Department of Agriculture and Food

GOVERNMENT OF WESTERN AUSTRALIA

LIVECORP

mla MEAT & LIVESTOCK AUSTRALIA

final report

Project code: **W LIV 0279**

Prepared by: **Department of Agriculture and Food, Western Australia**
RT Norris & GJ Norman

Date published: **November 2011**

ISBN: **9781741916997**

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

National livestock export industry shipboard performance report 2010

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

Executive summary

The objective of this project was to summarise the performance of the livestock export industry in terms of mortality levels of sheep, cattle and goats exported by sea from Australia during 2010.

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. The summary report provides a breakdown by species and major destinations.

The overall mortality rate for sheep during sea transport to all destinations during 2010 was 0.88% out of approximately 2.96 million sheep exported. This was lower than the 0.91% mortality rate observed in 2009. The main port of loading was Fremantle (2.4 million sheep exported with mortality rate of 0.75%), followed by Portland (0.4 million sheep exported with mortality rate of 1.5%) and Adelaide (0.1 million sheep exported with mortality rate of 1.5%).

The overall mortality rate among the 0.86 million cattle exported from Australia in 2010 was 0.15%. This was higher than the 0.10% mortality rate observed in 2009. The overall mortality rate on voyages to the Middle East/North Africa was 0.40% in 2010, a rise from 0.32% in 2009. The overall mortality rate on voyages to South-East Asia was 0.04%, half the rate of 0.08% observed in 2009. The highest overall mortality rate on a regional basis was 0.44% for exports to Miscellaneous destinations (79,473 cattle exported), including Mauritius, Russia and Turkey, while the lowest overall mortality rate was 0.04% for exports to South-East Asia (551,761 cattle exported).

The overall mortality rate among the 1,885 goats exported by sea from Australia in 2010 was 0.69%. This was substantially more than the 0.17% seen in 2009. All goats exported by sea during 2010 went to South-East Asia. Air transport of goats has been included in the 2010 report for the first time.

Contents

1	**Background**	**4**
2	**Project objectives**	**4**
3	**Methodology**	**4**
4	**Results and discussion**	**5**
4.1	**Sheep**	**5**
4.1.1	Performance trend	5
4.1.2	Overview	6
4.1.3	Port of loading	6
4.1.4	Destination	7
4.1.5	Mortality rates	8
4.1.6	Class of sheep	10
4.1.7	Time of year	10
4.1.8	Time of year and age of sheep	12
4.1.9	Ship	15
4.2	**Cattle**	**16**
4.2.1	Performance trend	16
4.2.2	Overview	17
4.2.3	Middle East/North Africa	18
4.2.4	South-East Asia	22
4.2.5	North-East Asia	26
4.2.6	Miscellaneous destinations	29
4.3	**Goats**	**32**
4.3.1	Performance trend	32
4.3.2	Overview	33
4.3.3	South-East Asia	33
4.3.4	Air transport of live goats	33
5	**Conclusion and recommendations**	**35**
5.1	**Sheep, cattle and goats**	**35**
6	**Appendices**	**36**
6.1	**Appendix 1 – Research update**	**36**
6.1.1	Investigating cattle morbidity and mortality to the Middle East	36
6.1.2	Veterinary pathology and disease investigation course for AAVets	36
6.1.3	“HotStuff” verification	36
6.1.4	Scabby mouth	37
6.2	**Appendix 1 - Published studies**	**38**
6.3	**Appendix 2 - Acknowledgements**	**40**

1 Background

The live export of sheep and cattle makes a significant contribution to the Australian economy and provides employment in services that support this industry. The livestock export trade provides important support for the sheep and cattle industries of Australia and is the only market outlet for producers in some areas of the country.

This report summarises information about mortalities in sheep, cattle and goats during sea transport from Australia. It allows industry, government and others to monitor mortality trends in these sectors. The report also lists relevant published studies.

The Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) also presents mortality data, though in a different format, at their website: www.daff.gov.au/animal-plant-health/welfare/export-trade/mortalities. The DAFF data refers to reports received during the calendar year, in contrast to the current report which refers to voyages which departed during the calendar year.

2 Project objectives

- Produce a report which summarises the mortality of sheep, cattle and goats for the 2010 calendar year and provide an informed analysis of mortality trends in the livestock export industry.

- 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 livestock mortalities and other information about each voyage, and also from "Yellow Books". "Yellow Books" record more detailed information about numbers of livestock mortalities (by age-sex category and port of loading) than is available from the Masters' report. The 2010 report is for voyages which departed Australia during 2010 and for which records were to hand on 28 April 2011. Information on the number of sheep exported to various destination countries from ports in Australia was sourced from the Australian Bureau of Statistics.

Readers should be aware that additional mortality information (Masters' reports or "Yellow Books") for a particular year may be received after publication of that year's summary report. These records are 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.

Summary information was produced using Statistix 7.0 (Analytical software 2000 Tallahassee, Florida USA)

4 Results and discussion

4.1 Sheep

4.1.1 Performance trend

Figures 1 and 2 show the number of sheep exported and the number of mortalities during sea transport from all ports in Australia to all destinations since 1985 as well as the trendline (linear regression) across the years. The 2.96 million sheep exported in 2010 is the lowest recorded since 1985. The number of sheep exported annually has varied between 2.96 and 6.65 million, and the annual mortality has varied between 0.75 and 2.98%. The trend for numbers of sheep exported and annual mortality has been downward, with a greater decline for annual mortality.

Figure 1 Number of sheep exported by sea from Australia to all destinations since 1985

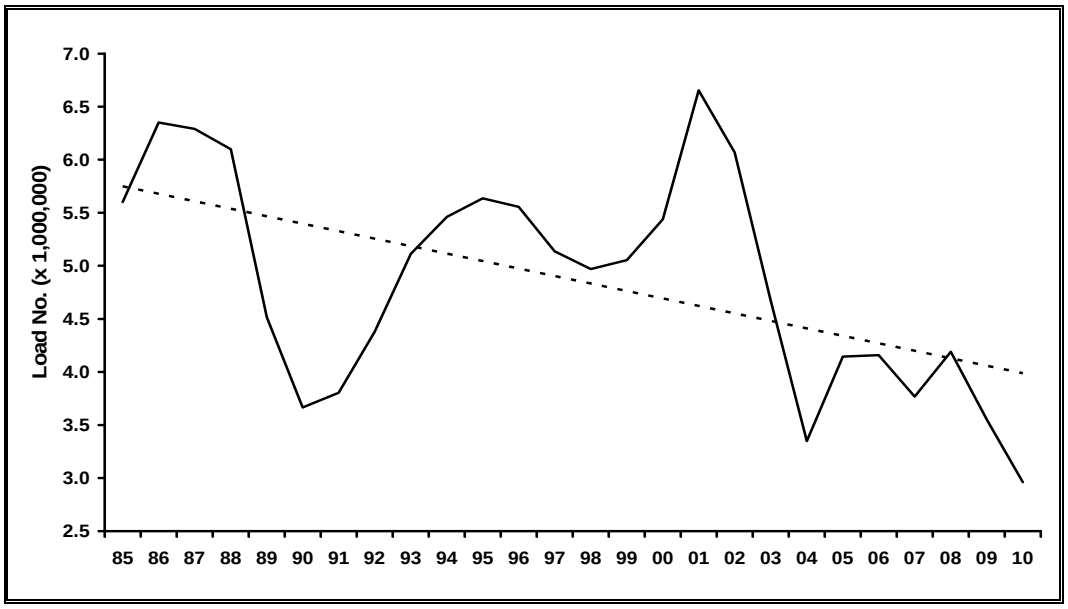
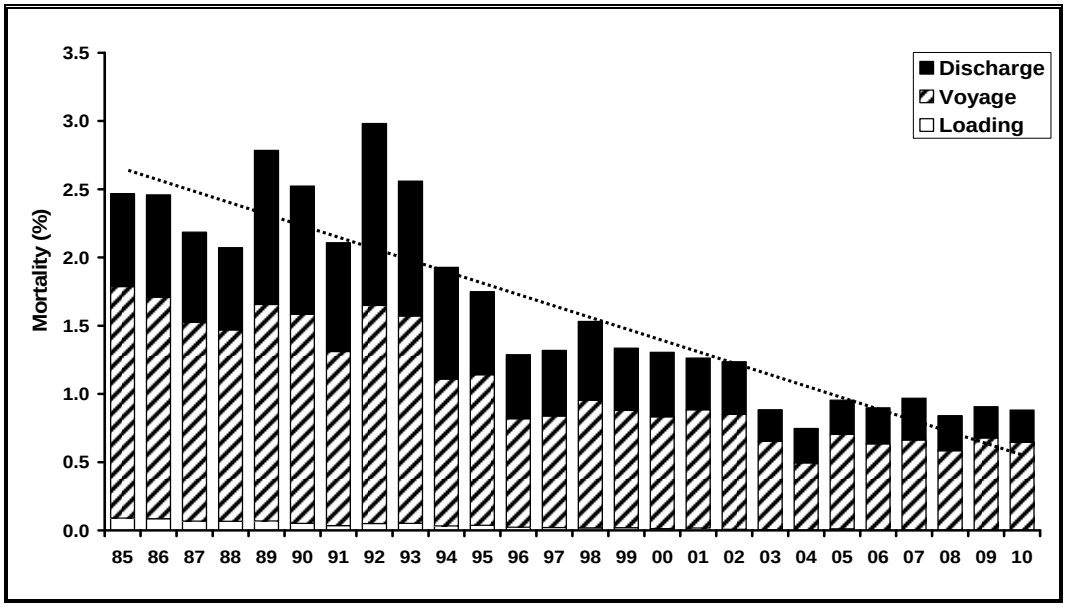


Figure 2 Annual mortality of sheep exported by sea from Australia to all destinations since 1985



4.1.2 Overview

All sheep exported live by sea from Australia in 2010 were loaded at Fremantle (81.6%), Adelaide (3.8%) and Portland (14.6%). The majority of these (92.5%) were sent to the Middle East/North Africa.

Over 215,000 sheep were exported to miscellaneous destinations, including ports in Turkey and Mauritius. The overall mortality rate for these sheep was 1.16% with an average voyage length (voyage to first discharge port) of 21.1 days with an additional 6.5 days discharging (most voyages had multiple discharge ports).

There were 5,430 sheep exported to South-East Asia which experienced a mortality rate of 0.33%. There was one voyage to the region; which lasted 10.5 days with 1.1 days discharging.

The average voyage length for exports to the Middle East/North Africa was 16.3 days with 5.1 days discharging (most voyages had multiple discharge ports).

Except where indicated, the comments below refer to voyages of sheep to the Middle East/North Africa.

4.1.3 Port of loading

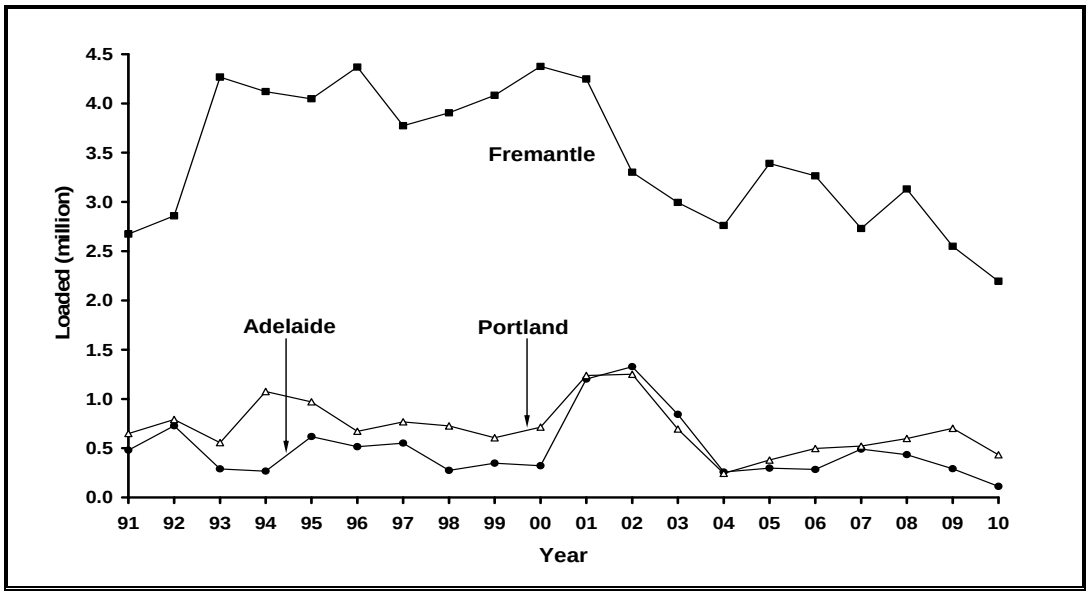
The number and classes of sheep exported by sea to the Middle East/North Africa from Fremantle, Adelaide and Portland during 2010 are shown in Table 1. Overall numbers exported in 2010 fell by over 22% compared to 2009, with exports from Fremantle, Adelaide and Portland falling by 14%, 61% and 38% respectively. The main changes in 2010 compared to 2009 were a 45% decrease in exports of wether hoggets and ram adults, and a 61% decrease in exports of adult ewes. The only classes to experience an increase in exports were ewe hoggets and lambs (108% and 6% respectively).

Table 1 The numbers and classes of sheep exported by sea to the Middle East/North Africa from Fremantle, Adelaide and Portland during 2010

Livestock		Fremantle	Adelaide	Portland	Total
Wethers	adults	1,014,176	92,651	365,763	1,472,590
	hoggets	98,488	4,398	39,277	142,163
	lambs	554,395	15,053	21,887	591,335
Rams	adults	35,725	158	4,003	39,886
	hoggets	53,330		644	53,974
	lambs	173,492			173,492
Ewes	adults	130,085		1,405	131,490
	hoggets	10,017			10,017
	lambs	125,407			125,407
Total	sheep	2,195,115	112,260	432,979	2,740,354

Most sheep exported by sea from Australia to the Middle East/North Africa during 2010 were loaded at Fremantle (80.1% of all sheep, Figure 3) with smaller numbers loaded at Portland (15.8%) and Adelaide (4.1%).

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 1991.



4.1.4 Destination

The main importing countries for Australian sheep in 2010 are shown in Table 2. Kuwait was the main market, increasing its imports to 36% of all sheep, followed by Bahrain (18%), Qatar (11%) and Jordan (9%).

Table 2 Destination country for sheep exported from Australia during 2010

Country	Fremantle	Adelaide	Portland	Other	Total
Bahrain	357,463	37,768	140,500		535,731
Israel	42,000				42,000
Jordan	247,636		18,350		265,986
Kuwait	782,185	58,492	235,778		1,076,455
Libya	75,026				75,026
Oman	37,573	9,000	22,500		69,073
Qatar	321,415				321,415
Saudi Arabia	262,500				262,500
Turkey	224,285				224,285
UAE	51,614	9,280	17,853		78,747
S.E. Asia	4,500			21,919	26,419
N.E. Asia				9	9
Other	150			358	508
Total	2,406,347	114,540	434,981	22,286	2,978,154

SOURCE – Australian Bureau of Statistics, April 2010

Note: - ABS figures also include exports by air; figures in Table 2 may not reflect those in Table 1.

4.1.5 Mortality rates

There were 11 voyages to the Middle East/North Africa in 2010 for which sheep were loaded at more than one port in Australia (split-load voyages). Mortalities for split-load voyages were attributed to the port of loading wherever possible. Where analysis involving split-load voyages has been performed, the consignments of sheep from each load port have been considered as separate “voyages”.

Using the above definition of voyage, there were 49 "voyages" of sheep to the Middle East/North Africa during 2010. This involved 39 ship journeys, one of which was a split-load voyage loading late in December 2009 and completing loading at the second port early in January 2010.

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 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.

The total mortality rate for all sheep exported to all destination regions during 2010 was 0.88% (Table 3), a decrease from 0.91% observed in 2009. The 0.71% mortality rate for Fremantle sheep shipped to the Middle East/North Africa was equal to the lowest ever recorded.

There were five shipments to Miscellaneous destinations (involving Turkey and Mauritius) for which the mortality rate was 1.16% for the 215,188 sheep loaded.

For shipments to the Middle East/North Africa, the main changes compared to 2009 were a rise in voyage and discharge mortality rates for shipments from Portland and Adelaide, while voyage mortalities for shipments from Fremantle fell to their second lowest on record (Table 3 and Figure 4).

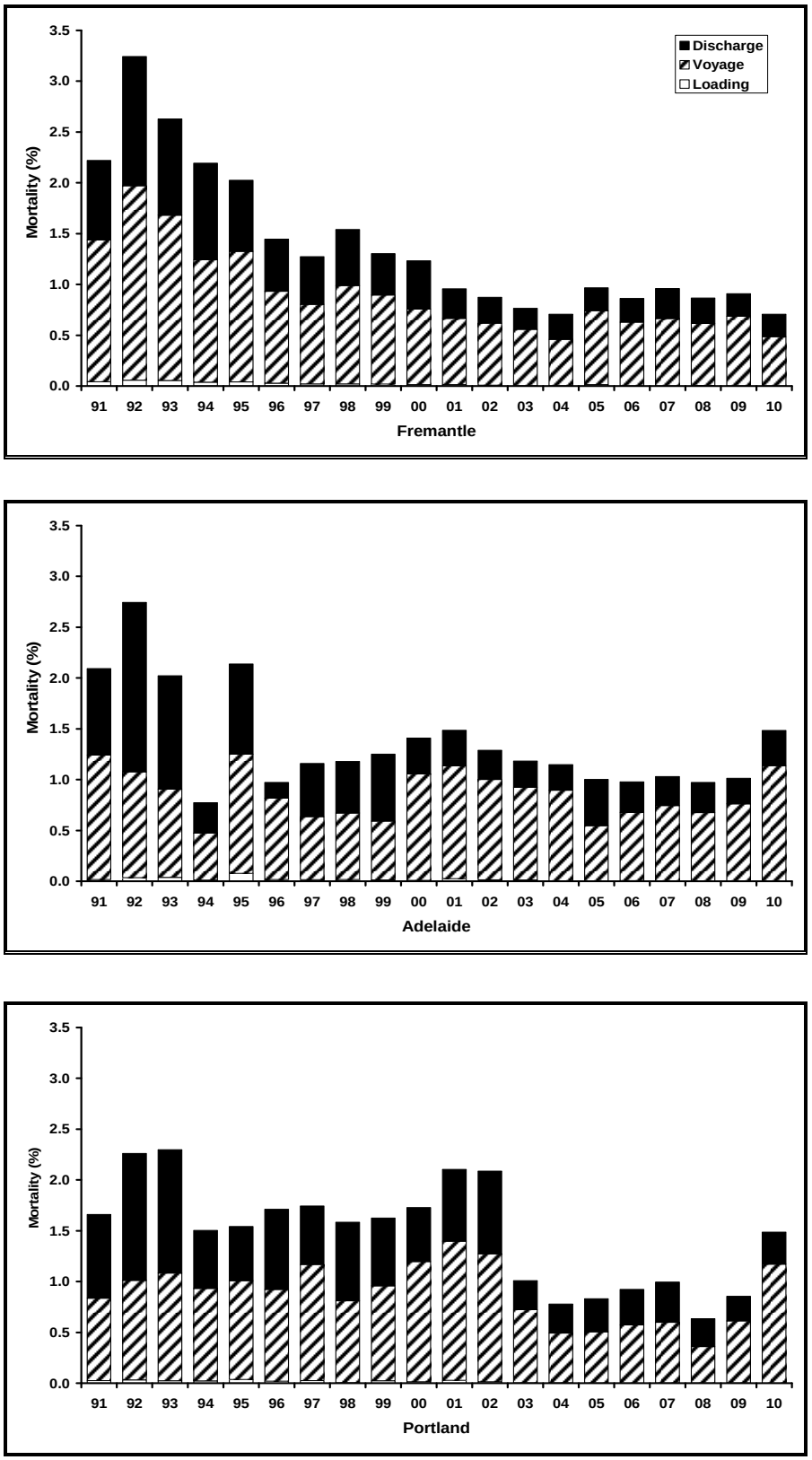
Table 3 Annual shipboard mortality rates for sheep exported from Fremantle, Adelaide and Portland to the Middle East/North Africa, and Total mortality rate for all sheep exported to all destinations

		Mortality rate (%)			
	Year	Load	Voyage	Discharge	Total
Fremantle*	2006	0.00	0.63	0.23	0.86
	2007	0.00	0.66	0.29	0.96
	2008	0.01	0.61	0.25	0.87
	2009	0.00	0.68	0.22	0.91
	2010	0.00	0.48	0.22	0.71
Adelaide*	2006	0.01	0.67	0.30	0.98
	2007	0.00	0.74	0.28	1.03
	2008	0.00	0.67	0.30	0.97
	2009	0.00	0.76	0.25	1.01
	2010	0.00	1.14	0.35	1.48
Portland*	2006	0.00	0.57	0.35	0.92
	2007	0.00	0.60	0.40	0.99
	2008	0.00	0.36	0.27	0.64
	2009	0.00	0.61	0.24	0.86
	2010	0.00	1.17	0.32	1.49
Total**	2006	0.00	0.63	0.26	0.90
	2007	0.00	0.66	0.31	0.97
	2008	0.00	0.58	0.26	0.84
	2009	0.00	0.68	0.23	0.91
	2010	0.00	0.64	0.24	0.88

* Middle East/North Africa only

** Total includes all sheep exported by sea from Australia to all destinations

Figure 4 Annual mortality for sheep exported from Fremantle, Adelaide and Portland to the Middle East/North Africa since 1991



4.1.6 Class of sheep

The mortality rates of various classes of sheep exported from Australia to the Middle East/North Africa are shown in Table 4 and Figure 5. The highest overall mortality rates for 2010 were in adult and hogget rams, (1.2% in both). The particularly high adult ram figure for Adelaide is the result of a few deaths in small numbers exported (see Table 1).

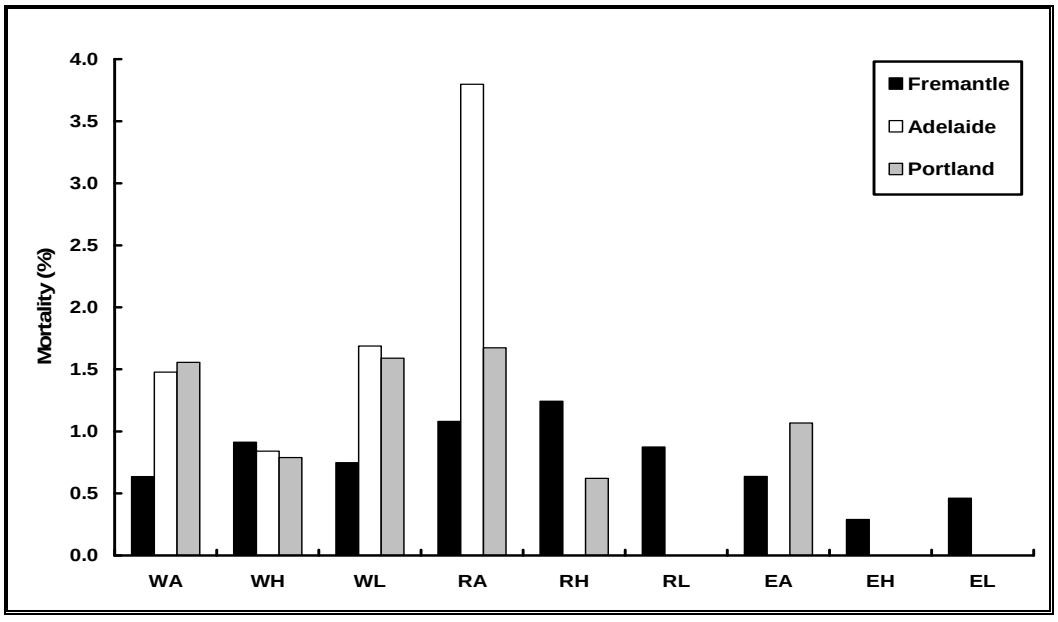
Table 4 Overall mortality (%) for classes of sheep exported from Fremantle, Adelaide and Portland to the Middle East/North Africa in 2010

Class of sheep		Fremantle	Adelaide	Portland	Total
Wethers	adult	0.6	1.5	1.6	0.9
	hogget	0.9	0.8	0.8	0.9
	lamb	0.7	1.7	1.6	0.8
Rams	adult	1.1	3.8	1.7	1.2
	hogget	1.2	n/a	0.6	1.2
	lamb	0.9	n/a	n/a	0.9
Ewes	adult	0.6	n/a	1.1	0.6
	hogget	0.3	n/a	n/a	0.3
	lamb	0.5	n/a	n/a	0.5

n/a - not applicable (no sheep of this class were loaded)

Figure 5 Overall mortality (%) for classes of sheep exported from Fremantle, Adelaide and Portland to the Middle East/North Africa in 2010

WA = wether adults WH = wether hoggets WL = wether lambs
RA = ram adults RH = ram hoggets RL = ram lambs
EA = ewe adults EH = ewe hoggets EL = ewe lambs



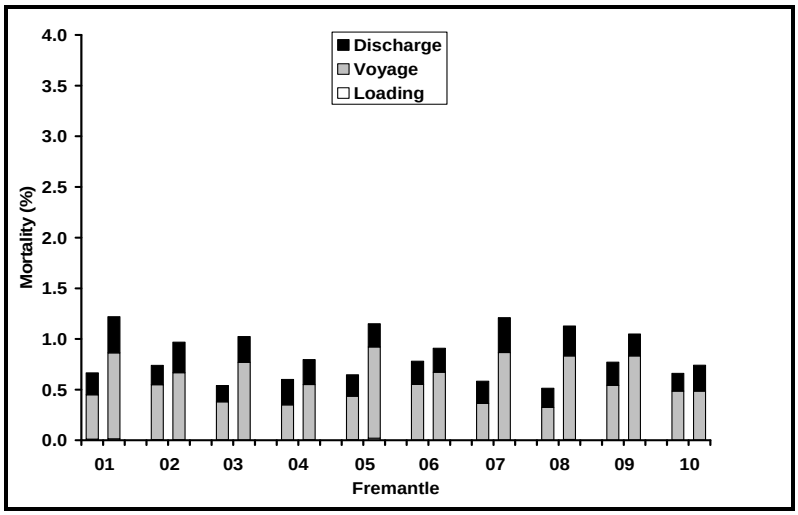
4.1.7 Time of year

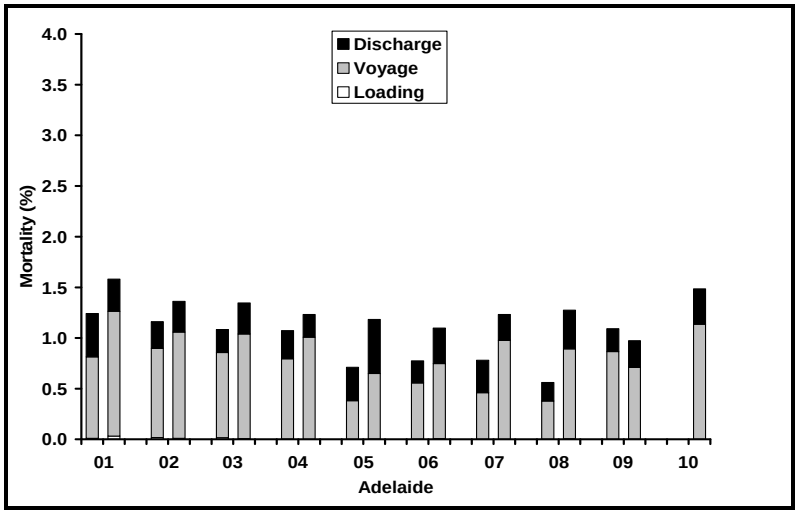
Mortality rates were higher ($P < 0.05$) in the second half of 2010 compared with the first half in sheep exported from Fremantle (0.66% and 0.74%) and Portland (1.07% and 2.07%). The effect could not be demonstrated for Adelaide as there were no exports from that port in the first half of 2010.

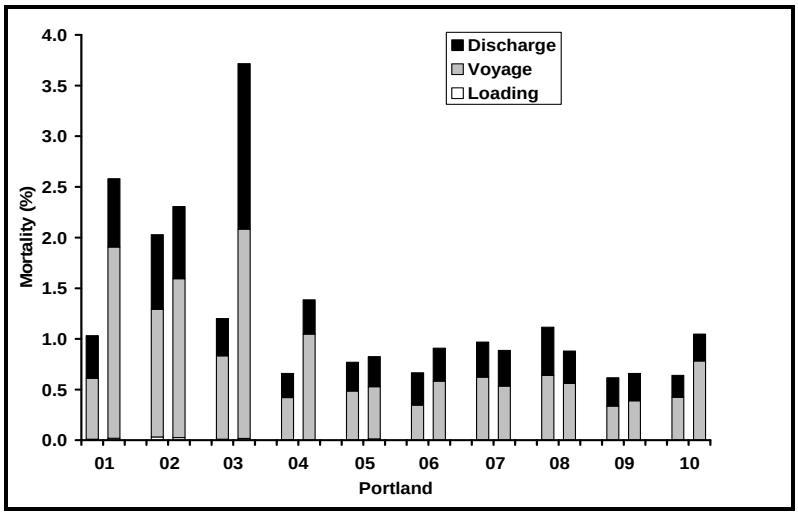
Research by Higgs *et al* (1991) indicates that seasonal metabolic cycles are the likely reason behind

the finding of lower mortality rates in the first half of the year compared to the second.

Figure 6 Mortality (%) for sheep exported by sea from Fremantle, Adelaide and Portland to the Middle East/North Africa for the first and second half of each year from 2001 to 2010

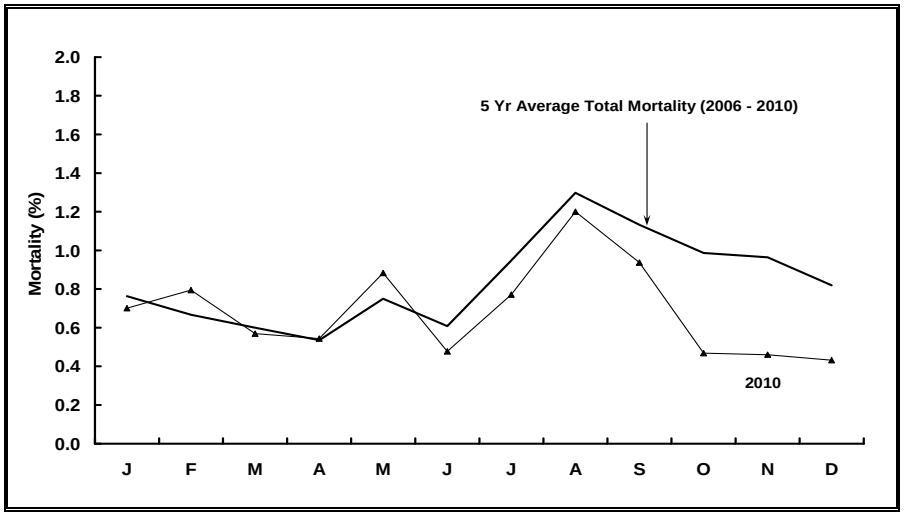






In 2010, monthly mortality rates (total mortality as a proportion of total loaded for each month) in sheep exported from Fremantle were similar to the 5-year monthly mortality rates except for a pronounced fall in the last quarter (Figure 7).

Figure 7 Monthly mortality rates for shipments from Fremantle to the Middle East/North Africa in 2010 and the 5-year monthly averages for the period 2006 to 2010



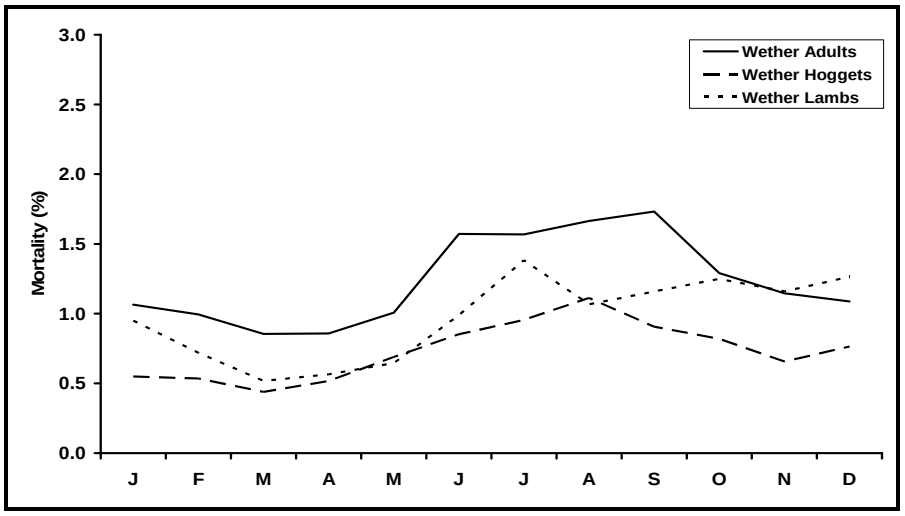
4.1.8 Time of year and age of sheep

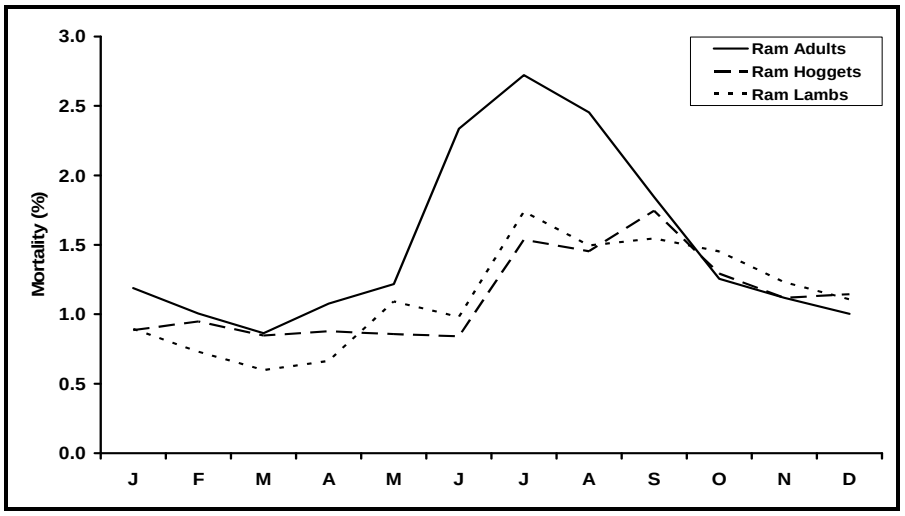
Figure 8 shows the monthly mortality rates (total mortality as a proportion of total loaded for each month) in wether and ram adults, hoggets and lambs, and ewe adults and lambs exported from Australia to the Middle East/North Africa from 1997 to 2010. Results for ewe hoggets are not presented because of the paucity of data. The figure shows a pronounced rise in mortalities of all classes of sheep exported during the southern hemisphere winter/spring.

Figure 9 shows the mortality rates in the first and second half of the year for the wether classes over the same period. There were significantly more deaths ($P < 0.05$) in the second half of the year than in the first half for each year and each age category of sheep with only two exceptions; wether adult and hogget mortality rates were similar in 2006.

Higgs et al (1991) identified a seasonal difference in mortality for adult wethers but not for wether hoggets and lambs. However, their data for this analysis was limited to 1989 only. The results as shown in Figures 8 and 9 indicate that seasonal differences in mortality exist for wether hoggets and lambs as well as adults. Similar findings were observed for ram classes and for ewe adults and lambs (half-year results for these classes not presented). For ewe hoggets, the paucity of data in most years made conclusions unreliable.

Figure 8 Monthly mortality (%) for wether and ram adults, hoggets and lambs, and ewe adults and lambs exported by sea from Australia to the Middle East/North Africa from 1997 to 2010





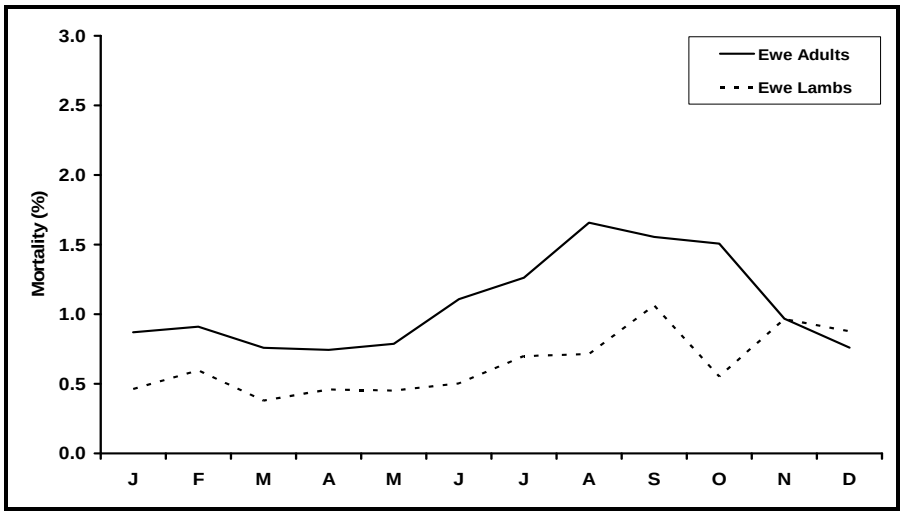
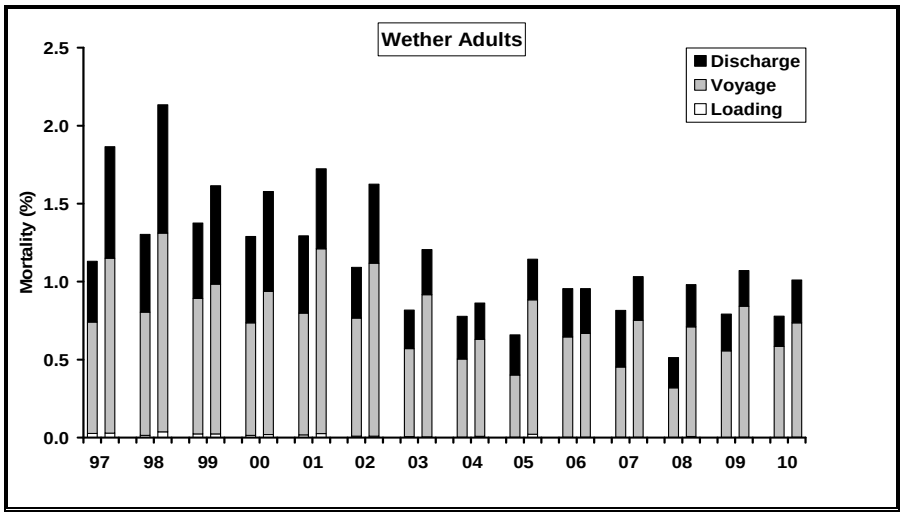
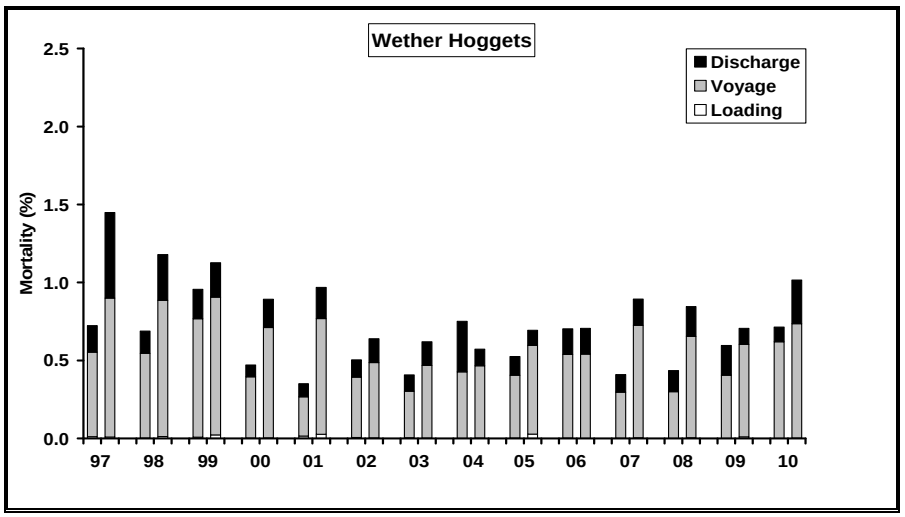
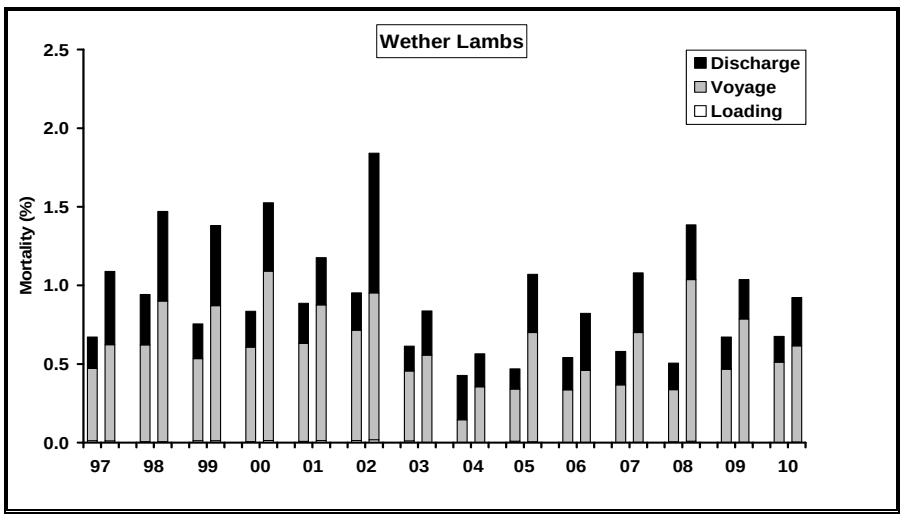


Figure 9 Mortality (%) for wether adults, hoggets and lambs exported by sea from Australia to the Middle East/North Africa for the first and second half of each year from 1997 to 2010







4.1.9 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 5a), Adelaide (Table 5b) and Portland (Table 5c).

There were four voyages in the "high" category in 2010, three of which involving ship 32 (but two of these three were consignments loaded at separate ports for the same journey). Approximately 80% of voyages from Fremantle, 25% from Adelaide and 30% from Portland were in the "low" category.

The number of voyages to the region fell by approximately 25%, from 65 in 2009 to 49 in 2010.

Table 5a Number of voyages in low, medium and high mortality categories for ships loaded at Fremantle in 2010

	Mortality rate			
Ship (code)	Low <1.0%	Medium 1.0–2.0%	High >2.0%	Total
2	5	0	0	5
32	6	0	0	6
33	0	3	0	3
34	5	0	1	6
35	3	2	0	5
42	4	0	0	4
43	4	1	0	5
44	1	0	0	1
Total	28	6	1	35

Table 5b Number of voyages in low, medium and high mortality categories for ships loaded at Adelaide in 2010

	Mortality rate			
Ship (code)	Low <1.0%	Medium 1.0–2.0%	High >2.0%	Total
32	0	2	1	3
34	1	0	0	1
Total	1	2	1	4

Table 5c Number of voyages in low, medium and high mortality categories for ships loaded at Portland in 2010

	Mortality rate			
Ship (code)	Low <1.0%	Medium 1.0–2.0%	High >2.0%	Total
2	1	1	0	2
32	1	2	2	5
33	0	1	0	1
34	1	1	0	2
Total	3	5	2	10

4.2 Cattle

4.2.1 Performance trend

The number of cattle shipped from all ports in Australia to all destinations since 1995 as well as the trendline (linear regression) across those years is shown in Figure 10. Similarly, Figure 11 shows the number of cattle mortalities during sea transport since 1995. The number of cattle exported annually has varied from approximately 450,000 to 960,000, and the annual mortality has varied between 0.10 and 0.42%. The trend for numbers of cattle exported has been slightly upwards whereas the trend for annual mortality has been downward.

Figure 10 Number of cattle exported by sea from Australia to all destinations since 1995

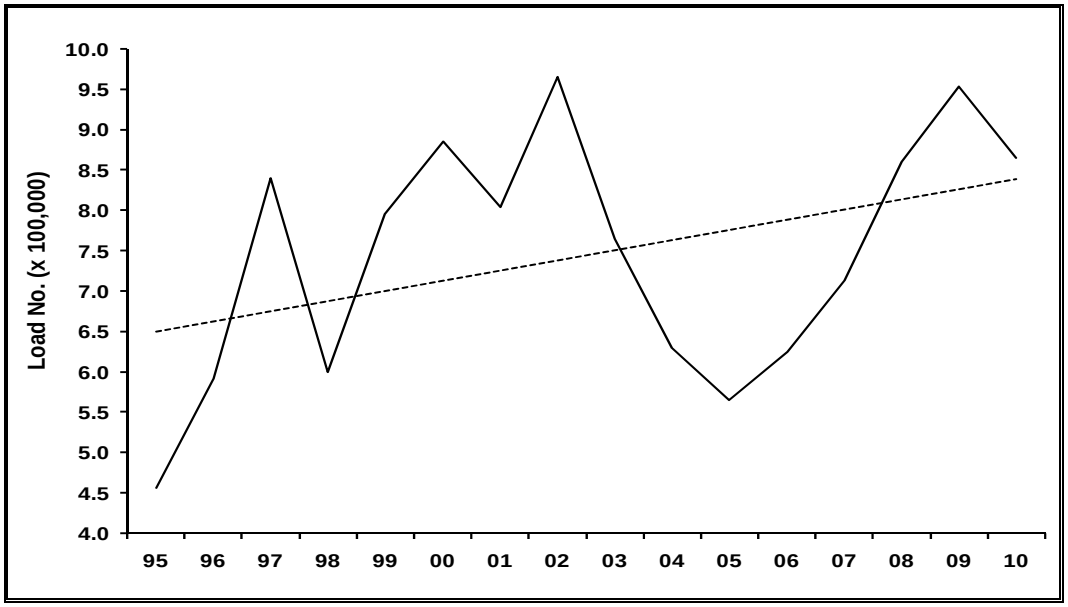
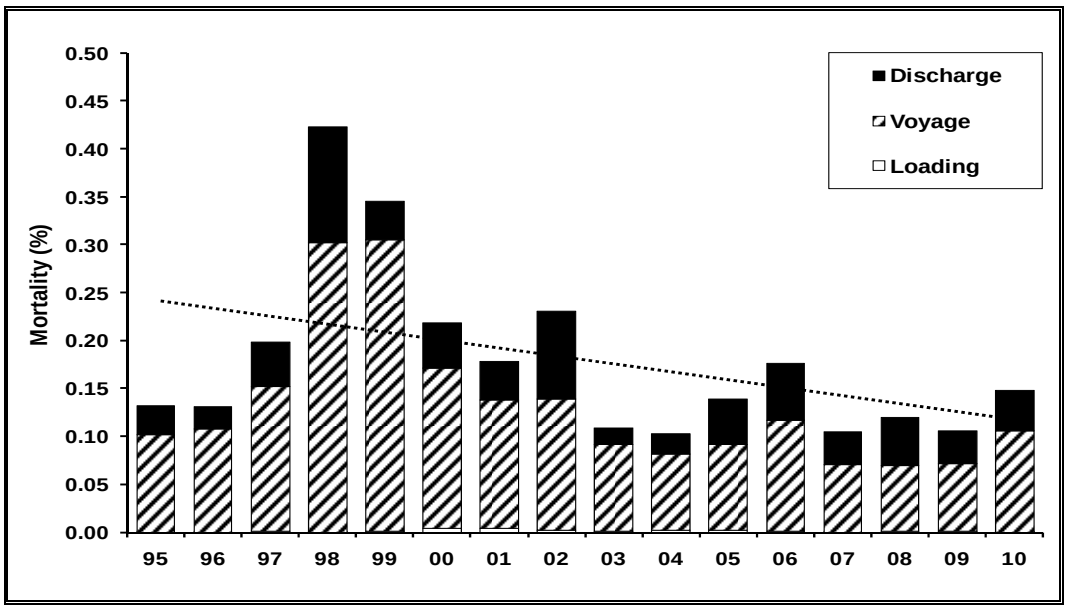


Figure 11 Annual mortality of cattle exported by sea from Australia to all destinations since 1995



4.2.2 Overview

The live cattle trade from Australia in 2010 was characterised by the large number of ports of loading in Australia and the regions to which the animals were shipped. This is in contrast to the live sheep trade where there were only three main ports of loading, and virtually all sheep were shipped to the Middle East/North Africa.

There were 13 voyages in 2010 for which cattle were loaded at more than one port in Australia. Mortalities for split-load voyages were attributed to the port of loading where possible. Where analysis involving split-load voyages has been performed, the consignments of cattle from each load port have been considered as separate “voyages”.

Using the above definition of voyage, there were 283 "voyages" of cattle during 2010. This involved 271 ship journeys, one of which was a split-load voyage loading late in December 2009 and completing loading at the second port early in January 2010.

There were 20% fewer ship journeys in 2010 than in 2009, and the overall number of cattle exported fell by 8.5% in 2010 compared to 2009.

The overall mortality rate among the 0.86 million cattle exported from Australia in 2010 was 0.15% (Table 6). This was higher than the 0.10% observed in 2009. The highest overall mortality rate on a regional basis was for exports to Miscellaneous destinations, which included Mauritius, Russia and Turkey. The lowest overall mortality rate was for exports to South-East Asia.

The number of cattle exported to the Middle East/North Africa in 2010 increased by 67% compared to 2009. This was due to a 27% increase in exports from Fremantle, as well as the largest number of cattle exported from northern ports since 2002.

Previously, exports to South-East Asia were characterised by small consignments on short voyages. More recently, larger ships have been introduced which have involved loading and discharging at more than one port. In 2010, these larger vessels accounted for 22% of the trade to the region over 8% of the voyages. The number of voyages to South-East Asia fell by 30% in 2010 compared to 2009 (202 and 288 respectively).

Exports to North-East Asia mainly comprised steers sent to Japan and dairy cattle sent to China. The number of cattle exported to the region in 2010 rose by 45% compared to 2009, a figure second only to that of 2004 (Table 18). This was mainly due to a 62% increase in dairy cattle exported from Portland to China.

Nearly half (46%) of all cattle voyages experienced no mortality during 2010.

Average voyage and discharge lengths for each region are presented in Table 6, below

Table 6 Mortality rates, number of voyages and number of cattle exported for voyages to major destination regions during 2010

Parameter	ME/N Africa	SE Asia	NE Asia	Misc	Total
Voyages (No.)	37	202	34	12	285
Cattle (No.)	163,869	551,761	69,638	79,473	864,741
Mortality rate overall (%)	0.40	0.04	0.08	0.44	0.15
Mortality rate range (%)	0.0 – 1.6	0.0 – 0.4	0.0 – 0.3	0.0 – 0.8	0.0 – 1.6
Voyage days (Ave.)	17.57	6.47	17.96	24.06	10.02
Discharge days (Ave.)	3.75	0.86	0.62	4.64	1.37
Voyages with nil mortalities (No.)	14	105	10	2	131

4.2.3 Middle East/North Africa

The live cattle trade to the Middle East/North Africa during 2010 rose by 67% compared to 2009, after remaining low over the previous seven years (Table 7). Overall mortality rates have remained below 0.5% since 1998 except for 2002 and 2006. In 2010 the mortality rate was 0.40% compared to 0.32% in 2009.

Table 7 Mortality rates, number of voyages, voyage and discharge length, and number of cattle exported to the Middle East/North Africa from 1995 to 2010

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
1995	11	14,557	0.67	0.0 – 2.1	14.64	6.91	2
1996	36	65,066	0.65	0.0 – 5.0	16.33	5.36	14
1997	62	137,869	0.67	0.0 – 4.2	18.85	3.76	15
1998	122	266,286	0.69	0.0 – 41.5*	20.02	3.05	23
1999	112	314,981	0.35	0.0 – 3.3	18.42	2.79	25
2000	96	274,159	0.42	0.0 – 8.0	17.91	2.92	22
2001	101	287,242	0.32	0.0 – 5.0	17.01	3.00	27
2002	102	265,005	0.61	0.0 – 35.0*	17.01	3.60	33
2003	52	106,080	0.45	0.0 – 2.0	16.31	5.65	18
2004	31	61,679	0.43	0.0 - 1.3	16.10	5.55	9
2005	38	90,808	0.34	0.0 – 1.0	15.60	5.17	12
2006	43	119,297	0.52	0.0 – 4.3	16.05	4.42	13
2007	41	74,256	0.19	0.0 – 0.5	16.43	4.23	16
2008	46	120,122	0.29	0.0 – 0.8	17.09	5.02	19
2009	41	98,183	0.32	0.0 – 1.8	15.37	4.62	13
2010	37	163,869	0.40	0.0 – 1.6	17.57	3.75	14

* exceptional voyages involving presumed heat stroke in 1998 and heat stroke in 2002

4.2.3.1 Port of loading

There were 5 ports of loading for voyages to the Middle East/North Africa in 2010, and most cattle were exported from Fremantle, followed by Townsville and Broome (Table 8). Mortality rates in 2010 were highest from Fremantle, followed by Portland.

The voyages from each port were classified into various mortality categories as shown in Table 9. There were seven voyages in the medium or high categories, six loaded at Fremantle and one at Portland. No mortalities occurred on 50% and 42% of the voyages from Portland and Fremantle respectively.

Table 8 Mortality rates, number of voyages and number of cattle exported from various ports to the Middle East/North Africa for 2010

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Fremantle	24	113,628	0.53	0.0 – 1.6
Townsville	2	31,353	0.08	0.1 – 0.1
Broome	2	8,994	0.09	0.1 – 0.1
Portland	8	5,940	0.27	0.0 – 0.6
Geraldton	1	3,954	0.05	n/a

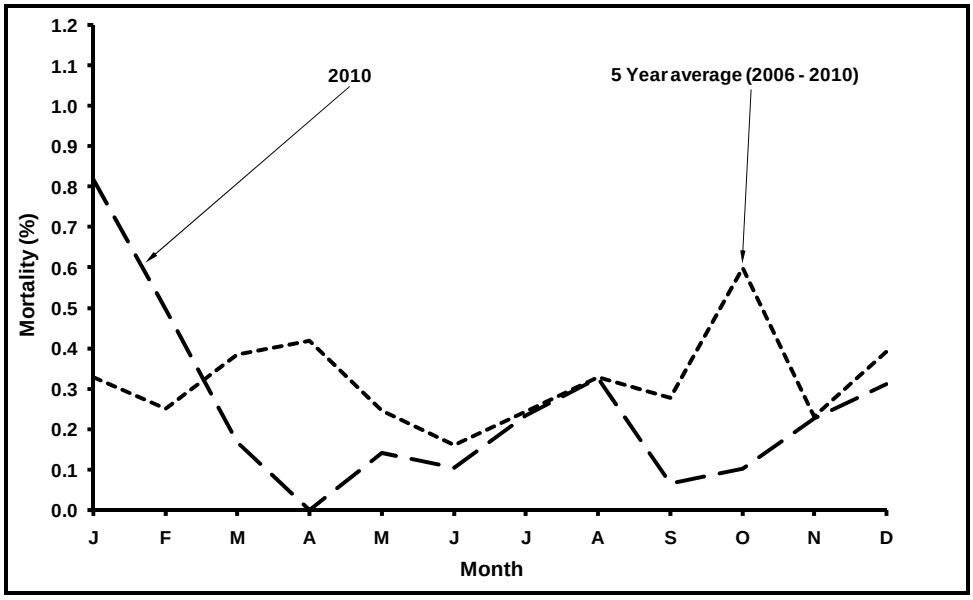
Table 9 Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to the Middle East/North Africa for 2010

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
Fremantle	10	8	5	1	24
Townsville	0	2	0	0	2
Broome	0	2	0	0	2
Portland	4	3	1	0	8
Geraldton	0	1	0	0	1
Total	14	16	6	1	37

4.2.3.2 Time of year

In 2010, monthly mortality rates (total mortality as a proportion of total loaded for each month) in cattle exported from all ports to the Middle East/North Africa remained below 0.82% throughout the year (Figure 12).

Figure 12 Monthly mortality rates of cattle on voyages from all ports to the Middle East/North Africa for 2010 and the 5-year monthly rates for the period 2006 to 2010



Note – one 2010 high mortality voyage excluded; if included, Feb' percentages would be 1.2% for 2010 profile and 0.6% for the 5 year average

4.2.3.3 Voyages from southern ports 1999 to 2010

Additional observations were made for the ports of Fremantle, Adelaide and Portland because of the higher mortality rates on voyages from these ports compared to northern ports in previous years.

0f the 37 voyages to the Middle East/North Africa in 2010, 32 originated from southern ports of Australia. The number of cattle exported from Fremantle in 2010 rose by 27% compared to 2009. The mortality of 0.53% is substantially higher, but would be 0.34% if one high mortality voyage is excluded. Mortality rates from Fremantle have remained relatively constant at 0.4% or less (Table 10).

The number of cattle exported from Portland in 2010 remained low. The mortality rate fell to 0.27% during 2010, 34% less than 2009. No cattle were exported from Adelaide during 2010.

Table 10 Mortality rates for cattle loaded at Fremantle, Adelaide or Portland from 1999 to 2010

Year	Fremantle			Adelaide			Portland		
	Voys (No.)	Cattle (No.)	Mort. (%)	Voys (No.)	Cattle (No.)	Mort. (%)	Voys (No.)	Cattle (No.)	Mort. (%)
1999	43	103,290	0.33	10	30,139	0.51	14	45,087	0.83
2000	45	94,787	0.43	7	19,158	0.66	13	40,748	1.01
2001	48	104,404	0.34	11	22,274	0.53	16	35,797	0.82
2002	57	103,914	0.36	17	25,035	0.47	15	46,624	2.03*
2003	50	68,167	0.45	9	16,083	0.70	9	11,146	0.35
2004	22	54,585	0.42	5	4,743	0.63	4	2,351	0.30
2005	28	66,098	0.39	1	1,171	0.08	6	11,310	0.14
2006	33	99,577	0.39	1	310	0.00	6	9,132	2.28†
2007	27	53,178	0.19	3	1,231	0.08	8	9,932	0.19
2008	34	102,007	0.31	2	1,053	0.28	9	13,404	0.18
2009	31	89,183	0.32	1	543	0.00	9	8,048	0.41
2010	24	113,628	0.53£	0			8	5,940	0.27

* 0.74% if one high mortality voyage is excluded
† 0.20% if one high mortality voyage is excluded
£ 0.34% if one high mortality voyage is excluded

4.2.3.4 Ship

The voyages of each ship from Australia to the Middle East/North Africa were classified into the following mortality categories: nil (no mortalities reported); low (mortality rate up to 0.5%); medium (mortality rate from 0.5 to 1.0%); and high (mortality rate greater than 1.0%). Note that for this comparison, "voyage" equates to consignment from a port. Consequently, if a ship loaded at two ports, then two "voyages" are shown for that ship, one for each port.

Table 11 shows the number of voyages in the various mortality categories for each ship. 81% of voyages were in the nil or low categories. There were seven voyages in the medium or high categories involving ships 33, 34, 35, 42 and 103.

Table 11 Number of voyages in nil, low, medium and high mortality categories for shipments to the Middle East/North Africa for 2010

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
32	3	1	0	0	4
33	0	1	3	0	4
34	5	0	1	0	6
35	0	4	1	0	5
42	1	5	0	1	7
43	3	1	0	0	4
44	0	1	0	0	1
195	0	1	0	0	1
103	0	0	1	0	1
121	2	2	0	0	4
Total	14	16	6	1	37

4.2.3.5 Class of cattle

In 2010, the highest mortality rates occurred in adult steers (0.52%) followed by weaner steers (0.35%), dairy cows (0.35%) and adult bulls (0.34%; Table 12).

To avoid any misunderstandings, young cattle are no longer referred to as “calf”, as this term may imply a small, unweaned animal. Since 2009, young cattle have been referred to as “weaners” in these reports.

Table 12 Mortality rates, number of voyages and number of cattle in various classes exported to the Middle East/North Africa in 2010

Class	Voyages (No.)	Cattle (No.)	Mortality rate (%)	Mortality rate range (%)
Steer adult*	21	70,122	0.52	0.0 – 1.7
Bull weaner	10	37,857	0.28	0.0 – 0.9
Bull adult*	28	37,167	0.34	0.0 – 0.9
Steer weaner	5	8,782	0.35	0.0 – 3.1
Heifer dairy	7	4,803	0.19	0.0 – 0.6
Heifer beef	6	4,535	0.31	0.0 – 0.4
Cow Beef	2	320	0.31	0.0 – 0.4
Cow dairy	3	283	0.35	0.0 – 0.7

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

4.2.4 South-East Asia

Approximately 0.55 million cattle were exported to South-East Asia in 2010 (Table 13). The mortality rate for voyages to the region halved to 0.04% while the number of voyages fell back to 2007 -2008 levels. No mortalities were reported on 52% of the voyages to the region. The mortality rate has remained below 0.1% since 2001.

Table 13 Mortality rates, number of voyages, voyage and discharge length, and number of cattle exported to South-East Asia from 1995 to 2010

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
1995	365	430,653	0.11	0.0 – 8.5	–	–	206
1996	415	505,777	0.05	0.0 – 1.2	–	–	280
1997	507	678,585	0.09	0.0 – 1.7	6.42	0.83	277
1998	229	296,823	0.17	0.0 – 8.8	7.19	0.76	127
1999	326	462,540	0.34	0.0 – 74.7*	7.17	0.67	162
2000	385	587,049	0.11	0.0 – 5.3	6.75	0.76	168
2001	312	472,363	0.08	0.0 – 5.0	6.69	0.76	139
2002	365	656,767	0.07	0.0 – 8.5	6.57	0.91	191
2003	306	587,716	0.05	0.0 – 2.2	6.46	0.87	190
2004	217	465,498	0.05	0.0 – 1.8	6.17	0.92	118
2005	169	403,819	0.09	0.0 – 0.8	6.06	0.97	73
2006	166	452,516	0.09	0.0 – 1.0	6.24	1.38	66
2007	205	573,729	0.09	0.0 – 4.0	6.47	1.10	92
2008	219	682,265	0.09	0.0 – 1.9	6.33	1.14	93
2009	288	795,465	0.08	0.0 – 0.9	6.27	0.99	130
2010	202	551,761	0.04	0.0 – 0.4	6.47	0.86	105

* exceptional voyage involving heat stroke caused by ventilation failure due to contaminated fuel

4.2.4.1 Port of loading

Most cattle exported to South-East Asia in 2010 were loaded at Darwin (53%) followed by Broome (15%) and Wyndham (9%, Table 14). The mortality rate was highest for cattle exported from Mourilyan (0.17%).

The voyages from each port were classified into various mortality categories as shown in Table 15. All except four voyages were in the nil or low categories. No voyages were in the high category in 2010.

Table 14 Mortality rates, number of voyages and number of cattle exported from various ports to South-East Asia in 2010

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Darwin	95	292,779	0.04	0.0 – 0.4
Broome	36	85,483	0.04	0.0 – 0.2
Wyndham	17	51,926	0.02	0.0 – 0.1
Fremantle	15	33,479	0.08	0.0 – 0.4
Townsville	6	32,199	0.03	0.0 – 0.1
Geraldton	14	28,762	0.06	0.0 – 0.2
Karumba	14	20,555	0.02	0.0 – 0.2
Mourilyan	5	6,578	0.17	0.0 – 0.4

Table 15 Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to South-East Asia for 2010

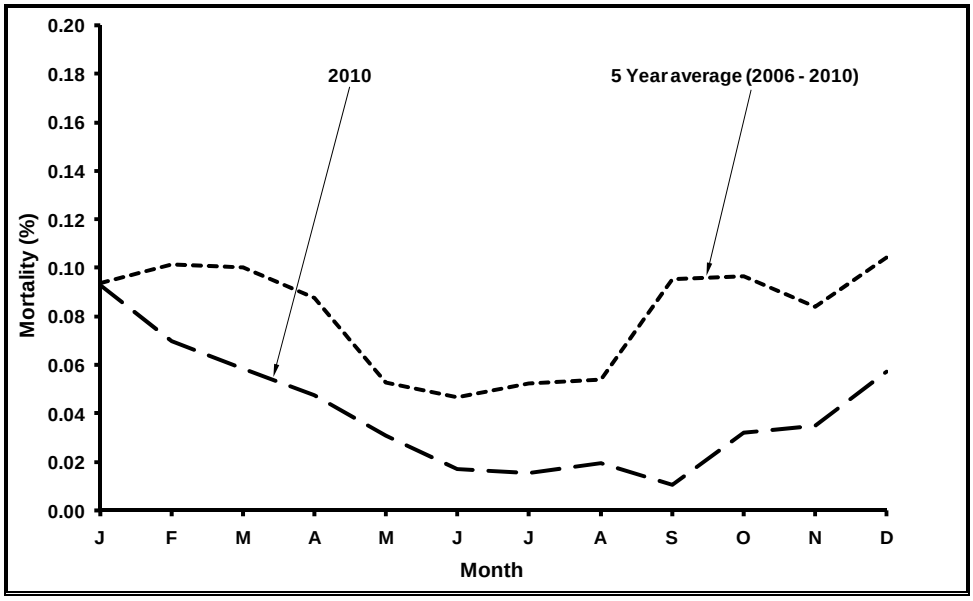
Port	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
Darwin	47	48	0	0	95
Broome	20	16	0	0	36
Wyndham	11	6	0	0	17
Fremantle	7	8	0	0	15
Geraldton	6	8	0	0	14
Karumba	11	3	0	0	14
Townsville	3	3	0	0	6
Mourilyan	0	5	0	0	5
Total	105	97	0	0	202

4.2.4.2 Time of year

Monthly mortality rates (total mortality as a proportion of total loaded for each month) for voyages to South-East Asia in 2010 were below 0.10% throughout the year (Figure 13).

The monthly mortality rate in 2010 remained below the 5-year average after January.

Figure 13 Monthly mortality rates of cattle on voyages from all ports to South-East Asia for 2010 and the 5-year monthly rates for the period 2006 to 2010



4.2.4.3 Ship

The voyages of each ship from Australia to South-East Asia were classified into various mortality categories as shown in Table 16. All voyages were in the nil or low mortality categories.

The number of voyages to the region decreased by 30% in 2010 compared to 2009.

Table 16 Number of voyages in nil, low, medium and high mortality categories for shipments to South-East Asia for 2010

	Mortality rate				
Ship (code)	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	Total
43	0	6	0	0	6
44	4	4	0	0	8
45	2	1	0	0	3
59	4	4	0	0	8
77	8	8	0	0	16
78	0	2	0	0	2
88	11	7	0	0	18
90	8	9	0	0	17
95	12	13	0	0	25
103	3	3	0	0	6
109	14	8	0	0	22
112	3	1	0	0	4
113	8	6	0	0	14
114	9	2	0	0	11
115	3	0	0	0	3
117	9	13	0	0	22
119	1	1	0	0	2
120	6	8	0	0	14
121	0	1	0	0	1
Total	105	97	0	0	202

4.2.4.4 Class of cattle

94% of cattle exported to South-East Asia in 2010 could be identified by class. Of those, the highest mortality rates occurred in beef cows (0.15%) followed by beef heifers and adult steers (both 0.03%; Table 17).

The 6% of cattle not identified to class provided 15% of all mortalities, with an overall mortality rate of 0.10%.

Table 17 Mortality rates, number of voyages and number of cattle in various classes exported to the South-East Asia in 2010

Class	Voyages (No.)	Cattle (No.)	Mortality rate (%)	Mortality rate range (%)
Steer adult*	171	306,062	0.03	0.0 – 0.5
Heifer beef	140	153,217	0.03	0.0 – 0.8
Cow beef	45	27,566	0.15	0.0 – 2.2
Bull adult*	76	25,670	0.05	0.0 – 1.9
Bull weaner	17	6,416	0.02	0.0 – 0.1
Steer weaner	2	1,778	0.00	n/a
Cow dairy	11	341	0.00	n/a
Heifer dairy	211	300	0.00	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 2010 rose by 45% compared to 2009, a figure second only to that of 2004 (Table 18). This was mainly due to a 62% increase in dairy cattle exported from Portland to China. Mortalities have remained low since 2007 at less than 0.1%. Prior to this the mortality rate has remained relatively constant over six years at about 0.1%.

Table 18 Mortality rates, number of voyages, voyage and discharge length, and number of cattle exported to North-East Asia from 1995 to 2010

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
1995	7	7,311	0.29	0.1 - 0.5	–	–	0
1996	9	12,587	0.40	0.1 - 1.2	–	–	0
1997	11	15,960	0.29	0.0 - 2.6	16.82	2.91	4
1998	10	14,734	0.17	0.0 - 0.4	16.00	2.10	2
1999	8	10,772	0.22	0.0 - 0.4	16.75	0.63	1
2000	10	13,830	0.14	0.0 - 0.4	17.00	0.30	4
2001	14	18,190	0.11	0.0 - 0.9	16.86	1.93	5
2002	17	22,483	0.12	0.0 - 0.7	18.24	1.12	7
2003	36	66,861	0.12	0.0 - 1.1	16.58	2.03	10
2004	50	95,534	0.10	0.0 - 0.8	16.00	1.26	12
2005	37	52,565	0.09	0.0 – 0.4	16.47	1.74	14
2006	26	37,963	0.12	0.0 – 1.3	17.09	1.28	11
2007	21	34,837	0.06	0.0 – 0.2	16.60	1.71	10
2008	19	29,873	0.06	0.0 – 0.4	17.51	1.04	10
2009	23	48,116	0.07	0.0 – 0.2	16.91	0.70	5
2010	34	69,638	0.08	0.0 – 0.3	17.96	0.62	10

4.2.5.1 Port of loading

Cattle were exported to North-East Asia mainly from Portland followed by Brisbane (Table 19). All cattle loaded at Brisbane were exported to Japan while those loaded at Portland and Fremantle were exported to China.

The voyages from each port were classified into various mortality categories as shown in Table 20. All voyages were in the nil or low categories.

Table19 Mortality rates, number of voyages and number of cattle exported from various ports to North-East Asia for 2010

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Portland	20	52,868	0.08	0.0 – 0.3
Brisbane	9	14,154	0.08	0.0 – 0.3
Fremantle	5	2,616	0.10	0.0 – 0.3

Table 20 Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to North-East Asia for 2010

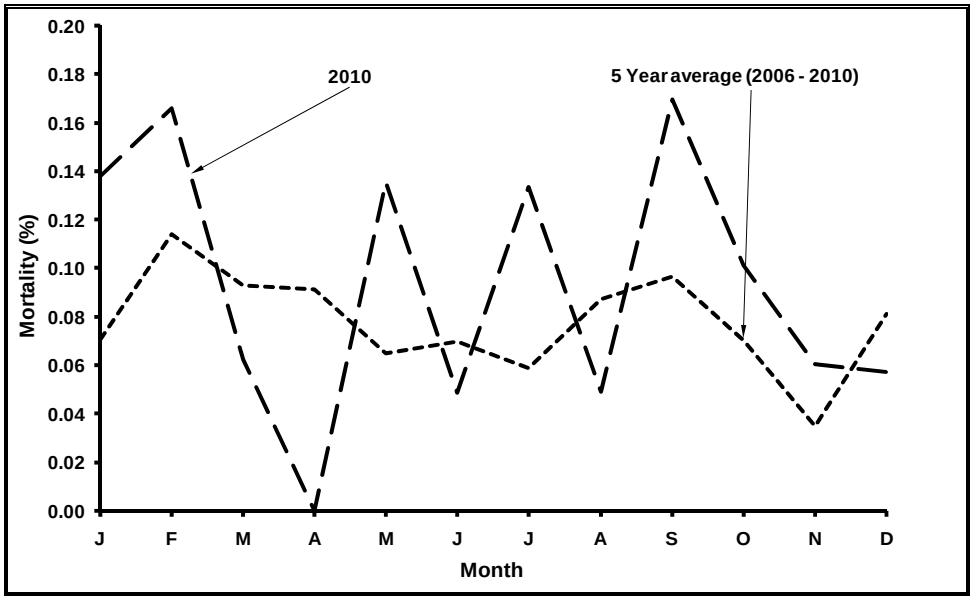
Port	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
Portland	3	17	0	0	20
Brisbane	3	6	0	0	9
Fremantle	4	1	0	0	5
Total	10	24	0	0	34

4.2.5.2 Time of year

Monthly mortality rates (total mortality as a proportion of total loaded for each month) for voyages to North-East Asia in 2010 were below 0.18% throughout the year (Figure 14).

The monthly mortality rate in 2010 fluctuated widely compared to the five year average, probably because there were only one or two voyages in five months of the year.

Figure 14 Monthly mortality rates of cattle on voyages from all ports to North-East Asia for 2009 and the 5-year monthly rates for the period 2006 to 2010



4.2.5.3 Ship

The voyages of each ship taking cattle from Australia to North-East Asia were classified into various mortality categories as shown in Table 21. All voyages were in the nil or low categories.

Table 21 Number of voyages in nil, low, medium and high mortality categories for shipments to North-East Asia for 2010

	Mortality rate				
Ship (code)	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	Total
44	0	3	0	0	3
59	0	7	0	0	7
77	1	2	0	0	3
87	3	4	0	0	7
103	4	2	0	0	6
114	0	1	0	0	1
119	0	3	0	0	3
120	2	2	0	0	4
Total	10	24	0	0	34

4.2.5.4 Class of cattle

Mortality rates for each class of cattle exported to North-East Asia during 2010 are presented in Table 22. The North-East Asian cattle trade comprised mainly steers exported to Japan and dairy heifers exported to China.

In 2010 the highest mortality rates occurred in dairy cows (0.17%) followed by adult steers (0.10%)..

Table 22 Mortality rate, number of voyages and number of cattle in the classes exported to North-East Asia in 2010

Class	Voyages (No.)	Cattle (No.)	Mortality rate (%)	Mortality rate range (%)
Heifer dairy	25	52,618	0.07	0.0 – 0.3
Steer adult*	9	13,800	0.10	0.0 – 0.3
Cow dairy	1	2,956	0.17	n/a
Heifer beef	1	264	0.00	n/a

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

4.2.6 Miscellaneous destinations

The Miscellaneous category frequently comprises relatively few of voyages to widely differing destinations. However in 2010, most voyages in the Miscellaneous category were to Turkey and the Black Sea.

The number of cattle exported to Miscellaneous destinations rose greatly in 2010 (Table 23). This was mainly due to the introduction of Turkey as a cattle export destination

Table 23 Mortality rates, number of voyages, voyage and discharge length, and number of cattle exported to Miscellaneous destinations from 1995 to 2010

Year	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)	Voyage days	Discharge days	Nil mortality voyages (No.)
1995	3	3,840	0.70	0.1 – 1.4	–	–	0
1996	4	3,493	0.40	0.0 – 0.9	–	–	1
1997	1	769	0.00	n/a	4.00	0.00	1
1998	0	0	n/a	n/a	n/a	n/a	n/a
1999	0	0	n/a	n/a	n/a	n/a	n/a
2000	1	828	0.00	n/a	12.00	1.00	1
2001	6	5,694	0.05	0.0 – 0.2	13.67	1.00	4
2002	4	4,184	0.05	0.0 – 0.1	11.25	0.25	2
2003	2	1,001	0.00	n/a	8.00	0.50	2
2004	2	573	0.52	0.0 – 0.5	11.00	0.50	1
2005	0	0	n/a	n/a	n/a	n/a	n/a
2006	1	3,382	0.09	n/a	19.18	1.98	0
2007	8	8,506	0.26	0.0 – 1.0	23.80	0.98	1
2008	12	20,109	0.11	0.0 – 0.2	23.30	1.08	4
2009	1	3,483	0.37	n/a	41.60	0.69	0
2010	12	79,473	0.44	0.0 – 0.8	24.06	4.64	2

4.2.6.1 Port of loading

Cattle were exported to Miscellaneous destinations from Fremantle and Portland (Table 24).

The voyages from each port were classified into various mortality categories as shown in Table 25. All voyages were in the nil or low categories. There were 4 voyages in the medium category, 2 from each port.

Table 24 Mortality rates, number of voyages and number of cattle exported from various ports to Miscellaneous destinations for 2010

Port	Voyages (No.)	Cattle (No.)	Mortality rate overall (%)	Mortality rate range (%)
Fremantle	7	65,695	0.45	0.0 – 0.7
Portland	5	13,778	0.37	0.1 – 0.8

Table 25 Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to Miscellaneous destinations for 2010

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
Fremantle	2	3	2	0	7
Portland	0	3	2	0	5
Total	2	6	4	0	12

4.2.6.2 Ship

The voyages of each ship taking cattle from Australia to Miscellaneous destinations were classified into various mortality categories as shown in Table 26. Four voyages were in the medium category, involving ships 42, 43, 45 and 119.

Table 26 Number of voyages in nil, low, medium and high mortality categories for shipments to Miscellaneous destinations for 2010

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
33	1	1	0	0	2
35	0	1	0	0	1
42	0	0	1	0	1
43	0	2	1	0	3
45	0	0	1	0	1
46	0	1	0	0	1
115	1	0	0	0	1
119	0	0	1	0	1
121	0	1	0	0	1
Total	2	6	4	0	12

4.2.6.3 Class of cattle

Mortality rates for each class of cattle exported to Miscellaneous destinations during 2010 are presented in Table 27. Trade to Miscellaneous destinations comprised mainly steers exported to Turkey and dairy cattle exported to Russia.

In 2010 the highest mortality rates occurred in weaner steer (0.86%) followed by dairy cows (0.66%). However, it should be noted that these two classes are each represented by only one voyage.

Table 27 Mortality rate, number of voyages and number of cattle in the classes exported to Miscellaneous destinations in 2010

Class	Voyages (No.)	Cattle (No.)	Mortality rate (%)	Mortality rate range (%)
Steer adult*	8	52,504	0.44	0.0 – 0.9
Heifer dairy	5	11,888	0.38	0.1 – 0.8
Bull adult*	8	5,393	0.37	0.0 – 1.7
Steer weaner	1	3,596	0.86	n/a
Cow dairy	1	3,180	0.66	n/a
Bull weaner	2	2,912	0.03	0.0 – 0.1

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

4.3 Goats

4.3.1 Performance trend

Figures 16 and 17 show the number of goats exported and the mortality rates during sea transport from all ports in Australia to all destinations since 1993 as well as the trend line (linear regression) across the years. The number of goats exported annually has varied between approximately 600 and 114,000, and the annual mortality has varied between 0.17 and 2.69%. The trend for annual mortality has continued downward.

Figure 16 Number of goats exported by sea from Australia to all destinations since 1993

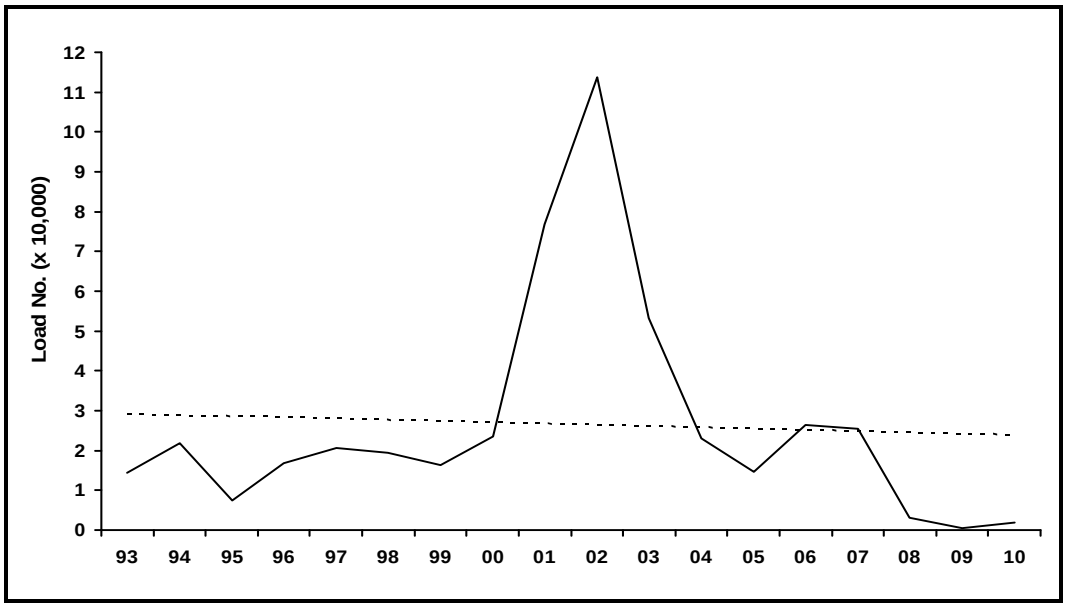
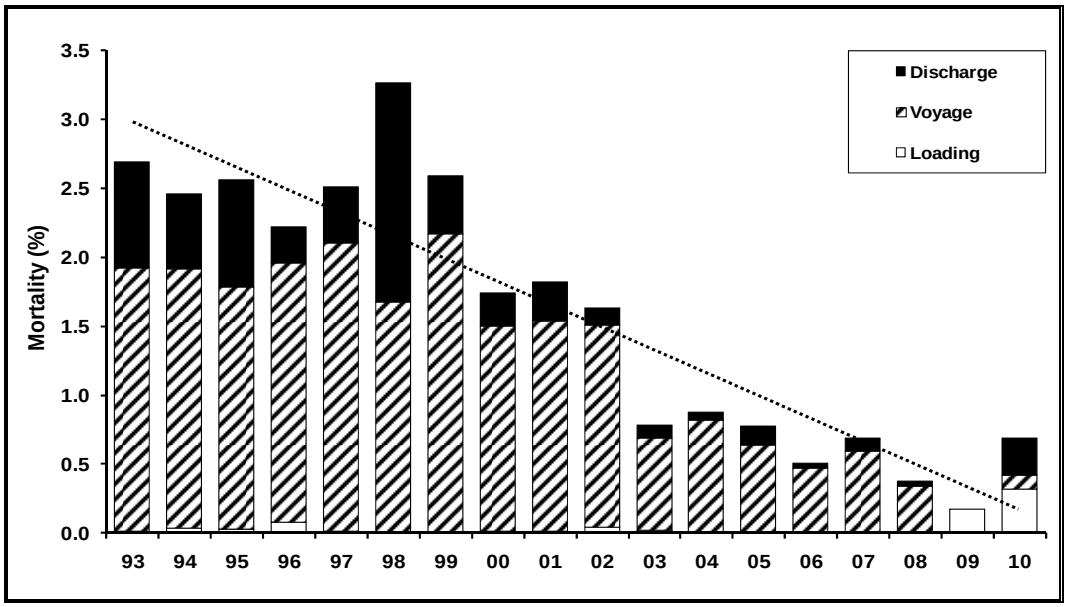


Figure 17 Annual mortality of goats exported by sea from Australia to all destinations since 1993



4.3.2 Overview

The number of goats exported by sea from Australia in 2010 was 1,885. These were shipped on five voyages to South-East Asia and incurred a mortality rate of 0.69% (Table 28).

All voyages carrying goats in 2010 departed from the port of Darwin.

For a number of years the export of live goats has been undertaken mainly by air, with minimal mortalities. South-East Asia is the main importer of goats exported by air.

4.3.3 South-East Asia

The number of goats exported by sea to South-East Asia peaked in 2002, but has fallen substantially since then (Table 28). The mortality rate in 2010 rose to 0.69%, up from the record low of 0.17% experienced in 2009.

Table 28 Mortality rates, number of voyages and number of goats exported by sea to South-East Asia from 1993 to 2010

Year	Voyages (No.)	Goats (No.)	Mortality rate overall (%)	Mortality rate range (%)
1993	17	7,497	1.63	0.0 - 4.7
1994	19	7,867	1.89	0.0 - 5.5
1995	11	4,818	2.24	0.0 - 7.8
1996	12	5,208	1.73	0.0 - 4.1
1997	26	14,363	2.53	0.0 - 7.0
1998	14	10,698	4.55	0.0 – 28.8*
1999	19	10,143	2.44	0.0 - 5.0
2000	28	14,728	1.65	0.0 - 8.7
2001	45	31,150	1.37	0.0 - 6.9
2002	49	42,032	1.05	0.0 - 9.9
2003	41	36,048	0.76	0.0 - 3.1
2004	29	20,801	0.93	0.0 - 2.6
2005	25	14,694	0.78	0.0 – 2.0
2006	25	25,353	0.49	0.0 – 3.0
2007	21	21,204	0.35	0.0 – 1.1
2008	8	3,180	0.50	0.0 – 2.9
2009	2	577	0.17	0.0 – 0.3
2010	5	1,885	0.69	0.0 – 1.2

* One voyage delayed at discharge, resulting in excessive discharge mortality

4.3.4 Air transport of live goats

Air transport has played a significant role in the export of live goats for many years, and currently accounts for the 97.7% of live goat exports (79,040 out of 80,925 goats exported).

4.3.4.1 Load point / destination

The loading points and destination countries for goats transported by air from Australia in 2010 are shown in Table 29.

The majority of these goats were loaded at Adelaide, Sydney and Melbourne airports.

The main importing countries for goats exported by air in 2010 were Malaysia (85% of total exports), Singapore (11%) and the Philippines (3%).

Table 29 Load point and destination country for goats exported by air from Australia during 2010

Country	Adelaide	Brisbane	Melbourne	Perth	Sydney	Total
Malaysia	14,410	8,534	20,454	4,572	19,425	67,395
Philippines					2,089	2,089
Singapore	8,709		20	104		8,833
Other			295		428	723
Total	23,119	8,534	20,769	4,676	22,286	79,040

SOURCE – Australian Bureau of Statistics, April 2010

4.3.4.2 Mortalities

Goats exported by air experienced few mortalities during 2010. Similar levels of mortality were seen in 2008 and 2009 (Table 30).

Table 30 Mortality rates and number of goats exported by air to all destinations from 2008 to 2010

Year	Goats (No.)	Total Mortalities (No.)	Mortality rate overall (%)
2008	73,167	1	0.001
2009	84,923	0	0.000
2010	78,905	8	0.010

SOURCE – Australian Quarantine and Inspection Services

5 Conclusion and recommendations

5.1 Sheep, cattle and goats

It was concluded that the project objectives were met; the mortalities of sheep, cattle and goats for the 2010 calendar year were summarised and mortality trends analysed. It is recommended that this project continue to be funded and reported on an annual basis in the future. This is the only comprehensive report of its type and is of interest and importance to a wide range of stakeholders.

In the past much of the analysis for South-East Asia was derived from ship Master's Reports (voyage mortality reports that must be provided to AMSA and DAFF for all shipments of livestock). In 2010 94% of cattle exported to South-East Asia could be identified by class, up from 27% in 2009. This improvement required much extra input from Industry which would have been unnecessary using an earlier version of the Master's Report. The current version of the Master's Report has been modified and no longer provides enough detail to allow the analysis required for this report. It is recommended that steps be taken to re-introduce an earlier version of the Master's Report.

It is recommended that graphs and tables presenting long-term overviews be restricted to a rolling ten-year basis. The older data does not reflect the current state of the trade in terms of standards required of industry, ships participating and markets serviced.

6 Appendices

6.1 Appendix 1 – Research update

6.1.1 Investigating cattle morbidity and mortality to the Middle East

This project has been initiated in response to concerns regarding elevated mortalities in some cattle voyages to the Middle East that were attributed to bovine respiratory disease (BRD).
The project aims to produce valid and credible descriptions of causes of death in cattle exported from Australia to the Middle East and to develop systems that can be implemented by industry to describe causes of death in a sustainable manner.

6.1.2 Veterinary pathology and disease investigation course for AAVets

A training needs analysis conducted as part of the MLA/LiveCorp R&D project 'Developing cattle data collection systems' reviewed the current levels of veterinary expertise required on board livestock ships and identified areas where further training would ensure optimal and standardised disease investigation and data collection techniques

Recommendations from the training needs analysis has led to the development of an R&D project which aims to:
1. Provide conceptual frameworks using interactive discussions involving scenarios and case studies to assist the investigation of animal disease events on sea voyages
2. Provide hands-on training in the safe and systematic necropsy of an animal and the photographic and written description, and packaging of specimens
3. Provide reference information, checklists and risk libraries that can be used on voyages to assist disease investigation.

The first of two of two scheduled training courses for AQIS Accredited Veterinarians (AAVets) was held at Murdoch University, Murdoch, WA in January 2011. The two-day course was completed by ten participants with an additional five attendees from the School of Veterinary and Biomedical Sciences, Murdoch University. It was considered to be very successful, being held in an excellent venue, with all planned activities completed on time. Participant feedback was very positive and reflected the high level of organisation, planning and expertise of the instructors in preparing and delivering the course.

The R&D project intends to deliver a second training course later this year.

6.1.3 "HotStuff" verification

Cattle and sheep being shipped to ports north of the equator can be exposed to conditions that impose thermoregulatory challenges. The maintenance of homeostasis in these animals can be aided by setting limits to the wet-bulb temperature on the animal decks. The wet-bulb temperature on the animal decks is, in turn, influenced by the ambient conditions and the stocking density.

A heat stress risk assessment model (named 'HotStuff') has been developed for MLA / LiveCorp for use on long haul live export voyages to the Middle East. The HotStuff model predicts restrictions in stocking density on live export ships based on expected ambient conditions and the ship characteristics (especially the ventilation rate, or 'pen air turnover' on the animal decks).

For the next two years research officers will deploy loggers measuring dry bulb temperature and relative humidity on board the animal decks of ships carrying livestock across the equator. From those measurements the deck wet-bulb temperature will be determined and compared to the predictions of the HotStuff model. These data will help determine the real world performance of the model and whether any adjustments in the model parameters are required.

6.1.4 Scabby mouth

A project is underway to review the literature relating to scabby mouth and vaccination, determine the current use of the vaccine, and to determine the incidence of scabby mouth in sheep prior to departure and at the port of discharge.

6.2 Appendix 1 - Published studies

A list of scientific and extension publications, relevant to the livestock export trade, is shown below.

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

Stockman, CA, Barnes, AL, Maloney, SK, Taylor, E, McCarthy, M and Pethick, D (2011) 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

Australian Government Department of Agriculture, Fisheries and Forestry (2011) Australian standards for the export of livestock (version 2.3) and Australian position statement on the export of livestock

6.3 Appendix 2 - Acknowledgements

The cooperation of ships' officers in recording details of daily mortalities is gratefully acknowledged.

The cooperation of Exporters, Ship Agents and Port Authorities for additional help in collating data is also gratefully acknowledged.

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

This work was funded by Meat and Livestock Australia, LiveCorp and the Department of Agriculture and Food, Western Australia.