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# **ECOLOGY AND DRIVERS OF DECLINE IN A TROPICAL ISLAND HONEYEATER: THE MA'OMA'O**

A thesis presented in partial fulfilment of the requirements  
for the degree of

**Doctor of Philosophy  
in  
Zoology**

at Massey University, Manawatu,  
New Zealand.



**Rebecca Stirnemann**

**2015**



# Declaration

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This thesis is my own work, except where otherwise acknowledged  
(see Preface and Acknowledgements).

Rebecca Stirnemann

September 2015

*"If you never did, you should. These things are fun, and fun is good"*

Dr Seuss

*To my family  
who have always encouraged me  
and to my friends for all of their support  
Thank you*

# Preface

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This thesis is structured as a series of connected manuscripts. With the exception of the Introduction, these papers have all been published, accepted or submitted for publication at the time of thesis submission. These manuscripts are listed below and are referred to as chapters in the text.

1. Rebecca L. Stirnemann, Murray A. Potter, David Butler, and Edward O. Minot (2015) Acoustic differences enable sex discrimination in Ma'oma'o (*Gymnomyza samoensis*), a species with high sexual morphological overlap. *The Wilson Journal of Ornithology*: 127(3) 376-386.
2. Stirnemann, Rebecca, M.A. Potter, David Butler, and Edward Minot. 2015. Slow life history traits in an endangered tropical island bird, the Ma'oma'o. *Bird Conservation International*, available on CJO2015.  
doi:10.1017/S0959270915000234.
3. Stirnemann, R., M.A. Potter, D. Stojanovic and E. Minot. Nest success does not predict reproductive success in a tropical island honeyeater. *Ibis*. In review.
4. Stirnemann, Rebecca, M.A. Potter, David Butler, and Edward Minot. 2015. Compounding effects of habitat fragmentation and predation on bird nests. *Austral Ecology*. doi: 10.1111/aec.12282.

All papers were intended as stand-alone pieces of work. For this reason, there is some unavoidable repetition between chapters, for example in the description of study areas and experimental design. An introductory context statement has been provided at the beginning of this thesis. This introduction is not intended to be a complete literature review, but rather an explanation of the relationships between different aspects of the research which makes up the thesis.

I performed the majority of the work for the papers that form this thesis. This included developing the research questions, experimental designs, data collection, statistical analysis, and writing. My supervisors Murray Potter, Edward Minot and David Butler made substantial contributions to the conceptualisation of research and revision of the manuscripts. The co-authors of each paper provided comments during the revision of the manuscripts. Dr D. Stojanovic provided guidance on the mark analysis and towards the conceptual development of Paper 4.

# Acknowledgements

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A big thank you to all my family and friends for all of their support throughout my PhD. Parents you have been brilliant. Dad for all your support both in the field and every day. Mum thanks for letting me escape home to you whenever I needed it and for always being there. Karl thank you so much for your support completing this work. Nic and Steen it was great having my own designers to save these endangered birds, you guys are great. Ingrid thanks for being the best sister and coming to do field work and reading my thesis, and most of all going through a PhD together with me. Special thanks to Severino for your excellent advice. Emma Moffitt thank you for reading an entire thesis and for always being a phone call away. It has been a journey and I am excited to see what is next!

Field work for this project received approval from the Massey University Ethics Committee under Protocol 10/115.

# Abstract

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There is a worldwide decline in biodiversity. Few studies have explored the processes that underlie biodiversity decline in some tropical regions, especially on tropical oceanic islands, where there are many threatened species and a high level of endemism. Indeed, even basic biological information is lacking for many Oceanic species. The Ma'oma'o (*Gymnomyza samoensis*), an endangered honeyeater endemic to Samoa, is an example of this. Here, I report results from an investigation on: 1) the breeding biology of this island honeyeater, 2) how survival varies with life history stage, 3) how to sex this monomorphic species in the field, and 4) how landscape and local-scale vegetation features influence nest predation of these cup nesting birds. I used observational data on breeding biology and survival at different life history stages to determine why this species is declining, and a combination of vegetation mapping and artificial nest surveys to determine how landscape processes and predation by invasive species contribute to declines in Oceanic forest birds. I also collected morphometric measurements and calls of known-sex individuals to develop a method of sexing Ma'oma'o in the field and to assess whether the declining populations showed sex bias. I found that the decline of this species is driven by interactions between the life history traits, predation by the black/ship rat (*Rattus rattus*), and fine and large-scale vegetation and landscape attributes. The Ma'oma'o produces at most one chick per year and therefore has a small maximum annual reproductive success rate compared to other honeyeaters. Furthermore, compared to other honeyeaters, the Ma'oma'o remains in the nest for longer and has an extended fledgling dependency period. My study highlights how predation by black rats at the nest reduces reproductive success. I found that the probability of nest success was significantly reduced near plantations. However, interior forest did not have lower nest predation rates than edge forest. My findings indicate that the maintenance of large sections interior forest alone is unlikely to increase reproductive success for the Ma'oma'o or indeed for other forest bird species sensitive to black rat predation. The key

management strategy is to have intensive rat control at breeding sites during the reproductive season.

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