

# **Did dingo control cause the elimination of kowaris through mesopredator release effects? A response to Wallach and O'Neill (2009)**

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Wallach & O'Neill (2009) recently suggested that poison baiting for dingoes (*Canis lupus dingo* and hybrids) caused the localized extinctions of kowaris (*Dasyuroides byrnei*) through mesopredator release effects. However, in this paper I briefly highlight some weaknesses in their approach to show that the information presented adds little to our knowledge of dingo–mesopredator or dingo–kowari interactions.

Wallach & O'Neill (2009) visited two cattle properties in northeast South Australia once each in the winter of 2007 where they used sand plot activity indices to compare the relative abundance of several carnivore and herbivore species at each site. Observations of dingo howling and scat counts were used as measures of social structure. In line with the mesopredator release hypothesis (Crooks & Soulé, 1999), the lethal control of dingoes (usually achieved through 1080 baiting campaigns), followed by abundance increases of mesopredators and herbivores was the suggested mechanism that produced the localized extinction of kowaris at one of the sites. Unfortunately though, the study design suffers from multiple critical weaknesses in the methods applied, considerably limiting its ability to make inferences about dingo populations and ecosystem processes.

1. The authors stated that across Australia, "it is extremely rare to find dingo populations that are not being subjected to lethal control" (Wallach & O'Neill, 2009, pg. 127). This is misleading, and in the context of their paper, gives the reader the mistaken impression that stable dingo packs are rare across Australia due to widespread control. Dingoes and dingo packs are, in fact, extremely common (Fleming et al., 2001; West, 2008), and control practices in South Australia are quite conservative (Allen, 2010b). "Lethal control" is also an ambiguous term, because it includes everything from occasional shooting through to intensive and coordinated poison baiting campaigns. Hence, the degree of control can vary immensely, and in the context of their paper, different forms of lethal control are unlikely to influence social structure in the same way. For example, it is possible that occasional shooting may simply replace natural mortality and have a minor overall effect on dingo social structure, though these processes would need to be investigated.

Furthermore, in the northeast pastoral district of South Australia where their two sites were located, official 1080 bait supply records (B. Allen, unpublished data, kept since 1972) indicate that poison baiting seldom occurs, with an average rate of 25% properties receiving baits in any given year (range: 0% in 1984 to 68% in 1991). Legislation permits a baiting intensity of up to 10 baits/km<sup>2</sup> (APVMA, 2008). But the greatest supply of baits occurred in 1989, and equated to a regional baiting intensity of only 0.07 baits/km<sup>2</sup> (Allen, 2010b). Requests for poison baits from the whole of the northern pastoral district have also reduced

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dramatically over the last five years to the point where only three (out of 19) properties in the northeast region received baits in the three years prior to their study and no baits at all were supplied in 2009. This means that approximately 600,000 km<sup>2</sup> of South Australia experienced very little dingo control that year (dingo populations in the indigenous lands in the northwest of the state—255,000 km<sup>2</sup>—have rarely, if ever, been subject to lethal control by Europeans). On a property level (i.e. 10,000 km<sup>2</sup>), even the most intensive baiting campaigns in northern pastoral areas rarely exceed 0.25 baits/km<sup>2</sup>. Therefore, lethal control of any kind may be a relatively minor fraction of total dingo mortality across the region in which Wallach & O'Neill (2009) conducted their study.

2. The use of sand plot activity indices are a common and useful tool for sampling dingo populations. However, their proper use is governed by principles that ensure that the data obtained from them can be used reliably in subsequent analyses. Specifically, activity indices cannot be validly compared between different habitats/land uses, seasons, or species because of the way these factors potentially influence animal activity (Wilson & Delahay, 2001; Engeman, 2005). Scat counts and howling can also be useful indicators of some population parameters when sampled properly (Corbett, 2001; Mitchell & Balogh, 2007). Wallach & O'Neill (2009) understandably chose these useful methods to assess populations, but their application of them did not follow the sampling principles that ensure their reliability. For example:

- The 'index of abundance' was calculated by multiplying a continuous measure (tracks/transect/night) with a binary measure (presence/absence of tracks on 2 ha plots). This could be argued as providing a potential synergy of assumption violations—leaving little prospect for a valid variance estimate—and unnecessary if the track sampling was representative of animal usage (Engeman et al., 1998; Blaum et al., 2008).
- Even before combining them, these measures included invalidated assumptions about the ability to distinguish between "fresh" and "old" tracks and the distance of one track to another as an indication of the same individual animal. Wind can have a dramatic effect on the readability of tracks in sand, often obliterating them within minutes, and the size, shape and direction of footprints on separated but sequential sand plots/transects reveals little about the identity of the individual responsible for them (Triggs, 2004; Funston et al., 2010).
- The relative abundance estimates derived from activity indices were invalidly compared between species, potentially confusing abundance differences with behavioural differences (Wilson & Delahay, 2001; Engeman, 2005).
- A once-off collection of scats around 119 rabbit warrens, water points and carcasses in two ~500 km<sup>2</sup> areas will provide a limited ability to assess the structure of dingo packs (or infer causal processes) at extensive rangeland sites (Wilson & Delahay, 2001; Mitchell & Balogh, 2007), and the representativeness of scats collected from resource points is unknown (Allen, 2010a).
- The *opportunistic* recording of dingo howls at remote water points in the presence of people (and companion dogs, A. Wallach pers. comms.) is also a particularly weak technique for making inferences about pack structure. To be useful, the sampling of vocalizations must be objective and repeatable. Vocalizations are also communicative behaviours, and in the case of Wallach and O'Neill's observations, dingoes may have simply been alerting any other dingoes to the presence of humans and/or other dogs.

Assessments of pack structure or social stability are founded in behavioural observations between individually identifiable animals (Whitehead, 2008), and is usually undertaken through radio collaring and/or direct observations (e.g. Corbett, 1988; Thomson, 1992). Identification of individuals was not attempted by Wallach & O'Neill (2009), and scats or howling cannot provide this information. Moreover, the once-off, opportunistic collection of dingo spoor (i.e. tracks and scats) and vocalizations cannot account for the known seasonal changes in their expression (Corbett, 2001), the multiple explanations for any given observation (Williams et al., 2002; MacKenzie et al., 2006), or the mechanisms/causes underlying any observed correlations (Caughley, 1977).

3. Ignoring these methodological issues, alternative explanations may equally describe the observations of Wallach & O'Neill (2009). For example, the greater abundance of dingoes observed at Pandie Pandie may not be due to relaxed dingo control but may be a symptom of the site's closer proximity to Goyder's Lagoon, a well-watered and resource-rich section of the Warburton Creek, which is not fed from local rainfall. Publicly available water-level data recorded upstream in the years preceding the study show significant flows into the lagoon which were not matched by local rainfall events on Mungerannie during the same period.

Additionally, the observed rarity of some small mammals on Mungerannie may reflect bottom-up processes, whereby rabbit abundance provides competition for vegetation, reduces its availability to invertebrates, and supports larger numbers of feral carnivores (increasing the risk of hyperpredation), which all work in concert to cause the localized extinction of some small mammals. These processes are known to occur with or without dingoes in the landscape.

Furthermore, the recorded activity of predators and prey alike can change rapidly in response to environmental perturbations, and their presence or absence on sand plots during a once-off survey may merely reflect such stochastic events. Such surveys have a limited ability to infer causal process because

there may be multiple alternative explanations for the data (Caughley, 1977; Williams et al., 2002; MacKenzie et al., 2006). Causal processes involving dingoes are best addressed using rigorous experimental techniques (such as BACI experiments) where confounding factors can be controlled (Glen et al., 2007).

In summary, while ecological data is scant for arid areas and is always welcomed, it is important to use research resources wisely in order to provide scientifically defensible information (Platt, 1964), used ultimately to inform threatened species recovery. While the conclusions of Wallach & O'Neill (2009) align nicely with the mesopredator release hypothesis, their foundations, methods, and interpretation are undermined by misleading contextual information, the poor application of otherwise robust sampling methods, and a lack of discussion on alternative explanations. As such, the study contributes little insight into the effect of dingo control on kowaris.

The study sites, methods, and results presented in Wallach & O'Neill (2009) have also been used elsewhere (Wallach et al., 2009a, 2009b, 2010), and these criticisms equally apply to those reports, and others similar to them. Researchers, reviewers and readers should therefore be vigilant in looking for design issues that may be more important than initially appears to be the case, before accepting intuitively sound conclusions on face value. Improving the quality of dingo–mesopredator studies is necessary if threatened species are to be managed more effectively.

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