

**Population decline in the endangered grassland
earless dragon in Australia:
Identification, causes and management**

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A thesis submitted in fulfillment of the requirements of the Degree of
Doctor of Philosophy at the University of Canberra.

September 2010

Abstract

Identifying species under threat from extinction and what is driving their decline is vital to biodiversity conservation. Currently, lizard populations worldwide are under serious threat with widespread declines and predictions of multiple extinctions through climate change. No reptile extinction has been recorded in Australia since European settlement. Yet, emerging signs indicate that Australian reptiles are facing major threats from habitat fragmentation and other extinction forces. Contractions in the distribution of Australian reptiles are well documented with 25 percent of the country's reptile fauna nominated by conservation agencies and individuals as warranting threatened status and requiring management. One of the most highly endangered lizards in the Australian Capital Territory (ACT), *Tympanocryptis pinguicolla* (grassland earless dragon), is facing range contraction from habitat loss and fragmentation, caused by agricultural and urban development. *Tympanocryptis pinguicolla* are of particular concern because they are native temperate grassland specialists, a habitat type of which only 0.5% of the pre-1770 area in southeastern Australia remains in a semi-natural condition. It is currently unclear if the remaining populations of *T. pinguicolla* are stable or if contraction is continuing.

In this thesis I report on the ecology of *T. pinguicolla* using long term mark recapture sampling at two locations: Jerrabomberra West and Majura, and re-sampling of ten former survey sites across the ACT. I compare historic population survey data to that collected for this thesis using a one-tailed sign test to estimate declines in population sizes across the ACT. I also used an exponential growth state space model to estimate population trends at Jerrabomberra West and Majura. In addition multistage mark recapture (MSMR) models were used to estimate population sizes and survival rates of *T. pinguicolla* at these two locations. A gradual non-significant decline in population sizes of *T. pinguicolla* was observed across all sites from 1995 followed by a dramatic reduction (88%) from 2006 at the most densely populated site (Jerrabomberra West). Annual survival at that site was estimated to be low (0.017 to one year of age and 0.024 to adulthood) over the three years of the study. Of the ten sites at which *T. pinguicolla* were previously known to be present, four (40%) contained no trace of the lizards, despite extensive survey.

To further understand what was driving these declines I conducted a Population Viability Analysis (PVA). Reproductive parameters for the PVA were informed using past survey data combined with data collected as part of this thesis work. Based on four discovered nests, clutch size was considered comparable to closely related agamids (5–7), with small (24 mm snout–vent length, 0.62 g) hatchlings and single clutches per year. In addition *T. pinguicolla* diet was examined using Schoener’s overlap index for differences between sites and electivity.

Tympanocryptis pinguicolla feed on invertebrate prey, selecting for a small number of orders such as Coleoptera (beetles) and Lepidoptera (butterflies and moths, including larvae). Using this survival and reproductive data to build the PVA, I showed that the Jerrabomberra population had a very high probability (100%) of extinction within ten years and that the parameters most likely to be driving this decline were juvenile survival and fecundity. Taken together, these data suggest a regional decline in *T. pinguicolla* that places the species in grave jeopardy of extinction. The key extinction factors for *T. pinguicolla* are likely to include extreme drought conditions, coincident with over grazing and habitat fragmentation.

The power of monitoring grids (each comprised of 56 artificial shelter burrows) to detect *T. pinguicolla* was also assessed. I combined the use of zero inflated models with the proportion of traps occupied at a location to determine the number of shelter burrows required to have a given probability of detecting the species if it is present. Three-visit detection probabilities for *T. pinguicolla* were low at the beginning of the six week sampling period (February – March) (0.12–0.22) but reached levels (up to 0.5) comparable with the few other lizards for which detection probability have been estimated. In the situation where population density was at its lowest, 26 artificial burrows are needed to be checked for six weeks (18 checks) from February into March to have a 50% confidence of detecting the species if it is present. This rises to 167 burrows checked over the same time period for 99% confidence of detection. Once the established confidence rises above 60%, surveying over a longer time period results in a decrease in the trap days (number of artificial burrows multiplied by the number of checks). Given that the timing of the sampling period is one of the most important factors when trying to increase detection, moving the trapping to later in the summer may increase detection success.

Overall, these data suggest that this is a species for which the effects of habitat fragmentation and destruction and drought are a real threat. They are clearly still declining within the Canberra region, and if nothing changes, the effects of low fecundity and juvenile survival will drive the populations to extinction within ten years. With low population densities a large effort survey is required but this will be necessary if we want to inform the life history parameters around fecundity for which we currently have little data and we need most to focus on if we are to better model these populations.

Acknowledgements

It's not the destination it is the journey, and what a journey it has been! I started my candidature single, incredibly homesick, knowing only two people in Australia and relatively broke. I have finished with an amazing husband, a new home, a fantastic group of like-minded friends and still relatively broke. In addition I have gained knowledge, not just about a species foreign to me, but on the ecology of a whole new continent! For all this I have a lot of people to thank. With five years of journeying there are many people who have touched my life and my research, please do not feel left out if my failing memory relieves me of your name, know you were part of it and I am appreciative.

Thank you *Kia Ora*

First to my supervisors Stephen Sarre and Will Osborne, thank you seems such an inadequate word to describe my gratitude for your support and encouragement. Even in the face of my, at times, clear ignorance you were kind and understanding. Thank you Will for your tireless hours in the field, you taught me more than just what my thesis entailed. Steve you helped open my eyes when all I could see were the details, I have learnt a lot from just following your example. If imitation is the sincerest form of flattery, I hope you are both flattered as I strive to emulate your skills in research and teaching. I'd also like to make a special thanks to Bernd Gruber and Murray Evans. Bernd, your advice with both statistics and computer modelling have really helped get me through, thank you for putting up with me both in Germany and Australia. Murray, your generosity in lending people, time, data and advice has been invaluable; I can only hope the benefit was mutual.

To all the members of the Institute for Applied Ecology (and AERG): Over the years I have worked with, or for, almost all of you and you have made my education a more well rounded one for it. In particular thanks to the other post graduate students, some who have shared a room with me over the years and had to put up with my crazy ramblings at the computer, you have made my stay here an experience not to forget. Thanks to Marion Hoehn, Don Fletcher, John Roe, Christy Davies, Ben Corey, Erika Alacs, Katarina Mikac, Alex Quinn, Martha Rees, Anna MacDonald,

Michael Jensen, David Wong, Carla Eisemberg, Kate Hodges, Larissa Schneider, Matt Young, Maria Boyle and Stewart Pittard. It has been an honour to share this journey with you.

Congratulations Anett Richter, *Frau Doktor*, my co-grassland researcher who helped teach me grasses I would never have learnt by myself. I would also like to thank those others who have given me advice and helped keep me in the real world particularly Niccy Aitken and Tony Buckmaster, I am grateful to call you friends. Lastly, but by no means leastly, the office staff, whom were much needed and appreciated arrivals in my candidature, especially Kerrie Aust, you all made the road much smoother.

None of this work would have been possible without all the help from my countless volunteers who tirelessly searched burrows, checked tubes and kept me company. Special thanks to Elliot Osborne for knowing what to do and getting on with it, even when the going got tough, your reliance at times was my rescue. Toni Stevens, Berlinda Bowler, Lesley Ishiyama and Sam Walker, it has been a pleasure working with all of you, I learnt a lot about giving direction but also on taking advice. A lot of data would never have been collected without you. Thanks must go to all the staff at ACT Parks Conservation and Lands who first led me and were later led by me, in and out of the grasslands over the last five years. To the IAE technical staff, my field work was much facilitated by your generous and practical advice and assistance. To James Dawson, Dave Hunter (both with NSW Department of Environment and Climate Change) and Art Langston (CSIRO) thank you all for your time, giving me both advice and data. For site access thanks to Department of Defence and Canberra Nature Parks staff and to the Margules family from Bonshaw, Louis was a great source of information and encouragement and will be sorely missed.

I would not be here if it weren't for my family. I mentioned in my last thesis you were waiting for me to enter the 'real world', it seems somewhere along the line I realised this is my real world and without you I would never have made it. Thank you Grandad Dimond for first introducing me to the real world on our walks in Albany, Dad for never letting me stop asking why and Mum for always making home home when the real world got too much. Little bro, thank you for reminding me not all words need to have three syllables to be meaningful. It is to my grandparents, past and present that I dedicate this work.

Finally, there is one person above all who has put up with me through all the highs and lows and still loved me. John Couch has been supportive beyond belief. I don't know if you understood what you were getting into when you met me but I could not be more grateful that coming to Australia brought me to you. It would not be an understatement to say that without you I would never have completed; you made the mountains look like mole hills but made sure I took seriously the important things. Thank you for the little things as well as the big, the cups of tea, the dinners, the wedding.

To everyone, like all things, it hasn't all been very "choice bro" every step of the way but your kindnesses, encouragement and problem solving has helped me forget the not so choice parts and learn the lessons I needed.

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