

National livestock exports mortality summary 2004

LIVE.225

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1 INTRODUCTION

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 live 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 provides summary information about mortalities in sheep, cattle and goats during sea transport from Australia. The main purpose of the report is to allow industry, government and others to monitor mortality trends in the live sheep and cattle trades. The report also lists relevant published studies. As in previous reports, codes are used where appropriate in order to maintain confidentiality.

The information in this report is obtained from ship Masters' reports which record livestock deaths and other information about the voyage, and also from "Yellow Books" which record more detailed information about numbers of livestock deaths than is available from the Masters' report. The results in this report are based on analysis of ship Masters' reports and "Yellow Books" which were to hand on 15 April 2005.

Readers should be aware that mortality information is sometimes received after publication of a particular year's summary report. These records are added to the database and used in subsequent analysis. Therefore, subsequent mortality summary reports referring to previous years' statistics may vary slightly from previously published mortality summary reports.

2 SHEEP

2.1 Overview

Most sheep exported live by sea from Australia are sent to the Middle East and are mainly loaded at Fremantle, Adelaide and Portland. Some sheep are exported to other regions, mainly South-East Asia. An overview of the findings of research into the causes of sheep deaths during export to the Middle East is given in Section 5.

2.2 Port of loading

The number of sheep exported by sea from Fremantle, Adelaide and Portland during 2004 is shown in Table 1. Compared with 2003, there were substantial falls in most classes of sheep exported from Portland and Adelaide. The figures in Table 1 are based on information provided in the "Yellow Books" and the ship Masters' reports, and the (column) totals may not match other sources of information.

Table 1 The number of sheep exported by sea from Fremantle, Adelaide and Portland during 2004

Livestock	Fremantle / other WA ports		Adelaide	Portland	Total	
	Middle East	S.E. Asia	Middle East	Middle East		
Wethers	adults	1,412,972	1,762	245,439	229,696	1,889,869
	hoggets	192,924	1,999	0	8,464	203,387
	lambs	461,321	3,931	0	0	465,252
Rams	adults	72,718	14,534	9,150	6,374	102,776
	hoggets	48,497	0	0	0	48,497
	lambs	390,591	7,180	3,028	0	400,799
Ewes	adults	81,326	0	0	0	81,326
	hoggets	0	0	0	0	0
	lambs	101,043	0	0	0	101,043
Total	sheep	2,761,392	29,406	257,617	244,534	3,292,949

Most sheep exported by sea from Australia during 2004 were loaded at Fremantle (85% of all sheep, Figure 1) with smaller numbers loaded at Adelaide (8%) and Portland (7%).

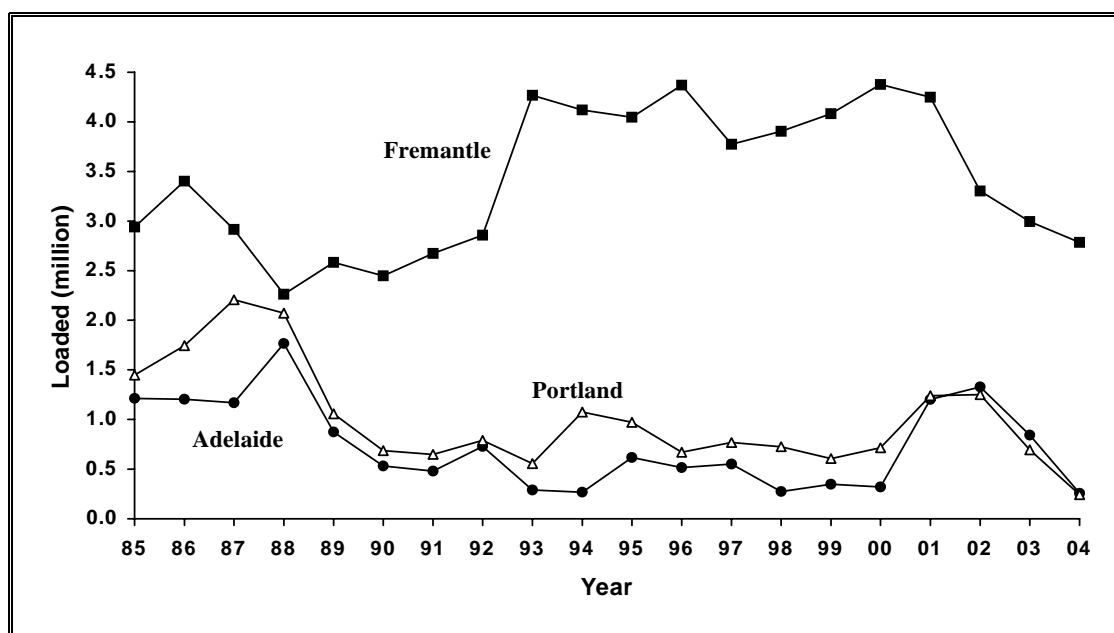


Figure 1 Numbers of sheep exported by sea from Fremantle (Western Australia), Portland (Victoria) and Adelaide (South Australia) since 1985

2.3 Destination

The main importing countries for Australian sheep in 2004 are shown in Table 2. Kuwait was the main market (35% of all sheep) followed by Jordan (29%).

Table 2 Destination country for sheep exported from Fremantle/WA, Adelaide and Portland during 2004

Country	Fremantle/WA	Adelaide	Portland	Total
Bahrain	367,170	13,040	95,000	475,210
Israel	32,189			32,189
Jordan	809,828	120,515		930,343
Kuwait	1,025,680	109,244	99,060	1,233,984
Lebanon	20,711			20,711
Oman	235,434	13,836	32,900	282,170
Qatar	137,086			137,086
S.E. Asia	27,551			27,551
UAE	165,155	1,540	20,000	186,695
Mauritius	500			500
Total	2,821,304	258,175	246,960	3,326,439

SOURCE – Australian Bureau of Statistics

2.4 Death rates

There were 18 voyages to the Middle East for which sheep were loaded at more than one port in Australia (split-load voyages) in 2004. 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 sheep from each load port have been considered as separate "voyages".

The shipboard part of the export process is divided into three phases: loading; voyage to the first port of unloading; and discharge. The discharge phase includes all deaths after arrival at the first port. Consequently if a ship called at more than one discharge port, all the deaths after arrival at the first port were included in the discharge phase.

The total death rate for all sheep exported to all destination regions during 2004 was 0.75% (Table 3). This is a new record low. In 2003, if the deaths on the MV Cormo Express after it was rejected at Saudi Arabia are included, the total mortality for shipments from Fremantle to the Middle East was 0.94% and the total mortality for all sheep exported to all destinations was 1.00%.

There were 16 shipments to South-East Asia, and the death rate was 0.20% out of 29,406 sheep loaded.

For shipments to the Middle East, there has been a remarkable drop in mortality of sheep exported from Portland in 2003 and 2004 compared to previous years (Table 3 and Figure 2). The long term trend for declining death rates of sheep exported from Fremantle continued in 2004 (Figure 2), while death rates for sheep exported from Adelaide also fell from levels observed in 2001.

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

	Year	Death rate (%)			
		Load	Voyage	Discharge	Total
Fremantle*	2001	0.01	0.66	0.29	0.96
	2002	0.01	0.61	0.26	0.87
	2003	0.01	0.56	0.20†	0.76†
	2004	0.00	0.46	0.25	0.71
Adelaide*	2001	0.03	1.11	0.35	1.48
	2002	0.01	0.99	0.29	1.29
	2003	0.01	0.91	0.26	1.18
	2004	0.00	0.89	0.25	1.15
Portland*	2001	0.03	1.40	0.73	2.15
	2002	0.01	1.27	0.82	2.10
	2003	0.00	0.72	0.29	1.01
	2004	0.00	0.49	0.29	0.78
Total**	2001	0.02	0.87	0.38	1.26
	2002	0.01	0.84	0.39	1.24
	2003	0.01	0.65	0.23†	0.88†
	2004	0.00	0.49	0.25	0.75

* Middle East only

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

† Excludes deaths on the MV Cormo Express after it was rejected at Saudi Arabia

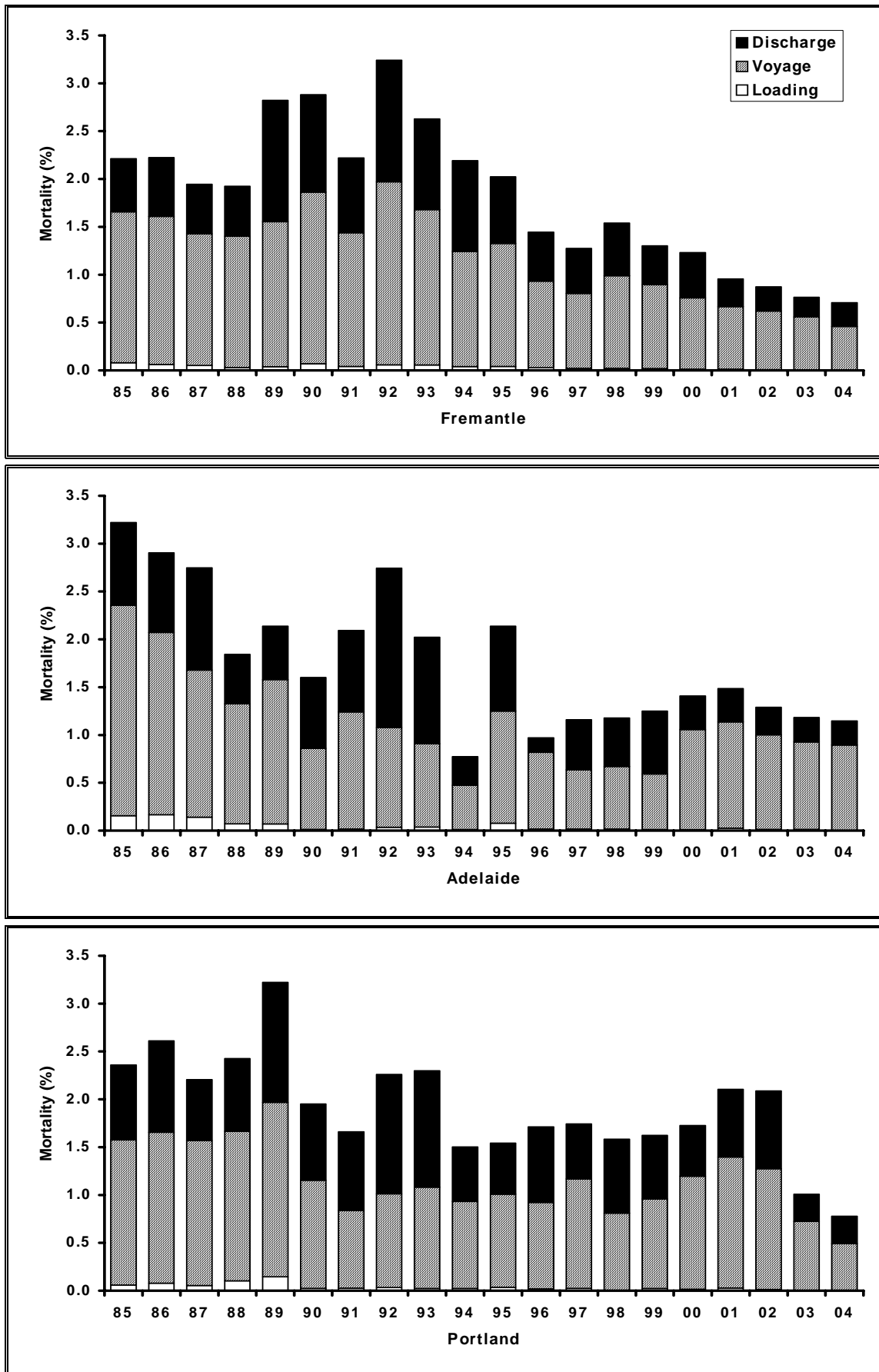


Figure 2 Annual mortality for sheep exported from Fremantle, Adelaide and Portland to the Middle East since 1985 – figure for Fremantle excludes deaths on the MV Cormo Express after it was rejected at Saudi Arabia in 2003

2.5 Class of sheep

The death rates of various classes of sheep exported from Australia to the Middle East are shown in Table 4 and Figure 3. The highest death rates were observed in ram lambs, adult rams and adult wethers exported from Adelaide – note that relatively few rams were exported from Adelaide (Table 1).

Table 4 Overall mortality (%) for classes of sheep exported from Fremantle, Adelaide and Portland to the Middle East in 2004

Class of sheep		Fremantle	Adelaide	Portland	Total
Wethers	adult	0.8	1.1	0.8	0.8
	hogget	0.6	n/a	0.6	0.6
	lamb	0.5	n/a	n/a	0.5
Rams	adult	1.0	2.0	0.8	1.1
	hogget	0.9	n/a	n/a	0.9
	lamb	0.8	2.2	n/a	0.8
Ewes	adult	0.9	n/a	n/a	0.9
	hogget	n/a	n/a	n/a	n/a
	lamb	0.4	n/a	n/a	0.4

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

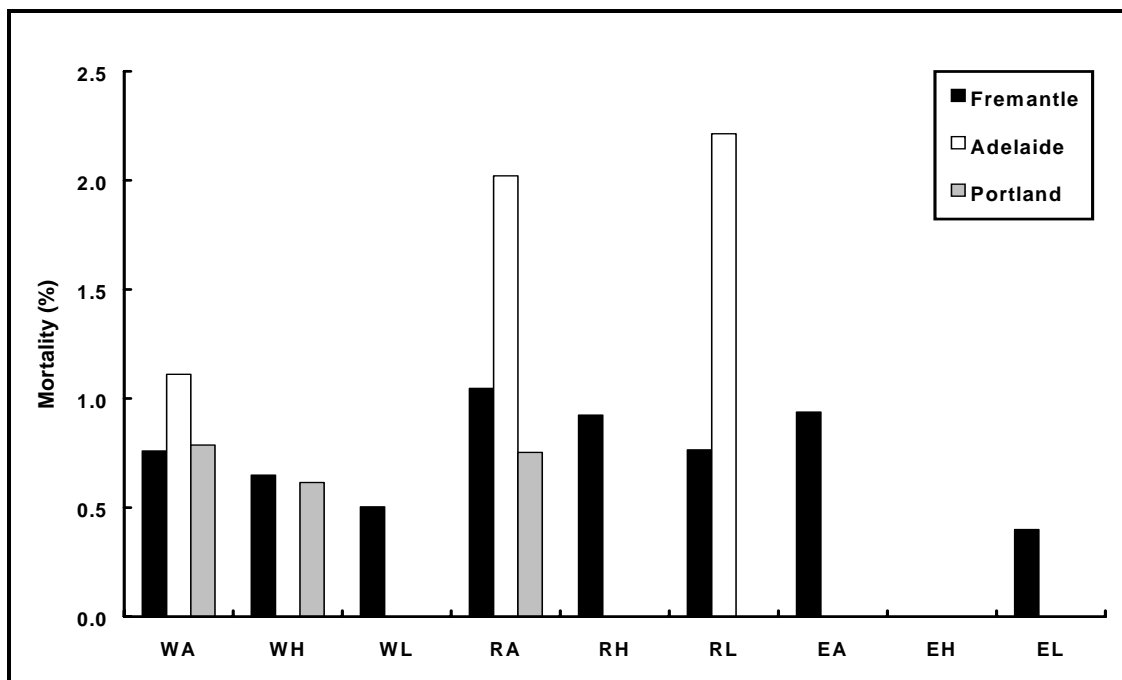


Figure 3 Overall mortality (%) for classes of sheep exported from Fremantle, Adelaide and Portland to the Middle East in 2004

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

2.6 Time of year

Death rates in sheep exported from Portland to the Middle East fell by more than half during the May to October period in 2003 compared to 2002, and fell by a similar amount during the same period in 2004 compared to 2003 (Table 5). In addition, the monthly death rate for shipments from Portland remained below 2.0% throughout 2003 and 2004 whereas the monthly death rate for shipments from Portland exceeded 2.0% on several occasions in the previous 3 years.

Table 5 Monthly mortality for all sheep exported from Fremantle, Adelaide and Portland to the Middle East from 2000 to 2004.

Port	Month	Year				
		00	01	02	03	04
Fremantle	J	0.8	0.7	0.9	0.5	0.8
	F	0.8	0.5	0.7	0.5	0.5
	M	1.0	0.5	0.5	0.4	0.5
	A	1.0	0.6	0.7	0.6	0.4
	M	1.1	0.7	0.7	0.6	0.5
	J	2.2	1.3	0.9	0.8	0.9
	J	2.4	1.4	1.4	0.9	0.6
	A	1.3	1.6	1.1	1.0	0.9
	S	1.8	1.7	0.9	1.0	1.0
	O	1.1	1.1	1.1	1.1	0.8
	N	1.0	1.1	0.9	1.2	0.7
	D	0.9	0.8	0.6	0.7	0.6
	M – O*	1.6	1.3	1.0	0.9	0.8
Total	1.2	1.0	0.9	0.8	0.7	
Adelaide	J	0.2		1.7	0.9	1.2
	F		1.5	0.8	1.0	1.3
	M		1.3	0.8	0.9	
	A	0.6		1.2	0.6	
	M	0.5	1.1	0.7	1.2	0.5
	J	2.4		1.8	2.3	1.1
	J	1.3	1.5	1.7	1.2	0.7
	A		2.4	0.9	1.0	1.3
	S	0.5	1.7	1.5	1.7	1.3
	O	0.7	1.0	1.9	1.1	
	N		1.8	1.1		
	D	2.3	1.4	1.4	1.8	
	M – O*	1.3	1.5	1.5	1.4	1.1
Total	1.4	1.5	1.3	1.2	1.1	
Portland	J	1.3	1.9	1.3	0.6	
	F		2.4	1.0		0.8
	M	0.9	0.7	0.7	0.6	1.0
	A	0.7	1.0	1.1	0.6	0.8
	M		1.8	1.0	0.7	0.5
	J		4.0	1.7	1.0	1.0
	J		1.6	5.5	1.7	0.7
	A		2.2	7.5	1.4	
	S	2.8	2.1	2.1	1.8	
	O	2.2	3.2		1.4	
	N	1.6	2.4			0.9
	D	5.3	2.1	1.3	0.7	
	M – O*	2.5	2.7	3.0	1.3	0.6
Total	1.7	2.2	2.1	1.0	0.8	

* May to October

Death rates were higher ($P < 0.01$) in the second half of 2004 compared with the first half in sheep exported from Fremantle and Adelaide but not for Portland (Figure 4).

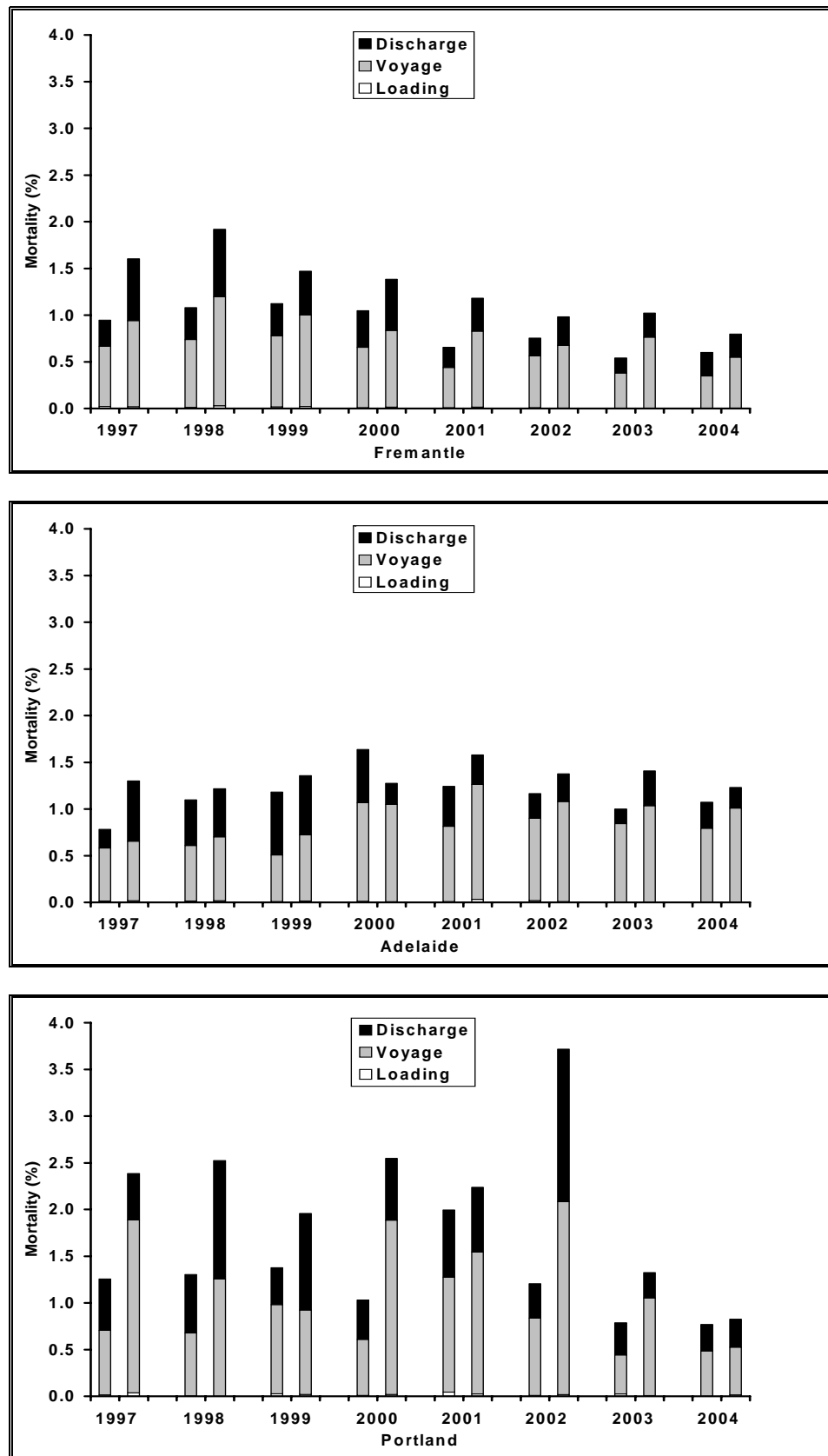


Figure 4 Mortality (%) for sheep exported by sea from Fremantle, Adelaide and Portland to the Middle East for the first and second half of each year from 1997 to 2004

2.7 Ship

The voyages of each ship were classified into low, medium and high mortality categories for sheep exported to the Middle East from Fremantle (Table 6a), Adelaide (Table 6b) and Portland (Table 6c). During 2004 there was only one voyage from Fremantle classified as "high mortality", and none from Portland and Adelaide. Approximately 86% of voyages from Fremantle, 87% of voyages from Portland and 33% of voyages from Adelaide were in the "low" category.

Table 6a Number of voyages in low, medium and high mortality categories for ships loaded at Fremantle in 2004

Ship (code)	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
2	6	1	0	7
7	4	0	0	4
27	2	0	0	2
32	6	0	0	6
33	4	1	0	5
34	4	2	1	7
35	4	0	0	4
37	7	0	0	7
93	0	1	0	1
103	1	0	0	1
Total	38	5	1	44*

* One low mortality split-loaded voyage excluded: mortalities could not be determined by consignment (port of loading)

Table 6b Number of voyages in low, medium and high mortality categories for ships loaded at Adelaide in 2004

Ship (code)	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
2	0	1	0	1
27	1	1	0	2
32	1	1	0	2
33	1	1	0	2
34	0	1	0	1
35	0	1	0	1
Total	3	6	0	9*

* One low mortality split-loaded voyage excluded: mortalities could not be determined by consignment (port of loading)

Table 6c Number of voyages in low, medium and high mortality categories for ships loaded at Portland in 2004

Ship (code)	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
2	2	0	0	2
32	1	1	0	2
34	4	0	0	4
Total	7	1	0	8

3 CATTLE

3.1 Overview

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

There were 19 voyages in 2004 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".

The overall death rate among the 0.61 million cattle exported from Australia in 2004 fell to 0.10% (Table 7), down from 0.11% observed in 2003. The highest overall death rate was to the Middle East/North Africa followed by the Mexico, while the lowest death rate was to South-East Asia. Exports to South-East Asia were characterised by small consignments on short voyages with very low death rates. Exports to North-East Asia were mainly dairy cattle exported to China. Voyages to the Middle East involved longer duration and higher death rates than those to other regions. The number of cattle exported to North-East Asia in 2004 was 40% higher than in 2003 while the number of cattle exported to the Middle East fell by 42%.

Table 7 Death rates, number of voyages and number of cattle exported for voyages to major destination regions during 2004

Parameter	ME/N Africa	SE Asia	NE Asia	Mexico	Total
Voyages (No.)	31	211	49	3	294
Cattle (No.)	61,679	453,969	93,303	5,633	614,584
Death rate overall (%)	0.43	0.05	0.10	0.37	0.10
Death rate range (%)	0.0 – 1.2	0.0 – 1.8	0.0 – 0.8	0.1 – 0.1	0.0 – 1.8
Voyages with nil deaths (No.)	9	115	12	1	137

3.2 Middle East

The live cattle trade to the Middle East has contracted substantially over the last two years (Table 8), and overall death rates have remained below 0.5% since 1999 except for 2002.

Table 8 Death rates, number of voyages and number of cattle exported to the Middle East from 1995 to 2004

Year	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)	Voyages with nil deaths (No.)
1995	11	14,557	0.67	0.0 – 2.1	2
1996	36	65,066	0.65	0.0 – 5.0	14
1997	62	137,869	0.67	0.0 – 4.2	15
1998	118	262,432	0.69	0.0 – 41.5*	22
1999	113	316,964	0.35	0.0 – 3.3	26
2000	98	274,639	0.42	0.0 – 8.0	22
2001	101	287,447	0.33	0.0 – 5.0	27
2002	102	265,005	0.61	0.0 – 35.0*	33
2003	52	106,080	0.45	0.0 – 2.0	18
2004	31	61,679	0.43	0.0 - 1.2	9

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

3.2.1 Port of loading

There were only 3 ports of loading for voyages to the Middle East in 2004, and most cattle were exported from Fremantle, followed by Adelaide and Portland (Table 9). Death rates in 2004 were highest from Adelaide (0.63%), followed by Fremantle (0.42%) and Portland (0.30%).

The voyages from each port were classified into various mortality categories as shown in Table 10. Only one voyage was in the high category, and this involved a consignment from Adelaide.

Table 9 Death rates, number of voyages and number of cattle exported from various ports to the Middle East for 2004

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Fremantle	22	54,585	0.42	0.0 – 0.8
Adelaide	5	4,743	0.63	0.0 – 1.2
Portland	4	2,351	0.30	0.0 – 0.6

Table 10 Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to the Middle East for 2004

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
Fremantle	7	10	5	0	22
Adelaide	1	2	1	1	5
Portland	1	2	1	0	4
Total	9	14	7	1	31

3.2.2 Time of year

Monthly death rates were below 1% throughout the year (Figure 5). There were no voyages to the Middle East from northern ports in 2004.

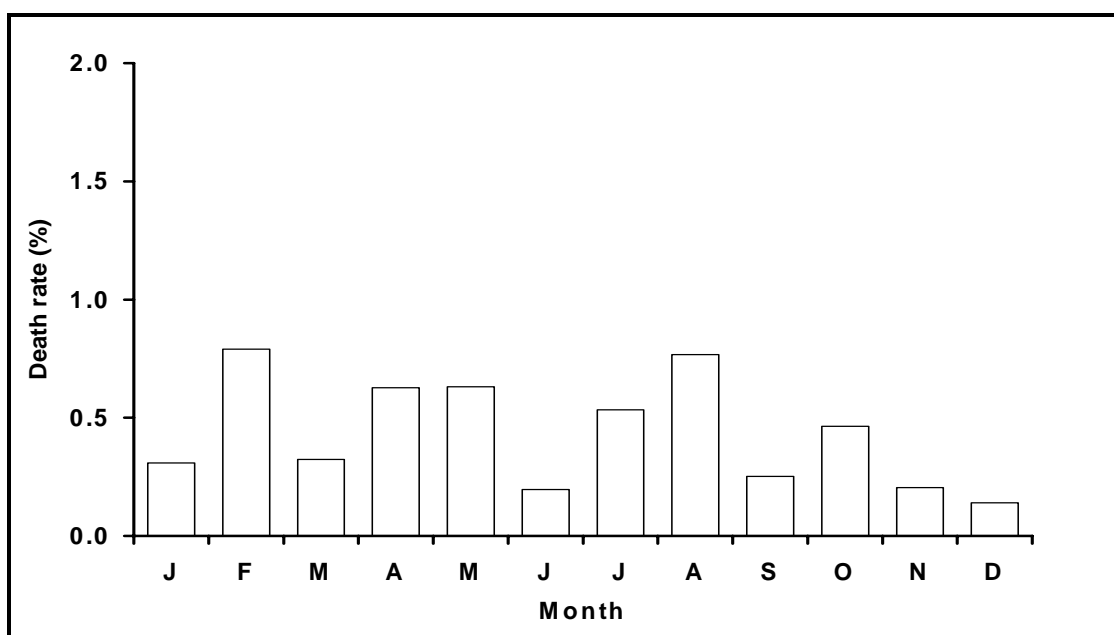


Figure 5 Monthly death rate of cattle on voyages to the Middle East for 2004

3.2.3 Voyages from southern ports 1999 to 2004

Additional analysis was conducted for the ports of Fremantle, Adelaide and Portland because of the higher death rates on voyages from these ports compared to northern ports in previous years. The number of cattle loaded at Portland and Adelaide in 2004 fell to about one quarter of the number exported in 2003 (Table 11) while mortalities fell by 14%, 10% and 7% for Portland, Adelaide and Fremantle respectively. Death rates of cattle were highest from Portland and lowest from Fremantle from 1999 to 2002 inclusive (Table 11); cattle exported from Portland had more than twice the risk of death compared to cattle exported from Fremantle during this period (Table 12). There was a marked reduction in risk of death from Portland in 2003 and 2004.

Table 11 Death rates for cattle loaded at Fremantle, Adelaide or Portland from 1999 to 2004

Year	Fremantle			Adelaide			Portland		
	Voys (No.)	Cattle (No.)	Dead (%)	Voys (No.)	Cattle (No.)	Dead (%)	Voys (No.)	Cattle (No.)	Dead (%)
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

* 0.74% if one high mortality voyage is excluded

Table 12 Relative risk of cattle deaths on voyages from Adelaide and Portland compared with Fremantle from 1999 to 2004

Year	Adelaide	Portland
	Relative risk (95% CI)	Relative risk (95% CI)
1999	1.6 (1.3-1.9)	2.5 (2.2-2.9)
2000	1.5 (1.3-1.9)	2.3 (2.0-2.7)
2001	1.5 (1.2-1.9)	2.4 (2.0-2.8)
2002	1.3 (1.1-1.6)	5.6 (5.0-6.4)*
2003	1.5 (1.3-1.9)	0.8 (0.6-1.1)**
2004	1.5 (1.1-2.2)	0.7 (0.3-1.5)**

* 2.1 (1.8-2.4) if one high mortality voyage is excluded

** not significantly different from Fremantle

3.2.5 Class of cattle

Recording of death rates for each class of cattle loaded began in July 2002. In 2004 the highest death rates occurred in adult bulls followed by dairy cows (Table 13).

Table 13 Death rates, number of voyages and number of cattle in various classes exported to the Middle East in 2004

Class	Voyages (No.)	Cattle (No.)	Death rate (%)	Death rate range (%)
Steer adult	17	4,704	0.40	0.0 - 1.2
Bull adult	19	29,599	0.54	0.0 - 1.2
Bull calf	14	22,432	0.34	0.0 - 1.2
Cow dairy	8	2,528	0.43	0.0 - 1.1
Heifer dairy	6	2,362	0.04	0.0 - 0.2

Note: one voyage excluded because mortalities could not be determined by class

3.2.6 Ship

The voyages of each ship from Australia to the Middle East were classified into the following mortality categories: nil (no deaths reported); low (death rate up to 0.5%); medium (death rate from 0.5 to 1.0%); and high (death 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 14 shows the number of voyages in the various mortality categories for each ship. Most voyages of most ships were in the nil or low mortality categories; there was only one voyage in the high category.

Table 14 Number of voyages in nil, low, medium and high mortality categories for shipments to the Middle East for 2004

Ship (code)	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
27	0	2	0	0	2
32	2	2	1	0	5
33	0	2	3	1	6
34	5	2	0	0	7
35	0	2	3	0	5
37	2	1	0	0	3
59	0	1	0	0	1
103	0	2	0	0	2
Total	9	14	7	1	31

3.3 South-East Asia

Approximately 0.45 million cattle were exported to South-East Asia in 2004 (Table 15) and the death rate was the same as 2003. No deaths were reported on half of the voyages to the region. The death rate from 1995 to 2004 has remained low at approximately 0.1% annually except in 1999 when the death rate was 0.34% (or 0.16% if one exceptionally high mortality voyage was excluded).

Table 15 Death rates, number of voyages and number of cattle exported to South-East Asia from 1995 to 2003

Year	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)	Voyages with nil deaths (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	277
1998	229	299,501	0.16	0.0 – 8.8	127
1999	326	462,540	0.34	0.0 – 74.7*	162
2000	384	586,569	0.11	0.0 – 5.3	168
2001	309	468,381	0.08	0.0 – 5.0	138
2002	354	634,642	0.07	0.0 – 8.5	186
2003	306	587,716	0.05	0.0 – 2.2	190
2004	211	453,969	0.05	0.0 – 1.8	115

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

3.3.1 Port of loading

Most cattle exported to South-East Asia in 2004 were loaded at Darwin followed by Broome (Table 16). The death rate from each port was 0.05% or less, with the exception of Fremantle.

Table 16 Death rates, number of voyages and number of cattle exported from various ports to South-East Asia in 2004

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Townsville	3*	3,747	0.05	0.0 - 0.1
Mourilyan	2	2,046	0.00	n/a
Weipa	1	1,200	0.00	n/a
Karumba	6	9,866	0.01	0.0 - 0.1
Darwin	91**	182,048	0.04	0.0 - 0.4
Wyndham	19†	57,789	0.02	0.0 - 0.2
Broome	44*	76,075	0.05	0.0 - 0.5
Port Hedland	6	11,773	0.04	0.0 - 0.1
Geraldton	19	32,024	0.05	0.0 - 0.1
Fremantle	17	26,188	0.22	0.0 - 1.8

(*) One, (**) three and (†) two split-load voyage excluded: mortalities could not be determined by consignment (port of loading). Total mortality for these voyages was 0.07% (range 0.04% - 0.11%)

3.4 North-East Asia

The number of cattle exported to North-East Asia in 2004 increased by 40% compared to 2003 (Table 17). Despite the large increase in exports in recent years, the death rate has remained relatively constant at about 0.1%.

Table 17 Death rates, number of voyages and number of cattle exported to North-East Asia from 1995 to 2004

Year	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)	Voyages with nil deaths (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	4
1998	10	14,734	0.17	0.0 - 0.4	2
1999	8	10,772	0.22	0.0 - 0.4	1
2000	10	13,830	0.14	0.0 - 0.4	4
2001	14	18,190	0.11	0.0 - 0.9	5
2002	17	22,483	0.12	0.0 - 0.7	7
2003	36	66,861	0.12	0.0 - 1.1	10
2004	49	93,303	0.10	0.0 - 0.8	12

3.4.1 Port of loading

The main port of loading for cattle exported to North-East Asia was Portland followed by Brisbane (Table 18). The cattle loaded at Portland were exported to China and those loaded at Brisbane were exported to Japan.

Table 18 Death rates, number of voyages and number of cattle exported from various ports to North-East Asia for 2003

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Portland	27*	70,034	0.09	0.0 - 0.5
Brisbane	12	16,992	0.12	0.0 - 0.8
Fremantle	9*	4,588	0.06	0.0 - 0.3

* One split-loaded voyages excluded: mortalities could not be determined by consignment (port of loading). Total mortality for this voyage was 0.24%.

3.5 China

Although considered part of North East Asia for the purposes of this report, exports to China are reported separately because of the rapid growth in exports of dairy cattle to this country (Table 19).

Table 19 Death rates, number of voyages and number of cattle exported to China from 1995 to 2004

Year	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)	Voyages with nil deaths (No.)
1995	0				
1996	0				
1997	1	1,290	2.56	n/a	n/a
1998	0				
1999	0				
2000	0				
2001	1	1,363	0.07	n/a	n/a
2002	6	8,407	0.25	0.0 - 0.7	0
2003	18	43,152	0.13	0.0 - 0.8	3
2004	36	75,460	0.09	0.0 - 0.5	7

3.5.1 Port of loading

Nearly all of the cattle exported to China in 2004 were loaded at Portland (Table 20).

Table 20 Death rates, number of voyages and number of cattle exported from various ports to North-East Asia for 2004

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Portland	27*	70,034	0.09	0.0 - 0.5
Fremantle	8*	3,737	0.08	0.0 - 0.3

* One split-loaded voyages excluded: mortalities could not be determined by consignment (port of loading). Total mortality for this voyage was 0.24%.

3.5.2 Class of cattle

Recording of death rates for each class of cattle exported to China was only introduced in July 2003. The results for 2004 are presented in Table 21.

Table 21 Death rate, number of voyages and number of cattle in the classes exported to China in 2004

Class	Voyages (No.)	Cattle (No.)	Death rate (%)	Death rate range (%)
Bull adult	1	36	0.00	n/a
Heifer dairy	35	73,771	0.09	0.0 - 0.5

4 GOATS

4.1 Overview

The live goat trade from Australia is characterised by the export of animals to the Middle East and South-East Asia. The overall death rate was 0.88% among the 23,048 goats exported from Australia in 2004 (Table 22). There were very few goats exported to the Middle East in 2004 and few deaths compared to exports to South-East Asia.

Table 22 Death rates, number of voyages and number of goats exported by sea for voyages to major destination regions during 2004

Parameter	ME/N Africa	SE Asia	Misc	Total
Voyages (No.)	4	29	1	34
Goats (No.)	1,021	20,801	1,226	23,048
Death rate overall (%)	0.10	0.93	0.65	0.88
Death rate range (%)	0.0 – 0.3	0.0 – 2.6	n/a	0.0 – 2.6

The number of goats exported annually to all destinations from Fremantle, Adelaide and Portland since 1993 is shown in Figure 6.

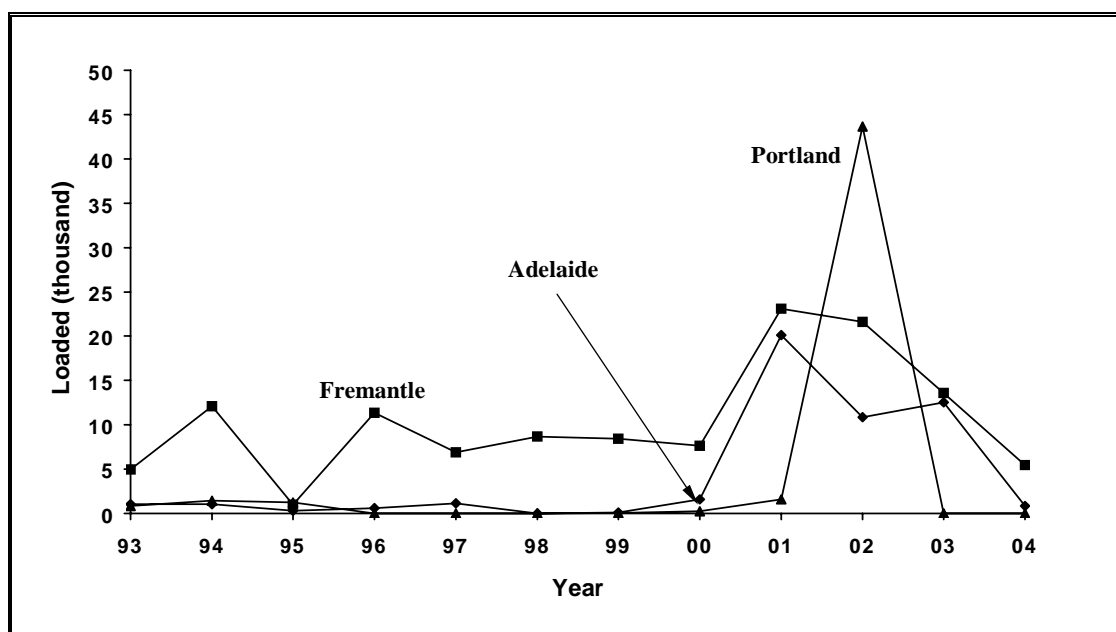


Figure 6 Number of goats ('000) exported by sea from Fremantle (Western Australia), Adelaide (South Australia) and Portland (Victoria) since 1993

The annual death rate of goats exported from Australia in 2004 showed a small increase compared to 2003 (Figure 7).

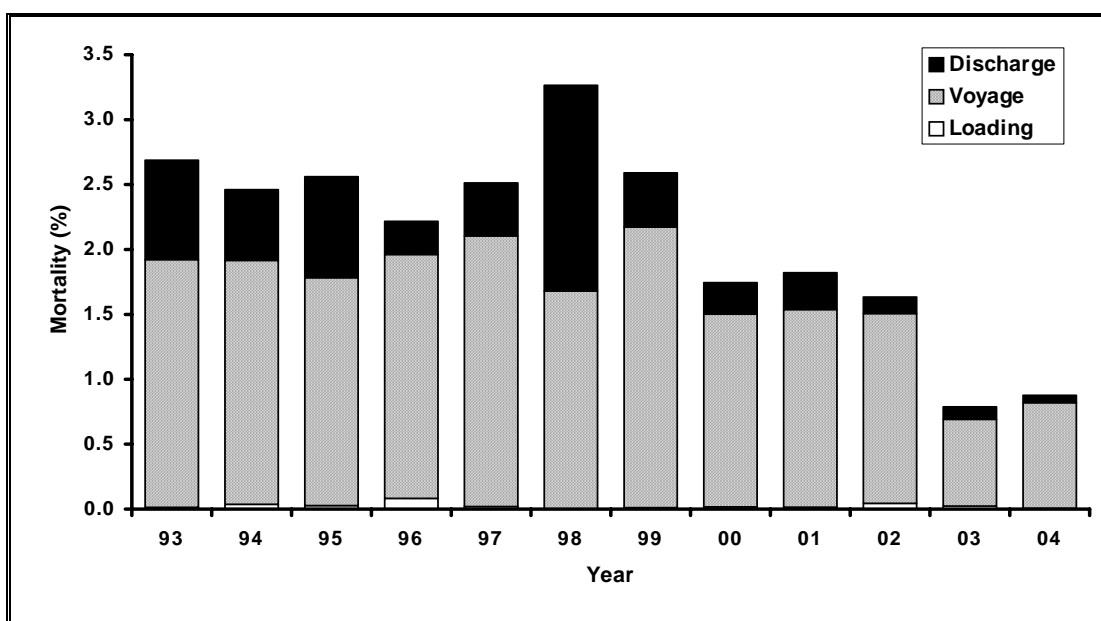


Figure 7 Annual mortality of goats exported by sea from all ports in Australia to all destinations since 1993

4.2 Middle East

Large numbers of goats were exported to the Middle East in 2001 and 2002 (Table 23) but the number has fallen dramatically in the last two years. The death rate remained below 3% since 1995 before falling to less than 1% in 2003 and 0.1% in 2004.

Table 23 Death rates, number of voyages and number of goats exported by sea to the Middle East from 1993 to 2004

	Voyages (No.)	Goats (No.)	Death rate overall (%)	Death rate range (%)
1993	15	6,681	3.85	0.0 - 7.2
1994	16	13,948	2.78	0.0 - 8.8
1995	4	2,526	3.17	0.0 - 6.5
1996	9	9,760	2.17	0.0 - 4.1
1997	10	6,259	2.48	0.0 - 4.6
1998	13	8,650	1.68	0.0 - 5.0
1999	8	6,193	2.80	0.0 - 7.6
2000	12	6,310	2.08	0.0 - 8.0
2001	35	42,878	2.25	0.0 - 9.0
2002	23	69,419	2.03	0.0 - 3.4
2003	16	16,552	0.88	0.0 - 1.7
2004	4	1,021	0.10	0.0 - 0.3

4.2.1 Port of loading

All goats exported to the Middle East in 2004 were loaded at Adelaide or Fremantle (Table 24). Death rates in 2004 were 0.31% from Adelaide and 0.00% from Fremantle. The voyages from each port were classified into various mortality categories as shown in Table 25. There were no voyages in the high or medium categories.

Table 24 Death rates, number of voyages and number of goats exported from various ports to the Middle East for 2004

Port	Voyages (No.)	Goats (No.)	Death rate overall (%)	Death rate range (%)
Fremantle	2	165	0.00	n/a
Adelaide	2	856	0.12	0.0 – 0.3

Table 25 Number of voyages in low, medium and high mortality categories for shipments from various ports to the Middle East for 2004

Port	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
Fremantle	2	0	0	0
Adelaide	2	0	0	0
Total	4	0	0	4

4.2.2 Ship

The voyages of each ship from Australia to the Middle East were classified into low, medium and high mortality categories. 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 26 shows the number of voyages in the various mortality categories for each ship. All voyages were in the nil or low mortality categories in 2004.

Table 26 Number of voyages in low, medium and high mortality categories for shipments to the Middle East for 2004

Ship (code)	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
7	1	0	0	1
20	1	0	0	1
32	1	0	0	1
34	1	0	0	1
Total	4	0	0	4

4.2.3 Time of year

The monthly death rate during 2004 and the moving 5-year "average" (proportion of all deaths divided by number loaded) in all goats exported to the Middle East are shown in Figure 8. There were no goats exported in February or from May to November 2004, and the monthly death rate in remaining months was 0.00% except for January (0.31%).

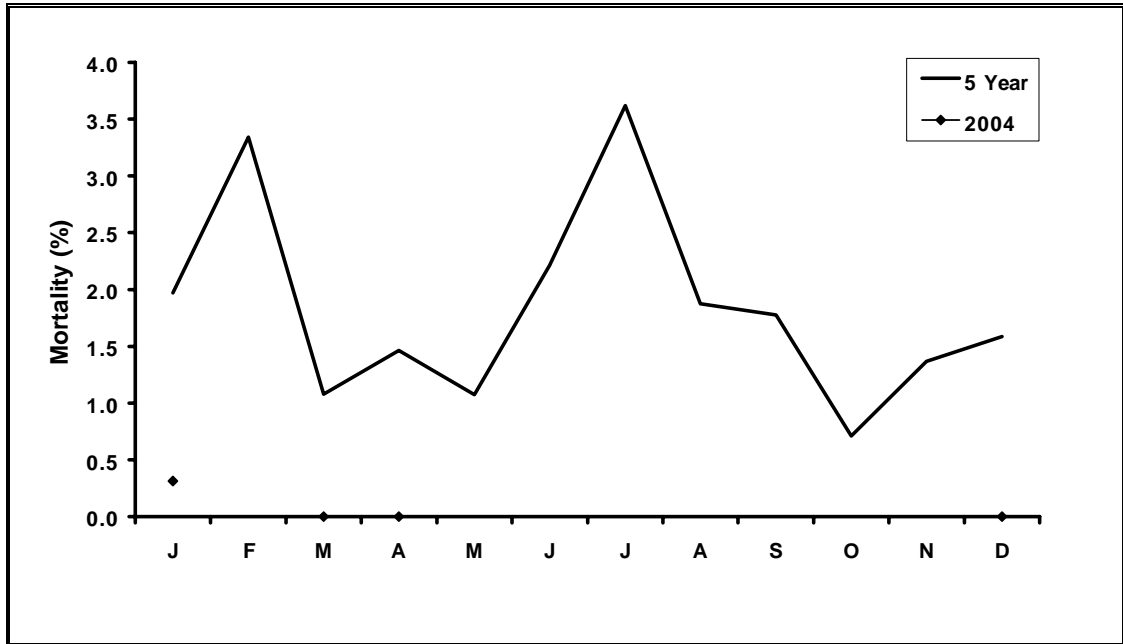


Figure 8 Monthly mortality during 2004 and moving 5-year average in goats exported to the Middle-East

4.3 South-East Asia

The number of goats exported by sea to South-East Asia increased substantially in 2001 and 2002 compared to previous years, but has fallen since then (Table 27). The death rate in 2004 rose slightly compared to 2003.

Table 27 Death rates, number of voyages and number of goats exported by sea to South-East Asia from 1993 to 2004

	Voyages (No.)	Goats (No.)	Death rate overall (%)	Death 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

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

4.3.1 Port of loading

For voyages to South-East Asia, most goats were exported from Geraldton, followed by Darwin and Fremantle (Table 28). Death rates in 2004 were highest from Port Hedland (1.55%), followed by Darwin (1.12%) and Fremantle (1.03%).

The voyages from each port were classified into various mortality categories as shown in Table 29. Two voyages out of 29 were in the high category and involved the ports of Darwin and Fremantle.

Table 28 Death rates, number of voyages and number of goats exported from various ports to South-East Asia for 2004

Port	Voyages (No.)	Goats (No.)	Death rate overall (%)	Death rate range (%)
Darwin	11	4,722	1.12	0.0 - 2.6
Wyndham	1	100	0.00	n/a
Broome	6	3,608	0.75	0.5 - 1.3
Port Hedland	1	1,872	1.55	n/a
Geraldton	5	5,975	0.67	0.0 - 1.8
Fremantle	4	4,084	1.03	0.0 - 2.1
Townsville	1	440	0.45	n/a

Table 29 Number of voyages in low, medium and high mortality categories for shipments from various ports to South-East Asia for 2004

Port	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
Darwin	6	4	1	11
Wyndham	1	0	0	1
Broome	6	0	0	6
Port Hedland	0	1	0	1
Geraldton	4	1	0	5
Fremantle	2	1	1	4
Townsville	1	0	0	1
Total	20	7	2	29

4.3.2 Ship

The voyages of each ship from Australia to South-East Asia were classified into the low, medium and high mortality categories. 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 30 shows the number of voyages in the various mortality categories for each ship. Most voyages of most ships were in the nil or low mortality categories. There were 2 voyages in the high category; involving ships 88 and 119.

Table 30 Number of voyages in low, medium and high mortality categories for shipments to South-East Asia for 2004

Ship (code)	Mortality rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
5	1	0	0	1
77	6	0	0	6
88	1	1	1	3
90	2	3	0	5
100	1	0	0	1
102	3	0	0	3
107	2	0	0	2
108	0	1	0	1
112	2	0	0	2
119	2	2	1	5
Total	20	7	2	29

4.3.3 Time of year

The monthly death rate during 2004 and the moving 5-year “average” (proportion of all deaths divided by number loaded) in all goats exported to the South-East Asia are shown in Figure 9. There were no goats exported during August 2004.

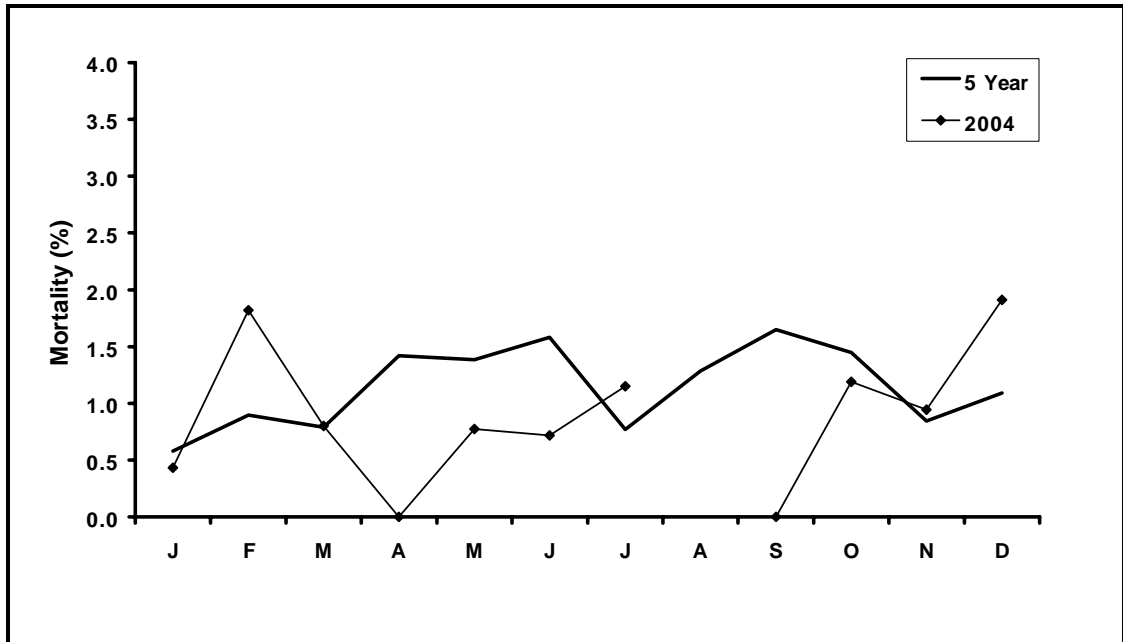


Figure 9 Monthly mortality during 2004 and moving 5-year average in goats exported to South-East Asia

5 SHEEP & CATTLE DEATHS: RESEARCH SUMMARY

To assist with interpretation of the results for sheep, the main findings from research conducted into the causes of death and the risk factors for sheep exported from Western Australia to the Middle East are summarised here. It should be noted that these findings are based on information published in the refereed scientific journal articles listed in Section 6.

The research involved analysis of industry mortality records, land-based studies and investigations on ships travelling from Western Australia to the Middle East. The aims were to define the level of sheep mortality during the export process, and to identify the causes of death and the risk factors.

A typical research voyage involved selecting and identifying about 10,000 sheep on arrival at a pre-embarkation feedlot, tracing them back to the farm and interviewing the farmer/manager to gather information about the previous management of the sheep, undertaking observations and treatments in the pre-embarkation feedlot, loading onto the ship, and conducting post mortem examinations and other observations during the voyage. Many research voyages and more than 1,000 detailed post mortem examinations were undertaken.

The main causes of sheep deaths during sea transport were inanition and salmonellosis (5 – figures in parentheses refer to the publication number in Section 6). These two causes accounted for about 75% of all deaths aboard ship. The most important risk factors for sheep deaths were failure to eat the pelleted feed, farm-group of sheep, age, time of the year, fatness, duration between leaving the farm and unloading in the Middle East, and occasionally, excessive temperature and relative humidity (4, 3, 11, 2, 21).

Death rates during the shipping phase varied widely between farm groups of sheep, with high death rates concentrated in only a few farm groups (3, 21). A study of 479 farm groups of sheep from 405 farms in Western Australia showed that death rates ranged from nil to 28% with half of all deaths in only 14% of the farm groups. There were more deaths in sheep from the zones of higher rainfall and longer pasture-growing season (21).

Bars wrapped in dye-soaked sponge were attached to feed troughs to identify sheep which ate the pelleted feed (3). Although most sheep began eating the pelleted feed in the pre-embarkation feedlot or aboard ship, a few became persistent non-feeders, and it is these animals that were most likely to die. Giving them abundant quantities of feed or increased access to the feed troughs did not reduce the number of persistent non-feeders (9).

Age, fatness and time of year predisposed to mortality (11). Death rates during sea transport were higher in adult wethers (castrated male) than in younger wethers, and were higher in adult wethers in fat condition than in lean condition, and there were more deaths during the second half of the calendar year than in the first half.

The explanation (13, 11) is that sheep coming from dry pasture in the first half of the year are in negative energy balance and are metabolically adjusted to using body fat reserves for energy – southern Western Australia experiences a Mediterranean climate and pastures decline in quality and quantity during the first half of the calendar year, and supplementary feeding usually with cereal grains or lupins is required for animals to maintain bodyweight. Any sheep which is not eating during the export process therefore has a better chance of survival because it is able to mobilise body fat reserves to produce energy.

In contrast, sheep coming from green pasture in the second half of the year are metabolically adjusted to laying down body fat and those which do not eat during the export process are not able to use body fat reserves for energy and are therefore at increased risk of death.

Immature sheep have a strong growth requirement and their powerful appetite drive overrides the seasonal cycles that are prominent in adult sheep. Consequently, there were fewer non-feeders and deaths among immature sheep.

Factors for which no association (or no consistent association) with mortality was shown include (4): distance trucked from farm to pre-embarkation feedlot, time on the truck, time off feed from yarding on farm to unloading at the feedlot, purchase history on the farm, social interaction on the farm, experience of

supplementary feeding and type of feed as unweaned lambs, experience of supplementary feeding and type of feed in the last 9 months before export and time of shearing on the farm.

An important finding was that most sheep began eating the pelleted feed within the first few days after loading onto the ship, even if they had not eaten this feed in the pre-embarkation feedlot. This was a consistent finding in research studies during actual commercial voyages and during simulated voyages (9, 14). In one such study, 85% to 93% of non feeders in the pre-embarkation feedlot ate pelleted feed within the first three days of simulated shipping (9).

In contrast to exports of sheep, live cattle are exported from many ports around Australia to destinations in south east Asia, north Asia and the Middle East. Investigations on voyages to the Middle East showed that the main causes of cattle deaths were heat stroke, trauma and respiratory disease (22). All of the deaths from heat stroke were in *Bos taurus* breeds and occurred in the latter half of the voyage.

The research also showed that the risk of death on voyages to the Middle East was three times greater among cattle exported from southern ports in Australia compared to northern ports. The likely reason is the higher content of tropically-adapted *Bos indicus* cattle in northern Australia and their ability to handle the heat and humidity encountered during the voyage, in contrast to the *Bos taurus* breeds from southern Australia.

6 PUBLISHED STUDIES

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

1. McDonald, C.L., Gittins, S.P. and Rowe, J.B. (1988) Effect of time of year and prior feeding experience on feeding behaviour of sheep as if for export. *Proc. Aust. Soc. Anim. Prod.* **17**: 226-229.
2. 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
3. Norris, RT, Richards, RB and Dunlop, RH (1989) An epidemiological study of sheep deaths before and during export by sea from Western Australia *Aust Vet J* **66**: 276-279
4. Norris, RT, Richards, RB and Dunlop, RH (1989) Pre-embarkation risk factors for sheep deaths during export by sea from Western Australia *Aust Vet J* **66**: 309-314
5. 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
6. Kelly, A.P. (1990) Health and welfare research in the live sheep export trade. Vic. Dept. of Agric. and Rural Affairs.
7. 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
8. Norris, RT, Richards, RB and Higgs, ARB (1990) Research on the health, husbandry and welfare of sheep during live export West Aust Dept of Agric Bulletin 4209
<http://www.agric.wa.gov.au/agency/pubns/journalofag/v31/LiveSheepExport.htm>
9. 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
10. Thomas, KW, Kelly, AP, Beers, PT and Brennan, RG (1990) Thiamine deficiency in sheep exported live by sea *Aust Vet J* **76**: 215-218
11. 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
12. Norris, RT (1991) Studies of factors affecting sheep deaths during lot-feeding and sea transport PhD Thesis, Murdoch University, Perth
13. 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
14. Norris RT, Richards RB and Norman, GJ (1992) The duration of lot-feeding of sheep before sea transport *Aust Vet J* **69**: 8-10
15. Scharp, DW (1992) Performance of Australian wethers in Arabian Gulf feedlots after transport by sea *Aust Vet J* **69**: 42-43
16. Higgs, ARB, Norris, RT and Richards, RB (1993) Epidemiology of salmonellosis in the live sheep export industry *Aust Vet J* **70**: 330-335
17. Richards, RB, Norris, RT and Higgs, ARB (1993) Distribution of lesions in ovine salmonellosis *Aust Vet J* **70**: 326-330
18. 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
19. Brightling, A and Lightfoot, JS (1994) Management of Australian sheep in the Middle East *Aust Meat and Livestock Corp Inkata Press, Melbourne*
20. 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
21. 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
22. 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

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