

# Roo town slow down: a community-based kangaroo management plan for Anglesea, Victoria

Danielle Inwood<sup>1,2</sup>, Helen Catanchin<sup>1,3</sup> and Graeme Coulson<sup>1,4</sup>

1. Department of Zoology, The University of Melbourne, Victoria 3010, Australia.

2. Office for Environmental Programs, The University of Melbourne, Victoria 3010, Australia.

3. Current address: Melbourne Museum, GPO Box 666, Melbourne, Victoria 3001, Australia.

4. Corresponding author. Email: gcoulson@unimelb.edu.au

## ABSTRACT

The town of Anglesea on the west coast of Victoria is famous for its Eastern Grey Kangaroos. However, conflicts have increased between people and kangaroos in the town. Many concerns are centred on the golf course, which can support a population of over 300 kangaroos at times. Road-kills of kangaroos are a major issue for residents, and have apparently increased over the last decade. Residents share a number of other concerns about kangaroos, and are interested in understanding more about them. These issues are being addressed by the development of a community-based kangaroo management program, which may become a blueprint for living with kangaroos in urban areas of Australia.

Key words: Eastern Grey Kangaroos, *Macropus giganteus*, overabundance, road-kill, urban wildlife, wildlife management.

## Introduction

Kangaroos are Australian icons (Higginbottom *et al.* 2004; Wilson and Croft 2005). Images of kangaroos can be seen on the coat of arms of the Commonwealth of Australia, on the tails of the national airline, on the shirts of the Australian soccer team, as well as on everyday items such as boxes of breakfast cereal. Kangaroos are a charismatic feature of Australian landscapes, and are a major component of the growing industry in wildlife tourism (Higginbottom *et al.* 2004).

The Victorian town of Anglesea is justly famous for its population of Eastern Grey Kangaroos *Macropus giganteus*. Anglesea is located on the Great Ocean Road in the Surf Coast Shire, about 100 km south west of Melbourne (Fig. 1). The town has a population of just over 2000 permanent human residents, and the population increases dramatically during summer, reaching 10,000 or more at peak times. Major attractions include the beaches and the Anglesea River, which are popular for surfing, swimming and fishing (Anglesea Online 2006). Anglesea also lies within the newly established Great Otway National Park, and is promoted as a coastal destination surrounded by beautiful bush with abundant native wildlife (Anglesea Online 2006). An adjacent area of heathland is leased to Alcoa Australia, which operates an open-cut coal mine and power station on the northern edge of the town.

Banners in the main shopping centre proclaim Anglesea to be "where bush meets sea." (Fig. 2). Kangaroo images can be seen throughout the town, from a huge kangaroo painted on the pavilion of the Anglesea Football Club to the iconic "kangaroo on a surfboard" logo on the back-bags of children at the Anglesea Primary School. Perhaps the strongest association is with the Anglesea Golf Club, which invites visitors to enjoy a game of golf amongst the resident kangaroos then dine at the Joey Bar.

The close association between the Anglesea community and its kangaroos has undoubtedly brought economic and other benefits to the town. However, wild populations of kangaroos pose a challenge for a number of communities around Australia (Adderton Herbert 2004; Ben-Ami 2005), and conflicts between kangaroos and people have become increasingly evident in the Anglesea area. Amongst these concerns was an apparent rise in the frequency of kangaroo road-kills, and a heightened risk of injury to sightseers at the golf course. These concerns led to the formation of the Anglesea and Airey's Inlet Community Kangaroo Plan Advisory Group in 2003. This group, abbreviated as the Kangaroo Advisory Group (KAG) had representatives of a number of stakeholders, including government agencies, non-government conservation groups, private industry and others listed in Table 1.

Since its formation, KAG has produced an information leaflet on living with kangaroos, lobbied for warning signage on streets around the town, sponsored a bumper sticker competition at the Anglesea Primary School (Fig. 3), and supported a postal survey of residents to identify concentrations of kangaroos around the town (Catanchin 2005). These actions all contributed to KAG's goals of raising awareness of kangaroos and reducing conflict with kangaroos. They also provided a foundation for the preparation of a community-based management plan, which "provides opportunities for engaging the community in the planning and implementation process and embodies the concept of people living harmoniously with kangaroos" (KAG meeting minutes, 17 Feb 2004).

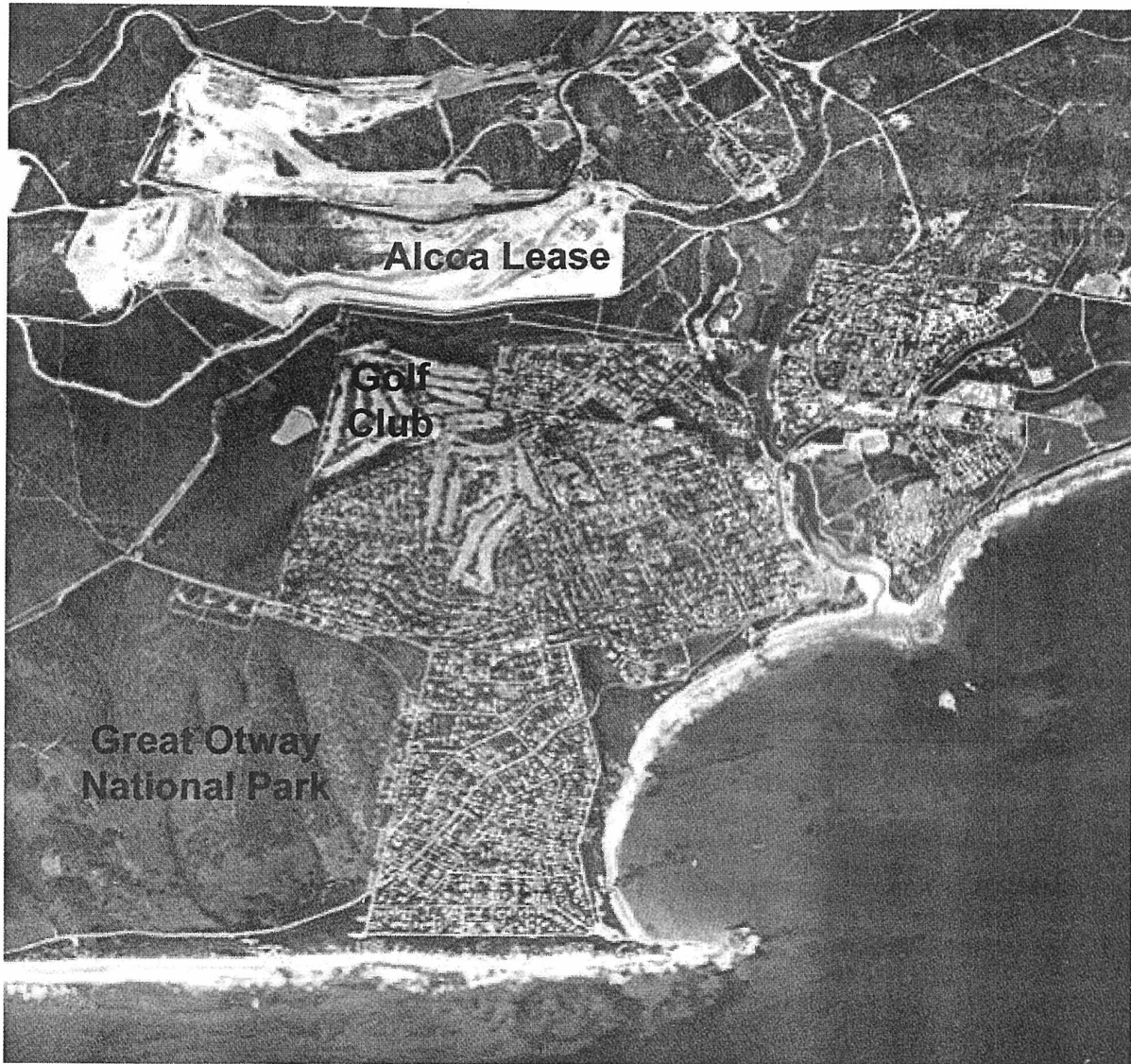


Figure. 1 Aerial photograph of Anglesea, Victoria, showing locations referred to in the text.

Table 1. Representatives from the Kangaroo Advisory Group (KAG) and other stakeholder groups involved in the consultation process during the development of a community-based management plan for kangaroos in Anglesea, Victoria.

KAG representatives	Other stakeholders
Alcoa of Australia	Anglesea IGA
ANGAIR Inc.	Anglesea NEIP
Anglesea Golf Club	Anglesea Primary School
Department of Sustainability and Environment (DSE)	Camp Wilkin
Flora and Fauna Action Unit	Eumeralla Scout Camp
Jirrahlinga Wildlife Sanctuary	Part-time residents
Parks Victoria	Permanent residents
Surf Coast Shire	Surf Coast Tourism
VicRoads	Wathaurong Aboriginal Co-operative
Victoria Police	

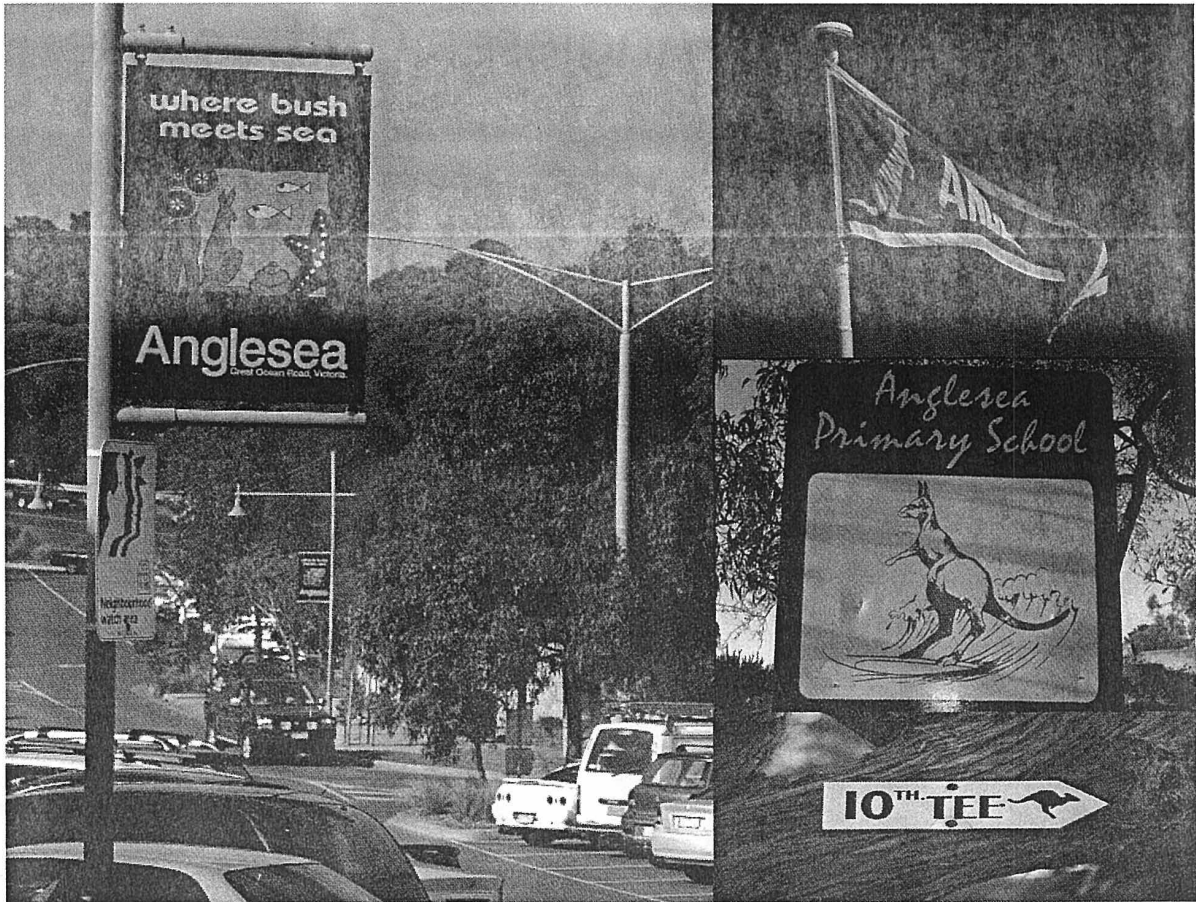


Figure. 2 Montage of images of kangaroos in Anglesea. Clockwise from left: banners in the shopping centre, flag of the Anglesea Golf Club, sign at Anglesea Primary School, sign at Anglesea Golf Club. Photographs by Graeme Coulson.

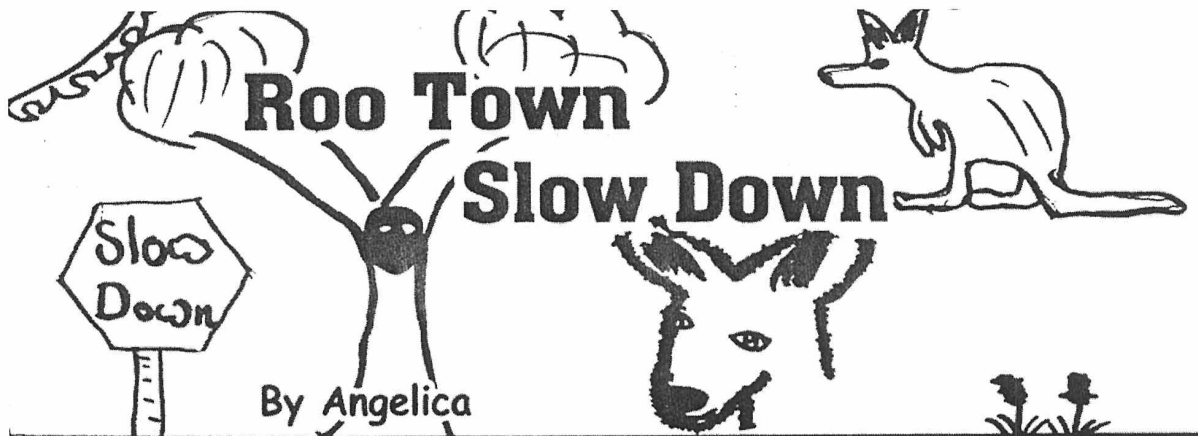


Figure. 3 One of the bumper stickers designed by Year 6 students at Anglesea Primary School.

This paper covers aspects of development of the kangaroo management plan for Anglesea. We report on a population survey of the golf course, to determine the abundance of kangaroos at the site with the largest concentration of kangaroos in the town, and report on an analysis of road-kill data in an attempt to quantify the extent of this problem. We also outline the process of community consultation, which identified the key kangaroo issues, and led to the formulation of the management plan.

## Methods

### Golf course population

The Anglesea Golf Club has an 18-hole golf course, covering an area of 73 ha. The course is bounded on the northern and western sides by coastal shrubland and heath woodland of Anglesea Heath, and on the southern and eastern sides by residential properties (Fig. 4). Kangaroos are commonly seen grazing on the greens and fairways, particularly in the afternoon and



# Anglesea Golf Course

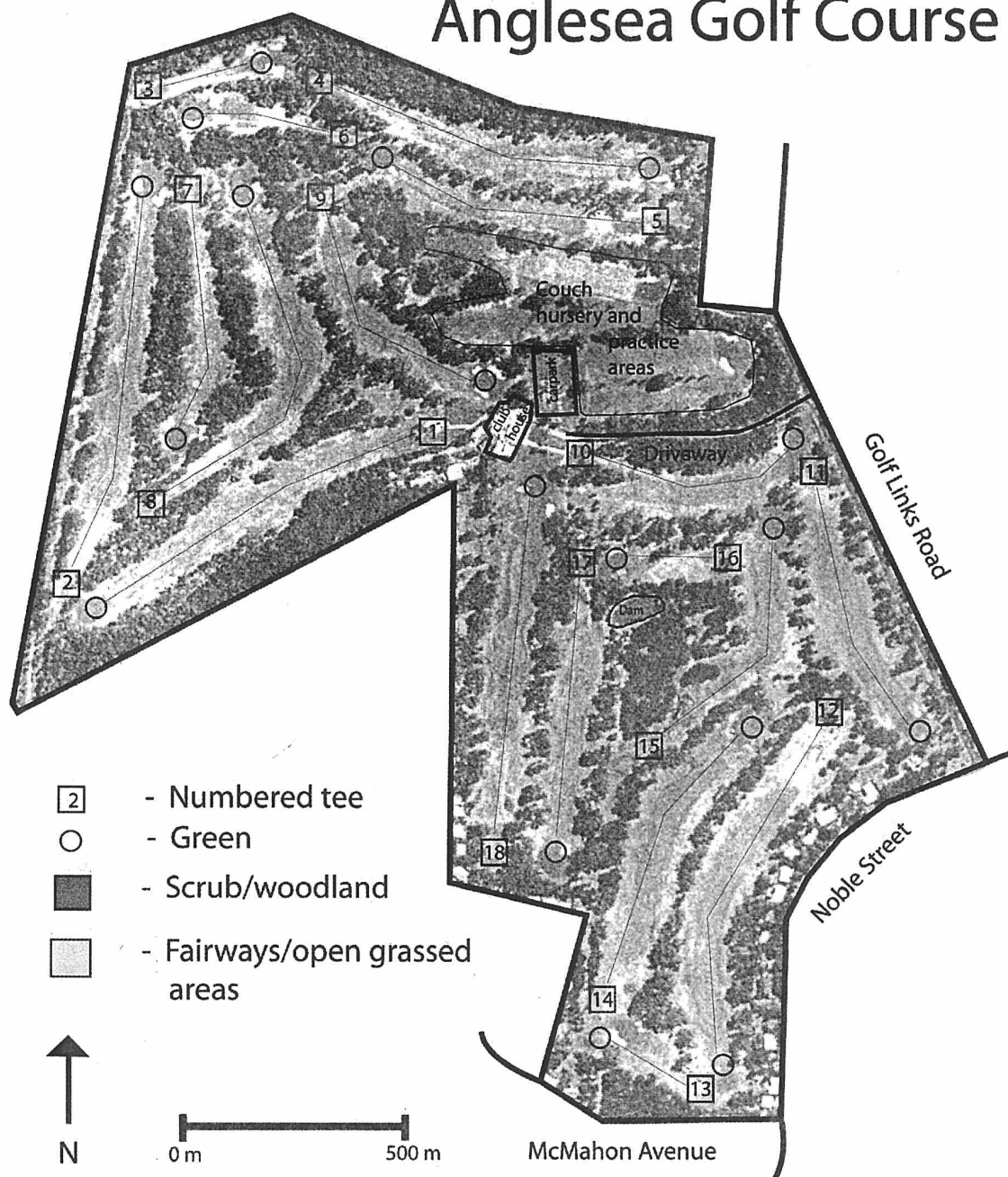


Figure. 4 Map of the Anglesea Golf Club, showing the layout of the 18-hole course where kangaroo surveys were conducted.

evening, and usually retreat to shelter in narrow belts of remnant native vegetation lining the fairways during the middle of the day.

One of us (HC) conducted total counts of kangaroos on the golf course from November 2004 to March 2005, counting at three times of day: early morning, starting at approximately 06:15 Eastern Summer Time (n = 9), midday (n = 7) and evening, starting at approximately 18:45 Eastern Summer Time (n = 8). Three counts were conducted on two days, two on four days and ten on one day. Another (DI) conducted a second set of surveys (n = 7) in August 2006, counting only in the early morning, starting at approximately 07:00 Eastern

Standard Time. In the early morning and evening surveys we walked down the fairways, following the order of play, so that we started at the 1<sup>st</sup> tee and ended at the 18<sup>th</sup> green and the couch grass nursery nearby. We conducted the midday counts along the same route, but also had an assistant, so that one person could search the 'rough' on one side of the fairway while the other searched the opposite side.

Our objective was to obtain a total count (Southwell 1989) of kangaroos on the course. We moved slowly and carefully to minimise disturbance to the kangaroos, and used binoculars to count large groups from distance of up to 100 m. The kangaroos were quite habituated and

generally unresponsive to humans, but sometimes moved in response to sightseers or vehicles of ground staff, necessitating a recount of some holes. We counted all adults and sub-adults, but excluded temporarily emergent pouch young and small, obviously dependent young-at-foot. Given the good visibility on the course and the habituation of the kangaroos, we were confident that we missed few if any individuals, and were aware of any local movements so that we could avoid double-counting.

**Road-kills**

We obtained "Use of Force" records from Anglesea Police. These relate to any incident to which a police officer has been called and has been required to use force, including the use of a firearm to dispatch injured kangaroos. These records gave the date and time and location of the incident, the reporting officer and brief descriptive notes. We extracted those in which a kangaroo had been struck by a vehicle, and the incident occurred in Anglesea, from 1997 to 2006.

**Kangaroo issues**

We compiled a set of potential kangaroo-related issues for residents of Anglesea. These issues were based on Caughley's (1981) four classes of problems arising from overabundant wildlife: (1) threats to human life or livelihood, (2) depression of populations of favoured species, (3) decline in body condition and fecundity, and (4) loss of equilibrium between plants and animal populations. We first discussed these issues at a meeting with KAG members in July 2006, and compiled their

responses. One of us (DI) then approached a range of other stakeholder representatives and interested individuals (n = 13). We incorporated these additional views into a full issues matrix, and terminated consultation with the community when no new issues were identified.

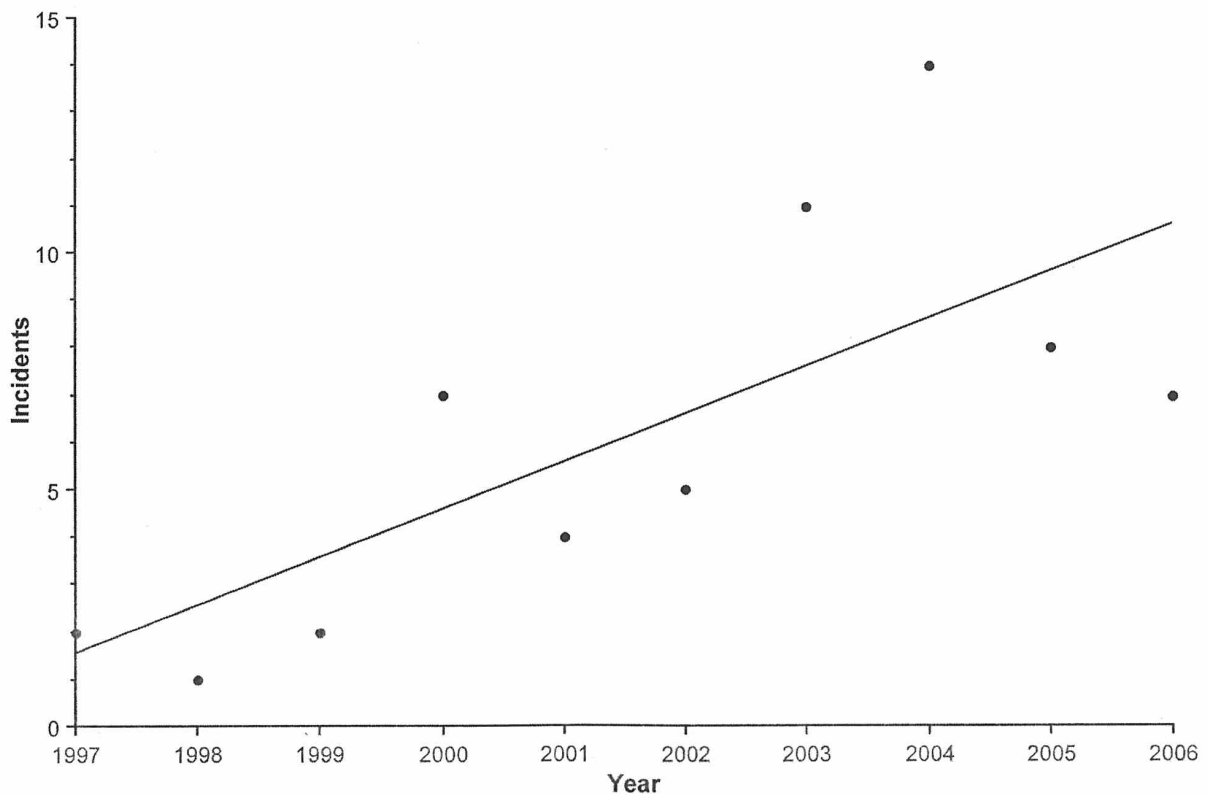
**Results**

**Golf course population**

The abundance of kangaroos on the golf course changed over the course of the day in the summer of 2004-2005 (F = 34.69, df = 2, P < 0.001, Table 2). The lowest number recorded was 204 on a midday count, and the highest was 358 on a morning count. Mean abundance at midday was significantly lower than in the morning and evening (Bonferroni P = < 0.001), which did not differ from each other significantly (Bonferroni P = 1.0). In winter 2006, the mean abundance of kangaroos in the morning surveys was 259 (Table 2).

**Table 2.** Abundance of kangaroos on the Anglesea Golf Course from two surveys at three times of day, showing mean, minimum, maximum and 95% confidence limits of the counts.

Survey	Time	Mean	Min	Max	95% CI
Summer 2004/05	Morning	298	266	359	±18
	Midday	229	202	297	± 24
	Evening	307	267	335	±14
Winter 2006	Morning	261	234	290	± 18



**Figure. 5** Annual frequency of police "Use of Force" records involving kangaroos reported in Anglesea over ten years.

## Road-kills

The frequency of road-kills, as measured by police records, increased by about 1 kangaroo per year over the ten-year period ( $y = 2019.7 + 1.1012x$ ,  $R^2 = 0.54$ ). Only one or two incidents occurred in the early years of records; the highest figure of 14 was recorded in 2004 (Fig. 5). Almost half (46%) of the incidents occurred on the two streets on the eastern boundary of the golf course. Incidents were reported in all months except November, but a log-likelihood ratio goodness-of-fit test indicated that there was significant difference among months ( $G = 14.85$ ,  $df = 45$ ,  $P > 0.05$ ). There were incidents at all hours of the day except from 03:00 – 06:00 h, which differed from an even temporal distribution in 2 h intervals ( $G = 26.02$ ,  $df = 11$ ,  $P < 0.01$ ).

## Kangaroo issues

Six key issues emerged from consultation with KAG members and other stakeholders (Table 3). These are summarized below.

1. *Understanding Anglesea's kangaroos.* The level of community interest in and attachment to its kangaroo population became obvious when stakeholders were completing the issues matrix. They asked us questions about kangaroos, and commented about kangaroos they had seen. It was apparent that the community wanted to know more about their kangaroos, particularly the health, demographics, movements and seasonal effects on kangaroos.
2. *Monitoring kangaroos.* Many stakeholders considered that monitoring of the kangaroo population was essential. A monitoring system was needed to record changes over time, as well as assessing the results of management actions. There was strong interest in being actively involved in the monitoring component of the management plan.
3. *Kangaroo-vehicle accidents.* Almost all stakeholders raised kangaroo-vehicle accidents as an important issue in Anglesea. Respondents identified accident hotspots,

particularly the roads around Anglesea Golf Club, Forest Road on the northern fringe of the town, and the section of the Great Ocean Road known locally as the "Mad Mile". Nearly all commented on being personally involved in kangaroo-vehicle accidents. The aspects considered to be most important were trauma to kangaroos, trauma to humans and cost of motor vehicle damage.

4. *Conflict with kangaroos.* A number of stakeholders expressed concerns about increasing conflict between humans, their pets and kangaroos. In one recent well-publicised incident, dead and injured kangaroos were found on the golf course, reportedly beaten with a golf club. Unescorted dogs had also been reported killing kangaroos. We were not told of incidents of kangaroos attacking people, but stakeholders were also concerned about this aspect of conflict.
5. *Managing sick and injured kangaroos.* Respondents raised two concerns about managing kangaroos that are sick or injured. Firstly, they were uncertain and confused about which organisation should be contacted for assistance when they found a kangaroo in distress. Secondly, people commented that it can take a long time before there is a response to an incident, adding to the distress for the kangaroo and the public.
6. *Kangaroos on the golf course.* The greatest concern for Anglesea Golf Club was the number of tourists visiting the course to get close to kangaroos, creating a serious legal liability for the club in the event of injury from errant golf balls or from kangaroos. A lesser concern was the heavy grazing pressure and accumulation of faecal pellets, which reduces the attraction for players and requires more work by ground staff.

## Discussion

Our survey of the golf course confirmed that it supported a high density of kangaroos, with narrow confidence limits indicating that our technique gave good precision. During the summer of 2004-2005, we recorded more

Table 3. Matrix of issues relating to kangaroos, as expressed by a range of stakeholders in Anglesea.

Issues	Alcoa of Australia	ANGAIR	Anglesea Golf Club	Anglesea IGA Supermarket	Anglesea NEIP	Anglesea Police	Anglesea Primary School	Sustainability & Environment	Eumeralla Scout Camp	Flora & Fauna Action Unit	Jirrahinga Wildlife Sanctuary	Parks Victoria	Real Estate Agent	Residents	Surf Coast Shire Council	Surf Coast Tourism	Vic Roads	Wathaurong Aboriginal Co-Op	Camp Wilkin
	1. Understanding kangaroos	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Monitoring kangaroos				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3. Kangaroo-vehicle accidents	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4. Conflict with kangaroos	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. Managing sick & injured kangaroos		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6. Kangaroos on the Golf Club			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

than 4.0 kangaroos per ha. This density is considerably higher than the average of 2.3/ha recorded on nature reserves in the Australian Capital Territory, which the A.C.T. Kangaroo Advisory Committee (1996) considered to be high when compared to other parts of the range of this species. The density at the golf course also exceeded the maximum densities reported by Coulson (2006) at two smaller, confined populations where management problems were evident: 2.9 ha<sup>-1</sup> at Woodlands Historic Park, Victoria, and 3.1 ha<sup>-1</sup> at Government House, A.C.T. The somewhat lower density in winter the following year could suggest a general decline in population size, or may reflect seasonal changes in occupation of habitats on the golf course. However, there was no other data available on the kangaroo population, and we are unaware of comparable data on seasonal patterns from other populations. A long-term study of the abundance and distribution of kangaroos in the town would be required to properly interpret this trend.

The road-kill records supported the impressions of the residents of Anglesea: many people commented that the number of collisions with kangaroos had increased over the last decade. Incidents were also reported throughout the year and at most times of the day, corresponding with residents' beliefs that they might hit a kangaroo at any time. It is noteworthy that the police records represent only the minimum number of road-kills in the town, since the number of incidents in which police are not called is unknown. As with the abundance of kangaroos on the golf course, long-term monitoring system would be needed to accurately assess the rate of road-kills in the town, and any relationship between the two measures. Many factors could have contributed to this increase in road incidents, particularly the volume and speed of traffic (e.g. Groot Bruinderink and Hazebroek 1996; Jones 2000).

The lack of data on population size and road-kills was a common theme in our discussion with stakeholders. Their concerns coalesced around six key issues. These issues have now been addressed in a community-based management plan for kangaroos in the Anglesea area (Inwood 2006). The plan sets six key goals:

1. Increase community understanding and support for the kangaroos.
2. Monitor kangaroo populations to gain more understanding of kangaroos.
3. Monitor kangaroos to provide information on which management decisions are based, and on which the effects of these decisions can be judged.
4. Minimise any negative impacts that could arise between the kangaroos and community; negative impacts can occur as a result of kangaroo-vehicle accidents, conflict with kangaroos and through managing sick and injured wildlife inappropriately.
5. Develop a sustainable coexistence of the kangaroos on the Anglesea Golf Club by providing improved off-street visitor facilities around the golf course and at another possible venue.
6. Provide opportunities for people to enjoy and learn about wildlife in a safe environment.

The plan proposes a set of 36 specific actions to address these goals, and work is now underway to implement these actions. The work will involve a range of government agencies, industry and community groups. With such strong community involvement, the town of Anglesea may become the pioneer of sustainable, harmonious coexistence between people and kangaroos in urban areas.

## Acknowledgments

We thank all of the members of KAG, past and present, which initiated the project and provided support, feedback and interesting stories about kangaroos. We also thank the many

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