A submission to the Australian Senate Inquiry into the status, health and sustainability of Australia's koala population.

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Dr Alistair Melzer has been researching and providing expert advice on koalas since he commenced research as a mature-age student in 1988. The majority of his research is located in central and north-western Queensland. With the support of CQUniveristy, community support (Central Queensland Koala Volunteers, Earthwatch, Xstrata Coal) and in collaboration with the Koala Ecology Group, University of Queensland and Queensland Parks and Wildlife Service, he maintains sites in the Hughenden, Tambo, Springsure and central Queensland coastal islands. Dr Melzer is currently an Adjunct Research Fellow at CQUniversity where he leads the Koala Research Centre of Central Queensland. He is the immediate former director of the Centre for Environmental Management. Dr Melzer is an executive member of the national Koala Research Network.

Summary

The status of the koala is uncertain, nationally. Local and regional populations are declining. There is not adequate data to address the IUCN criteria in any consideration of the formal status of the koala. Delaying any reclassification until data meets IUCN criteria produces a crisis driven response with limited capacity to recover the species. A proactive approach from the Commonwealth is recommended including: a move away from the IUCN criterion-based assessment of the koala's status, proactive implementation of the actions of the national koala strategy within the Commonwealth's sphere of influence, Commonwealth resourcing of research and community organizations pursuing the objectives of the national koala strategy, support for the establishment of a network of koala sentinel sites monitoring trends in population and habitat status. A strategic review of the approach to managing the koala and its habitat is required taking account of the distinctly different needs in (a) the over-abundant, genetically depauperate race of the koala in South Australia and Victoria, (b) the expanding urban and industrial footprint in predominantly coastal eastern Australia, and (c) the rural and regional western and northern habitats affected by climate extremes, fire and drought.

The status, health and sustainability of Australian koalas

Koalas are under pressure due to drought and climate variability pressures in rural and western areas and urban and industrial pressures in coastal Queensland and New South Wales. Their status is uncertain and populations do not appear sustainable under current management approaches.

Koala populations across Australia are under pressure from expanding urbanisation, intensification of industrial and resource extraction activities and the decline of habitat health under the influence of extreme weather events and shifts in weather patterns. In Victoria and South Australia the southern form of the koala has demonstrated a tendency to expand beyond the limit of the habitat's resources. In central Queensland, where I have most experience, western and central koala populations have contracted or collapsed during a decade of drought and tree death in the 1990's. Keystone species have died over large reaches of stream corridors in Central Queensland. High temperatures and extended extreme dry periods have resulted in the opening up of tropical forests. What is not clear at this stage is whether there is a long term weather cycle operating or whether there has been a shift to a new climatic regime. Whatever the case, there seems to be a general increase in temperature in spring and summer and intensification in the wet/dry seasonal differences.

In coastal Queensland and New South Wales there is an ongoing incremental loss of koala populations and fragmentation of coastal habitat as the coast is developed (urban, industrial and infrastructure corridors) with the most drastic declines occurring in south east Queensland and the Brisbane region.

Flagship koala – a national and international icon

Koalas are iconic animals invoking strong emotional reactions from people globally. The emotional response is sufficiently strong to induce public reaction to perceived threats to koala welfare. The political and regulatory response to public concerns has generally been reactive. The opportunity to utilize our relationship to the koala in a proactive sense for conservation outcomes has not been taken up by government or non-government organizations.

A deep-seated emotional link

It is undisputed that the koala is an iconic animal (Phillips 1990, Jackson 2007). The international appeal and recognition of the koala forms part of an overseas sense of Australia's gestalt. Consequently there must be some intangible contribution to the national tourism profile. Nationally there is probably a contribution to an Australian's sense of place. The property owners, on whose properties I work, always talk about *their koalas* and have a wealth of stories (and often photographs) of their koala experiences. Visiting a koala frequently involves three family generations (as well as any visitors and the dog). I have involved community volunteers as research assistants since I commenced working on koalas in 1988. There was, and is, always a strong emotional link to the animals – the primary driver for volunteering rather than participating in the research. By far the vast majority of local and international volunteers were women. They were open in their emotional response to the koalas. The few male participants were, generally, less open in their feelings but expressed similar feelings to the women when pressed.

The appeal of the koala seems almost primal in humans. This seems to be a consequence of the appearance of the face (large round eyes, round face, soft fur and rounded soft ears), the tendency of the animals to grasp (hug) when held, and the passive response when encountered.

Our emotional connection to koalas becomes evident when threats to individuals or populations are publicized – and the response is seldom purely rational (Bagust 2010). The classic example is the international and national public outcry to proposals to cull koalas on Kangaroo Island while there has been no widespread mention of culling of other native species on the island. A similar public response (around proposals to build a motorway through known koala habitat) was sufficient to influence state electoral results in Queensland. Despite that emotive campaign those same Queensland koala populations are now crashing under the unremitting pressure of urban traffic that cannot be slowed for koalas.

Flagship koala

The koala's place in Australia's eucalypt ecology combined with the heightened awareness of koala welfare in the broader public gives the koala a potential role as a flagship species for eucalypt forests, woodlands, riparian forests and associated ecosystems across eastern Australia. Currently this opportunity has not been taken up by governments, agencies or non-government organizations. The indications are that, in most of Queensland, koala populations are at best stable, generally in poor condition or declining steeply. While this bodes ill for the koala it is a reflection of the state of the ecosystems and environment that underpin these animals. Unfortunately government responses are defined by limits of regulation and prioritized under the pressure of public concerns. So, in Queensland for example, the status of the koala in south east Queensland was downgraded to "vulnerable" from "common protected" and strategic planning and regulations introduced to maintain the koala in the greater south east. Despite this, koala numbers crashed and local extinctions are likely. A crisis team and associated budget was recently established to "save" the koala in the Brisbane region. There are no initiatives in the rest of Queensland where the drivers of collapse are more amenable to management. In Canberra the status of the koala is reviewed within the context of the regulations which, despite the concerns of the scientific community, do not seem to be sensitive to the "real state" of the environment.

Getting the story right for the koala also gets it right for the ecosystems on which they depend. Perhaps the decision-making criteria need to be reviewed.

Estimates of koala populations and counting koalas

Estimating koala populations

Koala populations have changed in extent and abundance over European history. While we do not always understand the causes of population fluctuation we must be aware that populations are not static and can change naturally. Understanding the drivers of population fluctuation, especially anthropogenic drivers, is critical to successful management.

The tools

Koalas are not evenly distributed across the landscape. This uneven distribution probably predates European settlement of the Australian landscape and would reflect the variability in the plant communities and associated nutrient and moisture regimes. The contemporary distribution is further influenced by recent historical vegetation clearing, fire and land management practices as well as the active hunting of koalas into the early 20th century.

Incidental data and tracks and traces

Local koala populations are most easily identified by the sighting of koalas or hearing male koala bellows in spring and summer. The limits of any identified population can be defined by the extent of koala sightings, tracks and traces (scratches and faecal pellets). These can be geo-located and mapped with some precision. Such data can be confirmed by ground-truthing and by standardized surveys of tree use, faecal pellet distribution and koala sightings. There is the potential for bias in this approach, however, unless some randomized sampling techniques are applied. The issues are that (a) more sightings occur where there are more people (near habitation), near access routes (along roads), around areas of known occurrence (national parks or special places on properties) and (b) traces of koalas are more obvious in certain eucalypt communities (gum barked trees) and under certain ground conditions (short grass or bare ground). Habitats remote from habitation or difficult to access or where conditions make searching difficult or support low density populations will be under represented in the data sets.

Despite these issues it is easier to identify the presence or absence of koalas in a landscape by incidental sightings, tracks and traces than it is to assess abundance. Such data are applied to gauge the extent of distribution across the landscape. It does not provide much information about what is happening within the species' distribution, however.

Counting koalas

Currently koalas can only be counted in relatively small and discrete localities. Regional population numbers can only be estimated by extrapolation over areas of presumed equal habitat. Such counts and associated population estimates can only reflect contemporary numbers and will not account for any population dynamics. Repeated sampling over long time periods is required to understand any population trends. A network of long term sentinel sites could provide data informing future assessment of koala conservation status.

I have applied three approaches to counting koalas.

Absolute counts

Relatively small areas with well defined boundaries can be searched systematically (usually a line of searchers). Each tree and shrub capable of supporting a koala is examined. Care is taken not to double count animals – usually by marking the tree containing the koala. Critical assumptions are that (1) all animals are found – so the capacity of the search team is critical, (2) all of the search area is surveyed with equal intensity, (3) the survey area is searched in one day to avoid complicating the count as animals move in and out of the search area overnight – limiting the area of habitat searched. There are methods that attempt to calibrate the search efficiency. This method is practical in relatively small survey areas.

Mark-re sight

Koalas are caught, tagged with coloured ear tags and released. After some period of time the habitat is surveyed and koalas are sighted. The number of tagged and untagged animals is recorded. In its simplest form the proportion of re sighted tagged animals to the total number of animals tagged is assumed to be the same as the proportion of all koalas sighted to the unknown total koala population.

Hence the total koala population can be estimated. There are some assumptions and other issues. Depending on the time between tagging and resurveying, account needs to be taken of the death or emigration of tagged animals and the birth or immigration of new animals. Also, the method assumes an even mixing across the extent of the habitat subject to census. In theory this method can be used to estimate populations across relatively large areas but is limited by resources, access and infrastructure.

Density from distance

In this approach koalas are spotted during a systematic transect-based search of the target habitat. When a koala is sighted on or at a distance from the search route the perpendicular distance from the route to the koala is measured and recorded. The density of koalas is estimated from an analysis of the distances from the route to the koalas and the length of the route. It is assumed that all animals above the transect will be detected and that detection declines with distance from the survey transect. The probability of detecting an animal with distance from the transect can be calculated. Koalas are ideally suited to this survey methodology as they do not flee from the observer. However, skilled observers are required and a reasonable number of sightings are required for meaningful estimations of density to be made. So, although this method is suitable for surveying moderately large areas it is likely to be less useful or impractical in areas with low koala densities. This is simply because it will require extraordinary effort to gather sufficient data.

New approaches

The application of air-borne infrared detectors may allow the assessment of koala populations over large areas and in habitats where density is low.

Long term koala ecology monitoring

The extent of koala distribution, the frequent low density populations as well as the issues around resources and access to remote regions makes large scale assessment of the status of koala populations and habitat impracticable. We propose that a more effective approach is to establish a network of long-term koala ecology monitoring stations (LTEMS) in key biogeographic regions and zones

of interest. At these LTEMS trends in koala abundance can be monitored along with the habitat in conjunction with key environmental and weather parameters. For example we have maintained four LTEMS for periods up to 12 years and developed to various extents depending on available resources. The best developed of these is at St Bees Island off the central Queensland coast. Here the koala population and associated plant communities weather and microclimate have been under intensive study since 1999. We have a further three sites in western and central Queensland. While all are limited, being resourced through community funding, they provide a model for the koala LTEMS network.

Knowledge of koala habitat

There is a poor understanding of koala habitat across the species range. What is known suggests that the habitat is used in a complex way with a number of strategies employed. Microhabitat features may be critical for koala survival.

In most general terms koala habitat is well known – sufficient to allow a broad description of where one may be expected to find koalas across their range. Clearly more closely studied habitats are better understood. These are usually those with higher population densities or with high public profiles or particularly prominent management issues. However, little is known of the koala habitats in more remote areas and where koala populations are at low density. This applies to much of Queensland beyond the south east corner and, I expect, New South Wales. The vast majority of the koala's range is not understood. Further there is almost no understanding of the function of habitat elements and of the life strategies employed within these habitats. Recent research in tropical Queensland revealed (a) surprising complexity in habitat use (Pfeiffer *et al*. 2005, Ellis *et al*. 2009, Melzer *et al*. 2011) and (b) the significance of complex habitat structure in koala survival strategies – especially under climate extremes (Clifton *et al*. 2007, Payne 2008, Ellis *et al*. 2010). How koalas use their habitat during the day can be determined by direct observation. Their diet can be ascertained by faecal pellet analysis. Beyond that understanding how koalas use their habitat and which elements are critical requires detailed intensive study utilizing radio-tracking and gps technology. Clearly this cannot be undertaken over a broad scale. The only meaningful approach is to establish and maintain strategically placed intensive studies in representative habitat types and climatic zones.

What is emerging is that although the general extent of generic koala habitat can be mapped or modeled, much more detailed work is required to understand the structural integrity or "health" of the koala habitat.

Things change

Koala habitat, like all plant communities, changes over time under natural and anthropogenic pressures. The direction of change does not always favour koala populations. The rate of change may be gradual or very rapid. Any

consideration of sustainable koala populations must consider these changes in habitat composition and structure.

Our work in central and tropical Queensland indicated that koala habitat is not a static entity. Change is occurring through plant community succession and under the influence of land management practices (notably grazing) and climatic influences. This relates to both keystone habitat elements such as fodder species but also to structural elements employed to aid in metabolic regulation and water balance. In two examples (Springsure, CQld & St Bees Island, near Mackay) we identified the direction of change away from a koala friendly plant community towards a community that would not provide the fodder resources to a significant koala population. Further, under some environmental drivers there can be a catastrophic shift to a different state resulting in a rapid change in koala population density (notably regional death of keystone riparian eucalypt species in the Springsure region during extended drought.

National estimates of population abundance

Issues of scale as well as temporal and spatial uncertainty confound attempts to estimate national koala numbers.

The Australian Koala Foundation (AKF) has estimated koala numbers within states and bioregions across Australia. I commend their approach. In general terms this is to identify discrete bioregional units, obtain available data on population density within the units and then extrapolate to the area of the mapped koala habitat within each unit. While there are many limitations to this approach *it remains the only effective approach to deriving such estimates*. However the results must be interpreted cautiously because the data behind the estimates is uncertain. The mapping currently does not resolve riparian communities through the Mitchell Grass Downs, seems to also exclude those acacia communities that have a eucalypt component as well (Brigalow, Boree, Rosewood, Lancewood). The approach will underestimate the extent of koala habitat – albeit expected to support low density populations. The AKF utilize data from a range of published and unpublished sources and from different dates. There are problems with the comparability of data collected under different methods and with associated biases. The data sources come from different time periods and do not take account of site population changes since the work was published. Also there is almost certainly a lot of unrecognized variability in population size across landscapes within map units – perhaps reflecting underlying geology, fire history, succession stage of plant communities, local land use issues, weather events, disease issues and more. This is not a criticism of the AKF approach but rather an unavoidable limitation of what is probably the only effective approach.

The challenge is, understanding this limitation, to undertake the necessary information gathering to negate or work around these limitations. A significant investment in contemporaneous systematic auditing of koala abundance within national koala habitat map units would be necessary to improve the estimates of abundance. Further, some assessment of the landscape-scale variability would also be required. To provide a meaningful measure of trends in population useful for conservation purposes the estimates would need to be repeated to gain an

understanding of variability and then replicated over a consecutive series of koala generations (every 7 to 10 years).

Threats to koala populations and koala habitat

In Queensland, contemporary threats to koala populations and habitats can be divided into two geographic areas – those acting in rural and regional Queensland and those acting in areas of population and infrastructure growth and resource extraction. Across these regions, climate variability (fire, drought, extreme weather) acts as an additional driver of decline. In the developing regions, and despite regulation and zoning, there is not likely to be any change in the threats to koalas or their habitat until the growth in human population and resource extraction plateaus or declines. More broadly, disease, broad-acre land clearing (highly restricted) and dingos are not primary or significant threats to koala populations.

Rural and regional Queensland

Long term drought (through the 1990's) with consequent tree decline in many areas, a gradual simplification in habitat structure and weather extremes (high temperatures and short duration very dry spells) exasperated by catastrophic fire in places has resulted in widespread declines in regional koala populations. We hypothesis that the driving factors were a loss of leaf water content (including defoliation and death of some keystone species in riparian zones) and a loss of koalas to heat exhaustion and stress induced disease (I did receive reports of koalas with apparent chlamydiosis at the height of the population crash in Springsure, CQ, however, this is considered to be a consequence of drought stress rather than a primary driver of population decline).

Areas of population and infrastructure growth and resource extraction

In south east Queensland and around growth hubs along the eastern coast there is a rapid urban expansion and intensification of infrastructure and activity. Despite regulation and zoning there is not likely to be any change in the threats to koalas or their habitat until the growth in human population and resource extraction plateaus or declines.

Threats to koalas

The consequence has been that there is unrelenting koala mortality from road deaths and dog attacks as koalas move across a habitat mosaic now separated by

high volume traffic corridors. As resource extraction expands the use of infrastructure corridors (e.g. Bruce Highway, Capricorn Highway and other roads connecting mining and the coast) intensifies and there is no longer the early morning respite. Koala road kills have been increasing in frequency and will continue until the capacity of the adjacent habitat is exhausted.

Threats to habitat

Despite the controls on the clearing of remnant vegetation in Queensland there is an effective incremental loss of habitat in the urban expansion zones around the growth hubs. This is despite the regulations and zones in place.

Disease

There is no indication that any disease agents are providing a primary threat to koala populations in Queensland. The influence of overt chlamydiosis in south eastern Queensland and elsewhere seems to be associated with primary environmental stressors. The consequence, however, may be to reduce the resilience of the populations and lower the probability of future recovery. There is some discussion of the spread of a retrovirus within Australia's koala population (Tarlington *et al*. 2006). However, currently there is no indication of any population limiting disease associated with this spread. There are a wide range of diseases and "ill health" that can be found among wild koalas when examined intensively. I argue, however, that this is the normal state of any wild population and such disease profiles may well have an ecological role of keeping populations in check.

A proactive response to national koala conservation

The koala conservation issue can be clearly placed in three sets with distinctly different management requirements. Current government responses tend to be reactive and are not likely to achieve a sustainable national koala population.

Identifying national management zones

Set one encompasses koala populations and habitat that occur in areas of human population growth (mostly the eastern seaboard), infrastructure corridors and resource extraction. These can be clearly mapped and areas of future growth or intensification predicted. The driving forces here are population growth and increasing economic activity. Within these areas koala conservation management is effectively an acute response – trying to save what can be saved. However the long term prognosis is not good unless limits to growth are established.

Set two encompasses koala populations and habitat that occur in rural and regional Australia beyond the future resource interests and infrastructure corridors. Here the driving forces are the traditional ones associated with weather and climate as well as rural land management (clearing, fires, land management regimes). Within these areas koala conservation management can focus on landscape and catchment management. The issues are chronic rather than acute (although acute events do occur). With careful planning, appropriate resources and proactive management the prognosis of the koala can be good.

Set three overlaps the other two sets in southern Australia. The koala and its population dynamics in Victoria and South Australia are so different from the koala elsewhere in Australia that a separate management regime is warranted. The southern koala occupies a small portion of the koalas range, represents a very small portion of the genetic diversity and behaves in an abnormal manner. This tendency for populations to grow 'till resources are exhausted is an abnormal response and indicates an unhealthy population. This population growth tendency and the management intervention that has reintroduced the koala across its southern former range is distorting attempts to review the conservation status of the koala nationally. The long term prognosis for the southern koala remains uncertain while there is ongoing management intervention.

Reactive responses to koala crises.

Reliance on IUCN guidelines to trigger changes in conservation classification does not allow effective regulation and conservation of the koala. The inevitable outcome is crisis management. A review of this approach is warranted for such widely distributed and cryptic species.

Both state and federal governments rely on the IUCN guidelines (IUCN 2001) to trigger decisions on the classification of the koala. Absolute reliance on these guidelines means that a species needs to be measurably in trouble before a classification can be changed and regulations invoked. Conservation management then needs to fight back against the escalating conservation crisis. Perhaps the most extreme example of this can be seen in Queensland. Compare the accounts of conservation status in Queensland in the 1998 National Koala Conservation Strategy (ANZECC 1998) and the 2009 National Koala Conservation and Management Strategy (NRMMC 2009). The measurable loss of habitat allowed the koala in the south-east Queensland biogeographic region to be classified as "vulnerable". Elsewhere the classification changed from "common protected" to "least concern wildlife." Regulation and planning policies were brought into effect in the south east. Despite this, severe declines in that region's koala populations continued. A crisis response strategy was introduced. Subsequently a division of Koala Policy and Operations established with a substantial budget ($45.5 million over five years) and large staff to implement the Koala Response Strategy for south-east Queensland (www.budget.qld.gov.a/at-a-glance/2010-2011 accessed 19 January 2011). There is no attention to greater Queensland.

Despite the huge investment there are no guarantees that the koala will be secure in the south east while human populations increase and development pressures intensify.

The Queensland government is to review its classification of the koala in 2011 – after reviewing the Commonwealth's decision. The scientific community is concerned about the state of the koala elsewhere in Queensland. However, providing the measurable parameters to trigger any IUCN criterion is unlikely at this stage. There are not sufficient resources available to investigate koala

populations and habitats in remote and regional Queensland. Proactive ongoing monitoring of sentinel populations and baseline assessment of habitat health are required to inform proactive conservation measures. Adequate resources targeted to koalas and their habitats need to be allocated ahead of any need to reclassify the formal conservation status.

Adequacy of the National Koala Conservation and Management Strategy

There are no resources or drivers for the implementation of the national strategy. The Commonwealth can encourage the koala states and the ACT by proactively pursuing the intent of the strategy on Commonwealth lands and in areas where the commonwealth has influence.

The latest iteration of the national koala strategy provides a framework upon which koala conservation and management actions can be built. However, there is no associated "carrot and stick" to resource and guide the actions. State governments follow their own initiatives and non-government organizations and individuals must draw on their own resources or seek support elsewhere to consider implementing any elements of the strategy.

The Commonwealth has opportunities to implement the koala strategy in its own sphere of influence. This includes:

(1) Pursue the objectives of the koala strategy on lands controlled by the Commonwealth (e.g. Shoalwater Bay Military Training Area. Historically these lands held a large koala population. A remnant low density population may remain given koalas have been sighted close to the boundary. There are opportunities to restore this population and its habitat and use this as a focus for koala restoration and conservation management in Central Queensland);

(2) Make Commonweath in-kind resources available to research and community organizations in support of their efforts to pursue the objectives of the strategy;

(3) Encourage associated organizations (CSIRO, Bureau of Meteorology) to support or partner with research and community organizations;

(4) Make funding available to rural and regional land managers in support of koala friendly land management / rehabilitation practice.

Captive management for conservation

Captive animals can, and should, play a significant role in conservation if the captive populations are composed of appropriate animals and properly managed.

There are a number of captive koala populations across Australia and internationally. Current management is directed towards display and welfare and regulation of captive animals. The source and gene pool of these animals is commonly very mixed and, collectively, the captive population is unrepresentative of the wild type. Zoo populations can provide a significant insurance if the captive animals are (1) selected and managed to reflect the range of diversity found within the native population, (2) managed to provide a genotypic reservoir, and (3) are displayed with resource material that makes an effective contribution to the conservation effort. For example: (1) the Rockhampton Zoo could develop a breeding program of koalas derived from the regional genotype. This would be linked to a regional habitat management and restoration program and associated community program; (2) the San Diego Zoo could maintain a breeding program, with a carefully managed genetic base, as an offshore reserve of koalas.

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