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COMMENTARY

Unexpected outcomes of invasive predator control

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Experiments with an isolated population in New South Wales in the 1990s (Priddel & Wheeler, 1999) of malleefowl led to a widespread belief in the importance of fox predation to malleefowl population trends and led to fox-baiting at multiple sites. This view is supported by the first population viability analysis (PVA) for the species (Bode & Brennan, 2011), which suggests that intensive baiting to poison foxes should result in increased malleefowl populations in most circumstances. However, scepticism of the efficacy of fox baiting at the intensities actually used (Benshemesh, 2007) has now been corroborated by the latest meta-analysis (Walsh *et al.*, 2012).

In one sense, this is not surprising. Malleefowl are influenced by many factors, the relative strengths of which are highly likely to vary across space and time in such a widespread species. Thus, while fox baiting is not the panacea once believed (especially if too infrequent actually to reduce fox predation rates), it *is* likely to be necessary in some circumstances if populations are to be retained. However, further research is needed to determine the conditions under which it is genuinely cost-effective. Three areas for research stand out.

The first is the focus of Walsh *et al.*'s (2012) research. Much is known about losses of early life stages of the malleefowl, but little about the persistence of adults. Yet the PVA demonstrates that tiny changes in the probability of adult survival are far more important to population persistence than breeding success. Nevertheless, there is currently no monitoring of the survival of marked birds (Bode & Brennan, 2011). It is all very well knowing whether a mound is active (a nest with incubating eggs during the current breeding season) or not, but that confounds adult survival with recruitment, making it much harder to determine how an intervention is affecting population dynamics.

Secondly, more research could identify the maximum carrying capacity of a habitat. from which one might judge the importance of deviations arising from fire, predation or grazing, etc. An intervention that fails to produce an increase in the performance of the population growth factor may simply be because a population that is fluctuating around its natural limit. Interventions are only likely to be effective when populations are too low for density dependence to dominate population dynamics.

The third, and most interesting, area of research that emerges from the study is the need to understand how fox baiting impacts cat predation on malleefowl. Even when foxes are abundant, cats kill some young malleefowl (Priddel & Wheeler, 1994), and several authors (Benshemesh, 2007; Wheeler & Priddel, 2009; Bode & Brennan, 2011; Australian Government, 2012) suggest that mesopredator release (Crooks & Soule, 1999) of cats from foxes could occur when foxes are baited. Such mesopredator release has already been demonstrated in Western Australia (Risbey *et al.*, 2000; de Tores *et al.*, 2007). The current study exhibits just the sort of signature one would expect were more malleefowl being taken by cats following fox baiting – a short-lived surge in malleefowl numbers followed by a decline (Walsh *et al.*, 2012).

Fortunately (*contra* Bode & Brennan, 2011), cat baits are becoming increasingly effective, particularly in areas where sodium monofluroacetate can be applied (Denny & Dickman, 2010). Thus, malleefowl populations that decline after baiting for foxes may need more baiting rather than less, and for two species, not one. Alternatively, reintroduction of a much earlier human introduction, the dingo *Dingo familiaris dingo*, a species with which malleefowl have shared their habitat for at least 5000 years (Savolainen *et al.*, 2004), could reduce populations of both the more recently introduced smaller predators (Johnson, Isaac & Fisher, 2007; Letnic *et al.*, 2010). However, this idea may be harder to sell given that monitored malleefowl in south-eastern Australia live inside a 5500-km long fence erected with the specific purpose of excluding dingoes because they kill domestic stock. Alternatively, in south-western Australia, they are in habitat fragments from which dingoes have long been eradicated.

However, this begs a bigger question – whether malleefowl are threatened at all? By far the largest proportion of the 100 000 malleefowl thought to exist occur in an uncleared, and unmonitored, tract of semi-arid woodland dubbed the 'Great Western Woodlands', which covers about 16 million hectares in south-western Western Australia. This area still has a substantial population of dingoes and, on the basis of habitat change, is less likely to be declining than most of the monitored populations on which modelling has been undertaken. Currently, the threatened status of the malleefowl is justified on the basis of past clearance of the most productive habitat in the agricultural lands of south-east and south-west Australia. While the peak period of land clearance occurred in the 1960s, for malleefowl this is still just within the three generation period over which declines are measured under the International Union for Conservation Red List guidelines (48 years; Garnett, Szabo & Dutson, 2011). But ongoing declines are much harder to demonstrate. Hence, by 2020, the species may no longer meet the criteria for listing as threatened at all. This is not to say that effort should not be put into conserving local populations of malleefowl, a species that has generated extraordinary devotion among many community groups. Rather, at a national level, other species may soon be better able to claim priority for threatened species investment of public funds.

References

Australian Government (2012). *Leipoa ocellata* – Malleefowl. Available at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=934 (accessed 1 June 2012).

Benshemesh, J. (2007). *National recovery plan for malleefowl* Leipoa ocellata. Adelaide: South Australia Government Department for Environment & Heritage.

Bode, M. & Brennan, K. (2011). Using population viability analysis to guide research and conservation actions for the threatened malleefowl *Leipoa ocellata*. *Oryx* **45**, 513–521.

Crooks, K.R. & Soule, M.E. (1999). Mesopredator release and avifaunal extinctions in a fragmented system. *Nature* **400**, 563–566.

de Tores, P., Marlow, N., Algar, D., Morris, K., Glen, A., Sutherland, D., Cruz, J. & Bryant, G. (2007). Mesopredator release: a response to 1080 control of foxes in WA: what is the evidence and what are we doing (POSTER ABSTRACT). In Ecological Society of Australia 2007, Program and Abstracts: Perth Convention and Exhibition Centre, Perth, Australia, 2007, Monday 26th November to Friday 30th November 2007 p. 186.

Denny, E.A. & Dickman, C.R. (2010). *Review of cat ecology and management strategies in Australia*. Canberra: Invasive Animals Cooperative Research Centre.

Garnett, S.T., Szabo, J.K. & Dutson, G. (2011). *The action plan for Australian birds 2010*. Melbourne: CSIRO.

Johnson, C., Isaac, J. & Fisher, D. (2007). Rarity of a top predator triggers continent-wide collapse of mammal prey: dingoes and marsupials in Australia. *Proc. R. Soc. B* **274**, 341–346.

Letnic, M., Greenville, A., Denny, E., Dickman, C.R., Tischler, M., Gordon, C. & Koch, F. (2010). Does a top predator suppress the abundance of an invasive mesopredator at a continental scale? *Global Ecol. Biogeogr.* **20**, 343–353.

Priddel, D. & Wheeler, R. (1994). Mortality of captive-raised malleefowl, *Leipoa ocellata*, released into a mallee remnant within the wheat-belt of New South Wales. *Wildl. Res.* **21**, 543–552.

Priddel, D. & Wheeler, R. (1999). Malleefowl conservation in New South Wales: a review. In *Proceedings of the third international megapode symposium*: 125–141. Dekker, R., Jones, D.N. & Benshemesh, J. (Eds). Leiden: Backhuys Publishers.

Risbey, D.A., Calver, M.C., Short, J., Bradley, J.S. & Wright, I.W. (2000). The impact of cats and foxes on the small vertebrate fauna of Heirisson Prong, Western Australia. II. A field experiment. *Wildl. Res.* **27**, 223–235.

Savolainen, P., Leitner, T., Wilton, A.N., Matisoo-Smith, E. & Lundeberg, J. (2004). A detailed picture of the origin of the Australian dingo, obtained from the study of mitochondrial DNA. *Proc. Natl. Acad. Sci. USA* **101**, 12387–12390.

Walsh, J.C., Wilson, K.A., Benshemesh, J. & Possingham, H.P. (2012). Unexpected outcomes of invasive predator control: the importance of evaluating conservation management actions. *Anim. Conserv.* **15**, 319–328.

Wheeler, R. & Priddel, D. (2009). The impact of introduced predators on two threatened prey species: a case study from western New South Wales. *Ecol. Manag. Restor.* **10**, S117–S123.

