A Pilot Camel Survey of a Central Portion of Western Australia

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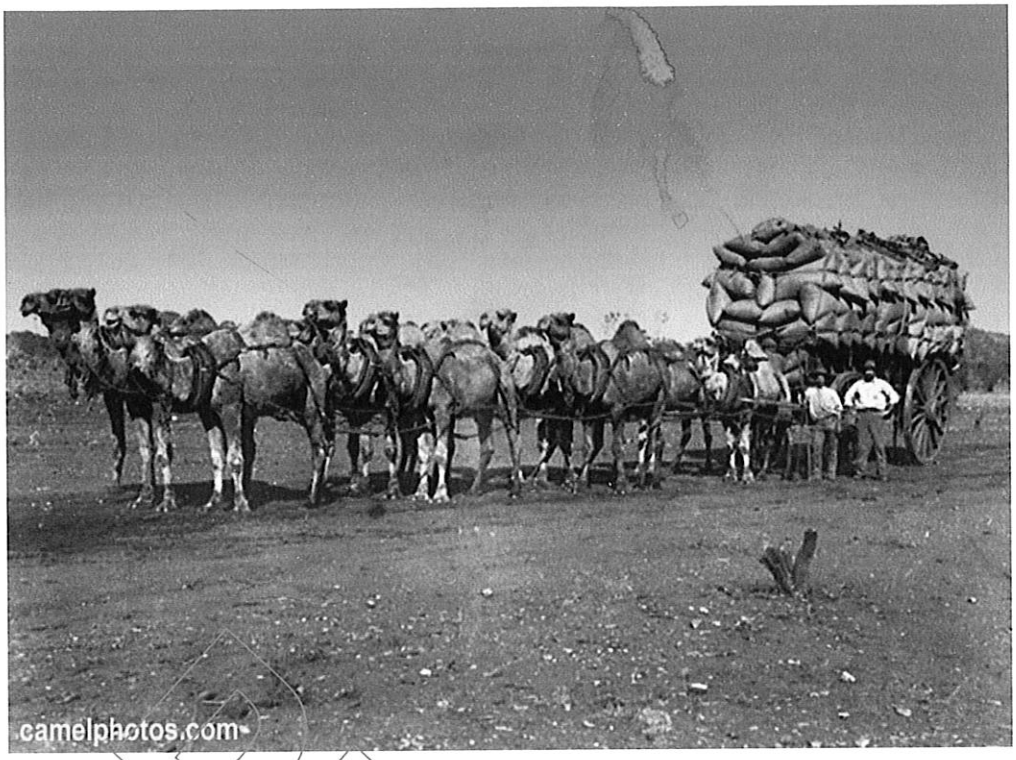


ABSTRACT

Standard aerial survey techniques were used to conduct a pilot broad scale camel survey of a portion of central Western Australia between 3 August and 9 August 2005. The area surveyed covered an approximate 67,000 km^2 in transects 400km long and 11km apart. One third of the area surveyed crossed pastoral land east of Wiluna and the remainder was undisturbed desert. Mean camel numbers were extrapolated to 238,000 for Western Australia at a density of 0.17/ km^2 after being corrected for perception bias. The pastoral area was one third of the survey area and contained about 10% of the camel numbers with densities of pastoral zone 0.05/km^2 and desert area 0.23/km^2. The discrepancy in these figures is most likely due to camel culling by pastoralists in the preceding couple years. A station in the middle of the survey area reported, taking 1287 camels in the previous 3 years (about 400/year). Dry summers leading up to the survey had driven camels out of the desert onto pastoral lands. Pastoralists were able to capitalise by culling camels and sending to the pet meat trade. As a result this survey is likely to be an underestimate of the camel population for Western Australia.

Introduction

The Arabian camel (*Camelus dromedarius*) was introduced into Australia in the 1840's to assist with transport and for exploration of inland Australia (Pest Animal Control CRC 2005). Between 10,000.and 20,000 were imported from India in the following years up till 1907. It is likely that some escaped and others turned loose into the wild once they were no longer needed. Early population of feral camels remained small and scattered until the whole sale abandonment of domesticated camels in the 1920's and 1930's (Edwards et al 2004). Early surveys conducted across Northern Territory, South Australia and Western Australia set base line populations for Camels (Short et al 1988). More recent surveys in the Northern Territory used the earlier survey results to show growth trends in camel populations and set a minimum figure of 300,000 camels for Australia in 2001 (Edwards et al 2004). Currently estimates are putting feral camel numbers as high as 600,000 for Australia (Jackson 2005).

The ecology of Camels makes them highly suited to the dry remote areas of central Australia and they have adapted well. Camels are free ranging, non-territorial and are able to travel up to 70km per day. They are essentially browsers and can feed on more than 80% of the available plant species (Dorges and Heucke 2003, Edwards et al 2004). The populations are relatively disease free, with no natural predators and an adequate food supply suggesting that there has been no limiting factors for growth of camel populations in Australia (Dorges and Heucke 2003). Caughley and Sinclair (1994) in their work on feral camel population dynamics reported that during the period 1966-2001 camels appeared to have been following an active growth trajectory typical of an establishing population. The rate of population increase reported by Edwards et al (2004) show that camel population is increasing at about 10% per year with a doubling of the population every 8 years and that once camel densities exceed >2 per km^{-2} serious damage to vegetation can occur. Much of his study area in the Northern Territory had camel densities equivalent or greater than this level.

This pilot camel survey aimed to determine:

- A baseline number for camels for the surveyed region of Western Australia
- Compare population levels between pastoral and undisturbed desert areas.
- Distribution of camels within the study area

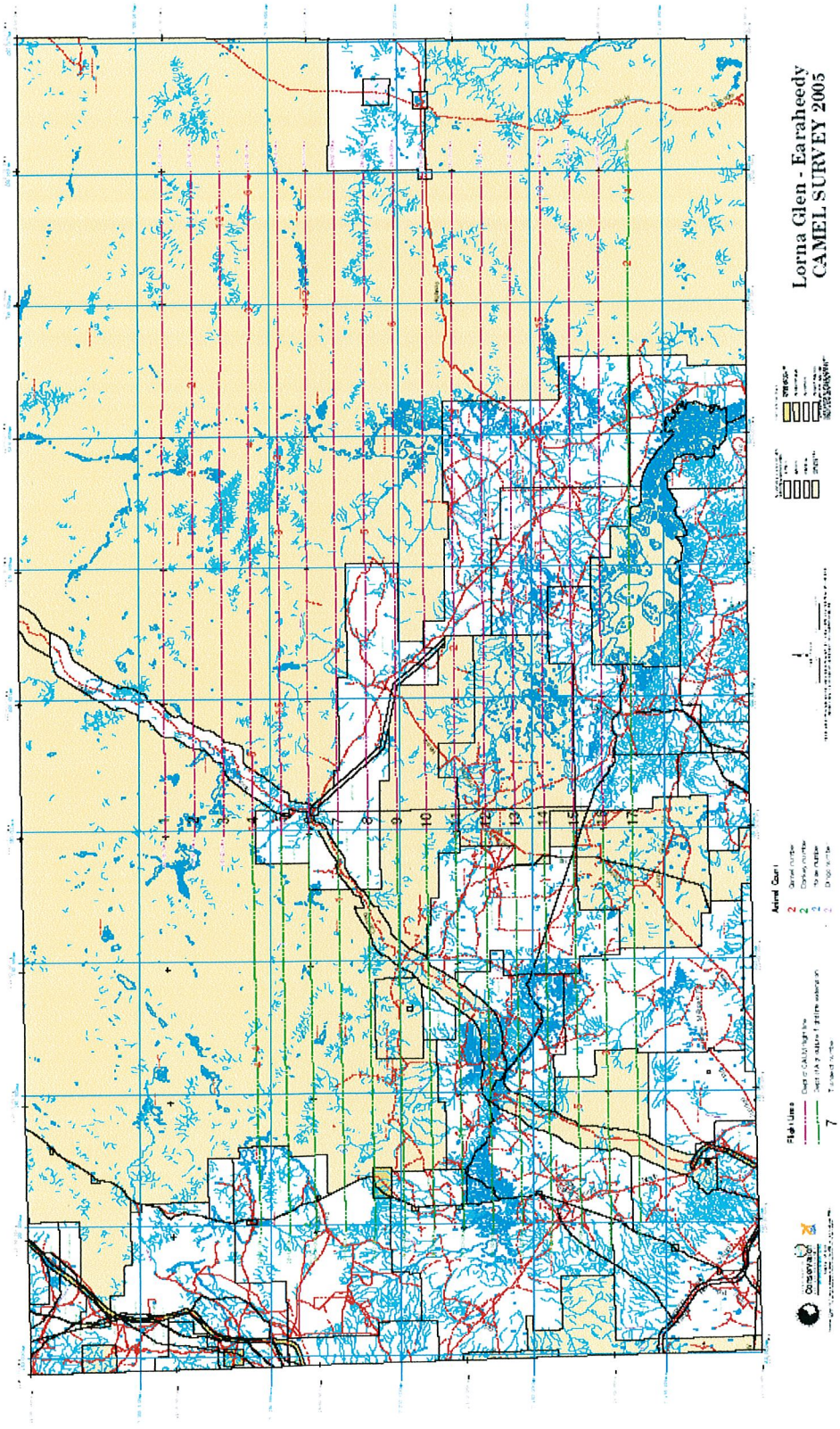


Figure 1: Map of survey area showing flight lines and animal observations

Methods

The survey area covered 67,700 km^2 and extended from longitude 120°.00E to 124°.00E. Transects were east west and 6 degrees latitude apart (See figure 1). Standard aerial survey methods developed for surveying wildlife populations was used. The aircraft was a Cessna 210 high wing fitted with radar altimeter and GPS (Global Positioning System). The survey was conducted at a height of 250 ft (76m) at a ground speed of 100kts (185 km/hr). Transects of 200m width on each side of the aircraft were delineated by a rope attached to specially fitted wire struts. The position of the rope was calibrated on the ground for each observer from tables and functions constructed for the purpose. The marker ropes were checked once airborne against two markers set 200m apart on the airstrip to confirm accuracy.

Figure 1: Map of survey area showing flight lines and animal observations

The flight crew consisted of pilot and three observers seated in the front right, rear right and rear left positions. The observers were rotated each flight and the tandem right observers counted the same transect independently. Species counted included camels, goats, red kangaroos, horses, donkeys, emus, bustard, dingo and cats, which were recorded onto data sheets designed for the purpose. Notes on flight path direction, temperature (°C) and visibility were taken at the time of measurement. The protocol for this technique requires counters to count for 97.5 seconds followed by a 7 seconds gap where data was recorded onto prepared data forms. A timing device was used and set so that an audible buzz marked the end of the count period and was continuous for the 7 seconds gap. The 7 seconds recording time gave a 360m gap between cells where no recording was done. In the 16 transects a total of 2196 cells were measured (1098 each side). Each counting period is equivalent to 1km^2. For camels, individual numbers and group size was recorded.

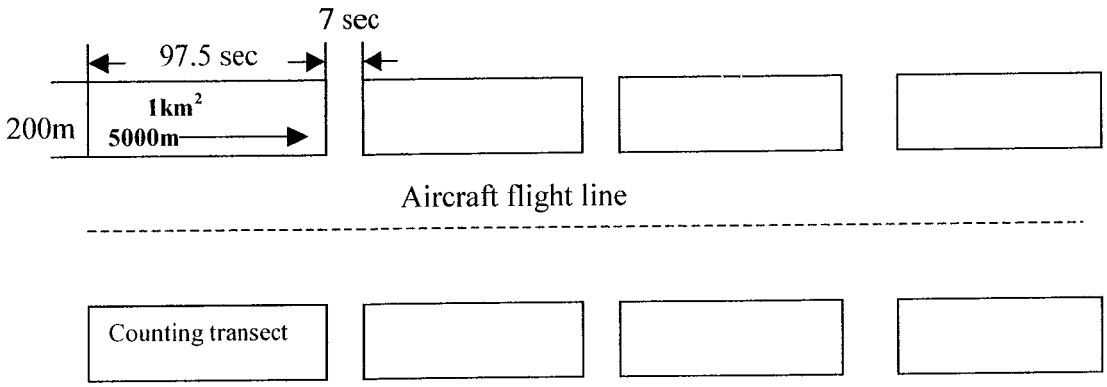


Figure 2: Schematic diagram of aerial strip-transects
Data analysis follows that of Edwards *et al* (2004) to compare results.

Results

The data were corrected for perception bias (that is for animals that were there but missed by the observer) This was done through correction factors calculated from tandem counts done on the right hand side. The mean group size was 4.71 (± 0.98 s.e.) camels and correction factors 1.23 for right transect and 2.45 for the left. The combined data gave a corrected camel density of 0.17/km^2 (pastoral zone 0.05/km^2 and desert area 0.23/km^2).

The observational performance of the observers was checked, by comparing results of the front and rear counters of the right hand transect. These data were analysed with a two sample t-test at $p<0.05$ and showed no significant difference between counters although the variability increased with some combinations. The predicted population for the study area after correction was 11,509 camels and this is extrapolated for the rest of Western Australia which puts camels in the order of 238,000 and for all of Australia 476,000 camels.

One third (34%) of the survey area was pastoral land and this contained only 10% of the camels. Rainfall through the area in July (37.6mm measured at Lorna Glen station) had provided surface water in remote desert areas and camels were able to disperse.

Discussion

The camel density determined by this survey (0.17/km^2) was about half that determined by Edwards et al (2004) survey for the northern Territory (0.31/km^2). He used results of earlier surveys to determine a minimum figure of 300,000 camels for Australia, whereas this survey is the first attempt at establishing some baseline data on camel numbers for Western Australia. In this we can only draw comparisons with surveys from other states. A number of studies undertaken throughout Australia to more accurately determine feral camel populations produced a range in estimated population (Table 1). From these other surveys, Edwards et al (2004) determined camel populations to have increased at a mean annual exponential rate of $r=0.093$ between 1993 and 2001. If this value is applied to the 1993 population estimate (NT Conservation Commission, 1994) and adjusted for each year this returns a current population estimate of 486,000 camels and close to our estimates 476,000. This however does not take into account any variation due to seasonal conditions. The study area was made up of 34% pastoral land and the remainder was undisturbed desert. Only 10% of the camels were recorded on the pastoral area and is likely to be due to culling by pastoralists and dispersal following rainfall across the survey area in the month prior to the survey.

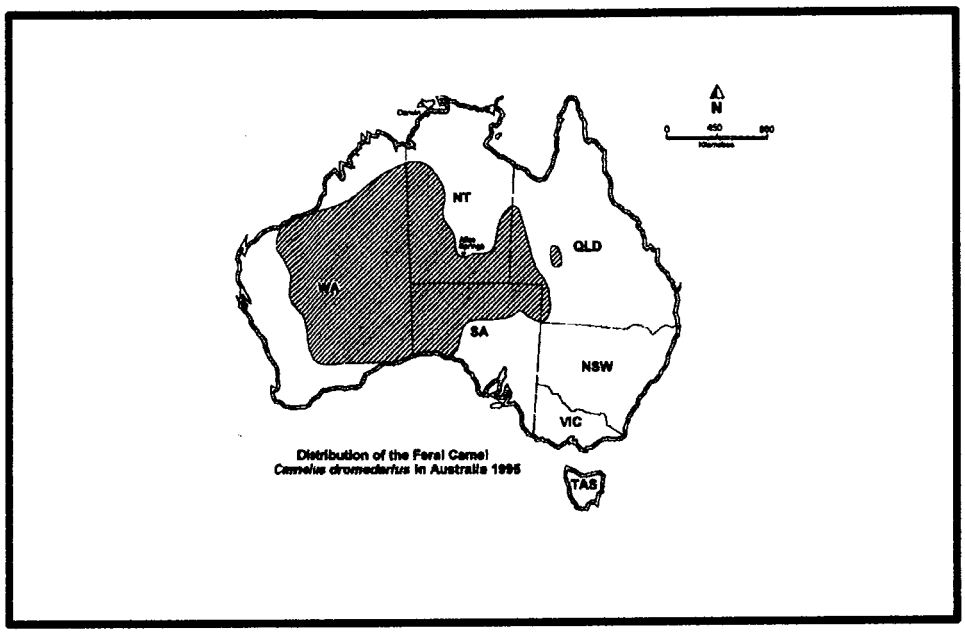
Table 1

Study Area	Year	Estimated Population	Estimated Australian Population	Reference
NT, SA & WA	1966		15,000 – 20,000	McKnight (1966)
Western Australia	1972	Distribution only		Long, (1988)
Northern Territory	1979	3,000 – 6,000 (NT)		Letts, (1979)
Australia	1976	Distribution only		Murray *et at* (1976)
Northern Territory	1986	31,570 (NT)	100,000	Graham *et al* (1986)
Australia	1988		> 43,000	Short *et al* (1988)
Northern Territory	!994	60,000	200,000	NT Conservation Commission (1994)
Northern Territory	2001	80,533	300,000	Edward *et al* (2004)
Western Australia	2005	238,000	476,000	Ward *et al* (2005)

(Source: Kevin Ellard, (2000) Agriculture Western Australia)

There is a likelihood that this survey may have under estimated camel density due to camel culling by pastoralists within the survey area. In the previous 12 months leading up to the survey harsh drought conditions forced camels out of the desert onto pastorals lands where permanent water could be obtained. Pastoralists were able to cash in on the high camel numbers by culling and sending them to the pet meat trade. This commercial outlet provided a method of offsetting the cost of the culling operations although was dependent on the availability of freezer trucks (Norma Ward, Millrose Station, 2005 personal communication). Record keeping of camel culling was quite variable amongst the stations from no records to meticulous data. Glen Ayle station in the middle of the survey area reported taking 1287 camels over the preceding 3 years. The effect of this culling and rainfall in the month prior to the survey allowed camels to disperse back into the desert and most likely has had an impact on survey results. It may be reasonable to take the camel density from outside of the pastoral area and apply this to give a number of camels for Australia. This has a density of 0.23/km^2 or a population of 644,000 for Australia, which is close to estimates reported by Woodford (2002) and Jackson (2005).

The migration patterns and population distribution of feral camels in Western Australia differ from that of the Northern territory due to regular movement between uninhabited desert and pastoral properties and occurs mostly during dry periods to utilise water supplies (Ellard, 2000). The fringing pastoral properties take the brunt of the camel encroachment however many properties further west in the shires of Wiluna, Meekatharra and Laverton also report camels. To determine the distribution of camels for western Australia groups such as The Rural Industries Research and Development Corporation undertook mail out surveys of pastoral properties. Similar methods have been employed to determine camel distributions for all of Australia (Figure 3)



(Source: Peter Seidel (2000), Arid Zone Research Institute, Northern Territory)

Figure 3: Predicted distribution of feral camels determined in 1995

A summary of camel populations from previous surveys (Table 1) show an upward trend in numbers from 15,000 in 1966 to 476,000 in 2005. It is evident that camel populations are still following and active growth trajectory similar to an establishing population (Caughley and Sinclair 1994, Edwards 2004). Increasing numbers are likely to have serious impacts on vegetation, which has shown to be the case when numbers exceed >2/ km^2 (Dorges and Heucke 2003). The average group size for this survey averaged 4.71 and is similar to that reported by Edwards (2004) of 4.55. These groups already exceed the densities recognised as causing damage to vegetation. Camels were observed in most areas across the survey area and appeared to have a preference for wash areas that contained trees and shrubs and around clay pans. Only few were seen on open spinifex plains and were probably traversed between water and more productive feeding areas.

It is likely that camel distribution patterns will expand with increasing numbers and may well have done so already. Factors that affect camel distribution is most likely determined by the physical environment and control measures by man (Ellard 2000). Camels range widely over sandy areas but avoid wet or very rocky regions, which supports the distribution patterns in Western Australia where camels do not extend far into the rugged regions of the Kimberley but may extend south as far as Esperance on the south coast (Ellard 2000).

CONCLUSIONS:

- A baseline number for camels for the surveyed region of Western Australia was found to be 238,000 at a density of 0.17/km^2 This may well be an underestimate due to culling by pastoralists
- Comparison of population levels between pastoral and undisturbed desert areas showed pastoral areas were one third of the survey area and contained only 10% of the camels (density of 0.05/km^2).
- Camels were widely distributed over the study area with a preference for wash areas that contained trees and shrubs and around clay pans.

REFERENCES:

Caughley G. and Sinclair A. (1994) Wildlife Ecology and Management. Blackwell science: Cambridge

Dorges B. and Heucke J (2003). Demonstration of ecologically sustainable management of camels on aboriginal and pastoral land. Final report. In Edwards et al 2004 Wildlife Research 31, 509-517.

Edwards G. P., Saalfeld K. and Clifford N (2004) Population trend of feral camels in the Northern Territory, Australia. Wildlife Research 31, 509-517

Ellard K. (2000). In Development of a sustainable Camel Industry. Rural Industries Research and Development Corporation Publication No 99/118. Barton ACT.

Jackson K. (2005). WA Country Hour- Camel Cull for NW South Australia. http://www.abc.net.au/rural/wa/stories/s1353840.htm accessed on 30/08/2005

Pest Animal CRC (2005)., Feral or Arabian Camel (*Camelus dromedarius*) http://www.feral.org.au/species/camel.asp accessed 30/08/2005.

Seidel P. (2000). In Development of a sustainable Camel Industry. Rural Industries Research and Development Corporation Publication No 99/118. Barton ACT

Short J. Caughley G. Grice D. and Brown B. (1988). The distribution and relative abundance of camels in Australia. *Journal of Arid Environments* 15, 91-97

Ward Norma (2005). Millrose station Via Wiluna. Personal communications

Woodford J. (2002), Welcome to camel country: future population 60million http:/www.smh.com.au/articles/2002/12/20/1040174390961.html accessed on 21/4/2005