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Road-Kills of Macropods on a Section of Highway in Central Victoria

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Abstract

A 20-km section of highway near Heathcote in Central Victoria was surveyed for road-killed macropods over 5 years. Road-kills of seven swamp wallabies, *Wallabia bicolor*, and 37 eastern grey kangaroos, *Macropus giganteus*, were recorded. Kills of grey kangaroos peaked in the autumn of two years. The majority of kills were of adult males, indicating that motor vehicles act as a selective mortality factor. Most road-kills also occurred around the time of full moon, suggesting that kangaroos are more mobile during that phase. The highest incidence of kills per kilometre was recorded between an area of woodland on one side of the road and farmland on the other. Kangaroo warning signs were erected during the study, but were not effective in reducing the incidence of road-kills.

Introduction

Several studies have analysed the importance of motor vehicle collision as a mortality factor affecting wildlife populations (Hodson 1966; Vestjens 1973; Disney and Fullager 1978; Waechter 1979). Road-kills can also provide valuable biological data (Case 1978; see also McCaffery 1973; Jefferies 1975; Russell and Dawson 1976; Coulson 1980; Salwasser *et al.* 1980; Seebeck and Johnston 1980), and the impact of roads on wildlife populations poses management problems (Bellis and Graves 1971; Oxley *et al.* 1974; Allen and McCullough 1976; Tyson 1980).

Relatively few accidents involving vehicles and macropods are reported to police in Victoria. State accident records list only 30 during the period from January 1977 to June 1979 (Country Roads Board, unpublished data); of these, nine involved injury to occupants of vehicles and the others caused some property damage. General observations suggest that many collisions go unreported when the macropod is the only casualty. In view of this apparent lack of reliable road-kill mortality data for macropods in Victoria, and the fragmented nature of much of their remaining habitat, the topic is worthy of further investigation. The value of the Country Roads Board's policy of erecting roadside warning signs, in an attempt to reduce the incidence of these collisions, is also worth investigating.

This study was aimed at documenting road-kills of eastern grey kangaroos, *Macropus giganteus* Shaw, and swamp wallabies, *Wallabia bicolor* (Desmarest), on a section of the Northern Highway passing through mixed farmland and forest in central Victoria. The erection of roaside warning signs on part of this section of highway during the course of the study allowed their effectiveness in reducing macropod mortality to be considered.

Method

From March 1975 to January 1980 the author surveyed a 20-km section of the Northern Highway for road-killed macropods as he travelled between Echuca (his home) and Melbourne. The section extends from Toolleen to a point just south of Mt Ida in central Victoria (Fig. 1); earlier experience had shown that almost all macropod road-kills on the Northern Highway occurred in this area.

The road passes through undulating country with a number of low cuttings, embankments, minor roads and creeks. Vegetation varies from open improved pasture to woodland and open forest in Crosbie State Forest and Mt Ida State Forest. A roadside reserve of woodland, about 100 m wide, extends the full length of the survey section. Detailed traffic statistics were not available, but the section of highway south of Ladys Pass carried the most traffic.

The road was surveyed, at irregular intervals and various times of day, a total of 124 times. The number of trips per year (excluding 1980) varied from 15 in 1979 to 31 in 1975 and 1977, and each calendar month was sampled a minimum of 4 and a maximum of 17 times (see Table 1). Additional information was obtained from Country Roads Board personnel, local farmers, and travellers through the area.

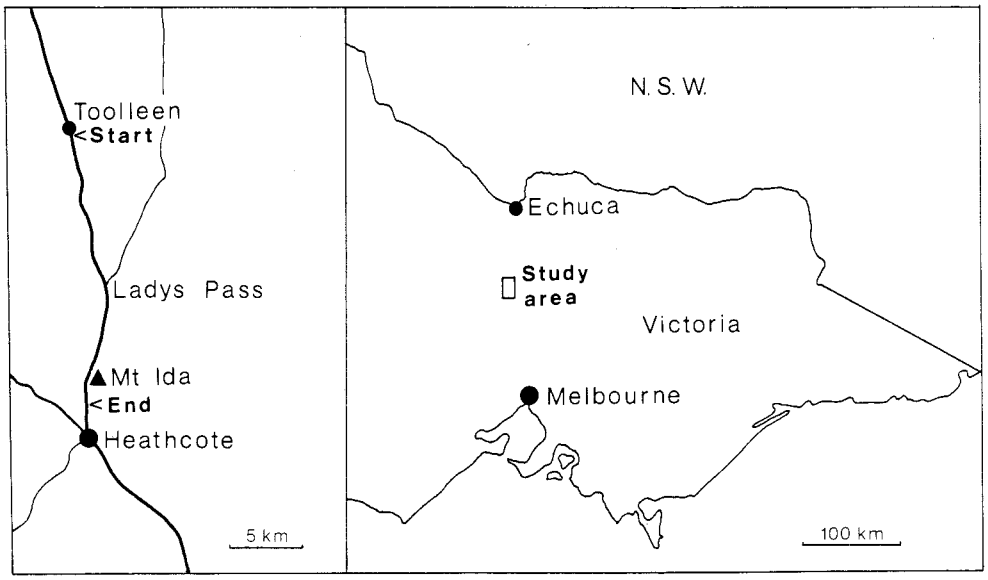

Fig. 1. Location of the study area near Heathcote in central Victoria. The inset shows the section of the Northern Highway surveyed for road-kills.

The carcasses were examined to determine species, sex and breeding condition. They were allocated to broad age classes on an assessment of size: adult (sexually mature), subadult (weaned but not mature) and young at foot. Some badly decomposed or damaged specimens could not be sexed or aged with certainty. The day of death was recorded for recently killed specimens where possible. The location of each road-kill was also recorded.

In February 1978, in response to local requests, the Country Roads Board erected standard kangaroo warning signs at each end of the southern half of the survey area. The signs displayed a silhouette of a kangaroo and the words 'next 8 km' on a yellow diamond.

Results

A total of 25 road-killed eastern grey kangaroos were located and an additional 12 road-kills were reported to the author. Seven swamp wallabies were also found, but the low numbers of this species precluded any detailed analysis.

The monthly distribution of road-kills is given in Table 1. There were distinct peaks of grey kangaroo road-kills: from March to June 1975 and from February to April 1978; these included almost two-thirds of all kills located or reported. Numbers of swamp wallaby road-kills recorded were low in most years, and they were restricted to the summer months, from November to March.

Table 1. Monthly distribution of trips to the section of the Northern Highway and frequency of road-kills of *Macropus giganteus* and *Wallabia bicolor*

K, eastern grey kangaroo, *Macropus giganteus*; W, swamp wallaby, *Wallabia bicolor*. [A]Road-kill reported but not located

Month	1975–76		1976–77		1977–78		1978–79		1979–80	
	Trips	Kills	Trips	Kills	Trips	Kills	Trips	Kills	Trips	Kills
Feb.			1	1 K	2	1 W	2	3 K	2	2 W
Mar.	7	3 K 1 W	2	–	3	–	3	6 K	1	–
Apr.	5	3 K	2	–	2	–	2	2 K	2	1 K
May	6	1 K	1	–	1	–	2	1 K	2	–
June	1	4 K[A]	1	1 K	4	1 K[A]	1	–	–	–
July	3	2 K[A]	3	–	6	–	3	–	2	–
Aug.	4	–	2	1 K	4	1 K	1	–	–	–
Sept.	1	–	2	–	3	1 K	2	–	1	–
Oct.	–	–	2	–	1	1 K[A]	1	–	1	–
Nov.	–	–	2	1 W	1	–	1	1 K	–	–
Dec.	4	–	3	–	3	1 W	–	–	1	–
Jan.	3	1 K[A]	1	–	3	1 K	3	1 W	2	1 K
Totals	34	14 K 1 W	22	3 K 1 W	33	5 K 2 W	21	14 K 1 W	12	2 K 2 W

The numbers of animals in each age and sex class are shown in Table 2. Only four swamp wallabies could be so assigned, but most of the grey kangaroo carcasses could be classified. Males, particularly large adults, predominated in the sample of grey kangaroos.

Table 2. Age and sex distribution of road-killed *Macropus giganteus* and *Wallabia bicolor*

Age class	Sex	*M. giganteus*	*W. bicolor*
Adult	M	10	1
Adult	F	4	1
Subadult	M	5	2
Subadult	F	0	0
Young at foot	?	1	0
Unidentified	?	5	3
Total		25	7

It was possible to accurately determine the day of death of 21 grey kangaroos. The incidence of road-kills was clearly related to phases of the moon. The lunar cycle (assumed to be 28 days) was divided into four intervals of 7 days duration,

corresponding to the day of a lunar phase ± 3 days. The number of road kills in each interval were as follows: new moon, one; first quarter, two; full moon, 13; last quarter, six. A goodness-of-fit χ^2 test indicted that this pattern was significant ($0{\cdot}01>P>0{\cdot}001$, 3 d.f.).

The location of road-kills along the section of highway is shown in Fig. 2. Swamp wallabies were distributed irregularly along the road, but grey kangaroo kills were concentrated in two principal areas: the more significant area was between farmland to the west and woodland (mainly derelict farmland with regeneration of *Acacia decurrens*) adjacent to Mt Ida State Forest to the east; the second area had part of Crosbie State Forest to the west of the road and farmland to the east.

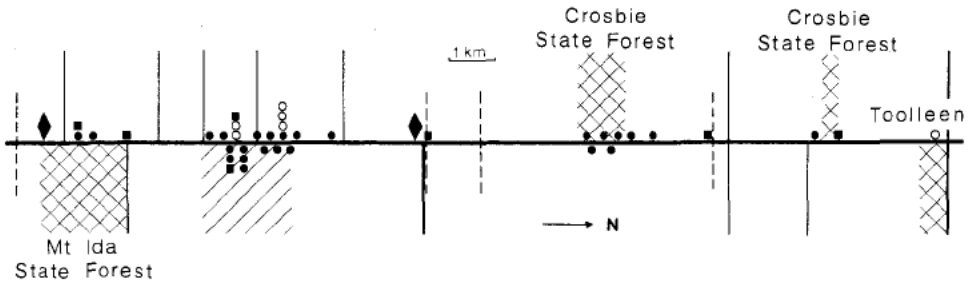

Fig. 2. Schematic diagram of the 20-km section of highway surveyed for road kills. ♦ Kangaroo warning signs. ● *M. giganteus* road-kill located. ○ *M. giganteus* kill reported. ■ *W. bicolor* kill located. Hatching indicates woodland; cross-hatching, open forest. —— Minor roads. - - - Creek crossing.

Fig. 2 also shows the location of the warning signs. Almost one-third of the grey kangaroo road-kills were found outside the section of road controlled by the signs. The incidence of kills before and after the erection of the signs was as follows:

	Between signs	Outside signs
Before signs	13	7
After signs	9	3

A χ^2 test of this 2-by-2 contingency table indicated that the presence of warning signs had no influence on the number of kangaroos killed ($P>0{\cdot}05$, 1 d.f.).

Discussion

Of the accidents involving kangaroos which were reported to police between January 1977 and June 1979, none corresponded to any of the road-kills recorded in this study. This confirms the view that the great majority of kangaroo road-kills go unrecorded. Furthermore, the data presented here are likely to be an incomplete record of actual road-kills, due to two factors discussed by Case (1978): removal of an unknown proportion of carcasses from the roadside before the next survey, and failure to detect any animals that died away from the road. Country Roads Board patrolmen removed (and kept a record) of a number of carcasses, and others were probably collected by local farmers for dog meat.

The predominance of males in the sample of eastern grey kangaroos has a number of possible causes. There are no published data for age structure or sex ratios in Victorian populations of *M. giganteus*, but studies of other populations

(Kirkpatrick 1965; Poole 1973) indicate that the sex ratio is close to parity, at least for pouch young. Unless this ratio changes with age, it seems that males are at greater risk of accidents with vehicles. The impact of this disproportionate loss of what are probably high-ranking males on the social organization and genetics of a localized population is unknown.

The concentration of grey kangaroo road-kills in the autumn of 1975 and 1978 is possibly due to a greater amount of movement between areas of feeding and resting. In those years the rainfall of the preceding summer was poor.

There was also a concentration of grey kangaroo road-kills in the period of full moon. The most likely explanation for this finding is that kangaroos are most active at this time. The species is essentially crepuscular (Coulson 1978) and the subdued illumination of moonlight could be expected to allow greater mobility than darkness, leading to a higher frequency of road-kills. This interpretation is supported by a study of activity in the western grey kangaroo, *M. fuliginosus*, which indicated a possible correlation between maximum activity and the time of the full moon (Stewart and Setchell 1974).

Road-kills were clearly concentrated on some sections of the highway. Although most were adjacent to one area of woodland and another of forest, other areas of forest beside the road did not yield a significant number of kills. The appreciation of such a pattern is obviously essential for the efficient location of warning signs. However, the findings of this study suggest that such signs will be ineffective. Similarly, a study of accidents between deer and cars, by Pojar *et al.* (1975), found that not even a lighted and animated deer crossing sign reduced the frequency of accidents over a 1-mile (1·6 km) section of road. Although motorists reduced speed slightly in response to the sign, they slowed down more when deer carcasses were deposited on the roadside. If this finding is applicable to Victoria, the removal of carcasses from the roadside by Country Roads Board patrolmen may well be counter-productive.

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