

It's the blues, Jim, but not as we know it: a response to FitzGibbon *et al.* (2017)

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Abstract. A cautious approach to managing the impacts of disturbance on free-ranging koala (*Phascolactos cinereus*) populations is fundamental to effective management of this iconic species. The critique by FitzGibbon *et al.* (2017) of a pioneering study by Phillips (2016) on the impacts of noise on koalas argued that a departure from aspects of the methods, a disregard for disease issues, other koala mortality data and an onerous approach to mitigation of potential impact detracted from the merit of the work. In response and while acknowledging some departures in evaluation criteria, the primary outcomes arising from the study remain unchanged, concerns about unreported koala mortalities are premature, while mitigation measures proposed by Phillips (2016) have been misinterpreted. Unravelling the implications of anthropogenic disturbance on terrestrial wildlife communities is a rapidly expanding field of ecological study. The work in question provides novel descriptions of aversive behaviour by koalas, each of which remains testable in the context of disturbance ecology, thus laying the foundations for further research to be undertaken.

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Introduction

In the broader context of wildlife management, the issue of 'stress' is increasingly being recognised as a syndrome with a pathology that is both poorly defined and understood (Reeder and Kramer 2005). As outlined in Phillips (2016) the impacts of stress on both individuals and populations of koalas (*Phascolactos cinereus*) have long been of interest to researchers due to a strong association with the onset and/or progression of diseases such as Chlamydiosis. More importantly, perhaps, and because of widespread declines throughout the greater proportion of its remaining range in eastern Australia, the koala is now listed as a Vulnerable species in Queensland, New South Wales and the Australian Capital Territory for purposes of the Federal Government's *Environment Protection and Biodiversity Conservation Act 1999*. Given this circumstance, a cautious approach must be taken to encroachments on habitats that are supporting resident koala populations concomitant with the need to develop policies and procedures that can work to minimise negative impacts.

FitzGibbon *et al.* (2017) provided a critique of 'Aversive behaviour by koalas during the course of a music festival in northern New South Wales, Australia' (Phillips 2016). Despite acknowledging that aversive behaviour in koalas did occur, FitzGibbon *et al.* (2017) directed their criticism to what they perceived to be four shortcomings:

- (1) errors related to home-range estimations,
- (2) the Type 2 aversive response typified by a movement pattern away from the source of disturbance but otherwise contained within the home-range area,
- (3) selective presentation of collected ecological data, and

- (4) while supporting the need to ameliorate the impacts of noise on koalas, FitzGibbon *et al.* (2017) considered that some measures proposed by Phillips (2016) were onerous.

The purpose of this short communication is to respond to the matters raised. FitzGibbon *et al.* (2017) focus on the movements of two koalas ('Brownie' and 'Emmylou') because the radio-tracking data for these animals did not meet the criteria specified by Phillips (2016) to enable consideration and assessment of movement patterns during the festival. As detailed in table 1 of Phillips (2016), there was no attempt to misrepresent any of the radio-tracking data that were obtained. Adequate numbers of radio-tracking fixes on these two koalas were eventually obtained (62 for 'Brownie' and 39 for 'Emmylou') to enable indicative home-range areas to be estimated, albeit based on radio-tracking loci that were obtained towards the end of the monitoring program rather than either side of the festival event, as stated in the methods. It may have been prudent to have been more circumspect and qualify the result accordingly, but the point remains as to whether it makes a material impact on the conclusions reached by the study, which in my opinion it does not. In terms of the Type 1 response (movement out of the home-range area), FitzGibbon *et al.* (2017) acknowledge that three of the six koalas exhibited this behaviour.

FitzGibbon *et al.* (2017) argued that the aforementioned discrepancy invalidated the concept of a Type 2 response because known home-range areas for 'Brownie' and 'Emmylou' were not determined in accord with the methods. Regardless, it is nonetheless of interest that the movement patterns of 'Etta', 'Brownie' and 'Emmylou' demonstrated similar directional trends during the festival event. When considered in this context,

matters of known home-range area become a moot point because it was the movement pattern that defined the Type 2 response (i.e. a perpendicular movement away from the disturbance source) more than the spatial context, which in itself is an entirely reasonable hypothesis to examine in the context of music festivals generally. FitzGibbon *et al.* (2017) were also critical of the reliance by Phillips (2016) on a single data point to make inferences about the movements of 'Etta', an adult female koala first captured and reported on by Hopkins and Phillips (2010), subsequently recaptured and referred to as 'Red Tag' by FitzGibbon and Ellis (2012). In particular, FitzGibbon *et al.* (2017) considered that a statement by Hopkins and Phillips (2010), that 'Etta' remained in her core area during the festival period, contradicted the statement in Phillips (2016) that described the single location in question as the '... *extreme southern edge of the known home-range area* ...'. Both statements are correct when considered in the context of known localities where this female was recorded. Subsequent data on the movements of this koala (see fig. 10 in FitzGibbon and Ellis 2012) fail to discount the earlier interpretation by establishing a spatially valid, more southerly ranging point before, during or after the 2012 festival event.

A further issue raised by FitzGibbon *et al.* (2017) relates to a perceived failure by Phillips (2016) to report 'crucial' ecological data regarding the incidence of underlying disease in the study population. The absence of such data served to underpin a broader concern by FitzGibbon *et al.* (2017) that other deaths that had occurred during the monitoring program reported by Hopkins and Phillips (2010) had neither been included nor considered by Phillips (2016). While it is acknowledged that koalas with pre-existing disease may have a higher risk of mortality, exploring factors that contribute to koala mortality is an important aspect of population management. Because of the numbers of deaths that occurred during the course of the work by Hopkins and Phillips (2010), a separate manuscript that took all mortalities into account was considered warranted. This manuscript (Phillips, in review) explores issues that may be contributing to the high numbers of koala deaths on the festival site (see below), including the notion of low genetic diversity leading to inbreeding and the associated potential for an elevated stress response and increased susceptibility to disease (Phillips, in review).

In acknowledging the need for mitigation measures, FitzGibbon *et al.* (2017) were critical of the concept of requiring compensation for koala habitat within a 725-m radius of the staging area, based on a presumption that all the habitat therein would be lost to koalas. In reality, the mitigation measure proposed by Phillips (2016) required 'assessment' of the amount of habitat that might be lost to koalas within this radial area, from which it follows that if habitat within this area remains demonstrably occupied, then no compensation is required.

Conclusion

With hindsight it would have been appropriate to acknowledge the limitations arising from the radio-tracking data for the two animals that form the basis of concern by FitzGibbon *et al.* (2017) and/or erect another category of response to reflect the lesser certainty in terms of home-range areas. However, even if the data relating to estimations of home-range size and single

observations at the periphery of known home-range areas were to be discounted, the observations reported by Phillips (2016) remain, in my opinion, both valid and of interest in the context of further research on aversive behaviour by koalas.

In the reckoning of the disease–disturbance–mortality equation, FitzGibbon *et al.* (2017) elected to conclude their critique with a selective presentation of the results of their work on the site since 2012. The perspective they provide makes little mention of the high numbers of koala deaths that appear to have been ongoing at the site since the inaugural festival in 2010. Only one of the 11 koalas originally tagged on the site by Hopkins and Phillips (2010) was still present when further koala studies resumed in 2012. 'Etta/Red Tag' was one of eight koalas captured, and also one of four that died during the 2012 monitoring program (FitzGibbon and Ellis 2012). During the 2013–14 monitoring periods five of 12 captured koalas died; four of these deaths were directly attributable to disease (FitzGibbon and Ellis 2012; FitzGibbon *et al.* 2013, 2014). Despite this knowledge FitzGibbon *et al.* (2017) present a simplistic population assessment of the site that leaves the reader with the impression that little has changed. The progressive reduction in the number of koalas occupying the central area of the festival site over the five years 2010–14, as well as a migration of the majority of research focus into more southern areas of the site and adjoining lands, would suggest otherwise.

Insights into aspects of koala ecology are often clouded by small sample sizes, from which further lines of investigation can be pursued. Hypotheses regarding longer-term implications for koalas on the festival site, as well as the underlying basis for each of the aversive responses described by Phillips (2016) remain testable. In the context of disturbance ecology, this sets the scene for further investigations and research to be undertaken.

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