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DETAILED ANALYSIS OF SCIENTIFIC PAPER ON CATTLE MORTALITY RISK IN LIVE EXPORT¹

Major Criticisms

1. This study has one serious fundamental flaw, namely excluding the extreme mortality voyages (>26% mortality rate) as outliers. It is reasonable to exclude outliers for statistical analysis but it is not reasonable to then ignore the outliers as a potential focus of enquiry eg as a separate data set. This is especially pertinent in a study aimed at identifying risk factors for mortality: the four outliers were extreme mortality incidents.

The voyages of the *Charolais Express* 1998 (inadequate ventilation and heavy weather), *Kalymnian Express* 1999 (cyclone), *Temburong* 1999 (power loss, ventilation failure and 74.7% mortality) and the *MV Becrux* 2002 (ventilation) were all disasters due to extreme weather conditions or ventilation problems and these are inherent risks of sea transport, thus should have been discussed as serious and legitimate risk factors.

Any scientific paper that assesses risk factors would hopefully identify future risks. By excluding the outliers, this study failed to do that. It is significant that all high mortality cattle voyages occurring after the study period until present occurred due to the “excluded” factors eg bad weather in Voyages 45 (2013), 50 (2014) and 52 (2014) and ventilation issues in Report 44 (2013). The fact that a paper analysing the main risk factors between 1995 and 2012 failed to identify these significant risk factors supports the conclusion that ignoring this data set was very poor science. Keniry (2004)¹ concluded that the live export trade was “uniquely and inherently risky”. There have been and always will be inherent shipping risks: fires, mechanical breakdowns, sinking and extreme weather. These affect cattle (and sheep and human) safety and can result in very significant mortalities, much higher than routine.

The study was funded by MLA/Livecorp and it is likely that acknowledging the inherent risk for high mortalities would not have been supported. However, ignoring

¹ See Livestock Export Review.

www.australiananimalwelfare.com.au/app/webroot/files/upload/files/keniry_review_jan_04.pdf

issues such as heavy weather could result in failure to address and mitigate such risks eg not heading off into heavy weather (as occurred in Voyage 50, which, from Day 1, ran into extreme weather that must have been predictable).

2. There is also a problem with the accuracy of the data available over the period used in the study. Until the early to mid 2000s, there was no requirement for the veterinarian or stockperson(s) to stay with the vessel until it was fully unloaded. Thus the voyage mortalities from that time period did not include any mortalities that occurred during discharge or as an act of discharge (such as fractured limbs or drownings). There is often a spike in mortalities at discharge as dead animals are discovered when crowded pens are emptied. Very lame or sick animals are more easily and frequently identified when trying to move them from their pens to unload. These animals are usually euthanased.

These port/ discharge mortalities in the earlier part of the study period would not have been reported to DAFF, and therefore will not have been considered in this study. The authors are unlikely to have been aware of this data omission (and current Department of Agriculture staff may be similarly unaware) but it remains an omission and will have affected their overall mortality percentages. In addition until 2004, there was no requirement for a veterinarian to be onboard long haul voyages which means mortality records may not have been accurate (see point 5).

3. Given that the main peak in daily mortality rate was 3-4 weeks (peak 25-30 days) after departure, the much higher voyage mortality rate in southern cattle shipped on short voyages to SE Asia should have received a thorough discussion. The obvious explanation would be that heat stress plays a major role in southern *Bos taurus* cattle suddenly exposed to high wet bulb temperatures in the tropics with no time to acclimatise. The failure to discuss this in detail has significant implications for other voyages (eg southern cattle sailing to southern China) and is a major omission in a paper that purports to be identifying risk factors.

4. The authors identify that there was a higher mortality rate in cattle destined for Aegean and Black sea ports due to the type of cattle and seasonal climatic condition. However, no comment was made that this occurred despite the fact that many of these will have been breeder animals, thus possibly provided with above average travelling conditions (as discussed by the authors in this paper). The authors conclude that exposure to temperature extremes without sufficient time for physiologic adaptation may have increased the mortality rate yet do not discuss heat stress specifically (or BRD). The lack of emphasis of the important influence of heat stress and omission of any reference to the recent peer-reviewed scientific paper on this topic² is disappointing.

5. The authors comment that it is reasonable to assume that between 1995 and 2003, most deaths were due to heat stress and that changes to cattle selection, minimising consignments from southern ports during winter and northern ports during summer have contributed to improvement. There are some fundamental issues with this comment. Bovine respiratory disease is unlikely to be an emerging disease. Pneumonia on ships, traditionally referred to as “shipping fever”, has been

known for decades. Failure to identify it may well have been due to lack of veterinarians on the voyages, lack of necropsies etc. It was only after the Keniry Enquiry (2004)² that all long haul vessels had to have a veterinarian. Prior to this, veterinarians were only required on voyages to Saudi Arabia and some specified trial voyages.

6. The authors also note that despite the Australian Standards for the Export of Livestock (ASEL) being released in 1997, there was no immediate effect and that it was only after its introduction in 2004 that mortality rates decreased. It is also possible that having veterinarians on voyages may have helped to reduce mortality. Page 341, 2nd graph shows a reduction in mortalities beginning to trend in 2003.

7. The authors recommend refinement of cattle selection for voyages but do not make the obvious conclusion that the Department of Agriculture should stop approving export of cattle below 26th parallel in winter (or at all), an obvious conclusion from the data and comments. This is disappointing when even a major government review in 2004³ made the following recommendation “Comparative information for cattle suggests that a prohibition on exports of *Bos taurus* cattle from southern ports should be in place from May-October inclusive. Almost all cattle mortalities are caused by heat stress, which is found not to be a problem with *Bos indicus* cattle exported from northern Australian ports.”

8. It is extremely disappointing that despite presenting data on cattle movement, there was no discussion about the potential adverse welfare aspects of the cumulative effects of transportation. For example, in the 90 days prior to export, some animals had been moved between 1 and 8 times, travelling 5-2375 km. A comment regarding minimisation of land transport prior to embarkation to minimise cumulative stress would have been logical.

Minor criticisms

1. There are issues with the study design. Ship exposure should commence with the first animal loaded and end with the last animal discharged as animals are exposed to on-board conditions regardless of whether the vessel is stationary or moving. Loading may take up to three days in a single port load, more if multiple ports and anchorage/pilot times involved. Voyage days, as recorded by the Department of Agriculture, only include port to port. As the authors discuss the concept that more voyage days equates with more deaths, the number of loading days should have been included.

² See Livestock Export Review.
www.australiananimalwelfare.com.au/app/webroot/files/upload/files/keniry_review_jan_04.pdf
(accessed 10th Dec 2015)

³ See Livestock Export Review.
www.australiananimalwelfare.com.au/app/webroot/files/upload/files/keniry_review_jan_04.pdf
(accessed 10th Dec 2015)

2. The study demonstrates that cattle type and voyage length result in lower mortality to SE Asia than Middle East and North Africa (MENA). Most voyages are to SE Asia. It would be appropriate to conclude that this factor affects overall mortality figures for the industry as most trade is to SE Asia. In essence, the voyage mortality rates are not likely to be normally distributed and as such, “average mortality percentage” is inappropriate. Non-parametric descriptive statistics should have been used.

3. There is a comment that ships built after 2004 had improved design but this ignores the fact that the vast majority of ships currently transporting Australian cattle were built well before 2004 including *Bader III* (1978), *Al Messilah* (1980), *Maysora* (1989) and *Al Shuwaikh* (1986).

4. Voyages to Turkey actually commenced in 2008 but with increased frequency from 2010/2011. It is surprising and disappointing that in a study of this nature, this error was made. Apart from anything, one of the high mortality voyages (Voyage 39) in 2011 had Turkey as a destination. All voyages and their destinations are tabled in Parliamentary Reports and available on the Department website⁴ so should have been easily available to the authors.

Useful Findings and Comments

1. “Average mortality” across all voyages was 0.17% (albeit if the earlier voyage data had included discharge data this would have been higher and the data is likely skewed by the predominance of SE Asian short-haul voyages as above). Average discharge period is 1.4 days. Average voyage duration is 9.2 days. Mortality range 0-74.7%.

2. The authors conclude that reduced mortality in cattle export was predominantly due to live weight restrictions: lighter weight cattle fare better. This is an interesting statement in that the industry always claims the improved mortality is due to improvements in the process. In this case, the process, serendipitously, happened to be dictated by consumer demand, ie the trade itself, not any conscious welfare investment.

3. There is a very important comment that there is no single repository for all the information on voyages ie even industry-funded researchers cannot get this information. For a government department not to have such data easily available, compiled and archived is a major criticism and indicates that the Department of Agriculture is not taking appropriate responsibility for data collection, data analysis or assessing HotStuff (the heat stress risk assessment model). Dr Mike McCarthy, an experienced live export veterinarian, recommended that this be done in 2005 in an industry publication³ but it obviously hasn't been. The Department should have been recording and retaining available temperature and humidity data to assess adequacy of Hotstuff, effect on mortalities etc.

⁴ See <http://www.agriculture.gov.au/export/controlled-goods/live-animals/livestock/regulatory-framework/compliance-investigations/investigations-mortalities?wasRedirectedByModule=true> (accessed 10th Dec 2015)

4. Heat Stress Risk Assessment (Hotstuff) cannot be analysed by the public² thus it is difficult for external veterinarians and researchers to assess all the factors included in analysis. The authors have listed the 'assessed' factors: weather at destination and en route, animal acclimatisation, animal coat and condition and the ventilation characteristics of the ship and then outputs optimal stocking density. They also comment that Hotstuff is being revalidated with results available soon but as there is no single repository of data, one wonders how that is being performed.

5. Voyage mortality induces bias as voyages different lengths thus the authors expressed voyage mortality as deaths per 1000 cattle days to adjust for duration of each voyage and produce a measure that could be compared between voyages of different lengths. The authors point out that the figures used cannot be compared with reportable voyage mortality etc. This is a useful calculation to make.

6. There was a significant correlation between the number of deaths during the voyage and the discharge phase. The authors made a very important comment: "Number of voyage deaths and discharge deaths were significantly correlated which is consistent with the hypothesis that deaths that occurred during discharge may be the final expression of an outcome that has been influenced by voyage events." Caulfield and others (2014)² also drew attention to this cumulative issue with heat stress also.

7. Information provided that southern cattle are used in 'wet season' live cattle export to SE Asia is particularly useful information. Increased mortality in the 'wet season' has consistently been evident in the reports and while this was assumed to be related to heat stress, it was not apparent in the Shipboard Performance reports that breed was also a factor.

8. The authors note a dramatic decrease in the number of cattle to SE Asia in 1997 due to economic downturn indicating that the industry has always been politically and economically volatile (not that they made that conclusion).

9. NE Asian market dominated by dairy breeder cows.

10. The authors noted that the voyages to Turkey (beef and dairy breeder predominantly) from 2012 (incorrect, see above) occurred not to supply protein (as is often claimed) but as "incomes rise with economic growth".

11. Decrease in mortality rate for 1999 has been attributed to increased *Bos indicus* in the trade to MENA after SE Asia trade collapse.

12. The study demonstrates that *Bos indicus* have far better tolerance for live export. The authors note that the observed rise in mortality in live export between December and March reflects use of Southern cattle *Bos taurus*. It is thus not surprising that voyages to MENA with longer days and *Bos taurus* cattle result in a higher mortality.

13. "Dairy cattle are worth much more, stronger financial incentive to keeping them alive and "housed in more comfortable areas of the vessel and provided with deeper bedding (SJM pers comm)". Whilst this is well known in the industry, it is useful to

have this comment made in a peer-reviewed paper. Given that dairy exports increased between 2010 and 2012 from 8.8% to 12.5%, it would be worth checking whether there was an effect of this on mortality. It would also have been worth checking whether this class of cattle had a similar or different mortality rate compared to slaughter and feeder animals.

14. Voyage mortality mirrors feedlot mortality trends, consistent with the first author's previous study that concluded BRD is the main cause of cattle deaths.

15. The authors recommend refinement of cattle selection. They also recommend optimising temperature and humidity control through adjustments to stocking densities, deck washing schedules and improved ventilation to reduce deaths during risk periods.

References

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2. Caulfield, M.L., Cambridge, H., McGreevy, P., Foster, S.F., 2014. Heat stress: A major contributor to poor animal welfare associated with long-haul live export voyages. *The Vet J* 199, 223-228.
3. McCarthy M. Pilot Monitoring of Shipboard Environmental Conditions and Animal Performance. Meat and Livestock Australia, North Sydney, NSW, Australia 2005