

MORTALITY INVESTIGATION REPORT 41: INVESTIGATION INTO REPORTABLE CATTLE DEATHS IN A SEA VOYAGE FROM DARWIN TO BRUNEI DARUSSALAM IN OCTOBER 2011

1. SUMMARY

Ten cattle died in a consignment of 1,286 cattle on a sea voyage from Darwin to Brunei Darussalam in October 2011. The 0.78% mortality rate exceeded the reportable mortality rate of 0.5% prescribed by Australian Standards for the Export of Livestock (ASEL).

The cause of death of the majority of cattle was not able to be confirmed. A lack of diagnostic information limited the capacity of this investigation to definitively diagnose the cause of death. The stockman has proposed bovine ephemeral fever (BEF), an insect-borne viral disease of cattle in northern Australia, as a possible cause of illness and death.

The report makes the recommendation that the end of voyage report template should be amended to require individual identification of cattle, the treatments received and the deaths that occurred.

The report makes two observations including that the onboard stockmen and AQIS Accredited Veterinarians (AAVs) should:

- make every effort to collect sufficient evidence to obtain a definitive diagnosis; and
- consider use of mineral and glucose treatments as a tool in the onboard management of recumbent cattle.

2. INFORMATION REVIEWED

DAFF investigated the deaths by reviewing the following information:

1. Report from the exporter.
2. End of voyage and daily reports from the stockman who accompanied the consignment on board the vessel.
3. A record from the AQIS accredited veterinarian (AAV) who prepared the consignment.
4. Report from the Master of the vessel.
5. Report from the Australian Maritime Safety Authority (AMSA).
6. Report from the DAFF regional certifying officer.
7. Records from the registered premises.
8. DAFF database on previous voyages.
9. Previous DAFF mortality investigations for consignments to South East Asia.

Attachment A

3. INFORMATION FINDINGS

In the seven years since the introduction of the *Export Control (Animals) Order 2004* and the ASEL, there have been 96 sea voyages of slaughter cattle to Brunei Darussalam. A single exporter accounted for all but three voyages. All voyages departed from Darwin apart from a single consignment from Mourilyan. All apart from five consignments were prepared in the same registered premises.

The average voyage duration to Brunei is 8.8 days (range 7–12 days). Approximately 52 of the 35,539 cattle exported to this market have died during the voyage, an overall mortality rate of 0.15%. This mortality incident is the first and only reportable mortality incident in a sea voyage to Brunei Darussalam since the introduction of ASEL.

Brunei Darussalam is located in South East Asia, close to other major Australian cattle destinations including Indonesia, Malaysia and The Philippines. These destinations share many common factors such as approximate voyage lengths from Australia, port of departure from Australia, cattle type and sailing routes. A summary of mortality events to these wider destinations is set out in Table 1. As set out, since 2006 DAFF investigated 11 consignments that experienced a voyage mortality rate greater than 0.5 %. These consignments represented 1.25% of the total number of consignments to South East Asia during this time period. For nine of the 11 consignments, the majority of deaths were reported in cows (i.e. female cattle that have given birth to at least one calf) and heavy bulls. The causes of death have historically been described as injuries and pneumonia in both in the DAFF investigations and in the wider literature (Norris et al 2003).

Table 1. Summary of South East Asian cattle mortality events 2006–present.

| Year | Number of mortality events/ Number of consignments | Month of Year | Departure port | Mortality rate | Causal factors | Type |
|------|---|----------------------|----------------|----------------|--|---|
| 2006 | 2/204 | July | Broome | 1.47% | pneumonia | heavy bulls |
| | | October | Wyndham | 0.63% | leg injuries/ recumbent/ aggression | heavy bulls |
| 2007 | 5/229 | March | Fremantle | 4.00% | cyclones/ injuries/ recumbent | older cows |
| | | May | Port Headland | 1.25%, | pneumonia/ injuries | cows |
| | | May | Darwin | 0.58%, | injuries/ recumbent | older cows |
| | | May | Karumba | 0.55%, | injuries | older cows |
| | | November | Fremantle | 0.76%, | lameness sudden death | heavy bulls cows |
| 2008 | 3/235 | January/ February | Geraldton | 1.93%, | recumbent/ unknown | cows |
| | | February | Fremantle | 0.84% | cyclone/ injuries | cows |
| | | December | Darwin | 1.14% | unknown | cows |
| 2009 | 1/295 | February/ March | Fremantle | 0.70% | unknown | cows |
| 2010 | 0/211 | N/A | N/A | N/A | N/A | N/A |
| 2011 | 1/123 | October | Darwin | 0.78% | Unknown/lameness/ recumbent. BEF postulated. | 7/529 cows 3/644 steers 0/143 bulls |

Attachment A

3.1. Pre-export preparation in the registered premises

Following sourcing from 19 properties, 1,286 Brahman- cross cattle and 232 buffalo were assembled at a single registered premises from 30 September 2011 prior to their export on 8 October 2011. Records indicate the cattle gained an average of 7 kg per head during their 8–19 day stay in the registered premises. Weather data during this period shows a temperature range of 18.4–37.7 °C, zero rainfall, and average relative humidity of 66.2% from 9 am recordings (Bureau of Meteorology 2012).

One bull was rejected due to a jaw abscess and two cattle died during the preparation period. The operator of the registered premises nominated BEF as a possible cause of death, because he observed that the two cattle were very hot to touch, could not stand and were very stiff in the joints. BEF as a possible cause is discussed further under Section 4.1 of this report. The AAV declared the remaining cattle to be fit for export and in excellent condition. The DAFF certifying veterinarian reported no issues during the pre-export preparation period.

All animals received a treatment for external parasites at the time of departure from the registered premises. The road journey from the registered premises to the port of Darwin is less than 45 kilometres.

3.2. Loading onto the vessel

The DAFF veterinarian and exporter reported that loading onto the vessel was notably slow. They attributed this to the fact that the vessel was relatively new, its maiden voyage having occurred on 16 September 2011, and the crew were unfamiliar with the flow of gates and raceways. No further issues or injuries were noted during loading of cattle.

3.3. Cattle deaths during the voyage

Ten cattle died in the consignment of 1,286 (mortality rate 0.78%). Two recumbent cows were euthanased by the stockman, the remaining eight cattle died during the voyage, typically following signs of lameness and failure to respond to treatment. The stockman postulated BEF as a probable cause of all morbidity and mortality, based on the clinical signs.

A single buffalo died during the voyage, but this animal is not included in this investigation because the buffalo consignment did not exceed the ASEL reportable mortality level.

A summary of events based on the daily voyage reports to DAFF is set out in Table 2. The reportable mortality level for cattle on voyages less than ten days is 0.5%. The reportable mortality level for this consignment was triggered on the final day of the voyage.

Attachment A

Table 2. Chronology of deaths and treatments during voyage

| Day | Event | Treatments | Daily deaths | Cumulative deaths | Cumulative mortality rate% |
|-----|--|--|--------------|-------------------|----------------------------|
| 0 | 1286 cattle loaded in Darwin | Nil | 0 | 0 | 0.00% |
| 1 | | Nil | 0 | 0 | 0.00% |
| 2 | | 1 steer: 35ml Alamycin (oxytetracycline 200mg/mL) and 10ml Flunixin (50mg/mL) | 0 | 0 | 0.00% |
| 3 | | 1 lame cow: 35ml Alamycin and 10ml Flunixin | 0 | 0 | 0.00% |
| 4 | (1 buffalo dies of unknown cause) | 1 lame cow: 35ml Alamycin and 10ml Flunixin | 0 | 0 | 0.00% |
| 5 | 1 cow dies: the same one treated on day 4 | 1 cow looking sick: 20ml penicillin (procaine penicillin 300mg/mL) and 10ml flunixin | 1 | 1 | 0.08% |
| 6 | 1 cow euthanased: knuckling on both front legs | 2 cows lame and 1 recumbent cow: 35ml Alamycin and 10ml Flunixin. 1 sick steer: 20ml penicillin and 10ml Flunixin. | 1 | 2 | 0.16% |
| 7 | 1 recumbent cow euthanased. One steer and one cow died of unknown cause. | Retreated sick steer from day 6 with 20ml Penicillin. | 4 | 6 | 0.47% |
| 8 | Discharging in Muara Port | | 4 | 10 | 0.78% |
| 9 | | | | | |

No veterinarian travelled with the cattle on the voyage and the stockman did not perform a clinical examination, postmortem examination or take clinical samples.

The majority of the deaths occurred in cows as set out in Table 3. In this voyage, cows were 2.84-times more likely to die than steers.

Attachment A

Table 3. Deaths by class of cattle on voyage

| Category | No. cattle loaded | Deaths | Mortality rate |
|----------|-------------------|--------|----------------|
| Steers | 644 | 3 | 0.47% |
| Bulls | 103 | 0 | 0.00% |
| Cows | 529 | 7 | 1.32% |

3.4. Conditions during the voyage

Deck conditions

Cattle deaths occurred on four of the five decks of the vessel. The deck conditions were described as 'OK' by the stockman throughout the voyage. Decks were washed on a rotating basis from day three.

Temperature and humidity

Throughout the voyage the temperature ranged between 27.5 and 30.6 °C and the relative humidity ranged between 66.4 and 80.4%. Table 4 is based on AMSA data that shows that temperatures were fairly consistent during the voyage; and also similar to the conditions during the pre-export preparation period.

Table 4. Temperature and humidity throughout the voyage on each of the five decks

| DAY | Deck 1 | | | Deck 2 | | | Deck 3 | | | Deck 4 | | | Deck 5 | | |
|-----|--------|------|------|--------|------|------|--------|------|------|--------|------|------|--------|------|------|
| | No | T | H | No | T | H | No | T | H | No | T | H | No | T | H |
| 1 | 343 | 28.5 | 66.4 | 360 | 28.7 | 72.7 | 323 | 27.5 | 79.6 | 292 | 28.7 | 78.4 | 200 | 30.4 | 71.2 |
| 2 | 343 | 28.8 | 66.9 | 360 | 29 | 70.7 | 323 | 29.0 | 73.7 | 292 | 29.8 | 75 | 200 | 30.4 | 73.3 |
| 3 | 343 | 29.4 | 73.5 | 360 | 28.7 | 72.7 | 323 | 28.8 | 76.8 | 292 | 30.5 | 70.8 | 200 | 30.6 | 74 |
| 4 | 343 | 28.6 | 80.4 | 360 | 29.0 | 70.7 | 323 | 29.8 | 76.2 | 292 | 29.9 | 72.1 | 200 | 30.3 | 78.3 |
| 5 | 343 | 29.8 | 70.7 | 360 | 29.4 | 72.7 | 323 | 30.0 | 78.5 | 292 | 30.1 | 75.0 | 200 | 30.2 | 75.7 |
| 6 | 343 | 28.9 | 75.3 | 360 | 29.7 | 75.0 | 323 | 30.1 | 80.1 | 292 | 30.2 | 76.3 | 200 | 30.3 | 77 |
| 7 | 343 | 29.0 | 76.0 | 360 | 29.6 | 78.9 | 323 | 29.7 | 79.6 | 292 | 30.3 | 80.4 | 200 | 30.3 | 76.1 |

Treatments administered

Nine cattle received treatments at therapeutic doses during the voyage, including two types of antibiotics (oxytetracycline 200mg/mL; procaine penicillin 300mg/mL) and one type of anti-inflammatory medication (Flunixin 50mg/mL). The treatments are further described in Table 2. The stockman also reported the provision of additional space for sick cattle.

The treatments administered and protocol followed reflect those prescribed for use in the Stockman's Handbook for Transport of Cattle by Sea (Ainsworth 2008) – with the exception of no record of treatment with glucose or mineral supplements.

It was unclear in a few cases if animals that received treatments later died, because the stockman did not give individual animal identification in the daily or end of voyage reports.

Feed and water

Feeding was done manually three times per day, giving at least the ASEL-prescribed rate of 2% of liveweight per animal per day.

The vessel has an automatic watering system and the vessel's water plant produced 60–65 tonnes per day, which is sufficient for *ad libitum* consumption.

Attachment A

3.5. Discharge

Discharge of livestock at Muara port was unremarkable.

3.6. Australian Maritime Safety Authority (AMSA) evaluation of the vessel upon return to Australia

AMSA conducted an investigation on the vessel on 25 October 2011 following its return to Darwin. The surveyor reported that the livestock services, equipment and general condition of the ship were closely examined, tested, and found satisfactory.

Decks one and two are open decks, and decks three to five are enclosed decks. AMSA conducted a ventilation performance test on decks four and five with satisfactory results; all smoke cleared within three minutes and there were no dead spots. AMSA checked the temperature readings on all decks and found the readings were the same across all areas apart from deck one, where there was a three-degree difference between the aft and forward pens with the forward windows open and a six-degree difference with the windows closed.

Based on this latter finding, the AMSA recommendations included at least six temperature and humidity readings to be taken on each deck to obtain a clear representation; blowers to be installed in the forward section of deck one in case the windows are kept closed; and continued monitoring of the airflow on open decks.

AMSA supported the stockman's proposal for a modification to the loading entrance (swinging the gate inwards) in order to make the loading process more efficient. This modification was made before the vessel's next voyage.

4. EVALUATION

4.1. Cause of death

A lack of diagnostic information has limited this investigation into the cause of the cattle deaths. There was no veterinarian on board; no recorded clinical signs apart from lameness and recumbence, no samples taken, and no postmortems performed. The same applies to the two deaths that occurred in the registered premises during pre-export preparation, with the additional clinical sign of the animals feeling 'hot to touch' prior to death (no temperature taken).

Two of the ten cattle deaths were due to euthanasia by the stockman, because the cattle had become recumbent for unknown reasons.

The exporter indicated from their own investigation that BEF may have caused the deaths. BEF is transmitted by several species of mosquitoes and biting flies. It is not spread directly from animal to animal. BEF causes fever, with general lethargy and may progress to inappetance, stiffness and lameness. Nasal and ocular discharges, and in some cases patchy subcutaneous oedema of the head (particularly around the eyes), may develop. Recumbency may develop and progress to death (St George 2004).

The few reported clinical signs of the cattle that died or were euthanased are consistent with BEF. However, there was no evidence of unusually high BEF occurrences during September or October 2011 at the National Arbovirus Monitoring Program (NAMP) monitoring sites in the Northern Territory.

Attachment A

The majority of the deaths occurred in cows as illustrated in Table 3. Cows represented a 2.84-times higher risk of death compared to steers. While the small sample size limits the statistical conclusions, the findings are consistent with qualitative data from previous mortality investigations to similar markets, and may support the theory of a disease such as BEF as a possible cause of death, given its propensity to higher morbidity and mortality in older, higher-producing animals (Center for Food Security and Public Health 2008). The investigation determined there is insufficient information to confirm that BEF, or any other specific disease, caused the cattle deaths on this voyage.

4.2. Property of origin factors

Animals in this consignment were sourced from a total of 19 properties of origin; however, the exporter was unable to link any animal that died back to any particular property of origin. The investigation was therefore unable to determine whether property of origin factors contributed individual cattle deaths.

If a cause of death such as BEF was suspected, it would be ideal to have traced animals back to their property of origin and determine whether they were more susceptible to BEF based on history of disease on the property and the location with respect to the vector-free zone.

4.3. Registered premises factors

Weather conditions in the registered premises were unremarkable during the preparation period.

A second reportable mortality event occurred in buffalo prepared at the same facility after the departure of this consignment. In this consignment, eight buffalo died out of 452 exported via sea from Darwin to Indonesia in late October 2011, that equates to a mortality percentage of 1.77%. The two consignments were not in-contact, and it is difficult to establish a link given a lack of definitive diagnosis for both consignments.

4.4. Vessel factors

Based on the information supplied by AMSA, and the dispersed location of dead animals on the vessel, it is unlikely that vessel factors contributed to the mortality rate.

4.5. Weather during the voyage

Dry bulb and wet bulb temperatures and humidity on board the vessel remained near-constant throughout the voyage. The wet bulb temperature remained below both the heat stress threshold (the point at which the body is unable to compensate through biologically available heat loss mechanisms) and mortality limit (the point at which death will occur due to temperature) for *Bos indicus* cattle (Maunsell 2003), so heat stress is unlikely to have contributed to the deaths. There are no reports of any adverse weather during the voyage.

Attachment A

4.6. Treatments administered

The stockman administered anti-inflammatory medication to the cattle; however, recumbent cattle may have additionally benefited from administration of minerals (calcium and magnesium) and glucose as prescribed in the livestock export *Stockman's Handbook* (Ainsworth 2008).

The lack of recording of individual animal identification against each treatment administered means that it was not possible to track the animals' response to treatment.

5. OVERALL CONCLUSIONS

The cause of death of the majority of cattle was not able to be confirmed. A lack of diagnostic information limited the capacity of this investigation to definitively diagnose the cause of death.

6. ACTIONS AND RESULTS FOR SUBSEQUENT VOYAGES

A subsequent, similar consignment for this exporter was subject to the following conditions:

1. An AAV must accompany the animals for the duration of the voyage.
2. The AAV must provide a daily report to DAFF in accordance with ASEL Appendix 5.1.
3. The travel and load plan supplied to DAFF NT must include the number and class of livestock to be loaded on each tier/deck.
4. The end of voyage report must specify the number of deaths that occurred on each tier/deck and the number of deaths in each class of livestock.
5. The onboard veterinary supplies must include medications in conformance with ASEL plus additional anti-inflammatory medication sufficient to treat 5% of the cattle.

This consignment departed from Darwin on 26 October 2011. No deaths occurred in cattle and the only clinical problem reported by the AAV was a few anorexic cattle.

7. OBSERVATIONS

7.1. Onboard stockmen and AAVs should make every effort to collect sufficient evidence to obtain a definitive diagnosis: taking samples, performing clinical and postmortem examinations, and measuring animal health parameters such as temperature. The more information available provides for more effective analysis and decision making to support positive health and welfare outcomes.

7.2. Onboard stockmen and AAVs should consider use of mineral and glucose treatments as a tool in the onboard management of recumbent cattle.

Attachment A

8. RECOMMENDATIONS

8.1. The end of voyage report template should be amended to require the individual identification of cattle, the treatments received and the deaths that occurred. This would contribute to better analysis of the cause of deaths for future investigations. Ideally this should include the information in Table 5 and 6.

Table 5. Record of treatments

| Animal ID Visual / RFID | Location Deck / Pen | Date of treatment | Treatment(s) administered | | Reason for treatment | Treatment outcome |
|-------------------------------|------------------------|----------------------|------------------------------|------|-------------------------|----------------------|
| | | | Drug | Dose | | |
| | | | | | | |

Table 6. Record of deaths

| Animal ID Visual / RFID | Location Deck / Pen | Date of mortality | Post mortem findings | Causes of death |
|-------------------------------|------------------------|----------------------|-------------------------|-----------------|
| | | | | |

7. REFERENCES

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