



BACKGROUND INFORMATION ON OUR MACROPOD CULLING POLICIES

National Parks Association ACT Inc.

February 2026

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ABBREVIATIONS

ACT	Australian Capital Territory
BNW	Bare Nosed Wombat <i>Vombatus ursinus</i> aka Common Wombat
BTRW	Brush Tailed Rock Wallaby <i>Petrogale penicillata</i>
BW	Black Wallaby (aka Swamp Wallaby) <i>Wallabia bicolor</i>
CNS	Controlled Native Species (declared under the <i>Nature Conservation Act 2014</i> (ACT))
CNSMP	Controlled Native Species Management Plan https://www.act.gov.au/open/eastern-grey-kangaroo-controlled-native-species-management-plan-2017
CoP	Code of Practice (generally referring to either the National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-commercial Purposes https://www.dcceew.gov.au/environment/wildlife-trade/publications/national-code-practice-humane-shooting-kangaroos-and-wallabies-non-commercial OR the National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Commercial Purposes https://cdn.environment.sa.gov.au/environment/docs/code-of-practice-commercial-kangaroos-2020.pdf)
EB	Eastern Bettong <i>Bettongia gaimardi</i>
EW	Eastern Wallaroo <i>Osphranter robustus</i>
EEC	Endangered Ecological Community
EGK	Eastern Grey Kangaroo <i>Macropus giganteus</i>
KMP	Kangaroo Management Plan
LNP	Long Nosed Potoroo <i>Potorus tridactylus</i>
LNTG	Lowland Natural Temperate Grassland, an EEC
NPA	National Parks Association (ACT)
NSW	New South Wales
pa	<i>per annum</i> , that is per year
PCS	ACT Parks and Conservation Service
PY	Pouch Young
RNW	Red Necked Wallaby <i>Notamacropus rufogriseus</i>
YAF	Young At Foot
YBRGW	Yellow Box-Red Gum Woodland, an EEC
WGK	Western Grey Kangaroo <i>Macropus fuliginosus</i>

BACKGROUND INFORMATION

This document provides information about culling of kangaroos and wallabies (macropods) in the ACT region, about the conservation status and biology of the relevant species, and about the thinking behind the relevant animal welfare principles. Thus ,it helps explain the 'NPA(ACT) position on macropod culling' found elsewhere on this web page.

What is the conservation status of the seven local macropod species?

The three smallest local macropod species are threatened with extinction and remain in the region only inside fences that are cat-proof, fox-proof and dog-proof. They are the Brush Tailed Rock Wallaby (*Petrogale penicillata*), Eastern Bettong (*Bettongia gaimardi*) and Long Nosed Potoroo (*Potorus tridactylus*).

Two wallaby species are widespread and relatively abundant, especially where fox abundance is suppressed, the Red necked Wallaby (*Notamacropus rufogriseus*) and Black Wallaby (*Wallabia bicolor*) aka Swamp Wallaby.

Two kangaroo species, the Eastern Wallaroo (*Osphranter robustus*) and the Eastern Grey Kangaroo (EGK), (*Macropus giganteus*) are widespread. The EGK is highly abundant in the ACT region. In a region of low inter-annual rainfall from around Goulburn (NSW), south to Wilson's Promontory (Vic), populations of EGKs in grassland areas such as abandoned grazing properties, which are not culled or subject to dingo predation, can reach densities higher than 700/ sq km. The EGK species is thought by ecologists to be more abundant now than at any time since the settlement of the region by European farmers, due to the effect on its food supply of forests and woodlands being converted to grasslands, as well as to the suppression of hunting by Aboriginal peoples and dingoes.

What are the five local kangaroo culling programs?

In NSW, the two wallaby and two kangaroo species are subject to damage mitigation culling and the two kangaroos are harvested under the NSW commercial kangaroo harvesting program. Damage mitigation culling also occurs on ACT rural land but is limited to EGK only. A 'conservation cull' of EGKs is conducted in NSW at Googong Foreshores and in 16 ACT nature reserves, which contain endangered ecological communities.

The relative magnitude of these five programs in recent years is as follows:

1 NSW SE Tablelands Kangaroo Management Zone (Figures 1, 2) commercial harvest of Eastern Grey Kangaroo + Eastern Wallaroo	Quota ~230,000, Tags purchased ~33,000 pa
2 NSW SE Tablelands Kangaroo Management Zone (Figures 1, 2) non-commercial damage mitigation culling of Eastern Grey Kangaroo + Eastern Wallaroo	~500 licences issued pa. Number shot not available
3 ACT damage mitigation culling	4,000-8,000 EGKs pa
4 ACT conservation cull	1,000 – 4,000 EGKs pa 0 – 100 RNW + BW pa
5 Googong Foreshores (NSW) conservation cull	500 – 2,000 EGKs pa

Aims of local macropod culls

Commercial harvesting is intended to provide a sustainable yield of meat or skins or both. Damage mitigation culling (conducted on rural land) is intended to protect grass for livestock. Conservation culls are intended to enable a ground-layer vegetation structure that favours small animals.

Figure 1: NSW Kangaroo Management Zones

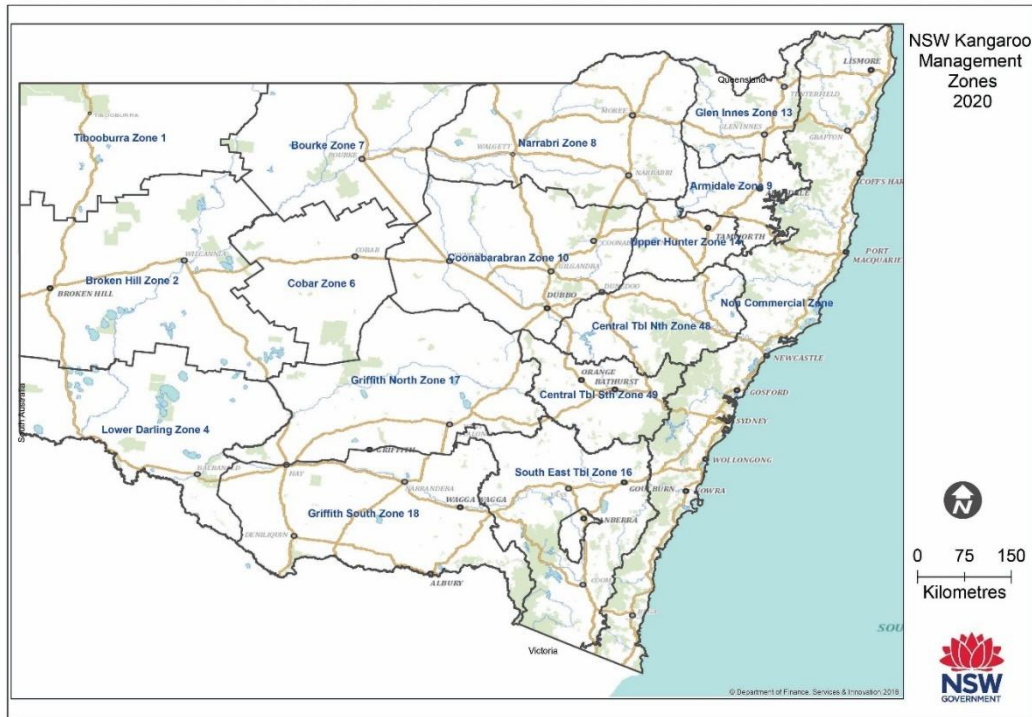
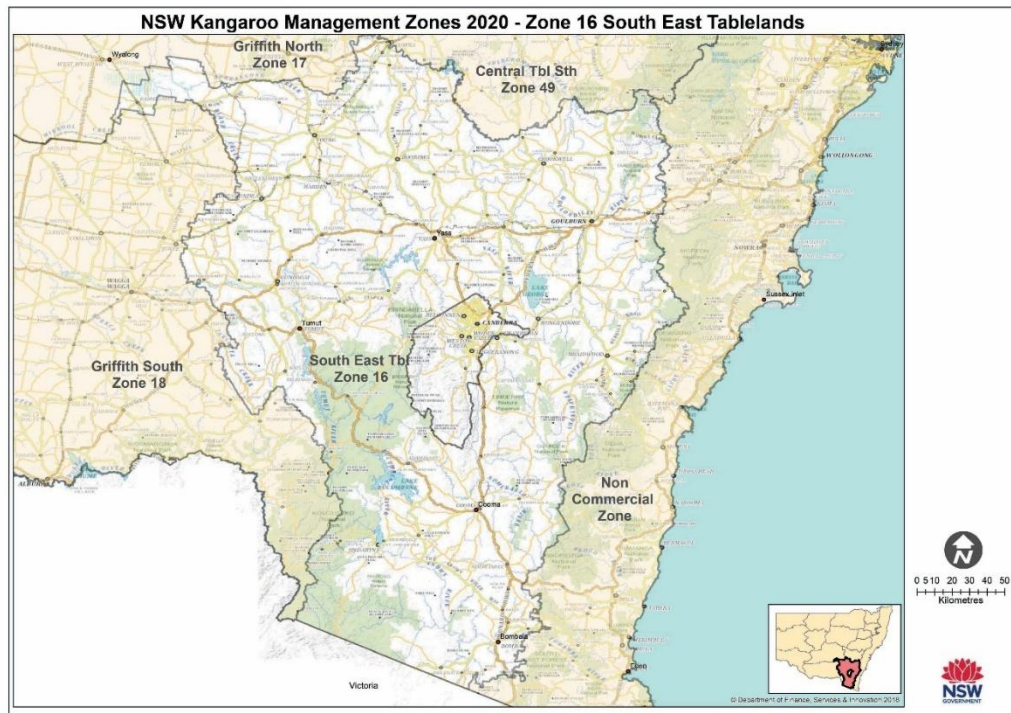


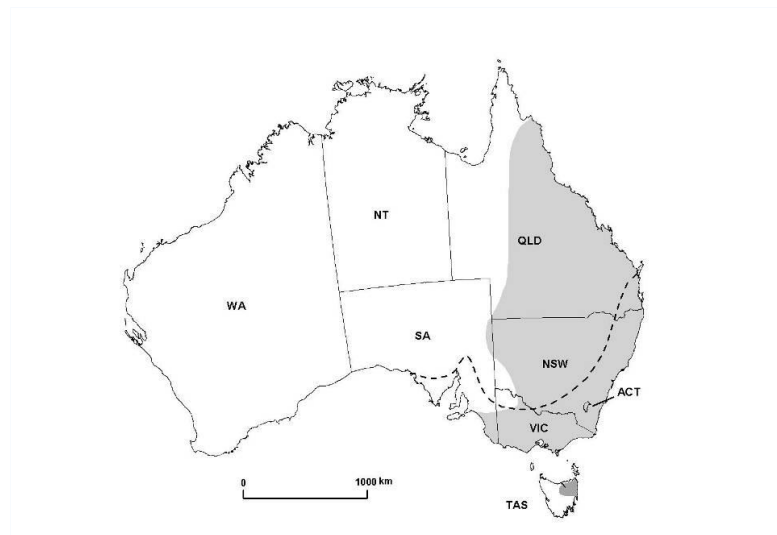
Figure 2: The NSW SE Tablelands Kangaroo Management Zone 16 surrounds the ACT



National distribution and abundance of Eastern Grey Kangaroos

Although it is confined to the east of the continent (Figure 3) the EGK is the most abundant of kangaroos in Australia. Also, more EGKs are harvested commercially in NSW than the other three commercial kangaroo species combined (Red Kangaroo, Western Grey Kangaroo, and Eastern Wallaroo/Euro). In the ACT region, the EGK is far more abundant than all other macropod species combined.

Figure 3: Distribution of the EGK (grey shading); dotted line = temperate zone



Kangaroo counts in the commercial harvest zones are conducted by the responsible state governments. The combined figures (excluding Victoria because it is a relatively recent addition to the commercial harvest) show that cycles of drought and wet years, are the main influence on kangaroo abundance in the rangelands, not harvesting (Figure 4).

Figure 4: Kangaroo population in the commercial harvest zones. Solid line and solid triangles = four commercial kangaroo species; Dashed line and hollow triangles = EGKs (EGKs and WGKs were not counted separately until 1999); Red circles = commercial harvest.

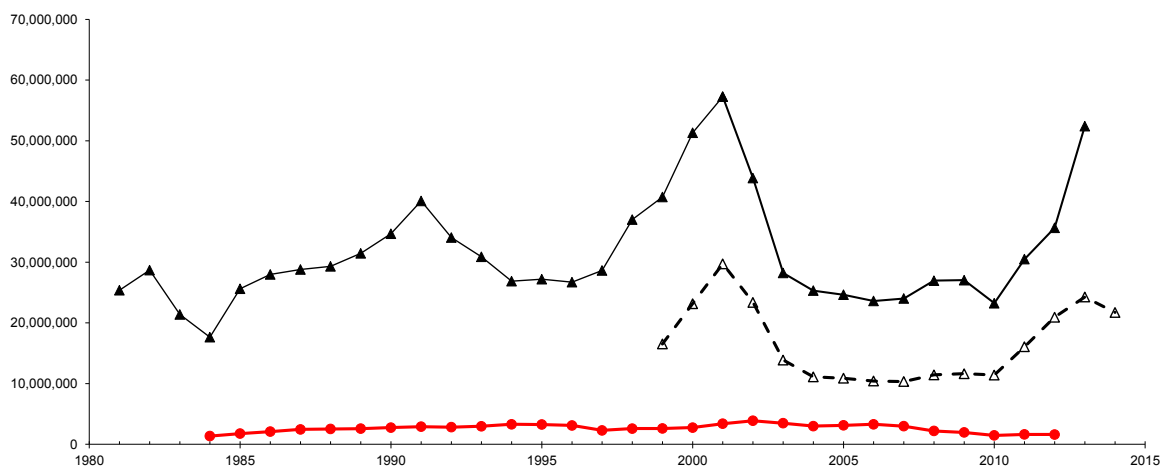


Figure 4 shows that natural variation in kangaroo abundance is much greater than the numbers shot (red circles) In the rangelands, kangaroo populations fluctuate according to drought cycles, not the commercial harvest, and can vary by many millions. Only the area of the commercial harvest is included in this count, so much of the range of the EGK is excluded, i.e. Victoria, the ACT and coastal parts of NSW and Queensland. See Figures 1 and 2 for examples of non-commercial zones. Thus, the true EGK population is greater than indicated by these counts, which are generally greater than 20 million up to well over 50 million in a good year.

Sustainability of culling, for kangaroos

Commercial harvesting is run on the principles of a 'sustained yield harvesting' described in most ecology texts. An important rule is that quotas (maximum number of kangaroos allowed to be taken from an area) are set to less than 17% of the kangaroo population. In practice shooters mostly achieve much less, for a combination of reasons. The harvest is limited to kangaroos with a dressed weight at the chiller of 17 kg and in some areas it is also limited to males. Although there is an advantage in shooting where the proportion of large kangaroos is highest (which corresponds to areas unshot for longest), in practice, harvesting is concentrated onto the properties that are easiest to reach, leaving large areas unharvested that are located at greater distance from towns. As ecological models demonstrate, even if most of these constraints are relaxed considerably (e.g. kangaroos of all sizes and sexes are targeted in all areas equally, every week) populations are reduced little below the unharvested level. Thus, there is no basis to doubt that commercial harvesting is sustainable.

Damage mitigation culling is managed differently in the ACT and NSW. There is ample information available to understand the former, where a formula is used to guide the maximum number allowed to be licenced per year on each property. Information about the NSW approach is less fulsome, where officers in local NPWS offices must exercise their judgment, within broad guidelines, about the number of kangaroos licenced on individual properties and the number of kangaroos licenced is not, in practice, available on the internet.

In the ACT and most of the SE Tablelands Kangaroo Management Area, EGKs are well conserved in reserves and other areas not subject to damage mitigation culling. Thus, landholders could be allowed to determine their preferred density of kangaroos without affecting the conservation status of the species.

In contrast to commercial harvesting and conservation culling, the basic principle of damage mitigation culling would theoretically enable eradication or near eradication of kangaroos over limited areas if the culling was increased somewhat above the legal allowance. In practice this has happened in some cases. However, the effect on the conservation status of the species has been limited.

Conservation culling in the ACT depends on a formula related to grass length, recorded rates of kangaroo population increase and annual measurements of kangaroo density. The aim is that the density per hectare of kangaroos retained after culling will be sufficient, but not too great, to achieve the condition specified for ground layer vegetation. Until 2019, the retained density was 1 EGK/ha in grassland and less in other communities in proportion to tree canopy cover. This density was too high in most years to achieve the desired vegetation condition hence the new formula described was introduced, based on annual measurement of grass length, as well as of kangaroo density. Cattle are used to provide higher grazing pressure temporarily in places where either:

- less ground layer vegetation is required to meet fire hazard requirements

- *Phalaris* grass is unpalatable or dangerous to kangaroos
- the culling formula has not achieved the required vegetation structure, especially if areas of rank vegetation unpalatable to kangaroos have increased.

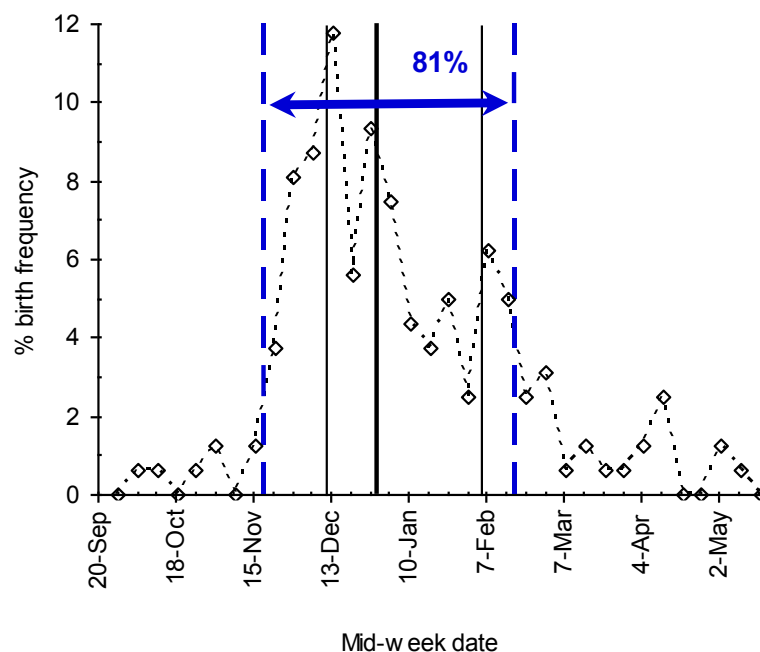
There is EGK species.

Ecological importance of EGKs

EGK populations can have both positive and negative conservation effects. Grazing effects such as they provide are essential for conservation. The effect of no grazing is that the structure of ground layer vegetation becomes more uniform. It also lacks the short grass or bare patches essential for many species. And floristic diversity declines. On the other extreme, where kangaroo density is high, the effect of overgrazing is also a more uniform structure, which lacks shelter for small animals, including several threatened species. In contrast, floristic diversity may be retained largely intact.

Thus, the EGK can be regarded as both a keystone species and an ecological engineer. For example, by maintaining uniformly short grass, EGKs exclude certain grassland bird species, which are favoured at moderate grazing pressure and their browsing of eucalyptus and acacia seedlings may help maintain grasslands against invasion of forest and woodland.

Figure 5: Birth season of EGKs near Canberra. □ = percent frequency of births per week, of 161 pouch young taken from female wild kangaroos shot in Tidbinbilla Nature Reserve in 1997. The light vertical lines delimit the upper and lower quartiles (11 December and 5 February), and the bold vertical line is the median date of birth (30 December). The dashed vertical lines indicate a 90-day range in which 81% were born (between 19 November and 17 February). Data collected by Graham Coulson.



Seasonal breeding and the ACT kangaroo season

EGK breed seasonally (Figure 5), with the effect stronger at higher latitude.

In the ACT, kangaroos may only be shot from to March to July. This greatly reduces the number of young kangaroos which shooters encounter which are of an 'animal welfare age of concern', i.e. the

pouch young large enough to be capable of leaving the pouch and those which have recently vacated the pouch for the last time. There is no kangaroo season in any other jurisdiction.

Head shots only

National Codes of Practice (CoP) for the control of a wide range of animals such as feral horses (*Equus caballus*) and feral pigs (*Sus scrofa*), require shooters to treat animals humanely. They specify chest (heart-lung) shots as the preferred target area. There is national and international recognition that such shooting is humane, although there is an appreciable time to death. In almost all these cases, shooters are also free to use head shots or shots to the upper cervical vertebrae, which result in instant insensibility followed by death, but they are not required to do so.

Kangaroos are the exception, with both CoPs requiring shots to the cranium which result in instant insensibility. (Exceptions are made for injured animals which will not remain stationary. They may be shot in the chest. Likewise for scientific research where organs of the head are being studied).

The term 'instant insensibility' is used here, or 'instant loss of consciousness' rather than 'death' because death is defined by the loss of heart function and the heart often continues to contract for an appreciable time after the brain has been destroyed. The critical requirement with head shots is instant loss of consciousness followed by death without consciousness being regained.

There is no evidence that kangaroos are more sensitive to the pain of being shot than horses, feral pigs or other mammals. There is no logical defence on animal welfare grounds for requiring head shots in one or more of these species and not in others. Yet for unknown reasons, the kangaroo CoPs alone require head shots.

Testing of applicants for shooting licences

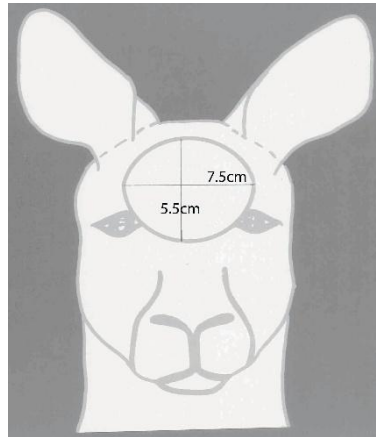
Shooters applying for licences to harvest kangaroo for commercial purposes (applicable in NSW, Qld, SA, Vic and WA) are required by the relevant national CoP to pass an accuracy test. The shooter must fire from a seated position in their vehicle (which moves slightly in response to shooter movement, wind and rifle recoil) and place 5 shots within a circular target 75 mm in diameter at a range of 100 m. Thus, the angular size of the target is 2.58 minutes of angle (MOA). For perspective, a US military sniper is required to achieve 1 MOA while lying on the ground and using a specially designed rifle positioned on a firm 'rest'.

Shooters applying for non-commercial licences are not tested except in the ACT. The ACT test is harder than the test for commercial kangaroo shooters. The target is the cranial area, measuring 55 x 75 mm, on a drawing of the head of a kangaroo (Figure 6). The reduction in vertical size of the target to 55 mm (1.89 MOA) requires 27% better precision from ACT kangaroo shooters than from professional kangaroo shooters.

In addition to the accuracy test, the ACT requires applicants to pass a macropod identification test in which at least 19 of 20 photos of macropods must be correctly identified. The photos of the four local species of extant macropods, taken with a spotlight at night, include ones that are genuinely challenging. There is also a test on the CoP.

Every year, some of the applicants fail one or more parts of the test (thereby raising the standard of kangaroo shooting). Staff who carry out the testing believe that the greatest value of the testing is the associated shooter education.

Figure 6: One of the three target diagrams used in shooter testing in the ACT, with dimensions of the target area added.



Five life stages of macropods ('pinkies', furred py, yaf, sub-adults, adults) in relation to animal welfare and population limitation

Pouch young

Pouch young are often referred to using the acronym 'PY'. PY include unfurred (or 'naked') 'pinkies' and fully furred individuals. They range from sightless, unresponsive, fetus-like young that are entirely dependent on continuous attachment to their mothers teat, inside the pouch, to active, vocal individuals able to make choices, hop around and forage on grass.

In eutherian mammals, much of the early development of young occurs inside the mother's uterus or womb. In marsupial mammals, the young are born at a much earlier stage of life. Advantages of marsupial reproduction are significant:

- the mother's locomotion is unaffected by pregnancy
- gestation is short, usually about the same as the length of one estrus cycle
- birth is not a demanding process and is not associated with a mortality rate
- pouch young can die or be discarded without threatening the life of the mother and can be replaced quickly.

In both eutherians and marsupials, the process of developing a new individual animal commences when a sperm cell and an egg cell unite inside the uterus. From that beginning, the characteristics required for independent life develop progressively, such as thermoregulation, which is the ability of the individual to regulate its own temperature, and nephrogenesis, which is the development of kidneys and the ability to regulate fluid volume and fluid concentrations. The same is true of the brain and its functions, including the ability to perceive pain, i.e. no pain can be experienced before that capacity develops at a certain stage. Importantly, it turns out that that stage is well after the young enters the pouch.

In eutherian young, the three functions mentioned all develop before birth. In marsupial young, they develop well after birth, at the same time that fur develops. Research has shown that unfurred ('naked') pouch young, or 'pinkies', completely lack the ability to perceive pain. In contrast, furred

pouch young should be treated as having the same ability to perceive pain as adults. Any concerns about the potential suffering of pouch young, are limited to the furred young.

The ACT kangaroo season has been set so that many of the pouch young carried by female kangaroos at the time, are at the unfurred 'pinky' stage. The proportion of females carrying large pouch young at that time is low enough that shooters can choose to avoid them, which is a widely held preference.

YAFs, sub-adults and ecological resilience

After a juvenile kangaroo leaves the pouch for the last time it suckles from outside the pouch and is referred to as a 'young-at-foot' or 'Yaf'. Gradually the Yaf transitions to a more independent 'sub-adult' which is able to subsist on the vegetation. At this stage there is high mortality, which occurs in late winter and early spring due to starvation. Although the number of carcasses involved can be astonishing, they are only rarely noticed by observers because in most years they are produced gradually, and the disappear rapidly.

In food limited populations, the main influence on density (EGK/ha) is the survival rate of sub-adults. Through over-production of young compared to the number needed to replace adult mortality, followed by high mortality of sub-adults, the population achieves a high degree of ecological resilience.

If a new source of mortality were to apply (e.g. a new predator, or the introduction of culling) the loss of some animals from the population would reduce intra-specific competition for food, thus lessening sub-adult mortality in late winter. Small reductions in the rate of sub-adult mortality compensate for the losses caused by the new source of mortality. A demonstration of this ecological resilience was inadvertently provided at Googong Foreshores in winter 2004 when 800 EGKs were shot in a few weeks by the ACT Government, but a few weeks after shooting the kangaroo population was no lower than before.

Animal welfare, animal rights and the need for careful objectivity

Animal welfare here refers to the prevention of animal suffering caused by humans. Animal rights refer to the (claimed) philosophical right of an animal not to be killed.

The prevention of unnecessary cruelty is almost universally accepted, and all Australian jurisdictions have laws for animal welfare such as the *Animal Welfare Act 1992* (ACT). None have laws for animal rights.

Admittedly, the animal rights principle is recognised in the widespread reluctance of Australians to kill more animals than necessary to achieve outcomes, even if no suffering is involved. This is made explicit with the 'Three Rs' principle which Animal Ethics Committees are required to adopt, where the Rs refer to Replace, Refine, and Reduce. 'Reduce' refers to the principle of minimising the number of animals which are treated by research procedures. However, that is well short of opposing all killing of animals – the animal rights position. A large majority of people take a different view, as indicated by the number of people who eat meat or wear leather shoes.

Animal welfare is an emotive topic. To reduce the potential for conflict, people making decisions about the welfare of animals need to take care to act in a consistent manner and make decisions that as far as possible, are logically and rationally defensible. For example, feral animals are just as deserving of protection from suffering as any other animals, so the widespread tendency to tolerate greater suffering of e.g. introduced Black Rats than of native *Rattus* and other animals, should be

resisted. All of us, but especially experts and representative committees should strive for rational, evidence-based decisions which, in principle, could be defended on objective grounds.

Widespread confusion between violence and cruelty

Much of the objection to the killing of kangaroo pouch young refers to violence as if it is the main problem, and the cause of animals suffering. But in general, regarding death, greater violence is associated with reduced suffering. For example, if an animal is killed by hitting it on the head with a hammer, insufficient force (or violence) may cause it to suffer, rather than the reverse. Likewise with firearms, a projectile with insufficient force is likely to wound an animal without killing it. Violence is not the same as suffering, and to equate the two indicates a lack of objective thought about animal welfare.

Is fertility control a way to reduce the number culled?

After decades of research on a variety of products, it is only since about 2020 that a practical method of fertility control in kangaroos has been found that has a high effectiveness rate (i.e. a high percentage of treated females become infertile) and that does not require retreatment every year or two to maintain infertility.

Hand injection of Gonacon is highly effective and delivers infertility for almost the entire reproductive life of a female EGK. Dart delivered Gonacon is slightly less effective but has the immense practical advantage that the kangaroo does not have to be captured. Trials are underway by the ACT Government in partnership with CSIRO to attempt to control fertility in free range kangaroo populations that previously have been culled to the desired density. The hope is to enable just sufficient reproduction for the population to maintain itself, thereby reducing the number which are culled in future. The trials should answer the question whether kangaroo movement in and out of the reserves may be too great for the fertility control program to be successful.

Translocation as an alternative to culling

The idea that translocation is an alternative to culling is highly impractical. There are no sites to accommodate thousands or tens of thousands of kangaroos per year and there is no technology to make this possible. Wild EGKs are a notoriously nervous, difficult species and even at very small scale, such as a one-off translocation of tens to hundreds, they may readily succumb to overheating, capture myopathy and misadventure. Experts have translocated them successfully on a number of occasions, with no mortality, so translocation is not impossible if sufficient attention is applied to the requirements, but several spectacular failures, in which all kangaroos died, have resulted from attempts by naive veterinarians and their helpers which did not allow for the nature of the species, nor for the effect of capture drugs in real-world conditions. This perhaps because the practitioners were more accustomed to working in the zoo environment, where the animals are more tractable and less prone to stress related conditions and the risks of hypothermia or hyperthermia are lower.

The animal welfare standard of kangaroo culling compared to other actions directed against animals

Society accepts the lethal control of numerous species of large mammals, e.g. feral pigs, which are at least as capable as kangaroos of suffering pain and stress. CoPs allow pigs and various other species to be poisoned, trapped and shot. In general, these practices are accepted by society as being an unfortunate necessity. Of those methods, shooting is by far the most humane.

It is apparent from the sections on shooter testing and head shooting, that kangaroos are shot to a higher standard than any other animals subject to shooting, such as feral pigs. The killing of kangaroos is one of the least cruel of all lethal interactions between humans and wildlife.

Much has been claimed about the suffering of juvenile kangaroos during culling operations. But most of the claims on the internet are completely unreliable. As stated under 'Five life stages ...' the unfurred pouch young lack the ability to perceive pain. And because kangaroos are seasonal breeders the ACT kangaroo season enables the vast majority of older pouch young and early young-at-foot (YAFs) to be avoided. When a furred pouch young is encountered and killed, the task is done by crushing its brain with a large hammer, causing instant insensibility. If the pouch young were instead injected with an overdose of barbiturate anaesthetic, as done routinely by veterinarians to euthanase pet cats and dogs, it would make many people feel better about it, but according to expert veterinarians that would take longer and cause greater suffering than using a hammer on their cranium to cause instant insensibility. It is as humane a death as can be provided to any animal.

Note that animal treatments in CoPs are not devised to spare humans from discomfort. They are chosen only on the basis of what is best for the animal.

Two national CoPs apply to kangaroo culling, as follows:

National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-commercial Purposes <https://www.dccew.gov.au/environment/wildlife-trade/publications/national-code-practice-humane-shooting-kangaroos-and-wallabies-non-commercial>

National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Commercial Purposes <https://cdn.environment.sa.gov.au/environment/docs/code-of-practice-commercial-kangaroos-2020.pdf>

Legal challenges and independent reviews of the ACT conservation cull

Conservation culling commenced in the ACT in 2009, in accordance with licences granted under the *Nature Conservation Act 1980* (ACT).

Successive draft plans for kangaroo management were submitted for public comment, in 2009 and 2016, with elected officials approving the final plans following analysis of the public comments.

Five opinion polls of Canberra adults conducted by Micromex Consulting in 2008, 2011, 2015, 2019 and 2022 found majority support for culling. Support grew from 59% in 2008, i.e. before culling commenced, to reach a plateau of 80% subsequently (range 76 to 86%). Contrary to fears expressed when culling started, that kangaroos would effectively disappear from Canberra, the proportion of Canberra adults who saw kangaroos in the week of the survey, ranged from 60 to 65% in the 2015, 2019 and 2022 surveys. This is unusually high visibility for any large wild animal species in a city and shows kangaroos were not eradicated by the culling.

The kangaroo management plan, or conservation culling, were independently reviewed in 2010, 2014 and 2024, as described below.

Also, from 2009 to 2014 the culling licences withstood four legal challenges that were mostly made on ecological and statistical grounds (plus animal welfare grounds in 2014).

After the EGK was declared a Controlled Native Species (CNS) under the new *Nature Conservation Act 2014*, court challenges were no longer possible, but the declaration required the CNSMP to undergo independent review every five years. See the heading 'The Legge review 2014'.

The Coulson review 2010

Immediately after the completion of the ACT Kangaroo Management Plan (2010) it was sent for 'peer review' to Professor Graeme Coulson of Melbourne University. The review examined five criteria:

- comprehensiveness, including structure and content
- policies based on evidence as far as possible
- scientific robustness of the material
- presentation of statistical material
- overall assessment as a wildlife management plan.

The review was highly favourable, with Professor Coulson recommending that it '*serve as a model for the management of kangaroos, and other wildlife, elsewhere in Australia*'.

The Kurahaupo review 2014

In April 2014, Kurahaupo Consulting (New Zealand) was engaged to review the kangaroo population count methods, the count results and the method of determining the number of kangaroos to cull set out in 'Calculation of the Number to Cull' (ACT Government 2016a) and the science behind the relevant parts of the 2010 Kangaroo Management Plan. The review endorsed the ACT Government's counting methods and culling advice and recommended a number of improvements. The Kurahaupo report can be viewed at

The Legge review 2024

The '*Independent Review of the ACT's Eastern Grey Kangaroo: Controlled Native Species Management Plan*' by Professor Sarah Legge of ANU, was an extraordinarily thorough and well conducted investigation which went well beyond the requirement to review the 75 page CNSMP, because it also covered operational aspects of kangaroo management and even involved *in-person* discussions with a wide range of interested parties, especially those opposed to the cull, such as Save Canberra Kangaroos. The resulting 122-page report was generally favourable and contained 39 far-sighted recommendations for improvement. The review can be found at https://www.act.gov.au/__data/assets/pdf_file/0005/2589035/independent-review-act-eastern-grey-kangaroo-controlled-native-species-management-plan.pdf

The compassionate conservation position is opposed by NPA

The NPA opposes the ethical opinion that it would be better to allow a whole population of a 'lower' or 'non-sentient' organism to become extinct, than to kill one or more individuals of a 'higher' or 'sentient' species. This ethical stance is the one adopted explicitly or implicitly by Compassionate Conservation, Save Canberra Kangaroos, Animal Liberation ACT and other animal-rights aligned organisations. It is directly opposite to the biodiversity agreement which has been adopted by the nine Australian Governments, and which is endorsed by the NPA.

Note that 'sentient' has an unusual meaning here. Sentient is defined by dictionaries as possessing the ability to sense things, such as pain. Thus, all adult animals (including invertebrates) would be included in that definition of sentient, but not foetal animals nor plants. An alternative view includes all vertebrates, cephalopods and decapod crustacea as sentient but omits the majority of invertebrates. The much narrower definition referred to here has been used occasionally by animal-rights aligned organisations to distinguish the larger mammals with which people tend to readily

establish an emotional bond, i.e. dogs, cats, livestock species, koalas, kangaroos, wombats and whales, i.e. supposedly 'higher' species. Using that approach, the vast majority of biodiversity, including the vast majority of Australian mammals, is placed in a lower 'non-sentient' category and would be allowed to become extinct if the only way to avert the extinction was to kill individuals of the 'higher' or 'sentient' species. Feral pigs often appear to be a de facto exception. That is, in spite of the high intelligence of pigs, many people who oppose the killing of other 'higher' mammals, allow an exception for feral pigs!

Kangaroo roadkill in the ACT region

As shown in Figures 7 and 8, there is a much greater incidence of serious motor vehicle collisions with kangaroos in the Goulburn-Yass-Queanbeyan triangle, than elsewhere in NSW. These data are from a NSW police database that records only collisions in which a person was injured, or the vehicle was towed away. Although labelled the 'Canberra' zone in the source paper (Ramp and Rogers 2008) there are no ACT roadkill data contributing to this analysis.

The ACT almost certainly experiences an even greater frequency of collisions than illustrated here for surrounding NSW. That makes Canberra not only the 'Bush Capital' but also the 'Roadkill Capital', and by a large margin. Thus, Canberra is both a leading place that would benefit from measures to reduce kangaroo-vehicle collisions and also one of the best places in the world to conduct trials on methods to reduce vehicle collisions with wildlife.

Figure 7: Number of serious motor vehicle collisions with kangaroos in NSW. Individual records are blue dots. Clustered records are represented as shaded kernel density contours; from Ramp and Roger 2008.

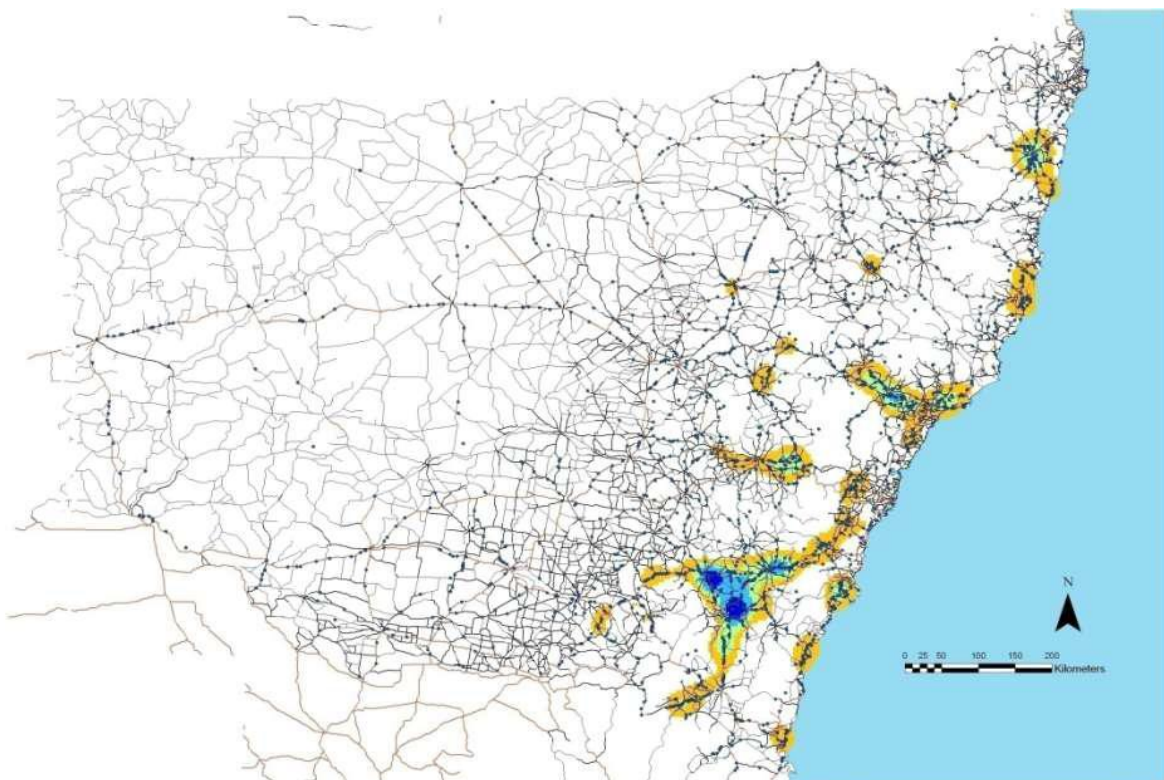
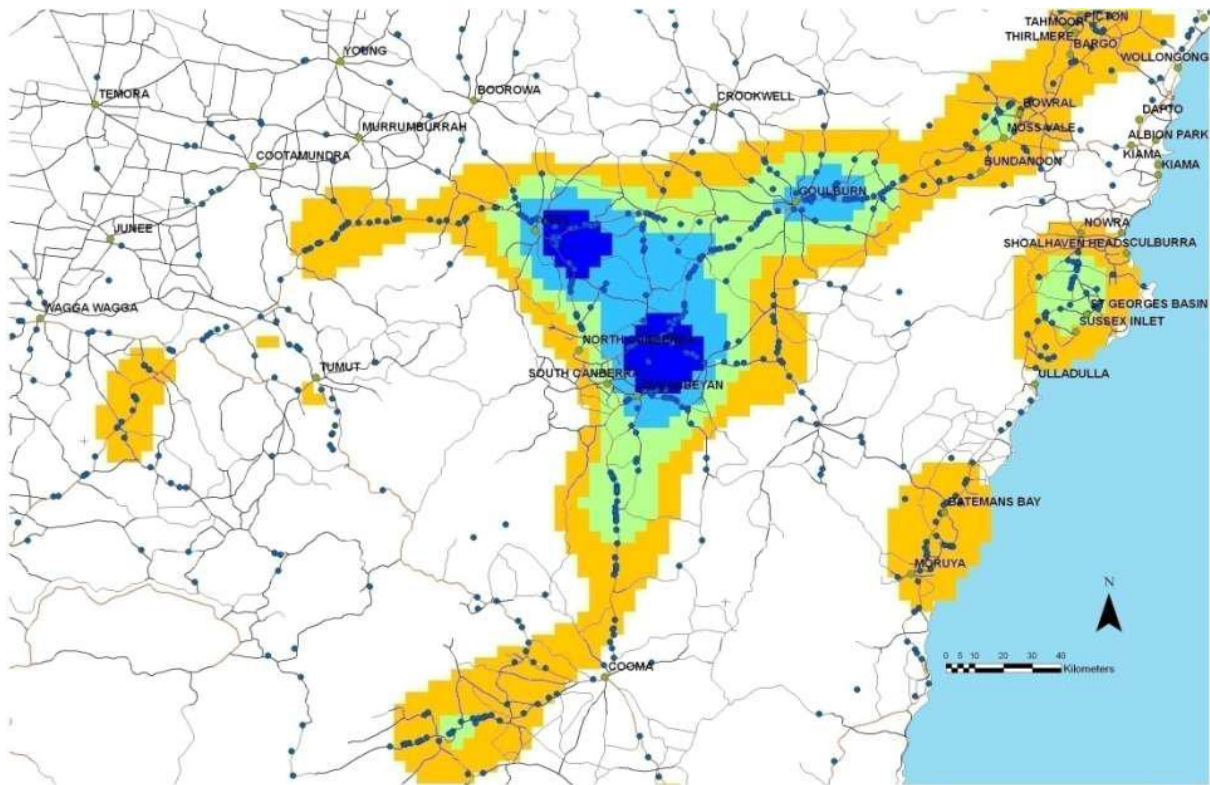


Figure 8: Enlargement of Figure 6 to show the Goulburn-Yass-Queanbeyan hotspot adjoining the ACT.



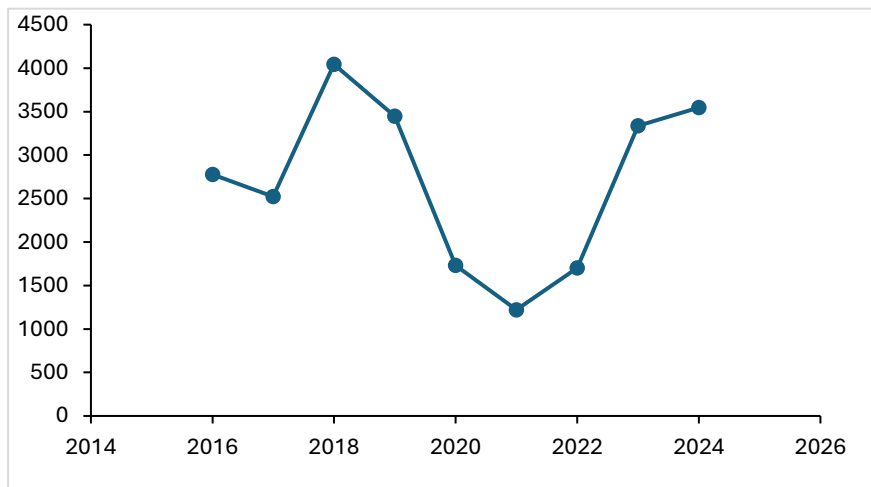
Publicly available reports of opinion polls of adult ACT residents conducted by Micromex Consulting in 2011, 2015, 2019 and 2022 included questions about motor vehicle collisions with kangaroos. From the answers to these questions, it is apparent that the majority of collisions with kangaroos:

- do not result in a carcass near the roadway
- do not generate an insurance claim
- are not reported to any authority, such as the police.

It is therefore apparent that the numbers of insurance claims, police reports, or carcasses counted on roads, are all gross underestimates of the true number of motor vehicle collisions, in spite of their common use for that purpose.

Parks and Conservation (PCS) staff in Canberra operate an Urban Wildlife service in which the main demand is roadside kangaroo incidents (e.g. to euthanase injured animals) and moving kangaroo carcasses off roadsides. This work is reported in an urban wildlife database which is publicly available through ACTmapi <https://www.actmapi.act.gov.au/>. The database recorded 1,700 to 4,044 carcasses per year from 2016 to 2024 (Figures 9, 10). It is clear that the variation is high between years. The spatial variation is also high, though not illustrated here.

Figure 9: Number of EGK carcasses attended by PCS urban wildlife staff in Canberra, per year, 2016 to 2024.

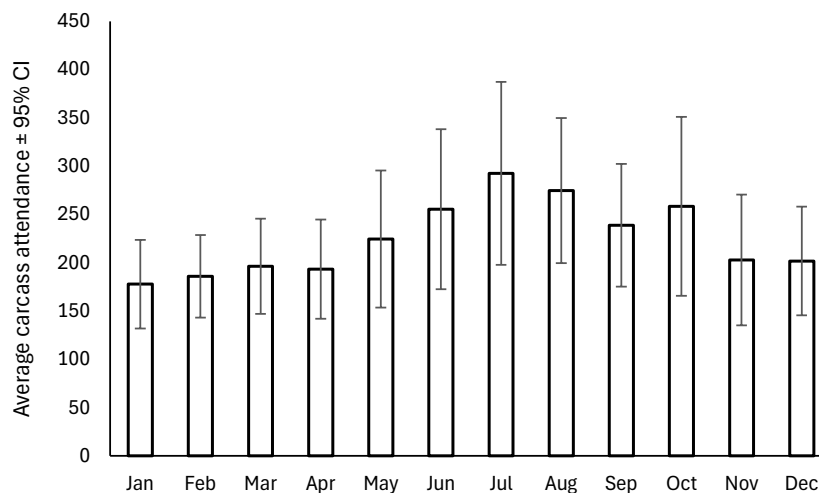


High year to year variation is evident in Figure 6. However, the decline in 2020 to 2022 is likely to be partly due to the response to the Covid pandemic, when road traffic would have been reduced, and people who attend to carcasses may have been less active.

Roadside deterrents and (virtual?) fencing

For many animal species, roads act as a partial barrier which causes habitat fragmentation, one of the main drivers of extinction. The effect can be ameliorated by attention to road design, especially the detail of drainage structures which are important *de facto* wildlife passages. Other measures used to ameliorate the barrier effect of roads are: underpasses, rope bridges and glider poles for arboreal mammals, minimising the spacing between trees to enable small birds to crossroads and even wide ‘land bridges’ designed for the full range of wildlife species and planted with local trees and other vegetation.

Figure 10: Mean monthly attendance by PCS urban wildlife staff at EGK carcasses in Canberra, 2016 to 2024. Seasonality is evident but it varies greatly between years.



Another side to the wildlife and roads issue is motor vehicle collisions with large species. In NSW, collisions with kangaroos cause more human fatalities than with any other animal type, so the issue merits attention, although traffic safety experts are often quick to point out that funds are better directed to reducing the number of other types of collision which cause far greater rates of death and permanent injury.

The most common way to separate large animals from motor traffic is roadside fencing. Much is known about the method, and it is a standard part of road design in NSW where the speed limit is 110 kph and is also used on some 100 kph and 80 kph highways. Kangaroo fencing has been provided in Canberra where the speed limits are 80 or 100 kph along Clarrie Hermes Drive, Drakeford Drive/Tuggeranong Parkway, Majura Parkway and Gungahlin Drive. The latter two examples include short sections of 'funnel fencing' to lead kangaroos to underpasses, a method that appears highly effective. Kangaroos readily use such underpasses. The Clarrie Hermes fence is only on one side of the road, like parts of the Drakeford Drive fencing, and this also appears effective, at half the usual cost and with reduced impact on access by other entities, such as bushfire tankers and other emergency vehicles. Kangaroos soon learn that there is no reason to cross the road when a fence on the far side prevents them moving to safe areas for feeding or meeting conspecifics.

Another proven method of reducing the risk of collisions with large animals is roadside lighting. This not only enables the drivers to see the animals but almost certainly deters animals from crossing in the lighted sections. Many prey species curtail their foraging on brightly moonlit nights, so they are pre-conditioned to avoid well illuminated roads.

Reducing the speed of vehicles is highly effective. However, signs have repeatedly been shown to be ineffective, even animated signs. Leaving carcasses on roadsides has been claimed to be effective.

The effective methods, fencing, lighting and reduced speed limits, are all expensive or politically difficult to retrofit to existing roads. Therefore, there is a history of attempts to find technology that is cheaper than fencing which deters wildlife from crossing roads when cars are passing, i.e. so-called 'virtual fencing'.

After half a century, so far there is only one published trial which claims effectiveness of any such deterrent, but that paper has been strongly criticised on scientific grounds and later trials of the same device by various scientists, found it had no effect. Wildlife carers are often the motivators of these trials and also responsible for data collection. History shows that it is wiser to have the data collected and evaluated independently, by consistent, diligent technical staff.

To reliably evaluate whether a method works to deter animals from crossing the road in front of motor vehicles, it is necessary to compare a sufficient number of replicated treated and untreated localities over a long enough time. Because roadkill data typically have high temporal and spatial variation, as illustrated here, the number of replicates and the length of time over which they must be consistently managed, can be surprisingly high.

Non-scientific bodies such as local councils and wildlife rescue groups have run trials that have insufficient replication or persistence to deliver reliable results. In some cases where claims were made for effectiveness, later investigation showed the devices could not possibly have had the claimed effect because they did not even produce the claimed signal, or in another case, the signal was undetectable to kangaroos. Thus, where possible, a first step before roadside trials are commenced, should be lab or pen trials to see that the devices do what is claimed and that the target animals do react to them in an appropriate way. And trials should be run, and data collected, by independent scientists.

Species involved in significant rates of motor vehicle collisions are exceptionally common species, such as EGKs in Canberra. For example, the database mentioned above contains 25,000 records for ranger attendance at roadside EGK incidents but less than 4000 attendances for all other species of animals combined. Wildlife carer groups approach the problem as an exercise in saving the lives of these overabundant species and typically neglect the impact on human life and property. However, it is the latter which matters more to road and traffic organisations, and the general public. A changed approach to the issue, hard-headed objectivity, and lateral thinking based on close knowledge of EGKs, are likely to be needed to make good progress in the virtual fencing area, if a successful method can be found.