

A photograph of several sheep with light brown wool, some looking towards the camera and others eating from a long white trough filled with yellow feed pellets. The background is a blurred green field. A large, dark blue diagonal graphic element covers the right side of the image, serving as a background for the text.

RESEARCH DEVELOPMENT AND EXTENSION

SUMMER 2017 UPDATE

For further information visit
the LiveCorp and MLA websites:

www.livecorp.com.au

www.mla.com.au



RESEARCH DEVELOPMENT AND EXTENSION

2017 UPDATE

The livestock export industry research, development and extension (RD&E) program is a joint investment between the Australian Livestock Export Corporation (LiveCorp) and Meat & Livestock Australia (MLA). The Australian Government also contributes a dollar for each levy dollar the Livestock Export Program (LEP) invests in eligible RD&E.

The RD&E program aims to support and enable continuous improvement, innovation and enhance productivity and sustainability through systematic, targeted, consistent, effective and transparent research.

Key strategies that form the basis of the livestock export industry RD&E are to continuously improve:

- Animal health and welfare outcomes throughout the supply chain
- Improve supply chain efficiency and regulatory performance
- Enhance market access and trade development

RD&E projects are assessed and prioritised through the Livestock Export Research and Development Advisory Committee (LERDAC) which is comprised of representatives from LiveCorp, MLA R&D, the Livestock Export Program (LEP), Cattle Council of Australia Sheep Producers Australia (formerly Sheepmeat Council of Australia), LiveShip and the Australian Livestock Exporters' Council (ALEC). An independent technical advisor also provides specialist advice to LERDAC on projects and their respective methodologies.

R&D reports are publicly available on both the LiveCorp (www.livecorp.com.au) and MLA (www.mla.com.au/Research-and-development) websites.

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SUMMARY

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SOURCING AND PREPARATION OF LIVESTOCK

RD&E training resources

The sourcing and preparation of livestock in Australia is critical in supporting good animal welfare outcomes and performance throughout the export journey and in foreign markets. The LEP continually develops tools, user manuals and training resources to support livestock exporters and stakeholders to implement improvements in these areas. The various resources can be downloaded from the LiveCorp website:

<http://www.livecorp.com.au/publications>



The background of the slide features a large, close-up photograph of a dense flock of sheep, with their heads and woolly bodies filling the frame. In the upper left, two workers are visible, one wearing a blue cap and the other an orange high-visibility shirt, both focused on their tasks. A large, dark blue diagonal graphic element overlays the right side of the image, containing white text and a small green icon.

 The sourcing and preparation of livestock in Australia is critical in supporting good animal welfare...



Preparation of Rangeland Goats for Live Export

The challenges of preparing rangeland goats for live export have been the subject of LEP research since 2003 with two reviews – Minimising mortality risks during export of live goats (2003), and Preparation of goats for export (2009) – completed prior to the latest project.

These earlier reviews identified two core animal welfare risk factors – being, whether the goats were feral or domesticated and the length of the sea voyage. The findings from these projects are broadly reflected in the current ASEL and government policy, which require a minimum domestication period of 21 days and apply strict limitations on the export of feral goats by sea (effectively preventing long haul exports).

A project undertaken, Preparation of Rangeland Goats for Live Export, sought to delve deeper into the two broad risk factors identified in the earlier research. It developed management strategies to mitigate the variety of risks each animal faces during long haul sea transport.

In relation to long haul sea shipments, the project identified that rangeland goats face a variety of unique mortality risks when in intensive management or the livestock export process. These risks include disease, dominance behaviour, inanition (inappetence), feed and water trough usage, exposure to environmental conditions and susceptibility to stress.

The project trialled a range of intervention strategies on groups of rangeland goats to mitigate these risks. While there was some success during the trials, the failure of the strategies trialled to definitively reduce mortality rates indicated serious challenges in further investigating ways to enable the long haul export of rangeland goats by sea.

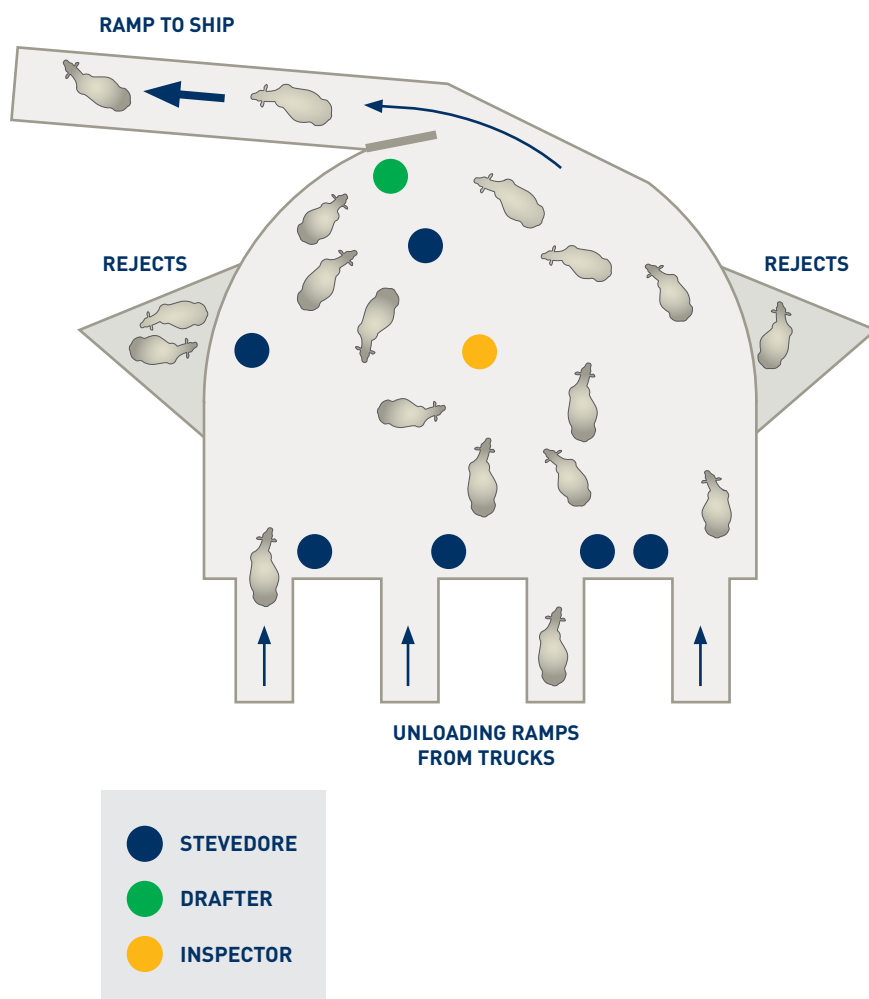
The primary cause of mortality identified by the project was Coccidiosis, a parasitic disease of the intestines that is generally spread from animal to animal by contact with infected faeces. With no reliable treatment for Coccidiosis currently available in Australia and on the recommendation of the researchers, the LEP suspended the project.

The learnings identified have been shared with the domestic goat industry and, if appropriate parasite treatments become available, the project may be re-convened.

Sheep inspection procedures prior to loading

In 2012, the LEP engaged an independent consultant to research the various inspection and rejection procedures for sheep destined for export through the Review of Sheep embarkation procedures project.

The researcher travelled to Fremantle and Port Adelaide to view inspections and interview people involved in the process. The project report describes each of the pre-export procedures for ports and registered premises in detail. Diagrams of these inspection procedures can be found below.



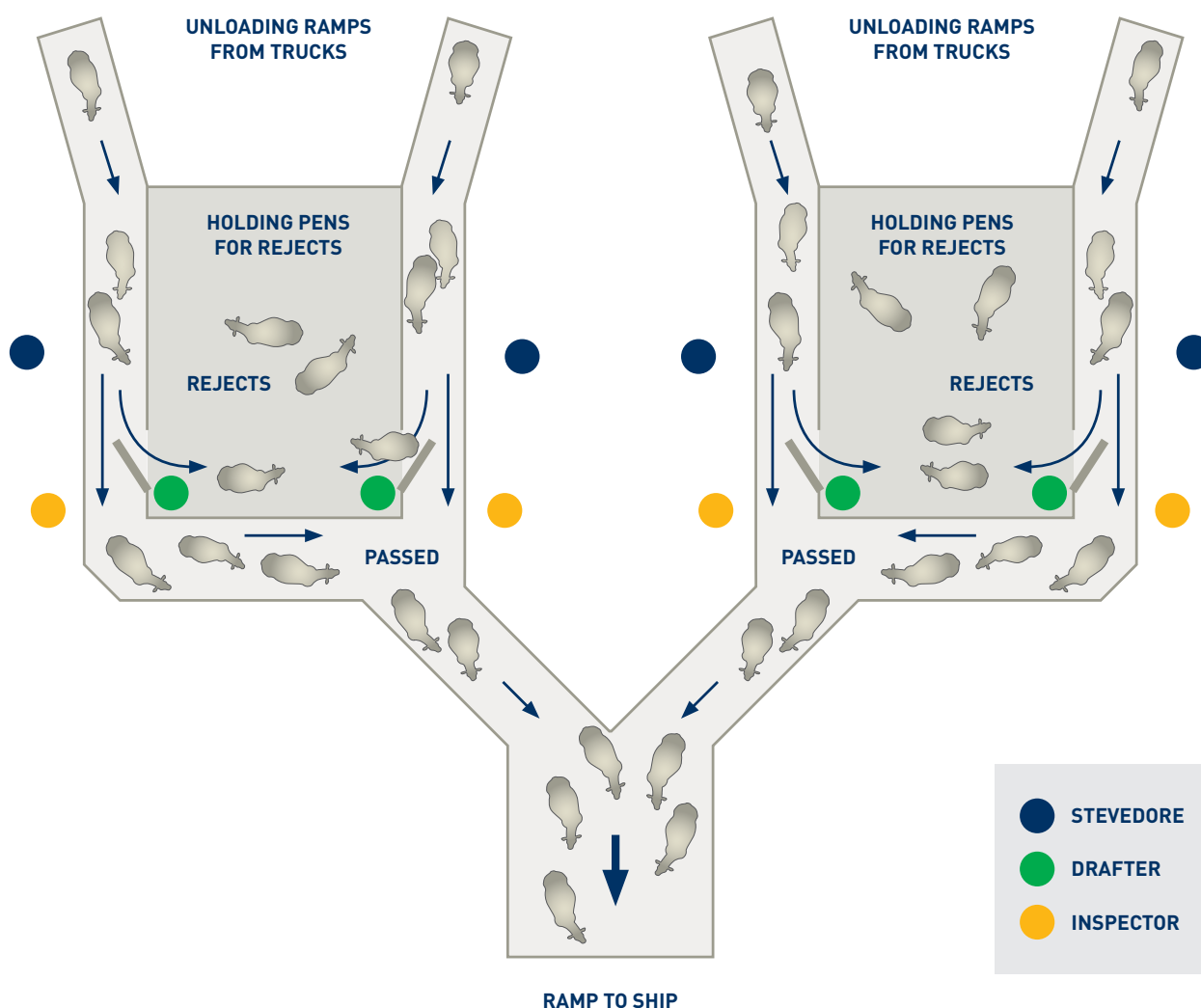
From its observations and analysis of rejection data (i.e. records of animals removed at the inspections), the project found that the individual animal inspection platform used in Fremantle provides a better opportunity to apply a consistently high level of inspection rigour to every animal.

The raised platform structure in Fremantle was also considered the most effective method for moving animals from trucks to the ship in a secure and safe manner.

The report also identified that there were some animals removed at the port that could have been identified earlier in the process, at the registered premise (or quarantine facility). However, it found

that while there is merit in improving inspection processes at the registered premises, this would not eliminate animals that may not be fit to export arriving at the port and the consequent need to have individual inspection and rejection procedures there.

The researchers concluded that there is insufficient benefit in having two individual animal inspection procedures very close together in time prior to loading (one at the registered premise and one at the port). They identified that the most logical place to have the final individual animal inspection process is at the port, immediately before sheep are loaded onto the ship – although improvements to registered premise inspections were also worthwhile.





NLIS Compliance materials project update

Identifying and recording the movement of livestock throughout Australia is important for biosecurity, food safety, disease management and market access. The National Livestock Identification Scheme (NLIS) and enabling state and territory legislation are key components of this framework.

Under NLIS, exporters and registered premise operators must meet a number of requirements to support the integrity of the animal movement database. This project was initiated to develop materials to improve awareness of these obligations and to develop tools to support exporters and registered premise operators efficiently and accurately keep track of livestock movements.

The project developed checklists, user manuals and flow charts / process maps to assist registered premises and exporters streamline and improve their reporting of livestock movements and animal identification activities.

The materials were released in mid-2017 and the LEP is completing extension activities with the support of the ALEC.

Quarantine Project

Pre-export registered or approved premises are a critical element of the livestock export supply chain, where animals for export are prepared, aggregated and quarantined. However, they are subject to an extensive range of regulations and standards (federal and state).

The need for the Pre-export Facility Biosecurity Review project was identified by industry stakeholders as a result of the current level of complexity, duplication and cost in the regulatory framework for pre-export facilities. The project will be guided by a steering committee and close consultation with industry stakeholders, particularly registered and approved premise operators.

The first stage of the project will undertake a stocktake of the existing regulations and standards to identify opportunities for improvement. The stocktake will enable industry to assess and determine priority reform areas to help pursue reductions in regulatory costs, complexity and duplication.

The second stage will be to produce a suite of quarantine, biosecurity and animal health guidelines. This package of materials will support new pre-export facility developments and improvement activities in existing facilities. This will also allow the establishment of a clear framework for industry and government to use in discussions with importing countries to explain the rigour of the pre-export pathways.

INTERNATIONAL TRANSPORT

Veterinary Handbook update

The Veterinary Handbook app and website provides information on the diagnosis, treatment and prevention of associated syndromes and diseases in cattle, sheep and goats. The app allows users to search by species, disease or syndrome to instantly access prevention and treatment advice.

The app has proven to be a valuable resource to veterinarians and stock people involved in the agricultural sector. The handbook and app has recently been updated to include new diseases of significance such as Grass Tetany and Caprine Arthritis Encephalitis. Necropsy findings have also been included for a number of syndromes. Users can expect ongoing improvements to the app functionality and general experience. A further update is being planned and will focus on expanding the photographic library within the app, to help in the identification of syndromes and diseases. The updates are due for release by the end of 2017.

The Veterinary Handbook app can be downloaded from the iTunes and Google Play app stores and accessed online at: www.veterinaryhandbook.com.au

On-board training DVDs

The conditions faced by stock people and the crews on-board livestock vessels are unique and require significant training. On-board training DVDs were produced to assist livestock export crews develop their understanding of the management, handling and husbandry of Australian cattle and sheep on livestock vessels.

The DVDs cover five core topics for both sheep and cattle – livestock handling; loading of livestock; managing feed and water, welfare and disease, and euthanasia. They have been translated into five languages (Arabic, Bengali, Tagalog, Indonesian and Urdu) to improve their uptake by livestock vessel crew.



LiveAir stockpersons manual

Approximately 10,000 cattle, 40,000 sheep and 70,000* goats are exported by air each year from Australia. These exports primarily include sheep and goats exported to Malaysia for meat production and breeding livestock of all species sent to a wide range of countries.

This project is developing a manual for operators and stockpersons involved in the air transport of livestock, to assist in the planning and safe completion of each stage of the export process.

The step-by-step guide begins with the planning of a consignment and concludes with the procedures for disembarking, end of flight reporting and advice for managing stock in the destination country.

Tips, tools and benchmarks have been included to give specific best practice advice, as well as clearly outlining the compulsory regulatory standards under ASEL.

The final manual is expected for release by the end of 2018.

* In 2016, the number of goats exported declined to 55,000 as a result of increased domestic demand and high prices.

Approximately 10,000 cattle, 40,000 sheep and 70,000* goats are exported by air each year from Australia.



Within crate ventilation

Livestock export by air has consistently delivered very low mortalities and provided a safe means of moving animals around the world. However, the conditions on an aircraft can be quite different to those on a vessel and it is important that these are well understood to maintain and continue to improve welfare outcomes. As such, this project has continued LEP research to collect and analyse data on the aircraft environment – in particular, this project aimed to monitor and assess carbon dioxide, ammonia, temperature and humidity (and their relationship to ventilation).

The initial focus of this project has been short-haul flights, as these are the most common type of export. Long-haul flights may be targeted for data collection at a later stage, depending on availability.

When completed, the report will provide a clearer picture of the on-board experience and outline recommendations to support ongoing improvements to the welfare outcomes of animals during air export journeys. A key component of this will be to review and update the Live Air Transport Risk Assessment tool – known as LATSA.

While this project was aimed for earlier completion, it has now been extended to ensure that a statistically relevant data set can be collected and to enable trialling of potential best practice approaches. The project is now expected to be completed later in 2018.



National livestock export industry transport performance report 2016

Industry stakeholders, government and the general public have a keen interest in monitoring the export patterns and mortality rates on board livestock vessels.

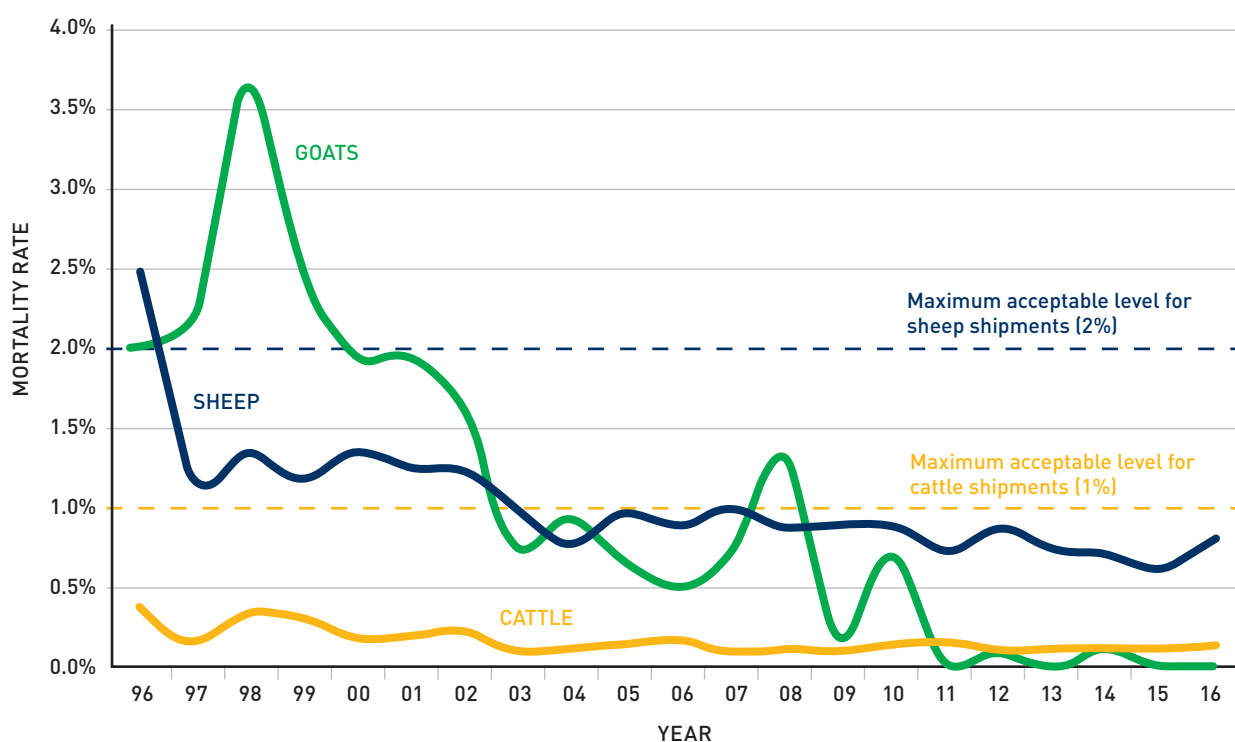
This annual summary report provides a comprehensive breakdown by species, time of year, vessels, load ports and major destinations over the calendar year, along with summary analyses of trends over time. The information helps to provide

insights into changing export patterns and identify evolving areas for further research.

The graph below highlights the mortality percentages for sheep, cattle and goats for sea shipments since 1996. Cattle shipment mortalities remain stable and low (0.13%), however after a record low in 2015 (0.02%) sheep mortalities have increased slightly to 0.80%.



Livestock mortality by sea transport (1996 - 2016)



Bedding and air quality on livestock vessels - improving the environment on board livestock vessels

The Australian livestock export industry has completed several projects aimed at improving environmental conditions on livestock vessels. This project produced an extensive literature review of bedding management and air quality on livestock export vessels. The review divided its analysis and findings into three sections focusing on air quality and environmental monitoring (temperature, pad moisture and emissions), bedding management (management strategies and ventilation), and the issue of reporting (advances in environmental monitoring technology).

The report found that while sawdust is the preferred bedding material, there is no formal quality assessment criteria and this is an area for future research. The report also recommended that further research be conducted into environmental monitoring and understanding / validating the pad moisture equation. The project developed best practice bedding management recommendations that are being progressed into a publishable format.



IN MARKET LOT FEEDING & PROCESSING

Alternative sheep restraining devices

Providing low stress restraint for animals prior to slaughter is an important objective of the livestock export industry. In 2014, the LEP conducted an extensive literature review to investigate and catalogue the different sheep restraint methods currently used in Australia and overseas. The aim was to identify possible approaches that exporters could consider using in their livestock export supply chains.

The literature review identified four broad categories of restraint in use. These were manual restraint (used in small processing facilities); knocking box single animal units; V-conveyor restraints (used in high throughput facilities); and side clamp restraints. Side clamp restraints were

identified as the most commonly used devices – primarily applied on farms to allow individual management practices, such as for foot trimming or shearing.

Based on the literature review, the researchers considered the potential application of restraint used in the on-farm situation to a processing facility in the Middle East. As a result, they developed a new prototype for a sheep restraint device that could be used for slaughter purposes.

The project then supported the development of a real-life prototype – see above – which has been exported to the Middle East for trialling.

Heat management of sheep in the Middle East

Heat load in sheep exported from Australia to the Middle East continues to have the potential to be a health and welfare concern. The LEP has ongoing research into this area to promote the development of best practice guidelines for infrastructure design and livestock management.

This research has been conducted in several phases.

Phase 1 of the research gathered information about the internal rumen temperatures of sheep exported from Western Australia to the Middle East at various times of the year, with comparison to environmental conditions.

Phase 2 of the research focused on monitoring environmental conditions and animal responses under different shade types and when different additional measures are applied to cool sheep.

Cooling interventions were tested and there was success in demonstrating greater decreases in the rumen temperatures of sheep held under double shade, exposed to fans and where ground wetting was applied (as compared to the control sheep that were kept under single shade structures). A Tips and Tools document was produced as a result of the first two phases providing guidance on infrastructure and management practices to support improved heat management.

Based on environmental data gathered at several Middle East feedlots, there was a need identified for further evaluation of different shade structures and interventions in different climatic conditions. This research will continue in 2017 – 18.

WHOLE SUPPLY CHAIN / OTHER

Salmonella and inanition

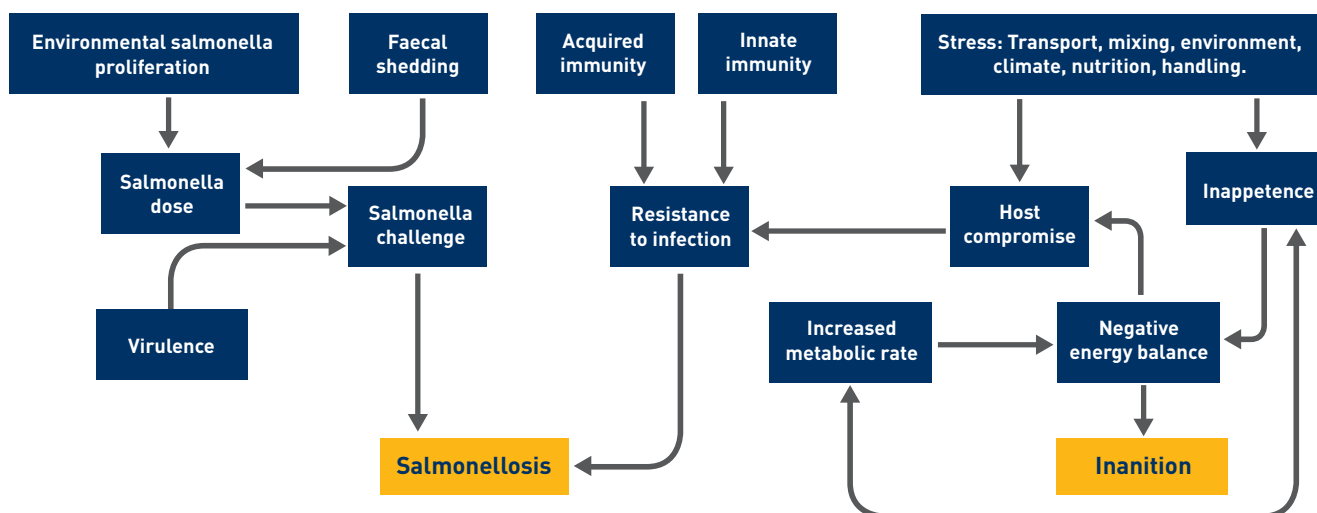
Livestock export industry research has shown that inanition and salmonellosis are the most common causes of death in exported sheep. Inanition and salmonellosis may occur separately (one disease resulting in death without evidence of the other) or together in the same animal. The first week of a sea voyage appears to be at elevated risk of salmonellosis while inanition tends to occur more in later stages of a voyage. Salmonellosis and inanition are also hypothesized to be factors that may influence the ability of animals to manage heat stress, where it occurs.

Mortality studies in the late 1980s and early 1990s suggested that persistent inappetence (reduced appetite) was the major initiating condition that then led to elevated risk of inanition or salmonellosis. More recent work conducted by the LEP in 2015 – 17 has suggested that inappetence / inanition and salmonellosis may occur separately or together and the occurrence of either condition can then lead to an increased

risk of the other. The causal web below describes the complex relationship between the conditions.

While salmonellosis and inanition are the most important causes of mortality for the live sheep trade, they are complex and difficult areas to understand and manage. The LEP has invested, more than \$2.8 million in investigating these areas and trying to achieve breakthroughs that can create the next big reduction in mortality. The research timeline, represented in the diagram on pages 16 and 17, has identified risk areas and also identified the inherent difficulty in trying to understand and manage property based factors.

As a result, the decision was made to focus on practical trials in export feedlots to understand inanition, which is now concluding, and the development of a salmonella vaccine. Summaries of these key projects are provided on pages 18 and 19.





LGAP implementation / update

In 2012, the LEP initiated research to investigate the potential role of quality assurance (QA) within the livestock export industry to support best practice, achieve ESCAS compliance and promote continuous improvement in animal welfare, control and traceability.

Based on this scoping study, a further project was commissioned which led to the development of a fully implementable conformity assessment and certification program. The program – known as the Livestock Global Assurance Program (LGAP) – was completed in 2016.

Following the completion of the research, ALEC established the LGAP Implementation Steering Committee (LISC) composed of LiveCorp, MLA, exporters, ALEC, Cattle Council of Australia, Sheep Producers Australia (formerly Sheepmeat Council of Australia), the Goat Industry Council of Australia and the Australian Department of Agriculture and Water Resources. LISC was formed to analyse and report to ALEC on the complex implementation challenges and pathways for LGAP.

LISC reported to ALEC in September 2017 and the industry is expected to make a decision on whether to proceed with implementation in December 2017.



Salmonellosis and inanition research & development







Salmonella Vaccine Development

Salmonellosis is a bacterial infection of humans and animals. It can cause enteritis, abortion and septicaemia. It is a disease of particular importance and interest to the livestock export industry, as it (including through its interaction with inanition) is the most common causes of death in sheep exported from Australia.

Animals may carry *Salmonella* organisms without any signs of illness and shed it in faeces. Carriers are difficult to identify, and the resulting environmental shedding can expose other animals to infection. Stress is also an important factor that can increase the level of *Salmonella* shedding or make animals more susceptible to infection.

LEP research has shown that historically the prevalence of sheep shedding *Salmonella* on entry to a registered premise is relatively low. However, over time as the same assembly depot receives multiple consignments of sheep, the likelihood of *Salmonella* organisms being shed increases, even though the individual animal prevalence in arriving sheep is very low. Under favourable conditions, the *Salmonella* organisms can then survive for years in the environment. As a result, registered premises that receive large numbers of sheep over many months for consecutive export voyages, may have much higher levels of *Salmonella* organisms present.

After investigating the causal pathways and potential management approaches to disrupt shedding / exposure / susceptibility (many of which are currently utilised), industry decided to proceed on the long process of developing a vaccine to manage *Salmonella*. The process to date has proceeded comparably to other vaccine developments and although taking many years, each stage has shown positive results.

The industry is now in the process of importing a DAM attenuated *S. Typhimurium* as a modified live vaccine. This process requires a number of core steps, firstly that the vaccine strain be imported from the United States to Australia and undergo Australian Government inspection. Once the vaccine has been imported, it is anticipated that a commercial partner to the LEP will then produce the vaccine at levels to provide for safety and efficacy testing to be completed in sheep. At this stage, safety studies and large field studies are scheduled for later in 2018, with commercial availability of the vaccine – pending further success with trials and approvals – around 2021.

Inanition

Inappetence has been identified as a problem for sheep in the live export process. Its impact is twofold – as a cause of death from inanition and due to the association with the development of Salmonella outbreaks.

While most inappetent sheep in assembly feedlots will start feeding within a couple of days, it is considered an indicator of increased risk of prolonged inappetence during the voyage with elevated likelihood of inanition and death.

In 2010, the LEP initiated a project to explore strategies to assist in reducing the incidence of inanition in sheep. In the project, sheep were monitored at a pre-embarkation feedlot in Western Australia using RFID tags and specially-designed tracking antenna to determine the time spent at feed and water troughs. On average, it took five days in the feedlot for more than 95% of animals to be spending an adequate time at the feed trough. The overall mortality of the monitored sheep was 0.85% with 61.4% of mortalities being due to Salmonella or inanition.

The project also trialled a number of feeding strategies to determine if they sped up the process of feed transition. The strategies tested in sheds were adding oats over pellets and provision of chaff. Additionally, the project tested also compared sheep in sheds with pellets to sheep in a paddock with pellets and in a paddock with hay and pellets.

The results of the trials found that housing sheep outside the raised sheds, with access to hay and/or pellets, for a day before entering the sheds did not hasten feed acceptance or increase the number spending an acceptable period at the feed troughs. Provision of oats on top of the pellets did not increase the number of visits or time at the troughs compared to those supplied with pellets only. The addition of chaff did result in more visits to feed troughs, than when pellets alone were available. In general, the feeding strategies tested at the feedlot did not appear to increase acceptance and consumption of the pellets.

The report was completed in 2017 and outlines some best practice guidelines for pre-embarkation treatment of sheep to minimise the incidence of inanition and Salmonella. These guidelines were produced into a best practice fact sheet.



Black organs (acquired visceral melanosis)

'Black liver' describes the melanin-affected livers of sheep and goats. Organs other than the liver may be affected, resulting in the name black organ disease. Black organs disease has significance for the live export process as it can unnecessarily cause the condemnation of offal and carcasses when sheep are slaughtered in the Middle East.

In 2013, a review was initiated to provide an up to date authoritative reference document that might be used if black organs became a trade or food safety issue. The core goal of the LEP project is to attempt to change the perception

that it is a "disease" and a food safety concern, to an awareness that it is simply an interesting, incidental condition.

Rat feeding studies were undertaken to assist in reducing concerns over the consumption of meat from affected sheep. The rats in the group which consumed the black liver ate more and grew faster than the rats in the control group. The project is due for release in the first quarter of 2018.

Competitiveness report

This project was initiated to provide a detailed analysis of Australia's livestock export industry.

It found that in 2015, Australian livestock exports were valued in excess of \$1.75 billion, making it one of the nation's most important rural export commodities. Australian live cattle exports were valued at approximately \$1.5 billion in 2015 and live sheep exports accounted for \$250 million.

The report focused on the industry's competitiveness and identified strategies that will assist in maintaining and improving Australia's competitiveness in the global marketplace. It also provided a detailed overview of the global trade in livestock - valued in excess of \$US 18 billion.

The project included a number of case-studies of farm businesses that examined the importance of livestock export to their financial viability. The findings indicated that the impact varied significantly based on location and proximity to processing works, with the most significant impact being for cattle farms located in northern Australia.

In all case studies, live export markets delivered a range of both tangible and intangible benefits that assisted the businesses in maintaining financial viability. Aside from the financial benefits, the livestock export industry was found to add marketing flexibility, in particular the ability for producers to market unfinished livestock in situations where adverse seasonal conditions precluded those stock reaching slaughter weights.

Pinkeye

Pinkeye in sheep and goats is an infection of the eye caused by bacteria (*Mycoplasma conjunctivae*, *Chlamydia* organisms, and other mycoplasma), targeting the conjunctiva and cornea. In cattle, pinkeye is mainly caused by *Moraxella bovis*, but may be associated with other bacteria including *Mycoplasma* and *Neisseria*. The condition can spread rapidly in susceptible groups of animals, although most cases recover within 4 to 6 weeks (for cattle) or 2 weeks (for sheep and goats).

Under ASEL, pinkeye is a condition that requires the rejection of the animal as unfit to export. In some export consignments, pinkeye can affect many animals leading to increased costs for exporters.

In 2013, the LEP concluded a project (Ovine Pink Eye Treatment Strategies), which investigated the best

INTERNATIONAL LIVE SHEEP

- Australia was the world's biggest exporter of live sheep in 2000, but is now fourth due to increased regulatory costs and a reduced sheep flock.
- North African and European exporters have gained market share in recent years.
- Approximately 5% of Australian sheep turned off are destined for live export markets and 80% of these are sourced from Western Australia.
- Western Australian sheep producers generally run sheep as a secondary enterprise for grazing on stubble and fallow pastures.

ECONOMIC BENEFITS OF THE LIVE EXPORT SECTOR

- The live export sector creates employment for more than 10,000 people.
- Many of these jobs are in regions with little alternative employment.
- Economic benefits also include higher livestock prices nationally.



treatment strategies for pinkeye in sheep. The study concluded that early identification and treatment was key to successfully resolving the infection. Two core treatment strategies were investigated using Oxytetracycline (OTC). The first was as an in-water medication, however it had the negative side effect of reducing appetite and thirst. The second method was two injections of OTC (4 days apart) and it was found to be the most effective, resolving pinkeye in sheep up to and including grade 5 infections.

In 2014, research was initiated to investigate pinkeye on long haul cattle voyages. This project will review existing strategies and propose best practice management of pinkeye in cattle. The project is currently scheduled to be completed in 2019.

Scabby mouth

Scabby mouth is a common disease found in all sheep-raising countries, including Australia. Scabby mouth is a viral disease that causes scabs, usually around the mouth and face of animals, and is most commonly found in lambs and weaners during summer. Animals become infected with scabby mouth when abrasions on the skin allow the virus to enter and establish. However, the disease is of a mild nature and short lived.

Within Australia, scabby mouth rarely causes problems of economic or animal welfare significance, with generally low prevalence and varying distribution across the country. However, scabby mouth has been a concern for the live export industry because of heightened sensitivities to the disease in some importing countries.

Building upon earlier research by the Western Australian Government, the LEP conducted research in 2000 to determine the effectiveness of vaccination in controlling scabby mouth. This was achieved through the project Controlling Scabby Mouth in the Live Sheep Trade. The project found that a single vaccination at lamb marking resulted

in low levels of scabby mouth at discharge in the Middle East, while two vaccinations (the second administered shortly before export) resulted in negligible levels. This report established that, with appropriate management, scabby mouth in exported sheep could be minimised to very low levels.

In 2012, a secondary review of the scabby mouth vaccination protocols in place for sheep travelling to Middle East markets was completed. The study, entitled Investigating Incidence of Scabby Mouth During Live Export, included a literature review and the practical collection of scabby mouth prevalence data from around 375,000 exported sheep at three points along the supply chain. The sheep in the data collection were split into three groupings reflecting the different vaccination approaches and locations. The three groups were; sheep sourced under a non-Saudi protocol from Eastern States; sheep sourced under a non-Saudi protocol from Western Australia and sheep sourced under the Saudi protocol exclusively from Western Australia. The prevalence of scabby mouth at receipt, load out and on board were recorded and the results are summarised below:

	Non Saudi, Eastern States	Non Saudi, WA	Saudi, WA
RECEIVAL	0.02%	0.02%	0.04%
LOAD OUT	0.01%	0.03%	0.12%
ON BOARD	0.04%	0.49%	0.01%

The study recommended that, based on its findings and subject to approval by appropriate authorities, a single vaccination strategy be considered to replace the current double vaccination strategy. It found that the ideal time for applying a single vaccination was at marking or at least 21 days prior to delivery to the pre-export quarantine yards (although the researcher noted the practical difficulties that this could present). The study also concluded that the development of a killed or virulent field strain vaccine administered intramuscularly or subcutaneously would have immediate industry application and recommended that the industry should continue to monitor developments in this regard.

Reopening livestock trade with Saudi Arabia continues to be an objective for the industry. Revisiting the trade protocol for sheep exports to Saudi Arabia, in the short term, to discuss a one vaccine approach to scabby mouth may be appropriate.



Standards and performance benchmarking the livestock export industry

Continuously improving animal welfare is a key priority for the livestock export industry. However, prior to this project the monitoring and reporting of animal welfare throughout the livestock export process was limited to a narrow lens of on-board mortality and non-compliances with ESCAS. Neither of these measures accurately depict the scale of industry effort and commitment to animal welfare throughout the livestock export supply chain to effectively support continuous improvement. As a result, the community's perception of the trade is limited to a narrow prism of isolated but often unacceptable incidents of animal cruelty.

The benchmarking project aimed to compare the welfare standards of the Australian livestock export industry throughout the supply chain against Australian domestic standards and international live export competitors (such as the European Union, Brazil, Canada / USA, and Somalia). The project compared the standards across these industry segments / trades against the internationally recognised and accepted standards of animal welfare for cattle, sheep and goats outlined by the World Organisation for Animal Health (OIE).

The key areas that it benchmarked Australia and others against included policy and planning, personnel, animal health facilities and equipment, handling, feed and water, environmental conditions, journey length, stunning and slaughter and monitoring.

The project will make recommendations for improvements in the content, scope, structure, implementation and verification of the Australian livestock export supply chain standards. The study also includes a framework for ongoing benchmarking by the industry. The final draft report has been completed and is being reviewed, with a release date expected by the end of 2017.



Development and assessment of animal welfare indicators – Quantifying welfare improvements in the live export industry

The monitoring and assessment of animal welfare throughout the livestock export process is essential to demonstrate care, the desire for continuous improvement and a sustainable future for industry. However, animal welfare is complex and multifaceted and it is therefore critical that valid, reliable and practical indicators are identified to underpin monitoring and assessment.

The aim of the project was to identify internationally accepted and current indicators of animal welfare for cattle, sheep and goats that could be used at each point along the livestock export supply chain. To identify these indicators, the project conducted a literature review of standards and regulations, as well as a stakeholder survey. The survey of over 900 people from the community, animal welfare groups and the industry found a high level of agreement in the perception and importance of animal welfare.

Based on this work, to date the project has identified 54 indicators. Twenty of these are currently monitored by industry and the additional indicators, that are relevant, are currently being assessed for validity and reliability. The monitoring / assessment of these indicators are in the process of being piloted throughout the supply chain and should ultimately result in a method to benchmark performance and identify areas of improvement using an integrated welfare assessment.

SUMMARY OF CURRENT RD&E PROJECTS

Project	Government Rural R&D Priority	Start Date	Finish Date	Life Budget
A Review of Black Organs	A	15/02/2013	1/03/2018	81,076
Pinkeye on Long Haul Cattle Voyages	A	15/03/2014	1/03/2019	79,000
Environmental and Heat Risk Assessment for NT Live Export Yards	B N	1/10/2016	21/05/2018	199,790
Development of a Manual for the Best Practice Quarantine & Security	B	1/05/2017	31/03/2018	121,597
LERDAC Independent Technical Committee Member	A	1/07/2017	30/06/2018	58,750
LEP R&D Systems Review	T	1/11/2017	1/05/2018	90,000
Shipboard Mortality Database (SMDB) Version Two Upgrade	T	23/01/2017	30/06/2018	157,531
Live Export Industry Transport Mortality 17-18	T	1/11/2017	30/06/2019	127,000
LGAP Implementation, Extension & Communications	A	14/02/2017	30/06/2017	75,000
LGAP Implementation and Steering Committee member	A	1/10/2017	30/06/2018	68,800
17/18 LERDAC Associated Expenses	A	1/07/2017	30/06/2018	40,000
17/18 Live Export Student Development	A	1/07/2017	30/06/2018	40,000
17/18 R&D Project Start-up & Monitoring	A	1/07/2017	30/06/2018	60,000
17/18 Production of Communication Materials	A	1/07/2017	30/06/2018	50,000
Determining Temperature and Humidity Thresholds in Sheep	T	15/06/2013	1/02/2018	261,810
Heat Management in the Middle East - Phase Three	N	15/09/2016	1/10/2018	251,635
Alternative Options to Power Captive Bolt Devices	T	30/11/2016	1/11/2018	277,816
Animal Welfare Indicators Pilot for the Live Export Industry	A	31/07/2017	31/05/2021	721,460
Development of a Global Index for the Live Export Industry	A	17/07/2017	29/04/2018	223,865
Capacity Constraints and Inefficiencies in the Live Export Supply Chain	A	31/07/2017	30/06/2018	142,250
LGAP Information Technology System Storage	T	30/10/2017	30/06/2018	125,646
Total Budget				3,517,025

Australian Government Rural R&D priorities key:

A = Adoption of RD&E

T = Advanced Technology

N = Soil, water & natural resources

B = Biosecurity

Note: Not all projects listed have an update included in this publication



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