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SHEEP HUSBANDRY

Report by the
Senate Select Committee on Animal Welfare

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Appointment of the Committee and its terms of reference

The Senate appointed the Select Committee on Animal Welfare on 16 and 17 November 1983 and reappointed it on 22 February 1985 and again on 22 September 1987 in each new Parliament to inquire into and report upon:

> the question of animal welfare in Australia, with particular reference to:
>
> (a) interstate and overseas commerce in animals;
>
> (b) wildlife protection and harvesting;
>
> (c) animal experimentation;
>
> (d) codes of practice of animal husbandry for all species; and
>
> (e) the use of animals in sport.

As a result of the broad nature of the terms of reference, the Committee decided to divide the inquiry into a number of discrete areas and, as far as possible, to examine two or more simultaneously. After preliminary public hearings in mid-1984, the Committee decided to examine kangaroos and the export of live sheep from Australia. It later added dolphins and

whales in captivity to this priority list. The Committee reported on live sheep exports on 13 August 1985, on dolphins and whales in captivity on 29 November 1985 and on kangaroos on 1 June 1988. Its next priorities were animal experimentation, on which it reported on 5 September 1989, and sheep husbandry.

The sheep husbandry issue

The Committee's decision to inquire into and report on aspects of on-farm sheep husbandry was motivated by concerns expressed to it during its inquiry into live sheep exports and by issues raised both in the media and in submissions to the Committee by the general community, by animal welfare organisations and by sections of the sheep and wool industry itself.

Perceived sheep welfare problems have provoked much passionate, emotive and heated debate. By inquiring into these problems, the Committee hoped it might provide a forum in which all interested parties could outline their concerns and from which guidelines for constructive change in one of Australia's most important industries might emerge.

Scope of the sheep husbandry inquiry

In this inquiry, the Committee has elected to consider only on-farm aspects of sheep husbandry, including the provision of food, water; shelter protection; control of injury and disease; protection from predation; and appropriate handling.

The Committee will reserve its consideration of sheep transportation issues, saleyards, abattoirs, and intensive production for inquiries into these issues across species.

Conduct of the inquiry

The Committee received numerous submissions which touched on or were wholly devoted to sheep husbandry issues. It heard evidence from 31 organisations or private individuals, on various aspects of sheep welfare. In addition, Committee members visited the Department of Mechanical Engineering, University of Western Australia, to observe robotic shearing; Merino Wool Harvesting in Adelaide, to observe electro-immobilisation; sheep properties at Tarago, New South Wales, to observe lamb marking and mulesing, and at Menindee, to observe arid zone production. They later visited the CSIRO Division of the Mechanical Environment to inspect the Auto-trough designed by Mr Tony Miller.

Acknowledgements

The Committee would like to thank all the organisations and individuals who contributed to this inquiry through their submissions or evidence given at public hearings.

In particular, Committee members would like to thank all the organisations and individuals who made possible the Committee's visits to observe sheep husbandry practices and procedures. They include Mr James Trevelyan and staff of the Department of Mechanical Engineering, University of Western Australia; Dr James Baxter and staff of Merino Wool Harvesting; Mr J. Caskey of "Larloona", Menindee; and Mr Robert Campbell and family of "Euroka", Tarago, and the Officers of the NSW Agriculture and Fisheries and the Sheepmeat Council who organised that visit and accompanied Committee members during it.

Thanks also go to Mr Tony Miller, Officers of the CSIRO Division of the Mechanical Environment and of Mono-Pumps, who demonstrated and discussed features of the Auto-trough.

LIST OF ACRONYMS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AFIC	Australian Feeds Information Centre
AFWA	Australian Federation for the Welfare of Animals
AMLRDC	Australian Meat and Live-stock Research and Development Corporation
ANZFAS	Australian and New Zealand Federation of Animal Societies
AVA	Australian Veterinary Association
AVCA	Australian Veterinary Chemicals Association
AWC	Australian Wool Corporation
CALM	Computer-aided Livestock Marketing
CEP	Community Employment Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DSE	Dry Sheep Equivalent
EGF	Epidermal Growth Factor
FAWC	Farm Animal Welfare Council (UK)
IED	Income Equalisation Deposits
MWH	Merino Wool Harvesting Pty. Ltd.
NTP	National Tree Program
PSMG	Pregnant Mare Serum Gonadotrophin
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SCAW	Sub-committee on Animal Welfare
SIRM	Sterile Insect Release Method

GLOSSARY

anthelmintics:	substances given to expel parasitic worms.
beta-endorphin:	a peptide from the pituitary gland.
cortisol:	a steroid from the adrenal gland.
cryptorchidism:	condition induced by forcing the testicles of ram lambs up close to the body and placing a ring around the empty scrotum. The animals retain male characteristics but cannot sire young.
cutaneous myiasis:	the invasion of sheep skin by fly larvae; flystrike.
dermatophilosis:	lumpy wool; a disease caused by the bacterium *Dermatophilus congolensis*. The bacteria infect the skin, causing scabs which lift with the growing fleece.
dystocia:	difficulty during lambing.
hypocalcaemia:	condition exhibiting the the symptoms of a deficiency of total calcium circulating in the bloodstream.
hypoglycaemia:	deficiency of sugar in the blood.
immunocastration:	immunisation of male animals against their own male hormone, testosterone, to prevent sperm production.
mulesing:	the surgical removal of strips of loose, wool-bearing skin from the breach and tail of the sheep.
pregnancy toxaemia:	an acute metabolic disorder occurring during the last few weeks of pregnancy, typically in ewes carrying twins or triplets.
prolactin:	a hormone associated with lactation and secreted by the pituitary gland.
transgenic:	animal which contains foreign DNA integrated into its own chromosomes.

CHAPTER 1

INTRODUCTION

1.1 The sheep, *Ovis aries*, evolved in the mountains of Eurasia about two and a half million years ago and was one of the earliest species to be domesticated.[1] For 12 000 years, sheep and man have lived in a symbiotic relationship. The sheep has provided man with food and clothing; man has provided the sheep with nourishment and protection from predation.

1.2 Feral sheep are known to exist in parts of the world, although it is unlikely that they do so in Australia. Australian sheep raised in the pastoral zone have frequently been described as semi-feral.[2] It can be assumed, however, that most Australian sheep are essentially dependent on man for their well-being.

1.3 By domesticating sheep, man has asserted his control over them. He has removed most freedom of choice in essential matters from them. He has changed their genes, their behaviour, their ability to fare for themselves, their environment. Present-day sheep in Australia cannot readily escape from man's dominion: they must adapt to the conditions provided, or die. More sheep are polled than not; the only defences left to them are flocking and stamping their feet. Man, as a moral agent, is therefore morally obliged to exert responsible stewardship over them.

1.4 Man's responsibility towards sheep was generally accepted by those who gave evidence to the Committee. The RSPCA (Australia) spoke for most witnesses when it said:

> It is generally accepted that when we keep animals for purposes of our own (as pets, for work, for recreation or for production) we acquire a responsibility for them ... we accept our obligations to look after them, keep them healthy and in some senses 'happy' and to avoid cruelty and suffering whether deliberate or not.[3]

1.5 What was less clear was what was encompassed by the term, "sheep welfare", and which, if any, current husbandry practices ran counter to that term.

1.6 Sheep welfare has been described as a state of complete mental and physical health in which the sheep lives in harmony with its environment. The Sub-committee on Animal Welfare of the Standing Committee on Agriculture stated:

> ... with due regard to their species and breeds, animals in the care of man should be protected from suffering and husbanded in a manner appropriate to their physical and behavioural needs in accordance with established experience and scientific knowledge.[4]

1.7 Unfortunately, in the case of sheep, the "scientific knowledge" concerning evidence of the existence and extent of suffering is far from complete. Indicators of well-being or of suffering have included biochemical and behavioural measures, the presence of disease, and productivity indicators.

1.8 Biochemical markers, such as cortisol levels, have been advanced as the most useful objective indicators presently available of distress in sheep, despite the fact that cortisol levels also rise in association with pleasant stimuli, such as exercise, copulation, or feed expectation.[5] Other biochemical indicators such as beta-endorphins and other peptides have also also been considered valuable as distress indicators in welfare investigations.

1.9 Behavioural indicators have been advanced as a necessary corollary to biochemical indicators as pointers to sheep well-being. By studying normal species-specific behaviour, such as flocking preferences in Merinos, aberrations from the norm can be identified and rectified if necessary. Guidelines for the recognition of pain in sheep have been published, and include signs such as a depressed appearance, little interest in surroundings, teeth grinding, grunting.[6] Preference tests and behavioural measures of aversion assist in clarifying what the sheep thinks about husbandry practices.

1.10 It is certain that sheep can experience pain, but pain threshholds vary from sheep to sheep.[7] The Committee considers there is little to be achieved in attempting to establish pain threshhold levels for any given husbandry procedure, because of the subjective nature of the phenomenon which is being dealt with.

1.11 Good physical health is equated with the absence of disease and is clearly a pre-requisite for sheep well-being. Obvious disturbances of physical health, such as lameness or lice infestation, are generally agreed to be signs of suffering. Yet short-term suffering may not have visible effects on physical health, and apparently healthy animals may exhibit physiological and behavioural abnormalities.[8]

1.12 Productivity measures such as wool growth, bodyweight, or reproductive success have sometimes been advanced as objective indicators of a sheep's well-being. However, sheep in a satisfactory welfare situation may exhibit a wide range of individual production levels. The rate of clean wool growth of adult Merinos, for example, may vary from 1.6 grams/day to 20.2 grams/day.[9] Suffering may be reflected by a fall in productivity, but it would be an oversimplification to consider that it always is.[10] Growth is not inconsistent with periods of acute, transitory, physical suffering; growth can, on occasions, be a pathological symptom.

1.13 While the precise parameters of sheep welfare are difficult to define, the Committee was left in no doubt about the features of sheep production which were deemed by certain groups and individuals to be inimical to the well-being of sheep. Practices which attracted attention included surgical procedures such as tail-docking, castration and mulesing; rearing and shearing practices which allow sheep and lambs to be exposed to extremes of heat or cold; deficient nutrition; inadequate supervision; unpreparedness for natural disasters. The desirability of raising sheep in the semi-arid zones of Australia was questioned on both welfare and ecological grounds. These, and related issues, are considered by the Committee in this report.

1.14 Production methods have to be viewed in the context of the economics of the industry. Economic considerations do influence production, and it is necessary to recognise that. The Australian sheep and wool industry has a long and proud history, but one that has been plagued by uncertainty, by the vicissitudes of nature and of international trade.

1.15 Wool has been a major Australian export industry since 1807, to the extent that we as a nation have been frequently described as "riding on the sheep's back". Generation after generation of Australian schoolchildren have learnt of the introduction of the first 26 Spanish Merinos from the Cape of Good Hope in 1797; of Captain John Macarthur's advocacy of wool as a suitable fledgling export commodity; of the success of his exports of it to England from 1807 onwards; of the subsequent expansion of settlement and sheep inland; of the development of fencing when labour vanished at the onset of the gold rushes; of the romance of the riverboats and bullock drays bearing bales of wool to market.

1.16 The significance of the sheep and wool industry to Australia cannot be understated, and it is a significance which goes far beyond monetary value. As Dr Rose pointed out:

> The values of rural life are an integral and important component of Australian culture. We all benefit and our lives are enriched by values derived from the relationship between the farmer, his livestock and the land. We would all be that much poorer if that component of our social matrix was lost.[11]

1.17 In March 1988, Australia's sheep population numbered 161.8 million. In the 1987-88 financial year, Australia produced its largest ever wool clip of 851 mkg, 97 per cent of which was exported, and the value of which was $5.7 billion.[12] In international terms, the Australian sheep flock represents about 20 per cent of the world's sheep and produces over 28 per cent of the total annual production of wool.[13] In addition, 153 286 tonnes of lamb and mutton were exported in 1987-88, at a value of $298 million.[14]

1.18 The sheepmeat and wool industries are of economic significance domestically, as well. Eighty-two per cent of lamb and 43 per cent of mutton produced in 1987-88 were consumed by the Australian market, with per capita consumption averaging 14.9 kg for lamb and 7.1 kg for mutton.[15] Australia's per capita domestic consumption of wool in 1987-88 was one of the world's highest, at 2.09 kg.[16]

1.19 In 1987-88, the sheep and wool industry was Australia's largest single export earner.[17] The above statistics reinforce the pre-eminence of the industry. Yet the other side of the coin is the fact that wool enjoys only a five per cent share of the world's textile market, and is constantly under threat from improved synthetics. Sheepmeat too lags behind beef, poultry and pigmeat in the apparent consumption stakes.[18] Sheep producers are constantly reminded that, unless their industry remains highly competitive, it will cease to be viable. If the industry ceases to be profitable, there will be few sheep left to be concerned about.

1.20 It is against this backdrop of constant pressure to remain viable in the face of fluctuating commodity demand and value, rising costs, and uncertain and unpredictable climatic conditions that sheep welfare must be viewed. But as the Committee noted in its report on live sheep exports:

> ... society has a duty to see that undue suffering is not caused to animals, and we cannot accept that that duty should be set aside in order that food may be produced more cheaply. Where unacceptable suffering can be eliminated only at extra cost, that cost should be borne or the product foregone. On the other hand all methods of domestic livestock rearing entail some loss of freedom, and where an imperfect but not unacceptable system can be improved only at disproportionate cost, it may be unreasonable to insist that this be done.[19]

1.21 In this report, the Committee has been concerned to weigh up the extent to which economic considerations should influence production methods, when those methods may adversely affect the welfare of sheep in the short or long term, and to strike a balance between welfare and economic considerations as compassionately yet as objectively as possible.

1.22 The Committee is concerned that the sheep welfare debate has been seen as yet another example of the rural/urban dichotomy existing in affluent western societies. It has been pointed out that more than 80 per cent of Australians now live in towns or cities.[20] These are people whose values about animals and their appropriate treatment are formed with reference to companion animals; and who, it is asserted, are separated from groups using sheep to provide their livelihood by a great cultural divide.

1.23 This explanation has sometimes been advanced to show that persons calling for changes to the methods of sheep production could not possibly know what they were talking about, and that such decisions were best left to the farmers themselves.

The Committee was, however, impressed with the overall awareness of welfare considerations and their consequences by all groups and individuals who appeared before it, whether or not they had a pecuniary interest in the industry.

1.24 As the Committee's inquiry progressed, it became apparent that both sheep producers and sheep welfare organisations realised that if their debate remained polarised, sheep welfare would suffer. Producers came to accept that welfare groups had legitimate concerns about sheep. They further acknowledged that some of their own practices could be improved. Animal welfare groups acknowledged that some of their proposals were unreasonable, and were prepared to modify them. While complete agreement has not yet been reached, it has nevertheless been heartening for the Committee to see that the protagonists are now prepared to engage in constructive debate on the issues which still separate them.

1.25 The Committee is aware that many of the sheep welfare issues raised in this inquiry are not within the Commonwealth's jurisdiction. A number of groups and individuals clearly considered this to be an unfortunate aberration on the part of the drafters of the Australian Constitution.[21] Nevertheless, the Committee inquired into these matters because they were of concern to the wider community and because it was perceived that no other appropriate forum existed for their airing.

1.26 One area in which there is federal responsibility is in research funding. The government has a commitment to match the sheep and wool industry contributions to research and development up to 0.5 per cent of the gross value of production,[22] although at present the wool industry's contribution is only 0.35 per cent.[23] Much research work stems from grants from the industry's two major funding bodies, the Wool Research and Development

Council of the Australian Wool Corporation and the Australian Meat and Live-stock Research and Development Corporation. Federally-funded agencies, such as CSIRO and the universities, carry out the bulk of the research work, often in conjunction with the state departments of agriculture.

1.27 The importance of research was acknowledged by the Minister for Primary Industries and Energy, the Hon. John Kerin, when he opened the World Sheep and Wool Congress in Hobart on 1 March 1989:

> The key to further productivity gains ... lies in effective research and development(R&D). A strong, market-oriented R&D effort, coupled with the effective uptake of new technology by industry, is essential ... In order to sustain a major R&D research effort resources both human and capital must be further developed and the effective and timely translation of research results into industry practice is vital.[24]

1.28 Throughout this report, the Committee has recommended further research on a number of matters. The Committee is convinced that research on issues which affect sheep welfare is essential and should be strongly supported. Given the productivity gains which would also result from improved sheep welfare, this makes good economic sense as well as meeting ethical concerns. It is important that the appropriate research agencies are adequately supported financially to carry out the research recommended in this report. The industry may need to take a more proactive role and seek out worthwhile research projects, if indeed a lack of them has been the explanation for the build-up of funds in the Wool Research Trust Fund to over $70 million at 30 June 1988.

1.29 From the beginning of this inquiry, the Committee has considered not only the specific welfare issues raised but also the concomitant problem of what to do when flagrant breaches of acceptable welfare standards occur. Each State has legislation

which deals with cruelty to animals, legislation which varies somewhat in the detail of offences and in the scale of penalties. It is generally accepted that such legislation is useful to cover cases of gross cruelty to, or neglect of, sheep. The number of cases which reach the courts is probably more a reflection of the resources of the RSPCA and other bodies employing inspectors empowered under the respective acts, than of the frequency of abuses. Furthermore, husbandry practices such as mulesing are specifically excluded from the cruelty to animals legislation.

1.30 There are clearly limitations as to what legislation can achieve. It is unlikely to do much to change human behaviour or to affect human motives. In this report, the Committee considers the respective roles and strengths of legislation and codes of accepted welfare practice, bearing in mind that sheep welfare depends on the interaction of the stockman, the sheep and the environment, and while advice can be proferred to the stockmen, it is most difficult to control the implementation of that advice.

1.31 It is not misguided to concern ourselves over animals which are bred to die, some at a tender age. The moral issue is the quality of life, while that life exists. The Committee is convinced that humane stewardship of sheep, allied with ecologically sensitive land management, is the key to ethically sound sheep production. In this report, it considers how best that can be achieved.

CHAPTER 2

THE BASIC NEEDS OF THE SHEEP

Introduction

2.1 A draft model code of practice for the welfare of sheep has been circulated for discussion and comment by the Sub-committee on Animal Welfare of the Animal Health Committee of the Australian Agricultural Council. In its current introduction, it lists the following basic requirements for the welfare of sheep:

- A level of nutrition adequate to sustain good health and vigour.
- Access to sufficient water of suitable quality to meet physiological needs.
- Social contact with other sheep; but with sufficient space to stand, to lie down and stretch their limbs.
- Protection from predation.
- Protection from pain, injury and disease.
- Protection from extremes of climate which may be life threatening.
- Provision of reasonable precautions against the effects of natural disasters e.g. firebreaks and fodder storage.
- Handling facilities which under normal usage do not cause injury and which minimise stress to the sheep.[1]

The Committee considers the above points broadly cover sheep welfare needs. In this chapter, the Committee will consider in more detail nutritional and water requirements and protection

from predation and climatic extremes. Natural disasters will be considered in chapter 8, while injuries and diseases will be covered in chapters 4 and 5 and handling issues in chapter 6.

Nutrition

2.2 Most witnesses who presented evidence to the Committee stressed how critical the provision of adequate nutrition was to sheep welfare.[2] In particular, the amount, quality and continuity of feed to maintain health and to meet the specific physiological requirements for growth, pregnancy, lactation and cold stress were highlighted. The need to protect sheep from harmful plants was also pointed out.

2.3 Sheep in Australia normally feed entirely on pasture and pasture products such as hay or silage. Grain is generally only provided during droughts, or in feedlots. Most of the pasture is indigenous, greatly exceeding the 25 million hectares that have been "improved".[3] It is susceptible to rainfall variations and depredation by insects and native fauna, and its quality declines as the growing season advances. Most fodder is conserved in the form of hay, and most of this is turned over on an annual basis as supplementary feed, rather than held as a drought reserve.

2.4 Two major welfare issues emerged from the evidence on sheep nutrition received by the Committee. Firstly, there was the question of undernutrition, particularly of certain classes of sheep, when pasture was inadequate in quality or quantity; and secondly, there was the issue of the welfare of sheep in droughts. The latter is considered by the Committee in chapter 8.

2.5 The Dry Sheep Equivalent (DSE) system is an approximate means of comparing the energy requirements of different classes of animals. In the last two months of pregnancy, the average DSE for Merino ewes carrying a single lamb has been estimated at 1.1,

carrying twins 1.3 and for crossbreds 1.7. Lactating Merinos have an energy requirement 2.4 times that of a dry sheep, while that of lactating crossbreds is 3.6 DSE.[4] Weaned lambs weighing 15 kg and gaining 200 grams per day have a DSE of 1.6.[5]

2.6 Inadequate nutrition during late pregnancy results in low birth weight of lambs, a reduced milk supply and hence a lower chance of lamb survival. It may also result in ewe and foetal loss through pregnancy toxaemia or "twin lamb disease". If a ewe cannot take in the additional quality feed she requires to sustain herself and her foetuses which are doubling in weight at this time, she will draw on her own body reserves. Blood glucose levels may fall below those needed to nourish the vital organs and death results. Hypocalcaemia or milk fever caused by a sudden drop in calcium intake can also cause the death of ewes in late pregnancy while an inadequate intake of magnesium can result in grass tetany in lactating ewes.[6] Good management techniques, such as the provision of supplementary calcium, are essential for the welfare of the sheep.

2.7 The Committee accepts that most sheep producers are well aware of the increased energy and nutrient requirements of their ewes in late pregnancy and during lactation. However, it appears that many producers are not fully aware of the nutritive levels of their pastures, despite the efforts of the State departments of agriculture, the Australian Feeds Information Centre (AFIC) and other bodies.

2.8 The AFIC database, operated by the CSIRO Division of Animal Production in co-ordination with the State departments of agriculture, has been set up to overcome the lack of information on the quality of available feeds. Quality is determined by an assessment of the energy, protein, mineral and amino acid content of the feedstuffs, and mathematical models and simulation programs are being developed to assist in the provision of specific recommendations on the type and quantity of feed supplements required.[7] This information is then disseminated to farmers and feed manufacturers.

2.9 Other nutrition-related management issues include the importance of allowing the ewe to remain undisturbed in late pregnancy, so that she can graze without hindrance. Transporting, crutching, shearing or even bad weather can limit the ewe's feed intake at this crucial time[8] and may cause death.

2.10 The nutritional implications of cold stress are largely determined by the sheep's condition, by its wool cover and by the availability of shelter. Sheep with even a few centimetres of wool are extremely cold tolerant and able to tolerate air temperatures below freezing without elevation of metabolic rate. New-born lambs and newly-shorn sheep, however, find cold far more stressful. The heat loss and cold stress induced by shearing can create an immediate demand for up to 50 per cent more food than pre-shearing.[9] New-born lambs are extremely susceptible to the cold, particularly if they are of low bodyweight, and need access to a plentiful and rich supply of milk within minutes of birth and at regular intervals thereafter in order to survive in low ambient temperatures, particularly if conditions are also wet and windy. In order to provide that milk, the ewe herself must have access to feed of ample quantity and quality, and within easy reach so that she does not abandon her lamb in the process of finding feed.

2.11 For the sheep producer who raises animals in cold climates, or where cold, wet and windy conditions prevail at a time when pasture growth is reduced in quality or quantity, supplementary feeding will probably be necessary, particularly if there are newly-shorn sheep or new-born lambs. The Committee urges all sheep producers who are uncertain as to the nutritive value of their pastures to have them tested, and to supplement them as necessary.

2.12 Another approach which should be considered in the longer term is pasture improvement. Considerable research effort has gone into improving the productivity of pastures, determining their nutrient status, improving their use by sheep and understanding the principles governing the role of nutrition in wool and meat production, reproduction and lamb survival. Research into clover cultivars, for example, has shown that some have a reduced oestrogen content, contributing to reduced fertility. By developing strains of clover which avoid this problem and which also are more digestible, researchers will make a significant contribution to both animal welfare and production.[10] It is imperative that such research advances be conveyed to the farming community in such a way that they are both meaningful and easy to be acted upon.

2.13 The Committee does not propose to advance specific guidelines on the appropriate nutrition of Australian sheep. Advice on nutrition issues is readily available from the State departments of agriculture and other extension services. The Committee encourages those departments to be more aggressive in publicising their nutritional guidelines, particularly in times of natural disasters. The Committee believes, however, that firm steps should be taken against the few producers who knowingly and wilfully undernourish their animals. This matter is addressed in Chapter 9.

Water

2.14 Sheep require access to water of sufficient quality and quantity.[11] The demands sheep make on water vary according to breed, age, salt and water content of pasture, topography and size of paddock and from individual to individual.[12] As a general guideline, however, the draft code of practice suggests that sheep should not be deprived of water for more than 48 hours.[13]

2.15 In temperate regions, sheep can remain healthy on green feed without drinking, although Merinos deprived of water tend to graze at night to benefit from the dew and leaf exudate. It is suggested that individual sheep vary in the efficiency of their water conservation, in their sheltering behaviour and in their ability to select pasture high in water content, since sheep in these regions may travel to water with a frequency varying from one to three days even in the summer.[14]

2.16 Water supply becomes an issue of significance to animal welfare particularly in the pastoral or semi-arid zones, where sheep may take in up to 200 g of salt per day by grazing saltbush. To excrete salt, it is estimated that sheep require an intake of 30 ml/g and hence may need to make two trips daily to water. This automatically reduces the distance they can forage away from the water source. In saltbush country, it has been shown that sheep tend to remain within three kilometres of water and overgraze the area around the waterhole. The bodyweight gain of Merino lambs declines as the distance between food and water increases beyond 1.6 km.[15]

2.17 The siting of watering points, especially in extensive grazing areas, has obvious implications for sheep welfare. Sheep will lose condition if they are forced to walk too far to water, thus reducing the time available for grazing and curtailing the area available for grazing. In extreme conditions, they will die.

2.18 In most States, financial assistance for water supply work is available, although the terms and conditions vary. In Queensland, for example, farm water supply loans for stock purposes are available from the Water Resources Commission at 13.5 per cent interest, while in New South Wales for farmers of moderate means and dependent on farm income, loans are available from the Water Resources Commission at an interest rate of 4.5 per cent.

2.19 The Committee believes that, following a good season, sheep producers should be encouraged to take advantage of the financial assistance available to upgrade farm water supplies, not only for the future benefit to stock but also as a soil conservation measure.

2.20 Sheep welfare is affected not only by the provision of adequate quantities of water, appropriately located, but by the quality of that water. Water quality is determined by such factors as salinity, mineral content, cleanliness and temperature. Water containing total soluble salts above 15 000 parts per million is considered generally unsuitable for all stock[16] although one witness indicated to the Committee that 17 000 parts per million was an acceptable concentration.[17] Algae-infested water can be lethal to sheep, while muddy water or water polluted by animal manure, pasture residues or miscellaneous objects blown or washed into it is often disliked, especially by weaners, some of whom may refuse to drink it.[18]

2.21 The Committee was interested to learn of one device which is being developed to overcome the problem of water quality in troughs. The "Autotrough" skims off the hot and dirty surface water, separates the pollutants and removes them, and puts the clean water back into the storage tank. Trough water remains at a temperature of approximately 16 degrees. Preliminary research on the effects of using the "Autotrough" has indicated a productivity increase of around ten per cent.[19] It therefore has the potential to serve both welfare and productivity ends. Mr Tony Miller, the inventor of the "Autotrough", pointed to additional possibilities of his device as a means of administering mineral supplements or medications.[20]

2.22 The Committee was encouraged to see that such innovations, which show evidence of both welfare and production benefits, are being developed in the industry. The Committee believes that a positive industry stance towards encouraging and publicising new and improved production methods, techniques and products would assist in defusing the criticisms of some sections of the public.

Protection from predators

2.23 The chief predators of sheep and lambs in Australia are ravens, eagles, dingoes, feral and domesticated dogs, foxes and feral pigs. Losses due to predation are thought to be generally small, however individual flocks in susceptible environments such as urban fringes may experience heavy losses.[21] Dr Crossing, then Director of the Bureau of Animal Welfare in the Victorian Department of Agriculture and Rural Affairs, indicated that in his State, "significant numbers" of sheep were killed annually on hobby farms in outer metropolitan areas.[22]

2.24 In the semi-arid zone, the extent of predation of the sheep flock can generally only be guessed at. One study in New South Wales showed that lamb marking percentages were reduced by 40 per cent because of predation by feral pigs.[23] Over 600 lambs, including healthy lambs up to one week old, were killed and eaten by the pigs.[24]

2.25 The New South Wales Agriculture and Fisheries in one of its advice sheets for farmers recommends that in areas where predation is known to be a problem, producers should all lamb at roughly the same time.[25]

2.26 The traditional method of wild or feral predator prevention has been the electric fence, particularly for lambing paddocks. Attempts at predator control have been via shooting or trapping.[26] As the Committee has yet not sought evidence on the subject of the control of wild or feral animals, it will defer making recommendations until it has obtained such evidence.

2.27 Similarly, on the question of the depredations by companion animals, the Committee has not yet actively sought evidence on appropriate methods of control. The Committee deplores the suffering caused to sheep by domestic dogs. The Committee believes, however, that the solution must come as part of the broader issue of dog control.

Protection from climatic extremes

Heat

2.28 It has been asserted that Merino sheep, which constitute 75 per cent of the Australian flock, are well adapted to the heat and can tolerate most extremes likely in sheep-raising districts by normal physiological adaption.[27] Sheep exposed to heat usually react by seeking shade, but when shade is unavailable or when the sheep have to walk to water, they increase their heat loss by increased blood flow to the skin and by enhanced evaporation by sweating and panting.[28]

2.29 It is likely that sheep are more affected by poor feed quality than by the heat itself, though sheep which are unacclimatised may reduce their feed intake, as will others when the high temperatures come unexpectedly. Reproductive performance of rams is lower in the heat, as is the fertility of ewes.[29]

2.30 New-born lambs in temperatures above 37^{o} have been shown to have a high mortality rate. Shade-seeking by the ewe helps facilitate lamb survival, and shade-seeking is practised by most sheep in hot weather, though some individuals do not seek shade, even when it is available.[30] It may be that these are the more submissive sheep, which elect not to share the shade with others of higher ranking. It seems likely, however, that heat does not unduly stress grown sheep in wool.

2.31 The provision of shade is probably not in itself a crucial sheep welfare issue, but as the provision of shade normally also means the provision of shelter, it has to be of benefit to the sheep, as well as possibly assisting in soil and pasture conservation. The Committee therefore concludes that adequate shade should be provided for sheep in hot weather.

Cold

2.32 Sheep with even a few centimetres of wool are extremely cold-tolerant. However, newly-shorn sheep and new-born lambs do not have the advantage of this insulation and hence suffer from hypothermia when their body cannot produce heat at the same rate at which it is lost. Cold, windy and wet conditions, particularly when they are prolonged or unseasonal, can then cause excessive losses of sheep in the first two to three weeks after shearing.

2.33 The extent of losses of mature newly-shorn sheep from hypothermia was outlined to the Committee by numerous witnesses. ANZFAS described the loss of more than 30,000 such sheep in the western districts of Victoria in November 1987, following severe gales, rain and low temperatures.[31]

2.34 The Australian Bureau of Statistics (ABS) indicated that for the year 1986-87, there was a total of 2,265,925 sheep and lambs lost in New South Wales, out of a total of 52 million sheep and lambs shorn, while in Queensland for the same year, there were 913,861 sheep and lamb losses.[32] These losses are not restricted to sheep which died of cold exposure but include animals which died of illness or were taken by predators.

2.35 Figures for sheep losses occasioned directly or indirectly as a result of cold stress are difficult to obtain. The ABS collects even its non-specific loss statistics only from two States, New South Wales and Queensland. The other States do not bother with such figures in the annual Agricultural Census conducted in March. It may be that they consider such sheep mortality figures unreliable, as does Dr Alexander, President of the Australian Federation for the Welfare of Animals (AFWA), who

pointed out the impossibility of obtaining an accurate assessment of the numbers of sheep which died, particularly on extensive properties. He also suspected that some farmers' returns might be based on tax minimisation motives.[33]

2.36 The contribution of cold exposure losses to overall sheep and lamb losses is generally thought to be considerable.[34] Mrs Townend cited New South Wales Department of Agriculture research which pointed to inclement weather being the principal reason for one million sheep losses annually in the 30 days following shearing.[35]

2.37 Lamb deaths are estimated from the number of ewes mated minus the number of lambs marked. This fails to allow for the number of barren ewes, and is at best a rough estimate of lamb mortality, which is very generally put at an average of 25 per cent for Merinos throughout Australia. Preliminary figures for the percentage of lambs marked to ewes mated for 1988 for all breeds was 81 per cent, ranging from a low of 64 per cent in Queensland to a high of 88 per cent in Victoria.[36] Cold exposure is a major factor in starvation, which has been estimated to account for 58 per cent of lamb losses.[37]

2.38 Much research has been conducted into the efficacy of the various means of reducing sheep and lamb losses from hypothermia. The provision of shelter is generally considered the most important preventative measure, with sheds which provide complete protection being the most effective in eliminating mortality in sheep.[38] Stands of trees, planted mixed windbreaks or shelter belts of tall, unpalatable grasses have all proved useful, if appropriately positioned.

2.39 Sheep do not automatically use available shelter, particularly if they are in wool,[39] and indeed may move away from it, travelling with the wind until stopped by fences. Nevertheless, the provision of shelter brings about proven benefits in survival terms. In one five-year study at Armidale, New South Wales, involving the use of Phalaris grass windbreaks positioned at 20 metre intervals, the survival rate of single fine-woolled Merino lambs was improved by 10 per cent and of multiple births by 32 per cent.[40]

2.40 Dr Foot, a research scientist with the Victorian Department of Agriculture and Rural Affairs, pointed out that the shelter needs of sheep are quite variable and for complete protection, they need to be under something as well as protected from the wind.[41] However, for new-born lambs, winds of ten km/h or more seem to be implicated as a major killer[42] and hence anything which reduces the wind speed will increase the length of time the lamb has to drink, and thus its survival chances will be enhanced.[43]

2.41 To maintain a good ecological balance between cleared and timbered land, as well as to meet the shade and shelter needs of stock and to minimise soil erosion, a minimum of five per cent of tree cover has been recommended.44

2.42 Industry representatives acknowledged that "Providing adequate shelter is good management"[45] and asserted that "Shelter generally is adequate".[46] The Committee is not convinced that this is the case.

2.43 Committee members were heartened by the attitude of Mr Robert Campbell, whose property "Euroka" at Tarago they visited. Since purchasing the property in 1977, Mr Campbell has embarked on an ambitious tree-planting programme, with 10,000 trees, both pines and native species, planted in 1987-88 alone. The results include total sheep and lamb losses of no more than three per per annum.

2.44 Encouragement and financial assistance at all levels is currently being provided to encourage the planting of trees. Since 1982, the National Tree Program (NTP) has established a national infrastructure linking government agencies in all States and Territories and a wide range of non-government organisations, particularly under the auspices of Greening Australia, to promote and undertake tree projects.

2.45 One example of the kind of activity undertaken has been the support to the Victorian Farmers Federation for the employment of a Farm Trees Executive Officer to promote activities in the rural sector. This led to the increase in the numbers of self-help Farm Tree Groups from four to 35 in three years and with it, an expansion of the numbers of effective tree projects.[47]

2.46 In New South Wales, again under the aegis of the NTP, the Riverina Trees on Farms Project is a joint project among the Department of Agriculture, the Forestry Commission, the Soil Conservation Service, community groups and landholders. Over half a million trees are being planted in a five-year period on ten demonstration farms.[48]

2.47 In the Midlands region of Tasmania, where rural tree decline has had a major impact on farm productivity, a Community Employment Program (CEP) project to collect seed from a wide range of local native tree species has been sponsored.[49]

2.48 Encouragement and support for the establishment and care of farm trees is readily available in all parts of the country. The Committee encourages all sheep producers to take advantage of this assistance to ensure that in the coming years, adequate shelter for stock will be provided. The Committee further encourages sheep producers to consider the possible benefits of agroforestry. Evidence from New Zealand points to welfare gains, livestock productivity increases of 20 per cent and increased carrying capacity from the use of permeable perimeter shelter belts and paddock-centre wood lots.[50]

2.49 Shelter sheds, if constructed of new materials, can be a more expensive option than trees or other forms of shelter. However, even the relatively simple two-sided and roofed structures of wood and galvanised iron as are seen on the Monaro offer useful protection and certainly save the lives of many new-born lambs and newly-shorn sheep. The Committee is of the opinion that such shelters should be more widely available than they are in districts subject to extreme cold and wind, and where good tree growth cannot be easily established. For sheep weather alerts broadcast by the Bureau of Meteorology to be of any value to sheep producers, they must have sufficient available shelter for their stock.

2.50 The use of sheep coats as protection against cold and wind is considered by the Committee in Chapter 6. The Committee strongly advocates the use of sheep coats on all sheep after shearing in cold climate sheep producing areas.

2.51 The Committee believes that sheep producers must take all reasonable precautions to ensure that their sheep do not suffer from climatic extremes. Depending on the location of their properties, this may mean the provision of stands of trees, windbreaks, grass shelter belts, sheep coats or sheds. Failure to make such provision will inevitably result in animal suffering and loss. Producers who are not swayed by welfare considerations should at least be won over by the proven productivity gains from the provision of appropriate shelter. The Committee does not believe specific inducements, other than those already available, should be offered to farmers to provide shelter. It hopes that a growing awareness of the value of shelter provision will be sufficient to ensure the necessary action. Should this not be the case, and should sheep continue to suffer and die from the lack of adequate shelter, then sheep producers who permit this to happen ought to be prosecuted under the relevant State prevention of cruelty to animals legislation.

CHAPTER 3

LAMBS, LAMBING AND LAMB MARKING

Introduction

3.1 Preliminary figures from the Australian Bureau of Statistics for the year ended 31 March 1988 indicate that from 60 144 000 ewes mated in Australia, 48 738 000 lambs, or 81 per cent, were marked. Marking percentages for the States ranged from a low of 64 per cent in Queensland to a high of 88 per cent in Victoria. Overall lamb markings were up three per cent on the previous year.[1]

3.2 Approximately 75 per cent of the Australian sheep flock is Merino, and as the Merino is noted for its lower fecundity than British breeds and crossbreds, it is perhaps unrealistic to expect high marking percentages in the States in which the Merino predominates, namely New South Wales, Queensland, South Australia and Western Australia. These States have large areas of what the Australian Bureau of Arigultural and Resource Economics (ABARE) terms the pastoral zone, which is deemed most suitable for wool-producing (particularly Merino) sheep. In the wheat-sheep zone with 44 per cent of Australian sheep and the high rainfall zone, with 33 per cent, dual-purpose sheep or meat-producing sheep are more common, a fact which is reflected in their marking percentages of 75.9 per cent and 83.9 per cent respectively, compared to 62.4 per cent in the pastoral zone.[2]

3.3 Border Leicester crosses are generally credited with the highest lamb output in Australia, with a maximum production from autumn mating of 160 per cent born.[3]

3.4 While marking percentages do vary significantly according to breed of sheep, many other factors more susceptible to good management practice can also influence the lambing outcome. They include the timing of lambing, the condition of the ewe, her mothering ability, the availability of shelter, the presence of predators or pathological conditions and the frequency of multiple births.

Current lambing practices

Timing

3.5 Lambing generally occurs in late winter to spring, or autumn, with spring favoured by many wool-producing enterprises so that late pregnancy and lactation coincides with improving pasture production, and so that the joining takes place when more ewes are in oestrus in autumn. In meat production enterprises, lambing can be scheduled for a specific market at a specific time. Autumn lambing is sometimes favoured in cold districts, to avoid inclement weather, though of course inclement weather is known to occur in all seasons.

3.6 Of itself, the timing of lambing is not a major welfare issue, provided that appropriate care is exercised in terms of nutrition of the ewes in late pregnancy and during lactation, and that shelter and supervision are provided as necessary.

Place

3.7 In most flocks, lambing occurs in the paddock. In the pastoral zone, this will probably be the paddock in which the ewes were mated. Flock size may be several hundred ewes. In high rainfall areas, ewes may be "drifted" through a series of small paddocks daily, with those ewes which have lambed being left behind with their lambs while the others are moved on. In rare instances, ewes may lamb in sheds.

3.8 Departmental extension services recommend that lambing paddocks contain the following: an adequate quantity of high quality pasture for the duration of lambing; good water so that ewes will not have to walk too far to it; and shelter. They further recommend that they should be free of predators, provide access for supervision and be of a sufficient size to prevent the lamb stealing or mismothering which can occur at high stocking densities.[4]

Timing of lambing in relation to shearing

3.9 Lambing may take place some months after shearing, just after shearing or before shearing. The Committee received evidence supporting the practice of pre-lambing shearing on the grounds that a ewe deprived of her coat will seek shelter in adverse climatic conditions and is thus more likely to lamb in shelter, improving the survival chances of the lamb(s). Further, a shorn ewe is less likely to get cast when she goes down to lamb.[5]

3.10 However, it was pointed out to the Committee that shelter-seeking by the ewe is most pronounced if she is shorn four days before lambing,[6] a practice which would cause certain stress to the ewe and heighten her chances of developing pregnancy toxaemia. Also a flock of ewes generally lambs over a four-to-six week period, so in management terms it would be difficult to organise shearing at an appropriate time for each ewe. The additional nutritional needs of a shorn, pregnant ewe (up to half as much feed again as her woolly sister)[7] may make pre-lambing shearing inadvisable if the required feed is unavailable.

3.11 Other management considerations, such as the presence of grass seeds at certain times of the year, may dictate the timing of shearing. As Mrs Townend pointed out, both pre-lambing and post-lambing shearing have certain welfare risks, which need to be weighed up by the individual producer.[8]

The extent of supervision

3.12 Australian sheep, with the exception of some stud animals, are generally expected to lamb unaided. There is evidence that producers are encouraged in their sheep breeding policies to select for traits which make for "easy care" sheep, such as easy lambing and good mothering skills.

3.13 The question of the desirable degree of supervision was one point on which producers and others were at variance. The former case was put by Mr Alan Bowman, representing the Wool Council of Australia, who considered "sheep do better if they are left alone" with the qualification, "providing that surveillance is sufficient to obviate the obvious cases of dystocia ...".[9]

3.14 However, ANZFAS cited instances of inadequate supervision, resulting in the death of hundreds of in-lamb ewes, and concluded that it was "vital that sheep be more closely inspected and shepherded, especially during the lambing season".[10] Dr Brennan, Technical Adviser to the RSPCA (Australia), pointed out that if sheep were more regularly supervised, the stress problems associated with inspection at lambing would be less likely to occur. He also advocated lambing in smaller spaces, and pointed to the success of the British method of lambing in sheds.[11]

3.15 Many witnesses depicted the plight of sheep in the semi-arid zones, for lack of supervision. Mr Miller, an agricultural consultant, described these sheep as "semi-feral".[12] Mrs Townend wrote:

> one of the most serious and basic flaws ... in the sheep industry, is failure to provide adequate labour input ... many Australian sheep are relegated to huge outback areas where, when they are injured, have troubles lambing, become fly-struck, are mauled by predators, there is no-body on hand to protect

> them from injury or death. Irregular inspections, varying from days to weeks (depending on the intensity of the production), mean that between inspections, sick or injured animals are left to suffer or die.[13]

3.16 The degree of supervision provided sheep at lambing depends at least partly on the size of the property and on the inclinations of the producer. One-third of all sheep-raising properties run less than 500 sheep,[14] while the median flock size in Victoria is 700 head.[15] Such numbers would not be beyond the capabilities of one person to shepherd adequately for the welfare of the sheep.

3.17 On the other hand, two-thirds of Australia's sheep are raised on properties with 2000 or more sheep. While it is virtually impossible to ascertain from the available manpower statistics the numbers of persons involved in tending these animals, it seems likely that in some instances at least, Mrs Townend's estimate of one labourer per 2000 sheep is not inaccurate.[16] More intensive supervision may be available at lambing time, but there is little evidence to suggest that it always is, and particularly not in extensive husbandry situations.

3.18 The RSPCA (Australia) recommended the training and subsidisation by the Commonwealth Employment Service of shepherds to assist producers during periods of peak labour demand, such as lambing time.[17] The Committee is not convinced that this would be a helpful initiative. It is not the responsibility of governments to assist primary producers in matters which are an essential and routine part of the production process. Nor is the Committee convinced that the temporary assistance proffered by raw and perhaps involuntary recruits would be of any real benefit to the sheep.

Lamb losses

The extent of lamb losses

3.19 As indicated in chapter 2, the precise extent of lamb losses from conception to marking is difficult to determine. The figures which are officially available through the Australian Bureau of Statistics are calculated on the basis of producer information supplied on returns to the annual March agricultural census. Lamb deaths are generally inferred by subtracting the figure for the number of lambs marked from the number of ewes mated. This practice fails to allow for the number of barren ewes, and it obscures the number of lamb losses in multiple births. At best, the resultant figures are a rough indication of the level of loss.

3.20 Preliminary figures for the percentage of lambs marked to ewes mated for 1987-88 for all breeds was 81 per cent, up 3 per cent on the previous year. The range was 64 per cent for Queensland to 88 per cent for Victoria.[18]

3.21 In evidence received by the Committee, lamb losses before marking were estimated at 20 per cent;[19] 20 per cent for singles and 40 per cent for twins;[20] 20 per cent,[21] with instances of losses rising to 80 per cent under extreme conditions. Lamb mortality records from research cited by Dr Bell ranged from a low of 10.7 per cent to a high of 58 per cent. Significantly more deaths occurred of twins; at high stocking rates; amongst lambs of maiden ewes; and amongst lambs born earlier in the season.[22]

Factors impeding lamb survival

3.22 Perinatal lamb mortality may occur through starvation, mismothering, exposure to adverse climatic conditions, difficult birth, low birth weight, predators, infection or exposure to

other pathological conditions. In its submission to the Committee, ANZFAS cited research which indicated that behavioural and physiological factors accounted for most of the lamb mortality.[23]

3.23 Starvation may come about because the ewe is in poor condition or lacks mothering ability; because the lamb is too small or weak, has become separated from its mother, has suffered a birth injury or lacks suckling drive; or because of extremes of climate which prevent the lamb from suckling, or suckling enough.

3.24 The nutrition of the ewe during pregnancy was singled out by many witnesses as the most important factor affecting lamb survival.[24] Information on the appropriate nutrition of ewes at joining and during pregnancy is readily available from State departments of agriculture and other extension services.[25] If the ewe is not provided with increased feed in the latter stages of pregnancy, the result will be a lamb of low birth weight and a poor maternal milk supply, both of which will endanger the life of the lamb. In the last six weeks before lambing, the ewe needs ample feed to cater for the increased foetal growth and to guard against pregnancy toxaemia and chronic hypoglycaemia.

3.25 Nutrition falls within the sphere of influence of the sheep producer and the Committee is firmly of the view that no ewes should be mated if the producer cannot guarantee adequate nutrition for those animals for the ensuing nine months of pregnancy and lactation. If natural pastures become inadequate, additional feeding must be provided and any failure to do so should be regarded as gross negligence on the part of the producer.

3.26 The mothering ability of ewes is less amenable to improvement by the sheep producer, although there is evidence to suggest that maiden ewes can learn from older sheep if they are allowed to lamb together. Selective breeding programmes can be undertaken to ensure that ewes which consistently manage to rear lambs are retained in the flock.[26]

3.27 The provision of shelter is, after adequate nutrition and selection for mothering skills, one of the most positive and practical steps producers can take to improve lamb survival rates. Research into the value of various types of windbreaks has shown that in the northern tablelands of New South Wales, strips of Phalaris grass positioned at 20 metre intervals improved the survival rate of Merino lambs by up to 32 per cent.[27]

3.28 The timing of lambing is another management issue which should be considered as a factor in improving lamb survival rates. According to Professor Kennedy, avoiding summer lambing in the hot, semi-arid conditions of far western New South Wales was "the most obvious thing to do to improve lamb survival rates".[28] Research in Hamilton, Victoria, showed that in cooler climates, early lambing in September produced greater losses than an October lambing, with 14.7 per cent and 9.2 per cent respectively for single lambs and 40.2 per cent and 19.2 per cent for twins.[29]

Is there an acceptable level of lamb losses?

3.29 In no species is perinatal loss unknown. Determining an acceptable level of such loss for sheep is a difficult issue, however, as so many factors are implicated. Guidelines issued by the New South Wales Agriculture and Fisheries suggest that if more than 20 per cent of maiden ewes or 15 per cent of mature ewes have lost their lambs by marking, then a lamb loss problem exists.[30]

3.30 Under extensive conditions, Professor Kennedy spoke of achieving lamb mortality rates as low as 12 per cent, and doubted whether in semi-arid zones, any improvement on that figure could be achieved as certain factors affecting lamb mortality were out of management's control.[31]

Reduction of lamb losses

3.31 The Committee accepts that most sheep producers are concerned about their lambing rates. However, if New South Wales averages 81 per cent of lambs marked, it is already outside the State departmental guidelines indicated above. The Committee **recommends** that the industry, together with the State departments of agriculture, develop lamb loss parameters for the common breeds in each district as a minimum target at which producers should aim.

3.32 The Committee further **recommends** that research continue into the comparative efficacy of the various forms of shelter on a regional basis and that the results be promptly disseminated through all appropriate media outlets.

3.33 The survival rate of twin lambs or multiple births is considerably inferior to that of single births.[32] The Committee received anecdotal evidence to the effect that the costs of using ultrasound imaging on pregnant ewes could be easily outweighed by the benefits of being able to distinguish sufficiently early the ewes bearing more than one lamb, and then to draft them off for special nutrition and attention. The Committee **recommends** that more research into the cost-benefits of using ultrasound imaging on ewes in early pregnancy be conducted.

3.34 Considering the level of lamb losses, the Committee was concerned to learn of the development and marketing of fecundity-enhancing products. It fears that these products could be used indescriminately to mask the real level of lamb deaths by increasing overall births, thus obscuring the number of unviable births.

3.35 In defence of the vaccine Fecundin, developed by the CSIRO Division of Animal Production, Dr Scott, then Chief of the Division, pointed out that users of Fecundin were advised of the

additional nutritional and other management requirements of ewes being treated with the vaccine, and further, that the vaccine was primarily intended for use in Border Leicester-Merino crosses which have a superior mothering ability.[33]

3.36 The Committee **recommends** that research be continued into the mothering ability of Merino ewes in particular, so that multiple birth lambs, whether the result of fecundity treatment or not, may enjoy a better chance of survival. The Committee further **recommends** that funding for the development and improvement of existing fecundity vaccines be tied to a requirement also to investigate methods of enhancing lamb survival.

Lamb marking

3.37 The term "lamb marking" comprises the earmarking of lambs for identification of ownership, the removal of part of the tail (also termed "docking"), and the castration of ram lambs. Mulesing is frequently performed at the same time, but for the purposes of this report it will be chiefly discussed in Chapter 4, as a means of flystrike control. An associated procedure is vaccination against a number of diseases, including tetanus, pulpy kidney, blackleg, malignant oedema, scabby mouth and cheesy gland.

3.38 The marking operations are generally carried out at the end of the lambing period, when the lambs are from one to eight weeks of age. The lambs are held by hand or more commonly in cradles for the procedures, which may take place in temporary yards erected for the purpose in the lambing paddock, or in other permanent yards.

Earmarking

3.39 All sheep older than six months, other than registered stud sheep, are required to have an earmark which is registered with the Pastures Protection Board in New South Wales. Other States similarly require unique earmarks as proof of ownership. Earmarks further indicate the sex of the animal, with ewes being marked in the right ear and rams in the left.

3.40 Traditionally, the earmarks have been produced by metal clippers. Sometimes coloured ear tags as indicators of age are attached at the same time. The procedure, while not painless, causes a brief reaction from the lamb but not an acute behavioural response to the pain, according to Dr Alexander.[34]

3.41 Alternatives include tattooing of numbers, letters or symbols on the ear, using needles and tattooing ink. This practice is sometimes demanded of stud sheep by the bre societies. It takes longer than clipping an earmark and is difficult to read, as wax and dirt can build up in the ta but in welfare terms, is not considered to differ significa from ear clipping.[35]

3.42 The electronic identification of sheep is now possible via the implanting of a small device in the sheep's ear. Scanners enable individual sheep to be identified, as well as providing ownership information. The positioning of the electronic implants requires a very minor surgical procedure.[36] The major disadvantages of electronic eartags are their expense, and the fact that they can be easily removed. The implant procedure is unlikely to cause the lamb any more problems than a clip or a tattoo, and has distinct welfare benefits. It can reduce handling, electronic drafting becomes a possibility, and individuals can be recognised.

3.43 Some form of sheep identification is desirable to discourage stock theft and to facilitate breeding and treatment programmes. For the benefits which may accrue from the latter, the Committee believes the temporary inconvenience of all present forms of earmarking is worthwhile.

Tail docking

3.44 Lamb tails, if left intact, promote the collection of faeces, and in the case of the female, urine. Apart from the discomfort this causes the animal, it also increases the likelihood of skin eczema, infections in the genital area and breech strike.[37]

3.45 In the interests of hygiene, therefore, most lambs' tails are shortened at marking time. Exceptions are lambs destined for export to the Middle East. The recommended length is just to cover the tip of the vulva in the ewe lamb, and an equivalent length in the ram lamb. A shorter length is not recommended, as it can result in sunburn or cancer of the vulva.[38]

3.46 Some breeds, such as Dorsets, have their tails docked very short as a requirement of breeding associations. ANZFAS condemned this practice, describing it as "a mutilation done merely to please the aesthetic senses of humans".[39] Mr Binns, President of the Association of Stud Sheep Breeders of Australia and himself a Dorset breeder, agreed that the practice was undesirable.[40] The Committee **recommends** that no sheep have its tail completely removed.

3.47 There are three commonly used methods of tail docking - rubber rings, a knife or searing with a hot (generally gas heated) knife. Each causes pain, as measured by cortisol levels and observed from behavioural indices, and results in a temporary setback in growth rate.[41] Each has its own particular drawback.

3.48 Elastrator rings result in a wound which is slower to heal, with one study showing a mean healing time of 36 days, compared with 21.5 for the knife.[42] Some lambs remain unhealed 43 days after the procedure.[43] Because of the slower healing process, the wound is more likely to attract flies for a longer period.[44] The initial response of lambs to rubber rings was described by Shutt et al. as "characterised by very agitated behaviour indicative of considerable distress for a period of up to one hour".[45]

3.49 The hot knife, by cauterising the blood vessels of the tail, reduces the shock caused by blood loss and lambs appear to suffer less pain.[46] The moist wound, however, is slower to heal than a knife wound and is susceptible to fly strike unless an insecticide is used. When marking is combined with mulesing, the hot knife has an advantage for both lamb and operator in reducing the blood flow.

3.50 Tail docking with a knife causes bleeding which can be severe in older lambs.[47] The comparison of tail docking methods by Shutt and colleagues showed that lambs tail docked with a knife were initially somewhat subdued but their behaviour returned to normal after they were re-united with their mothers. Plasma cortisol levels were raised significantly higher than in those lambs docked with the rings after 15 minutes and remained so after 24 hours.[48]

3.51 On the day following the operation, Shutt and colleagues observed that all lambs, regardless of the method of tail docking which had been performed on them, were behaving normally and showed no awkwardness of gait or stance. Previous research by Wohlt and colleagues found no sustained effects in terms of bodyweight gain between lambs docked by rings or the knife.[49]

3.52 The Committee concluded that on the basis of the evidence presented to it, tail docking is a helpful management procedure and that there may be a case for concluding that docking with a knife causes less distress than with rubber rings. However, all of the above methods of docking are acceptable, provided the equipment is sterile, the operators skilled, and the lambs are not separated from their mothers for too lengthy a period.

Castration

3.53 Castration is the removal of the testicles of the male animal. It is performed on most ram lambs as part of the marking process for a variety of reasons, some of them welfare-related. Rams run together are notorious for their fighting and sodomising, and weaker or smaller animals run the risk of being deprived of feed, water or shelter, whereas castrated males (wethers) are easier to manage and create fewer welfare problems amongst themselves.[50] Another reason advanced for castrating ram lambs, particularly in an extensive environment, is that some reach sexual maturity as young as four months of age and can then cause unwanted, untimely and even dangerous pregnancies in their mothers and sisters. A third argument in favour of castration is that there is buyer resistance to the supposed "taint" of ram meat. Under the Federal Pastoral Industry Award, the cost of shearing doubles for rams,[51] and there are other labour disincentives for leaving the males entire, such as differential slaughter fees.[52]

3.54 The early castration of ram lambs stops the development of secondary sexual characteristics, including horn growth. Fighting and injury from horns are therefore reduced in wethers.

3.55 The two common methods of castrating ram lambs are by using a knife or rubber rings. A third method, crushing the testicles with a Burdizzo emasculator, is less reliable and is now infrequently used.[53] Special marking knives enable the

operator to slit or remove the bottom portion of the scrotum then hook or clamp the testicles in turn and pull them out. Elastrator rings, on the other hand, are slipped over the scrotum using special pliers. The ring restricts the flow of blood to the testicles and scrotum, causing the tissue below the ring to die and drop off in about three weeks.[54]

3.56 Castration is obviously a stressful procedure for the lamb, particularly when combined with other marking procedures. ANZFAS even considered it should only be performed under anaesthetic.[55] A recent study by Mellor and Murray, comparing tail docking alone with tail docking plus castration (in both instances using rubber rings) showed that 30 minutes after the procedure, lambs which had undergone both tail docking and castration had mean plasma cortisol levels of 42.7 ng/ml compared with 17.3 ng/ml for those which had only been tail docked. A return to pre-treatment values took three and two hours, respectively.

3.57 Shutt and colleagues from New South Wales Agriculture and Fisheries compared the stress responses of three-to-six weeks old lambs to docking and castration by the knife or by rubber rings. When both procedures were performed using rings, the lambs exhibited abnormal behaviour for an hour, including "bleating, looking around, stamping, shaking hind limbs and tail, and running back and forth in an increasingly frantic fashion ... rolling about ... straining their heads towards their hindquarters and emitting deep-pitched bleats". Their plasma cortisol levels were slightly raised, reaching 128 nmol/l after 15 minutes but dropping back to 99 nmol/l after 24 hours; and in comparison with control lambs, no significant increases in plasma immunoreactive beta-endorphins were measured. The lambs on which both procedures were performed surgically huddled together and some lay down briefly, and after an hour their behaviour was quite normal, although "movement was slightly restricted". Significant increases occurred in both plasma immunoreactive

beta-endorphin and cortisol concentrations, which the researchers attributed to the tissue damage from the surgery and the loss of blood. Cortisol levels reached 171 nmol/l after 15 minutes and remained at 165 nmol/l after 24 hours; while beta-endorphin levels reached 276 pg/ml after 15 minutes compared with 64 pg/ml for the control lambs.[56] It was suggested that the release of endorphins post-surgery may afford a degree of analgesia and reduce pain for a short time after the operation. This would be consistent with the lack of immediate behavioural response from the surgically-treated lambs and was consistent with the behaviour of the lambs viewed by Committee members after marking and mulesing at "Euroka".

3.58 A key finding of Shutt and colleagues was that on the day after the operations, normal behaviour was observed in all lambs. The research also detected no long-term effect on bodyweight, a finding consistent with previous work.[57]

3.59 The consensus of opinion seems to be pointing to surgical marking, rather than the use of rings. The Committee is not convinced that the difference in stress levels between the two methods is of such magnitude that one method should be preferred to the other. The Committee noted the comments by Dr Barton, President of the Australian Veterinary Association, that inexperienced operators should be encouraged to use rings, as they are easier to manage.[58] Realistically, most marking will continue to be performed by owner/operators and the method of marking with which they feel most competent is also likely to be the one which is best for their sheep.

3.60 The Committee concludes that, although obviously unpleasant for the lamb, tail docking is a necessary procedure and one which should take place on lambs early so as to minimise the suffering and to facilitate swift healing. Castration, on the other hand, was viewed by the Committee as more a management tool than an operation primarily for the welfare of the sheep. On

balance, the Committee conceded that the removal of the aggressive and reproductive tendencies of male sheep was desirable in many instances and, at present, that involves castration.

3.61 The Committee was less convinced, however, that castration needs to be performed as often as it is. Ram lambs reared for the meat trade grow faster and leaner if left entire and there is little difference in palatability between them and wethers until they reach at least 12 months of age.[59] It was suggested to the Committee that frequently, castrated lambs are then injected with the male hormone, testosterone, to ensure they grow more like rams.[60] The irony of such a practice was noted by the Committee. It accepts that it is difficult to ensure that ram lambs reach a marketable weight and that a market can be found for them before they reach sexual maturity and become behaviour problems. However, it does not accept that the answer is always castration. Far more could and should be done to break down the prejudices and financial disincentives against ram lambs in the saleyards.

3.62 A promising development which may lessen the stress associated with castration is the vaccine being investigated by CSIRO Division of Animal Production. It is designed to make male animals temporarily sterile by immunising them against one of their own hormones, and has the effect of moderating their aggression while still allowing them to grow large and lean.[61] Immunocastration received a cautious response from witnesses who appeared before the Committee, however. Dr Denholm, of the Victorian Department of Agriculture and Rural Affairs, applauded the concept of a single injection replacing surgery, but pointed out that problems such as the potential to produce auto-immune diseases can be associated with immunocastration.[62] Professor Egan of Melbourne University considered that the vaccine as yet was not completely reliable and that work remained to be done on the injection sequence to ensure that the right animal got the right dose at the right time.[63]

3.63 The Committee recommends continued research into immunocastration. If the vaccine can be shown to be 100 per cent effective and without side-effects, it should be widely promoted on welfare grounds.

3.64 Cryptorchidism was suggested to the Committee as an alternative to castration. This is induced by pushing the ram lamb's testes back into the body cavity and applying a rubber ring to cause the scrotum to atrophy. However, according to New South Wales Agriculture and Fisheries, some testes grow subcutaneously and remain fertile, so the practice is not necessarily efficient.[64]

General marking welfare issues

3.65 The age at which lambs are marked was of concern to the Committee. If mating is spread over a two-month period and lambs are all mustered and marked together, some will be marked at a very tender age while others will be old enough to suffer excessively from bleeding and their wounds will take longer to heal. Where for manpower reasons, mustering for marking can only take place once, the joining period should be restricted to six weeks so that the disparity in the ages of the lambs is not too great. Alternatively, ram harnesses should be used at mating so that the ewes can be separated into groups according to when they are due to lamb and marking can take place more often in smaller groups when the lambs are of an appropriate age, preferably six weeks or younger.

3.66 The Committee does not accept that multiple marking periods are only feasible on small, intensively managed properties, as Dr Osborne of the Australian Veterinary Association suggested.[65] In extensive environments, the producer is under the same obligations to care for his animals, hence should reduce his joining period or create smaller lambing paddocks so that lambs can be marked at a suitable time for them.

3.67 It was suggested to the Committee that, should marking be delayed beyond the age of 12 weeks, the procedure should not be attempted without the use of an anaesthetic.[66] ANZFAS, however, argued that "putting precise ages on when an operation does or does not require an anaesthetic seems very arbitrary" and based on custom and/or convenience rather than welfare grounds. It suggested, as a preferred principle, that operations "should always be performed at the earliest time physiologically possible".[67]

3.68 The Committee concludes that lamb marking should take place at as young an age as possible. The Committee further concludes that marking of older animals be avoided if at all possible, and where it becomes necessary, it should be performed under anaesthetic by a veterinarian.

3.69 It seems unlikely that the pain induced in young lambs by marking is sufficiently acute or prolonged to warrant the use of analgesic drugs for pain control. Consideration should perhaps be given to using analgesics in situations where the presumption of considerable post-operative pain exists, for example following the marking of an older animal. Practical knowledge of appropriate analgesic drugs for sheep, dose levels, routes of administration and frequency of administration in sheep is almost non-existent, however.[68] While accepting that analgesics can have disadvantages, such as the propensity to mask early indicators of post-operative complications, the Committee believes the potential of analgesics to benefit sheep has not been explored. The Committee therefore concludes that research into the post-operative use of analgesics in sheep would be desirable.

Lamb losses after marking

3.70 Lamb losses during or after marking appear not to be a problem of similar proportions to losses between birth and

marking, but they do occur. Mr Boultbee of the Pastoralists and Graziers Association of Western Australia stressed that most stockmen pride themselves on getting their lamb marking done with few to no mortalities.[69]

3.71 Starvation from mismothering can occur, particularly in lambs less than a week old. Management techniques recommended to reduce the incidence of this include marking in temporary yards in the paddock so that the lambs do not have to travel far; avoiding marking in bad weather; avoiding a prolonged marking period; and shepherding for a sufficient time afterwards to ensure that lambs mother up before nightfall.

3.72 Poor marking can result in lamb losses from shock or haemorrhage, while infection from dirty yards or unsterile instruments may also cause losses. All ewes should be vaccinated with a multi-purpose vaccine before lambing to ensure 6 weeks' protection for their lambs against tetanus and other wound infections. Marking should be timed so that marking wounds are healed before there is any danger of their becoming flystruck.

3.73 The New South Wales Agriculture and Fisheries has stated that "losses after marking greater than 3 per cent are unacceptable".[70] The Committee considers that this is a minimum standard and that every effort should be made to ensure that no losses occur after marking.

CHAPTER 4

THE SHEEP BLOWFLY AND ITS CONTROL

Introduction

4.1 All external parasites, including flies, keds, lice and itchmite, present major problems for sheep welfare. However, most witnesses who appeared before the Committee singled out blowfly strike as the most important problem confronting the wool and sheepmeat industries in Australia today, in both economic and welfare terms.[1] For the sheep, blowfly strike means the extreme discomfort of maggots eating away at its skin and flesh; a rising temperature, pulse and respiratory rate; a disinclination to feed; and if death does not occur, the stresses of handling, crutching and jetting associated with treatment.[2] For the sheep producer, blowfly strike has been calculated to cost $1.05 (at 1985 prices) per sheep in an average season, or an average of approximately $2 300 per farm.[3] In a high-risk year, this can rise to $3 500. The cost to Australia in a normal year was estimated at one million dollars in 1980. These costs are derived from reduced wool growth or wool loss from the struck region, reduced bodyweight, impaired fertility, deaths and treatment.[4]

4.2 Funding for research into methods of control from the Australian Wool Corporation alone amounted to $1 424 970 in the present financial year, reflecting the seriousness with which the Corporation views blowfly strike.[5] Nineteen research projects are supported, including work into the development of vaccines, improved insecticide application, alternatives to mulesing and genetic control of blowfly populations.[6] The Australian Meat and Livestock Research and Development Corporation similarly supports research into the prevention of blowfly strike and control of the sheep blowfly.

4.3 In this chapter, the Committee will consider the flies responsible for primary and other strikes, and their epidemiology, along with the factors which predispose sheep to flystrike and how flystrike affects sheep. It will then consider prevention and control measures, including chemicals, biological control and management strategies such as mulesing.

Sheep blowflies

4.4 Nineteen species of fly are known to be involved in flystrike in Australia.[7] One, *Lucilia cuprina*, initiates up to 90 per cent of all strikes, while *L. sericata* and the native flies *Calliphora stygia*, *C. augur* and *C. nociva* may also act as primary strike flies. Other flies can invade and extend the wound area created by the primary strike fly. Given the predominance of *L. cuprina* in initiating strikes, the Committee will particularly consider this fly and its control.

4.5 It is thought that *L. cuprina* was introduced into Australia in the late nineteenth century, probably from South Africa or India, and probably on struck sheep.[8] Cutaneous myiasis, or the invasion of sheep skin by fly larvae (flystrike), was recognised as a problem in 1901-02.[9] Blowfly strike occurs most commonly in the breech area of the sheep, although other parts of the animal may also be affected ("body strike"). Strikes around the poll, the pizzle, or in wounds also occur.

The life cycle of *L. cuprina*

4.6 *L. Cuprina*, a small, metallic green fly, breeds almost entirely on the living sheep. The female fly is attracted to a moist liquid protein environment, such as that provided by faeces, urine-saturated breeches, fleece rot, dermatophilosis or wounds, and there she lays her eggs, depositing them in batches of 50-250. During her two-to-three week life, she can lay up to three batches of eggs, if conditions are suitable.

4.7 The eggs hatch in as little as eight hours in hot humid weather, but take up to three days when the temperature drops to 15°C. When protein, warmth and humidity are present, the larvae (maggots) pass through three stages of development, called instars, becoming fully developed in four to six days. At the second and third instar stages, they can break the sheep's skin to feed on exudate.

4.8 The mature third instar drops to the ground, usually at night, to pupate at an average depth of 1.5 cm in the soil. Pupation may take only one to three days in summer, but when soil temperatures drop below about 10°C, development is halted and the fly overwinters in the prepupal stage.

4.9 Development recommences when the soil temperature rises, although high pupal mortality is recorded in midsummer when soil temperature becomes too high. Summer rains increase the survival rate of larvae and pupae, and also predispose sheep to fleecerot and dermatophilosis, making them attractive to flies. Females can mate and produce eggs within a week of emerging from the soil.

4.10 Flies have been recorded as travelling 7.5 km within 47 hours,[10] though the majority are thought to remain within two kilometres of where they emerge from the soil.

Susceptibility of sheep to blowfly strike

4.11 Sheep become attractive to flies for a variety of reasons, all related to the presence of moisture. This may be in the form of rain, urine, wound exudate, diarrhoea or skin inflammation. If the moistened part is conducive to the retention of moisture (for example a wrinkly breech), the likelihood of strike is increased, provided that the temperature is also suitable.[11]

4.12 Merino sheep are the breed most susceptible to flystrike, while plain open-fleeced British breeds are least affected. The dense, compact Merino fleece deflects light rain but persistent heavy rain reaches the skin and the fleece takes a long time to dry out.[12]

Breech strike

4.13 Breech strike involves the perineum, the tail and surrounding areas, and is the most common form of blowfly strike, particularly in ewes.[13] The breech region of ewes is regularly made wet with urine. Ewes with a wrinkly rear end conformation, or ewes which have not been mulesed or crutched, are particularly susceptible to breech soiling, especially if they are carrying more than six months' wool. A soiled breech in turn attracts primary strike flies.

4.14 Worm infestations have been shown to cause diarrhoea, which is in turn associated with breech strike. Research by Morley and colleagues has shown that if worm infestations are controlled, the incidence of breech strike in weaner sheep can be reduced by 90 per cent.[14]

4.15 Diarrhoea may also be induced by grazing sheep on lush pastures, by changing feed, by bacterial infection and by other causes. Any management practices which reduce the incidence of diarrhoea also lessen the predisposition of the sheep to breech strike.

Body strike

4.16 Body strike refers to blowfly strike on all parts of the sheep except the breech, pizzle and head. Bacterial infections of the skin, such as fleece rot and dermatophilosis, associated with prolonged wetting from persistent summer rain, high humidity, or long wet grass, are the major predisposing conditions for body strike.

Other strikes

4.17 Poll strike, or strike around the horns, is generally confined to rams. It results from moisture trapped beneath the horns and the accumulation of skin secretions in the area.[15] In wethers and rams, pizzle strike occurs when the long hair around the preputial opening becomes soiled with urine. Sheath rot is also a predisposing condition. Any infected wound on a sheep is susceptible to flystrike, and these may include shearing cuts, footrot sites, scabby mouth or conjunctivitis.

Effects of blowfly strike on the sheep

4.18 Blowfly strike is a disease process which is accompanied by inflammation and often by systemic changes. Crutch strike, while the most common strike, is not necessarily the most severe, as body strike is not so readily detected and tends to be further advanced when it is noticed.[16]

4.19 Little evidence of disturbance is noted during the first two days after the female fly has laid her eggs, except for tail-twitching, feet-stamping and attempts to bite the affected part by the sheep. However, once the second and third instars burrow into the flesh and extend the wound, the infected sheep reduces its feed intake, its rectal temperature rises to about 41°C, its pulse and respiratory rates increase and it loses weight rapidly.[17] Broadmeadow and colleagues considered that these changes were consistent with severe toxaemia, due either to toxins produced by the larvae or by bacteria proliferating on the wound site.[18]

4.20 Many sheep die from the effects of strike. In high-risk years, an extension officer survey showed this to be, on average, 3.2 per cent of the flock,[19] while during a flywave in the Charleville and Quilpie districts in early 1974, mortalities in excess of 35 per cent in ewes and 45 per cent in wethers were recorded.

4.21 The rapid decline in food intake was demonstrated by Heath and colleagues, who subjected sheep to a single, artificially-induced flystrike. The sheep lost up to 5.5 kg over four to six days and took up to 36 days to regain their original bodyweight.[20]

4.22 Wool production has also been shown to be reduced by blowfly strike by up to 26 per cent, and this is thought to be stress-related.[21]

4.23 The common method of treating flystruck sheep is by cutting the wool away from the affected area and applying a larvicidal dressing,[22] a procedure which, when combined with the stresses of being rounded up and caught, makes for a most unpleasant and painful episode for the sheep and one which may need to be frequently repeated.

4.24 Sheep may recover without treatment, with the maggots dropping off and a scab forming over the wound. Some of the fleece may be shed from around the wound. The incidence of "covert" strikes, that is, those which go undetected by the sheep producer, have been shown to be up to 14 times more frequent than the "overt" or conspicuous strikes.[23] In one study, 72 per cent of properties were found to have covert strikes, some of which remained active for more than two months. The Committee concluded that, in all probability, a great many more sheep suffer from flystrike than are ever treated for it, and while they may recover, their welfare in the process has been seriously jeopardised.

Prevention and control of flystrike

4.25 Broadly speaking, the flystrike problem can be addressed in two ways: by reducing the fly population; or by rendering the sheep less susceptible to its attacks. Frequently both methods

are used in combination, as on present evidence, it seems unlikely that either, alone, will be the ultimate solution.

4.26 Fly densities may be reduced by trapping, by biological control methods, or by genetic control, either using the sterile male technique or by introducing lethal genes. Sheep susceptibility to flystrike may be reduced by selective breeding programmes, by mulesing, by crutching, by pizzle dropping, by the use of chemicals or by vaccination, or by combinations of these methods.

Fly trapping

4.27 Trapping or baiting of flies has frequently been tried as a method of reducing the fly population. University of New South Wales researchers at the Fowlers Gap Arid Zone Research Station have used a variety of traps to identify where flies congregate, and to bait selectively in those places.[24] Combined with mulesing and chemical control, the approach has resulted in low blowfly strike rates compared with neighbouring properties. Professor Kennedy assessed the results so far as "promising".[25]

4.28 Trapping has been used as part of an early warning system for the timing of insecticide application in Western Australia. By using traps, officers of the Department of Agriculture have been able to ascertain when sufficient flies are present to sustain a strike. This information, combined with data on wind speed, temperature, and sheep susceptibility, provide the basis for a predictability model for "flystrike alerts".[26]

4.29 Trapping per se would seem to be of limited effect in reducing the fly population, but it may have a place in combined strategies as outlined above.

Biological control

4.30 A natural enemy for *L. cuprina* has not yet been found. Some initial work by Cooper and colleagues has shown that the microsporidian pathogen, *Octosporea muscaedomesticae*, may have a role in suppressing field populations of *L. cuprina*. Bacterial pathogens, principally *Bacillus thuringiensis*, have been used as larvicides as a preventative measure, with some success.[27]

Genetic control

4.31 Genetic control involves the transfer of deleterious genetic material from released flies to wild flies by mating. The material in question can be either inherited, in the case of genetically altered strains, or induced each generation by chemical or radiation treatment.[28]

4.32 Research into the use of genetic control methods has been underway in Australia since the late 1960s. It was clearly inspired by the success of the sterile male technique in eradicating the screw-worm fly from the southern States of the USA.[29]

4.33 The classic sterile insect release method (SIRM) involves the release of irradiated flies whose progeny all carry dominant lethal mutations. This does not produce a persisting genetic load to reduce the fly population, however, and repeated releases are required to achieve low fly densities. The vastness of the sheep-raising areas of Australia and the costs of breeding, rearing, irradiating and releasing the flies have made this method of genetic control biologically feasible but economically and logistically unsuitable.[30]

4.34 The CSIRO Division of Entomology is currently producing blowflies which carry chromosomal defects such as compound chromosomes and sex-linked eye colour mutations, which cause blindness and sterility in subsequent generations. Field trials

have shown the sex-linked translocation strains are competitive with wild blowflies and can lead to 90 per cent genetic deaths by reducing the fitness of the wild *L. cuprina* population.[31]

4.35 Trials to investigate the feasibility of this technique over a broad area have been conducted in the Shoalhaven district of New South Wales, on Flinders Island and currently on all the Furneaux group of islands in Bass Strait. In the Furneaux experiment, researchers will endeavour to suppress the native fly population on the islands by releasing sex-linked translocation males, and when the population reaches a manageable level, fully sterile males will be introduced in an attempt to eradicate the fly population.[32] The cost-benefits of this form of blowfly control will also be examined in detail in this latest study.

4.36 The limitations of genetic control methods were outlined by Dr Mahon, Senior Research Scientist with the CSIRO Division of Entomology:

> while eradication is considered a viable option in the Furneaux group, and perhaps even in Tasmania, the absence of comparable barriers to immigration on the mainland probably makes eradication not feasible.[33]

He further indicated that the more appropriate approach on the mainland would be the suppression of the indigeneous blowfly population by the continual release of sex-linked males. In low-density sheep areas, he considered the costs of release of the flies (from light aircraft) would be far more than the potential returns to the industry. However, in the more intensive sheep-raising areas, he considered the number of sheep per hectare warranted the use of genetic control methods and he believed they could be cost-effective there.[34]

4.37 Many witnesses were most supportive of fly-centred research. Mr Peden, representing AFWA, considered it should have top priority because of the extent of the flystrike problem and the suffering and loss it causes.[35]

4.38 The Committee supports the continuation of research into methods of genetic control of the sheep blowfly and the cost-benefit parameters involved. While the method has logistic and economic problems, it has been shown to be effective and it has the added welfare attraction of being fly-centred rather than involving the sheep.

Selective breeding programmes

4.39 Selective breeding has been advanced as a method of making sheep less susceptible to flystrike. This is not a new development, for as early as 1937, Belschner concluded:

> Body strike in sheep depends almost entirely upon the pre-existence of fleece rot, and it is obvious that there exists a type of sheep definitely predisposed to the latter condition ... the prevention of body strike depends principally on reducing the susceptibility of our flocks by selective breeding.[36]

4.40 Fleece characteristics and also body conformation are important in determining a sheep's susceptibility to flystrike. Fleeces which are dense, compact, soft-handling, thick-stapled, and white and bright in colour are associated with resistant sheep. Similarly, plain-bodied sheep, without devil's grip (prominent hocks) or wrinkly breeches, are more resistant to flystrike.[37]

4.41 The ease with which these desirable characteristics can be bred into a flock depends on their heritability, which has been calculated on the basis of experimental evidence to be 0.40 for fleece rot.[38] New South Wales Agriculture and Fisheries has

run an experimental flock at Trangie in which the fleece rot incidence in hoggets has been reduced from 60 per cent to 17 per cent in 20 years, under the same environmental conditions.[39]

4.42 Selection for fleece rot resistance is made more difficult in dry environments, where the problem of fleece rot does not regularly occur. However, as Mr Butt, Principal Livestock Officer of the Department, pointed out, an active selection programme is feasible in other areas.[40]

4.43 In Western Australia dermatophilosis (mycotic dermatitis, or lumpy wool) is as significantly correlated with flystrike as is fleece rot, and officers of the Western Australian Department of Agriculture were sceptical as to the likely success of direct selection. Dr Monzu pointed out that a flock with 80 per cent incidence of dermatitis will not get an 80 per cent incidence of flystrike, and it is not feasible to cull such a number of sheep.[41]

4.44 Plain-bodied sheep, such as the British breeds, are far more resistant to flystrike than the Merino in general, and wrinkly Merinos in particular. However, as Dr Meischke and others pointed out to the Committee, breeding wrinkles off sheep reduces, but does not eliminate, the flystrike problem.[42] In addition, breeding for plainness of body or breech presents an economic problem, in that it also tends to select against a heavy-cutting fleece and other desirable traits. Dr Meischke further implied that the practice of mulesing removed the evidence of a faultily-conformed breech, rendering the selection process more difficult.[43]

4.45 The Committee concludes that selection for resistance to flystrike is an important tool in the effort to reduce the welfare horror that flystrike represents for our sheep flocks. Such selective breeding has the added advantage that it in itself is not inimical to the welfare of individual sheep. The Committee

recommends continued research into flystrike resistance characteristics, as one of a range of methods designed to reduce the suffering caused by flystrike.

Mulesing

4.46 Of all the issues which were raised by critics of the sheep and wool industry, the practice of mulesing was the one which attracted the most vigorous condemnation. Dr Auty referred to it as "the partial flaying" of the sheep and indicated that in his view, mulesing did not lie within the parameters of acceptable interference with animals.[44] ANZFAS considered the mules operation "a crude and barbaric substitute for good husbandry" and quoted a Mr Douglass of the RSPCA (UK) who described mulesing as a "particularly abhorrent and quite unnecessary and unacceptable mutilation of an animal".[45]

4.47 The industry, academics and the departments of agriculture, on the other hand, were unanimous in their support for the practice, perceiving that the benefits which accrued from it far outweighed the disadvantages.[46] Clearly, though, they agreed that mulesing was a painful procedure, and one which should and would be replaced as soon as acceptable and effective alternatives were found.[47]

4.48 Mulesing is an operation which consists of the surgical removal of strips of loose, wool-bearing skin from the breech and tail of the sheep. Its purpose is to remove the skin folds which accumulate moisture and fragments of excreta and which in turn attract the sheep blowfly. When the cuts heal, the naturally bare area around the vulva and anus is stretched and enlarged, reducing the dampness of the surrounding wool. An advocate described the mules operation as "simple skin surgery, causing little blood loss or surgical shock".[48]

4.49 The operation was first advocated by Mr J.H.W. Mules of South Australia, who outlined his answer to breech strike in a letter to the *Adelaide Advertiser* in 1931. Its subsequent history has been extensively reviewed elsewhere.[49] Radical and modified forms of the operation evolved, with most present-day advocates recommending a crescent-shaped cut on each side of the vulva and the removal of all but a "V" of wool-bearing skin extending one third of the way down the docked tail.[50]

4.50 The mulesing operation is most commonly performed at lamb marking. Reasons given for this timing are that the lamb only has to endure the stress of being mustered once; that wounds heal more quickly on a young animal; and that the lamb will be able to go immediately to its mother for comfort and a drink. New South Wales Agriculture and Fisheries recommends the mulesing of appropriate sheep at marking time, when lambs are from one to seven weeks of age, in most situations.[51] This recommendation is echoed by most extension services.[52] The *Prevention of Cruelty to Animals Act 1979* requires mulesing to be undertaken before the sheep is 12 months of age. When mulesing is delayed until weaning or later, the animal suffers more of a setback in growth. However, mulesing is clearly not indicated in the middle of a flywave or when lambs are already weakened by poor nutrition during drought.[53]

4.51 Mulesing is performed either by farm labour or by mulesing contractors. New South Wales estimates were that 60 per cent was done by contractors and that this percentage was dropping.[54] Highly sharpened, modified shears are used and are disinfected between uses. The operation is performed on restrained, unanaesthetised animals.

4.52 The precise numbers of animals mulesed are unknown. Recent New South Wales surveys indicate that 80 per cent of Merinos and 45 per cent of other breeds and crosses born in that State are mulesed.[55] In the western district of Victoria, 56 per cent of wool-producing sheep were mulesed, according to a survey

by Morley, compared with only 11 per cent of meat sheep, while in Western Australia, 75 per cent of respondents to a 1983 survey mulesed, and the larger the flock, the more likely it was to be mulesed.[56]

4.53 Mr Bowman, representing the Wool Council, suggested that mulesing rates were in part dependent on location. In the high rainfall areas where more meat-producing sheep were raised, he considered there was no need to mules prime lambs.[57] Mr Coombes, Executive Director of the Sheepmeat Council, suggested that there was a correlation between the presence of good contractors in an area and the percentage of mulesed sheep.[58]

4.54 Even the opponents of mulesing did not query the fact that it was effective in significantly reducing the incidence of breech strike. Two studies provided as examples by Kevin Bell showed strike rates of 0.4 per cent in mulesed sheep compared with 27 per cent in unmulesed; and none with 60 per cent.[59]

4.55 Clearly, mulesing is a practice which has gained widespread acceptance among sheep producers, and particularly amongst those who raise sheep primarily for wool. It is a practice widely promoted by the departments of agriculture, and one which can be seen to achieve its aim of reducing the incidence of breech strike. Two issues remain to be addressed, however: firstly, whether the practice is so painful for the sheep (and so inhumane) that it should be banned on welfare grounds; and secondly, whether the pain and suffering caused by mulesing is justifiable compared with the pain and suffering which may eventuate from breech strike.

4.56 As the Committee has discovered in its previous inquiries, it is all but impossible to quantify the degree of pain experienced by a given animal. As Dr Meischke reminded the Committee, pain is a subjective experience.[60] It seems likely also that there is a spectrum of pain susceptibility in sheep,

and what is painful for one may not necessarily be painful, or as painful, to the next.[61] The best objective indicators of pain that exist at present appear to be hormonal responses, such as cortisol and beta endorphin levels, which when elevated and when combined with behavioural indicators, probably suggest the presence of pain, and certainly point to the relative effects of different stressors.

4.57 On this premise, recent research by Shutt, Fell and colleagues from the New South Wales Agriculture and Fisheries indicates that mulesing is indeed an unpleasant experience for the lamb, albeit a short-lived one. Lambs aged four weeks had significantly raised plasma free cortisol levels 15 minutes after either tail docking and mulesing, or tail docking, castration and mulesing, compared with the control lambs (46, 61 and 13 nmol/l respectively). Severe flystrike was associated with similar plasma cortisol values to the maximum recorded from the surgical procedures.[62]

4.58 In a later study by the same team, the responses to mulesing of six-to-seven months old weaners was assessed. Five to fifteen minutes after the operation, plasma cortisol and beta endorphin levels were markedly raised (from pre-operational levels of 70 nmol/l and 95 pg/ml respectively to 207 nmol/l and 209 pg/ml), reaching their highest levels (233 nmol/l and 266 pg/ml respectively) 24 hours after surgery. For up to two hours after surgery, an analgesic effect associated with the release of beta endorphin was observed, but thereafter the sheep evidenced abnormal posture and locomotion and grazed less than usual. After three days their behaviour was back to normal and wound healing was evident, but was not regarded as complete for another 19 days. No significant effect on growth rate was recorded.[63]

4.59 An interesting behavioural aspect of this study was the marked aversion the mulesed sheep showed to the presence of the person who handled them during the operation, an aversion which persisted for five weeks. The researchers caution that this may have been a reaction to their having being handled in their post-operative state, or it may have been a residual effect of the operation itself. The researchers concluded that mulesing of weaners by contractors rather than owners, and minimal post-operative handling, were indicated as a means of reducing stress.

4.60 Some evidence was presented to the Committee on whether mulesing should be carried out by contractors or by owner-operators or other farm labour, and how best these persons should gain the necessary skills for the task. If it is to be done at all, there is no question that it needs to be done quickly and well. New South Wales departmental officers suggested that owner operators tended to do the job themselves at marking time, but that training was offered by departmental regional officers. On the other hand, the larger flocks were more likely to be mulesed by contractors, who again could have the benefit of departmental training and the experience gained by repeating the operation many thousands of times.[64] Dr Osborne, representing the Australian Veterinary Association, considered "it would be impractical and perhaps even not especially desirable to have rigid rules and certifications" covering owner-operators and their performance of surgical procedures. However, in the case of contractors who mulesed for fees, he considered some form of certification was desirable.[65] The Committee agrees. It considers that the training offered by departmental regional officers is quite adequate to provide a person with the requisite skills to mules sheep, and suggests that any person wishing to mules for financial gain should be able to prove, by way of a certificate from the training officer, that he has been trained and has

reached an appropriate level of competence in the procedure. The Committee considers that this would not become a burden for departmental officers. Indeed one department indicated it perceived an organisational and co-ordinating role for the departments in this regard.[66]

4.61 Another suggestion put to the Committee was that, to alleviate pain, sheep should be anaesthetised for the mules operation.[67] Most witnesses who commented on the use of anaesthetics disagreed with their use on lambs at mulesing. It was felt that the whole mulesing operation would be slowed down, lambs would be away from their mothers longer and could become disoriented, thus increasing the risk of mismothering.[68] An AFWA representative, Mr Plant, pointed out that experimental work with anaesthetics had been done at the Orange Agricultural College, with fairly undesirable results.[69] It was also suggested that the post-operative period was the most painful, at which time the effect of the anaesthetic would have worn off. The Committee considers that the use of anaesthetics at lamb marking is inadvisable and impracticable.

4.62 From the work by Shutt and Fell and other studies, from evidence it received, and from its own observations of mulesing at the property of Mr Robert Campbell at Tarago, the Committee concluded that mulesing is an unpleasant practice, one which is generally performed with distaste and one which certainly causes sheep and lambs pain, although pain which is temporarily alleviated by the analgesic effect of the release of beta endorphins. This pain and discomfort is, however, of short duration, and the operation appears to have no long-term adverse consequences.

4.63 The Committee then considered whether the infliction of such pain in the short term could be justified, in view of the perceived long-term benefits mulesing provides by way of reduced susceptibility to breech strike.

4.64 It reviewed the arguments of Dr Meischke and others, who pointed out that sheep are individuals, many of whom are naturally quite resistant to flystrike and for whom mulesing is an unnecessary and painful indignity.[70]

4.65 The Committee noted that in areas of higher sheep density and smaller flocks, there was evidence that some producers were able and willing to put in the extra time and effort to breed out faults in sheep, to select resistant sheep, to control worms, to inspect and crutch and jet with chemicals more frequently to ensure a healthy flock without recourse to mulesing. It also noted, however, that some were not. In cases where sheep are going to be managed with less than optimum care and attention, the Committee would prefer to see the sheep mulesed than unmulesed. The Committee considers that the "all or none" approach to mulesing is probably inevitable in extensive environments, and on balance considers that "all" is the preferred option.

4.66 In the absence of effective alternatives to mulesing, the Committee decided that the practice should continue. The Committee **recommends** continued research into all means of preventing blowfly strike, so that the need for mulesing is removed. In the interim, it considers that mulesing should be performed where possible on lambs at marking rather than later.

Crutching

4.67 Crutching, or the removal (by clipping or shearing) of wool from around the breech area of sheep, is standard practice throughout the sheep industry. Short wool on the breech soils less and dries more quickly, hence reduces the sheep's susceptibility to breech strike. Crutching serves other purposes than blowfly strike control, and is routinely performed prior to mating and sale of sheep, and sometimes pre-lambing. Extension services recommend at least one thorough crutching between annual shearings, even for mulesed sheep.[71]

4.68 Crutching alone does not prevent the wetting or soiling of the breech.[72] If it is carried out just before likely flywave periods, it can reduce, but not eliminate the incidence of breech strike.

Pizzle dropping

4.69 Pizzle dropping is a simple technique which involves the severing of the tissues between the sheep's belly and sheath enclosing the penis so that following healing, the prepuce hangs some 50 mm below the wool. The tissue is severed some 60 mm with hand shears, mulesing shears or surgical scissors. The procedure can be carried out at lamb marking but is best carried out at six to 14 months of age, according to New South Wales Agriculture and Fisheries.[73]

4.70 The procedure of pizzle dropping has been advocated to reduce urine staining and flystrike in belly wool. Urine staining is an economic, rather than a welfare issue, as stained wool is considerably less valuable than unstained. Pizzle strike, however, is facilitated by urine staining, and is clearly a welfare issue, although some have claimed its prevalence is not sufficiently high to justify treatment.[74] Wardhaugh and colleagues found otherwise in their 1978-80 study, considering it the main form of covert strike.[75]

4.71 Staining can be reduced by ringing (the removal of wool from around the prepuce using a shearing handpiece). New South Wales field trials have shown that when ringing and pizzle dropping were both performed, urine staining was reduced by 67 per cent and belly flystrike by better than 90 per cent. Pizzle dropping alone resulted in a 26 per cent reduction in staining and 88 per cent reduction in belly strike. In conjunction with testosterone treatment, pizzle dropping had the added advantage of reducing the incidence of sheath rot.[76]

4.72 The use of insecticides to treat the area is a viable alternative to pizzle dropping in reducing the incidence of flystrike, though it has no effect on the proportion of stained wool.

4.73 Pizzle dropping has not gained wide acceptance in Australia, despite its advocacy by the New South Wales Agriculture and Fisheries. The reason most probably lies in the fact that shearers are said to dislike shearing pizzle-dropped animals.[77]

4.74 Welfare and production benefits both seem to accrue from pizzle dropping. Little evidence was available on the stress levels induced by the procedure, however. The Committee is not opposed per se to pizzle dropping as a method of reducing the incidence of flystrike, but as with all surgical interventions in sheep, it would prefer to see viable, safe and effective alternatives in use.

Chemical control

4.75 Insecticides have been available for protecting sheep against flystrike since the sheep blowfly problem arose. They are applied to the sheep by dipping or jetting. Three groups of insecticides offer control against blowfly strike: the organophosphates; the triazines, of which Vetrazin is the only commercially available product; and synthetic pyrethroid-based products which are oviposition suppressants.[78]

4.76 One of the problems with the use of insecticides is the speed with which *L. cuprina* develops resistance to them. The organophosphate insecticides were first introduced in 1957, but by 1965 resistance was reported,[79] and they now offer at best one to three weeks protection. Vetrazin and the oviposition suppressants still offer from six to twelve weeks protection, but as Dr Mahon pointed out:

> There is little doubt that increased use of chemicals would hasten the evolution of resistance to that chemical and reduce its useful life.[80]

4.77 The problem of resistance is acknowledged by the agricultural and veterinary chemicals industry, which supports an Insecticide Resistance Action Committee to monitor the onset of resistance and to minimise its impact.[81] It was suggested there was a very real danger of the present chemicals becoming ineffective through overuse before alternatives could be developed.

4.78 Another problem with insecticides is the method of application. Formerly dipping was the preferred method, but now jetting, either by hand or through a jetting race, is more common. The efficacy of an insecticide is largely dependent on the thoroughness with which it is applied.[82] Hand jetting can be less reliable in this regard, unless slowly and carefully done, while automated jetting may not ensure an exact dose of chemical per sheep.

4.79 The timing of the application of chemicals is a vexed matter, and one which will be largely solved if accurate predictions of flywaves can be made. If treatment is delayed until many overt strikes are observed, many sheep may be lost because they cannot be mustered and treated quickly enough. Fly numbers may also be at a maximum when treatment takes place, thus increasing selection pressure for insecticide resistence. An early preventive spraying may be wasted if conditions inimical to the development of a flywave occur.

4.80 The Committee does not oppose the sensible use of the new low-toxicity insecticides against flystrike. Unlike their predecessors, their environmental impact is negligible. The

Committee received no evidence indicating that their application was stressful to the sheep. It appears, however, that the problem of resistance to chemicals is not unique. As the United States Council for Agricultural Science and Technology reported:

> The loss of effectiveness of pest-control measures is not unique to chemicals. An analogous process occurs when crops and animals are bred with built-in genetic resistance to destructive pests. When confronted with a resistant host, the pest eventually evolves into new race or strain with counter-resistance or virulence. Thus, many resistant crops and animals do not remain resistant indefinitely. Additionally, pests may evolve resistance, but generally at a relatively slow rate, to introduced biological controls, including pathogens, parasites and predators; to control measures based upon physical factors and mechanical action; and to managerial practices ... [83]

4.81 The Committee considers chemicals still have an important role in an overall strike-minimisation programme, but should not be seen as the ultimate solution.

Vaccination

4.82 Modern techniques of molecular biology may eventually allow the production of protective antigens against flystrike. Research is also in progress to find ways of immunising sheep against the bacterium *Pseudomonas aeruginosa* which is implicated in the development of fleece rot. Preliminary field studies have indicated the feasibility of the approach.

4.83 In line with its "broad brush" approach to flystrike prevention, the Committee **recommends** the continuation of research into immunological approaches to flystrike prevention. For the present, however, and in the immediate future, the Committee considers many welfare gains can be made by the inplementation of better, more scientific and less hit-and-miss flystrike prevention and control management programmes by individual producers.

CHAPTER 5

OTHER HEALTH AND HANDLING ISSUES

Introduction

5.1 In the course of its inquiry, the Committee obtained evidence on a number of sheep welfare issues. Some of these issues inevitably were considered less extensively than others. The presence of a sheep welfare issue in this more general chapter is not, however, an indication of its relative lack of significance as a welfare issue in the eyes of the Committee.

Internal parasites

5.2 Internal parasites in sheep include tapeworms, liverfluke and gastro-intestinal nematodes. Their effects are particularly felt by sheep in high rainfall areas, and vary according to breed, the severity and length of infection, the sheep's nutritional status, resistance level and physiological state.[1]

5.3 A sheep infected by internal parasites will be anaemic, will scour excessively and will lose appetite, resulting in weight loss, a reduction in wool quantity and quality, and eventually weakness, dehydration and possibly death. Internal parasites may also be responsible for decreased fertility, lower birth weight and an increased susceptibility to flystrike.[2]

5.4 In a year of high infection risk, an extension officer survey estimated that 3.4 per cent of the sheep flock would die of worm infestations, a slightly higher proportion than would be expected to die of flystrike (3.2 per cent). The cost of internal parasites, derived from prevention and treatment measures and production losses, was estimated at $3292 (at 1985 figures) per "average" farm of 2200 sheep in a low-risk season to $6187 in a high-risk season.[3]

5.5 Drenching is the standard treatment for internal parasite infestation, followed by placing the stock on clean pasture.[4] As has been noted previously, however, resistance to chemical treatment develops rapidly, and is accelerated by the frequent use of the same chemical. As worms develop resistance to anthelmintics (worm treatments), sheep need to be mustered and drenched (both minor stressors in themselves) more frequently, and so the cycle continues in ever-shortening time periods. Dr Keith Dash, of the CSIRO Institute of Animal Production and Processing, pointed out that some sheep are dosed seven to eight times a year.[5]

5.6 Dr Brennan, representing the RSPCA (Australia), pointed out that chemical treatments for worm infestations were frequently relied on at the expense of a whole array of husbandry techniques, including rotational grazing and cropping paddocks between using them for grazing.[6]

5.7 The Committee learnt that there was extensive collaboration among the pharmaceutical and grazing industries, the CSIRO and the departments of agriculture on the subject of worm resistance and control. For the foreseeable future, it seems likely that both grazing management and the use of anthelmintic drugs will be required.[7] The latter may be delivered via a controlled-release capsule, which when lodged in the sheep's

rumen, releases the anthelmintic albendazole at a constant rate for 100 days. State departments of agriculture promote worm control programmes based on computer-simulation models of parasite populations, such as the New South Wales WORMKILL and DRENCHPLAN programmes.

5.8 Controlled-release capsules, which are inserted down the animal's throat with a rumen gun, promise to prolong the life to the older, broad-spectrum anthelmintics. Concerns were informally expressed to the Committee that the capsules sometimes failed to reach the rumen, or to stay there despite the plastic wings intended to make them do so. The Committee nevertheless believes they represent a promising approach, when combined with pasture management, to the worm problem, and encourages continued research into their efficacy.

Footrot

5.9 Footrot is a bacterial infection which occurs at the skin-horn junction of the hoof and in the soft tissues under the hoof of the sheep. It distresses and debilitates sheep, by causing severe lameness and an associated reduction in condition, wool growth and lambing success. In 1979 figures, each infected sheep was estimated to cost its owners $4.50 for treatment and $4.20 in lost production.[8]

5.10 Footrot is a problem of the higher rainfall areas of southern Australia. Outbreaks tend to occur in spring when lush pastures and warm, moist conditions favour the spread of the disease. It is a notifiable disease in the New England districts of New South Wales, where a successful eradication programme has been waged.[9] In Victoria, similar programmes have been attempted in the western districts and East Gippsland, and the Department of Agriculture and Rural Affairs hopes to have eradicated footrot from Victoria by the year 2010.[10]

5.11 Traditional methods of treatment involved paring the affected area of the foot by hand, and foot bathing. Vaccines were developed in 1971, but failed and were subsequently withdrawn from sale because they were not effective against all the different strains of *Bacteroides nodosus*, the footrot bacterium. Second generation vaccines, when correctly used, offer protection rates of 80 per cent or better for 12 to 14 weeks, and will assist the healing process for those sheep already with footrot. However, they sometimes cause irritations at the injection site.

5.12 The development of a third generation of vaccines, using recombinant DNA technology, is being actively supported by the Australian Wool Corporation.[11] The Committee supports continued research into improved footrot vaccines, with the ultimate aim of eradicating the footrot organism.

Dehorning

5.13 The Committee was informed that dehorning was not a common industry practice.[12] Tipping of horns, or taking the last five to seven centimetres off the end of the horn, is done, particularly on Merino rams, to prevent them from harming one another or getting caught in fences. The practice of keeping horn tips blunt was, according to Mr Thirkell-Johnston, President of the Tasmanian Fine Merino Breeders Association, a regular management practice but one which caused the sheep little distress because the cut never went down to the quick.[13]

5.14 Horn tipping is performed with clippers or a hacksaw if necessary, followed by emery paper to make the horn smooth. It is a practice condoned by the model code of practice for the welfare of sheep, which recommends, however, that the amount of horn removed should be limited to avoid damage to soft horn tissue and to limit associated bleeding.[14]

5.15 As Mr Beggs pointed out, there are occasions when a horn has to be removed, for example when it is damaged or when it grows into the jawbone of the animal, preventing it from eating.[15] Surgical wire is then used. The procedure is not one that the AVA recommends as a routine measure, and the Committee agrees. Horn removal in the situations outlined is acceptable, and horn tipping is also, provided it is carefully done. As poll sheep of all breeds are readily available, there seems little justification for breeding the horned varieties, only to cause them distress by tipping or removing the horns.

Teeth grinding

5.16 The natural abrasive action of pastures in sandy or granite country tends to keep the sheep's teeth in good condition for many years, rendering dental treatment of any kind unnecessary.[16] In wetter areas with softer pasture, the sheep's teeth may eventually grow longer than desirable and become unstable, leading to the condition known as "broken mouth". The sheep can no longer feed properly and loses condition. Sheep with wobbly or missing incisor teeth are generally doomed anyway, as it has been observed that most Australian sheep farmers cull their mature sheep on the basis of the condition of their incisors.[17]

5.17 Many attempts have been made over the years to prevent or correct faulty dentition in sheep. Even dentures have been used, without conspicuous success.[18] Hence clipping, trimming or grinding the teeth have been tried in an effort to prolong the productive life of the sheep.

5.18 Clipping is performed with side-cutters or pliers and involves evening the length of the incisor crowns on an individual sheep basis, to salvage an animal that would otherwise be culled. In teeth trimming, the crowns of the incisors are cut off with the edge of an angle grinder disc to create a level bite.[19] The procedure takes less than ten seconds per sheep.

5.19 The method which has generated most controversy is the "Caldow technique", named for Australian sheep farmer Howard Caldow, who used an electric grinder running at 11 000 rpm to cut the incisors level with the lower dental pad with a side-to-side motion.[20] This procedure takes longer than teeth trimming, and generates considerable heat. Pulp exposure occurs in most cases, but is rapidly repaired. A gag is inserted in the mouth of the sheep while the grinding is performed, to protect the lips and depress the tongue. The sheep is normally held against the side of a race for the procedure.[21]

5.20 The Farm Animal Welfare Council in the United Kingdom recommended a ban on the practice of tooth grinding in June 1986 and the British government agreed, later in the same year.[22]

5.21 Currently the practices of teeth trimming and teeth grinding enjoy only modest support in this country. One estimate suggested that the procedure is applied to approximately one million sheep annually.[23] Dr Meischke condemned its application on a whole-flock basis, as obviously only a certain number of the sheep concerned would be suffering from poor dentition. He considered teeth grinding "ought to be relegated to a procedure that is done on an individual animal basis".[24]

5.22 The 1989 policy statement of the Australian Veterinary Association on sheep dentition declared:

> The Australian Veterinary Association believes that, with the present state of knowledge, tooth clipping, tooth grinding and tooth trimming are procedures that cannot be justified or recommended because of the lack of demonstrated benefits to individual sheep and/or to flock productivity.
>
> The Association recommends that the procedures not be done unless research establishes that benefits exist for the welfare, health and production of the sheep.[25]

The Association pointed out that objective studies had indicated that the pain experienced by sheep exposed to teeth trimming or teeth grinding was of low intensity and short duration, and that healing was rapid.

5.23 Dr Denholm, one of the Victorian Department of Agriculture and Rural Affairs researchers engaged in a teeth-grinding project, outlined the results of preliminary work to the Committee. He found "the procedure is painful but that the level of pain is no greater and is probably substantially less than that associated with a range of other routine husbandry practices".[26] Plasma total cortisol values returned to normal levels in 90 minutes after teeth trimming, and the sheep ate as much thereafter and gained weight at the same rate as their non-treated peers.[27] However, Dr Denholm also stated that sheep show no immediate benefit from the procedure.[28]

5.24 Periodontal problems are of genuine welfare concern to the Australian sheep industry, in the opinion of the Committee, and every effort should be made on an individual basis to ensure that mature ewes who may be excellent mothers are not culled before their time because of faulty dentition, if that dentition can be effectively repaired without undue pain to the sheep. The Committee considers that the practice of teeth grinding as a preventative measure for entire flocks should be discouraged until research shows demonstrable productivity gains for the treated sheep.

Electro-immobilisation

5.25 Electro-immobilisation refers to the use of a pulsed low-voltage electric current to an animal to produce a state of immobility. The current causes skeletal muscles to contract so that the animal becomes rigid. Electrodes are attached to each end of the animal and electric pulses of about one millisecond are passed at a rate of 50 per second.[29]

5.26 Such immobilisers have been available since the 1970s and have been used to restrain animals, particularly cattle, to facilitate routine husbandry procedures. Only minor use of immobilisers occurs in sheep husbandry, with the notable exception of the automated shearing system under development in Adelaide by the private company, Merino Wool Harvesting Pty Ltd (MWH).

5.27 Committee members viewed the electro-immobiliser in action in Adelaide and heard the rationale for its use there. Mr Baxter, Technical Director of MWH, considered electro-immobilisation provided a safer method of restraint for automated shearing than leg restraint. He also asserted that there was behavioural evidence that electro-immobilisation produced pain suppression and some subsequent short-lived analgesia or calming effects.[30] The passage of a current of twice the level needed to immobilise a large sheep was considered by the human researchers to be "strange" or "unpleasant" but not painful, though Dr Kuchel noted that the variety of descriptions of the sensation bore testimony to the problems of studying anything so subjective as pain.[31] Dr Kuchel further indicated that, although large changes in cardiovascular and biochemical functions occur during electro-immobilisation, they are not life-threatening and the sheep recover within 30 minutes, on average.[32]

5.28 Much research evidence exists, and Dr Kuchel himself acknowledges, that electro-immobilisation is a procedure which sheep find aversive.[33]

5.29 Choice tests by American animal handling authority Dr Temple Grandin showed that ewes overwhelmingly preferred restraint by squeeze-tilt table to electro-immobiliser. After once experiencing the latter, 56 per cent never chose it again, whereas 94 per cent of sheep volunteered again for the squeeze-tilt table.[34]

5.30 Researchers from the University of Melbourne studied the effects of electro-immobilisation at the request of the Australian Wool Corporation, and with its financial assistance. Rushen compared the aversive properties of physical restraint with electro-immobilisation, on the basis of the amount of time the sheep took to run, or be pushed, through a race to the testing site on a subsequent occasion. Both forms of restraint increased the time required to run through the race, though after four trials, the sheep which had had the experience of immobilisation had a greater average transit time. However, the difference was not apparent after only one exposure. The aversiveness was more dependent on the intensity of the current used than on its duration.[35]

5.31 Another study by the Melbourne team offered sheep a choice between electro-immobilisation and shearing, which is among the the more physiologically stressful of the routine treatments that sheep undergo. Results indicated a slight preference towards shearing, with the mean proportion of choices for shearing being .625.[36]

5.32 When the effects of electro-immobilisation and shearing on plasma concentrations of beta-endorphin/beta lipotrophin and cortisol were compared, the responses to the two procedures were not significantly different in terms of beta-endorphin levels though one group of electro-immobilised animals which were also sham-shorn showed significantly higher plasma cortisol concentrations than did sheep which were only sham-shorn.[37]

5.33 Plasma cortisol levels in electro-immobilised sheep have been shown to increase as the intensity of the current increases, though current duration does not significantly affect cortisol response. The researchers concluded that 30 mA would appear to be the optimum current level.[38]

5.34 In the light of the research outlined above, many witnesses to the Committee reacted cautiously. ANZFAS considered insufficient research had been done on electro-immobilisation to warrant a definitive comment.[39] Dr Auty suspected electro-immobilisation had the convenience of the operator more in mind than the welfare of the sheep.[40] The AVA's attitude was one of suspicion, but it was willing to review its attitude when and if concrete evidence on the pain and analgesia questions was provided.[41] Dr Lindsay's concern was that painful procedures might be performed on the immobilised animal without adequate anaesthesia.[42] Professor Egan of the University of Melbourne pointed out that repeated electro-immobilisations brought about a reduction in the aversiveness of the procedure.[43]

5.35 In reviewing the research into the effects of electro-immobilisation, and the evidence presented on the topic, the Committee concluded that the procedure is clearly aversive to sheep but that the level of aversion is of a similar order of magnitude to that felt towards other routine husbandry procedures. It is still unclear whether any analgesia results from electro-immobilisation, and if it does, it may or may not compensate for the associated stress. The Committee therefore considers that research should be continued into the possible analgesic effects of electro-immobilisation.

5.36 The Committee remains unconvinced that electro-immobilisation is the least stressful means of restraining sheep, and encourages research into innovative, less stressful alternatives. In the meantime, the Committee considers that the technique should be applied with caution until further research clarifies the stress parameters associated with its use.

Handling techniques and facilities

5.37 Many of the sheds, yards and races in use on sheep properties today were erected before research into sheep behaviour outlined more desirable alternatives. While wholesale rebuilding or altering of existing facilities may not be feasible, there is scope for enhanced sheep welfare with the use of facilities designed to accommodate the sheep's behavioural preferences.

5.38 Reviews of sheep behaviour in yards have shown that sheep are more co-operative when they are allowed to use fixed routes with wide laneways, and when they are kept with their own flock and not harrassed.[44] Characteristics of sheep which have implications for handling facilities are their excellent wide-angled vision and their depth perception. Unobstructed views of where they are meant to move are desirable for ease of sheep movement, as are floors without shadows, grates or longitudinal slats.[45]

5.39 Handling stress in sheep has been tested to show the relative aversiveness of different situations. The most aversive was found to be involuntary rotation in isolation from other sheep (as occurs in shearing, for example). Isolation was more aversive than restraint in the presence of other sheep, while the presence of humans was least aversive.[46] Manual restraint of individual sheep in a well-designed race for a simple procedure, such as a vaccination, should not normally be considered a significant stressor. Little work has been done on the comparative aversiveness of the many mechanical restraints available, though some information will emerge on this issue from the automated shearing research.

5.40 Agricultural extension services have been active in disseminating specific information about yard design and handling techniques.[47] The Committee therefore will not consider these

issues in detail, as their implications for sheep welfare seem to be uncontroversial and are recognised and accepted by all parties.

5.41 An integral part of the handling process is the interaction between humans and sheep. Where yards are well designed, the yarding process flows smoothly and both operators and sheep become less stressed. Where treatment generally is gentle and thoughtful, the sheep respond positively with better reproduction rates et cetera. Behavioural research at the University of Melbourne showed that aversions can even be extinguished if sheep are offered rewards (food that they liked) after the procedure.[48]

5.42 The Committee recognises that any handling of sheep, no matter how carefully and gently it is done, may be associated with a modest level of stress. Good sense would therefore dictate that if husbandry operations can be combined, they should be, to minimise the number of mustering, yarding and handling occasions.

5.43 The Committee supports the suggestion of Professor Egan, who called for more training in behaviour-based skills in animal handling both for the benefit of the animal, which would run less risk of stress and injury, and of the operator, who would find his work easier and more productive.[49]

Marketing

5.44 The welfare aspects of the selling of sheep were addressed by only a few witnesses as the principal thrust of this inquiry was on-farm sheep welfare. Issues relating to the transport of stock will be addressed in a separate inquiry. The Committee was impressed, however, with what it learnt about computer-aided marketing systems. One such system is CALM, an acronym for Computer Aided Livestock Marketing. It is a private

company established by the Australian Meat and Livestock Corporation. In CALM, stock remain on the property until they are sold. Physical descriptions of the animals, prepared by accredited assessors according to recognised standard measurements, are made available electronically to prospective purchasers one day in advance of the sale, at which bidders can log in from all over the country.[50]

5.45 Such a marketing system has to be preferable for the welfare of the animals concerned, as they do not have to be mustered, loaded, transported and held in yards, enduring sometimes adverse weather, for the duration of the sale.

5.46 CALM achieved a market penetration of one per cent of all sheep sales in 1987-88, its first year of operation. (ibid) In 1988-89, 945 000 sheep or two per cent of all sales were listed with CALM. According to the Minister for Primary Industries and Energy, the Hon. John Kerin, MP, CALM is expected to be commercially viable by the early 1990s.[51]

5.47 The Committee supports the development of computer-aided sheep marketing on welfare grounds.

Intensive husbandry

5.48 The Committee will consider the welfare implications of the intensive raising of sheep in the inquiry into intensive livestock production which it is currently undertaking.

Slaughter

5.49 From time to time, sheep will need to be killed on the farm, either to release them from further suffering following an injury, or to provide meat. A quick and painless death can be

achieved by the use of a firearm (a .22 calibre rifle or .32 calibre humane killer pistol) to the head of the sheep or by stunning to the front of the skull with a captive bolt stunner, followed by immediate bleeding out.

5.50 The time-honoured practice of bleeding-out of sheep using a sharp knife, followed by dislocation of the neck, without pre-stunning, is considered a humane alternative method of slaughter by draft three of the model code of practice for the welfare of sheep, provided that the task is performed by a skilled person. Research is continuing into appropriate forms of humane slaughter.

5.51 The Committee encourages all centres which train persons in agricultural skills to ensure that its students acquire the necessary ability to despatch animals humanely.

CHAPTER 6

SHEARING

Introduction

6.1 Shearing, or the process of removing the wool from a sheep, is necessary as today's sheep has lost the capacity of its ancestors to shed its fleece naturally. Fleece growth depends on many factors, including the breed of the sheep, its condition and environmental conditions. In 1986-87 the average Australian fleece weighed 4.51 kg.[1]

6.2 If the wool is not harvested, it continues to grow indefinitely, causing great discomfort to the sheep. Apart from having to bear the additional weight of the fleece, the sheep may become wool-blind, it may become more prone to attack from external parasites or, if female, she may lose her lamb because of the difficulty the latter experiences in suckling.

6.3 A graphic illustration of the results of non-shearing was provided to the Committee in the form of 160 sheep which had been confiscated from a property near Bombala in southern New South Wales by the RSPCA on the grounds of neglect. The animals had staple lengths of up to 54 cm; they were crawling with lice and encrusted with dags; and entwined in their fleeces were barbed wire, twigs, twine and assorted insects. Many of the sheep had difficulty in walking, feeding or suckling their young.[2]

6.4 In Australia, shearing is normally performed annually, although the Committee was informed that some carpet wool sheep were shorn twice a year.[3] Depending on owner preference and the availability of shearers, shearing can take place in any month of the year, with the peak period ranging from April to November.

The timing of shearing

6.5 The timing of shearing has a considerable bearing on sheep welfare, as in the two to three weeks following shearing, the sheep is highly susceptible to adverse climatic conditions, particularly driving rain, wind and cold. The Committee noted that some of the worst cases of post-shearing losses of sheep occurred in December, a month in which such conditions would not normally be expected.[4]

6.6 The most appropriate time for shearing in the various districts was canvassed by many groups and individuals who appeared before the Committee, as was the question of the timing of lambing in relation to shearing. Advocates for most alternatives were found. Adherents of autumn shearing insisted that it was safer, because of the relatively mild weather generally experienced then. Others favoured winter shearing so that the ewe lambing in spring would be more likely to seek a sheltered spot, thus enhancing the survival chances of both ewe and lamb. Supporters of spring shearing, post lambing, maintained that there was less likelihood of damage to the foetus if the pregnant ewe did not have to go through the stressful shearing process. Summer shearing was not advocated, on human rather than animal welfare grounds.

6.7 The Committee concluded that the timing of shearing was not a major sheep welfare issue, provided that two points were borne in mind. Firstly, sheep need to go into shearing in good condition, so that they can better cope with the shock of the sudden loss of a warm fleece and are physically strong enough to be able to eat more and thus to stay warm. Secondly, adequate shelter needs to be provided for the sheep after shearing. This may take the form of trees, shelter belts of tall non-palatable grasses or shrubs, sheds, or sheep coats. Trees, shelter belts and sheds have been discussed in Chapter 3, as they pertain equally to the survival of the new-born lamb.

Sheep coats

6.8 Post-shearing losses were a source of worry to the majority of witnesses appearing before the Committee. One method advocated for preventing such losses, particularly in the tablelands, was the use of sheep coats. Sheep coats are generally constructed of lightweight plastic, sometimes with elasticised fronts. They are available in various sizes to fit neatly over the sheep, leaving the breech free. Costs range from two to five dollars, although as Dr Brennan graphically illustrated at a Committee hearing, makeshift coats can be prepared at little cost from plastic garbage bags.[5] Research has shown that such coats are nevertheless quite efficacious in the short term. One experiment by Ellis et al. showed that such coats succeeded in keeping alive even wet sheep which showed acute signs of hypothermia.[6] The better-quality coats are reusable.

6.9 The Committee was informed that up to one million sheep are now being protected by sheep coats in Australia, particularly in the colder areas of New South Wales and Victoria.[7]

6.10 Advocates of sheep coats point to their many advantages, in addition to saving sheep from climatic extremes. The currently used fabrics, such as polyethylene, are rain-resistant yet allow a free flow of air, so problems with lumpy wool or fleece rot are reduced. Burrs, grass seeds and dirt are eliminated from the covered area, thus improving sheep comfort and wool quality. Coated sheep show marked bodyweight gains, particularly in the winter months. The labour involved in coating or decoating the sheep is not prohibitive and can normally be combined with routine husbandry procedures. It has also been claimed that the use of coats reduces the incidence of body strike,[8] although the evidence here is more equivocal.

6.11 Other groups and individuals, while accepting the value of coats as thermal insulators, felt compelled to criticise them on other grounds. The Australian Veterinary Association representatives pointed out how poorly sheep coats wear in timber or scrub country. They also alluded to the potential for wool contamination from weathered artificial fibre particles.[9] Dr Meischke commented that the problem of fit had not yet been adequately resolved. In the case of coats left on all year, fleece growth results in the coat becoming progressively tighter, and either restricting the sheep's movement or tearing.[10] The labour involved in coating the sheep was such that Dr Osborne deemed it "prohibitive" in an extensive situation.[11]

6.12 On balance, the Committee believes that the value of sheep coats as protectors from cold and wind stress has been proved. The Committee is not in favour of the mandatory use of coats on newly shorn sheep, as many properties provide other adequate forms of shelter, or do not experience climatic extremes which would require their use. However, in the colder areas of the country, the Committee believes that the use of coats for at least three weeks post-shearing is invaluable. It urges the relevant departments of agriculture to continue their advocacy of the coats as a means of reducing post-shearing losses. It further urges manufacturers of the coats to continue work on the fabric and design of the coats.

The shearing process

6.13 Shearing is normally carried out in purpose-built sheds by teams of contract shearers, using a power-driven metal handpiece consisting of a cutter and a comb. The sheep are yarded some time in advance of the process and deprived of food and drink, sometimes for up to 24 hours. They are then urged up a

race, penned, caught, upended, dragged to the shearing station and shorn. The time taken per sheep by a skilled shearer ranges from 1.5 to 3 minutes, depending on the size of the sheep, its fleece characteristics and degree of body wrinkle.[12]

6.14 Not surprisingly, research has shown that the sheep finds this process quite stressful on a number of counts. Being rounded-up, yarded, separated from its fellows for the shearing itself, being involuntarily rotated and possibly being nicked or cut, have been shown individually and cumulatively to induce raised cortisol levels, whether measured in plasma or saliva.[13]

6.15 The Australian Wool Corporation estimates that, as of 1 January 1989, the total cost of shearing and crutching the Australian sheep flock, including classing and pressing the wool, amounted to $652 million. The contract shearing rate, per sheep, was $3.14.[14] Apart from the costs involved, the problem of labour is worrying the industry. The number of young shearers is dropping, a fact which may accentuate the problems for farmers of obtaining shearing teams at the time they would like to shear. In 1988 the Australian Wool Corporation spent $635,000 on training shearers and shed staff[15] in an effort both to maintain the supply of shearers and to ensure that those shearers are trained in the proper techniques of handling and shearing sheep.

6.16 Apart from addressing the training needs of shearers, the industry has not been unmindful of the other improvements that can be made to the traditional shearing process. Yard and shed design can be improved, in the light of recent research into sheep behaviour. While it would be unrealistic to expect farmers to pull down their old sheds and construct new ones more attuned to the needs of the sheep, at least those starting from scratch will be able, with advice from their local department of agriculture, to erect a structure which will obviate some of the problems of the old sheds. Inexpensive modifications can also be

made, including front-fill catching pens, slide-swing, lift-swing and tip-swing gates, and distance ramps rather than chutes by which the sheep can exit. Improvements such as raised shearing boards, Fawcett shearing mats, self-pinning presses and rotating circular wool tables are of little direct assistance to the sheep, but by improving the work flow and working conditions in the shed, they may bring with them indirect benefits from relaxed, less-pressured shearers and shed hands.[16]

6.17 Other areas in which the traditional shearing process can be improved for both sheep and shearer are in the design of the handpiece, and in support devices. Wide combs, which are now generally accepted despite the acrimonious industrial disputes of the early 1980s, speed up the shearing at least a little.[17] Work is in progress to make handpieces lighter, cooler, quieter, more manoeuverable and to vibrate less.[18] The Australian Wool Corporation (AWC) is currently supporting four research projects worth in total $A152,344 to "develop and evaluate novel and conventional manual shearing concepts".[19]

Alternatives to conventional shearing

6.18 The extent to which the present and predicted future problems associated with shearing dominate industry thinking is reflected in the priorities accorded to research into alternatives to conventional shearing by the AWC and other funding bodies. Almost two million dollars of the AWC budget of six and a quarter million dollars for research and development to improve the health and welfare of sheep are devoted to projects which are investigating biological wool harvesting or robotic shearing. Both approaches offer considerable potential to improve the welfare of sheep.

Biological wool harvesting

6.19 The CSIRO has been researching skin and fleece biology for many years and has been engaged in the search for a chemical alternative to shearing for 15 years. Recently the Division of Animal Production patented a new process of harvesting wool, using a naturally occurring protein, epidermal growth factor (EGF). A small dose of the EGF (that is, between 100-130 ug/kg body weight) is given in a single, subcutaneous injection. This results in a weakening of the wool fibres temporarily, with normal growth resuming in a matter of days. The weakened zone is then carried above the skin and the fleece is protected by a retention system for four to six weeks, at which time the fleece may be removed by hand.[20] Commercial quantities of EGF are now able to be produced in co-operation with Coopers Animal Health Australia Ltd, using genetic engineering techniques.

6.20 In their evidence to the Committee, CSIRO officers stressed that the then fleece retention system (a nylon net) was a prototype, with design work continuing in that area.[21] More recently, they have begun using a full lightweight body jacket which "breathes" and which is fastened with Velcro strips. The upended sheep is clipped in by its legs to a sheep "train" for its EGF shot, a pre-shearing clean-up and jacket fitting, all of which takes about one minute. Wool harvesting is still by hand, about six weeks later, with the harvester running his fingers down under the fleece much in the way a shearer does, to remove the fleece in one piece.[22]

6.21 Preliminary trials of the technology have been conducted in the field and, according to Dr Trevor Scott, then Divisional chief, were "extremely well-received".[23] The CSIRO is aiming to have a first generation biological wool harvesting technology available commercially by 1991.[24] Current project aims are to

refine the dose rate and variation in response across strains; to ascertain the optimum treatment period; to define the wool retention and removal system; to carry out large-scale field trials; and to ascertain cost-benefits.[25]

6.22 According to the CSIRO officers, biological wool harvesting has many advantages over conventional shearing. Initial problems with cold stress or sunburn of the sheep's bare skin have been overcome by allowing sufficient wool regrowth before the fleece is harvested. As the fleece becomes loose after six weeks, no pain is experienced by the sheep when its wool is removed and it suffers no cuts or bruises in the process. There is also less danger of infection. If crutching were carried out at the time of the EGF injection, there would be the added advantage for the sheep of less yarding and handling, and for the owner, a cleaner clip.[26]

6.23 The critics of biological wool harvesting have pointed to a few areas in which they believe the process to be deficient. Professor Setchell, Professor of Animal Sciences at the University of Adelaide, observed that the threshold between an effective dose of EGF and a lethal dose was very narrow.[27] To this, Dr Scott replied:

> During the past 4 years we have administered EGF to approximately 1000 sheep at dose rates in the range of 30-600ug/Kg/body weight and no deaths have occurred.[28]

In its submission to the Committee, ANZFAS pointed out that sheep show wide variations in response to EGF and therefore a standard dose could not be administered to the flock to achieve the same effect on every animal.[29]

6.24 Another area in which concerns have been expressed is that of the effects of EGF on the sheep's reproductive characteristics. In rams, CSIRO research has shown that, while their sexual activity was not influenced by EGF, temporary

impairment in spermatogenesis does occur for up to nine weeks after treatment with depilatory doses of EGF (that is, doses of > 100 ug/kg body weight). In ewes, dosing in early or mid cycle may lead to slightly delayed oestrus and normal to increased fecundity, while dosing late in the cycle results in approximately twice the length of interval between cycles but unimpaired fecundity.[30] If further research confirms these findings on a larger population, then in welfare terms, EGF could not be said to be harmful in terms of its effects on reproduction.

6.25 Questions have been raised about the effects of residual EGF on humans, were they to consume a dosed sheep. While detectable amounts of EGF and its metabolites do remain in muscle, fat, liver and kidneys, it is presumed that these residues would be broken down by intestinal enzymes in the human gut.[31]

6.26 While wool growth and wool quality are not significant welfare issues, they are of vital concern to the industry. Research is currently in progress to determine the long-term qualitative and quantitative effects of EGF on wool.

6.27 Not all animal welfare organisations were enthusiastic about the prospects of biological wool harvesting. ANZFAS, for example, declared that it was "a project before its time",[32] that it had run for 15 years with little to show for the money expended and that there were more worthy research areas with a greater likelihood of timely solutions.

6.28 While not denying the existence of other sheep welfare problems, the Committee believes that research into biological wool harvesting should be continued until the long-term effects of the application of depilatory doses of EGF have been fully examined; the stresses, if any, of the harvesting process compared with those caused by other shearing methods; and its economic viability assessed.

Robotic shearing

6.29 An alternative method of harvesting wool has been developing in competition with biological wool harvesting, namely automated or robotic shearing. Projects are underway in both Adelaide and Perth, using different methods of animal restraint and different sensing mechanisms.

6.30 The Perth project has been conducted by the Department of Mechanical Engineering of the University of Western Australia since 1978 and is supported financially by the Australian Wool Corporation. It relies on an automatic manipulator which moves the sheep from one shearing position to another, and stretches its neck and legs. A blindfold helps keep the sheep extremely still. The shearing robot, consisting of a mechanical arm powered by hydraulic actuators, has sensors in the cutting mechanism which measure the distance between the cutter and the sheep's skin. Force sensors and overload projection devices are fitted to prevent injury to the sheep in the event of uncontrolled actuator movement.

6.31 The project, when fully developed, hopes to achieve fully automated shearing of the whole sheep in four minutes, a time comparable with manual shearing; software development which will allow for the biological variability of sheep; compact units able to be easily transported; and allow for automated or manual capturing of the sheep.[33] By February 1989 it had reached the stage where a sheep could be fully shorn in twenty minutes and major changes were being made to the restraint mechanisms which would significantly improve the comfort of the sheep during the operation.

6.32 The Adelaide project has been undertaken by a private company, Merino Wool Harvesting Pty Ltd, with initial financial support from the Australian Wool Corporation until 1987-88, the Industrial Research and Incentives Scheme and other sources. Its

present funding comes from Elders IXL, which has committed $5.4 million to see the research and development phase throught to its completion. It differs from its Western Australian counterpart in that it relies on electro-immobilisation as its method of restraining the sheep, which is then shorn upright rather than rotated.[34] It also differs from the Perth project in that it leaves the awkward wool (for example around the legs) to be removed by hand, by shearers. The rationale for this is that shearers will retain their skills and indeed perhaps develop other skills, such as classing, while the heavier, more back-breaking job of fleece removal is done robotically. It will also allow for faster throughput of sheep, with each party doing the job most suited to him.

6.33 By the end of 1988, the Adelaide project had reached the stage where the robot performed its part of the shearing process in 100 seconds. Questions which remained to be answered were the methods of getting the sheep to the robots and the order in which the manual and the robotic parts of the process were performed. Goals of the project now are to attain a complete throughput time of 105 seconds with a prototype in the field by December 1990 for twelve months of field trials.

6.34 Electro-immobilisation has been considered in more detail in Chapter 5. In the case of robotic shearing, its application certainly provides an immobile animal around which the robot can work with little to no danger of mishaps. However, serious questions are still being voiced about this procedure and the extent to which sheep find it aversive. Before advocating any robotic shearing device which depended for its operation on an electro-immobilised subject, the Committee would wish to see the results of a controlled aversion trial comparing conventional manual shearing, robotic shearing using the Western Australian restraints and robotic shearing using electro-immobilisation.

6.35 In the opinion of the Committee, alternative shearing techniques must be pursued with vigour. There is a move away from all forms of heavy manual labour, such as traditional shearing represents, in our society.[35] Traditional shearing costs can be expected to continue to increase faster than wool prices,[36] particularly in respect of the compensation component, which is already approaching $1 million per annum in Western Australia alone.[37] There is an urgent need to ensure that widely-based research continues into efficient methods of harvesting wool.

6.36 Concerns have nevertheless been expressed about robotic shearing in its present state of development. It is only fair to say that many of these concerns have been recognised by the developers themselves and will be or are already being addressed.

6.37 Firstly, there is concern about the safety of the process for both sheep and operator. One sheep died in the Perth trials when a robot moved inadvertently through the rib cage, an accident which brought the programme to a halt for six months until automatic measures were built into the equipment to ensure that such a horrific event would not recur.[38] Other more minor injuries, such as cuts, have been sustained by the Perth sheep. A final product will have to demonstrate a proven safety record before it is acceptable.

6.38 The method of sheep restraint is also a cause for concern. Any process which involves involuntary rotation has been shown to be stressful to sheep. The studies referred to in Chapter 5 show that sheep find the process of electro-immobilisation more aversive than traditional shearing, although it must be recognised that preference studies can only demonstrate relative and not absolute values.

6.39 Thirdly, there are the practical concerns about the transportability of sensitive electronic and other equipment, its maintenance and general robustness in remote and climatically intemperate locations, and the industrial sensitivities of the introduction of such technology.[39]

6.40 Finally, the economic viability of robotic shearing has yet to be demonstrated. While this is not strictly speaking a welfare matter, it does have welfare implications. If robotic shearing can be shown to produce a clean, uncut and unstressed sheep in a relaxed environment, it will encourage productivity increases which may offset additional costs of the technique.

The future of shearing

6.41 Most wool industry representatives were in agreement with Mr Alan Bowman, a representative of the Wool Council of Australia, who expressed the opinion that both biological wool harvesting and robotic shearing had a long way to go before they could be considered viable options.[40]

6.42 The Committee commends the Australian Wool Corporation, Elders IXL, the CSIRO and other organisations which have had the foresight to fund the investigation of alternatives to traditional shearing practices. The Committee **recommends** that research be continued into alternatives to conventional shearing, and particularly into the sheep welfare aspects of all alternative methods of wool harvesting. As an interim measure, pending the likely future introduction of alternative methods of wool harvesting, the Committee **recommends** that research be continued into improvements to manual shearing.

CHAPTER 7

REPRODUCTION

Introduction

7.1 One of the aspects of sheep husbandry which was unanimously criticised by non-industry groups was the poor reproductive performance of Australian sheep, particularly in comparison with European sheep. As discussed in Chapter 3, such comparisons are potentially misleading, given the different breeds of sheep raised in the two regions and the differing climatic conditions in which they are raised.

7.2 Lamb losses and preventive measures have been considered in Chapter 3. In this chapter, the Committee will consider the welfare aspects of the reproductive process itself, rather than its aftermath. Issues such as the timing, length and frequency of joining of rams with ewes, the number of rams used and the size of mating paddocks will be considered, as will the influences of such factors as nutrition and breed. The Committee will then analyse the welfare aspects of some methods of manipulating reproduction, such as artificial insemination, embryo transfer and genetic engineering. Finally, the Committee will consider the breeding objectives of the wool and sheepmeat industries and their implications for sheep welfare.

Traditional sheep reproduction

7.3 The reproductive performance of Australian sheep, measured by lamb marking percentages, was 78 per cent for 1986-87. It varied from 92 per cent in Tasmania to 62 per cent in

Queensland, reflecting the influence of climate and breed of sheep.[1] In other words, the genetic potential for reproduction is not being realised in most Australian pastoral enterprises.

7.4 The reasons for this are economic - it is generally not financially worthwhile to hand-feed, when pasture is deficient in quality or quantity; nor is it generally financially worthwhile, or indeed sometimes even possible, to increase human labour input. Whether or not it is desirable for a sheep to realise its reproductive potential is a moot point in any case. An ability to reproduce generally suffices to ensure that a ewe is not culled, while multiple births, unaided, and particularly in Merinos, can be a health hazard to the ewe.

7.5 The timing of joining depends firstly on the time the sheep are sexually active. In most British breeds of sheep, this is generally between February and June. In Merinos the breeding season is much longer, from December to September, and even in the intervening months a high proportion of the ewe flock can be induced to sexual receptivity and ovulation by the introduction of rams.[2]

7.6 The main breeding season in most Australian States is autumn, allowing the lambs to be born in spring after a gestation period of from 147 to 152 days. This is possibly the optimum choice for the welfare of ewes and lambs, as a spring lambing normally coincides with improving weather and new pasture growth. However, its corollary is that the ewes mate and are pregnant at times when pasture is at its least plentiful and least nutritious, resulting in a greater susceptibility of the ewes to dystocia.

7.7 It is unlikely, however, that "encouraged" matings at a time when the ewe flock is largely anoestrous in spring are positively harmful in welfare terms, though they may be less successful.[3]

7.8 The length of joining has more welfare implications. Ewes are in oestrus at intervals of 17 days on average, with a range of 15 to 20 days,[4] while the oestrus itself lasts for 24 to 36 hours.[5] A joining period of six weeks, as recommended by the New South Wales Agriculture and Fisheries[6] allows ewes two cycles in which to conceive, yet restricts the lambing period to a manageable length. A prolonged joining period would result in an equally prolonged lambing period, resulting in the likelihood of some lambs being marked very late and others being weaned very early. Late-lambing ewes may not regain appropriate liveweight and condition before the next mating period, thus jeopardising their chances of a successful outcome.

7.9 Other factors affecting the success of mating are the age of both rams and ewes, the number and fertility of rams used and the size of the mating paddocks.

7.10 The fertility of the ewe is at its peak at four years of age and remains constant at that level until eight.[7] British breeds are more precocious than Merinos, and in good conditions can reach puberty at four months, though it is generally accepted that they should not give birth until they are two years old.[8]

7.11 Ram welfare also needs to be considered before and at joining time. Merino rams can attain puberty from four months to two years[9] but are at their peak in reproductive terms from two to three years of age. Rams need to be carefully examined before being introduced to the ewes to ensure they are in good physical health. As the usual joining ratio of rams to ewes is 1:50, it is important that the ram is not suffering from arthritis, foot abscesses or abnormalities of the testis, epididymis or penis, any of which would make his duties potentially painful. Recent surveys of flocks in New South Wales and Victoria have shown that between 15 and 20 per cent of rams were unsound for breeding,[10] suggesting that more attention needs to be paid to the condition

of rams before joining, for both welfare and sound management reasons. Blood tests for ovine brucellosis should be carried out and replacement rams should be acquired from ovine brucellosis-free accredited flocks. Crutching and jetting of the rams is advisable if there is any danger of their being flystruck, as that can reduce fertility.[11]

7.12 Large mating paddocks, and especially undulating ones with sheltered gullies, are not a welfare hazard per se, but may result in lower conception rates as rams may simply fail to find all the ewes or have to expend much more energy in doing so. If such areas have to be used, commonsense and animal welfare considerations would both dictate that a higher percentage of rams be used.

7.13 Nutrition, in both a qualitative and quantitative sense, is the dominant influence on reproductive success. Mating of stock should not be contemplated in conditions of fodder scarcity, if the owner is not prepared to hand-feed as and when necessary. Nature intervenes to some extent in this situation, as ewes below a certain critical liveweight (30-35 kg, depending on breed and strain) will not get in lamb. Once in lamb, however, and especially in the six weeks before birth, it is vital for both ewe and foetus that the food supply be increased in order to prevent pregnancy toxaemia and to ensure a good milk supply.[13]

Breeding objectives

7.14 The end products of the sheep-raising industry are wool and meat, the relative importance of which varies among the different parts of Australia. Sheep breeders are constantly aiming to improve the overall standard of their flock by selecting sheep for increased fleece weight, for a specific fibre diameter, for reproductive performance or for body weight.

7.15 Substantial progress can be attained by rigorous selection for the desired characteristics. In research flocks at Trangie, New South Wales, after eight generations (23 years) a 20 per cent increase in wool production was achieved. However, at that point, the flock ceased to respond to further selection. Also, the gains were made at the expense of fibre diameter, which increased from 19 to 21.2 microns.[14]

7.16 Body weight and early growth rate respond well to selection, with an established heritability figure of 0.35.[15]

7.17 Increasingly, however, attention is being paid to other breeding objectives, such as "easy-care" sheep resistant to flystrike, fleece rot and internal parasites and which require little assistance at lambing.

7.18 While such objectives are obviously highly desirable in sheep welfare terms, and have been enthusiastically supported by many animal welfare groups, there are two major problems concerning their realisation. Firstly, there can be incompatibilities among objectives, and secondly, as Professor Kennedy pointed out to the Committee, in conventional quantitative genetics, the improvements which can be made are very slow.[16] The establishment of large group breeding schemes is helping to overcome the problem of slow genetic response to selection within small private flocks.[17]

7.19 Selection for resistance to flystrike, for example, is a possible long-term solution to the problem of flystrike. According to New South Wales Agriculture and Fisheries researchers Raadsma and Rogan[18] the heritability of liability to body strike and to fleece rot, one of the major predisposing causes of body strike, is about 0.4.[19] though other researchers have cited a lower figure.[20] However, it seems that fleece rot

and fleece weight are positively correlated, so that by selecting against fleece rot, a producer may find his animals produce less wool.[21] Similarly, by opting to produce heavier fleeces, a producer will be faced with wool of increased fibre diameter.

7.20 In their review of genetic parameters for reproductive traits, Purvis and colleagues[22] concluded that many traits, such as maternal rearing ability, would respond better to management decisions than they would to selective breeding programmes.

7.21 An interesting development in manipulating sheep prolificacy has been the use of Booroola Merinos, named for the Cooma property whose Merino ewes were noted in 1958 for their twinning propensity. In mixed-age Booroola research flocks, mean litter sizes of 2.5 have been observed. Research has shown that a single major gene, now known as the F gene, affects the Booroola ovulation rate additively - one copy of the gene increases ovulation by up to 1.5 eggs, two copies by 3 eggs. However, in breeds of high prolificacy, second copies of the F gene are less dominant.[23] The gene appears not to affect body weight, fleece weight or fibre diameter. The most promising results from the use of the Booroola Merino are in crosses with British breeds, where the high litter sizes are exploited for increased prime lamb production.[24]

7.22 The Committee is concerned that attempts to exploit the potential of the Booroola strain also take into consideration the problem of lower lamb birth weight and greater lamb losses, especially amongst higher order births.

7.23 The development of WOOLPLAN in 1984 by a sub-committee of the Sheep Performance Recording Co-ordinating Committee, established by the Standing Committee on Agriculture, has enabled breeders to use objective measures in their selection programmes. WOOLPLAN is the national performance recording scheme for Merino and other non-pedigreed wool sheep breeds. It ranks animals on

predicted breeding value according to breeding objectives selected by the producer, and is available through accredited wool testing laboratories.[25] It could be the stimulus for co-operative sheep-breeding research projects which could lead to real genetic progress in the national wool sheep flock.

7.24 Even were producers to be swayed to the welfare rather than the economic side of the selective breeding debate, dramatic results could not be expected in the short term. Professor Kennedy suggested that, with conventional selective breeding, improvements in fleece weight of about only one per cent per annum could be achieved. More dramatic changes are unlikely because of the sheep's natural balancing or homeostasis.[26]

7.25 The Committee believes that every effort should be made to encourage research into breeding for resistance to deleterious and heritable diseases and parasites. It accepts that most producers cull animals with obvious defects from their flocks. However, more can and should be done to lessen our dependence on chemicals and to lessen the problems associated with parasitic resistance to chemicals.

Manipulation of reproduction

7.26 Reproduction can be artificially manipulated in a number of ways, involving no direct contact between ram and ewe in the process of fertilisation. They include artificial insemination, embryo transfer and genetic engineering.

Artificial insemination

7.27 Artificial insemination is a method of breeding in which semen is obtained from the male and introduced into the female reproductive tract by means of instruments.[27] Semen can be collected from the ram by training him to use an artificial

vagina or by the use of an electro-ejaculator, while the ewe is inseminated cervically or vaginally by pipette, or laparascopy is used to deposit the semen directly in the uterus.[28] Either fresh or frozen semen may be used.

7.28 The technique of artificial insemination is widely used throughout the world, especially in the cattle industry. It appears to be gaining ground slowly but steadily in Australia in the sheep industry. In the 1988-89 season, it is estimated that less than half of one per cent of the total ewe flock will be artificially inseminated.[29]

7.29 The advantages of artificial insemination are many. With conventional mating, a ram is expected to cover generally 50 and up to 100 females per year, while with intrauterine insemination of frozen-stored semen, it is estimated that up to 25,000 ewes could be inseminated from a single ram each year.[30] Even allowing for the reduced fertility sometimes experienced with artificial insemination, the number of lambs per ram will be far in excess of that achieved naturally. The influence of superior rams can thus spread further, faster.

7.30 Semen, whether fresh or frozen, can be transported more easily and cheaply than rams and can be obtained from valuable animals which may be prevented by some infirmity from mating. Semen banks can preserve frozen semen for use long after the death of the provider ram, and when his progeny have proved themselves to be superior animals.

7.31 When synchronised breeding is used in conjunction with artificial insemination, lambing and lamb marking can be more easily managed at appropriate times for both animals and producer.

7.32 Artificial insemination has some potential hazards, however. If the rams used are not thoroughly checked for diseases, then those diseases may be spread much more rapidly than otherwise. Similarly, as Professor Kennedy pointed out, unfavourable genes can be spread rapidly.[31]

7.33 The methods used to collect semen, while not in themselves hazardous, may cause some discomfort to the ram, particularly electro-ejaculation. In this method, a probe in the rectum transmits low voltage electric pulses to stimulate output of spermatozoa. The ram is restrained on his side for the procedure. Studies by Martin and colleagues have reported significantly elevated plasma concentrations of cortisol and prolactin for up to two hours following electro-ejaculation.[32]

7.34 The use of an artificial vagina, a device which imitates the vagina and provides temperature and pressure stimulation to the erect penis of the ram, seems to be a preferred option, where possible. Rams are trained to use the device easily, by the presence of a "teaser" oestrous ewe restrained in a bail. While cortisol and prolactin levels still rise with the use of an artificial vagina (as they do with natural mating) they do so to a far lesser extent and return to normal levels more quickly.[33]

7.35 It was unclear to the Committee how widespread the use of electro-ejaculators is. The Committee accepts that their use may be necessary on health grounds for semen examination when the ram is unable to use an artificial vagina. However, for semen collection purposes, artificial vaginas would appear to be preferable.

7.36 Artificial insemination is certainly more stressful to the ewe than natural mating, as it involves human handling and, in the case of intrauterine insemination, minor surgery. The simplest method, and one used extensively in Western Australia

with apparently good results, is to walk the oestrous ewes through a race, restrain each one momentarily and insert the semen via plastic pipette into the vagina. Cervical insemination involves locating the entrance to the cervix with a speculum and depositing the semen there with a pipette. The ewe's hindquarters need to be elevated for this to be done successfully. Larger quantities of semen are required for both these methods than for intrauterine insemination, which involves the use of a local anaesthetic, after which small incisions are made in the abdominal wall to allow the passage of a laparoscope to identify the organs and a pipette to place the semen.

7.37 Intrauterine insemination is the most successful of the three procedures and is the preferred option of many of the major studs, such as Collinsville, which uses the procedure on more than 50 per cent of its ewes.[34] The resulting conception rates at Collinsville currently average 70 per cent, meaning that 30 per cent of the ewes undergo the stress of minor surgery to no avail. Laparoscopy has the advantage of being the only technique to be able to use (thawed) frozen semen, so that neither ewes nor ram have to be transported.

7.38 A management difficulty associated with artificial insemination is the need to synchronise the oestrus period of the ewes, as under normal pastoral conditions the number of ewes in oestrus on any given day is highly variable. The most common method in current use involves the insertion in the ewes of intravaginal sponges soaked in progestagen. The sponges are removed after 12 to 14 days, and the ewes injected with pregnant mare serum gonadotrophin (PSMG). Sometimes teaser rams are introduced to the flock at the same time. Fifty-five to 56 days later, the ewes are in oestrus and ready for insemination.[35] The dose of PSMG is varied according to the age and breed of the ewe and to the season of the year. PSMG is known to cause a decline in fertility, but this is partly compensated for by a higher ovulation rate.[36]

7.39 The Committee accepts that artificial insemination is of valuable assistance in the genetic improvement of sheep in Australia and as such should be encouraged. However, the Committee would like to see further research into the efficacy of non-invasive techniques using (thawed) frozen semen to keep the stresses associated with the process to a minimum. It would also like to see continued research into methods of synchronising oestrus.

Embryo transfer

7.40 This method involves the removal of embryos from a desirable donor ewe after two to six days of development and their transfer to the reproductive tracts of synchronised recipient ewes. The method of transfer uses a laparoscopic technique similar to that used in artificial insemination. General anaesthetic is commonly used for both the collection and transfer of embryos.[37] Sometimes the donor ewe is encouraged to superovulate by prior treatment with PSMG. Success rates of from 50 to 70 per cent can be achieved.[38]

7.41 Compared to artificial insemination, embryo transfer is likely to be more stressful for the ewes concerned. Surgery may cause adhesions of the reproductive tract.[39] Apart from its cost, embryo transfer is unlikely to have the same impact as artificial insemination as fewer than 100 embryos can be transferred from a single ewe in her lifetime and her influence could never match that of a ram which, via artificial insemination, fathered thousands of offspring.[40]

7.42 A further refinement of the embryo transfer process is the recently developed technique of splitting embryos microsurgically. If the implanted embryo results in a highly successful animal, its frozen clones will be able to be used to create identical creatures even well into the future.

7.43 Concern was expressed to the Committee by the Australian Veterinary Association that in some States, non-veterinarians were performing such "sophisticated invasive techniques" as laparoscopic insemination and embryo transfer.[41] The veterinary surgeons legislation varies somewhat from State to State, but frequently it contains provisions for properly accredited persons who are not veterinarians to perform artificial insemination. Owners, whether competent in the procedures or not, are exempt from the provisions of the legislation.

7.44 As artificial breeding is becoming more popular, the Committee believes it is important to ensure that all persons who perform either laparascopic insemination or embryo transfer in sheep are competent in the procedures. It considers that it is the responsibility of the Veterinary Surgeons' Board in each State to ensure that only properly accredited persons, either veterinarians or technicians with certificates of competency, perform the procedures.

Genetic engineering

7.45 Isolating a gene from one organism and transferring it to another is known as genetic engineering. The most visually dramatic research to date involves genes coding for growth factors. "Supermice" have been bred since 1982 by transferring copies of the human growth hormone gene into one-cell mice embryos. These transgenic mice grow to twice the size of their normal litter mates, and the changes are passed on to successive generations.[42]

7.46 Work has been conducted by the CSIRO into the growth hormone gene in sheep, with the aim of producing larger, faster growing sheep with leaner meat for the prime lamb market. Four transgenic sheep have been bred but none has survived a year and all have had the classical signs of growth hormone toxicity, such

as diabetes and swollen joints.[43] In the case of sheep, the yield of transgenic sheep born following micro-injection of foreign DNA is very low. Fewer still of these express the foreign gene, because the control mechanisms are still not well understood.

7.47 CSIRO researchers are now attempting to transfer into sheep the bacterial genes which make the enzymes for cysteine synthesis, so that the transgenic sheep could make extra cysteine to increase their wool production significantly.[44]

7.48 Genetic engineering holds enormous promise as the means of transferring single desirable genes or genetic combinations to Australia's sheep. However, the technology is still in the experimental phase. Retrieving embryos for manipulation in the laboratory often requires repeated surgery; in many cases the foreign DNA does not "take" or the embryo fails to develop; and researchers cannot readily control the placing of the foreign gene or how it works.[45]

7.49 Most important economic traits in sheep, such as growth rate, fleece weight and milk production are multigenic and hence present major transfer difficulties. Single gene differences include fecundity, as expressed by the F gene in the Booroola Merino. This gene appears to operate to increase ovulation rate by reducing the activity of the hormone inhibin, but this effect is difficult to achieve using current genetic engineering technology.[46]

7.50 That we cannot predict all the consequences of adding foreign genes to adult domestic animals was graphically illustrated by the case of the Beltsville pig. Growth hormone genes introduced to pigs in the United States Department of Agriculture farm at Beltsville, Maryland in 1986 produced a severe side effect in the form of crippling arthritis in the one animal which survived to adulthood.[47]

7.51 In their evidence to the Committee, CSIRO researchers also pointed to the possibilities of using genetic engineering techniques to breed animals with greater inherent resistance to disease.[48] While accepting that this is a laudable aim, as is the genetic improvement of the Australian sheep flock, the Committee urges caution with regard to the extent to which genetic manipulation should be allowed. The Committee supports continued research into genetic manipulation in sheep, provided that it is not detrimental to sheep welfare and provided that all research proposals are scrutinised attentively by the relevant ethics committees.

CHAPTER 8

NATURAL DISASTERS

Introduction

8.1 Droughts, floods and fires ravage the Australian landscape irregularly but frequently, such that they must be considered an inevitability for the landowner and be planned for accordingly. Some regions are more prone to one of these natural disasters than the others. The eastern tablelands, for example, have a one in five chance of a potentially serious fire season each year. Disasters are also frequently interlinked, with major flooding often following the breaking of a drought or fire breaking out early in a drought, when pasture growth or undergrowth has dried off.

8.2 Given the inevitability of these natural disasters, it might be assumed that mechanisms for dealing with them and their consequences had been perfected over the years. Natural Disaster Relief Arrangements (NDRA) have provided assistance by all States and the Commonwealth, on slightly varying terms and conditions. In general, low interest rate loans provide carry-on finance and funds for restocking purposes. Fodder, water cartage and stock transport subsidies may also be available.[2] From 1 July 1989, however, drought provisions have been removed from the NDRA scheme, pending the final representation of the Drought Policy Review Task Force.

8.3 Longer-term preventive measures, such as farm water supply works, erosion control measures and fodder conservation are also generally supported at State level by low interest loans of around 4.5 per cent, with varying eligibility criteria,

repayment terms and required security.[3] In New South Wales, for example, farmers of "moderate means" can obtain loans of up to $3000 at 4.5 per cent for fodder conservation purposes through the Rural Industries Agency of the State Bank, with repayment terms up to 15 years and on security of the farm mortgage.

8.4 This support, while valuable to the farmer in the longer term, is rarely of immediate benefit to burnt, stranded or starving sheep. The Committee accepts that the majority of farmers does consider the welfare of stock in such emergencies. It further acknowledges that there may well be, for example, farmers who are still paying off debts incurred in 1982-83 when they chose to feed their sheep during the drought.[4] Nevertheless, the Committee concludes that more can and should be done to ensure the welfare of sheep before, during and immediately after natural disasters.

Bushfires

8.5 In bad fire seasons, the extent of damage caused to the Australian environment and to its wildlife, stock animals and humans by bushfires is horrendous. In the 1974-75 fire season, 15.2 per cent of the land area of this continent was burnt, including over 60 million hectares of pastoral land. The cause, in the majority of cases, was a lightning strike.[5] In more recent times, the Ash Wednesday fires in south-eastern Australia in 1983 caused the loss of 71 human lives, the loss of 334 500 sheep[6] and damage estimated at $400 million.[7]

8.6 There is often insufficient warning of bushfires for sheep to be moved out of danger, although if that is an option, it should be taken. Following a fire, burnt stock need to be inspected as quickly as possible, divided into groups according

to the severity of their burns and dealt with appropriately. The State Departments of Agriculture produce and update guidelines concerning burn injuries and their treatment and may also provide local officers to assess stock.[8]

8.7 The most severely burnt sheep need to be euthanased where they lie and their carcasses disposed of. To spare the sheep further suffering, this task should be done immediately. An acceptable method of euthanasia is a shot to the centre front or back of the skull with a .22 rifle at close range. In moderately closely settled areas, sufficient competent volunteers can generally be found to perform this task promptly. The Committee is concerned that in the thinly settled pastoral zone, and particularly following an extensive fire, sheep must frequently linger unaided until death supervenes.

8.8 Sheep which can still walk but which are unlikely to recover from their burns are sometimes transported to an abattoir. While sympathising with the farmer in his intent to minimise his losses, the Committee accepts this as an option only if the abattoir is not too distant and can accept the sheep at once. The Committee notes the advice tended by the Victorian Department of Agriculture and Rural Affairs to the effect that abattoir salvage of sheep should occur within 24 hours and preferably within 12 hours.[9] The Committee **recommends** that more specific guidelines on acceptable parameters for the transport of burnt stock be devised and incorporated in the codes of practice on road transport of livestock.

8.9 Treatment of burnt sheep should be undertaken only if the sheep have a good chance of recovery and can be adequately fed and watered until pasture growth resumes. A sheep which is severely burnt through the skin of the legs below the knees or hock joints is unlikely to survive longer than a couple of weeks and should be humanely slaughtered. Burns to bare-skinned areas other than the legs are more likely to heal and the sheep should recover with no long-term loss in productivity.

8.10 Perhaps the most important issue in post-fire sheep care is regular, at least daily, surveillance to ensure that all animals are responding to treatment, and that their weeping wounds do not become flystruck. If unfamiliar rations need to be provided, all sheep must be watched to ensure that they are eating. There is some evidence to suggest that it would be helpful if all sheep were introduced briefly to grain as lambs, as they readily learn to consume grain at a young age and retain a willingness to accept it when necessary later in life.[10]

8.11 A major welfare issue, especially following widespread fires such as those of Ash Wednesday, is the provision of fodder, as reserves in the district may have been destroyed. The Committee received no evidence to indicate that the co-ordinating arrangements by the State departments of agriculture for emergency fodder provision were inadequate.

Floods

8.12 Flooding is an irregular but frequent occurrence, particularly in the eastern States. It may take the form of a broadscale though shallow inundation of the floodplains of the inland river systems, or flash coastal floods.

8.13 Floods are arguably the least threatening of natural disasters for sheep welfare. Enough warning of the danger of flooding is usually given so that sheep can be moved to higher ground if this is available. However, problems of feeding isolated stock until the floodwaters recede can be immense and the exercise is inevitably costly. In certain areas, sheep may be marooned for months, during which time they must subsist on airlifted hay or provisions and medications conveyed by boat. Nevertheless the Committee is of the opinion that if sheep are raised in an area which is prone to flooding, adequate provision must be made for them during and following floods.

8.14 No specific cases of cruelty to, or neglect of, flood-bound sheep were presented to the Committee. However, it is certain that many sheep die in floods and it seems probable that many others suffer partially avoidable food deprivation and disease following floods. The Committee stresses the responsibilities of owners to ensure that, as the Victorian code of accepted farming practice for the welfare of sheep recommends, "reasonable steps should be taken for stock to be attended to promptly after either fire or flood".[11] Given the variety of flood situations, it is hard to be more precise than this.

8.15 Flood relief finance is provided through the States to landowners under similar terms and conditions to bushfire relief.

Drought

8.16 Drought is, and will in all probability continue to be, a prominent feature of Australian life. Since the 1860s there have been nine major droughts and six other droughts of a lesser degree of intensity, but nevertheless causing appreciable losses in large areas of several States.[12] There are rarely any periods in which some part of Australia, however small, is not drought-declared.

8.17 There are significant problems associated with objectively defining drought, establishing criteria for its onset and declaring it ended, none of which is within the Committee's remit to consider. However, the ramifications of drought declaration are of particular importance for the sheep producer, for until an area is drought-declared by the local Pastures Protection Board in New South Wales or its equivalent in the other States, financial assistance in the form of water cartage or fodder subsidies is unavailable. Until that assistance is forthcoming, some producers seem to be unable or unwilling to feed or water their stock adequately.

8.18 Producers' obligations to their sheep are spelt out in the Victorian Government's 1982 code of accepted farming practice for the welfare of sheep and reiterated in the national draft model code of practice being developed by the Sub-committee on Animal Welfare of the Standing Committee on Agriculture. The Victorian code states unequivocally "Sheep should not be allowed to starve to death" and "Sheep should not be allowed to die of thirst".

8.19 While such provisions might appear self-evident and even superfluous to the majority of sheep farmers, the need for them was amply demonstrated during the 1982-83 drought. ANZFAS has calculated that, on the basis of available figures from the Department of Agriculture and Rural Affairs, 769 000 sheep deaths were recorded in Victoria between September and March.[13] Dr Harrison, a Principal Veterinary Officer with the Department, indicated that Departmental officers had to shoot 160 000 unwanted and unsaleable sheep during 1982-83 rather than allow them to continue suffering.[14] Dr Harrison further pointed out that the majority of prosecutions launched by the Department concerning the maltreatment of sheep was on the grounds of failure to feed correctly in a drought situation.[15]

8.20 The Committee accepts that in most cases, sheep owners are not guilty of wilful acts of cruelty towards their animals in a drought. Owners are themselves the victims of the drought, as Dr Meischke pointed out.[16] They may well be put in the invidious position of not being able to buy feed because it is unavailable. Further, when they make the decision to sell their stock, there is no guarantee that even many trips to the saleyard will ensure a buyer, or that the local abattoir will be able to cope with the supply.

8.21 Droughts are relatively unpredictable phenomena, although the Bureau of Meteorology is engaged in international data exchange with the World Climate Programme in the hopes of being able to assess the likelihood of major anomalies in

rainfall patterns over Australia well in advance.[17] However, as Professor Egan of the University of Melbourne's Department of Agriculture pointed out, when a farmer mates his animals, he is committed to "an entrained programme of events progressing into an unpredictable future environment".[18] When feed deficiencies then occur, decisions have to be made about taking actions which are not routine. The heart of the welfare issue then becomes the timeliness of the decisions. Professor Egan summed up the position as follows:

> While most farmers act in time to take reasonable action, they differ in their optimism, in their knowledge of the costs and benefits of the options available and in their ability to make the committing decisions.[19]

8.22 Other witnesses were more critical of the actions or inaction of sheep owners during drought periods. Mrs Townend outlined the following scenario:

> During times of drought the television screen shows the dogged farmer doing the rounds with the rifle, and placing a bullet through the skull of his emaciated animals. The distressed viewer is led to believe that this unavoidable suffering is a natural result of the climate and there is no other way of dealing with droughts. Unfortunately there are two fallacies about the myth of the shooting farmer. The first is that he ... may well not shoot his animals, but allow them to live as long as possible in the hope that rain will come. The second fallacy is that drought must bring starvation of stock. Good farmers begin to sell animals when they know that they can no longer feed them properly. They do not overstock in the good years, and ensure thereby that their property has maximum feed to carry them through the bad times.[20]

Mrs Townend further reported cases in which sheep were reputedly bought for next to nothing in drought sales and "put out into the bush somewhere" with no care or attention, in the hopes that some would survive and be profitable for the speculative buyer.[21]

8.23 The Committee was unable to determine if such reprehensible conduct occurred, and if so, with what frequency. The Committee believes that the wilful neglect of the nutritional needs of sheep is rare, but when it occurs, the provisions of State prevention of cruelty to animals laws are theoretically sufficient to deal with the owner. As far as the unfortunate animals are concerned, the Committee considers that the most promising approach is the education of the farming community as to its responsibilities to report cases of neglect to the relevant authorities, if informal approaches to their neglectful colleague bear no result.

8.24 A number of acceptable welfare options are open to a sheep farmer in a drought, some of which were outlined by Mrs Townend above. Stock may be sold, fed or agisted. In welfare terms, feeding is probably the number one choice. It may consist of protein or energy supplements to available pasture, such as urea, grain or hay; or it may consist of complete survival feeding. Advice is readily available from veterinarians, State departments of agriculture and other extension services on bodyweight at which survival feeding should begin, quantities of food which should be provided and the economics of feeding. The New South Wales Department, for example, suggests that feeding should commence when weights fall to 45 kg for British breed sheep, 40 kg for large-framed Merinos and 35 kg for small-framed Merinos.[22]

8.25 If prolonged feeding of stock is uneconomic, or if feed is not readily available, agistment may be an option for the sheep producer. In welfare terms, this has the disadvantage of involving sheep in lengthy road or rail transport. Also not all sheep adapt well to different terrain, feed and water. On the positive side, the sheep can generally continue producing at a reasonable level and breeding programmes can continue. In a widespread drought, however, agistment is unlikely to be available except at a considerable distance and even with 50 per cent transport subsidies may be uneconomic.

8.26 A third option in a drought is the sale of part or all of the stock. To avoid the pitiable spectacle of emaciated sheep being dragged from one saleyard to the next, the decision to sell should be made before the sheep are in really poor condition. The Committee **recommends** that guidelines be established by the State departments of agriculture concerning the bodyweight and/or condition score below which the different breeds of sheep should not be permitted to be sold in saleyards. Sale by computer-aided systems such as CALM would still be an option for those sheep, but would spare them the stresses of transport and saleyard.

8.27 Current governmental provisions for drought relief were criticised by many of the witnesses who appeared before the Committee. AFWA suggested that fodder subsidies in fact rewarded the improvident and that farmers who put away fodder reserves were disadvantaged.[23] Dr Meischke pointed out that fodder subsidies in effect advantaged those who had fodder, not those who had stock.[24] Dr Barton, President of the Australian Veterinary Association, commented on the problem of farmers who overstocked in the expectation of being "bailed out" by subsidies in a drought situation.[25]

8.28 Whether sheep producers should conserve fodder or conserve cash was questioned by Mr Bowman, representing the Wool Council of Australia. He pointed out that no farmer could have been expected to provide the fodder requirements needed during the 1982-83 drought and that even if it had been attempted, the fodder would have deteriorated.[26] Mr Bowman concluded that incentives to preserve cash were preferable, combined with an assurance from the Australian Wheat Board that it keep contingency stock on hand at all times to cover expected requirements during drought. The Wheat Board has no formal brief to do this, but apparently there is an unwritten understanding that it does so.

8.29 Incentives to preserve cash exist in the form of the Income Equalisation Deposits (IED) Scheme. This encourages farmers to build up cash reserves by putting aside money in good years for use in bad years, thus reducing income fluctuations. The scheme lost favour somewhat after 1983, when its tax-deductibility provisions were removed. The Federal Government accepts that some incentive is justified to encourage farmers to provide for income fluctuations. It therefore proposes to introduce a tax-linked IED Scheme for primary producers from 1 July 1989, in which deposits will be tax deductible in the year of deposit and assessable in the year of withdrawal and interest will be paid at the appropriate Government bond rate.[27]

8.30 The Committee accepts that drought relief is a most difficult issue, given the problems of resolving the competing and at times conflicting requirements of industry survival, stock survival and producer survival. Nevertheless, the Committee holds that the stock should not perpetually come out second or third best.

8.31 The problem of the timing of drought declarations should not be underestimated. Pockets of drought can exist in non-declared areas and vice versa. Climatic drought and agricultural drought may or may not coincide. The Committee understands that the bulk of research into drought declaration and the use of drought relief provisions has been done on New South Wales data. Hence it will consider the findings of that research on the assumption that it is not atypical of the situation in Australia generally.

8.32 In New South Wales, a Pasture Protection District can request to be drought-declared, but this request must be independently recommended by a veterinary inspector of the Board or a Regional Director of Veterinary Services of the Department

of Agriculture and Fisheries, and the final decision rests with the Minister for Agriculture. For a district to be drought-declared, 50 per cent of it must be drought-affected, as determined by the need for survival feeding of stock.[28]

8.33 In practice, for the period between 1957 and 1981, the probability of a given New South Wales district being drought-declared in any given month was 20 per cent, and one district was drought-declared for 44 per cent of the time. Such high frequencies are clearly inconsistent with the normal definition of a natural disaster and many such droughts should be considered as forming an integral part of farm management.[29]

8.34 Disaster relief payments have been shared equally by States and the Commonwealth up to 0.225 per cent of each State's annual revenue, thereafter the Commonwealth contributes 75 per cent.[30] In the case of particularly severe disasters, the Commonwealth has provided additional financial aid, as in the case of the *Drought Relief (Primary Producers) Act 1982*, which extended subsidies for the cost of purchasing fodder for producers in drought-declared areas.

8.35 Drought relief assistance has been routinely available to primary producers in the form of concessional loans for carry-on, restocking and repair purposes; 50 per cent freight rebates on the transport of fodder or stock; and assistance to State and local authorities for the disposal of helpless or unsaleable stock, and assistance with water provision.[31]

8.36 An analysis of the drought relief subsidies for 1972-73 (a year of widespread drought) for New South Wales revealed that the average payment was $203. Total payments amounted to $305 566 for 1508 claims from 1092 producers. Individual claims ranged from a high of $3375 to a low of $1. Eighty-four per cent of claims were for transport subsidies. The number of producers who lodged claims for subsidies was only a small proportion of those farming in drought-declared areas.[32]

8.37 A further analysis of drought relief payments in five New South Wales districts over the years 1976-87 showed that the average payment amounted to $551. Over 80 per cent were for transportation of stock or fodder. Fifty-eight per cent of individual claims were for less than $500, and again, only about 20 per cent of individual producers in drought-declared districts claimed relief.[33]

8.38 The conclusion which must be drawn from the above studies is that efficient farm managers operating in appropriate areas do not need and do not apply for drought relief subsidies. Any sheep producer whose viability depends on a $500 subsidy should clearly not be in the business of raising sheep and should not be supported by the Australian taxpayer to do so. The inequity of a situation in which financial support is available for the improvident is untenable.

8.39 The Committee learnt anecdotally of instances of abuse of drought relief assistance, but received no firm evidence that it occurs, and if so, with what frequency. The Committee notes, however, that overall drought relief subsidies are not high, so that abuse of the scheme, if it does occur, must do so on a relatively small scale.

8.40 The Committee is aware of the at times conflicting needs of soil conservation authorities and primary producers. At the onset of a drought, the former would like to see all stock agisted elsewhere to limit the extent of soil degradation[43] yet the latter may not be convinced of the need for urgent action, particularly if the timing coincides with shearing or lambing.

8.41 In considering the question of drought relief, the Committee feels it lacks the hard evidence necessary to make recommendations which go well beyond the specific ambit of sheep welfare. The Committee nevertheless believes that in the

long-term interest of sheep welfare, there is no place for marginal producers in the more arid areas, and the removal of drought relief subsidies might be one way of achieving this.

8.42 The Committee puts forward the following suggestions to the Drought Policy Review Task Force, which is currently investigating alternative arrangements relating to the future involvement of the Commonwealth in providing assistance for drought:

- no drought relief subsidies should be available until drought conditions have persisted for longer than six months.

- the monies thus saved be put towards the employment of more inspectors under the prevention of cruelty to animals acts, to ensure that no sheep are being adversely affected; that overstocking is not permitted.

- no drought relief subsidies should be available in areas drought-declared more than 25 per cent of the time over the last ten years.

8.43 The Australian Soil Conservation Council (ASCC) has recommended that optimum stock-carrying capacities should be determined for each region[35] and the information disseminated by the State agricultural authorities. The Committee considers this recommendation has some merit and believes that any producer who exceeded those optimum capacities should then be ineligible for drought relief subsidies or concessional loans.

8.44 The Committee **recommends** that joint guidelines be devised by the Australian Soil Conservation Council, the State departments of agriculture and forestry and the National Farmers Federation on conservation farming techniques which would benefit both sheep and the environment.

CHAPTER 9

REGULATION

Introduction

9.1 Responsibility for good sheep husbandry rests largely with the producers and the industry. The welfare of the sheep is in their hands. It is their investment which is at risk if production is reduced through undue stress being placed on the sheep through neglect or abuse. However, they also have a moral responsibility and a legal obligation to maintain proper care of their animals.

9.2 Evidence received by the Committee was unanimous on the point that the majority of sheep producers are responsible people who do not maltreat their animals. Although industry sources could be expected to take this line, and did,[1] groups with no vested interest supported them. Dr Brennan, representing the RSPCA (Australia), stated "most producers are abiding by good husbandry standards; it is a small proportion that is not".[2]

9.3 In good times, there is probably little neglect or abuse of sheep by producers; it would only impact on production. However, in a drought or in the aftermath of bushfires or floods, welfare may be at odds with economics. As discussed in Chapter 8, some producers have delayed taking action in the hope of improvements in the weather or in their circumstances and thereby causing increased distress to sheep already in a poor condition.

9.4 The Committee's concern is twofold: firstly, to ensure that the ground rules for good sheep husbandry are precisely and unambiguously laid down so that everyone understands the framework within which they are operating; and secondly, to ensure that incidences of malpractice are dealt with as swiftly as possible to protect the animals in question from further suffering, and to deter further neglect or abuse.

9.5 In this chapter, the Committee examines the controls which operate in the industry to prevent abuse or neglect of sheep.

The present regulatory situation

9.6 All Australian States and Territories have legislation for the prevention of cruelty to animals. Although legislation varies in detail, penalties and enforcement provisions among the States and Territories, it outlines to some extent the type of conduct towards animals that is generally regarded as unacceptable, namely ill-treatment, failure to feed, water or shelter adequately, abandonment, needless mutilation and so forth. The acts, or their regulations, specifically exclude from their provisions surgical operations on livestock such as tail docking and castration.

9.7 The State and Territory legislation provide for inspectors who are usually specified RSPCA or other animal welfare personnel or departmental officers. The inspectors normally conduct investigations following complaints about offences which have allegedly been committed under the legislation. Most inspectors are based in the capital cities and consequently most investigations are carried out in or around those cities. The RSPCAs and other specified non-government organisations do not have the resources to appoint more inspectors to carry out inspections more widely in country areas.

9.8 In Queensland, for example, the RSPCA in 1983-84 had four inspectors to cover most of the State. Sometimes, the RSPCA asked the police in country towns to make initial inquiries to find out whether the case warranted an inspector travelling to the town.[3]

9.9 Inspectors usually try to solve problems through advice or persuasion rather than by taking legal action. Prosecuting people can be time-consuming and expensive. In Victoria, for example, in 1987-88, of 419 cases involving sheep which were investigated by RSPCA inspectors, only 23 needed to be prosecuted.[4] The intervention of the inspectors was generally sufficient to obtain the requisite remedial action in the other instances of neglect.

9.10 Sometimes, attempts to resolve a problem by negotiation go on for too long to the detriment of the animal. In the case described in paragraph 6.3 above, the sheep which had not been shorn for four years were in a terrible state when they were eventually confiscated by the RSPCA. Many attempts by various people and organisations to persuade the owner to shear the sheep were to no avail.

9.11 When cases have been taken to court, and convictions recorded, the penalties imposed do not always reflect the gravity of the offence. A Tasmanian case of failure to treat flystruck sheep, which resulted in the deaths of 20 of them, attracted a $50 fine for cruelty and a $25 fine for failure to remove carcasses.[5]

9.12 The RSPCAs take action on the receipt of complaints. If there are no complaints, then there are no inquiries. Most cases of neglect or abuse of sheep only come to the attention of neighbours or other people working in the area. As there is a reluctance within the rural community to inform on members of that community, it is difficult for cases of neglect or abuse of sheep to come to the notice of the authorities.

9.13 Given the difficulties in detecting neglect or abuse and in getting action to resolve it, the Committee believes that every effort should be made to try to prevent neglect or abuse of sheep in the first place. The industry has an important role to play through dissemination of information and in encouraging producers to care for their sheep at all times. The industry must be pro-active in its approach to the development of good animal husbandry practices. If innovative methods of sheep production evolve from research, methods which benefit both sheep and producer, they must be embraced and be seen to be willingly embraced by a forward-looking, caring industry. If, on the other hand, research findings are not presented to producers, or are not acted upon, the industry will stand condemned in the eyes of a public which has become more alerted to welfare issues in recent times. If the sheep and wool industry fails to present a humane face to its consumers, it may be faced with a boycott of its products.

9.14 Developments elsewhere in the world may provide useful pointers to what can be done to show concern for animal welfare issues. To maintain the reputation of its industry, the Iowa Cattlemen's Association has issued a public statement to the effect that any cattle producer in the State who finds himself unable to care for his animals, for whatever reason, can contact the Association, which will assist in agisting the stock or selling them.[6] The sheep industry in Australia should think about the adoption of a similar policy.

Codes of Practice

9.15 The development of codes of practice for animal husbandry has been underway in Australia over the last decade. Victoria developed a code of accepted farming practice for the welfare of sheep in 1982. Dr Crossing of the Victorian Department of Agriculture and Rural Affairs described its evolution to the Committee, through consultations with animal welfare and industry

interests and public comment. In Victoria, following ministerial approval of a code of practice, it has to lie on the tables of both Houses of Parliament for 14 sitting days before it is gazetted under the Prevention of Cruelty to Animals Act. The code's status was outlined by Dr Crossing as follows:

> ... the code ... is a standard. ... It can be used by a person in his defence against a charge of cruelty. If a person is operating in accordance with this code of practice he is exempted from legal action under the Prevention of Cruelty to Animals Act. So what this code of practice does is to encourage people ... to adopt animal husbandry practices that are specified in the code.[7]

9.16 A national draft model code of practice for the welfare of sheep is still being revised by the Sub-committee on Animal Welfare of the Animal Health Committee of the Australian Agricultural Council.

Rationale behind codes of practice

9.17 The development of codes of practice has come about not to resolve specific welfare issues, but to "provide an expression of an acceptable level of husbandry and so establish a basis for further legislative, educative or extension activity".[8] Codes of practice provide the benchmark against which an individual's treatment of his sheep can be measured; a guide to the state of the science of sheep husbandry.

9.18 Codes of practice work on the assumption that it is preferable to encourage, rather than to mandate, considerate treatment of animals. To their supporters, codes of practice which encourage voluntary compliance with their provisions are preferable to "eternal litigation".[9]

9.19 A number of witnesses stressed that part of the value of the codes lay in the process of consultation among the interested parties during their development.[10] The detailed discussion of issues amongst industry, welfare and research groups, veterinarians and departmental officers helps reach a consensus in the codes, without which their acceptance by the farming community would be in jeopardy.

9.20 Codes of practice, as opposed to legislation, provide flexible guidelines which allow for changes brought about by technological developments.

Limitations of codes of practice

9.21 Codes of practice have been criticised as being "motherhood statements", merely representing the lowest common denominator of acceptable practice, and as such, irrelevant for the vast majority of producers who more than comply with the standards.[11]

9.22 Further, concern has been expressed that codes of practice can never be highly specific or relevant to all the differing husbandry situations which occur throughout Australia.

9.23 The difficulty of enforcing the provisions of codes of practice was noted by many welfare groups[12] and the question then arose as to whether they should be incorporated in legislation or be attached to legislation as regulations or annexes.

Increased monitoring

9.24 Self-regulation alone has been insufficient to eliminate sheep welfare problems in the past. Although it is an important first step, it must be supplemented, in the view of the Committee, by regular external monitoring. The persons with

inspectorial powers under the prevention of cruelty to animals legislation, generally RSPCA inspectors, can act only on a complaint. Further, they are few in number and primarily based in urban areas.

9.25 RSPCA officers report that in the majority of sheep cruelty cases which they investigate, remedial action is taken by the producer without the need for the RSPCA to prosecute. This is obviously the preferred way to deal with the situation. Were there to be more inspectors, it would seem likely that they could forestall more cases of either inadvertent or deliberate cruelty or neglect more quickly, particularly if they had the active co-operation of State department of agriculture officers and local sheep producers.

9.26 The Committee **recommends** that State and Territory Governments increase the number of RSPCA inspectors authorised under the relevant State prevention of cruelty to animals legislation and provide additional funding to support them.

9.27 Cases of blatant cruelty to animals are covered under existing prevention of cruelty legislation. There are other cases, however, where unnecessary suffering by sheep has occurred, and where the owners have ignored advice or requests by authorities. In some of these cases, proving cruelty under existing legislation has been difficult. Prevention of cruelty to animals legislation has been revamped in recent years in New South Wales, Victoria and South Australia. In Queensland and the Australian Capital Territory, legislation is in the process of being updated. The Committee believes that the States and Territories which do not have revised prevention of cruelty legislation should in fact carry out a revision. This matter is dealt with in more depth in the Committee's report on animal experimentation.

9.28 The Committee believes that State and Territory Governments should include in or attach to regulations a code of practice for sheep husbandry which sets standards against which cases brought to court for neglect or abuse under the legislation may be judged. In other words, a breach of the code of practice cannot be used to launch a prosecution, but when a prosecution is launched under the provisions of the Act itself, the code of practice becomes the standard to assist in determining whether a breach of the Act has occurred. The Committee emphasises that it sees legal action as the last resort except where blatant cruelty has occurred.

9.29 The inclusion of a code of practice for sheep husbandry in regulations as in Victoria is also a protection for the grazier. The grazier just has to show that he is complying with the code of practice to be successful in defending a case brought against him. As the RSPCA or other body bringing an action against a grazier is responsible for its legal costs in unsuccessful cases, it has to be careful as to which cases it proceeds with legal action. It would be rare for the RSPCA or other body with statutory responsibilities to launch a prosecution without a strong case.

CHAPTER 10

SUMMARY AND RECOMMENDATIONS

10.1 The Committee has drawn various conclusions in this report and has made a number of pronouncements, some in the form of recommendations and others as statements of policy. In many cases, the Committee did not make recommendations because it was inappropriate to do so. Where the Committee makes a statement rather than a recommendation, it is often not meant to be of less importance.

10.2 A number of issues were raised in the inquiry which were regarded by some people as being inimical to good husbandry practice or resulted in sheep undergoing undue stress. The Committee discussed these issues, taking into account both ethical and scientific factors, and examined possible alternatives. The Committee does not, however, provide a panacea for all the unpleasant husbandry procedures and practices in the sheep industry. In many cases, there are no satisfactory alternatives to current procedures and practices. If there were, some of those procedures would not have been condoned.

10.3 The Committee noted the research being done in many areas of sheep husbandry, particularly research examining alternatives to some of the more stressful procedures or problems. The Committee supported this research and recommended additional research in some areas. Once alternatives have been found and proven, it will be incumbent on the industry to ensure quick and widespread use of them.

10.4 There are some practices which sheep producers can undertake now to improve welfare. These are identified and discussed in the report.

10.5 The recommendations made by the Committee in the body of the report are listed below.

10.6 The Committee **recommends** that the industry, together with the State departments of agriculture, develop lamb loss parameters for the common breeds in each district as a minimum target at which producers should aim. (Paragraph 3.31)

10.7 The Committee further **recommends** that research continue into the comparative efficacy of the various forms of shelter on a regional basis and that the results be promptly disseminated through all appropriate media outlets. (Paragraph 3.32)

10.8 The Committee **recommends** that more research into the cost-benefits of using ultrasound imaging on ewes in early pregnancy be conducted. (Paragraph 3.3)

10.9 The Committee **recommends** that research be continued into the mothering ability of Merino ewes in particular, so that multiple birth lambs, whether the result of fecundity treatment or not, may enjoy a better chance of survival. (Paragraph 3.36)

10.10 The Committee further **recommends** that funding for the development and improvement of existing fecundity vaccines be tied to a requirement also to investigate methods of enhancing lamb survival. (Paragraph 3.36)

10.11 The Committee **recommends** that no sheep have its tail completely removed. (Paragraph 3.46)

10.12 The Committee **recommends** continued research into immunocastration. (Paragraph 3.63)

10.13 The Committee **recommends** continued research into flystrike resistance characteristics, as one of a range of methods designed to reduce the suffering caused by flystrike. (Paragraph 4.45)

10.14 The Committee **recommends** continued research into all means of preventing blowfly strike, so that the need for mulesing is removed. (Paragraph 4.66)

10.15 In line with its "broad brush" approach to flystrike prevention, the Committee **recommends** the continuation of research into immunological approaches to flystrike prevention. (Paragraph 4.83)

10.16 The Committee **recommends** that research be continued into alternatives to conventional shearing, and particularly into the sheep welfare aspects of all alternative methods of wool harvesting. As an interim measure, pending the likely future introduction of alternative methods of wool harvesting, the Committee **recommends** that research be continued into improvements to manual shearing. (Paragraph 6.42)

10.17 The Committee **recommends** that more specific guidelines on acceptable parameters for the transport of burnt stock be devised and incorporated in the codes of practice on road transport of livestock. (Paragraph 8.8)

10.18 The Committee **recommends** that guidelines be established by the State departments of agriculture concerning the bodyweight and/or condition score below which the different breeds of sheep should not be permitted to be sold in saleyards. (Paragraph 8.26)

10.19 The Committee **recommends** that joint guidelines be devised by the Australian Soil Conservation Council, the State departments of agriculture and forestry and the National Farmers Federation on conservation farming techniques which would benefit both sheep and the environment. (Paragraph 8.44)

10.20 The Committee recommends that State and Territory governments increase the number of RSPCA inspectors authorised under the relevant State prevention of cruelty to animals legislation and provide additional funding to support them. (Paragraph 9.26)

Senator A.R. Devlin
Chairman

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APPENDIX 1

LIST OF WITNESSES WHO APPEARED BEFORE THE COMMITTEE

Agricultural and Veterinary Chemicals Association
Represented by: Mr G.A. Van Rijswijk, Technical Manager

Association of Stud Sheep Breeders of Australia
Represented by: Mr L.J.B. Binns, President

Australian Agricultural Health and Quarantine Service
Represented by: Mr R.G. Brennan, Principal Veterinary Officer, Animal Welfare
Mr I.G.R. Davis, Principal Veterinary Officer, Animal Welfare
Mr K.A. Doyle, Assistant Director
Mr J.H. Jenkins, Acting Deputy Director
Mr L.W. Lane, Acting Director
Mr B.L. Moore, Principal Veterinary Officer

Australian and New Zealand Federation of Animal Societies
Represented by: Ms B. Dover

Australian Bureau of Animal Health
Represented by: Mr J.H. Auty, Acting Assistant Director
Mr R.W. Gee, Director
Dr H.R.C. Meischke, Acting Principal Veterinary Officer
Mr B.L. Moore, Acting Senior Veterinary Officer

Australian Federation for the Welfare of Animals Inc.
Represented by: Dr G. Alexander, President
Mr D.I. Aspinall, Councillor
Dr D.B. Lindsay, Vice-President
Mr D.R. Peden, Member
Mr J.W. Plant, Member

Australian Meat and Livestock Corporation
Represented by: Mr L.D. Beeby, Manager, Livestock Services Section
Mr L.E. Brownlie, Director of Technical Services
Mr J.C. Hughes, Senior Livestock Officer and Animal Welfare Officer
Mr R.S. Jordan, Acting Managing Director
Mr F.D. Shaw, Consultant

Australian Veterinary Association
Represented by: Dr J.H. Arundel, President, 1984
Dr M.D. Barton, President, 1988
Dr T.E. Jones, President-Elect, 1984
Dr D.B. Lindsay, Convenor, Standing Committee on Animal Welfare
Dr H.G. Osborne, President, Australian Sheep Veterinary Society
Dr M.A. Rose, Member

Australian Wool Corporation
Represented by: Dr N.A. Evans, Group Manager, Research and Development
Dr S.C. Van Mourik, Production Research Officer

Auty, Mr J.H., Private Citizen, Binalong, New South Wales

Batey, Dr R.G., Private Citizen, Karragullen, Western Australia

CSIRO Division of Animal Production
Represented by: Dr R.M. Hoskinson, Senior Principal Research Scientist
Dr B.A. Panaretto, Senior Principal Research Scientist
Dr T.W. Scott, Chief
Dr B.D. Stacy, Assistant Chief

CSIRO Division of Entomology
Represented by: Dr R.J. Mahon, Senior Research Scientist

Department of Agriculture (Tasmania)
Represented by: Mr J.T. Bruce, Agricultural Officer
Mr A.L. Jones, Agricultural Officer
Mr F.B. Ryan, Chief Veterinary Officer
Dr A.N. Smith, Director

Department of Agriculture and Rural Affairs (Victoria)
Represented by: Mr R.C. Couchman, Senior Analyst, Policy Development Branch
Dr R.C. Crossing, Director, Bureau of Animal Welfare
Dr L.J. Denholm, Senior Veterinary Research Officer
Dr J.Z. Foot, Research Scientist, Pastoral Research Institute
Dr M.A. Harrison, Principal Veterinary Officer, Extensive Livestock

Department of Agriculture (Western Australia)
Represented by: Dr R.J. Lightfoot, Chief, Division of Animal Production
Dr N. Monzu, Entomologist
Dr G.J. Sawyer, Research Officer, Cattle Branch
Mr P. Smetana, Principal Officer, Intensive Industries Branch

Flinders Medical Centre
Represented by: Dr W.B. Runciman, Senior Lecturer, Intensive Care Unit

Meischke, Dr H.R.C., Private Citizen, New South Wales

Merino Wool Harvesting Pty Ltd
Represented by: Mr A.R. Arthur, Managing Director
Mr L.H. Lines, Director
Dr J.R. Baxter, Technical Director

Miller, Mr G.A., Private Citizen, Culcairn, New South Wales

National Farmers Federation
Represented by: Dr A. Bos, Research Officer
Mr N.L. Holland, Producer Representative
Mr J.R. MacNamara, Director, Public Relations

New South Wales Agriculture and Fisheries
Represented by: Mr J.A. Butt, Principal Livestock Officer, Sheep and Wool
Mr J. Cahill, Adviser, Sheep and Wool Production
Dr L.R. Fell, Senior Research Scientist
Mr B.P. Healy, Assistant Principal Veterinary Officer
Mr J.W. Plant, Special Veterinary Officer, Sheep Health

Pastoralists and Graziers Association of Western Australia
Represented by: Mr A.P. Boultbee, Chairman, Meat and Livestock Division
Mr A.F. Cleland, Chairman, Wool Committee
Mr G.A. Savell, Executive Director

RSPCA (Australia)
Represented by: Dr R.G. Brennan, Technical Adviser
Dr H.R.C. Meischke, Veterinary Surgeon, Technical Adviser
Mr J.F. Strachan, President
Dr H.J. Wirth, Vice-President
Mr C.M. Wright, Executive Director

RSPCA (South Australia)
Represented by: Lt-Col. M.J. Harries, Secretary and Public Officer
Dr D.N. Mackie, Deputy Chairman

RSPCA (Victoria)
Represented by: Mr P.J. Barber, State Director
Dr H.J. Wirth, President

Sheepmeat Council of Australia
Represented by: Mr P.B. Blandford, President
Mr D.T. Coombes, Executive Director
Mr K.R. James, Immediate Past President
Mr R. Moxham, Executive Director

South Australian Department of Agriculture
Represented by: Dr T.R. Kuchel, Principal Clinical Veterinary Officer, Central Veterinary Laboratories

Tasmanian Farmers and Graziers Association
Represented by: Mr M.C. Cleland, Chairman, Animal Industries Committee
Mr D. Eddington, Chairman, Meat Council

Tasmanian Fine Merino Breeders Association
Represented by: Mr R. Thirkell-Johnston

Townend, Mrs C.E., Private Citizen, Gordon, New South Wales

University of Adelaide, School of Animal Sciences
Represented by: Professor B.P. Setchell, Professor of Animal Sciences

University of Melbourne, School of Agriculture and Forestry
Represented by: Dr R.G. Beilharz
Professor A.R. Egan

University of New South Wales, Department of Wool and Animal Science
Represented by: Associate Professor J.P. Kennedy

University of Western Australia
Represented by: Mr D. Elford, Senior Mechanical Design Engineer, Automated Sheep Shearing Project
Professor D.R. Lindsay, Professor of Agriculture and Chairman, Animal Welfare Committee
Mr J.P. Trevelyan, Technical Director, Automated Sheep Shearing Project

Wool Council of Australia
Represented by: Mr H.S. Beggs, President
Mr A.H. Bowman, Member
Mr M.P. McBride, Wool Councillor
Mr E.J. McMahon, Wool Councillor
Mr B. Parkinson, Wool Councillor