The principal importers of Australian furs are the Federal Republic of Germany, followed by the United Kingdom (table 16.1). Most furs imported to the United Kingdom are sold at auction in London and re-exported, mostly to Germany. Since 1982–83, the largest quantity exported was 9161 furs in 1987–88, while the highest export earning was $128 000 in 1986–87 (figure 16.1).

Since 1982–83, the average export value of cat fur has ranged between about $8 and $18 per fur (figure 16.2). It appears that the increased commercial harvest in 1987–88 was due to increased supply in anticipation of the higher prices received in the previous year. This response suggests that supply of feral cat fur will increase rapidly when market conditions are favourable.

Trade in feral cat fur can be controversial (Anon. 1986) because it is not possible to distinguish between furs from feral cats and furs from the common domestic cat. Further, the feral status can vary from semi-domesticated cats living in urban areas through to truly feral cats living in remote rural areas. It is likely that some cat fur entering the commercial trade originates from domestic cats.

World demand for fur products has declined in recent years in response to diminished demand for high fashion fur garments. No exports of raw cat fur skins have been recorded by the Australian Bureau of Statistics since 1988–89. The long-term trend in demand for fur products remains unclear; however, it will be some time before any improvement in demand will influence feral cat fur production.

Non-commercial harvesting

It is worth noting that Aboriginals in many rural communities in Northern and Central Australia include feral cats in their diet. Indeed, some groups consider feral cats to be a delicacy and make special efforts to hunt them (Macfarlane 1978).

Although feral cats are not declared pests in Australia, they are perceived as a potential threat to small native animals. Therefore, government pest control agencies will take actions to control feral cats in problem regions. The main method of control is by poisoning, although shooting and trapping are also used (Mawson et al. 1990).

The extent of baiting for feral cats is very low and records of the quantity of poison used are therefore difficult to retrieve. For example, in Tasmania during the five-year period between 1984–85 and 1988–89 inclusive, baits were laid specifically for feral cats on only five occasions. The main purpose was to control feral cats on Macquarie Island where predation by cats is thought to have contributed to the extinction of some native animals (Taylor 1979). The poisons used included 1080, alphachloralose and pindone. The number of cats killed in Tasmania and other States by vertebrate pest control agencies is unknown. A few feral cats may be killed on mainland Australia during baiting programs for other carnivores such as the European red fox.

Biological control of feral cats has been attempted by South African conservation authorities on sub-Antarctic Marion Island (Van Rensburg et al. 1987). Feline panleucopenia, a highly infectious viral disease, was introduced to the feral cat population on the island in 1977, resulting in a 29 per cent annual rate of decrease in the population over five years (from 3400 cats in 1977 to 615 in 1982). Once infected, mortality is high. However, cats that recover remain immune for life. Feline panleucopenia is endemic in Australia, and could already exert some control on feral cat abundance.

Diseases

Feral cats are capable of distributing the infective stages of parasites that cause diseases in humans and domestic livestock (Hartley & Munday 1974; Munday 1975; Langham & Charleston 1990). The protozoan parasite *Toxoplasma gondii* is of particular concern because it can cause congenital abnormalities if pregnant women are infected.

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Toxoplasmosis causes abortion and perinatal mortality in sheep (Hartley & Munday 1974). The disease also threatens the conservation of endangered small native mammals such as the Eastern barred bandicoot *Perameles gunnii* (Obendorf & Munday 1990). Gregory and Munday (1976) found 51 of 53 feral cats serologically positive to *Toxoplasma gondii* in Tasmania.

Another protozoan parasite that is spread by feral cats is *Sarcocystis spp.* It causes economic losses to the sheep meat industry in southern Australia because macrocysts must be trimmed from the carcase and heavily infected carcases are condemned (Munday 1975). The main option for control of these parasites is to reduce the density of feral cats (Callow 1984).

Conclusions

Commercial use of feral cats in Australia is negligible, although it could increase significantly with higher market prices. As most cat fur is exported, the scale of harvesting will remain sensitive to changes in overseas demand for fur products. Fur products are now out of fashion, and the long-term prospects remain uncertain.

There is growing concern about the damage that feral cats may be causing to native fauna populations. If more evidence of the adverse impact of feral cats on populations of small native animals emerges, greater efforts may be needed to control cats in environmentally sensitive regions.

17 WATER BUFFALO

Distribution and abundance

Water buffalo (*Bubalus bubalis*) were brought to Australia between 1824 and 1886 as a source of meat (Letts 1962). They came from Timor, Kisar, and probably other islands from the Indonesian archipelago. The first importations of water buffalo were to Melville Island and to the Cobourg Peninsula on the mainland. Stock were left behind when the first settlements were abandoned, and herds of wild buffalo were observed as early as 1843 (Letts 1962). These animals subsequently colonised Melville Island, and also the northern coastal floodplains and, to a lesser extent, inland timbered areas adjacent to waterways on the mainland (Letts et al. 1979).

Feral buffalo herds are restricted to the Northern Territory, although occasional sightings have been reported in Western Australia and Queensland (Long 1988; Wilson et al. 1992a). A habitat preference for swamps and floodplains has limited the distribution of feral buffalo. Water buffalo form distinct family groups numbering up to 250 and tend to live in well-defined home ranges (200–1000 hectares) for many years (Letts et al. 1979).

A series of aerial surveys in the Northern Territory estimated that the feral buffalo population was 282 000 in 1981, rising to 341 000 in 1985, then declining to 122 000 in 1989 (Bayliss & Yeomans 1989). The dramatic decline in feral buffalo numbers since 1985 is due to extensive culling under the national Brucellosis and Tuberculosis Eradication Program (BTEC). Bovine tuberculosis is regularly found in feral buffalo (Garner & O'Brien 1988), and uncontrolled populations are being removed as part of a national effort to eradicate the disease.

Feral buffalo can cause extensive environmental damage, including vegetation damage through grazing and trampling; soil compaction; saltwater intrusion into low-lying freshwater swamps through breaching of natural levee banks by swim channels; wallowing and erosion; siltation and pollution of water bodies; noxious weed dispersal; and impact on other animals through modification of habitat (Letts et al. 1979; Fogarty 1982). On the other hand, water buffalo are well adapted to the wet tropics, and have been the basis of a commercial industry since the 1880s.

Status

Feral water buffalo are variously considered a resource for hunting and supply of livestock and commodities, a pest causing environmental damage and a reservoir for bovine diseases. Water buffalo are recognised as slaughter animals under the Northern Territory Abattoirs and Slaughtering Act and the Pet Meat Act. They are classed as stock under the Northern Territory Stock Diseases Act, but regarded as pests when present on national parks.

Commercial use

The resource value of the feral buffalo population in Australia was recognised over a century ago. An industry based on field shooting for the hides commenced in the 1880s, and buffalo hide exports averaged 4000 per annum between 1886 and 1911 (Letts 1964). Omitting the war years, 1939–45, an average of 7000 bull hides were exported annually between 1911 and 1956, with a record of 16 549 in 1937–38. The buffalo hide industry caused a marked reduction in the abundance of feral water buffalo and in 1939 the Buffalo Protection Ordinance was introduced to control hunting and protect the animals (Letts et al. 1979). The hide market collapsed in 1956 due to competition from other hide exporters, declining international prices and poor hide preparation by Australian suppliers. This caused industry participants to seek alternative markets for feral buffaloes.

Slaughters for human consumption

Production of buffalo meat for human consumption began in 1959 to supply domestic and export markets. Most buffalo

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Table 17.1: Number of buffalo slaughtered at export and domestic abattoirs, by the BTEC program, or exported live from the Northern Territory

PURPOSE	1980–81	1981–82	1982–83	1983–84	1984–85	1985–86	1986–87	1987–88	1988–89	1989–90	1990–91
Export abattoirs	34 811	23 954	27 827	19 729	12 375	12 024	28 195	33 879	26 946	21 275	11 442
Domestic abattoirs	9 142	9 321	6 632	9 616	12 695	14 128	6 119	2 019	1 221	859	135
Total all abattoirs	**43 953**	**33 275**	**34 459**	**29 345**	**25 070**	**26 152**	**34 314**	**35 898**	**28 167**	**22 134**	**11 577**
BTEC slaughters	0	0	0	0	0	4 302	16 668	16 975	16 203	NA	NA
Live exports	698	736	2 802	2 903	4 367	4 014	5 468	3 487	1 736	2 498	1 807
Total number taken	**44 651**	**34 011**	**37 261**	**32 248**	**29 437**	**34 468**	**56 450**	**56 360**	**46 106**	**24 632**	**13 384**

Source: Northern Territory Department of Primary Industries and Fisheries BTEC = Brucellosis and Tuberculosis Eradication Campaign

Table 17.2: Quantity, destination and value of buffalo meat exported from the Northern Territory (all values in Australian dollars)

Destination		1980–81	1981–82	1982–83	1983–84	1984–85	1985–86	1986–87	1987–88	1988–89	1989–90	1990–91
Germany	Tonnes	2 541	1 920	1 598	1 902	125	17	1 894	1 374	82	904	633
	($'000)	5 311	3 571	3 356	4 755	256	43	5 076	5 482	331	3 761	2 089
Benelux *	Tonnes	2	0	0	0	0	0	67	653	1 312	17	33
	($'000)	4	0	0	0	0	0	216	1 953	4 749	71	108
Sweden	Tonnes	713	75	536	0	507	225	253	833	493	1 082	0
	($'000)	1 854	129	965	0	1 339	565	855	3 357	2 874	4 663	0
Taiwan	Tonnes	199	564	582	456	877	443	775	408	1 068	241	536
	($'000)	416	1 128	1 571	1 249	1 868	1 112	2 596	1 485	4 432	1 041	2 214
Other	Tonnes	15	228	236	0	0	0	0	2	38	0	4
	($'000)	39	416	497	0	0	0	0	6	165	0	4.4
Total	Tonnes	3 470	2 786	2 951	2 358	1 509	686	2 989	3 270	2 993	2 243	1 206
	($'000)	7 624	5 244	6 389	6 004	3 463	1 719	8 744	12 283	12 551	9 536	4 415
	$/kg	2.2	1.88	2.17	2.55	2.29	2.51	2.93	3.76	4.19	4.25	3.66

Source: Northern Territory Department of Primary Industry and Fisheries * Benelux includes Belgium, The Netherlands and Luxembourg. All values in current dollars Figures may not add to totals due to rounding

meat produced by the first enterprises was derived from field-shot animals. However, since 1968 export certification has required ante-mortem inspection and all feral water buffalo are now captured live and transported to an abattoir for slaughter.

Water buffalo weigh up to 1000 kilograms live weight, and have carcase characteristics similar to cattle, but the meat is consistently leaner (Johnson & Charles 1975).

Feral buffalo are mustered into yards using helicopters and four-wheel drive vehicles. Young animals that are suitable for domestication are retained, and the remaining animals are transported to an abattoir for slaughter. Care must be taken during the capture, holding and transport of feral buffalo to reduce stress and injury to the animals (Senate Select Committee on Animal Welfare 1991).

Harvesting operations are usually carried out during the dry season (April to November), because high rainfall received during the wet season prevents access to buffalo habitat.

The number of buffalo slaughtered at abattoirs in the Northern Territory has tended to decline since 1980–81, when 43 953 animals were processed (table 17.1). In addition, the number of buffalo killed at domestic abattoirs has decreased markedly since 1985–86 when over 14 000 animals, or 54 per cent of the total abattoir kill, were processed at domestic abattoirs. The domestic meat manufacturing industry purchased most of this meat. However, by 1989–90 buffalo slaughters at export abattoirs amounted to over 21 000 animals, or 96 per cent of the total abattoir kill. The growth in the number slaughtered at export abattoirs has been due to higher demand and prices offshore, compared with domestic markets.

Taiwan, Germany, Sweden and the Benelux group, which includes Belgium, the Netherlands and Luxembourg, are the major importers of Australian buffalo meat (table 17.2). The quantity of buffalo meat shipped and the principal destination have varied widely over the past decade. Annual exports have varied from 686 tonnes (1985–86), to 3470 tonnes (1980–81), but the average volume of trade is 2000–2500 tonnes per annum. In 1989–90, 2243 tonnes of buffalo meat worth $9.5m or $4.25 per kilogram were exported. Exports slumped to 1206 tonnes worth $4.4m in 1990–91, primarily due to the shortage of livestock for slaughter following the extensive culling of wild herds by BTEC.

Germany has tended to be the principal destination for Australian buffalo meat exports. However, when demand and prices were depressed in Europe in the mid-1980s, Taiwan was the leading buyer, which was in turn surpassed by Sweden in 1989–90. The volatility of sales between importers has occurred because the supply of buffalo meat is limited, and exporters are trading with the highest bidder.

Within Australia, there is a small but profitable market in the food service industries for prime cuts of buffalo meat.

Slaughters for pet food

Water buffalo are field-shot to produce pet meat for domestic and export markets. Most buffalo pet meat is sold on the domestic market, but the scale of the trade has declined as demand and prices for buffalo meat for human consumption has increased. An increased demand for live animals for domestication has undoubtedly also contributed to this trend.

There is little information on the scale of buffalo pet meat trade. To comply with the Northern Territory regulations, hunters are required to submit monthly returns showing the number of animals killed. These records showed that at least 304 buffalo were harvested for pet food during the 1988–89 financial year.

An unknown number of buffaloes slaughtered during BTEC helicopter shoots are used by pet meat processors. The processors follow the helicopter and collect carcases, but the success of this tactic is limited by rough terrain and low ground speed.

Hides

Water buffalo hides and by-products are absorbed into the wider market for cattle products. In 1989–90, over 21 000 hides worth an estimated $509 000 were produced in the Northern Territory. This dropped to 11 005 hides worth $198 000 in 1990–91.

Trade in livestock

Exports of live water buffalo from the Northern Territory peaked in 1986–87 when over 5000 animals worth $2.5m were shipped overseas (table 17.3). Major buyers include Brunei, Indonesia and, more recently, Cuba. Brunei imports live animals primarily for slaughter, while most other importers are purchasing breeding stock. In 1990–91, exports had fallen to 1807 head, worth $975 000. All these animals were shipped to Brunei. The value of breeding stock is enhanced by the absence of major bovine diseases in Australia (Garner & O'Brien 1988).

Domestication of water buffalo has been experimented with in Australia since 1920, but several factors have recently hastened progress. These include the dramatic effects of the BTEC program, which is reducing the feral population, and changes in land use such as the expansion of national parks (e.g. Kakadu), which is reducing habitat available for feral buffaloes. As a consequence, the size and distribution of feral herds have been substantially reduced, and farmed stock now offer the best option for development of the buffalo industry. This has generated a strong demand for good quality disease-free breeding stock for domestic producers.

Table 17.3: Number, destination and value of live buffaloes exported from Australia (all values in Australian dollars)

Destination		1980–81	1981–82	1982–83	1983–84	1984–85	1985–86	1986–87	1987–88	1988–89	1989–90	1990–91
Brunei	Number	118	43	692	227	1 593	1 332	1 649	2 345	1 365	1 231	1 807
	($'000)	28	9	189	51	370	306	474	961	754	609	975
Indonesia	Number	580	492	1 429	2 676	2 749	2 328	2 106	27	0	0	0
	($'000)	180	320	507	1 524	1 358	1 429	1 137	27	0	0	0
Sarawak	Number	0	0	0	0	0	199	160	926	371	0	0
	($'000)	0	0	0	0	0	55	77	357	185	0	0
Cuba	Number	0	0	0	0	0	0	1 466	0	0	1 267	0
	($'000)	0	0	0	0	0	0	806	0	0	1 140	0
Other	Number	0	201	681	0	25	155	87	189	0	0	0
	($'000)	0	136	272	0	6	38	25	89	0	0	0
Total	Number	698	736	2 802	2 903	4 367	4 014	5 468	3 487	1 736	2 498	1 807
	($'000)	208	464	969	1574	1 735	1 827	2 520	1 434	939	1 749	975

Source: Northern Territory Department of Primary Industry and Fisheries (all values in current dollars) Figures may not add to totals due to rounding

Non-commercial

Pest control

Water buffalo are culled by conservation authorities to control environmental damage. This culling is usually timed to take place after commercial harvesters

have removed as many animals as economically viable. The remaining feral buffaloes are removed by helicopter shooting, which is the most cost-efficient and widely employed method (Senate Select Committee on Animal Welfare 1991).

During the period 1985–1990, 5564 feral buffalo in parks and reserves administered by the Conservation Commission of the Northern Territory were shot from helicopters.

Disease eradication

Culling under BTEC has escalated since 1985 to account for at least 36 per cent (16 203 animals) of all water buffalo slaughtered in 1988–89 in the Northern Territory (table 17.1). Implementation of BTEC has had a dramatic and controversial impact on feral water buffalo herds and the domestic buffalo industry.

As with the pest control programs operating in environmentally sensitive areas, commercial harvesters initially remove feral buffalo from regions designated for destocking. However, some regions harbour populations that are either too small to be economically viable or are inaccessible to commercial operators. Infected herds in these regions are usually removed by helicopter shooting.

Hunting

Water buffalo are Australia's largest game animal and a highly prized quarry for local and international hunters. There were at least nine professional safari outfitters in the Northern Territory in 1990 and the water buffalo trophy fee averages about $1000 per bull. The number of animals taken by this form of hunting is difficult to establish. Safari outfitters are very independent and there is no formal industry structure. In addition to guided hunting, many animals are also taken by private hunters. The scale of private shooting is also unknown.

The declining populations of feral water buffalo could result in the demise of this species as a valuable hunting resource in Australia. An alternative viewpoint is that reduction in numbers will increase their value if managed adequately. At best, hunting will be restricted to specific regions where disease-free herds can be maintained.

Discussion

The buffalo industry in the Northern Territory is in a state of dramatic change due to depletion of the feral herds upon which the industry has previously depended. The rapid population decline is due to a combination of commercial and non-commercial harvesting pressures. However, since 1985 slaughters for disease eradication have become the dominant component of the total cull.

Meat production for export markets was the basis of the buffalo industry during most of the 1980s. With the collapse of the feral buffalo herds on which the industry has been dependent, the future of the water buffalo industry will now depend on development of domesticated disease-free herds. The growing demand for domesticated stock in Australia will boost livestock prices on the domestic market. However, there is a conflict between the objective of increasing the size of the domesticated herd and the need to maintain cash flow by slaughter. The buffalo industry is undergoing a huge transition.

In recognition of the opportunity to maintain a profitable buffalo industry, the Northern Territory government is supporting domestication efforts through the Buffalo Development Scheme. In this scheme, young buffaloes are captured during BTEC destocking and retained for local farms. Funds for erection of new fences have also been provided through BTEC. In 1981, there were about 2 700 domesticated water buffalo in Australia. By 1988, domesticated buffalo herds had increased to about 18 000 animals (Standing Committee on Agriculture 1989). Domesticated buffaloes are now also being farmed in Western Australia.

There are ready markets for high quality buffalo meat in Australia and overseas, and large tracts of land in tropical Australia are suitable for buffalo production. The outlook for the Australian buffalo industry is encouraging. The challenges now facing the industry are to solve livestock production and husbandry problems, and to develop an efficient and profitable trade based on domesticated buffalo.

18 ARABIAN CAMEL

Distribution and abundance

One-humped or Arabian camels (*Camelus dromedarius*) were brought to Australia several times between 1840 and 1907 to provide personal transport and for use as a draught animal in arid and remote regions (McKnight 1969). Their role was supplanted by motorised vehicles in the early 1900s, and many camels were either released or escaped to establish feral populations. The total population of feral camels in Australia is now at least 43 000 animals, distributed throughout Central Australia (Short et al. 1988). About 50 per cent of the camel population live in Western Australia, 27 per cent in the Northern Territory, and most of the remainder are in South Australia. Isolated populations also occur in Queensland.

Feral camels are well-adapted to the arid environments of Central Australia. Anatomical adaptations include the thermal insulation provided by the animal's coat, long legs that enable rapid movement over long distances, and a heavy pad on the foot which insulates against hot ground surfaces and provides good traction over sandy or stony substrates. Physiological adaptations include their ability to use water economically, to maintain blood volume during periods of water deprivation, and their capacity for rapid and complete rehydration (McKnight 1969).

Feral camels are primarily browsers and feed opportunistically on a wide range of plants (McKnight 1969). This habit, combined with an ability to travel great distances from water to forage, gives camels an advantage over other livestock in arid regions.

Camels are gregarious. An aerial survey showed that the average group size is about five animals, while the population density is generally less than one animal per square kilometre (Short et. al. 1988). Larger groups occur during drought, when camels are forced to congregate at scarce water supplies (Letts et al. 1979).

The effect of camels on the ecosystem is poorly documented. The low population density, browsing habits, broad dietary range, and soft feet have been the basis for suggestions (McKnight 1969; Letts et al. 1979; Grigg 1987; Long & Mawson 1990) that their impact in arid regions is likely to be less than for other feral animals such as donkeys and horses. Detrimental effects would increase with population density, for example during drought, or when farmed.

Feral camels in Australia represent the only substantial population of wild camels in the world.

Status

Feral camels are unprotected in all States and Territories of Australia. The introduction and keeping of camels is subject to conditions and restrictions in the Northern Territory, Western Australia, Queensland and South Australia.

Camels are classed as stock in the Northern Territory and Queensland, where they are slaughtered at abattoirs for the domestic meat trade. Feral camels present on national parks and conservation areas are regarded as environmental pests.

Commercial use

The worldwide population of Bactrian (two-humped) and Arabian (one-humped) camels is about 19 million (FAO 1989). Arabian camels account for most of the world camel population, and most Arabian camels (14.5 million) are found in Africa.

Camels are an important means of transport, and a significant source of meat, milk, and fibre in some African and Middle East countries (Wilson 1978; Babiker 1984; Khalifa 1988). For example, in the Sudan (which has the second largest population of camels in the world after Somalia), camels produced 33 657 tonnes of meat in 1985–86, or 8.8 per cent of total meat consumption in the nation (Salih & Musa 1988). The trade in camel meat is the most important commercial use of camels in the Middle East and Africa. However, it is usually consumed

by low income groups who purchase it owing to their income limitations, rather than by preference (Babiker 1984; Khalifa 1988). Camel hide has little commercial value (Wilson 1984).

In Australia, commercial use of feral camels only occurs on a small scale. The three main uses are slaughter for meat production, sale as livestock, and for tourist pleasure rides.

Meat production

Two types of camel meat production occur in Australia. Firstly, camels are field-shot in the Northern Territory or Western Australia to produce pet meat for the domestic market. The carcases are cut into portions and transported to field chillers to await transport to a processing facility for boning and packing for sale. The meat is retailed in Western Australia and the Northern Territory as fresh or frozen meat or mince. The retail value in 1990 was between $1.50 and $2.00 per kilogram.

Camels can also be slaughtered for pet meat at registered knackeries in Queensland, but no slaughters have been recorded since 1985. There are no readily available figures to show either the number of animals killed or the quantity of pet meat produced from camels in Australia.

Secondly, camels may be captured, transported to an abattoir, and slaughtered to produce meat for the domestic restaurant trade. This is a new and novel industry, which began in 1988 when an abattoir near Alice Springs in the Northern Territory began processing camels for meat. The methods of capture are trapping at watering points using a yard enclosure, or mustering into portable yards using vehicles. Live adult camels are worth about $300 when delivered to an abattoir. The slaughter method and processing is the same as for domestic cattle.

Adult male camels can weigh more than 700 kilograms (Newman 1983; Babiker 1984). A study in the Sudan (Yousif & Babiker 1989) found that the average live weight of adult male camels in good condition was about 450 kilograms, yielding a dressed chilled carcase of about 252 kilograms (table 18.1). By comparison, 159 camels that were slaughtered in the Northern Territory during 1989–90 produced 41 646 kilograms of meat, or 262 kilograms per animal (Anon. 1991).

Table 18.1: Carcase composition of Sudanese camels

Product	Percentage	Kilograms
Muscle	56	141
Bone	19	48
Fat	13.7	35
Trim	7.5	19

Source: Yousif & Babiker 1989

Sale of camel meat to restaurants and retail stores is new to Australia, having commenced in October 1988. Wholesale prices vary depending on cut: prime cuts such as scotch fillet sold for $32 per kilogram in early 1991, while lower grades such as topside and silverside sold for about $8 per kilogram. Trade in prime cuts is strong; however, lower grade cuts have proven difficult to sell because there is little demand for these products within the restaurant industry. Camel meat is clearly a novelty product that is sold to upmarket consumers (mainly tourists), particularly in Queensland and the Northern Territory. No camel meat has been exported in commercial quantities to date.

Livestock

Australian feral camels are free of major livestock diseases (Garner & O'Brien 1988; Siebert & Newman 1989) and represent a potential source of breeding stock for overseas countries where the camel is used as a production (milk and fibre) or racing animal.

Very few camels are captured, domesticated, and exported from Australia. Most exports are from the Northern Territory, and records held by the Northern Department of Primary Industry and

Fisheries show that since 1978–79:

- 38 camels were exported in 1984–85;
- 93 camels were exported in 1988–89 (eight to Brunei and 85 to the United States of America); and
- 30 camels were exported in 1989–90 (six to Brunei and 24 to Cuba).

The largest export market for Australian camels is the United States of America where they are used by tourist enterprises and zoological collections.

Camel racing is of some social and economic importance in countries such as Saudi Arabia and the United Arab Emirates, and a small market exists for well-bred animals in these countries (Babiker 1984). Good quality racing camels can be worth almost as much as a thoroughbred racehorse (Snow et al. 1988). However, feral camels are unlikely to be competitive with animals that have been selectively bred for racing, in the same way that wild horses are unlikely to be valuable to the thoroughbred horseracing industry. The main value of Australian feral camels for livestock concerns their resilience to environmental stress, which is a result of their wild origins.

Most of the feral camels exported so far have been for zoological collections. The unit value of live camels destined for export is unknown. However, the costs of capturing feral camels from remote regions, and then domesticating and delivering them to a port are considerable.

Tourism

A few feral camels are captured, broken in, and used to provide short tourist rides, or longer treks. Most of these enterprises are based in the Northern Territory. Camel racing has developed into a novelty event in some centres such as Alice Springs in the Northern Territory and Bordertown in South Australia. The success of these ventures is tied to the fortunes of the tourist industry.

Non-commercial

Feral camels damage fences and foul watering points, particularly during times of drought (Letts et al. 1979). However, there is no coordinated control of feral camels in any Australian State or Territory, and landowners are responsible for controlling camel numbers. Therefore, there are little data on the number of feral camels killed for pest control.

Control techniques include field-shooting and enclosure trapping at watering points. Some feral camels are shot as part of other control activities by State and Territory pest control agencies. The Agricultural Protection Board in Western Australia shot at least 111 feral camels in 1988–89 and at least 578 in 1989–90 (Agricultural Protection Board 1990).

Discussion

Commercial use of feral camels in Australia is negligible and the short-term prospects for expansion are uncertain. The best prospects for increasing the size of the camel industry in Australia are probably to expand sales of meat on the domestic market and to develop tourist enterprises. Livestock exports are often touted as potentially lucrative, but the small number of these exports so far suggests that these specialist markets are uncertain.

A greater degree of industry organisation may improve the scale of the live camel export industry. The current arrangements are ad hoc, with suppliers capturing wild camels in response to occasional import inquiries, rather than being based on preparation and marketing of animals with the required qualities.

A long-term strategy of capturing wild camels, and selecting and breeding animals with characteristics required in particular markets, such as for racing, milk, meat or fibre, may prove successful. Careful market research would be necessary before investing in such an enterprise. However, a camel farm that also incorporated a tourist enterprise could be a more attractive investment.

The commercial viability of harvesting camels for meat, either as pet food or for human consumption, is limited by the practical and economic constraints associated

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with operating in remote regions. The freight costs to haul livestock or refrigerated trailers over long distances are high. Further, handling and transporting wild camels could injure the animals, unless special care is taken. Injuries reduce the value of stock and raise animal welfare concerns.

The Australian domestic market for camel meat has not been fully tested. At present, all camel meat is sold through gourmet restaurants. There has been little effort to define the various cuts of meat, which complicates development of more efficient marketing of camel meat. Further, the meat quality can be highly variable, depending on the age, sex and condition of the animals captured. Abattoirs tend to slaughter animals in batches, pack the meat, and store it for many weeks (or months) until sold. This practice is economical for the processor, but frustrating to restaurant owners seeking fresh high quality product.

The largest overseas markets for camel meat are in developing countries such as Egypt and Nigeria, where the meat is sold as a down-market product. Increasing camel populations overseas, combined with declining demand for the meat, has led major producers such as the Sudan and Somalia to seek new markets outside Africa and the Middle East (Babiker 1984). The prospects for export of camel meat from Australia are not encouraging at present. If an export market for Australian camel is established, strong competition from developing countries can be expected.

The low population density and wide distribution of feral camels increases harvest (or control) costs. The most cost-effective time to harvest camels is likely to be during a drought, when the animals are concentrated around watering points.

Non-commercial harvesting carried out by State and Territory vertebrate pest control authorities is usually an adjunct to the control of more important pest animals. If more evidence of the deleterious effects of camels is presented, greater control may become necessary, particularly in areas with conservation value.

Camels are well adapted to the arid regions of central Australia. Until profitable markets for camel products are identified and developed, there is little incentive to expand commercial use by wild harvesting or farming. Nonetheless, the scale of production and trade in camel products overseas is sufficiently large to encourage periodic reappraisal of the prospects for Australian feral camel products.

19 CANE TOAD

Distribution and abundance

The cane toad (*Bufo marinus*) is an amphibian with a natural distribution across Central and South America (Easteal 1981). It has been extensively introduced to the Caribbean Islands, Hawaii, the Philippines, New Guinea and many other Pacific Islands (Easteal 1981). Many of these introduced populations have since thrived and are now regarded as pests.

Cane toads were introduced into North Queensland in 1935 to control the grey-backed cane beetle, *Lepidoderma albohirtum* (Easteal 1981). Although overseas experiences have yielded circumstantial evidence of the efficacy of cane toads as a biological agent (Freeland 1984), there is no experimental evidence that they have provided short-term control of any agricultural pest in Australia.

Cane toads have colonised most of northern and coastal Queensland, as well as recently extending into coastal areas of northern New South Wales and eastern Northern Territory (Freeland & Martin 1985). Population densities around waterholes in the Gulf of Carpentaria lowlands reach as high as 5000 animals per hectare during the dry season (Freeland & Kerin 1988).

The total number of cane toads in Australia is unknown, but apparently increasing as their range extends into new regions. A notable observation relating to the spread of cane toads is an apparent tendency for a decrease in population density with time (Freeland 1986). Reductions in body size and body condition have also been associated with the drop in population density (Freeland 1986); however, the explanation for this observation is unclear.

Status

Cane toads are not declared as pests in any State or Territory of Australia. Besides the present lack of convincing evidence of the impact of cane toads, there is no practical method available to control them. As a result, cane toads are unprotected fauna and no special licenses are necessary to harvest them for commercial purposes.

One legislative restriction that can influence commercial trade is that cane toads are prohibited entrants to some States and Territories. For example, live cane toads cannot be imported into the Northern Territory because they are not included in Schedule 4 of the Territory Wildlife Regulations of the *Territory Parks and Wildlife Conservation Act 1988*. Live cane toads can only be imported into Western Australia and South Australia for research purposes if permits are issued by State vertebrate pest control authorities.

Commercial use

Cane toads are used commercially in Australia in three ways: as biological specimens, for their products, and by taxidermists to produce souvenir items (figure 19.1). The estimates of use provided by industry participants show that less than 30 000 toads are used each year, and use as biological specimens is the most important component of trade.

Research and teaching laboratories in northern Queensland have been using cane toads as biological specimens for at least two decades. Indeed, many schools and universities in Queensland can now collect all the cane toads they require from local sources, and therefore don't rely on commercial suppliers. However, institutions outside Queensland depend on commercial suppliers to obtain cane toad specimens.

Cane toads are collected from the wild and then air-freighted to buyers of biological specimens. These animals are shipped interstate from Queensland to all parts of Australia, except the Northern Territory. Between 16 000 and 20 000 live cane toads are sold interstate from Queensland each year. The number used within Queensland is unknown.

The value of live specimens varied from $1.50 to $5.00 each in 1990, depending on size. Cane toads over 130 mm long fetch

the highest price; however, they are generally only available in limited numbers. A few cane toads are preserved (either in phenol, formalin, alcohol or glycerin) and sold as biological specimens. Some of the preserved specimens are exported to universities in Germany and New Zealand.

The second and more recent commercial use of cane toads is for production of goods such as leather from the skin and toxin from the parotoid glands. Cane toad skins can be tanned to produce a high quality exotic leather which is used as a feature or highlighting material on fashion articles such as wallets and handbags. The average value of tanned cane toad skins was about $4.00 each in 1990, while the average retail value of finished products, such as wallets or keyholders, was about $27.00.

Production and sales of cane toad leather developed rapidly in Australia since early 1988. The main limitation to further commercial use is the lack of adequate large toads. Unless the skin is at least 80 mm long, it is uneconomical to process.

Trade in toad skins has also developed in other countries, such as the Philippines, where abundant populations of cane toads occur. Nonetheless, the skin market, both in Australia and overseas, demands large toads, which are difficult to supply.

Toads secrete a toxin through parotoid glands and dorsal glands located just posterior to the eye. The venom is a passive defence mechanism that is highly toxic. Domestic dogs that are well exposed to the toxin can die within 15 minutes of the onset of symptoms (Knowles 1964). The toxicity of cane toad venom has raised concerns over the potential impact of cane toads on native predators such as snakes, goannas, and birds (Freeland 1984). However, no studies have proven any persistent effect of predation by cane toads on other animals in Australia.

Cane toad venom, or bufotoxin, is used for pharmaceutical purposes, particularly in traditional medicine in some Asian countries. Market prices vary according to quantity and demand. Quantities of less than 1 kg traded for around $100 per gram in 1990. Adult cane toads are individually 'milked' for bufotoxin, but the quantity produced is highly variable. The bufotoxin is vacuum-dried and sold as a powder. To collect the venom efficiently, it would be necessary to farm cane toads.

Taxidermists have recognised the novelty value of the cane toad and now collect and preserve whole toads for sale as souvenir items. Several thousand preserved cane toads were sold at the World Expo in Brisbane in 1988. The retail value is about $20 each.

Non-commercial

There is presently no organised non-commercial killing of cane toads. However, the Council of Nature Conservation Ministers has provided funding for research into options for biological control of cane toads. Further, in early 1990 the Federal Government committed $1.25m over three years for research into ways of controlling cane toads. The search for biological control agents is now underway (Speare 1990).

There is little data to support the perception that cane toads have a substantial negative impact on native animals. Indeed, a recent study (Freeland & Kerin 1988) found that cane toads had no observable impact on native frog communities or populations. Nonetheless, some action may be taken to stop or slow the spread of cane toads to ecologically sensitive regions such as Kakadu National Park in the Northern Territory.

Conclusions

Commercial use of cane toads occurs on a small scale, and the best opportunity for expansion appears to lie with toad products such as leather and bufotoxin. The total revenue generated by the commercial use of cane toads is likely to be less than $150 000 per year.

Some doubt remains over the impact of the cane toad on native ecosystems. Present data suggest the effect may be nil or small. However, if the negative impact is

determined to be unacceptably high, and a practical and cost-effective method of control can be devised, organised pest control may happen.

The evidence from Australia and overseas which suggests that invading cane toads decrease in size and population density in the long term has important implications for both commercial use and pest control. Future commercial use of cane toads will depend on a steady supply of large animals, while the impact of cane toads on native habitats could decrease with population density. It appears that farming is likely to be the best option for efficiently producing large quantities of bufotoxin, along with skins of adequate size.

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20 DEER AND OTHER SPECIES

Over 20 species of deer were introduced into Australia, largely during the nineteenth century, and six species now survive in the wild. These are fallow (*Dama dama*), the chital (*Axis axis*), hog (*A. porcinus*), red (*Cervus elaphus*), rusa (*C. timorensis*) and sambar deer (*C. unicolor*) (Bentley 1978). The distribution of these deer is patchy, which partly reflects the sites of first release rather than areas into which deer have dispersed (Wilson, Dexter, O'Brien & Bomford 1992). The largest species is the sambar, with males weighing on average 190 kilograms, while the smallest is the hog deer, with males weighing 42 kilograms on average.

The legal status of wild deer is inconsistent, with Victoria and Tasmania affording them protection under wildlife legislation, and other States classifying wild deer as feral animals. Accurate estimates of wild deer numbers in Australia are scarce, but a rough estimate of the total is 48 200 head (Cribb 1991).

The main purpose of the introductions of deer to Australia was for recreational hunting with firearms or hounds. Today, wild deer are still a sought after quarry for recreational hunters in Australia. However, these deer have also been a valuable source of breeding stock for the emerging deer farming industry. Deer farming was initially reliant on the use of enclosure traps to capture wild deer for breeding stock (English 1981). Dependence on wild captures has declined recently, with emphasis now on farm breeding and import of red deer and wapiti (*C.e. nelsoni*) from New Zealand (Ramsay & English 1991).

In 1991, the Australian deer farming industry held about 130 000 head of livestock on farms. During the mid-1980s, fallow deer were the dominant species, comprising some 65 per cent of the national herd. This proportion has now declined to about 40 per cent, with red deer comprising 50 per cent and other species (rusa, chital and sambar) the remaining 10 per cent (AACM 1991).

The deer farming industry in Australia

During the 1980s, the Australian deer industry was aiming to increase stock levels, and consequently, trade in breeding stock and sale of velvet were the main sources of income. However, the deer industry is entering a new phase of its development where venison and velvet are the principal sources of income. This is a challenging time for the industry, which faces the classic dilemma of a small and emerging industry with a long agenda of important actions, but few resources to implement them. The deer industry is now working closely with the Rural Industries Research and Development Corporation (RIRDC) and is implementing an industry development strategy.

A detailed analysis of the Australian and international trade in deer and deer products was prepared recently in a report on deer marketing and production for the RIRDC by AACM (1991). The following discussion draws heavily on the AACM report.

World trade in venison is thought to be about 11 000 tonnes per annum. Germany is the dominant importer, but Japan, the USA and other European countries import significant quantities. Taiwan and South Korea are also emerging as potential growth markets for venison.

The largest exporter of venison is Poland, followed by New Zealand and eastern European countries including Hungary. Australia exports small quantities of venison, but domestic slaughters are still too low to supply the domestic market. A large component of the domestic venison market is therefore supplied by imports from New Zealand. Venison is a meat with low fat attributes which should appeal to health-conscious consumers. However, most venison consumed within Australia, and in many overseas countries, is sold through the food service industry as a gourmet food.

A consumer survey by AACM (1991) found that people who consume venison

in Australia tend to be in higher income professional occupations, in the 41–65 year age group, and have at least one parent born in Europe. Venison marketing in Australia is at a very early stage of development. Product quality and availability have, at least in the past, tended to be highly variable. The Australian deer industry is now working to improve the quality and consistency of venison supplies, and has developed a formal descriptive language for the various meat cuts available.

An important component of the income from deer farming comes from the sale of the antler velvet. This is used to manufacture oriental medicines, and Korea is the major importer on the world market. Other products of value are the skin, which is used for high quality garment leather, and the tails, pizzles and tendons which are used for oriental medicines.

The New Zealand deer industry is about ten times larger than the Australian deer industry, with over 1 million animals in farms, and will continue to have a major influence on the prospects for the Australian industry throughout the 1990s.

Other species

There are many other species of wild animals that are used commercially, or have commercial potential.

Native birds

One industry with a significant volume and value of trade is the native bird industry. Many abundant native birds, including the sulphur-crested cockatoo and the galah, are collected as hatchlings each year to supply the domestic pet trade. These harvests are controlled by the State agencies responsible for conservation. The domestic market for native birds seems to be saturated, but there is considerable demand for these birds in international markets. However, no native birds can be exported live for commercial purposes under existing Commonwealth legislation.

The question of whether to allow exports of live native birds is a controversial issue. Species such as the sulphur-crested cockatoo and the the galah are regarded as a significant pest in some grain-growing areas, and landowners shoot and poison large numbers each year. It has been argued that it would be more appropriate to have a sustainable harvest of these populations to reduce the impact on agricultural productivity. This would also be consistent with the philosophy of sustainable use of wildlife as a method of achieving conservation objectives. However, adult birds are not suitable for the pet trade. It has also been argued that allowing a legal trade would reduce the incentive for poachers and smugglers involved in supplying overseas buyers. However, there are also concerns that this would encourage poachers to switch their activities to less common species. Further informed debate on the merits or otherwise of commercial use and export of native birds is needed.

Feral donkeys

Several thousand feral donkeys (*Equus asinus*) are shot for pet meat in the Northern Territory and Western Australia each year to supply domestic and export markets. The animals are shot with a heavy calibre rifle, before being eviscerated, cut into quarters and transported to a field chiller to await transfer to a processing

Table 20.1: Number of donkeys killed by helicopter shooting in Western Australia since 1981–82

1981–82	56 000
1982–83	31 800
1983–84	43 500
1984–85	29 057
1985–86	27 228
1986–87	26 441
1987–88	33 990
1988–89	30 822
1989–90	49 990

Source: Agricultural Protection Board 1990

facility. A major problem for the industry is that the large donkey populations are in remote and rugged areas which are difficult to access and costly to operate in. Industry participants report that the harvest was substantial during the 1970s, with in excess of 30 000 donkeys being processed annually.

Today, the commercial harvest has largely been supplanted by helicopter shooting for pest control, where the animals are shot to waste. Table 20.1 shows the scale of the helicopter shoots in Western Australia. The cost of the Western Australian helicopter shoots in 1989–90 was $312 000.

APPENDIX

Australian Harmonised Export Commodity Classification codes

(used in compiling this report)

Code	Description
0104.20.90	Live goats (excluding angora)
0204.50.00	Meat of goats, fresh, chilled or frozen
0205.00.00	Meat of horses, asses, mules or hinnies, fresh, chilled or frozen
0208.10.00	Meat and edible meat offal of rabbits or hares, fresh, chilled or frozen
0208.90.10	Kangaroo meat, fresh, chilled or frozen
0503.00.00	Horse hair and horse hair waste
0511.99.20	Kangaroo and wallaby meat, unfit for human consumption
4101.40.00	Hides and skins of equine animals, fresh, or salted, dried, limed, pickled or otherwise preserved but not further prepared
4103.10.00	Goat or kid hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.61	Kangaroo, *Macropus rufus* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved but not further prepared
4103.90.62	Kangaroo, *Macropus giganteus* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.63	Kangaroo, *Macropus fuliginosus* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.64	Kangaroo, *Macropus robustus* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.65	Wallaby, *Macropus parryi* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.66	Wallaby, *Macropus rufogriseus* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.67	Wallaby, *Thylogale billardierii* sp, raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared
4103.90.68	Kangaroo raw hides and skins, fresh, salted, dried, limed, pickled or otherwise preserved, but not further prepared (excluding *Macropus rufus, Macropus giganteus, Macropus fuliginosus, Macropus robustus, Macropus parryi, Macropus rufogriseus and Thylogale billardieri*)
4106.11.00	Goat or kid skin leather, without hair on (excluding leather of 4108 or 4109), vegetable pre-tanned
4106.12.00	Goat or kid skin leather, without hair on (excluding leather of 4108 or 4109), otherwise pre-tanned
4106.19.00	Goat or kid skin leather, without hair on (excluding leather of 4108 or 4109), other
4106.20.00	Goat or kid skin leather, without hair on (excluding leather of 4108 or 4109), parchment dressed or prepared after tannin
4107.90.12	Leather of kangaroo, without hair on (excluding leather of 4108 or 4109)
4301.20.00	Raw, whole furskins of rabbit or hare
4301.60.00	Raw, whole furskins of fox
4301.80.10	Raw, whole furskins of kangaroo and wallaby
4301.80.20	Raw, whole furskins of opossum
4301.80.30	Raw, whole furskins of cat
4302.12.00	Tanned or dressed, whole furskins of rabbit or hare, not assembled

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