Shelter aggregations, social behaviour, and seasonal plasma corticosterone levels in captive and wild Duvaucel's geckos, *Hoplodactylus duvaucelii*

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Manuela Barry

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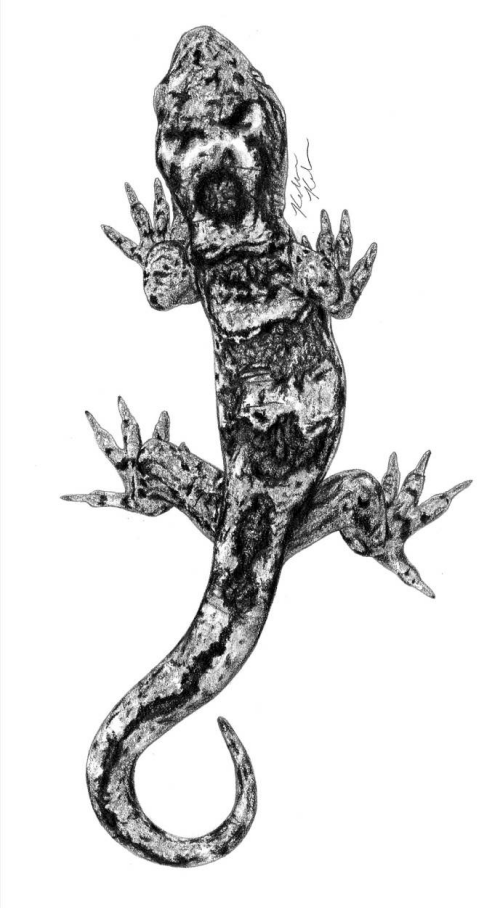

“Whatever you do will be insignificant,
but it is very important that you do it. “

Mahatma Gandhi (1869 - 1948)

Abstract

The development of effective conservation management strategies is reliant on a thorough understanding of the basic biology and life history of the species of concern. New Zealand's endemic herpetofauna species have undergone severe range contractions since human arrival due to habitat modifications and predation by introduced mammalian pests. Current conservation management practice involves the eradication of such pests as well as the restoration of habitat involving native species reintroductions. Albeit these conservation attempts, detailed information on physiology, ecology and behaviour of most New Zealand's lizards is scarce, including the Duvaucel's gecko (*Hoplodactylus duvaucelii*). In recent years, several *H. duvaucelii* have been translocated to islands within their historical range as part of restoration projects and in 2006/7 a captive breeding-for-release programme has been established. This provided an excellent opportunity to explore some fundamental aspects of *H. duvaucelii's* basic physiology and behavioural ecology. I investigated seasonal plasma corticosterone concentrations of captive and wild geckos in relation to several physiological and ecological factors to enhance our understanding of natural fluctuations of seasonal hormone patterns. Such information can aid in evaluating stress related changes in hormone patterns of individuals and populations, which is particularly relevant for the captive management. I compared plasma steroid hormone patterns of captive geckos from a breeding colony with their wild source population over several seasons to assess whether captive lizards suffered from chronic stress, which could compromise their wellbeing and the fitness of future offspring. Further, I explored several aspects of *H. duvaucelii's* social behaviour, including diurnal shelter aggregations, scent communication and social interactions using experimental and exploratory studies on captive and wild geckos. The hormone study provided evidence that *H. duvaucelii* are suitable for captive breeding as they seem to have adapted well to captivity and did not show a chronic elevation of stress hormone levels. Moreover, my research has shown that *H. duvaucelii* are essentially social lizards that form shelter aggregations year-round. Adults showed a high tolerance of juveniles in their diurnal shelters and geckos were able to detect and discriminate scents from conspecifics in several social contexts. These social traits as well as the year-round occurrence of male-female pairs combined with *H. duvaucelii's* life history traits suggest that this species may possess a social system of high complexity. In conclusion, this dissertation provides a foundation for future research and delivers the first insight into the social behaviour and basic endocrinology of this New Zealand endemic lizard.

Foreword

This dissertation explores some fundamental aspects of the endocrinology and behavioural ecology of *Hoplodactylus duvaucelii,* a New Zealand endemic gecko. Chapter One introduces the reader to the main objectives of this dissertation and provides information on the study species and the central areas this research has focused on. The data Chapters Two to Six are based on manuscripts that were written as independent scientific research papers intended for publication in relevant peer reviewed journals. Each data chapter includes a detailed introduction providing specific background information on the respective research topic. Due to this approach some repetition was inevitable. However, chapters were cross-referenced wherever possible and all references and appendices were combined at the end of this dissertation. The final conclusion Chapter Seven synthesizes all findings and discusses future directions.

The research presented in this dissertation has been designed, implemented, analysed and written by myself. I received significant guidance and advice by my supervisors Dianne Brunton, Uri Shanas and Weihong Ji who provided valuable input on data analyses and essential feedback on the write-up process.

Chapter Two is based on a research paper published in the *Australian Journal of Zoology* (http://www.publish.csiro.au/nid/90/paper/ZO10023.htm, doi: 10.1071/ZO10023) with co-authors Dianne Brunton and John Cockrem. John Cockrem contributed significantly to this study by providing hormone kits and conducting all necessary hormone assays to analyse the plasma samples. Both co-authors provided advice on the data interpretation and manuscript preparation. I have conducted the field work, collected all blood samples used for the hormone analysis, carried out the data analyses and wrote the paper.

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There are several people I met along this journey who offered me helpful advice, taught me essential skills and most importantly inspired me with their dedication and fascination for New Zealand's reptiles. I would like to thank Dr Alison Cree for her demonstration on how to palpate female geckos and her advice on the blood sampling procedure. Special thanks to Marleen Baling, who 'dragged' me along to all herp meetings that we could possibly attend and for introducing me into this new unknown 'world of lizards'. I would like to thank Malcolm and Lesley Bazeley for enabling my first encounter with a Duvaucel's gecko (you got me hooked!).

I was extremely lucky to have had support from many wonderful volunteers, who assisted me in the field and also helped with the data collection in the captive facility: Marleen Baling, Dylan van Winkel, Chris Wedding, Jo Peace, Jon Cope, Robin Gardner-Gee, Doug Ashby, Uri Shanas, Chee-Ho Wong, Weihong Ji, and Monique Jansen van Rensburg. Thanks so much, guys! The logistic support in the field by Dave Towns and Rob Chappell was very much appreciated. I am grateful to have met two lizard enthusiasts and good friends, Dave Craddock and Doug Ashby (and their lovely wives), who provided valuable advice on lizard husbandry and cage-design and who always had time to answer questions over a cup of tea!

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