

**No place to go and nowhere to be?
Characterising demography of the
southern scrub-robin (*Drymodes
brunneopygia*) using molecular and
modelling tools for conservation**



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Submitted for the degree of Doctor of Philosophy August 2012

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Thesis summary

In Australia anthropogenic development has resulted in substantial loss and modification of natural habitats. This development has occurred most intensively around the continent's southern and eastern coastal areas where fertile soils and climates appropriate for agriculture are located. Consequently, a diverse range of species found within this region frequently suffer from fragmented distributions that alter evolutionary processes and result in increased population structure and the erosion of genetic diversity. Augmenting the effect of habitat clearing and alteration, climate change is predicted to result in increasing temperature and decreasing rainfall in many regions of Australia. What makes anthropogenic climate change a major threat is that its impact will occur in ecosystems already suffering fragmentation and other perturbations associated with human activity.

This thesis seeks to characterise the molecular demography of the ground-dwelling southern scrub-robin (*Drymodes brunneopygia*), a species whose future is at risk from both habitat loss and climate change. I begin by reviewing the current use and potential role of molecular demography to inform species distribution modelling for conservation. My study of the southern scrub-robin itself begins with the development of microsatellites. Employing these microsatellites, I investigate genetic diversity and recent migration across intact and fragmented mallee vegetation in southern Australia. Our assessment of habitat protection for this species reveals that large areas of contiguous native vegetation are most often conserved toward the climatically extreme, northern distribution of the southern scrub-robin. Conversely, we find that genetic diversity and larger effective population size are concentrated in southern regions, which are dominated by agriculture.

Subsequently I investigate the composition and structure of different mallee understorey vegetation types, and the nature of their resources and risks to dispersing southern scrub-robins in both the historic (pre-clearing) and contemporary landscapes. Landscape types with an open or inaccessible understorey were shown to increase population genetic structure in the southern scrub-robin, in particular chenopod habitat. Conversely, landscape types that offered a dense, accessible understorey structure decreased genetic structuring, possibly due to increased predator protection and foraging

opportunities during dispersal. I proceed by investigating the relationship between genetic diversity and habitat quality at southern scrub-robin home sites. Genetic diversity was diminished by the presence of feral predators and weed infestations, suggesting the control of invasive species should be a conservation priority for the southern scrub-robin. I also confirm the fundamental requirement of a dense shrubby understorey for this species, suggesting that control of feral herbivores may also be of conservation benefit.

Finally, I consider the role that adaptation to change can play in securing the future of the southern scrub-robin in an era of habitat loss and climate change. Simultaneously considering the effects of distance and the environment, I identify substrate and temperature conditions among the most important environmental variables associated with spatial patterns of genetic diversity. To prioritise regions for additional conservation actions, I consider predicted genetic uniqueness, land use, current and future habitat suitability and the amount of pressure existing genetic-climate relationships are expected to experience.

Declaration of Authorship

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution to Jolene Scoble and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968. The author acknowledges that copyright of published works contained within this thesis (as listed below) resides with the copyright holder(s) of those works.

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Scoble J, Lowe AJ (2010). A case for incorporating phylogeography and landscape genetics into species distribution modelling approaches to improve climate adaptation and conservation planning. *Diversity and Distributions*, 16, 343-353.

Scoble JA, Lowe AJ, Gardner MG (2011). Isolation via 454 sequencing, and characterisation of microsatellites for *Drymodes brunneopygia*, southern scrub-robin (Aves: Petroicidae): a species at risk due to substantial habitat loss and climate change. *Conservation Genetics Resources*, 4, 331-333.

I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library catalogue, the Australasian Digital Theses Program (ADTP) and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Jolene Scoble

August 2012

Cover photo: *Drymodes brunneopygia* (southern scrub-robin). Photo courtesy of Matt Goulton.

Thesis acknowledgements

Completion of this thesis would not have been possible without the support of my many supervisors. Thank you to Andy Lowe for assisting with my difficult transition to molecular biologist, and helping me to become a more independent and confident scientist; to Mike Gardener for his time, patience and knowledge around molecular lab work and analyses, to Anita Smyth for her constant confidence in me and modelling expertise; to Leo Joseph for his keen interest in helping me develop my writing style; and to Peter Cale for being my sounding board in the field and helping me to not take myself too seriously.

Special thanks are also in order to some collaborators on my PhD. Wally Klau's mentorship around bird capture and banding enabled me to obtain my student license and work independently. Nigel Willoughby from the Department of Environment and Natural Resources helped me find my feet both in the Murray Mallee and with the southern scrub-robin. Kathy Saint from the University of Adelaide, Alison Fitch from Flinders University and Ralph Foster from the Museum of South Australia were all incredibly supportive of me in the lab. Bert Harris from the University of Adelaide was an immense help to me with his never-ending patience and cheerfulness throughout our modelling collaboration. Kristen Williams from CSIRO was a knowledgeable and patient collaborator with my last modelling manuscript toward the end of my PhD, when time was of the essence.

I would also like to thank my fellow PhD students, whose friendship, skills and knowledge were always available to me, and made my PhD such a positive experience. I would like to make particular mention of my fantastic and ever supportive lab group, especially those who shared my corner of the office, Elly Dormontt and Martin Breed, and also Fran (Phyllis) MacGillivray. To the ladies who lunched, Kym Abrams and Christina Adler, and the many people who eventually joined us, thank you for making the Darling building a more social and friendly place.

This project would have been impossible without the generous funding made available by CSIRO (Climate Adaptation Flagship), Department of Environment and Natural Resources in South Australia

(Wildlife Conservation Fund), Sir Mark Mitchell Research Foundation, Birds Australia (Stuart Leslie Bird Research Award) and Australian Geographic Society. I would also like to thank the many organisations and people who welcomed me onto their properties, including Calperum and Taylorville sanctuaries (Australian Landscape Trust), Gluepot Reserve (Birds Australia), Yookamurra and Mt Gibson sanctuaries (Australian Wildlife Conservancy), Brookfield conservation park (Conservation Volunteers Australia), and the many reserves cared for by the Department of Environment and Natural Resources, South Australia and Department of Environment and Conservation, Western Australia.

Lastly, I would like to acknowledge all my volunteers for giving their time so generously to my make project a reality. In particular I would like to thank Matthew Goulton, the one volunteer silly enough to stick around and become my husband. You were my hero during the good times and the tough times alike, and gave me the encouragement and support I needed to see this PhD through to the end.