Submission No 270

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

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28 April 2021

Dear Portfolio Committee No. 7

Legislative Council Inquiry – Portfolio Committee 7 Planning & Environment
Health and wellbeing of kangaroos and other macropods in New South Wales

Thank you for this opportunity to make a submission to the inquiry into the health and wellbeing of kangaroos and other macropods in New South Wales.

I am a consulting ecologist/conservation biologist with over 20 years professional experience in the flora, fauna and threatened species management space across NSW. I have delivered ~300 projects including flora/fauna surveys, reporting, research and management.

I also have direct experience with kangaroos and other macropods as a large animal handler in the rural/regional rescue space since 2008, where my on-ground expertise is regularly requested by wildlife rescuers, vets and the general public.

I have also been mapping and analysing NSW kangaroo survey transects, survey count data and harvest statistics since 2009, examining the validity and robustness of the published science and critiquing and collating the history of kangaroos and their interaction with politics in Australia.

With direct reference to the terms of reference of this inquiry:

(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

Raw data from official kangaroo surveys indicates populations persist today generally at critically low densities. Populations have become fragmented and depleted, and local and regional extinction has already occurred in many instances.

Early explorer and settler journals, as well as other primary historical sources, describe kangaroos across most Australian landscapes, and often in terms of abundance that are never seen today. This includes where are now the CBD streets of Sydney or Melbourne, cities and towns across NSW, intensively farmed/irrigated/dairy districts, and landscapes that have been transformed into dams, mines or other intensive industries.

When considering indicators of macropod (and other wildlife) decline it is important to understand that local extinction exists anywhere you cannot see kangaroos/macropods, in landscapes where they were recorded historically. For example a lack of kangaroos in Macquarie Street and Sydney's CBD is *local extinction*.

First Fleet diarists did not venture far into the bush, but they all reported kangaroos: "The Animal described in the Voyage of the Endeavour call`d Kangaroo we find in great Numbers" (John Hunter 1788)

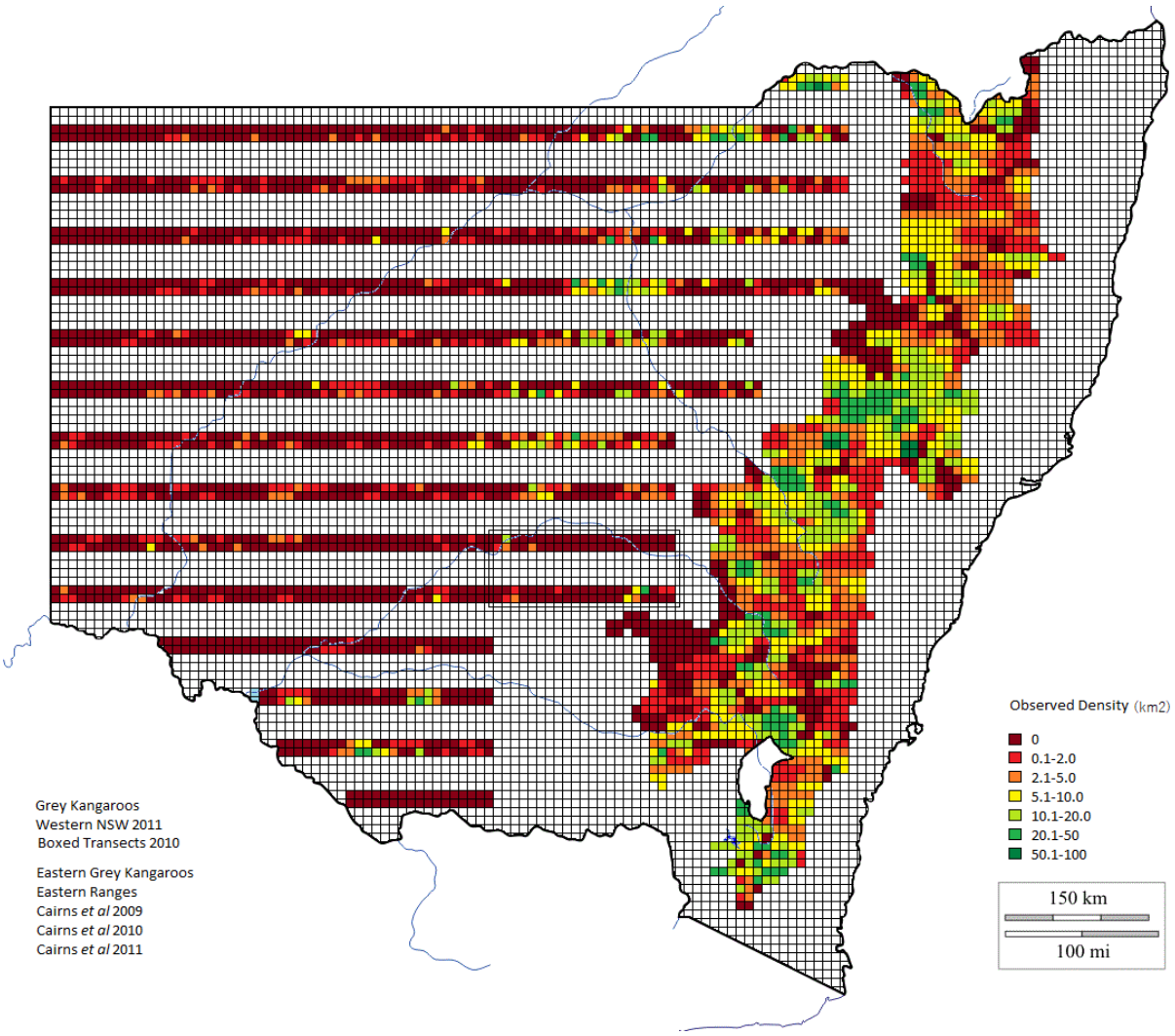
What the actual (raw) survey data shows

Spatial analysis of the raw data for the western districts in 2010 and 2011[1] and in the eastern ranges between 2009-2011[2] indicates that kangaroos have been effectively if not completely eliminated across much of their former range in NSW at a local, bioregional and state level. Where they persist populations have become fragmented and much-depleted.

The following illustrations map *observed* densities (kangaroos/km^2) recorded by the official surveys (actual count data) in districts where they were conducted in the period 2009-2011 .

Note: many regions where kangaroos have disappeared completely, such as most of the Sydney basin and much of the intensively developed eastern coastal strip and intensively farmed districts etc, are not sampled during survey. Examination of survey transects locations over time also show transects have been periodically dropped from the survey program when they start returning nil observations.

[1] using actual count data from the survey data sheets
[2] referencing data from Cairns (2010-2012)



Mjadwesch 2018

Note that Hacker *et al* (2004) considered that:

- "… *average long term density <10/km²* [in yellow above] *should be rejected since in all such cases density is likely to fall to below critical levels…*"
- less than 5 kangaroos/km² [in orange above] was "*a threat to species conservation*", and
- less than 2 kangaroos/km² [in red above] is "*generally considered at risk of extinction*".

Dark red indicates no kangaroos were observed; these are landscapes where critically low densities have been reported (functional or local extinction). Consecutive NIL OBSERVATION transects sometimes extend for hundreds of kilometres along the survey lines, where historically they were often reported in abundance.

In the eastern commercial zones (the northern and central tablelands, and the SE-NSW zone) kangaroos persisted then (2009-2011) at "normal" densities in less than 0.4% of the surveyed area - assuming that the maximum numbers of ~60 kangaroos per square kilometre reported by the Cairns' *et al* survey were representative of the prevalence of persistence at normative observable maximums across the eastern ranges at the time.

Grey kangaroos had been effectively eliminated from 17.9% of the survey area, and were quasi-extinct (only 1 or 2 per square kilometre) from a further 21.3% of these survey zones. The reported frequency of observations suggested an instantaneous rate of decline, in terms of comparative abundance, in the order of ~90%.

If we accept Cairns' *et al* extrapolated population estimates for each of the three zones (at the time) as valid (totaling 2,249,759 Eastern Grey Kangaroos), comparison with the *observed* maximum density suggested decline in the order of at least 94% through the three eastern kangaroo management zones at the time of survey.

Between 2001 and 2010 absence of "grey" kangaroos[3] from western zone transects, as observed during survey, increased from 53% of transects to 69%.

By 2011 zero-counts were returned from 75% of transect segments surveyed. That is, by this stage government survey data suggested grey kangaroos persisted across only 25% of their former range in western NSW. Their distribution had become patchy, and where they remained this was often at vanishingly low densities.[4]

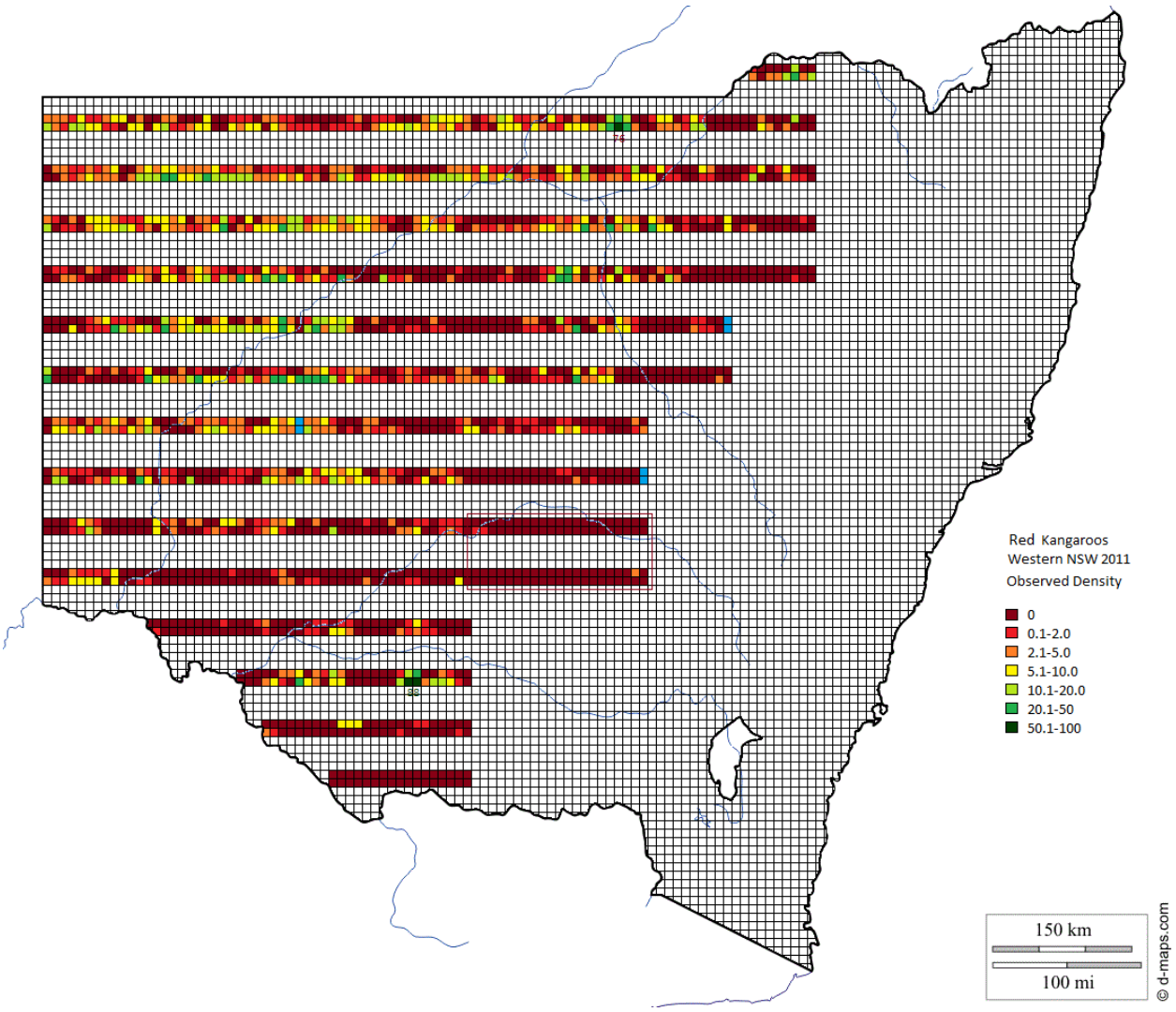
Assuming that suitable habitats across the western zones could have supported populations in the mid-range of numbers observed in 2011 (20-50 kangaroos per km2, even under degraded conditions) prior to the arrival of stock in the rangelands, and assuming that the later official population estimate of ~6.3M grey kangaroos in western NSW was correct (NSW OEH (2017)), then decline across the west of the state is in the order of at least 65%.

Again taking the precautionary approach and considering the possibility that official population estimates may be substantially over-estimated,[5] if the actual density is closer to the observed density (based on the raw survey data) of grey kangaroos in western NSW, then numbers may have been reduced by as much as ~98%, in the western parts of their range in NSW.

An analysis of the raw data from surveys in western NSW in 2010/2011 illustrated that there were no Red Kangaroos at all across 48.9% of the surveyed districts at the time (dark red in the image below).

Where Red Kangaroos were found to persist this tended to be at extremely low density. Half of the observations that were made were of only 1 or 2 kangaroos, and in an increasingly fragmented mosaic. Contraction out of the eastern and southern (Murray/Murrumbidgee) catchments as per Pople *et al* (2010) was confirmed, where previously they had been described in *"swarms"* (Mitchell (1831)) and "*abounding*" (Gould (1852)).

[3] …western NSW data in government datasets is an aggregated total combining Eastern and Western Grey Kangaroos.
[4] …approximately half of the observations recorded were of only 1 or 2 kangaroos (red).
[5] …there are serious problems with the derivation of official population estimates. Problems include flawed survey methodologies (animals counted in national parks have been used to derive densities applied to farmlands) and increasing bias in analysis (for example "correction factors" used in fixed wing surveys have been periodically increased).

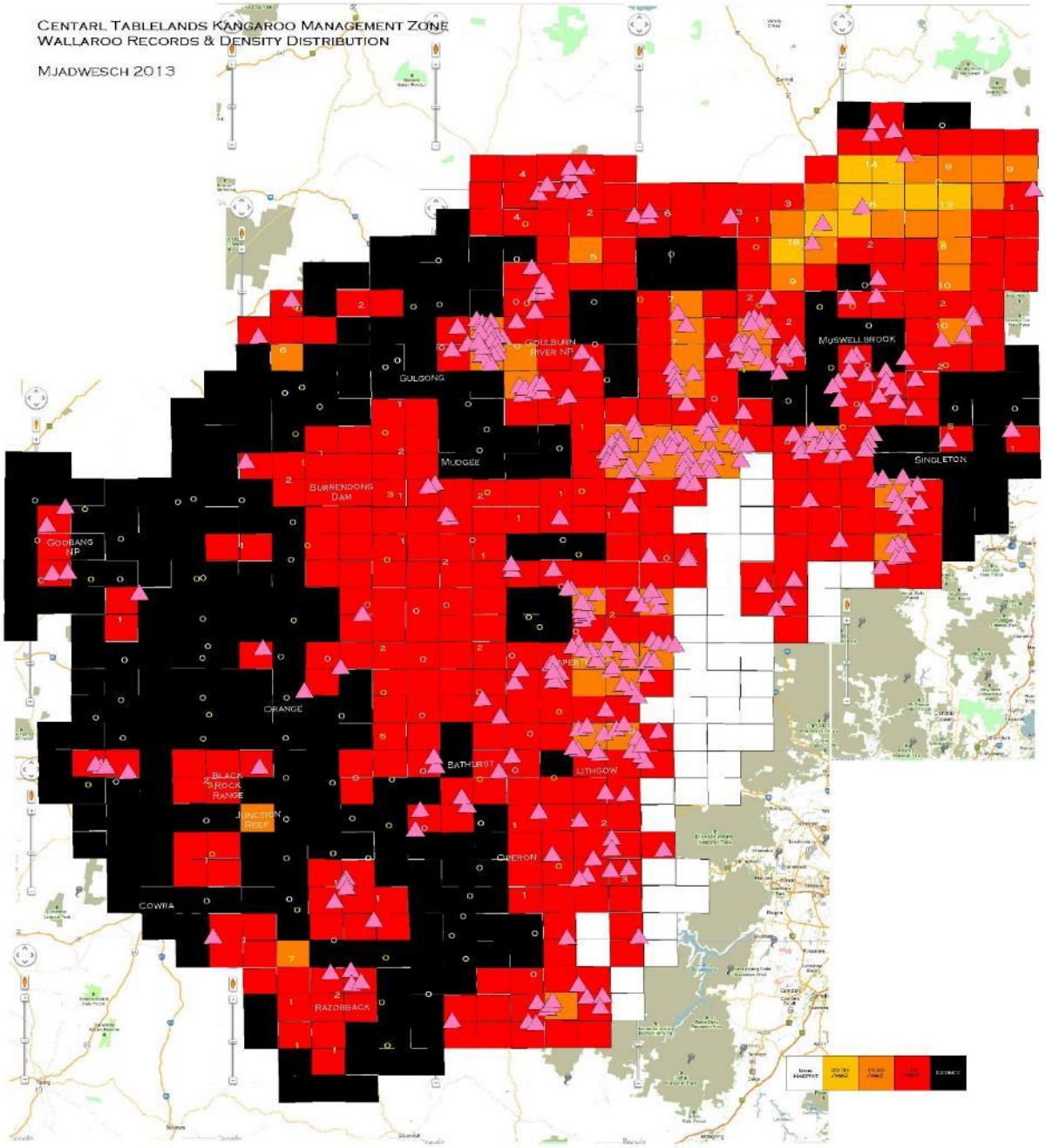


Mjadwesch 2018

As kangaroos disappear entirely from some districts survey transects have been progressively truncated. For example the boxed data in the illustration above is from 2010, however these transect segments were inexplicably not sampled in 2011 – this strategy subtly increases density. In terms of generating the official population estimates, in analysis kangaroos observed in habitats where they persist (national parks etc) have been used to generate densities that have been extrapolated across districts which are effectively devoid of kangaroos, and which have not necessarily been sampled.

In response to a nomination to list the large macropods as threatened species in NSW in 2011 (see www.kangaroosatrisk.net) in 2015 the NSW Scientific Committee acknowledged that decline in the period leading up to 2010 (as illustrated in the graphics above) was accepted (NSWSC (2015a-d)). However the Committee concluded, on the basis of a reported but biologically impossible rates of increase in numbers in the years immediately after the nomination had been lodged, that populations "*fluctuate*". The Committee rejected the nomination on the basis of the reported increase in the extrapolated population estimates, even though drought continued and even intensified (kangaroos stop breeding during drought; all of the juveniles die and adult mortality can run at 50%+ *per annum* during severe drought); even though shooting continued and even intensified; and even though the reported rates of increase in the official population estimates were biologically impossible.

Unfortunately the Committee did not review the survey methodology or the analysis that underpin the official population estimates, on the basis that they considered that the harvest model and surveys were "*rigorous and scientific*" and it was "*not their responsibility*" to review the commercial shooting of kangaroos in NSW[6] (NSW SC *pers comm*). Commercial shooting of Wallaroos does not occur in the Central Tablelands; nonetheless their population here is highly fragmented and depleted, and the NSW Scientific Committee ignored this fact, too.

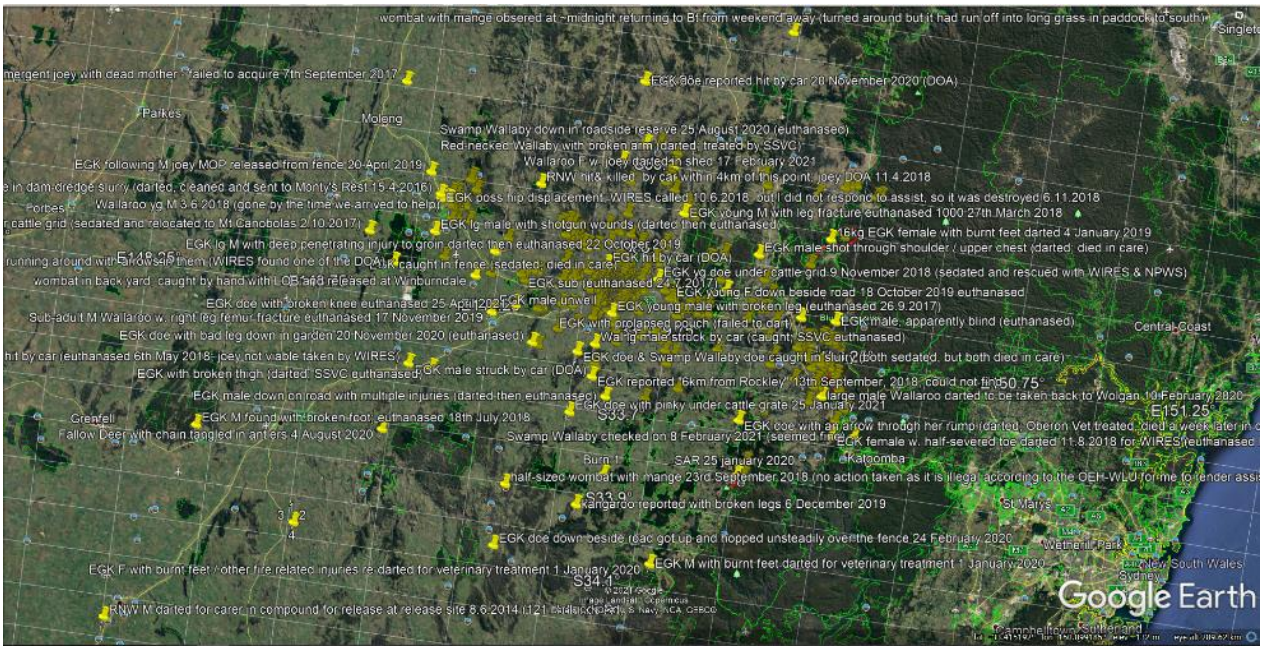


Wallaroos have been largely eliminated in the Central Tablelands even without commercial shooting

[6] …commercial shooting and errors in the survey methodology and harvest model were specifically identified as threats to the species in the nomination.

At a local level kangaroos are frequently involved in accidents with motor vehicles. The media often reports the cost of accident insurance and the frequency of claims against kangaroos, however they rarely consider the cost to wildlife. Brunton (2018) studied kangaroo populations in a peri-urban environment (south-east Queensland) and found general decline to local extinctions, with roadkill playing a major part.

Not only are peri-urban populations often in decline, but on an individual level many animals suffer severe trauma during this process. A sample of large animal "*rescues*" in the Bathurst district for the period 2008-2021 is illustrated below, mapping ~1,500 incidents I have personally attended. In my experience kangaroos and wallabies are frequently killed and/or catastrophically injured by vehicle-strikes; they are entangled in fences which injures and kills them, often slowly; they are chased, attacked and killed by dogs; they fall into swimming pools; they get trapped in drains, mine shafts and flood waters and suffer other misadventures; they are burnt in bushfires; people shoot at them and injure them, and they run away missing their nose or their jaw; other people shoot at them with arrows.



At a local level (Bathurst / Lithgow / Orange) kangaroos are frequently involved in misadventure

Kangaroos are not thriving in the anthropocene, despite assertions to this effect. In terms of their "*well-being*" at an individual level I will not horrify the Inquiry with photos from my experience interacting with and managing wildlife throughout my professional and rescue career.

Interestingly urban development does sometimes provide a measure of short-term protection for kangaroo populations. There are sometimes small resident mobs that persist on the outskirts of towns, in an abandoned orchard, or in bush reserves on urban fringes (like on Mount Panorama in Bathurst, which is a special case). Because of the proximity and density of residential development in some precincts it is sometimes dangerous to discharge high-powered firearms, so some "lucky" animals sometimes find refuge in vacant land, until they are eventually displaced by development onto adjacent roads and into farmland.

Historic records and the raw data from surveys indicate that kangaroos have been completely eliminated from many landscapes in which they formerly abounded, this represents local extinction, and

this process continues to the present day. It is the sum of local extinctions that lead to regional extinction, it is the sum of regional extinctions that lead to extinction in the wild. Fortunately they go well in captivity, and some people like having kangaroos around their golf-course, so the risk of total extinction is low.

(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

Contrary to best scientific practice, population survey methodologies have been constantly changed since the 1970s. For example, "corrections" used in analysis have been constantly increased (see Pople (2004)), resulting in ever-inflated Population Estimates. In the latest reversal the long-term western district survey methodology in NSW has been abandoned whereby in 2016 surveys in western NSW went to a MRDS methodology. Then in 2018 the survey transects, which had been used since the 1980s, were abandoned. Compare this ever-changing macropod survey program to Professor Richard Kingsford's water bird surveys, where the same transects have been surveyed and the same methodologies have been applied for nearly 40 years.

The NPWS recently announced (Wolter (2018)) that the surveys no longer use correction factors (since 2016), or sample national parks (from 2018). These were two of the criticisms of the survey program made in the 2011 nomination (and supplements) to list the large macropods as threatened species in NSW (Mjadwesch (2011-2013))[7].

Constantly changing survey methodologies is a key indicator of pseudo-science; changing survey methodologies after critical errors in a program have been identified in an independent review could be seen as *shifting the goal posts*. Good science relies on repeated and replicated methodologies, however kangaroo monitoring in NSW has failed in this regard completely.

With the latest change to the survey methodologies in western NSW (total abandonment of the methodology and survey transects up to that point), and with survey methodologies changing every time they are conducted in the eastern management zones, we are left without any valid population estimates for the period 1988-2015, or anything remotely resembling a long-term data series for NSW, despite assertions to this effect (eg Lunney *et al* (2018))[8].

Considering the survey data spatially and in the context of the species' historic abundance, catastrophic and ongoing decline is clearly indicated. However this is nowhere acknowledged in the management space. Not only is the monitoring of populations not being done to a standard that should be expected for a program that results in the deaths of millions of native wildlife annually, monitoring is so deficient, in my professional opinion, that the opposite trajectory (population increase) is sometimes indicated in

[7] The NSW Scientific Committee, in rejecting the large macropods threatened species nomination in 2015, described the official surveys as "*rigorous and scientific*", when in fact subsequently the survey methodologies were abandoned. The NSW Scientific Committee excluded from their consideration of the threatened species nomination all discussion about the commercial program in NSW, including discussion of clear errors in survey methods and positive bias in analysis. When the NSW kangaroo management team subsequently abandoned the long-term methodology in 2016, and changed the survey layout in 2018, population estimates based on surveys conducted between 1988 and 2016/2018 were rendered invalid. The publically reported population estimates that the Scientific Committee relied on in rejecting the threatened species nomination had been demonstrated in that nomination to be neither rigorous nor scientific. In my opinion the survey program would not have been abandoned if the methodology was "good"; the errors in the survey program and analysis were obvious and the official population estimates were indefensible.

[8] It is worth noting Lunney et al have been involved in the NSW kangaroo management program since its inception in the 1970s, and/or continue to be involved in the program. Any review of the merits of the kangaroo management program should probably be conducted by authors completely independent of the program.

official estimates, often at rates which far surpass biological maximums.[9] The many errors in the survey program feed into officially published population estimates through a number of flawed system processes which are compounded. The result is significantly inflated population estimates, which in turn leads to an over-allocation of (unobtainable) quota.

Accurate population estimates and long-term data series need to be based on multiple-replicates of repeated survey transects flown annually, and the data should be analysed spatially with consideration for (but not necessarily limited to) the land-uses and vegetation types sampled.

Unfortunately delivering the surveys and analysis properly would be more expensive. The margins in funding the Kangaroo Management Units' management and oversight of the commercial program[10] are tight, and barely cover the program as it is presently run. The various survey programs which support the industry (the sole purpose of surveys is to provide population estimates, on which basis the commercial quota is calculated) are therefore "*cheap*" in that they use single replicates, and a rudimentary and flawed analysis, in my opinion.

Surveys do not meet best practice science given methodologies are constantly changed. Further, analysis is biased whereby kangaroos from non-shooting areas are used to derive densities which are applied to shooting areas, and data is not analysed spatially. As a consequence official population estimates are positively skewed.

The margin of error in the population estimates is unknown, however given the size of the reported "fluctuations" reported by the official estimates, they cannot be termed "accurate". No-one has ever attempted to generate precise population estimates for kangaroos in NSW - the harvest zone estimates do not reflect what the survey count data actually describes, and these estimates are not for all of NSW in any event. Further no-one has ever attempted to quantify numbers of other macropod species not (yet) subject to commercial exploitation in NSW. I note that Red-necked and Swamp Wallabies were counted in the recent survey of the Northern Tablelands.

(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*

SHOOTING: The most serious threat to kangaroos, shooting, has been inexplicably left off this list. Every kangaroo shot results in the kangaroo population instantaneously declining by one. If a doe is shot, then the joey she has and every joey that she was ever going to have in her lifetime, and all of their joeys for all time disappear from the account books. Populations are severely impacted by shooting, as shooting is indiscriminate (see below).

MISMANAGEMENT: Official survey methodologies and the harvest model contained critical flaws from the "regulated" industries inception in the 1970s. The aspirational harvest rate exceeds species' reproductive rates, and shooting during drought when populations are in decline was always going to be a disaster.

[9] Reported rates of increase >400% per annum in the period immediately after the nomination was submitted far exceed the species maximum reproductive rate (~10% per annum, under optimal conditions).

[10] traditionally via fees attached to tags and licenses, and from royalties per carcass

CLIMATE CHANGE (particularly increased heat) causes increased mortality in juveniles and reduced fertility in males. For a species with an already low rate of reproduction this is very serious. Climate change is also expected to result in increased incidence and severity of DROUGHT, with serious implications for kangaroo persistence, where populations crash during drought and generational loss of fertility occurs in does. Natural decline is exacerbated under intensified shooting regimes during drought, as farmers react to perceived impacts of kangaroos on their livelihoods by blaming kangaroos for the damage caused principally by stock, and generations of farming practices that have degraded environmental systems.

WATER: Converse to popular opinion, the science confirms that installation of artificial water points does not increase the persistence or density of kangaroos. Further, dams act as population sinks, concentrating the interactions of shooters and other predators onto points of intersection with kangaroos in water-depleted landscapes. In addition as dams dry out and become muddy bog-holes they act as a source of direct mortality, as animals are drawn to the water, and become bogged and die in the mud.

Note that despite the dominant discourse on the topic, in fact there is less water in the landscape today than there was prior to the occupation of landscapes for agriculture and establishment of artificial water points (AWPs). Early explorers described deep clear pools fringed with vegetation, which they revisited later to find cattlemen and sheep-herders had often claimed the land and waterholes were degraded, trodden into muddy bog-holes, and destroyed by sheep and cattle.

Rivers, streams and ephemeral water courses have run dry or been diverted, lakes and wetlands have dried out. Extraction of water through bores has decreased pressure in the Great Artesian Basin so that ancient mound springs have ceased to flow in arid zones, and bores in national parks have been shut off. Farmers protect every drop of water for their stock.

The "*proliferation*" of AWPs has not turned Australia into a wonderland for kangaroos. In fact AWPs have increased the range and impact of stock animals, so that landscapes in the rangelands are no longer half-as-productive as they were historically (according to Archer *et al* (1985)).

BUSHFIRE: I was engaged to dart and euthanase burnt animals in and around the fire-grounds of the Blue Mountains and Cooma districts during the bushfires in 2019-2020. I have witnessed first-hand the impacts of bushfire on macropod species, and I was sometimes surprised at the numbers which made it through unscathed. This seemed to depend on their place in the landscape, the behavior of the fire and the nature of the fire-fighting response. However few animals that were affected by the fires were able to be saved; who knows how many were killed. Ramp (unpublished) reported 27 out of 30 radio-collared Swamp Wallabies died in a fire or in the weeks after a fire in Kuring--Gai Chase National Park (*pers comm*), and there may have been a similar or greater scale of loss in Namadgi National Park in the ACT historically (some mobs studied historically seem to have disappeared), so impacts of fire can be severe.

Impacts of habitat loss (LAND-CLEARING for any number of reasons) are second only to the impacts of SHOOTING, and is complementary. The science confirms long-term persistence of kangaroos is dependent on habitat (shelter in the form of remnant vegetation and grazing opportunities). Short & Grigg (1982) reported that clearing exposed kangaroos to "the measures brought against them" by farmers, and described the devastating impact of broad-scale agriculture on kangaroo populations. Clearing of bushland is not good for kangaroos: Arnold *et al* (1995) reported that after the size of remnants (kangaroos dropped out of landscapes once remnants became less than ~2ha in area), the second most important factor influencing persistence was the absence of humans.

Kangaroos trapped by urban development often suffer from increased mortality which is the path to localized extinction (see Brunton (2018)). Sometimes they are deliberately killed because they are in the way of development (cases of this in the ACT are clear). In other instances they are simply ignored as development proceeds, and they are pushed out of occupied habitats into surrounding farmland and get themselves involved in the commercial space, or they are dispersed onto roads, or into suburbs, and simply die as collateral.

Interestingly MINING seems to provide a small measure of protection for kangaroos, where they are not persecuted in off-set and/or buffer areas as much as they are in farmland. However in the absence of progressive rehabilitation the loss of habitat as mining progresses may outweigh the benefits of offsets and buffer zones.

There is also an increasing interest in killing kangaroos in conservation areas and even in NGO conservation properties as a consequence of reports of supposed kangaroo impacts on conservation values, or on seemingly "preferred" species.[11] This gathering narrative ignores the millions of years that kangaroos coevolved with an incredible diversity and abundance of wildlife in Australia, before the arrival of the Europeans. This agenda seems to have principally been driven out of the ACT in recent years, where they have described kangaroos as "*a major threat to biodiversity*" (Fletcher (2014)). Confusingly in one example where the kangaroos were killed purportedly to protect a rare lizard, the lizards were later caught and removed, and the area was covered in housing, confirming that URBAN DEVELOPMENT is also a direct threat to the species.

EXCLUSION FENCING has been brought in under the guise of wild dog management, however kangaroos seem to be the principle victim of management programs conducted within exclusion fenced areas. This is a program that is supported by funding from government offices, possibly in an effort to win favour with the farming sector. Normal rural fencing also kills and injures thousands of kangaroos annually, and contributes to the increasingly anthropocentric landscape's continuous grinding daily toll on numbers. If kangaroos manage to escape entanglement they often do so with injuries to their feet and legs which can take weeks to kill them (*pers obs*).

(d) current government policies and programs for kangaroo management, including: (i) the method used for setting quotas for kangaroo culling, (ii) the management of licenses to cull kangaroos, (iii) temporary drought relief policies and programs

When a population is in decline (for example during drought) then setting quota based on the previous years' population estimate automatically results in over-allocation of quota. Sometimes aspirational harvest targets have been equivalent to 40% of a population, or even more. The regulators, the industry and their supporting scientists describe harvest rates of 15-17% as "sustainable" in various publications. However replacement rates (the maximum rate of increase for kangaroos), generally runs at only 10% per annum after mortality is taken into account, and this under good (non-drought) conditions.

The fact that population estimates (and quota) have diverged from "take" to such an extraordinary degree in recent years, where allocated quota has become unobtainable, further indicates that there are critical errors in the derivation of population estimates and the resulting quota.

Since 2018 "management" of licenses has become no such thing.

[11] …bettongs or bandicoots, or rare lizards, "woodland birds" or threatened plants, for example.

- Landholders are routinely provided with "damage mitigation" permits on demand – in 2010 a NPWS ranger described permit approvals as "PR" (*pers comm*). Since 2018 approvals in NSW have been provided over the phone or by email.
- Commercial take is in no way limited by the "quota". In fact commercial take has exceeded quota in some cases[12] and in recent years a "special quota" has been allocated when quota has run out. Commercial shooters are able to shoot as many kangaroos as they can find.
- Shooting continues and even intensifies during drought when populations go into steep decline due to cessation of breeding and high juvenile and adult mortality. Commercial shooters prefer to shoot the healthy kangaroos during drought (emaciated kangaroos would not be accepted by processors), effectively increasing the rate of mortality during drought.

Apart from the existence of some paperwork to fill in (there are two tick-a-box/streamlined processes for the destruction of kangaroos) there is effectively no regulation or limitation on the killing of kangaroos in NSW. Breaches of the old Code[13] and prescribed operational procedures have been frequent however they have rarely been sanctioned. Point-of-kill monitoring rarely occurs in the commercial space. On rare occasions when independent observers have accompanied professional shooters breaches of the Code have been observed (McLeod & Sharp (2014)), and very poor animal welfare outcomes have been reported (Cowan (2018)). There has never been accuracy testing or point-of-kill monitoring of damage mitigation shooting.

No-one knows how much illegal shooting there is, however shooters frequently and freely make admissions and jokes about what appear to be illegal activities in public and social media forums - this also passes without prosecution. The changes to shooting provisions brought in as part of the drought-relief package in 2018 meant that there was no impediment for city shooters to join up to the "farmer assist" program and shoot kangaroos as entertainment. This program was shared widely in shooter forums on social media. The slender protections afforded to kangaroos provided until 2018 were all but removed under the drought relief provisions, which has resulted in an all-too predictable decline in populations according to the latest official population estimates.

(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 new Code changed the focus of some provisions from the former Code which were supposed to have provided better animal welfare outcomes for joeys that were not being applied in the field. McLeod & Sharp (2014) reported general non-compliance with the old Code for the killing of at-foot joeys, and a failure to kill (two misses) when a professional shooter did attempt to destroy an at-foot joey. Promotional campaigns claim that commercial shooters only shoot males, however the provision that recommended that shooters avoid shooting female kangaroos with obvious joeys was removed from the new Code in 2020 (a recommendation from the KMAP minutes #31). Often farmers will not allow commercial shooters on their property if they do not shoot females, and shooters can't make good money if they only shoot males. Meanwhile processors advertise their price per kilo for female carcasses on Facebook, and the department advises shooters to affix damage mitigation tags to female

[12] ...for example 17,164 Eastern Grey Kangaroos were taken commercially in the Upper Hunter Zone in 2003, when the quota was set at 14,281. This is not an isolated case, however the problem seems have been resolved in later years as population estimates have become increasingly inflated, and as quota has become unobtainable, and through the introduction of "special quota".

[13] *The National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Commercial Purposes*

kangaroos shot during operations, if they are going to leave the carcasses in the field (KMAP minutes #25).

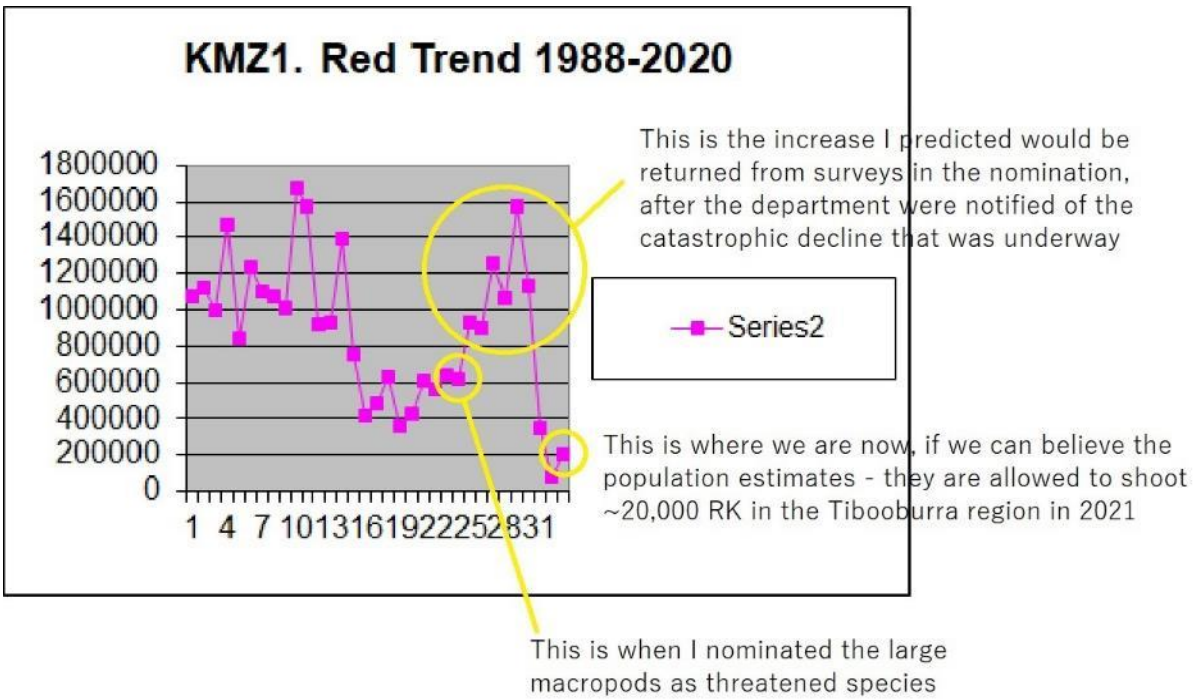
After shooting, the high rate of juvenile mortality is the next most important factor influencing the species' slow (or negative) population growth rates. Reported rapid increases in official population estimates (>400%) are rendered impossible by the actual slow rate of population growth - even under optimal conditions and in the absence of shooting the maximum population growth rate is only ~10% per annum, according to detailed field studies and life-tables. I would like the opportunity to take the Committee through how population growth rate is calculated, if the Committee would like me to support my submission with verbal testimony.

(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

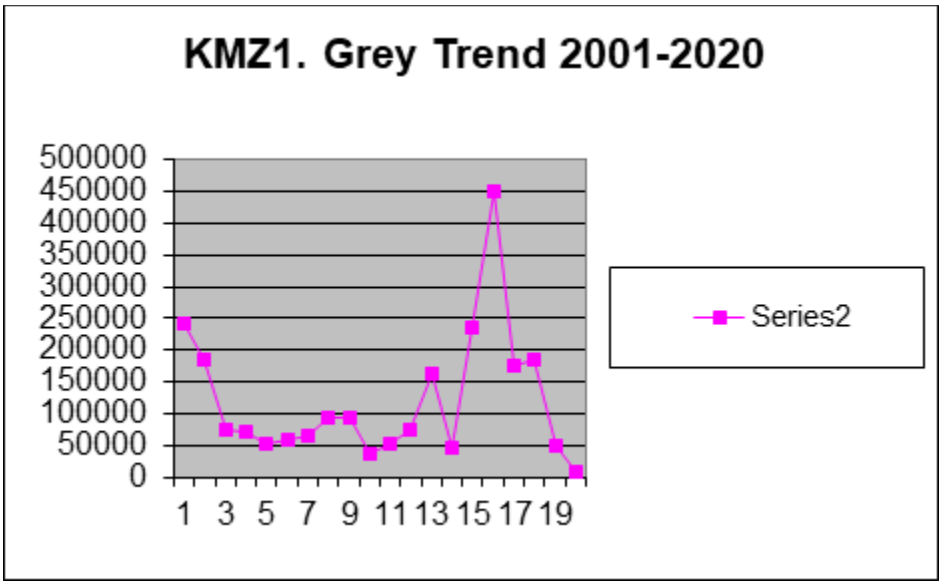
The management of kangaroos in NSW is in breach of every piece of legislation that is supposed to protect the environment and our wildlife, simply on the basis that, in my opinion, it is materially *and deliberately* ommissive and misleading. Confected / inflated population estimates are being produced to service a commercial exploitative industry, which provides outcomes (population reduction) that are actively pursued by the farming sector, and which therefore has 100% political support. The program is in no way based on rigorous and defensible science according to my analysis, and a lack of critique or questioning seems to be underwritten by a long-term promotional and strategic communications campaign that seems to have established as fact the fiction of supposed population increase under a range of untested pretexts, and that "the industry is well-regulated and sustainable".

(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

As an example the illustration below indicates that at the present time some populations have crashed to even more catastrophic lows than were being reported in 2011. This submission contends that decline in recent years is a principal consequence of combined commercial, non-commercial and illegal shooting, in combination with drought. Note that these illustrations are based on the official population estimates, which this submission considers to be highly inflated, particularly in the period immediately following submission of the threatened species nomination (2011-2016), when the official population estimates seemed to be attempting to conceal actual decline.



Grey kangaroos in KMZ 1 (illustrated below) have reportedly declined from 450,000 kangaroos in 2016 to only ~7,000 in 2020. If the 450,000 figure was correct[14] then this is a decline of 98.5% in just 4 years, suggesting the program is clearly neither carefully monitored, well regulated, nor sustainable.



Biologically impossible rates of increase in official population estimates are not questioned, and the resulting over-allocation of quota unleashes a hail of bullets on depleted populations

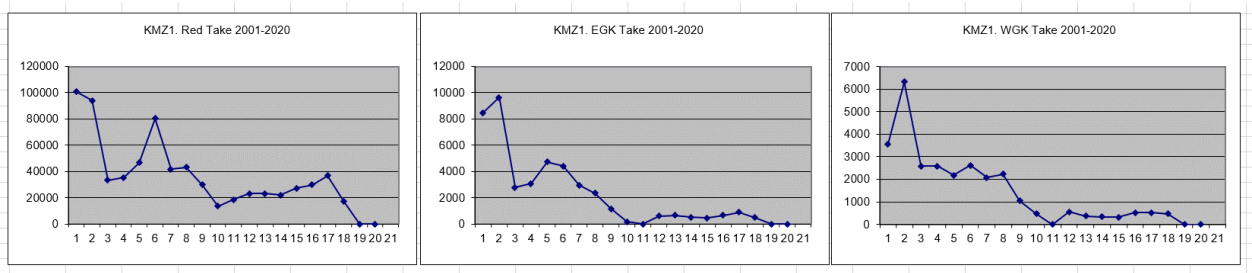
[14] …the reported increase in the grey kangaroo population between 2014 and 2015 (~425%), and 2015 and 2016 (~92%), are biologically impossible. The Senate Select Committee in 1988 described a reported 84% increase in South Australia as "biologically impossible", implying that there is something very wrong with the ~450K population estimate in 2016. No-one has questioned the reported (and extremely convenient) statewide increase after the threatened species nomination was lodged in 2011.

Let's consider the term "sustainable" more carefully.

DEFINITION OF SUSTAINABLE: …*capable of being maintained at a steady level without exhausting natural resources…*[15]

Take data

In comparison with the ease with which population estimates can be manipulated (unexplainable and biologically impossible increases in official population estimates render them invalid), the number of animals processed commercially are harder to manipulate. The reported NSW Take data has been used below to illustrate that the so-called "sustainable harvest" does not adhere to the definition of the term. "Take" is in long-term decline, and even stops. This is not "*being maintained at a steady level without being exhausted".*

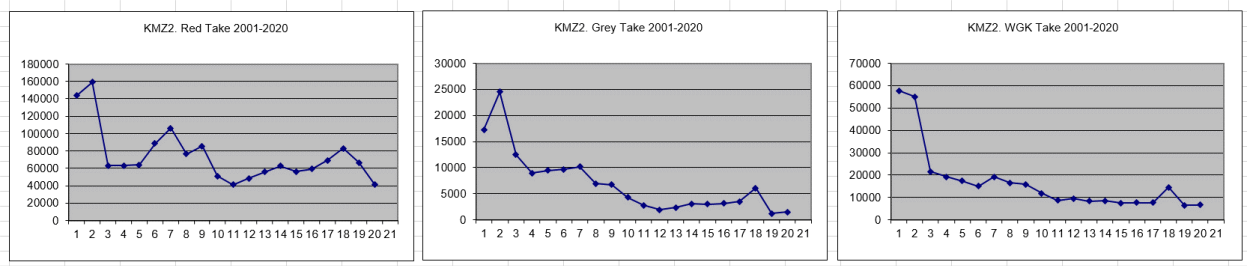


TIBOOBURRA: "Take" in the Tibooburra zone does not look sustainable according to the definition.

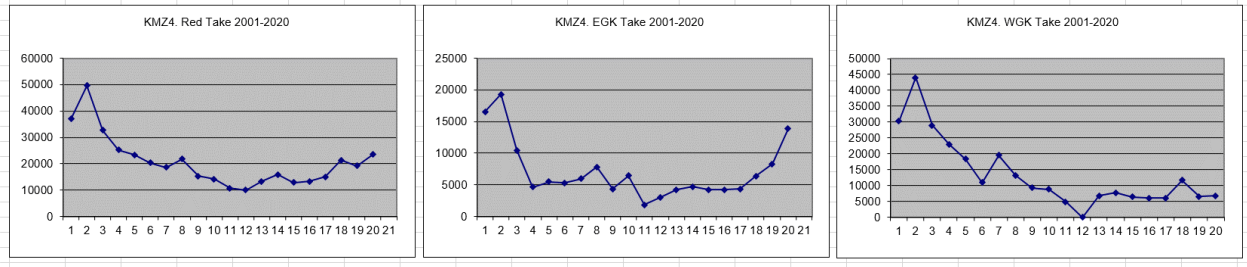
How population increases at rates exceeding 400% can be reported without any corresponding up-tick in "take" defies explanation. In 2021 quota for Red Kangaroos in the Tibooburra zone has been reduced to 10% of the *reported* population, after quota was completely suspended in 2019 and 2020 due to low numbers. For grey kangaroos there is no quota in the Tibooburra zone in 2021.

No grey kangaroos were shot in the Tibooburra zone in 2019 despite there being over 27,000 animals allocated as quota. No grey kangaroos were shot in 2020 despite there being quota allocated for nearly 7,000 more of them. On the basis of quota allocations in 2019-2020 the grey kangaroo population appears to have been in decline even in the absence of commercial shooting, possibly on account of relaxed provisions regulating shooting which were introduced as part of the drought relief package in 2018. There seems to be no publicly accessible database providing an accounting of land holder shooting in NSW; it seems to be too much of an imposition for farmers to report how many they shoot, and anecdotal evidence is that NPWS staff do not tend to follow up or make inquiries.

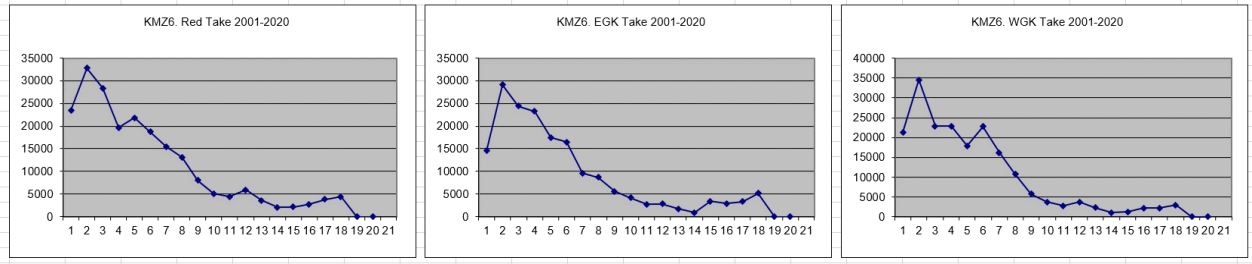
[15] https://dictionary.reverso.net/english-definition/sustainable+harvest+and



BROKEN HILL: The Broken Hill zone was the backbone of the industry – it is not any more

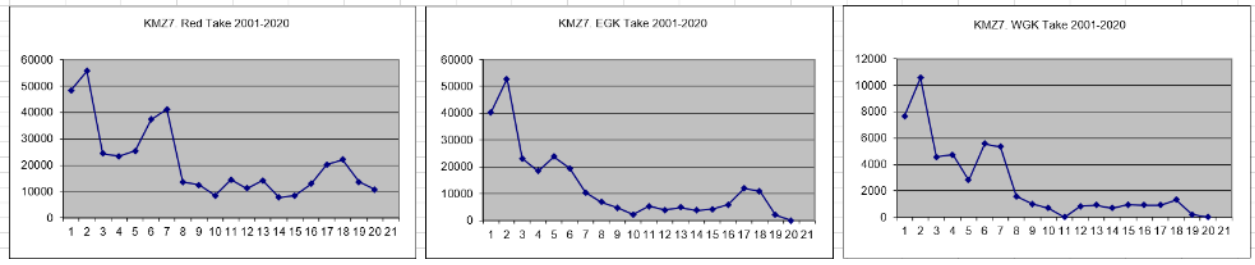


LOWER DARLING: As kangaroos run out (like in KMZ1) there is increased pressure in other zones



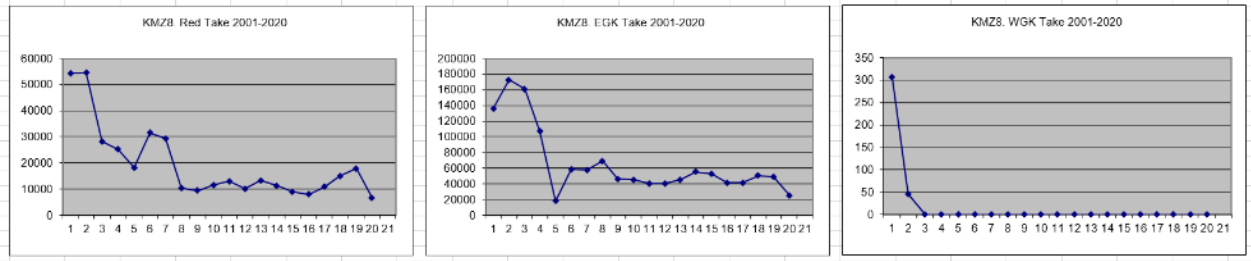
COBAR: There is no way the "take" data from KMZ6 can be spun to suggest this is a sustainable industry

Quota was discontinued in the Cobar zone (above) in 2019/2020, and for grey kangaroos in the Bourke zone (below) in 2020. Shooting in some of these zones has been resumed at a rate of 10% in 2021. Given that a 15% quota is unobtainable, the question remains how does reducing the quota to an equally unobtainable 10% limit the numbers that will be shot?



BOURKE: "take" can be very low for a while before monitoring detects decline, and zones are closed…

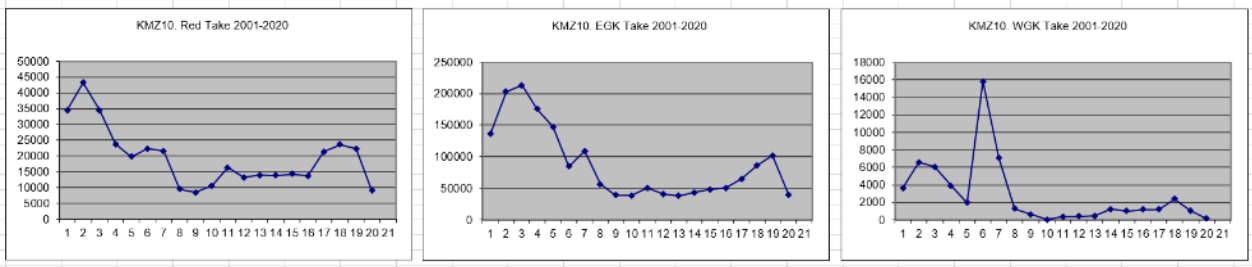
Western Grey Kangaroos were shot out completely in the Narrabri zone in 2002, when they only managed to shoot about 50. Commercial killing of the species stopped there in 2003.



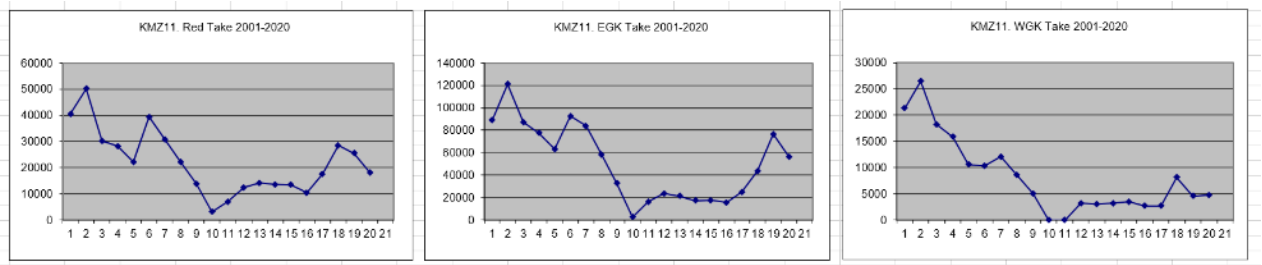
NARRABRI: Is shooting in KMZ8 sustainable? Western Greys dropped out of the harvest there in 2003

The program is not "adaptive". The shooting only seems to stop when they run out of kangaroos. Western Grey Kangaroos persist in the national parks in the Narrabri zone, and they continue to be killed by landholders under damage mitigation permits in the region. They are possibly still being shot commercially, as checks on species being processed have returned misidentifications as noted in historic minutes of the NSW Kangaroo Management Advisory Panel. There is little doubt they are being shot illegally, as illegal shooting is almost impossible to detect, but is thought to be common (NPWS ranger, *pers comm*).

There does not seem to be any take data available for Western Grey Kangaroos in the Narrabri zone prior to 2001, which might have illustrated something more of the speed and scale of their decline there. Similarly there is evidence that the Wallaroo/Euro used to be killed commercially in the western zones, however there does not seem to be any information at all about the numbers remaining (their numbers are not reported during western zone surveys) or how many have been killed. Nor is there any explanation for why they no longer form part of the "sustainable harvest" in the western harvest zones.



COONABARABRAN: Spikes in data sets are sometimes anomalous, but may relate to commercial shooters making an effort locally to access kangaroos in the damage mitigation management stream

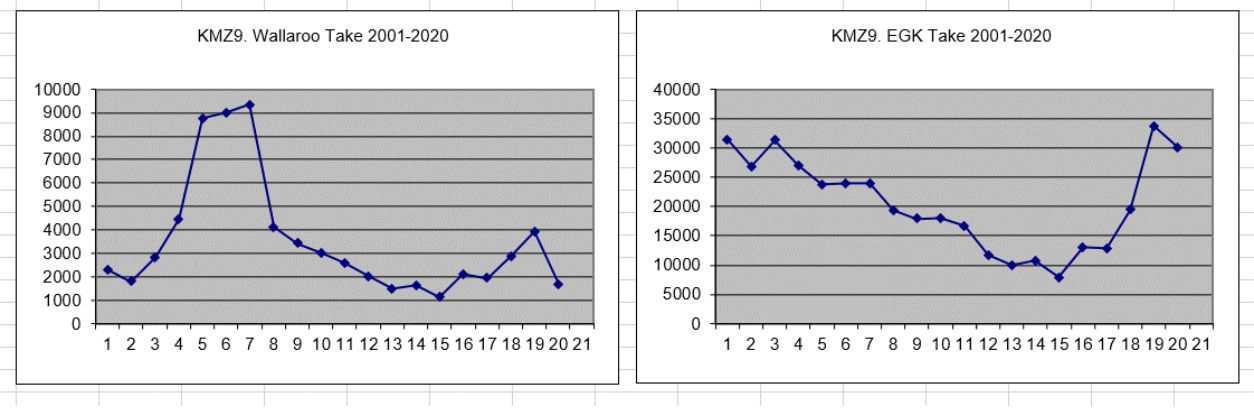


GRIFFITH: The Griffith zone was enlarged and split into two in 2018, bringing an increase in carcasses out of the expanded zone; this recent increase is expected to fall off rapidly, as has occurred everywhere else

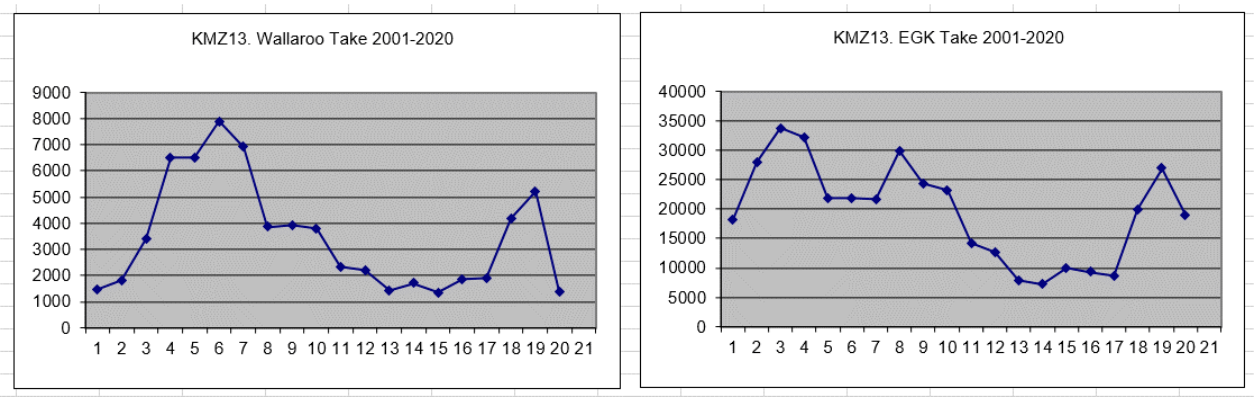
Commercial harvesting was stopped for 9 months in 2010 in the Griffith zone, and Red Kangaroos were below the threshold again in 2019.

It is easy to understand why the industry has been pushing for expansions to existing harvest areas and for new harvest zones; “product” has been getting scarce in the western districts for a long time.

The Northern Tablelands zone was opened to commercial activities in 1991.

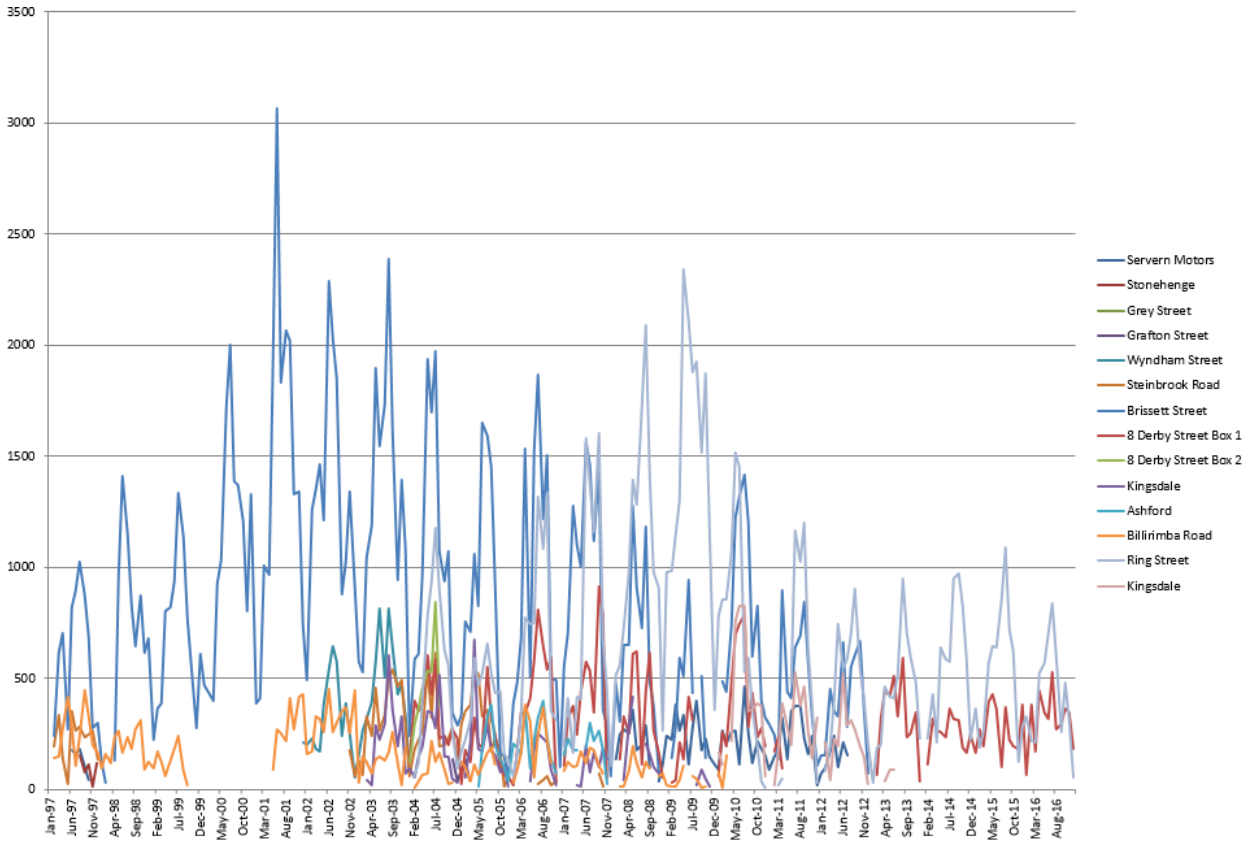


ARMIDALE: With numbers becoming depleted in the western zones, shooters are increasingly targeting animals in the eastern harvest zones; depts. are also promoting commercial shooting to landholders

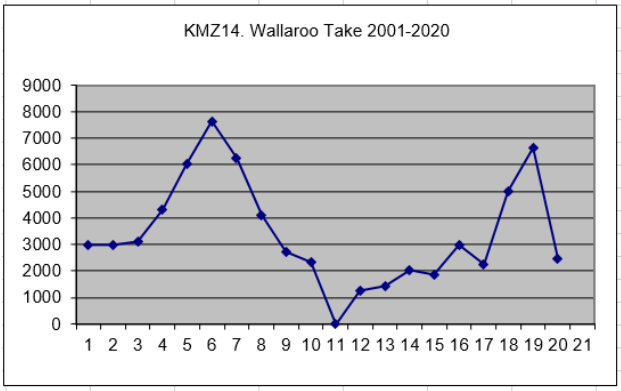


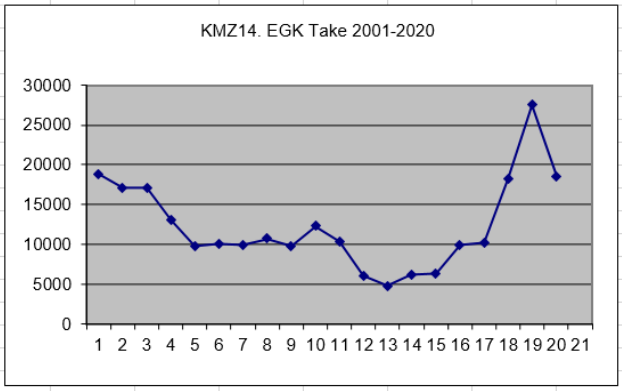
GLEN INNES: In terms of industry through-put, the relatively small numbers being shot in the eastern zones can’t replace the loss of the animals in the western zones

Interestingly when you examine the “take” data more closely (“inward consignments”, being the harvest statistics relating to weekly loading rates at carcass collection points) the shooting in the Glen Innes zone follows an annual seasonal pattern. Analysis indicates that the peaks occur in winter, so the motivation here is clearly skin-shooting.



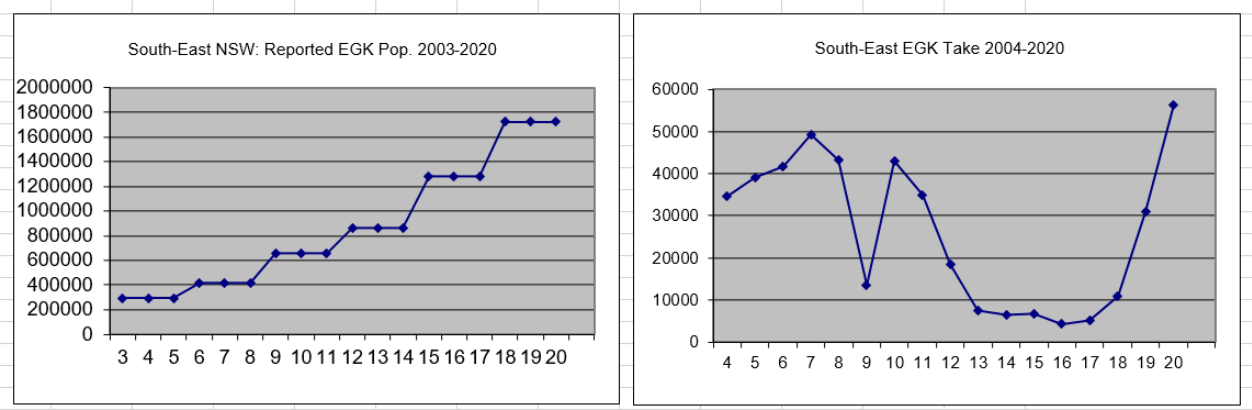
Monthly carcass loading rates in the Glen Innes zone indicate that someone is shooting for furs, with no consideration for the conservation of the species (Mjadwesch in prep)





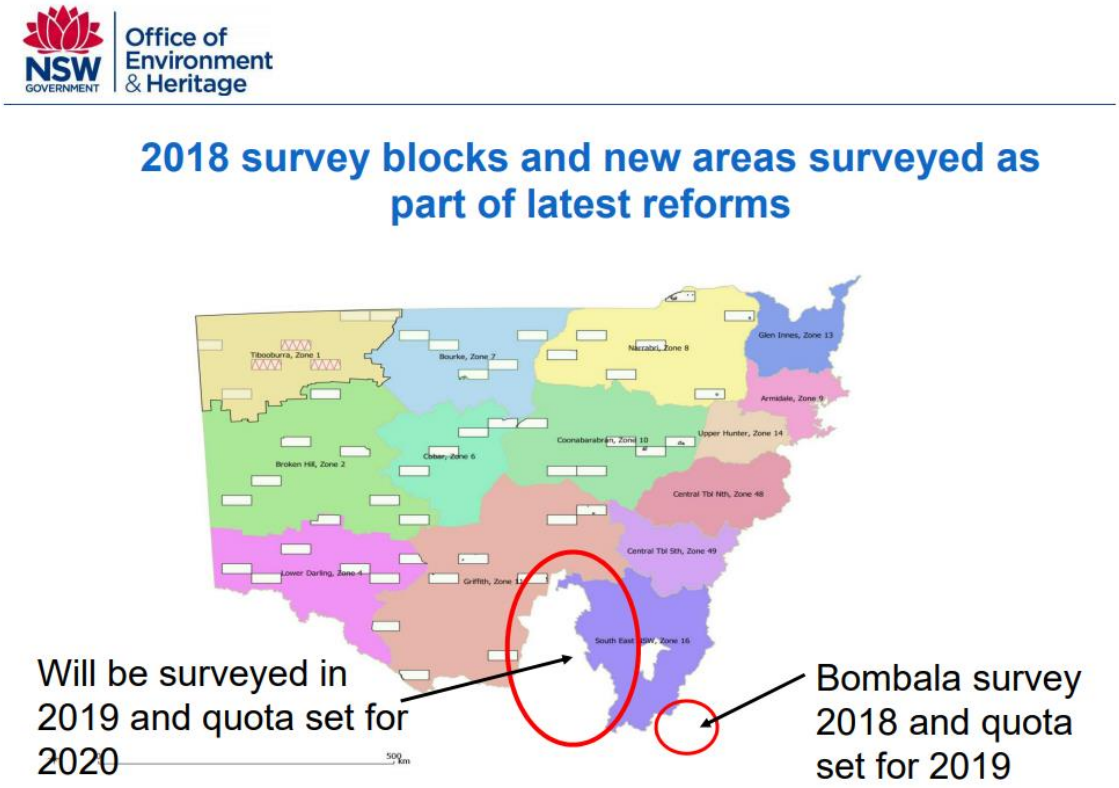
UPPER HUNTER: Shooters are putting a lot of pressure on populations in the eastern harvest zones, with a travelling roadshow (Wolter (2018)) promoting the commercial industry to landholders

The South-East NSW zone was surveyed in 2003 and opened in 2004.



SOUTH EAST NSW: The reported population increase seems anomalous

Initially the increasing SE NSW "take" data looks anomalous – why was "take" decreasing in the period 2007-2016 while the population was reported to be steadily increasing? And then why does "take" increase in the period 2017-2019?

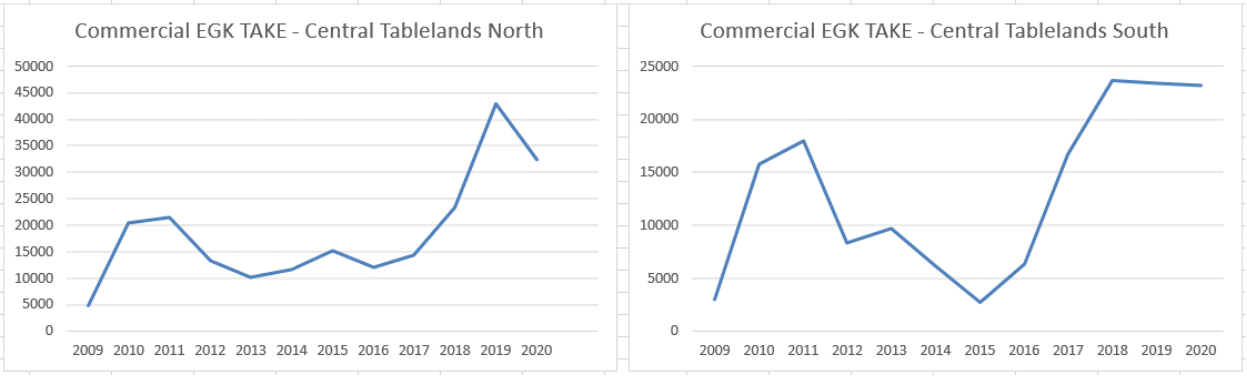


A presentation by the then Kangaroo Management Unit manager Stephen Wolter indicated in 2018 how expanding harvest areas allows more kangaroos to be taken from a designated zone

Interestingly the initial survey of the South-East zone in 2003 indicated that there were probably ~300K animals there. In the period 2004-2016 around ~340K kangaroos were shot commercially in the zone, and "take" had declined to almost nothing. These facts suggest that the initial population estimate might have been close to the mark, and indicates also that most of the accessible population had been shot. However after the initial survey the survey methodology has been changed out of all recognition,

and the zone has been incrementally expanded. While "take" was declining, official population estimates have been reported to be increasing by ~300K animals every three years, so that by 2017 the SE NSW population was reported to be 1.7M. Addition of new harvest areas to the zone, and changes to how non-commercial licenses are administered[16], means that "take" is on the increase, as more animals are directed into the commercial "management" stream.

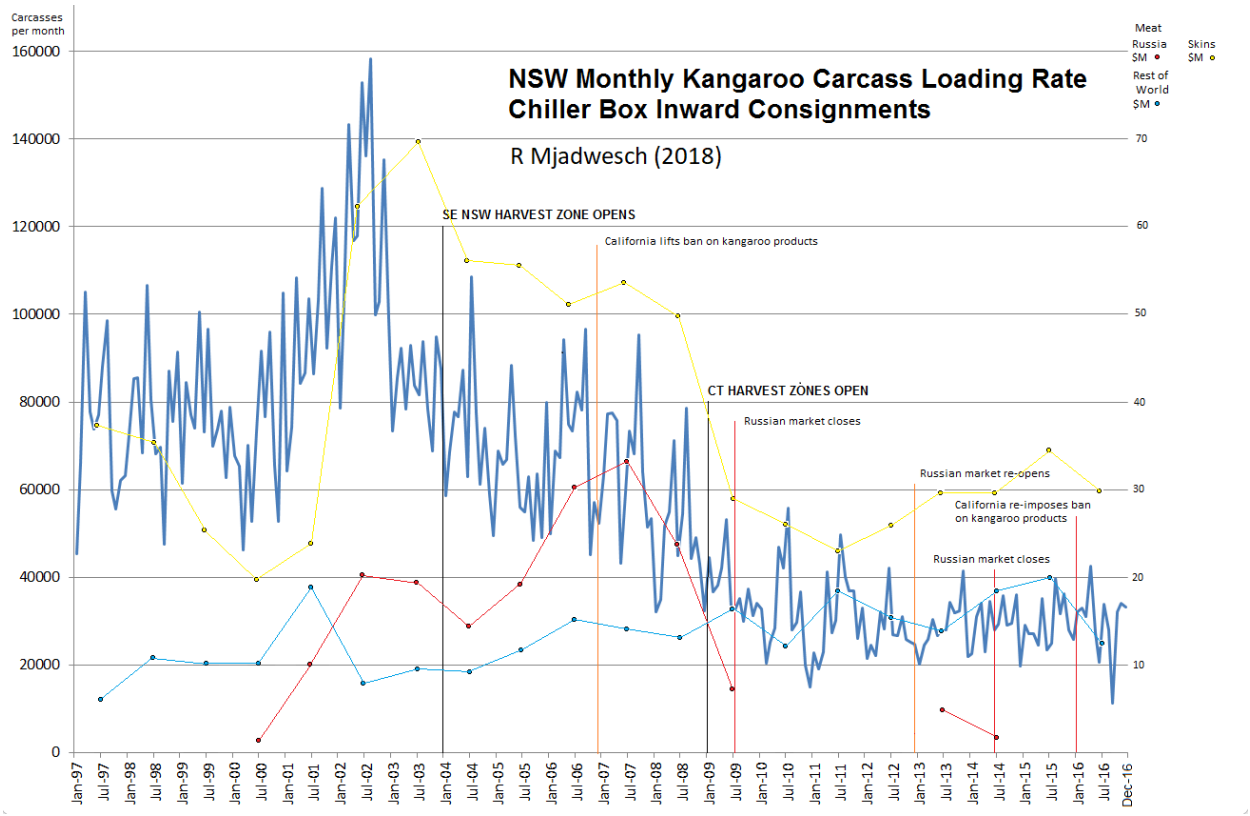
The Central Tablelands zone was first surveyed in 2008 and opened to commercial shooting in 2009.



CENTRAL TABLELANDS: Commercial killing in the eastern zones is escalating as the regulating office instructs NPWS rangers to direct landholder shooting towards commercial utilization

In aggregate, "take" in NSW is declining as populations crash.

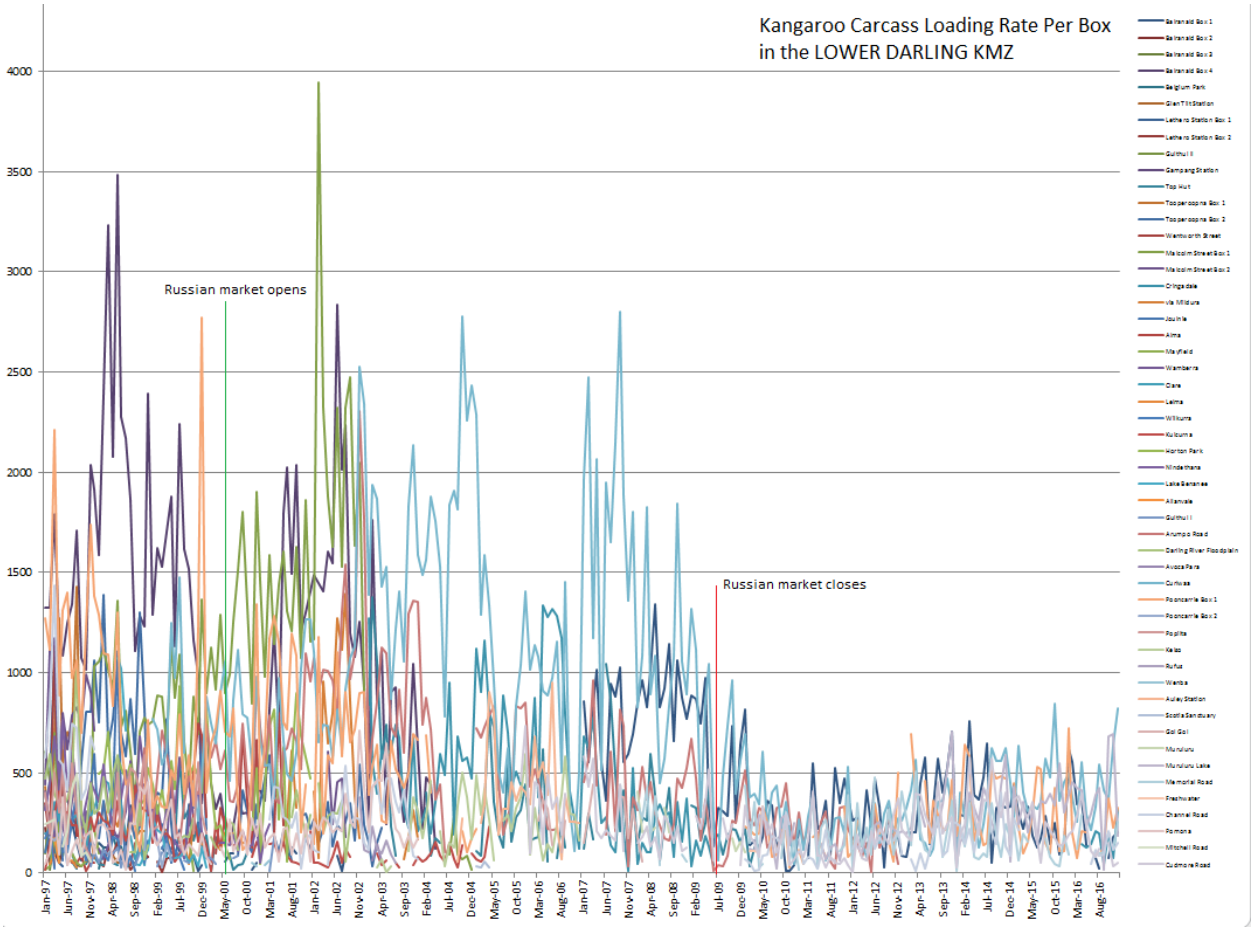
[16] The KMAP wanted amendments to the permit application process, obligating land holders to first pursue commercial shooters; non-commercial shooters were only to be used if commercial shooters were not available (minutes #32); subsequently KMAP minutes #33 states that non-commercial licenses were reduced by 50% from January 1 2019. These strategies indicate that it is possible for the regulatory process to manipulate commercial take data by forcing landowners to use commercial shooters.



After peaking in 2002 in response to the opening of the Russian market, "take" has been in long-term decline in NSW

Just as in other wildlife exploitative industries (see Reynolds & Sutherland (2003), Letnic (2004), Ueno *et al* (2014), Bressan (2017), and Edgar *et al* (2018), for example), the kangaroo industry's capacity to generate product is directly related to the availability of animals, and "take" declines as populations decline. "Take" has been in decline in South Australia since the mid-1990s, so assertions made on behalf of the industry that "take" is in decline because of "market forces" (specifically referring to the closure of the Russian market in 2009) are clearly incorrect according to the data.

The notion that reduced numbers of shooters is the cause of declining "take" is also incorrect. When harvest statistics are analysed it is obvious that carcass collection points experience declining load rates over the medium to longer term, until the "chiller box" is closed on account of depleted numbers being loaded at that location. As multiple boxes close in a town or throughout a zone, shooters lose their "patch", and unless they can engage with new land-owners and establish themselves in a new district, they are forced to leave the shooting industry. It is declining numbers of kangaroos that results in declining numbers of shooters; it is not declining numbers of shooters that results in less "take".



Large numbers of shooters were supplying chiller boxes in the Darling zone until ~2005; the number of boxes in the zone had dropped off well before the Russian market closed in 2009 (Mjadwesch in prep)

John Kelly, former President of the Kangaroo Industry Association of Australia (KIAA) said in 2017 that "*The general volume of exports increases at least 10 per cent per annum. That's a pretty significant, pretty healthy growth."* Daniel McGettigan, general manager of a processing plant in QLD, stated "*The demand for kangaroo meat is very big, very big*." Ray Borda, CEO of Macro Meats (Australia's largest kangaroo meat exporter) said in 2017 "o*ver the last 10 years* [consumption of kangaroo meat domestically has] *grown about 500 per cent",* after commenting in 2011 that they can't get enough product to supply their existing markets – *"the demand is there, it's high, but the industry can't keep up with demand for manufacturing meat."*[17] KMAP minutes (#34) reported that prices being paid to shooters in 2020 were at record highs, indicating shooters were being retained in the industry; the KMAP minutes (#35) reported current prices (2020) were breaking records, but processors are "struggling to secure kangaroos"; they blamed the rain.

Processors want as many kangaroos as they can get, however in 2020 the Walgett processing plant needed to start processing camels to keep the facility profitable and people in work, because there were not enough kangaroos coming in.

[17] http://www.youtube.com/watch?v=z_xpCyetztI

If shooting is not limited by quota (it isn't), and if processors are desperate for product and are paying top dollar, then shooters can shoot as many kangaroos as they can find, yet the industry asserts "take" is at an all-time low because of "market forces". The reason that export volumes (and consumption of kangaroo meat by humans more generally) has increased over the last 30 years (refer to the pale blue line in the graph above) is that kangaroo meat has been increasingly diverted out of the pet food production line into product marked for human consumption, as the industry attempts to increase the per kilo value of their dwindling product (this has most recently happened in Victoria).

Discrepancies and errors in the official datasets presented in various formats by the regulating department are numerous[18], however they will not be itemised here. Poor record keeping, "take" exceeding harvest limits, crashing "take" data and local extinctions (illustrated when survey data is considered spatially) are all characteristics of a program which does not conform with the definition of what is promoted internationally by industry advocates and the Australian Government as "sustainable". In terms of uncertainty around the numbers killed under non-commercial permits, KMAP minutes #32 describe non-commercial returns as "unreliable". Not only do we not know how many kangaroos there are, we don't know how many there were, and we don't know how many are being killed each year. Kangaroo "management" in NSW is categorically NOT a sustainable program.

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

Nothing has ever been done to conserve the large macropods in Australia. Every cent seems to have been spent on bounties, bullets and barbed wire. Research seems to be almost entirely negative, being focused on describing (asserted) impacts on other species, the environment and themselves, rather than on their status or their value as key-stone species in the ecosystem.

Keys to turning perceptions around will include educating rural communities about their low reproductive rate, instead of scaring people with farcical graphs that seem to indicate that kangaroo populations have "exploded". People need to understand that kangaroos are not immune to the impacts of drought, despite official population estimates indicating biologically impossible rapid increases during drought - these reported increases are due to flaws, changes and errors in survey methodologies, and bias in analysis.

In the 1970s scientists reported that kangaroos and stock animals eat different things, termed "dietary partitioning". However records show the farmers would not have a bar of it at the time, and the scientists were told by the supervising government agencies (and issuers of research funding) to listen to the farmers. The opportunity to explain to the farmers the incontrovertible evidence - scientists had shot thousands of kangaroos and examined their stomach contents - and that this sort of scientific inquiry was far superior to whatever traditionally espoused theories the landowners had, was lost.

The actual biology and ecology of kangaroos needs to be effectively communicated to farming communities, to dispel the myths that have been uncritically promulgated by their grandfathers, the scientists who support the industry, governments and government agencies, and the media alike. It will only be with the cooperation of farming communities that kangaroos can be conserved in the wild, as farming has preferentially taken the land that was formerly the domain of the kangaroo.

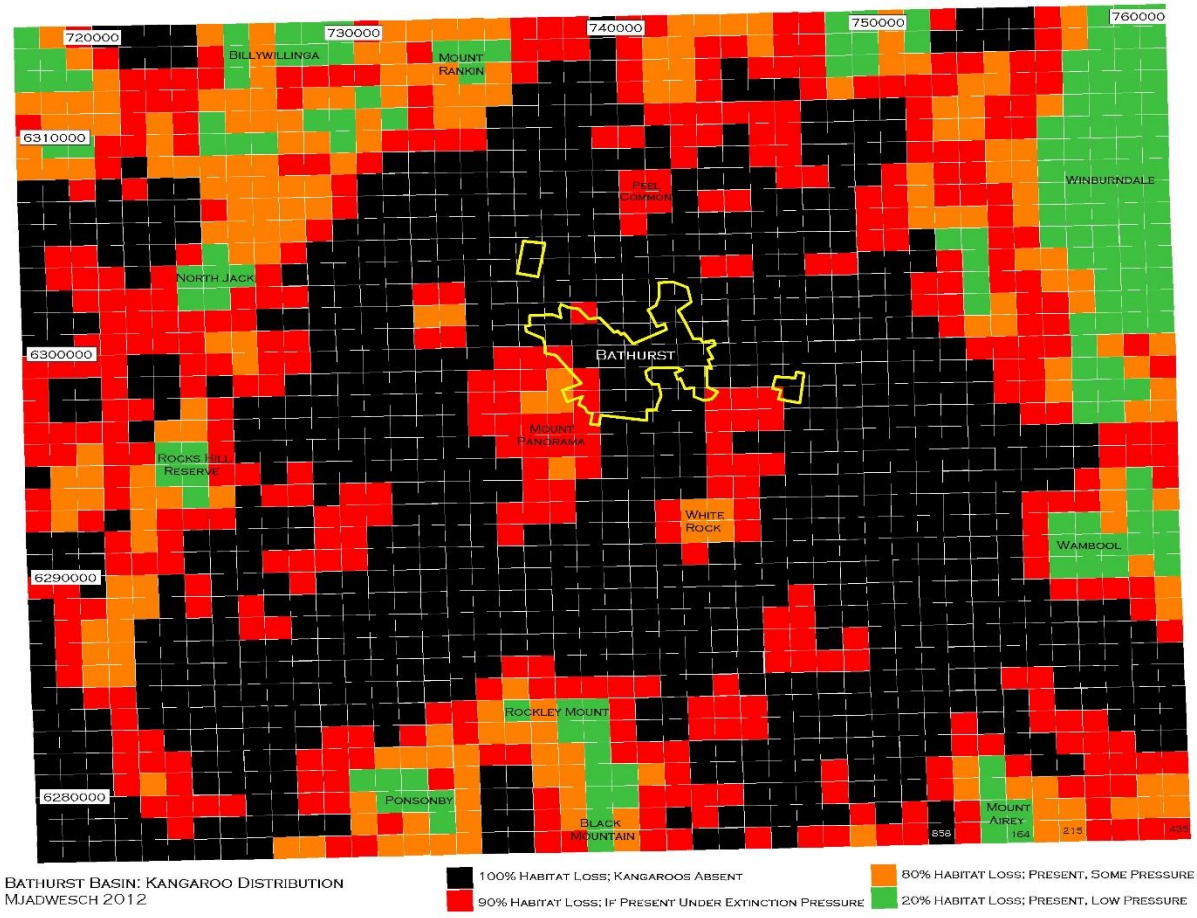
[18] …for example the cumulative harvest report dated October 2018 says that 18,182 Red Kangaroos had been killed in the Tibooburra zone by then, as well as 518 Eastern Grey and 522 Western Grey Kangaroos. However the Annual Report for 2018 indicated that only 17,481 Red Kangaroos had been killed in the zone in 2018, as well as 492 and 463 grey kangaroos (Eastern and Western Greys respectively). How did harvested numbers go backwards between October 2018 and the end of the year?

I am confident that if farmers knew that ~200 years of shooting had actually reduced the populations to a significant degree, instead of being told “there are more than ever before”, some of them would relax about kangaroos a little bit.

I hope the Inquiry finds this information and comments helpful.

The Committee are going to be bombarded with a lot of the standard pro-industry propaganda, including various population increase theories that we hear all the time in the media, and claims the industry is well-regulated and sustainable, and that killing kangaroos is good for them, and good for the environment.

I sincerely hope the Committee members open their eyes and look around – it is a sad fact that Australia has been fooled by the swindlers trick in the Emperor’s New Clothes. The plagues that farmers are so hysterical about, and that are reported in the official estimates, are figments in our imagination – a product of Group Think and confirmation bias. In reality landscapes are generally completely devoid of kangaroos; while they sometimes persist in scattered pockets the fiction that there were 48 kangaroos / km^2 in the Bathurst district in the period 2017-2019 (for example) was farcical, and the fact the official density estimates were halved in 2020 is scarcely more credible.



The notion that kangaroos persist at densities of 24 / km2 across the Bathurst basin is preposterous

Unfortunately the reality of how this Inquiry is likely to respond to reports of decline or concerns about the conservation of the species is all-too predictable. The NPWS and DoPIE are trusted agents of the government, they are reputationally locked onto the notion that they have been doing a good job since they were given oversight of the industry in the 1970s, so they will say that everything is just fine, however an appeal to authority and/or argument by assurance are logical fallacies. Look around; look at the actual data (not the official population estimates, which are hyper-inflated extrapolations of the raw data). Where are the kangaroos?

I have been actively engaged in this space now for over 10 years, and given how warning bells have been ignored to date, unfortunately I have precisely zero confidence that the majority in the Committee[19] or managers and researchers in this space more generally, will ever countenance any variation to the objectives or implementation of any aspect of the kangaroo management program in NSW, no matter what evidence is submitted in support of such concerns. To date the only thing that has ever stopped the shooting of kangaroos is there being none left.

All the best

Ray Mjadwesch
Consulting Ecologist

[19] …the major parties will not sign off on any change to the status quo that might put votes in rural electorates at risk.

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