

**HABITAT SELECTION BY GROUND-FORAGING ROBINS IN
EASTERN AUSTRALIA: SCALE DEPENDENCE AND
HIERARCHICAL SELECTION.**

JARRAD ANTHONY COUSIN

BSc (Zoology)(Botany) *University of Western Australia, Australia*

MSc (Environmental Management) *Edith Cowan University, Australia*

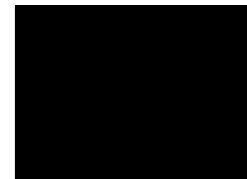
A thesis submitted for the degree of Doctor of Philosophy, University of New
England, Armidale, New South Wales, Australia.

February, 2007

DECLARATION

I certify that the substance of this thesis has not already been submitted for any other degree and is not being currently submitted for any other degree.

I certify that any help received in preparing this thesis, and all sources consulted have been acknowledged in this thesis.



Jarrad Cousin

February, 2007

ACKNOWLEDGEMENTS

A PhD degree really *is* a long and arduous voyage. They always begin by building on an idea and aiming for a destination. You climb on board and ride the waves of success and hold on in waves of despair. Occasionally you stray off course, but in the end you arrive at your destination, and even though it is not quite where you expected to be, it is still a fascinating and inspiring feeling to be there. The journey, as much as it is defined by its destination, is complemented with an enormous set of resources and support crew, without whom the voyage could never have been achieved!

Travelling across the Nullarbor from Perth to Armidale in April of 2003 was a difficult decision. Not only was this transition a hard one personally, but also professionally. Differences in variety of species, topography, species interactions, species ecology, vegetation, landscape morphology, landscape management and climate are just *some* of the factors that I needed to grasp, incorporate and overcome before commencing my PhD. However, these and other challenges I faced were made all that much easier by the friends and colleagues I made while in Armidale.

Firstly, I need to thank my two principal supervisors, Professor Hugh Ford and Dr Veronica Doerr, for all of their inspiration, support and guidance that they provided me, and continue to provide me. Hugh was the initial catalyst for my move to Armidale, with a rich history in woodland bird ecology and conservation fueling the interest I developed during my Masters. Veronica became my supervisor following my research proposal seminar, where my passion for all

things 'robins' saw me propose to research *everything* from fluctuating asymmetry of robins in various sized and quality remnants, to writing a review paper on the Petroicidae!! One of her many comments following that afternoon proposal seminar went along the lines of "...a PhD is a three-year degree. What you have proposed to do in that time represents a career." Without her expertise in avian ecology and patience with me in regards to statistics, I would not be in the same calm state of mind that I am today. Thank you to the University of New England, who provided financial support in the form of a University of New England Research Assistantship (UNERA) scholarship, and the provision of the Grant Initiative Scheme Research Encouragement Award, which provided funding for me to attend and present a spoken paper at the 2005 Australasian Ornithological Conference in New Zealand. Associate Professor Andrew Bennett (Deakin University), Dr Mark Whittingham (Newcastle University, UK) and Dr Richard Major (Australian Museum) not only provided valuable comments in the process of examining the thesis, but also provided constructive suggestions when preparing for publication, for which I am most appreciative.

Thank you also to my family, in particular to Mum and Dad for believing in me and urging me to continue when times were hard, and housing me on my many trips back to Perth. Thanks also to my sister Anouska, and her fiancé Ben for their interest and encouragement also. Thank you Huong for sticking with me through all the hard months while I was on the opposite side of the country. You played one of the biggest parts in me completing my PhD, and I am sorry that I put you through so much over the three years.

Upon arriving in Armidale after the long arduous trip across the Nullarbor, Mary White College became my home. To all of the friends I made over the years at this great place, I thank you. In times of hardship and despair, true friends are those that make the PhD experience easier, and all the better. Thank you in particular to Mark Dollin, Clinton Moore, Jamie Ford, Marko Todoroski, Roweena Singh, Ann Leong, Chris Stone, Hayley Stone, Kate Oliveri, Jean Drayton, Joel Killey, Leah Seed, Rebecca Gerard, Renae Lidman, Stephan Probst, Nicole Fewings, Fabien Fayard, Mel Buenviaje, Lisa-Maree Hudspeth, Ashlee Tribel, Hayley Moore, Chloe Haseltine, Emma Northam, Augusta MacDonald and others. Your times of friendship, support and riveting discussions provided me with inspiration and occasional comic relief. Thank you also to all the staff at Mary White College, especially Nick Hanson, Sally James, Tony Boston, Barb Shaw, Carolyn Coman-Jeffries and Phillip Ward.

Thank you also to all of the people whom have provided support, feedback and advice in the Zoology Department at the University of New England including Stephen Debus, Greg Lollback, Nereda Christian, Stuart Cairns, Nigel Andrew, Keith Cornish and Sandy Higgins. Thank also to my Perth mates for keeping in touch, and those of you who came over to visit, including Ryan Phillips, Sean Tomlinson, Glynn Hughes, Duc Nguyen, Vinh Nguyen, Cameron Hart, Tristan MacAuley, Dion Christie, John Bunn, Rohan Currey, Adam Howe and Ben Piek.

Thank you to all of the landowners of the greater Armidale region who allowed me access to their property, often on multiple occasions, including John Dell (Newholme Research Station), Jeff Ritchie, Susan Newey, Ian Holmes, Laurie Smith, Rob McClanigan, Don and Faye Tulley, Howard Schaeffer, David and

Aida Tibbets, David Kennelly (Thalgarrah Field Studies Centre), Kevin Wilcox, Ian Hamilton, Warren Yeomans, Tony and Janet Gall, Helen Thackway and Chris Stanburg.

Thank you also to the Gerard family (Neil, Michele, Rebecca and Emma) for your incredible hospitality during my thesis write-up in the Christmas holidays of 2006/07. Lastly, thank you to you Rebecca for your love and support over the last few months of my thesis write-up. Your support and encouragement has been incredible, and has made the stress so much easier to bear.

ABSTRACT

Throughout the world, the continued clearing and subsequent fragmentation of native vegetation has resulted in an unprecedented loss of biodiversity. While some species adapt to such habitat change, many others respond unfavorably; declining in distribution and abundance. To understand reasons for this response in such species requires an understanding of the processes governing habitat selection, which operate at multiple spatial and temporal scales. In birds, habitat selection is generally assumed to be hierarchical in nature. An inevitable consequence of such a hierarchical structure is that habitat selection at a given spatial scale is constrained by habitat selection at other spatial scales. Unfortunately, habitat selection studies are often limited in spatial scope, focusing on management units operating at the landscape scale. The problem with this approach is that it assumes a ‘top-down’ model of habitat selection, and focuses on species responses at the coarsest spatial scales (e.g., landscape and remnant scale), while underestimating the importance of responses at fine spatial scales (e.g., foraging microhabitat). Furthermore, it also underestimates the potential for fine scale selection to constrain selection at coarser spatial scales, represented by a ‘bottom-up’ model of habitat selection.

In the present study, I examined habitat selection at four spatial scales in two species of sedentary, ground-foraging birds in northern New South Wales; the Eastern Yellow Robin (*Eopsaltria australis*) and the Scarlet Robin (*Petroica multicolor*). I assessed habitat selection in the two species at the foraging microplot scale (pounce site, 0.3 m x 0.3 m), foraging mesoplot scale (foraging

area surrounding pounce site, 5 m x 5 m), territory scale (represented by 100 m x 5 m transects), and landscape scale (10 km x 10 km). In addition, in an attempt to provide information that might explain why particular foraging microhabitat was selected by the two species, I also investigated the association of microhabitat structure with the abundance of the invertebrate orders that constitute the majority of the robins' diet.

Both species selected their foraging microplot and mesoplot on the basis of habitat attributes that probably maximise the detectability of invertebrates at the microplot scale, rather than selecting foraging microhabitat with specific invertebrate prey. They selected areas with a greater cover of leaf litter, logs and canopy and a reduced cover of plant material which probably allowed greater detectability and chance of capture of epigeic prey. Eastern Yellow Robins selected sites at the mesoplot and territory scales with a greater density of sapling trees, subcanopy trees and a greater density of shrubs at the territory scale. This reflects the important roles that these habitat structural attributes also potentially play in maximising detectability and capture of epigeic invertebrate prey, by providing perches from which robins can search and pounce onto prey. Landscape scale occupancy by Eastern Yellow Robins was governed by selection of remnants with lower perimeter to area ratios, and thus a reduced amount of edge habitat. Edge habitat is typically characterised by reduced tree and shrub recruitment, a reduced cover of leaf litter and logs, and an elevated cover of ground plants and weeds; habitat attributes that are in direct contrast to those selected for by Eastern Yellow Robins at the scale of foraging sites. Selection at the landscape scale is thus potentially constrained

by habitat attributes selected for at the foraging microhabitat and territory scales, suggesting a potential 'bottom-up' model of habitat selection.

While Scarlet Robins are also predominantly ground-foraging, they occupy different habitat from Eastern Yellow Robins and also forage in other habitat strata, so they selected the same microplot habitat characteristics as Eastern Yellow Robins but preferred different habitat attributes at the mesoplot scale. At both mesoplot and territory scales, Scarlet Robins selected sites with a greater cover of leaf litter, and at the mesoplot scale they selected sites with a reduced density of shrubs. These choices allow a greater chance of detection and capture of epigeic invertebrate prey by the Scarlet Robin. At the landscape scale, Scarlet Robins tended to occupy larger remnants. Given that small remnants are usually characterised by degraded habitat (especially the ground substrate), selection for leaf litter at the foraging microplot, foraging mesoplot and territory scale may effectively constrain occupation of remnants at the landscape scale, also suggesting a potential 'bottom-up' model of habitat selection.

I suggest hierarchical habitat selection in the Eastern Yellow Robin and Scarlet Robin potentially operates in a 'bottom-up' manner. Both species select their foraging microhabitat first, in order to maximise detectability of epigeic invertebrates at the microplot scale. This then constrains their habitat selection at coarser spatial scales (e.g., territory and landscape). There are very few examples of ecologists suggesting a 'bottom-up' model of hierarchical habitat selection in the published literature, and species and landscape management plans (e.g., regional plans, catchment management plans etc) are usually

based on 'manageable scales' such as the regional or landscape scale. If hierarchical habitat selection in resident woodland birds is governed by 'bottom-up' processes, management at coarser spatial scales needs to consider the role of finer spatial scale information in constraining such coarse spatial scale selection. Even when coarse spatial scale data is not obviously associated with finer spatial scale attributes (e.g., area-sensitivity of Scarlet Robins), ignoring finer spatial scale information could lead to misinterpretation of the factors governing such coarse spatial scale habitat selection, and less than optimal management of the species.

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