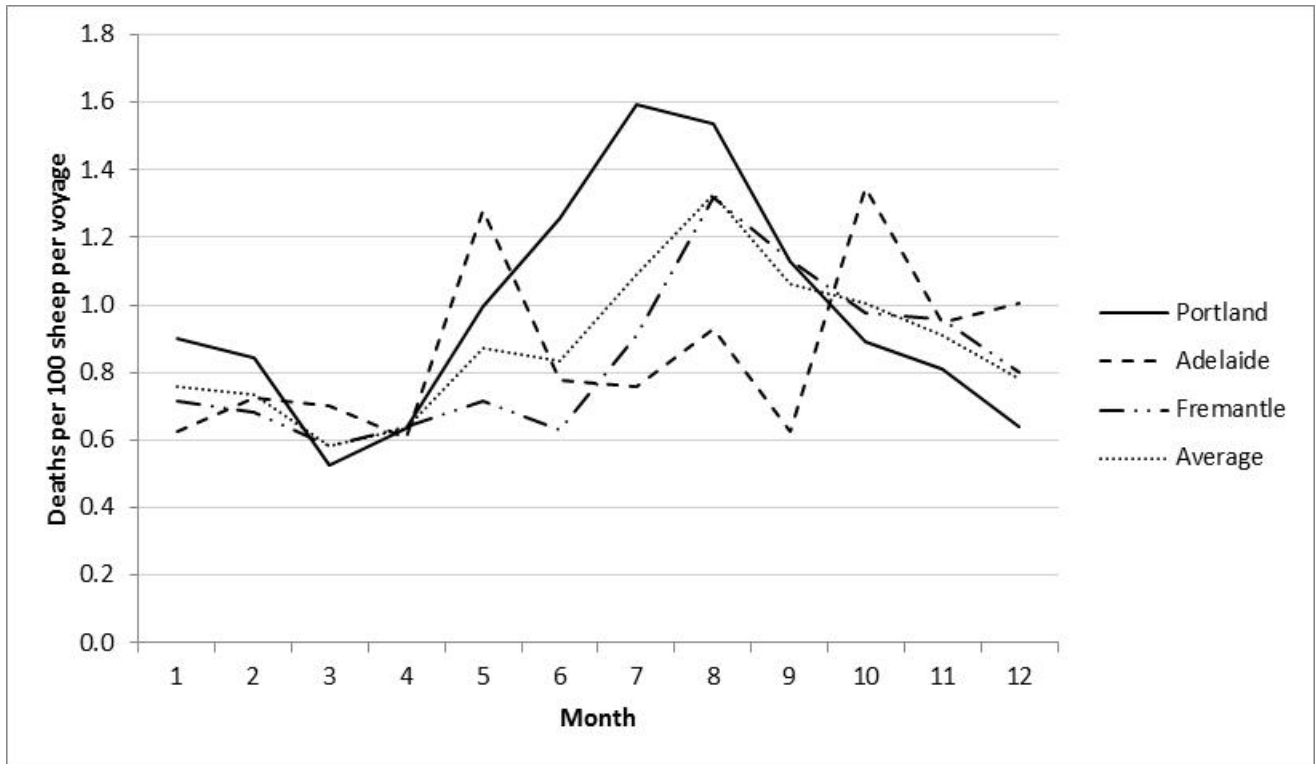


Figure 6.2: Plot of mortality rate (deaths per 100 sheep per voyage) by port of loading and month of loading.

The average line is a plot of the estimates presented in Table 6.3. The lowest mortalities occur in the first 4 months of the year and then rise from May to a peak in August before slowly declining. This is consistent with previous reports suggesting a general pattern with higher mortalities in the second half of the year.

The pattern appears slightly more variable when plotted by port of loading.

It is important to understand what Figure 6.2 is showing. The line labelled Portland is not an estimate of mortality rate for sheep loaded at Portland. It is an estimate of mortality rate for all those voyages that included sheep loaded at Portland. These voyages often included sheep that were loaded at Fremantle and less commonly included sheep from Adelaide.

Similarly the line labelled Adelaide is an estimate of mortality rate for those voyages that included sheep loaded at Adelaide. Many of these voyages also included sheep loaded at Fremantle.

The line labelled Fremantle is a direct measure of mortality rate for sheep loaded at Fremantle since these voyages contain only sheep loaded at Fremantle.

The value of this plot lies in the visual comparison of the lines. The lines for Portland and Fremantle both contain sheep loaded at Fremantle. The major difference between these lines is the fact that the Portland line contains sheep loaded from Portland.

If we can assume that the Fremantle component of a voyage that begins at Portland would include sheep that are not different to those that might be included in a Fremantle only voyage, then the difference between these two lines is likely to be driven by factors associated with sheep loaded at Portland.

There are a number of useful points that can be made from this graph.

For the first four months of the year (Jan to April) all the lines are very close together and also very close to the overall average line (line produced by aggregating all ports together). This suggests that there is essentially no difference in overall mortality risk between different ports of loading.

For those voyages containing sheep loaded at Portland, there is a rise that becomes apparent in May and that continues to rise to a peak in July and August before declining later in the year. The general pattern is similar to that seen for Fremantle but with a higher rise and peak.

The pattern for voyages containing sheep that were loaded in Adelaide is more variable. There is a short peak of mortalities in May and then a second peak in October. There are fewer voyages in this category and only two voyages in May. Neither of these voyages included any reportable mortalities but one voyage had a mortality rate of 1.84% and therefore the rise in the plot line was due to the effects of a single voyage in that month. This sort of effect needs to be interpreted with caution because there may have been particular circumstances associated with that voyage that may not reflect general or repeatable trends. Similarly for the rise in October for voyages including Adelaide sheep, there were only three voyages and no voyages with reportable mortalities. The rise was due to the fact that 2 of these 3 voyages had mortalities at 1.25%. As a result it is more difficult to be confident of an overall pattern that may be appropriate for voyages containing sheep loaded in Adelaide. The data suggest that it may be highly variable because of individual voyage variation.

At the back end of the year (from September onwards), the lines converge again and track along a similar path to the overall average line.

Export of sheep from southern ports to the Middle East in winter months

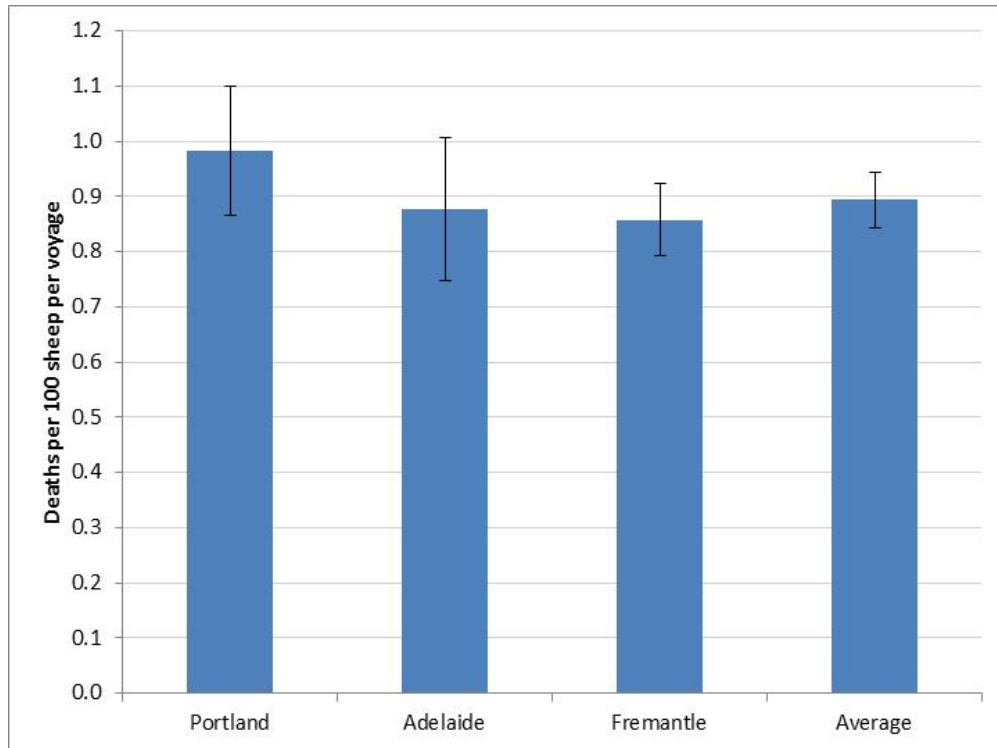


Figure 6.3: Mean overall mortality rate (deaths per 100 sheep per voyage) for each port, averaged over all months and all years. Bars represent 95% confidence interval either side of the mean.

Figure 6.3 shows that mortality rates for Portland voyages were higher than those from the other two ports. However, there was no statistical difference between the three ports when mortality rates were averaged over all months and all years.

The overall average mortality rate (across all ports, years and months) was 0.89% deaths (95% confidence interval from 0.84 to 0.94%).

Export of sheep from southern ports to the Middle East in winter months

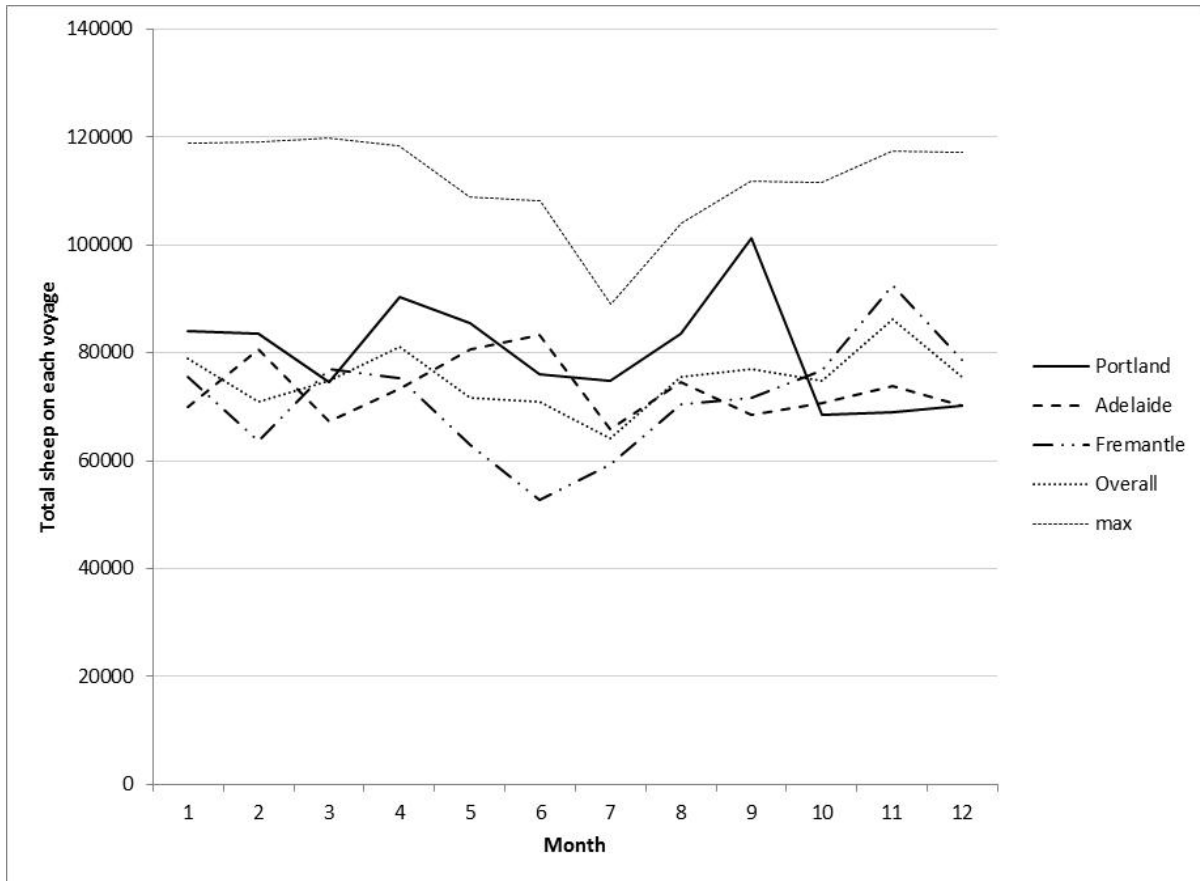


Figure 6.4: Plot of average total sheep per voyage arranged by port of loading and month. The top dotted line shows the maximum load for any voyage in each month. The other lines show the average for each port for each month and the dotted line in the middle of the plot shows the overall average for each month.

The reason for showing Figure 6.4 is to see if the visual display of average total loads might support any hypothesis that part of the elevated mortality rate in a particular month may be influenced by a tendency to load more sheep onto ships in a particular month. The data shown in Figure 6.4 do not support this hypothesis. In the mid to latter part of the year when mortality rates are at their highest, the maximal loads per voyage are reduced and the average loads are also reduced, most notably for Fremantle. There is an increase in average load for Portland in September but this does not coincide with peak mortality rates.

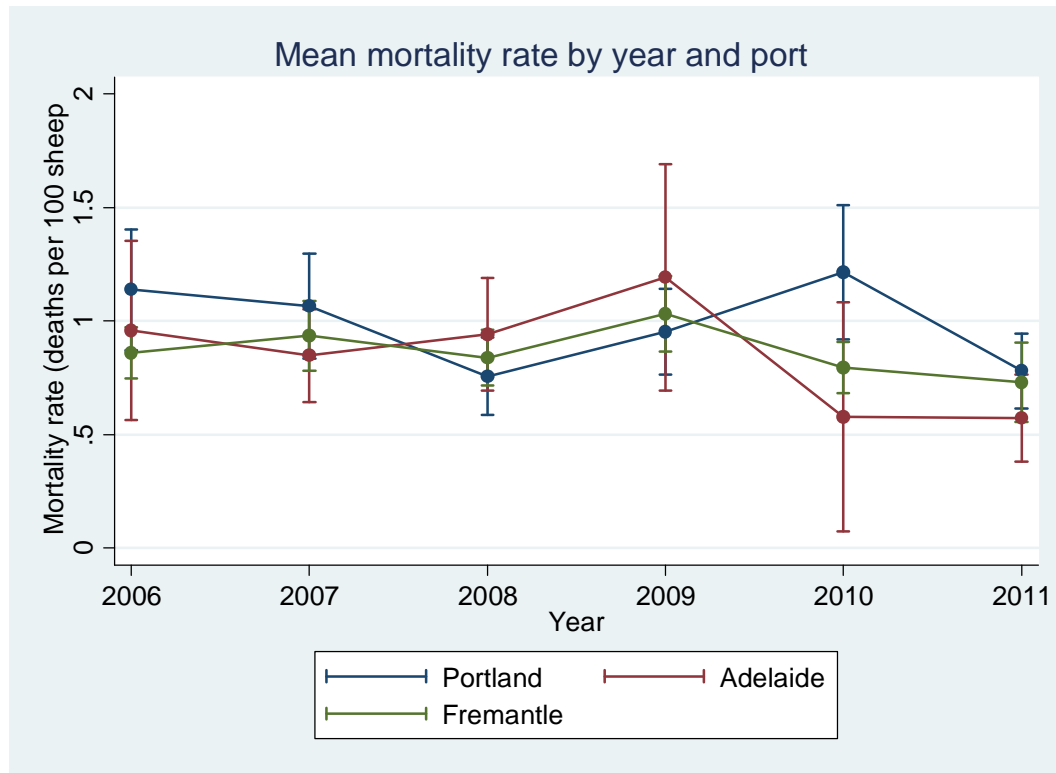


Figure 6.5: Mean mortality rate estimates by year and port. Bars represent 95% confidence intervals.

The above plot was generated from an interaction term involving year*port that was added to the statistical model. It demonstrates that in any given year, there is variability between ports with respect to average annual mortality rate. Voyages that included sheep loaded from Portland had the highest annual mortality rate in four of the six years and the lowest annual mortality rate in the two remaining years. It is also useful to note that voyages containing only sheep from Fremantle only had the lowest annual mortality rate in one year and in all remaining years were in the middle.

6.2 Odds of reportable mortality events

The dataset was inspected against the reports from mortality investigations involving sheep voyages and the 13 voyages relating to the mortality investigations were identified.

A binary variable was then developed to apply case-control coding to voyages:

- 0=control = those voyages that did not involve any reportable mortality event for sheep (n=264)
- 1 = case = those voyages that incorporated one or more consignments that involved a reportable mortality event (n=13)

Export of sheep from southern ports to the Middle East in winter months

All other variables were coded as indicated above.

The binary outcome variable was then used as the outcome in a logistic regression model to look for factors that may be associated with the odds of a reportable mortality event.

Because there were only 13 case voyages, there were more numeric problems in fitting the statistical model to this particular outcome. Case voyages only occurred in some months and only in some years and not for all exporters and therefore it was not possible to derive as much detail as for the negative binomial analyses described above. However, the findings are valid and are useful.

It was not possible to incorporate exporter or any interaction in the final model. The results from the final model are presented below as odds ratios (OR).

Table 6.4: Results from multivariable logistic regression analysis. OR=odds ratio, se=standard error, z=z-statistic, CI=confidence interval.

Variable	Level	OR	se	z	p-value	95% CI		
						lower	upper	
Year	2006	reference						
	2007	7.94	8.58	1.92	0.055	0.96	65.95	
	2008	1	(empty)					
	2009	0.53	0.73	-0.46	0.6	0.04	7.91	
	2010	2.14	2.40	0.68	0.5	0.24	19.30	
	2011	0.40	0.55	-0.66	0.5	0.03	6.08	
Month	1	1	(empty)					
	2	1	(empty)					
	3	1	(empty)					
	4	1	(empty)					
	5	reference						
	6	5.38	7.49	1.21	0.2	0.35	82.21	
	7	1.00	1.66	0	0.9	0.04	25.89	

Export of sheep from southern ports to the Middle East in winter months

	8	3.68	4.94	0.97	0.3	0.27	51.03
	9	1.07	1.79	0.04	0.9	0.04	28.40
	10	0.54	0.88	-0.38	0.7	0.02	12.95
	11	1	(empty)				
	12	1	(empty)				
Port	Fremantle	reference					
	Portland	9.15	7.46	2.72	0.007	1.85	45.23
	Adelaide	0.85	1.14	-0.12	0.9	0.06	11.77
Intercept		0.01	0.02	-2.75	0.006	0.00	0.29

Odds ratios (OR) provide a measure of the strength of association relative to the reference level for that particular variable. Examples of the interpretation of the above results are provided below.

A case voyage is a voyage that has a reportable mortality event. Odds ratios provide a measure of the likelihood of a case voyage occurring, expressed as the odds. When the OR is greater than one then the factor is associated with an increased odds or likelihood of the event happening.

It is also important to look at the p-values to determine if the comparison is statistically significant. Most of the comparisons in this model are not statistically significant and this reflects the small number of cases.

There was a 7.94 increase in the odds of a mortality event occurring in 2007 compared to 2006. In contrast the odds of a case occurring in 2011 was greatly reduced compared to 2006 (OR=0.4). If the odds of an event was reduced by a multiple of 0.4, this is the same as a $1-0.4=0.6$ or 60% reduction in odds. Notice that none of the years were statistically different.

The two months with the highest odds of a mortality event occurring were June and August (compared with May). Again there was no statistical difference between months of the year.

Those voyages containing sheep loaded in Portland had a 9-fold higher odds of a reportable mortality event compared to voyages containing only sheep loaded in Fremantle. This difference was statistically significant ($p=0.007$). There was no difference in odds of a reportable mortality event between Fremantle and Adelaide ($p=0.9$).

In summary, the logistic regression model is of limited use because of the small number of case voyages. Caution should be applied to avoid over interpretation of the findings.

Nonetheless, the most substantive finding of this analysis is that there appears to be an increased risk of mortality events for voyages containing sheep that were loaded at Portland. This finding is consistent with the findings from the negative binomial modelling discussed in the previous section.

While some caution is advised, the findings also suggest that there is little difference between sheep loaded in Adelaide and sheep loaded in Fremantle with respect to the risk of a reportable mortality event.

6.3 Results of statistical analyses in context

The findings described above from the last six years of voyages, are consistent with earlier reports (Norris and Norman, 2003, Norris and Norman, 2010).

The major findings from the analyses described above are:

- Within any one year there can be variability in mortality rates.
- An overall pattern displayed by the overall average line which suggests a low mortality rate in the first four months of the year, followed by a gradual rise to a peak in August and then a gradual decline between August and December. Overall monthly voyage mortalities remain above 1% until after October.
- Within this pattern, there appears to be a distinct difference between voyages containing sheep loaded at Portland and voyages containing sheep loaded at Fremantle. Voyages containing sheep loaded at Portland have a more dramatic rise in mortality rate which peaks in July and remains high in August before falling to merge with the overall pattern by September.
- There is insufficient data to make conclusions about patterns for voyages containing sheep from Adelaide. These voyages do show a rise in the latter part of the year but within that there is variability due to individual voyages that may occur at any time.
- The results of the logistic regression analysis support a conclusion of elevated risk of a reportable mortality event for voyages in the winter months that included sheep loaded at Portland, and that there was little evidence of any difference between voyages containing sheep loaded in Adelaide and those containing only sheep loaded in Fremantle.
- There is year to year variation which resulted in the highest overall annual mortality rate in 2009 and the lowest overall annual mortality rate in 2011.

- There is no evidence to suggest that the rise in mortality rates in the mid to latter months of the year may be associated with an increase in total sheep numbers loaded per voyage. ASEL restrictions concerning sheep from southern ports to the Middle East

There are a number of areas where the current ASEL stipulates specific requirements relating to export of sheep from southern ports to the Middle East.

Most of these specific requirements are found in Standard 3, relating to management of livestock in the registered premises.

The only specific requirement relating to export of sheep from southern ports in winter that appears elsewhere in the ASEL is the section 4.1.6 relating to minimum pen area per head for sheep and goats that has different requirements for the periods from November to April, and May to October.

Within Standard 3, there are two broad areas where the ASEL content may be viewed as providing guidance for management of livestock during winter months.

The first relates to non-specific requirements such as Standards 3.4 and 3.5 that relate to issues such as drainage and shelter from climatic extremes. These requirements may be considered to be important in winter months when there may be rain, wind and cold weather that can result in adverse effects on animal welfare due to the direct effects of thermal stress or indirect effects associated with adverse impacts of stress on immune function and potential increased risk of pathogen exposure. The requirements in the ASEL relating to drainage and shelter are considered appropriate.

The second area where the ASEL is relevant to preparation of sheep in winter months relates to specific requirements:

- S3.7 (c) (iii): use of fully sheltered feed troughs
- S3.8 (a): sheep in paddocks to be held for 5 clear days at the premises in winter with *ad lib* feeding with onboard pellets for 3 clear days
- S3.9 (a): restrictions on the type of sheep that can be prepared for export to the Middle East between May-October.
- S3.9 (b): All sheep being prepared for export to the Middle East between May-October must have wool not more than 25 mm in length and must be at least 10 days off shears on arrival at the premises.

6.4 Origins of ASEL requirements

The *Farmer Review* states that:

Standards need to be clear, essential (causally related with mortality or otherwise scientifically based), consistent and verifiable.

(Farmer 2011, p xv)

The ASEL provides little or no information to support or justify some of the specific requirements relating to sheep exported to the Middle East between May-October.

A review of the literature and of information available on the Australian Government websites (parliamentary documents and documents available on the DAFF website) did not provide a clear explanation of the origin or scientific justification for these requirements.

The following section provides background to the development of the wording in the current ASEL.

A 1985 report on *Export of live sheep from Australia* by the Senate Select Committee on Animal Welfare provided background information on animal welfare issues and concerns. The report included discussion of apparent increased risk of mortality in winter months, identified a high mortality event in sheep in a Victorian registered premise in March that was attributed to the combination of a severe cold weather change and sheep that were just off shears, included discussion of the possibility that sheep from pastoral or low rainfall areas do not adapt well to the confinement of feedlots or ship pens, and discussed (but did not proceed with) a decision to ban the sheep export trade during the three Australian winter months when conditions are at their worst in southern waters as well as in the Middle East.

This report indicates that many of the issues related to the current ASEL had been at least identified as issues in the 1985 report. Earlier sections in this review have identified the factors leading up to reviews in 1999, 2002 and the Keniry Review in 2003. Scrutiny of the reports and recommendations arising from these reviews does not provide detailed science-based evidence to support the wording of the current ASEL.

In the period from 2000-2002, there were concerns expressed about losses from salmonellosis during live sheep export feedlotting (More, 2002a). Outbreaks were noted in sheep that had been maintained in assembly feedlots in paddocks in Western Australia, Victoria and South Australia. These incidents coincided with tremendous increases in throughput of sheep as the total number of sheep exported from Australia rose dramatically to peak in 2001.

More (2002a) noted that there had been few detailed outbreak investigations and that diagnoses were mostly based on clinical presentation alone.

More (2002a) went on to indicate that outbreaks were more common in the winter months and coincided with high feedlot throughput. In addition the following observation was made:

Although not consistently affected, high-risk lines include young animals, animals in poor condition and long-haul and pastoral animals. Risk of disease is substantially higher if animals arrive when the weather is cold, windy and wet.

(More 2002a, p15)

More (2002a) also refers to an industry review meeting in Adelaide in August 2002 that developed recommendations for best practice for preparation of sheep and goats.

In October 2002, the Minister for Agriculture, Fisheries and Forestry imposed a temporary ban on live sheep exports from Portland. The ban was lifted by November 2002 with additional requirements to be met by industry. These requirements were described in media reports from the time and appeared to be similar to those subsequently described in the Initial Standards for the Export of Livestock²¹.

Standard 3.9 from the Initial Standards for the Export of Livestock (released in November 2004), contained the following wording:

Export to the Middle East

a) The operator of pre-embarkation registered premises must not prepare the following classes of sheep for export to the Middle East by ship during the period from May to October, because these classes pose higher risks of inanition and/or salmonellosis:

i. For livestock held in paddocks:

- pastoral and station sheep;*
- lambs (no permanent incisors); and*
- sheep and goats that have been transported more than 800 km or held on trucks for more than eighteen (18) hours.*

ii. For livestock held in paddocks or sheds:

- full-mouth wethers with a fat score greater than 4;*
- broken-mouth sheep; and*

²¹ <http://www.spec.com.au/blog/2002/11/01/ban-on-sheep-exports-lifted/>

– *pregnant ewes.*

b) All sheep for export to the Middle East by ship during the period from May to October held in paddocks in the pre-embarkation registered premises must have wool length not more than 2.5 cm and must be at least ten (10) days off shears on arrival at the premises.

It seems likely that the wording of the initial Standard 3.9 has incorporated inputs from industry review groups and from reports completed about that time (More, 2002a).

There are a number of issues relating to the meaning of various terms in the ASEL.

6.5 Southern ports

The ASEL specifically defines southern ports based on the threshold of the line defined by latitude 26° south. This is shown on a map of Australia in Figure 10. The major ports where sheep are loaded for export are in Portland, Adelaide and Fremantle.

The justification for the combination of southern ports and the May-October period (Australian winter) is understood to be based on the fact that sheep are being prepared in Australian winter months when temperatures are colder and then being exported to the Middle Eastern summer where the prevailing climate is expected to be very hot. There are multiple risk factors potentially operating under these circumstances including the potential for increased stress and pathogen exposure in registered premises in the winter in Australia, associated difficulties in adapting to onboard rations, rough seas and adverse climatic conditions in the initial part of the voyage in the southern ocean and then the extreme hot weather when the ships reach the Gulf region.

There is ample scientific evidence to document the increase mortality risk for sheep exported from southern Australia in the period from May to October, and the association between this time period and the two major causes of death in export sheep, namely enteritis and heat stress.

The concept of additional risk management for sheep exported from Australia during the period from May to October therefore is warranted.

There appears to be some uncertainty around the justification for a demarcation at the line defined by latitude 26° south.

While there are some sheep exported from north of this line, the vast majority of sheep exported from Australia are loaded at one of three ports: Portland, Adelaide and Fremantle. It is not clear whether there are any data to suggest that sheep exported from north of this line in the Australian winter have a reduced risk of the adverse outcomes that are associated with sheep exported from south of the line.

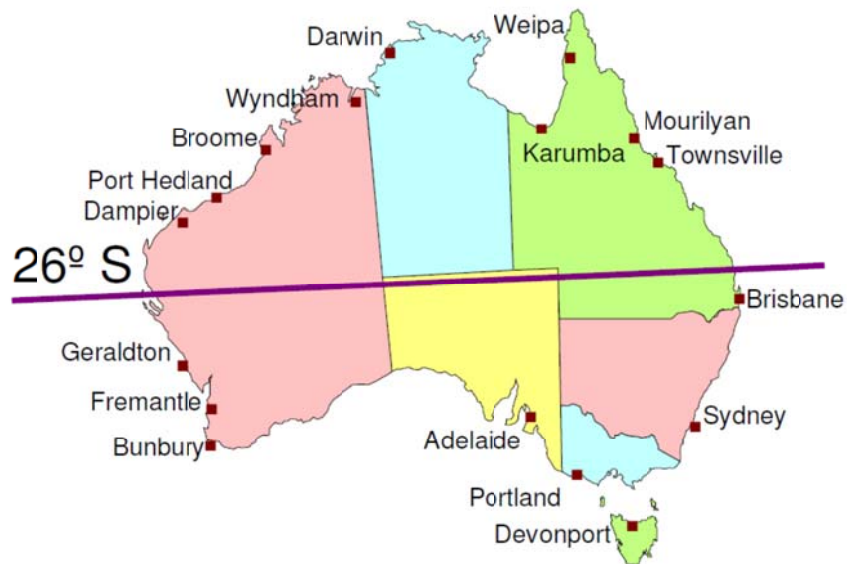


Figure 6.6: Map of Australia showing the line represented by latitude 26° south and ports from which livestock are commonly loaded for export.

6.6 Pastoral and station sheep

The ASEL (Standard 3.9) refers to classes of sheep that either must not be prepared for export to the Middle East between May-October or with differing criteria based on whether sheep are to be prepared in paddocks or in pens at the registered premise.

There are two issues associated with the term *pastoral and station sheep*.

The first is whether there is a clear and consistent understanding of what this term means i.e. how might one determine if a mob of sheep does or does not meet this classification. The second is whether this class of sheep is associated with increased risk of mortality in exports to the Middle East in May-October such that their exclusion from export at this time is warranted.

The *Farmer Review* (Farmer 2011, p51) indicates that the ASEL does not define 'pastoral' and 'station' sheep.

There are general sources that refer to different sheep production zones across Australia and that include pastoral zone as one of three different production zones. A map displayed on the Australian Wool Innovation website displays these zones²². It is not clear how these zones were developed and

²² http://www.wool.com/Grow_Pastures-and-Nutrition.htm

whether they may still be appropriate or whether farming and grazing practices in these areas may have changed over time.

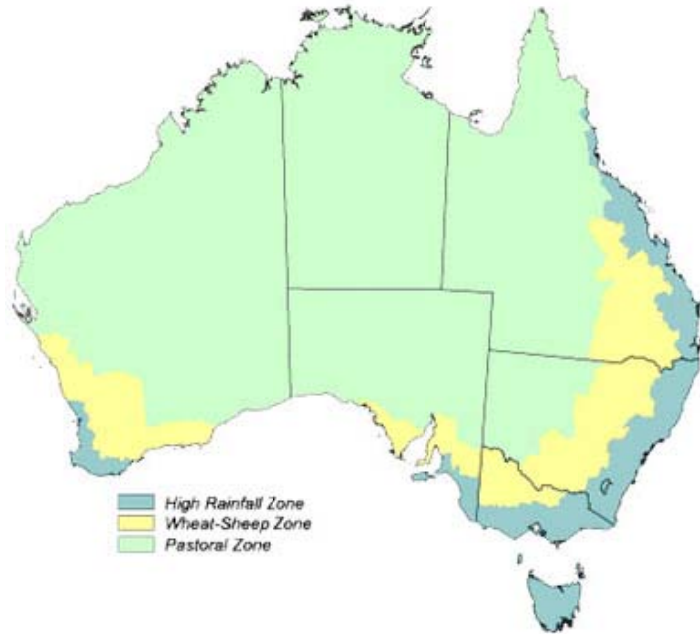


Figure 6.7: Production zones for Australian sheep production²².

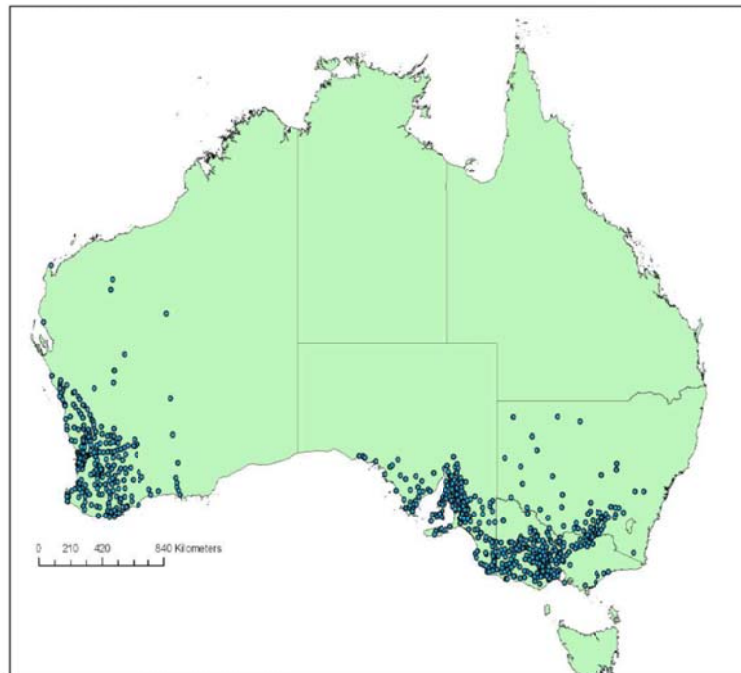


Figure 6.8: Dots displaying location of property of origin for sheep exported from Australia on 27 voyages enrolled in a three year study of morbidity and mortality in sheep exported from Portland and Adelaide (Makin et al 2009).

During the course of the 2011 Senate Estimates, a question was asked of the Minister for Agriculture, Fisheries and Forestry about the criteria for classifying land with respect to this issue, and the following response was provided.

For the purpose of sourcing sheep for the live export trade, the pastoral zone in South Australia is considered to be the area north of Port Augusta and includes those properties that have a Property Identification Code (PIC) with the 3rd and 4th characters: 70, 80, 81, 82, 83, 84 and 85. The pastoral zone in NSW includes the Livestock Health and Pest Authorities in the western division. Properties with PICs with the following 3rd and 4th characters are considered pastoral: 03, 05, 07, 09, 13, 31, 39, 58, 60 and 61²³.

The information from the 2011 Senate Estimates hearings suggests that within South Australia, the classification is very similar to the Pastoral zone as displayed in Figure 6.7. This is confirmed by inspection of a map provided on the PIRSA website that shows the PIC codes for South Australia²⁴.

However, the information contained in the response above concerning New South Wales is not quite so straight forward.

In January 2009, 14 Livestock Health and Pest Authorities replaced the more than 60 Rural Lands Protection Boards (RLPB) in New South Wales. Within New South Wales, the 3rd and 4th characters of the PIC code reflect the former RLPB districts in which the property lies. Inspection of the PIC codes and the relevant RLPB and LHPA districts indicates that the 10 district codes listed in the response above, are all from the area identified as **Western Division** within the former RLPB district coding system, but that these 10 PIC codes comprise two districts (Western and Darling) within the current LHPA coding system.

If the two LHPA districts are accepted as forming the areas defining pastoral sheep for New South Wales then it would appear that this is also very similar to the pastoral production zone as displayed on the AWI map of Australia.

It is therefore postulated that the production zone terminology has been the basis for identification of pastoral sheep in the ASEL.

²³

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=rat_ctte/estimates/sup_1112/daff/index.htm

²⁴ http://www.pir.sa.gov.au/_data/assets/pdf_file/0011/24104/picbound_20080507_03.pdf



Figure 6.9: Map of New South Wales showing the boundaries of the various districts forming the 14 Livestock Health and Pest Authorities.

- discussed (but did not proceed with) a decision to ban the sheep export trade during the three Australian winter months when conditions are at their worst in southern waters as well as in the Middle East. Much of the content of this report appeared to be based on anecdote and opinion rather than on detailed scientific studies.

In the period from 2000-2002, there were concerns expressed about losses from salmonellosis during live sheep export feedlotting (More, 2002a). Outbreaks were noted in sheep that had been maintained in assembly feedlots in paddocks in Western Australia, Victoria and South Australia. These incidents coincided with tremendous increases in throughput of sheep as the total number of sheep exported from Australia rose dramatically to peak in 2001.

More (2002a) noted that there had few detailed outbreak investigations and that diagnoses were mostly based on clinical presentation alone. More (2002a) went on to indicate that outbreaks were more common in the winter months and coincided with high feedlot throughput. In addition the following observation was made:

Although not consistently affected, high-risk lines include young animals, animals in poor condition and long-haul and pastoral animals. Risk of disease is substantially higher if animals arrive when the weather is cold, windy and wet.

(More 2002a, p15)

Research conducted by individuals associated with the Department of Agriculture and Food, Western Australia had indicated that there was a higher mortality risk in rams and in adult wethers (Norris and Norman, 2003). For adult wethers the risks appeared to be highest in fat wethers exported in the second half of the year (interaction between season, age and adiposity). This was postulated to be due to an association between grass growing season, factors influencing appetite control and fat mobilisation in animals (Higgs et al., 1991, Richards et al., 1991). Animals in good condition on high quality pasture (most commonly occurring in the second half of the year in Western Australia) were in a positive energy balance situation and less able to mobilise body fat quickly when presented with any form of nutritional stress such as inappetence associated with live export conditions.

There was also evidence of an association between property of origin and mortality risk in that a small proportion of properties accounted for most of the mortalities. It was felt that some properties were likely to be associated with factors that meant sheep from those properties might repeatedly be associated with higher mortality risk. A series of studies were performed to try and identify property-level factors that might explain mortality risk in export sheep (Higgs et al., 1991, Higgs et al., 1993, Higgs et al., 1999, Norris et al., 1989a, Norris et al., 1989b). The findings supported the conclusion that some lines of sheep were likely to be associated with higher mortality risk but there were difficulties identifying explanations for this.

Export of sheep from southern ports to the Middle East in winter months

Earlier studies suggested that there may have been inadequate statistical power to identify explanatory factors (Norris et al., 1989b). A subsequent study reported spatial clustering with farms associated with higher mortality risk coming from the south-east region of Western Australia - an area of higher rainfall and longer pasture growing seasons, compared with the more extensive pastoral areas to the north and east of Perth (Higgs et al., 1999).

When these findings are interpreted in association with maps of Australian sheep production zones, it appears reasonable to infer that pastoral sheep may have a lower mortality risk than non-pastoral sheep. This issue was a major motivation behind the development of the LIVE.123 study which was initiated to provide information on causes of death in live export sheep, to identify factors contributing to the risk of death, and to determine if the risk of mortality for pastoral and “distance” sheep and lambs during the May to October period was higher than that for other classes of sheep.

The LIVE.123 study was able to document an elevated mortality risk for pastoral sheep in the period from May to October. This was particularly the case for sheep originating from the Broken Hill region of New South Wales and from Queensland, regardless of whether they were held over in Victoria before preparation in the assembly feedlot (Makin et al., 2009).

Sheep sourced from the far west of NSW had the highest mortality with sheep from the former RLPB districts of Milparinka, Broken Hill, Wanaaring and Wilcannia having the highest mortality. The following table summarises the performance of the NSW pastoral sheep by district (Makin, 2010). There were four lines of sheep in the final dataset that were received as pastoral sheep for the purposes of the trial but their property identification code was not recorded.

Table 6.5: Mortality for NSW pastoral sheep. The table shows district of origin, number of lines from each district, total number of sheep, mortality count and mortality % and 95% CI (Makin, 2010).

Former RLPB District	Number of lines	of Sheep	Mortality Count	Mortality %	95% CI	
					Lower	Upper
Balranald	5		1,826	9	0.49	0.26 0.93
Bourke	2		1,235	15	1.21	0.74 1.99
Broken Hill	17		6,236	328	5.26	4.73 5.84
Hillston	7		4,839	14	0.29	0.17 0.49
Milparinka	5		4,127	328	7.95	7.16 8.81
Wanaaring	8		4,693	152	3.24	2.77 3.78
Wentworth	2		605	0	0.00	0.00 0.63
Wilcannia	20		11,180	215	1.92	1.68 2.19
Total	66		34,741	1061	3.05	2.88 3.24

The above table is suggestive of the potential for different mortality risk for sheep raised within New South Wales, in that sheep from the southern districts (Balranald, Hillston, Wentworth) may have different risks compared with sheep raised in districts that are further north or west. This raises the question of whether the use of a broad classification system such as the sheep production zones to determine whether sheep may or may not be prepared for export, may be discriminatory and subject some sheep to unfair exclusion from export.

There appears to be little research further investigating associations between pastoral sheep in Western Australia and South Australia and the risk of morbidity and mortality during export.

Several studies have now documented what appears to be an association between lines of sheep and mortality risk that suggests that some properties or areas may have characteristics that result in repeatedly higher risk of mortality (Norris et al., 1989a, Higgs et al., 1999, Makin et al., 2009). There is also evidence that the term pastoral sheep may include some geographic areas associated with higher mortality risk and other geographic areas that are not associated with higher mortality risk (Makin, 2010).

There is an opportunity as traceability improves in the sheep export supply chain in association with ESCAS, to conduct research to develop methods for tracking mortality risk to line of origin on routine export voyages. This information could be used to identify properties with high and low mortality risk and to better understand the driving factors that may influence this risk as well as providing a direct opportunity to act on this information by avoiding sheep from properties or areas with demonstrated higher mortality risk.

There is a need to conduct additional research to investigate the broader issue of classifying sheep based on origin (pastoral or otherwise) and using this classification to define suitability for the export supply chain. The term *pastoral sheep* appears to be a broad and relatively non-specific classification.

6.7 Paddock vs shed

Standard 3.9 differentiates between sheep held in paddocks and sheep held in sheds.

Several of the registered premises in Western Australia have elevated sheds with mesh flooring to allow faeces and urine to drop through the floor and collect underneath the building. Sheds offer advantages over paddocks including protection from weather, elimination of soil erosion and dust, and improved facilities for sheep handling and general management (Norris et al., 1989b). Sheded sheep are believed to have decreased risk of salmonellosis because of reduced exposure to environmental contamination and protection from the potentially stressful effects of adverse climatic conditions that may reduce host resistance (More, 2002a). Preparation of sheep in sheds is identified as a management strategy for reducing (or eliminating) outbreaks of salmonellosis (More, 2002a).

A more detailed discussion of the potential advantages and disadvantages of sheds has been provided by More (2002b), including consideration of cost-benefit issues. It appears highly likely that shedding would reduce risk of salmonellosis in sheep during preparation for export, and would therefore have a beneficial impact on mortalities in export sheep throughout the supply chain.

However, a more detailed review of all feasible options and potential impacts for control and prevention of salmonellosis should be conducted before any decision should be made to require shedding in all registered premises

6.8 Age of sheep

Standard 3.9 prohibits preparation of lambs held in paddocks for export between May-October.

There appears to be variable evidence for increased mortality risk in lambs (no permanent incisors) that may justify exclusion of lambs from export to the Middle East during the period from May-October. Monthly mortality estimates are produced for various age classes of sheep covering the period from 1997-2009 (Norris and Norman, 2010). These figures indicate that adult wethers have a higher mortality risk than hoggets and lambs throughout the May-October period, and that mortality in wether lambs may be higher than in hoggets for some of the months in the risk period and not different in other months. A similar pattern is shown for rams (adult vs hogget vs lamb) and for ewes (adult vs lamb) (Norris and Norman, 2010). The findings do provide sufficient evidence for elevation in mortality risk in lambs in at least part of the risk period and therefore there seems to be rationale for exclusion of lambs from export during the May-October period. It should be noted that should further research identify explanatory factors for this apparent difference in risk that can be effectively managed then these restrictions may warrant revisiting.

6.9 Transport distance

Standard 3.9 prohibits preparation of sheep held in paddocks for export between May-October if they have been held on trucks for more than 14 hours.

There appears to be little specific evidence linking longer transport distances (>800 km in the initial standards, and greater than 14 hours on trucks in the current standards) with increased mortality risk in export sheep.

In a study of pre-embarkation risk factors, there was no clear association between transport factors for the trip to the registered premise (distance travelled, hours on truck, hours off feed) and mortality with sheep travelling up to 850 km and having maximal truck times of up to 26 hours (Norris et al., 1989b).

In the LIVE.123 study, increasing distance travelled was associated with an increase in the risk of rejection on arrival at the registered premise and also with an increase in the mortality rate during the journey (based on the number of deaths recorded on arrival at the registered premise) (Makin,

2010). In addition, longer distances travelled to the registered premise was also associated with elevated mortality risk during the voyage but this effect was not statistically significant. This is likely to reflect the general risks and stresses associated with land transport. There was no difference in either rejection or mortality rates on arrival between the two seasons (May-Oct vs Nov-April).

In terms of general welfare standards and research underpinning transport standards, a recent publication has suggested that healthy adult sheep, transported under good conditions, can tolerate transport durations of up to 48 hours without undue compromise to their welfare (Fisher et al., 2010).

These findings suggest that longer land transportation periods (distance or hours travelled) may result in increased rejection and mortality rates on arrival at the registered premise. However, there is less evidence linking road transport measures to mortality risk during the voyage.

It may be reasonable to require more conservative or restrictive measures relating to road transport of sheep to a registered premise based on the expectation that those animals may be entering an environment/time-period that may be associated with additional stresses relative to livestock transported for other routine purposes. Animals entering a registered premise may be held in a novel environment, at relatively high stocking densities, mixed with unfamiliar sheep, and exposed to novel feed stuffs. These factors may also be associated with increased risk of exposure to potential pathogens. However, there is a need for additional research to justify such requirements based on clear demonstration of risk and benefit associated with various options.

The current ASEL does appear to have a range of requirements that relate to transport of livestock and that are specified separately to the national land transport standards.

There are benefits in terms of clarity, compliance and regulatory lines of responsibility if land transport requirements were left to the national land transport standards and state and territory authorities.

It is recognised that this is dependent on assessment to show that there is no adverse effect on animal welfare outcomes if any additional requirement in the current ASEL that relates to land transport were to be removed.

Where there is any uncertainty or if there is an identified welfare benefit of a different standard, then it will be necessary to retain these as additional requirements in the ASEL. This would also require identification of an appropriate regulatory body to be responsible for monitoring compliance.

6.10 Full mouth wethers, broken mouth sheep and pregnant ewes

The current ASEL prohibits export of three classes of sheep altogether: full mouth wethers with a body condition score greater than 4, broken mouth sheep and pregnant ewes. These recommendations are all consistent with findings of elevated mortalities in older fat wethers (Richards et al., 1989, Norris et al., 1989a, Norris and Norman, 2003, Norris and Norman, 2010),

and with general principles of optimising animal welfare by preventing export of sheep that may be considered more likely to have adverse welfare outcomes (aged, broken mouthed and pregnant sheep).

6.11 Time on feed

Standard 3.8 requires that sheep prepared for export in paddocks between May-October must be held at the premises for five clear days with the last three clear days being fed *ad lib* only with the onboard pelletised ration. In contrast, sheep prepared in sheds or during November-April only need to be held in the premises for three clear days.

The level of scientific evidence supporting a requirement for a longer time on feed in the winter or in paddocks is unclear.

There appears to be a consensus view that there are welfare benefits in minimising the number of days that sheep spend in the export system between leaving the farm and unloading at the destination port (Richards et al., 1989, Norris et al., 1992, More, 2002c, Perkins et al., 2009, More, 2002a).

The welfare benefits of minimising time spent in feedlots are based on a reduction in opportunities for sheep to be exposed to potential pathogens such as salmonella, and reduced opportunities for exposure to other stressors, including extreme weather events (More, 2002a).

There have been concerns over the time necessary during preparation to ensure that sheep have adapted to pelleted feed and whether a shortened preparation time may produce increased risk of inappetence in sheep with consequent risks of inanition and salmonellosis. However, it has been noted that most non-feeders in the feedlot begin eating within days of loading onto the ship (Norris and Norman, 2003) and there were no differences in the proportion of non-feeders or in body weights in simulated voyages between groups of sheep lot-fed for 3 days, 8 days or 13 days (Norris et al., 1992).

There continue to be advances in production of palatable pellet feeds and there are currently on-going studies in registered premises in Western Australia examining inappetence and inanition in sheep being prepared for export (W.LIV.0142 - Inanition in sheep at a pre-embarkation feedlot).

It is suggested that consideration be given to reviewing the requirements for minimum time on feed in assembly feedlots.

6.12 Sheltered feed troughs

Standard 3.7 (c) (iii) stipulates that sheep prepared in paddocks between May-October must be fed from fully sheltered feed troughs.

This standard is based on principles aimed at ensuring feeding systems allow feed to remain dry and with minimal faecal contamination throughout the feeding period (More, 2002a). It also assists in maintaining feed intake by ensuring animals can access feed that is not affected by rain or environmental contaminants.

An inadvertent complication resulting from this requirement was observed by the author during the LIVE.123 project when project team members were present at registered premises in South Australia and Victoria in the winter. The registered premises tended to have open feed troughs in many paddocks and sheltered feed troughs just in some paddocks, presumably to conserve costs. In the non-restricted period (November-April) this allowed a registered premise to house sheep in any available paddock. At any given time premises had the potential to employ strategies including lower stocking densities in paddocks and paddock rotation that might conceivably also act to lower stress and minimise risks of disease.

In the winter months premises were restricted to housing sheep in paddocks that had sheltered feed troughs. In some cases, this restriction may have inadvertently resulted in increased salmonella exposure risk rather than reduced salmonella exposure risk. This was considered possible mainly when the same paddocks were used for subsequent consignment preparation and when conditions (wet weather, susceptible sheep, presence of salmonella) favoured the shedding of increased numbers of salmonella organisms.

These conditions may have favoured the build-up of heavy environmental contamination of salmonella organisms over time and inadvertently favoured the creation of conditions that could lead to increased risk of salmonellosis. These factors could have contributed to increased salmonellosis risk even though the feed troughs themselves were in compliance with requirements and feed was being kept dry and uncontaminated.

This issue is an example of a specific regulatory requirement that was put in place for the best of intentions and that is justified based on science, but where there are unintended consequences that may result in some years from the way that the requirement has been implemented in some premises.

It is not necessarily appropriate to require all premises to have sheltered feed troughs in all paddocks. Nor is it appropriate to require lower stocking densities or forced paddock rotations.

The value of this example is to reinforce the notion that the causal web for salmonellosis is complex and multi-factorial and dynamic. Running sheep at maximal stocking densities allowable under ASEL and using the same paddocks for subsequent consignments may be fine except under some

conditions. If there was an adverse climatic event or a minor salmonellosis event (some sick sheep in one line), then these conditions could result in contamination of one or more paddocks and lead to elevated risk. If this situation could be recognised through monitoring then it could potentially allow separate management of an affected line and possibly spelling of that paddock for a future consignment to allow environmental pathogen loads to decline. These issues have been discussed and options outlined for studies to better understand the potential of practices such as salmonella vaccination and also environmental and animal management to minimise salmonella risk (Perkins et al., 2009).

6.13 Wool length

Standard 3.9 (b) stipulates that sheep held in paddocks during the period from May-October must have wool not more than 25 mm in length and be at least 10 days off shears on arrival at the premises.

It is understood from discussion with exporters that it is common practice to shear sheep during the assembly period in Western Australia where sheep can then be housed in sheds and provided with protection from climatic extremes. This ensures that sheep have minimal extra wool cover when they are loaded onto ships for export during the Australian winter.

It is unclear whether differences in wool length under 25 mm might have any impact on likelihood of heat stress when sheep arrive in the Middle East. If there were evidence to support a benefit then this may be a strategy worth considering.

It is noted that in paddock based feedlots, shearing sheep in the Australian winter may be associated with increased risk of adverse outcomes particular if sheep are shorn and then placed in paddocks when there might be cold wet weather. This situation has resulted in large mortality events in the past.

7 Heat stress risk assessment (HSRA)

The Australian livestock export industry developed a Heat Stress Risk Assessment (HSRA) model called *HotStuff* in 2003. The HSRA has been used during planning of export voyages to mitigate the risk of mortality due to heat stress and is an essential part of the export application process.

Exporters must submit a Heat Stress Risk Assessment (HSRA) to DAFF with the Notice of Intention to Export/Consignment Risk Management Plan (NOI/CRMP) for the export of livestock by sea.

The HSRA output is intended to manipulate stocking density onboard to provide a less than 2% probability of a 5% mortality.

The heat stress risk estimates are derived from the integration of: (i) wet-bulb temperature distributions en route and at port for the specific time of year, (ii) estimated animal mortality distributions for a given wet-bulb temperature adjusted for animal factors (liveweight, body condition, coat type (sheep) and acclimatisation zone) and (iii) ship and stocking density factors (i.e. that influence ventilation and therefore pen air turnover (PAT)) (Ferguson et al., 2008).

The HotStuff model has undergone several refinements since development and the current version 4 has been required to be used since May 2012²⁵.

In a 2008 review of the HotStuff model, the authors indicated that imposition by AQIS of a 15% stocking density reduction on two tier open deck vessels for the northern summer months of 2008 appeared to have a beneficial impact in that heat stress mortality levels on two tier decks were reduced to less than those on single tier decks without a single reportable heat stress event.

The 2008 review noted problems in methodology in dealing with open deck vessels and the need for further improvements in modelling heat stress risk for open decks (Ferguson et al., 2008).

The 2008 review also noted difficulties in validation of performance of the HSRA given that there do not appear to be available records of mortalities during voyages that were attributed to heat stress. The report provides an illustrative example:

suppose there have been 5000 cases where accurately recorded heat related mortalities have been recorded and that in only 80 of these cases have there been mortalities of 5% or higher (giving an average incidence rate of 1.6%). In the broadest validation process, this overall incidence rate can be compared with the HotStuff stipulation of 'less than 2% incidence'.

In fact this sort of assessment has not been possible because there are not sufficient data.

²⁵ W.LIV.0277: HotStuff Version 4.0 – Revised methodology and additional ports.

The 2008 review then notes that given the large number of voyages undertaken following implementation of the model it probably supports the conclusion that the mortality risk has been managed within acceptable limits.

In fact, it is possible at the consignment level to undertake some assessment of this process. The industry data of 277 voyages that was compiled from reports to parliament (available on the DAFF website), provides assessments of overall voyage mortality rates. Every voyage where there is a reportable mortality event then triggers a mortality investigation and these investigation reports (also available from the DAFF website) provide the consignment specific mortality rates. The 13 reports include details of 14 consignments (two consignments exceeded the 2% threshold in voyage 37). The consignment specific mortality rates ranged from 2.04% to 4.19%.

Because of the requirement to report (and investigate) any consignment level mortality that exceeds 2%, all other voyages (277-13 = 264) since 2006 must have had consignment level mortality rates lower than 2%. This process is necessary because the reports to parliament only contain voyage mortality rates and therefore may not represent consignment level mortalities if a voyage has more than one consignment.

These findings indicate that at the consignment level, there has not been a single mortality event since January 2006 attributable to heat stress, where the mortality rate in a consignment has exceeded 5%.

This does provide some confidence that the HSRA is performing as expected. The model output is set at a level where it is intended not to eliminate all risk of heat stress mortalities but to provide confidence that there will be a less than 2% probability of a mortality event where the mortality rate is greater than 5%.

In the years between 2006-2011, there have been 277 sheep voyages to Middle East destination ports and not a single mortality event has occurred where the mortality rate in a consignment due to heat stress exceeded 5%.

In a mathematical sense, if we observe zero events out of 277 trials, the point estimate for the observed proportion is $0/277=0$. We can then use a 95% confidence interval to estimate an upper estimate of the mean proportion to incorporate sampling uncertainty into the estimates. At this point, it is appropriate to consider that the total of 277 voyages includes voyages from all months of the year and that it may be more appropriate just to consider voyages during months when heat stress events are more likely. The heat stress events associated with mortality investigations occurred for voyages with loading dates between May and August. The total number of voyages with loading dates between May and August was 89.

The 13 mortality investigation reports concerned 13 voyages, of which there were 10 voyages with two consignments each and three voyages that contained a single consignment.

The number of consignments across all voyages is unknown but it may be reasonable to assume that say one third to one half of all voyages may contain two consignments.

This produces a proportion which is based on a numerator of zero (zero mortality events where mortality rate in a consignment exceeded 5%), and where the denominator ranges from 89 (assuming one consignment per voyage), to 118 (assuming one third of all voyages contain two consignments), to 133 (assuming one half of all voyages contain two consignments).

The upper 95% confidence intervals for these three proportions were estimated using the Wilson method for estimating confidence intervals for proportions (Brown et al., 2001).

The estimates were 2.18% (0/133), 3.15% (0/118) and 4.14% (0/89).

Note that all three estimates exceed 2%.

This means that in a probabilistic sense, even though we have not observed a single event where the mortality rate in a consignment due to heat stress has exceeded 5%, the theoretical probability that such an event could occur is still greater than 2%, under all three approaches to estimation.

Using this approach, if we had a minimum of 190 voyages/consignments and zero observed events then the upper 95% confidence limit for the proportion would be 1.98% (below the desired threshold of 2% probability).

There are multiple possible inferences that can be drawn from these results.

It does seem reasonable to interpret the findings as suggesting that the HSRA models are operating as expected since we have not seen a single event where heat stress mortality rates in a consignment have exceeded 5%.

The fact that the 95% confidence intervals for an estimated proportion exceed 2% is partly due to the fact that we only have 6 years of data to consider. It is not clear whether earlier years may have had a heat stress event with a consignment level mortality exceeding 5%. Adding more years of voyages will improve the precision of the estimates and narrow the confidence intervals potentially.

Alternatively, it may be reasonable to reassess the parameters of the HSRA model (is a 2% probability of a 5% mortality event appropriate).

If there were consideration of applying the upper confidence interval of a proportion as a performance measure then it would be important to assess this using multiple years of data because of the penalties that would be imposed on limits derived from smaller sample sizes as a result of the underlying mathematical algorithms.

It is understood that there is an ongoing project²⁶ that is collecting data during routine export voyages to further validate and refine the HSRA models.

²⁶ W.LIV.0276: Statistical analyses of the HotStuff model

Findings

7.1 Current problems

Review of the reportable mortality investigations indicates that the 13 events that have occurred since 2006 have all occurred in the period from May to October. There were reportable events involving sheep loaded from all three ports, indicating the problems were not confined to any one port.

Review of national annual mortality reports and analyses of data derived from summary reports to parliament have confirmed that there continues to be an elevated mortality risk in the second half of the year.

Multivariable analyses indicated that the mortality risk was highest for voyages containing sheep loaded in Portland and in the period from May to September.

There were two major drivers of mortality identified in the investigations: enteritis or more broadly salmonella-inanition, and heat stress.

7.2 Why are the problems occurring

7.2.1 Salmonellosis-inanition

A number of reports have provided detailed consideration of factors contributing to salmonella-inanition and these remain relevant to the current situation (Norris et al., 1989a, Norris et al., 1989b, Richards et al., 1989, Richards et al., 1993, Higgs et al., 1993, More, 2002a, More, 2002b, Makin et al., 2009, Perkins et al., 2009).

Reviews with particular relevance to the current situation include (More, 2002a, More, 2002b, Makin et al., 2009, Perkins et al., 2009). More recent work has suggested that enteritis alone is more important as a cause of death in export sheep than enteritis in combination with inanition or inanition alone and a recent review has presented a unified causal web describing factors that may contribute to enteritis in sheep (Perkins et al., 2009).

Salmonellosis risk is dependent on multiple factors but particularly environmental levels (challenge) of virulent/pathogenic strains, and animal resistance.

There seems to be little doubt that the combination of winter weather patterns and paddock-based preparation are important in creating conditions that favour development of salmonellosis. The pathogens are likely to be ubiquitous though at very low shedding rates in normal healthy sheep. If conditions then favour development of salmonellosis in some sheep at the registered premise, the levels of shedding and environmental contamination can then rapidly reach very high levels and present a very high risk to healthy cohort sheep in the same consignment.

Environmental contamination with organisms can then provide continual high challenge to subsequent consignments being prepared in the same paddocks or handled through the same yards and can result in multiple consignments in a short period of time with salmonella outbreaks. It seems almost certain that this type of pattern occurred in 2000-2002 and also possibly in mid-2007.

A series of recent research publications involving researchers in Australia and the USA, has reported very promising results from the use of in-water vaccination of calves and sheep against *Salmonella enterica* serovar Typhimurium (Mohler et al., 2008, Mohler et al., 2011, Mohler et al., 2012). The oral vaccine has been shown to be safe (Mohler et al., 2012) and effective in reducing clinical disease and mortality when given to sheep 7 or 28 days before challenge with virulent *Salmonella* organisms (Mohler et al., 2011). The vaccine was readily consumed in the drinking water and produced robust protection against virulent challenge 7 days after vaccination. The authors hypothesise that this vaccine may offer an important risk mitigation strategy for Salmonellosis in sheep being prepared for live export and may also mitigate against inanition which may result as a sequelae to exposure to virulent *Salmonella* organisms.

More (2002a) provides an excellent discussion of options for mitigating the risk of Salmonellosis including a cost-benefit analysis of developing elevated sheds in the eastern states (Victoria and South Australia) for managing sheep to minimise risk of exposure to virulent *Salmonella* organisms.

Data presented elsewhere in this report indicates that outbreaks of salmonellosis-inanition are occurring in sheep prepared in all three states (Victoria, South Australia and Western Australia). While registered premises in Western Australia do often prepare sheep in elevated sheds, not all registered premises have elevated sheds and not all sheep that are prepared in Western Australia are housed in sheds (registered premises may prepare some sheep in sheds and others in paddocks for the same voyage). While anecdotal comments do appear to indicate that outbreaks of Salmonellosis in sheep from Western Australian premises are more likely to have been housed in paddocks than in sheds, the authors have not viewed data to support this suggestion and summary statistics do not indicate whether sheep may have been prepared in sheds or paddocks.

7.2.2 Heat stress

The heat stress risks are well understood and strategies have been developed over time to reduce heat stress risks, at the planning stage through the HSRA, selection of sheep, ensuring sheep are shorn before export, ship design (including ensuring appropriate air flows), and loading densities.

Strategies for detecting and managing heat stress onboard ship have also been outlined in the Live Export Veterinary Handbook published in May 2012 as an industry reference source intended to be used by onboard veterinarians and stockpersons.

The fact that heat stress deaths are continuing to occur at levels that trigger mortality investigations suggests that there is scope for improving the way that export is managed to ensure that heat stress risk is maintained at lower levels.

7.3 Changes in preparation practice for various classes of sheep

The standard of management at sheep export feedlots in Australia is very high regardless of whether the sheep are being prepared in paddocks or sheds.

Registered premises serve as assembly points for aggregating large numbers of sheep in preparation for an export voyage, and also provide an opportunity for acclimatising sheep to ship-like conditions and feed stuffs.

In a 2002 report, More estimated that sporadic outbreaks of salmonellosis may affected approximately 20% of consignments (More, 2002a). The problem in the period from 2000-2002 was temporally associated with a period of very high throughput in southern feedlots, particularly in Victoria and South Australia. It is considered almost certain that the high throughput provided additional stress on the entire system and particularly sheep being processed. The system was likely to have been operating at peak capacity with very little or no downtime between successive consignments.

Once salmonella outbreaks had occurred there was a very high likelihood of environmental contamination that would have exposed the subsequent consignment to high challenge levels as soon as sheep entered the premises.

More (2002b) also describes outbreaks of clinical salmonellosis with elevated mortality rates that occurred in the registered premise in the period from 2000-2002. These patterns do not appear to be features of the mortality investigations reviewed as part of this report and it is suggested that this is due to improved industry practices between 2002 and the current review period.

There appears to be an apparent decline in voyage and annual mortality rates over the years since the period from 2000-2002 and this is likely to be attributed in part to the decline in total numbers of sheep being prepared for export as well as to the implementation of the current ASEL.

There have been a number of changes over time in a range of areas related to sheep supply and management of preparation of export sheep.

Sheep numbers in Australia dropped to record lows in 2010 and have increased marginally since then due to a combination of better seasons and stronger prices. However, the long term trend has remained in a downward direction.

The age of sheep exported from Western Australia has also fallen over the period from the 1990s to the 2000s, partly because of shortages of sheep but also because the national flock structure was changing over time, away from a wether dominated wool production focus to a market more dominated by meat (lamb) production.

There has been a progressive phase in of livestock identification systems for sheep under the NLIS. All sheep must now have NLIS compliant ear tags inserted before they can travel from one property to another. This has improved traceability. However, the sheep identification system is still based on mob-level identification and does not provide the level of assurance that is being delivered by the individual animal identification system that is implemented for Australian cattle.

There have been anecdotal comments from exporters to support the conclusion that pelleted feed quality and palatability has improved over time and that sheep are adapting to pelleted feed better than in the past. This may have contributed over time to a lessening of the relative importance of inanition as a cause of mortality in export sheep.

There has been a progressive improvement in animal welfare standards in the industry attributed in part to the increasing regulation imposed on industry by the ASEL.

7.4 Assessment of the current standards for sheep being prepared in southern ports

This review supports the finding of the *Farmer Review* that the Standards need to be clear, essential (causally related with mortality or otherwise scientifically based), consistent and verifiable.

There are a number of areas where improvements may be made to the current ASEL with specific reference to preparation of sheep for export in southern facilities.

There are current requirements in the ASEL that are considered to be either unclear or not necessarily consistent with findings from relevant scientific research. These include in particular:

- pastoral and station sheep (S3.9)
- transport distance (S3.9)
- time on feed (S3.8)

The use of standards in the ASEL to provide guidance for management of sheep for export during the months from May to October is justified based on the evidence suggesting that this period is associated with increased mortality risk, mainly due to enteritis and heat stress.

Review of the reports from mortality investigations indicates that exporters and other responsible parties are operating in compliance with ASEL or other requirements. There was no suggestion in reports that there were breaches of procedures or standards.

7.5 Gaps in the current standards

There are a number of gaps in the understanding of factors that are influencing adverse welfare outcomes. Some of these have been identified in the DAFF mortality investigation reports and others in recent reports.

With respect to heat stress these include:

- Review of performance of HSRA models and benefits of modifications to model structure and function as well as simpler adjustments such as additional space requirements per animal (10-20%) in the high risk period (Australian winter months);
 - Version 4.0 of HotStuff is understood to only have been implemented since May 2012. It is not clear whether Version 4.0 may be managing loading densities to prevent heat stress events more effectively than earlier versions.
- Consideration of the maximal wool length for sheep being exported to the Middle East in the Australian winter. At the moment the ASEL stipulation is for wool length not longer than 25 mm. It is understood that some exporters may be shearing animals close to the time of departure from the registered premise to ensure that sheep have minimal wool cover when they are exported (while still ensuring sufficient cover for optimal health).
- Are there additional measures that may be useful for managing excessive heat load (EHL) onboard ship either by design (air-flow for example) or as interventions when periods of EHL are encountered.
- Improved reporting of mortalities at the consignment level and by key categories of cause of death would provide additional value to national summary statistics.

With respect to enteritis (including salmonellosis and inanition), gaps include:

- The ecology of salmonella organisms over time in the assembly feedlot environment and particularly risk of shedding in sheep, environmental loads, exposure risk and association with clinical disease in sheep both during the feedlot period and the subsequent voyage.
- Options and efficacy for reducing environmental challenge in feedlots, including elevated sheds, one-way animal flow in feedlot systems and paddock/yard management (scraping yards, spreading lime).
- Review of feedlot practices against best practice recommendations for minimising salmonella risk. Best practice recommendations for minimising salmonella risk may be drawn from recent reports (More, 2002a, Makin et al., 2009, Perkins et al., 2009). Some of these practices have

been implemented in the current standards but it is not clear whether there may be opportunities for improvements in practices.

- Effect of shortened time period on feed in assembly feedlots (including direct loading onto ships) on adaptation to pelleted diet and on salmonella exposure risk.
- Improved understanding of factors influencing inappetence in sheep being prepared for export and options for minimising inappetence. There is an existing project (W.LIV.0142) examining factors associated with inanition in pre-embarkation feedlots and a recent review of inappetence of sheep that describes current literature (Barnes et al., 2007).
- Potential role of oral vaccination against salmonella in sheep and alternative strategies that may be used to strengthen innate immunity.
- Options for early identification and removal or treatment of animals that may be shedding large numbers of salmonella organisms and posing a threat to cohort animals.
- Options for identification and management or rejection of lines of sheep that may be shedding salmonella organisms and presenting exposure risk to other sheep in the consignment.
- Review of options for identification and management of sheep that may be clinically affected with salmonellosis or posing exposure risk (shedding) to other sheep while onboard the ship, in order to minimise adverse welfare outcomes in affected sheep and in the unaffected, at-risk cohort of animals on the ship.

There is an identified need for an integrated monitoring and surveillance capacity. This has been identified in the DAFF mortality investigation reports and has previously been described (Perkins et al., 2009). The quality assurance requirements imposed by the ESCAS requirements provide an opportunity for industry to implement a system that is embedded within routine operations and that can provide compliance with ESCAS as well as broader industry benefits.

There are major lessons to be learnt from the current project (W.LIV.0252) which has developed standardised methods for monitoring onboard cattle health and establishing causes of death in export cattle. These should be incorporated into a similar development for the sheep export industry. A number of projects have established the major causes of death in export sheep and standardised approaches to their diagnosis based on gross post mortem (Richards et al., 1989, Richards et al., 1993, Makin et al., 2009). A recent project has also produced a Live Export Veterinary Handbook (W.LIV.0278) which includes information on conditions in export sheep. It should be possible to use existing resources to develop a brief manual on how to differentiate the major causes of death in export livestock by gross post mortem alone so that onboard veterinarians and stockpersons can better diagnose major conditions without having to meet import requirements to bring samples back into Australia for pathology examination.

It will be important to have colour photographs of post-mortems done on export animals to provide real-world examples of common conditions. This sort of resource is well suited to delivery via web platforms and also on hand-held devices (tablets, smart phones or i-Pod/i-Pad style devices).

An important benefit of an integrated monitoring and surveillance system will be the potential to use this information to monitor and improve performance in the supply chain. An example of the potential for improvement is in the area of linking performance through the chain to lines of sheep. Several reports have identified the fact that a small number of lines appear to be associated with the most mortalities in export sheep (Norris et al., 1989b, Higgs et al., 1999, Makin et al., 2009). All of these reports involved additional activities conducted as part of the research projects to trace lines and link mortalities to lines. However, these researchers were not able to identify specific farm of origin characteristics that might explain the association between some farms and increased mortality. An effective monitoring system has the potential to use this information to identify lines of sheep that have high mortality risk in the supply chain (and those that have low mortality risk) and use that information to better understand drivers as well as improving selection practices to minimise mortality risk.

There is also an identified need to move the regulatory framework towards a quality assurance framework with an outcomes focus. This has been previously identified as a preferred long term approach for managing the export industry (Whan and More, 2003), and has been supported by the *Farmer Review* and by recent movements towards a whole of chain QA system.

8 Options for further industry research

One of the objectives of this review was to identify gaps in the current standards and identify options for improved control measures to monitor welfare outcomes.

Many of the issues identified in the report will require targeted research projects to deliver results that can then contribute to improvements in the regulatory framework.

Caution is urged to avoid making additional prescriptive changes to the ASEL and also to avoid making changes unless there is unequivocal evidence to support a view that the changes are both warranted and likely to result in measurable benefit. As can be seen in some of the discussion in this report, there are existing requirements in the ASEL that may not be warranted when assessed for science-based justification and that may not necessarily be having measurable beneficial impacts on welfare outcomes. However, these requirements are nonetheless difficult to change, largely because they are already incorporated into the Standards.

One option may be to consider some changes as interim changes until such time as further research is conducted or evidence accumulated to warrant implementing change into the Standards. An example may be implementing measures as export advisory notices with a defined timeline in conjunction with further research.

Options for further research and consideration include:

1. That a framework be developed that will allow appropriately justified research findings to inform modifications to the Standards over time. There is a sense of frustration within the industry that it is difficult to modify sections of the Standards once they are written, even when there is a body of accumulating evidence to justify change.
2. That consideration be given to removing the term *pastoral and station sheep* from the Standards and replacing it with a clear definition of any restrictions that may be placed on sheep sourced for export during winter months. It is suggested that the definition be linked to the geographic locations of the origins of sheep that have been shown to be at elevated risk of mortality during winter months.
3. That the land transport components of the Standards be simplified by referring to the National Land Transport Standards without additional criteria that must be met or checked. This change is likely to simplify issues relating to responsibilities and compliance and means that everyone can refer to a single set of Land Transport Standards.
4. That consideration be given to implementing research to test whether there is a benefit in allowing a shorter minimum time on feed for sheep being prepared in registered premises. There have been a number of occasions where reviews have suggested that shortened feedlot time may be beneficial in terms of reducing exposure risk to *Salmonella* organisms in the registered premise.
5. That further research be conducted to assess options for risk mitigation against Salmonellosis including in particular oral vaccination and management of sheep in registered premises during winter months. There are ongoing questions about the benefit of sheds versus paddocks (in both the west and the east), as well as how best to manage sheep in paddocks to minimise exposure risk and also whether it may be possible to monitor environmental loads and mob level shedding.
6. That appropriate research be conducted or expert opinion sought on the benefits of shearing sheep in the days before loading onto ships as a preventive measure against possible heat stress. It is understood to be a common practice in sheep prepared in sheds in Western Australia but the benefits do not appear to be documented.
7. It was not possible to identify definite suggestions concerning options to mitigate the risk of heat stress in sheep prepared in southern ports during winter months. There has been a new version of HotStuff implemented recently and there is also ongoing work validating the application of HotStuff in managing heat stress risk.
 - a. It is suggested that the findings of ongoing work aimed at validating HotStuff and HSRA models be considered in developing further recommendations for refining and improving HSRA.

- b. It is suggested that industry consider reviewing the strategic objective for HotStuff (lower than 2% probability of a 5% mortality event) during the validation process.
8. That industry consider developing and implementing an integrated monitoring and surveillance capacity that can underpin QA systems and provide important benefits to the industry in terms of documenting good performance, allowing early identification of problems and underpinning and informing industry R&D.

9 References

- Barnes, A, Beatty, D, Stockman, C & Miller, D 2007. Inappetence of sheep. *Meat and Livestock Australia Report LIVE.243*, 44 p.
- Brown, L, Cai, T & DasGupta, A 2001. Interval estimation for a binomial proportion. *Statistical Science*, 16, 101-139.
- Ferguson, D, Fisher, A, White, B, Casey, R & Mayer, B 2008. Review of the Livestock Export Heat Stress Risk Assessment Model (HotStuff). *Meat and Livestock Australia Report W.LIV.0262, W.LIV.0263, W.LIV.0264, W.LIV.0265*, 42 p.
- Fisher, A, Niemeyer, D, Lea, J, Paull, D, Reed, M & Ferguson, D 2010. The effects of 12, 30 or 48 hours of road transport on the physiological and behavioral responses of sheep. *Journal of Animal Science*, 88, 2144-2151.
- Higgs, A, Norris, R, Love, R & Norman, G 1999. Mortality of sheep exported by sea: evidence of similarity by farm group and of regional differences. *Australian Veterinary Journal*, 77, 729-733.
- Higgs, A, Norris, R & Richards, R 1991. Season, age and adiposity influence death rates in sheep exported by sea. *Australian Journal of Agricultural Research*, 42, 205-214.
- Higgs, A, Norris, R & Richards, R 1993. Epidemiology of salmonellosis in the live sheep export industry. *Australian Veterinary Journal*, 70, 330-335.
- Makin, K. 2010. *Investigating mortality in sheep and lambs exported through Adelaide and Portland*. PhD, University of Sydney.
- Makin, K, House, J, Perkins, N & Curran, G 2009. Investigating mortality in sheep and lambs exported through Adelaide and Portland. *Meat and Livestock Australia Report LIVE.123*, 143 p.
- Mohler, V, Heithoff, D, Mahan, M, Hornitzky, M, Thomson, P & JK, H 2012. Development of a novel in-water vaccination protocol for DNA adenine methylase deficient *Salmonella enterica* serovar Typhimurium vaccine in adult sheep. *Vaccine*, 30, 1481-1491.
- Mohler, V, Heithoff, D, Mahan, M, Walker, K, Hornitzky, M, Gabor, L, Thomson, P, Thompson, A & House, J 2011. Protective immunity conferred by a DNA adenine methylase deficient *Salmonella enterica* serovar Typhimurium vaccine when delivered in-water to sheep challenged with *Salmonella enterica* serovar Typhimurium. *Vaccine*, 29, 3571-3582.
- Mohler, V, Heithoff, D, Mahan, M, Walker, K, Hornitzky, M, Shum, L, Makin, K & House, J 2008. Cross-protective immunity conferred by a DNA adenine methylase deficient *Salmonella*

- enterica* serovar Typhimurium vaccine in calves challenged with *Salmonella enterica* serovar Newport. *Vaccine*, 26, 1751-1758.
- More, S 2002a. Salmonellosis control and best-practice in live sheep export feedlots. *Meat and Livestock Australia Report LIVE.112*, 67 p.
- More, S 2002b. Salmonellosis control and best-practice in live sheep export feedlots: Literature review. *Meat and Livestock Australia Report LIVE.112*, 47 p.
- Norris, R & Norman, G 2003. Mortality and morbidity risk factors for livestock during sea transport from Australia. *Final report prepared for MLA and Livecorp*, Live.216.
- Norris, R & Norman, G 2010. National livestock export industry shipboard performance report 2009. *MLA LiveCorp Report W.LIV.0270*.
- Norris, R, Richards, R & Dunlop, R 1989a. An epidemiological study of sheep deaths before and during export by sea from Western Australia. *Australian Veterinary Journal*, 66, 276-279.
- Norris, R, Richards, R & Dunlop, R 1989b. Pre-embarkation risk factors for sheep deaths during export by sea from Western Australia. *Australian Veterinary Journal*, 66, 309-314.
- Norris, R, Richards, R & Norman, G 1992. The duration of lot-feeding of sheep before sea transport. *Australian Veterinary Journal*, 69, 8-10.
- Perkins, N, House, J & Barnes, A 2009. Investigating the relationship between Salmonella-inanition and property of origin. *Meat and Livestock Australia Report W.LIV.0132*, 57 p.
- Richards, R, Hyder, M, Fry, J, Costa, N, Norris, R & Higgs, A 1991. Seasonal metabolic factors may be responsible for deaths in sheep exported by sea. *Australian Journal of Agricultural Research*, 42, 215-226.
- Richards, R, Norris, R, Dunlop, R & McQuade, N 1989. Causes of death in sheep exported live by sea. *Australian Veterinary Journal*, 66, 33-38.
- Richards, R, Norris, R & Higgs, A 1993. Distribution of lesions in ovine salmonellosis. *Australian Veterinary Journal*, 70, 326-330.
- Whan, I & More, S 2003. LIVE.117: Review of the Australian Livestock Export Standards. *Meat and Livestock Australia Project LIVE.117*, 139p.

10 Appendix 1: Recommendations arising from the Independent Reference Group reviews

The IRG report in 2000 included 11 recommendations:

1. Recommendation 1

The IRG recommends that animals at farm gate should:

- first meet minimum Australian health requirements and standards for fitness to travel; then
- meet the health requirements of the country of destination; and
- be prepared properly to enable them to cope with the range of subsequent environments they will encounter, including sufficient time for adjusting to feed and restoring stress-handling capability.

The IRG recommends that existing processes be reviewed and modified if necessary to fully meet the above requirements, with clearer emphasis on the method of preparation on the property of origin. This preparation should be documented in a manner that can be audited.

2. Recommendation 2

The IRG therefore recommends that:

- documentation of animal health history on farm or from other place of origin be considered for incorporation within the processes of the Livestock Export Accreditation Program (LEAP) and Australian Livestock Export Standards (ALES), and form part of the overall documentation provided to AQIS by exporters for health certification and the issue of export permits;
- documentation could be provided either by formal vendor declaration, or by certification through a recognised quality management program such as CATTLECARE or FLOCKCARE (which may be modified if necessary), or both. As in the above dot point, documentation must be cleared through the registered veterinarian who is accredited for inspection and certification of live exports (see Recommendation 4);
- in order to achieve improved animal welfare outcomes, Industry should consider the incorporation into ALES of protocols for the preparation of different species, from different regions, to different destinations and in different seasons;

- existing State mechanisms for farm health certification should be validated for their effectiveness and consistency, particularly in connection with current disease status and reporting under NAHIS.

3. Recommendation 3

The IRG recommends that all States and Territories that have not already done so should ensure a consistent legislative basis on agreed national animal health and welfare standards to underpin industry initiatives, and that this be given priority.

4. Recommendation 4

The IRG recommends that:

- AQIS should retain the power to perform separate indirect or direct audits on certification or any relevant aspect of an export of livestock, including matters affecting licences;
- The exporter clearly be the responsible and accountable entity for all aspects of the export process, including the provision of qualified and trained staff covering health and welfare matters (see last dot point below); Existing arrangements for the provision of 3rd Party services be continued whereby accredited veterinarians are employed or contracted directly by the exporter to assist in certifying that animals meet health and welfare standards;
- The exporter deliver documentation to AQIS to support the issuing of export permits and health certificates by that agency. The documentation must cover whatever is relevant to a given export including details on selection, land transport and assembly of animals, health certification for animals and farms, and any necessary testing and treatment;
- Existing 3rd Party provisions be incorporated into ALES as standards and be jointly developed and reviewed by industry and AQIS, and modified if necessary. Exporters should be audited on their performance against these standards;
- The Accreditation Program for Australian Veterinarians (APAV) of the Australian Animal Health Council Ltd should be extended to provide the basic training in health and welfare inspection and certification of animals for live export. Only APAV accredited veterinarians should be employed or contracted by exporters to inspect and certify animals for export.

5. Recommendation 5

The IRG recommends that Industry restructure present arrangements, whereby the LASC advises on changes to the ALES, to an arrangement where the LASC approves any changes and has overall management authority of the LEAP program.

6. Recommendation 6

The IRG recommends that existing legislation and regulation be reviewed in detail and modified in light of LEAP and ALES coverage, to provide both additional support for industry QA standards, and to ensure efficient and effective coverage for all livestock export activities. This may involve re-scoping of government provisions and restructure of legislative instruments, or possibly consolidation of regulations and orders. The Government must maintain an ability to intervene directly or through judicial action if necessary.

7. Recommendation 7

The IRG recommends that an (AUSVETPLAN like) approach to emergency management be jointly developed by industry and government for the livestock export trade.

8. Recommendation 8

The IRG recommends that Industry and Government review the livestock export industry data requirements, acquisition and maintenance systems, and public availability of performance information, with a view to both improved efficiency and transparency.

9. Recommendation 9

The IRG recommends that industry commit to and continue to improve general and industry performance communication, with particular emphasis on transparency.

10. Recommendation 10

The IRG recommends that industry strengthen the emphasis of an epidemiological basis for current and future research activity.

11. Recommendation 11

The IRG recommends that industry and government adopt and communicate a clear definition of animal welfare for the purposes of the live export trade, and use this definition as a benchmark for future considerations and operation.

The IRG report in 2002 included the following recommendations that were based in large part on the recommendations arising from the 2000 IRG report:

1. Action Plan

- a. Agree to the immediate establishment of a dedicated joint government and industry Working Group to develop an Action Plan for the Livestock Export Industry (APLEI) by 18 October 2002 that provides a comprehensive framework for delivery of a

sustainable live animal export industry into the future that meets the expectations of the community and livestock producers on animal welfare outcomes.

2. Risk Assessment

- a. Agree that before a decision to revoke the moratorium on sheep exports and the ban on exports of Bos Taurus cattle is taken, that risk assessments be undertaken before the trade re-commences having particular regard to matters such as dry conditions, sourcing of stock and conditions at destinations.
- b. Agree that Biosecurity Australia and AQIS immediately develop a risk assessment template to be attached to and submitted for each consignment as part of the Notice of Intention. No export permit should be issued until AQIS has approved the risk assessment.
- c. Agree to implementation of a risk assessment for each voyage as a risk reduction measure pending the implementation of a range of new measures to be defined in the Action Plan.

3. Investigation of Incidents

- a. Agree that a memorandum of Understanding between AQIS , AMSA and Livecorp should be finalised immediately to facilitate a more timely approach to investigations and reporting of export livestock incidents by DAFF (formerly AFFA).

4. Risk Communication

- a. Agree to improve transparency to all stakeholders by appropriate risk communication, including the release of regular media statements by the Minister and industry to cover incidents and developments, actions being taken and the residual risk of further incidents until the Action Plan is implemented.

11 Appendix 2: Principles and recommendations from the Keniry Review

1. The welfare of the animals in the livestock export trade is a primary consideration in all areas of the industry:
 - all stages of the livestock export chain, from farm to discharge into the market, must be able to demonstrate that the welfare of the animals has been addressed in its operation.
2. The Australian Government is responsible for protecting the broader interests of the Australian community in the export process by setting clear standards for the export of livestock, administering them firmly and consistently, and for ensuring governance and reporting arrangements in relation to animal welfare during export are transparent:
 - Australian livestock export consignments must reliably meet international criteria, importing country requirements and Australian animal health and welfare standards.
3. The Australian livestock industry is responsible for development of the livestock export industry by establishing and managing systems that support the adoption of best practice animal husbandry and commercial practices along the export chain:
 - the industry must continue to build its capability so that all participants in the industry are competent and demonstrably operating according to best practice standards and translating that to outcomes consistent with best practice.
4. The livestock export industry is part of the wider Australian meat and livestock industry and the way it operates has implications for the industry as a whole:
 - governance standards and structural arrangements applying to the wider industry must apply to the livestock export industry unless there are clear and objective reasons for varying them.
5. The livestock export industry is uniquely and inherently risky because it deals with sentient animals along an extended production chain, from farm to discharge into the market:
 - the preparation of an export consignment must recognise the risks at each stage of the chain and an exporter must be able to demonstrate that appropriate systems are in place to ensure the risks have been met in accordance with government regulatory requirements and industry quality assurance systems.

The *Keniry Review* then made 8 recommendations.

1. Recommendation 1

There must be a national standard for livestock exports, the “Australian Code for Export of Livestock”, which focuses on the health and welfare of the animals during export and which is consistent with the Model Codes as they are updated:

- States and Territories should be consulted in the development of the standard and the views of industry and animal welfare groups should be taken into account;
- the standard must recognise the outcomes sought in the export of livestock and take into account the whole process for sourcing, preparing, assembling and transporting animals for export;
- the standard must be directly referenced in the Australian Meat and Livestock Industry Act 1997 and the Export Control Act 1982; and
- an interim national standard must be in place by 1 May 2004 and finalised by 31 December 2004.

2. Recommendation 2

Government must be solely responsible in the relevant legislation for granting export licences and permits and enforcing compliance by exporters against the national standard:

- the Government may take into account the views of an industry group on whether a particular exporter has met industry quality assurance standards but must not be constrained by those views in making its decision.

Industry should be responsible for research and development and management of quality assurance systems to support its members translate best practice standards into outcomes consistent with best practice:

- its activities should be funded by compulsory levies.

3. Recommendation 3

The criteria for approval of export licences and export permits should be more closely linked in the legislation and include:

- an assessment of the export history of the exporter as well as their related entities;
- for the grant of an export licence, an exporter must be required to demonstrate that they have systems in place to meet the national standard for livestock export; and

- for the grant of an export permit, an exporter must be required to attest that the national standard has been met.

4. Recommendation 4

'Third party' veterinarians responsible for the treatment and preparation of animals for export must be directly contracted and accountable to AQIS in the performance of their duties:

- they must be registered with a state veterinary board;
- their responsibilities must be referenced in export legislation with suitable penalties for any breach;
- livestock exporters should be allocated a 'third party' veterinarian by AQIS at the time they advise AQIS that they intend to export; and
- livestock exporters should pay all costs associated with the services of these veterinarians.

5. Recommendation 5

A registered and suitably qualified and trained veterinarian should be on board all livestock export ships where the journey would take over 10 days:

- AQIS should randomly nominate at least 10% of other livestock export voyages and a veterinarian should be on those voyages;
- the veterinarian should be required to report directly to AQIS on specified matters including any animal mortalities or morbidity, and any environmental conditions on the ship that might impact on the health and welfare of the animals, including any malfunction of feeding, watering or ventilation systems;
- copies of the veterinarian's report should be made available to industry to enable it to enhance its quality assurance programs; and
- livestock exporters should pay all costs associated with the services of these veterinarians.

Industry should continue to develop its Shipboard Program for stockmen to ensure appropriate knowledge and skills are available on board vessels during a voyage.

6. Recommendation 6

There must be a continuation of the current industry investment in rigorous research and development programs on the suitability of different types of livestock for export:

- in the meantime exports should be banned in circumstances where the available evidence indicates that the risks of adverse outcomes are predictably high;
- this would mean the closure of ports such as Portland and Adelaide during those periods of the year when the risks are greatest.

7. Recommendation 7

Government and industry must work cooperatively to secure the agreement of a country in the Middle East region to establish an operational quarantine holding facility by the end of December 2004:

- if such a facility is not available by that time, the livestock trade to the region should be reviewed;
- if animals exported from Australia are not unloaded within 48 hours of the ship berthing, they must be moved as quickly as possible to the quarantine facility; and
- the quarantine facility must allow for testing and analysis of animals in the shipment for final determination, access to a robust and transparent dispute resolution mechanism, and quick destruction of the animals if necessary.

The livestock export trade with Saudi Arabia must not resume until there are robust written conditions determined between the governments of Australia and Saudi Arabia which ensure that:

- Saudi Arabia or the Gulf Cooperation Council is involved at an early stage, possibly pre-embarkation, in approving the health status of the animals;
- testing and analysis of the animals in the shipment at the time of first arrival is transparent and reliable; and
- the animals can be moved to the quarantine holding facility for further determination.

8. Recommendation 8

A national response system should be established to plan and manage any future livestock export emergency, possibly modelled on AUSVETPLAN.

12 Appendix 3: Recommendations from the Farmer Review

1. Recommendation 1

The Review recommends that the Australian Government expedite work with the states and territories to more clearly articulate respective roles and responsibilities for regulating the livestock export supply chain.

2. Recommendation 2

The Review recommends that the Australian Government urge the states and territories to develop and implement, as a priority, enforceable standards of welfare to replace Codes of Practice, incorporate the standards into legislation and prepare and implement compliance programs to monitor and enforce the regulations in the domestic phase of the livestock export trade.

Cattle, sheep and goat welfare standards should be produced as a priority for incorporation into state and territory legislation.

3. Recommendation 3

The Review recommends that in line with ASEL, industry develop and implement a through-chain QA system to complement government regulatory compliance programs.

4. Recommendation 4

The Review recommends that the current inspection regime prior to export from Fremantle be reviewed, to ensure that thorough individual animal inspection by the AAV is conducted.

5. Recommendation 5

The Review recommends that the existing system of exporters contracting AAVs and stockpersons be supplemented by the following provisions:

- enhanced auditing processes including targeted on-site (including shipboard) audit
- daily and end-of-voyage reports to be forwarded to AQIS and the exporter simultaneously
- enhanced training and induction processes for AAVs
- consideration by industry of enhanced training and mentoring programs for stockpersons.

6. Recommendation 6

The Review recommends that a comprehensive review of ASEL be undertaken.

- The review should inter alia examine the policy on export of sheep from southern ports to the Middle East in winter months, with a view to:
 - mitigate feedlot and shipboard losses in adverse weather conditions
 - mitigate losses from heat stress and inanition during the voyage.
- The review should also consider additional specific criteria, identified in recent industry-funded research, for selection of suitable livestock for export.

7. Recommendation 7

The Review recommends that the role and function of the Livestock Export Standards Advisory Group should be reviewed.

8. Recommendation 8

The Review recommends that the Australian Government should work with states and territories and industry to implement individual identification of all sheep and goats as soon as practicable.

As a priority, current exemptions applying to export cattle from the Northern Territory and Western Australia should be removed.

9. Recommendation

The Review recommends that the Australian Government, on the basis of its recent decisions, recommendations in this Review and recommendations by Industry Government Working Groups, set out a clear statement of its intended policy and operational approaches to the livestock export industry, emphasising the elements of sustainability of trade and assurance of animal welfare for exported Australian livestock.

10. Recommendation 10

The Review recommends that the approach developed for the export of feeder and slaughter livestock to Indonesia should be developed for all supply chains (that is, all markets and all species of feeder and slaughter livestock), with variations which might be necessary to take account of different species or market circumstances. The minimum requirements should be that all elements of the supply chain must meet, at a minimum, the OIE standards; that animals entering a supply chain must be accounted for; that there be independent third party assessment of each supply chain; and that the exporter demonstrate whole of supply chain control, enabling accounting for animals and ensuring treatment according to OIE standards.

In implementing the new arrangements, the Australian Government should set a timeframe which will take account of the following elements:

- a. There should be consultation with foreign governments.
- b. There should be consultation with Australian industry.
- c. There should be a clear articulation of regulatory mechanisms, expectations and requirements.
- d. The process should be completed for all supply chains by the end of 2012.
- e. The process should set out priorities for attention, beginning with the largest markets or others with special circumstances; any proposed exports to new markets should be subject to the proposed arrangements with immediate effect.
- f. There should be no interruption of trade in the meantime.

11. Recommendation 11

The Review recommends that industry should make its own plans to move to arrangements consistent with the proposed approach and do so to the extent possible before the onset of transition timeframes established by the Australian Government. The prevention of leakage from supply chains should be a particular priority in the immediate future.

12. Recommendation 12

The Review recommends that:

- DAFF/AQIS should examine resourcing, information and other requirements necessary for the efficient discharge of policy advice, regulatory and other responsibilities in relation to the overseas elements of the supply chain.
- DAFF/AQIS should also review issues identified in the Review in relation to service delivery and regulation in the domestic elements of the supply chain.

13. Recommendation 13

The Review recommends that, on the basis of experience during the implementation of the new arrangements, the Australian Government should if necessary refine the requirements. It should report to the Australian Parliament by June 2013, outlining initial experience and making judgements about the effectiveness of the approach in delivering animal welfare outcomes and facilitating trade.

14. Recommendation 14

The Review recommends that the Australian Government should articulate an approach to the question whether there is a need for any additional conditions for the export trade in breeder livestock.