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**The prevalence of *Salmonella* and the spatial
distribution of its serovars amongst New Zealand's
native lizards**

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Abstract

This thesis considers the prevalence and spatial distribution of *Salmonella* serovars amongst wild endemic lizards on offshore islands around the coast of New Zealand. The mean test prevalence of faecal excretion of *Salmonella* was 4.7%. Skinks (*Scincidae*) were more likely (8.5%) to be carriers of *Salmonella* than geckos (1.6%). Each island was host to between one and three *Salmonella* serovars that were not found on any other islands in this study. Two exceptions were *Salmonella* Bousso and *Salmonella* Mana which were found on two islands within the same geographical area. Based on the findings of this study, different islands are likely to be hosts to different *Salmonella* serovars which could have implications for future translocations of native lizards.

I also assessed the prevalence and spatial distribution of faecal excretion of *Salmonella*, *Aeromonas* and *Hafnia alvei* within Mana Island. The prevalence of *Salmonella* on Mana Island was estimated at 5.8%. *Salmonella* was found predominantly in skinks (10.0%) and less often in geckos (4.1%). *H. alvei* was found at a prevalence of 1.9%. No *Aeromonas* species were cultured from any of the cloacal swabs, suggesting that the 95% confidence interval for the true prevalence is 0-3%. Each site sampled in this study was host to one or more unique serovar of *Salmonella* not found at any of the other sites. The results of this study indicate that *Salmonella* serovars may become established within populations of lizards and is not spread between them. This may be due to a lack of dispersal of lizards between sites, raising important considerations for the translocation of native lizards.

I investigated the prevalence of faecal excretion of *Salmonella*, *H. alvei* and *Aeromonas* by New Zealand native lizards from two captive populations. The mean prevalence of faecal excretion of *Salmonella* in the captive lizards sampled was 11.5%. There was a higher prevalence of *Salmonella* within captive population A (22.0%) than in population B (3.6%). No *Aeromonas* was cultured from any of the lizards. *H. alvei* was found at a prevalence of 5.2%. The prevalence of *Salmonella* and *H. alvei* was significantly higher in captive lizards than in wild populations. Captive lizards may, therefore, not be appropriate founders for new populations of wild lizards.

Finally I assessed the different efficiencies of two media and two temperatures in isolating six *Salmonella* serovars from a reptilian source. All serovars grew equally well at 37°C and 27°C. For most serovars XLD agar was the more successful media than MacConkey agar but the success of different culture media depended on the serovar being cultured. Because lizards are frequently host to a wide range of *Salmonella* serovars, screening samples using multiple microbiological methods is likely to give the best chance of isolating all *Salmonella* serovars present.

Acknowledgements

Within this thesis I wanted to incorporate my passion for conservation, lizards and microbiology. This was to prove to be a daunting task. Not only because much of New Zealand's lizard fauna are maintained on offshore islands where access is restricted and difficult but also due to the multidisciplinary nature of the topic. So whilst it is accepted that a thesis has a single author this project would not have been possible without the help of a great many people who helped in a vast array of ways.

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This thesis is dedicated to my late grandmother who did not get to see this thesis in its completion, but whose love and support was a driving force behind it. Her spirit lives on through my desire for a sustainable future.

Preface

This thesis has been written as a series of self-contained chapters, which will form the basis of a number of papers to be submitted to peer-reviewed scientific journals. Each chapter is therefore written as a fully referenced self-contained paper, and investigates specific components of the spatial distribution and prevalence of *Salmonella* amongst New Zealand endemic lizards. Because of this, there is some overlap between chapters, but essentially they each provide new information towards different components of the spatial distribution and prevalence of *Salmonella* amongst New Zealand native lizards.

I conducted the fieldwork, statistical analyses and have written each chapter. My supervisors have contributed throughout the thesis with help during the fieldwork, analysis, and write-up stages of the study.

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