

No prescription yet to counter the roadkill of our native fauna: a study of roadkill in the Narrabeen Catchment of Sydney

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ABSTRACT

This study describes a survey of roadkill in a suburban area of Sydney, Australia. The study was conducted by a community activist motivated by the rejection of a roadkill mitigation proposal by state Roads and Traffic Authority on the basis of insufficient evidence of need. Roadkills were recorded in suburban bushland on two roads in the north-east of Sydney. The study was conducted over a 36-week period. Eighty four native animals were observed dead on or adjacent to the roads. The predominant species killed were swamp wallabies *Wallabia bicolor*, brushtail possums *Trichosurus vulpecula* and long nosed bandicoots *Perameles nasuta*. The great majority of killed swamp wallabies were male. There was a noticeable absence of small fauna.

The dissemination of this study and others led to a public forum on road kill being held. From this public forum, a “RoadKill Committee” was formed comprising local stakeholders. Strategies for mitigating roadkill were implemented and a public awareness campaign was also developed. These activities are presently being evaluated.

Roadkill surveys such as this helps provide information about the nature and extent of roadkill. They can also galvanise local community opinion and help develop and monitor local roadkill mitigation strategies.

Key words: road kill, suburban bushland, Sydney, swamp wallaby, *Wallabia bicolor*, brushtail possum, *Trichosurus vulpecula*, long nosed bandicoot, *Perameles nasuta*, stakeholders, gender, mitigation, community awareness.

“I clearly recall my first encounter with the icon of our native fauna on the side by the road, dead, bloated, stinking, covered with flies. More dead kangaroos followed. I hardly had ever seen a dead animal on a road in Germany, but my boyfriend just drove on” (Conny Harris – presentation to RZS 2006)

Seeing dead native fauna on Australian roads is a common experience for road users and is so frequent as not to be remarked upon by most Australians, yet it stands out to tourists and others who have not become habituated to this sight. Studies examining the incidence of roadkill in New South Wales have focused on non-metropolitan areas up to now (Taylor and Goldingay 2004; Klöcker *et al.* 2006). This ignores the experience of the majority of Australians who see roadkill in such an area when they travel in the suburban and bushland fringes of our major cities (Figure 1). This study is a field study of roadkill along roads in the Narrabeen Lagoon Catchment in the north east of Sydney.

An important dimension of the experience of roadkill in Australia is the effect that this has upon the community. The ubiquity of roadkill and the perceived difficulty in attacking this problem may have caused the community response to be understated. This



Figure 1. A dead swamp wallaby *Wallabia bicolor* lying on the side of the Wakehurst Parkway. Photo, J. Marlow.

passivity has been attacked by community activists publicising the problem in local and other news media (Belessis 2000; Morcombe 2002; Muxworthy 2006) and the establishment of wildlife rescue services in many areas throughout Australia. This activity has contributed to a slow uptake of roadkill mitigation projects by state road and traffic authorities or local governments (eg Compton Road Project – Brisbane City Council [Sauter, M 2006]; Pacific Highway fauna underpass – RTA [AMBS, 2001]).

This project field study was motivated by the exposure of the first author to dead animals on roads in her local area. Prior to Christmas 2004 cyclists in and around Narrabeen Lagoon noticed a very large number of ringtail possums *Pseudocheirus peregrinus* dead on these roads. While a possum crossing had been installed by the Road and Traffic Authority of New South Wales (RTA) on the southern end of the major road traversing the Narrabeen Lagoon Catchment, the Wakehurst Parkway, it seemed far removed from roadkill hotspots and because of its construction with bare posts, metal ladders and enclosed suspended runway unlikely to be conducive to use by possums. Discussions with National Parks and Wildlife Service of New South Wales (NPWS) and the Environmental Management Department of Warringah Council, the local government authority, resulted in a proposal to erect a simple marine grade rope between two healthy trees where the canopy was nearly bridging the road and where a large number of dead possums had been observed. The project was supported by a community fundraising event and the local council offered to cover ongoing maintenance. However the RTA rejected the proposal. One of the reasons for its rejection was the lack of data documenting the need for intervention. The aim of this study was to address this deficiency. It was designed to locate and enumerate fauna fatalities on that road – the Wakehurst Parkway, in comparison to an adjoining local road – Morgan Road.

Method

Study area

The study examined two sections of contiguous road. The first road was the Wakehurst Parkway (33° 43' S 151° 14' E), an arterial road, of which a 7.4 km section was surveyed. It is a two lane road which has a speed limit of 80 km per hour. The surveyed section follows Middle Creek in a deep valley, bridging the creek via three culverts until it reaches the side of Narrabeen Lagoon. Average daily traffic flow is 11,435 vehicles per day (RTA traffic volume sample August 2005, monitoring site MR397 provided to author JM by RTA).

The second road was a local road, Morgan Road becoming Oxford Falls Road West, within the same bushland area. The length of this road is 4.2 km from the intersection with the Wakehurst Parkway to Forest Way. Over the last few years, since it was completely sealed, it has become a well known short cut between these two arterial roads. It is a windy road that had a 60

km per hour speed limit. It crosses three creeks, one via a one lane bridge, ascends 2 hilltops, and accesses a few rural properties. A traffic count in June 2006 conducted by Warringah Council, the local government authority, monitored an average of 1594 vehicles per day.

The roads in the surveyed area pass through several vegetation communities which vary from sandstone heath along the hilltops beside Morgan Rd to woodland and differing forest communities in the valley. Near Narrabeen Lagoon sedgeland and a freshwater swamp exist alongside the Parkway (Smith and Smith 2005b).

Both roads are adjoined by large sections of bushland as well as highly weed-infested areas. Both roads are subject to flooding rendering them impassable for hours or at most a few days. Artificial illumination is restricted to less than 2 kilometres of the roads. Both roads are located within the Narrabeen Lagoon Catchment which is 55 square kilometres in size. Of this area, half is still bushland, a quarter is residential and the other quarter is composed of parkland, golf courses and rural properties. Given its relatively unspoilt nature (Smith and Smith 2005a), the catchment presumably supports a high level of biodiversity, although the extent of any losses since European settlement remain largely unknown.

Roadkill data - Timeframe and Method

Data were collected over a total of 36 weeks spanning April to November 2005 and again from February to April 2006. The period in between was omitted from observation because of the unavailability of the researchers. Observations were made once weekly on Saturday mornings between 7 and 7:40 am while cycling along the roads.

All roadkill seen while cycling was examined and identified. Dead fauna were identified using field guides or reference indices (Ehmann 1992; Griffiths 1997; Slater *et al.* 1989; Strahan 1992). If it was a mammal, the sex was determined if possible and for females, evidence of young was recorded. Presence of pouch young, no matter what size or clear evidence as demonstrated by the presence of enlarged teats in combination with an extended pouch, was counted as two fatalities, mother and offspring. If pouch young were still alive they were triaged for their chance of survival. No pouch young during the study period were mature enough and all were left to die within the pouch. In all five pouch young were counted as fatalities. No further data were recorded.

The approximate location with the date, and species and other particulars were plotted on aerial photographs of the surveyed route at the time of examination or shortly thereafter (see Maps 1, 2 & 3).

Results

The roadkill found are detailed (Tables 1 and 2) below and their position illustrated in three maps proceeding from west to east, (1) Map Morgan – Oxford Falls West Rd, (2) Wakehurst Parkway (Map 1) and (3) Wakehurst Parkway (Map 2). The three maps adjoin each other.

Eighty four dead animals were observed over the survey period with swamp wallabies *Wallabia bicolor* being the most frequently killed species. The pattern of roadkill of the swamp wallabies was affected by gender and local topography. These animals were more likely to be killed in restricted sections of the road defined by a waterway or by a specific “run”. Almost all were killed in sectors bounded by larger areas of bushland. Far more males were killed than females (14 male: 4 female, remainder gender unknown). A very high number of deaths occurred along Morgan Road (3.8 deaths/km over the observed period) when compared to the Wakehurst Parkway (1.6 deaths/km over the observed period).

Dead possums were widely spaced along the roads surveyed. Brushtail possum *Trichosurus vulpecula* deaths far out numbered ringtail possum *Pseudocheirus peregrinus* deaths on both Morgan Rd (0.75 deaths /km vs 0 deaths) and the Wakehurst Parkway (2.8 deaths/km vs 0.4 deaths/km).

Three dead tawny frogmouths *Podargus strigoides* were found in a section where road widening and artificial illumination was installed during the survey period. All deaths occurred after the installation of the illumination suggesting a negative impact of such lighting on this species, possibly due to the attraction of insect prey.

Most bandicoots could be identified as being long nosed bandicoots *Perameles nasuta*. However if due to their condition identification was impossible they were recorded as long nosed, as the southern brown bandicoot *Isodon obesulus* has not been recorded along these roads (Smith and Smith 2005a).

Discussion

This study describes the roadkill observed on roads through bushland in a suburban setting in Sydney. Surveys of roadkill have in the main been conducted in Australia in rural settings (Coulson 1997; Taylor and Goldingay 2004; Klöcker et al. 2006) however the majority of Australians are likely to observe roadkill within a setting similar to that of this study. An understanding of the factors contributing to the death of animals on these roads (Ramp and Ben-Ami 2006) is essential if these populations of wildlife are to be sustained and to assess the effectiveness of roadkill mitigation interventions.

The original impetus for the study, the observation of large numbers of ringtail possum deaths, was not borne out by the study itself with only 4 out of 28 possums found to be ringtails. This finding was observed by the author C.H. and other bicycle riders who supported the impression that ringtail possums disappeared as roadkill in the wider area. It is possible that the predation of ringtail possums by powerful owls *Ninox strenua* was a contributing factor in this change as several were reported in the area over the period of the survey. Outside the survey time period a powerful owl with a ringtail possum in its claws was found killed on this road. On the Wakehurst Parkway section, brushtail possums were the species most frequently killed. A possum was four times more likely to be killed on the Parkway (2.8 deaths/km over the surveyed period) than on Morgan Road (0.7 deaths/km over the surveyed period).

The large number and clustering of dead swamp wallabies was similar to that observed by Ramp et al. (2006). However we were nonetheless surprised to see wallaby fatalities outnumber possum deaths. When considering the numbers killed per kilometre

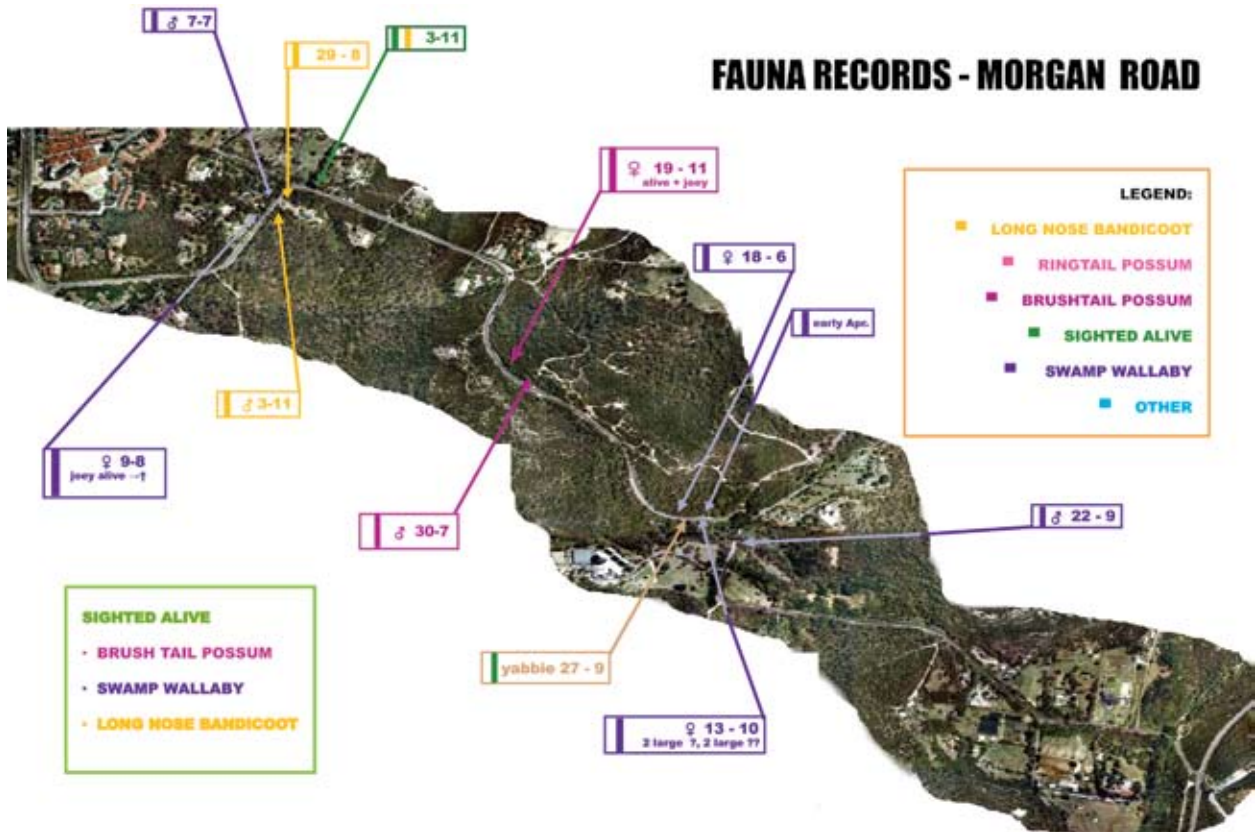
Table 1. Species, Gender, Number and Location of mammals found dead.

Common name	Scientific name	Wakehurst Parkway			Morgan Road			Total
		M	F	U	M	F	U	
Swamp wallaby	<i>Wallabia bicolor</i>	6	1	5	8	3	5	28
Brushtail Possums	<i>Trichosurus vulpecula</i>	6	4	11	1	1	1	24
Ringtail Possums	<i>Pseudocheirus peregrinus</i>	2	0	2	0	0	0	4
Long-nosed bandicoot	<i>Perameles nasuta</i>	3	2	6	1	0	1	13
Echidna	<i>Tachyglossus aculeatus</i>	0	0	1	0	0	0	1

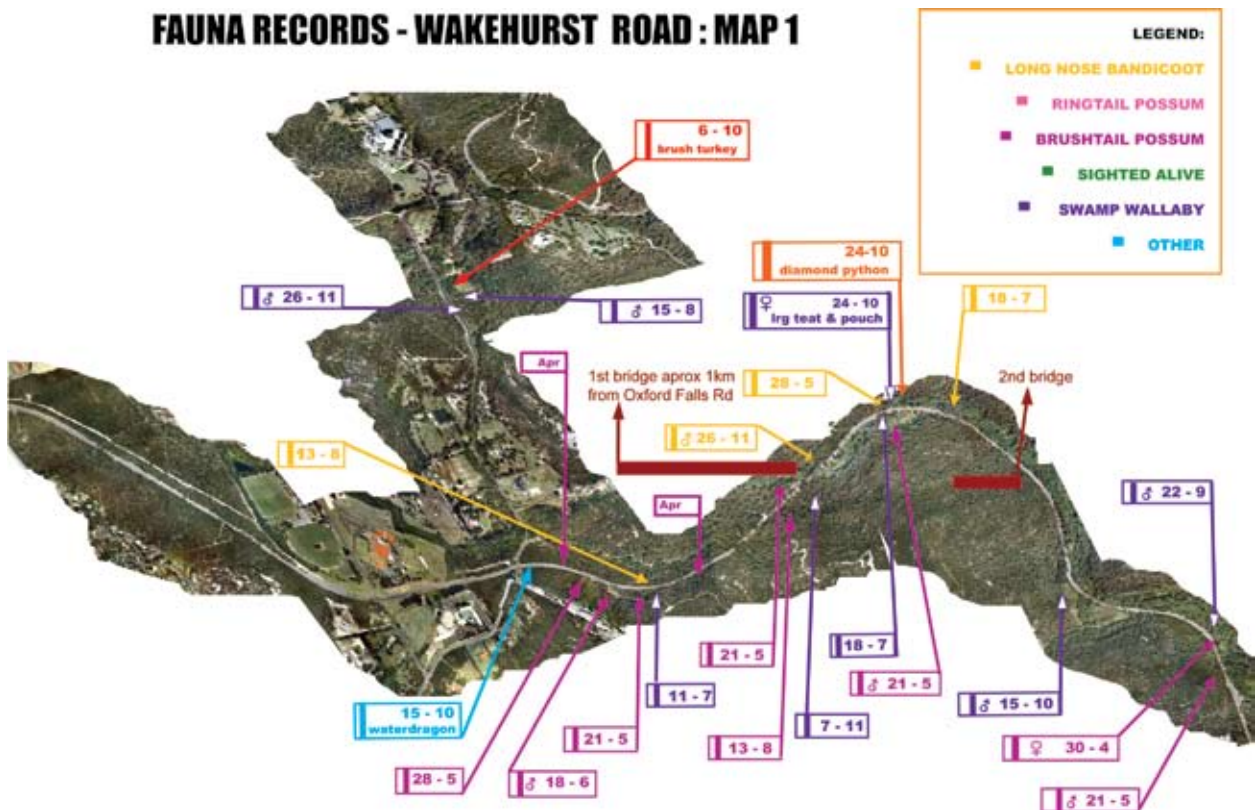
M=male, F=female, U=unknown gender due to injury or decomposition

Table 2. Species, Number and Location of other animals found dead

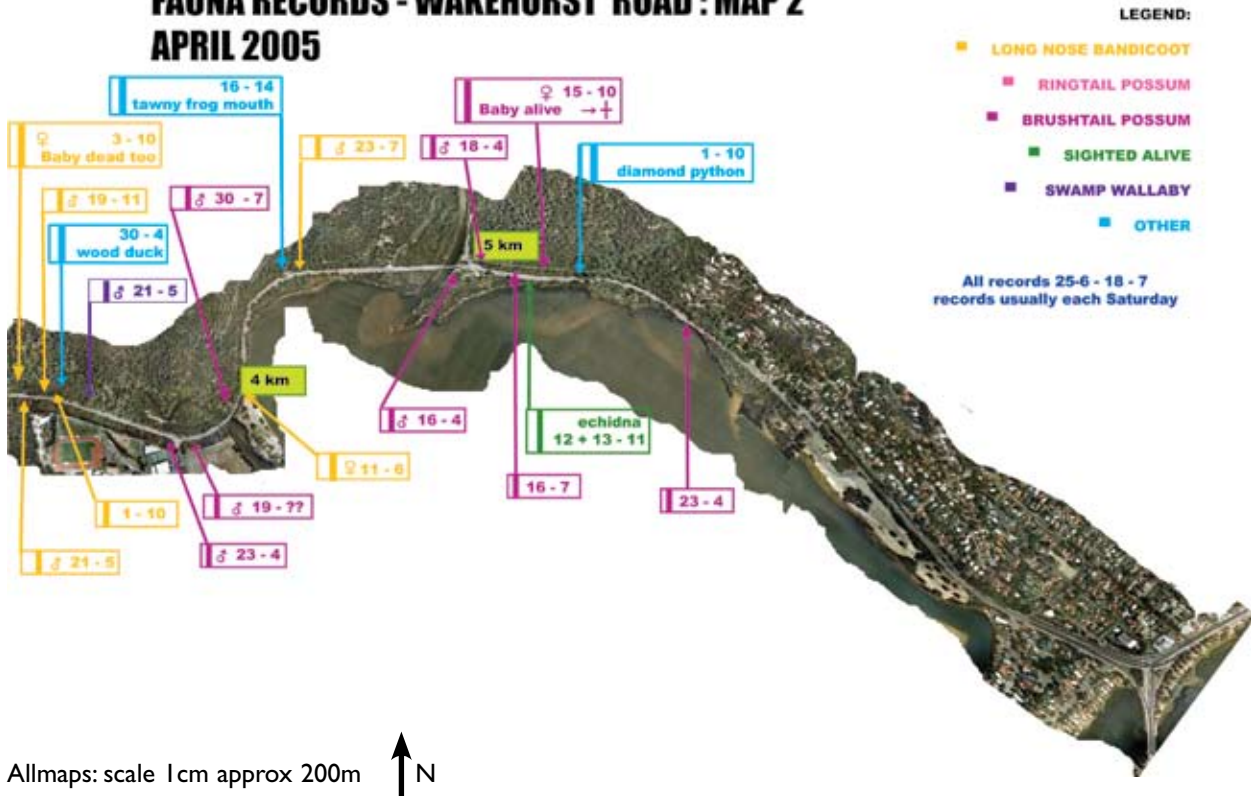
Common name	Scientific name	Wakehurst Parkway	Morgan Road	Total
Tawny frogmouth	<i>Podargus strigoides</i>	6	0	6
Wood duck	<i>Chenonetta jubata</i>	1	0	1
Eastern Water Dragon	<i>Physignathus lesueurii</i>	1	1	2
Lace Monitor	<i>Varanus varius</i>	1	0	1
Eastern Blue Tongue	<i>Tiliqua scincoides</i>	1	0	1
Blind Snake	<i>Ramphotyphlops nigrescens</i>	1	0	1
Diamond python	<i>Morelia spilota</i>	2	0	2



FAUNA RECORDS - WAKEHURST ROAD : MAP 1



FAUNA RECORDS - WAKEHURST ROAD : MAP 2 APRIL 2005



wallabies were about 2½ times more likely to be killed along Morgan Road than on the Wakehurst Parkway. Furthermore the hit zones for wallabies on Morgan Road were mostly restricted to sections of a few metres in length only, whereas on the Wakehurst Parkway the killing zones stretched for longer distances. Swamp wallabies differed from brushtail possums in that the latter were killed along the full length of the Wakehurst Parkway. This suggests that modelling of factors contributing to collision hotspots such as done in Ramp *et al.* (2006) may be ignoring important species specific factors when combining all mammal species data. Importantly one hit zone accounted for half the female fatalities. This section of road has been frequented by other female swamp wallabies with young since the study period. The existence of swamp wallaby hit zones and the possibility that some may be gender specific suggest that this species will be more amenable to roadkill mitigation strategies.

The range of animals killed in this study differed from that observed by Ramp *et al.* (2006), the only comparable study of which we are aware of in the Sydney region. They found a far greater number of birds amongst the species killed with birds making up 66.1% of dead animals as against only 8.3% in this survey. Amongst the mammals observed killed they also noted a large number of swamp wallabies— 41.7% of the total mammals killed vs 40.0% in our sample- but comparatively few long nosed bandicoots – 2.8% vs 18.6%. The differences between the two studies may be explained by a number of factors. Firstly different sampling methods were used.

In our study the observer cycled once weekly over a 36 week period. In Ramp *et al.* (2006) a pair of observers drove along a set route daily over a five month period. The daily observations may have helped record smaller animals such as birds that could have been scavenged over the week between observations by the cyclist. Secondly the Wakehurst Parkway is approximately three times as busy as the roads monitored in the Royal National Park by Ramp *et al.* (2006). The density of traffic flow may alter the range of wildlife willing to come near the road. Finally, although the bushland between the two survey sites may have some similarities, they differ in the habitat they provide and hence the animals exposed to risk.

The absence of small animals from this survey may reflect a number of factors. Firstly no small mammals or small birds were seen. All reptiles found dead were recorded. Dead frogs were rarely seen but not recorded. So this result may be a true result of few such deaths. This seems unlikely. Alternatively this may be a function of the survey method. Small animals like lizards, frogs and birds can be missed when cycling and so the accuracy of any count could have been compromised. The surveyed roads had thick undercover growing close to the edges of the road obscuring any dead animal not on the road or close to the roadside. However we note that the speed travelled (<20km/hr) is comparable or slower than in other surveys eg Taylor and Goldingay (2004) or Ramp *et al.* (2006). Finally, the survey was performed once weekly so it is very likely that a high proportion of these smaller animals would have been scavenged or decomposed

by the time the weekly survey was performed whereas larger animals such as wallabies remained to be observed. Taylor and Goldingay (2004) noted that 30-50% of birds and mammals killed in their survey were removed within a week, suggesting that a significant proportion of roadkill would not have been observed in our study. This is especially true for the smaller bodied species.

The effect of roadkill on the remaining species within an area such as Narrabeen Lagoon Catchment is significant. Within the last few years highly significant road kills within the Catchment included a koala *Phascolarctos cinereus* (Published Anon. 26.7.2000), a spotted-tailed quoll *Dasyurus maculatus* (NPWS – Sept. 2001), a Powerful owl, a Lewin's rail *Rallus pectoralis* and a Bandi Bandi snake *Vermicella annulata*. This is in addition to the cumulative effect that continued roadkill is likely to have on the long term viability of other animals such as the swamp wallaby. Ramp and Ben-Ami (2006) modelled the impact of roadkill on swamp wallabies in the Royal National Park, Sydney, and found that this factor could lead to population decline and local extinction. Although a listing of the fauna of this area has been completed (Smith and Smith 2005a) we are not aware of any population assessments that would allow us to estimate animal populations and hence to model the impact of this degree of roadkill more accurately.

Impact of the Survey

This survey was presented to the Administrator of Warringah Council, the local government area, in a public forum of the council meeting held in April 2006. It received front page coverage in the local paper and was discussed on talkback radio. Extensive community support was demonstrated by a continuous flow of letters to the press and further articles.

The administrator championed the issue along with one of the local members of state parliament and a public meeting on roadkill took place with over 100 people attending. At the meeting this survey along with other presentations was discussed. Subsequently, a "Roadkill Committee" representing relevant stakeholders was set up to address the need for remediation of the situation and to raise public awareness.

As a result of further inspections of roadkill hotspots several runs used by swamp wallabies were identified and mitigation options were discussed. On Morgan Rd a speed limit of 50 km per hour was established.

On the Wakehurst Parkway two of the culverts for Middle Creek were identified as alternate crossing



Figure 2. Warringah Kids Care Calendar illustration addressing the Roadkill issue.

options for animals and their use was confirmed by observing animal tracks in sand plots in these culverts. A wallaby exclusion fence was constructed along the section of road between these culverts. This fence was funded by the RTA and Warringah Council.

Raising Public Awareness

Local primary school students created artwork about roadkill. The best piece of work was published in the Warringah Kids Care Calendar 2007 (See Figure 2). A series of car "bumper stickers" have been designed to alert drivers about modifying their driving style and to provide information about aiding injured native animals. From the public roadkill meeting a data base of over 100 volunteers to document roadkill was established.

Conclusion

This study describes an observational study of roadkill on suburban and peri-urban roads in Sydney, Australia. Recordings were made during a weekly bicycle tour of a defined section of road. Roadkill was predominantly mammalian (83%) and consisted primarily of swamp wallabies, brushtail possums and long-nosed bandicoots. The composition of species observed dead differed from the only other comparable local study (Ramp *et al* 2006) in the gender and species composition.

The information contained in this study was used to develop local roadkill mitigation strategies and to raise public awareness. The effectiveness of these actions is the subject of continuing investigation. We see this as an example of the positive contribution that community activism can achieve.

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