IMPROVING MAMMALIAN REINTRODUCTION SUCCESS IN THE AUSTRALIAN ARID ZONE

Katherine Elizabeth Moseby

School of Earth and Environmental Science, Faculty of Science
The University of Adelaide

Thesis submitted for the degree
Doctor of Philosophy

June 2012
Thesis Declaration

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 Katherine Moseby 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. 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.

Moseby, K.E.\textsuperscript{1,2}, Read, J.L.\textsuperscript{1,2}, Paton, D.C.\textsuperscript{2}, Copley, P.\textsuperscript{3}, Hill, B.M.\textsuperscript{4} and Crisp, H.M.\textsuperscript{1} (2011). Predation determines the outcome of 11 reintroduction attempts in arid Australia. \textit{Biological Conservation} \textbf{144}, 2863-2872.

Moseby, K.E.\textsuperscript{1,2} and Hill, B.M.\textsuperscript{4} (2011). The use of poison baits to control feral cats and red foxes in arid South Australia I. Aerial Baiting Trials. \textit{Wildlife Research}, \textbf{38}, 338-349.

Moseby, K.E.\textsuperscript{1,2}, Read, J.L \textsuperscript{1,2}, Galbraith, B.\textsuperscript{1}, Munro, N.\textsuperscript{5}, Newport, J.\textsuperscript{5} and Hill, B.M.\textsuperscript{4} (2011). The use of poison baits to control feral cats and red foxes in arid South Australia II. Bait type, placement, lures and non-target uptake. \textit{Wildlife Research} \textbf{38}, 350-358.

Moseby, K.E.\textsuperscript{1,2}, Neilly, H.\textsuperscript{6}, Read, J.L.\textsuperscript{1,2} and Crisp, H.A.\textsuperscript{1} (2012). Interactions between a top order predator and exotic mesopredators. \textit{International Journal of Ecology} Article ID 250352, doi:10.1155/2012/250352.

Moseby, K.E.\textsuperscript{1,2}, Cameron, A.\textsuperscript{7} and Crisp, H.A.\textsuperscript{1} (2012). Can predator avoidance training improve reintroduction outcomes for the Bilby (\textit{Macrotis lagotis}) in arid Australia? \textit{Animal Behaviour} \textbf{83}(4) 1011-1021.

\textsuperscript{1} Arid Recovery, P.O. Box 147, Roxby Downs, Australia, 5725.
\textsuperscript{2} The University of Adelaide, North Terrace, Adelaide, Australia, 5005.
\textsuperscript{3} The South Australian Department for Environment and Natural Resources, G.P.O. Box 1047, Adelaide, Australia, 5000.
\textsuperscript{4} The Northern Territory Department of Natural Resources, Environment, the Arts and Sport, P.O.Box 496, Palmerston, Darwin, Australia, 0831.
\textsuperscript{5} Fenner School of Environment, The Australian National University, Canberra, Australia, 0200
\textsuperscript{6} 118 Utah Drive, Moranbah, Queensland, Australia, 4744
\textsuperscript{7} Queensland Department of Environment and Heritage Protection, Kabool Road, West Burleigh Queensland, Australia, 4221

Signed_______________________________________________
# Table of Contents

1. CHAPTER ONE : Literature review and contextual statement 8
   1.1 Mammalian extinctions in arid Australia 8
   1.2 Mammalian reintroductions 11
      1.2.1 Criteria for success of mammalian reintroductions 12
      1.2.2 Intrinsic factors affecting reintroduction success 13
      1.2.3 Extrinsic factors affecting reintroduction success 16
      1.2.4 Post-release monitoring 18
   1.3 Contextual statement 18
      1.3.1 The influence of predation 20
      1.3.2 Improving reintroduction protocols 21
      1.3.3 Predictive tools for post-release monitoring 23
      1.3.4 Conclusion 23
   1.4 Study Area 24
      1.4.1 Arid Recovery Reserve 24
      1.4.2 Wild West Zone 29
      1.4.3 Dingo Pen 30
   1.5 Study Species 30
      1.5.1 Greater stick-nest rat (Leporillus conditor) 30
      1.5.2 Greater bilby (Macrotis lagotis) 31
      1.5.3 Burrowing bettong (Bettongia lesueur) 32
      1.5.4 Western barred bandicoot (Perameles bougainville) 33
      1.5.5 Feral cat (Felis catus) red fox (Vulpes vulpes) and European rabbit (Oryctolagus cuniculus) 34

2. CHAPTER TWO: Predation determines the outcome of 10 reintroduction attempts in arid South Australia. 36
   2.1 Introduction 38
   2.2 Methods 40
      2.2.1 Study sites 40
      2.2.2 Reintroductions 42
      2.2.3 Monitoring 43
      2.2.4 Success criteria 45
   2.3 Results 48
      2.3.1 Main Exclosure reintroductions 48
      2.3.2 Red Lake reintroduction 50
      2.3.3 Wild West reintroductions 50
   2.4 Discussion 52
   2.5 Acknowledgements 55
   2.6 References 56

3. CHAPTER THREE : The use of poison baits to control feral cats and red foxes in arid South Australia.
   I. Aerial baiting trials. 61
6. CHAPTER SIX: Can predator avoidance training improve reintroduction outcomes for the bilby? 131

6.1 INTRODUCTION 133

6.2 METHODS 135
   6.2.1 STAGE ONE - predator free environment 135
   6.2.2 STAGE TWO - predators present 140

6.3 RESULTS 141
   6.3.1 STAGE ONE - predator free environment 141
   6.3.2 STAGE TWO - PREDATORS PRESENT 147

6.4 DISCUSSION 149
   6.4.1 STAGE ONE - predator free environment 149
   6.4.2 STAGE TWO - Predators present 151

6.5 ACKNOWLEDGEMENTS 153

6.6 REFERENCES 153

7. CHAPTER SEVEN: Do release protocols influence translocation outcomes when predation risk is low? 156

7.1 Introduction 158

7.2 Methods 160
   7.2.1 Study Site 160
   7.2.2 Reintroductions 161
   7.2.3 Soft versus hard release burrowing bettongs 163
   7.2.4 Soft versus hard release of captive and wild greater bilbies 164
   7.2.5 Captive bred versus wild stick-nest rats 164

7.3 Results 166
   7.3.1 Hard versus soft released burrowing bettongs 166
   7.3.2 Hard versus soft released bilbies 168
   7.3.3 Captive-bred versus wild stick-nest rats 170

7.4 Discussion 172
   7.4.1 High predation risk 173
   7.4.2 Ethical grounds 173
   7.4.3 Unbounded release sites 174
   7.4.4 Social or sedentary life history strategies 174
   7.4.5 Supplementation 175

7.5 Conclusions 176
8. CHAPTER EIGHT: Keep on counting: The importance of long term post release monitoring in reintroduction programs

8.1 Introduction

8.2 Methods
   8.2.1 Study site
   8.2.2 Reintroductions
   8.2.3 Population monitoring
   8.2.4 Variables
   8.2.5 Data analysis

8.3 Results
   8.3.1 Rainfall
   8.3.2 Track abundance
   8.3.3 Rate of increase
   8.3.4 Explanatory variables

8.4 Discussion

8.5 Conclusions

8.6 Acknowledgements

8.7 References

9. CHAPTER NINE: Conclusions

9.1 Guiding Principles

9.2 Limitations Of My Research

9.3 Directions For Further Research

9.4 Arid Zone Mammal Decline

10. ACKNOWLEDGEMENTS

11. BIBLIOGRAPHY
Abstract

The Australian arid zone has the highest recent mammal extinction rate in the world with most species in the critical weight range of 35 g to 5.5 kg now regionally or globally extinct. Reversing arid zone mammal decline has become a major focus for conservation organizations and reintroduction programs are a common tool in species recovery. Unfortunately, reintroduction success in Australia is low and predation from introduced cats and foxes is commonly cited as the cause of reintroduction failure. In this thesis, I aimed to improve reintroduction success in the arid zone by exploring predation, release protocols and post release abundance at the Arid Recovery Reserve in northern South Australia. Firstly, I attempted to reintroduce threatened mammal species into both a predator free area and one where predators were controlled. Results suggested that successful reintroductions only occurred when cats and foxes were excluded. I then tested different predator reduction strategies to determine if reintroduction success could be improved, including aerial baiting, strategic bait placement and the use of a native top-order predator. Although the use of dingoes to control foxes and cats showed promise, I was unable to improve reintroduction success using poison baiting as it did not significantly reduce feral cat abundance.

I investigated the role of release strategies on reintroduction success and conducted predator avoidance training, soft and hard releases and using captive versus wild stock. Predator avoidance training did not assist long term reintroduction success of the bilby but some behavioural differences were detected. Results suggest that Australian arid zone species may be able to learn predator avoidance behavior but this may not necessarily translate into improved reintroduction outcomes. The use of soft and hard releases and captive and wild stock had little effect on reintroduction success when cats and foxes were excluded. Interspecific differences in post-release mortality and behaviour indicated that soft releases may be useful at unrestricted release sites, in situations of high predation risk and where social, sedentary species which invest heavily in their shelters are being released.

Finally, I analysed long term monitoring data for four reintroduced threatened species to determine whether factors such as rainfall, time since release or temperature influenced post-release population fluctuations. Factors significantly influencing abundance included the Indian Ocean Dipole and temperature. Time since release was still the most important factor influencing abundance even 10 years after release indicating that reintroduced populations may not stabilize for decades and long term monitoring is essential.

Regardless of reintroduction protocols, new methods of broadscale cat control are required before broadscale reintroduction success can be improved in the Australian arid zone. Present control methods are insufficient to enable successful reintroductions of cat-sensitive mammal species without exclusion fencing. However, exclosures are relatively small and expensive, and can create problems such as overstocking. Future arid zone reintroductions should focus on broadscale reintroductions without fences to ensure widespread recovery but this will require the development of improved cat control methods. Species-specific predator thresholds are also needed to trigger management actions and improve the predictability of reintroduction outcomes.