Effects of global climate change on an abundant and widely distributed reptile (*Amalosia lesueurii*)

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Certificate of Original Authorship

I, Santiago Cuartas Villa declare that this thesis is submitted in fulfilment of the requirements of the degree of Master in Science (Research) in the School of Life Sciences, Faculty of Science, at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualification at any other academic institution. This research was supported by the Australian Government Research Training Programme.

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Santiago Cuartas Villa

25th November 2019

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As John Donne said “No man is an island”, and I am not the exception. If I am here, finishing my Master of Science is because I am standing on giants shoulders. Those giants, those pillars that have brought me all the way to this desired fulfilment have been a long list of people and situations and I wanted to mention them all here, as without their contribution it would not have been achievable.

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Preface

The main body of this thesis consists of four chapters, including two data chapters that are ready to submit. I have therefore formatted each chapter to general guidelines of ecology journals. This has caused some unavoidable repetition in the species description, and background information in some of the chapters.

At the beginning of each chapter, I have acknowledged all authors involved, in the same order as they appear in the manuscripts soon to be submitted. In all of the chapters, I am listed as the first author and was primarily responsible for conceiving, designing and implementing the research and writing the manuscripts.

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Abstract

Reptiles are susceptible to changes in climate because their physiology and behaviour is strongly influenced by temperature. However, reptiles may adapt to shifts in climate migrating to new areas or altering their nesting behaviour in ways that buffer embryos from thermal stress. In this thesis, I investigated geographic variation in nest site selection in the velvet gecko (*Amalosia lesueurii*), a widely distributed and abundant lizard species. To assess how this species might shift its geographic range in future, I modelled the species current and future distribution using the algorithm MaxEnt.

To examine plasticity in species' nest-site selection, I compared the thermal regimes, physical structure and incident light variables of nests in two geographically distant populations (Morton National Park and Yengo National Park). I found strong positive correlations between air temperatures and nest temperatures, with temperatures in some nests exceeding the species' critical thermal maximum during summer heatwaves. Both populations differed in the physical structure, incident light and thermal characteristics of nest sites, so that mean nest temperatures did not differ between locations. Notably, females from the southern population selected more open nest sites than females from the northern population, suggesting that females can adjust nest-site choice to suit local environments. However, nests in the northern population experienced much higher daily maximum temperatures than nests from the southern population, which could have negative consequences for hatching success during hot summers.

To predict the geckos' future distribution, I used a correlative modelling approach in MaxEnt. Modelling showed that the species has a high predicted occurrence across the Sydney Basin, the New England Tablelands, and the southern part of New South Wales (NSW) North Coast. The most important predictor variable in my models was the mean temperature of the warmest quarter. Potentially, the effects of air temperatures on the embryonic life stage may influence the species distribution. The species is predicted to suffer range contractions under future climatic conditions for every emission scenario. The greatest losses are likely to occur around the Sydney Basin region and New England Tablelands. Loss of the velvet gecko from the Sydney region would have serious consequences for the persistence of the vulnerable broad-headed snake (*Hoplocephalus bungaroides*) which relies on geckos as the main food source. My study gives an insight of the threats and general effects of the rising temperature on an abundant and widely distributed Australian reptile.