

Investigation into the reportable sheep mortality level on a sea voyage from Portland, Victoria to Qatar, Kuwait and Bahrain in June and July 2011.

1. Purpose

To report on the investigation into the cause of mortalities in sheep exported by sea to Qatar, Kuwait and Bahrain, and to make recommendations with the objective of reducing the likelihood of a recurrence.

2. Summary

There were two consignments of livestock on this voyage. In the first consignment of 28 607 sheep, loaded at Portland on 24 June 2011, there were 703 mortalities recorded which equates to a mortality of 2.46 per cent. In the second consignment of 36 596 sheep and 784 cattle, loaded at Fremantle on 30 June 2011, there were 267 sheep mortalities recorded which equates to a percentage mortality of 0.73 per cent. No mortalities were recorded in the consignment of cattle loaded in Fremantle. This investigation only reports on the consignment of sheep loaded in Portland which exceeded the reportable mortality limit of 2%. The main causes of mortality were enteritis and inanition though mortalities due to heat stress were also recorded. High temperatures and humidity experienced in the Arabian Gulf contributed to the mortality rate exceeding the reportable level.

3. Background

The investigation into the mortality was completed by reviewing the following information:

1. Report from the exporter
2. End of Voyage and daily reports from the AQIS accredited veterinarian (AAV) who accompanied the consignment on board the vessel.
3. Records from the AAV who prepared the consignment.
4. Report from the master of the vessel.
5. Correspondence from the Australian Maritime Safety Authority (AMSA).
6. Report from the AQIS regional certifying officer.
7. Records from the registered premises.

Table 1 Chronology of events showing cumulative mortality (count and percentage) by day

Date	Day	Event	Cumulative voyage mortality count	Cumulative Mortality %
24/06/2011	Load	28 607 sheep loaded in Portland. No mortalities	0	0.00%
25/06/2011	1	2 Mortalities	2	0.01%
26/06/2011	2	4 Mortalities	6	0.02%
27/06/2011	3	6 Mortalities	12	0.04%
28/06/2011	4	7 Mortalities	19	0.07%
29/06/2011	5	11 Mortalities. Loading in Fremantle	30	0.11%
30/06/2011	6	12 Mortalities. Loading in Fremantle	42	0.15%

01/07/2011	7	13 Mortalities	55	0.19%
02/07/2011	8	20 Mortalities	75	0.26%
03/07/2011	9	7 Mortalities	82	0.29%
04/07/2011	10	12 Mortalities	94	0.33%
05/07/2011	11	25 Mortalities	119	0.42%
06/07/2011	12	51 Mortalities	170	0.59%
07/07/2011	13	55 Mortalities	225	0.79%
08/07/2011	14	56 Mortalities	281	0.98%
09/07/2011	15	69 Mortalities	350	1.22%
10/07/2011	16	39 Mortalities	389	1.36%
11/07/2011	17	52 Mortalities	441	1.54%
12/07/2011	18	38 Mortalities	479	1.67%
13/07/2011	19	26 Mortalities	505	1.77%
14/07/2011	20	50 Mortalities	555	1.94%
15/07/2011	21	76 Mortalities Vessel arrived in Qatar and commenced unloading sheep.	631	2.21%
16/07/2011	22	28 Mortalities	659	2.30%
17/07/2011	23	20 Mortalities Vessel unloading sheep in Kuwait	679	2.37%
18/07/2011	24	11 Mortalities Vessel completed unloading sheep in Kuwait	690	2.41%
19/07/2011	25	1 Mortality Vessel unloading in Bahrain	691	2.42%
20/07/2011	26	12 Mortalities Vessel completed unloading in Bahrain	703	2.46%

The reportable mortality trigger for sheep is 2.0% (or 3 animals whichever is greater). The reportable mortality level was triggered on day 21 of the voyage (15 July 2011) as the vessel arrived in Qatar.

4. Findings

4.1 Preparation in the Registered Premises

The 28 607 sheep exported from Portland were assembled at a registered premises near Portland, Victoria. Between 17 June and 24 June 2011, 29 400 sheep were prepared at the registered premises. There were 22 mortalities recorded in the registered premises during the assembly period which equates to a mortality of 0.07%.

Records obtained from the registered premises indicate that rain occurred on all of the 7 days of the preparation period, as well as the day that the sheep were loaded onto the vessel. The exporter, AQIS veterinary officer and the AQIS accredited veterinarian did not report that these adverse weather conditions had a negative effect on the health and welfare of the sheep.

The AQIS veterinary officer and AQIS accredited veterinarian inspected the sheep on 23 and 24 June 2011. Both the AQIS veterinary officer and AQIS accredited veterinarian were satisfied with the general health status and condition of the sheep though some scouring in individual sheep was noted.

4.2 Loading onto the Vessel

The loading records indicate the stocking density and the amount of fodder loaded was in accordance with the ASEL. Sheep from this consignment were loaded onto all decks of the vessel apart from decks 5 and 9. During loading, 933 sheep were rejected from the consignment by the AQIS accredited veterinarian. Approximately half of those sheep that were rejected were found to be scouring. Other reasons for rejection included eye problems, lameness and scabby mouth.

4.3 Conditions during the Journey

Figure 1 shows the wet bulb temperature for each deck and each day as well as the heat stress threshold (HST) and mortality limit (ML) for adult merino sheep. Heat stress threshold is the maximum ambient wet bulb temperature at which heat balance of the deep body temperature can be controlled using available mechanisms of heat loss. Mortality Limit is the wet bulb temperature at which the animal will die. For adult merino sheep the heat stress threshold is 30.6°C and the mortality limit is 35.5°C.

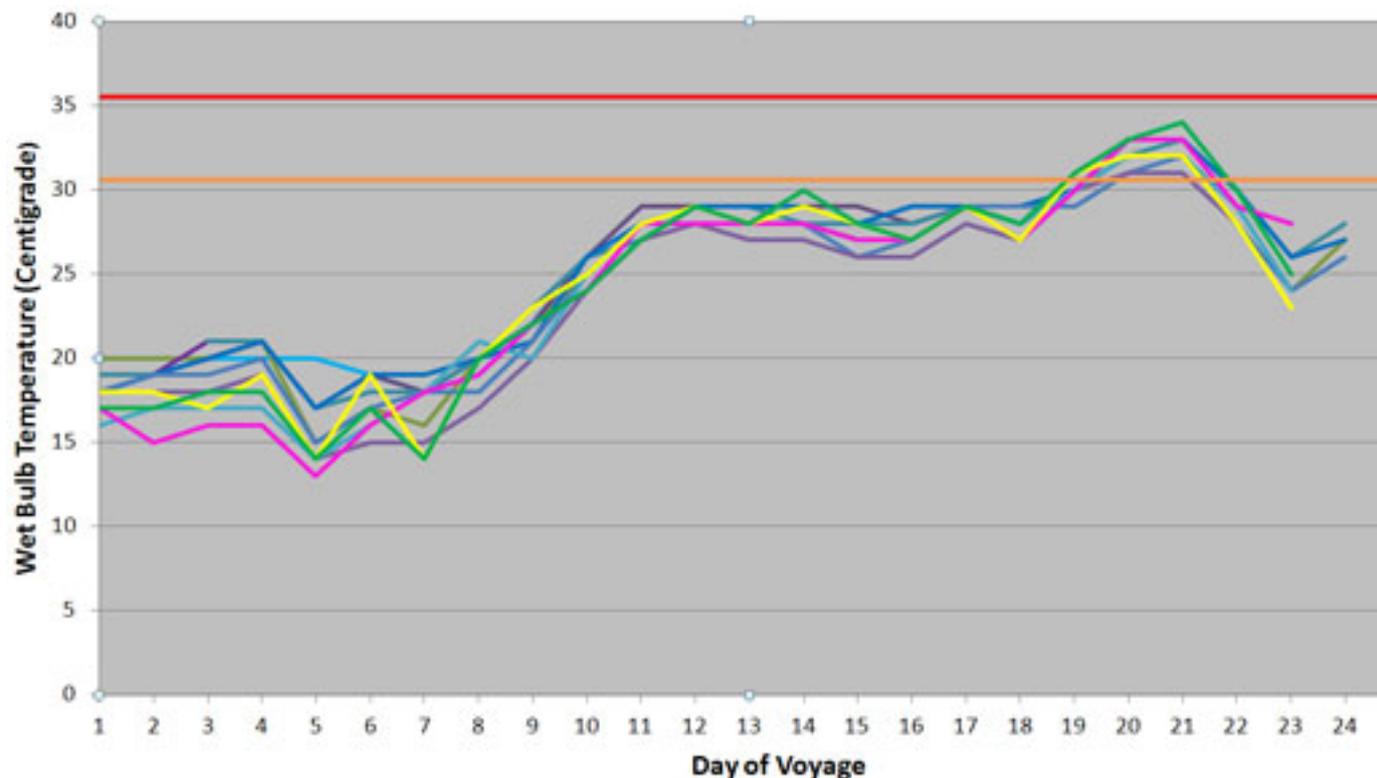


Figure 1 Wet bulb temperatures by deck and day, heat stress threshold (HST) and mortality limit (ML).

The available information indicates that the sheep were exposed to temperatures above the heat stress threshold on days 19 – 21 of the voyage. During days 19 – 21 of the voyage the vessel was in the Arabian Gulf and discharging sheep in Doha, Qatar. Figure 1 shows that the recorded wet bulb temperatures did not exceed the mortality limit at any stage during the voyage. The onboard AQIS accredited veterinarian reported mortalities due to heat stress on day 20 of the voyage.

4.4 Mortality by Cause

The causes of mortality were reported in the veterinarian's daily reports and end of voyage report but were not recorded for each individual deck. Post mortems were performed each day, up to and including day 20 of the voyage. From day 21 onward, the vessel was within the Arabian Gulf and post mortems could no longer be performed.

According to the veterinarian's daily reports, 399 post mortem examinations were undertaken during the voyage and a diagnosis was reached in 354 of these. Based on his findings, the veterinarian concluded that 54.0% of the mortalities during the voyage were due to enteritis, 26.6% were due to inanition and 12.4% were due to enteritis/inanition. A further 6.2% were due to heat stress. The remaining mortalities were due to other causes such as pneumonia.

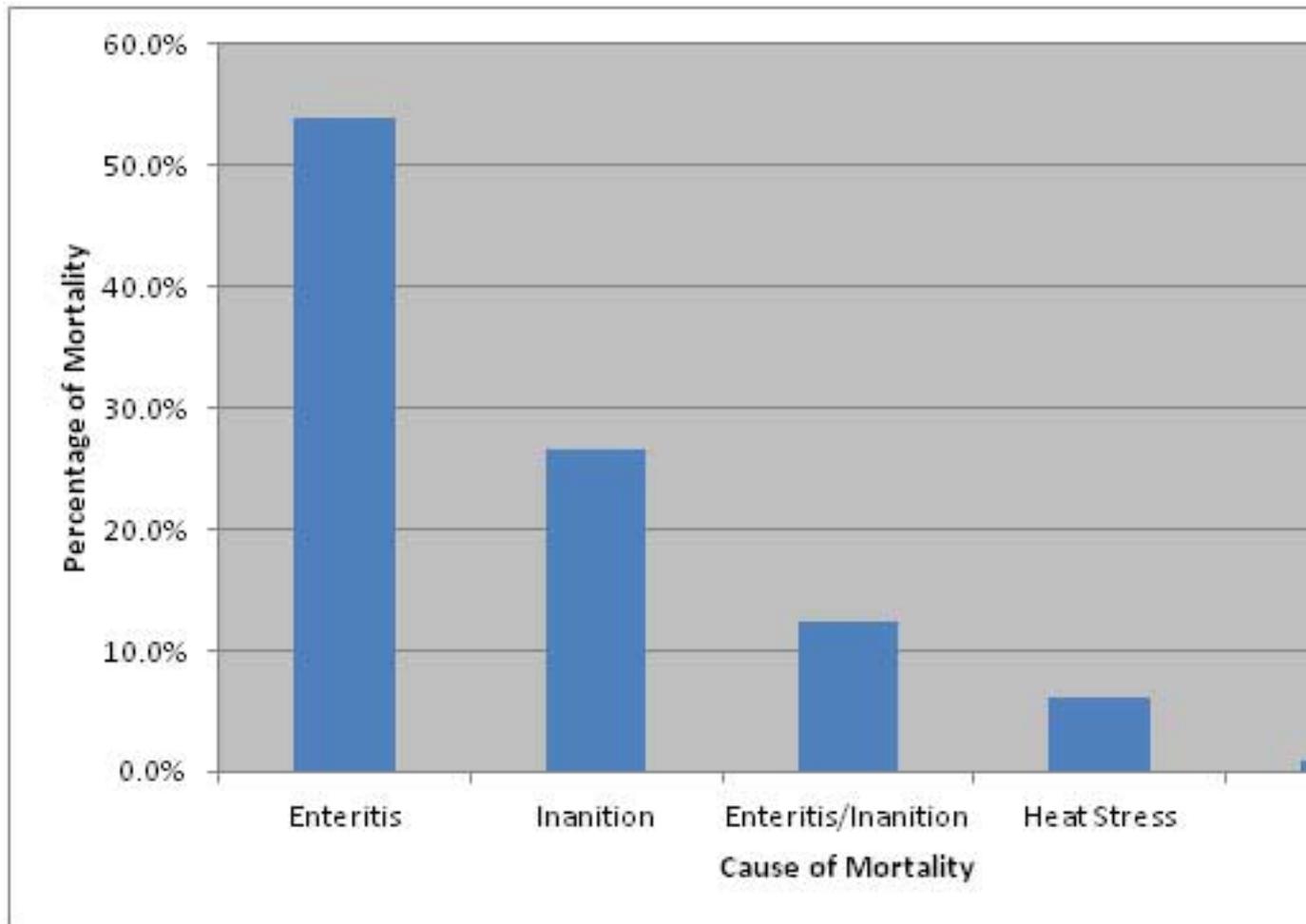


Figure 2 - Percentage of mortality assigned to each cause

4.5 Mortality by Day

Figure 3 shows the percentage of sheep that died each day (this is not a cumulative mortality) and the average wet bulb temperature across all decks of the vessel. The available information suggests that the initial significant increase in mortality was caused by enteritis. The second significant increase in mortality appears to be due to both enteritis and heat stress. The veterinarian's reports indicate that enteritis was the dominant cause of mortality throughout the voyage.

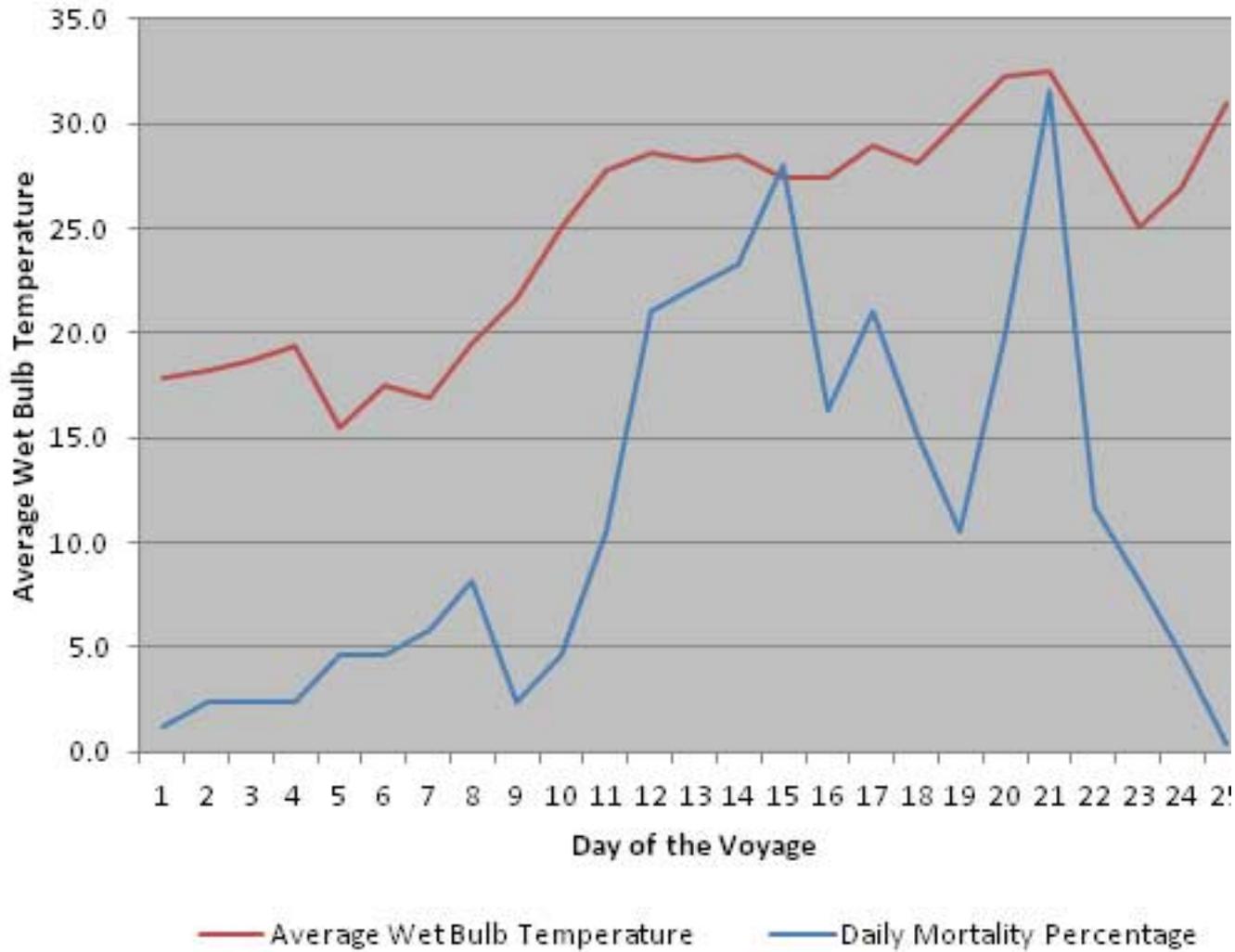


Figure 3 - Daily percent mortality and temperature
 The blue line indicate the percentage of sheep that died each day (not cumulative)
 The red line indicates the average wet bulb temperature across all decks

4.6 Mortality by Class

Figure 4 shows the mortality percentage for each class of sheep. Class of sheep refers to the age and sex of sheep, i.e. wether, ewe or ram as well as the commercial class of sheep, i.e. an A class wether is larger than a B class wether which is larger than a C class wether.

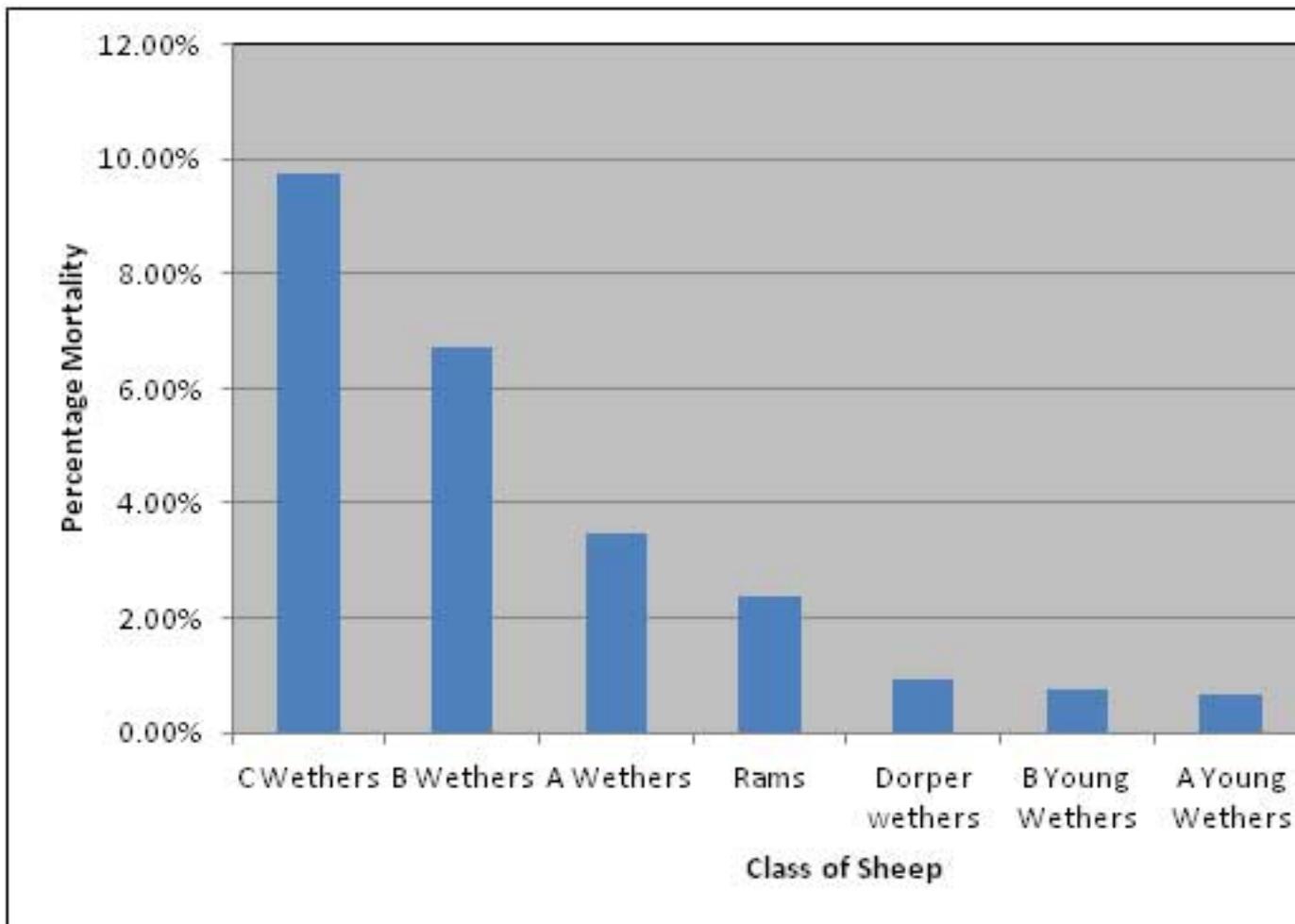


Figure 4 - Mortality percentages for each class of sheep arranged in order of decreasing mortality rate.

The sheep classes with the highest mortality percentages were the C and B class wethers. In addition to this, the mortality in the A class wethers and rams also exceeded 2%. The veterinarian's daily voyage reports indicated that the B and C class wethers were most severely affected by enteritis. Available information indicates that one group of sheep within the B class wethers, and identified by ear tag as originating from one property, experienced a higher percentage mortality than other groups of sheep from different properties.

Table 2 showing the percentage contribution to the total loaded, the percentage mortality and the percentage of the total voyage mortality of each class of sheep

Class of sheep	% of loaded sheep	% Mortality	% of total mortality
B Young Wethers	35.09%	0.73%	10.38%
A Young Wethers	29.41%	0.68%	8.11%
B Wethers	22.47%	6.72%	61.45%
A Wethers	5.73%	3.48%	8.11%
Dorper Wethers	2.96%	0.94%	1.14%
C Wethers	2.55%	9.74%	10.10%
Ewes	1.20%	0.29%	0.14%
Rams	0.59%	2.37%	0.57%

Table 2 shows the percentage each class of sheep represented of the total number loaded, the percentage mortality that each class experienced and the contribution these mortalities made to the total voyage mortality. It can be seen that the three classes of wethers, A, B, and C experienced the highest percentage mortality. B class wethers represented only 22.47% of the sheep loaded but contributed to 61.45% of the total voyage mortality. Likewise, the C class wethers represented only 2.55% of the sheep loaded and contributed to 10.10% of the total voyage mortality. B class young wethers however represented 35.09% of the sheep loaded, experienced a mortality of 0.73% and contributed to only 10.38% of the total voyage mortality. From the available information, classes of sheep which displayed clinical signs of enteritis subsequently experienced a higher percentage mortality than those which did not and contributed to a greater percentage of the total voyage mortality.

4.7 Mortality by Deck

Table 3 shows mortality by deck. The stock loaded on decks 10 and 3 aft experienced the lowest percentage mortality. The stock loaded on decks 2 and 3 forward, as well as 8 experienced the highest percentage mortality. The B class wethers and C class wethers were loaded on decks 2 and 3 forward, as well as 8 and the veterinarian reported that these classes of sheep were severely affected by enteritis. Post mortem results were not recorded by location and it is difficult to determine if the variation in mortality rates was due to deck or sheep factors.

Deck	Number Loaded	Mortality Count	Mortality %
11	2258	43	1.90%
10	4480	22	0.49%
8	3077	136	4.42%
7	307	4	1.30%
6	6290	33	0.52%
4 Fwd	2465	25	1.01%
3 Fwd	2151	129	6.00%
2 Fwd	2020	260	12.87%
4 Aft	2440	17	0.70%
3 Aft	1582	8	0.51%
2 Aft	1537	26	1.69%
Total	28 607	703	2.46%

4.8 Management of the livestock during the voyage

From the veterinarian's reports presented to AQIS, the following actions were instituted by the veterinarian, stockman, officers and crew of the vessel:

1. Measures to reduce the spread of infectious disease:
 - Mortalities and sick sheep were promptly removed from pens
 - Groups of sick sheep affected by enteritis were isolated from those unaffected
 - Water and fodder troughs were cleaned regularly
2. Measures to treat the sick sheep:
 - Sick individual sheep were promptly treated with antibiotics and moved to hospital pens
 - Groups of sheep affected by the increased incidence of enteritis were provided with a chaff ration to promote fodder and water consumption.

The stocking density was reduced after unloading was completed at Qatar, and again after Kuwait, to take advantage of the extra space that became available. The available information indicates that the onboard management of the livestock was compliant with Standard 5 of the ASEL.

5. AMSA evaluation of the vessel upon return to Australia

An inspection of the vessel by AMSA on 7 August 2011 following the vessels return to Australia revealed that one of the two osmosis plants used for producing freshwater was unserviceable. Freshwater was still able to be produced from the second osmosis plant. No evidence was presented to the investigation which suggested that the supply of freshwater to the livestock was inadequate or contributed to the reportable mortality event.

6. Conclusion

The main cause of mortalities was identified to be enteritis, but mortalities due to inanition and heat stress were also recorded. These results are consistent with existing knowledge on the causes of mortality in sheep exported live by sea^{2,3}. The B and C class wethers experienced an outbreak of enteritis, and mortalities within those classes of sheep contributed to more than two thirds of the total voyage mortality. High temperatures and humidity in the Arabian Gulf also contributed to the mortality exceeding the reportable level.

7. Recommendations

A research project entitled W.LIV.0252 – Investigating cattle morbidity and mortality to the Middle East is currently being undertaken through the MLA / LiveCorp Live Export Research and Development Program. This project includes standardised post mortem techniques as well as collection and return to Australia of samples from cattle such that a definitive diagnosis can be made.

In this incident, the infectious agent that caused the outbreak of enteritis was not identified. DAFF will write to the Live Export Research and Development Advisory Committee recommending that the above project be replicated or extended to include sheep being exported to the Middle East.

8. Actions

The exporter loaded additional antibiotics and chaff for the following consignment of sheep exported from Portland to the Arabian Gulf on a different vessel in July 2011 for use in the event of a similar outbreak of enteritis.

9. Results

The result for the following consignment of sheep was 304 mortalities reported out of 37,094 sheep loaded equating to a percentage mortality of 0.82%.

The exporter has regularly shipped similar consignments of sheep to the Arabian Gulf. Since January 2005, this exporter has exported over 2 million sheep to the Arabian Gulf on 53 voyages with an average mortality of 0.88%.

10. References

1. Maunsell Australia Pty Ltd. 2003. LIVE.116 Development of a heat stress risk management model. Meat and Livestock Australia.
2. Richards, R., R. Norris, et al. (1989). "Causes of death in sheep exported live by sea." Australian Veterinary Journal 66(2): 33-38.
3. Kelly, A. P. (1996). Mortalities in sheep transported by sea. Faculty of Veterinary Science. Melbourne, University of Melbourne. PhD.

