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National livestock exports mortality summary - 2002

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Table of Contents

INTRODUCTION

The live export of sheep and cattle makes a significant contribution to the Australian economy, returning almost $1 billion in 2002 and providing 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 and cattle during sea transport from Australia. The information is obtained from ship master's 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.

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.

SHEEP

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.

The following results are based on analysis of ship Masters' reports which were to hand in April 2003 and also "Yellow Books" which record more detailed information about the number of sheep deaths. Some results, such the as number of sheep exported, may differ slightly from other sources of information.

Port of loading

The number of sheep and goats exported by sea from Fremantle, Adelaide and Portland during 2002 is shown in Table 1. Compared with 2001, total sheep exports decreased by 12%, while exports of goats increased by 28%. Exports of all sheep fell by 26% from Fremantle, increased by 12% from Adelaide and were relatively unchanged from Portland compared to 2001.

Exports of wether hoggets fell by 68% and wether lambs fell by 50% whereas exports of adult wethers were relatively unchanged. Exports of adult rams and adult ewes increased by 15% and 11% respectively.

Table 1 The number of sheep and goats exported by sea from Fremantle, Adelaide and Portland during 2002

Livestock		Fremantle and other WA ports		Adelaide	Portland	
		Middle East	S.E. Asia	Middle East	Middle East	Total
Wethers	adults	1,524,077	1,499	1,067,666	923,057	3,516,299
	hoggets	297,981	0	102,313	28,195	428,489
	lambs	556,188	5,010	72,067	221,568	854,833
Rams	adults	71,201	14,654	45,756	22,965	154,576
	hoggets	55,141	0	570	489	56,200
	lambs	476,327	650	34,311	11,261	522,549
Ewes	adults	134,530	0	1,611	33,729	169,870
	hoggets	0	0	0	0	0
	lambs	220,799	0	4,882	15,060	240,741
Total	sheep	3,336,244	21,813	1,329,176	1,256,324	5,943,557*
	goats	14,897	31,839	10,843	43,674	101,253

* Includes 58,547 sheep sent to Mexico

Most sheep exported by sea from Australia were loaded at Fremantle (56.4% of all sheep), with smaller numbers loaded at Portland (21.2%) and Adelaide (22.4%) during 2002 (Figure 1). Compared with 2001, sheep exports increased from Adelaide (by 12%) and Portland (1%) but decreased substantially from Fremantle (by 26%).

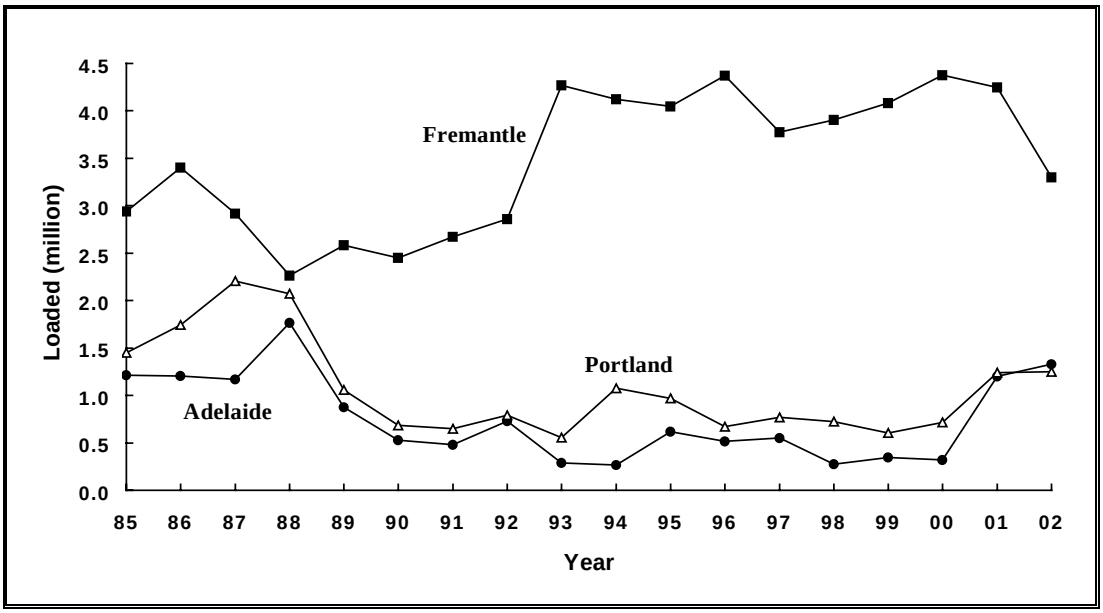


Figure 1 *Numbers of sheep exported by sea from Fremantle* (*Western Australia*)*, Portland* (*Victoria*) *and Adelaide* (*South Australia*) *since 1985*

Destination

The main importing countries for Australian sheep are shown in Table 2. Saudi Arabia remained the main market (32% of all sheep) followed by Kuwait (26%) and Jordan (10%). Compared with 2001, exports increased to Lebanon (by 93%) and Israel (60%), but decreased to Mexico (down by 60%), United Arab Emirates (38%), Egypt (32%) and Oman (31%).

Table 2 Destination country for sheep exported from Fremantle/WA, Adelaide and Portland during 2002

Country	Fremantle/WA	Adelaide	Portland	Total
Bahrain	86,962	48,000	235,100	370,062
Egypt	117,686	26,603	0	144,289
Israel	130,022	49,080	76,712	255,814
Jordan	390,041	147,159	32,411	569,611
Kuwait	812,294	215,692	492,401	1,520,387
Lebanon	49,000	21,622	0	70,622
Mauritius	910	0	0	910
Mexico	39,088	0	19,459	58,547
N.E. Asia	288	0	8,712	9,000
Oman	165,024	23,500	153,356	341,880
Qatar	186,440	0	73,441	259,881
Saudi Arabia	1,218,323	644,991	69,454	1,932,768
S.E. Asia	22,283	0	0	22,283
UAE	141,309	152,529	103,990	397,828
Miscellaneous	81	0	0	0
Total	3,359,463*	1,329,176	1,256,324	5,944,963

* Includes sheep exported to S.E. Asia and New Zealand by air from Perth (1,406)

Death rates

There were 44 voyages to the Middle East in 2002 for which sheep were loaded at more than one port in Australia (split-load voyages) and mortalities for split-load voyages were attributed to the port of loading where possible. In such cases, 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 were included in the discharge phase.

The total death rate for all sheep exported to the Middle East during 2002 was 1.24% (Table 3). This is a new record low and reflects a declining trend over the last four years.

The total death rate for shipments from Fremantle was lower in 2002 compared to previous years and was due to reduced death rates during the voyage and discharge phases. The death rates for sheep exported from Fremantle in 2002 were the lowest recorded since 1985 (Figure 2).

The total death rate for shipments from Adelaide was lower in 2002 compared to the previous two years. In contrast, the total death rate for shipments from Portland was similar to 2001.

Table 3 Annual death rates during the shipboard phase for sheep exported from Fremantle, Adelaide and Portland

	Death rate (%)			
	Load	Voyage	Discharge	Total
Fremantle				
2000	0.01	0.74	0.47	1.23
2001	0.01	0.65	0.29	0.96
2002	0.01	0.61	0.26	0.88
Adelaide				
2000	0.01	1.05	0.35	1.41
2001	0.03	1.11	0.35	1.48
2002	0.01	1.01	0.30	1.32
Portland				
2000	0.01	1.18	0.53	1.73
2001	0.04	1.36	0.71	2.10
2002	0.01	1.27	0.82	2.09
Total				
2000	0.01	0.82	0.48	1.31
2001	0.02	0.87	0.38	1.26
2002	0.01	0.84	0.39	1.24

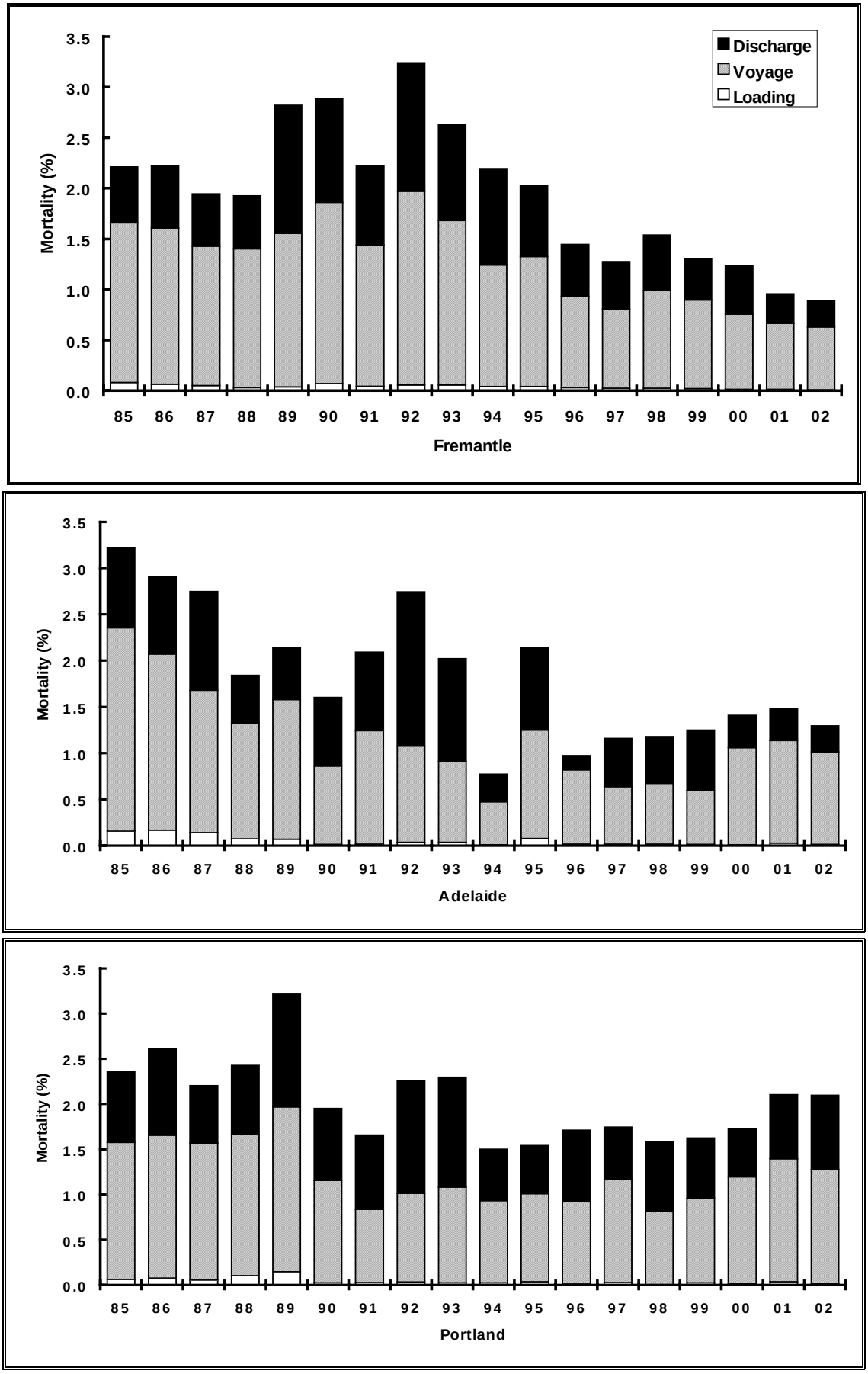


Figure 2 *Annual mortality for sheep exported from Fremantle, Adelaide and Portland to the Middle East since 1985*

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. There was a trend for increasing death rates from Adelaide and Portland compared to Fremantle in adult wethers, wether lambs, adult rams, ram lambs and ewe lambs.

Table 4 Overall mortality (%) for classes of sheep exported from Fremantle, Adelaide and Portland to the Middle East in 2002

Class of sheep		Fremantle	Adelaide	Portland	Total
Wethers	adult	0.9	1.3	2.1	1.4
	hogget	0.5	0.9	0.8	0.6
	lamb	0.9	1.4	2.2	1.3
Rams	adult	1.1	1.4	2.3	1.4
	hogget	0.8	1.4	n/a	0.8
	lamb	0.8	1.6	2.0	0.8
Ewes	adult	1.4	2.0	1.6	1.5
	hogget	n/a	n/a	n/a	n/a
	lamb	0.6	1.1	1.3	0.7

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

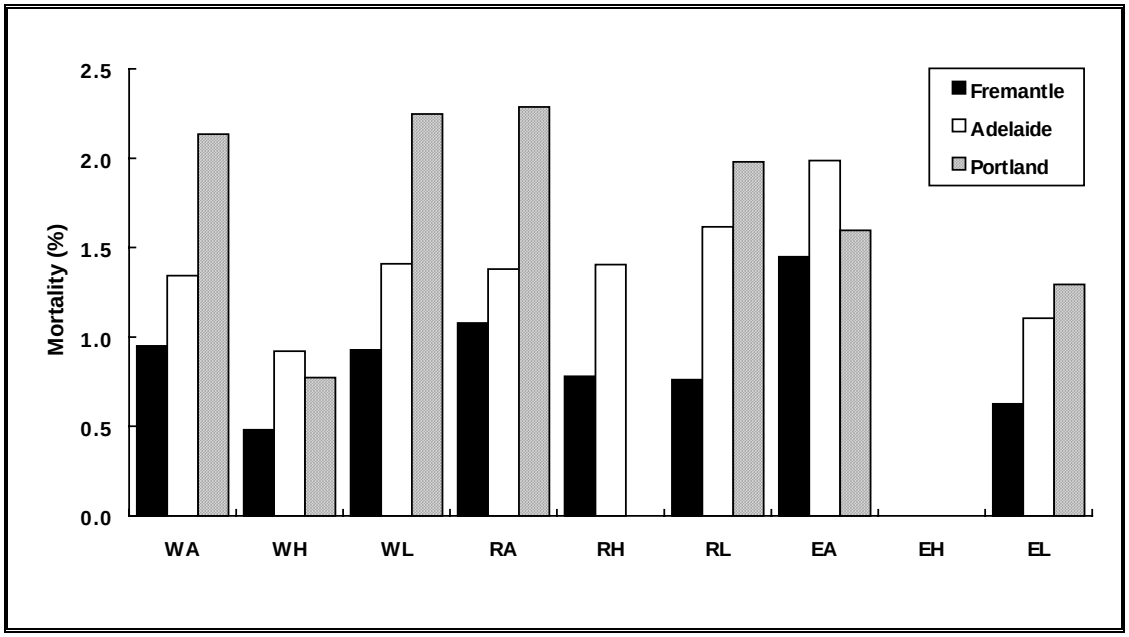


Figure 3 *Overall mortality (%) for classes of sheep exported from Fremantle, Adelaide and Portland to the Middle East in 2002*

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*

Time of year

The monthly death rate during 2002 and moving 5-year average in all sheep exported from Fremantle, Adelaide and Portland are shown in Figure 4a, 4b and 4c respectively. There was a trend for higher death rates from Portland in July and August 2002, and this was also apparent in the 5-year average. Investigations indicate that salmonellosis was involved in the extra deaths from Portland in these months.

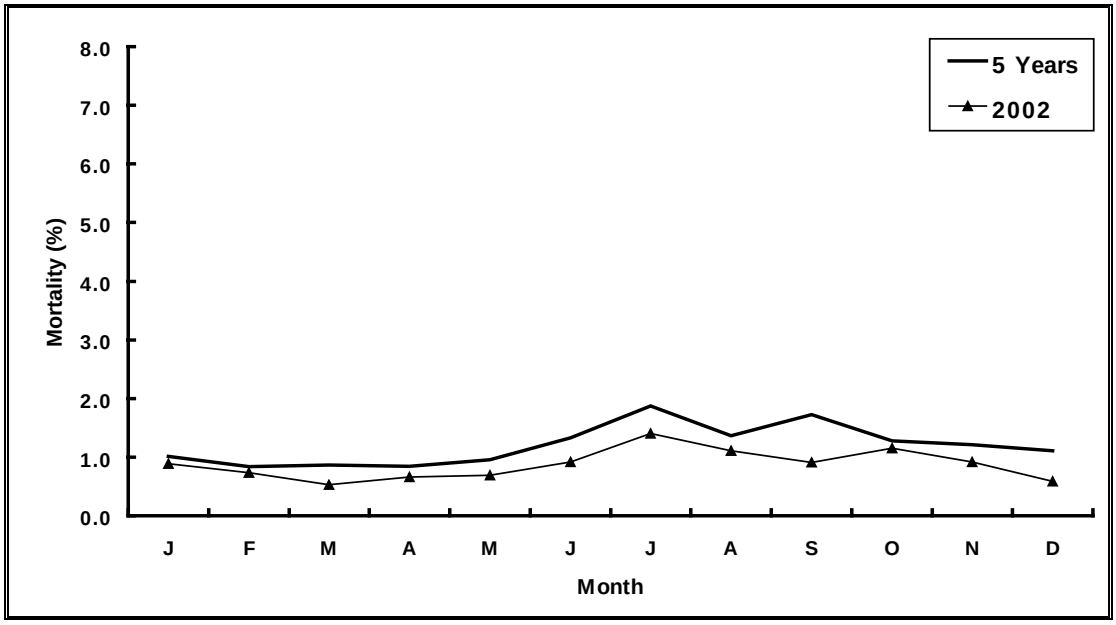


Figure 4a *Monthly mortality during 2002 and moving 5-year average in sheep exported from Fremantle to the Middle East*

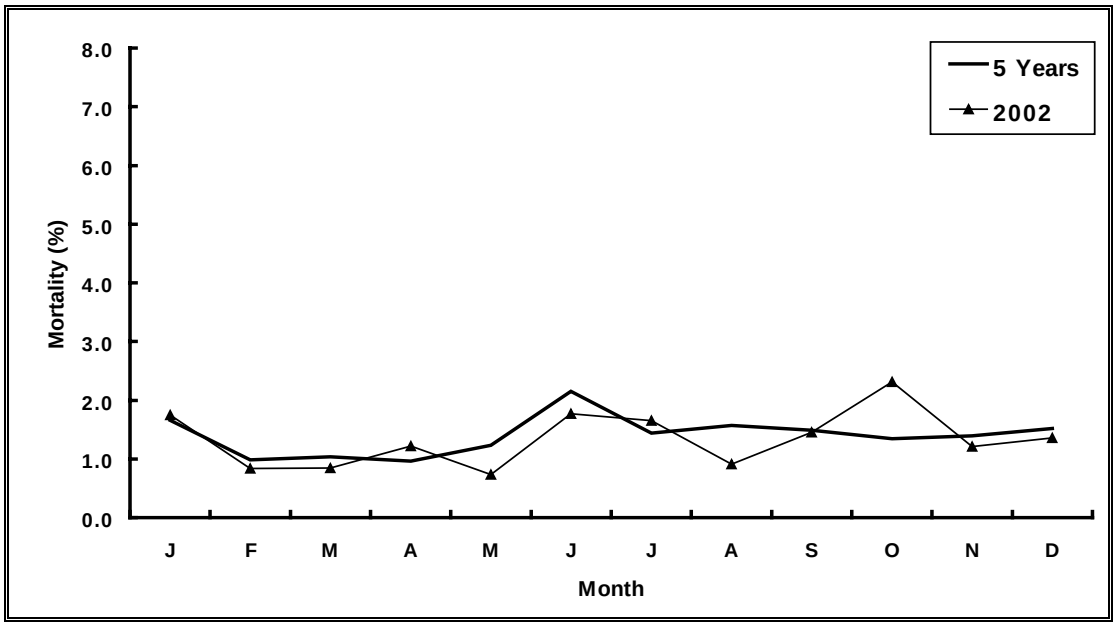


Figure 4b *Monthly mortality during 2002 and moving 5-year average in sheep exported from Adelaide to the Middle East*

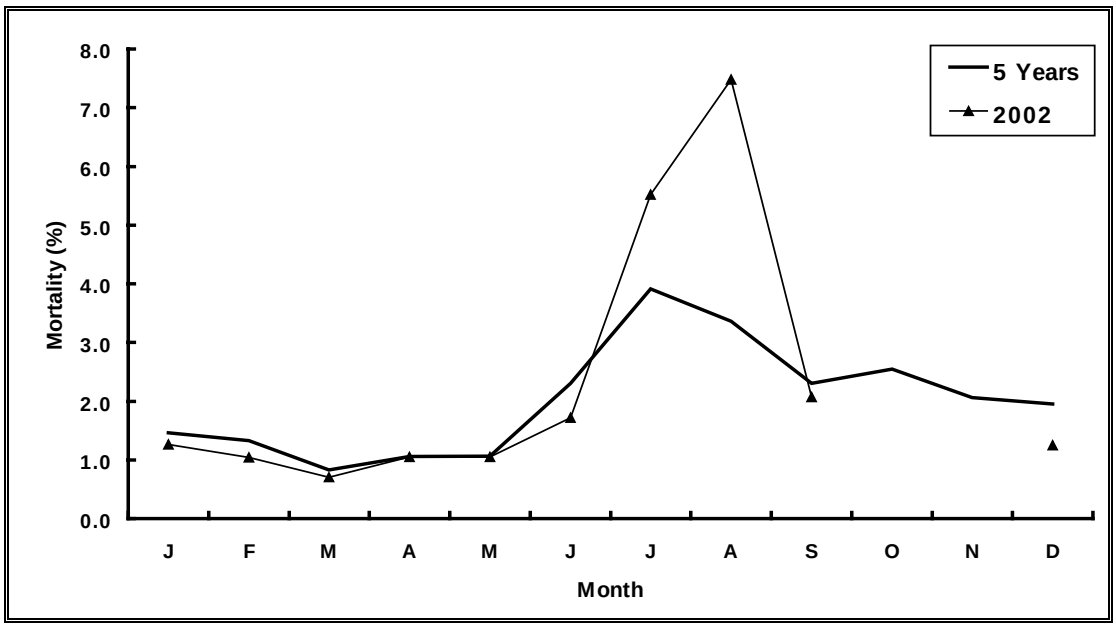
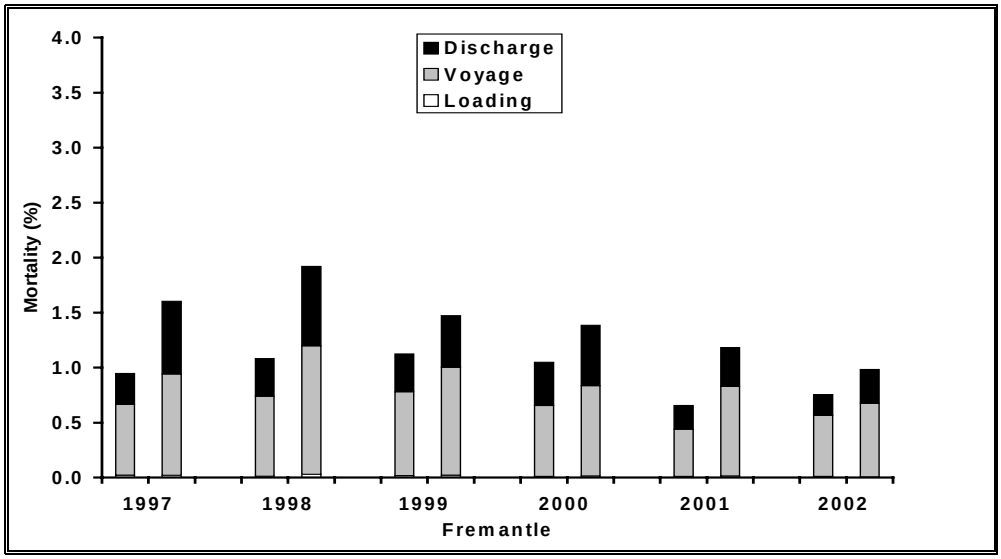


Figure 4c *Monthly mortality during 2002 and moving 5-year average in sheep exported from Portland to the Middle East*

Death rates were higher ($P < 0.01$) in the second half of 2002 compared with the first half in sheep exported from Fremantle, Adelaide and Portland (Figure 5). This observation is consistent with previous years for voyages from Fremantle, and research on ships and in Middle East feedlots has indicated that most of the deaths are due to inanition and salmonellosis.



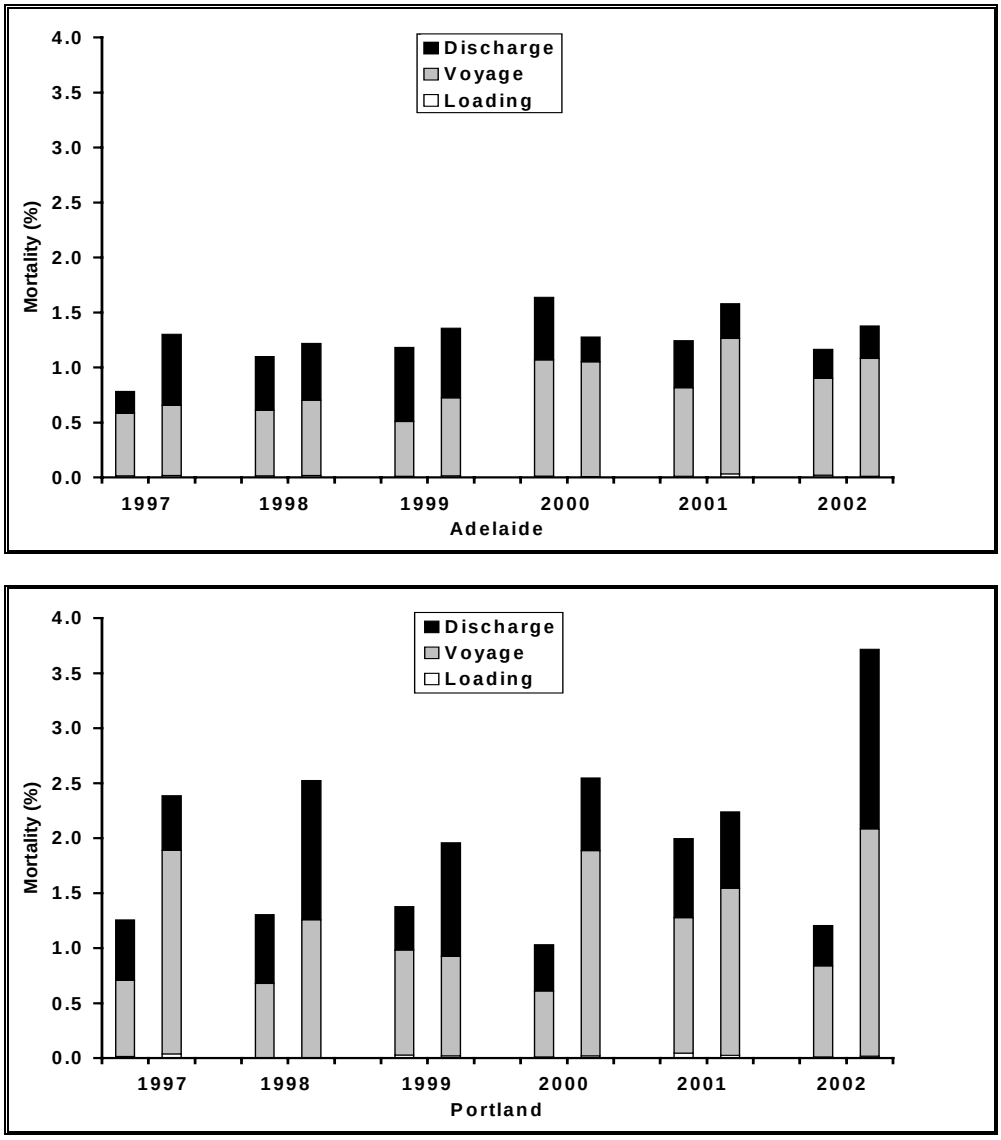


Figure 5 *Mortality (%) for sheep exported by sea from Fremantle, Adelaide and Portland to the Middle East for the first and second half of each year from 1997 to 2002*

Ship

The voyages of each ship were classified into low, medium and high mortality categories for sheep exported from Fremantle (Table 5a), Adelaide (Table 5b) and Portland (Table 5c). There were six voyages from Portland classified as "high mortality", three from Fremantle and two from Adelaide during 2002. Approximately 70% of voyages from Fremantle, and 40% of voyages from Adelaide and Portland were in the "low" category.

Table 5a Number of voyages in low, medium and high mortality categories for ships loaded at Fremantle in 2002

	Death rate			
Ship (code)	Low <1.0%	Medium 1.0–2.0%	High >2.0%	Total
1	9	0	0	9
2	3	3	0	6
5	1	0	0	1
7	4	3	1	8
13	3	0	0	3
20	3	0	0	3
22	4	2	0	6
27	3	3	0	6
31	4	2	0	6
32	0	3	1	4
33	6	1	0	7
34	4	2	1	7
35	3	2	0	5
36	2	1	0	3
37	6	1	0	7
55	1	0	0	1
74	3	1	0	4
93	2	1	0	3
99	5	0	0	5
100	2	0	0	2
Total	68	25	3	96

Table 5b Number of voyages in low, medium and high mortality categories for ships loaded at Adelaide in 2002

	Death rate			
Ship (code)	Low <1.0%	Medium 1.0–2.0%	High >2.0%	Total
13	4	1	0	5
20	2	1	0	3
22	0	2	1	3
27	0	6	0	6
31	1	0	0	1
32	0	0	1	1
33	1	0	0	1
34	0	1	0	1
35	2	2	0	4
Total	10	13	2	25

Table 5c Number of voyages in low, medium and high mortality categories for ships loaded at Portland in 2002

Ship (code)	Death rate			Total
	Low <1.0%	Medium 1.0–2.0%	High >2.0%	
2	4	1	0	5
7	0	1	2	3
22	0	1	0	1
32	1	4	1	6
33	1	0	0	1
34	1	1	2	4
35	2	1	0	3
37	1	0	1	2
Total	10	9	6	25

CATTLE

Overview

The live cattle trade from Australia is characterised by the wide range in ports of loading in Australia, the large number of ships involved and the areas 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.

The following results are based on analysis of ship Masters' reports which were to hand in April 2003 and also "Yellow Books" which record more detailed information about the number of cattle deaths. Some results, such the as number of cattle exported, may differ slightly from other sources of information.

There were 31 voyages in 2002 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 0.9 million cattle exported from Australia in 2002 rose to 0.24% (Table 6) and was above the death rate of 0.18% recorded in 2001. However, the death rate for 2002 was 0.17% if one exceptionally high voyage was excluded. The highest overall death rate was to Mexico followed by the Middle East while the lowest death rate was to South-East Asia. Exports to South-East Asia were mainly to Indonesia, and were characterised by small consignments on short voyages with very low death rates. Voyages to the Middle East, mainly Egypt, involved longer duration and higher death rates than those to South-East Asia.

Table 6 Death rates, number of voyages and number of cattle exported for voyages to major destination regions during 2002

Parameter	ME/N Africa	SE Asia	NE Asia	Mexico	Total
Voyages (No.)	102	354	17	6	479
Cattle (No.)	268,936	630,711	22,483	17,434	939,564
Death rate overall (%)	0.61	0.07	0.12	0.74	0.24
Death rate range (%)	0.0 – 35.0	0.0 – 8.5	0.0 – 0.7	0.0 – 3.0	0.0 – 35.0
Voyages with nil deaths (No.)	33	186	7	1	227

Mexico

The number of cattle exported to Mexico and the annual death rates are shown in Table 7.

Table 7 Death rates, number of voyages and number of cattle exported to Mexico from 1995 to 2002

Year	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)	Voyages with nil deaths (No.)
1995					
1996	2	4,359	0.67	0.6 – 1.0	0
1997	3	6,960	1.80	0.6 – 1.0	0
1998	2	21,163	0.83	0.4 – 1.1	0
1999	4	7,701	0.60	0.0 – 0.7	1
2000	5	9,556	1.38	0.0 – 4.8	1
2001	10	20,478	0.47	0.0 – 1.2	2
2002	6	17,434	0.74	0.0 – 3.0	1

Port of loading

Most cattle exported to Mexico were loaded at Portland and the death rate was less than from Fremantle ($P < 0.01$, Table 8). Voyages were on average 2 days longer from Fremantle (mean 24.0, range 19-26 days) than from Portland (mean 21.8, range 14-34 days).

Table 8 Death rates by port for cattle exported to Mexico in 2002

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Fremantle	2	1,106	2.17	0.0 – 3.0
Adelaide	1	470	0.64	n/a
Portland	3	15,858	0.64	0.3 – 0.7

Class of cattle

Recording of death rates for each class of cattle loaded began only in July 2002. The results to the end of the year are shown in Table 9.

Table 9 Death rates, number of voyages and number of cattle in various classes exported to Mexico in 2002

Class	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Steer adult	0			
Steer calf	0			
Bull adult	1	20	5.00	n/a
Bull calf	0			
Cow dairy	0			
Heifer beef	2	246	0.00	n/a
Heifer dairy	3	11,659	0.85	0.7 – 3.0

Middle East

The live cattle trade to the Middle East expanded rapidly between 1995 and 1998, with the number of voyages and number of cattle exported doubling every year (Table 10). Despite the rapid expansion of the trade over this period, the death rate remained constant at approximately 0.7% annually before falling by half in 1999. The death rate among nearly 0.3 million cattle exported to the Middle East in 2002 was 0.61% or 0.38% if one high mortality voyage was excluded.

Table 10 Death rates, number of voyages and number of cattle exported to the Middle East from 1995 to 2002

	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

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

Port of loading

For voyages to the Middle East, the most cattle were exported from Fremantle, followed by Townsville and Portland (Table 11). Death rates in 2002 were highest from Portland (2.0%, or 0.7% if one exceptional voyage is excluded), followed by Adelaide (0.5%) and Fremantle (0.4%). Death rates were low from northern loading ports.

The voyages from each port were classified into various mortality categories as shown in Table 12. Eight voyages out of 102 (7.8%) were in the high category and involved the ports of Fremantle and Portland.

Table 11 Death rates, number of voyages and number of cattle exported from various ports to the Middle East for 2002

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Townsville	4	54,968	0.2	0.1 – 0.4
Darwin	4	18,111	0.2	0.0 – 0.4
Wyndham	1	3,626	0.2	n/a
Port Hedland	2	10,729	0.2	0.0 – 0.3
Geraldton	1	1,982	0.0	n/a
Fremantle	57	103,914	0.4	0.0 – 1.6
Adelaide	17	25,035	0.5	0.0 – 0.7
Portland	15	46,624	2.0	0.0 – 35.0
Devonport	1	16	0.0	n/a

Table 12 Number of voyages in nil, low, medium and high mortality categories for shipments from various ports to the Middle East for 2002

Port	Mortality rate				Total
	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	
Townsville	0	4	0	0	4
Darwin	0	4	0	0	4
Wyndham	0	1	0	0	1
Port Hedland	1	1	0	0	2
Geraldton	1	0	0	0	1
Fremantle	26	24	3	4	57
Adelaide	3	8	6	0	17
Portland	1	6	4	4	15
Devonport	1	0	0	0	1
Total	33	48	13	8	102

Loading region (North vs South)

For voyages to the Middle East, death rates were compared between selected ports in the north and south of Australia. The death rate from southern ports has been approximately 3 times higher than from northern ports since 1998 (Table 13).

Table 13 Death rates, number of voyages and number of cattle exported from northern and southern regions to the Middle East from 1997 to 2002. Relative risk shows risk of death in cattle loaded from southern areas compared to northern areas.

Year	Region	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Relative risk (95% CI)
2002	North	9	76,705	0.20	
	South	90	175,589	0.82	4.1* (3.5,4.9)
2001	North	18	86,202	0.13	
	South	77	172,061	0.47	3.6 (3.0,4.4)
2000	North	22	89,156	0.19	
	South	68	157,843	0.61	3.4 (2.9,4.0)
1999	North	39	123,097	0.18	
	South	65	172,243	0.50	2.8 (2.4,3.3)
1998	North	46	88,041	0.28	
	South	71	186,094	0.89	3.2 (2.8,3.7)
1997	North	11	26,704	0.43	
	South	51	109,374	0.75	1.8 (1.4,2.2)

North: Ports north of 20^{o} latitude south.
South: Ports south of 31^{o} latitude south.
* RR = 2.41 (2.0,2.9) if one exceptional voyage is excluded

Time of year

Monthly death rates were compared between selected northern and southern ports (same ports as in previous section). Monthly death rates from southern ports were approximately 0.5% throughout the year, except for June (Figure 15) which included an exceptionally high mortality voyage involving heat stroke. If this exceptional voyage is excluded, the death rate for June was 0.4%. Cattle were shipped from northern ports only between May and October, and death rates were consistently lower than from southern ports.

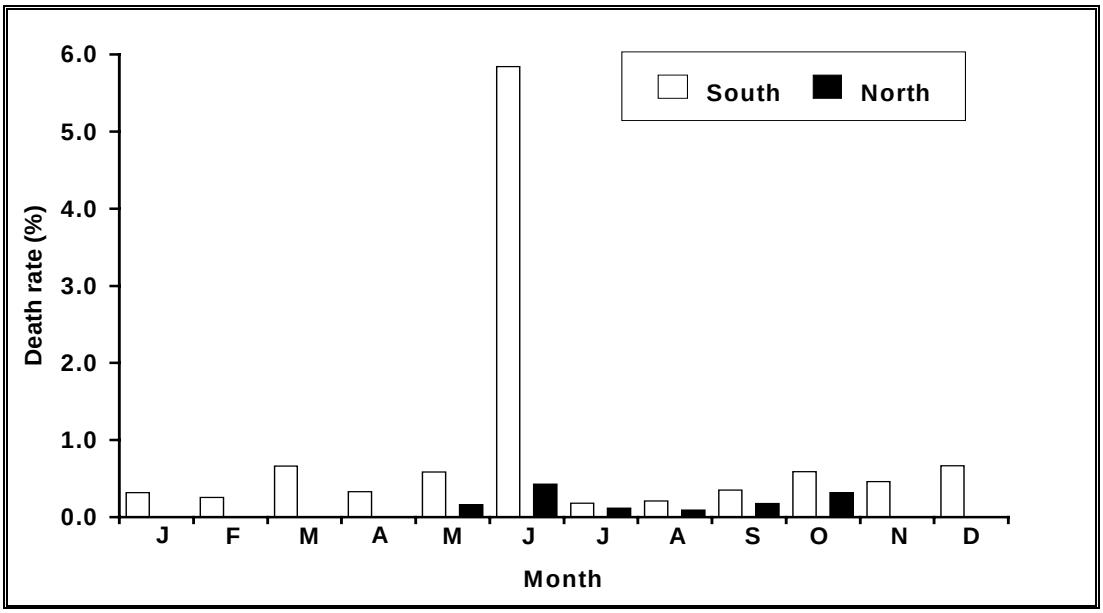


Figure 6 *Monthly death rate of cattle on voyages from selected southern and northern ports to the Middle East for 2002*

Voyages from southern ports 1999 to 2002

Additional analysis was conducted for the main southern ports because of the higher death rates on voyages from these ports compared to northern ports. The years 1999 to 2002 were selected because of changes in stocking density following a high mortality incident in June 1998. Death rates of cattle were highest from Portland and lowest from Fremantle, and this was consistent in each year (Table 14). Cattle exported from Portland have more than twice the risk of death compared to cattle exported from Fremantle (Table 15) while cattle exported from Adelaide have approximately 1.5 times the risk of death compared to Fremantle.

Table 14 Death rates for cattle loaded at Fremantle, Adelaide or Portland from 1999 to 2002

	Fremantle			Adelaide			Portland		
Year	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*

* 0.74% if one high mortality voyage is excluded

Table 15 Relative risk of cattle deaths on voyages from Adelaide and Portland compared with Fremantle from 1999 to 2002

Year	Adelaide Relative risk (95% CI)	Portland 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)*

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

Arabian Gulf vs Red Sea

Death rates for cattle exported to the Arabian Gulf were compared with those to the Red Sea, based on voyages from southern Australia. The years 1999 to 2002 were selected because of a change in livestock density following a high mortality incident in June 1998. Death rates for cattle exported from Fremantle, Adelaide or Portland were not different between the Arabian Gulf and the Red Sea in 1999 or 2000 (Table 16) but there was a significantly higher death rate to the Arabian Gulf than the Red Sea in 2001 and 2002 ($P < 0.01$, Chi-square test). However, the death rate was lower to the Arabian Gulf than to the Red Sea in 2002 ($P < 0.01$) if one high mortality incident is excluded.

Table 16 Death rates for cattle exported to the Arabian Gulf or Red Sea from Fremantle, Adelaide or Portland between 1999 and 2002

Year	Arabian Gulf			Red Sea		
	Voys (No.)	Cattle (No.)	Dead (%)	Voys (No.)	Cattle (No.)	Dead (%)
1999	15	1,686	0.30	51	185,045	0.49
2000	18	1,786	0.67	45	152,338	0.61
2001	25	8,347	1.08	48	153,334	0.44
2002	36	20,421	3.25*	53	155,152	0.50

* Death rate 0.26% if one high mortality incident is excluded

Class of cattle

Recording of death rates for each class of cattle loaded began only in July 2002. The results to the end of the year indicate that the highest death rates occurred in adult bulls followed by adult steers and dairy cows (Table 17).

Table 17 Death rates, number of voyages and number of cattle in various classes exported to Middle East in 2002

Class	Voyages (No.)	Cattle (No.)	Death rate (%)	Death rate range (%)
Steer adult	35	109,326	0.64	0.0 – 40.1
Steer calf	1	500	0.20	n/a
Bull adult	34	29,799	1.76	0.0 – 32.6
Bull calf	10	21,504	0.18	0.0 – 0.4
Cow dairy	1	544	0.37	n/a
Heifer beef	2	22	0.00	n/a
Heifer dairy	3	1,119	0.09	0.0 – 0.2

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 18 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 8 (7.6%) voyages in the high category; this involved ships 31, 32, 33, 36, 37 and 59.

Table 18 Number of voyages in nil, low, medium and high mortality categories for shipments to the Middle East for 2002

	Mortality rate				
Ship (code)	Nil 0.0%	Low >0.0–0.5%	Medium >0.5–1.0%	High >1.0%	Total
1	5	3	0	0	8
7	3	0	0	0	3
13	5	3	1	0	9
22	1	5	2	0	8
27	3	0	1	0	4
31	0	5	2	2	9
32	7	4	2	1	14
33	1	6	2	1	10
35	1	9	2	0	12
36	0	1	1	2	4
37	3	3	0	1	7
59	0	2	0	1	3
75	0	2	0	0	2
93	0	1	0	0	1
95	1	0	0	0	1
99	0	1	0	0	1
100	3	2	0	0	5
103	0	1	0	0	1
Total	33	48	13	8	102

South-East Asia

Over 0.6 million cattle were exported to South-East Asia in 2002 (Table 19) and the death rate was 0.07%, down slightly from previous years. No deaths were reported on half of the voyages to the region. The death rate from 1995 to 2002 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 19 Death rates, number of voyages and number of cattle exported to South-East Asia from 1995 to 2002

	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

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

Port of loading

Most cattle exported to South-East Asia were loaded at Darwin followed by Townsville and Broome (Table 20). The death rates from each port were less than 0.1% except for a shipment from Brisbane.

Table 20 Death rates, number of voyages and number of cattle exported from various ports to the South-East Asia for 2002

Port	Voyages (No.)	Cattle (No.)	Death rate overall (%)	Death rate range (%)
Brisbane	1	921	0.33	n/a
Townsville	41	99,316	0.05	0.0 – 0.9
Weipa	2	2,716	0.07	0.0 – 0.2
Karumba	27	39,962	0.07	0.0 – 0.3
Darwin	172	291,624	0.08	0.0 – 8.5
Wyndham	28	57,429	0.05	0.0 – 0.4
Broome	36	66,348	0.07	0.0 – 0.8
Port Hedland	8	12,348	0.06	0.0 – 0.3
Geraldton	16	23,005	0.06	0.0 – 0.7
Fremantle	23	40,973	0.06	0.0 – 0.5

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 (1990a) 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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