Ecology of warru
(*Petrogale lateralis* MacDonnell Ranges race) in the Anangu Pitjantjatjara Yankunytjatjara Lands, South Australia

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Declaration

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Abstract

Australia has one of the world’s worst rates of mammal extinctions, accounting for about one third of the mammal species that have become extinct in the world since 1600 (Burbidge and Manly 2002). Most of these documented declines and extinctions have been concentrated towards mammals in the arid-zone of central Australia. In South Australia (SA), one of the arid-zone species that has undergone substantial declines in range and abundance is the black-footed rock-wallaby, *Petrogale lateralis* (MacDonnell Ranges race). Animals are now restricted to the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands in the state’s far northwest, where there remain two known metapopulations. The decline of this race, which is known as „warru” by Western Desert Indigenous people, is presumed to have been precipitated by introduced predators. However, in order to exclude other potential causes and establish if recovery is feasible, the current project investigated the ecology of warru in the SA APY Lands.

In order to make inferences about the habitat and environmental conditions that best facilitate warru persistence, a modelling approach at multiple spatial scales was used. At a landscape scale, warru presence was correlated to geology, slope, soil type and elevation. At a finer scale, fieldwork established that a number of parameters, including aspect, vegetation, rock complexity and refuges’ physical characteristics were important determinants of warru presence and use. The work presents the first analysis of *P. lateralis* habitat requirements.

To establish animals” use of this preferred habitat, the thesis provides preliminary data on warru home range and movement patterns. Unfortunately, catastrophic failure of Global Positioning System collars meant that data were limited to those from one adult female in one month. Nevertheless, during this time, the animal had a larger than expected home range and undertook a number of long-range movements, including a sojourn off the hill. These results have implications for management, including predator and fire management strategies.

An investigation of the genetic structure of animals in the three largest-known warru colonies indicated that all colonies are genetically diverse, with levels of heterozygosity approximating expected values. All three also exhibited substantial population structuring, with genetic groups correlating to geographic colonies. However, there was also evidence for sub-structuring being present within one of the colonies and for migration occurring into two
colonies, with approximately 5% of sampled individuals having mixed ancestry. An analysis of the parentage of offspring indicated that warru have a polygamous mating structure, although one instance of intra- and inter-year monogamy was also established.

Population modelling was used to provide an estimate of the sizes of each of the three studied colonies. Combined with recent aerial survey data, these data suggested that there are likely to be fewer than 200 warru remaining in SA. However, all three colonies showed signs conducive to potential recovery, including high average reproductive rates, even sex ratios and high adult survivorship (>75%). Juvenile survival, however, was significantly lower (51%) and positively correlated with winter rainfall, indicating that access to water is important during the drier winter months.

The potential for warru recovery was supported by an analysis of warru blood chemistry in both the wild and captive colonies. The latter was established as part of the recovery program and aimed to produce animals for in-situ supplementation and reintroduction. In 2009, when blood samples were taken, warru colonies did not manifest with results that are indicative of population-wide disease. However, the biochemical parameters of animals in one of the in-situ colonies, „New Well”, suggested some level of nutritional and water stress. This suggests that managers could consider providing warru at New Well with supplementary food and water during drought, and/or using fire to promote vegetational diversity. The study presents the first detailed haematological reference values for P. lateralis and potentially, a methodology for other threatened species recovery programs to follow in order to establish the health of their populations.

The current results have implications for management of both the in- and ex-situ warru populations. For example, results pertaining to habitat selection can be used to guide selection of appropriate reintroduction sites. Overall, results indicate that although the extant colonies have small population sizes, the animals therein have high reproductive rates, are not suffering the effects of disease and are genetically diverse. The rock-wallabies” polygamous mating strategy is also likely to continue to facilitate this genetic diversity. Furthermore, although warru have specific habitat preferences, they have the capacity to disperse to surrounding available habitat. Overall, this suggests that, given appropriate management, warru recovery is feasible. Some of these data may also be pertinent for management of P. lateralis in the Northern Territory and Western Australia.
When conditions were...still virgin...both the mammal fauna and the aboriginal population being virtually undisturbed, (*P. lateralis* MacDonnell Ranges race) was one of the commonest mammals...with swarming populations in many of the rocky outliers of the main ranges. Hedley Finlayson, 1961

Warru has been here for a long time, before us, and they should be in our lands because they are Traditional Owners too. Alice Springs are responsible for their warru, we are responsible for ours. We want to see them back in all places where they used to be. And not just warru, we should bring back ninu, mala, stick-nest rat and possum too. All of them.

Frank Young, Traditional Owner, APY Land Management

Warru Recovery Team Logo by Amanyi Haggie, Traditional Owner, Pukatja, APY Lands.

The painting depicts warru, the puli and kulpi in which warru live and piranpa scientists and Anangu working together to conserve warru.
Acknowledgements

Approval to undertake this project was granted by the APY Lands Executive Board, Department of Environment and Natural Resources Wildlife Ethics Committee (15/2007) and University of Adelaide Animal Ethics Committee (S-002-2008).

Fieldwork was conducted entirely on Indigenous land and I would like to thank the Traditional Owners of the APY Lands for not only supporting the project, but taking an active interest in it. Special thanks to warru minyma – Dora Haggie, Tjariya Stanley, Inpiti Winton, Nyinguta Edwards, Malpiya Davey, Margaret Winton and Josephine Mick. Tjilpi tjuta to thank include Donald Fraser, Thomas Tjilya and Frank Young. Special thanks to Eric Abbott, who was a great friend, superb navigator, fantastic language teacher and unfailingly interested in the sometimes confounding piranpa work. I feel truly privileged that these people generously shared their time, knowledge, laughter, language and culture with me.

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Undertaking a project in remote areas is expensive and I am extremely grateful to the following for providing financial support – ANZ Holsworth Wildlife Research Endowment, Department of Environment and Natural Resources Wildlife Conservation Fund, Field Naturalists’ Society of SA (Lirabenda Endowment Fund), National Geographic Society (Committee for Research and Exploration), Nature Foundation SA and the Norman Wettenhall Foundation. I also appreciated the work of Sandra Moss and John Grenfell from ZoosSA in managing this grant money.

Since this project is closely linked to the broader warru recovery program, I would also like to thank the following organisations that provided financial and in-kind support to the recovery efforts - Alinytjara Wiluṟara NRM Board, Aŋangu Pitjantjatjara Yankunytjatjara Land Management, the Department of Environment and Natural Resources (SA) and the Department of Sustainability, Environment, Water, Population and Communities.

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negotiate the challenge that is working on remote Indigenous land and for making me tell a story ;o) I also wish to acknowledge Assoc. Professor Bill Breed’s significant contribution in reviewing drafts and providing moral support, especially given that he was not an official supervisor. My gratitude also extends to members of the Warru Recovery Team for sharing their knowledge and enabling me to make a contribution towards conserving this race.

The fieldwork aspect of this project required hard physical work and some hair-raising bouldering in an extremely remote area for a longer stint than „normal“ fieldwork. And, most often, all of this without even seeing warru! My sincerest gratitude is therefore extended to the following fieldwork volunteers and assistants – Eric Abbott, Colin Bailey, Elijah Bravington, Nadine Brown, Anika Dent, Caragh Heenen, Dragos Moise and Nathaniel Staniford. Thank you also to those who collected samples and data on my behalf – John Read, Anika Dent, Jason van Weenen, Reece Pedler and vets Ian Smith, David McLelland and Wayne Boardman. Thank you to APY Land Management for assisting with fieldwork logistics, particularly Anika Dent and Thalie Partridge.

On a personal note, I extend my sincere gratitude to my family and friends. Thank you for sticking through it with me, reminding me that I can achieve it and providing valuable „out“ time. Thank you to Joel for your contribution, especially for encouraging me to begin and supporting me in the initial stages. Thank you to Glenn and Irena for all of your support, both in the past and during this journey. Thanks Nat for your significant contribution in the latter stages of this work. My gratitude also to Jasmin, Graham and Ori, Bec D. and family, Kami, Bisty, Tom and Bridget, Shanelle and James and their littlies. I would also like to thank the Waite library staff for providing an invaluable „quiet place“ for writing up.

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<table>
<thead>
<tr>
<th>Pitjantjatjara/Yankunytjatjara</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anangu</td>
<td>term used by Indigenous people of the Central Desert to refer to themselves</td>
</tr>
<tr>
<td>Anangu Pitjantjatjara Yankunytjatjara</td>
<td>traditional land in north-western South Australia that is owned by Anangu</td>
</tr>
<tr>
<td>kulpi</td>
<td>cave, cavern, shelter</td>
</tr>
<tr>
<td>minyma</td>
<td>female Indigenous elders</td>
</tr>
<tr>
<td>piranpa</td>
<td>white (non-Indigenous) people</td>
</tr>
<tr>
<td>Pitjantjatjara</td>
<td>one of the two main Indigenous languages spoken on the APY Lands</td>
</tr>
<tr>
<td>puli</td>
<td>hill</td>
</tr>
<tr>
<td>tjilpi</td>
<td>male Indigenous elder</td>
</tr>
<tr>
<td>warru</td>
<td>black-footed rock-wallaby, <em>Petrogale lateralis</em> MacDonnell Ranges race</td>
</tr>
<tr>
<td>Yankunytjatjara</td>
<td>one of the two main Indigenous languages spoken on the APY Lands</td>
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