

**PART ONE**

**HISTORY, DISTRIBUTION AND BIOLOGY**

# 1. History of Introduction and Spread

## Section summary

*Horses were first introduced to Australia in 1788. Irregular shipments of horses followed, mostly from the Cape Colony. Mortality was high during the early voyages and presumably only the hardiest horses survived. The start of recognised horse racing in 1810 prompted an influx of quality thoroughbreds from England. Horses adapted well to conditions in eastern Australia, and the number grew to about 3500 by 1820.*

*Initially, the demand for riding horses was low and they served mainly as utility horses or working farm horses. The number of horses in eastern Australia rose sharply between 1830 and 1850 from 14 000 to 160 000, largely by natural increase. Draught horses began to replace bullocks for transport in the 1850s and 1860s. The opening up of pastoral lands owed much to horses.*

*The first record of horses either escaping into the bush or being abandoned was made in 1804. Minimal fencing combined with infrequent musters led to the growth of feral herds of abandoned and stray stock. Feral herds were first recognised as pests in the 1860s. Many horses became redundant with the increase in mechanisation, giving rise to large unmanaged herds, particularly in the extensive cattle-raising areas.*

### 1.1 Arrival of horses in Australia

Horses were introduced into Australia in 1788 with the arrival of the First Fleet (Australian Encyclopaedia 1983; Kennedy 1986). One stallion, three mares and three juveniles of Arab/Barb stock were shipped from Cape Colony and arrived in Sydney

Cove in good condition (Barrie 1956; Kennedy 1986).

### *'Horses arrived with the First Fleet in 1788.'*

Irregular shipments followed, mostly from the Cape Colony, and some stallions of Arab blood were imported from India to help improve stock (Barrie 1956). Early government reports indicate that horses adapted well to conditions in eastern Australia. By 1800 there were about 200 horses, and by 1820 around 3500 (Kennedy 1986). Saddle breeds, predominantly Arab and cross-bred Arabs, strongly dominated imports before 1820 (Barrie 1956; Kennedy 1986). The demand for riding horses was low and they served mainly as utility horses or working farm horses. Government priorities in the new colony focused on livestock production for meat (cattle, sheep, pigs) rather than for riding (horses) (Barrie 1956; Kennedy 1956; Lang et al. 1983). Improvement in horse stocks relied largely on the private settlers (Kennedy 1986).

Before 1820, about 20% of shipped horses died during the voyage, with only the most hardy surviving. Importers learnt the value of selecting robust stock to reduce losses. After 1820, imports of horse breeds were more varied, and included ponies, saddle, harness and draught horses (Kennedy 1986).

Recognised horseracing began in Sydney in 1810 and prompted an influx of quality thoroughbreds from England (Barrie 1956; Australian Encyclopaedia 1983). This led to an improvement not only in racehorses, but also in stock and work horses, as thoroughbred bloodlines began to dominate (Australian Encyclopaedia 1983).

The number of horses in eastern Australia rose sharply between 1830 and 1850 from 14 000 to 160 000, largely by natural increase. Draught horses began to replace bullocks for transport in the 1850s

and 1860s (Kennedy 1986). As the colony matured and expanded, horse-breeding became an important rural industry (Kennedy 1986).

## 1.2 Horses in exploration and pastoral development

Settlement was confined to the Sydney region until the early 1800s. There were four horses on the first crossing of the Blue Mountains (Barrie 1956) in 1813 which promoted a general expansion of the colony (Australian Encyclopaedia 1983). Grazing lands were opened up and the need for fast and enduring saddle horses increased (Lang et al. 1983).

Most of Australia's explorers relied on horses and bullocks for transport (Kennedy 1986). Camels were not used until 1860, when they were imported especially for the Burke and Wills expedition (Australian Encyclopaedia 1983).

During the nineteenth century, Australia developed a pastoral economy and grazing gradually occupied all but the harsh deserts. Horses were important for cattle and sheep droving. Much of the better-watered land was occupied by 1850, with further expansion into the more remote and arid regions in the latter half of the century (Kennedy 1986).

## 1.3 The process of becoming feral

A feral animal is an exotic animal which was initially introduced for domestic purposes, but which now has populations which survive and reproduce in the wild state (Berger 1986). This compares to non-feral pests such as foxes, which were never domesticated in Australia, but deliberately introduced as a free living animal. Domesticated horses can become feral simply by being left to fend for themselves (Berger 1986). Unmanaged horses and their descendants revert to a wild pattern of behaviour (McKnight 1976), ranging freely to feed and reproduce without human interference.

*'Little or no fencing and incomplete musters led to wild populations of domestic livestock including horses.'*

## 1.4 Sources of feral herds

Extensive pastoralism in Australia encouraged the establishment of feral herds. Little or no fencing, combined with infrequent and incomplete musters, led to feral populations of domestic livestock, including horses. Feral horse herds had many sources, including horses that strayed or were abandoned when stations failed, and horses that were lost from droving plants (McKnight 1976).

The decline of the Indian army remount trade after World War I created a further source of unwanted horses. Increasing mechanisation led to low prices for horses and most inland horse breeding stations switched to cattle, leaving their horses unmanaged. Further contributions to feral herds came from the deliberate release of stallions into the feral mobs to upgrade the herds from which stock horses were taken (McKnight 1976).

Conditions in Australia were generally suitable for horses, drought being the main factor restricting their dispersal (McKnight 1976). Fortunately, horses brought early into Australia were free of disease (Kennedy 1986). The long sea voyage and poor transport conditions meant that only the healthiest horses survived. Subsequent quarantine laws reduced the likelihood of disease entering the country. It is believed that the near absence of disease and large predators enabled feral horse numbers to increase relatively unchecked except for the degradations due to drought.

## 1.5 Spread of feral horses

Pastoral activities spread outward from the Sydney region in the early 1800s. The first records of horses escaping into the bush or of being abandoned date from 1804 (Rolls 1969). 'Bush horses' were

plentiful in the hills around Sydney by the 1830s (Sidney 1854, cited in McKnight 1976). Feral herds gained recognition as pests during the late 1860s (Rolls 1969).

The initial appearances of feral horses in the broad regions of Australia (Table 1) are linked to the spread of settlement and grazing.

Date	Region	Reference
Early 1800s	Eastern Tasmania	McKnight 1976 Australian Encyclopaedia 1983
1820s	Northern Australia (Cobourg Peninsula)	Letts 1962
1830s	Victoria	Australian Encyclopaedia 1983
1840s	Southern Queensland Southern South Australia Southern Western Australia	Australian Encyclopaedia 1983 Implied – Australian Encyclopaedia 1983 Long 1988
1860s	Northern Queensland	McKnight 1976
1870s	Southern and northern Northern Territory	Australian Encyclopaedia 1983
1880s	Kimberley, Western Australia	Australian Encyclopaedia 1983

**Table 1:** First occurrence of feral horses in various parts of Australia.

## 2. Distribution and Abundance

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### Section summary

*Australia has the largest number of feral horses in the world. Most feral horses occur in remote, usually rugged, semi-arid areas.*

*The total Northern Territory feral horse population was estimated at 206 000 based on aerial surveys in the early 1980s. Queensland was estimated to have 100 000 feral horses in 1982, mainly in the northern and western regions. Most are on extensive pastoral country, particularly in unfenced areas and on stations with absentee landlords. In Western Australia, the main concentrations of feral horses are in the Kimberley, the east Pilbara and northern Goldfield districts.*

*South Australia's feral horses are mainly in the arid northern pastoral zone, in some national parks and on some stations. The major concentration of feral horses in New South Wales is in the south-eastern subalpine areas. Many small herds inhabit national parks and State forest. In Victoria most feral horses are found in alpine regions.*

### 2.1 World distribution

***'Australia has the world's largest population of feral horses, approximately 300 000.'***

Australia has the largest population of feral horses in the world (estimates range from 300 000 to 600 000) (Berman and Jarman 1987; Clement et al. 1990) followed by the western United States of America with an estimated 40 000 (Berger 1986). Small populations also occur on islands off the east coast of North America, on the North Island of New Zealand (approximately 1100) (Rogers

1989), in South Africa and possibly other countries, although information is scant. Most feral horses occur in remote semi-arid areas with natural water supplies and sparse human settlement.

### 2.2 Domestic horses in Australia

Clement et al. (1990) estimated that there were approximately 650 000-700 000 domesticated horses in Australia. Most are on agricultural properties in Queensland and New South Wales, followed by Western Australia and Victoria (Pilkington and Wilson, in press). Although modern domestic horses are a potential source of feral populations, most are unlikely to become feral because of their location and management. Those in extensive pastoral districts present the greatest risk of contributing to feral populations.

### 2.3 Australian feral horse populations, distribution and abundance

Feral horses occupy most of the habitat to which they are suited in Australia. Populations are dynamic, fluctuating in response to seasonal conditions and human intervention (McKnight 1976). Numbers increase in wetter seasons and decline during drought, when many horses die of starvation or thirst, or from eating toxic plants (Berman and Jarman 1987). Increases of around 20% a year have been recorded in North America under good conditions (Eberhardt et al. 1982). Drought is a common feature of extensive pastoral areas and is the main limit, apart from human intervention, on horse numbers. Organised control operations have been used to reduce feral horse numbers in some areas.

Feral horses are widely dispersed and most common throughout most of the extensive cattle-raising districts of the Northern Territory and Queensland and, to a lesser extent, Western Australia. They are uncommon in extensive sheep-raising districts because the stations are generally

smaller and more intensively fenced, and also because the original numbers of domestic horses, from which the feral herds were derived, were small (McKnight 1976). Information on feral horse distribution and abundance for each State and Territory follows.

The major concentrations of feral horses are in Queensland and the Northern Territory. Substantial numbers occur also in Western Australia and South Australia, with smaller populations in New South Wales and Victoria. There are reportedly none in Tasmania or the Australian Capital Territory. Table 2 presents available data, much of which is either of questionable reliability or old.

From a land management perspective, it is sufficient to know the feral horse density for a given region rather than the total numbers. Maximum densities for whole properties of one horse a square kilometre, approximately 30% of cattle density, have been recorded in the Alice

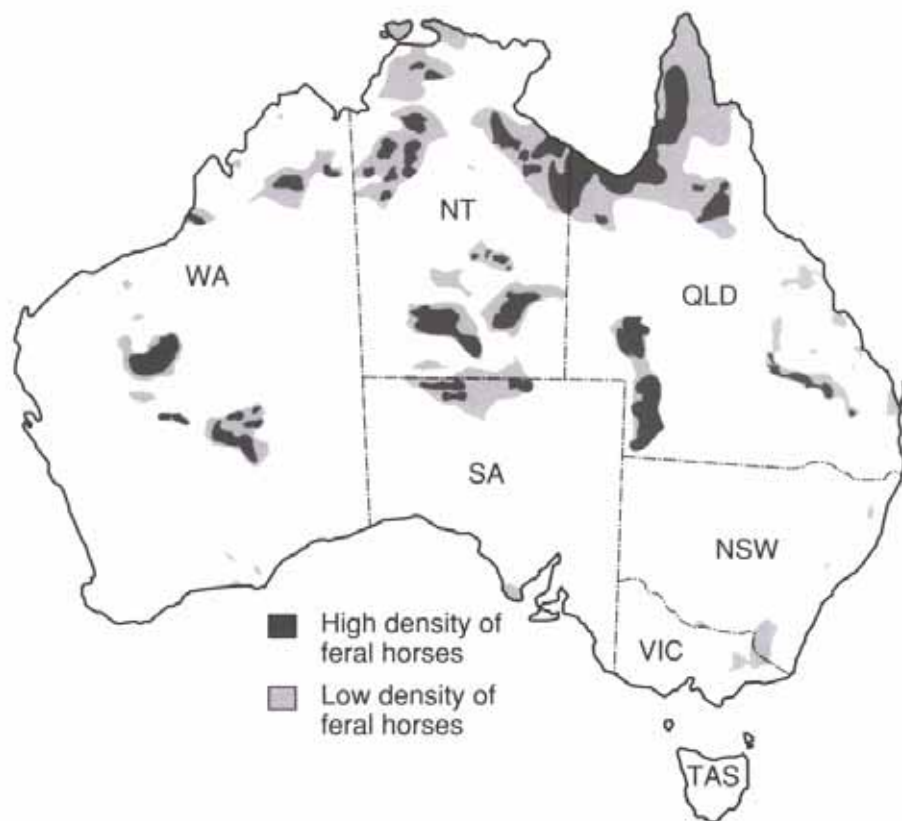
Springs region (Berman 1991). Approximate feral horse densities in various Australian regions are shown in Figure 1.

### 2.3.1 Northern Territory

The total Northern Territory feral horse population in the early 1980s was estimated at 206 000, based on aerial surveys by the Conservation Commission of the Northern Territory (CCNT) between 1981 and 1984. Horses are common in the Victoria River District, Gulf Country, Arnhem Land/Darwin region and Alice Springs region. The central ranges area of the Alice Springs region was resurveyed in 1988 and numbers had declined to approximately 23% of their level four years earlier (Low and Hewett 1990). Dry seasonal conditions and feral horse control contributed to the decline. The population could return to high levels within three or four years with favourable rainfall and pasture growth.

State or Territory	Estimated population	Method	Source
Northern Territory	206 000	Aerial survey	Graham et al. 1982 a,b
		Aerial survey	Graham et al. 1986
Queensland	100 000	Interview	Mitchell et al. 1982
Western Australia	10 000–20 000	Subjective assessment by authors	Various pers. comms.
South Australia	3000–10 000	–	Various pers. comms.
New South Wales	5000–10 000	Questionnaire or interview	McKnight 1976
Victoria	1000–3000	–	Dyring 1990
Tasmania	Nil	–	Gregory, Department of Primary Industry and Fisheries (DPIF) Tasmania, pers. comm. 1991
Australian Capital Territory	Nil	–	Dyring 1990

**Table 2:** Estimated sizes of feral horse populations within each State and Territory of Australia.



**Figure 1:** The main concentrations of feral horses in Australia based on the data in Table 2. Other small scattered populations probably exist in the extensive pastoral districts.

*'Some properties in central Australia had more than one feral horse to every three cattle.'*

Analyses of aerial survey data for the Alice Springs district indicated a low density of both horses and cattle in sand dune and sand plain spinifex areas (Bowman 1985). Horse density was highest in spinifex hills and scrubby hills and near natural waterholes or dams. Cattle were more commonly found in areas with bores or dams.

During the early 1980s, some properties in central Australia had more

than one feral horse to every three cattle (Graham et al. 1986). Estimates by pastoralists of feral horse numbers per station indicated that 8% of 38 stations surveyed supported more than 2000 feral horses each (Bowman 1987b).

Feral horses are common in the north of Vanderlin Island in the Gulf of Carpentaria (Johnson and Kerle 1991), and also occur on Bathurst and Melville Islands off Darwin (B. Walsh, CCNT, pers. comm. 1991). There are about 400 Timor ponies on the Cobourg Peninsula (Letts et al. 1979).

### 2.3.2 Queensland

Based on a questionnaire, Mitchell et al. (1982) estimated that approximately 100 000 feral horses inhabit Queensland, mostly in the northern and western regions. Main concentrations are in the Gulf region (particularly the north-west), the west of Cape York Peninsula, near Hughenden, Georgetown and Croydon, and in far south-west Queensland. East of the Great Dividing Range there are a few small scattered populations. Most are in extensive pastoral country, particularly in unfenced areas and on stations with absentee landlords. Scrub or open forests fronting a creek were reported as favoured habitat, although in the western division mulga plains and sandhill country are also favoured (Mitchell et al. 1982). Water availability was reported as a strong influence on their distribution.

Feral horse numbers in Archer Bend and Rokeby-Croll Creek National Parks were reduced a few years ago by shooting, and currently horses persist in low to moderate densities (B. Vincent, Department of Environment and Heritage (DEH), pers. comm. 1991). Substantial numbers probably occur in Staaten River National Park, with few in Lakefield National Park.

In the Mareeba Shire they occupy rough hilly country (B. Toms, Department of Lands (D of L), pers. comm. 1991).

Several hundred feral horses were reported to be on Fraser Island (McKenzie et al. 1990) although, more recently, park rangers report the horse population to be around 40. Only four horses remain on Moreton Island, off the coast of Brisbane, where for environmental reasons there was recent culling (C. Poffitt, DEH, pers. comm. 1991).

Low numbers occur in the Mount Moffat section of Carnarvon National Park, mostly in remote tableland country (M. Pyke, DEH, pers. comm. 1991). Some pastoral properties in the district also contain feral horses.

Feral horses are present in low numbers in Mount Elliott National Park near Townsville. A 'few hundred' are thought to inhabit parts of the Leichhardt Range near Mackay, mostly south of Collinsville, and a few are reported from the Clarke Range. About 200 to 300 occur in Shoalwater Military Training Area near Rockhampton, mainly in mountainous terrain and high plains, but they have also been seen on saltplains and near mangroves (Warrant Officer Brearley, Department of Defence, pers. comm. 1991).

Low numbers exist in White Mountains National Park to the west of Charters Towers (P. Hartney, DEH, pers. comm. 1991).

### 2.3.3 Western Australia

In Western Australia the main concentrations of feral horses are in the Kimberley, the east Pilbara and northern Goldfields districts (Campbell 1989). There is no recent, reliable population size estimate.

In the Kimberley the number is low. Raw data yet to be analysed from aerial surveys in the central Kimberley District indicate a possible population of 2500-4000 feral horses (S. Wheeler, Agriculture Protection Board (APB), pers. comm.) whereas landholder estimates range from 6000 to 8000 (Diver 1991). The number and distribution in the Kimberley appear to be severely restricted by the widespread occurrence of a plant toxic to horses, *Crotalaria* spp., which can cause what is locally known as Kimberley horse disease. Feral horses are locally abundant (more than 1000) on at least three stations (L. Ward, APB, pers. comm. 1991). Smaller scattered populations (50 to 500) occur on several pastoral properties and Aboriginal land. The potential for their numbers to increase exists on some Aboriginal lands recently destocked of both donkeys and cattle but not horses (L. Ward, APB, pers. comm. 1991).



Up to 5000 feral horses are estimated to inhabit the east Pilbara, mostly east and south of Newman (A. Cook, APB, pers. comm. 1991). In addition, a significant number inhabit the southern section of Karijini (Hamersley Range) National Park (P. Kendrick, Department of Conservation and Land Management, pers. comm. 1991).

There were about 2500 feral horses in the north-eastern Goldfields district in 1986–87 (A.J. Stevens, APB, pers. comm. 1991). However, more than 1700 horses were culled in 1987, and subsequent dry seasons have suppressed population recovery. Horses are known to frequent sandy country fringing large salt lake systems. Elsewhere in the district, feral horse numbers are low (fewer than 150 a station).

Some small mobs are present in the south of the State. There are between 20 and 60 feral horses in mallee country approximately 70 km south of Balladonia on the fringe of pastoral land. About 20 are seen frequently near the highway between Esperance and Kalgoorlie. There are few horses in Cape Le Grand National Park near Esperance, perhaps only half a dozen. A sparse population occurs in a strip east of Eneabba from near the Arrowsmith River to south of Jurien Bay area (K.R. Dean, APB, pers. comm. 1991). At the southern end of Lake Muir south-east of Manjimup there are about 50 (G. Power, APB, pers. comm. 1991).

#### *2.3.4 South Australia*

Feral horses are present in the northern pastoral zone of South Australia. A questionnaire of station managers in 1986 indicated that feral horses were present on 70% of the 30 northern region stations surveyed (Gibson 1986). According to managers' estimates, about 3200 were reported in the northern cattle-raising districts. There were major concentrations in the North-West District (approximately 1300), Strzelecki District in the north-east

(approximately 950) and Oodnadatta District in the State's central north (about 750) (Gibson 1986). Relatively few were reported from the Birdsville Track (approximately 200) and Marree districts (fewer than 50). The survey did not include land under Aboriginal freehold in the far north-west where feral horses are abundant (R. Breckwoldt, NSW landholder, pers. comm. 1991). Approximately half the surveyed stations reported populations of over 100 feral horses; the highest estimate on a single lease was 600.

In Coffin Bay National Park, there are about 70 feral horses, often called Coffin Bay ponies (G. Saunders, Department of Environment and Land Management (DELM), pers. comm. 1991). The ponies, said to be of Timor, thoroughbred and Arab descent, apparently have inhabited the area since the early 1900s. The largest herd is in the Point Sir Isaac area.

#### *2.3.5 New South Wales*

##### *'Kosciusko National Park contains several hundred feral horses.'*

Feral horse populations exist in several localities in New South Wales, although there has been no population estimate within the last 20 years. The major concentration is in the south-eastern subalpine region. Several hundred horses are reported in southern Kosciusko National Park near the Victorian border (Dyring 1990). Fewer horses occur in the northern section of the Park (more than 70), and in the Byadbo region east of the Snowy River. Other small, localised mobs occur within the Park.

Geographical barriers prevent these mobs from migrating between various regions of the Park. Feral horses also occur outside Kosciusko National Park on adjoining forested land (Dyring 1990). About 60 are thought to inhabit Maragle

and Bago State Forests to the west, with about ten at Muzzlewood Flat to the south-east.

Feral horses also occur in Barrington Tops National Park (Dyring 1990) and in hill country east of Armidale, although numbers appear to be low. Small numbers also occur in the Pilliga forest on the western side of the nature reserve (D. Buggan, National Parks and Wildlife Service (NPWS) NSW, pers. comm. 1991). There is an unconfirmed report of feral horses in Morton National Park near Nowra.

### 2.3.6 Victoria

An estimated 1000–3000 feral horses occur in Victoria (Dyring 1990). The population is thought to be increasing (Department of

Conservation and Environment Policy issued 3/88). Between 1200 and 1400 horses are estimated to occur in the Cobberas–Tingaringy Unit of the Alpine National Park. Small numbers are reported from the Errinundra National Park, and cattlemen estimate that there are about 300 in Bogong National Park. Feral horses are uncommon in the Wonnongatta–Moroka National Park. About 40 occur in the Gutturmurgh Creek region within the Snowy River–Byadbo Wilderness area. Feral horses have also been seen in the Nunniong region, south-west of the Cobberras.

About 200 are estimated to occupy the Barmah State Forest near Echuca (Management Plan for Barmah State Forest 1990).

## 3. Biology

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### Section summary

*Australian feral horses are adaptable and hardy, inhabiting country ranging from semi-arid plains and rocky ranges to tropical grasslands and swamps, temperate ranges, subalpine mountains and small offshore islands. They have been most intensively studied in semi-arid central Australia. These studies provide most of our knowledge about Australia's feral horses. Research on feral horses has also been conducted in the subalpine mountains of Victoria and New South Wales, and another study has commenced in the wet-dry tropics of the Northern Territory.*

*Feral horses usually form small social units called harem groups and bachelor groups. Harem groups usually contain a dominant stallion, one to three mares and their offspring. They favour areas near permanent water, while bachelor groups will range more widely. Feral horses in central Australia have home ranges of about 70 km<sup>2</sup> to which they are strongly attached.*

*Besides human control, the primary cause of death in feral horses is associated with drought, mainly through starvation, lack of water and consumption of usually avoided toxic plants. Old horses, juveniles and mares with young are the most vulnerable during dry times. Feral horse populations can increase by 20% each year when conditions are good.*

### 3.1 Wild horses of the world

There are no truly wild (that is, never domesticated) horse populations remaining. Examples of wild horse ancestors are Przewalski's and Tarpan horses. Przewalski's horses are kept in

captivity but are presumed extinct in their native range of central northern Asia (Berger 1986). The Tarpan horses of Poland were finally hunted to extinction in the mid-nineteenth century, although horses with Tarpan-like qualities were later bred in an attempt to recreate a similar herd (Harbury 1984). Horses were first domesticated 2500 to 5000 years ago, and today domestic horses are widely distributed throughout the world. Free-roaming but managed herds of horses exist in reserves in England and southern France (Berger 1986). Most of what is known about wild horses comes from studies of these English and French free-roaming populations or feral horses in North America.

### 3.2 Special adaptations of the horse

Most feral horses are very wary and difficult to approach although some, especially young bachelors, can be inquisitive. In a few instances, feral horses have become used to traffic or people, but most rarely have contact with humans and remain extremely cautious and easily frightened.

Horses are highly adapted for fast, free movement across open grassy areas. The long bones of the legs provide leverage for locomotion, and the short bones of the joints absorb concussion (Evans et al. 1977). Flight from perceived danger is their main form of defence.

They possess both monocular and binocular vision, enabling a wide view of their surrounds (Evans et al. 1977). Although both distant and very close objects are poorly seen, any movement is readily detected. Their hearing is well developed. Their sense of smell helps them locate food, which is directed into the mouth by the pliable upper lip and then cut by the front incisors. These are angled forward, enabling horses to graze close to the ground (Evans et al. 1977).

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<sup>1</sup> Ruminant—any animal of the artiodactyl sub-order or division Ruminantia, which comprises the various cloven-hoofed and cud-chewing animals.

Horses are non-ruminant<sup>1</sup> herbivores. Roughage is broken down by microbial fermentation in the caecum and large colon (Wagoner 1977). Unlike cattle, horses do not need to spend time ruminating, allowing them more time to be selective during grazing. Feral horses can walk up to 50 km from water to feed (Berman and Jarman 1988). Their mobility, teeth and digestive system make them well suited to utilising the sparsely distributed and unpredictable food and water of arid Australia.

*'Horses are well adapted to the highly variable Australian environment.'*

### 3.3 Overseas research

During the last 20 years there has been a proliferation of studies on the ecology of wild, free-ranging and feral members of the horse family. Significant research has been conducted in Africa, North America, Asia and Europe. Initially zebras (Klingel 1965, 1969) received attention, followed by free-ranging but managed ponies in Britain (Tyler 1972). During the 1970s and early 1980s, feral horses and donkeys in North America were studied by several researchers (Feist 1971; Welsh 1973; Mochlman 1974; Rubenstein 1981; Miller 1983; Berger 1986). Duncan (1980) investigated the Camargue horses in France and Kaseda et al. (1984) studied free-ranging horses in Japan. Recent comprehensive accounts are to be found in books by Waring (1983) and Berger (1986).

### 3.4 Australian research

McKnight (1976) conducted an Australia-wide questionnaire survey, initiated in 1966 and followed up in 1971, researching general aspects of Australian feral livestock including horses. The CCNT studied feral horses in central Australia

between 1984 and 1990. Research included:

- aerial surveys in the Alice Springs and Gulf districts to determine distribution and abundance;
- the ecology of feral horses and their interaction with cattle;
- the environmental impact of feral horses;
- the economic aspects of managing feral horses;
- the home ranges<sup>2</sup> and movement of feral horses; and
- a refinement of harvesting techniques.

#### 3.4.1 Habitat

Horses can occupy a range of habitats although they are best adapted to open grassy plains. In Australia, feral horses inhabit country ranging from semi-desert plains and rocky ranges to tropical grasslands and swamps, temperate ranges, subalpine mountains, and small offshore islands.

Feral horses are commonly found in areas of low pastoral value away from the more intensively managed areas, although they usually select the 'sweetest' country on which to graze, a common complaint from pastoralists. Feral horses prefer grassy flats, but often retreat to hill country to escape drought or mustering activities (Berman and Jarman 1987). Hill country is the hardest sort of area in which to catch or cull them.

Dyring (1990) found that horses avoided the forests in Kosciusko National Park (New South Wales), preferring to graze the grasslands and heaths throughout the year. However, in the heat of the day in summer, they use forests for shade and relief from horseflies (Tabanidae).

<sup>1</sup> Home range — the area over which an animal normally roams.

Feral horses in Coffin Bay National Park (South Australia) frequent degraded she-oak (*Allocasuarina verticillata*) and melaleuca (*Melaleuca lanceolata*) low open woodland, and appear to graze spinifex and sword sedges (*Lepidosperma gladiatum*) (G. Saunders, DELM, pers. comm. 1991).

### 3.4.2 Diet

Horses eat mainly grasses, but they will eat emergent and sub-emergent plants in swampy areas. They also eat roots, bark, buds and fruits (Waring 1983). The study by Berman and Jarman (1987) is the only publication on feral horse diets in Australia. Conducted in the Alice Springs district, the study found that horses mainly feed on short grasses, preferably oat grasses or bottlewashers (*Enneapogon* spp.). They are selective grazers, capable of walking long distances to locate the most palatable feed (Berman and Jarman 1988), which means that they can obtain more grasses and higher quality grasses than cattle can, and that they browse shrubs less than cattle do. Horses spend more time grazing than do ruminants such as cattle.

***'Horses are selective grazers, capable of walking long distances to locate the best feed.'***

In central Australia, feral horses graze near drinking water if feed is plentiful (Berman and Jarman 1987), although as feed is depleted they are forced to forage further from water to areas that are less intensively grazed by other herbivores (Berman and Jarman 1987; Dobbie and Berman 1990). They drink probably once a day in summer, and every second day in winter, and in central Australia spend most of their time grazing more than 3 kilometres from permanent water.

### 3.4.3 Social organisation

Feral horses tend to form small social units, either in a harem, which consists of a dominant stallion, his mares and their offspring, or in a bachelor group, a group of from one to three males comprising mainly two to four year olds who have been forced out of their harem groups (McKnight 1976; Berman and Jarman 1987). In central Australia harem groups often comprise five to seven individuals (Berman and Jarman 1987). In south-eastern Australia, Dyring (1990) stated that typical group size was one to four individuals. Hoffmann (1983), during observations of horse groups in central Australia, reported a large proportion of multiple male harem groups although later studies (Berman and Jarman 1987) found these to be uncommon. Bachelors usually occur either alone or in groups of from two or three males (Berman and Jarman 1987). Young females experiencing first oestrus<sup>1</sup> are usually ignored by the dominant stallion and tend to leave their groups (Berger 1986). Keiper (1986) reports instances of dispersing fillies remaining unattached for up to a year before forming a harem with a bachelor male or joining an existing harem.

Small social groups tend to come together and form large herds of 100 or more horses at watering points in the following conditions:

- when palatable feed is abundant. However, the horses soon disperse into smaller groups when feed is scarcer and they are forced to travel further from water to graze; and
- during drought, when many horses use the few remaining watering points (Berman and Jarman 1987).

Harem stallions, mares and foals require reliable resources and generally favour areas surrounding permanent

<sup>1</sup> Oestrus—a period of the oestrous cycle, usually lasting one to two days, during which ovulation occurs, and the mare is receptive to males.

waterholes. Bachelor groups are more mobile and more readily occupy areas where water is less reliable, needing to maintain only their own condition for growth. They probably return to more predictable areas for food and water when they are old enough to acquire mares, or in periods of drought (Dobbie and Berman 1990). Horses relying solely on temporary waters are more prone to perish during drought.

#### 3.4.4 Group stability

Harems tend to be stable breeding units, whereas bachelor groups are more unstable with frequent changes.

When food supplies are low the size of social units decreases, mainly because bachelors steal mares from large harems (Berman 1991), and because both the foaling rate and the foal survival rate are low. Sub-adult animals probably are forced to leave their harem groups earlier than usual (Berman and Jarman 1987). Stevens (1990) reported that harem groups become unstable when food supply is low.

#### 3.4.5 Home range

In central Australia, food and water resources are shared by many feral horse social groups (Dobbie and Berman 1990). Interaction between them is common, particularly while watering. Dominant males maintain a group without defending a territory. Vast home range boundaries make it impossible for them to successfully patrol and exclude intruders. Most acts of aggression between stallions are displays such as prancing, neck-arching, head-tossing and pawing, and a variety of vocalisations (Berger 1986). Only about 10% of aggressive encounters are fights.

***'Permanent waterholes are an important focus for control operations.'***

Permanent waterholes tend to attract larger groups of horses and a high proportion of harem or breeding groups, highlighting the importance of permanent waterholes as foci for control operations in arid areas.

Mitchell et al. (1982) roughly estimated that feral horses in Queensland occupied a maximum home range of 100 km<sup>2</sup>. Using radiotelemetry in central Australian range country, Dobbie and Berman (1990) reported home ranges of approximately 70 km<sup>2</sup> (range 52–88 km<sup>2</sup>). This is similar to ranges of feral horses in the North American deserts, but much larger than in the wetter areas of the world. There has been no study of feral horse home ranges in other parts of Australia.

Bachelor males tend to occupy the largest living areas, whereas harem groups occupy smaller, more stable living areas (Dobbie and Berman 1990; Berger 1986). Bachelors appear to avoid domineering harem males except during the breeding season when the older bachelors attempt to gain females.

Studies in central Australia indicate that feral horses have a strong attachment to their home range and resist being forced out of it by helicopter (Dobbie and Berman 1990). This affinity of horses for their home range implies that intensive control activities such as mustering or helicopter shooting, over a limited area are usually more effective than extensive programs that leave more animals behind which are more difficult to remove in subsequent operations.

Feral horses near areas mustered by helicopter are not greatly disturbed. They remain within their home ranges (Dobbie and Berman 1990) and can be mustered in later programs.

#### 3.4.6 Breeding

Horses breed during spring and summer (Wagoner 1977). Mares have a regular oestrous cycle which averages 21 days

and an oestrus or receptive period of between four and a half and nine days. The mean gestation period is 336 days, with mares returning to heat within nine to 14 days of giving birth (Hungerford 1990). The twinning rate is very low (Evans et al. 1977). Foaling is concentrated over spring and summer (Dobbie and Berman 1990). On average, puberty in females is attained at 12 to 24 months (Hungerford 1990).

***'Populations can increase by 20% a year under good conditions.'***

Feral horse populations can increase by 20% a year when resources are not limiting (Eberhardt et al. 1982). Most mares in good condition breed successfully but very few mares in poor condition foal (Berman and Jarman 1987). Although mares are capable of foaling every year, pregnancy stress usually results in their raising one foal every two years, the intervening year allowing them to recover sufficient body condition to support another pregnancy (Wagoner 1977).

Feral horses in Victoria have developed several defects attributed to inbreeding, including cow-hocks, knock-knees and hammer-heads. Such horses are regarded as hardy and agile but as lacking stamina.

### ***3.4.7 Mortality factors***

***'Mortality in feral horses is due mainly to factors associated with drought and human control operations.'***

The main causes of death are associated with drought (through starvation, thirst and poisonous plants), and internal parasites in foals. Pregnant or lactating mares, young horses under two years old and very old horses are the first to die in drought. Bushfires in Victoria are also

known to have caused dramatic localised reductions in feral horse numbers (Dyring 1990).

Up to 80% of mares in good condition, approximately 24% of the population, are pregnant at any one time (Berman 1991). Survival of each age class depends on seasonal conditions. An average of 20% of the population, mostly juveniles and sub-adults, dies each year.

Dingoes are potential predators of young foals but, although not studied, probably have little or no effect on recruitment (Campbell 1989).

Research in the United States suggests that males have a higher death rate than females, possibly associated with male aggression and the energy costs and stresses involved in obtaining and maintaining harems (Berger 1986).

In some areas poisonous plants limit horse populations. Horses generally avoid these plants unless other feed is scarce, so plant poisonings are more common during dry times and in overgrazed or burnt areas. Kimberley horse disease or 'walkabout' is usually fatal, affecting primarily horses that eat rattlepods (*Crotalaria crispata* and *C. retusa*) (Payne, n.d.). Kimberley horse disease is prevalent in the Victoria River district and the Kimberley district of Western Australia.

Birdsville disease results from prolonged feeding on Birdsville indigo (*Indigofera tinnaei*) and occurs in the Northern Territory, western Queensland and northern South Australia. Fatalities are not as high as for Kimberley horse disease, and recovery of mild cases is common (Hungerford 1990). Toxicity varies with season and locality. The plant is toxic in central Australia but is reported to be harmless on the Barkly Tableland (Hungerford 1990). Meat from badly affected horses can be toxic to pets. For this reason, horse meat from central Australia cannot be used in pet meat. Darling pea (*Suaresona* spp.) is also toxic

to horses and the possible cause of some poisonings in central Australia (Berman and Jarman 1987).

Apart from toxicity, there are a few diseases that cause poor health but are not considered to contribute significantly to feral horse mortality (Berman 1991). Horses frequenting wetland areas are liable to carry heavy worm burdens that cause 'ill-thrift'. Pollitt (1990) revealed that feral horses occupying wetland areas of Moreton Island carried heavy worm burdens (strongyles), but little is known

about parasite loads in other areas. Swamp cancer (cutaneous habronemiasis) is an ulceration of the skin as a result of infestation by *Habronema* larvae (Hungerford 1990). It affects horses in northern Australia, particularly during the wet season. Horses in tropical Australia are liable to tick burdens. Those in sandy country often suffer from elongated hooves, whereas horses in rocky country tend to maintain well-trimmed feet in good condition, which may influence longevity.