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Putting power into practice: Collaborative monitoring of a threatened marsupial predator using a power-optimized design

Harry Moore[1,2] | **Judy Dunlop**[2] | **Daniel Bohorquez Fandino**[1] | **Lesley Gibson**[1,3] | **Annabelle Coppin**[4] | **Budadee Aboriginal Corporation**[5] | **Mat Oliver**[6] | **Richard Variakojis**[7] | **Taryn Milroy**[8] | **Kanyirninpa Jukurrpa Martu Rangers**[9] | **Sue Davenport**[9] | **Craig Williams**[1] | **Chantelle Jackson**[1] | **Mitchell Cowan**[2,10] | **Clarrie Robinson**[11] | **Jo Webb**[11] | **Harriet Davie**[12] | **Phil Davidson**[13] | **Damien Cancilla**[14] | **Astrid Heidrich**[15] | **Dale Nimmo**[10]

[1]Department of Biodiversity, Conservation and Attractions, Bentley Delivery Centre, Bentley, Western Australia, Australia

[2]School of Agriculture and Environment, University of Western Australia, Crawley, Western Australia, Australia

[3]School of Biological Sciences, University of Western Australia, Crawley, Western Australia, Australia

[4]Outback Beef, Marble Bar, Western Australia, Australia

[5]Budadee Aboriginal Corporation, West Perth, Western Australia, Australia

[6]Terra Rosa Consulting, Fremantle, Western Australia, Australia

[7]Murujuga Aboriginal Corporation, Dampier, Western Australia, Australia

[8]Yindjibarndi Indigenous Rangers, Roebourne, Western Australia, Australia

[9]Kanyirninpa Jukurrpa (KJ), Newman, Western Australia, Australia

[10]Gulbali Institute, School of Agricultural, Environmental and Veterinary Sciences, Charles Sturt University, Albury, New South Wales, Australia

[11]Strelley Community School, Marble Bar, Western Australia, Australia

[12]Roy Hill Iron Ore Pty Ltd, Perth, Western Australia, Australia

[13]API Management Pty Ltd, Perth, Western Australia, Australia

[14]Fortescue Metals Group, Perth, Western Australia, Australia

[15]Spectrum Ecology and Spatial, Leederville, Western Australia, Australia

Correspondence
Harry Moore, Department of Biodiversity, Conservation and Attractions, Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia, Australia
Email: harryamos07@gmail.com

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In our recently published study in *Conservation, Science, and Practice* (Moore et al., 2023), we compared new (camera trap) and conventional (live trap) monitoring designs in terms of cost and statistical power for tracking changes in occupancy of the endangered northern quoll (*Dasyurus hallucatus*), a marsupial predator native to northern Australia (Oakwood et al., 2016). Results indicated that the optimal camera trap monitoring designs detected a reduction in northern quoll occupancy of 30%, 50%, and 80% at a substantially reduced cost compared to the optimal live trap design, without sacrificing statistical power (Figure 1).

Since 2014, the Western Australian Department of Biodiversity, Conservation, and Attractions (DBCA) has monitored northern quolls in the Pilbara bioregion, a stronghold for the species given the toxic cane toad is yet to invade, primarily using live traps. Although effective, live traps require a considerable amount of resources in terms of both cost and effort—including appropriate training. Using the results of our study, DBCA has successfully transitioned to an entirely camera trap-based monitoring program, which is superior in both cost and statistical power, while being less invasive to the animals being monitored, and enables a more expansive monitoring program.

The optimal camera trap design identified by Moore et al. (2023), and implemented by DBCA, consists of 33 sites, each measuring ~70 hectares in size and surveyed with five downward-facing camera traps for a minimum of 10 days annually. All sites are surveyed between the months of April and October to avoid periods when males are absent from the population due to seasonal die off. Twelve of these sites were part of the previous monitoring program, while 21 new sites have since been established across a range of land use types, including national parks, Indigenous reserves, pastoral leases, and mining tenure, spanning a total area of 178,060 km^2.

A hallmark of effective and enduring threatened species monitoring programs is the presence of on-ground community support (Lindenmayer et al., 2020). For this monitoring program, the scale and diversity of the study area required DBCA to form additional partnerships with a variety of stakeholders, including Traditional Owners, pastoralists, mining proponents, and environmental consultants. These partnerships not only strengthen DBCA's capacity to monitor northern quolls effectively, but also create capacity-building opportunities for stakeholders to undertake their own monitoring, especially for Indigenous ranger groups, who were interested in using camera traps to monitor other culturally significant fauna, or as

FIGURE 1 Pilbara northern quoll (*Dasyurus hallucatus*) monitoring program. (a) Kanyirninpa Jukurrpa Martu Rangers installing cameras traps on Martu country in Karlamilyi National Park. (b) Staff demonstrating camera installation with school students. (c) A northern quoll detected using a camera trap at Indee Station in the Pilbara bioregion. (d) Yindjibarndi rangers and research staff entering site habitat data on Yindjibarndi country in Millstream National Park. (e) Budadee rangers conducting a site assessment on Palyku country in Woodstock-Abydos Protected Reserve. (f) northern quoll captured as part of live trapping.

part of broader on country ecosystem monitoring programs. Given the use of cameras traps requires very little training, uptake of these monitoring methods by ranger groups is enhanced. However, it is important to recognize that camera traps should not provide a total replacement for live trapping surveys, given the collection of data related to morphology and reproduction is only possible using the latter. In addition, live trapping provides the opportunity to obtain live animals, which can hold greater significance for Traditional Owners when compared to camera trap images alone.

Results from monitoring so far confirm the effectiveness of the proposed camera trap design in detecting changes in northern quoll occupancy at scale, with high detectability recorded across all sites. Success of the updated design has been further demonstrated in the uptake of these methods by other groups in the Pilbara, highlighting the potential of camera traps to be used to monitor additional threatened species, both in this region and elsewhere.

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ORCID

Harry Moore https://orcid.org/0000-0001-9035-5937
Mitchell Cowan https://orcid.org/0000-0001-8432-5301

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