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Technical Notes – Transport animals by sea

Use of Animal Behaviour in Handling

Animal behaviour is a broad concept referring to everything that animals do, including actions and reactions. Behaviours can be induced from internal and external stimuli and may be conscious or subconscious.

Natural behaviours may be defined as behaviours that animals have a tendency to exhibit under natural conditions, often because these behaviours are pleasurable and promote biological functioning [1].

Having the freedom to express natural behaviours is considered of great importance when considering the welfare of animals.

The OIE Terrestrial Code defines animal welfare as the following:

“Animal welfare means how an animal is coping with the conditions in which it lives”

The OIE guiding principles on animal welfare also mention the universally recognised “Five Freedoms” which describe the right to welfare of animals under human control. One of the five freedoms required to meet an animal’s primary welfare needs includes “Freedom to express normal patterns of behaviour”

FIVE FREEDOMS OF ANIMAL WELFARE

1. Freedom from hunger, malnutrition and thirst
2. Freedom from fear and distress
3. Freedom from physical and thermal discomfort
4. Freedom from pain, injury and disease
5. Freedom to express normal patterns of behaviour



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The ability of animal handlers involved in sea transport to understand both normal behaviours (healthy behaviours commonly seen in farmed animals) and natural behaviours (behaviours which they would undertake in their natural environment) of animals is essential in providing good animal welfare during handling practices.

Understanding Behaviour

The behaviour of individual animals or groups of animals will vary depending on their breed, sex, temperament and age and the way in which they have been reared and handled.

Cattle, for example, form general opinions on humans based on their overall experiences. If their overall experiences are bad they will become stressed and fearful of any future interaction. If they experience consistently good handling, they will be easier to manage. Handlers involved in sea transport will deal with animals from a range of different farming systems and practices, and may encounter both individuals and herds or flocks of animals with a range of previous experiences in regards to human interaction. It is important that handlers are able to observe the behaviour of animals, distinguish their reactions and adapt their practices to provide the most humane handling experience possible.

Despite these differences, the following behaviour patterns, which are always present to some degree in domestic animals, should be taken into consideration in handling and moving the animals.

- Most domestic livestock are kept in herds or flocks and follow a leader by instinct
- Animals which are likely to be hostile to others in a group situation should not be mixed
- The desire of some animals to control their personal space should be taken into account in designing loading and unloading facilities, transport vessels and containers.

Awareness of these behaviours can enable animal handlers to prevent problems before they arise.

- Using the animals' natural instinct for gregarious behaviour can make them much easier to move. Individuals will panic if separated from the group, but if handlers move it down a clear route, allowing the herd to move at their normal walking pace rather than trying to rush them, the handling process will be faster and possible injuries can be prevented.
- Livestock balk or become frightened if rushed or threatened, and the process is unpredictable and potentially dangerous for stock and handlers.
- Where possible, known aggressive animals should be separated from the group.
- Enough space should be provided for animals to be able to move away from others in order to control their personal space.

Risk Factors

Loading and unloading are times when livestock are easily stressed, behave abnormally and suffer injuries

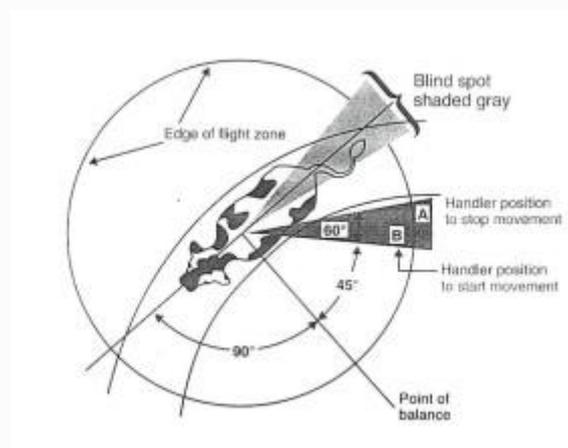
Livestock can suffer from motion sickness on board ship. A forecast of sea conditions should be obtained and the captain should avoid rough seas, even if it means longer travelling time.

Flight Zones

Domestic animals will try to escape if any person approaches closer than a certain distance. This critical distance, which defines the flight zone, varies among species and individuals of the same species, and depends upon previous contact with humans.

Animals reared in close proximity to humans (i.e. tame) have a smaller flight zone, whereas those kept in free range or extensive systems may have flight zones which may vary from one metre to many metres.

Animal handlers should avoid sudden penetration of the flight zone which may cause a panic reaction which could lead to aggression or attempted escape and compromise the welfare of the animals.



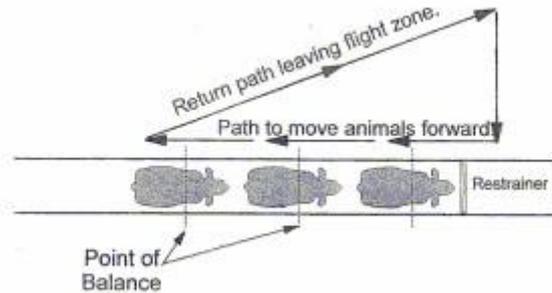
An example of the flight zone of cattle, showing how an approach from the side can be used to start and stop movement, and how a cow can see people approaching from every angle, except a small sector just behind it

If handlers understand the concept of the flight zone they will be able to move animals more easily. Generally when handlers enter the zone of awareness (pressure zone) of the animals, they will initially turn and face the handler and then, once accustomed to their presence, will move away.

The handler should move slowly inside the flight zone in the opposite direction of desired movement. When handling herd animals in a single file chute handlers should stay back and not continuously stand inside the flight zone when animals are waiting in line [2].

Good Handling/Point of Balance

Animal handlers should use the point of balance at the animal's shoulder to move animals, adopting a position behind the point of balance to move an animal forward and in front of the point of balance to move it backward.



Handler movement pattern to move cattle forward

Cattle, sheep and horses all have a wide-angle vision but only have a limited forward binocular vision and poor depth perception. This means that they can detect objects and movements in front, beside and behind them, but may have limited ability to judge the position of the objects close to them [3].

Animal handlers should avoid entering the blind spot behind the animal's rear.

Deep penetration of the flight zone can cause animals to panic and display escape behaviour (turning back in an attempt to escape the handler).

When moving a herd, there will be a group point of balance. If animals begin to turn back, the handler should back up from the flight zone. If lead animals balk at something ahead, handlers should be patient and wait for the animals to move forward again naturally. [2]

Ensure mindful and gentle handling of animals; do not hit them or engage in unacceptable handling practices that may cause distress, pain or injury.

Poor Handling

Rushing animals, kicking, striking and throwing them, sudden breaches of flight zones and making loud noises are all examples of poor handling which ignore the natural behaviours of the animals.

Sea transport often requires handling large numbers of animals relatively quickly. Poor handling is not only an animal welfare issue but can lead to stress and loss of weight on the voyage. During the voyage the movement of the vessel also causes stress, which makes it important for the crew and others responsible for the animals' welfare to move quietly and slowly in their presence [4,5].

Using adverse techniques to move animals not only causes stress and panic, it can also cause injuries and bruising, which will affect the quality of the carcass.

Rough and abusive handling is the number one cause of bruises on livestock and may account for up to 50% of all carcass bruising. [6]

Studies indicate that a very high percentage of this bruising results from rough treatment during unloading and unloading of livestock and during transport to the slaughter plant. Animals who are excited appear to bruise both more easily and more severely than those who are calm [6].

Animal Handlers [7]

Animal handlers should be experienced and competent in handling and moving farm livestock and understand the behaviour patterns of animals and the underlying principles necessary to carry out their tasks.

Animal handlers are responsible for the humane handling and care of the animals, especially during loading and unloading.

To carry out their responsibilities, the crew should have the authority to take prompt action, in consultation with the responsible stockperson or veterinarian. If not present, liaison with the captain is essential.

All animals should be inspected before and during loading onto the ship. Where an animal handler believes that there is a significant risk of disease among the animals to be loaded or significant doubt as to their fitness to travel, the animals should be examined by the stockperson/veterinarian when present.

The exporting company, or in the case of national transport, the local carrier, is responsible for the presence of an animal handler competent for the species being transported during the journey. Although the original owners and managers of the animals are not legally responsible for the animals after sale to an importer, they hold a moral responsibility to ensure that animals are only sold to reliable, trustworthy organisations or purchasers.

Managers of facilities at the start and at the end of the journey and at resting points are responsible for providing an adequate number of animal handlers to load, unload, drive and hold animals in a manner that causes minimum stress and injury.

Animal Behaviour and Responsibilities

Recognising animal behaviours allows handlers to ensure humane treatment during handling.

One example already touched on is the recognition of the herd movement of livestock and allowing animals to maintain visual contact with each other and follow the leader. If animals

do become bunched up, handlers can calmly move the leaders forward rather than trying to push animals forward from the rear of the herd.

Unnecessary stress to the animals can also be caused if a person is perceived as a threat. Handlers should take care to approach the animals in a non-threatening manner.

New experiences (such as loading animals onto a vessel) are frightening and stressful. If animals are introduced slowly to a novelty (such as a loading ramp) and allowed to voluntarily approach, they are less likely to be afraid of them [8].

Keeping animals in their original groups if at all possible will reduce stress. Loading ramps must be used, in preference to hoisting animals onto the ship by the neck (eg by crane), which stresses them and may result in neck injury.

Behaviour changes in animals can indicate illness or injury, making them unfit to travel.

Handlers should be able to recognise certain behaviours which could indicate an animal welfare problem.

For example, in cattle, an increased respiratory rate or panting, the demonstration of stereotypic, aggressive, depressive or other abnormal behaviours can all be indicators of a problem [9].

Distractions and their removal [7]

When considering animal handling during sea transport, acknowledging the behaviours of animals allows us to remove possible distractions which can cause reaction when moving livestock.

Some common distractions and how to remove them include:

- Reflections on shiny metal or wet floor – move a lamp or change lighting
- Dark entrances – illuminate with indirect lighting which does not shine directly into the eyes of approaching animals.
- Animals seeing moving people or equipment up ahead – install solid sides on chutes and races or install shields.
- Dead ends – avoid if possible by curving the passage or make an illusory passage.
- Uneven floors or a sudden drop in floor levels – avoid uneven floor surfaces or install a solid false floor to provide an illusion of a solid and continuous walking surface.
- Sounds of air hissing from pneumatic equipment – install silencers or use hydraulic equipment or vent high pressure to the external environment using flexible hosing.
- Engine noise and clanging and banging of metal objects – install rubber stops on gates and other devices to reduce metal to metal contact.
- Air currents from ventilation fans or air curtains blowing into the face of animals – do not stock so tightly that some animals are exposed all of the time

Species Specific Issues [10]

Cattle

Cattle are sociable animals and may become agitated if they are singled out. When groups are mixed, social order has to be re-established and aggression may occur until a new order is established.

Cattle should be penned in smaller groups than sheep, preferably no more than 10 in a group and these should not be mixed from different sources if possible. They should be given bedding for comfortable lying. Pens should be tall enough to prevent cattle getting stuck on them after mounting behaviour, which is more common under stressful conditions.

Crowding of cattle increases aggression as the animals try to maintain personal space. Trapped legs are more likely and gaps below partitions should be high enough so that their legs are not trapped when they rise. Social behaviour varies with age, breed and sex; *Bos indicus* and *B. indicus*-cross animals are usually more temperamental than European breeds.

Sheep

Sheep are sociable animals that tend to “flock together”, especially when they are agitated.

They should be handled calmly and their tendency to follow each other should be exploited when they are being moved.

Sheep may become agitated if they are singled out for attention and will strive to rejoin the group.

Activities which frighten, injure or cause agitation to sheep should be avoided.

They can negotiate steep ramps.

Pigs

Pigs do not have the wide field of vision that cattle and sheep have. They may move reluctantly in unfamiliar surroundings. They benefit from well-lit loading bays.

Since they negotiate ramps with difficulty, these should be as level as possible and provided with secure footholds. Ideally, a hydraulic lift should be used for greater heights.

Pigs also negotiate steps with difficulty. A good ‘rule-of-thumb’ is that no step should be higher than the pig’s front knee.

Serious aggression may result if unfamiliar animals are mixed.

Pigs are highly susceptible to heat stress.

Goats

Goats should be handled calmly and are more easily led or driven than if they are excited.

When goats are moved, their gregarious tendencies should be exploited. Activities which frighten, injure or cause agitation to animals should be avoided.

Bullying is particularly serious in goats. Housing strange goats together could result in fatalities, either through physical violence, or subordinate goats being refused access to food and water.

Camelids

Camelids include camels, llamas, alpacas, guanaco and vicuna.

They have good eyesight and, like sheep, can negotiate steep slopes, though ramps should be as shallow as possible.

They load most easily in a bunch as a single animal will strive to rejoin the others.

Whilst they are usually docile, they have an unnerving habit of spitting in self-defence.

During transport, they usually lie down. They frequently extend their front legs when lying, so gaps below partitions should be high enough so that their legs are not trapped when the animals rise.

Horses

Horses in this context include all solipeds, donkeys, mules, hinnies and zebra.

They have good eyesight and a very wide angle of vision.

They may have a history of loading resulting in good or bad experiences. Good training should result in easier loading, but some horses can prove difficult, especially if they are inexperienced or have associated loading with poor transport condition. In these circumstances, two experienced animal handlers can load an animal by linking arms or using a strop below its rump. Blindfolding may even be considered.

Ramps should be as shallow as possible. Steps are not usually a problem when horses mount a ramp, but they tend to jump a step when descending, so steps should be as low as possible.

Horses benefit from being individually stalled, but may be transported in compatible groups.

When horses are to travel in groups, their shoes should be removed.

Discussion 1

Taking into consideration the specific issues of handling sheep, is this loading procedure using good or bad animal handling practices?



Relevant points include:

Methods of handling – all handlers appear to be calm – no goads can be seen and most handlers are standing outside the flight zone.

Where handlers are standing in relation to animals – Handler in the front of the picture is standing within the flight zone and animals are displaying avoidance behaviour (keeping a safe distance and even beginning to turn away). The animals are being inspected before loading and there is a pen available for unfit animals. There are ample people available to conduct the operation smoothly.

Exit ramp from transit – This ramp does make them move single file, however it exploits their natural tendency to follow each other.

Entrance ramp to vessel – Sheep can negotiate steep ramps and tend to flock together and follow each other – this ramp allows them to flock as they move up the ramp rather than making them walk single file.

Discussion 2

Taking into consideration the specific issues of handling cattle, is this loading procedure using good or bad animal handling practices?



Relevant points include:

Exit from vehicle – Cattle are following each other from the vehicle at their own pace.

Route to vessel – Dead end passages have been avoided. However chute is not solid so cattle can see people ahead.

Ramp to vessel – Cattle are being released onto the ramp in pairs, so crowding is avoided.

Handler position – handlers are not moving deeply into the flight zone and there are sufficient people available to inspect the cattle before they enter the loading ramp.

Planning and Preparations for the Journey

Competent Authority and Whole of Chain Risk Assessment

In order to minimise the chances of adverse animal health and welfare outcomes during sea transport, it is important to adopt a whole of chain risk based approach.

In Australia, the world's largest exporter of livestock, the Australian Standards for the Export of Livestock requires the exporter to undertake adequate planning encompassing a thorough risk assessment and development of appropriate risk mitigation measures. [11]

Exporters, operators of registered premises and accredited veterinarians must comply with all relevant standards [11].

Once critical risks of a sea transport journey are identified risk management measures can be developed and implemented. [11]

According to the Australian Standards for the Export of Livestock, planning should cover the sourcing, land transportation, treatments and inspections before export, and specific plans to manage the animals' health and welfare during the journey [11].

Sea transport journeys must be planned to meet all requirements of the relevant Competent Authority(s). Competent Authority is defined by the OIE as the Veterinary Authority or other Governmental Authority of a Member having the responsibility and competence for ensuring or supervising the implementation of animal health and welfare measures, international veterinary certification and other standards and recommendations in the Terrestrial Code and in the OIE Aquatic Animal Health Code in the whole territory [12].

Differing legislation may be in place from the importing and exporting countries, states and territories.

Planning the Journey –Section 7.2.5 [13]

Adequate planning is a key factor affecting the welfare of animals during a journey. Before the journey starts, plans should be made in relation to:

- i) Preparation of animals for the journey
- ii) Type of transport vessel required
- iii) Route, taking into account distance, expected weather and sea conditions
- iv) Nature and duration of journey
- v) Daily care and management of the animals, including the appropriate number of animal handlers, to help ensure the health and welfare of all the animals
- vi) Avoiding the mixing of animals from different sources in a single pen group
- vii) Provision of appropriate equipment and medication for the numbers and species carried
- viii) Emergency response procedures

Responsibilities – Section 7.2.3 [14]

Exporters, shipping companies, business or buying/selling agents, and masters of vessels are jointly responsible for planning the journey to ensure the care of the animals, including:

- i) Choosing appropriate vessels and ensuring that animal handlers are available to care for the animals
- ii) Developing and keeping up-to-date contingency plans to address emergencies (including adverse weather conditions) and minimise stress during transport
- iii) Correct loading of the ship, provision of appropriate food, water, ventilation and protection from adverse weather, regular inspections during the journey and for appropriate responses to problems arising
- iv) Disposal of carcasses according to international law

To carry out the above mentioned responsibilities, the parties involved should be competent regarding transport regulations, equipment usage, and the humane handling and care of animals.

Exporter Responsibilities [14]

The exporter is responsible for the organisation, carrying out and completion of the journey, regardless of whether duties are subcontracted to other parties during transport.

According to the Australian Standards for the Export of Livestock:

- The exporter should demonstrate that the loading of the livestock has been conducted in accordance with the approved loading plan, any importing country requirements relating to the consignment and the relevant requirements of the government, state or territory for loading of livestock [11].
- The exporter must ensure that equipment and medication are provided as appropriate for the species and the journey. [11]
- This should include restraint facilities, instruments and medicine stores based on the injuries and diseases most likely to occur on a normal voyage, as well as appropriate equipment for the humane killing of animals should that be required [11].

The exporter must secure the presence of the appropriate number of animal handlers competent for the species being transported.

They must also ensure compliance with any required veterinary certification.

Handler Responsibilities [14]

The responsibilities of animal handlers include humane handling and care of the animals, especially during loading and unloading.

Tasks animal handlers should be competent in include:

- Planning a journey, including appropriate space allowance, feed, water and ventilation requirements.
- Ensuring the welfare of animals during the journey, including loading and unloading.
- Identifying animal behaviour, general signs of disease, and indicators of poor animal welfare such as stress, pain and fatigue, and their alleviation.
- Identifying individuals whose fitness to travel may be in doubt and ensure they are examined by a veterinarian.
- General disease prevention procedures, including cleaning and disinfection.
- Maintaining a journey log and other records.

Other Specific Responsibilities [14]

Owners of the animals are responsible for the selection of animals that are fit to travel based on veterinary recommendations.

According to the Australian Standards for the Export of Livestock, animals may be unfit to travel for a number of reasons, including being emaciated or over fat, uncoordinated, collapsed, weak, unwell, pregnant, lethargic or dehydrated or showing signs of contagious infections such as skin diseases [11].

The responsibilities of the business or buying/selling agent include selection of animals that are fit to travel based on veterinary recommendations and availability of suitable facilities for the assembly, loading, transport, unloading and holding of animals at the start and at the end of the journey, and for emergencies.

Masters of vessels must provide suitable premises for animals on the vessel.

The responsibilities of managers of facilities during loading include providing suitable premises for loading, providing an appropriate number of animal handlers to load the animals with minimum stress and the avoidance of injury, minimising risk of disease transmission and providing appropriate facilities for emergencies. They must also provide facilities and trained staff capable of killing animals humanely when required.

Vessel Design - Section 7.2.5 [13]

Vessels used for the sea transport of animals should be designed, constructed and fitted as appropriate to the species, size and weight of the animals to be transported.

Special attention should be paid to the avoidance of injury to animals through the use of secure smooth fittings free from sharp protrusions and the provision of non-slippery flooring. The avoidance of injury to animal handlers while carrying out their responsibilities should be emphasised.

Vessels should be properly illuminated to allow animals to be observed and inspected and should have adequate ventilation to meet variations in climate and the thermo-regulatory needs of the animal species being transported. The ventilation system should be effective when the vessel is stationary. An emergency power supply should be available to maintain ventilation in the case of primary machinery breakdown.

According to the Australian Standards for the Export of Livestock, a vessel used for the export of livestock should comply with all Competent Authority and international vessel biosecurity requirements and all requirements for the safe carriage of livestock [11].

If the vessel to be used is not permanently equipped for the carriage of livestock for the export of livestock, the ship must still comply with all necessary requirements [11].

Animal Welfare Responsibilities - Section 7.2.3 [14]

Once the decision to transport the animals by sea has been made, the welfare of the animals during their journey is the paramount consideration and is the joint responsibility of all people involved.

Exporters, importers, owners of animals, business or buying/selling agents, shipping companies, masters of vessels and managers of facilities are jointly responsible for the general health of the animals and their fitness for the journey, and for their overall welfare during the journey, regardless of whether duties are subcontracted to other parties during transport.

Preparing Animals for the Journey - Section 7.2.5

When animals are to be provided with a novel diet or unfamiliar methods of supplying of feed or water, they should be preconditioned for a reasonable amount of time.

Sheep and goats in particular can struggle to adapt to the pellets provided during ship transport. This can result in inanition, often in combination with salmonellosis, which together are the main cause of high mortality rates during ship transport [15].

Some possible methods to counter this include extending the time spent in the assembly depot and inclusion of roughage (chaff) in the feeding material [15].

Water and feed should be made readily available for the journey. Feed should be of appropriate quality and composition for the species, age and condition of the animals. [13]

According to the Australian Standards for the Export of Livestock, water should be of a quality to maintain good health and feed should satisfy the energy requirements of the livestock for the duration of the voyage. Reserves should also be in place [11].

Extreme weather conditions are hazards for animals undergoing transport and require appropriate vessel design to minimise risks. [13]

Special precautions should be taken for animals that have not been acclimatised or which are unsuited to either hot or cold conditions. In some extreme conditions of heat or cold, animals should not be transported at all. [13]

Animals more accustomed to contact with humans and with being handled are likely to be less fearful of being loaded and transported. Animals should be handled and loaded in a manner that reduces their fearfulness and improves their approachability. [13]

Tranquilisers and other medications should not be used as standard. Behaviour modifying medications should be administered only by a veterinarian or other trained person when required for an individual animal and treated animals should be kept in a dedicated area. [13]

Holding Areas - Section 7.2.7: Pre-Journey Period [16]

Vessels should be thoroughly cleaned before each journey and treated for health purposes if necessary.

Pre-journey assembly holding may be required. Rest is necessary if the welfare of the animals has become poor during the collection period and when a change of food or food/water supply will be taking place.

If animal handlers have concerns over disease or fitness to travel, they must refer animals to a veterinarian.

Pre-journey holding areas should securely contain the animals in an environment that is safe from hazards such as predators and disease. Animals should be protected from adverse weather conditions and allow them to rest, water and feed while maintaining social groups.

Planning Group Housing - Section 7.2.7: Pre-Journey Period [16]

Selecting compatible groups prior to transport is essential to avoid adverse animal welfare consequences.

As a general rule, animals of different species should not be mixed. Animals of the same species can be mixed unless there is likely to be aggression. For some species, animals from different groups should not be mixed as poor welfare may occur without an existing social structure.

Aggressive individuals may be segregated, and young or small animals may also need to be separated from older/larger animals.

Animals with horns or antlers should not generally be mixed with animals lacking horns or antlers.

Existing social groups should be maintained and those with a strong social bond (dam and offspring) should be transported together.

According to the Australian Standards for the Export of Livestock, a suitable loading plan should be prepared before loading begins to ensure group housing is planned appropriately. This should include details of the net available pen area on the ship (not including the hospital pens) according to the vessel's record and the number of livestock that can be loaded on the vessel. This figure should be based on the minimum pen area per head for each species. If any animals are found to be surplus to requirements, humane and effective arrangements should be in place for their handling and care [11].

Fitness to Travel: Section 7.2.7: Pre-Journey Period [16]

Animals should be inspected by a veterinarian or animal handler to assess fitness to travel. It is the responsibility of a veterinarian to determine an animal's ability to travel if it is in doubt. Any animal found unfit to travel should not be loaded on to the vessel and plans must be in place for their humane and effective care.

If euthanasia is required it should be carried out in a humane manner and as quickly as possible.

Animals unfit to travel may include those that are sick, weak, fatigued, unable to stand, heavily pregnant, newborn and blind.

To reduce the health risks during travel, animals should be selected who are suited to the conditions of the journey.

Those animals at particular risk of poor welfare during the journey may require special conditions including additional attention and specially designed facilities. This may include very large, young or old animals, excitable or aggressive animals, animals subject to motion sickness and animals unused to human handling.

According to the Australian Standards for the Export of Livestock, any dead animals should be removed from the port and disposed of in compliance with relevant health and environmental legislation [11].

Disease Control - Section 7.2.5: Planning the Journey [13]

Animal transport can be a significant factor in the spread of infectious diseases. When planning the journey, animals should be vaccinated where possible against diseases they are likely to be exposed to.

To avoid the spread of disease, animals from different sources should not be mixed in a single consignment.

Loading - Section 7.2.8 [17]

Loading has the potential to be the cause of poor welfare in transported animals. Loading should be supervised by the Competent Authority and conducted by well-trained animal handlers who are able to load animals quietly and calmly, without unnecessary noise, harassment or force.

According to the Australian Standards for the Export of Livestock, before loading begins, a communication plan involving all responsible parties should be in place. This should cover the roles and responsibilities of all concerned, arrangements for regular meetings of key people and the reporting procedures in place. Animals should be presented for loading, and penned on the vessel, in lines segregated by species, class, age, weight and any other relevant characteristics. This should be outlined in the loading plan [11].

The loading facility should be designed and constructed to take into account the needs and abilities of the animals being transported (eg. whether they can handle steep ramps). There should be good ventilation during loading and the facility should be properly illuminated to allow easy movement and inspection of the animals.

Travel - Section 7.2.9 [18]

Animal handler(s) should check the consignment immediately before departure to ensure that the animals have been loaded according to the load plan.

Documentation - Section 7.2.6 [19]

Animals should not be loaded until the documentation required to that point is complete. The documentation should include a journey travel plan, emergency management plan, loading details, a journey log expected details for unloading, veterinary certification where required, animal identification for traceability, details of any animals at particular risk, the number of animal handlers and their competencies and stocking density estimates.

According to the Australian Standards for the Export of Livestock, Standard Operating Procedures should be in place for the care and handling of the livestock being exported, to maintain their health and welfare during the voyage, before the vessel departs [11].

Discussion

Suppose these cattle are awaiting loading for long distance sea transport.

What assessments should be made on them first and who is responsible for this?



Possible discussion points include:

- Handler referring animals to veterinarian.
- Veterinarian responsible for final assessment on fitness to travel.
- Discussion on how the chain failed in allowing these animals to be selected for transport.

Loading and Transport by Sea

Vessels and Container Design and Maintenance- Article 7.2.5: Planning the Journey [13]

Vessels used for the sea transport of animals should be designed, constructed and fitted as appropriate to the species, size and weight of the animals to be transported. Special attention should be paid to the avoidance of injury to animals through the use of secure smooth fittings free from sharp protrusions and the provision of non-slippery flooring.

It has been shown that animals respond to a moving floor during transport by stepping in different directions to maintain their balance. Simulated ship motion has shown that sheep step according to the specific movement of the vessel. Heave produced the biggest stepping responses, with sheep most commonly stepping straight forwards and backwards with the fore limbs, then forwards, backwards and sideways with the hind limbs. Stepping movements were associated with reduced high frequency heart beats. As this suggests a negative emotion associated with stepping, it is essential that further negative emotions or physical difficulties are avoided by ensuring that animals stepping to maintain balance during transport by sea are not also exposed to slippery floors or gaps/protrusions. [20]

The avoidance of injury to animal handlers while carrying out their responsibilities should be emphasised.

Vessels should be properly illuminated to allow animals to be observed and inspected. They should permit thorough cleaning and disinfection, and the management of faeces and urine. The faeces or urine from animals on upper levels should not soil animals on lower levels, or their feed or water.

Vessels and their fittings should be maintained in good mechanical and structural conditions. Loading and stowage of feed and bedding should be carried out in such a way to ensure protection from fire hazards, the elements and sea water. Where appropriate, suitable bedding, such as straw or sawdust, should be added to vessel floors to assist absorption of urine and faeces, provide better footing for animals and protect animals (especially young animals) from hard or rough flooring surfaces and adverse weather conditions.

Pen design is an important consideration when fitting the vessel. Sheep in pens with high ammonia concentrations, high wet-bulb temperatures, and low wind speed have been shown to stand longer and spend less time feeding and ruminating than those in pens with low ammonia, low wet-bulb temperature, and high wind speed. [21]

According to the Australian Standards for the Export of Livestock, if a ship is not permanently equipped for the carriage of livestock, it should still meet all requirements of the Competent Authority and any international vessel biosecurity requirements [11].

Roll On/Roll Off Vessels - Section 7.2.5: Planning the Journey [13]

Roll on/roll off refers to the sea transport of animals in an existing vehicle or container, where the animals are not loaded and unloaded from that vehicle or container throughout the journey.

Road vehicles and containers should be equipped with a sufficient number of adequately designed, positioned and maintained securing points enabling them to be securely fastened to the vessel. They should be secured to the ship before the start of the sea journey to prevent them being displaced by the motion of the vessel.

When animals are being transported in a secondary vehicle or container on enclosed decks, it is especially important that the vessel has adequate ventilation to meet the variations in climate and the thermo-regulatory needs of the animal species being transported. Due to the risk of limited airflow on certain decks of a vessel, a road vehicle or container may require a forced ventilation system of greater capacity than that provided by natural ventilation.

Nature and duration of the journey –Section 7.2.5: Planning the Journey [13]

The amount of time animals spend on a journey should be kept to the minimum. Once the decision to transport the animals by sea has been made, the welfare of the animals during their journey is the paramount consideration and is the joint responsibility of all people involved.

The maximum duration of a journey should be determined taking into account factors that determine the overall welfare of animals, including:

- The ability of the animals to cope with the stress of transport (such as very young, old, lactating or pregnant animals).
- The previous transport experience of the animals.
- The likely onset of fatigue.
- The need for special attention.
- The need for feed and water.
- Space allowance and vessel design.
- Weather conditions.
- Vessel type used, method of propulsion and risks associated with particular sea conditions.

According to the Australian Standards for the Export of Livestock, for animals being exported from Australia (the world's largest exporter of livestock by sea) if a journey is to last for ten days or more it is required that an accredited stock person must provide daily reports on the health and welfare of the livestock to the relevant Australian Government agency, commencing on day 1 of the voyage. Where an accredited veterinarian is on board, the veterinarian rather than the stock person must provide the daily report [11].

This is a valid practice to be considered even when not required under existing legislation.

Space allowance - Section 7.2.5: Planning the Journey [13]

The number of animals which should be transported on a vessel and their allocation to different pens on the vessel should be determined before loading. The amount of space required, including headroom, depends on the species of animal and should allow the necessary thermoregulation.

Each animal should be able to assume its natural position for transport (including during loading and unloading) without coming into contact with the roof or upper deck of the vessel. When animals lie down, there should be enough space for every animal to adopt a normal lying posture.

Calculations for the space allowance for each animal should be carried out in reference to a relevant national or international document. The size of pens will affect the number of animals in each. The same principles apply when animals are transported in containers.

According to the Australian Standards for the Export of Livestock, a loading plan should be prepared before loading begins, including details of: the net available pen area on the ship and the number of livestock that should be loaded on the vessel, based on the minimum pen area per head for the relevant livestock species and class. The Australian standards require an *absolute minimum* space requirement for sheep of 0.29 m² for a 40 kg animal and 1.22 m² for a 300 kg cattle [11].

It is suggested that stocking densities be determined from allometric relationships between bodyweight, space availability and behaviour [4].

Loading Facilities and Procedures –Section 7.2.5: Planning the Journey [13]

Loading should be carefully planned as it has the potential to be the cause of poor welfare in transported animals. It should be supervised by the Competent Authority and conducted by animal handler(s).

Animal handler s should ensure that animals are loaded quietly and without unnecessary noise, harassment or force, and that untrained assistants or spectators do not impede the process.

Facilities [17]

The facilities for loading, including the collecting area at the wharf, races and loading ramps should be designed and constructed to take into account the needs and abilities of the animals with regard to dimensions, slopes, surfaces, absence of sharp projections, flooring, sides, etc.

This will vary between species. The maximum loading ramp angle for cattle, for example, is 20-25°. Whereas sheep can manage steeper ramp angles.

Ventilation during loading and the journey should provide for fresh air, and the removal of excessive heat, humidity and noxious fumes (such as ammonia and carbon monoxide). Under warm and hot conditions, ventilation should allow for the adequate convective cooling of each animal. In some instances, adequate ventilation can be achieved by increasing the space allowance for animals.

Loading facilities should be properly illuminated to allow the animals to be easily inspected by animal handlers, and to allow the ease of movement of animals at all times. Facilities should provide uniform light levels directly over approaches to sorting pens, chutes, loading ramps, with brighter light levels inside vehicles/containers, in order to minimise baulking.

Many animals prefer lighted areas to darkness, however dim light levels may be advantageous for the catching of some animals. Artificial lighting may be required.

Loading facilities should take into account the background of the animals being transported. For example, animals raised in dimly illuminated buildings may not be willing to move towards direct sunlight [22].

Goads and other aids [17]

When moving animals, their species-specific behaviour should be used (more information on this is available in Section 7.2.12.).

If goads and other aids are necessary, the following principles should apply:

- Animals that have little or no room to move should not be subjected to physical force or goads and other aids which compel movement.
- Electric goads and prods should only be used in extreme cases and not on a routine basis to move animals. The use and the power output should be restricted to that necessary to assist movement of an animal and only when an animal has a clear path ahead to move.
- Goads and other aids should not be used repeatedly if the animal fails to respond or move. In such cases it should be investigated whether some physical or other impediment is preventing the animal from moving.
- The use of such devices should be limited to battery-powered goads on the hindquarters of pigs and large ruminants, and never on sensitive areas such as the eyes, mouth, ears, anogenital region or belly. Such instruments should not be used on horses, sheep and goats of any age, or on calves or piglets.

- Useful and permitted goads include panels, flags, plastic paddles, flappers (a length of cane with a short strap of leather or canvas attached), plastic bags and rattles; they should be used in a manner sufficient to encourage and direct movement of the animals without causing undue stress.
- Painful procedures (including whipping, tail twisting, use of nose twitches, pressure on eyes, ears or external genitalia), or the use of goads or other aids which cause pain and suffering (including large sticks, sticks with sharp ends, lengths of metal piping, fencing wire or heavy leather belts), should not be used to move animals.
- Excessive shouting at animals or making loud noises (e.g. through the cracking of whips) to encourage them to move should not occur as such actions may make the animals agitated, leading to crowding or falling.
- The use of well trained dogs to help with the loading of some species may be acceptable.
- Animals should be grasped or lifted in a manner which avoids pain or suffering and physical damage (e.g. bruising, fractures, dislocations). In the case of quadrupeds, manual lifting by a person should only be used in young animals or small species, and in a manner appropriate to the species; grasping or lifting animals only by their wool, hair, feathers, feet, neck, ears, tails, head, horns, limbs causing pain or suffering should not be permitted, except in an emergency where animal welfare or human safety may otherwise be compromised.
- Conscious animals should not be thrown, dragged or dropped.
- Performance standards should be established in which numerical scoring is used to evaluate the use of such instruments, and to measure the percentage of animals moved with an electric instrument and the percentage of animals slipping or falling as a result of their usage.

Feed and Water – Section 7.2.9: Travel [18]

The feeding and watering system should be designed to permit adequate access to feed and water appropriate to the species, size and weight of the animals, and to minimise soiling of pens .

Each pen of animals should be observed on a daily basis for normal behaviour, health and welfare, and the correct operation of ventilation, watering and feeding systems. There should also be a night patrol. Any necessary corrective action should be undertaken promptly.

According to the Australian Standards for the Export of Livestock [11]:

- Adequate access to suitable feed and water should be ensured for all animals in each pen.
- All stock for export should be offered feed and water as soon as possible after being loaded on the vessel, and no later than 12 hours after loading.
- There should be an adequate supply of water of a quality to maintain good health and suitable feed to satisfy the energy requirements of the livestock for the duration of the voyage. Feed and water reserves should also be loaded.

- Feed and water provisions should take into account the livestock species, class, age and expected weather conditions.
- There must be a contingency plan to provide satisfactory tending, feeding and watering of the livestock in the event of a malfunction of the automatic feeding or watering systems, but without compromising the safe navigation of the vessel.

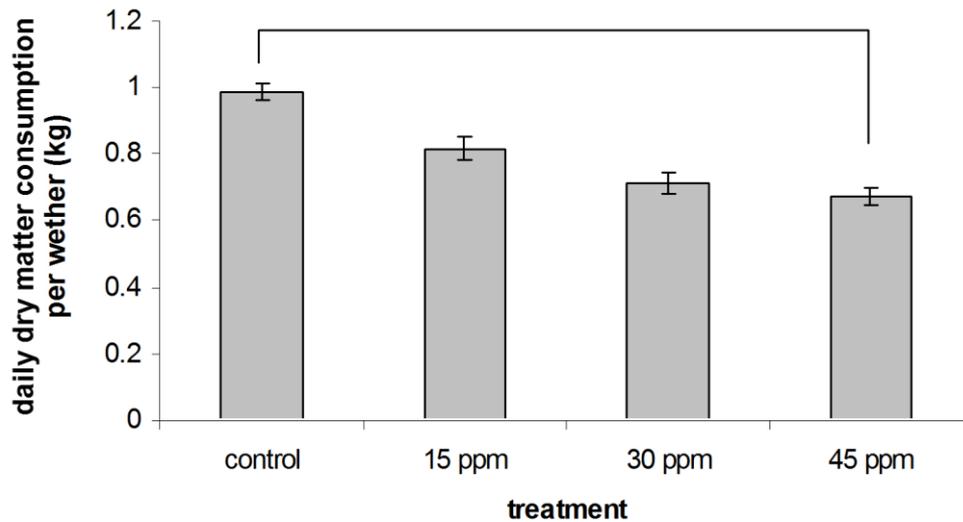
Ventilation – Section 7.2.5: Planning the Journey [13]

Vessels should have adequate ventilation to meet variations in climate and the thermo-regulatory needs of the animal species being transported. The ventilation system should be effective when the vessel is stationary. An emergency power supply should be available to maintain ventilation in the case of primary machinery breakdown.

- According to the Australian Standards for the Export of Livestock [11]: When livestock for export are loaded on vessels with enclosed decks, the ventilation system must be run continuously from the commencement of loading.
- Ventilation should be monitored each day to ensure adequate thermoregulation of the livestock.

Research has shown that orientation of the ship is important if naturally ventilated. Stocking density is also critical to ventilation. Poor ventilation increases ammonia accumulation [17]. Ensuring adequate ventilation is essential both in planning/designing the vessel and also in consideration of each load. Sheep have been shown to exhibit a moderate aversion to ammonia, with aversion clearly demonstrated in 75% of sheep exposed to 45-ppm ammonia [23].

Ammonia can accumulate to high levels in ships carrying livestock and cause inflammation of mucosal surfaces and a temporary macrophage response. Effects of high ammonia can include reduced feed intake and weight loss [4].



Feed Consumption of Sheep [24]

Microclimate [17]

Heat stress is a major risk for animals during sea transport. The greatest risk occurs when cold-adapted animals enter summer temperatures, for example when sheep from southern Australian ports enter summer temperatures in the Middle East. Their heat stress threshold is approx. 26-28°C [23] while the mean maximum wet bulb temperature may be 30°C.

According to the Australian Standards for the Export of Livestock, if the ambient temperature is greater than the animals' body temperature, ventilation will be less effective. Humidity also increases with wet faecal pad [11].

Under conditions such as this, reducing the stocking density and emergency wetting may be appropriate [11].

Emergency Response Procedures – 7.2.5: Planning the Journey [13]

There should be an emergency management plan that identifies the important adverse events that may be encountered during the journey, the procedures for managing each event and the action to be taken in an emergency. For each important event, the plan should document the actions to be undertaken and the responsibilities of all parties involved, including communications and record keeping.

A contingency plan outline emergency actions should be prepared for the following emergencies:

- Mechanical breakdown
- Feed or water shortage during the voyage
- An outbreak of a disease during the voyage

- Extreme weather conditions during the voyage
- Rejection of the consignment by the overseas market.

Emergency Procedures – Section 7.2.9: Travel [18]

Sick or injured animals should be segregated and appropriately treated or humanely killed, in accordance with a predetermined emergency response plan. Species specific recommendations for the killing of animals for disease control purposes are available in Chapter 7.6. Veterinary advice regarding the appropriateness of a particular method of euthanasia or on appropriate treatment should be sought as necessary.

All drugs and products should be used according to recommendations from a veterinarian and in accordance with the manufacturer's instructions.

A record of treatments carried out and their outcomes should be kept.

According to the Australian Standards for the Export of Livestock there should be provision of clearly identified hospital pens (or stalls), which should be constructed to a suitable standard for the species of livestock for which they are intended. These should be present on each deck or otherwise in a manner readily accessible to livestock [11].

Actions in the Event of a Refusal to Allow the Importation of a Shipment – Section 7.2.11 [25]

The welfare of the animals should be the first consideration in the event of a refusal to import. When animals have been refused import, the Competent Authority of the importing country should make available suitable isolation facilities to allow the unloading of animals from a vessel and their secure holding, without posing a risk to the health of the national herd, pending resolution of the situation.

In this situation, the priorities should include:

- The Competent Authority of the importing country providing urgently in writing the reasons for the refusal, urgent access to an OIE-appointed veterinarian(s) to assess the health status of the animals with regard to the concerns of the importing country, and the necessary facilities and approvals to expedite the required diagnostic testing.
- The Competent Authority of the importing country should provide access to allow continued assessment of the ongoing health and welfare situation.
- If the matter cannot be promptly resolved, the Competent Authorities of the exporting and importing countries should call on the OIE to mediate.
- The Competent Authority of the importing country should allow provisioning of water and feed as necessary.

Inspection of Animals During the Journey - Section 7.2.9: Travel [18]

Each pen of animals should be observed on a daily basis for normal behaviour, health and welfare, and the correct operation of ventilation, watering and feeding systems. There should also be a night patrol. Any necessary corrective action should be undertaken promptly.

According to the Australian Standards for the Export of Livestock [11]:

- Livestock and livestock services (including feed and water supply systems) on the vessel should be regularly and systematically inspected (day and night) to ensure that the health and welfare of the livestock are maintained while the livestock are on the vessel.
- The master and/or the master's representative, accredited stock person and veterinarian should hold a daily meeting to discuss all issues relating to the health and welfare of the livestock.
- Pen stocking densities be checked regularly throughout the voyage and adjustments made as required.

Documentation – Section 7.2.6 [19]

The journey log is a daily record of inspection and important events which includes records of morbidity and mortality and actions taken, climatic conditions, food and water consumed, medication provided and mechanical defects.

Impact of Transport by Sea on Animal Health and Welfare- Section 7.2.7: Pre-Journey Period [16]

Risks during transport can be reduced by selecting animals best suited to the conditions of travel and those that are acclimatised to expected weather conditions. Animals at particular risk of suffering poor welfare during transport and which require special conditions (such as in the design of facilities and vehicles, and the length of the journey) and additional attention during transport, may include:

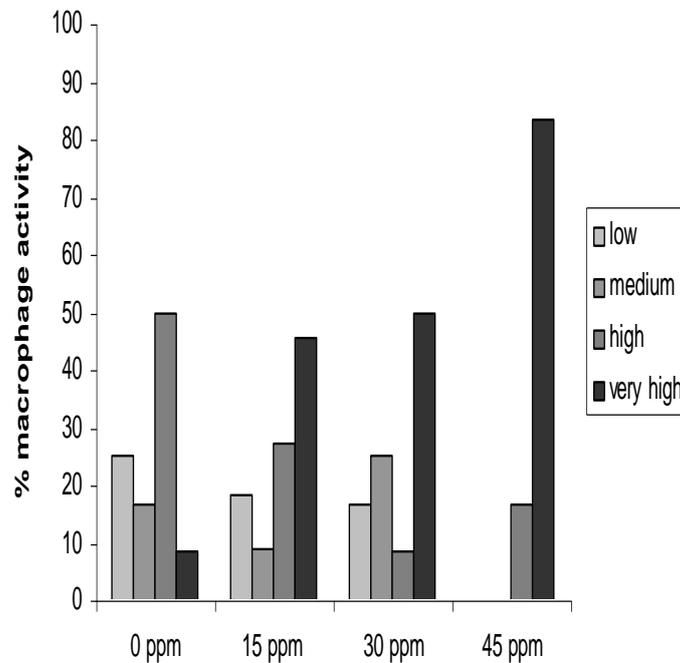
- Very large or obese individuals
- Very young or old animals
- Excitable or aggressive animals
- Animals subject to motion sickness
- Animals which have had little contact with humans
- Females in the last third of pregnancy or in heavy lactation.
- Hair or wool length should be considered in relation to the weather conditions expected during transport.

Control of Disease – Section 7.2.5: Planning the Journey [13]

As animal transport is often a significant factor in the spread of infectious diseases, journey planning should take into account the following:

- When possible and agreed by the Veterinary Authority of the importing country, animals should be vaccinated against diseases to which they are likely to be exposed at their destination.
- Medications used prophylactically or therapeutically should only be administered by a veterinarian or other person who has been instructed in their use by a veterinarian.
- Mixing of animals from different sources in a single consignment should be minimized.

Impact on Animal Health – Ammonia



Cattle macrophage responses [25]

Reducing the Risks of Ammonia – Section 7.2.5: Planning the Journey [13]

Vessels should permit thorough cleaning and disinfection and the management of faeces and urine.

There should be adequate ventilation to meet variations in climate and the thermo-regulatory needs of the animal species being transported. Lower stocking densities can help ammonia levels.

Unloading and Post Journey Handling - Section 7.2.10 [27]

The required facilities and the principles of animal handling during loading apply equally to unloading, but consideration should be given to the likelihood that the animals will be fatigued.

Unloading should be carefully planned as it has the potential to be the cause of poor welfare in transported animals.

Unloading Facilities and Procedures [27]

A livestock vessel should have priority attention when arriving in port and have priority access to a berth with suitable unloading facilities. As soon as possible after the vessel's arrival at the port and acceptance of the consignment by the Competent Authority, animals should be unloaded into appropriate facilities.

The accompanying veterinary certificate and other documents should meet the requirements of the importing country. The veterinary inspection should be completed as quickly as possible.

Unloading should be supervised by the Competent Authority and conducted by animal handler(s).

Unloading – Animal Handling [27]

The animal handlers should ensure that animals are unloaded as soon as possible after arrival but sufficient time should be allowed for unloading to proceed quietly and without unnecessary noise, harassment or force, and that untrained assistants or spectators do not impede the process

Unloading – Facilities [27]

The facilities for unloading including the collecting area at the wharf, races and unloading ramps should be designed and constructed to take into account of the needs and abilities of the animals with regard to dimensions, slopes, surfaces, absence of sharp projections, flooring, sides, etc.

All unloading facilities should have sufficient lighting to allow the animals to be easily inspected by the animal handlers, and to allow ease of movement of animals at all times.

There should be facilities to provide animals with appropriate care and comfort, adequate space, access to quality feed and clean drinking water, and shelter from extreme weather conditions

Unloading – Sick or Injured Animals [27]

An animal that has become sick, injured or disabled during a journey should be appropriately treated or humanely killed. When necessary, veterinary advice should be sought in the care and treatment of these animals.

In some cases, where animals are non-ambulatory due to fatigue, injury or sickness, it may be in the best welfare interests of the animal to be treated or humanely killed aboard the vessel.

If unloading is in the best welfare interests of animals that are fatigued, injured or sick, there should be appropriate facilities and equipment for the humane unloading of such animals. These animals should be unloaded in a manner that causes the least amount of suffering. After unloading, separate pens and other appropriate facilities and treatments should be provided for sick or injured animals.

Cleaning Procedures Post Journey [27]

Vessels and containers used to carry the animals should be cleaned before re-use through the physical removal of manure and bedding, by scraping, washing and flushing vessels and containers with water until visibly clean. This should be followed by disinfection when there are concerns about disease transmission.

Manure, litter and bedding should be disposed of in such a way as to prevent the transmission of disease and in compliance with all relevant health and environmental legislation.

CASE STUDY [28]

Background Information

Millions of cattle and sheep are sent from Country A to Region C each year, a journey of some 10-14 days. En route, the animals will face challenges of heat stress, ammonia accumulation, lack of feed, overcrowding.

Exporter companies are required to employ a veterinarian and/or stockperson to accompany long haul shipments of cattle, who meet with the Captain of the ship regularly to discuss the animals' welfare, and they should also complete a voyage report, which identifies the mortality and documents any problems during the voyage. If cattle mortality exceeds a threshold of 0.2%, there is a government investigation. Government theoretically has the power to stop shipments of the animals by any exporter.

Scenario

You are employed by a live export company as a veterinarian to accompany cattle on long haul shipments to Country B. The ship is loaded in Country A in August with 500 Angus steers, which have been trucked from interstate, held overnight and loaded first thing in the morning. Up until the equator the voyage goes well, but as you approach the Persian Gulf the wind drops and the temperatures climb to over 40°C. With limited ventilation capacity on the vessel, the cattle close to the engine room are obviously stressed by the heat, with open mouthed panting and copious salivation.

DISCUSS APPROPRIATE ACTION HERE

- Advise the captain not to enter the Gulf until temperatures have dropped

OR

- Wait and see what happens

Factors to consider:

- Importance of sticking to schedule
- Risks relating to heat stress
- Who is responsible for the welfare of the cows
- What are the potential issues (government investigation, loss of stock etc)

Encourage group to reach appropriate conclusion:

You advise the captain not to enter the Gulf until the temperatures have dropped.

He answers that he has a schedule to keep to and must continue.

Problems Worsen

The next day as you approach the Suez Canal you find three cattle dead and you notice that the internal temperature on the ship is 46°C.

DISCUSS APPROPRIATE ACTION HERE

- Advise the Captain not to enter the Canal, but to wait out in the Gulf where there is a breeze and document the deaths in your report.

OR

- Start emergency wetting of the cattle to try and bring down their temperature.

Factors to Consider:

- The number of mortalities are already at a reportable level
- Hosing down cattle is unlikely to bring down their body temperature when the ambient temperature is higher than their body temperature
- Heat stress is a major cause of cattle mortality on live export ships
- What are the potential issues

Encourage group to reach appropriate conclusion:

You advise the captain not to enter the Canal, but to wait out in the Gulf where there is a breeze.

He insists on continuing and does not accept your report, which includes the mortalities.

The Journey Ends

By the end of the voyage, ten cattle have died and relations between yourself and the captain are even more strained.

You are aware that any complaints to the company may jeopardise your position.

DISCUSS APPROPRIATE ACTION HERE

Recommended Responses

Advise the captain that your duty to the animals, to your profession and to the Company as ship's veterinarian requires you to report the high mortality, but that you are not wanting to impair what has otherwise been a cordial relationship.

You then contact the company Chief Executive and advise that there was high cattle mortality on the voyage that you accompanied. You further advise that you believe that some deaths would have been avoidable if you had waited at the entrance to the Gulf.

You advise that the continuation of the voyage was contrary to your advice and that the Australian Standards for the Export of Livestock requires an advance weather report to be obtained that, had it been obtained, might have averted the disaster.

You indicate that there will now be a government investigation of the causes of the mortality and ways of preventing it in future, which will consider your report.

You end by stating that you are concerned by the many impacts of these journeys on the animals and that you would like to meet with him to explain these, and help develop alternatives as soon as possible.

Summary

Once the decision to transport the animals by sea has been made, the welfare of the animals during their journey is the paramount consideration and is the joint responsibility of all people involved.

Animal Welfare in Transport and Meat Quality

Information on impact of sea transport on animal health, welfare and meat quality

Animal welfare means how an animal is coping with the conditions in which it lives [29].

An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear, and distress [29].

The OIE guiding principles on animal welfare also mention the universally recognised “Five Freedoms” published in 1965 to describe the right to welfare of animals under human control. According to this concept, an animal’s primary welfare needs can be met by providing [29]:

- Freedom from hunger, malnutrition and thirst
- Freedom from fear and distress
- Freedom from physical and thermal discomfort
- Freedom from pain, injury and disease
- Freedom to express normal patterns of behaviour

FIVE FREEDOMS OF ANIMAL WELFARE

1. Freedom from hunger, malnutrition and thirst
2. Freedom from fear and distress
3. Freedom from physical and thermal discomfort
4. Freedom from pain, injury and disease
5. Freedom to express normal patterns of behaviour



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Guiding principles for animal welfare include:

That there is a critical relationship between animal health and *animal welfare*.

That the internationally recognised 'five freedoms' (freedom from hunger, thirst and malnutrition; freedom from fear and distress; freedom from physical and thermal discomfort; freedom from pain, injury and *disease*; and freedom to express normal patterns of behaviour) provide valuable guidance in *animal welfare*.

That the scientific assessment of *animal welfare* involves diverse elements which need to be considered together, and that selecting and weighing these elements often involves value-based assumptions which should be made as explicit as possible.

That the use of animals carries with it an ethical responsibility to ensure the welfare of such animals to the greatest extent practicable.

That improvements in farm *animal welfare* can often improve productivity and food safety, and hence lead to economic benefits.

That equivalent outcomes based on performance criteria, rather than identical systems based on design criteria, be the basis for comparison of *animal welfare* standards and recommendations [29].

Good Animal Welfare [29]

Good *animal welfare* requires *disease* prevention and appropriate veterinary treatment, shelter, management and nutrition, humane handling and humane *slaughter* or *killing*. *Animal welfare* refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment.

Animals at High Risk - Section 7.2.7: Pre-Journey Period [16]

Animals at particular risk of suffering poor welfare during transport and which require special conditions (such as in the design of facilities and vehicles, and the length of the journey) and additional attention during transport, may include:

- Very large or obese individuals
- Very young or old animals
- Excitable or aggressive animals
- Animals subject to motion sickness
- Animals which have had little contact with humans
- Females in the last third of pregnancy or in heavy lactation
- Hair or wool length should be considered in relation to the weather conditions expected during transport.

Impacts of Sea Transport – Stress

“The transport of livestock by ship is growing in importance, but there are concerns about the welfare impact on the animals. Short sea journeys are usually completed in the vehicles that are used to transport the animals by road, and injury and stress can result”. [4]

Animal Welfare in Loading and Unloading – Section 7.2.8: Loading [17]

- Fear/stress high risk during loading/unloading
- Use of goads, striking, throwing animals
- Ramp angles and poorly lit areas causing trip risk

Loading should be carefully planned as it has the potential to be the cause of poor welfare in transported animals.

Animal handlers should ensure that animals are loaded quietly and without unnecessary noise, harassment or force.

When moving animals, their species-specific behaviour should be used.

If goads and other aids are necessary:

Animals that have little or no room to move should not be subjected to physical force or goads and other aids which compel movement.

Electric goads and prods should only be used in extreme cases and not on a routine basis to move animals.

Goads and other aids should not be used repeatedly if the animal fails to respond or move.

Useful and permitted goads include panels, flags, plastic paddles, flappers (a length of cane with a short strap of leather or canvas attached), plastic bags and rattles; they should be used in a manner sufficient to encourage and direct movement of the animals without causing undue stress.

Painful procedures (including whipping, tail twisting, use of nose twitches, pressure on eyes, ears or external genitalia), or the use of goads or other aids which cause pain and suffering (including large sticks, sticks with sharp ends, lengths of metal piping, fencing wire or heavy leather belts), should not be used to move animals.

Excessive shouting at animals or making loud noises (e.g. through the cracking of whips) to encourage them to move should not occur as such actions may make the animals agitated, leading to crowding or falling.

Animals should be grasped or lifted in a manner which avoids pain or suffering and physical damage (e.g. bruising, fractures, dislocations).

Conscious animals should not be thrown, dragged or dropped.

The facilities for loading, including the collecting area at the wharf, races and loading ramps should be designed and constructed to take into account the needs and abilities of the animals with regard to dimensions, slopes, surfaces, absence of sharp projections, flooring, sides, etc.

Loading facilities should be properly illuminated to allow the animals to be easily inspected by animal handlers, and to allow the ease of movement of animals at all times. Facilities should provide uniform light levels directly over approaches to sorting pens, chutes, loading ramps, with brighter light levels inside vehicles/containers, in order to minimise baulking. Dim light levels may be advantageous for the catching of some animals. Artificial lighting may be required.

Meat Quality – Poor Handling [30]

Poor handling can not only cause bruising and injuries such as broken limbs but can also lead to acute stress through panic, and can trigger the fight or flight response.

Acute (intensive and short term) stress which occurs shortly before slaughter can have adverse effect on meat quality. This is particularly relevant during unloading of the vessel, when slaughter may be imminent.

The quality of the meat changes following the fight or flight reaction because as the animal's metabolism and body temperature increases, levels of glycogen in the muscles decrease and there is a rapid decrease in pH immediately after slaughter.

The result of this process is pale, soft and exudative (PSE) meat.

This occurs particularly in pigs but can also occur in ruminants. The meat becomes very pale with pronounced acidity and poor flavour. This type of meat is less valuable, as it is difficult to use and can even be discarded as waste [31].

Meat Quality – Poor Handling – Bruising

Bruising of flesh occurs when blood escapes from damaged blood vessels into the surrounding muscle tissue.

Bruising can be caused by a physical blow (from a human or another animal in panic) or when an animal falls.

There is a risk of bruising occurring throughout the handling and transport process. Appropriate handling, mixing of animals and facilities can all reduce the risk of bruising.

Bruised meat is disposed of as wastage as it is not acceptable to the consumer and it also decomposes/spoils more rapidly. Meat that is bruised is wasted as it is not suitable for use as food because. Bruised meat is a massive loss to industry [31].

Heat stress and humidity

Heat stress is one of the major risks facing animals transported by sea.

High temperatures, particularly in journeys to more extreme climates, have been shown to reduce feed intake in some sheep.

During high temperatures, animals can experience an initial increase in respiration rate and open-mouth panting may be seen. When experiencing the greatest heat load, there may be a reduced respiration rate.

Studies have shown that heat stress can cause an increase in core body temperature and plasma creatinine and urea concentrations, which indicates renal dysfunction [4].

Social Stress and Other Issues

- Social stress and lack of space
- High ammonia levels
- Ship motion
- Noise

“Long sea journeys require offloading of the animals into pens, where they are mixed and provided with feed, water and sometimes artificial ventilation. In addition, animals are often exposed to high stocking densities, elevated temperature and ammonia concentration, as well as noise and changes in photoperiod and light intensity. Mortality rate is the main measure of

welfare used by the Australian live export industry for long distance shipments, and the rate is higher at sea compared to the same period of transport on land” [4].

Due to the high costs involved in shipment of animals, vessels often have high stocking densities. This not only can cause social stress but also lead to high levels of waste products [4].

Ship motion can cause motion sickness in cattle, sheep and goats. Motion sickness may contribute to inappetence. The Australian Bureau of Animal Health found that 2% of 294 sheep carcasses from on board mortalities showed external signs of vomiting [4].

CHRONIC STRESS AND MEAT QUALITY

Chronic (long term) stress can be caused by a number of factors which are found during sea transport, including heat stress, social stress (overcrowding/mixing) and other environmental stressors such as noise.

Chronic stress can be physical (long distance transport), physiological (hunger, disease, heat stress, exertion) or behavioural (fights).

Chronic stress occurs when glycogen in the animal’s body decreases dramatically and results in changes to the biochemical composition of the meat [30].

Chronic stress can lead to a condition called Dark, Firm and dry (DFD) meat, which can be found in the carcasses of cattle, sheep and pigs.

DFD meat occurs because of the reduced muscle glycogen, which results in little lactic acid production after slaughter. The meat colour is much darker than normal, and the carcass is much drier with a firmer texture [31].

DFD meat is considered to be of inferior quality consumers do not accept the dark colour and less pronounced taste. It also has a shorter shelf life [31].

It has a lower economic value and is normally mixed with processed meats [30].

High Ammonia [4]

Exposure of steers to high levels of ammonia in simulated ship transport has shown adverse physiological effects.

Steers exposed to air ammonia concentrations of 15, 30 and 45 ppm showed increased pulmonary macrophage activity, compared to a control group exposed to <6ppm.

In addition, in steers exposed to a level of 30–45 ppm, increased lacrimation, nasal secretions and coughing were observed. This indicates irritation of mucosal surfaces. There were also indications of active inflammation.

A maximum air ammonia concentration of 30 ppm has been recommended for cattle voyages.

Sheep have also been exposed to high concentrations of ammonia in simulated sheep transport. With concentrations of up to 15–45 ppm, sheep were observed to show increased pulmonary macrophage activity, compared to a control group.

Feed intake and bodyweight also decreased and there was evidence of mucosal irritation in the form of sneezing at the higher concentrations of ammonia.

Sheep were also seen to actively avoid concentrations of 45 ppm ammonia. [23]

Health and Welfare – Inanition [4]

Inanition is a major risk for animals, particularly sheep and goats, during long voyages by sea.

Sheep may struggle to adapt to new feed (pellets) offered in the assembly depot and on the ship. There have been several methods used to try and help sheep to adapt to the new pellets, including adding chaff and bentonite (a clay mineral which reduces acidosis) to the mix. These have shown limited success. Other possible causes of inanition are high ammonia levels and motion sickness.

Goats have been shown to suffer from similar inappetence problems to sheep). In goats, extending the length of time spent in the assembly depot adjusting to new feed was found to reduce the incidence of inappetence, but it was also found to increase liveweight loss.

Liveweight loss and high mortality rates through inanition can cause substantial financial loss.

Sea Transport and Animal Health – Section 7.2.5: Planning the Journey [13]

Animal transport is often a significant factor in the spread of infectious disease.

When possible and when agreed by the Veterinary Authority of the importing country, animals should be vaccinated against diseases to which they are likely to be exposed at their destination.

Mixing of animals from different sources in a single consignment should be minimized.

Health and Welfare – Section 7.2.11: Refusal to allow the importation of a shipment: [24]

Refusal to import has serious implications for the health and welfare of ship bound animals.

The welfare of the animals should be the first consideration in this event.

In the event of a refusal for animal health reasons, the Competent Authority of the importing country should provide urgent access to an OIE-appointed veterinarian(s) to assess the health status of the animals with regard to the concerns of the importing country, and the necessary facilities and approvals to expedite the required diagnostic testing.

The Competent Authority of the importing country should provide access to allow continued assessment of the ongoing health and welfare situation.

This must be provided whether the animals are able to be placed in a suitable isolation area onshore or if they must remain on the vessel.

If the matter cannot be promptly resolved, the Competent Authorities of the exporting and importing countries should call on the OIE to mediate.

Good Practice, Animal Health – Section 7.2.10: Cleaning and Disinfection [27]

Vessels and containers used to carry the animals should be cleaned before re-use through the physical removal of manure and bedding, by scraping, washing and flushing vessels and containers with water until visibly clean.

This should be followed by disinfection when there are concerns about disease transmission.

Manure, litter and bedding should be disposed of in such a way as to prevent the transmission of disease and in compliance with all relevant health and environmental legislation.

Animal Disease and Meat Value

Where an outbreak of disease has been identified, carcasses will usually be rejected for human consumption. In the case of animals transported by sea, this can mean the rejection of the entire consignment of animals.

Disease may have a significant local impact but with the growing interdependence of livestock markets it can also lead to broader costs on livestock industries around the globe [32],

Market instabilities have been increased by escalating outbreaks of animal diseases have increased market instabilities, which has led to a slow in growth in livestock trade [30].

Market losses are highest for countries where the outbreak occurs and can lead to a ban on any international trade [32].

Good Animal Welfare for Good Meat Quality [33]

Good animal welfare can increase productivity and lead to economic benefits.

The Animal Welfare Standards Project was a collaboration between the Australian and New Zealand World Animal Health Organisation Collaborating Centre for Animal Welfare and Bioethical Analysis and Universiti Putra Malaysia (UPM), which aimed to increase awareness of standards for slaughter and transportation via land, sea and air in SE Asia;

The project focused on working with local experts and stakeholders and focused on a Top Ten list of animal welfare requirements (both for slaughter and transport of animals) which would provide better outcomes both for the animals themselves and their productivity.

These included:

- Providing suitable rest, space feed and water and monitor consumption.
- Careful low stress handling to prevent panic, bruising and injuries.
- Ensuring a steady and smooth journey to reduce stress.
- Minimising ammonia and biohazards with good ventilation.
- Preventing temperature extremes.

Animal Welfare Standards Project “Top Ten”

CARING FOR THE WELFARE OF ANIMALS DURING TRANSPORT

- 1 Prepare animals well for travel with suitable feed and handling.**
- 2 Do not load sick or injured animals.**
- 3 Load animals, or containers with animals, into suitable vehicles carefully and calmly.**
- 4 Use low stress techniques to handle and transport livestock.**
Don't move animals by frightening or hurting them.
- 5 Don't overcrowd vehicles or animal containers.**
- 6 Rest animals during and after long journeys.**
Ensure you provide them with feed, water and somewhere to lie down.
- 7 Do not throw, drag or drop animals or containers with animals.**
- 8 Ensure steady and smooth journeys to avoid injury and reduce stress.**
- 9 Don't let animals suffer from heat and cold stress.**
Be aware of their temperature requirements.
- 10 Provide clean and well-ventilated space for animals during transport.**
Minimise ammonia, dust and biohazards.

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