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The ecology and conservation of the antilopine wallaroo (*Macropus antilopinus*)

Thesis submitted by

Euan Gowar Ritchie

BSc (Hons) James Cook University

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for the degree of Doctor of Philosophy

in the School of Marine and Tropical Biology

James Cook University

Top – Dry season, Mornington Sanctuary, Kimberley region, Western Australia.© E. Ritchie
Centre – Large male (left) and adult female (right) antilopine wallaroos (*Macropus antilopinus*). © D. Webb
Bottom – Wet season storm, Undara National Park, Einasleigh Uplands region, Queensland. ©E. Ritchie

This thesis is dedicated to my late father Michael

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Declaration

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

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Statement on the contribution of others

Emily Bolitho (a collaborator) assisted with bioclimatic modelling and the production of distribution maps (Chapter 5). Dr. Mark Eldridge (a collaborator) assisted with the analysis of molecular data (Chapter 6). C.S.I.R.O (Davies laboratory) provided laboratory space and the use of equipment (Chapters 2 and 4).

Declaration on Ethics

The research presented and reported in this thesis was conducted within the guidelines for research ethics outlined in the *National Statement on Ethics Conduct in Research Involving Human (*1999*),* the *Joint NHMRC/AVCC Statement and Guidelines on Research Practice* (1997)*,* the *James Cook University Policy on Experimentation Ethics. Standard Practices and Guidelines* (2001), and the *James Cook University Statement and Guidelines on Research Practice* (2001). The proposed research methodology received clearance from the James Cook University Experimentation Ethics Review Committee (approval number A814).

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Preface

Publications arising from this thesis:

Chapter 2 - (in review) Large herbivore distribution and abundance in the tropics: intra- and inter-specific niche variation across species' ranges, Euan G. Ritchie, Jennifer K. Martin, Andrew K. Krockenberger, Stephen Garnett and Christopher N. Johnson, *Ecological Monographs*.

Chapter 3 - (in review) The socio-ecology of large marsupial herbivores in Australia's tropical savannas, Euan G. Ritchie, *Austral Ecology*.

Chapter 4 - (submitted) Sexual segregation in a tropical marsupial: links between reproductive biology, social behaviour and rainfall seasonality, Euan G. Ritchie, Jennifer K. Martin, Peter C.G. Fossan and Christopher N. Johnson, *Austral Ecology*.

Chapter 5 - (in review) Climate change and the distribution of large, wide ranging herbivores: severe range contractions and the extinction of Australia's tropical macropods? Euan G. Ritchie and Elizabeth E. Bolitho, *Austral Ecology.*

Appendix 1 - (2005) An extension to the known range of the eastern grey kangaroo (*Macropus giganteus*) on Cape York Peninsula, Euan G. Ritchie, *Australian Mammalogy* 27:225-226.

Appendix 2 - (in review) The effect of an extensive, late, dry season fire on the abundance of three sympatric large macropod species in Undara volcanic national park, northern Australia, Euan G. Ritchie, *Australian Mammalogy*.

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Abstract

Research into the factors which limit the distribution and abundance of species has a long tradition in ecology, and knowledge of such factors is vital for guiding the conservation of biodiversity. However, few studies have investigated the way in which intraspecific and interspecific differences in the niche requirements of species vary geographically, despite growing demand for such information in the face of large-scale environmental change, particularly the predicted effects of global warming.

The antilopine wallaroo (*Macropus antilopinus*) is a large macropod endemic to the extensive tropical savannas of northern Australia. This thesis investigates the ecology and conservation of the antilopine wallaroo across its distribution; in addition, I provide comparative information on other sympatric macropod species.

At 50 sites across northern Australia, I collected detailed information on the abundance and social behaviour of a number of macropod species as well as and data on climate, fire history, habitat and resource availability. Using these data I constructed habitat models for species at varying spatial scales. Interpreting broad-scale patterns of species' distributions and abundance also requires an understanding of the individual requirements of species-specific characteristics, such as socio-ecology and behaviour. Therefore, I also conducted an intensive study of the behaviour of the antilopine wallaroo at one site in north Queensland.

The antilopine wallaroo occurred at 68% of the sites that I surveyed, and the abundance of this species varied substantially across its distribution. The factors influencing the distribution and abundance of the antilopine wallaroo varied according to the spatial scale of analysis. At the largest scale (complete distribution), availability of water, frequency of fire, geology (soil fertility) and land management were the most important factors, whereas within Queensland and at smaller bioregional scales, the abundance of a potential competitor (eastern grey kangaroo, *M. giganteus*) and aspects of habitat structure and composition were of greater importance. In contrast, the abundance of eastern grey kangaroos and common wallaroos (*M. robustus*) was strongly influenced by climate. The abundance of antilopine wallaroos increased after fire whereas the abundance of common wallaroos declined.

The antilopine wallaroo was the most gregarious macropod and group sizes increased significantly with population density. The eastern grey kangaroo and whiptail wallaby (*M. parryi*) were less gregarious than the antilopine wallaroo, and the common wallaroo and agile wallaby (*M. agilis*) were essentially solitary. Compared with other large tropical macropods, the antilopine wallaroo's pattern of reproduction was strongly seasonal, centred around the monsoon season. There was marked seasonal variation in the associations between sex and size classes of the antilopine wallaroo, which appear related to reproduction and sexual segregation in this species.

Climate change poses a significant risk to the continued survival of the antilopine wallaroo. The relatively restricted distribution, dependence on water and seasonal breeding pattern of the antilopine wallaroo makes this species the most vulnerable of the four large macropods in northern Australia. The capacity for climate change to alter habitat structure and influence fire regimes within this region is also likely to result in changes to both local and regional macropod communities.

Preliminary genetic data suggest that there has been recent restriction of gene flow between populations of antilopine wallaroos in Queensland and the rest of the species' distribution, which may be associated with an arid ecological barrier to dispersal at the base of the Gulf of Carpentaria. My results also indicate that hybridisation between the antilopine wallaroo and common wallaroo has occurred across the former species' range. Further work is therefore required to resolve the taxonomic status of the antilopine wallaroo and the phylogeny of large macropods.

The results of my study provide the most comprehensive information to date on the ecology and conservation of the antilopine wallaroo, and also filled a significant gap in our overall knowledge of macropodid marsupials by expanding our limited knowledge of the tropically-occurring members of this group. More broadly, my research has demonstrated spatial variation in the niche requirements of a large herbivore and has identified many of the key environmental and biological factors influencing the distribution and abundance of species that live in tropical savannas. In addition it has made a substantial contribution to a more comprehensive understanding of the global ecology and evolution of large herbivores.

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