



Department of  
Primary Industries and  
Regional Development



# Final report

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## National livestock export industry sheep, cattle & goat transport performance report 2020

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Date published: March 2021

PUBLISHED BY  
Meat & Livestock Australia Limited  
PO Box 1961  
NORTH SYDNEY NSW 2059

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

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## Executive Summary

The objective of this report was to summarise the performance of the Australian livestock export industry in terms of mortality levels of sheep, cattle and goats exported by sea and air from Australia during 2020. It has a new format compared to that of the report series covering years 1988 to 2018.

Industry stakeholders, government, animal welfare groups and the general public have a keen interest in monitoring performance in different sectors of the livestock export trade. This report provides the only comprehensive breakdown by species, ships, load ports and major destinations over the calendar year.

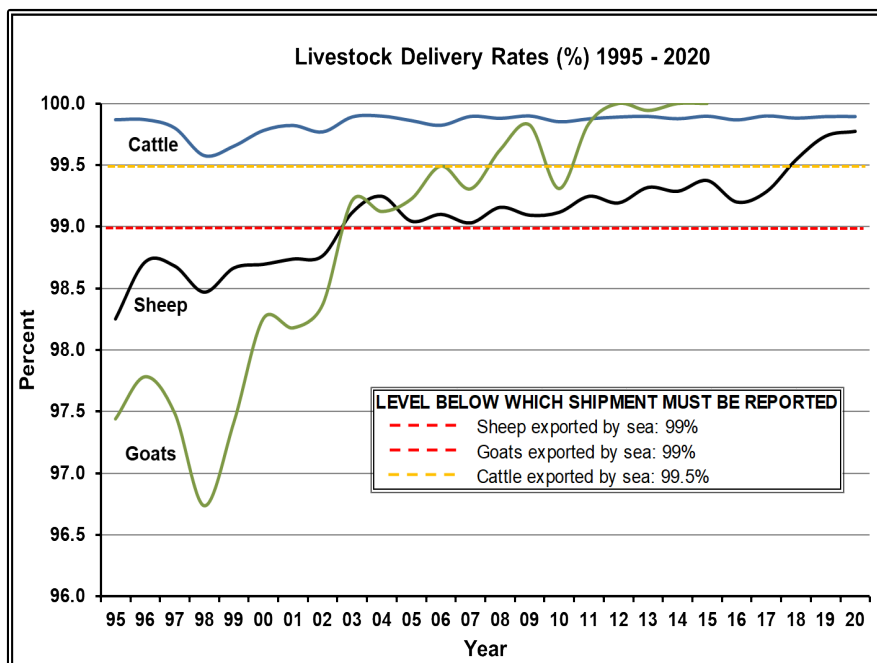
Previously documented comparisons over time (year on year, region to region) have been disrupted by the Middle East export restrictions introduced in 2018. These comparisons will again be made in the future when enough data describing the new export timeframes has been gathered to allow meaningful results.

The overall mortality rate for sheep during sea transport to all destinations during 2020 was 0.22% (1,739 mortalities in 0.78 million sheep exported). This was a 15% fall compared to the mortality rate of 0.26% observed in 2019. All sheep exported by sea during 2020 were loaded at Fremantle, Western Australia.

The overall mortality rate for cattle during sea transport to all destinations during 2020 was 0.11% (1,107 mortalities in 1.04 million cattle exported), the same as observed in 2019. The overall regional mortality rates were: Middle East/North Africa, 0.14% (72 mortalities in 52,000 cattle exported); South-East Europe, 0.38% (116 mortalities in 31,000 cattle exported); North-East Asia, 0.16% (225 mortalities in 143,000 cattle exported); and South-East Asia, 0.9% (694 mortalities in 816,000 cattle exported).

No goats were exported by sea from Australia in 2020.

Percentages of sheep, cattle and goats successfully delivered by sea since 1995 are shown below.



Summary information regarding the 33,683 sheep, 6,411 cattle and 8,400 goats exported by air during 2020 has also been included in this report. These experienced overall mortality rates of 0.01% (3 mortalities), 0.02% (1 mortality) and 0.01% (1 mortality) respectively.

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## 1. Background

In 2020 the live export of sheep, cattle and goats made a significant contribution to the Australian economy, valued at around \$1,470 million, and provided employment in the many services that support this industry. The livestock export trade provides important support for the sheep, cattle and goat industries of Australia and is the only market outlet for producers in some areas of the country.

This current report summarises information about mortalities in sheep, cattle and goats during sea and air transport from Australia during the calendar year 2020, providing ongoing evidence of the industry's willingness to fully expose its performance to public scrutiny.

The Australian Government Department of Agriculture, Water and Environment (DAWE) also presents mortality data, though in a different format, under "Reports to Parliament" at their website:

<http://www.agriculture.gov.au/export/controlled-goods/live-animals/live-animal-export-statistics/reports-to-parliament>.

It should be noted that the DAWE mortality figures refer only to voyages for which data was *received* during the calendar year, in contrast to this current report which refers to the complete set of data for all voyages which *departed* during the calendar year.

DA undertakes investigations into voyages that exceed certain mortality limits, publishing their findings under "Investigations into mortalities" at their website:

<https://www.agriculture.gov.au/export/controlled-goods/live-animals/livestock/regulatory-framework/compliance-investigations/investigations-mortalities>

For this current report, where high mortality figures are detailed, the relevant investigation(s) can be viewed at the above website.

Summary information on areas of new and ongoing research can be viewed at the following website: <https://livecorp.com.au/researchAndDevelopment>

## 2. Objectives

The project objectives were to:

- a) Produce a report which summarises the mortality of sheep, cattle and goats exported from Australia for the 2020 calendar year and provide an informed analysis of mortality trends in the livestock export industry;
- b) Maintain data and expertise to provide analysis and informed comment.

## 3. Methodology

The information in this report was obtained from ship Master's Reports (which record voyage livestock mortalities dates and times for ports of loading and discharge), other tailored shipboard records and from "Yellow Books", which record more-detailed information than is available from the Master's Report (including daily mortality for each deck by type-age-sex categories over the loading, voyage and discharge phases).

It should be noted that high-mortality voyages have always been and will continue to be included in summary figures in this series of publications.

This current report is for all voyages and flights which departed Australia during the calendar year 2020. Information on the number of sheep exported to various destination countries from ports in Australia was compiled from records supplied by ships and Livestock Export Companies. Information for livestock exported by air was provided by DAWE.

Readers should be aware that additional mortality information for a particular year may be received after publication of that year's summary report. Such information will be added to the database and used in subsequent analyses. Therefore, statistics for a particular year may vary slightly in subsequent reports from those originally published.

In order to maintain confidentiality, individual ships are identified by codes in this report.

Summary information was produced using Statistix 10.0 (Analytical Software, 2015, Tallahassee, Florida USA).

### **3.1 Voyage**

The majority of voyages by sea involve loading at one port and discharge at one port. But each year a number of voyages involve loading at multiple Australian ports (split-load voyages), and discharge at multiple destination ports, often in different countries. Where analyses involved split-load voyages, the consignments of livestock from each load port were considered as separate "voyages", so that the definition of a "voyage" came to be "consignment from load port to discharge region".

More recently shipboard reporting has become so comprehensive that in most cases it allows tracking of consignments from individual load ports to individual discharge ports. This is a great credit to the diligence of ships' officers.

To take advantage of this comprehensive reporting, where it has been possible, all voyages have been split into separate "voyages" based on loading and discharge ports. This breakdown better reflects the actual conditions that occurred for the livestock consigned to those destinations.

It can be seen that a comprehensively reported voyage involving one or more load ports and an extended discharge phase over a number of ports, has the potential to generate numerous "voyages". So, a ship might load at three ports and discharge at two ports, effectively generating six "voyages" if livestock were sent to each discharge port from each load port. In most cases the current high quality of the information supplied allows this close description of the actual conditions experienced.

So, the definition of "voyage" has almost completely shifted from "consignment from load port to discharge region", to "consignment from load port to discharge port". While this widens the scope for voyage analyses and related research work, results in this series of publications will continue to be reported on the basis of discharge regions for the foreseeable future.

#### **3.1.1 Load, Voyage & Discharge Phases**

The shipboard part of the export process is divided into three distinct phases; Load; Voyage and Discharge. These phases are precisely demarcated by dates and times.

Date and time for the end of loading marks the end of the Load phase and the beginning of the Voyage phase. Date and time for the beginning of discharging marks the end of the Voyage phase and the beginning of the Discharge phase.

In the few cases where a ship delivers livestock to more than one discharge port without providing comprehensive information, all the mortalities after the beginning of discharge at the first port through to the end of discharge at the last port have been combined into one overall Discharge phase.

## 4. Results & Discussion

### 4.1 Sheep

#### 4.1.1 Performance Trend

Figures 1 and 2 show the number of sheep exported and the percentage of mortalities during sea transport from all ports in Australia to all destinations over the last decade as well as the trend line (linear regression) across those years. The 0.78 million sheep exported in 2020 was the lowest number exported since recording began in 1985. The number of sheep exported annually since 2011 has varied between 2.42 and 0.78 million, and the annual mortality has varied between 0.81 and 0.22%. The trend for numbers of sheep exported and annual mortality continues downward.

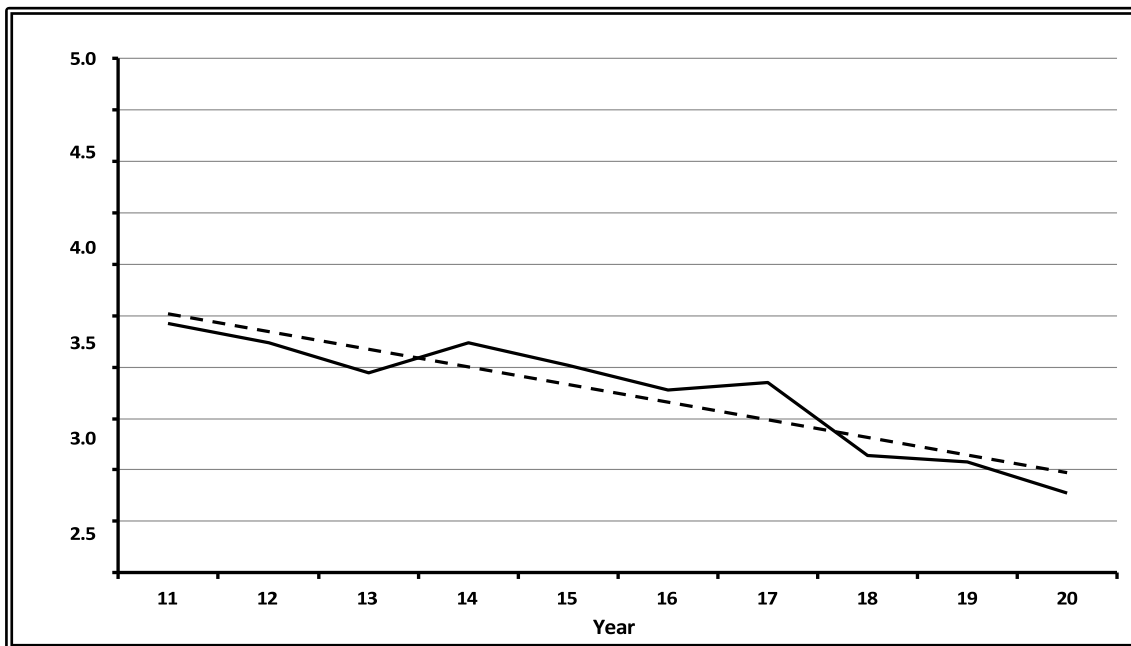


Figure 1: Number of sheep exported by sea from Australia to all destinations since 2011

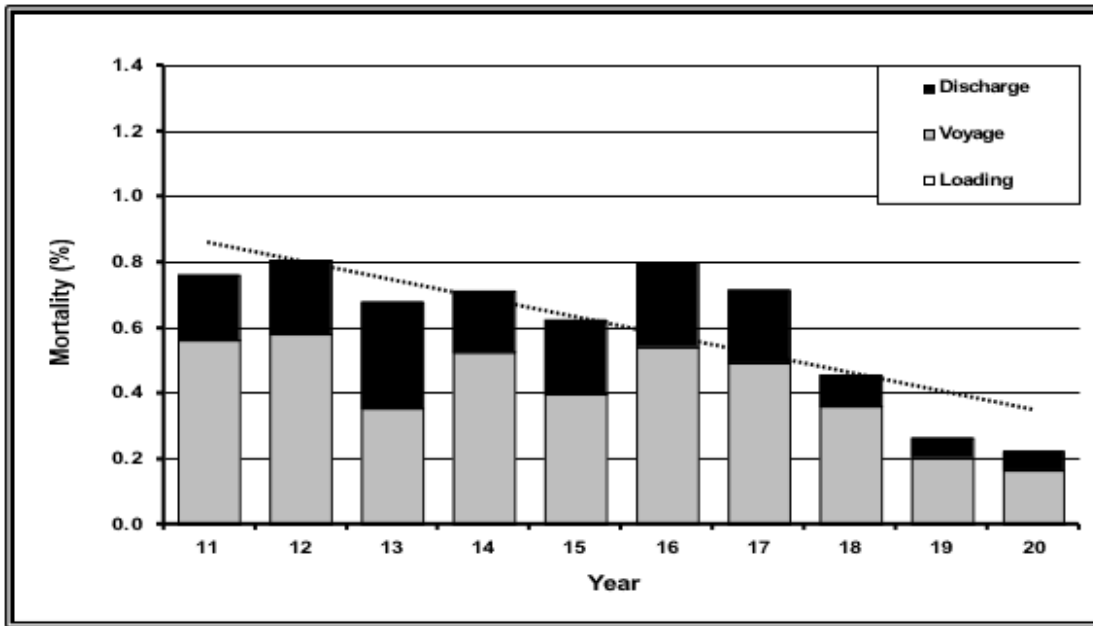


Figure 2: Annual mortality of sheep exported by sea from Australia to all destinations since 2011.

#### 4.1.2 Overview

All sheep exported live by sea from Australia in 2020 were loaded at Fremantle, Western Australia. The overall average voyage and discharge lengths were 16.57 and 3.69 days respectively (Table 1, below).

The shipboard part of the export process is divided into three phases: loading (load); voyage to the first port of unloading (voyage); and discharge. The discharge phase usually includes all mortalities after arrival at the first port. Consequently if a ship called at more than one discharge port, all the mortalities after arrival at the first port were included in the discharge phase. See the Methodology (3.1 Voyage) section of this report for a more detailed explanation of the voyage phases and instances of split-loading and split-discharging.

There were no voyages to the Middle East/North Africa or South-East Europe in 2020 for which sheep were loaded at more than one port in Australia (split-load voyage). Thirteen voyages involved discharge at multiple ports, but only two of these were able to be split by port of discharge

Using the definition of voyage described in the Methodology, there were 18 "voyages" of sheep to the Middle East/North Africa and South-East Europe during 2020. This involved 16 ship journeys, two of which were split for discharge.

769,882 sheep were exported to the Middle East/North Africa (99.0% of all sheep exported) and the average voyage length (voyage to first discharge port) for exports to this region was 16.04 days with 3.88 days for discharge. The overall mortality for these sheep was 0.22%.

7,916 sheep were exported on a single voyage from Fremantle to South-East Europe (0.01% of all sheep exported). The voyage length was 25.66 days with 0.55 days for discharge, and the mortality rate was 0.34%. These sheep will not be examined further in this report.



The overall 2020 mortality rate of 0.22% is a reduction of 15% on the 2019 figure of 0.26%.

During 2020, 60% of exports were in the hogget and lamb wether classes. All sheep were exported from Western Australia, which over time has shown a significantly lower overall mortality rate than other sources.

*Table 1: Mortality Rates, number of voyages, voyage and discharge days, and number of sheep exported for voyages to major destination regions during 2020*

Parameter	ME/N Africa	SE Europe	Total
Voyages (No.)	17	1	18
Sheep (No.)	769,882	7,916	777,798
Mortality rate overall (%)	0.22	0.34	0.22
Mortality rate range (%)	0.08 – 0.60	n/a	0.08 – 0.60
Voyage days (Ave.)	16.04	25.66	16.57
Discharge days (Ave.)	3.88	0.55	3.69

#### 4.1.3 Destination Country

Countries that imported Australian sheep in 2020 are shown in Table 2. The main importing countries were Kuwait (42% of all Australian sheep exports), followed by Qatar (22%) and Jordan (16%).

Export numbers to all major markets fell during 2020, with an overall fall of 27% compared to 2019.

Exports to Qatar, UAE, Jordan and Kuwait fell by 46%, 42%, 30% and 12% respectively.

*Table 2: Destination Countries for sheep exported from Australia during 2020*

Country	Fremantle	Other	Total
Israel	27,879		27,879
Jordan	133,106		133,106
Kuwait	337,597		337,597
Oman	32,000		32,000
Qatar	180,000		180,000
Russia	7,916		7,916
U.A.E.	59,300	115	59,415
S.E. Asia		30,255	30,255
N.E. Asia		760	760
Other		2,553	2,553
<b>Total</b>	<b>777,798</b>	<b>33,683</b>	<b>811,481</b>

Note: figures include exports by air

#### 4.1.4 Middle East/North Africa

Over the last decade the numbers of sheep shipped to the Middle East/North Africa and the overall mortality experienced has fallen by almost three quarters.

The number of sheep exported to the Middle East/North Africa in 2020 was 769,882 (99.0% of all sheep exported) and the average voyage length (voyage to first discharge port) for exports to this region was 16.04 days with 3.88 days for discharge (Table 3). The overall mortality for these sheep was 0.22%.

Table 3 Mortality rates, number of voyages, average voyage and discharge length, and number of sheep exported to Middle East/North Africa from 2011 to 2020

Year	Voyages (No.)	Sheep (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days
2011	45	2,068,498	0.746	0.25 – 2.42	17.02	5.81
2012	37	1,978,618	0.811	0.18 – 4.23	17.01	4.14
2013	37	1,939,501	0.680	0.16 – 7.28	16.31	6.25
2014	42	2,227,868	0.709	0.22 – 3.89	17.20	5.92
2015	38	2,005,913	0.623	0.15 – 1.75	16.96	5.73
2016	41	1,758,898	0.795	0.20 – 2.99	17.15	5.12
2017	57	1,646,965	0.741	0.15 – 4.58	17.45	3.14
2018	25	903,149	0.451	0.13 – 1.96	17.13	4.15
2019	23	1,060,274	0.261	0.11 – 0.62	16.76	3.20
2020	18	769,882	0.224	0.08 – 0.60	16.04	3.88

**4.1.4.1 Port of Loading**

All sheep exported by sea from Australia to the Middle East/North Africa during 2020 were loaded at the port of Fremantle (Table 3, above). This is the second year running that Fremantle has borne all the trade to the region.

The number of sheep exported by sea to the Middle East/North Africa during 2020 are shown in Figure 3. Overall numbers exported to the region in 2020 fell by 27.4% compared to 2019.

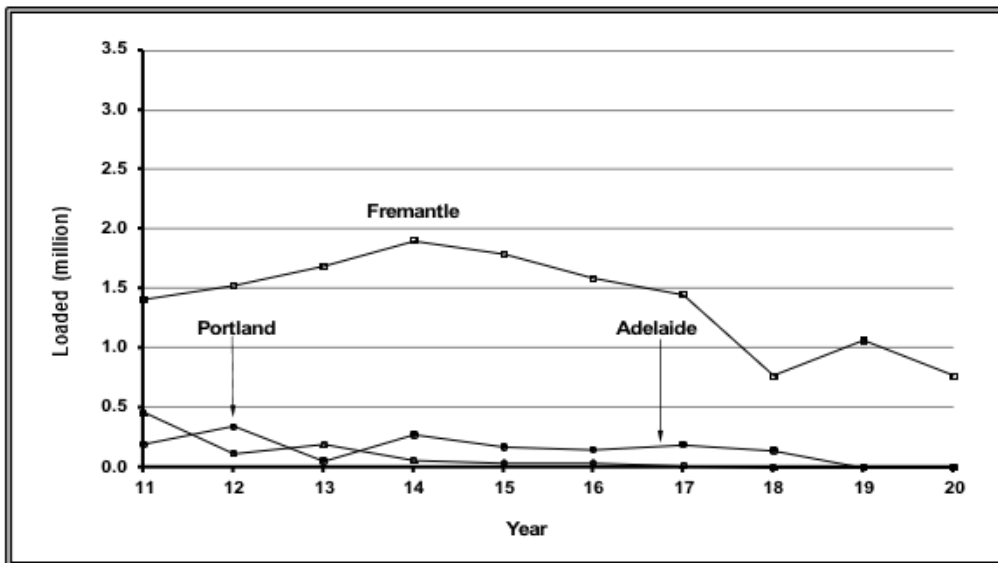


Figure 3 Number of sheep exported by sea to the Middle East/North Africa from Fremantle (Western Australia), Portland (Victoria) and Adelaide (South Australia) since 2011

#### 4.1.4.2 Mortality Rates

The total mortality rate for all sheep exported to all destination regions during 2020 was 0.22% (see Table 1 above).

For sheep exported to the Middle East/North Africa during 2020, the Fremantle total mortality rate fell to 0.22% in 2020, a fall of 14% compared to the 2019 figure of 0.26%.

No sheep were exported to the region from either Adelaide or Portland.

Since 2018, regional and annual mortality rates are no longer comparable because of the legislated restrictions imposed on exports to the Middle East/North Africa region during the Middle-Eastern summer.

When a substantial body of data representing these changed conditions has been gathered, analyses involving trends over time will be re-introduced to this series of reports.

#### 4.1.4.3 Class of Sheep

The numbers and mortality rates of the various classes of sheep exported from Australia to the Middle East/North Africa are shown in Table 4 and Figure 4. The highest total mortality rates by class for 2020 were in hogget and lamb ram classes (0.69% and 0.44% respectively), followed by ram adults and ewe lambs both with 0.36%.

The greater numbers of wether classes and their lower mortality percentages account for the overall low outcome experienced in 2020.

*Table 4 The numbers and overall mortality (%) for classes of sheep exported by sea to the Middle East/North Africa from Australia during 2020.*

	Livestock	Fremantle	% Mortality
Wethers	adults	219,062	0.21
	hoggets	157,291	0.17
	lambs	287,846	0.24
Rams	adults	12,883	0.36
	hoggets	2,476	0.69
	lambs	15,812	0.44
Ewes	adults	0	0
	hoggets	0	0
	lambs	2,532	0.36
Total	sheep	769,882	0.22

WA = wether adults  
RA = ram adults  
EA = ewe adults

WH = wether hoggets  
RH = ram hoggets  
EH = ewe hoggets

WL = wether lambs  
RL = ram lambs  
EL = ewe lambs

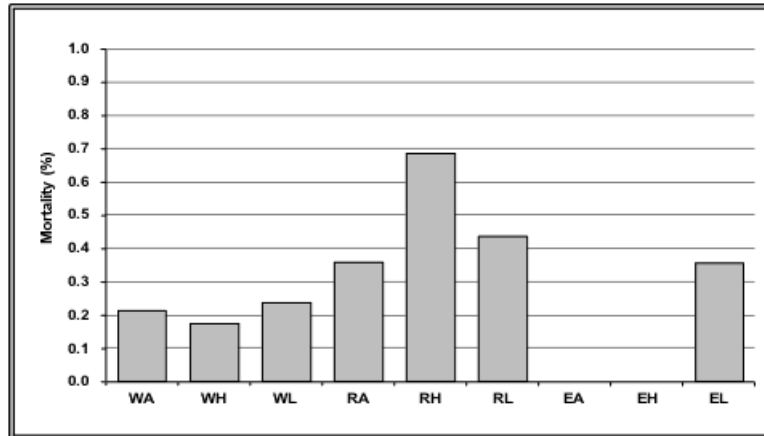


Figure 4 Overall mortality (%) for classes of sheep exported from Fremantle to the Middle East/North Africa in 2020

A number of class-related mortality patterns have prevailed over the duration of the Live Sheep Export Trade. These have been clearly demonstrated in previous reports in this series.

The overall annual mortality rate is closely linked to the adult wether mortality rate. This is because historically this class has comprised the vast majority of Trade.

All the ram classes and adult ewes have consistently returned higher mortality rates, their contribution to overall mortality being limited by their lower numbers exported.

Wether hoggets and lambs, and ewe lambs have consistently returned lower mortality rates, again their contribution being limited by their lower numbers exported. While it seems unusually high, the 2020 ewe lamb mortality rate of 0.36% was not significantly different from the 0.145 experienced in 2019.

Once again, these patterns are broadly reflected in the 2019 class mortality results (Figure 5, above).

#### 4.1.4.4 Time of year and age of sheep

Previous reports in this series show clearly that there are indisputable patterns of seasonal difference in mortality rates for all classes of sheep when examined by sex and age. The only exception is for ewe hoggets, which are not exported in sufficient numbers to allow reliable conclusions to be drawn.

These established patterns include:

- A significantly lower mortality rate in the first half of the year compared to the second half
- An annual pattern of monthly mortality rate with lower mortalities over the months February to May and higher mortalities over the months June to September.
- A higher mortality rate seen in adults compared to the younger hoggets or lambs – though this distinction has become blurred in recent years, as less sheep, and particularly lower proportions of wethers, have been exported.

#### 4.1.4.5 Ship

The voyages of each ship were classified into low (mortality rate up to 1.0%), medium (mortality rate from 1.0 to 2.0%) and high (mortality rate greater than 2.0%) mortality categories for sheep exported to the Middle East/North Africa from Fremantle (Table 5).

There were no voyages carrying sheep to the region from either Adelaide or Portland during 2020.

There were no voyages in the “high” category during 2020. All voyages from Fremantle were in the “low” category.

Table 5: Number of voyages in low, medium and high mortality categories for ships loaded at Fremantle in 2020

Ship (code)	Mortality rate			Total
	Low <1.0%	Medium 1.0 – 2.0%	High >2.0%	
32	3	0	0	3
34	3	0	0	3
35	5	0	0	5
43	1	0	0	1
137	1	0	0	1
139	1	0	0	1
142	3	0	0	3
Total	17	0	0	17

## 4.2 Cattle

### 4.2.1 Performance Trend

The number of cattle shipped from all ports in Australia to all destinations since 2011 as well as the trend line (linear regression) across those years is shown in Figure 5. Figure 6 shows the number of cattle mortalities during sea transport since 2011. The number of cattle exported annually has varied from approximately 620,000 to 1,310,000, and the annual mortality has varied between 0.10 and 0.12%. The overall trend for numbers of cattle exported is upwards while the trend for annual mortality continues slightly downward.

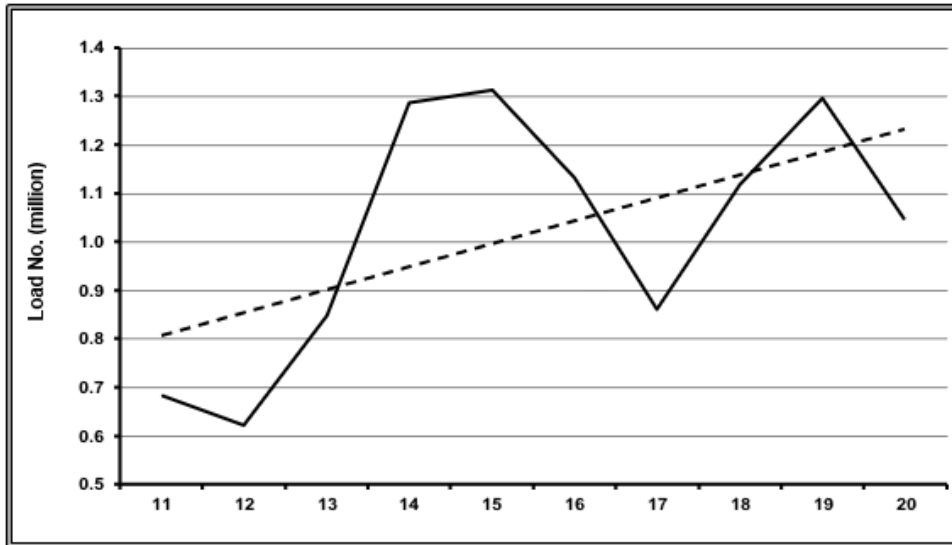


Figure 5: Number of cattle exported by sea from Australia to all destinations since 2011

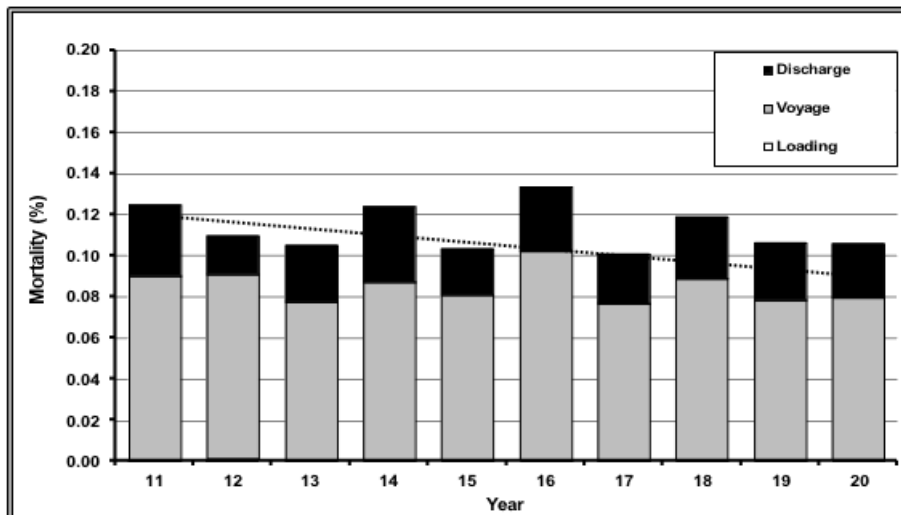


Figure 6: Annual mortality of cattle exported by sea from Australia to all destinations since 2011

#### 4.2.2 Overview

The live cattle trade from Australia continues to be characterised by the large number of loading ports in Australia and the widely distributed destination ports. This differs from the live sheep trade which usually has only three southern ports of loading, with the majority of sheep being shipped to the Middle East/North Africa.

There were 338 cattle "voyages" during 2020. This involved 316 ship journeys, which was 11% less than in 2019. There were 16 ship journeys which were split for loading or discharge, and these generated a further 22 "voyages" as a result.

Where analysis involving split-load/discharge voyages has been performed, cattle consignments from each load port to each discharge port have been considered as separate "voyages". See the

Methodology (3.1 Voyage) section of this report for a more detailed explanation of the voyage phases and the involvement of split-loading and split-discharging.

The overall number of cattle exported from Australia in 2020 fell by 19% compared to 2019, to 1.04 million (Table 11, below). The overall mortality rate in 2020 was 0.106%, the same figure as that observed in 2019. 31% of all cattle voyages returned a nil mortality rate during 2020.

The highest overall mortality rate on a regional basis was for exports to South-Eastern Europe (0.38%), while the lowest overall mortality rate, as expected, was for exports to South-East Asia (0.09%). There were no exports to either Mexico or Miscellaneous destinations in 2020

The number of cattle exported to the Middle East/North Africa in 2020 fell by 45% compared to 2019. The number of voyages to the region fell by 47% compared to 2019, while the mortality rate fell by 42% from 0.24% in 2019 to 0.14% in 2020.

Exports to South-East Asia fell by 17% in 2020 compared to 2019. The number of voyages fell by 12%, from 299 in 2019 to 263 in 2020. Trade to South-East Asia accounted for 78% of all cattle exported in 2020.

Exporting to South-East Asia involves a mix of smaller ships performing short single-load/single-discharge voyages, and larger ships that load and/or discharge at more than one port. In 2020, these larger vessels accounted for 19% of the cattle exported and 9% of the voyages made to South-East Asia.

Exports to North-East Asia in 2020 fell by 17% compared to 2019. The mortality rate for the region rose by 14%, from 0.14% in 2019 to 0.16% in 2020.

Exports to South-East Europe in 2020 fell by 16% compared to 2019, while the mortality rate rose by 138%, from 0.16% in 2019 to 0.38% in 2020.

*Table 6: Mortality rates, number of voyages, voyage and discharge days, and number of cattle exported for voyages to major destination regions during 2020*

Parameter	ME/N Africa	SE Asia	NE Asia	SE Europe	Total
Voyages (No.)	27	263	44	4	338
Cattle (No.)	51,605	816,265	143,496	30,973	1,042,339
Mortality rate o/all (%)	0.14	0.09	0.16	0.38	0.11
Mortality rate range (%)	0.00 – 0.79	0.00 – 0.64	0.00 – 0.67	0.21 – 0.46	0.00 – 0.79
Voyage days (Ave.)	17.65	7.79	16.23	28.71	9.92
Discharge days (Ave.)	0.53	0.93	0.85	4.78	0.93
Voyages with nil mortalities (No.)	15	84	7	0	106

#### 4.2.3 Middle East/North Africa

The number of live cattle exported to the Middle East/North Africa during 2020 fell by 45% compared to 2019 (Table 12), while the number of voyages also fell by 47%.

The mortality rate for these cattle fell by 42% from 0.24% in 2019 to 0.14% in 2020.

It should also be noted that since 2018, regional and annual mortality rates are actually no longer comparable because of the legislated restrictions imposed on exports to the Middle East/North Africa region during the Middle-Eastern summer.

Table 7: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported to the Middle East/North Africa from 2011 to 2020

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
2011	28	80,180	0.17	0.00 – 0.67	17.91	3.14	10
2012	31	98,236	0.16	0.00 – 0.86	18.53	2.74	11
2013	33	121,780	0.17	0.00 – 0.44	19.28	3.99	12
2014	25	106,065	0.36	0.00 – 2.75	19.21	4.72	11
2015	31	99,558	0.26	0.00 – 0.78	19.10	3.21	12
2016	28	72,721	0.30	0.00 – 0.72	17.77	4.33	14
2017	26	41,384	0.17	0.00 – 1.00	17.14	4.13	15
2018	28	67,006	0.14	0.00 – 0.60	18.04	3.47	10
2019	51	93,730	0.24	0.00 – 1.39	17.86	0.81	31
2020	27	51,605	0.14	0.00 – 0.79	17.65	0.53	15

#### 4.2.3.1 Port of Loading

There were only two ports of loading for voyages to the Middle East/North Africa in 2020, with 90% of cattle being exported from Fremantle and the remainder from Portland (Table 13). The port with the highest mortality rate in 2020 was Fremantle.

The percentage of voyages in the nil or low mortality categories was 96% for Fremantle, and 100% for Portland (Table 9).

Table 8: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported from various ports to the Middle East/North Africa for 2020

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days
Fremantle	24	46,503	0.14	0.00 – 0.79	17.09	0.52
Portland	3	5,102	0.10	0.07 – 0.20	22.08	0.60

Table 9: Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to the Middle East/North Africa for 2020

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
Fremantle	15	8	1	0	24
Portland	0	3	0	0	3
Total	15	11	1	0	27



### 4.2.3.2 Ship

The voyages of each ship carrying cattle from Australia to the Middle East/North Africa were classified into four mortality categories: nil (no mortalities); low (mortality rate up to 0.5%); medium (from 0.5 to 1.0%); and high (greater than 1.0%).

Table 10 shows the number of voyages in the various mortality categories for each ship. There was only one voyage in the medium or high categories, involving ship 43. 96% of voyages were in the nil or low categories.

Table 10: Number of voyages in nil, low, medium and high mortality categories for shipments to the Middle East/North Africa for 2020

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
32	6	1	0	0	7
35	1	3	0	0	4
43	1	2	1	0	4
77	0	1	0	0	1
137	3	0	0	0	3
139	0	4	0	0	4
141	4	0	0	0	4
Total	15	11	1	0	27

### 4.2.3.3 Class of Cattle

Bull classes made up 65% of all cattle shipped to Middle East/North Africa in 2020.

The highest overall class mortality rates occurred in adult steers and dairy cows, both with 0.20% (Table 11).

Table 11: Mortality rates, number of voyages and number of cattle in various classes exported to the Middle East/North Africa in 2020

Class	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Bull adults*	16	21,508	0.14	0.00 – 0.36
Bull weaners	8	12,139	0.08	0.00 – 0.36
Heifers beef	6	6,505	0.18	0.00 – 0.82
Steer adults*	19	4,934	0.20	0.00 – 1.80
Heifers dairy	4	4,454	0.11	0.00 – 0.79
Steer weaners	4	1,085	0.18	0.00 – 0.64
Cows dairy	1	980	0.20	n/a

\*may include young as well as mature animals (i.e. animals not separately classified as 'weaner')

#### 4.2.4 South-East Asia

The number of cattle exported to South-East Asia in 2020 fell by 17% compared to 2019 and the number of voyages fell by 12% (Table 12). The overall mortality rate has remained under 0.1% over the last decade, at an average of 0.08%.

The overall mortality rate for voyages to the region has remained remarkably stable at 0.08 – 0.09% for the last eight years.

Cattle exports to the region accounted for 78% of the overall numbers shipped in 2020.

A nil mortality rate was reported on 32% of the voyages to the region.

*Table 12: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported to South-East Asia from 2011 to 2020*

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
2011	113	446,708	0.04	0.00 – 0.79	6.95	1.72	55
2012	127	361,383	0.04	0.00 – 0.80	6.71	1.32	63
2013	177	594,457	0.08	0.00 – 0.73	7.27	1.92	71
2014	266	995,138	0.08	0.00 – 3.52	7.66	1.55	96
2015	310	1,066,664	0.08	0.00 – 3.68	8.34	1.52	102
2016	272	863,960	0.09	0.00 – 1.42	7.96	1.47	86
2017	231	704,683	0.09	0.00 – 10.05	7.46	1.44	83
2018	269	838,283	0.09	0.00 – 1.85	8.13	1.24	65
2019	299	989,627	0.09	0.00 – 2.87	8.23	1.16	83
2020	263	816,265	0.09	0.00 – 0.64	7.79	0.93	84

##### 4.2.4.1 Port of Loading

Most cattle exported to South-East Asia in 2020 were loaded at Darwin (44%) followed by Townsville (33%) and Broome (12%, Table 13). The mortality rate was highest for cattle exported from Port Alma (0.18%) followed by Fremantle (0.14%) and Townsville (0.13%).

The voyages from each port were classified into various mortality categories as shown in Table 19. 99% of voyages were in the nil or low categories in 2020. There were four voyages in the medium involving the ports of Darwin, Townsville, and Fremantle.

The port of Darwin accounted for 51% of voyages to the region.

*Table 13: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported from various ports to South-East Asia in 2020*

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days
Darwin	133	355,355	0.05	0.00 – 0.63	6.51	0.81
Townsville	69	268,480	0.13	0.00 – 0.56	10.30	1.16
Broome	29	97,942	0.06	0.00 – 0.39	6.50	1.03

Fremantle	23	64,716	0.14	0.00 – 0.64	9.83	0.88
Wyndham	6	19,982	0.01	0.00 – 0.06	5.54	0.65
Port Alma	1	3,957	0.18	n/a	13.42	1.07
Geraldton	1	3,252	0.06	n/a	6.36	0.45
Port Hedland	1	2,581	0.00	n/a	4.72	0.34

Table 14: Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to South-East Asia for 2020

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
Darwin	55	76	2	0	133
Townsville	10	58	1	0	69
Broome	11	18	0	0	29
Fremantle	3	19	1	0	23
Wyndham	4	2	0	0	6
Port Alma	0	1	0	0	1
Geraldton	0	1	0	0	1
Port Hedland	1	0	0	0	1
Total	84	175	4	0	263

#### 4.2.4.2 Ship

Voyages for each ship from Australia to South-East Asia were classified into various mortality categories as shown in Table 20. 99% of voyages were in the nil or low categories.

There were only four voyages in the medium or high categories, involving ships 59, 95, 124 and 136. The number of voyages to the region fell from 299 in 2019 to 263 in 2020, a decrease of 12%.

Exporting to South-East Asia involves a mix of smaller ships performing short single-load/single-discharge voyages, and larger ships that load and/or discharge at more than one port.

In 2020, these larger vessels with a carrying capacity of 6,000 or more head accounted for 9% of voyages to South-East Asia. They also accounted for 19% of cattle exported to the region, 22% of mortality, 11% of voyage days and 20% of discharge days.

It should be noted that the larger ships undergoing more complex loading and discharging schedules, can generate more “voyages”, as discussed in “Voyage”, Section 3.1 of the Methodology.

Table 15: Number of voyages in nil, low, medium and high mortality categories for shipments to South East Asia for 2020

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
43	1	4	0	0	5

44	0	2	0	0	2
47	2	6	0	0	8
49	3	7	0	0	10
50	0	1	0	0	1
59	3	6	1	0	10
77	4	7	0	0	11
95	1	7	1	0	9
103	4	6	0	0	10
120	11	8	0	0	19
124	5	11	1	0	17
125	2	10	0	0	12
126	9	6	0	0	15
127	3	12	0	0	15
128	2	9	0	0	11
129	4	13	0	0	17
130	4	7	0	0	11
131	1	4	0	0	5
132	1	11	0	0	12
133	12	9	0	0	21
134	0	1	0	0	1
135	3	7	0	0	10
136	8	8	1	0	17
137	0	3	0	0	3
138	1	8	0	0	9
141	0	2	0	0	2
Total	84	175	4	0	263

#### 4.2.4.3 Class of Cattle

The highest class numbers exported to South-East Asia in 2020 were adult steers (44.6%) followed by beef heifers (19.2%), adult bulls (18.3%) and weaner steers (9.5%; Table 16).

The highest class mortality rates occurred in dairy cows (0.77%) followed by dairy heifers (0.27%) and beef cows (0.21%).

Table 16: Mortality rates, number of voyages and number of cattle in various classes exported to the South- East Asia in 2020

Class	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Steer adults*	239	364,080	0.08	0.00 – 0.93
Heifers beef	158	156,961	0.04	0.00 – 0.81
Bull adults*	170	149,073	0.12	0.00 – 1.15
Steer weaners	30	77,267	0.06	0.00 – 0.60
Cows beef	78	35,320	0.21	0.00 – 1.98

Bull weaners	32	29,209	0.11	0.00 – 0.85
Heifers dairy	5	3,701	0.27	0.00 – 1.58
Cows dairy	1	654	0.77	n/a

\*may include young as well as mature animals (i.e. animals not separately classified as ‘weaner’)

#### 4.2.5 North-East Asia

The number of cattle exported to North-East Asia in 2020 fell by 17% compared to 2019, with the number of voyages falling by 12% (Table 17).

The mortality rate for voyages to the region during 2020 was 0.14%. Except for 2018, the mortality rate has remained under 0.2% over the last decade, at an average of 0.14%.

A nil mortality rate was reported on 16% of voyages to the region.

The North-East Asia cattle trade has been characterised by steers exported exclusively to Japan and dairy classes sent to China, but in 2020 slaughter classes made up 30% of cattle sent to China.

Table 17: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported to North-East Asia from 2011 to 2020

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
2011	31	68,773	0.15	0.00 – 0.46	18.08	0.87	5
2012	30	74,941	0.17	0.00 – 0.70	17.55	0.76	7
2013	31	81,521	0.15	0.00 – 1.18	17.63	0.68	5
2014	39	123,583	0.14	0.00 – 2.04	17.47	0.76	10
2015	32	98,213	0.08	0.00 – 0.56	17.35	0.66	7
2016	35	102,487	0.14	0.00 – 0.64	17.28	0.75	8
2017	31	87,877	0.11	0.00 – 0.52	17.18	0.81	4
2018	49	148,943	0.24	0.00 – 1.51	16.96	0.80	5
2019	50	172,427	0.14	0.00 – 1.37	16.04	0.79	8
2020	44	143,496	0.14	0.00 – 0.67	16.23	0.85	7

##### 4.2.5.1 Port of Loading

The majority of cattle exported to North-East Asia in 2020 departed from Portland (77%), followed by Brisbane (10%) and Fremantle (9%; Table 18). All cattle loaded at Brisbane were exported to Japan while those loaded at other ports were exported to China.

The voyages from each port were classified into various mortality categories as shown in Table 19.

During 2020 there were two voyages in the medium or high mortality categories involving the port of Fremantle, while 96% of all voyages were in the nil or low categories.

Table 18: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported from various ports to North-East Asia for 2020

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days
Portland	23	109,835	0.16	0.05 – 0.34	17.14	1.08
Brisbane	10	13,859	0.04	0.00 – 0.27	14.39	0.30
Fremantle	9	13,502	0.25	0.05 – 0.67	15.83	0.91
Geelong	2	6,300	0.13	0.06 – 0.21	16.64	0.70

Table 19: Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to North-East Asia for 2020

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
Portland	0	23	0	0	23
Brisbane	7	3	0	0	10
Fremantle	0	7	2	0	9
Geelong	0	2	0	0	2
Total	7	35	2	0	44

#### 4.2.5.2 Ship

The voyages of each ship taking cattle from Australia to North-East Asia were classified into various mortality categories as shown in Table 20.

During 2020 there were two voyages in the medium or high mortality categories, involving ship 130. 96% of voyages were in the nil or low categories.

Table 20: Number of voyages in nil, low, medium and high mortality categories for shipments to North-East Asia for 2020

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
43	0	3	0	0	3
44	0	4	0	0	4
47	0	2	0	0	2
49	0	1	0	0	1
103	0	5	0	0	5
122	7	3	0	0	10
127	0	1	0	0	1
128	0	2	0	0	2
130	0	4	2	0	6
131	0	1	0	0	1

132	0	1	0	0	1
134	0	1	0	0	1
135	0	4	0	0	4
140	0	2	0	0	2
141	0	1	0	0	1
Total	7	35	2	0	44

#### 4.2.5.3 Class of Cattle

Mortality rates for classes of cattle exported to North-East Asia during 2020 are presented in Table 21.

The North-East Asian cattle trade comprised mainly steers exported to Japan (10%), and dairy and slaughter classes exported to China (60% and 30% respectively).

The highest class numbers exported to North-East Asia in 2020 were dairy heifers (53%) followed by beef heifers (21%) and adult steers (17%).

The highest class mortality rates occurred in adult bulls (0.40%) and beef cows (0.27%).

*Table 21: Mortality rate, number of voyages and number of cattle in the classes exported to North-East Asia in 2020*

Class	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Heifers dairy	17	75,679	0.17	0.00 – 0.36
Heifers beef	18	30,268	0.19	0.00 – 1.00
Steer adults*	19	24,961	0.10	0.00 – 1.12
Cows dairy	6	9,833	0.07	0.00 – 0.13
Bull adults*	15	2,003	0.40	0.00 – 1.49
Cows beef	6	752	0.27	0.00 – 1.82

\* may include young as well as mature animals (i.e. animals not separately classified as "weaner")

#### 4.2.6 South-East Europe

The significant rise in livestock exports to Turkey and the Black Sea over the last decade initially had the effect of excessively boosting numbers of cattle exported to the Miscellaneous region. In 2012 a new destination region, South-East Europe, was introduced to allow a more meaningful examination of exports to this area.

The number of cattle exported to South-East Europe in 2020 fell by 16% compared to 2019 while the number of voyages fell from 6 to 4 (Table 12).

The overall mortality rate for cattle exported to the region was 0.38% in 2020. The mortality rate has remained at or below 0.5% over the last decade, at an average of 0.33% (Table 22).

Table 22: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported to South-East Europe from 2011 to 2020

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
2011	15	83,033	0.51	0.19 – 1.43	26.78	5.00	0
2012	14	75,170	0.28	0.00 – 0.87	28.78	3.58	1
2013	5	44,560	0.18	0.00 – 0.61	24.58	3.87	0
2014	5	54,006	0.47	0.34 – 0.60	25.62	3.88	0
2015	4	40,666	0.53	0.23 – 0.79	30.52	3.59	0
2016	12	86,846	0.29	0.08 – 0.65	24.71	1.97	0
2017	3	20,791	0.21	0.00 – 0.32	25.61	3.26	1
2018	10	61,657	0.24	0.00 – 0.47	24.80	4.68	3
2019	6	36,839	0.16	0.00 – 0.23	34.47	4.22	0
2020	4	30,973	0.38	0.21 – 0.46	28.71	4.78	0

#### 4.2.6.1 Port of Loading

All cattle exported to South-East Europe in 2020 were loaded at the southern ports of Portland (76%) followed by Fremantle (24%; Table 23).

The mortality rate was highest for cattle exported from Portland (0.43%) followed by Fremantle (0.21%).

The voyages from each port were classified into various mortality categories as shown in Table 24. All voyages were in the low or nil categories in 2020.

Table 23: Mortality rates, number of voyages, average voyage and discharge length, and number of cattle exported from various ports to South-East Europe in 2020

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days
Portland	2	23,495	0.43	0.39 – 0.46	31.54	9.56
Fremantle	2	7,478	0.21	0.21 – 0.22	25.90	9.56

Table 24: Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to South-East Europe for 2020

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
Portland	0	2	0	0	2
Fremantle	0	2	0	0	2
Total	0	4	0	0	4



#### 4.2.6.2 Ship

The voyages of each ship carrying cattle from Australia to South-East Europe were classified into various mortality categories as shown in Table 25. All voyages for 2020 were in the nil or low mortality categories.

Table 25: Number of voyages in nil, low, medium and high mortality categories for shipments to South-East Europe for 2020

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0 – 0.5%	Medium >0.5 – 1.0%	High >1.0%	
46	0	2	0	0	2
50	0	2	0	0	2
Total	0	4	0	0	4

#### 4.2.6.3 Class of cattle

Exports to South-East Europe during 2020 were made up entirely of weaner steers (Table 26).

Table 26: Mortality rate, number of voyages and number of cattle in the classes exported to South-East Europe in 2020

Class	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Weaner Steers	4	30,973	0.38	0.21 – 0.46

### 4.3 Air Transport

#### 4.3.1 Air transport of live sheep

During 2020 air transport accounted for the 4.15% of live sheep exports (33,683 out of 811,481 sheep exported). The 33,683 sheep exported by air in 2020 represents a fall of 19% compared to 2019, well below the average export figure of approximately 40,000 for the 2011 to 2020 period.

Air transport of live sheep comprises a mix of breeding and slaughter types. In 2020, 78% of air-transported sheep were for slaughter.

##### 4.3.1.1 Load point/destination

The loading points and destination countries for sheep transported by air from Australia in 2020 are shown in Table 27. Almost all sheep were loaded at Perth, Adelaide and Sydney airports, each accounting for 59.8%, 18.5%, and 12.1% of the number exported respectively.

The main importing countries for Australian sheep exported by air in 2020 were Malaysia (84.4%) and Uzbekistan (6.2%).

Table 27: Load point and destination country for sheep exported by air from Australia during 2020

Country	Adelaide	Melbourne	Perth	Sydney	Total
Malaysia	6,214		20,149	2,065	28,428
Uzbekistan		2,100			2,100
Philippines				1,609	1,609
China		610			610
India		420			420
Taiwan				150	150
UAE		115			115
Sarawak				102	102
Indonesia				66	66
Vietnam				50	50
New Zealand		16		8	24
Argentina				9	9
Total	6,214	3,261	20,149	4,059	33,683

Source: Department of Agriculture, Water and the Environment, March 2021

#### 4.3.1.2 Mortalities

As outlined in the 2020 “Australian Standards for the Export of Livestock 3.0”, the reportable level for air-transported sheep is 1.0% or 3 sheep, whichever is the greater number of animals.

There was one high mortality flight in 2013 (38.39%), 2014 (7.91%) and 2015 (18.66%). If these flights were excluded, the mortality rates for those years would have been 0.01%, 0.01% and 0.02% respectively.

For air-transported sheep from 2011 to 2020, all but 4 mortalities occurred in slaughter types and all but 17 mortalities occurred in the second half of the year. Mortalities occurred on 3.2% of flights over the decade (42 out of 1,326).

Sheep exported by air experienced 0.01% mortalities during 2020 (Table 28).

Table 28: Mortality rates and number of sheep exported by air to all destinations from 2011 to 2020

Year	Flights	Sheep (No.)	Total Mortalities (No.)	Mortality rate overall (%)
2011	94	30,865	42	0.136
2012	120	23,688	0	0.000
2013	139	35,875	45	0.125
2014	162	39,227	177	0.451
2015	194	56,945	137	0.241
2016	308	62,588	10	0.016
2017	138	42,144	16	0.038
2018	53	31,834	4	0.013
2019	69	41,505	5	0.012
2020	49	33,683	3	0.009

Source: Department of Agriculture, Water and the Environment, March 2021

Over the period 2011 to 2020, mortalities were significantly higher in the second half of the year ( $P < 0.05$ , Figure 7).

All but 17 mortalities occurred in the second half of the year over the period 2011 to 2020.

It is of interest to note that the trend line for the annual mortality profile approximates the enduring reverse tide pattern seen in sheep exported by sea.

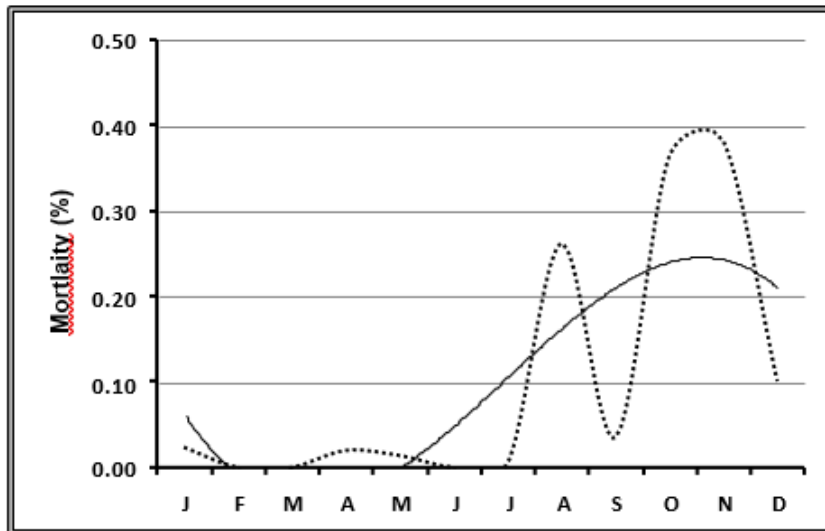


Figure 7: Monthly mortality (%) of sheep exported by air from Australia to all destinations since 2008

Mortalities were significantly higher in slaughter sheep than breeder sheep ( $P < 0.05$ ) with all but 4 mortalities occurring in slaughter types.

### 4.3.2 Air transport of live cattle

During 2020 air transport accounted for 0.88% of live cattle exports (6,411 out of 1,048,750 cattle exported).

The 6,411 cattle exported by air in 2020 represents a fall of 44% compared to 2019. The 2020 figure is well below the average export figure of approximately 9,200 for the 2011 to 2020 period.

Air transport of live cattle is almost exclusively confined to breeding types, but this figure was 91% in 2020.

#### 4.3.2.1 Load point/destination

Load points and destinations for cattle transported by air from Australia in 2020 are shown in Table 29. Almost all cattle were loaded at Sydney and Melbourne airports, accounting for 68.0% and 23% respectively.

The main importing countries for Australian cattle exported by air in 2020 were Malaysia (49%), Indonesia (15%), and Japan (10%).

Table 29: Load point and destination country for cattle exported by air from Australia during 2020

Country	Adelaide	Melbourne	Perth	Sydney	Total
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Malaysia	116		464	2,558	3,138
Indonesia		234		697	931
Japan		322		345	667
Cambodia		437		131	568
Taiwan		228		205	433
Thailand		200		149	349
Philippines				239	239
UAE		69			69
Vietnam				12	12
Sabah				5	5
Total	116	1,490	464	4,341	6,411

Source: Department of Agriculture, Water and the Environment, March 2021

#### 4.3.2.2 Mortalities

As outlined in the 2020 “Australian Standards for the Export of Livestock 3.0”, the reportable level for air- transported cattle is 0.5% or 3 cattle, whichever is the greater number of animals.

There were two high mortality flights in 2013 (6.45% and 15.26%). If these flights were excluded, the mortality rates for the year would have been nil.

Cattle exported by air experienced 0.02% mortalities during 2020 (Table 30). Mortalities occurred on 0.9% of flights over the 2011 to 2020 period (6 out of 637).

Table 30: Mortality rates and number of cattle exported by air to all destinations from 2011 to 2020

Year	Flights	Cattle (No.)	Total Mortalities (No.)	Mortality rate overall (%)
2011	48	8,738	0	0.000
2012	41	7,825	1	0.013
2013	54	9,691	67	0.691
2014	74	9,458	0	0.000
2015	76	11,315	2	0.018
2016	57	6,060	0	0.000
2017	72	9,261	0	0.000
2018	79	11,646	0	0.000
2019	85	11,466	0	0.000
2020	51	6,411	1	0.016

Source: Department of Agriculture, Water and the Environment, March 2021

#### 4.3.3 Air transport of live goats

Air transport has played a significant role in the export of live goats for many years, and during 2020 accounted for all live goat exports.

The 8,400 goats exported by air in 2020 represent a fall of 48% compared to 2019, and is well below the average figure of 47,700 for the years 2011 to 2020.

Air transport of live goats comprises a mix of breeding and slaughter types, the majority of which are for slaughter. 2019 represented a significant change, in that numbers of air-transported goats for breeding overtook numbers for slaughter. 2020 saw a continuation of this reversal, with breeding goats (61%) again outnumbering slaughter goats (39%).

#### 4.3.3.1 Load point/destination

The loading points and destination countries for goats transported by air from Australia in 2020 are shown in Table 31.

47% of these goats were loaded at Melbourne airport, with Perth, Sydney and Adelaide airports each taking approximately one third of the remainder.

The main importing countries for Australian goats exported by air in 2020 were China (45%), Malaysia (41%) and the Philippines (8%).

Table 31: Load point and destination country for goats exported by air from Australia during 2020

Country	Adelaide	Melbourne	Perth	Sydney	Total
China		3,763			3,763
Malaysia	1,459		1,498	522	3,479
Philippines				651	651
Indonesia		101		92	193
Nepal		28		83	111
UAE		70			70
Vietnam				65	65
Thailand				57	57
New Zealand		11			44
Total	1,459	3,973	1,498	1,470	8,400

Source: Department of Agriculture, Water and the Environment, March 2021

#### 4.3.3.2 Mortalities

As outlined in the 2020 “Australian Standards for the Export of Livestock 3.0”, the reportable level for air-transported goats is 1.0% or 3 goats, whichever is the greater number of animals.

For the years 2011 to 2020, there has been only one flight with a reportable mortality level.

All mortalities for goats transported by air from 2011 to 2020 occurred in slaughter types except for one breeder goat in 2017 and three breeder goats in 2018.

While breeder goats have outnumbered slaughter goats for the past two years, it should be noted that slaughter types have made up the vast majority of goats exported over 2011 to 2020 (88.8% of all goats exported by air).

Mortalities occurred on 4.4% of flights (42 out of 964) over the decade.

Goats exported by air experienced 0.012% mortalities during 2020 (Table 32).

Table 32: Mortality rates and number of goats exported by air to all destinations from 2011 to 2020

Year	Flights	Goats (No.)	Total Mortalities (No.)	Mortality rate overall (%)
2011	99	51,487	1	0.002
2012	90	64,209	0	0.000
2013	111	74,484	9	0.012
2014	160	86,705	11	0.013
2015	129	86,925	74	0.085
2016	130	83,959	22	0.041
2017	54	12,245	2	0.016
2018	69	22,644	12	0.053
2019	88	16,059	4	0.025
2020	34	8,400	1	0.012

Source: Department of Agriculture, Water and the Environment, March 2021

Over the period 2011 to 2020, mortalities were significantly higher in the second half of the year ( $P < 0.05$ , Figure 8).

Overall, 81% of mortalities occurred in the second half of the year over the period 2011 to 2020.

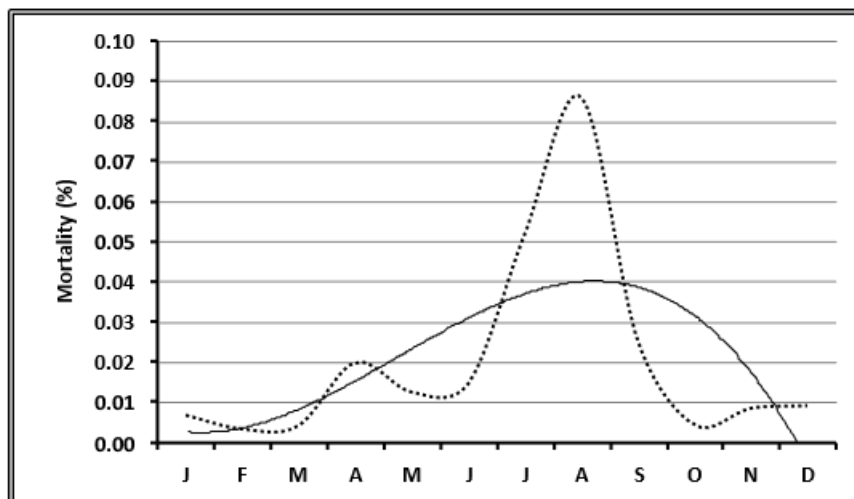


Figure 8: Monthly mortality (%) of goats exported by air from Australia to all destinations since 2008

## 5. Conclusion & Recommendations

This report successfully summarises the mortalities of sheep, cattle and goats exported live for the 2020 calendar year. Mortality trends were analysed and the overall mortalities for sheep and cattle exported by sea were shown to be 0.224% and 0.106% respectively, while overall mortalities for sheep, cattle and goats exported by air were 0.009%, 0.016% and 0.012% respectively. No goats were exported by sea in 2020.

This is the only comprehensive report of its type, providing breakdowns by ship, species, time of year, load ports and major destinations over the calendar year for both shipboard and air exports, as well as summary analyses of trends over time.

It is recommended that expression of results move from rates (mortality/loaded) to median values, with comparisons made to standardised measures of performance in the trade for classes of animal, time of year, destination etc. This use of standardised rates is intended to further clarify trends over time.

Much of the analysis for the South-East Asia region has been derived from the ship Master's Report, a voyage report for all shipments of livestock that must provide details meeting the reporting requirements of AMSA and DAWE. Unfortunately, a version of the ship Master's Report introduced in 2009 excluded details crucial to this study, therefore we needed additional and ongoing Industry input from that time. Only recently, in mid-2018, a newer Master's Report version saw much of the previous information re-introduced, once again enabling much of the analysis for the South-East Asia region to be taken from this source. This has removed a significant burden for ships' Officers who have voluntarily filled the gap over the previous decade. Industry cooperation in the matter is laudable for the wholehearted support shown.

It is recommended that the list of DA mortality investigations be replaced by the one reference, as mentioned in the project Background (Section 1), to their website where all their investigations are noted. These can be found at: [Investigations into notifiable mortality incidents - DAFF \(agriculture.gov.au\)](https://www.agriculture.gov.au)

It is also recommended that the Research Update section, outlining areas of new and ongoing research in the Live Export Trade, be replaced by references in the Bibliography section to MLA / LiveCorp summary information that can be viewed at the following website: [LiveCorp - Research & Development](https://www.livecorp.com.au)

As mentioned in the Executive Summary, previously documented comparisons over time (year on year, region to region) have been disrupted by the 2018 Middle East export restrictions. It is recommended that these comparisons be made again in the future when enough data describing the new export timeframes has been gathered to allow meaningful results.

## **6. Appendix**

### **6.1 Appendix 1 – Published Studies**

A list of scientific and extension publications, relevant to the Livestock Export Trade, follows in date order.

Norris, RT and Richards, RB (1989) Deaths in sheep exported by sea from Western Australia – analysis of ship Master's reports Aust Vet J 66: 97-102

Norris, RT, Richards, RB and Dunlop, RH (1989a) An epidemiological study of sheep deaths before and during export by sea from Western Australia Aust Vet J 66: 276-279

Norris, RT, Richards, RB and Dunlop, RH (1989b) Pre-embarkation risk factors for sheep deaths during export by sea from Western Australia Aust Vet J 66: 309-314

Richards, RB, Norris, RT, Dunlop, RH and McQuade, NC (1989) Causes of death in sheep exported live by sea Aust Vet J 66: 33-38

McDonald, CL, Norris, RT, Ridings, H and Speijers, EJ (1990) Feeding behaviour of Merino wethers under conditions similar to lot-feeding before live export Aust J Exp Agric 30: 343-348

Norris, RT, McDonald, CL, Richards, RB, Hyder, MW, Gittins, SP and Norman, GJ (1990) Management of inappetant sheep during export by sea Aust Vet J 67: 244-247

Thomas, KW, Kelly, AP, Beers, PT and Brennan, RG (1990) Thiamine deficiency in sheep exported live by sea Aust Vet J 76: 215-218

Higgs, ARB, Norris, RT and Richards, RB (1991) Season, age and adiposity influence death rates in sheep exported by sea Aust J Agric Res 42: 205-214

Norris, RT (1991) Studies of factors affecting sheep deaths during lot-feeding and sea transport PhD Thesis, Murdoch University, Perth

Richards, RB, Hyder, MW, Fry, JM, Costa, ND, Norris, RT and Higgs, ARB (1991) Seasonal factors may be responsible for deaths in sheep exported by sea Aust J Agric Res 42: 215-226

Norris RT, Richards RB and Norman, GJ (1992) The duration of lot-feeding of sheep before sea transport Aust Vet J 69: 8-10

Scharp, DW (1992) Performance of Australian wethers in Arabian Gulf feedlots after transport by sea Aust Vet J 69: 42-43

Higgs, ARB, Norris, RT and Richards, RB (1993) Epidemiology of salmonellosis in the live sheep export industry Aust Vet J 70: 330-335

Richards, RB, Norris, RT and Higgs, ARB (1993) Distribution of lesions in ovine salmonellosis Aust Vet J 70: 326-330

McDonald, CL, Rowe, JB and Gittins, SP (1994) Feeds and feeding methods for assembly of sheep before export Aust J Exp Agric 34: 589-94

Higgs, ARB, Norris, RT, Baldock, FC, Campbell, NJ, Koh, S and Richards, RB (1996) Contagious ecthyma in the live sheep export industry Aust Vet J 74: 215-220

Higgs, ARB, Norris, RT, Love, RA and Norman, GJ (1999) Mortality of sheep exported by sea: evidence of similarity by farm group and of regional differences Aust Vet J 77: 729-733

Norris, RT, Richards, RB, Creeper, JH, Jubb, TF, Madin, B and Kerr JW (2003) Cattle deaths during sea transport from Australia Aust Vet J 81: 156-161

Norris, RT, (2005) Transport of animals by sea Rev Sci Tech Off Int Epiz 24: 673-681

Beatty, DT, Barnes, A, Taylor, E, Pethick, D, McCarthy, M and Maloney, SK (2006) Physiological responses of *Bos taurus* and *Bos indicus* cattle to prolonged, continuous heat and humidity J Anim Sci 84: 972-985

Stockman, CA (2006) The physiological and behavioural responses of sheep exposed to heat load within intensive sheep industries PhD Thesis, Murdoch University, Perth

Beatty, DT, Barnes, A, Taplin, R, McCarthy, M and Maloney, SK (2007) Electrolyte supplementation of live export cattle to the Middle East Aust J Exp Agric 47: 119-124



Phillips, CJC, Pines, MK, Latter, M, Muller, T, Petherick, JC, Norman, ST and Gaughan, JB (2010) The physiological and behavioural responses of steers to gaseous ammonia in simulated long distance transport by ship *J Anim Sci* 88: 3579-3589

Pines, MK and Phillips, CJ (2012) Accumulation of ammonia and other potentially noxious gases on live export shipments from Australia to the Middle East *J Environ Monit* 13: 2798-2807

Stockman, CA, Barnes, AL, Maloney, SK, Taylor, E, McCarthy, M and Pethick, D (2012) Effects of prolonged exposure to continuous heat and humidity similar to long haul live export voyages in Merino wethers *Anim Prod Sci* 51: 135-143

Pines MK, Phillips CJ (2013) Microclimatic conditions and their effects on sheep behaviour during a live export shipment from Australia to the Middle East *J Anim Sci* 91(9): 4406-4416

The Veterinary Handbook for Cattle, Sheep and Goats Application (2014) is available for download onto mobile devices at: <http://www.veterinaryhandbook.com.au/>

Moore SJ, Madin B, Norman G, and Perkins N (2015) Risk factors for voyage mortality in cattle during live export from Australia by sea *Aust Vet J* 93: 339-348

Phillips CJ (2016) The welfare risks and impacts of heat stress on sheep shipped from Australia to the Middle East *Vet J* 28: 78-85

Zhang Y, Lisle AT, Phillips CJ (2017) Development of an effective sampling strategy for ammonia, temperature and relative humidity measurement during sheep transport by ship *Biosystems Engineering* 155: 12-23

Collins T, Hampton JO, A Barnes AL (2018) Systematic Review of Heat Load in Australian Livestock Transported by Sea *Animals* 8(10): 164-180

Fleming P, Wickham S, Dunston-Clarke E, Willis R, Barnes A, Miller D, Collins T (2020) Review of Livestock Welfare Indicators Relevant for the Australian Live Export Industry *Animals* 10(7): 1236

Australian Government Department of Agriculture, Water and the Environment (2020) Australian standards for the export of livestock (version 3.1)

Willis RS, Fleming PA, Dunston-Clarke EJ, Barnes AL, Miller DW, Collins T (2021) Animal welfare indicators for sheep during sea transport: The effect of voyage day and time of day *Appl Anim Behav Sci* 238 (2021)

## 6.2 Appendix 2 – Acknowledgements

The cooperation of ships' officers in recording details of daily mortalities for this series of reports is again acknowledged with thanks. Some of these officers have faithfully contributed to the work for over 30 years, and their dedication to supporting the project and to the voluntary exposure of their Industry to public scrutiny is remarkable and worthy of high praise and grateful appreciation.

The cooperation of Exporters, Shipping Agencies and Port Authorities for additional help in collating data is also gratefully acknowledged. Again, some of these Industry participants have faithfully and unstintingly contributed to the work for over 30 years, marking an exemplary willingness to see their industry fully presented for public scrutiny, and their great trust in the integrity of this surveillance work and its findings.

The Australian Maritime Safety Authority (AMSA) is again gratefully acknowledged for ongoing provision of ship Master's Reports.

The cooperation of the Australian Government Department of Agriculture, Water and the Environment for provision of miscellaneous information and data regarding the transport of livestock by air is again also gratefully acknowledged.

This work was funded by Meat and Livestock Australia, LiveCorp and the Department of Primary Industries and Regional Development, Western Australia.