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The Ecology and Management of the Common Brushtail Possum
*Trichosurus vulpecula* in central Australia.

Applied Ecology Research Group
University of Canberra

A thesis submitted for the degree of Doctor of Philosophy in Applied Science in the University of Canberra.

January 2001
Statement of Originality

The studies presented here were completed by the author while a part-time student in the Applied Ecology Research Group, University of Canberra, Canberra, ACT, Australia. This thesis is my original work and has not been submitted, in whole or in part, for a degree at this or any other University. Nor does it contain, to the best of my knowledge and belief, any material published or written by another person, except as acknowledged in the text.

Jeffery Neil Foulkes

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Jeffery Neil Foulkes
ACKNOWLEDGMENTS

I would like to thank my supervisors, Arthur Georges and Anne Kerle for their patience, encouragement and support throughout the long development of this thesis. Arthur provided a levelling influence and input from a non-possum perspective. Anne provided the opportunity of working on possums and the encouragement that I could complete this task. Anne shared her extensive possum knowledge and enthusiasm for arid Australia, and provided encouragement to help in the development of my ideas of possum ecology in arid Australia. Anne in particular helped me through the crises such as the aftermath of floods in the field (thanks also to those who rescued us!), floods in the lab, Ross River Fever and permit refusals, to name just a few. Both Anne and Arthur provided valuable comments on my drafts throughout.

I thank Lynn Baker, formerly of Uluru-Kata Tjuta National Park, for proposing the original project at Uluru, which grew into the study presented herein. Lynn also provided Pitjantjatjara/English interpretation skills in the early stages until my communication skills improved. This study gave me the unforgettable experience and privilege of working with Anangu people, in particular, Kata Kura and the late Peter Kanari. These wonderful old men (tjijpi) shared with me with their knowledge of common brushtail possums (wayuta), tracking skills and endured heat and floods to help me find wayuta. To see the joy on the faces of these old men upon seeing and touching a possum for the first time in many years was something I will never forget. Sam and Martha Protoy, Maureen Kanari, Mick Mima, Ruth O'Connor, Willie Wamantjangu, Jim Nyukatji, Jim Ilyatjari, Yipati Yipati, Tjukapti Kunytji and Raymond James all provided assistance with tracking and traditional ecological knowledge on possums in the Irving Creek area. I received strong support from the Mutitjulu Community, Docker River Community Council and the Uluru Board of Management. Jon Willis, the Community Liaison Officer assisted in providing communication with Anangu.

Special thanks to my partner, Amanda Brook for making valuable comments on the drafts as well as preparing all the maps. I am indebted to her patience, encouragement and support during the sometimes traumatic development of this work. I could not have completed this thesis without her and its final form benefited greatly from her input and advice.
Ken Johnson and Mike Fleming provided lab and office space in the Wildlife Research section at the Parks and Wildlife Commission of the Northern Territory offices, Arid Zone Research Institute, Alice Springs. They and the rest of the wildlife research mob endured the horrible smells of scats of every description, and noises from the blender and fume hood, emanating from the lab.

Nicki de Preu and Jane Bell provided considerable assistance in the field with checking traps and radio-tracking, as well as assisting with scat preparation in the lab. Keith Bellchambers also provided assistance with radio-tracking and his unique style of encouragement. Ann Grattidge assisted with skull measurements and data entry. Lee Heard, Bill Ryan, Carralyn Dean, Peter Nagle, John Harvey, Patrick Hookey, Bruce Grey, Mac Moyses, Else Foster, Gwen Foulkes and Dave Clarke all assisted in the field at various stages. Thanks to all for their companionship and friendship under sometimes difficult conditions. Peter Copley and Lynnette Samblich provided valuable comments on earlier draft chapters.

Peter and Tracey Bloomfield 'Atnarpa', provided hospitality and constant access to the Hale River study site. Access permits to the Irving Creek study site were provided by the Central Land Council with approval from the Traditional Owners of the Petermann Land Trust. Tony Davis 'Milton Park', Tom and Wendy Webb 'Alcoota', Jamie Turner The Garden', Chris Connellan 'Narwitooma' and Ian Morton 'Glen Helen' also allowed access to their properties. Angus and Karen Emmott generously provided the opportunity to work on possums at 'Noonbah' and assisted in recording possum distribution information in Western Queensland.

Bruce Thompson and Peter Latz provided confirmation of plant identifications. Many thanks go to the mob in the lab at AZRI, particularly Peter Latz, Mike Fleming, Jeff Cole, Dave Gibson, Keith Bellchambers, Nicki de Preu and Geoff Lundie-Jenkins who provided valuable insights into their knowledge of central Australian ecological processes.

Doug Wilson (DPI, Arid Zone Research Institute, Alice Springs), kindly undertook the nutrient and digestibility analysis of foliage samples in return for regular supplies of 'reagents' (Scotch Whisky).
Steve Cork and Mandy Yialeloglou (CSIRO Division of Wildlife and Ecology, Canberra) undertook analyses for tannins and phenols in a number of plant specimens.

Steve Donnellan, Malcolm Kreig (South Australian Museum), John Wombey (National Wildlife Collection), Don Colgan (Australian Museum) and Des Cooper (Macquarie University) provided frozen tissue specimens. Andrea Taylor (Macquarie University) undertook the mtDNA analyses. Steve Donnellan provided advice and assistance with analysis of the mtDNA data.

Cath Kemper (South Australian Museum), Steve van Dyke (Queensland Museum), John Wombey (Australian National Wildlife Collection), Norah Cooper (Western Australian Museum), Tasmanian Museum, Linda Gibson (Australian Museum), Ian Archibald (N. T. Museum) and Ken Johnson (Finlayson Collection-Alice Springs) kindly lent specimens from their collections.

Last but not least, thanks to my mother Gwen, for prodding me along the way to get it all finished!

Approval to undertake the procedures on captured animals described in this thesis were given by the Arid Zone Research Institute Animal Ethics Committee, Alice Springs. Approval to trap and take possums in western Queensland was provided by the Queensland Department for Environment and Heritage.

Financial support for the study was provided by Environment Australia (formerly Australian National Parks and Wildlife Service) and a grant from the Estate of Winifred Violet-Scott.
ABSTRACT

This study investigates the ecology of one of the best known Australian marsupials, the Common Brushtail Possum *Trichosurus vulpecula*, in central Australia. *Trichosurus vulpecula* is one of few medium-sized mammal species that persist in arid Australia today. Its distribution within the arid zone has declined markedly since European settlement. Two populations, one within the East MacDonnell Ranges along the Hale River and the other on Irving Creek, a River Red Gum creek in the Petermann Ranges, were studied in the southern Northern Territory. Others locations in the region were visited opportunistically. The central Australian *Trichosurus* is not distinct genetically from populations elsewhere in Australia.

The diet of *T. vulpecula* consisted of a range of leaves, flowers and fruits of perennial dicotyledonous species as well as some ephemeral herbs. Grasses were absent from the diet. Variation in the diet reflected seasonal availability in flowers and fruits. The species preferentially consumed at each site had significantly higher moisture content and dry matter digestibility than species not consumed. Preferred species included *Amyema maidenii* leaves (a mistletoe), *Acacia* spp. flowers and fruits, *Santalum lanceolatum* leaves (a shrub), *Marsdenia australis* leaves (a vine), *Solarium quadriloculatum* fruit (shrub) and *Euphorbia* spp. leaves (herb). Small amounts of invertebrate material were consumed throughout the year. Other non-plant material consumed included honeycomb and unfledged birds eg. Budgerigars. There were no significant differences in the diet between the sexes.

*Trichosurus vulpecula* were found in six main habitats: *Acacia aneura/Callitris glaucophylla* on rocky hills; *E. camaldulensis* sandy creek-lines; mixed *Acacia* rocky hills, Rocky *Eucalyptus* creek-lines; Degraded drainage lines; and Wet gullies. Logistic regression modelling revealed a significant correlation between mistletoe species richness, higher levels of soil nitrogen and the presence of *T. vulpecula*. In habitats occupied by *T. vulpecula* species richness of mistletoes was associated with the absence of fire and the presence of reliable ground water supplies.

*Trichosurus vulpecula* were highly mobile with mean home ranges at Hale River of 44.21 ± 22.76 ha and considerably higher than those recorded in previous studies in Australia. Mean home ranges at Irving Creek were much smaller, at 4.99 ± 1.46 ha and
similar to that recorded in other studies in Australia. At both sites, males had larger home ranges and there was a high degree of overlap with other males and females. At the Hale River study site, T. vulpecula predominantly denned in caves or cavities in rocks, whereas at Irving Creek all den sites were in large Eucalyptus camaldulensis on the drainage line. Adult and pouch young sex ratios were at parity. During this study, T. vulpecula was found to breed continuously, with births recorded in almost all months. Growth of the young were more rapid than previously recorded for Trichosurus in Australia. This is interpreted as an adaptation for living in an arid environment, enabling the young to achieve independence before quality food supplies diminish.

No single exotic predator or competitor was solely responsible for the decline of T. vulpecula in arid Australia, implying an interactive impact. Prey switching by dingoes from rabbits to T. vulpecula, macropods and echidnas followed the crash of rabbit populations at Hale River. Predation by dingoes on T. vulpecula was only recorded once, at the Irving Creek study site, where numbers of rabbits remained stable throughout the study. The impact of exotic herbivores occurred through habitat degradation rather than competition.

Evaluation of the ecological data collected during this study generally supports current models of decline and extinction in medium-sized mammals in arid Australia, integrating the effects of predators, competitors, drought and fire. However, the importance of each factor on populations of T. vulpecula was found to vary depending on their location in the landscape. This study suggests two separate models to explain the decline of T. vulpecula in arid Australia after the arrival of Europeans. The first operates in the riparian lowlands and the second on the rocky ranges. In both models, prior to European settlement, T. vulpecula occupied refuge habitats characterised by readily available moisture for plant growth (run on areas and/or shallow water tables) and soils with higher soil nutrient concentrations. The impact of fires on these refugia was minimal, as Aboriginal burning practices protected them with mosaic burning generally preventing large-scale fires from developing. Following European settlement, the forces impacting on populations were different in the riparian lowlands from those affecting rocky ranges.
In the riparian lowlands, the effects of rabbits and livestock together with predation were found to have the major impact on *T. vulpecula* populations. Fire was not a significant factor in these areas.

In the rocky ranges, fire was the most significant factor affecting *T. vulpecula* populations. Introduced herbivores did not degrade these habitats as they did in the riparian lowlands because the rugged and steep nature of the ranges acted as a physical barrier. Similarly, predator numbers were lower because of the relative difficulty in moving over rough ground and the generally lower relative abundance of preferred prey such as rabbits.

An adaptive management strategy needs to be implemented to determine the effects of different management regimes on *T. vulpecula* population viability. The key elements of a management strategy in the riparian lowlands involves the manipulation and monitoring of predators, rabbits and livestock numbers. In the rocky ranges, the key management strategy involves the implementation of a patch burning to prevent fires entering habitats occupied by *T. vulpecula*. Importantly, any management strategies should involve Aboriginal people. *Trichosurus vulpecula* is an important part of Aboriginal culture. Its decline is of great concern to many people and several of the remaining populations and potential reintroduction locations are on Aboriginal land. Because of their relationship with the land and the animals, people have both the knowledge of the animal and the skills (such as patch burning) to provide information to managers which will assist with management.

To achieve these management directions a coordinated national education programme is required to inform and convince the Australian community that conservation of *T. vulpecula* is deserving of attention in arid and semi-arid Australia. This is particularly important given the perception that *T. vulpecula* is a common species throughout Australia, despite its massive decline in arid Australia since European settlement.
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