

PORTFOLIO COMMITTEE 7 – PLANNING AND ENVIRONMENT

INQUIRY INTO THE HEALTH AND WELLBEING OF KANGAROOS AND OTHER MACROPODS

During their hearing on 11 June 2021, Claire Galea and Ray Mjadwesch raised a number of strong concerns about the methodology for estimating kangaroo populations.

1. Mrs Galea and Mr Mjadwesch questioned the veracity and validity of published DPIE data used to estimate macropod populations and set thresholds quota reports, as reflected in:
 - the use of different methodologies over time, whilst nevertheless predicting trends
 - mathematical errors in the 2019-20 wallaroo quota report, including in percentage calculations
 - failure to apply correction factors over numerous years, and use of a correctional factor lacking in rigour (Evidence, Ms Galea, 11 June 2021, pp 2 and 3)
 - reliance on aerial surveys, which are biased by sighting probability and visibility challenges (Ms Galea, p 4) when more effective photographic, drone and/or satellite imagery used internationally is available (Ms Galea, pp 4 and 11)
 - use of statistical models that work well for large populations but less well for sparse populations (Ms Galea, p 4)
 - revised correctional factors, while justified, have not enabled a consistent analytical constant being applied in calculations to estimate final populations (Mr Mjadwesch, p 4)
 - rates of population growth that are biologically impossible and do not match with accepted patterns of reproduction and mortality (Mr Mjadwesch, pp 7 and 8)
 - poor standards in coefficients in variation of 46 per cent form surveys in the Northern Tablelands (Ms Galea, p 10)
 - a 4.8 per cent survey being taken to reflect an entire zone (Ms Galea, p 11).

What is your response to these criticisms of DPIE's methodologies?

ANSWER:

We thank Mr Mjadwesch and Ms Galea for their concerns. The methods that the Department of Planning, Industry and Environment uses to monitor macropod species throughout NSW are well established, independently peer-reviewed, and best-practice. The methods are widely and globally used in fauna and flora monitoring programs (Buckland et al., 2001, 2004; Borchers et al., 2006; Burt et al., 2014). For an extensive list of distance sampling related references that demonstrate extensive theoretical development and wide application of distance sampling methods, see the bibliography of references maintained by academics at the University of St Andrews (<http://distancesampling.org/dbib.html>), which currently lists 1513 publications. The sampling strategies (line transect sampling and mark recapture distance sampling), have been developed and refined over many years by a global community of population ecologists and biostatisticians driven by the common need for accuracy in population estimates (e.g. Oedekoven et al., 2013; Miller et al., 2013; Arandhara et al., 2020). These sampling strategies are the most appropriate, given the vehicles available for sampling (helicopter in topographically diverse country, fixed-wing aircraft in topographically heterogenous country), and the large areas over which population sizes are estimated. While the sampling strategies have been largely developed outside of this program, the methods themselves, by necessity, must be applicable within the environmental constraints, resource availability and monitoring goals of the program. These sampling

strategies have been adapted to the unique problem of estimating macropod populations, statewide and on an annual basis.

The Commercial Kangaroo Management Program (KMP), like other wildlife management programs globally, operates within an adaptive management framework (see Holling, 1978). This facilitates refinements where necessary, a process which is widely considered critical to the longevity of any long-term monitoring program (Williams, 2011a). For this reason, the KMP is interested in any new monitoring methods deemed suitable. As discussed in our response to supplementary question 37, photographic, drone and/or satellite imagery is currently not at the stage where it can be efficiently, and cost effectively used as a tool in KMP sampling strategies. Despite this, the KMP continues to critically evaluate independently peer-reviewed research in this area.

KMP methods have undergone several refinements since program inception, each with the intention of increasing certainty around the accuracy of the surveys and therefore the population estimates (Richardson et al., 2020, Williams, 2011b) (Table 1). While the methodology has been refined over the years, the validity of the data remains as true as it always has been (Lunney et al., 2018). Its validity, however, ultimately relies on appropriate use and interpretation by biostatisticians. There are limits to our data; for example, it cannot be used for linear regression to predict 'day zero'. This is because kangaroo populations exhibit a highly non-linear relationship with time (they go up and down over time). The use of population data by biostatisticians should follow published criteria of acceptable use, including the use of appropriate statistical or mathematical analyses, transparency around estimated precision, citing the original source and providing the age of the estimated data (Hone and Buckmaster, 2014). The KMP meets all these criteria when publishing population estimates (e.g. NSW DPIE, 2020a).

Table 1. Timeline of kangaroo management program (KMP) methods.

Period	Method	Reason	Key References
Pre 1974	nil	Landholder driven commercial industry.	Lunney (2010)
1974	First aerial transects are flown by Caughley with intent to use population estimates to guide management decisions.	Growth of industry prompts need to monitor populations.	Fox (1974)
1975-1983	Annual aerial surveys of six systematic-randomly selected blocks (16 000 km ² each) in the inland plains. Correction factors implemented.	Formalise methodology and facilitate repeated measures. Correction factors developed to resolve observer bias (underestimation).	Caughley (1974, & 1977)
1984-2000	Fixed wing transects surveyed along the 15' and 45' parallels of each degree of latitude covering the entire western plains. That is, 15 transects were surveyed across the breadth of western NSW.	Commercial industry growth meant parts of inland were being under sampled.	Caughley et al. (1987)

2001-2016	Helicopter Surveys implemented using line transect sampling in the Tablelands. Fixed wing transects reduced to 100m strip width.	Fixed-wing and walked-line not suitable for repeatable measures over large areas in the tablelands. Strip width reduction to reduce observer bias.	Cairns (1996); Cairns and Gilroy (2001); Cairns (1999)
2016	Implementation of mark-recapture distance-sampling (MRDS) using trained observers throughout the western plains.	Proactive step to refine methods. Use survey-specific detection probabilities (taking into account covariates) rather than use correction-factors.	Fewster and Pople (2008)

Occasionally yielding increased error in ecological survey data is a reality of working with ecological data. KMP has no misconceptions about this and openly provides statistically derived measures of precision through publicly available quota and population reports annually. Similarly, if a mistake is made in a report, this does not elucidate deceit. KMP transparently reports any such instance as soon as it arises (e.g. NSW DPIE, 2020b).

Ms Galea asserts that kangaroos are 'sparse populations'. This is also misinformation. A review of the literature provides clear evidence that kangaroos are widely distributed across Australia (Pople, 2006; Caughley, 1964; Fox, 1974). The most recent population estimates for kangaroos across the NSW western plains are 2,924,368 (\pm 241,382) for red kangaroos, and 3,118,439 (\pm 403,442) for grey kangaroos, over an area of 500,000 square kilometres. The statistical models employed work well for large kangaroo populations.

In summary, KMP utilises the most applicable and scientifically rigorous methods available. KMP is transparent about methods used to derive estimates and publishes reports on any revisions that need to be made. KMP provides estimates of precision in relation to all population estimates and it is the responsibility of anybody using that data to do so in a transparent and appropriate way so as not to mislead and misinform their audience.

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2. In addition, the witnesses highlighted the need for greater peer review, for greater transparency about the methodology underlying official figures, and for a greater willingness to engage in discussions about counting methodology (Galea p 10; Mjadwesch, p 8). How do you respond to these views?

Please see the response to question 1.

3. Consequently, Ms Galea (p 2) recommended that an independent investigation of the methodology for calculating macropod numbers take place, to ensure mathematical rigor is applied. What is the Department's response to this suggestion?

The Department is willing to consider independent review of the survey methodology by appropriately skilled scientists that are published in the contemporary peer reviewed literature in the field of broadscale wildlife population survey.