The Australian Kangaroo Populations, 1984

G. C. Grigg and L. A. Beard
University of Sydney
G. Caughley and D. Grice
CSIRO Division of Wildlife and Rangelands Research
J. A. Caughley and N. Sheppard
NSW National Parks and Wildlife Service
M. Fletcher and C. Southwell
Australian National Parks and Wildlife Service

Between the first Australian-wide aerial survey of kangaroos in 1980-82 and the second in 1984, indices of relative abundance determined by the same methods show that red kangaroos declined by 24% and western and eastern greys by 35%. The declines are attributed mainly to drought in the eastern half of the continent, partly offset by increases in the western half. We estimate numbers in 1984 at 6.3 million red kangaroos (cf. 8.3 in 1980-82), 1.2 million western greys (1.8) and 5.8 million eastern greys (9.0), a total of 13 millions of all three species compared with 19 millions in 1980-82. This is an overall drop of about 30%. Because recent work suggests that the sightability of both species of grey kangaroos is lower than that for reds, estimates of grey kangaroos will be less than the real numbers and should, therefore, be regarded as indices of relative abundance rather than as absolute estimates.

We present data compiled from extensive aerial surveys in 1984 that allow comparison of 1984 populations of red kangaroos *Macropus rufus*, eastern grey kangaroos *M. giganteus* and western grey kangaroos *M. Fuliginosus* with those of 1980-82 when the first Australia-wide survey was carried out (Caughley *et al.*, 1983). Surveys were undertaken during 1984 by the CSIRO (parts of Queensland), Australian National Parks and Wildlife Survey (parts of Western Australia, Queensland and South Australia), New South Wales National Parks and Wildlife Service (western New South Wales) and the University of Sydney in association with South Australian National Parks and Wildlife Service (Pastoral Zone of South Australia). The surveys in New South Wales and South Australia are part of a continuing programme and are undertaken annually. Details of each individual survey will be presented elsewhere; the present paper is an attempt at a nation-wide overview.

The surveys were carried out during the winter months of 1984, using the same methods as in earlier surveys (see Caughley *et al.*, 1976). Many observers were common to both surveys. However, the results of the different teams have not been fully calibrated against each other and therefore the results of the 1980-82 and 1984 surveys should be compared with caution. Within the area of sympatry, counts of grey kangaroos (unreliably distinguishable to species from the air) were distributed to either western or eastern grey totals in proportion to their relative abundances reported by Caughley *et al.*, (1984). We used the same factors to correct for visibility bias as were

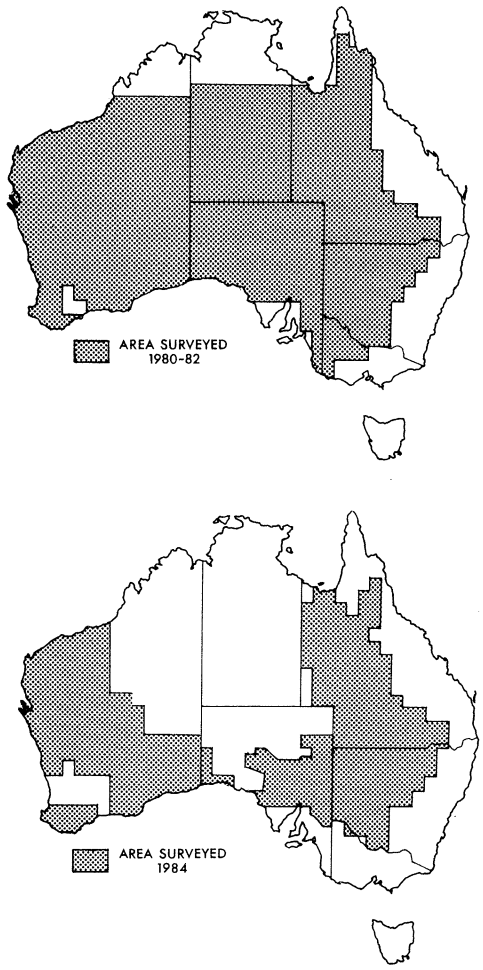

FIGURE 1 Areas covered by aerial survey in the 1980-82 and the 1984 surveys.

used in the 1980-82 surveys, as determined for red kangaroos (Caughley *et al.*, 1976). Recent work by Short and Bayliss (1985) and Bayliss (pers.comm.) suggests that these factors are too low for grey kangaroos, which are harder to see. Larger corrections, therefore, are needed in order to return acceptable estimates of absolute numbers of grey kangaroos; values reported hitherto and herein are too low. Our retention of those original correction factors here is to allow a direct comparison with the 1980-82 data, the two surveys now being viewed as returning density indices for the grey kangaroos.

Collectively the 1984 surveys covered 55% of the area covered by the 1980-82 surveys (Fig.1). They covered much of the geographical ranges of the western and eastern grey kangaroos but rather less of the range of the red kangaroo (Fig.2). However, almost all of the higher density areas of the red kangaroo were covered and the surveys included the bulk of areas subject to commercial harvesting of kangaroos.

Comparative results for those areas surveyed in both 1980-82 and 1984 are given in Table 1, broken down by States. Overall, reds have declined by 24%, western greys by 35% and eastern greys by 36%. Because almost all of the 1980-82 survey area in which greys occur was re-surveyed and areas within the distribution of reds that were not resurveyed have only low densities, the percentage changes within doubly-surveyed areas should be closely representative of changes in populations for the entire 1980-82 survey area. Accordingly, estimates for the Australian populations can be circulated for 1984 for comparison with 1980-82 (Table 2). Once again we need to advance what Caughley *et al.* (1983) called a 'plausible guess' for the number of eastern greys in the eastern highlands where steepness of terrain makes aerial survey difficult. For want

TABLE 1 Trend in indices of kangaroo abundance between 1980-1982 and 1984 within the areas covered by both surveys.

	Red		Western		Eastern	
	1980-82	1984	1980-82	1984	1980-82	1984
Queensland	2,156,000	1,760,000	104,000	55,000	3,028,000	2,317,000
New South Wales	3,836,000	1,663,000†	876,000	241,000†	1,936,000	887,000†
South Australia	1,085,000	710,000	256,000	126,000†	—	—
Western Australia	1,010,000	2,001,000†	426,000	666,000	—	—
	8,087,000	6,134,000	1,662,000	1,088,000	4,964,000	3,204,000
Percent change, 1980-82 to 1984 (within '84 survey area)		-24.2%		-34.5%		-35.5%

† Totals differ at better than P = 0.05 by binomial test on frequency of blocks yielding increases and decreases between surveys.

TABLE 2 Comparable estimates for the total populations of red, western grey and eastern grey kangaroos in 1980-82 and 1984.
Note that, as discussed in the text, the values given for greys are likely to be underestimates.

	Red	Western	Eastern	Total
Total Population 1980-82	8,351,000	1,774,000	8,978,000†	19,103,000
Total Population 1984	6,330,000	1,162,000	5,791,000‡	13,283,000
percent of 1980-82 survey area covered in 1984 (approx.)	63%	84%	95%	

† includes estimate of 4 million eastern grey kangaroos in eastern highlands not surveyed in 1980-82.
‡ includes estimate of 2.6 million eastern grey kangaroos in eastern highlands not surveyed in 1984.

of better information, we have assumed that the populations in the ranges fell by the same proportion as elsewhere within the range of this species, i.e. by 35.5%, from 4 to 2.6 millions. Hence, a total of 13 million kangaroos emerges as a figure to be compared with 19 millions in 1980-82, an overall drop of about 30%.

Dissecting the figures in Table 1 regionally, it can be seen that between the earlier survey and 1984 kangaroo numbers increased in the western half of the continent and decreased in the eastern half. Both these changes were predicted, (Caughley *et al.*, 1985), because prior to 1980-82 the eastern populations had had the benefit of about seven years of good conditions, suggesting that the numbers reported from that survey were likely to be above the long-term average. By 1982, however, the eastern states were in the grip of drought to which most of the drop in kangaroo numbers can be attributed (Caughley *et al.*,). In the west, on the other hand, the 1980-82 survey followed a drought of 2-4 years duration that broke in 1980.

The increase in numbers between the two surveys can be attributed to the return of good conditions. It must be remembered that mortality is detectable in a population much more quickly than natality which follows the onset of good conditions by a lag of one to two years because of the time it takes for a new generation of kangaroos to be born and grow large enough to be seen by aerial survey.

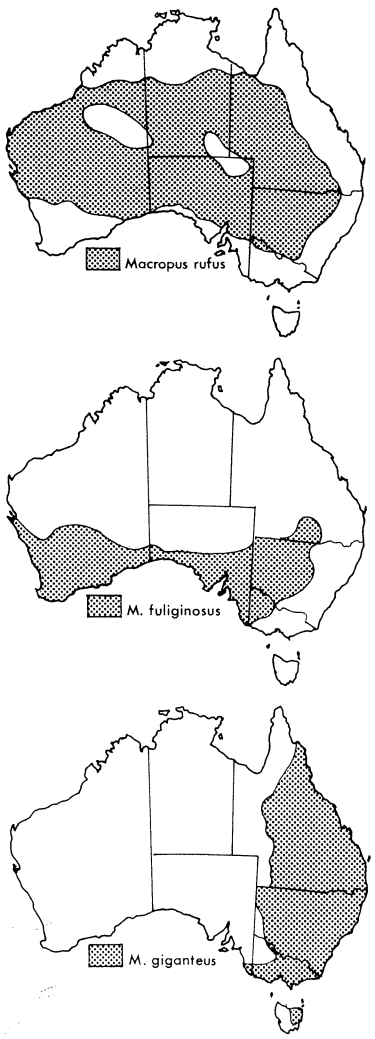

FIGURE 2 Distribution of three species of kangaroos (Caughley *et al.*, 1983)

How frequently and over how extensive an area should aerial monitoring of kangaroo populations be maintained? A full answer cannot be given here because it depends upon the aim of the exercise. Few questions would require regular monitoring of an area as large as that covered by the 1980-82 surveys. Aerial surveys are now made annually in the pastoral zone of South Australia and New South Wales. Surveys are conducted less regularly in Queensland and Western Australia. The Northern Territory and western Victoria have comparatively few kangaroos. Data presented in this paper show clearly how populations in the east and west of the continent may change in opposite directions. South Australia and New South Wales authorities use aerial survey data to identify areas of low density that are then closed to shooting. In view of the rapid fluctuations that typify kangaroo populations (Grigg, 1984), such close management warrants a regular count.

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Note added in proof.

Surveys carried out in 1985 indicate that there have been substantial increases in kangaroo populations in both New South Wales and South Australia since the end of the drought. Results suggest that in N.S.W., the visible population of red kangaroos increased by 43% and greys by 55% since the 1984 surveys were undertaken. Comparable figures for South Australia are 57% increase (reds) and 68% increase (greys). We are grateful to N.S.W. and South Australia National Parks and Wildlife Services for allowing us to include these recently determined estimates.

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