FAUNA *of* AUSTRALIA

60. CAMELIDAE

B. D. SIEBERT &
D.M.R. NEWMAN

DEFINITION AND GENERAL DESCRIPTION

The Camelidae is the sole family of the Tylopoda, one suborder of the Artiodactyla, the even–toed ungulates. Another suborder is the Ruminantia. Camels evolved from 2 kg, five–toed animals of the Eocene into 1000 kg, two–toed tylopods of the Pleistocene. This evolution took place in the west of what is now the United States in arid areas around latitude 35°N.

Three million years ago, some forms of camelids crossed the Bering Strait ice to Asia, where the Bactrian Camel with two humps evolved and is found today. The one–humped Dromedary occurs in India, Pakistan, the Middle East and Africa. Other forms migrated south and became the llamas, alpacas, guanacos and viçunas of South America.

HISTORY IN AUSTRALIA

Because of their site of origin and of Australia's isolation as a land mass there was no member of this family of ungulates present in the land until the Dromedary (*Camelus dromedarius*) was introduced by Europeans in the 19th Century. Ironically, Australia is now the only country in which there are wild camels. The first introduction occurred in 1840. A number of small introductions followed over the next 25 years mainly to assist with explorations. It was not until 1866, however, when a large number was imported by Thomas Elder (McKnight 1969) and a camel stud established at Beltana some 550 km north of Adelaide, that the basis of a national herd began. Importations continued for another 40 years, the animals being used extensively in inland Australia for draught purposes. In excess of 10 000 camels probably were imported into the country. In 1985 there were an estimated 25 000 camels in Australia, most of which were wild.

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MORPHOLOGY AND PHYSIOLOGY

External Characteristics

The coat comprises both fine and coarse fibres. The shedding of the coat in the spring results in a short summer coat, and a long insulating coat grows during winter. Camels living on the equator have is a short coat throughout the year.

The hump of the camel is absent in the new–born, but can be as heavy as 200 kg in a 700 kg animal. It is made up of fat, blood vessels and fibrous tissue. During drought, the hump is a source of energy and a camel can last as long as 6 months if water is available. Because of a slower metabolism, the camel uses fat at only half the rate of cattle. The nostrils of camels have sphincteric muscles which keep the nares closed except when breath is drawn (they open for about 1 second, ten times a minute). The upper lip is labile and muscular with a split centrally which allows each side to act independently during foraging.

Locomotion

Camelids walk on the pads of the third and fourth fingers and toes. The nails are placed dorsally where they hardly touch the ground. The two digits are fused almost completely and the elastic tendons of the small muscles in the fingers and toes are expanded into very large cigar–shaped springy pads of yellow elastic

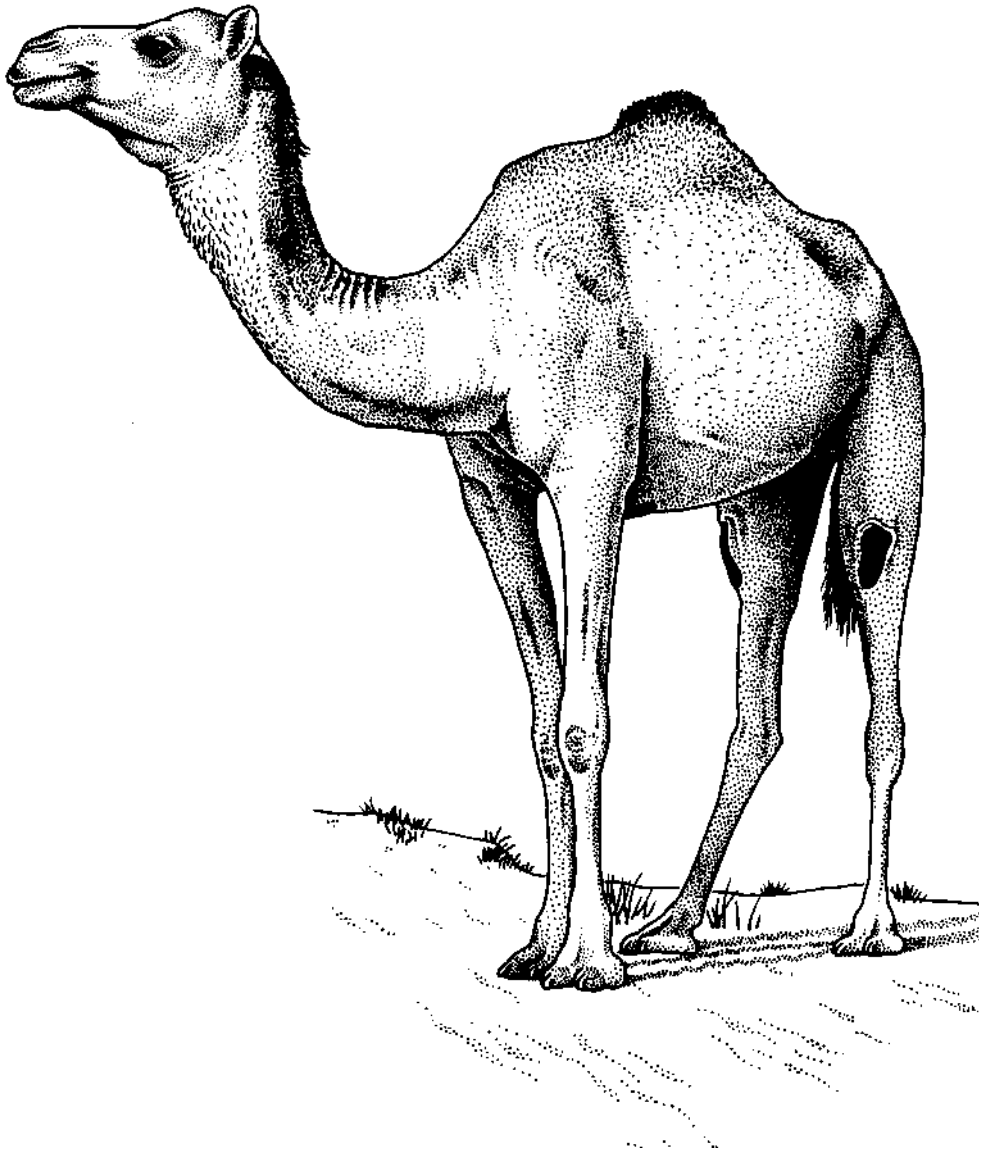

Figure 60.1. Adaptations which suit the Camel to central Australia's hot, dry conditions include: the fat-storing hump, as a source of energy and metabolic water; nostrils held closed when not breathing and; broad pad-like toes that support its weight on soft sand. (© Environment Australia) [K. McInnes]

fibre. The legs are unusual in folding at wrist and ankle, as well as at knee and elbow, so that the camel sits evenly on its sternum; callosities of skin on the sternum, heels and elbows to take the pressure.

Digestion and Metabolism

Camelids have similar foregut fermentation to that of ruminants, but differ in that they have secretory glands in the wall of the rumen; the gut of cattle and sheep has no glands before the abomasum. Camels use water, energy and protein at comparatively slow rates (Macfarlane, Morris & Howard 1963; Schmidt-Nielsen 1964). The turnover of these metabolites is about one–third that in cattle (wet tropical species) (Siebert & Macfarlane 1969, 1971) and about the same as in desert goats or *Oryx*. Shown in Table 60.1 are the quantities of water turned over by British breed cattle and camels grazing the same area near Alice Springs during winter and summer. Water was freely available at all times. Camels have

a high tolerance to salt and can drink a 5% salt solution and live. Their blood sodium (normally 140 mEq/L) can rise to 205 mEq/L without ill effects. Men and cattle die with blood sodium levels at 175 mEq/L.

Table 60.1 Turnover of water in camels and cattle in winter and summer at Alice Springs.

SEASON	MEAN MAX. TEMP. (°C)	SPECIES	LIVE WEIGHT (LW) (kg)	WATER TURNOVER (L/day)	(ml/kg LW/day)
Winter	26	Camels	377	14.3	38
		Cattle	243	30.1	121
Summer	41	Camels	451	35.6	79
		Cattle	299	57.8	193

Renal Function

The kidney of the camel saves water, then retains sodium and urea. Although the volume of urine is small, it is not particularly concentrated (reaching 3000 mOsmol/L). When camels are denied water, filtration through the kidney is reduced so that urine flow becomes quite small for animals of such a size (Siebert & Macfarlane 1969). This means that sodium and urea accumulate in the blood and reach over 200 mEq/L and 100 mmol/L, respectively, without disturbing the animal.

Body Fluids

As camels become dehydrated when deprived of water, protein is secreted into the plasma. Blood volume is maintained while water is drawn from the gut and cells (Siebert & Macfarlane 1975). This process allows them to continue in circumstances where men, horses, cattle and sheep would suffer circulatory failure and die. At such times the camel's body temperature may rise to in excess of 41°C during the day then drop to as low as 37°C during the night. This diurnal pattern minimises heat input by day and saves sweat. Camels sweat potassium bicarbonate and thus eliminate potassium. Sodium is retained to restore extracellular fluid balance when water becomes available again. They orient their body so that there is minimal sun radiation upon them. They browse a wide range of plants and leaves, drawing off what water is available and producing a certain amount from the metabolism of food. In winter they need not drink at all.

Reproduction

Although moult is determined by day length, reproduction is opportunistic. Females come into oestrus several times a year, but males come into rut only during periods of abundant food when the pituitary gland secretes gonad stimulating hormones. Gestation lasts some 360 – 380 days. The single young weighs about 40 kg at birth and is suckled for more than a year. Oestrus can recur as early as 1 month after parturition, but the interval between births is normally 18 – 24 months. Sexual maturity is reached in about 4 years. Camels have a life span of 20 – 25 years.

NATURAL HISTORY

Ecology

The physical and physiological characteristics referred to above enable the camel to live in the most remote and, to a large extent, the most arid areas of Australia. It occupies a variety of habitats, but is chiefly found in sandy ridge–dunes (Newman 1983). It is gregarious, living in herds which range from a few animals to several hundred. The camel forages a range of plant material, but seems to prefer prostrate succulents, shrubs and leaves to native or introduced grasses. It is thus not a competitor with domestic livestock or even kangaroos for vegetation resources. Also, the camel mainly exists far away from most pastoral properties. Under study situations, shrubs and forbs comprised 70% of the diet during winter and 90% during summer (Newman 1984). Plants high in moisture, salt and oxalate content feature prominently in the diet. Species of mulga, saltwort, saltbush, spurge and pigweed are preferred. The thorny nature and bitter taste of many of these plants makes them unpalatable to other herbivores. The ability to use little food or water, utilise a wide range of vegetation, store many months of energy and tolerate high body temperatures and high electrolyte loads are the major reasons that the camel has existed unaided and, indeed, increased in number in Australia over the past 80 years.

Prevalence of disease: Camels have been remarkably disease–free in Australia, possibly partly because of the arid environment in which they live and also the stringent quarantine precautions that exist in Australia. Trypanosomiasis (*Trypanosoma evansi*) was found in camels imported into Port Hedland in 1907 (Cleland 1908). Nine cases were identified and the animals destroyed. The disease did not spread. Outbreaks of foot–and–mouth disease may have led to the prohibition of imports between 1896 and 1907 and prohibition after 1907 was presumably due to the outbreak of Trypanosomiasis.

Mange (*Sarcoptes scariei* var. *cameli*) has been present in Australian camels since the first imports, but is controlled under domestication by quick treatment (Barker 1964). Its prevalence in feral populations is not a major problem, but it can have a debilitating effect on individual animals.

The presence of Camel Bot–fly (*Cephalopsis tittilator* Clark) has been reported in Australia (Roberts 1952; Barker 1964). Hippobosca camelina and *Haematopinus tuberculatus* also have been found in camels in Australia (Roberts 1952) as has been the nematode, *Camelostrongylus mentulatus* (Beveridge, Barker & Rickard 1974).

Major eradication programs for tuberculosis and brucellosis in cattle presently are being carried out in Australia, but pilot investigations thus far have failed to reveal the presence of these diseases in camels (Letts, Bassingthwaighte & de Voss 1979).

The comparative disease–free status of the Australian camel, compared with overseas counterparts, has aided the development of the small export trade of Australian animals to zoos and breed–improvement programs in other parts of the world.

Behaviour

Feeding: The feeding habits of the Camelidae in relation to their role as productive animals have been reviewed by Newman (1984). Earlier understanding of their dietary requirements was based on information of Leese (1927). Later, Gauthier-Pilters (1961) in Africa and Newman (1975) in Australia provided more detailed data on the behaviour and plant preferences of camels in

confined and unconfined states under arid conditions. They are browse feeders of shrubs and trees and are adept in preserving their own environment as they are nomadic and spend little time in one location.

Some investigators (for example, Whyte 1947) consider that camels have been the cause of desertification, but these assessments have been made when sheep, goats and camels have grazed in combination and it is difficult to say where the blame should lie. In Australia, the camel feeds in areas away from most other animals and there have been few reports or complaints that they interfere with the grazing habits of cattle (Letts *et al*. 1979). They seldom spend long feeding at one location and frequently cover distances of 50 – 70 km per day. After heavy rain or flood they may spend more time than usual in favoured areas. Newman (1984) observed heavy grazing of *Trichodesma zeylanicum* and *Euphorbia tannensis* subspecies *Eremophila* in the Simpson Desert region following such circumstances.

In the Middle East and Africa, where the camel is under the control of man, forage utilisation studies (for example, Huss 1978; Batanouny 1979) indicate that lack of feeding management, the number of animal species in one area and, above all, the cutting of shrubs and trees by man for firewood are the major causes of desertification in arid ranges and not the feeding habits of one particular species. The pressure on vegetation by camels in Australia, however, is quite different to that in its native lands. The stocking rate is low: — a population of some 15 to 25 000 feral camels in some 130 million ha (McKnight 1969, 1976) — approximately one animal per 50 ha. In terms of growth, camels have exhibited live–weight gains equal to or greater than cattle under the same conditions, although the two species had different dietary preferences (Newman 1984).

Economic Significance

The number of domesticated camels reached a peak in the early 1920s when a population of some 10 to 20 000 existed (McKnight 1969). This number declined to less than 2 000 by 1940 when no official records were kept except in the Northern Territory where only 40 were recorded in 1960. Over these years, however, it seems that the feral animal had progressed well.

Because of the remoteness and nature of the terrain in which camels live in Australia there are no accurate records of the present population, but McKnight (1969) estimated that there were between 15 to 25 000 in the country in 1966. Later estimates of the number in the Northern Territory carried out by wildlife officers with the use of aircraft put the figure for that area alone at over 30 000 (K.A. Johnson, personal communication). Conceivably, 40 000 camels presently exist in a feral state in Australia. The camel is not used for any meat, milk or fibre purpose in Australia, its only economic use deriving from a small export to other countries for zoos and breeding purposes and for a number of tourist activities throughout the country. The latter includes a variety of enterprises ranging from camel racing to rides through wine growing areas.

Despite the fact that camel meat is largely indistinguishable from beef in both quality and taste, it is not generally considered acceptable by the Australian population. The same may be said for the milk (Barker 1964). Camel hair is a prized fibre and the possibility exists that animals could be produced for specialised exotic fibre use similar to that required for mohair from goats. Unless the animals are raised under intensive farming conditions, the low population densities of the animals under natural conditions and the costs of harvesting animals in remote situations makes the economic use of camels prohibitive.

DISTRIBUTION IN AUSTRALIA

McKnight (1969) suggested that there are several broad areas of camel population, chiefly in central and eastern Western Australia and in the southern part of the Northern Territory (Figure 60.2).

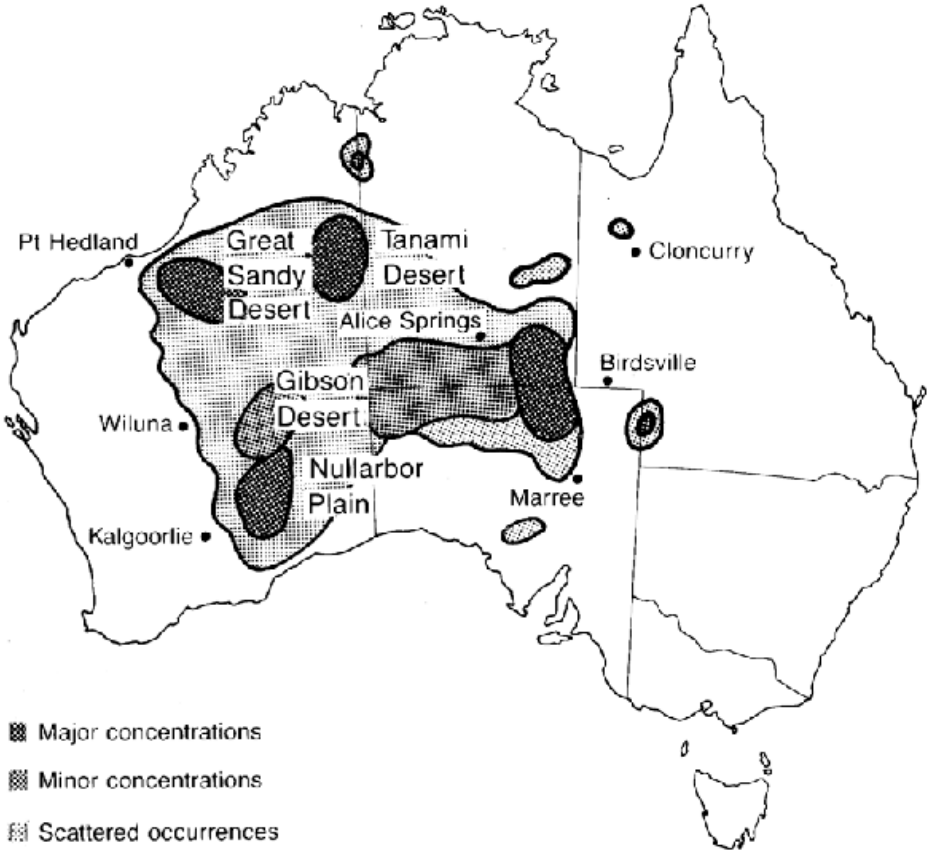

Figure 60.2 The distribution of the camel in Australia. (After McKnight, 1976)

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