

**Submission
No 273**

**INQUIRY INTO HEALTH AND WELLBEING OF
KANGAROOS AND OTHER MACROPODS IN NEW SOUTH
WALES**

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Submission to the NSW Parliamentary Committee of Inquiry into the Health of the NSW Macropod Population

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I

Personal Statement

I am a writer and an ex-academic, encouraged into early retirement by growing disability and a desire to work for animals. I live with rescued sheep in the Blue Mountains. I have been working in animal advocacy for a dozen years. Although I remain attached in an honorary capacity to the University of Sydney, I am an independent researcher, not supported by any other organisation or institution, and not paid by anyone.

In 2016, concerned by the annual slaughter of eastern grey kangaroos in the A.C.T., I wrote an investigatory piece ([‘Roogate’](#)) examining the intellectual and bureaucratic practices that sustain it. In late 2017, in response to that year’s slaughter and certain disturbing pieces I had read subsequently, I decided to further educate myself about kangaroos and their perplexing predicament in Australian society, and undertook to curate, and to write most of, [one hundred blog posts](#)

about kangaroos in one hundred days. Since then I have maintained and deepened my research, writing a number of essays on various historical and contemporary aspects of kangaroo management, and Australian conservation policy and practice. Numerous of these essays are collected in [*Animal Dreams*](#), just published by Sydney University Press.

In the Terms of Reference for the current inquiry into the ‘health’ of the macropod population in New South Wales, ‘health’ itself is not tightly defined. My assumption is that a principal concern of the inquiry will be NSW population estimates. Although I think that the actual size of the NSW population may be almost impossible to know, there are indications that the NSW population estimates are systemically inflated and that this is all the more reason for concern that, in certain parts of the state, one or another of the dominant species of kangaroo may be in danger of regional extinction. I discuss these concerns, and my concerns with current survey methods and the processing, reporting and tabling of their results, in section IV.

My hope is that other kinds of ‘health’ will be considered. In section III of this submission I offer comments on the deeply interrelated areas of *physical health*, *psychological health*, *mob/cultural health*, and *species/genetic health*.

In section II, in light of your specific terms of reference, I make some further comments on matters mutually concerning us but not covered in my discussions in sections III and IV. I have ordered my material in this way because I feel sections II and III provide material vital to a proper understanding of section IV.

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II

Summary of Responses to Terms of Reference

(Terms in italics)

(a) historical and long-term health and wellbeing indicators of kangaroos, and other macropods, at the local, bioregional and state levels, including the risk of localised extinction in New South Wales,

I have taken it that the principal resource referred to here are historical tables of kangaroo numbers since governments began to keep such numbers, such historical accounts of presence/absence of kangaroos in various areas as may have survived, and such indicators as may have begun to emerge from climate/drought studies, and the (now clear) inverse relation of the 'health' of the kangaroo population and the 'health' of the sheep industry (the size of the kangaroo population appearing to rise when the size of the state/national flock falls, etc.). Government figures, historical and contemporary, are extremely unreliable and systemically inflate kangaroos numbers. The manner in which they do so is detailed in part IV below. That even these figures at present indicate that, in several parts of the state, kangaroos generally, or one or another particular species of macropod, are at risk of regional extinction is particularly alarming.

(b) the accuracy with which kangaroo, and other macropod, numbers are calculated when determining population size, and the means by which the health and wellbeing of populations is assessed,

As detailed in part IV of this submission, these annual estimations have a systemic inflationary bias. It would appear that a part of this problem stems from inherent assumptions that kangaroo populations can 'explode', that a 15% population annual growth in 'normal' times is an appropriate rule-of-thumb figure in population estimations, that red and grey kangaroo females are able to raise more than one joey to adulthood in a year, etc. Neither the annual aerial surveys nor the MRDS (Mark-Recovery Distance Survey) system appear to be operating properly with regard to NSW

kangaroos, nor able to stem the inflationary bias. There are numerous indicators of this problem.

(c) threats to kangaroo, and other macropod, habitat, including the impact of:

(i) climate change, drought and diversion and depletion of surface water sources,

(ii) bushfires,

(iii) land clearing for agriculture, mining and urban development,

(iv) the growing prevalence of exclusion fencing which restricts and disrupts the movement of kangaroos,

With the exception of bushfires (I discuss the impact of the 2019/20 fires upon east-coast genetic reserves in part III below), I have not discussed these issues in any detail in this submission, in large part because I see their impacts to be obvious. Neither the NSW nor the Federal government has seen good many of its promises made in the immediate aftermath of the 2019/20 megafires, and indeed the NSW government has back-tracked upon some of them, using heightened economic imperatives brought on by the pandemic as an excuse to expedite land-clearing projects, mining and urban developments without proper scrutiny, and to shelve, ignore or place on the back burner wildlife and other environmental urgencies. I might have doubled the size of this submission by considering some of these, but given the shortness of preparation time and the limitation of my resources, have had to prioritise, and to hope that other submissions attend closely to these matters.

I think it self-evident that we have to find, and find urgently, ways of living in this landscape more wisely and sustainably. When it comes to *exclusion fencing*¹ (and *climate change*, deprivation/diversion of *water sources*, and *land clearing*), I advocate the mandatory inclusion/incorporation (in *any* extensive fencing) of wildlife corridors, in the conviction that these will serve the triple function of bush regeneration, mitigation of range deracination, and the local effects of climate change. Numerous people around the country are working on designs for kangaroo gates, and these projects should be encouraged. The aim of several of these projects is to devise a gate that could allow passage to kangaroos and

¹ Discussed, as are many others of the matters mentioned here, in the *100 Days project*.

deny it to dingoes/wild dogs. Were such a thing possible, it would take away one of the major objections to providing wildlife corridors.

(d) current government policies and programs for kangaroo management, including:

(i) the method used for setting quotas for kangaroo culling,

This, as I have said, is discussed explicitly and in some detail in part IV.

(ii) the management of licences to cull kangaroos,

It is my opinion that there should be so such licences. The kangaroo is a protected species, albeit with no non-private protectors. The NPWS supposedly performs this role, but they are deeply compromised in this regard and one would not be far wrong in suspecting that it is the agricultural and kangaroo industries they are protecting. Ditto, I am sad to say, the RSPCA. Again, I could say a great deal more – and have written elsewhere on these and related matters – but, given the time constraints, have had to prioritise.

(iii) temporary drought relief policies and programs,

I wonder whether it might be possible to include a measure of kangaroo protection/welfare – and/or evidence that such protection/policies have been adopted/complied with (such as the provision/existence of water sources, or wildlife corridors on the property) – as a condition of receipt of such assistance. These policies, packages and programs, this is to say, could be used to educate the public and improve conditions for kangaroos, perhaps even before (and therefore, perhaps, helping to allay) the droughts to which they respond.

(e) current government policies and programs in regards to 'in pouch' and 'at foot joeys' given the high infant mortality rate of joeys and the unrecorded deaths of orphaned young where females are killed,

The only advice so far seems to be to do with how to kill them. Why is it not mandatory to rescue them? A rhetorical question, and I know the answer, but I also know that there are some hunters out there who would prefer this course. Amongst other things, the inconvenience might lead to shooters taking more care not to shoot females.

(f) regulatory and compliance mechanisms to ensure that commercial and non-commercial killing of kangaroos and other macropods is undertaken according to the Biodiversity Conservation Act 2016 and other relevant regulations and codes,

Notwithstanding that the Biodiversity Conservation Act 2016 and what I see as its ‘sister’ Act, the NSW Biosecurity Act 2015, are troublesome pieces of legislation, serving, amongst many other things, to institutionalise *conservation killing* as the preferred mode of wildlife management, to promote the interests of *corporate conservation*, and to silence those who attempt to draw attention to institutionalised animal abuse in this country, such protections as the Act *does* offer kangaroos have been subsequently weakened by NSW drought mitigation measures in 2018. That these measures should urgently be reconsidered, and oversight/scrutiny of kangaroo ‘disposal’ practices tightened, is obvious, but as always the problem is budgetary. The NPWS budget has been cut and cut and cut. While governments continue to give wildlife protection one of the lowest of their priorities it’s hard to see that any effective scrutiny can be put in place. There *may* be some procedural adjustments that could be made to improve reporting (random compliance testing? Increased penalties for violation?) and perhaps the inquiry could consider these.

(g) the impact of commercial and non-commercial killing of kangaroos and other macropods, including the difficulty of establishing numbers killed by landholders since the removal of the requirement for drop tags, and

It was hard enough, when drop tags *were* in use, to have much confidence in the numbers. With drop tags now discontinued and reporting done by phone and email it is now even harder. Given that the problem is hardly likely to be *over-reporting*, the question can only be *how many kangaroos are being shot and not reported?* We now have very little idea of how many macropods are privately killed, let alone whether or not that killing conforms to the Biodiversity Conservation Act, etc. And whatever numbers we do not have will therefore not be included in the ‘take’ (commercial, special, or otherwise). Since macropod *population* numbers will nevertheless include those extrapolated onto private land, this can only lead, ultimately, to further inflation of the overall population figures.

(b) current and alternative measures to provide an incentive for and accelerate public and private conservation of kangaroos and other macropods.

I'm starting to think that the concept of conservation killing is now so embedded in land and wildlife 'management', that even the term 'conservation' can't be used with much confidence any more. But if what is meant by conservation is the attempt to help *save* kangaroo lives and to make provisions for their welfare, then my comments above re mandating wildlife corridors, watering sites, etc., and making them a part of one's eligibility for drought and other relief packages are pertinent here.

III

Physical, Psychological, Mob (Cultural) and Species (Genetic) Health

Mob/Cultural Health

The macropod population of New South Wales has been under attack since white settlement introduced the gun, sheep, cattle, land ownership, massive land clearing and subdivision (fencing) to denote that ownership, and attempts to maximise the profit from sheep and cattle raised upon that subdivided land. Kangaroos have been slaughtered since the first days of settlement, at first for food, then in order to reduce or eliminate competition for grazing, to the point where (I evidence the mere existence of government quotas) the killing of kangaroos has become a part of settler culture itself, sustained by cultural myths of kangaroo superabundance ('plague proportions'), fertility (the myth of kangaroo *hyperfecundity*) and danger to landscape and biodiversity.

Latterly this pressure has been intensified by the attempt to establish – and establish the sustainability of – a kangaroo ‘industry’, marketing kangaroo products world-wide, and the phenomenon of ‘conservation killing’, essentially a scapegoating of the kangaroo for the massive ecological damage done by humans.

This continual hunting has had a significant impact upon the health and wellbeing of what we might call, for want of a better term, the national mob, and, by extrapolation, that portion of the national mob that lives, and suffers, in the state of New South Wales.

Psychological health

Range deracination:

To look at this from just one perspective, the combination of hunting, land clearance and fencing have led to a significant deracination in kangaroo culture. Mobs are deeply territorial. They have a *range*. They know the features, uses, and dangers of this range; as mobs they have worked out how best to live upon this range, and pass on this knowledge – of water locations, of places to shelter, of places to avoid, etc. – from generation to generation. The clearing of land occurs fairly gradually and to a certain extent mob culture could be expected to adjust to such changes in their range, or, where possible, adjust their range itself. They might also, to a far more limited extent, make adjustments to the fencing of that land, although it might be registered that, after hunting, and natural causes aside, fencing itself is perhaps the greatest killer of kangaroos (arguably even more dangerous than vehicular traffic).

Hunting, however, introduces a particularly severe exacerbation to this deracination, in order to introduce which I must write briefly about mob structure. The myth of the boxing kangaroo has its roots in the habit of play-boxing amongst young males. This play-boxing is one of several ways in which young males contend in the process of developing and slowly ‘selecting’ what we might, for want of a better term, call the mob’s ‘alpha’ male. A mob will have several males but there will always be one who is preeminent. Over multiple generations this is of course a genetic process, the play-boxing (etcetera) repeatedly ‘selecting’ the strongest/fittest to become the mob’s leader and – since that leader is also sexually dominant – ensuring the passing on of the ‘strongest’ (healthiest?) genes.

This lead individual, *as* the strongest, becomes also the mob’s principal defender/protector, and a significant source of order and cohesion. ‘Dominating’

the females in the mob, for example, he also helps to ensure that they are not harassed by other males, etc. By virtue of these and other functions of leadership, he becomes also, over time, and notwithstanding the fact that the mob is essentially *matriarchal*, one of its principal repositories of mob lore and range-knowledge.

One key function of this individual is to keep watch for threats while the mob grazes. If a threat is detected, this dominant male stands tall, flexes, and, as it were, ‘stares down’ that threat. Whether or not this self-enlargement and staring down serves (as it will often do) to deter or fend off that threat, it also serves to draw attention *to* this alpha male in order to create a diversion and allow the rest of the mob to safely disperse. Ironically, however, – and very significantly – this means that, if that threat is a *human* hunter, the alpha male is virtually making himself the first/primary target and ensuring that he is shot.

Whatever else it serves to achieve, a regime of such shooting – ‘harvesting’ – leads to the persistent removal of the alpha males. Over time – and this does not take a great deal of time – this has an impact on the *genetic* health of the species, and of course it has an immediate impact on the mob. A major source of order is removed. Younger males are able to sexually harass the females in the mob. They take whatever opportunities they can to do so; they compete for the ‘right’ to do so. The mob becomes a more violent place. Stress levels are elevated.

When one considers that shooters are unlikely to stop, having shot the alpha male, and that any encounter with shooters is likely to see several members of a mob eliminated, one can begin to understand that, in a *regime* of state-sponsored hunting, kangaroos in New South Wales suffer culturally and individually from a kind of perpetual, rolling grief and TSD (i.e. a Post-Traumatic Stress Disorder from which one has removed the ‘Post’).

The psychological health of the population, this is to say, is not good. Nor is the physical. Shooters – this is anecdotal evidence – have been reporting that the size of the kangaroos they have been shooting has been reducing (‘the big fellas are gone’). The relation of continual and systematic hunting of a species and reduction of size/carcass weight of that species is long and well attested (Pople et al, 2006, 294). This progressive reduction is of course far more likely to be a matter of the *age* of the kangaroos being shot than a genetic matter *per se*, but is not the less significant for that. If the older and larger roos are less and less evident, then it is logical to assume that the average age of the mob is also reducing, that the

quantum of life experience is reducing, and that the mob culture suffering accordingly.

*

I am not sure that I'd say that, in some of these respects, the health of the kangaroo population might not in time recover. I do know it won't happen while 'harvesting' is still a factor. We speak of 'mobs' of kangaroos, but it is perhaps time we set that term aside. Not only has mob size (the average numbers of kangaroos in a mob) been steadily decreasing, to the point where 'mob', in most of the state, seems a gross exaggeration, but the term tends to distract us from, even occlude, the individuals it comprises. When you consider that every kangaroo is first and foremost an individual, taught, as are human individuals, by a process of deep early attachment, nurtured by familial bonds, and sustained, in youth and maturity, by a social network, one perhaps gets closer to comprehending the devastation caused by commercial hunting. Every kangaroo is a son or daughter, niece or nephew, brother or sister. They may also be a father or mother, aunt or uncle, grandmother or grandfather. They may be several or all of these. And every kangaroo shot leaves a significant tear in these networks, a hole in these lives. A single encounter with a shooter or shooters, can leave numerous such holes. We can only assume that the resultant grief, damage and disorientation shred the psyches of those who remain. Within such a lethal regime – of 'management', 'harvesting', 'control': the euphemisms abound – it is hard to see how we could be speaking of *health* at all.

The suffering of kangaroos is complex, their grief is complex, and any attempt to ameliorate or remediate it will be complex: difficult and complex. The physical and psychic health of the species are profoundly impacted by 'harvesting' and other immediate and lethal impacts – the number of deaths from vehicular impacts each year is extraordinary – but there is also the huge, perennially progressive impact of habitat loss and/or deprivation, through human practices, of access to the habitat remaining. We need a vast regime-change in our landscape and wildlife management, from shared or dedicated access to water, to legislated provision of wildlife corridors, to careful demarcation of *refuges* to serve as genetic reservoirs, to wildlife provisions in our bushfire and other emergency planning, to (a fundamental, seismic paradigm shift, but it is time our wildlife and animal management policies matured to take it on) an insistence upon non-lethal methods of 'pest' and land management.

Bushfires, Genetic Refuges

Two people are being interviewed on the radio. One is a woman who has spent her life providing sanctuary to wild animals just near Town C. Before the fires, the animals to whom she had offered sanctuary included 800 eastern grey kangaroos. When she returned to her home after the fire she found twenty still alive. Of the 800, for whom there was no shelter to take when the fire approached, 780 were burnt alive, died from smoke inhalation, or perished soon after from burns and injuries.

– Danielle Celermajer, *Summertime*, 129

Pople et al (2006, 293 *et seq.*)² recognise the genetic impact of consistent hunting and the importance of *genetic refuges* and the periodic *resting* of target populations (extended moratoria upon hunting in impacted areas) to allow for genetic replenishment from such refuges. One logical way of doing this would be to declare, in designated kangaroo shooting/hunting areas (Kangaroo Management Zones [KMZs]), on a rotational basis, moratoria of sufficient periods (ten years plus?), to allow for some genetic recovery. Although this of course is not being done, it is possible that national parks and state forests in NSW, in which (at least at this point in time) the hunting of kangaroos is proscribed, might be being seen to serve as a kind of genetic refuges, problematic as forested areas are for such. If there *has* been a substantial genetic reservoir that might have helped a properly ‘managed’ target population west of the Great Dividing Range recover from the genetic damage of consistent harvesting, it has been the coastal strip not historically or presently designated as a kangaroo management (harvesting) area, but any such potential restorative to the health of the rest of the NSW population has suffered a significant, indeed devastating blow in the 2019/2020 bushfires, which could be said to have targeted this area mercilessly. No assessment of the health of the NSW macropod population could ignore this profound double wound, i.e. the terrible wound to the coastal macropod population, and, for the rest, the damage to its one true genetic reservoir.

² Pople, A.R., *Modelling the spatial and temporal dynamics of kangaroo populations for harvest management*, final report to the Department of Environment and Heritage, Canberra (The Ecology Centre, University of Queensland: March 2006).

IV

Population Estimates & Population Health

Introduction

From a certain perspective, ‘health of population’ in New South Wales will be taken to refer to the *size* of that population in the state, and ‘health’ more specifically to whether those kangaroos can be ‘harvested’ without significant damage to that population – that is, without subjecting that population to irreversible decline.

In my opinion the population is *not* healthy in this regard.

Although it is difficult to estimate the size of the population in the first place, and current methods of doing so are flawed and persistently inflate the respective NSW populations of red kangaroo, grey kangaroo, and wallaroo, there are clear current indicators – the closing of three huge areas of NSW to the harvesting of one or another of these species, or to kangaroo harvesting in general because the population in those areas has fallen to dangerously low levels; the steady decline in the number shooters active in the field (i.e. who find the commercial harvesting of kangaroos to be a viable income option); and the persistent failure, over recent years, of the ‘take’ (actual harvest) to reach any more than 25% of government quotas, etc. – that the population is in decline (which is to say has already been hunted out) and that in various parts of the state there is a risk of regional extinction.

A mirage of numbers?

One of the things I find most troublesome about the method of calculating the annual quotas for each Kangaroo Management Zone (KMZ) is that quotas are based on the previous year’s population estimates. This will seem a strange thing to say – how else, after all, could it be done? – but let me explain.

If, in the year for which the quota has been determined, there is a sudden and dramatic fall in the kangaroo population, then the quota will in effect allow a substantially *larger* proportion to be taken/killed from a significantly *smaller* population. Although the overall rule-of-thumb in quota calculations is that no more than 15% of the population should be taken in any year, this discrepancy can

mean that, in potential, up to 25% and even 33% can be taken. And this, potentially, could have disastrous effects on that population.

In 2002, for example, the population of kangaroos in NSW was estimated to be 15,479, 854. Based upon this figure, a quota of 2,083,590, or 13.5% of that population, was set for the year following. In *that* year (2003) there was a ‘take’ of 996,507: that is, almost one million kangaroos ‘harvested’ (shot) *for the industry* (we must always remember that there are many others shot privately, many of whom are never recorded). In that year, however (2003), the Millennium drought had begun to bite. The estimated population for 2003 was 8,127,976, a little over half of what it had been the year before. The ‘take’ (996,507), that is to say, represented approximately 12% of that year’s population, and the *quota* represented over 25% of the population. Ultimately, to put it rather crudely – but how else to see it? – this amounts to kicking the species while they are down.

Should we reflect that these figures are almost 20 years old, and that the methods of quota calculation have improved since then, we might note that the same phenomenon has occurred several times in the intervening period, and occurs again at numerous points in the NSW Department of Planning, Industry & Environment’s *2021 Quota Report*, the latest data available. The 2020 NSW quota (2,102,131) is based on the 2019 population estimate of 13,861,850, but in 2020, the next decade’s drought peaking, the estimated population had fallen to just over 10 million (and in truth – and leaving aside that that figure may have been systemically inflated in the first place – by the end of 2020, and not including the loss of lives in the great fires, was probably a good deal lower), and the quota represents something in excess of 20% of the population.³

But, as I’ve acknowledged already, how else could these quotas be done? I see the ‘logic’ of this system, and, within that logic, don’t see how such anomalies (and there are many others) can be avoided. Perhaps they are just indications, were we brave enough to admit them, of the iniquitous nature of the activity in the first place.

All this is in any case to accept and work within the regime of these figures to start with. I don’t think we can do that. Leaving aside the possibility that there may be a certain governmental/bureaucratic bias in the figures in the light of the government’s commitment to the idea of a ‘sustainable’ kangaroo ‘industry’, the figures give us only a very vague notion of what the population might be. Amongst

³ An anomaly reflected even more dramatically in the tables for individual zones.

other things, we must note that these overall figures are based upon a compilation of figures and information coming from each of the fifteen⁴ Kangaroo Management Zones, and that the methods by which these contributed figures are reached vary in a manner that determines a measure of *inaccuracy* in the overall (compounded) figure.

For example, if, in the *2021 Quota Report*, one looks at the population tables for Glen Innes, Armidale, Upper Hunter, South-eastern NSW, Central Tablelands North, and Central Tablelands South, one sees not only that they run in three-year cycles, but that the population figure in those zones remains exactly the same for each of the years in each three-year cycle. This means that, whenever there is a fall in the kangaroo population over that period, the figures for the second and third of those years are inflated. In the South-eastern NSW KMZ, for example, an aerial population survey conducted in 2017 – a year in which the Eastern Grey kangaroo population was amongst the highest recorded in that zone – determined the population estimates for the next three years (2018, 2019 and 2020), which in their turn determined the quotas set for 2019, 2020 and 2021: years in which kangaroo numbers in the state overall had plummeted (2019 was one of the worst years for NSW kangaroo numbers in a decade), which is simply to say that, once again, quotas are set at their highest level when population is particularly low. Kicking, once more, when the species are down.

A glance at the Central Tablelands North KMZ [table 43] confirms this problem. The three-year cycle in this KMZ begins a year earlier than the South-eastern KMZ. The South-eastern KMZ was last surveyed in 2020 and the population estimate for 2021 has not yet been released. The Central Tablelands North KMZ, on the other hand, was surveyed in 2019, the year in which the recent drought took its greatest toll and kangaroo figures in NSW plummeted. While the three-year cycle anomaly has meant that the South-eastern KMZ figures have been artificially sustained at their highest level, the Central Tablelands North figure, because surveyed in 2019, registers in 2020 a population decline in that region of 55% (777,350 kangaroos, down from 1,728,200). The neighbouring KMZ, Central Tablelands South, we might note [table 44] – surveyed in the same cycle, registers a 48% population decline. If one were to bring to these dry but rather tragic figures even the slightest concern for animal welfare one might find oneself asking why on earth, with kangaroo numbers plummeting throughout the state, was no *out of cycle* attempt made to adjust in any way the figures for the South-eastern KMZ so that

⁴ Historically fourteen. The Griffith zone (#11) was in 2018 extended by 31,712km² and divided into Griffith North and Griffith South zones.

the numbers harvested might cause less damage to the population in those regions. The answer to which, I would imagine, were we able to find one, is likely to be not so much bureaucratic blindness, incompetence or laziness, as the stubborn intransigence of systems.

Only six of the current KMZs *shelve* their estimates in this manner – that is, repeat each population estimate twice without change. In all others the aerial surveys are annual and the figures change year-by-year. These annual surveys and consequently *fluctuating* estimates, however, can be even more puzzling. The case of red kangaroo population estimates and resultant quotas in the Lower Darling KMZ for the years 2008 to 2020 is fairly typical:

Year	Population	Density per km ²	% Change [from previous year]	Quota	% of population
2008	251,731	4.5	+33.9	31,963	17.00
2009	185,450	3.3	-26.3	42,794	17.00
2010	193,931	3.4	+4.6	31,527	17.00
2011	186,473	3.3	-3.8	32,968	17.00
2012	295,180	5.2	+58.3	31,700	17.00
2013	423,518	7.5	+43.5	50,181	17.00
2014	289,106	5.1	-31.7	71,998	17.00
2015	387,272	6.9	+34.0	49,148	17.00
2016	619,113	11.0	+59.9	65,836	17.00
2017	289,385	5.1	-53.3	105,249	17.00
2018	307,619	5.4	+6.3	49,195	17.00
2019	691,119	12.2	+124.7	52,295	17.00
2020	583,802	10.3	-16	117,490	17.00
				99,246	17.00

Density per km² refers to the estimated number of kangaroos per square kilometre. In the first line of this table, a density of 4.5, multiplied by the number of square kilometres in the KMZ (Lower Darling KMZ is 56,460 km²), should give us the population figure (there is a slight discrepancy here: the ‘density’ figure should be 4.58). A *% Change* of +33.9 means that the current year’s figure is 33.9% higher than the previous year’s population figure. The *Quota* is based on that previous year’s figure (which was in this case 188,018), and *% of population* means that the quota has been calculated at 17% of the overall population. This (17%) is an unvarying benchmark figure for all red kangaroo quotas; for eastern grey kangaroos the benchmark is 15%, though this can vary, sometimes substantially, from year to year and zone to zone.

Unlike the six easternmost KMZs already discussed, the aerial surveys in the Western Plains are conducted annually. What I find curious about this table – but

it is a feature of several (it is also in the Lower Darling *grey* kangaroo table, for example, and the corresponding tables for the Broken Hill and Griffith KMZs) – is that every third year, there is a sudden *fall* in the estimated population. In several instances this is a very dramatic fall. The population estimate then rises, often *also* very dramatically (I will come to this), in the second and again in the third year, then falls. One could surmise that there is, regular as clockwork, a significant natural disaster – an awful drought, say – late in every third year, or early in the fourth (first of the next three-year cycle), but the natural world is not so regular and the drought pattern is quite different. What is far more likely is that, every third year, some further factor is introduced – or returned – to the algorithm that amounts to a kind of correction, or reality check. The state-wide, compound population estimates tend to absorb this, so it may be a *fata morgana*, but a question remains.

Were the population rises we see in the second and third years we've been referring to consistent with the 15% rule-of-thumb natural population increase that the Kangaroo Management Plan seems to have adopted for seasons when the kangaroo population is not environmentally/climatically stressed, then at least one could see something of a rationale and might not be quite so curious about them, but they are almost normatively so *far in excess of any biological possibility* that (a) one cannot but wonder how on earth they have been arrived at, and (b) one must assume that either the aerial surveys are seriously and fundamentally incorrect, or that the formulae being applied in extrapolating the surveyed areas to the rest of the KMZ in question are fundamentally incorrect and misleading.

It is possible that this anomaly could be explained not by natural increase (the number of births) but by migration into the KMZ in question from another zone,⁵ but the fact that similar increases are found in the tables for the same years from neighbouring zones would seem to rule this out (were there migrations from those zones then surely they would show losses). It is possible, too, that, on occasion, the *correction factor* built in to aerial estimates – the number of kangaroos presumed to have *not* been seen for every kangaroo seen – has either been set far too low or far too high and needs to be recalibrated.

This, or something very like it, seems to have occurred to the NSW Kangaroo Management Committee itself, which in 2018 added the Mark-Recapture Distance Sampling (MRDS) technique to the estimation tool-kit. While this seems to have brought about some smoothing-out of the few subsequent estimations, generally

⁵ Although the Wandoo Woodland study (see footnote 8 below) found a very low degree of migration into and emigration from the area annually (approximately 5%).

and not unsurprisingly on the high side, it has produced some very elevated estimates for what was, for kangaroos, *off* paper, an appalling period, when, elsewhere in the state, other KMZs have registered the kinds of dramatic population declines history has taught us to expect in the later stages of a savage and extended drought. Where *Cobar*, for example [table 23], registers a fall in eastern grey numbers of 54.6% (from 405,079 to 184,069) from 2016 to 2017, another of 55.8% (from 184,069 to 81,391) in 2018, and a staggering drop of 91% (to 7,317) in 2019, *Lower Darling*, while it registers the same large fall from 2016 to 2017 (from 566,970 to 212,474: a drop of 62.5%), then records a sustained rise over the next two years (to 281,035 in 2018, 378,718 in 2019: i.e. of 32.3%, then 34.8%), and registers only a slight decline (17%) in 2020.

It may be that these 2018-2020 anomalies, whereby some KMZs register dramatic drought-related population falls while others, subjected to much the same conditions (by mid 2018 the entire state had been declared drought stricken) show very little drought impact at all, are owing to problems in the implementation of the MRDS system. The MRDS system is not fool-proof. It operates most efficiently in a closed system, where there is minimal migration of the wildlife being assessed, and where the population is not stressed by natural disasters or dramatic natural fluctuations, which is to say where large numbers are not dying off, or where normative procreation is not disrupted, etc. 2018 was the first year of MRDS operation in NSW KMZs and it was anything but a 'normal' year.

If MRDS is a problem, however, I think it is a subsidiary one. The propensity for all-but-impossible inflations of kangaroo numbers has been evident in NSW and Federal government tables for a long time. To restrict ourselves to recent history, and to the historical tables in the 2021 Quota Report, there are, for example, the reported rise of 426% in the Tibooburra KMZ grey kangaroo population in 2015 [table 17], the reported rise of 153% in the Tibooburra red kangaroo population in 2020 [table 16], the recorded rise in the Broken Hill KMZ eastern grey population of 164.4 % in 2013 [table 19], or the astonishing 504% rise reported in the Cobar KMZ eastern grey population in 2020 [table 23].⁶

These rises are astronomical. From one perspective it is scarcely credible that they could be presented to us *as* such, but it seems that those who present them either believe that they *are* credible, or believe they can be accepted as such. Once again, I do not mean to imply that there is conscious deceit involved, but clearly there is

⁶ Or the reported 184% rise in the Cobar red population for that year [table 22], or the recorded rise, in the Bourke KMZ grey population for 2012 of 249.1% [table 25], etc. etc.

some confounding factor here, and we should give some thought as to what that factor might be.

Hyper-fecundity?

There is a widespread belief in the state – and, it would seem, in kangaroo management nationally – that ‘explosions’ are possible in kangaroo numbers. A key supporting factor in this belief is the further understanding that kangaroos are in some way *hyper-fecund*. Representatives of the kangaroo industry, for example, have been reported saying that kangaroos are capable of producing three offspring per year. Were this true – were it in any way possible – then it is just conceivable (barely, but conceivable) that a kangaroo population in some region or another might, in perfect conditions, come somewhere near doubling its size in one year (though not tripling, not quadrupling). But this capacity to reproduce three times in a year is a shibboleth, bred by the same cultural prejudice that insists that kangaroos can be ‘in plague proportions’, even in years and regions when they are under threat of regional extinction.

That a kangaroo can *give birth* to three offspring in a year is a biological impossibility – or, rather, would be possible only if one of those offspring died in very early infancy. Kangaroos are capable of having three children in one year only in the sense in which, in any one year, a *human* woman (or man) might be able to say they have three children, one of whom might be seven or eight or twelve years old, another seventeen, another twenty, etc. A kangaroo female, that is to say, may, at one particular point in time, have an *at-foot joey* (a joey that is now living out of the pouch), a *pouch joey* (still living in and returning to the pouch), and an *embryo-in-waiting* (through a phenomenon known as *embryonic diapause*⁷) – this, in a very good season, might even be somewhere close to the norm. It is this that would seem to have led many people to the misapprehension of the kangaroo as a creature of extraordinary fecundity. Leaving aside the question as to whether we can speak of the embryo-in-waiting as a third young in the first place, however, an alternate view of the same phenomenon, is that this capacity of female kangaroos

⁷ A phenomenon whereby a fertilised ovum/blastocyst is kept as a ‘spare’ to be released upon an hormonal signal, indicating that adverse seasonal conditions have improved, for example (and nutrition increased), or that a pouch joey has reached the at-foot stage. Taken adventitiously as an indication that kangaroos do are perpetually pregnant, embryonic diapause is in fact something of a furphy, given that the second and third most numerous species of the five under discussion – the Eastern and Western Grey kangaroos – do not (the Western) or only very rarely (the Eastern) manifest it.

is an indication not of extreme *fecundity*, but of the great *difficulty* of seeing joeys past infancy, and the way evolution has tried to deal with this.

No ‘expert’ I’ve found lists an in-pouch period of less than 185 days, for *any* of the major macropods (red, eastern and western grey, wallaroo) concerned in this current inquiry. If a doe gives birth to a new infant on the very day that she shifts her previous joey permanently from the pouch, and if each of these joeys stays in the pouch for the 185-day lower-end estimate, then we are still looking at a 370 day period for the two, already just over a year. In terms of population estimates, that a kangaroo doe produces two *countable* joeys in one year might just be biologically possible (it would only be a *white* lie...), but how likely is it? It tends to assume, first of all, that the doe’s body is operating like clockwork. René Descartes might have found that feasible, but there some are significant other factors to consider. Some experts, I note, give the 185 as the lower end of a range extending as high as 300 days, i.e. suggesting an in-pouch period of *anywhere between six and ten months*. This would seem to tally with figures from various wildlife sanctuaries and refuges suggesting that the in-pouch period is of between 9 and 11 months.

In a scientific world that would seem at last to have acknowledged sentience in higher-order mammals (and in fact a great many more creatures than that), we can perhaps assert, too, that the emotions and judgement of the doe (and the joey) might have some role here. A doe who has lost her previous pouch- or just-out-of-the-pouch joey to a fox (or eagle or dingo), let’s say, might wish to keep the next joey in the pouch a little longer. She might also make a judgement as to whether her joey is ready enough – *mature* enough – to become an at-foot joey. Some may be ready at 185 days (does she count the days? not likely...), but others may require more time.

The only way, I would suggest, that, under such circumstances, a doe might produce *two* countable joeys in a year, is if there is some *overlap*, i.e. if a second, immature joey can be in the pouch at the same time as a much larger and more mature joey who is not yet ready to be evicted from the pouch. But this is biologically most unlikely. A doe will not give birth to another joey while there is a joey still in the pouch. There is a simple and very sound evolutionary logic to this. A tiny and very fragile joey is not going to survive in the pouch when there is a much larger joey tumbling into and scrambling out of it. So, no overlap, and some justification for a view that even an average of 1.5 joeys per year may be pushing the bounds of probability.

Evidently whether we assume, for a good or even a ‘normal’ year, a single offspring for each ‘productive’ female kangaroo, or accept the story that she can produce two or even three offspring a year, or, steering a safer course, determine that three offspring over a period of two years is the most likely figure (an ‘average’ of 1.5 offspring per year), will have a major impact upon our estimations for each year’s population. But of course there are further matters to consider.

The higher the proportion of females to males in the kangaroo population overall, for example, the higher the number of joeys one might plausibly expect, and the higher the survival rate one factors in to one’s equation, the more joeys will be projected to make it into the next year. In any year, too, a certain number of the adult kangaroos in any mob will die of natural or unnatural causes (including ‘harvesting’, which the present Quota Report suggests removes approximately 4% of the population each year), and this attrition must be allowed for. No matter what one has taken as one’s male-to-female ratio, one must also allow that a certain proportion of females in any mob will be either too young or too old to reproduce.

With the exception of the death rate amongst the adult kangaroo population in an *unexceptional* year,⁸ which (excluding the 4% ‘harvested’) seems fairly undisputed at 5%, there is not a great deal of consensus on any of these figures, although there are some upper and lower boundaries. The male-to-female ratio, for example, varies from parity (one-to-one) to a 1:2 ratio, i.e. twice as many females as there are males; the pre-adult mortality/survival rate varies from an approximate 25% survival rate up to a 50% survival rate (i.e. a mortality rate of 75% and 50% respectively). Some have estimated that the proportion of ‘unproductive’ females in a mob is as high as 36%.

The limits of possibility: population growth-rate tables

Given the centrality of these particular factors in any estimations of overall kangaroo population, I have drawn up a set of calculations in order to demonstrate, amongst other things, the effect a shift in one or another of these variables can have on an overall figure. (I might mention before proceeding that Annual population growth rates estimated by various experts, bureaucrats and industry representatives vary dramatically, from as low as 9% [observation of the regrowth

⁸ That is, with no mass deaths from drought, disease, etc.

rate of the wandoo woodland population⁹] to as high as 67% and 92% [Pople and Griggs, 1999, concerning the reproduction rate of Red Kangaroos],¹⁰ and – setting momentarily aside the bizarre and astronomical population leaps in so many of their tables – the fact that the NSW government, like the Federal Government, would seem to have adopted a very high 15% annual population increase as an acceptable and expectable norm.)

Each calculation below presumes a base group size of one hundred kangaroos.

First, a cautiously optimistic version:

100 kangaroos

50% female (i.e. 50 does)

minus a proportion of those (20%, or 10 does) either too young or too old to reproduce

[therefore] 40/100 (80% of females) producing *1.5 young per year* (that is, three young over a two-year period: the biological upper limit?)¹¹

40x1.5=a total of 60 young per year

with a **25% survival rate** (i.e. one out of four reaching adulthood)

this will mean **15 additions to the population**

subtract annual adult mortality of 5% of the original 100 (i.e. 5 individuals)

-> adjusted addition number of 10

subtract percentage 'harvested' (c.4% =4 kangaroos)

-> Adjusted additional number of 6 (i.e. 106 kangaroos at year's end)

= absolute maximum of **6% population growth rate per year**

Pushing at the upper end of 'normal' as the proportions in this table do, some would still say that these figures are too conservative, so let me present a couple of

⁹ A ten-year study of a discrete group of western grey kangaroos in the south-west of Western Australia published in 1991, which, along with the population regrowth rate of 9%, found them to have a male-to-female ratio of 46 to 54, an adult mortality rate of 5%, that c.90% of adult females would have offspring each year, and that only 27% of young survived the first year after leaving the pouch. See GW Arnold et al, 'Population ecology of western grey kangaroos in a remnant of wandoo woodland at Baker's Hill, southern Western Australia', *Wildlife Research* 18.5, 561-75.

¹⁰ The Kangaroos at Risk website suggests 'an Eastern Grey Kangaroo population growth rate of 10%, a Red Kangaroo population growth rate of 13.5%, a Wallaroo population growth rate of 14%, and a Euro population growth rate of 12%.' <http://www.kangaroosatrisk.net/2-biology--population-ecology.html> (21.iv.18) See also Daniel Ramp and Karl Vernes in *The Conversation* ('Fact Check: Are Kangaroos at Risk?'): 'Juvenile mortality rates are high and female kangaroos tend to have only three or four joeys survive in their lifetime. Compare that to rabbits, which [can produce](#) up to 14 young in a litter. Kangaroo populations, as a whole, do not grow more than 10% in a year.' <https://theconversation.com/factcheck-are-kangaroos-at-risk-37757> (21.iv.18)

¹¹ It's hard to say whether we should accept, as a margin call, that the biological upper limit is two joeys per year, or whether it would be more realistic to suggest that it be averaged to one-and-a-half (i.e. three joeys over a two year period). Although folk wisdom and refuge experience tend to suggest that 'kangaroos tend to have one joey a year', again figures vary, though in the mean they suggest that a kangaroo doe is capable of having a second joey after 185-200 days, which would mean two joeys in a 370-400 day period, not quite a year but who's watching? My own sense is that estimating, for a good year, one joey per capable female might just be plausible, and that anything beyond this is wishful thinking.

variations. If we change the proportion of female-to-male to 55%/45%, for example, reduce the proportion of those females too old or too young to reproduce from 20% to a very low 5%, and (against biology) raise the number of joeys per year from 1.5 to (an impossible) 2.00, the absolute maximum growth rate figure climbs to 22.5%, and if we maintain these adjustments but then raise the survival-rate figure from 25% to 50%, the absolute maximum growth rate figure becomes 45%. Much better numbers, yes, but, I would suggest, already well into the territory of the utterly implausible.

A more plausible argument for elevating the overall annual population growth rate would be to adopt the upper level of estimated proportions of females to males in a mob, i.e. to presume a ratio of two females to every male. Given that males tend to be the principal guardians of the mob, given that the males do actually fight (although very rarely to the death) for their place in the reproduction hierarchy, and given, perhaps especially, that various states (and the Kangaroo Industries of Australia) have for some years now been following a male-only 'harvesting' policy, it may be that there has been a gradual decline in the proportion of males in the population. It seems only appropriate, therefore, to present a revised form of my original table, with the ratio adjusted:

100 kangaroos

66% female

Minus a proportion of those (20%) too young or too old to reproduce (i.e. 13.2 [therefore] 52.8/100 (80% of females) producing 1.5 young per year (the biological upper limit?)

= 79.2 young per year total

with **25% survival rate** (to adulthood)

-> 19.8 (say 20) additions to the population

Subtract adult mortality of 5%

-> Adjusted addition number of 15

Subtract percentage 'harvested' (c.4% =4 kangaroos)

->Adjusted additional number of 11

= absolute maximum of **11% population growth rate per year**

If, as we did with the earlier table, we adjust, to their respective highest/lowest limits, the variables of those either too young or too old to reproduce (from 20% to 10%), and the survival rate to adulthood (from 25% to 50%), we find this absolute maximum of 11% population growth rate rises to 35.55% - a high figure, but perhaps not beyond the realms of (remote) possibility. When we assume the birth capacity to be *two*, however, the growth rate rises to 50.4%. Be tempted by

the mythological *three* births per year and one finds oneself working with a possible growth rate of 80.1%. In a base figure of 100 kangaroos this might not seem a great amount, but in a KMZ the size of Lower Darling, this would mean that the 2012 eastern grey figure of 232,187 would become, the next year, either 257,725 (at 11%), 349,209 (at 50.4%), or 418,168 (at 80.1%).

Even these figures, however – stretching credibility and biological possibility to their very limits, are still a long way from the kind of extraordinary population leaps listed earlier from the current NSW tables (and so frequent in historical tables), but they serve, on the one hand, to indicate how great an impact even the smallest factor-change in an equation can have, and, on the other, to indicate just how bizarre and questionable those population leaps, and the tables within which we find them, may be, and how cautious any committee of inquiry must be in basing any assessment of the health of the NSW kangaroo population upon them.

There are still many anomalies in the government's figures to be discussed – but the point is simple and perhaps now made: that government estimations of NSW kangaroo populations are inherently and systemically inflated, that any impression they may give that that population is robust and in a state of 'health' must be meticulously *and independently* interrogated, the likelihood being that the real population is considerably lower, a great deal more damaged, and much more fragile, than officially conceded.

V

Coda

It may be, of course, that these figures I have been contesting *are* in some sense accurate, and that, for the extraordinary leaps I have been listing, there is a logical explanation that I have simply been unable to find. It may be that the year-by-year biases – the seemingly impossible rises and all-too-possible dramatic falls, or the dangerous imbalances caused by determining one year's quota by the previous year's population (etc.) – all balance themselves out in the end. I'm not sure, however, how much such corrections and explanations, were they to come forward, would quell a lingering sense that the brouhaha of numbers – of

population figures and resultant quotas – are not a kind of distraction, a bureaucratic mirage in the first place.¹²

The *real* figure – the one figure, I think, that we can rely upon – is the *take*, or rather the *take* of the take, since the number of kangaroos shot privately and not recorded remains unknown to us. And the take tells a story of its own. For eight of the last eleven years the take has sat very steadily within twenty to twenty-five thousand of a mean of about 360,000, the only exceptional years, and they have not been hugely exceptional, being 2018-2020, when the recent drought was biting and what I call the *drought paradox* came into play. (Kangaroos, that is to say, tend to become more evident during times of drought. As the landscape becomes drier and drier and fodder reduces, they become more evident along roadsides and near settlements and remaining water sources, or gathered at exclusion fences, driven by thirst and hunger, congregating not because they are supernumerary – the dry plains emptying behind them – but because they are desperate. That they are seen so much more during these periods not only creates the impression of ‘plague’ proportions, but also, of course – to explain why the take may be higher when they are at their worst – means they are easier to find and kill.)

The population – to return to my point – may fluctuate widely (as it has, over this period, from a low of eight million to a high of seventeen), the quotas may range from as high as 2.7 million to as low as one million, and the percentage of the overall quota and population may vary proportionately, but the number of kangaroos actually registered as having been shot has remained strangely very close to the same, as if this has reached a limit of the possible, regardless of what the government has predicted or determined permissible.

What this possible *is* is not entirely clear. It may be the shooters; it may be the shot. The kangaroo industry, pointing to the government figures, insists that there are plenty of kangaroos, just not enough people to shoot them, but it’s hard to imagine how it could not in fact be a case of shooters finding the quarry too scarce and meagre to make hunting them worthwhile. How, if kangaroos *are* as abundant as population estimates and the KIA suggest, could this be so? I may be alone in this interpretation but this – and the fact that the overall take dropped dramatically in the years 2006-2010 and has not really risen in the decade since, suggests to me that we’ve reached a point that we must examine very closely. My feeling is that it

¹² It may be, for example – a significant point, but I find I have not made it elsewhere – that, rather than any conscious, intentional deception, the huge and seemingly impossible leaps we find in government figures are owing to some hitherto undetected or at least unresolved problem in the survey processes, or the processing of survey results, but how to allay the suspicion that they have helped sustain the overall population figures at an unrealistic level – indeed, created a ‘ghost’ population?

is the clearest indication we have yet had that the species is declining, and that the kangaroo industry, as such, is no longer viable, if it ever was. The great tragedy is that kangaroos are still being slaughtered, at an unacceptable rate (as if there were such a thing), in the attempt to prove otherwise.