



Chapter 9:
Review of commercial options for
management of feral camels

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List of shortened forms

APY	Anangu Pitjantjatjara Yankunytjatjara
AQIS	Australian Quarantine Inspection Service
CACIA	Central Australian Camel Industry Association
CDA	Community Development Advisor
CDU	Charles Darwin University
CLC	Central Land Council
DBERD	Department of Business, Economic and Regional Development
DPI&F	Department of Primary Industry and Fisheries (Queensland Government)
DPIFM	Department of Primary Industry, Fisheries and Mines
FAOSTAT	Food and Agriculture Organization of the United Nations (FAO) Databases
FOB	Free on Board
ILC	Indigenous Land Corporation
MBI	Market Based Instrument
MCDST	Multiple Criteria Decision Support Tool
NRETAS	Natural Resources, Environment, The Arts and Sport
NRM	Natural Resource Management
NTCA	Northern Territory Cattlemen's Association
PFIAA	Pet Food Industry Association of Australia
RIRDC	Rural Industries Research and Development Corporation
SAAL NRM	SA Arid Lands Natural Resources Management
UAE	United Arab Emirates
UK	United Kingdom

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Chapter 9: Review of commercial options for management of feral camels

1. Summary

Feral camels have potential commercial uses. A camel industry has been emerging in Australia over the last 20 years, but it is still very small. This chapter reviews the potential for the commercial utilisation of feral camels in Australia and discusses the implications for feral camel management arising as a consequence. Recommendations are made that aim to encourage the development of a strategic management approach to feral camel control within an emerging camel industry.

1.1 Conclusions

Internationally, there is a significant camel industry based on meat, live animals, and by-products. In Australia, by contrast, the industry has struggled to gain momentum because it has been based on the ad-hoc harvest of a feral animal herd that is located in very remote parts of the country and a long distance from domestic markets, let alone international markets. The lack of appropriately located and accredited processing abattoirs has also been a significant obstruction for the industry. The harvesting of feral camels started in the late 1980s, and by 2007 it was estimated that the Australian camel industry harvested around 5000–6000 camels per annum: 3600–4600 for pet meat, fewer than 400 for live export, and 1000 for mainly domestic human consumption. The camel industry in Australia is still very small when compared internationally. However, the size of the feral camel resource of approximately one million animals makes the Australian herd the fifth largest in the world behind Somalia, Sudan, Ethiopia, and Mauritania.

There is potentially a large market for camel products, and a well-developed camel industry could provide an important management tool for the control of feral camels and their impacts and provide much-needed employment and economic activity in desert Australia. Although the current number of camels removed is small, commercial utilisation could potentially remove enough animals to have a significant localised impact on the levels of damage being caused at present and form part of a wider management program to arrest the continued growth in the feral population. However, a flourishing camel industry alone can not bring down the camel population in the short term, as the industry will take some time to develop. Therefore, commercial utilisation is potentially an effective tool for managing feral camels and their impacts in targeted areas rather than across their whole range and as part of a more substantial integrated management approach.

Of the commercial uses investigated in this research, the slaughtering of feral camels for pet meat seems likely to make the greatest contribution to managing camel impacts in the short term, followed by a meat industry for human consumption and live export. Pet meat is attractive as it involves minimal capital infrastructure to develop and could quickly provide livelihoods for Aboriginal people. However, the contribution from commercial activities will depend on the development of secure markets that are prepared to pay the real costs of harvesting and transport.

The industry at present is not organised and lacks some key components to allow it to develop. The key missing elements are the lack of suitable capital infrastructure for harvesting, transporting and processing animals; incomplete information on potential markets including meat for human consumption and pet meat; no collective vision on how the industry should develop; and a lack of dialogue and consultation with land owners.

In many Aboriginal communities there has been considerable discussion about the development of the camel industry and the use of feral camels (e.g. for pet meat). This has contributed to a perception that feral camels are a resource rather than a pest in remote desert settlements (Gee & Greenfield 2007). Aboriginal people and pastoralists are keen to take up opportunities presented by the commercial

utilisation of camels and see it as an opportunity for local economic development, employment, capacity building, and empowerment (refer to Zeng & Edwards 2008a, Vaarzon-Morel 2008a). They generally would like to be directly involved in the industry rather than see economic benefits go to external businesses.

The camel industry in Australia must have a unique structure because commercial utilisation would also form part of a national strategy to mitigate negative impacts by controlling feral camels. Commercial utilisation must be integrated into the comprehensive feral camel management strategy. There is clearly a market failure in play at present that has allowed camel numbers to increase in an uncontrolled manner, as society has not factored in the non-market impacts of feral camels on Australia's natural and cultural resources. A Market Based Instrument (MBI) approach is currently being trialled in South Australia and may prove to be an effective way of dealing with this market failure. However, this approach should be limited to situations where the commercial extraction of feral camels is a strategic component of a wider cross-jurisdictional feral camel management plan and not as a subsidy for the establishment of a new industry.

The farming of camels could support a sustainable alternative pastoral industry but would not contribute to the management of feral camels, because camel farming will establish and maintain a permanent domesticated population of camels. Given that this will need to occur to ensure a sustainable industry in the long-term, appropriate regulatory structures must ensure that domesticated animals are contained so they cannot return to the feral herd and are traceable through electronic tagging in the same way as cattle.

Live camel export, meat for human consumption, and pet meat are the major commercial enterprises that would contribute directly to feral camel management. While there should be a focus on continuing to enlarge the international market, the domestic market must also be considered. Other commercial uses for feral camels – such as the production of milk, skin, and game meat, the development of camel tourism and camel farms, and their use for undertaking weed control – would contribute very little to reducing the impacts of feral camels. However, the multiple use of camels would increase the economic viability of a camel industry

1.2 Recommendations

- The commercial utilisation of feral camels can, and should, be integrated into a national feral camel management strategy. Commercial utilisation will have localised impact on feral camel numbers (and their negative impacts), but such utilisation needs to be seen as part of a comprehensive feral camel management strategy aimed at significantly reducing the negative impacts of the species.
- Harvesting for commercial utilisation should focus on two regions. These are the tri-state border region (SA, NT, and WA) and the Alice Springs region.
- There is a need to develop critical capital infrastructure, particularly export-accredited abattoirs to support the development of commercial activities in the two target regions. While this should be funded by the private sector, governments have a role in correcting an existing market failure (where the market does not account for the environmental, cultural, and social costs associated with a feral camel herd).
- A Market Based Instrument (MBI) approach should be trialled across tenures and jurisdictional boundaries, but MBIs should only be used to encourage the reduction in feral camel impact and should not be seen as a subsidy for the establishment of a new industry.
- The commercial utilisation of feral camels provides an opportunity for local economic development, employment, capacity building, and empowerment. Aboriginal people and pastoralists suffering from the impact of camels must be consulted fully on the management approaches adopted on the land that they manage. Such consultation should involve the sharing of information on the costs and benefits of all options, including commercial options, so people can make informed decisions.

- Any future operations on Aboriginal land (and other areas) should attempt to increase the involvement of local people. An effective business model that supports broader and deeper local participation should be encouraged and supported by governments. Such a model should include direct commercial utilisation of camels but also, in the longer term, environmental management initiatives such as Aboriginal Ranger Groups and should be supported by training, including mentoring in business management.
- A national peak body should be established to coordinate the camel industry's development. The role of the peak body would be to speak for the commercial industry; advise government on the needs of the industry in terms of legislation and regulation, capital infrastructure, training, market development, and research based on an industry strategic plan; research potential markets for camel products; facilitate communication, information sharing, and cooperation among the industry participants; and develop a dialogue between the industry, land managers, and government.

2. Introduction

There are two species of camels significantly commercially used in the world: one-humped Dromedary (*Camelus dromedarius*) and two-humped Bactrian (*Camelus bactrianus*). In this chapter, when speaking in general terms, the term 'camel' refers to both species. In the Australian context, the term 'camel' refers to the one-humped Dromedary camel.

In many countries in the Middle East, Asia, and Africa, camels (both species) have been commercially exploited for hundreds of years. However, this utilisation has been based on farmed camels, and has never been linked to the control of a feral population. The industry in these countries is often built around a structured value chain that includes farming, trading, transport, slaughtering, processing, and marketing to final consumers. A wide range of products are traded: live animals for racing and beasts of burden, meat, milk, hides, and components of medicinal products. In Australia, the commercial utilisation of camels (Dromedary camels) is different as it is based on a wild harvest of feral camels; it is often seen as a management option for controlling the feral camel population rather than an integrated industry such as the beef or sheep industry with their associated infrastructure. As a result, the commercial utilisation of camels in Australia is disjointed and lacks a cohesive strategy, which means that it remains a niche activity. There have been numerous attempts to develop both a live-export trade and a meat industry based on feral camels, but these have failed to generate enough capital to make the industry sustainable in the long-term. This chapter reviews the possible commercial uses of camels and discusses the implications for the management of feral camels and their impacts in Australia.

3. Camel products and uses

3.1 Meat

Camels are used as a source of meat for both humans and pets. Comparisons of camel meat with other meats show that camel steak has protein levels similar to beef and has significantly less fat than lamb and chicken which have eight times more fat, and pork chops which have 14 times more fat than a camel steak. Camel steak also contains less cholesterol: 61mg of cholesterol per 100 g of uncooked camel meat compared with 70 mg, 130 mg, and 100 mg for beef, lamb chops and chicken meat respectively (Table 9.1).

Table 9.1: Comparison of camel and other meats

per 100 grams uncooked mass				
	Energy (KJ)	Protein (g)	Fat (g)	Cholesterol (mg)
Lean camel steak	420	20.7	1.8	61
Lean beef steak	600	21.0	12.0	70
Lamb chop	840	12.0	15.0	130
Chicken meat	710	19.0	15.0	100

Source: CACIA 2006

Camel meat has a similar flavour and texture to that of beef but with a comparatively higher moisture content (Ellard & Seidel 2000). However, there is a difference in the percentages of protein, water, fat, and ash of meat from various parts of the body. The age of the animal also affects the composition of the meat. Camels younger than five years have less protein, fat, and ash than older camels. Nevertheless, these relatively small differences in protein are comparable with the protein content of beef whether it is from a bull, cow, or steer. The fat and ash content of camel meat is lower than that of beef (Table 9.2).

Table 9.2: Comparison of the basic nutritional value of camel and beef

	Water (%)	Protein (%)	Fat (%)	Ash (%)
Beef: bull	76.4	20.9	1.2	1.05
Beef: cow	75.5	21.2	4.0	1.02
Beef: 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

Source: Ellard & Seidel 2000

Camel meat is a high quality product in terms of nutrition and is seen as a valid alternative to beef both for human consumption and for pet food.

3.2 Milk

The camel has been used for milk production in Africa for hundreds of years. There has recently been significant interest in camel dairy products in South East Asian countries as a result of reports that camel milk is a good source of protein and vitamin C, and is much more nutritious and has more therapeutic value than the milk of any other animal (Inayat & Farooq 2005). It has been reported that camels produce milk comparable in quality and taste to that of cattle (Table 9.3).

Table 9.3: Composition of camel milk compared with other livestock

	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	-

Source: Yagil 1982; Wilson 1984; Khanna et al. 1993

While slightly saltier than cow's milk, camel milk is highly nutritious. Produced by animals that can live in some of the toughest environments, it has three times the vitamin C as cow's milk and is also known to be rich in iron, unsaturated fatty acids, and B vitamins.

Camel milk stays fresh much longer than cow's milk. In times of drought, camels continue to lactate long after goats, sheep, and cows have stopped. A lactating camel can produce 4–12 l of milk a day, but may, under intensive conditions, produce between 15–20 l per animal per day (Haddad 2006). Research indicates that camels, intensively managed in the same way as dairy cows, produce a high quality product.

3.3 Medicine

Camel milk, meat and urine have been used for medicinal purposes in many countries. The medicinal properties of camel products were known to Arab physicians centuries ago (Haddad 2006). Early in the sixteenth century one of most well-known medicinal encyclopaedias in China recorded in detail the medicinal value of camel products (Li 1596). This traditional knowledge has been respected, improved, and applied in modern medical practice. A large number of studies have been conducted into the medicinal value of camel products.

It is thought that camel milk and urine contain the diuretic and liver-strengthening properties of the wild herbs they prefer to eat, such as rosemary, thyme, wormwood, and southernwood (Haddad 2006). Camel milk has been used to cure diseases caused by chronic imbalance of the liver, such as jaundice, oedema, and swelling of the belly (Haddad 2006). Recent research reveals that raw camel milk contains insulin-like proteins that can bypass the stomach and be absorbed intact (Agrawal et al. 2005). This characteristic of camel milk could be exploited to help control diabetes in isolated Aboriginal settlements and perhaps to develop pharmaceutical products. Scientists in Israel and Sweden are currently investigating camel milk and its potential benefits to the pharmaceutical industry. Other research indicates that camel milk has a positive effect on children with severe food allergies. The effects are rapid and long lasting, although much research still needs to be done on the healing effects of the milk (Shabo et al. 2005). In India, camel milk is used therapeutically against oedema, jaundice, problems of the spleen, tuberculosis, asthma, anaemia, tuberculosis, and haemorrhoids (piles), and also used for improvement of bone formation (Yagil 1982). In Russia and Kazakhstan, doctors often prescribe camel milk to convalescing patients (Haddad 2006).

Camel meat has been used since the late sixteenth century in traditional Chinese medicine. Camel meat is used to improve resistance to disease, to strengthen the muscles and bones, to moisten the skin, and to relieve internal pain. The fat extracted from the camel's hump is used to effectively relieve pain and swelling (Li 1996; Encyclopedia 1990). Many Chinese restaurants serve, or plan to serve, their customers camel meat. Although camel meat is not commonly consumed in many parts of China, people are increasingly interested in tasting the meat (Liu 2006). In Australia, the National Heart Foundation has endorsed camel meat (Ellard & Seidel 2000).

Camel urine is also used as a medicine in some countries. It was a standard prescription in Arabic medicine and still remains a staple of Bedouin natural remedies, as a diuretic, snuff, and delousing hair wash; it has also been endorsed by mainstream modern medicine (Haddad 2006).

The active constituents of these camel products are unknown despite the fact that many parts and products of the camel are currently being used for medicinal purposes. If an industry is to develop around these products in Australia, then more research is needed into these medicinal properties, the usefulness of camel products in the management of chronic diseases such as diabetes, and the size of potential markets in Australia and internationally.

3.4 Other products and uses

Camel hides, hair, and wool can also be utilised commercially. Camel hides are used for making footwear, fashion accessories, luggage, garments, and bed covers. The average skin size of a six-year-old Australian camel ranges between 1.6 and 2.8 m². Skin thickness varies from 2.5 mm at the belly to 6 mm at the ridge. The camel leather has a high tensile strength (MacNamara et al. 2003).

The production of wool and hair by adult camels ranges from 1 kg (El-Amin 1979) to 5 kg (Keikin 1976). Wool is shed at the end of winter. If the wool is not gathered, the animal rubs itself against trees and bushes until the wool is shed. Camel wool is used for making padded cloth, quilts, and as a mattress filler. In addition to wool, Dromedary camels produce long hair that can be shorn and used for making clothes, tents, carpets, robes, saddle-girths, and blankets (El-Amin 1979).

Camels are used for tourism worldwide, especially in desert areas. In Australia there are about 50 camel tourism operations (see Edwards, Zeng & Saalfeld 2008), the most famous example being the camel ride offered at Cable Beach near Broome in Western Australia. Camel trekking and riding are the most common forms of camel tourism, but camels are also used in camel races such as the annual Alice Springs camel race. While camels do contribute to tourism, the number used is very small.

Camels are used also for other purposes such as ploughing, transporting people and materials, dung for fuel, removal of woody weeds, as props in film and video production, and racing.

4. Commercial utilisation of camels – international perspective

Camels (both Dromedary and Bactrian camels) are used commercially in many countries, primarily as a source of meat, milk, medicinal products, leather, and wool. The international camel industry is based on farmed, not feral animals.

The global population of domestic camels is relatively stable, at around 22 million, with only 5% of them being Bactrian camels. In 2007, the largest herds existed in the African nations of Somalia, Sudan, Ethiopia, Mauritania, Kenya, Chad, Mali, and Niger and the subcontinent countries of Pakistan and India, for a population of 18.8 million, with the other 3.2 million distributed across 36 other countries (Table 9.4).

Table 9.4: World camel stocks

Countries	2000	2001	2002	2003	2004	2005	2006	2007
Somalia	7 001 600	7 078 600	7 156 000	7 200 000	7 210 000	7 230 000	7 000 000	7 000 000
Sudan	3 108 000	3 203 000	3 342 000	3 503 000	3 724 000	3 908 000	3 700 000	3 700 000
Ethiopia	2 190 000	2 222 000	2 254 000	2 286 000	2 291 000	2 324 000	2 358 000	2 300 000
Mauritania	1 356 000	1 411 000	1 467 000	1 511 000	1 556 000	1 603 000	1 603 000	1 600 000
Kenya	824 800	819 100	889 200	895 100	1 193 600	931 300	1 057 900	1 060 000
Pakistan	775 000	767 000	758 000	751 000	743 000	736 000	738 000	900 000
Chad	720 000	725 000	725 000	730 000	735 000	740 000	745 000	749 500
India	759 000	714 000	672 000	632 000	632 000	632 000	632 000	632 000
Mali	467 000	467 000	470 000	470 000	472 000	472 000	474 000	476 000
Niger	410 000	415 000	421 000	427 000	433 000	439 000	427 000	430 000
Other	3 214 086	3 160 175	3 056 035	3 106 667	3 164 046	3 159 971	3 158 909	3 161 932
World total	20 825 486	20 981 875	21 210 235	21 511 767	22 153 646	22 175 271	21 893 809	22 009 432
Africa	17 049 378	17 319 372	17 697 672	18 012 894	18 632 992	18 647 511	18 374 748	18 304 243
Asia	3 764 108	3 650 503	3 500 563	3 486 273	3 513 262	3 520 356	3 511 972	3 698 004
Europe	12 000	12 000	12 000	12 600	7392	7404	7089	7185

Source: FAOSTAT 2008

Australia is the only country in the world with a large feral camel population. Its population of one million (refer to Saalfeld & Edwards 2008) is approximately 4.3% of the world total (23 million including both domestic and feral population) and is the fifth largest population in the world behind Somalia, Sudan, Ethiopia, and Mauritania. The Australian camel population is believed to be doubling about every nine years (refer to Saalfeld & Edwards 2008).

4.1 Meat production

Camel meat is not eaten everywhere; however, it is an important meat source in Middle Eastern and some South-East Asian countries (Yagil 1982). Internationally, there is a significant camel meat industry, but only a very small amount is recorded as internationally traded (Foster et al. 2005). Between 2000 and 2007 the number of camels slaughtered annually remained constant at around 1.4–1.5 million (Table 9.5), although these figures appear to be estimates rather than based on accurate data as all numbers have been rounded apart from the ‘other’ category.

Table 9.5: World camel slaughter figures

Countries	2000	2001	2002	2003	2004	2005	2006	2007
Somalia	230 000	245 000	240 000	260 000	262 000	263 000	260 000	260 000
Sudan	133 000	178 000	185 000	195 000	194 000	235 000	215 000	200 000
Saudi Arabia	181 000	182 000	182 000	184 000	194 000	193 000	186 000	186 000
Mauritania	112 000	117 000	122 000	127 000	130 000	134 000	134 000	134 000
Egypt	130 000	170 000	150 000	126 000	130 000	130 000	130 000	130 000
United Arab Emirates	72 606	76 950	81 210	85 480	85 500	85 500	86 000	86 000
Ethiopia	77 000	78 000	79 000	81 000	81 000	82 000	82 500	80 000
China	67 000	85 000	69 000	65 000	65 600	65 400	68 000	70 000
Kenya	66 000	66 000	66 000	66 000	95 000	85 000	66 000	66 000
Mali	46 000	46 000	47 000	47 000	47 200	47 200	47 400	47 600
Other	253 525	252 220	241 151	234 290	254 839	258 186	250 717	251 899
World Total	1 368 131	1 496 170	1 462 361	1 470 770	1 539 139	1 578 286	1 525 617	1 511 499
Africa	905 500	1 013 702	1 001 677	1 016 553	1 058 471	1 097 240	1 056 393	1 036 922
Asia	461 266	481 333	459 774	453 217	479 668	479 914	468 475	473 827
Europe	1365	1135	910	1000	1000	1132	749	750

Source: FAOSTAT 2008

4.2 Global trade in live camels

There is significant global trade in live camels (Foster et al. 2005). While it is hard to obtain accurate information, the following Food and Agriculture Organisation of the United Nations (FAO) data (Figure 9.1, Figure 9.2) show that since 1990, global trade in live camels has oscillated considerably, with an average annual number traded of 80 000 head for an average annual value of approximately US\$28 million. Since the late 1990s, the world trade in live camels has been declining at a rate of approximately 8% per year.

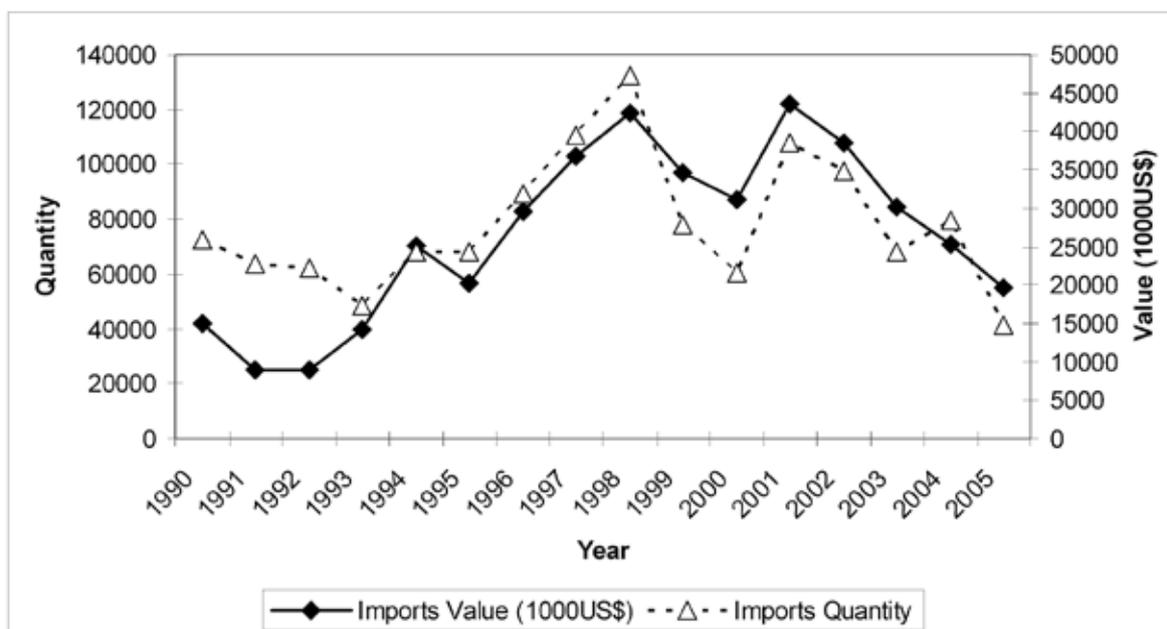


Figure 9.1: Live camel imports in the world

Source: FAOSTAT 2008

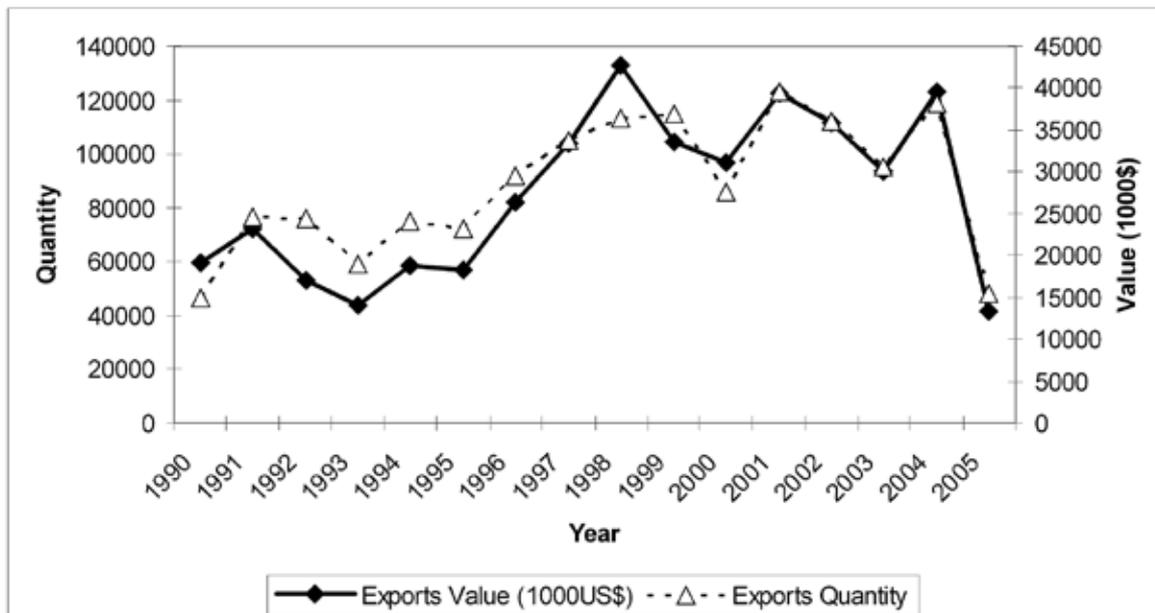


Figure 9.2: Live camel exports in the world

Source: FAOSTAT 2008

The Arab nations of Egypt, Saudi Arabia, Qatar, the United Arab Emirates, and Oman were the world's largest importers of live camels in 2000–2005, accounting for more than 90% of total world imports (Table 9.6).

Sudan was the world's largest exporter of live animals from 2000 to 2005 (Table 9.7). In this period the country's live camel exports varied from ~22 000 to ~97 000 head per annum, accounting for approximately 53–68% of total international live camel exports. Other key exporting nations recorded by FAOSTAT between 2000 and 2005 were Qatar, United Arab Emirates, Oman, Saudi Arabia, and Djibouti (Table 9.7) with Mauritania (Goulding et al. 2007) and Ethiopia (Ethiopian News Agency 2008) beginning to export large numbers.

Recent reports suggest that the international trade in live camels has started to recover, with the second largest live animal exporting company in Ethiopia, SAAFI Trading and Agro Industry PLC, predicting it would export 20 000 camels worth US\$6 million abroad in 2008. This is a 50% increase on its previous year's export figures, and they continue to expect an average price of US\$300 per head. It is interesting to note that the company requested the Ethiopian government strengthen its control over contraband trade, which, it said, is disabling the exporter's competitive capacity in the global market (Ethiopian News Agency 2008).

Table 9.6: World live camel imports 2000–05

Countries	2000		2001		2002		2003		2004		2005	
	Imports quantity (head)	Imports value (1000US\$)										
Egypt	61 354	12 185	99 651	26 861	77 284	20 617	48 867	10 625	39 711	7745	45 456	9549
Saudi Arabia	25 160	8 700	10 785	3650	20 600	8500	25 762	7200	10 160	3226	-	-
Qatar	417	299	10 331	6984	4568	1823	541	218	8281	4240	8695	4801
Oman	-	-	-	-	5327	3768	8114	5867	5072	8422	-	-
Other	398	354	1347	973	178	45	1284	461	7857	4739	746	387
World Total	87 329	21 538	122 114	38 468	107 957	34 753	84 568	24 371	71 081	28 372	54 897	14 737
Africa	61 354	12 234	99 651	26 997	77 284	20 617	50 081	11 074	40 692	8388	45 456	9549
Asia	25 975	9304	22 463	11 471	30 673	14 136	34 487	13 297	30 389	19 984	9441	5188

Source: FAOSTAT 2008

Table 9.7: World live camel exports 2000–05

Countries	2000		2001		2002		2003		2004		2005	
	Exports quantity (head)	Exports value (1000US\$)										
Sudan	61 400	12 186	97 441	26 200	50 896	13 500	60 949	12 255	84 545	15 268	22 296	4561
Qatar	13	10	1223	1789	5	3			12 441	3829	10 863	7564
United Arab Emirates	-	-	5305	4400	6443	4360	8114	5860	8865	11 050	-	-
Oman	-	-	-	-	436	375	4166	6222	5007	3393	-	-
Saudi Arabia	591	360	7765	2800	3322	1150	194	66	4059	1167	-	-
Djibouti	-	-	2110	670	25 248	6780	15 900	3900	4049	840	3376	609
Mali	-	-	-	-	41	13	1817	1094	1636	1163	1636	1163
Chad	2986	1550	1478	770	1500	780	1500	800	1500	800	1500	800
Somalia	25 161	10 000	4610	2000	20 600	8500	950	400	981	574	1000	600
Other	6613	3524	2359	937	3027	565	65	8	39	28	1005	256
World Total	96 764	27 630	122 291	39 566	111 518	36 026	93 655	30 605	123 122	38 112	41 676	15 553
Africa	95 192	26 740	105 639	29 640	98 307	29 577	81 181	18 457	92 711	18 645	30 653	7880
Asia	1572	890	16 652	9926	13 211	6449	12 474	12 148	30 411	19 467	11 023	7673

Source: FAOSTAT 2008

4.3 Other products

In Africa and the Middle East, camel milk is an important dairy product. The annual production of camel milk is around 5.4 million tonnes (Fletcher 2006). The major demand for camel milk comes from countries in the region from the Sahara to Mongolia. The demand in Europe is currently small but the FAO has recently predicted that camel milk could appear on European supermarket shelves one day (Fletcher 2006).

The processing of camel hides is common in Northern Africa and the Middle East (MacNamara et al. 2003). The data relating to the production of camel hide and leather is not available; however, the slaughter figures suggest that the countries with the greatest volume of camel hides available are: Sudan, Saudi Arabia, Egypt, Mauritania, the United Arab Emirates, and China, which collectively account for almost 53% of camels processed for meat in 2005 (Goulding et al. 2007). Italy and the United States are the major markets. Italy is currently the most promising market for leather because the

Italian industry believes the hides are well suited to the production of accessories, belts, jackets, shoes, and upholstery. The industry has also stated that natural scarring does not diminish a hide's quality because it makes each one unique (Goulding et al. 2007).

Camel wool is harvested and processed for making padded cloths, quilts, and mattresses. In China in the early 1980s, approximately 1500 tonnes of wool was collected annually and consumed domestically (Yagil 1982).

5. Commercial use of feral camels in Australia

5.1 Industry size

The presence of a significant feral camel population in Australia provides an opportunity to develop a commercial camel industry. Feral camels were first harvested for meat in 1988 in Alice Springs in the Northern Territory (NT). Since then, commercial harvesting has occurred irregularly in both the NT and Western Australia (WA). In the mid-1990s, initial investigations showed possible markets for Australian feral camel products did exist, particularly internationally. The launch of the Central Australian Camel Industry Association (CACIA) in 1995 was a landmark event in the establishment of the Australian camel industry.

Unlike the rest of the world, the development of the camel industry in Australia has focused on the wild harvest of feral animals, not on the development of a domesticated population. Wild harvest for live export and meat production has been the major components of the camel industry in Australia up until now. Marketing efforts have concentrated on live camel exports to Asia and the Middle East where camels are used for racing and for breeding stock. Domestically, Australian camel meat is mainly used for human consumption. There is only a small quantity of camel meat exported currently because of little international market development and lack of an export accredited abattoir. In the past few years the harvest of camels for pet meat has become an important component of the industry, in terms of the numbers of animals harvested. This component of the industry is growing because of its acceptability to stakeholders and due to the accessibility of a proven market, including the international pet food market.

Reliable data that measures the production, consumption, and live export of camels and meat is hard to obtain as it is not included in national statistics. According to a report produced by the Rural Industries Research and Development Corporation (RIRDC), the farm gate value of the camel industry in Australia is small and has declined since the late 1990s. In 1999–2000 the report estimated that the value of camel meat was \$200 000, dropping to \$100 000 in 2003, and less than \$100 000 in 2004, while live export declined from \$200 000 in 2003 to less than \$100 000 in 2004 (RIRDC 2005).

However, based on the best information we have been able to find, we estimate that the gross sales value of camel primary products is currently between \$1.87–2.50 million (Table 9.8), including \$0.27–0.36 million for live exports, \$0.92–1.10 million for meat production for human consumption, and \$0.68–1.04 million for meat production for pet food manufacturing. The total export value is around \$0.45–0.58 million, or 24% of the total sales value. The number of feral camels harvested for commercial use in 2006 was estimated to be 2200–3200: fewer than 400 for live export, 800 for human consumption, and 1000–2000 for pet meat. However, in 2007 this number increased to 5000–6000, as the commercial use of camel meat for pet food was dramatically increased to 3600–4600 camels and the use for human consumption was also increased to 1000 camels, including 200 camels slaughtered for international markets. The details will be discussed in following sections.

Table 9.8: Australian camel production (2007–08)

Camel meat production for human consumption		
Slaughtering	no.	1000
Meat production (natural fall)	tonnes	167–200
Gross sales value	\$ million	0.92–1.10
Export value	\$ million	0.18–0.22
Camel meat production for pet food manufacturing		
Harvesting	no.	3600–4600
Meat production (carcass)	tonnes	900–1,380
Gross sales value	\$ million	0.68–1.04
Live camel exports		
Volume	no.	<400 (363)
Sales value	\$ million	0.27–0.36
All camel products		
Harvested camels	no.	5000–6000
Total export value	\$ million	0.45–0.58
Gross value of production	\$ million	1.87–2.50

5.2 Major participants in the Australian camel industry

Currently involved in the Australian camel industry are:

- four main companies involved in slaughtering camels and processing them for human consumption. They are Territory Camel Pty Ltd in the NT, Strath Meats and Metro Velda in South Australia (SA) and Meramist Pty Ltd in Queensland (Qld) (refer to Section 5.5.1)
- a small number of meat wholesalers and retail businesses
- a small number of live export traders, and their number is determined by the current demand for camels. Camel Exports Pty Ltd, based in Alice Springs, has consistently maintained a profile in this area over a number of years (refer to Section 5.4.1).
- at least three pet food companies using camel meat for pet food manufacturing and more interested in using camel meat (refer to Section 5.5.2)
- only a small number of professional shooters directly involved in pet meeting operations, with most of them operating in WA
- approximately 50 small businesses involved in camel tourism, most of them operating on a small scale using small numbers of camels (refer to Section 5.6.2).

5.2.1 Aboriginal people

Aboriginal people have an important role in the emerging camel industry because a significant number of the existing population of camels live on Aboriginal-owned and -managed land. Many Aboriginal people have had some involvement in pastoral enterprises and the camel industry (Vaarzon-Morel 2008a, 2008b), especially in the harvesting of animals for meat or live export (refer to Section 5.3). As the managers of significant tracts of the camel range, Aboriginal people will strongly affect the implementation of any management actions, whether it is the development of a commercial industry or the implementation of a culling regime. The involvement of Aboriginal land managers in the development of a sustainable camel industry is crucial to its success. An expansion of the current industry could provide much needed employment, business opportunities, and income to remote areas.

According to the survey of 27 Aboriginal communities in the camel range carried out as part of this research project, most Aboriginal people support the commercial use of feral camels and would like to be involved in a camel industry. They expect that the development of the industry would not only achieve economic returns but also create employment and empower local communities (refer to Vaarzon-Morel 2008a, 2008b).

5.2.2 Pastoralists

Pastoralists have been both active participants and strong disbelievers in the development of a camel industry. They have established facilities and used their pastoral infrastructure to muster and hold camels for on-selling. They have also been very vocal in their scepticism about the sustainability of a camel industry. Their dilemma can best be explained as follows: they want to actively participate in feral camel management activities because of the substantial impact that feral camels have on their pastoral operations, and from a financial perspective they would like see camels supplement their pastoral income. They also have concerns about the economic viability of a camel industry and its potential competition with the cattle industry, which is currently more profitable. This is confirmed by the results of a survey of pastoralists (described in Zeng & Edwards 2008a). According to the survey of 209 pastoral properties, 21% of pastoralists have been involved in camel use, and approximately 1599 camels were harvested over the period July 05 – June 07. This was around 20% of the total number of camels harvested in the same period by the whole camel industry in Australia.

5.2.3 Industry bodies

Industry pioneers formed a representative industry body, the Central Australian Camel Industry Association (CACIA), in Alice Springs in 1995. CACIA is comprised of members of the pastoral industry, the meat industry, representatives from Aboriginal settlements, tourism operators, transport operators, contractors, and government agencies, who all have a common interest in developing the commercial potential of the camel industry. The role of CACIA is to promote the sustainable development of the camel industry through promoting the use, understanding, and wellbeing of camels in Australia. Since its inception it has been one of the most important players in the development of the Australian camel industry.

CACIA is involved with camel product and market development through its trading company Camels International Pty Ltd. It has also developed and disseminated a significant amount of industry information, including information for livestock dealers, zoos, safari parks, veterinarians, meat brokers, exporters, butchers, executive chefs, food and beverage managers, and supermarket meat buyers. It has developed the specifications and ordering codes for domestic and international trade and guidelines for the capture and handling of camels destined for the abattoir (CACIA 2007). Also, a Camel Industry Steering Committee has been established in WA, to facilitate and coordinate the commercial utilisation of camels.

5.2.4 Governments

It is estimated that since 1998, the total government investment in the camel industry has been over \$4.37 million (Edwards, Zeng & Saalfeld 2008). Governments have also played an important role by developing the policies and laws associated with the use of camels in Australia (Carey et al. 2008).

The roles that governments have played include the following:

- The Commonwealth Government, through initiatives such as the RIRDC, has supported research into, and implementation of, camel management, including evaluations of the viability of commercial activities.

- The NT Government through its then Department of Primary Industry, Fisheries and Mines (DPIFM) and Department of Business, Economic and Regional Development (DBERD) supported the development of the CACIA with funding of approximately \$120 000 per year for ten years. This support ceased in 2006.
- The Qld Government has allocated a senior officer in the Department of Primary Industry and Fisheries (DPI&F) to coordinate and support the development of the camel industry. A series of studies have been conducted to explore the viability of a camel farming industry.
- The WA Government has set up a special camel group to coordinate camel management in Western Australia, where live export is considered one of the most important commercial uses for feral camels.
- The SA Government is supporting a market-based instrument project through SA Arid Lands Natural Resources Management (SAAL NRM) Board and Rural Solutions SA. This project aims to investigate the creation of a market mechanism that would drive sustainable feral camel control.

5.3 Camel harvest

Pastoralists, Aboriginal communities, professional shooters, and musterers are all involved in camel harvesting. Harvested animals are either sold to abattoirs, or to live exporters, or slaughtered on site and sold to pet food companies, or occasionally consumed. Harvesting is usually accomplished by trapping or mustering the camels using helicopters, motorbikes, horses, or other vehicles, or by shooting in the field from the ground. Harvesting has not been undertaken on a consistent basis as there has not been a steady market demand. There is evidence that feral camels have been held in sizeable enclosures in anticipation of markets becoming available, but this is unusual. Harvesting has mainly occurred in SA, the NT, and WA. In Qld the feral camel population is relatively small and there has not been substantial wild harvest activity.

5.3.1 Camel harvest in South Australia

Feral camels are harvested from the SAAL NRM region for economic return. They are sold for live export, human consumption, pet food and, to a lesser extent, for domestication, racing, and for on-selling to Qld for the control of woody weed species (Gee & Greenfield 2007). Mustering wild camels for sale mainly occurs on an ad hoc basis from stations including Macumba, Cowarie, Bollard's Lagoon, and Clifton Hills.

The Anangu Pitjantjatjara and Yankunytjatjara (APY) Lands in SA have a high feral camel density (refer to Saalfeld & Edwards 2008). The APY Land Management unit at Umuwa has been attempting to develop a sustainable live harvest camel industry. Feral camels mustered on the APY Lands are transported for slaughter to Wamboden (NT), Peterborough, and Strathalbyn abattoirs (SA), and some are purchased by Camel Exports Ltd for live export when the opportunity arises. It is estimated that around 2 000 feral camels were harvested in the APY lands in 2007 for commercial utilisation, including human consumption, pet meat manufacturing, and other uses (Phil Gee 2008, Senior Consultant, Rural Solution, SA, pers. comm.).

5.3.2 Camel harvest in Northern Territory

In the NT there are a number of pastoral stations that maintain camel herds including Henbury, Narwietooma, Aileron, Kings Creek, Horseshoe Bend, and Ringwood. The feral camels are mustered or trapped and are then maintained and fed, awaiting buyers. Camels are also mustered on other stations and Aboriginal lands on an ad hoc basis.

Henbury Station started a camel business in 2000 and currently has 1500 camels. These animals were mustered and trucked to the station from the Kaltukatjara (Docker River) region. According to Ross Morton, the owner of the property, the camels impose little extra cost on the property. Since 2000,

approximately 3000 camels (most of them harvested from the station) have been sold, including 1600 that were slaughtered at an abattoir; the remainder were sold for live export (Ross Morton 2008, owner of Henbury Station, NT, pers. comm.).

An interest in harvesting feral camels was sparked in many Aboriginal settlements by the formation of the CACIA about 10 years ago. A number of initiatives have been developed to provide funding and skills development. The Undurana Camel Farm is a pilot program for the camel industry. The initial proposal for the project was completed in 2000 by the Central Land Council (CLC) with funding from the Indigenous Land Corporation (ILC). The proposal involved fencing a 50 km x 50 km v-shaped area, enclosed by ranges, with trap gates at one end. Trapped camels were managed as a semi-domesticated herd, with regular mustering for live export. The ILC, CLC, and Tjuwanpa Resource Centre provided funding and practical assistance to build the fence. The energy company Santos also became involved, providing further funding and support staff when funding ran out (Peter Donohoe 2007, CLC, pers. comm.). The fence was completed in 2005 and it has been reported that there are now around 500 camels within the paddock. There has been little activity since this time, apart from the occasional sale of animals to camel traders. In 2006 a proposal was made to lease the paddock for cattle grazing; however, local people were not interested because this would have meant taking the camels elsewhere. Andrew Drenen, the Indigenous Protected Area Officer from the CLC Land Management Unit, also approached the local Aboriginal people in 2006 regarding the possibility of their selling camels for pet meat. However, the \$25 offered per head fell far short of the figure they expected to receive for their camels and none were sold. In March 2008 approximately 100 animals were helicopter mustered into yards and 40 were sold to Wamboden Abattoir in Alice Springs (James Huston 2008, Independent community health worker, pers. comm.).

Kaltukatjara (Docker River) received a small grant from the Winemakers' Federation of Australia in 2000–2001 to help establish a local camel harvesting enterprise. Local Aboriginal people were to be employed to muster, maintain, and slaughter camels. The money was used to build a camel holding yard that was designed to catch some of the thousands of feral camels at Junti, near Lasseter's cave. Only half of the yard was completed during this project. The project was overseen by Ngaanyatjarra Aboriginal Corporation but was interrupted when senior community members protested about the young men involved being paid in food (i.e. pies from the community store). A further grant from the Winemakers' Federation was received in 2005. This money was used to buy a vehicle and complete the stockyard. A single water trough was put in place to lure feral camels into the yard. However, there has been no mustering and trucking out of camels since the stockyard was completed, mainly because there is no market for the meat. The bore to feed the trough is not currently working. The main way that camels are currently being used in the Docker River area is as meat for community consumption, with approximately one animal per week being killed and butchered.

In other settlements such as Kintore, on the western border of the NT, there has been some interest in harvesting feral camels for the past 10 years. There has not been a commercial harvest yet, although young men do hunt camels and distribute the meat to old people in the community (ABC Online 2008).

5.3.3 Camel harvest in Western Australia

There are no stations in WA running commercial camel herds. The closest thing to a commercial operation is conducted at Anna Plains Station where the camels are not culled but are rounded up by the rouseabouts and sold to augment their wages (Peter Kendrick 2007, Head of Nature Conservation in the Pilbara Region for WA Department of Environment and Conservation, pers. comm.). It has not been established whether these camels were used for live export or were intended for domestication. Two or three Aboriginal settlements have mustered small numbers of camels for live sale: Warburton, where a few small truckloads (possibly two loads of 10 camels) have been sold to the camel farm in Kalgoorlie; and Jameson where one load was sent for live export (Andrew Drenen 2007, Regional Land Management Officer, CLC, pers. comm.).

The West Australian Ngaanyatjarra settlements have started working with the SA APY camel program. Community members travelled to the APY lands for training in camel butchering techniques and to see first hand what APY Land Management have been doing in relation to herd management and mustering (Alex Knight 2007, Director of Land and Cultural Management Unit, Ngaanyatjarra Land Council, pers. comm.). Since March 2007, a small group of professional shooters has been harvesting feral camels for pet meat around Ngaanyatjarra settlements (Warakurna, Jameson, and Tjukurla). They were contracted by Ngaanyatjarra Council and the local settlements. Approximately 2000 camels have been shot from the ground for pet meat (see Appendix 9.2: Case study: Pet meat operation in Warakurna for details).

Kunawarritji settlement in the Great Sandy Desert has built a mustering yard and is interested in developing a live harvest enterprise (Peter Kendrick 2007, Head of Nature Conservation in the Pilbara Region for WA Department of Environment and Conservation, pers. comm.).

5.3.4 Harvest cost

Feral camel mustering consumes a lot of time and money. Mustering costs vary from case to case, depending on the geography, camel density, road access, transportation distance, harvest method, and the skills and knowledge of the harvesting team. Permanent trap yards can be used to capture animals, but once trapped the camels still need to be further aggregated, using motorbikes, vehicles, and even helicopters, before loading onto trucks. From the trucks they can go either for sale or to holding paddocks awaiting a buyer. In the case of Henbury Station in the NT the estimated cost of mustering was between \$50 and \$100 per head (Ross Morton 2008, owner of Henbury Station, NT, pers. comm.). In addition to this, the station faced a transport cost of between \$100 and \$150 per head making a total cost of between \$150 and \$250 per head. The current farm gate price for live export is \$400 and for meat it is \$200.

5.4 Live exports

The live export of feral camels is currently one of the most important components of the camel industry in Australia. Camels are traded both domestically and internationally. Domestically, they are sold to abattoirs, tourism operators, and camel farms where they are stocked for meat production and other commercial purposes including the control of woody weeds. The number of camels traded within Australia is approximately 1500 per year. This figure is determined by the demand for camel meat (discussed in more detail in Section 5.5).

5.4.1 Current situation

Camel Exports Pty Ltd has been operating a live export business for 19 years. The volumes and destinations of live camel exports vary substantially from year to year. According to CACIA, the total number of camels exported live from 1988 to 2007 was 4761 head (Table 9.9), an average of approximately 250 head annually. In 2007 this figure was 363 head. The majority (77%) were exported to South-East Asia, with most going to Malaysia; the rest were exported to the Middle East and America.

Table 9.9: Numbers of Australian camels exported 1988–2007

Export destination	Number	Export destination	Number
USA	612	Taiwan	20
Brunei	991	Korea	25
UAE	45	Saudi Arabia	126
Cuba	24	Kuwait	122
Indonesia	53	Jordan	160
Thailand	96		
Pen. Malaysia	2487	Total	4761

Source: CACIA 2006; Camel Exports Pty Ltd

Since 2003, the income received from exports of live camels has declined. The value of live camel export trade reached a peak of \$579 000 in 2003, but since then has declined to \$100 000 or less, with a rise again in 2007 (Table 9.10).

Table 9.10: Income received from Australian live camel exports

	Unit	2000–01	2001–02	2002–03	2003	2003–04	2004	2005	2006	2007
Number	no.	197	415	130	-	115	-	-	-	363
Value	\$'000	141	297	93	579	82	104	30	27	272–363

Source: Data for 2000–01, 2001–02, 2002–03 and 2003–04 from (Foster et al. 2005); Data for 2003, 2004, 2005, 2006 and 2007 from CACIA Office (Peter Seidel 2008, Central Australian Camel Industry Association, pers. comm.).

There seems to have been some recent signs of recovery in the number of live camels exported. In 2003–04 there were 115 live camels exported to Malaysia (57% of total), Brunei Darussalam (35% of total), and Saudi Arabia (7% of total), which is less than half of the average number over the last 19 years (250 camels per annum). However, in 2006–07 there was a significant increase in the number of camels exported, with 363 camels shipped, most of them to Malaysia (94%) (DAFF 2008). The value of live camels sold is currently around \$272 000–363 000 per annum, i.e. \$750–1000 Free on Board (FOB) per camel. It should be noted, however, that the numbers exported have remained small, there are no long-term supply agreements in place, and sales occur on an ad hoc basis. There is therefore no incentive for companies and individual landholders to invest in infrastructure.

The majority of camels are shipped through Darwin, but other ports, including Townsville, Broome, Wyndham, and Adelaide have been used, or have the capacity to export live camels.

5.4.2 Markets

South-East Asian, Middle Eastern, and African countries are currently the major markets for Australian feral camels. Australian animals are sought after because they are free range and have none of the diseases that have impacted herds in the destination countries. The current world trade in live camels is around 100 000 camels per year (refer to Section 4.2). They are mainly supplied by African countries such as Mauritania and Sudan.

The landed price is the major factor that determines Australia's capacity to penetrate this market. As noted above, the current Free On Board (FOB) value of camels in Darwin is between \$750–1000 per camel. As a comparison, in 2003 the average price for a camel in Pakistan was Rs.21 500 (AU\$579) (Isani 2003). Recent research in Pakistan has found that, at the Mangrota Camel Mela (Fair) in 2006–2007, 8000–10 000 camels were traded, with an average price of Rs.50 000 (AU\$1039). The camels were bought for a variety of purposes including physical work, domestic slaughter, live export to Iran, and meat export to Gulf countries (Raziq 2007). While there is an opportunity for Australia to export camels, the margins are likely to be small unless they are supplied into high value niche markets.

5.5 Meat production

5.5.1 Human consumption

In the early 2000s, the number of camels slaughtered for human consumption was around 400 head per year. With the advent of new businesses such as Territory Camel in the NT, the number slaughtered has been increasing since 2005. It has been estimated that currently the Australian camel industry slaughters a total of about 1000 head per year for human consumption, including 800 for domestic and 200 for international markets (Table 9.11). The value of this production is estimated to be \$1.01 million. This figure is based on an average live weight of 500–600 kg, generating an average saleable meat volume of 184 kg (167–200 kg) at a price of \$5.50 per kg.

Table 9.11: Number of camels slaughtered in Australia

Period	Number of camels slaughtered (per year)	Source
2001–2005	400	(Goulding et al. 2007)
2003	397	(Invest Australia 2005)
2005/06	600	Garry Dann 2008, Managing Director of Territory Camel Pty Ltd, pers. comm., Peter Seidel 2008, Central Australian Camel Industry Association, pers. comm.
2006/07	800	Garry Dann 2008, Managing Director of Territory Camel Pty Ltd, pers. comm., Peter Seidel 2008, Central Australian Camel Industry Association, pers. comm.
2007/08	1000	Garry Dann 2008, Managing Director of Territory Camel Pty Ltd, pers. comm., Peter Seidel 2008, Central Australian Camel Industry Association, pers. comm.

The value of camel meat sold can be estimated by another method. If only 26.6% of a camel carcass is retail cuts (including topside, silverside, eye of round, sirloin, silverside heel, hind shank, loin without bones, tenderloin, shoulder clod, chuck tenderloin, blade, small shoulder cut, shank for roasting, and fore shank) (Farach & Fischer 2004), a camel would have around 66.5–79.8 kg of meat that could be for sold for human consumption in retail outlets. There are, therefore, around 66.5–79.8 (an average of 73.2) tonnes of camel meat currently produced each year that could be sold.

According to CACIA, from 2003–2006, 14 tonnes of camel meat (retail cuts) valued at around \$175 000 were sold annually by Camels International Pty Ltd. The average price for camel retail cuts was, therefore, around \$12.50 per kg. Using this price, the current value of camel retail cuts sold for human consumption (73.2 tonnes) is about \$0.91 million. If the value of other saleable meat is included (e.g. processing materials such as camel meat with some visible fat and connective tissue) in the estimate, the total value of camel meat sold would be over \$1.00 million.

The main processors of camel meat for human consumption domestically are Territory Camel in the NT (refer to Appendix 9.1: Case study: Territory Camel Pty Ltd), Strath Meats, and Metro Velda, these last two both in SA. They mainly process camels from the NT and SA, mustered from wild and commercial herds. Small numbers of camels from both Qld and SA have been processed by Meramist in Caboolture, Qld for export. In 2007/08 Territory Camel Pty Ltd slaughtered 450 camels, and the meat was supplied only to domestic markets. Meramist Pty Ltd is currently the only company with export accreditation that is processing camel meat for export. In 2007/08 Meramist started to export camel meat to the United Kingdom (UK). Currently around 4.7 tonnes of camel meat are exported every fortnight (Lauren Brisbane 2008, Brisbane Hornery Partnership, pers. comm.).

The main wholesaler of camel meat for the domestic market is Wyuna Meats in Adelaide, SA (Peter Seidel 2007, Central Australian Camel Industry Association, pers. comm.). They sell directly to restaurants, butchers, and manufacturers across Australia. Other businesses, including Territory Camel, also sell their own camel products direct to the public.

A small number of restaurants serve camel meat; these are usually confined to tourist areas where tourists are interested in trying camel meat for variety, for its novelty appeal and because it is ‘bush tucker’ (Warfield & Tume 2000). Some supermarkets in SA and the NT have sold camel meat in the past (Woolworths and Coles in Alice Springs were the main outlets) (Warfield & Tume 2000), but discontinued it a few years ago, along with other exotic meats such as buffalo and crocodile because of lack of demand (Peter Seidel 2007, Central Australian Camel Industry Association, pers. comm.).

5.5.2 Pet food

5.5.2.1 Scale of camel harvest for pet meat

Pet meat is an important commercial use for feral camels in Australia. The industry initially relied on off-cuts from the slaughter of feral camels for human consumption, and the specialty pet meat operations commenced in a substantial way in 2006 on some pastoral properties in WA and the NT. Since 2007, a small scale third-party pet meat operation (see Appendix 9.2 for a case study) has been undertaken on Aboriginal land in WA, and more pastoral properties have been conducting opportunistic harvesting. It is estimated that between 3600 and 4600 feral camels were harvested for pet meat in 2007 (Table 9.12), which was an increase of approximately 3000 from the previous year. Compared with live export and the slaughter for human consumption, more camels are currently harvested for pet meat in Australia. To date, camels used for pet meat have been mainly harvested from Aboriginal land and pastoral properties in WA by professional hunters and contractors.

On average a camel sold for pet meat is worth between \$187–225 (i.e. 250–300 kg carcass sold for \$0.75 per kg) (refer to Appendix 9.2). Based on current numbers this gives a total value of the pet meat industry of between \$0.68–1.04 million annually (an average of \$0.86 million).

Table 9.12: Estimated number of camels harvested for pet meat in 2007

State/Territory	Location	Estimated camel numbers	Harvester	Source
NT	Mulga Park Station	400	A pet meat company	Shane Nicolle 2007, Manager of Mulga Park Station NT, pers. comm.
WA	Warakurna settlement	1000	Professional hunters	Appendix 9.2
WA	Jameson settlement	700	Professional hunters	Gordon Sanders 2008, Project officer, Ngaanyatjarra Council, pers. comm.
WA	Pastoral lands	1000–1500	Contractors and shooters	Estimate based on the pastoral survey, Chapter 3.
SA and NT	Pastoral lands and Aboriginal lands	500–1000	Pet meat companies, contractors and shooters	Estimated based on the pastoral survey, community survey and personal communication, Chapter 3, 5 and Phil Gee 2008, Senior Consultant, Rural Solution, SA, pers. comm. Shane Nicolle 2008, Manager of Mulga Park Station, pers. comm.

5.5.2.2 Pet meat operations

A number of pet food companies and local Aboriginal settlements have been keen to work together to develop commercial pet meat operations. Although these operations have only occurred in a small way, there is potential and a willingness to undertake the commercial harvest of camels for pet meat.

There have been a number of enquiries from pet meat companies and other enterprises wanting to access camels on Aboriginal land in the NT over the past few years. In general, these proposals are more acceptable to Aboriginal people than ‘shoot to waste’ culling programs, particularly where they include possible financial returns and the employment of locals (Vaarzon-Morel 2008a, 2008b). The returns to Aboriginal communities from this type of operation are, in reality, likely to be very low, and it is not certain how viable these operations are for the companies themselves. Nonetheless, there are some companies very interested in these operations (such as V.I.P. Petfoods (Aust) Pty Ltd, Howard Springs Petmeating, and burgeoning Aboriginal crocodile farm enterprises).

We are aware that Centre Farm (NT) has recently been studying the viability of Aboriginal communities establishing small-scale pet meat enterprises. They have assessed the environmental, social, and market factors that would affect the long-term sustainability of small-scale live harvest enterprises that provide camels for commercial use, including for pet meat (Andrew Drenen 2007, Regional Land Management Officer, CLC, pers. comm.).

In SA and the NT, some small scale, ad hoc harvesting of camels for pet food has also been undertaken. Around 400 camels were taken from Mulga Park Station in the NT (Shane Nicolle 2008, Manager of Mulga Park Station, pers. comm.) and an estimated 500–1000 camels were harvested for pet food from other areas in SA and NT (see Table 9.12).

In Western Australia, Ngaanyatjarra Land Management has recently negotiated a contract with a national pet meat company to undertake field-based slaughter and butchering on a settlement-by-settlement basis on the Ngaanyatjarra Lands. This operation – the first to have been negotiated for Aboriginal land – has been in progress since late March 2007. Local people have been employed to guide the operation and are also involved in the killing and butchering processes. This operation has been completed in two settlements (Warakurna and Jameson), with 1000 and 800 camels harvested respectively, and is continuing in Tjukurla. By May 2008, the operation in Tjukurla had harvested 500 camels. A case study of the pet meat operation in Warakurna has been undertaken and is reported in Appendix 9.2. Pet meat operators and kangaroo shooters have also carried out the field-based slaughter of relatively large numbers of camels on pastoral stations during dry periods. It is estimated that 1 000–1 500 camels were harvested for pet food on pastoral properties in WA in 2007.

5.5.3 Markets

5.5.3.1 Human consumption

People closely involved in the camel meat industry believe that once consumers try camel meat, this healthy and superior meat will become commonplace in Australian households (Garry Dann 2008, Managing Director of Territory Camel Pty Ltd, pers. comm.). RIRDC research suggests that there are two potential markets for camel meat domestically. The primary target market includes tourists and Australian Muslims, with a secondary target market of consumers of other game meats (Warfield & Tume 2000; NTCA 2003). According to wholesalers and retailers, Muslims from the Middle East, Indonesia, Malaysia, Pakistan, India, and Turkey are most likely to buy camel meat. Tourists are perceived to be the target market by restaurants, while butchers perceived local residents as well as tourists as the most likely buyers of camel meat (Warfield & Tume 2000). However, the current domestic market for camels is quite small: equivalent to about 12 carcasses (two tonnes of meat) per week, of which 78% goes to the food service, primarily restaurants in the Adelaide and Sydney areas; 20% to manufacturing, and the remaining 2% to retail; mainly in supermarkets in the NT and some butcher shops (NTCA 2003). The size of the Muslim market within Australia is difficult to assess. There are strong indications from mosques in Sydney and Perth that Muslims in big cities are interested in camel meat; however, this demand would only account for the equivalent of 30 animals per week in a slash pack form (NTCA 2003). These animals would have to be killed in accordance with Halal requirements.

There is potentially a large market for camel meat in Muslim countries in the Middle East, Africa and Asia. However, it is difficult to get an estimation of the true market size and the profitable product types, because the live trade in camels is so small internationally and no accredited camel meat has been exported. According to Sarah Debney, Senior Manager of Territory Camel, the traditional markets for camel mostly want a 'wet' product, which is very costly for Australian producers to provide because it relies on live export, and the current Australia live animal export infrastructure is geared towards smaller animals. Recent reviews of camel meat markets in some Middle Eastern countries suggested that currently there is no market for imported boxed camel meat (Ash et al. 2008; Students 2008b).

It must be noted that there are limits to market research about the effect of cultural factors on demand for camel products. These markets are extremely price sensitive. Most camel meat goes to wet markets, or is sold through mosques where it is provided as cheap food, primarily for low income families. This means that there is a high degree of price sensitivity and the product must be sold within an affordable range (NTCA 2003). It is understood that the Muslim market differentiates between male and female camels, with a preference for males, and there is a stipulation that only male camel meat be used during the Haj religious period. In some cases female camel meat will be accepted, provided the camels are not in calf (NTCA 2003).

Australia may be in a position to supply quality meat animals, because camel meat is of poor quality in many countries where there are large numbers of camels (Warfield and Tume 2000). It is understood that camels are normally slaughtered at the end of their working life in Sudan (Warfield and Tume 2000) and Pakistan (Isani 2003). Reports say that in Pakistan, camel meat is not liked by a majority of the population because of its inferior taste and quality due to the meat coming from old (>20 years old), worn out camels. However, it is estimated that nearly 9000 metric tonnes of camel meat, valued at Rs. 270 million (AU\$7.3 million), is produced and consumed annually in Pakistan (Isani 2003). Although the price is very low, Australian camel meat producers could find opportunities to meet the demands of undersupplied markets like this. However, a better prospect is to supply a quality product to the higher end of these markets. This would require the development of a consistent quality product of two-year old male animals to medium- to high-income earners in Saudi Arabia and the United Arab Emirates (Rouda 2004).

A more realistic international market is in Europe, especially in the UK. According to recent research conducted by Charles Darwin University (Bell et al. 2008), it is clear that the existing market price of camel meat (e.g. a 340 g pack of pre-portioned camel steaks is sold at \$16.50 AUD each in the UK market, almost \$50 AUD per kilo, compared with the market price of camel retail cuts of \$12.50 AUD per kg in Australia) is attractive for Australian exporters, although the market capacity is still not clear. The current camel meat exports from Meramist in Qld are targeting the UK market.

The issues in marketing camel meat include a low public acceptance and high market prices. To gain a broad public acceptance, camel meat needs a coordinated public education and marketing campaign. The high market price, which acts as a barrier to many people tasting camel meat, is due to the high costs associated with the small size of the industry. If the scale of production were increased, the unit cost would come down, and consequently the market price for camel products would also come down. Since it takes time to achieve such an economy of scale, the industry has pushed for government to accelerate this process by introducing a series of policies that support the camel industry in its early stages. Such policies include investment in infrastructure and regulatory institutions, publicity, and marketing (NTCA 2003).

5.5.3.2 Pet meat

The pet care industry is one of the largest industries in Australia, contributing approximately \$4.62 billion to the economy annually and employing 44 700 people (Petnet 2007). In 2005, the total consumer expenditure on pet food exceeded \$2 billion and the total volume of pet food sold was 438 000 tonnes (Hill 2006). The huge scale of the pet food market in Australia has the potential to provide a market for feral camel meat.

International research conducted with pet owners reveals another exciting niche market for camel meat used as pet food. Pet owners are increasingly looking for healthier food to feed to their pets. Natural and organic pet food products have a compound annual growth rate of 15–25% of sales. This is such a significant trend that sales of natural and organic pet foods are expected to outpace those in the overall pet food market in the near future (Pet Industry News 2007). This does not directly relate to the use of camel meat, but it does show a niche market that could be exploited.

There are at least four pet food companies in Australia that use camel meat for pet food production: V.I.P. in Qld, Howard Springs Petmeating in the NT, and TuckerTime for Pets and Prota Pet Food Co. both in WA. There are more companies interested in introducing camel meat into their pet food manufacturing (refer to Section 5.5.2.2). The survey conducted by this project of manufacturers who are members of The Pet Food Industry Association of Australia (PFIAA) indicates that there is a niche market for camel pet meat and some of them would like to use camel meat for pet food manufacturing in the future. It is also suggested that ‘... the meat/bones/offal could be dried/smoked for use as a treat i.e. as per current pig trotters/ears/liver pieces/kangaroo tails in supermarkets’.

The prices (at gate) proposed by different pet food processors were \$0.50–0.75 per kg for bone-in meat and \$0.90–1.20 per kg for bone-out meat (Table 9.13). The market price for kangaroo meat (as pet meat) was suggested by some pet food companies as a benchmark price for camel meat, given that it is a similar ingredient with similar logistical challenges.

Table 9.13: Offered price of camel meat for pet food by Australian pet food manufacturers

	Bone-in	Bone-out	Information source
Processor A (actually offered)	---	\$1.20/kg	Garry Dann 2007, Managing Director of Territory Camel Pty Ltd, pers. comm.
Processor B (willingness to pay)	\$0.50/kg	\$0.90/kg	Survey with PFIAA members
Processor C (willingness to pay)	---	\$1.00/kg	Survey with PFIAA members
Processor D (actually paid)	\$0.75/kg	---	Appendix 9.2

It is believed that camel meat will gradually be accepted by the pet meat market (both pet owners and pet food companies), thereby creating a significant market for feral camel meat as pet food.

5.6 Other commercial utilisation of camels

Camel by-products may include camel milk, wool and hair, hump fat, and offal. The commercial utilisation of camel by-products is currently very small in Australia.

5.6.1 Camel by-products

Currently, there is only a small amount of camel skin and leather used in Australia. There is only one tannery in Australia that processes camel hides: Austanners Pty Ltd in Victoria (Peter Seidel 2007, Central Australian Camel Industry Association, pers. comm.). Their leather is made into a variety of different products. Camel hide is a popular material for fashion accessories, belts, jackets, shoes, and upholstery as it has high tensile strength and an attractive grain pattern. According to Peter Seidel, camel skin will be increasingly used by the leather industry, particularly for making boots. The world-renowned footwear company RM Williams has started to use camel leather to make their footwear. This is a sign that there could be a promising future for camel leather footwear; however, product development is in its very early stages. Camel leather has become more popular in the United States and Italy in recent years.

The development of camel milk and wool as marketable commodities has been limited by the lack of domesticated animals and suitable infrastructure. There are currently no commercial producers of camel milk or wool, in Australia.

Hump fat is sold for cosmetics and for food for some animals (such as emus) at variable prices (from \$1.00 up to \$3.00 per kg) (refer to Appendix 9.1). It is unclear how much camel hump fat is being used currently but it is likely to be a very small amount.

The CACIA is continuing to work with manufacturers to promote the value of camel by-products such as camel oil, wool, and leather (Peter Seidel 2008, Central Australian Camel Industry Association, pers. comm.).

5.6.2 Camel tourism

The tourism industry uses a small number of camels, and the camel is an icon used by Tourism Australia to attract domestic and international tourists (Figure 9.3); the most well-known camel tourism operation is that which offers camel rides on Cable Beach in Broome, WA.

In the late 1960s there was renewed interest in camels in tourism, and by 1970 Australia had two tourist attractions using camels, both operating in Alice Springs. In 1971, the inaugural Lions Club Camel Cup race was held in Alice Springs and there are now several camel races held around Australia (CACIA 2007). An international camel race event has recently been promoted. This big event, The Sheikh Zayed International Camel Endurance Race, was held in Hughenden, Qld, in late August 2008. The race covered 160 km and is said to be one of the longest camel races in the world. Teams and camels come from all over Australia, the Middle East, America, Asia, and Europe to participate (Admin 2008).

There are about 50 camel farms around Australia targeting international and local tourists (see Edwards, Zeng & Saalfeld 2008). They offer camel races, camel rides, and desert trekking. Although camel tourism businesses may benefit the economy, it is clear that tourism businesses do not use enough camels (only 150–200) to significantly influence the feral camel population. Increased running costs have also meant that the operation of camel treks and expeditions is declining (John Wilkinson 2008, experienced Australian cameleer, pers. comm.). However, camel tourism may strongly influence people's perspectives on feral camels and their management.



Figure 9.3: Home page of Tourism Australia's website

Source: Tourism Australia 2007

5.6.3 Woody weed control

Feral camels have been purchased by land holders in Qld to control woody weeds. Currently there are around 5000 camels in Qld that are used for this purpose (Nicholas Swadling 2008, Industry Development Officer, Qld Department of Primary Industries and Fisheries, pers. comm.). The likelihood that the numbers will increase significantly enough to have an impact on feral camel numbers is slight. Animals currently used for woody weed control could, however, form the basis of a sustainable domesticated herd.

6. Potential contributions of commercial utilisation to feral camel control in Australia

6.1 Estimated maximum camel numbers for commercial utilisation

The Multiple Criteria Decision Support Tool described in Saalfeld et al. (2008) has allowed the camel range to be categorised according to its suitability for commercial utilisation activities including live export, human consumption, and pet meat. Commercial utilisation of feral camels is not practical over much of the feral camels' range due to constraints that significantly limit commercial activities such as distance to markets, inaccessibility, low density of feral camels, etc.

The Decision Support Tool indicated that the commercial utilisation of camels is most likely to be economically viable in two regions: in the corner of NT, SA, and WA border region, and the Alice Springs district. These regions are largely suitable to live export, human consumption, and pet meat operation (Figure 9.4, 9.5, and 9.6).

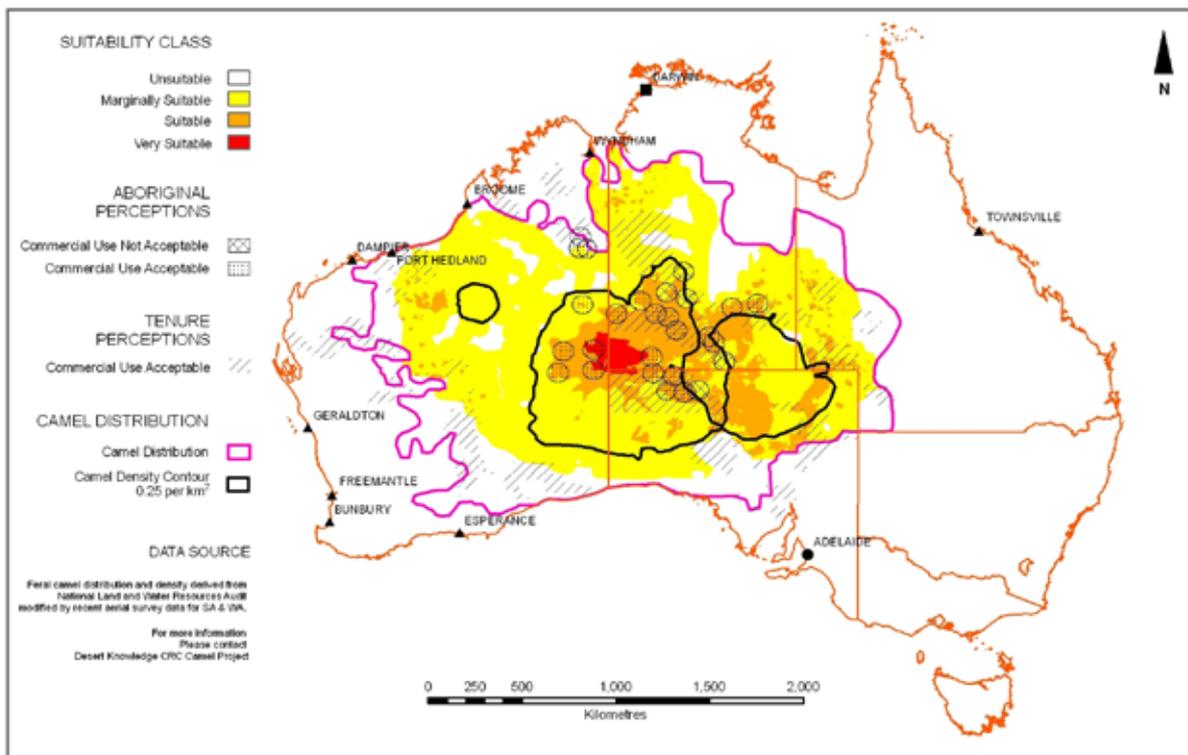


Figure 9.4: Map of live export suitability

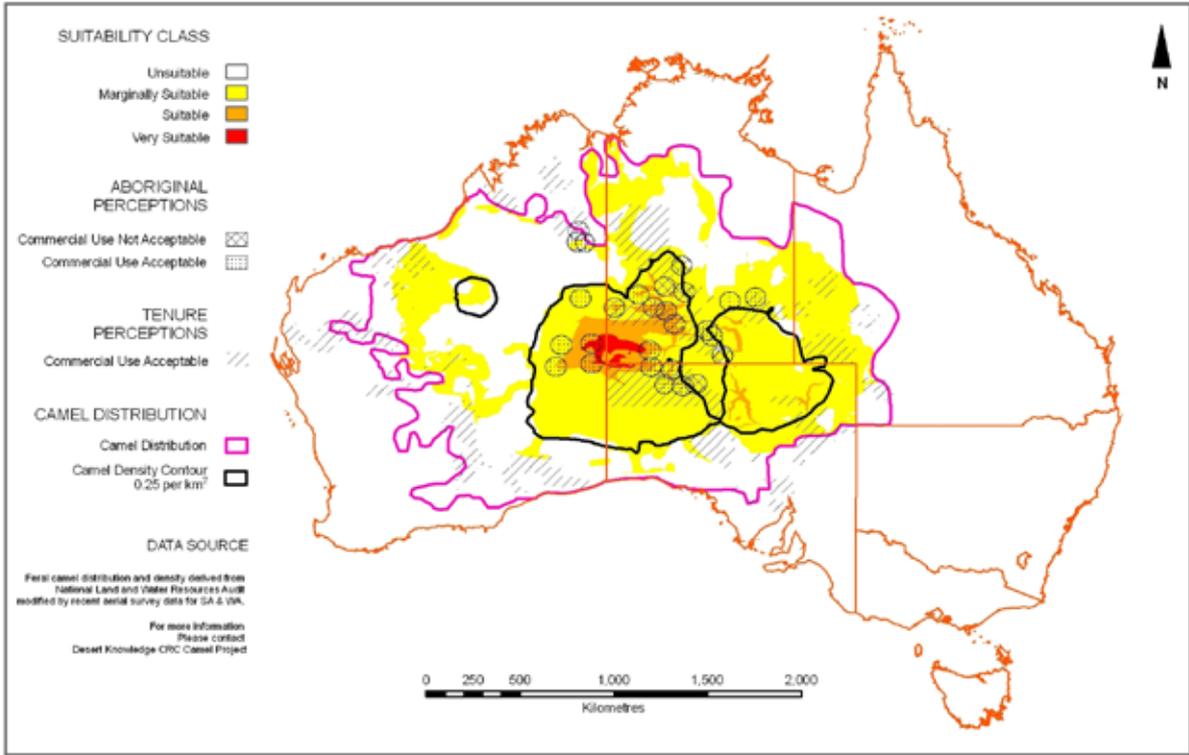


Figure 9.5: Map of human consumption suitability (not considering existing abattoirs)

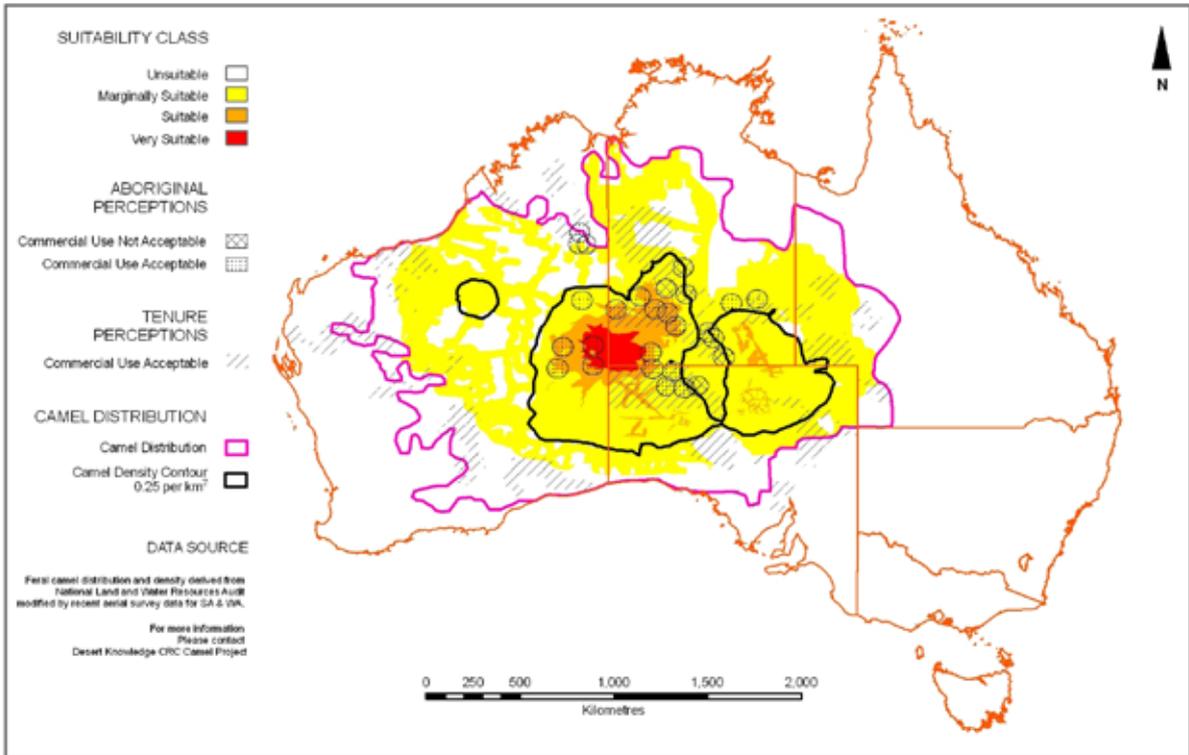


Figure 9.6: Map of pet meat operation suitability

The area that is estimated to be suitable for commercial operations is 3–8% of the total camel range, that is, 110 000–260 000 km², and it is estimated to contain 9–19% of the total feral camel population, that is, 90 000 to 190 000 camels. This population should be interpreted as the maximum feral camel population that could potentially be used for commercial harvest and processing in the identified areas. However, this does not mean that 90 000 to 190 000 camels can be harvested for commercial utilisation annually, as it still relies on market, industry capacity, and the increasing marginal costs of harvesting when the camel density is reduced by continuous commercial use or other integrated management instruments. The mean broadscale camel density in these areas is high at around 0.8 camels/km². When camel density is lower than 0.25 camels/km², the areas are unlikely to still be suitable for commercial use. Therefore, the number of camels currently available for commercial utilisation would be approximately 62 500–125 000.

It is recognised that there is currently some ad hoc and opportunistic harvest of camels occurring outside the identified suitable regions. However, these activities have been small scale where there may be higher localised camel densities (but a lower broadscale density) and are operating on a short time horizon rather than a longer-term sustainable operation.

The following sections attempt to describe the possible scenarios for different forms of commercial utilisation.

6.2 Potential contribution of major commercial opportunities

6.2.1 Live export

If 1% of the world live camel trade came from Australian camels (one-fifth of Australia's 5% share of the camel population in the world), that would be 800 camels per year, which is three times the average number of camels exported in the past 19 years. If this rose to 5%, which is equivalent to Australia's share of the world camel population, the live camel export would be 4000 camels per year, with a value of around \$2–3 million. Live camel exports on this scale would significantly expand the industry and benefit other participants, such as pastoralists and local Aboriginal communities. However, an increase in feral camel harvesting on this scale would still have little impact on the total feral camel population (currently one million and increasing at 8% per year) (refer to Saalfeld & Edwards 2008) and hence on their impacts.

It would also be very difficult to achieve this level of live exports in the next ten years as it represents a more than ten-fold increase on current export levels and would equate to a continuous increase of 26% per year over that period. A number of other factors would need to occur including a detailed understanding of potential markets and their requirements, alignment of supply with market demand, and a significant increase in handling infrastructure at point of harvest, through the logistics chain, to the export port and shipping. While such changes are possible, the levels of growth will be slow and live export is unlikely to make a significant contribution to reducing the numbers or impacts of feral camels.

6.2.2 Meat for human consumption

The amount of camel meat sold for human consumption in Australia is currently approximately 800 camels per year, which is equivalent to 134–160 tonnes of saleable camel meat (refer to Section 5.5.1). If camel meat production increased in line with its trajectory of the past ten years (15% growth over 10 years), the number of camels harvested for human consumption would be around 3200 in 2018. At these growth rates, the human consumption of camel meat will not contribute significantly to reducing the numbers or impacts of feral camels. There have been a number of enquiries from domestic and international investors in developing a camel meat industry based on an export-accredited abattoir. It has been suggested that the scale of these operations would require 20 000–25 000 animals per year to make them, viable and the proponents have indicated that they have a ready market for the product. At these levels of off-take, the industry would make a contribution to reducing the numbers and negative impacts of feral camels.

Key enablers to achieve this are to identify committed investors; the development of an export accredited plant; and development of a supply system that would ensure continuity and quality of animals to ensure that the capital invested operated efficiently.

6.2.3 Pet meating

The increasing use of kangaroo meat in the pet food market provides the camel industry with a useful precedent. Currently the pet meat market absorbs over 75% of the kangaroo meat harvested each year. In 2002, sales of fresh pet meat were calculated to be 20 000–30 000 tonnes of kangaroo meat (PacALLIANCE (Australia) Pty Ltd 2002).

If camel meat gained a market share equivalent to 20% of the kangaroo meat share in the pet meat market in the next 10 years, that would be 4000–6000 tonnes of fresh camel meat sold. That is equivalent to 16 000–24 000 (an average of 20 000) camels slaughtered per year, which is around a four-fold increase on current numbers (3600–4600 camels, an average of 4100) or an annual increase rate of 17% per annum over ten years. If such numbers were achieved it is likely to contribute significantly to the reduction in the feral population.

6.3 Potential contribution of other commercial utilisation opportunities

6.3.1 By-products

There is little experience in Australia of using camel hides and hump fat, and the markets are yet to be proved. However, according to Wondur Business and Technology Services (2004), the revenue obtained through the use of camel by-products can reduce first stage processing costs by more than 30%.

Camel hide is considered the most competitive by-product for international markets (Italy and USA particularly) where it is valued for its high tensile strength. Australian camel hide has less scarring than camel hide supplied by other countries; this makes it well suited to the Western-style boot market (Goulding et al. 2007). Promotion to these markets must be improved to take advantage of the increase in number of camel hides available as the number of camels slaughtered for human consumption increases. The harvest of camels for pet meat would mostly occur in the field, and in many cases camels would be slaughtered on the ground where it is hard to harvest their hides.

Hump fat is another by-product that could make the commercial use of camels more profitable. All camels slaughtered could easily have their humps harvested.

It is unlikely that it will be feasible to use camel milk in the near future, simply due to the high costs involved. Not only is it expensive to feed milk-camels, but there are also substantial costs associated with establishing the milking and associated processing infrastructure. There is no doubt that there is a substantial international market (Fletcher 2006), but there is little chance that Australia would be competitive in the international market (Ellard & Seidel 2000).

The use of camel by-products will be increased in association with increased camel meat production. It does not seem realistic for feral camels to be harvested to produce by-products, so by-products will not directly contribute to feral camel population reduction. However, the sale of by-products will definitely increase profits and thereby make the industry more viable.

6.3.2 Game meat

In Australia there is a significant game meat industry. The main animals hunted are hare, deer, wild boar, kangaroo, rabbit, buffalo, and goat. The industry is worth approximately \$20 million a year. Feral pigs are a major source of game meat, and the export of wild pig meat generates between \$3 and \$5 million in annual revenue (House of Representatives of AFF 2005).

The consumption of game meat is growing strongly in Europe, North America, and some countries in Africa. In the UK alone, the market for game meat has grown 58% since 2002 (albeit from a small base), with annual sales in 2006 of £57 million. This market growth is more than that of red meat, poultry, or fish and is on par with the growth in the market for organic products. A recent study in South Africa revealed that most tourists from Germany and Belgium know and like eating game meat. Tourists indicated that game meat was the meat type they preferred to order in restaurants, although only a few of them had hunted before (Hoffman et al. 2003).

The sale of camels for game meat could provide another opportunity to use feral camels commercially. Game meat comes from an animal that is exotic or unusual to eat, although not necessarily wild, which is killed in its natural environment. According to the *Australian standard for hygienic production of game meat for human consumption* (Agriculture and Resource Management Council of Australia and New Zealand 2003) 'game animal' is defined as:

Any vertebrate animal: (a) including a mammal, bird or reptile but, excluding fish; (b) of a species that can be legally harvested; and (c) has not been husbanded in the manner of a farmed animal and is killed in the field.

and 'game meat' is defined as:

The edible part of any game animal that has been dressed or prepared in a game-processing establishment, and passed by an inspector as fit for human consumption.

The standard states that only animals of healthy appearance can be killed, and that this should occur in a humane way and the meat handled in such a way as to minimise the risk of contamination. A key element here is that the carcass must be refrigerated within two hours of being harvested and the deep muscle temperature must be reduced to 7°C as soon as possible (within a maximum of 24 hours). There is also a requirement that the person killing the animal must be trained and approved in the approved killing procedures, field inspection, and hygiene practices. Courses have been established for kangaroo harvesting, but there is currently no such course for camel harvesting.

There is an opportunity to promote camel meat as a game meat and to initiate game meat production. This would broaden camel consumption and contribute to feral camel removal. There are some remote areas with a high density of camels and reasonable road access where the use of a mobile abattoir to produce game meat would be feasible (refer to Saalfeld et al. 2008). However, it is critical that marketing, investment, and policing issues are addressed before embarking down this path.

6.3.3 Camel tourism

Currently, camel tourism enterprises do not make a significant contribution to feral camel control as they use very few camels in a non-consumptive way, and therefore do not have a continuous demand for camels. However, the hunting of camels for entertainment could be classed as camel tourism. As feral camels are considered a pest in Australia and need to be controlled, feral camels could be a target species for game hunters. Although camel is not a favoured species for international or domestic hunters, it is a 'big game' animal (Dryden & Craig-Smith 2004). Although camels are not used for game hunting currently, hunting could contribute to camel population reduction in future. However, the potential contribution would not be very significant.

6.3.4 Camel farming

Camel farming could be developed in some areas to provide a supplementary source of camels. This would reduce the risk of an inconsistent supply in terms of numbers and quality from wild harvest. Currently, camels have been used to control woody weeds and, apart from some camels being held in sizeable holding areas, there has been no development of an intensively managed camel herd. The

farming of camels is likely to occur as a consequence of a more mature meat-oriented industry, but in the short to medium term it is unlikely to have any contribution to the reduction of feral camel numbers or their negative impacts.

7. Value chain approach to camel industry development

Supply and value chains are vertically integrated strategic alliances between a series of independent businesses that have come together as a group to more efficiently capitalise on specific market opportunities (Cox 1999). The goal of a supply/value chain is to optimise performance in that industry using the combined expertise and abilities of the members of the chain. Successful chains depend on integration, coordination, communication, and cooperation between partners with the traditional measure of success being the return on investment (O'Keefe 1998, Boehlje 1999).

The conventional view of a successful value chain is that it incorporates competitive advantage (Porter 1985) with some acknowledgement and consideration of social factors such as trust, satisfaction, appropriate power structures, commitment, communication, relationship-specific investment, and strong personal relationships (Batt 2003). These social factors relate to both vertical and horizontal connections within the chain (Lazzarini et al. 2007). At present there are multiple entities wanting to participate in the utilisation of feral camels, but little evidence exists to suggest either integration of these entities for competitive advantage or, as has been noted in the bush foods industry (Cleary et al. 2008), an understanding of the need to recognise and develop the social components of a potential value chain.

It has been noted that the Australian bush foods industry sits in an inter-cultural space; as such, the focus of the value chain needs to accommodate non-market social and cultural considerations in addition to profit (Cleary et al. 2008). This is also the case in the developing camel industry where there will be a need to recognise financial, social, and environmental factors in the decisions relating to the operation of the chain.

The development of a consumer orientation, cooperative relationships, and effective information and communication systems proved to be critical to the new bamboo shoot industry (Collins & Keilar 2005). As an emerging industry, the camel industry in Australia has three major risks to its development: lack of accurate information, lack of a strategic orientation that incorporates the needs of the marketplace and its stakeholders in desert Australia, and failure to implement a collective vision. This does not mean that one industry should be created, but means that the value chains that do develop need to incorporate these factors in their structure if they are to operate efficiently.

7.1 Supply chain in the camel industry

A value chain for the commercial use of camels was structured and discussed in the Feral Camel Action Plan Workshop held in Alice Springs in April 2005 (Figure 9.7).

All current and potential management options for feral camels, including commercial and non-commercial options, should contribute to natural resource management (NRM) and should benefit stakeholders, including Aboriginal communities and pastoralists. Direct economic value can be realised by the commercial utilisation of feral camels. These elements have been discussed in Section 5.

The value chain for the camel industry (commercial use of camels) includes all the kinds of camel resources through to the final camel product market. The issues along the supply chain are addressed, including the availability of the resource, supply capacity (harvesting and processing), market capacity and accessibility, and economic viability.

The camel industry value chain is an important tool for ensuring the viability of the camel industry in Australia, as it can identify the issues connected to each node of the supply chain.

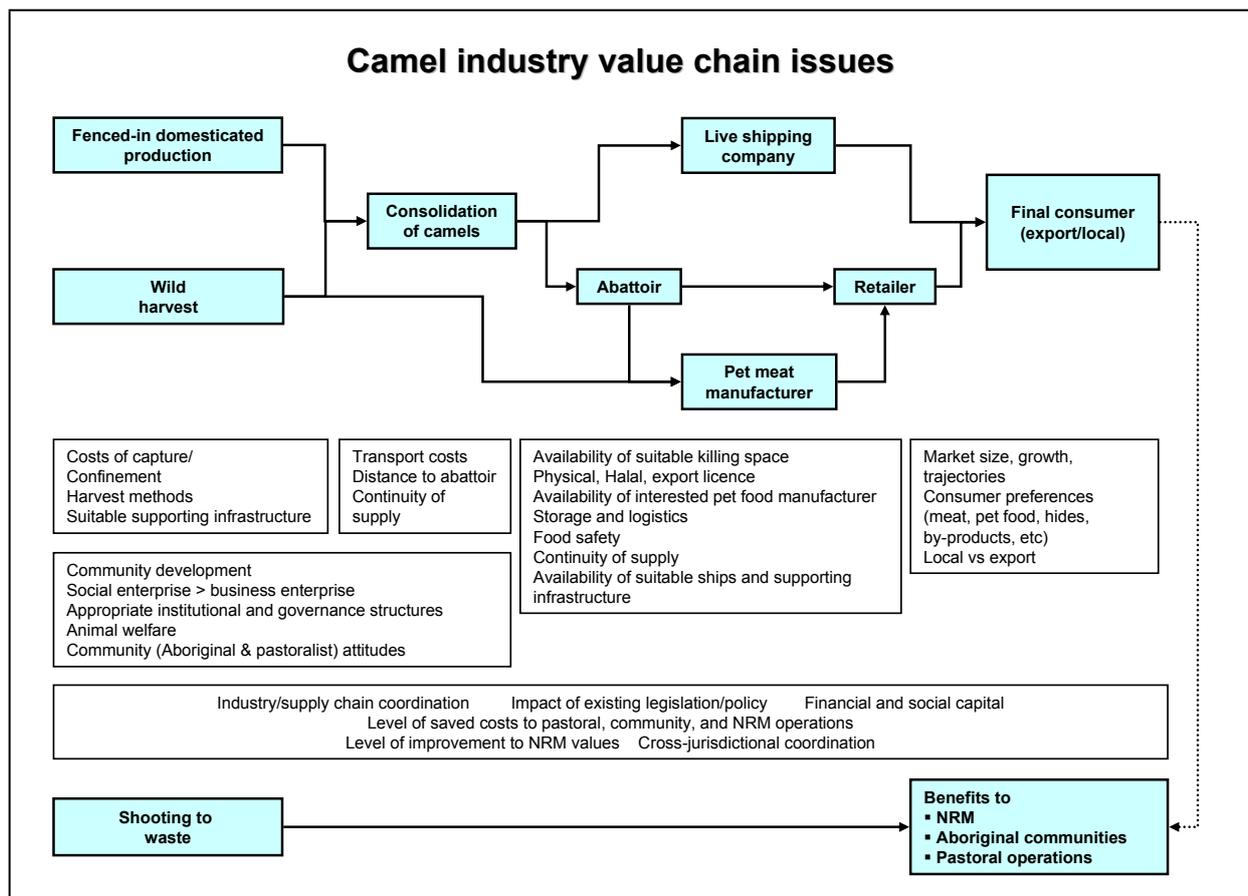


Figure 9.7: Camel industry value chain

Source: McGregor 2008

7.2 Camel industry structure

The camel industry comprises a range of enterprises that use camels commercially, as shown in Figure 9.7, including harvesters, camel farmers and consolidators, transporters, live exporters, abattoir operators, pet meat manufacturers, product wholesalers, and retailers. These enterprises vary in size from one-person businesses to major abattoirs employing tens of staff. The industry can be divided into five sectors: harvest, live export, meat for human consumption, pet meat, and by-products.

7.3 Continuity of supply

7.3.1 Extent of the resource and its availability

Recognition of the commercial value of feral camels does not necessarily lead to a good understanding of the feral camel resources available for commercial use. It is important to address the difference between the presence of feral camels and a commercial supply of camels. This is because camels are highly mobile and also potentially very expensive to harvest. Many factors influence harvest efficiency: population distribution, density, the local social and physical environment which affects this availability, economic feasibility, and the numbers of camels available. Moreover, the influencing factors vary between different types of usage.

A focus group discussion listed the major factors that would influence the effectiveness of the commercial uses of feral camels (Table 9.14).

Table 9.14: Factors influencing the commercial use of camels

Factors	Rank for each commercial utilisation option			
	Human consumption	Pet meat	Live export	Overall
Roads	1	1	1	1
Bore and yards	1	3	4	3
Camel density	1	1	2	1
Abattoir	3	-	-	3
Aboriginal settlements	4	3	-	3
Tenure, perception	4	3	3	3
Port	-	-	3	3

Table 9.14 indicates that accessibility (roads) and camel density are the most important factors that affect the commercial utilisation of feral camels (see also Saalfeld et al. 2008).

Although camel density is important, it is less important than accessibility. Economic viability will be dramatically reduced even in locations where there is a high camel density but low road accessibility.

Other infrastructure, including water sources, yards, abattoirs, and settlements (providing a base with established facilities) are also major factors. Port location is important for live export. The perception of the camel industry by land owners is another major factor significantly affecting the commercial utilisation of feral camels. The major land tenure types in the camel ranges are pastoral, Aboriginal, and Crown land. The perspectives of the different stakeholders, especially Aboriginal communities, pastoralists, and governments (responsible for the policies and laws related to the management of feral animals) should be understood and addressed in the development of new value chains (see Zeng & Edwards 2008a, 2008b; Vaarzon-Morel 2008a; Carey et al. 2008).

Generally, there are enough feral camels to support a large scale camel industry in Australia. A 10% removal of the established one million camels (refer to Saalfeld & Edwards 2008) in Australia each year equates to 100 000 camels, which would only contain population growth. However, many camels are not accessible because they are in the Simpson Desert and other regions (refer to Saalfeld & Edwards 2008, Saalfeld et al. 2008) where it is uneconomical to muster, and many camels are in regions with low population density. Based on recent GIS work associated with this project, there would be a maximum of 62 500–125 000 camels available in Australia per year, moderately to highly suited to commercial use (refer to Section 6.1).

7.3.2 Harvest efficiency

The availability of a resource does not necessarily convert to an efficient, continuous commercial supply. Appropriate harvest techniques must provide a sustainable and timely camel supply and also possibly provide them at a lower price. These factors are important in the value chain sense as substantial capital assets may be employed further down the chain – assets which rely on a continuity of supply to ensure that the capital is employed at optimal levels.

Trapping and mustering are the main methods used to harvest camels for commercial purposes. Helicopters, motorbikes, horses, or other vehicles are used. As harvest efficiency mainly relies on the number of camels harvested in a time period, the time taken to locate a reasonable number of camels becomes very important. Therefore, any system that improves the chances of locating herds of camels, and facilitates their subsequent capture, is financially beneficial. Because of their gregarious nature, the ‘Judas’ animal technique (Parkes et al. 1996), which uses a radio-collar on one camel, should prove a useful tool to locate herds of feral camels for population control or for commercial utilisation (Edwards et al. 2004). Satellite telemetry could provide cost-effective technology to implement the Judas animal technique, particularly in the more arid regions where camels move over very large areas. A recently developed technology called ‘wireless sensor network’ could also be used to locate camel groups for

harvest. This technology could be used to achieve continuous monitoring of a group of animals without human involvement (Zhou et al. 2007). The research of camel's physiology, anatomy, and behaviour suggested that it is possible to use water sources (especially in dry times) and satellite greenness images to locate camels, as well as using sacrifice water points and salt lakes to attract camels (Coventry et al. In press).

Harvest efficiency is also affected by the fact that around 50% of camels are currently on Aboriginal land. The involvement of the relevant Aboriginal community, either as direct participants or through participation in a royalty scheme, is necessary to gain access to the camels. Engagement with communities is occurring, but the development of a capacity to harvest feral camels is still at an early stage. It is important to remember that Aboriginal people have valuable traditional knowledge of their country and the wildlife there. If local Aboriginal people are engaged properly, and they use their knowledge (e.g. to locate camels), operations would be much more efficient. This engagement would broaden supply and build a mutually beneficial partnership, which is critical for a sustainable operation and would provide livelihood opportunities where few exist at present.

Meanwhile, to increase the harvest efficiency and continuity of supply in some more marginal country, pastoral stations could be encouraged to co-graze cattle and camels, since research suggests that this kind of approach can generate extra income for stations without having a significant negative impact on cattle production (Phillips et al. 2001).

7.4 Efficient development of the camel industry: Comprehensive utilisation of camels

Currently the camel industry uses only some of the camels mustered and only some parts of camel carcasses. This kind of usage does not provide good economic returns for camel harvesters and processors. The comprehensive utilisation of camels is one of the key issues for the camel industry.

Live camel importers have strict quality requirements, so only a very small proportion of mustered camels qualify for live export. Furthermore, because of height restrictions in the boats, they can only take younger camels. Generally, only one in seven camels mustered can be used for live export (Peter Seidel 2007, Central Australian Camel Industry Association, pers. comm.). This ratio seems unlikely to significantly increase as the overseas quality requirements are tending to become stricter and more specific.

This raises the issue of how the rest of the camels mustered for live export could be utilised instead of releasing them back into the wild, which is illegal in most jurisdictions. This amounts to a large number of camels that would be suitable for slaughter for human consumption or pet meat. Both live trade and slaughter should be developed simultaneously to make the camel harvest more effective and economical by providing an outlet for stock that is not suitable for the live trade.

There is a big difference in the price offered to harvesters for live-export camels and that offered for meat production. The price for live-export camels is much higher than that for meat production (e.g. \$400 vs. \$150 farm gate price). This is because there are different value chains and different requirements for these two products. This means that camel harvesters have to accept two different prices for the camels mustered and maintained in their yards. There is a need for individual supply chains to develop clear quality parameters so that harvesters understand that different camels will be utilised for different purposes with different values. This then needs to be supported by feedback to the suppliers on how individual animals were valued in the final market or how they were processed in the abattoir. Information asymmetry leads to the development of power relationships in a value chain, which is not conducive to chain participants identifying opportunities at each stage in the chain and which prevents an otherwise possible increase in value through the chain.

In abattoirs, camel meat is generally the only part taken for commercial use. Moreover, only some of the meat is sold to butchers or other retail outlets. It is important to develop a variety of camel products so that the camel is comprehensively utilised, such as skin for leather, meat for human consumption, and some cuts for pet meat, camel hair and wool, offal, etc. Modern abattoir management has moved to zero-wastage and cleaner production approaches, both of which will lead to maximum returns and increased efficiency of capital usage. This comprehensive utilisation of camels would increase the commercial benefits for musterers and producers, and as a result would guarantee the sustainable development of the camel industry and a continuity of supply for live export and meat production.

7.5 Market and its accessibility

7.5.1 Target market

A number of researchers (Ellard & Seidel 2000, McCloy & Rowe 2000, Warfield & Tume 2000, NTCA 2003, Rouda 2004) have looked at the potential markets for Australian camels: meat for human consumption (local and export), pet meat, hides, live export, dairy production, and specialist by-products.

As discussed in Section 5, the traditional market for live export is the Middle East and South-East Asia. For camel meat, the market is mainly in South-East Asia, Europe, and North America. For leather, milk, and other by-products the market is in Europe and North America, especially Italy and USA. Meanwhile, some growing markets – such as China and India – should be considered because of their potentially huge niche markets backed by their large population, strong economic growth, and abundant food culture.

The domestic market is also very important, both for camel meat for human consumption and pet meat.

7.5.2 Marketing strategy: Customer orientation

The main issue with marketing is not that there is no market, but that producers have difficulty accessing that market. Marketing is, therefore, a very important issue. A customer-oriented marketing strategy is necessary for an emerging industry (Collins & Keilar 2005). An in-depth market investigation to understand the customer demand for camel products is desperately needed. The marketing strategy and implementation should be based on this customer analysis. For example, since wet meat is preferred by Middle Eastern countries (refer to Section 5.5.3), it is likely to be a good marketing option for Australia to export live camels rather than boxed camel meat to those countries. Since Muslims prefer camels to be Halal-butchered, it is essential that any abattoirs built (or modified) in Australia are compliant. The APY Land Management Unit has been investigating the potential to develop a market for Halal camel meat domestically and for export.

One of the barriers to accessing the international market is the shortage of abattoirs with an export license that are suitable for processing camels. This issue will be discussed further in Section 7.6.1.

On one hand, it is necessary to keep Australian camel products visible in the international market to gain a reasonable share of that market. On the other hand, it is crucial to promote camel consumption in the domestic market, since there is real potential for camel meat to become popular in Australia. The absence of both general consumer awareness and established retail outlets across Australia needs to be addressed. A promotional campaign would need to include information on how to identify and cook the various cuts (NTCA 2003). A source of funds for this advertising would need to be identified, and the industry itself should bear the cost.

7.6 Efficient flow from suppliers to producers to consumers

An efficient flow along the supply chain is critical for business and for the industry. In the camel industry, the renovation or building of abattoirs, the establishment of mutually beneficial relationships, and the active functioning of trading companies, agents, and brokers are the urgent issues to be addressed.

7.6.1 Abattoirs

There is a lack of appropriately located abattoirs for processing camels. The hot spots for commercial utilisation of camels are the tri-state corner region of NT, SA, and WA borders and the Alice Springs district. In the Alice Springs district, there is only one small abattoir (Wamboden) processing a small number of camels for human consumption, and there is no abattoir in the vicinity of the tri-state border region. Currently, the access to camels is difficult for most abattoirs and camels are slaughtered and processed in permanent abattoirs, far away from where the feral camels are found in numbers. The transportation costs are significant as animals are often transported large distances for processing. Industry margins are very sensitive to transportation costs (refer to Appendix 9.1 and Appendix 9.2), so it is important to find a way to decrease these costs. One way would be to design a new vehicle for transporting camels or using the existing rail network where appropriate (see Section 7.6.2). Another way would be to move abattoirs closer to the camel supply, by building new abattoirs in Aboriginal settlements with a high camel density nearby, or by building mobile or demountable abattoirs that could move to access greater camel supplies.

There is also a lack of accredited abattoirs for camel meat export. Expansion of the camel meat industry into export markets can only be achieved if abattoirs have licences for export processing. Currently, there are only three abattoirs with international export license for processing camel meat for export (Peter Seidel 2007, Central Australian Camel Industry Association, pers. comm.). Once an international market for Australian camel meat is established, the current capacity will not meet the increased demand.

New abattoirs built in the right places with international export licenses are critical to the expansion of camel meat production. A proposed abattoir in the Alice Springs district with an export licence would cost \$6–7 million to start up (Garry Dann 2008, Managing Director of Territory Camel Pty Ltd, pers. comm.). Funding is an issue. International investment is possibly an option for this abattoir. A small abattoir is being built in the APY lands in SA (refer to Appendix 9.1 for more detail).

If the creation of an international camel meat market were to be achieved in a short time, constructing new abattoirs to meet market demand seems reasonable. However, given that marketing consumes time and money, especially for a new industry, and that the current capacity for camel meat export (three accredited abattoirs) has yet to be realised, new abattoirs would need to develop both a domestic and international market simultaneously to warrant the capital expenditure. There has been interest from overseas investors who, we believe, have access to markets, but they have been concerned about the continuity of supply arrangements into their abattoir. There is a possible point of intervention here relating to the use of a Market Based Instrument (MBI) approach – similar to that being trialled in SA (Pastoral Board SA 2008) – as a mechanism to help secure continuity of supply while simultaneously reducing the negative impacts that feral camels are having on the nation's natural resource values.

Mobile abattoirs are another option to facilitate a more efficient flow from camel suppliers to producers. Mobile abattoirs allow the processor to work closer to the feral camel resources. There have been arguments about their feasibility, however, and there are no mobile abattoirs continuously operating. While some consider that mobile abattoirs are too impractical and uneconomical (Ellard & Seidel 2000), field processing using mobile abattoirs is an immediate industry option that has the potential to impact significantly on feral camel populations (Gee & Greenfield 2007). They would be most suited to areas where camels are densely populated and reasonable infrastructure is established (Garry Dann 2008,

Managing Director of Territory Camel Pty Ltd, pers. comm.). Cairns-based inventor Harvey Douglas has created a prototype mobile abattoir for use in remote areas to harvest camels, pigs, and horses. Field trials are underway and the results look promising (Stephen 2007). Although there is no hard evidence to prove the viability of mobile abattoirs, it must be an option for some regions where there is reasonable road access and high camel density.

7.6.2 Transportation

Currently, camels are transported using truck and trailer units designed for cattle. Because of regulation¹ only a single deck (carrying approximately 20 camels) can be used, which in turn means that transport costs are twice those for cattle. This is proving a significant impediment to the development of a meat industry and for live export. An option would be to investigate the viability of utilising the rail network that traverses some of the feral camel range to transport animals to abattoirs or ports.

7.6.3 Mutual benefit

The price paid for camels has an effect on the number of camels supplied for slaughter. Prices need to be sufficiently high to make the capture of feral camels attractive to contract musterers, pastoralists, and Aboriginal communities. In some seasons the numbers of camels mustered are not sufficient to cover mustering costs. Meat processors and live exporters need to work closely with their suppliers to ensure that pricing reflects the true costs of harvesting.

Different stakeholders have different expectations of harvested feral camels. Most pastoralists suffering from the negative impacts of feral camels want to eradicate them to avoid more losses, and they are doing so mainly by culling (refer to Zeng & Edwards 2008a). They are likely to accept a lower price for allowing harvesters to access feral camels on their properties, and many regard the income from harvesting feral camels as a bonus. However, if they are interested in harvesting camels for themselves, they are likely to deal with it as an additional business alongside their current livestock production. Aboriginal people are keen to use camels as a livelihood and income opportunity (refer to Vaarzon-Morel 2008a). It is, therefore, important to understand that they would like to be directly involved in feral camel harvesting. There is a clear need for value chains to work synergistically with Aboriginal people in developing a sustainable supply of camels such that their expectations for income and livelihoods can be met.

Processors and exporters would like to pay a lower price to get camels of an acceptable quality. On top of this, trading costs make the gap between sellers' and buyers' price expectations even bigger. Lower prices are only possible when there are sufficient camels to allow for cheaper harvesting, the different stakeholders have reasonable expectations, and an effective trading system exists. This result is only achievable when all the participants recognise the value added by the different chain members, and that this added value is necessary for a profitable camel industry. A perception of mutual benefit and a more efficient supply chain built on value creation and benefit sharing are essential to bridge the price gap. As noted earlier there is a possible point of intervention here relating to the use of an MBI approach – similar to that being trialled in SA – as a mechanism to help secure continuity of supply at a price that makes both supply and processing economic in the early phases of the industry's development.

Oscillation and uncertainty in the market have made it difficult to develop a successful trade in live camels. Currently, live camel export is irregular. There is no certainty of a sufficient supply of high quality camels or a reliable shipping service that will guarantee punctual delivery once a contract is offered. As payment is usually made after successful delivery, musterers must take costly risks when there is no payment in advance for their work mustering camels. This situation discourages them from being involved in the provision of a reliable camel supply. It is, therefore, important to set up

¹ According to the *Model Code of Practice for the Welfare of Animals – The Camel*, 'camels must only be transported in single deck trailers with sufficient clearance for them to stand comfortably' (Agriculture and Resource Management Council of Australia and New Zealand 1997).

a mechanism to coordinate supply and demand, but the greatest gain will come from having a strong meat-based industry that will allow animals deemed unsuitable for live export to have an economic value as meat animals.

It would seem likely that over time the industry as a whole will mature to the extent that it will rely on domesticated rather than feral animals in a similar way that deer farming evolved in New Zealand. This will allow the industry to concentrate on producing animals of a size, sex, and conformity that maximises returns in both domestic and international markets. It will be important that appropriate regulatory structures are put in place ahead of this occurring. Such regulatory structures will need to ensure that domesticated animals are contained in such a way that they cannot return to the feral herd and are traceable through electronic tagging in the same way as cattle are now.

7.6.4 Trading companies, agents, and brokers

Along the supply chain trading companies, agents, and brokers are important links between supply, processing, distribution and the market. The emerging camel industry needs an effective trading sector that is focused on developing the industry in a sustainable rather than an ad hoc way. Current barriers that need addressing include weak and asymmetric market information; lack of quality standards for camels harvested; lack of a genuine partnering with Aboriginal managers and traditional owners in developing a sustainable industry; the informal nature of contracts (in particular with Aboriginal communities) which, when linked with asymmetric market information reduces harvesters' ability to negotiate on an equal footing; and lack of a skilled workforce. As there are currently very few companies addressing these issues, there is a significant weakness in the trading sector of the camel industry.

7.7 Integration of industry

7.7.1 Collective vision

It is important that an industry builds a collective vision among all its participants. The collective vision should include an expectation of mutual benefit, information sharing, cooperation, and effective competition. National peak bodies have been effective in other new industry areas. Such bodies have been found to be effective in lobbying for the industry, consolidating industry information including market information, establishing industry wide standards, and developing long-term visions for the industry. The Australian wine industry is a good example.

7.7.2 Information sharing

A lack of accurate information puts the camel industry at risk. There are two aspects to this problem: insufficient accurate information and insufficient exchange of information. According to a survey conducted (refer to Zeng & Edwards 2008a), pastoralists – some of the most important participants in the camel industry – generally do not feel that they have sufficient information to guide their involvement in the industry.

Important industry information regarding supply, production, and markets is not being collected and organised. Additionally, information regarding techniques and knowledge has not been sufficiently shared by industry stakeholders. There has been substantial duplication in some studies of camel industry development, in areas such as camel meat nutrient analysis, and in discussions about camel markets. Increased information sharing could avoid a waste of resources, circumvent some confusion, reduce conflict, and generally assist industry development. For example, delivery and slaughtering procedures are well established in the NT and SA. Experienced people from the trapping, penning, transport, slaughter, and retail sectors could pass on advice that would be valuable to start up the industry in WA. This information sharing could benefit all stakeholders and facilitate the cooperation between them.

8. Conclusions

Internationally, there is a significant camel industry based on meat, live animals, and by-products. In Australia by contrast, the industry has struggled to gain momentum because it has been based on the ad hoc harvest of a feral animal herd that is located in very remote parts of the country and is a long distance from domestic markets, let alone international markets. The lack of appropriately located and accredited processing abattoirs has been also a significant obstruction for the industry. The harvesting of feral camels started in the late 1980s, and by 2007 it was estimated that the Australian camel industry harvested around 5000–6000 camels per year: 3600–4600 for pet meat, fewer than 400 for live export, and 1000 for mainly domestic human consumption. The camel industry in Australia is still very small when compared internationally. However, the size of the feral camel resource of approximately one million animals makes the Australian herd the fifth largest in the world behind Somalia, Sudan, Ethiopia, and Mauritania.

There is potentially a large market for camel products, and a well-developed camel industry could provide an important management tool for the control of feral camels and their impacts and provide much-needed employment and economic activity in desert Australia. Although the current number of camels removed is small, commercial utilisation could potentially remove enough animals to have a significant localised impact on the levels of damage being caused at present and form part of a wider management program to arrest the continued growth in the feral population. However, a flourishing camel industry alone cannot bring down the camel population in the short term, as the industry will take some time to develop. Therefore, commercial utilisation is potentially an effective tool for managing feral camels and their impacts in targeted areas rather than across their whole range and as part of a more substantial integrated management approach.

Of the commercial uses investigated in this research, the slaughtering of feral camels for pet meat seems likely to make the greatest contribution to managing camel impacts in the short term, followed by a meat industry for human consumption and live export. Pet meat is attractive as it involves minimal capital infrastructure to develop and could quickly provide livelihoods for Aboriginal people. However, the contribution from commercial activities will depend on the development of secure markets that are prepared to pay the real costs of harvesting and transport.

The industry at present is not organised and lacks some key components to allow it to develop. The key missing elements are the lack of suitable capital infrastructure for harvesting, transporting, and processing animals; incomplete information on potential markets, including meat for human consumption and pet meat; no collective vision on how the industry should develop; and a lack of dialogue and consultation with land owners.

In many Aboriginal communities there has been considerable discussion about the development of the camel industry and the use of feral camels (e.g. for pet meat). This has contributed to a perception that feral camels are a resource rather than a pest in remote desert settlements (Gee & Greenfield 2007). Aboriginal people and pastoralists are keen to take up opportunities presented by the commercial utilisation of camels, and they see it as an opportunity for local economic development, employment, capacity building, and empowerment (Zeng & Edwards 2008a, Vaarzon-Morel 2008a). They generally would like to be directly involved in the industry rather than see economic benefits go to external businesses.

The camel industry in Australia needs to have a unique structure because commercial utilisation would also form part of a national strategy to control feral camels. Commercial utilisation must be integrated into the comprehensive feral camel management strategy. There is clearly a market failure in play at present that has allowed camel numbers to increase in an uncontrolled manner as society has not factored in the non-market impacts of feral camels on Australia's natural and cultural resources. A MBI approach is currently being trialled in SA and may prove to be an effective way of dealing with

this market failure. However, the use of MBIs should be limited to situations where the commercial extraction of feral camels is a strategic component of a wider cross-jurisdictional feral camel management plan and not as a subsidy for the establishment of a new industry.

The farming of camels could support a sustainable alternative pastoral industry but would not contribute to the management of feral camels because camel farming will establish and maintain a permanent domesticated population of camels. It will be important that appropriate regulatory structures are put in place to ensure that domesticated animals are contained so they cannot return to the feral herd and are traceable through electronic tagging in the same way as cattle.

Live camel export, meat for human consumption, and pet meat are the major commercial enterprises that would contribute directly to feral camel management. While there should be a focus on continuing to enlarge the international market, the domestic market must also be considered. Other commercial uses for feral camels – such as the production of milk, skin, and game meat; the development of camel tourism and camel farms; and their use for undertaking weed control – would contribute very little to reducing the impacts of feral camels. However, the multiple use of camels would increase the economic viability of a camel industry.

8.1 Recommendations

- The commercial utilisation of feral camels can, and should, be integrated into a national feral camel management strategy. Commercial utilisation will have localised impact on feral camel numbers (and their negative impacts), but such utilisation needs to be seen as part of a comprehensive feral camel management strategy aimed at significantly reducing the negative impacts of the species.
- Harvesting for commercial utilisation should focus on two regions. These are the tri-state border region (SA, NT, and WA) and the Alice Springs region.
- There is a need to develop critical capital infrastructure, particularly export-accredited abattoirs to support the development of commercial activities in the two target regions. While this should be funded by the private sector, governments have a role in correcting an existing market failure (where the market does not account for the environmental, cultural, and social costs associated with a feral camel herd).
- A Market Based Instrument (MBI) approach should be trialled across tenures and jurisdictional boundaries, but MBIs should only be used to encourage the reduction in feral camel impact and should not be seen as a subsidy for the establishment of a new industry.
- The commercial utilisation of feral camels provides an opportunity for local economic development, employment, capacity building, and empowerment. Aboriginal people and pastoralists suffering from the impact of camels must be consulted fully on the management approaches adopted on the land that they manage. Such consultation should involve the sharing of information on the costs and benefits of all options, including commercial options, so people can make informed decisions.
- Any future operations on Aboriginal land (and other areas) should attempt to increase the involvement of local people. An effective business model that supports broader and deeper local participation should be encouraged and supported by governments. Such a model should include direct commercial utilisation of camels but also, in the longer term, environmental management initiatives such as Aboriginal Ranger Groups and should be supported by training, including mentoring in business management.
- A national peak body should be established to coordinate the camel industry's development. The role of the peak body would be to speak for the commercial industry; advise government on the needs of the industry in terms of legislation and regulation, capital infrastructure, training, market development, and research based on an industry strategic plan; research potential markets for camel products; facilitate communication, information sharing, and cooperation among the industry participants; and develop a dialogue between the industry, land managers, and government.

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10. Appendices

Appendix 9.1: Case study: Territory Camel Pty Ltd

(**Benxiang Zeng**, Department of Natural Resources Environment, The Arts and Sport, Northern Territory Government)

Acknowledgements

Thanks to Garry Dann, the Managing Director of Territory Camel, for his kind support and close cooperation in this case study. Thanks to Murray McGregor and Glenn Edwards for their valuable comments and discussion.

1. Introduction

Territory Camel Pty Ltd is an Alice Springs-based company that slaughters, processes, and supplies camel products to the domestic market. The Managing Director of Territory Camel, Garry Dann, has a lifetime commitment to the rural industry. Garry and his family have operated several significant beef cattle properties in the Northern Territory. In 1988, Garry started to produce and sell camel meat for human consumption in cooperation with Centapakit Meats (a meat wholesaler that operated in Alice Springs until 1991).

In 2005, Garry leased a local abattoir (Wamboden) to process his own natural grass-fed, free range beef cattle under the brand name 'Centralian Gold'. He used this opportunity to become commercially involved in the camel industry under the brand name 'Territory Camel'.

Garry has a belief in natural goodness, both in relation to the health of his camels, and the health and wellbeing of consumers. Camels living in central Australia are recognised to be among the healthiest in the world. They forage on natural bush land that is untainted by chemicals, pesticides, or disease; they are like cattle and sheep, except they use more bush and shrubs for food.

Territory Camel is one of the key members of the Central Australian Camel Industry Association (CACIA), and Garry himself has had an involvement in camel and industry associations for the past 10 years and has been the Deputy President of CACIA since 2007.

Territory Camel is a major player in the camel industry. An analysis of its development reveals the key issues faced by the camel industry generally, especially in relation to camel meat production, and provides valuable experiences and lessons.

Over the last 12 months Garry has been interviewed four times by the DKCRC camel project. This case study is mainly based on those interviews; otherwise information sources are cited.

2. Camel meat production

2.1 Source of supply

Territory Camel runs a commercial camel herd on Garry's station, Aileron. There are currently 500 camels on the station, which partly supplies the camels needed to meet existing demands. Territory Camel also buys camels from other stations in the Northern Territory and from the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands in South Australia (SA). Garry has said: 'Where in Alice a mob of 60 to 70 is a big mob, in the APY lands you get mobs of 700 to 1500 or better.' (Garry Dann 2008, Managing Director of Camel Territory Pty Ltd, pers. comm.).

2.2 Processing

Wamboden Abattoir, just to the north of Alice Springs on the Tanami Road, has a slaughtering capacity of 300 animals per week. The abattoir is currently slaughtering and processing cattle and camels for the domestic market.

The abattoir employs three staff, one full-time and two part-time. Every week 20–40 camels can be slaughtered for human consumption; however, the actual number of slaughtered camels varies with the market demand. Garry emphasised that if the abattoir were accredited as Tier 1 (T1) with the Australian Quarantine Inspection Service (AQIS), he would be able to export the meat to up to 26 countries, and he could employ approximately 15 staff to process around 200 camels per week.

2.3 Camel products

Territory Camel is focusing on value-added camel meat products for human consumption. These products are manufactured for it by Charbray Meats, an Alice Springs–based company. The products include: plain and gourmet sausages (date, chilli, curry, cheese, Italian); Territory camel burgers; marinated and BBQ steak; scotch (yearling, large); porterhouse; T-bone; fillet; rump; corned brisket; premium diced or minced cuts; and smallgoods (cabana, mettwurst [chilli, garlic], pepperoni [hot, mild]).

All products are processed in Alice Springs using free range camels. The products are quality controlled and provided at competitive prices. The sausage, burger, and mince products are preservative and gluten free, and for this reason they are all supplied fresh, snap frozen, or in cryovac.

3. Camel meat sales

Camel meat has been provided to the domestic market by Territory Camel since 2005. There were 450 camels slaughtered and sold in 2007/08, which is approximately 40% of the camels slaughtered for human consumption in Australia. Over the last three years, production and sales of camel meat have slowly been increasing. Market development is still a challenge.

Territory Camel has sold hump as feed for emus in Qld. The quantity sold was very small, and at \$1.25 per kg does not significantly influence the value of the animal.

3.1 Market strategy

A lot of time has passed since Centapakit sold camel meat, either locally or to various states in Australia. The camel industry is still very small. The current small size of the market is one of most important issues hindering industry development.

Garry believes that camels are a great resource and produce good meat. He also understands that the benefits are only real if there is a market for his products. Garry believes that camel should be promoted in the domestic market, particularly to some specific groups such as the Muslim communities in big cities. He says that there is an international market but that it is difficult to access at the moment.

Territory Camel mainly distributes its camel steaks, mince, and sausages through consumer outlets in Adelaide, Darwin, and Alice Springs, but some also go to Qld, NSW, and other parts of SA.

A Territory Camel direct-to-public outlet and two retail outlets have been successfully selling camel products – from sausages and mettwurst to prime cuts – for over 12 months, and another outlet has recently approached the company wanting to sell their camel products. Sales are increasing (Finnane 2008). The Camel Hump Restaurant in Alice Springs is supplied with \$1500 worth of camel meat every week by Territory Camel.

Creating more consumer demand is, however, the biggest challenge for the company. Territory Camel is making a great effort to explore the international market. Researchers from Charles Darwin University (CDU) were commissioned by Territory Camel to do an ‘opportunity analysis’ of the market in five overseas countries. Territory Camel wanted to find a market for ‘boxed’ meat (not just the wet meat that is provided through live exports) and was hoping the CDU research would point to opportunities in new markets, such as the European Union countries. The research reports were completed in late July 2008. These five reports analysed the opportunities and challenges for Territory Camel’s camel meat products in:

- the United Kingdom (UK) (Bell et al. 2008)
- China (only focusing on north China) (Chen et al. 2008)
- Indonesia (Students 2008a)
- Saudi Arabia (Students 2008b)
- United Arab Emirates (UAE) (Ash et al. 2008).

They found that there is a realistic market opportunity in the UK, but not in the other four countries because of a low demand for boxed camel meat (e.g. in Saudi Arabia and UAE) or because of the low prices that would be paid and the high transportation costs (e.g. in China and Indonesia).

Public acceptance of camel meat is Territory Camel's most important concern. Territory Camel aims to address this through public education and marketing events. In order to explore the market in Australia (particularly Muslim and Asian ethnic groups), camel meals – such as Camel Green Curry and Camel Pasta – have been developed with a Queensland-based company. These products are now being promoted. Brochures have also been distributed that provide information about the nutritional value of camel meat and how to cook it. A senior manager of the company has moved from Alice Springs to Darwin to spearhead the development of the market there, attending trade shows and conducting retail trials (Finnane 2008).

3.2 Industry margins

An approximation of the industry margin can be made using data provided by Territory Camel and other service providers.

3.2.1 Mustering and handling cost

The mustering cost varies substantially. According to Ross Morton, a pastoralist who has been involved with camel mustering for eight years in central Australia, mustering using trucks and motor bikes costs around \$50–100 per camel (an average of \$75) in a high camel density area (>0.5 camel per square kilometre, in areas such as Docker River and the APY lands) (Ross Morton 2008, owner of Henbury Station Northern Territory, pers. comm.).

Feral camels need to be yarded for up to a week after mustering to ensure the meat quality is of a sufficiently good standard. This holding period helps to reduce bruising and stress which would otherwise diminish meat quality. The animals need to be held at a staging facility or at the abattoir (McCloy & Rowe 2000). For this analysis an amount of \$35 per camel is assumed to include feed, watering, and management costs and an annual contribution to the cost of establishing a yard facility.

3.2.2 Transportation cost

Transport from where the camels are trapped to the abattoir site is a major cost for the feral camel industry. Camels need to be transported on a single level trailer because they are so much taller than cattle. Additionally, camels are more safely transported over long distances while seated. This means they can take up to 40% more space than cattle. Only about 18–20 adult camels can be carried on each trailer (Agriculture and Resource Management Council of Australia and New Zealand 1997; McCloy & Rowe 2000). It costs \$3.50–4.00 per km to freight live camels using cattle trucks; that is, \$130–140 per camel (an average of \$135) from the APY lands in SA to the Wamboden Abattoir, a distance of approximately 700 km.

3.2.3 Processing cost

Slaughtering and processing costs total approximately \$300 per animal, which covers all stages of the process: slaughtering, processing, freezing, packing, freighting, the cost to adapt killing facilities, the cost to put yarding facilities in place, and the cost to train personnel.

3.2.4 Industry margin

Table 9.15 summarises the estimated costs to process a camel for human consumption.

Table 9.15: Costs of processing a camel for human consumption based on Territory Camel operation

Item	Cost (\$/animal)	percentage of total cost (%)
Mustering	75	14
Handling	35	6
Transportation	135	25
Processing	300	55
Total cost	545	100

This table demonstrates that the total cost to process a camel is \$545. The industry margin must be set to cover that cost.

The live weight of adult camels is about 600 kg and the dressing rate is 50%. This yields a 300 kg camel carcass. Another third of the carcass will be cut off (bones, offal and tendons, hump, and other cutting loss) leaving 200 kg of saleable meat (natural fall) from each camel. Without considering the camel skin and hide usage (currently not utilised), the marginal cost for a kilogram of natural fall meat would be \$2.73.

According to Garry, the price accepted by the camel slaughtering sector needs to be a minimum of \$5.50 per kg (for natural fall), which is nearly double the marginal cost. Given Territory Camel's small scale, this amount of profit for the production of camel meat is still very small given that the fixed costs of running the abattoir need to be covered. The price offered by some wholesalers and other meat processors has been much lower than this price. For example, a recent enquiry (29 November 2007) for 20 boxes of camel meat for human consumption was at a price of only \$3.50 per kg.

3.2.5 Sensitivity analysis

The cost per kilogram is sensitive to processing costs, which make up 55% of the total cost (Table 9.15), but also to handling and transport costs. Sourcing animals from areas closer to the abattoir and from a confined space would have a significant impact on costs. A farmed supply close to the abattoir would help reduce costs but would also ensure continuity of supply and animals of the optimal weight, age, and sex. Camel live-weight is also an important driver. If live-weight decreases by 10%, the marginal price is increased by 10%. This implies that large animals should be harvested for human consumption to keep the marginal price lower. However, this must be balanced by the fact that the age of a camel determines the camel meat quality.

4. Accredited abattoirs

Besides marketing, the renovation of the existing Wamboden abattoir and the set up of new abattoirs are major tasks being undertaken by Territory Camel. As mentioned in Section 2.2, the company is upgrading its Wamboden Abattoir to T1 accreditation to permit export sales. The inspection from AQIS has been completed, and the renovation is being done according to the requirements of AQIS. It is hoped that it will be accredited in the near future.

To shorten the distance between abattoirs and camel sources, Territory Camel is seeking cooperation from APY Council to set up a joint venture to run an abattoir in the APY lands, where the local Aboriginal communities will provide most of the workforce to muster camels. This proposed abattoir

would be a permanent, small, multiple-species abattoir to produce camel meat and other feral animal meats (e.g. horses) for human consumption and pet food. It would be built and start operation in the near future. Feral camels will be mustered and drafted for different uses: human consumption, pet food, and domestication. Once the abattoir is built, the cost of camel production will be dramatically reduced because of lower transportation costs. The abattoir is also intended for use in processing game meat.

The construction of another big, multiple-species abattoir is also proposed for an Alice Springs suburb. A businessman from Saudi Arabia is interested in setting up a joint venture with Garry to supply 1000 tonnes of frozen camel cuts (with bone in) per year to countries overseas (through the Alice Springs Airport). This is equivalent to 3000–3500 slaughtered camels each year. Garry is very confident that it would be viable. The proposed multiple-purpose abattoir would have the capacity to handle at least 1000 animals per week, but in the early stages it would handle fewer than that. More time would be needed to get it fully operational. The potential abattoir site has been identified and negotiations with the NT Government are in progress. A total of \$6 million investment would be required, including land and underground infrastructure worth around \$1.5 million. Strong support from the NT Government is crucial to the success of this international venture.

5. Discussion and conclusions

Territory Camel is a major provider of camel meat within Australia. It currently has approximately a 40% share of the domestic camel meat market. Territory Camel is confident that the demand for Australian camel meat will increase both in Australia and overseas, despite the fact that production in Australia has not significantly increased in the 20 years since camel meat was first provided in Alice Springs in 1988. Territory Camel will put more resources into marketing in both the domestic and international markets. A public campaign and special promotional events will be conducted in domestic markets to create more demand for camel meat.

Territory Camel believes that boxed meat is much more viable for Australian camel meat producers to export to international markets, rather than ‘wet’ meat. Abattoirs with international accreditation and Halal accreditation are necessary to provide uninterrupted camel meat production.

Territory Camel has the capacity to produce greater quantities of camel meat in Wamboden abattoir. However, the limited market is a constraint on the plant reaching full production capacity. Major constraints at present are that the abattoir does not have export accreditation for camel meat, and its distance from the main camel harvesting region. This has meant that the business is looking to establish facilities closer to the source of animals. It is important that the existing processing capacity of Wamboden abattoir is integrated with the establishment of any new abattoirs. If markets are created in a short time period, this arrangement seems a reasonable way to meet the market demand by increasing production capacity. However, because the marketing process consumes time and money, the decision to build new abattoirs must be based on expected demand in both the international and domestic markets.

International investment is possible, but investors would have an expectation of substantial economic returns over the defined time period. It is important to demonstrate to investors the existence of abundant camel resources, ambitious business operators, strong government support for the camel industry, and to convince them that there is an accessible market for camel products.

Considerable hard work – including new product development, marketing research, and public education – is critical to create and maintain increased demand for camel products and to keep the Australian camel industry visible in Australia and internationally. This tiny industry needs help to diminish the risks involved in channelling resources into an undeveloped market (Finnane 2008).

If the scale of production increases, Territory Camel could supply the market with camel meat at a more competitive price and offer camel harvesters a higher purchase price. This in turn would improve the efficiency of the plants’ operation and significantly improve both market competitiveness and continuity of camel supply.

Appendix 9.2: Case study: Pet meat operation in Warakurna

(**Benxiang Zeng**, Department of Natural Resources Environment, The Arts and Sport, Northern Territory Government; **Gordon Sander**, Land and Culture Unit, Ngaanyatjarra Council)

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1. Background

Warakurna is one of 12 settlements on the Ngaanyatjarra lands (250 000 km²) in Western Australia (WA) (Figure 9.8).

The Warakurna settlement has 150 Aboriginal residents and around 35 staff working for the community, Ngaanyatjarra Council, and other entities. There are approximately 50 houses. There are a large number of camels living around the settlement. According to an aerial survey in 2007 that covered this area, the overall camel density was 0.84 camel/km² (refer to Saalfeld & Edwards 2008, Saalfeld et al. 2008). Population growth and serious drought in recent years has led to feral camels causing considerable damage to property, waterholes, and vegetation in and surrounding the settlement. In the summer of 2006–07 a large number of camels got into the settlement and wandered around looking for water. They pushed over a fence, broke off taps and air-conditioners, and pulled down a water tank and a windmill. Local people thought there were ‘too many camels’. In addition to the considerable mess they caused in the settlement, the community members noticed a significant reduction in the number of kangaroos, a favourite food for local people, in the immediate vicinity. According to Chris Moon, the former Community Development Advisor (CDA) in Warakurna, in the summer of 2006–07 feral camels directly caused \$100 000 worth of economic damage (refer to Edwards, Zeng & Saalfeld 2008).

With this background, a small-scale, local action to shoot camels for pet meat was initiated in March 2007. This third-party pet meat operation has moved away from Warakurna but is still continuing operations from other settlements in the Ngaanyatjarra lands. On 22–23 June 2007, scientists from the DKCRC camel project visited Warakurna to document this operation. The partners involved in the operation were interviewed, and the Aboriginal people in Warakurna and other neighbouring settlements were asked about their attitudes towards the operation and about their general perspectives on feral camel management.

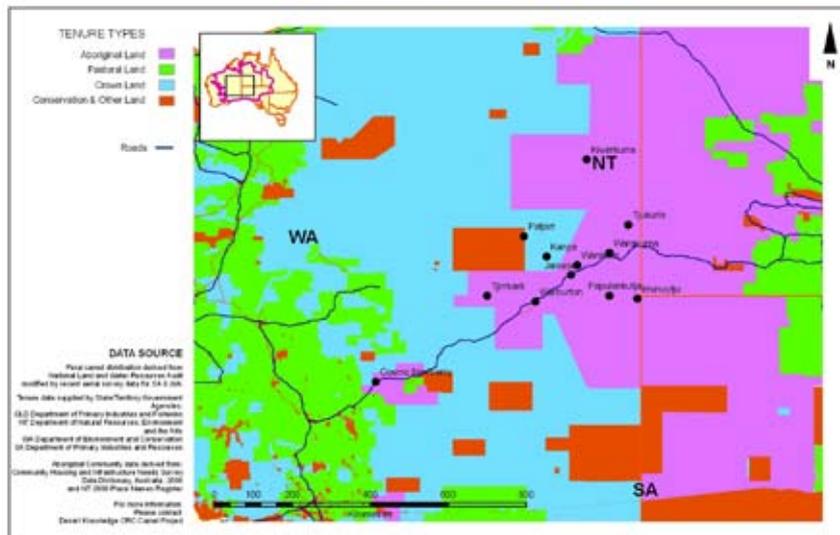


Figure 9.8: Location of Warakurna

2. Operation

The camel shooting operation was done under permit and a contract was arranged by Ngaanyatjarra Council's Land and Culture staff and lawyers. Ngaanyatjarra Council and Warakurna are both signatories to the contract, which states that professional hunters will conduct the operation. Ngaanyatjarra Council has been instrumental in getting this highly successful program together. The arrangement was supported and negotiated by Ngaanyatjarra Council Land and Culture staff members.

The operation started in late March 2007. The first term of the contract between the settlement and the shooter lasted three months to the end of June 2007. The operation was settlement-based and happened on a small scale with two professional hunters (with skills in both shooting and slaughtering), together with support staff, working at Warakurna. They worked on a four-week shift (one professional hunter and a support person worked together for four weeks as one shift). The operators lived in a house that was provided free by Warakurna. Camel meat was stored in a 40-foot refrigerated shipping container – with a capacity for the meat from 75 camels – parked at the power station on the outskirts of the settlement. The operators used a 4WD Toyota utility, equipped with a powered lift, as the main work vehicle and a 0.243 calibre rifle for shooting (from right behind the skull).

The operation was conducted every day, including weekends. Hunters always began with a search for camels, driving out along the main road tens of kilometres away from the settlement, then driving off the road to target a herd, shoot one or two, and then chase and shoot the rest. Only the bone-in cuts (four legs and the neck, approximately 250 kgs) were taken, while the remainder of the animal was left without any further treatment. The meat from five–eight animals was loaded onto the utility with the lift, transported to the settlement, and packed into the chiller for temporary storage. This operation took about one hour. Every week another chiller truck was hired to transport the cuts to a company in Perth.

The areas that the hunters were allowed to shoot in were established through consultation with senior Warakurna community members who accompanied them in the early stages. Camels are usually shot away from sensitive areas.

3. Key figures

The field survey has collected some useful numeric information on the operation. This information provides a base case for small-scale, settlement-based pet meat operations.

Operators: Only two professional hunters were involved in this operation. Each shift of four weeks was carried out by only two people: one professional hunter and one support person.

Camels taken per day: Ten–fifteen camels were harvested each day. In the Warakurna operation the operators went out twice a day and took five–eight camels each time.

Number of camels removed: During the term of the operation at Warakurna just over 1000 camels were removed. The hunters have since been based in Jameson, Wanarn, Docker River, and Tukurla Communities with over 5000 camels shot, butchered, and the pet meat sold.

Commercial benefits: The pet meat operation was a commercial venture that benefited all the partners involved. The operators sold the bone-in camel cuts to Protas Pet Foods for \$0.75/kg. The local community received a royalty from the operators of \$0.05/kg of cuts. The pet meat company got fresh meat at a low price to produce high quality pet food for the domestic and international pet care market.

4. Local involvement

4.1 People's attitudes to this operation

The operation began after approval for the project was given at a meeting of Warakurna Community Council. Members of the Shire Council were consulted directly prior to permission being granted to the camel shooters. The Ngaanyatjarra Council (Aboriginal Corporation) was informed about the operation at a full meeting of the Council held in Warakurna in 2007. Ngaanyatjarra Council worked closely with the community to implement the program.

As the operation progressed, local people became more and more supportive. Warakurna people supported the operation because the camels were damaging community buildings and local waterholes. They also supported the approach because the animals were not being wasted, as they would have been in a culling operation. The community received a small royalty per kilogram, and young men were employed as field hands by the shooter and learned useful work skills. Interviews with local people indicated most people thought something must be done to control feral camels. They felt that getting paid for the camels was one of the best options. Although the local people's perspective on feral camels is linked to commercial use without caring much about economic viability, their attitude towards camel control was positive and at odds with the attitudes reported by Rose (1995), which suggested that Aboriginal people did not want any killing of feral animals, including camels. It is interesting to note that most of the other Ngaanyatjarra settlements support Warakurna's initiative and are now keen on similar operations in their own areas. Similar pet meat operations have now been undertaken in areas such as Docker River, Northern Territory (NT) since then.

4.2 Local participation

A small number of local Aboriginal people were employed for a short time as guides during the operation. In the first two weeks, two men guided the shooters and showed them where feral camels were. The two local guides were paid \$400 by shooters for the two weeks they were employed. The pet meat operation also passed on skills to members of the Ngaanyatjarra Council Land and Culture Team to help local Aboriginal people butcher camels for their own consumption.

One of the guides said in an interview that he was very happy and proud of his involvement in the operation. He got income from the involvement and he did something useful. Other local people said they would like to be involved in camel management in some way. Some people suggested that they have skills that could contribute to camel control: they know their lands well, they know where camels are, and they know how to muster camels using motorbikes. Some people also suggested that they could build yards to hold camels. Any future operations on Aboriginal land should attempt to involve local people more. Therefore, an effective business model that supports broader and deeper local participation should be encouraged and supported by governments.

4.3 Local benefit from the operation

The benefits obtained by local people must be analysed from several perspectives. From an economic perspective, not much benefit flowed into the local Aboriginal community. According to the contract between the settlement and the operators, the local community received a royalty of \$0.05/kg of camel cuts. Ultimately, Warakurna settlement received over \$10 000 in royalties from the three-month operation that removed 1000 camels. This amount of money was significant for a small settlement with only 150 residents. However, it was a relatively small proportion of total income generated, especially when accounting for the fact that the community had to pay the electricity costs for the operators and provided them with free accommodation. Any settlement conducting a similar operation should aim for an increased proportion of the economic benefits. Local communities should be considered one of the major collaborators and should share not just the non-financial but also the financial benefits. Such small-scale operations could be established by communities themselves.

From the environmental and social perspectives, however, the community did get a great deal of benefit. Obviously this operation has reduced the number of camels around the settlement, which will reduce the damage and mess to the settlement and the negative impact on native animals, vegetation, landscapes, and waterholes. As stated above, the damage done in the community in 2006–07 has been estimated at approximately \$100 000, not including damage caused in road accidents. Additionally, the operation showed local Aboriginal people that effective action could be taken to control feral camels, reduce their impact on the settlement, and provide some economic benefit. Aboriginal communities are likely to become engaged in camel management in different ways. The presence of this operation, and the benefits it brought in terms of employment, reduction of camel numbers, and production of pet meat may have influenced people to accept a more diverse range of camel management strategies than may otherwise have been the case (refer to Vaarzon-Morel 2008a).

4.4 Community support

Community support was critical to the success of this operation. Free electricity and free accommodation were provided for the initial trial of this program – a voluntary offer made by Warakurna – in a bid to attract the shooters by reducing their financial risks. This demonstrates the willingness of Warakurna (and Ngaanyatjarra Council) to get a program running. Although the shooters paid for their electricity and rent in later programs, the free offer was important to initially establish the pet meat operation.

5. Financial viability and sustainability

A simple model has been developed to test the financial viability of small-scale pet meat operations. The model is based on a model developed to assess sustainable wildlife enterprise trial sites (Stayner 2007) and has assumptions based on the Warakurna case study discussed above.

5.1 Base case

Following the model adopted by the Rural Industry Research and Development Corporation (RIRDC) (Stayner 2007), the base case is built on the following assumptions:

1) Total area over which harvesting takes place

In this case the professional hunters were based at the settlement. They worked for eight hours per day with two returns to the settlement. The distance they drove out from the settlement was on average 40 km. We can assume an area of 5000 km² – within a circle of around $3.14 \times (40\text{km})^2$ – was harvested around the settlement. According to the shooters in this case, one team could work two areas based on two settlements over a 12-month period. Therefore, in the base case, we assume the total harvested area could be two 5000 km² areas, that is, a total of 10 000 km² harvested in one year.

2) Camel density

There is a wide variation in the density of camels over desert areas (refer to Saalfeld & Edwards 2008, Saalfeld et al. 2008). Based on the research reported here, the average density over the whole camel range in Australia is around 0.3 camel/km². A recent aerial survey has estimated 0.84 camel/km² in WA (Ngaanyatjarra Lands) and 0.65 camel/km² in South Australia (SA) (APY Lands). This survey was undertaken between May and June 2007, in an area of 128 000 km² that straddles the northern part of the WA–SA border (Lethbridge 2007). This area is believed to have one of the highest densities of feral camels in Australia (refer to Saalfeld & Edwards 2008).

For the base case scenario, we assume a density of 0.8 camel/km².

3) Harvest rate per year

In this case, professional shooters actually harvested 1000 camels in the area around the Warukurna settlement, which equated to approximately 25% of estimated camel numbers in the harvest area. For the base case we have assumed a harvest rate of 25%. This will reduce the feral camel population quickly and lessen the impact of camels on the land. It is not a rate that will maintain sustainable harvesting. However, it is a realistic estimate of the harvest size likely to be accepted by local Aboriginal communities, pastoralists, and natural resource management (NRM) managers trying to reduce feral camel impacts, as well as by operators seeking economic returns while minimising their harvest costs.

4) Camels taken per day

The base case assumes 10 camels are harvested per day, although discussions with experienced hunters indicate that this number is often exceeded thereby improving the profitability of the enterprise substantially (see sensitivity testing).

5) Average camel cuts weight

A full-grown male camel weighs over 600 kg. Female and young camels weigh less, so the average weight of a camel is around 400–600 kg. Based on the real case in Warakurna, the average weight of camel carcass taken was assumed to be 250 kg in our base case. Economic returns are highly sensitive to reductions in this figure.

6) Labour cost

A figure of \$440 a day equals \$55 per hour for an eight-hour working day for two people: a professional shooter and one support person.

7) Cost and useful life of capital items

A dedicated vehicle fitted with a purpose-built lift is required for camel harvesting. A new 4WD vehicle at 2007 prices (on average \$50 000) is used in these calculations. Capital costs are estimated to be \$60 000 including the lift (hydraulic hoist), a rifle, and knives. For simplicity, all capital items are assumed to have the same useful life of eight years. The returns for harvesting (net of variable costs) must be adequate to repay the capital costs within eight years. The length of time to recoup capital costs, taking discounting into account, is relatively insensitive to the interest rate. Based on these assumptions, the base case is summarised in Table 9.16.

Table 9.16: Camel harvesting for pet meat – base case assumptions

	Rate		Total per year
Target Harvesting Area (HA)	This case study assumes that the team work two x 5000 km ² over a 12-month period from two bases		10 000 km ²
Income			
Camels present in target area (CN)	Camel density (CD): 0.8/km ²		8000 head
Camels harvested	Harvest rate (HR): 25 %	8000×25% = 2000	2000 head
Camels harvested per day (ND)	10		
Harvesting days (HD)		2000/10 = 200	200 days
Camel meat harvested	Carcass weight (CW): 250 kg		500 000 kg
Price at pet food company (PG)	\$0.75/kg		--
Total income			\$375 000
Variable costs			
Distance travelled	200 km/day		--
Vehicle running cost (RC)	Including fuel, tyres, services, interest on loan, registration, insurance, and license \$0.60/km	200×0.6×200 = 24 000	\$24 000
Ammunition (AC)	\$0.80 per camel	0.80×2000 = 1600	\$1600
Chiller storage (SC)	\$40 per head	40×2000 = 80 000	\$80 000
Transport to pet food company (TC)	Transport distance (DI): 2000 km Cost per km: \$3/km TC = 2000×3 = \$ 6000 TC for per camel carcass (chiller holds 75 carcasses) \$6000/75=\$80 per carcass	80×2000=160 000	\$160 000
Total variable costs (VC)			\$265 600
Gross margin (before labour)			\$109 400
Labour cost (LC)	\$440/day	440×200=88 000	\$88 000
Annual contribution to fixed costs (ACFC)			\$21 400
Fixed costs (capital items)			
Vehicle	50 000		\$6250
Lift (hydraulic hoist)	8000		\$1000
Rifle	1500		\$187.50
Knives	500		\$62.50
Useful life of capital items	8 years		
Total fixed costs per year (FC)			\$7500
Net annual profit (NP)			\$13 900
Payback period (no discounting) PY = 8×FC/ACFC			3 years (2.8 years)

5.2 Sensitivity analyses

The sensitivity of the base case model was re-calculated by varying independently six of the key variables. The results of this analysis are presented below.

1) Camel population density

Because of the substantial capital investment required to establish a camel harvesting enterprise, the number of animals harvested in a year is a major determinant of its economic feasibility. The number of camels harvested in a year can be increased either by increasing the population density or by increasing the harvest rate.

Camel density on harvest sites largely depends on the selection of harvest sites in feral camel hot spots (regions), with some possible management interventions such as the introduction of attractant water sources at extra cost. However, it seems unlikely that landowners would be in favour of an increase in camel density (particularly using money to achieve it) as this would cause more damage to the landscape. Therefore camel density will not vary much in a selected site but will be affected by harvest site selection.

This model demonstrates that the density of camels (keeping all other variables at their base case level) is a key variable in determining the economic efficiency of harvesting (Table 9.17).

Table 9.17: The effect of camel density on ability to recoup fixed costs

Camel density (camel/km ²)	Contribution to fixed costs (\$)	Payback period @ zero interest (Years)	Discounted payback period 5% (Years)
0.40	10 700	6 (5.61)	7 (6.74)
0.60	16 050	4 (3.74)	5 (4.24)
0.80 (Base case)	21 400	3 (2.80)	4 (3.10)
1.00	26 750	3 (2.24)	3 (2.44)
1.20	32 100	2 (1.87)	3 (2.01)

Compared to the base case with 0.8 camel/km², a harvest area with a lower density (e.g. 0.40 camel/km²) would find that it could take a longer time (e.g. 7 years vs. 4 years) to recoup the capital costs, given that all other assumptions remain unchanged. On the other hand, a higher density (e.g. 1.20 camel/km²) would result in a payback period of three years (just over two years). The break-even camel density for the operation to be able to pay off the fixed costs is 0.35 camels/km².

2) Harvest rate

The scenario in this case is to control and constructively reduce feral camels, so the harvest rate is assumed to be increased without the necessity of considering the long-term sustainability of the camel population from a biological perspective. Increasing the harvest rate significantly increases the annual contribution to fixed costs and reduces the payback period (Table 9.18). It should be noted that the analysis presented here assumes all other factors remain constant, but in reality there is likely to be higher marginal costs associated with increasing the percentage harvested. The break-even harvest rate for the operation to be able to pay off the fixed costs has been calculated as 11%.

Table 9.18: The effect of camel harvest rates on the ability to recoup fixed costs

percentage harvested p.a. (%)	Contribution to fixed costs (\$)	Payback period @ zero interest (Years)	Discounted payback period @5% (Years)
15	12 840	5 (4.67)	6 (5.45)
20	17 120	4 (3.50)	4 (3.95)
25 (Base case)	21 400	3 (2.80)	4 (3.10)
30	25 680	3 (2.34)	3 (2.55)
35	29 960	2 (2.00)	3 (2.16)

3) Camels harvested per harvesting day

Table 9.19 shows that a variation in the number of camels taken per day has a significant impact on the economics of the operation. A reduction to eight camels per day reduces the contribution to fixed costs to a level that does not allow for replacement of capital equipment within the useful life of the assets. This analysis also shows the importance of harvester efficiency to the economics of the operation, in the sense that a 20% increase in the number of animals taken per day (from 10 to 12) doubles the contribution to fixed costs and halves the payback period. The break-even number of camels that must be harvested per day for the operation to be able to pay off the fixed costs is 9 animals.

Table 9.19: The effect of the number of camels harvested per harvesting day on ability to recoup fixed costs

Camels taken per day (No.)	Contribution to fixed costs (\$)	Payback period @ zero interest (Years)	Discounted payback period 5% (Years)
6	-53 267	Not repaid	Not repaid
8	-6600	Not repaid	Not repaid
10 (Base case)	21 400	3 (2.80)	4 (3.10)
12	40 067	2 (1.50)	2 (1.60)
14	53 400	2 (1.12)	2 (1.19)

4) Average carcass weight

A variation in the average carcass weight (while keeping all other factors constant) makes a significant difference to the economic performance of this enterprise (see Table 9.20). For example, a 50 kg reduction in average carcass weight precludes the replacement of capital items over their useful life. This highlights the importance of a harvester being able to maximise the meat harvested from each animal in the field. It also emphasises the importance of building a model with a better capacity to take into account the sustainability of different harvesting regimes (harvest rate, age, and sex ratios). The break-even average weight of meat taken per animal – that is, the weight of meat at which the returns from the operation are able to pay off the fixed costs – is 242 kg.

Table 9.20: The effect of carcass weight on the ability to recoup fixed costs

Average carcass weight (kg)	Contribution to fixed costs (\$)	Payback period @ zero interest (Years)	Discounted payback period @5% (Years)
150	-128 600	Not repaid	Not repaid
200	-53 600	Not repaid	Not repaid
250 (Base case)	21 400	3 (2.80)	4 (3.10)
300	96 400	1 (0.62)	1 (0.65)
350	171 400	1 (0.35)	1 (0.36)

5) Price per kg of camel meat

Table 9.21 shows that maximising the return per kilogram of meat harvested has a similar effect to increasing the meat harvested per animal. If the value of meat drops below \$0.75 per kg (while keeping all other factors constant) then there are significant impacts on the viability of the enterprise. At meat prices greater than \$0.90 per kg the repayment of fixed costs is dramatically shortened to less than one year. This highlights the importance of negotiating contracts with processors that include price premiums for characteristics that can be reasonably assured or managed over time. The break-even price received per kilogram – at which the returns from the operation are able to pay off the fixed costs – is \$0.73 per kg.

Table 9.21: The effect of market value on the ability to recoup fixed costs

Price (\$/kg)	Contribution to fixed costs (\$)	Payback period @ zero interest (Years)	Discounted payback period 5% (Years)
0.45	-128 600	Not repaid	Not repaid
0.60	-53 600	Not repaid	Not repaid
0.75 (Base case)	21 400	3 (2.80)	4 (3.10)
0.90	96 400	1 (0.62)	1 (0.65)
1.05	171 400	1 (0.35)	1 (0.36)

6) Transport costs

Table 9.22 shows that transportation distance is critical to a viable pet meat operation. When the transportation distance increases to 2400 km, the expected returns do not allow for replacement of the capital equipment within the useful life of the assets. The break-even distance – at which the project returns would just be able to pay off the fixed costs – is 2151 km.

Table 9.22: The effect of transportation distance on the ability to recoup fixed costs

Distance to pet meat company (km)	Contribution to fixed costs (\$)	Payback period @ zero interest (Years)	Discounted payback period @5% (Years)
1200	85 400	1 (0.70)	1 (0.73)
1600	53 400	2 (1.12)	2 (1.19)
2000 (Base case)	21 400	3 (2.80)	4 (3.10)
2400	-10 600	Not repaid	Not repaid
2800	-42 600	Not repaid	Not repaid

6. Discussion and conclusions

The third-party pet meat operation in Warakurna was generally successful economically, environmentally, and culturally. It created a new model for feral camel management – a small-scale, settlement-based pet meat operation. Such an operation could work very well with lower inputs to achieve a realistic, yet greater, output: continuously reducing camel numbers, making roads safer, protecting infrastructure and ephemeral waters, and consistently employing local young people. However, some issues need to be addressed so that future operations can be improved.

In this case the enterprise was extensively canvassed both at the local and regional level. It was supported by the Warakurna community and by a full council meeting of Ngaanyatjarra Council. This degree of support would not have been achieved without the preliminary consultations that took place in the preceding months. It is also very important to publicise clear and detailed information about sensitive issues, such as animal ethics, because this kind of settlement-based operation must be supported by the community.

An appropriate way to dispose of the unused parts of the slaughtered camels needs to be developed, rather than leaving them exposed in the bush. Burial is an option; however, there is a potential risk of serious environmental damage as a result of burial. For example, if weeds are spread into the country by disturbance of the ground, this could cause greater damage than that caused by the camels themselves. The increased costs arising from burying the remainders would probably make the operation unviable.

A standard for harvesting camels in the wild should be developed, including harvest quantities, timing, style, gender structure, and other relevant issues. The *Model Code of Practice for the Welfare of Animals – The Camel* (Agriculture and Resource Management Council of Australia of Australia and New Zealand 1997) should be applied in the standard. The existing standard operating procedure for ground shooting (HOR001), mustering (HOR003), and trapping (HOR004) of feral horses (Sharp and Saunders 2005a, 2005b, 2005c, 2005d) developed by New South Wales Department of Primary Industries (NSW DPI) might be adapted to guide the harvesting of feral camels.

The financial benefits accrued locally were relatively modest due to the minor amount of local participation, a minimal royalty rate paid to the community, and the free electricity and accommodation provided by the settlement. The latter was a necessary strategy to attract pioneer hunters to operate this program. However, this arrangement did hide the real cost of this operation and ultimately reduced the actual economic gains for the community from this operation further. It is critical that a more balanced partnership be set up in the long-term. The benefits should be shared by engaging all the stakeholders, including having local people actively involved in the operation. This would make this kind of enterprise sustainable.

This enterprise is not a social welfare project and so there is no budget, either financial or temporal, to cover the intensive training that would be required for the involvement of local Aboriginal community members. However, there is no doubt that the greatest environmental and social benefits would flow from a collaborative approach, with a program that is adequately funded to train local people to shoot, butcher, and prepare meat not only for the pet food industry, but also to game meat standards for human consumption.

Although this pet meat operation was effective, it only occurred at a small scale. It cannot simply be extended to other places at a bigger scale. The operators sold their products to pet food manufacturers, but it is unclear how big the market is for camel meat as pet food. The operators are exploring the possibility of exporting their camel meat directly to an international pet food market (Jim Craig 2008, pet meat operator, pers. comm.).

Small-scale pet meat operations are very economically sensitive to market price, camel weight, and transportation costs. Prospective pet meat operations must attend to the selection of their harvest area and the individual animals that will be harvested, and they must keep an eye on oscillation in the market price. A pre-harvesting arrangement with pet meat processors regarding carcass price and demand capacity is critical. Using mobile abattoirs to process the pet meat in the field is likely to be a more economically viable way of doing business, as the cost to transport the packed meat would be much cheaper than transportation of carcasses.