

A SURVEY OF ROAD-KILLED OWLS IN NORTH-EASTERN NEW SOUTH WALES

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All owls found dead along roads were noted as part of a larger survey of road-killed vertebrate fauna in north-eastern New South Wales between February 1978 and December 1999. 197 owls of five species, comprising two hawk owls, genus *Ninox*, and three masked owls, genus *Tyto*, were recorded. An average of 9.1 owls/yr was recorded. The Barn Owl *Tyto alba* and Southern Boobook *Ninox novaeseelandiae* comprised 91.3% of all records. Only three specimens (1.5%) of the Powerful Owl *Ninox strenua*, seven (3.6%) of the Masked Owl *Tyto novaehollandiae* and seven (3.6%) of the Grass Owl *Tyto capensis* were found. The Barn Owl, Masked Owl and Southern Boobook were recorded throughout the year. The Grass Owl was recorded only between late winter and late spring. The relative numbers of owls killed compared with other vertebrate species, the reasons for the seasonal bias, where present, and factors causing owls to be road-killed are discussed.

INTRODUCTION

Seven of the nine Australian owl species occur in north-eastern New South Wales: Powerful Owl *Ninox strenua*, Barking Owl *N. connivens*, Southern Boobook *N. novaeseelandiae*, Sooty Owl *Tyto tenebricosa*, Masked Owl *T. novaehollandiae*, Barn Owl *T. alba* and Grass Owl *T. capensis*.

Owls, along with many other animals, are often killed by motor vehicles along roads in the region. This paper reports on records of road-killed owls from 1978 to 1999.

METHODS

The region surveyed extended north to the Queensland border, south to Nahiab (south of Taree) and Forster, east to the Pacific Ocean and west to the E 152° line of longitude. The survey was carried out on all trips within the study area between 18 February 1978 to 17 December 1999. All road-killed vertebrates, excluding domestic animals, were noted. The date, species, location and condition of carcass were recorded. The location details allowed castings and northings to be determined from a map at a later date. The condition of the carcass was noted to allow an assessment of whether a road-killed animal observed at the site on a subsequent visit was the same animal. Other details were taken whenever possible and included age, sex, morph or phase. If the identity of a species was in doubt it was not recorded. Nearly all owls, in particular the *Tyto* species, were checked closely to ensure correct identification of species. Two Masked Owls and one Grass Owl from south of Nahiab are included, as records of these species are sparse.

RESULTS

One hundred and ninety-seven owls of five species, comprising two hawk owls, genus *Ninox*, and three masked owls, genus *Tyto*, were recorded, an average of 9.1 owls/yr. Ninety-one per cent of all records comprised the two common species, the Barn Owl and Southern Boobook. Only three specimens (1.5%) of the Powerful Owl, seven (3.6%) of the Masked Owl and seven (3.6%) of the Grass Owl were found.

In the ten years from 1978 to 1988 113 Tawny Frogmouths and 1 Australian Owlet-nightjar were recorded, an average of 11.3 and 0.1 per year, respectively. There were 85 owls (all species combined) for the same period.

Annual and seasonal variation

Owls were found in all years of the study with the Southern Boobook and Barn Owl represented in all years. The Powerful Owl was found in 3 years, the Masked Owl in 6 years and the Grass Owl in 7 years. The number of owls killed per year ranged from 4 to 20 (mean of 9 ± 4). The highest number occurred in 1986 (20) reflecting a higher than average number of Barn Owls killed. The next highest was 1998 (18) with twice the average number found killed, reflecting high numbers of both the Southern Boobook and Barn Owl. Six Boobooks were found on the same day, between Herons Creek and Nahiab, in that year.

The lowest count was in 1994 with only 1 Barn Owl and 3 Southern Boobooks recorded.

Seventy-two owls (36.5%) were killed in the winter, 62 (31.4%) during spring, 34 (17.2%) in autumn and 29 (14.7%) in summer (Table 1). The month with the highest number was September with 36 (18%). One hundred and eight (54.5%) owls were recorded from June to September.

The highest number of Southern Boobooks occurred from May to July with 42 (46.6%) recorded. Barn Owls were more commonly located from August to October with 53 (58.9%) found dead in that period. All Grass Owls were found between August and November.

Monthly patterns of road-kill records of the Southern Boobook and Barn Owl differed significantly (Chi-square = 42.9, d.f. = 11, $P < 0.001$), the Southern Boobook being more frequently found road-killed than expected from April to July and the Barn Owl from August to October. There were insufficient records for a statistical comparison including other species.

DISCUSSION

Impact of owl road-kills

The impact on the Masked Owl, Grass Owl and Powerful Owl could be significant as these species have small populations, but the total numbers killed annually are still quite low. A survey in East Germany recorded 51 Barn

TABLE 1
Seasonality of Owl Road-kill Records.

Species	Summer			Autumn			Winter			Spring			Totals
	D	J	F	M	A	M	J	J	A	S	O	N	
Southern Boobook	6	5	6	5	8	12	12	18	5	9	3	1	90
Powerful Owl	0	0	1	0	0	0	0	0	0	1	1	0	3
Barn Owl	3	4	2	5	1	2	8	7	19	23	11	5	90
Masked Owl	1	1	0	0	0	1	1	0	0	1	0	2	7
Grass Owl	0	0	0	0	0	0	0	0	2	2	2	1	7
TOTALS (monthly)	10	10	9	10	9	15	21	25	26	36	17	9	197
(seasonal)	29			34			72			62			

Owl road-kills on a 2.5 km stretch of freeway over a seven day period (Uhlenhaut 1976) and the main causes of Barn Owl deaths in Great Britain ($n > 1000$) were starvation and collision (mostly with road traffic) (Newton *et al.* 1997). Owls and diurnal raptors accounted for 81.5 per cent of all birds in a study in France (Baudvin 1997) In Far North Queensland 13 road-killed Southern Boobooks were recorded between Mount Garnett and Georgetown on the one day (Emmerson 1999). There are also 'hotspots' where large numbers of animals are road-killed, either single species or multiple species. There are seven published records of road-killed Masked Owls between 1973 and 1984 in the Bulahdelah district, just south of my study area (Rogers 1975, 1976, 1977; Lindsey 1984; Debus and Rose 1994). This is a high number considering that my study located the same number for the whole north coast region in nearly 22 years of recording. Road-killed Masked Owls in that area appeared to decrease following a deviation of the route of the Pacific Highway. A very recent deviation (1999) of the Highway has dissected previously undisturbed or lightly disturbed habitat suitable for the Masked Owl, Powerful Owl and Sooty Owl. Monitoring of this section of highway will determine whether greater numbers of the larger owls, in particular the Masked Owl, are road-killed as a result of this deviation.

Large numbers of owls may be killed occasionally by motor vehicles but the impact on local populations would depend upon a number of factors such as the original population size, the age of the birds killed and whether a high percentage of mature breeding adults were involved. Adult mortality of Barn Owls, killed by motor vehicles, was estimated to be approximately 11% in a study in Germany (Illner 1992). Illner considered that road deaths could have contributed to the observed long-term decline in Barn Owls and Little Owls. Therefore it is desirable to reduce the incidence of road-killed owls, particularly at sites with multiple deaths.

Annual and seasonal variation

The total of 16 Southern Boobooks killed in 1986 was interesting, being nearly four times the average. These records were spread over the period from February to September. The reason for this high count is not known but could reflect a bias in terms of areas surveyed although this would have also been present in other years. A variation in the availability of prey (see Vestjens 1973) is more likely to be a significant cause. A monthly study of road-kills between Canberra and Lake Cowal over a two-year

period found 19 Southern Boobook and 28 Barn Owl road-kills. 22 Barn Owls and 13 Boobooks were found in the first year of the study. The higher number killed in the first year was attributed to a plague of the House Mouse *Mus musculus* just before the commencement of the survey (Vestjens 1973). A similar survey between Gungahlin and Murrumbateman over two years recorded only one Barn Owl and one Southern Boobook (Lepschi 1992). A two-year survey in Western Australia (Brown, Brown and Pesotto 1986) and two single-day counts between Yass, New South Wales and Seymour, Victoria did not record any owls (Disney and Fullagar 1978).

The majority of owl road-kills occurred during winter and spring. Southern Boobooks predominated in the late autumn-early winter period with the late winter-early spring records comprising mostly Barn Owls. Boobook juveniles disperse in late summer or autumn (Higgins 1999) and the late autumn-early winter population would comprise a percentage of inexperienced birds in their first year of life. The age of the road-killed Boobooks was not determined but young birds are difficult to separate from adults some months after dispersing. Birds of all ages may migrate to the area from higher altitudes or higher latitudes. Some Tasmanian Southern Boobooks are known to winter in Victoria and New South Wales (Higgins 1999). It is not known whether any of these birds reach north-eastern New South Wales but as their plumage is distinctive identification would be relatively easy with a close examination. However, not all road-killed Boobooks were closely examined. Another possible explanation is that Boobooks of all ages, but probably immature birds in particular, would find hunting during the winter more difficult. At this time of the year roadsides, and animals injured by motor vehicles or attracted to the lights of the traffic, may become more profitable hunting sites.

The seasonal predominance of the Barn Owl is harder to explain. This species breeds at any time of the year, usually in response to abundant food (Higgins 1999). The species may be a more seasonal breeder in the north coast region as this area experiences less year to year climatic variation than many parts of Australia. Young birds could be dispersing during late winter-early spring, explaining the peak, although there is no evidence to support this hypothesis. A study in Great Britain found that Barn Owl deaths (from starvation and collision) were much higher outside of the breeding season with peaks in autumn (mainly juveniles) and late winter (adults and juveniles) (Newton *et al.* 1997).

The Grass Owl results, although consisting of only a few records, are consistent with a survey of the species in north-eastern New South Wales, which found that the majority of records occurred between July and October (Maciejewski 1997). That study, however, found records from throughout the year and Maciejewski suggested that the seasonal increase was probably attributable largely to the dispersal of juveniles, after fledging in winter.

Species composition of owl road-kills

The larger numbers of Southern Boobooks and Barn Owls compared with the other owl species reflects their relative abundance. The Powerful, Masked and Grass Owls are habitat specialists, and are considered rare in New South Wales, being listed as 'vulnerable' on schedule 2 to the *Threatened Species Conservation Act, 1995*.

The very small number of Powerful Owls killed may also reflect the species' habit of preying on arboreal mammals and birds which would rarely cause the species to frequent areas near roads, where collision with a vehicle could occur. The Masked and Grass Owls procure much of their prey from the ground, making them more vulnerable to collision. Road corridors constructed through forest habitats can provide open feeding sites for species such as the Southern Boobook, Barn Owl, Masked Owl and Grass Owl, making them more susceptible to being killed by vehicles.

Road category

All owl road-kills were on sealed roads with most being on highways/freeways or major sealed roads. This result is partly due to observer bias in that more time was spent driving along sealed roads. This cannot explain the total absence of road-killed owls from unsealed roads, however, as many hours were spent driving such roads during fauna survey work. It is clear from the data that the larger the road and the heavier the traffic load and higher speed of vehicles, the greater the chance of an owl road-kill occurring. The possible reasons for this are that larger roads may have been constructed through more optimal owl habitat than unsealed roads, that the large, and sometimes constant, traffic flow increases the risk of owls being killed, or, that the greater average speed of vehicles on highways/freeways results in a larger number of owl road-kills. A study in Germany found that car speeds of more than 80 km/h resulted in about 21 times as many owls being killed by cars (Illner 1992). In this study it was also found that density of traffic had little effect on road death rates. The prevalence of heavy vehicles on major roads in the study area is almost certainly an additional factor. Many heavy vehicle movements are made at night. Significantly fewer road-kills were found on a section of gravel road compared to sealed sections of the same road in a study in southern New South Wales (Vestjens 1973).

The nature of the road corridor along major roads could also provide attractive foraging habitat for owls, thus increasing the chance of owl mortality. Owls were attracted to roadsides in France, preying on voles, with a number being killed by motor vehicles (Baudvin 1997). Baudvin recommends that the roadside vegetation be managed to make it a less suitable for hunting owls.

SUMMARY

Owls of a number of species are regularly killed on roads within the study area with the number of records in this study representing an unknown proportion of all owl road-kills. The impact could be great, especially at the local level. Therefore road design, and vegetation management within the road corridor, are important in addressing the impact of motor vehicles on owls.

This study was limited by time constraints which prevented full documentation of details such as distance travelled per year. Future studies of road-killed fauna should record distance travelled per year and per road category. This would not be difficult for short-term studies.

There have been only a few short-term studies of road-killed fauna carried out in Australia to date. Studies of this type are useful and further surveys are encouraged.

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A FIELD KEY FOR THE IDENTIFICATION OF AUSTRALIAN OWLS

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Detailed descriptions of morphological and morphometric characters allowing the various Australian owls to be distinguished are contained in the scientific literature (Disney 1974; Higgins 1999) and field guides (Pizzey and Knight 1997). The following key is presented to facilitate identification of road-killed owls in the field and is based on the published literature and the author's own field experience.

Key to Australian owls

1. Distinct facial disc and ruff present (genus *Tyto*) 2
 1* No distinct facial disc or ruff (genus *Ninox*) 6

Key to *Tyto* owls

- 2 Tarsus feathered for about half its length, lower tarsus covered with sparse hair-like feathers 3
 2* Tarsus fully feathered to base of toes (with 'trousers') 4
 3 Crown and back ash-grey to ash-grey and buff with brown spots tipped off-white, legs relatively short, extending 20-40 mm past tail tip when stretched Barn Owl *Tyto alba*
 3* Crown and back dark brown, some buff, with white spots, legs long and extending 70-90 mm past tip of tail, eyes small Grass Owl *Tyto capensis*
 4 Upperparts sooty grey with fine or large white spotting and flecking, underparts similar but paler, or with mottling of blackish Vs. black edging to grey or silver facial disc 5
 4* Upperparts dark brown and buff with white spots or speckles, white to buff facial disc Masked Owl *Tyto novaehollandiae*
 5 380-500 mm total length, breast spotted, facial disc grey Sooty Owl *Tyto tenebricosa*
 5* 310-380 mm total length, breast with Vs. facial disc whitish-silver (tropical Queensland) Lesser Sooty Owl *Tyto multipunctata*

Key to *Ninox* owls

- 6 Large owl (total length 460-600 mm) 7
 6* Small to medium sized owl (total length 300-440 mm) 8
 7 Total length 500-600 mm, dark brown to dark grey-brown, upperparts heavily barred, underparts off-white with bold dark chevrons (south-eastern Australia) Powerful Owl *Ninox strenua*
 7* Total length 460-570 mm, dark brown to dark rufous brown, upperparts barred, underparts off-white with close rufous-brown or dark-brown barring (northern Australia) Rufous Owl *Ninox rufa*
 8 Total length 390-440 mm, shaped like a small Powerful Owl, dark, brown to grey-brown upperparts, indistinct facial mask, iris pale yellow to yellow, toes yellow Barking Owl *Ninox connivens*
 8* Total length 300-350 mm, more compact than Barking Owl, dark-brown to pale sandy-brown upperparts, distinct dark mask, iris light greenish-grey to bright yellow, toes grey Southern Boobook *Ninox novaeseelandiae*

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