



Development of a Sustainable Camel Industry

**A compilation of two reports for the Rural
Industries Research and Development
Corporation**

Part 1 – Western Australia
by Kevin Ellard, Agriculture Western Australia

Part 2 – Northern Territory
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Foreword

This publication is a compilation of two individual research reports prepared for the Rural Industries Research and Development Corporation. They form part of a joint State and Territory project undertaken with Agriculture Western Australia, the Northern Territory Department of Primary Industry and Fisheries and the Central Australian Camel Industry Association.

Part 1 details Agriculture WA's investigations into the long-term viability of developing a new livestock industry utilising existing herds of feral camels present throughout Western Australia. The report describes the proposed development potential for a sustainable camel industry within this state and also contains biological and production information from other relevant sources.

Part 2 provides progress to date of the Central Australian Camel Industry Association's establishment of basic standards and specifications required to promote this new industry and lead to eventual quality assurance and long term commercial benefits.

This report is new to RIRDC's diverse range of over 400 research publications and forms part of our New Animal Products R&D Program, which aims to accelerate the development of viable new animal industries.

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Peter Core
Managing Director
Rural Industries Research and Development Corporation

Part 1

Development of a Sustainable Camel Industry in Western Australia

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Executive Summary

In 1993 an aerial survey of central Australia indicated that the total Australian feral camel population could be as high as 200 000 animals. It is estimated that 50% of this population is located within the remote pastoral or desert regions of Western Australia.

Within this state feral camels are a declared species and can constitute a nuisance to pastoralists through their destruction of fences and watering points. At present they are periodically culled but no use is made of the carcass apart from occasional sales for pet meat. Between 1987-1995 over 3500 camels were destroyed by Agriculture WA officers during routine culling operations and a similar number were also shot for pet-meat. Small numbers of feral camels are occasionally mustered for overseas export and are also utilised by the local tourism industry.

This project's goal was to investigate the potential of developing a sustainable livestock industry utilising existing herds of feral camels. This investigation was undertaken in five stages:

1. A literature search of past and existing commercial uses of camels and their general biology.
2. Assessment of the degree of interest amongst pastoralists in developing a camel livestock industry.
3. An estimation of the distribution of camels throughout pastoral regions of Western Australia.
4. A description of the available infrastructure and the legislative requirements necessary to develop such an industry.
5. Investigations into potential production systems and future needs of the industry.

The project was undertaken with the cooperation and assistance of Western Australian pastoralists, industry representatives, the general community and government agencies. A postal survey was sent out to all pastoral properties throughout Western Australia which, when combined with existing Agriculture WA records, provided data on 108 pastoral properties. In responding to this survey pastoralists provided basic information on:

- estimated numbers of feral camels,
- seasonal movements,
- interest in developing a commercial camel industry and
- perceived constraints to industry development.

In May 1998, as a final stage of the project, industry workshops were conducted at both Kalgoorlie and Newman. At both of these workshops there was general agreement amongst participants that;

- feral camels within Western Australia represented a potential economic resource and an opportunity for pastoralists to diversify their operations,
- an economically viable camel livestock industry could be developed if it were possible to access export markets on a regular basis,
- the domestic market was not sufficient to sustain an industry at the present time,

- in order to develop an such an industry, a 'steering committee' should be formed to address industry constraints and
- there was sufficient interest amongst Western Australian pastoralists to justify further efforts in developing a camel industry.

The project found that feral camels regularly moved from desert regions onto pastoral properties during dry periods in search of water. Three shires were identified as having significant numbers of camels present during these periods, East Pilbara, Wiluna and Laverton. Very few properties had feral camels present at all times of the year.

Although there was significant interest shown by all types of pastoral enterprises, the majority of managers who indicated an immediate interest in catching and grazing camels were existing cattle enterprises. These properties had existing infrastructure required to handle camels and saw potential benefits in beef production through co-grazing.

It was concluded that any commercialisation of the feral camel would need to be based around a meat industry or live animal export. A number of ancillary industries such as tourism, dairy production and breeding technology could also be developed but these alone would not at present sustain a viable industry. However, more research is required into "niche" markets before the above comment may be accepted as absolute. Breed development and aspects of dairy production were identified as future potential areas of development where technology and camelid genetics could be developed for sale to overseas markets.

The high cost of transport together with the current lack of available export registered abattoir facilities were identified as the major constraints for development of an industry within this state at the present time. In addition, the variable supply of camel numbers together with poor access to suitable types of animals when required were also identified as major constraints which would need to be addressed in the early stages of industry development.

1. Setting the Scene

1.1 Project Description

This project investigated the potential economic and ecological benefits of harvesting feral camels for commercial purposes within Western Australia.

The project was undertaken in five stages:

- 1. A literature search of past and existing commercial uses of camels together with their general biology.*
- 2. An estimation of the distribution of camels throughout pastoral regions of Western Australia.*
- 3. An assessment of the degree of interest amongst Western Australian pastoralists in developing a sustainable camel livestock industry.*

Aspects of stages 2 & 3 were achieved through the use of a postal survey which was sent out to all pastoral properties within the state. A total of 78 properties responded to the survey which represented a 17% response rate. Data on an additional 30 properties was obtained from existing Agriculture WA records, thus providing information on a total of 108 pastoral properties and reserves throughout the state. Further data was also obtained from a series of workshops and meetings held at Kalgoorlie, Newman and Laverton.

Data from these sources has been summarized in sections 6.2 and 6.3 of this report.

- 4. Assessment of infrastructure and legislative requirements necessary to develop such an industry.*

Assessment of these requirements was achieved through industry meetings and the circulation of discussion papers throughout relevant government agencies.

- 5. A description of production systems and future needs of the industry.*

Although this project was originally designed as a viability study, the degree of interest shown by Western Australian producers has required a significant amount of time to be spent on industry liaison and in addressing individual enquiries. Many producers, although indicating a strong interest in this new industry, due to the lack of relevant information on camel production within Australia were unable to provide comment on specific issues. In response to this, information packages were also produced as part of the project and were distributed to any interested persons. This slight change in focus could not be avoided and is viewed as a valuable basis for future projects relating to the development of a Western Australian Camel Industry.

1.2 History of the camel in Western Australia

Camels first entered Western Australia accompanying expeditions undertaken by Warburton, Gosse and Giles during the early 1870's. Records indicate that during at least one of these expeditions camels were released into areas of Western Australia, but it was Giles who finally brought the first camel to Perth after he successfully travelled overland from Port August to Fremantle in 1875 (8).



The value of the dromedary camel in the development and exploration of arid regions within Western Australia was recognised early in this state's history when the colonial government offered a reward of 100 pounds for the first successful import of a pregnant female.

Although this reward was offered during the 1840's it was not until the 1880's that this goal was finally achieved when camels bred in South Australia were imported to Western Australia by ship.

A number of years earlier South Australia had begun importing animals from the British India. These animals formed the nucleus of a small group of breeding enterprises within that state, the most famous of which was the stud established by Sir Thomas Elder at Beltrana. This property remained the most important camel breeding centre within this country for many years and supplied camels for most of the early expeditions. Beltrana received praise in both Western Australia and India on the quality and breeding of their animals.

In 1886 the first direct overseas shipments of camels began arriving at a number of Western Australian ports, which included Fremantle, Albany and Geraldton. It is believed that between 1894 & 1897 nearly 6600 animals were imported into the state from the Indian subcontinent (8). Although most were of heavy build, as they were to be used as draught animals, a number of lighter types were also imported for riding purposes. Attempts to import bactrian camels into Australia for crossbreeding purposes are reported to have occurred and one breeder in Coolgardie is reputed to have produced dromedary/bactrian crosses which had superior draught capabilities (8).

Camel teams very soon became an essential link in the transport of supplies and produce throughout the goldfields and pastoral regions of Western Australia. They were used both as pack animals and in teams of up to 20 animals to pull drays. Camels were used extensively in the establishment of the Canning Stock Route together with the Transcontinental Railway and in the construction and maintenance of vermin barrier fences.

These teams proved so efficient that there was serious concern from the operators of traditional horse teams that in the face of reduced cartage rates from camel transport, they would not be able to remain viable. During May 1897 members at a 'Conference of

Producers' lobbied the Western Australian government to ban further imports of camels into the colony (1). The conference also recommended applying taxes on the use of camels and restricting their movements to specific regions within the colony.

Following this conference, the Minister of Lands indicated that a prohibition order had been put in place and that it was unlikely to be removed (2).

In 1902 the Western Australian Department of Agriculture used camels extensively in the establishment and maintenance of the No.1 Rabbit Proof Fence. The Department also established camel depots at Dromedary Hills and Jiggalong Station,



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where up to 350 camels were held at any one time for use on the fence. Similar depots were also established at Londonderry near Coolgardie by the Mines Water Supply Department and later at Yalgoo during the building of the No 2 fence. Depot buildings and yards still remain today at Dromedary Hills (5).



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The total number of camels brought into Western Australia from direct overseas imports or via South Australia is estimated to be between 7000 & 10 000 animals, however it was not until 1895 that rudimentary quarantine requirements were introduced for all overseas imports. This entailed thirty days isolation at the port of entry (8).

Western Australia's and possibly this country's final camel importation occurred in 1907 after a shipment of 500 animals

landed at Port Hedland were diagnosed with a blood parasite known to cause the disease 'Surra' (trypanosomiasis). The shipment had been transported from Bombay for use within the Pilbara region under special permission from the state government and was later to become known as the infamous 'Century Shipment' (4).

Of the 500 camels within the Century Shipment only nine animals were found to be infected with trypanosomes. These were then tested for the virulent form of the disease 'Surra' by inoculating dogs with blood from these animals. Two camels were subsequently destroyed as a result of this testing, however as the post mortem examination did not reveal any changes consistent with the disease the investigating officers concluded that;

“If these were the parasites associated with Surra the long period that they have been present within their host has destroyed their virulent nature; or that we have been dealing with some trypanosome of a less injurious nature.”(4) and that;

“In all probability some other camels which have been previously imported have been so infected.” (6).

All remaining camels were finally released from quarantine in April 1908 following twelve months quarantine and isolation.

Within a very short space of time Western Australian camels developed a reputation as hardy, disease free stock which were well suited for use as draught animals. In 1908 veterinary representatives from the Indian Army contacted the Western Australian Department of Agriculture with the aim of purchasing breeding animals and obtaining information on improving husbandry techniques (3). These officials complemented the Department of Agriculture on the health and breeding of camels within this state.

With the advent of motor transport during the 1920's large numbers of domestic camels were released into pastoral and desert regions and formed the basis of the large feral population seen today. Feral camels were declared vermin in the Nullagine and Halls Creek areas in 1949 and later in the Laverton and Port Hedland areas in 1959 (7). It is estimated that up to 100,000 feral camels may now be present within the central desert and pastoral regions of Western Australia. A further 250-300 domesticated animals are privately owned throughout the state.

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2. Biology

Over recent years there has been increased interest in the importation of arid adapted livestock breeds into Western Australia. The Awassi sheep from the Middle East, the Boar goat of South Africa together with Boran and Tuli cattle from Zimbabwe are all examples of such breeds. The dromedary camel, although physiologically well adapted to survival within arid regions has, until recently, been ignored as a potential livestock species within this state. Although this report is not intended as a study of camel biology, it is important to illustrate specific adaptations and behaviour which make this species well suited to arid pastoral conditions.

2.1 Classification

The dromedary camel belongs to the family Camelidae which is made up of the ‘New World Camelids’ of South America (llamas, alpacas, vicunas and guanaco) together with the larger ‘Old World Camelids’ of Asia and Africa. This latter group consists of only two species, the bactrian camel (*Camelus bactricanus*) and the dromedary camel (*Camelus dromedarius*).



Bactrian camel



Dromedary camel

Within Western Australia, Old World Camelids are commonly referred to as camels, whilst the New World Camelids are simply referred to as camelids.

Members of the camelid family belong to the sub-order Tylopoda and therefore are not true ruminants, however they have evolved to form a multi-chambered forestomach which is similar in function to that of the ruminants (2). This forestomach is divided into three distinct compartments (C1, C2 and C3), the largest being C1 which is analogous to the rumen in other herbivores (5).

2.2 Breed Development

Although originally introduced to this continent as domesticated livestock, Australia remains the only region throughout the world where wild herds of dromedary camels continue to exist. The bactrian camel is limited to the colder environments of northern Asia throughout Mongolia and eastern Russia and is a comparatively shorter and heavier animal than the dromedary camel. Wild herds of this species are extremely rare with an estimated 900 animals remaining in the wild (3).

The dromedary camel was domesticated by man approximately 4,000 years ago and has been widely utilised for meat, milk and as a draught animal throughout the Indian subcontinent, the Middle-East and northern Africa (7).

Worldwide, the dromedary camels occur as a number of distinct body types which have largely evolved through their geographical location and physical environment. The relatively short period of domestication has meant that breed improvement has been limited, thus causing the camel to remain as a multi-purpose species (7).

Specific exceptions to this rule are the camels of Somalia which have been predominantly used as milking animals by nomadic groups for thousands of years; the selection of lighter animals for riding purposes throughout India and the Arab states; and more recently, the intensive development of racing camels within the Middle East. Even so, the camel has not undertaken the intensive breed development of other domestic species and therefore still holds large genetic potential for improved production through selective breeding.

All members of the camelidae family have an identical karyotype which suggests that, in theory at least, all species within this family may be able to interbreed (6). Members of the New World camelids do readily interbreed and produce fertile offspring. Cross breeding of dromedary and bactrian camels has occurred for many hundreds of years and is reputed to produce a hardy draught animal but some first cross males are sterile (12). During 1998 the first successful cross between a llama and a dromedary camel was achieved at the Camel Reproduction Centre in Dubai (2). This successful fertilisation produced the first 'llamel' and illustrates the potential for specialised breed development using modern artificial breeding technology.



Feral camels within Western Australia are descendants of stock originally imported from India and Pakistan as draught animals. As such they are comparatively heavily built general purpose animals which would be well suited in the development of specific meat or dairy breeds, or for use as surrogates within embryo transfer programs.

2.3 Adaptations for Arid Environments

Dromedary camels possess a number of characteristics which enable them to persist as a large mammalian species within hot arid environments.

2.3.1 Heat Adaptation

The localisation of body fat within the camel's hump aids in the dissipation of body heat, as does the distribution of the hair which is short on the lateral and ventral aspects of the body but long on the hump and over the dorsal surface. This has the effect of reducing absorption of radiant heat on the dorsal surface of the body whilst allowing the dissipation of body heat on all other aspects.

When water is available the camel utilises sweating rather panting for evaporative cooling. This method is highly effective in cooling the animal because areas where sweat production occurs has limited subcutaneous fat and the coat in these areas is relatively short, allowing sweat to evaporate directly from the skin surface.

Even when dehydrated the camel is able to maintain plasma volume and thereby continue blood circulation to the skin for heat exchange. This ability to maintain plasma volume is achieved through the modification of plasma proteins and the balance of osmotic pressure through the retention of sodium ions.

Evaporative cooling is also aided by specialised blood vessels within the camel's legs which allow counter current heat exchange during normal blood circulation (17).

The long legs of the camel allows better ventilation when standing but also reduce the amount reflected heat absorbed from the ground surface during the day. The large keratinised pad on the chest has a similar effect as it reduces surface contact with the ground when the animal is recumbent.

2.3.2 Water Conservation

Although sweating is the major method of body cooling in a heat stressed camel, during periods of severe dehydration the animal changes strategy by reducing sweat production and increasing respiratory evaporative cooling (18). This has the effect of maintaining the brain at a normal temperature but allows the body temperature to rise.

As with all mammals the camel is normally homoeothermic, however during periods of water stress the body temperature is reported to undergo diurnal variation up to 6⁰ C (12) whilst, when water is available normal body temperature variation is much lower and may be only 2⁰ C. By allowing the large body mass to heat slowly throughout the day the temperature gradient between the animal and its environment is reduced, thereby conserving body moisture normally used for physiological cooling. This accumulated body heat is then dissipated during the cooler night hours.

Water conservation in the camel is enhanced through an ability to produce highly concentrate urine and at the same time dramatically restrict urine output. These two mechanisms, high concentration and low urine flow, combine to significantly reduce water loss more than any other livestock species (17). This comparatively small water loss in urine together with a ability to produce very dry faeces ensures that only minimal essential body moisture is lost during the elimination of metabolic wastes.

2.3.4 Maintenance of Appetite

A major factor in lost production within livestock grazing in hot arid environments has traditionally been the loss of appetite associated with dehydration. The camel maintains its appetite under conditions of up to 25% dehydration compared with 10% in cattle (7).

Although the specific mechanisms are yet to be determined, this characteristic is most likely related to a unique ability to recycle alimentary water using specialised cells within the wall of C1 referred to as 'glandular sac areas'. The glandular sac areas are thought to aid in the maintenance of appetite by ensuring that adequate levels of moisture are maintained in the food contents of C1 thereby ensuring continued food passage through the gastro-intestinal tract (5, 16). The maintenance of appetite may also be aided through an ability to maintain plasma volume and circulation to the gastro-intestinal tract under dehydrate conditions.

Once water does become available the camel is able to rehydrate rapidly without risk of osmotic imbalance. Wilson (1984) reports that camels may take in up to 30% of their body weight over a very short period by consuming over 100 litres of water at a single session. This rate of water intake would cause severe osmotic stress in other livestock species but is compensated within the camel by highly flexible red blood cells which are able to return to normal size without rupture and the regulation of gut water osmolarity through the active transfer of sodium ions (13).

The net effect of the adaptations which have been outlined above is, the dromedary camel expends less energy and water in maintaining body temperature within acceptable physiological limits when compared to that of sheep and cattle under similar arid environmental conditions; and is therefore able to graze over a wider range away from permanent water sources.

2.4 Grazing and Nutrition

The camels have evolved a multi-chambered fore-stomach which is used in microbial digestion in a similar way to that of the true ruminants. Although comparative studies have shown that the morphology, histology and motility of the forestomach differs markedly between the Tylopods and Ruminants, the overall biochemical patterns of microbial digestion are similar (5). Camelids are however reported to be better able to adapt to extreme dietary conditions.



2.4.1 Pastoral Conditions

Camels have a split upper lip which is slightly prehensile and is used during browsing to select palatable vegetation. This adaptation together with their long mobile neck allows camels to selectively graze to a height of 3.5 meters and utilise the majority of plant species available. Dorges *et al* (1992) found that camels browse up to 80% of available species (52.9% trees & shrubs, 42.5%, 3% grasses) under rangeland conditions of central Australia. This contrasts with cattle and to a lesser extent sheep which feed predominantly on herbs and grasses under similar conditions.

Observations on grazing behaviour by researchers in both Africa and Australia (7) indicated that camels graze for limited periods each day (8-12 hours) but are highly mobile during these periods. Satellite tracking of individual camels fitted with tracking collars undertaken by the Northern Territory Conservation Commission has revealed that camels may travel 50 kilometres in one day (10) and that their total range may be as large as 60 000 square kilometres. This feeding pattern is thought to be a reason why the impact of camels on vegetation is reduced when compared to cattle and sheep which graze for longer periods when the vegetation is poor.

White (1997) concluded that although camels graze selectively they choose a wide range of plants in their diet. Where many plant species are present, camels will utilise a substantial range and only have an impact on a species if it is actively selected for browsing.

In addition to being able to be highly selective during feeding and therefore utilise the best available feed, the camel has a number of modifications which aid in the digestion of low quality feeds:

1. An ability to increase mean retention time of feed particles within the fore-stomach if high quality feed is not available.
2. Camels receiving low protein diets can efficiently recycle body urea for microbial protein synthesis within C1.
3. The microbial composition within the forestomach of camels is thought to aid in the more efficient digestion of high tannin feeds.

The aspects of camel grazing and digestion which have been outlined above are thought to aid in their ability to survive on poor quality pastures under arid conditions and may be summarised by:

- an ability to select high quality feed from natural pasture,
- an ability to increase digestion of poor quality forage,
- an ability cover large distances and utilise grazing areas inaccessible to other stock
- the browsing nature of camels compared with the grazing of sheep and cattle.

2.4.2 Intensive Feeding

Camels fed in yards require a diet high in bulk, however they are quite adaptable to the gradual introduction of supplements or pelleted foods.

Aspects of camel nutrition under intensive farming systems has been poorly investigated in the past, however research undertaken by Guerouali *et al* (1992) concluded that camels require less comparative energy for maintenance than sheep or cattle whilst Gidad *et al* (1992) concluded that camel protein requirements are at least 30% less than that dairy cattle, sheep or goats.

Camels are reputed to have a high dietary salt requirement however the reasons for this are poorly understood. Feral camels are known to concentrate in areas with salt lakes during wet periods and have been observed to preferentially select halophyte species during normal grazing. Lack of access to salt has been reported to induce arthritic and skin conditions in camels held under controlled conditions (12).

Experience amongst camels owners within Western Australia has indicated that camels are also susceptible to selenium/vitamin E deficiency, particularly amongst young animals. This may simply be a result of Western Australia's highly leached sandy soils over many areas where domesticate camels are held. It is now common practice to supplement camels with selenium in these areas. Copper deficiency has also been reported in camel calves within this state.

2.5 Reproduction

The breeding behaviour of camels differs from sheep and cattle in two primary ways; males show strong seasonal activity (rut), whilst the female is an induced ovulator in which the act of mating stimulates ovulation.

Males come into rut between May and October within the southern hemisphere and is characterised by aggressive behaviour, exudation of secretions from poll glands at the back of the head and protrusion of the soft palate or 'diulaa'. Male camels will generally become sexually active by three years of age. Bulls held under controlled conditions with good nutrition may mate with up to 80 cows (12) in a season however observations of feral camels in central Australia suggest that breeding groups are normally much smaller (4).

The female camel also shows some seasonal activity but this is not as pronounced as in males. Peak sexual activity occurs between July and November in arid regions of Australia, however under favourable environmental conditions they may become pregnant at any time throughout the year. Female camels are therefore seasonally polyoestrus but with a continuous supply of good nutrition they may be regarded as truly polyoestrus.

Oestrus occurs in waves of follicular development over a 20 day period rather than a true cycle. Ovulation generally occurs 3-4 days after mating. Females may reach puberty by two years of age however this is reliant on growth rate and nutritional conditions. Recent production work in India has indicated that early puberty followed by successful mating may be artificially induced in young female camels if stall fed and treated with gonadotrophins (15). Other authors have reported artificially inducing oestrus in animals as young as 1.5 years. Under free range conditions, puberty is generally reached by three years of age.

Gestation is reported to vary between 364 and 419 days and again is influenced by the plane of nutrition. Average gestation length is 375 days. The calving interval under extensive conditions tends to be at least 24 months, whilst in intensive well managed conditions it is possible to reduce this to 15 months. Lahlou-Kassi *et al* (1990) reported that 17.8% of camels in a herd studied within western Sahara had calving intervals of less than 15 months.

2.6 Social Organisation

Detailed observations of the social organisation of feral camels has been undertaken by Dorges *et al* (1992) in central Australia. This work found that wild camels live in non-territorial groups which are determined by the breeding status of the animals.

Three basic groups have been identified:

- Bachelor groups which are found throughout the year consisting of up to 20 males.
- Cow groups with their calves.
- Breeding groups, consisting of one bull with cows and calves.

During the breeding season, May to November, a bull in rut will join a cow group and actively defend this group from other sexually active bulls. Cows will generally leave the breeding group to give birth in seclusion then rejoin other cows with young calves. The segregation of the cows pre-partum is considered a strategy against infanticide by bulls. This practice of killing young calves by bulls in rut is considered a reproductive strategy as cows will generally become reproductively receptive three weeks after losing a calf.

During the summer months bulls leave the cow herds and rejoin bachelor herds or may remain solitary.

2.7 Disease

Australian camels are considered to free of significant diseases which affect overseas herds, of which the two most significant are camel pox and trypanosomiasis. Camels are also reported to be highly susceptible to diseases such as rabies, rinderpest and anthrax. They are resistant to 'foot and mouth disease' but may act as carriers (17).

Camel pox is caused by the virus *orthopoxvirus cameli*. This infection is highly contagious and may lead to significant disease and death, especially in animals less than two years of age or those animals not previously exposed to infection (14). With the exception of Australia, camel pox occurs in all camel regions of the world and would represent a major potential threat to the naive herds of Australia should imports of live animals or genetic material to again take place. Similarly it must be considered as a disease risk to any Australia camels exported overseas for breeding purposes. Both papilloma virus infections (warts) and camel contagious ecthyma are important differential diagnoses for camel pox as the clinical signs are often similar. Papillomatosis has previously been diagnosed in Western Australian camels.

In terms of lost production, trypanosomiasis is considered to be the most important disease affecting camels. Trypanosomiasis or ‘Surra’ is caused by the blood parasite *Trypanosoma evansi* which is spread by insect vectors and most commonly leads to progressive weight loss, abortion, infertility and occasionally death. As outlined in section 1.2, ‘Surra’ was suspected in a shipment of Indian camels which entered Australia in 1907. The prevalence of infection within previous camel shipments imported into Australia has never been determined, however no further cases of the disease have ever been diagnosed.

Although susceptible to a similar range of clinical conditions affecting other livestock within Western Australia, the most common diseases reported to affect domesticated camels within this state include sarcoptic mange (*Sarcoptes scabiei*), lymph node abscessation (*Corynebacterium pyogonense*), whipworm parasitism (*Trichuris sp.*), selenium responsive myopathies, dermatophytosis (*Trichophyton sp.*) and clostridial infection.

As with other livestock within Western Australia, camels are considered to be free of significant diseases such as tuberculosis, brucellosis and Johne’s Disease. Whilst feral camels regularly move onto pastoral properties and share watering points with both sheep and cattle, it has previously been impractical to include feral camels in disease surveillance and eradication programs. Opportunistic testing of several hundred camels within the Northern Territory undertaken at the NT Government Veterinary Laboratories has so far not revealed any evidence of tuberculosis, brucellosis, trichomoniasis, vibriosis, Johne’s Disease or liver fluke within the animals tested (19). Should a camel industry be developed within this state, regular processing of camels through licensed abattoirs would allow Agriculture WA to undertake routine surveillance of herds and provide further data to support existing declarations of disease freedom.

Conclusions from this section

- **Camels utilise a wider range of plant species than sheep or cattle under pastoral conditions.**
- **Camels have specific anatomical and physiological adaptations which allow them to survive in hot arid environments and graze further from watering points.**
- **Western Australian camels herds are relatively disease free.**
- **Generation interval is greater than sheep or cattle.**
- **Control of bulls in rut is a major factor affecting calf mortality.**

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3. Survey Results

3.1 Estimated Population

Since the initial survey by McKnight in 1966 there have been a number of studies undertaken in an attempt to more accurately determine the feral camel population and its distribution throughout Australia. Results from this work has produced population estimates which have ranged from 15,000 to 200,000 animals. A summary of these studies is listed in table 3.1 below. Although past surveys differ in their estimates it should be noted that each has utilised differing techniques and concentrated on different parts of a known population range.

Table 3.1

Study Area	Year	Estimated Population.	Estimated Australian Population	Reference
NT, SA & WA	1966		15,000 – 20,000	McKnight (1966)
Western Australia	1972	Distribution only.		Long, (1988)
Northern Territory	1979	3,000 – 6,000 (NT)		Letts (1979)
Australia	1976	Distribution only.		Murray <i>et al</i> (1976)
Northern Territory	1986	31,570 (NT)	100,000	Graham <i>et al</i> (1986)
Australia	1988		>43,000	Short <i>et al</i> (1988)
Northern Territory	1994	60,000 (NT)	200,000	NT Conservation Commission (1994)

The most extensive study undertaken so far was by Short *et al* in 1988 which concluded that the feral camel population is **at least** 43,000 animals. This survey also concluded that the relative population distribution within Australia 50% was within Western Australia, 25-30% in the Northern Territory and the remainder in the South Australia and Queensland (10). This population distribution is also supported by less extensive surveys undertaken by Long (1988), Murray *et al* (1976) and Graham *et al* (1986).

In 1993 the Conservation Commission of the Northern Territory conducted an aerial survey in central Australia. This survey indicated that between 50,000 & 60,000 camels inhabited the Northern Territory and that the figure was 50% greater than the previous survey of the region undertaken by Graham *et al* in 1986.

It is therefore reasonable to assume that the number of feral camels in Australia is between 150,000 and 200,000 animals and that Western Australia may have a total feral camel population close to 100,000 animals. Whether the whole of this population is accessible to commercial production is yet to be determined.

3.2 Distribution

During this project, information from two postal surveys together with data from the Industry Resource Protection (IRP) section of Agriculture WA was used to estimate the current range of feral camels within Western Australia.

The postal survey asked respondents to indicate the number of feral camels moving onto their properties throughout the year together with specific seasons or conditions in which this occurred. IRP records listed properties reported to have camels present at some time of the year since 1985 and gave an estimation of camel numbers by Agriculture WA officers on these occasions. These reports are listed in Appendix 2 whilst the distribution of survey respondents together with the location of IRP reports is outlined on Map 4.1.

Responses from pastoral owners indicated that camels regularly move into the eastern pastoral regions ('fringe properties') during dry periods. Reports of camels occur as far north as Lake Argyle in the Kimberley and extend south along the pastoral boundary to the Nullarbor. In the Kimberley they are reported only from a strip of country near the Northern Territory border.

Major concentrations of camels are reported to occur in the East Pilbara, Wiluna and Laverton regions. Map 3.2 outlines the estimated distribution of feral camels throughout Western Australia from both survey and IRP data. This map also indicates various wet or dry periods for different locations within this range and thus gives an indication at what times feral camels may be present on fringe properties throughout the state.

Very little information is available for desert regions outside of pastoral areas however previous surveys (listed in table 3.1) have suggested that significant numbers do occur within these areas. Reports from the aboriginal communities at Ruddle River National Park, Kiwirrikurra Community and Nyinmy Outstation supported these findings (7, 8).

The distribution of camels within Western Australia is most likely determined by two major factors; the physical environment and control by man. Wilson (1988) reports that camels being pad footed animals range widely over sandy areas but avoid wet or overtly rocky regions. This finding supports the distribution pattern found within Western Australia where camels do not extend far into rugged regions within the Kimberley but may extend south as far as Esperance on the south coast. Reports from pastoral managers also indicated that camels preferred open flat country on they properties (8).

In the past, it has been suggested that poisonous plants may have played a factor in this distribution, with Cooktown Ironwood Poison killing most animals grazing throughout the Kimberley. This is now thought to be of minor significance as their grazing habits ensure that only limited amounts of poisonous plants are ingested.

Map 3.1: Estimated distribution of feral camels within Western Australia

Camels are also known to concentrate around areas of salt lakes particularly in winter and within regions with plants containing a high salt content. Their high physiological requirement for salt may play a major factor in their migration patterns throughout desert regions (9), however further work on the migration patterns of camels in Western Australian is required in order to confirm this.

The migration patterns and population distribution of feral camels in Western Australia differ from that of the Northern Territory due to the regular movement between uninhabited desert regions and pastoral properties. Owners report that groups of camels regularly move onto properties along defined migration routes but the timing of this movement is highly dependent on seasonal conditions. This characteristic may enable pastoralists to predict the movements of camels and to design boundary fences to incorporate bayonet traps that could be used to harvest feral camels in a cost effective manner.

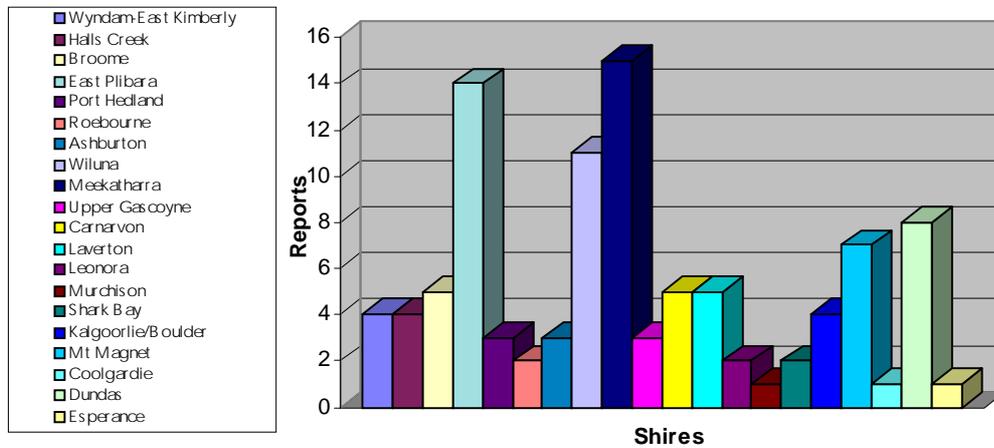
Results of the pastoral survey also indicated that most reports of camels occur as transient populations as camels tended to move onto pastoral properties from desert regions during dry periods in order to utilise water supplies. Damage caused to property infrastructure during these periods is of concern to some pastoralists and has led to opportunistic culling in many regions. Camels were reported to cause damage to fences, particularly when rutting bulls fight across fence lines.

A number of properties further west of the pastoral fringe region also reported the presence camels, however these tended to remain throughout the year and suggested that camels on these properties only remain when tolerated by the station managers. Many managers reported that the camel's large size and it's preference for more open and flat country made it relatively easy to control in pastoral areas by shooting. Many managers also commented that uncontrolled amateur shooting of feral camels was a major problem in some areas, in particular mining regions around Kalgoorlie and Laverton, and that their attempts to domesticate camels was continually hampered by such shooters.

Graph 3.1 summarises the regions in which report of feral camels have occurred. The shires of East Pilbara, Wiluna and Meekathara had the highest number of property reports. Most reports within Meekathara occurred in the far eastern portion of the shire which bordered the shire of Wiluna. A number of the reports within this shire were also from IRP officers and the camels have subsequently been culled. The shires of Laverton Leonora and Dundas had proportionally less pastoral properties but more current reports of feral camels moving onto pastoral properties from desert regions.

Graph 3.1

Property Reports of Feral Camels within WA Shires



3.3 Present Use

Commercial use of camels within Western Australia is currently limited to a number of small tourism operations located throughout the state, opportunistic use for pet meat production and occasional overseas exports of small numbers of live animals.

3.3.1 Tourism

There are currently twelve known tourism enterprises operating throughout Western Australia which utilise camels. These provide short recreational rides whilst three also provide longer day and overnight treks. The larger and more profitable operations are centred at Broome and Perth, whilst smaller enterprises operate within smaller regional centres or may travel throughout the state to agricultural shows or similar events.

Broome is currently the most widely recognised centre for camel associated tourism, arguably throughout Australia. Within this town camels provide a valuable tourism activity which supports three independent operations. Although difficult to calculate in monetary terms, ‘camel tourism activities’ provide an alternative experience for visitors which is integral to the towns culture. The success of these camel operations at Broome lies in their easy access, the incorporation of other attractions such as Cable Beach into the rides and a well established flow of international and domestic tourists.

Reports from camel tourism enterprises in other locations throughout the state suggest that their economic success has been limited largely because they cater only to local or domestic tourism and are not linked with other attractions within the region.

One property within the Pilbara also utilises feral camels for recreational shooting as part of their tourism ‘station stay’ enterprise.

3.3.2 Pet-meat

A small number of professional shooters who operate throughout the goldfields and Laverton regions are known to regularly utilise feral camels for pet-meat. Current prices average 50c/kg, giving gross returns of \$80 to \$100 per animal depending on its size (8). Only the whole leg, including the muscles of the rump and shoulder together with the neck are utilised in this process.

Due to the variable number of camels present on pastoral properties it is difficult to predict the average number processed for pet-meat however during 1995, one pet-meat producer reported shooting 600 camels on one property alone.

3.3.3 Live exports

Sales of live animals overseas have occurred in the past but are infrequent and always in low numbers. The majority of these shipments have been to zoos or private buyers, of which the most recent shipment from Western Australia occurred in December 1997. This shipment highlighted the difficulties exporters have in readily sourcing animals of suitable age and quality at short notice, due to the lack of an effective communication network between buyers and camel owners.

More recently, the Central Australian Camel industry Association was successful in obtaining contracts for the sale of live camels to Kuwait to be used as milking animals. Western Australia has previously been by-passed for such exports simply because it does not have the network of producers available to supply feral camels and a recognised organisation to promote sales.

Limited domestic sales of feral animals also occur throughout Western Australia. Prices range from \$500 to \$2,000 depending on age, type, condition and training.

3.4 Pastoral Survey

A postal survey of all pastoral properties was conducted in August 1997 with follow-up questionnaires sent out to targeted properties in January 1998. Data obtained from this survey and information from a series of meetings with industry groups provided information on the following subjects:

1. General interest in the industry.
2. Property infrastructure requirements.
3. Pastoralist concerns.
4. Camel numbers.

A copy of the questionnaire which was sent out to pastoralists is attached in appendix 2. A summary of the survey results is outlined within tables 3.2 to 3.6 below.

Table 3.2 <i>Interest in the industry</i>	<i>Percentage of respondents.</i>	<i>Number of respondents.</i>
Interested in developing a camel industry.	54.5%	42
Not interested in such an industry.	40.2%	31
Interested but require further information.	3.9%	3
Question not answered.	1.3%	1

Table 3.3 <i>Potential for development</i>	Percentage of respondents.	Number of respondents.
Respondent sees potential for such an industry.	66.2%	51
Do not see any potential for development.	18.2%	14
Positive but requires further information.	10.4%	8
Has no opinion.	5.1%	4

Table 3.4 <i>Presence of camels on property</i>	Percentage of respondents	Number of respondents
a. Camels present all year.	18.1%	24
b. Camels present seasonally.	31.9%	14
Camels present (a+b)	49.4%	38
No camels present.	50.6%	39

An addition 30 properties have been recorded by IRP officers to have feral camels present at various times of the year. A total of 97 pastoral properties or reserves were reported to have feral camels present on a regular basis (IRP reports + survey).

Table 3.5 <i>Grazing camels</i>	Percentage of respondents.	Number of respondents.
Would be prepared to graze camels.	45.5	35
Would not be prepared to graze camels	41.6	32
Question not answered	6.5	5
May be prepared to graze camels but requires further information on economic viability	6.5	5

Table 3.6 <i>Current Enterprise</i>	Percentage of respondents	Number of respondents.
Livestock: Cattle.	33.3	24
Livestock: Sheep.	26.4	19
Dual Livestock: Cattle & Sheep.	19.4	14
Dual Enterprise (livestock + other).	16.7	12
Mining.	4.2	3

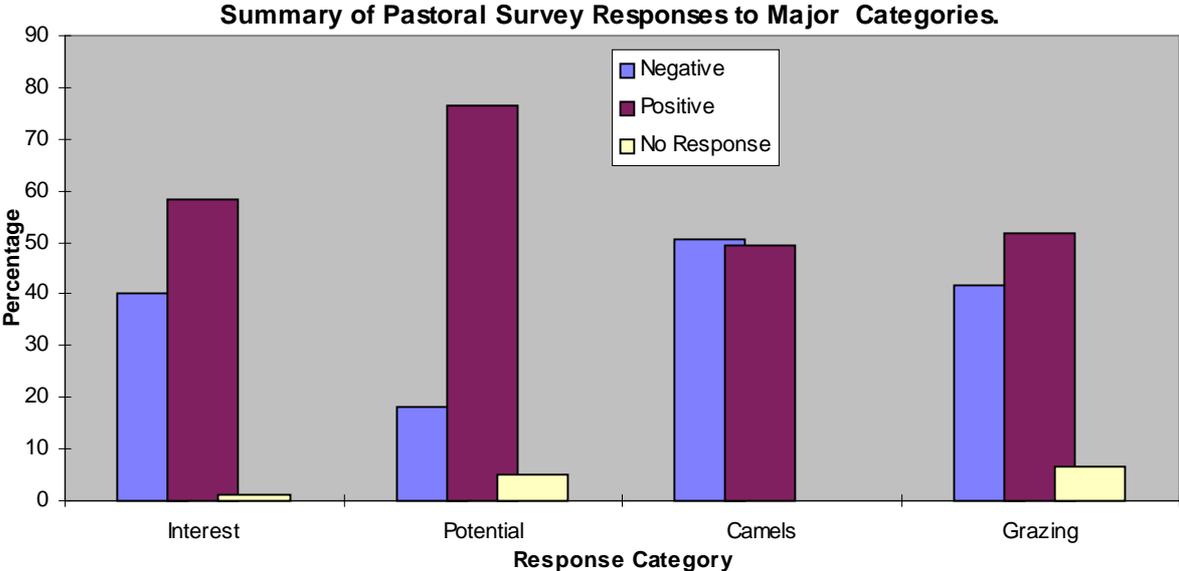
Of the property managers surveyed approximately half (54.5%) had an interest in developing a camel industry within Western Australia, whilst a much larger proportion (76.6%) felt that there was definitely potential for the development of such an industry within this state.

Half of all properties surveyed had camels present at some time of the year (49.4%) and it was predominantly these managers (69.8%) that indicated an interest in developing such an

industry. However only 44.1% of all managers were prepared to graze camels on their properties, as many felt that the potential damage to fences and watering points or the capital investment required to hold camels was not economically viable at present prices.

Graph 3.2 below illustrates the proportion of responses to four of the major category questions asked in the pastoral questionnaire.

Graph 3.2



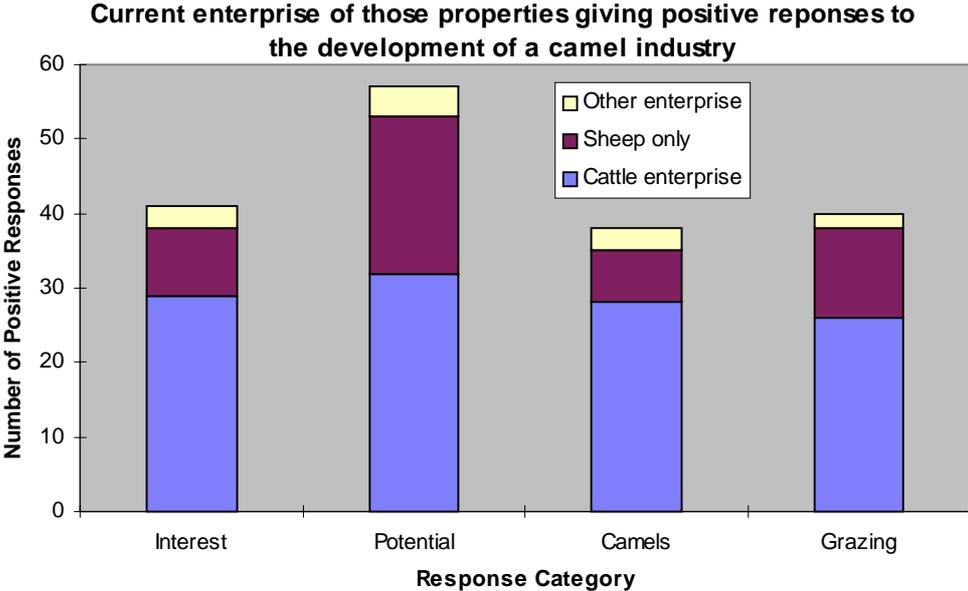
Map 3.2: Responses to pastoral survey together with reports of feral camels.

Most managers who were willing to graze camels were existing cattle enterprises, as these properties already had the appropriate yards and fencing in place. Very few sheep grazing enterprises were willing to graze camels but a number indicated that if the industry was shown to be economic they would consider making the capital investment to put appropriate fencing and yards in place.

Although the production benefits of co-grazing was not highlighted during the postal survey, strong interest was shown by cattle pastoralists at the industry workshops. Many indicated that this factor alone would be sufficient incentive for them to run small numbers of camels on a trial basis. Aspects of co-grazing are discussed further in Section 5.

Many managers also indicated that they wished to diversify their operations as an insurance against future loss of existing livestock markets. These managers stated that camels represented a readily available resource that could be accessed at relatively low cost. Many of those wishing to diversify also felt that pastoral tourism or ‘station stay’ would be enhanced by the presence of camels as it would offer an alternative attraction to overseas visitors.

Graph 3.3



The survey also asked property managers to indicate any problems they envisaged with the development of a camel industry, either when harvesting feral animals or grazing domesticated camels. These responses are listed in order of frequency within tables 3.7 and 3.8 below.

Table 3.7

Major problems identified by station owners in harvesting camels. <i>Listed in order of frequency.</i>
<ol style="list-style-type: none"> 1. <i>Lack of adequate fencing and other handling facilities.</i> 2. <i>The capital investment required.</i> 3. <i>Industry infrastructure required.</i> 4. <i>Lack of available labour.</i> 5. <i>Interference with existing operations eg. mining.</i> 6. <i>Control of bulls.</i> 7. <i>Inaccessible country</i> 8. <i>Current government policy relating to control of vertebrate pests</i>

Table 3.8

Major problems identified in grazing camels. <i>Listed in order of frequency.</i>
<ol style="list-style-type: none"> 1. <i>Lack of adequate or damage to existing fencing</i> 2. <i>Cost of capital improvements required to run camels</i> 3. <i>Existing industry policy relating to vertebrate pests and current state legislation</i> 4. <i>Controlling and calculating stocking densities</i> 5. <i>Interference with existing operations</i> 6. <i>Interference from amateur shooters</i> 7. <i>Lack of adequate industry infrastructure</i> 8. <i>Cost of transportation</i>

A number of managers within the Kalgoorlie Laverton area also felt that the loss of stock caused by illegal hunting would be a major problem. These managers indicated that amateur shooters from nearby towns and mining camps already caused significant problems on their properties and would be difficult to control. Within this area many traditional grazing properties were being taken over by mining companies and although a number of these had indicated that they would be willing to run camels as a trial enterprise, most had already destocked all livestock and were therefore unwilling to divert from their mining operations.

Conclusions from this section

- **The feral camel population within Western Australia could be as high as 100 000 animals.**
- **Camels move onto pastoral properties during dry conditions in order to utilise water supplies.**
- **Little is known about the range and distribution of camels within desert regions of Western Australia.**
- **The East Pilbara, Wiluna and Laverton regions are considered major areas of concentration of feral camels.**
- **Feral camels on pastoral properties are relatively easily controlled by shooting due to their large size and preference for flat open country.**
- **There is no current effective use made of feral camels within Western Australia.**
- **Approximately 50% of the properties responding to the postal survey had camels present at some time of the year.**
- **Approximately 50% of managers responding to the pastoral survey had an interest in developing a camel industry.**
- **More than 60% of managers surveyed felt that the industry had potential**
- **The cost of capital investment and damage to fencing was give as the main reasons for being unwilling to graze camels.**
- **Inappropriate fencing and government regulations relating to the grazing of feral livestock was identified as the major perceived constraint within traditional sheep areas.**
- **Cost of industry infrastructure and transport was identified as the major perceived constraint within traditional cattle grazing regions.**
- **Strong interest was shown in the potential benefits of cograzing.**

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4 Legislation

In September 1997 a discussion paper was circulated to officers within the Industry Resource Protection (IRP) section of Agriculture WA, the Agriculture Protection Board (APB) and the Department of Conservation & Land Management (CALM). This paper outlined current legislation and industry policies affecting the development of a camel industry within this state and requested clarification on the following points:

- Legal requirements of trapping, transporting and holding declared animal species.
- Legal identification of camels.
- Recent vertebrate pest policy changes from control to domestication/eradication.

4.1 Declared Animal Species

Feral camels are currently classified as a declared species under the '*Agricultural & Related Resource Protection Act*' (ARRP). This act requires that feral camels be reduced or controlled and that permits are obtained to keep them as livestock. The keeping of feral camels is also subject to the presence of adequate fencing and control measures.

Specifications which define adequate fencing for camels has not yet been clarified by Agriculture WA and requires further investigation. Although most camels are reported to adapt well to standard cattle fencing, with most problems being caused by bulls in rut during the breeding season, it is likely that future regulations will require some periods of training using electric fencing.

The classification of feral versus domestic also requires further clarification. Under the ARRP a domestic camel is one which is born in captivity. In practice, the vast majority of camels kept under controlled conditions in Western Australia have been sourced from wild stock and are generally not identified in any way nor are permits obtained to keep them. Current opinion within the IRP section of Agriculture WA suggests that camels may be considered as domesticated if they are identified using an approved method and they are held under controlled conditions. These requirements also needs further clarification together with formal approval by the APB.

4.2 Legal Identification of Camels

The dromedary camel is not currently recognised as livestock under the Western Australian '*Stock, Identification & Movement Act*' of 1997 (Stock Act). Within this act the term camelid refers only to alpaca (*Lama pacos*), llama (*Lama glama*) and vicugna (*Vicugna vicugna*).

It is possible to add the dromedary camel to the list of gazetted livestock within this Act, but any request must have the support of industry before being accepted as a recommendation by the APB. In June 1997 a decision paper entitled '*Compulsory Identification of Camels*' was submitted to APB by officers from Agriculture WA. This paper recommended compulsory identification of all domesticated camels within pastoral areas and voluntary identification of domestic camels situated within the South-West Division of the State (4). The proposal was

rejected by the APB on the basis that it did not have uniform support from camel owners and was not initiated by industry.

Although the identification of camels is not compulsory, owners wishing to legally identify their animals may do so according to the requirements outlined for camelids within the Stock Act, which includes the use of an ear tag or ear tattoo (5). Practical methods of identifying camels were demonstrated as part of this project and it was found that these recommendations were inappropriate as a means of identifying dromedary camels. Instead, it was concluded that fire, freeze and paint branding were the most practical and easily read methods of identification for camels.

The basic findings and recommendations for each method were:

- Although fire branding remains the only practical method of permanent identification for pastoral situations, this is may soon be considered unacceptable on welfare grounds. The brand should be applied to the neck of the camel.
- Freeze branding produced an easily read brand similar in appearance to the fire brand if applied for 5-10 seconds longer than standard cattle recommendations. This is considered to be the method choice for domesticated camels however it is time consuming as it requires the area of skin to be clipped prior to application of the iron. A dry ice/ethanol mix and liquid nitrogen produced similar results. Due to the light coat colour in many camels the freeze brand was applied for the period necessary to kill hair follicles rather than leucotrichia. This produced a result similar in appearance to heat brands. Due to the time necessary and the chemicals used this method is not practical for use under pastoral situations.
- Paint branding on the neck of feral camels may be suitable as a temporary method of identification for periods less than six weeks. This method has been suggested as a temporary means of identification for feral animals being sent for slaughter or export but its use would require approval from the APB.
- The use of ear tags is favoured by many but specific camel tags would need to be developed as they are often pulled out by other camels. Nose tags were also tried by one owner in the survey. Here cattle button tags were placed in the nose as a replacement for traditional nose pegs. This method has merit but also requires further investigation.
- Other methods of identification, such as tattooing, microchips and ear marking were also investigated. Microchips were successful when applied subcutaneously but did not provide a visible means of identification. Ear tattooing could not be read against the dark pigmentation of the inside of the ear. Ear marking was not favoured by any of the owners questioned.

4.3 Land Use

In the past, the '*Land Act (1933)*' was the relevant legislation governing appropriate use of pastoral leases within Western Australia. This Act defined livestock as either sheep or cattle and therefore precluded the grazing of camels for commercial purposes on pastoral leases.

During 1998 the '*Land Administration Act (1997)*' was proclaimed by the Western Australian Parliament. This new Act now refers to livestock as 'birds, crustaceans, fish, mammals, reptiles or other animals of any kind which are farmed, kept or managed', and therefore includes camels as acceptable livestock for pastoral properties (1). As such, they are subject to the same conditions and regulations which have in the past applied to sheep and cattle.

4.4 Policy Changes

Recent changes in policy by industry and the APB has meant that pastoralists are now discouraged from the opportunistic harvesting of feral goats or other feral species within this State. Instead, pastoralists wishing to run feral goats for commercial purposes are required to domesticate these goats according to a prescribed protocol. Any goats which are not domesticated must be eradicated from the pastoral lease.

This change in policy may complicate the possibility of opportunistic harvesting of feral camels for slaughter during the early stages of industry development as it is likely that a similar policy of 'Domestication & Eradication' will be applied to feral camels.

These requirements will add to the initial costs of establishing an industry in Western Australia but are required to develop a total grazing pressure management system for pastoral properties. If a camel livestock industry is to be developed within Western Australia certain points will require further clarification and approval by the APB. These are:

- minimum requirements of fencing,
- requirements for legal identification and
- the legal requirements for trapping and transporting feral animals for slaughter or export.

4.5 Taxation

During 1997 a taxation ruling was requested by a camel producer and tourist operation in Perth. This ruling concluded that camels are animals which may be kept for the purpose of selling them for bodily produce, including natural increase under the '*Income Tax Assessment Act (1936)*' (6) and are therefore subject to the same requirements and conditions as other legitimate forms of primary production.



Conclusions from this section

- **Regulations governing the capture and grazing of feral camels require further clarification.**
- **Any changes to current regulations or policy must be initiated by industry and requires approval by the Agricultural Protection Board of Western Australia.**
- **Camels may be recognised as livestock and their production as a legitimate primary industry.**

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5. Infrastructure Requirements

Although markets have been identified within the Middle East and South-East Asia for camel meat and live animals, the infrastructure requirements needed to transport live animals from isolated locations and to process camel meat are viewed as the major constraints to industry development within Western Australia. The following section outlines infrastructure currently available together with the needs for industry development.

5.1 Abattoirs

There are 43 licensed abattoirs currently operating within Western Australia.

Within this group, abattoirs which have the facilities to process camels are classified according to the following criteria;

AS (abattoir specials):	8 facilities.
AX (export abattoirs):	3 facilities.
CA (code abattoirs, domestic):	12 facilities.
DA (domestic, trade restricted):	9 facilities.

Camels sent for slaughter are generally between 3 & 10 years and range in body weight from 350kg to 600kg. Bulls in 'rut' cannot be used for human consumption since the meat is generally tainted.

Camels may be processed in standard cattle facilities subject to there being sufficient height in the race, entry doors and processing rail. Minor modifications to the slaughter procedure are required, however these have been easily overcome in other Australian abattoirs.

Recommended modifications to slaughter procedures and facilities when processing camels are listed below:

- Minimum height for race crossbars and doorways: 2.7meters.
- Rail Height: 2.8m
- Depending of the height of the rail, chains may have need to be shortened.
- The neck is removed after skinning and hung inside or beside carcass.
- Hide puller must be high enough to ensure contamination of the carcass does not occur and should be a downward pull.
- Back fat hump is removed from the carcass before it is split.
- The carcass contains a higher content of pleural fat and lower kidney fat.
- Depending on rail height, the forelegs may need to be taken off at either the shoulder or the shank to avoid them dragging on the ground.

A small number of companies have expressed interest in processing camel meat within Western Australia. General opinion within these companies is that camel meat production represents a niche market that they may be able to fill at a time when competition from other companies for traditional livestock species is high. These companies are also aware of the large export potential of camel meat.

Recent changes to policy by the Commonwealth Department of Primary Industries & Energy now allows the export of meat from domestic abattoirs under specific circumstances where the

importing country consents. Unlike 'export registered' abattoirs, plants producing specifically for the Australian domestic market are not normally required to provide on plant veterinary inspection and certification. A Western Australian company has previously been granted exemption under the '*Export Control Act*' which enabled it to export processed pork products to Indonesia. These changes are aimed at allowing small companies to access niche export markets and are particularly relevant to the camel meat industry where at least one Western Australian company has expressed strong interest in accessing export markets through this process. Agriculture WA is currently assisting companies to improve domestic abattoir standards (Meat order 14/83 & 38/83 within AUS-MEAT Export Accreditation Standards) in order to access such markets.

5.1.1 Mobile Abattoirs

Mobile abattoirs have been suggested as an alternative to existing abattoir facilities for the slaughter and processing pastoral livestock or feral species. In 1994 a 'Mobile Abattoir Study' was commissioned by the Midwest Labour Market Advisory Council. This study stated that the development of a mobile abattoir facility had a number of advantages for the pastoral industry of Western Australia over fixed abattoirs. Specifically the report concluded benefits of mobile abattoirs included:

- Maintaining rangeland condition through profitable turn-off of sheep, goats and kangaroos.
- The flexibility to respond to variable seasonal stock supply and sustain continuous operations.
- Facility for harvesting feral animals such as goats.
- Providing an export processing facility to enable economic harvesting of kangaroos for human consumption.
- Employment generation.
- Support of the fledgling emu industry.
- Supporting the Feral Goat Eradication Program.

Similar benefits would also apply to the camel meat industry as the predicted seasonal nature of the industry and the high livestock transport costs would lend itself to mobile abattoir facilities.

It should be noted that the study only investigated facilities suitable for processing small livestock and the economic feasibility was highly reliant on obtaining regular supplies of livestock. A cost benefit analysis would be required to determine whether a mobile facility capable of processing camels would be economic. The capital investment required to process large livestock species could make this method uneconomic, particularly if camels were the only species processed.

Other constraints facing this type of abattoir would be the high labour cost in remote locations and the lack of adequate supplies of potable water.

5.2 Transport

The transport of feral camels from pastoral regions within the Pilbara and northern Goldfields has been identified as one of the major constraints in the development of this industry. Although a road transport network already exists for the transport of sheep and cattle to abattoirs or export facilities throughout the state it is envisaged that camels will need to be sourced from outlying pastoral or desert areas such as Ruddle River.

During the postal survey pastoralists were asked to give details about access to their properties. Of those responding to this question 39% of property managers indicated that access to their properties is restricted following rains. This restriction also affects other livestock transport for these properties, however as camels would be sourced exclusively from these regions during the initial stages of industry development, it is likely that this may affect continuity of supply for abattoirs. It is expected that depot properties would be required to ensure supplies of animals are available at all times of the year.

The planned future development of the 'Central Desert Road' linking Laverton to Alice Springs as has been proposed by the current Western Australian Government could have major benefits the collection and transport of feral camels from the Great Victoria and Gibson Desert regions.

Feral camels may be transported on cattle trucks subject to certain specifications. Cross cleats must either be removed from trailers, or alternatively covered with rubber matting or sand. Failure to do so will cause injuries as the animals sit down during transport and chafe on these cleats. Due to their greater height camels can only be transported on single deck trailers which have sufficient head room (recommended 2.4 meters). These requirements constraints will add to the cost of transport as only an estimated 20 animals of approximately 400kg can be transported on a standard 5.5 meter deck. This compares to an estimated fifty head of cattle on double deck trailers of the same length. Transport costs for camels from Alice Springs to Adelaide is currently \$95 per head. It is expected that the cost of transport from the Pilbara to Perth would be equal or exceed this figure.

Camels are reported to travel well during road transport and may be transported for up to 3 days in suitable trailers and do not require off-loading for watering during this period.

Existing road transport operators could currently service a camel livestock industry if required to do so, however transport operators would need to make minor modifications the trailers to transport camels and would need to be educated in appropriate handling and transport procedures.

5.3 Holding Yards

Yards and holding facilities are available at Kalgoorlie, Kununurra & Port Hedland. During the initial stages of development, the Kalgoorlie yards could be used as a depot for those animals harvested from the northern Goldfield or Nullarbor regions prior to slaughter or export.

5.4 Livestock Export

Camels may be loaded as live cargo at Wyndam, Broome, Dampier, Port Hedland, Geraldton, Fremantle, Bunbury or Esperance. This large number of ports provides flexibility to the industry, however the exit port will still remain heavily reliant of other livestock cargoes for many years. It is predicted that the Middle East market for cattle will grow in future years and this increased live export traffic will offer greater opportunities for small loads of camels (21).

Conclusions from this section

- **The lack of suitable export abattoirs willing to process camels is the current single major constraint to industry development.**
- **High transport costs from pastoral regions will be a major factor in the profitability of the industry.**
- **Opportunities exist to transport small shipments of live camels from Western Australian ports on existing cattle boats servicing the Middle East and Asian markets.**

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6. Potential For Development

The following section outlines possible benefits and potential areas of development which may occur with the establishment of a camel livestock industry within Western Australia. It must be stressed that the conclusions outlined within this section have been drawn in the absence of specific scientific information relating to the production of dromedary camels within Western Australia. If an industry were to be established ongoing research and environmental monitoring must be undertaken to ensure that such an industry is both economically viable and sustainable in the long term.

6.1 Grazing Pressure

The development of a camel grazing industry, if done with adequate scientific support, has the potential to assist in reducing the formation of degraded pastoral land by re-introducing balanced grazing pressure on all vegetation types. It is also recognised that the camel's physiological requirement for dietary salt may offer some possibility of utilising salt affected land for commercial livestock production.

6.1.1 Co-grazing

White (1997) reports that 'woody weeds' have become a problem in Australia and other arid and semi-arid rangelands following the introduction of intensive grazing by domestic livestock. In Australia, Booth (1986) estimated that the woody biomass has changed on 210 million hectares of *Acacia spp.* woodland. Shrubs have replaced palatable grasses and livestock production has been reduced due to poorer nutrition and the sustainable grazing management is a potential technique for maintaining country in an open, productive condition.

Research on mixed species grazing systems in Australia has previously concentrated on grazing goats with sheep and sometimes cattle, however local pastoralists within the Northern Territory have made the following observations:

- cattle perform better during drought when grazed in paddocks with camels; and
- no difference in cattle performance is noticed during good seasons.

The reasons behind these observations are thought to be due to a combination of rumen microbe transfer, and that camels break branches which gives cattle access to browse that otherwise would be out of reach. Another long term factor is that tree canopies are opened up resulting in increased pasture production.

Heuche *et al* (1992) during their investigations of the grazing habits of feral camel camels in central Australia concluded that grasses make up only 3% of their diet. It has therefore been suggested that camels do not compete with cattle for grazing under appropriate stocking rates. Research is currently being undertaken in the Northern Territory into possible benefits of co-grazing camels with cattle and their effect on vegetation ecology. There is currently a lack of data to support this theory and similarly what long term effects co-grazing has on vegetation

however preliminary conclusions from other studies also suggests that there is little grazing competition between cattle and camels.

It has also been suggested that camels may be used to replace traditional burning and chaining methods that are sometimes used to enhance grass growth in pastoral areas. Research previously undertaken in Kenya and South Africa has shown that camels have been used to re-introduce a balance to grazing pressure on vegetation where selective grazing by domestic livestock has reduced production. It has been suggested that in areas where prolonged grazing by sheep and cattle has altered the rangeland to produce a dominance of woody vegetation, camels may be used as top-browsers to open up the vegetation and promote growth of herbs and grasses.

White (1997) as part of his investigations into grazing habits of camels in western New South Wales concluded camels could be used to prevent, rather than control, shrub encroachment. In this way shrub populations might be maintained in a stable state by running camels with other stock at reasonable stocking densities. Significant research into sustainable stocking rates and total grazing pressure would be required as a high priority to ensure that the industry is ecologically sustainable. A recommendation of 1 camel: 10 cattle has been recommended by the Central Australian Camel Industry Association as a conservative stocking rate for co-grazing camels and cattle under pastoral conditions. Further research and monitoring is essential to calculate the total grazing pressure for these types of management systems and must be considered as a priority to ensure long term ecological sustainability.

The Northern Territory DPI has also conducted preliminary research into gut microflora, which may be utilised to break down tannins. Five gut bacterial species within camels are known to contribute to this enhanced digestion. Transfer to cattle occurs through regurgitation at water troughs.

Responses from pastoralists attending the Camel Workshops indicated that the potential benefits of co-grazing was a major area of interest and that many they would be keen to trial this management system.

6.1.2 Salt Affected Land

There are now some 200,000 hectares of acutely degraded saltland in Western Australia and an estimated 600-800,000 hectares which is winter water logged and going saline (Warren). Pasture and livestock production is being reduced on these large areas without an alternative source of production currently available. In most parts of the world where there is saline land, saltbushes often form an important component of the forage utilised by browsing animals such as goats and camels. Until recently farmers were planting relatively large areas of affected land to salt tolerant forage species, generally saltbushes, Acacias and other shrubs. The planting of saltbushes was essentially to serve three purposes:

- manage saltland and slow encroachment to arable land,
- provide an improved environment for domestic and native fauna, and
- provide forage for sheep at times when other pastures are poor.

Recent work undertaken by Agriculture WA (ref) concluded that due to their high salt content live-weight gains by sheep grazing saltbush were poor and at best the pasture could only be

used for maintenance of dry sheep. In contrast, saltbush and Acacia form an important part of camel nutrition and therefore have the potential to be used as a source of income from these increasing areas of salt affected land. Salt affect areas could be used as holding facilities for suitable classes of camels collected from pastoral regions prior to export or slaughter. These areas could therefore serve as a link between pastoral properties and processing facilities, thereby providing income and a sustainable use of salt affected land.

6.2 Meat Industry

During 1997 approximately 1,000 carcasses from the Northern Territory were processed for the domestic Australian market and this is predicted to increase 3,000 by the year 2000. This relatively small kill supplied meat to the domestic market throughout Australia with food chains such as Coles, Woolworths and By-Lo routinely stocking the product.

Current domestic meat prices return 95c/kg dressed weight to the pastoralists for camels delivered to Alice Springs. This represents an average of \$220 per animal in meat value and is comparable to returns from pastoral beef. Recent returns per head of livestock to the pastoralists within the Alice Springs region from camel meat have in a number of cases exceeded that of beef and is largely due to the recent decline in the Asian export market for live cattle (P.Seidel, pers. com).

Net returns for camels is largely reliant on the method of capture and the distance required for transport. In cases where capture involves the use of bayonet traps operational costs are much reduced and has shown be economically viable for capturing feral camels for sale to the meat industry. This method has the additional advantage in the animals are less stressed and are watered in the capture yards immediately prior to transport. Bayonet traps require camels to be acclimatised to the structure and are generally only successful if there is no other water source in the immediate locality. On properties where camels are mustered the use of a helicopter and chase vehicles is generally required. This type of operation has large operating labour costs and is generally uneconomic unless large number of camels are required.

Camel meat is recognised as having similar flavour and texture to that of beef but a comparatively higher moisture content and less fat. Comparative studies of camel with other meats indicated that camel steak has similar protein levels (20.7g/100g uncooked(u/c)) to that of beef but significantly less fat (1.8g/100g u/c camel, 12g/100g u/c beef). Comparisons with lamb and chicken also indicated that these meats had 8 times the fat content of camel steak whilst pork chops were 14 times. Similarly camel steak contains comparative less cholesterol, with 61mg of cholesterol per 100g of uncooked camel meat compared to 70mg, 130mg, 120mg and 100mg for beef, lamb chops, pork chops and chicken meat respectively (P.Seidel, pers. com).

As a consequence camel meat is marketed within Australia as having significant health benefits and has been endorsed by the National Heart Foundation.

Table 6.1: Comparison of the basic nutritional value of Camel and Beef .
(from *The Centralian Camel Industry: Strategies for Development.*)

	Water %	Protein %	Fat %	Ash %
Bull	76.4	20.9	1.2	1.05
Cow	75.5	21.2	4.0	1.02
Steer	73.0	20.4	4.9	0.97
Camel > 5 yrs	76.2	22.0	1.0	0.86
Camel < 5 yrs	78.2	20.1	0.9	0.76

Wholesale prices for various cuts of camel meat are comparable to that of beef. Limited supplies of camel meat are available from specialist game meat wholesalers within Western Australia but are not generally available through retail outlets as within the Northern Territory or other states.

Woolworths is currently marketing camel meat products under the “Wild Oz” label, however this fresh product has limited shelf life and the retail outlet is now moving to frozen products in order to avoid price markdown close to expiry date. Coles is also marketing camel produces under the label “Bush Tucker Foods” through Kevron Foods. Kevron Foods is also undertaking product development and is using camel meat to produce pilot runs of pressed meat products. The use of camel meat within pressed meat products has certain advantages over other meats as it does not require blending with other meats in order to achieve the appropriate pH balance. Camel pressed meat products are considered to be ideal acceptable replacement for ham within Muslim markets.

Dried meat products are produced within Alice Springs on a regular basis. This product generally sells well however market development has in the past been hampered by poor continuity of supply.

At the present moment camels are only processed at one domestic abattoir in South Australia. With the advent of export registered abattoirs processing camel meat significant overseas markets will become available to Australian producers. Recent market research suggests that there are large existing markets in both the Middle East and South East Asia, particularly within the Muslim communities.

Figures suggest that the weaning weight of camels at one year is 150 to 180 kg, and weight at maturity is 500 to 600 kg. The weight of mature bulls killed at Wamboden Abattoir, Alice Springs, have ranged from 514 to 635 kg for bulls and 470 to 510 for cows. Animals of an estimated 5 years of age ranged in live weight from 340 to 430 kg.

Dressing out percentage is reported to be 53% for bulls greater than 7 years, 53% for younger bulls (4 years) and 48% for cows. Camel dressing out percentages exclude fat contained within the hump which is approximately 40kg in animals processed. Boning percentages are reported to range between 54 - 60%.

During this project only two companies expressed strong interest processing camel meat in Western Australia, a domestic facility based at Esperance and an export registered abattoir at Carnarvon. The Esperance facility is currently investigating accessing export markets through limited export registration as outlined in section 5. The Carnarvon abattoir is currently building beef processing facilities which will have full export registration and is likely to also process camels if profitable markets and sufficient quantities of camels can be obtained. The

transportation of live camels to both of these facilities will be a major cost impediment to the ongoing viability of camel meat production within this state.

The development of a camel industry within Western Australia will rely heavily on the availability of export registered premises able to process camel meat for overseas markets. At present the domestic market within Australia is relatively small and is filled by supplies of camels from the Northern Territory which are processed within South Australia. Options for the marketing of camels meat within Australia and overseas include:

- Camel meat as a healthy alternative to other red meats, being low in fat & cholesterol but high in protein.
- The development of culturally acceptable products produced from camel meat for Muslim communities.
- Development of restaurant markets and processed products (eg 'Camel Jerky') focusing on local tourist markets.

6.3 Live Animal Export

The export of live camels to Middle East markets potentially offers the most viable short term opportunity for industry development within Western Australia. Markets in the Middle East prefer young animals of approximately 7-9 months of age for slaughter during religious festivals and will pay a premium during these periods.

An order for 3,000 young camels has already been placed with the Central Australian Camel Industry Association for shipment to Morocco. Quoted prices were \$1100US per animal delivered, which would represent a minimum \$400A net return to the producer (P. Seidel). If existing transport problems were overcome CACIA would require regular supplies of animals from Western Australia.

Similarly this Association was recently successful in exporting pregnant female camels to Kuwait to be used as milking animals. The price paid ex-Australia was \$300A per head for up to 300 animals. The Association is also registered with the United Nations as a supplier of camels as draught animals in developing nations. Similar enquiries have been made to Agriculture WA from India and South East Asia for camels to be used for draught and dairy purposes.

Live animal export has the advantage that regular supplies of animals and large capital investment such as is needed for meat production is not required. In the past live animal export has been hampered by a lack of suitable classes of animals and appropriate ocean transport. Cattle transport ships have until recently concentrated in South East Asian markets whilst only sheep transport ships were travelling to the Middle East market. The recent decline in Asian cattle markets has meant that more ships capable of carrying small shipments of live camels at an economic rate are now loading at a number of Western Australia ports before travelling directly to the Middle East.

In order to access potential markets Western Australian pastoralists must have supplies of suitable classes of camels, pregnant females and juveniles, present on their properties which

can be readily accessed. Co-grazing of controlled numbers of camels with cattle on pastoral properties would provide a source of animals for export at relatively low cost.

It is also strongly recommended that Western Australian producers work in cooperation with rather than in competition to the Central Australian Camel Industry Association whose role it is to act as a central marketing body to promote the industry within Australia and overseas, and to coordinate the sale of camels.

6.4 Dairy Industry

Dry-land dairy production utilising camels represents one of the major development possibilities for Western Australia. The camel has been used for milk production within Africa for many hundreds of years. Production averages 10 litres per day under free range grazing but may increase under intensive conditions to between 15-20 litres per animal per day. Knoess (1997) reported achieving production figures of up to 35 litres per day in well fed Pakistani camels but 8 litres per day under desert conditions. Australian camels largely come from Pakistani stock.

Unlike other domestic dairy breeds such as the cattle, buffalo and goats the camel has not passed through the process of selection for improvement of milk production. The data on milk production potential of camels have very wide variation and may be misleading due to the lack of acceptable farming practices associated with other breeds. Under present management conditions within countries such as India and Somalia, where milking of camels occurs, there is no consistency in milking nor provision for the required nutrition necessary for commercial milk production. Khanna *et al* (1993) revealed that without extra nutritional allowance a female camel could produce up to 10kg per day. A comparison of forage requirement and management of cattle and cattle under field conditions in arid zones indicated that camels milk production was more economical. Khanna *et al* (1993) also reported that camels kept on a good nutritional plane and managed in a clean hygienic environment produce milk comparable in quality and taste to that of cattle.

Table 6.2: Composition of camels milk compared to other livestock.
from Wilson (1984), Yagil (1982) & Khanna *et al* (1993).

	Moisture	Non Fat Solids	Fat	Lactose	Protein	Ash
Camel	86.3-87.6	7.0-10.7 8.9-14.3	2.9-5.4 2.9-5.5	3.3-5.8 2.9-5.8	3.0-3.9 2.5-4.5	0.6-0.8 0.35-0.95
Cattle	86.1	8.5	5.4	4.6	3.2	0.7
Goat	87.1-88.2	7.8-8.8	4.0-4.5	3.6-4.2	2.9-3.7	0.8
Sheep	79.5-82.0	11.6-12.0	6.9-8.9	4.3-4.7	5.6-6.7	0.9-1.0
Human	88.0-88.4	8.3-8.9	3.3-4.7	6.8-6.9	1.1-1.3	

Camels represent a possible source of dairy production within arid regions as they tolerate hot conditions well, and will out-produce cattle housed under similar conditions.

There has recently been significant interest from South East Asian countries in camel dairy products as it is thought to be low in lactose and high in vitamin C. In addition, recent research has indicated that camel milk contains an insulin like proteins which can by-pass the stomach and thus be absorbed intact. This characteristic could have huge advantages in the control of diabetes within isolated aboriginal communities and in the development of an oral

form of the drug. Scientists in Israel and Sweden are currently investigating camel milk and its potential benefits to the pharmaceutical industry.

6.5 Racing Industry

The Australian Camel Racing Industry is currently in its infancy but has grown over recent years with a number of meetings now offering attractive prize-money. This industry has recently had significant financial assistance from Middle Eastern investors who see potential in the development of a racing and breeding industry in Australia. Camel racing occurs only sporadically within Western Australia and has not been established on any organised basis.

There is a tendency for newcomers into the Camel Industry to talk about Racing Camels, as this is where the “big money” is, however it should be borne in mind that Australia’s feral camel herd is descendant from animals that were imported into Australia as draft animals, and this was also the breeding program that was established to cater for the needs of the Australian Camel industry in the pre motorised era. According to the Executive Officer of the Central Australian Camel Industry Association Mr Peter Seidel, it is estimated that only one in every thousand feral camels within the Northern Territory falls into this category (racing).

Anecdotal information also indicates that camels within Western Australia are shorter in the leg and more heavily built than those originally imported from South Australia (trotman). It is therefore unlikely that suitable racing animals will be found in Western Australia without the establishment of an intensive breeding program. Whilst it is true that a racing camel can bring fantastic prices overseas, at the sort of draughting rate required, it is unlikely that there will be profits made in the short term.

An application has recently been made to AQIS to allow the importation of animals from the United Arab Emirates for breeding purposes. Australia’s large numbers of disease free camels would be ideal for the development of artificial breeding programs, which could provide genetic gains in both milk production, and racing. It is likely that Australia will attract major investment from overseas sources in the future however unless there is an existing industry based within this state which can supply surrogate animals this investment will most likely be lost to eastern states groups.

6.6 Other Products

Export markets have been identified for camel by-products such as feet, tallow, hides, reproductive organs and bone ivory. Local markets already utilise hides for leather products and tallow for cosmetics. The development of these markets and industries would see direct increases in current returns to the pastoralist from the sale of feral camels.

Existing meat markets return \$90-\$150 net profit (\$220 gross return for meat) per animal in the Northern Territory depending on the method of capture, trapping vs mustering (Peter). Development of export and by-product markets could realistically see net returns increase to \$250-\$300 per animal through;

- Up to \$2.00/kg of tallow for cosmetics (currently being paid by one manufacturer).
- \$25-\$100/ foot to Asian markets.

- \$0.90-\$1.50/kg carcase weight for export.
- \$20/hide (current price).

By-products such as bone, camel feet, reproductive organs and hair could realistically be exported by small abattoirs producing meat for the domestic market under a specific exemption of the *Export Control Act* as has been previously outlined in section 5.1. This would provide opportunity to sell products overseas which would otherwise be worthless within Australia.

Conclusions from this section

- **Opportunities exist to incorporate camel grazing with existing pastoral beef enterprises.**
- **Camels may provide an opportunity to utilise salt affected land for commercial production.**
- **Livestock exports represent an immediate market which may be accessed by Western Australian pastoralists.**
- **Milk production and breeding represent potentially viable industries but require further research and development of technology.**
- **Development of a camel meat industry in Western Australia will rely heavily on the development of export markets.**

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APPENDICES

1. Pastoral Survey Questionnaire

Please find listed below 11 questions relating to your pastoral property and the development of a viable Western Australian camel industry. All questions are optional however in order to achieve accurate data please answer as many as possible and feel free to write additional comments as required. Any information supplied will remain completely confidential.

Business trading name: _____

Property name: _____

Property Location (Shire): _____

Name of person answering the questionnaire: _____

Position (eg. Owner, Manager): _____

1. Are you interested in having input into the development of a Western Australian camel industry? Yes/No

Comments: _____

2. Do you see any potential for such an industry in the Pastoral areas of Western Australia? Yes/No

Comments: _____

- 3a. Do you have feral camels on your property or have heard of camels within you locality? Yes/No

3b If yes where and how many?: _____

4. If you have a history of camels on your property at what times of the year are they present?:

5. What type of enterprise do you currently operate? (eg. Cattle grazing, tourism):

6a. Is your property readily accessible by road at all times of the year? Yes/No

6b. If no, at what times of the year is the property accessible? _____

7. Who is the major transport operator that your property uses? _____

8. Do you have facilities available to you to hold camels for short periods of time whilst awaiting transport? Yes/No

9a. Do you see any major problems or hurdles associated with catching and/or grazing of camels on your property? Yes/No

9b. If yes, what problems? _____

10a. Would you be prepared to hold camels on your property for short periods to produce a readily harvestable resource? Yes/No

Comments: _____

10b. Do you see any associated problems with this? (Quest. 10a.) Yes/No

10c. If yes, what problems concern you?

11a. May I contact you by telephone to discuss this project further? Yes/No

11b. If yes, please supply phone number and most convenient time: _____

12a. Would you be interested in attending an industry workshop in May 1998 to discuss issues relating to this industry? Yes/No.

12b. If yes what would be your preferred venue location? Please tick preferred option.

1. Newman
2. Kalgoorlie/Coolgardie

Any enquires or comments should be directed to:

Kevin Ellard,
Project Officer for the Camel Industry Project (Veterinary Officer),
Agriculture WA Albany WA 6330.

Phone 08 9892 8444 (b/hrs), 08 9844 8310 (a/hrs) or 08 9841 2707 (fax).

2. IRP Property Reports of Feral Camels

3. Pastoral Survey Data

Part 2

Development of a Sustainable Camel Industry

in the Northern Territory

Part 2 Contents

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Executive Summary

Objectives

Through collaboration between the Northern Territory, Queensland and Western Australia; increase the utilisation of feral and farmed camels and improve the quality and value of both camel meat and the live camel trade.

The NT role is to establish and disseminate key herd and product information including the establishment of product descriptive languages and handling techniques for both live camel and for camel meat.

Background

Australia has a feral camel population of approximately 200,000 head. It has been established that this population doubles about every ten years. There are two options available to control these numbers. The first is a 'shoot to waste' program which is costly and largely ineffective as most of these herds are inaccessible. The second option is to create a new industry for Australia, utilising this feral resource. In 1992, a steering committee was formed at the request of the NT government and it was decided to take the second option and develop an industry. Initial research determined that there was a demand for live camels, camel meat and by products. To assist with establishing these commodities in the market place it was essential to develop product descriptions, specifications and handling techniques.

Research and Outcomes

To achieve the desired awareness of this new product, it was decided to research every possible aspect of the live camel, capture and handling techniques, and camel meat and by products and then publish the results in high quality colour publications using professional photography.

“Camel Selected Meat Cuts and Information”

Extensive research was carried out in Alice Springs to develop and refine slaughter methods and boning procedures. The Central Australian Camel Industry Association (CACIA) did this in conjunction with the NT Department of Primary Industry and Fisheries (DPI&F).

The expertise and services of Ausmeat Ltd were utilised to research the muscular and skeletal breakdown, identification and description, code allocation, photography and publication.

“Capture and Handling of Camels Destined for the Abattoir”

Members of CACIA in conjunction with DPI&F carried out the research for this book exclusively in Central Australia. It was a combination of years of practical experience and years of scientific research providing essential information under the headings of Selection; Biology; Social Organisation; Locate and Capture; Handling and Transport and Humane Destruction.

“Descriptive Language for Live Camels”

This book was researched entirely in Central Australia and contains charts, descriptions and specifications under the headings of Age; Sex; Conformation; Condition; Breed and Colour.

The format of this publication will conform to the Ausmeat National Livestock Language for other commercial species.

Implications

The purpose of producing these books is to assist in the establishment of national standards for the developing camel industry. The ultimate aim of setting these standards is to facilitate the production of a consistent high quality product, which meets consumer's requirements, thereby promoting the industry in general. The distribution of these publications is world wide as the camel industry has a strong export focus.

It is envisaged that research and development of this new industry will continue for many years. The potential of the camel in Australia is enormous, particularly in arid zone production. The members of CACIA agree that the focus of research should be mainly on meat production and both domestic and export marketing as this is the only facet of the industry with the potential to utilise volume numbers of this feral resource.

1. Objectives

Through collaboration between the Northern Territory, Queensland and Western Australia; increase the utilisation of feral and farmed camels and improve the quality and value of both camel meat and the live camel trade.

The NT role is to establish and disseminate key herd and product information including the establishment of product descriptive languages and handling techniques for both live camel and for camel meat.

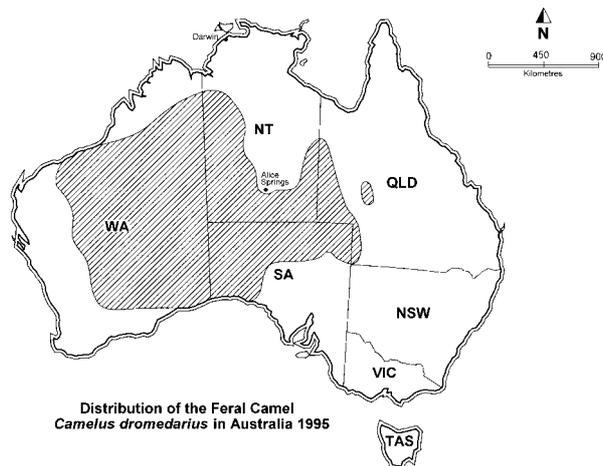
Qld's role is to research the market potential in the Muslim, Chinese and general Australian communities, determine their specific requirements and recommend ways to meet these requirements.

WA will investigate sourcing feral camels from the remote deserts and the practicabilities of transporting over long distances to abattoir.

In collaboration, assist the Central Australian camel meat and live trade industries meet their \$10 million goal by the year 2000 through increased quality, consumer acceptance and value of both camel meat and live trade. This will be achieved by establishing and disseminating key herd management, product handling and market information.

2. Background to the Proposal

Most of Australia's 200,000 feral camels are located in the remote areas of Central Australia and large proportions of the camels are found on aboriginal lands. The 1993 Conservation Commission of the Northern Territory aerial survey of Central Australia indicated a population of between 60 – 70,000 camels ie. population estimates have doubled in the past 10 years. Earlier surveys found that about 50% of the camels exist in Western Australia, 25% in the Northern Territory and the remainder in Queensland and South Australia.



The sustainable usage of the feral herd is estimated at 10% or 20,000 camels per year. Currently less than 600 feral camels are used annually in the combined live trade, tourism and abattoir industry in Australia.

The Centralian Camel Industry, including tourism, was worth \$2.25 million in 1992. The industry has set a goal to be worth \$10 million by year 2000. To meet this goal, and in line with resource availability, industry members made a development plan which takes a three-pronged approach focusing on tourism, live trade and meat and its associated by-products. Although the live trade and tourism has contributed most of the current income, the industry has stimulated an embryonic meat industry, which is now generating significant consumer interest and returns.

The processing of camels commenced in Australia in Alice Springs in 1988 with 10 slaughtered, increased to 277 in 1992, 401 in 1993 but fell to 300 in 1994. This fall was due to abattoir problems and not due to decreased demand.

Consistent with the goal to improve returns to producers for meat camels, the Central Australian Camel Industry Association Inc. (CACIA) undertook product development to meet the desires of the major customers ie supermarkets and restaurants. It soon became evident that without a descriptive language and specifications for camel meat, marketing of this new product would be very difficult. Equally important was the requirement for developing industry standards and guidelines for the correct husbandry procedures for handling live camels. Early research discovered that handling in the 5 minutes prior to slaughter has as much influence on camel meat quality as handling over the previous 5 days.

Subsequent to this was the realisation that only approximately 40% of a feral herd are suitable for the meat trade. There was also a requirement for development of a live trade descriptive language to enable producers to supply market needs thereby ensuring consistent quality.

3. Research

3.1 Camel Selected Meat Cuts and Information

To produce this publication extensive research was carried out initially in Alice Springs where production of camel meat for human consumption was pioneered. Slaughter methods and boning procedures were developed and refined by CACIA. NT Dept. Primary Industry and Fisheries (DPI&F) provided technical assistance to record live camel weights and monitor pH levels in meat cuts. At this stage CACIA also developed and documented the “Risk Assessment, Hazard Analysis and Inspection Procedures for Camel Meat Production”.

This document was provided to AQIS, who adopted and refined it, and it is now in use for domestic and export abattoirs. To produce a publication which would be accepted by the meat industry and also provide credibility for CACIA the expertise and services of Ausmeat were utilised. This entailed anatomical research, carcase breakdown, accurate identification and technical description, photography and layout, commercial code allocation and publication.

3.2 Capture and Handling of Camels Destined for the Abattoir

This research was carried out exclusively in Central Australia where commercial feral camel capture was pioneered in the 1970’s. This was a collaborative project involving members of CACIA and DPI&F who provided data relevant to every aspect of capture and handling of camels for the meat trade. Extensive research was also carried out for the categories of selection, biology, behaviour, transport and animal identification.

3.3 Descriptive Language for Live Camels

The research for this publication was carried out entirely in Central Australia by members of CACIA in consultation with Dr Taffy Williams BVSc. MVS. Information available from overseas publications is not applicable to the Australian herd because it is the only wild herd in the world. Because of this unique situation, all of the criteria used to describe Australian camels had to be thoroughly researched and developed specifically so as to conform to other National Livestock Language publications.

4. Outcomes

4.1 Camel. Selected Meat Cuts and Information

Published in 1997 ISBN 0642 25351. This publication contains information under the following headings.

1. Camels in Australia

Bearing in mind that this is an industry book targeting supermarkets, butchers, restaurants and wholesalers it was felt that generic information of this type should be included to educate staff in these retail outlets so that they are better informed to answer customer's questions thus assisting promotion of the product.

2. Standard Carcase Definition

This describes the necessary slaughter floor procedures required to prepare a camel carcase to achieve the classification (HSCW) Hot Separated Carcase Weight.

3. Side Skeletal Diagram

This diagram describes the bone structure anatomy of a side of camel prepared to HSCW.

4. Selected Primal Cuts

This is a double page diagram indicating the position on the carcase of the location of each primal cut.

5. Carcase

This diagram indicates the anatomical location for separating the neck, forequarter and hindquarter and provides the trade codes for these cuts.

6. Hindquarter

This five-page section indicates the anatomical location of each primal cut derived from the hindquarter, providing the reader with boning and trimming specifications and trade codes.

7. *Forequarter*

This five-page section indicates the anatomical location of each primal cut derived from the forequarter, providing the reader with boning and trimming specifications and trade codes.

8. *General*

The final five-page section describes Offal Specifications and trade codes, examples of further Processed Camel Meat, examples of Value Added Products, Packaging Instructions and more general information titled Camels Today.

This publication contains professional colour photography throughout and is printed on high quality, heavy gloss paper.

4.2 Capture and Handling of Camels Destined for the Abattoir
Published in 1999. ISBN 0957705409.

This publication is targeted at primary producers, aboriginal communities, contract mustersers and government agencies and has been developed to assist the welfare of feral camels captured for the abattoir trade. Most of the content of this book also applies to camels in a domesticated situation.

1. Suitability

This section deals with the selection criteria. As mentioned earlier, only about 40% of any herd are suitable for the meat trade.

2. Camel Biology

This section has sub-headings.

- Need for Water
- Food Preferences
- Seasonal Herd Structure

Knowledge of this information will provide the reader with assistance to locate wild herds at different times of the year taking into account varying seasonal conditions.

3. Social Organisation

This three-page section is the culmination of many years of scientific study and research by Jurgen Heucke and Birgit Dorges and is unique to Australia. It contains information to assist the reader in planing the time of year to capture. This information is also valuable to use when contemplating establishing a domesticated herd.

4. Methods to Locate and Capture

This three-page section has the following subheadings.

- Portable Yards
- Fixed Yards
- Trap Yards
- Mustering by Horses or Motor Bikes

Many years of practical experience from the members of CACIA have resulted in the methods listed here. It must be stated that readers may discover or develop variations that best suit their particular situation. There is always room for improvement.

5. Handling Freshly Caught Camels

This two-page section has the following sub-headings.

- Feeding in Yards
- Identification
- Use of Dogs or Electric Jiggers

This section is also a compilation of many years of experience by members of CACIA to provide the reader with safe, humane methods of handling and can also be applied to domesticated camels.

6. Camel Transport

Being the most cost efficient method for general commercial livestock movement, road transport is the feature of this section. The specifications stated here have resulted from some hard-learned lessons from attempts to transport camels using stocking densities and equipment as for cattle.

7. Emergency Destruction of Camels

This page is replicated from the “Model Code of Practice for the Welfare of Animals – the Camel” which was written by CACIA Member Dr Taffy Williams. It is a combination of abattoir methods devised by CACIA, and common accepted veterinary practice.

Both inside covers contain historic and general information about camels in Australia.

This publication also contains professional colour photography throughout and is printed on high quality heavy gloss paper.

4.3 Descriptive Language for Live Camels

This publication is currently in the hands of the printer however, it can be accurately described for this report from its draft form.

The target audience for this book is mainly primary producers who are supplying to the live trade, however some sections are equally applicable to suppliers to the meat trade.

This book will conform to the format of the Ausmeat National Livestock Language for other commercial species however, because the camel industry is new and developing, it will contain additional information to assist in setting standards.

This system is based on six criteria;

- Age
- Sex
- Conformation
- Breed
- Condition
- Colour

1. Age

There are several dentition charts available in overseas publications but these are conflicting, confusing and unclear in detail. To be able to conform to other national livestock language formats the services of Dr Taffy Williams and a professional artist have been employed to produce an easy to follow chart. This is the only accurate method of determining age in camels.

2. Sex

For this section CACIA has used the terminology used to determine the gender status of cattle, ie., bull, cow, heifer, steer, bullock, calf, weaner, yearling etc. This system is to be used in conjunction with the dentition chart.

3. Conformation

The criteria in this section are used to distinguish between heavy draft, light riding and racing types of camel.

4. Condition

This section has been developed mainly to assist the reader with the selection of camels for the meat trade. A chart has been developed with a score from 1 to 4 based on hump development. This is the most visible evidence of fat reserves in a camel. The bigger the hump the better the condition.

5. Breed

Although there were mainly one humped draft type camels (*Camelus dromedarius*) imported into Australia there were also some two humped (*Camelus bactrianus*) and light framed Sudani riding camels imported. The development of the camel industry has become far more diverse in the last five years so there is a need to try to categorise camels for breed traits for different end use. For example:

- Tourism
- Meat
- Racing
- Dairying
- Fibre Production
- Draft

6. Colour

This criteria is used exclusively for the live trade. CACIA has allocated five categories for this section, white, sandy, red, grey, and black. However as with all animal species the variations are endless, but there is a definite need to have a basic system for colour coding camels.

This publication will be allocated an ISBN number and will be printed on heavy gloss paper. The photography contained therein is of a professional standard. The book will be presented and bound in a manner so as to conform to the Ausmeat national livestock language for other species.

5. Implications

The purpose of producing these books is to assist in the establishment of national standards for the developing camel industry. The ultimate aim of setting these standards is to facilitate the production of a consistent high quality product, which meets consumer's requirements, thereby promoting the industry in general.

Over 1,000 copies of the meat cuts book have been distributed nationally to wholesalers, supermarkets, restaurants, caterers, TAFE colleges, smallgoods manufacturers and butchers. Copies have also been distributed to key areas overseas via Austrade and Meat and Livestock Australia (MLA) and by request to commercial export companies. To date, this book has proved to be the best marketing tool for camel meat for the domestic trade targeting wholesalers and retailers. Promotion to consumers will commence in earnest when a Camel Marketing Plan becomes available in July 1999. Approximately 100 copies of the capture and handling book have been distributed to members of CACIA and government agencies in the month since publication. It is intended to advertise the availability of this book through the public library system, Australian Camel News and the various State government primary industry departments.

The descriptive language book will be distributed to all members of CACIA, all pastoralists who are involved in camel production, live export companies and various State government primary industry departments. This book will also be provided to prospective overseas customers to enable them to supply more accurate specifications when ordering. The availability of this book will also be advertised through the public library system, Australian Camel News and various state government departments.