The Great Australian 'Icon' or Great Australian 'Pest'?

An examination of the welfare implications of Eastern Grey Kangaroo (Macropus giganteus) population management strategies.

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Introduction

Eastern Grey Kangaroos (*Macropus giganteus*) have adapted to agricultural development and urbanisation (Soulsbury & White, 2015). Consequently, highdensity kangaroo populations have become part of rural and urban ecology leading to human-animal conflicts (Coulson *et al.,* 2014). These include increased competition burden with livestock, land degradation from overpopulation and safety concerns pertaining to vehicle-kangaroo collisions (Adderton, 2004). This overabundance in conjunction with the aforementioned conflicts has resulted in commercial and non-commercial kangaroo culling as a means of population management (Descovich *et al*, 2015). Nevertheless, the kangaroo is an iconic, protected species in Australia and concerns regarding the welfare impact of such programs have arisen. This review will consider Eastern Grey Kangaroo welfare in the contexts of traditional lethal culling (Hampton & Forsyth, 2016), alternative fertility control (Wilson & Coulson, 2016) and the issue of orphaned dependent young secondary to culling (Sharp & McLeod, 2016).

Discussion

Lethal culling of kangaroos involves rendering a standing animal instantaneously insensible via a single shot aimed at the head in accordance with a national code of practice (Commonwealth, 2008). The code specifies the distance of the shot, the type of firearm/ ammunition, as well as the need to euthanase orphaned young and follow up confirmation of death. Hampton and Forsyth (2016) have examined wounding rate, instantaneous death rate, time to death and anatomical locations of bullet wounds as quantifiable parameters for assessing animal welfare outcomes of a non-commercial peri-urban Eastern Grey Kangaroo culling program. Using thermal imagery for visualization during the night time shooting and post-mortem analysis, a wounding rate of 0 and instantaneous death rate of 98% was determined (n=143). This night shooting program was undertaken in a location in which kangaroos were habituated to humans, during a time of year with lowest number of young, using noise suppressors and no spotlights. Consequently, the authors deemed that shooting, under these circumstances, was a low stress population management strategy. Despite the mitigation of welfare concerns under the study's settings, this model may not generalise to a commercial setting where shooting can occur during peak reproductive periods, without regulation of spotlights/noise suppressors and under the pressure of increased output to maximise financial gains (Descovich *et al.*, 2015). Alternative models of subsidised commercial culling (Mawson *et al*., 2016) and tradable culling permits (Boronyak-Vasco & Perry, 2015) have been proposed in an attempt to address welfare concerns in a commercial setting. Notwithstanding, Hampton and Forsyth have filled a crucial knowledge deficit in describing welfare parameters in traditional lethal culling.

Fertility control via sterilisation is an alternative to lethal culling practices for Eastern Grey Kangaroo population management. Wilson and Coulson (2016) compared the efficacy of levonorgestrel and deslorelin implants as hormone-based contraception in female kangaroos over an eight-year period (n=65). By measuring occurrence of pouch young, it was found that females with levonorgestrel or deslorelin implants were, respectively, 74 times and 4 times more likely to have a failed pregnancy compared to a control group. Levonorgestrel had a longer period of activity with effects lasting at least 5 years compared to deslorelin (which was ineffective after 3 years). Welfare concerns

stemming from fertility control strategies are due to method of capture, anaesthesia effects and trapping (Hampton & Forsyth, 2016). By refining implant choice, these factors are mitigated since levonorgestrel requires fewer instances of intervention to efficaciously control reproduction. Long-term welfare concerns regarding fertility control are founded on the need to maintain 'telos' of natural behavior (Hampton *et al.*, 2015; Rollin, 2007). In this respect, levonorgestrel has been shown to not significantly alter behavior (Poiani *et al*., 2002) in females and thus better maintain telos than other fertility strategies, such as castration, that alter male behaviour (Tribes *et al*., 2014). Further, fertility control can improve body condition (Gelin *et al*., 2015) of female kangaroos whilst vaccine sterilisation technologies may bypass capture stressors (Naz & Saver, 2016). The work of Wilson and Coulson (2016) is therefore useful in refining current reproductive technologies for population management in urban settings where shooting may be inappropriate due to risk of human safety and property damage.

Orphaned dependent young secondary to culling must be euthanised to minimise suffering by inhumane death through starvation or predation (Commonwealth, 2008). Sharp and McLeod (2016) have applied the theory of planned behavior and direct observation to investigate the attitudes, beliefs and behaviors of commercial kangaroo harvesters towards euthanasia of dependent young-at-foot (young that spend time both within and outside the pouch). Whilst this study was limited by a low response rate (n=21), the results indicate that harvesters familiar with the Commonwealth code of practice, with more experience carrying out euthanasia and with the belief that euthanasia reduces joey suffering are more likely to value and carry out euthanasia. Nevertheless, the observational study component (n=14) revealed a discrepancy between intention and action of carrying out euthanasia in orphaned young. According to the survey, the primary cognitive conflict that inhibited harvesters from carrying out euthanasia was the perception of negative social pressure towards the use of a single forceful blow to the head as a euthanasia technique (Mason *et al*., 2016). Alternatives such as captive-bolt have been suggested to improve compliance but this method had a poor instantaneous death rate (62%) which is well below the minimum requirement (95%) in livestock practices (Sharp *et al*., 2014). By gauging the attitudes of kangaroo harvesters, Sharp and McLeod have been able to assess the effectiveness of the code of practice in protecting kangaroo welfare as well as inform the development of future management policies – for example, the implementation of euthanasia training.

Conclusion

Eastern Grey Kangaroo population management is a complex ongoing issue within Australia. It requires the collaboration of various stakeholders as well as a more precise description of welfare concerns in both lethal culling and non-lethal fertility population management strategies. The welfare implications of such programs must be considered holistically and with foresight to include individual animal welfare, indirect welfare effects (e.g. on orphaned young) as well as species welfare (e.g. to preserve continued natural behavior).

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