

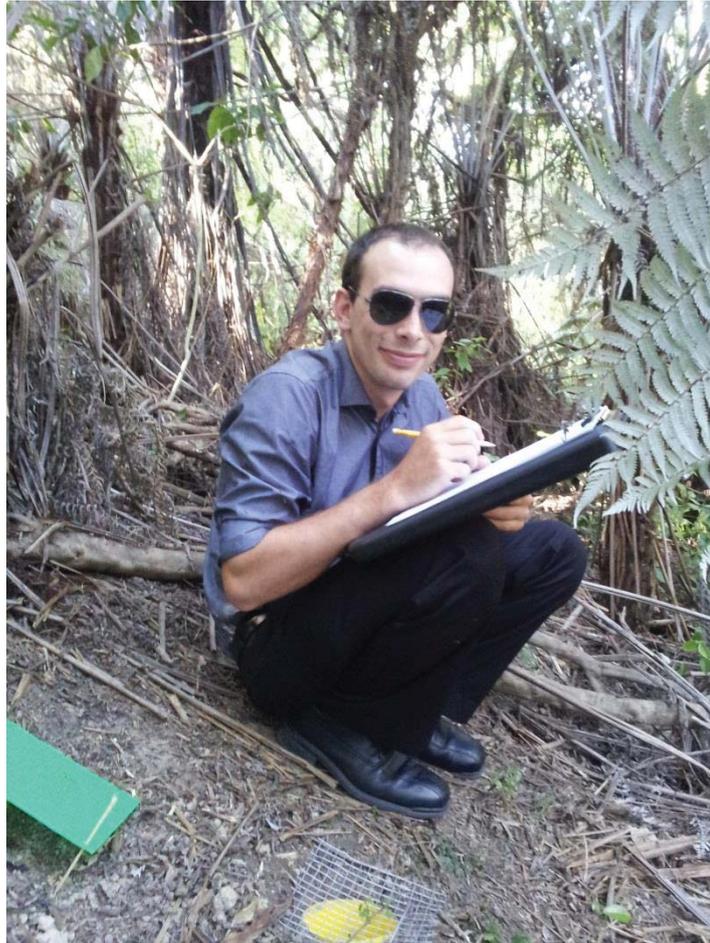
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**Habitat features of urban forest fragments
supporting native lizards in the presence of
introduced mammals**

A thesis presented in partial fulfilment of the requirements
for the degree of Master of Science in Conservation Biology at
Massey University Albany, New Zealand.

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For Andy - the best field assistant anyone could ask for.

Abstract

Introduced species are responsible for declines and extinctions of native biota around the world, particularly on islands where native species are often more vulnerable to the effects of invaders due to a lack of shared evolutionary history. New Zealand's native lizards have suffered considerable range contractions, declines and extirpations as a result of predation and competition from introduced mammals, with some species being more vulnerable than others. Little is known about the mechanisms which allow some ground-dwelling native lizards to persist in the presence of introduced mammals. In this study, I describe the species composition and abundance of ground-dwelling lizard and introduced mammal assemblages in urban forest fragments, and investigate the relationship between them. I also describe the habitats used by native ground-dwelling lizards where introduced mammals are also present and investigate habitat features that may be important in promoting the coexistence of native lizards with introduced mammals. Finally, I compare various methods for surveying lizard (hand searching, artificial cover objects, pitfall traps) and mammal (tracking tunnels, snap traps) populations in urban forest fragments.

Estimating the proportion of tail loss can be used as a proxy to determine predation pressure on lizard populations. The rate of tail loss among urban lizards in this study was relatively high (41%), suggesting that these lizard populations are under considerable predation pressure. However, no relationship between the abundance of introduced mammals and native lizards was identified. Key features of the habitats supporting the highest abundance of native lizards in the presence introduced mammals include high

canopy cover and high cover and structure of debris (leaf litter and branches/logs) in the lower shrub layer. Food availability in the form of invertebrate abundance does not appear to play a significant role in the coexistence of introduced mammals and native lizards, and the abundance of introduced mammals and exotic lizard competitors was not correlated with invertebrate abundance. Hand searching is the most efficient method for identifying lizards in urban bush fragments. ACOs and pitfall traps had only low efficiency in this study and are not recommended for future studies. I found that tracking tunnels may be an alternative to snap traps for indexing mammal abundance in urban environments where the risk of trapping non-target wildlife, pets and the public is high.

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Preface

*Ko Pukeatua
Ko Te Wharau
Ko Tumupakihi
Ko Te Taoū
Ko Ngāti Whātua
Te Aute Te Awhe!*

Hoinei te mana, hei maru mōku i te Kunenga ki Pūrehuroa kei Oteha

*Nō reira, rātou ki a rātou
Tātou ki ā tātou
Kia ora mai tātou katoa*

This is the pepeha¹ of the tāngata whenua whose rohe includes Massey University's Albany campus and several of the forest patches used in this study.

According to Maori kōrero, mokomoko are descended from Punga - the ancestor of sharks, rays, fish, insects, reptiles and all other things considered to be ugly or repulsive. Mokomoko were feared and often seen as omens of bad luck as they were thought to be representatives of Whiro, the god of darkness, evil and death. However, they were also seen as kaitiaki that would protect burial sites and important buildings. What follows is a re-telling of this kōrero describing the origin of lizards following the creation of the earth and sky.

¹ A glossary of Maori terms can be found at the end of the preface

In the beginning there was no sky, no sea and no earth, only darkness. Papatūānuku, the earth mother, and Ranginui, the sky father, held each other in a tight embrace. They had many children, including Tangaroa (god of the sea), Tūmatauenga (god of war), Rongomā-Tāne (god of cultivated foods) and Tāne-mahuta (god of the forest). The children became frustrated with living in darkness between their parents and decided that their parents must be separated. Many of them tried and failed, but it was Tāne-mahuta who finally managed to push apart his parents, breaking their embrace and letting in the light.

Tāwhirimātea, the god of storms and winds, was angry at the separation of his parents, and vowed to his brothers that they would have to deal with his anger. He went to the heavens to join his father Ranginui and sent his children, the winds, to attack his siblings. Tangaroa fled to the sea to escape the onslaught. Tangaroa's son, Punga, had two offspring: Ikatere and Tū-te-wehiwehi (also called Tū-te-wanawana). Terrified by Tāwhirimātea's attack, Ikatere and Tū-te-wehiwehi had to decide where to go. Ikatere went to the sea with his children, the fish. Tū-te-wehiwehi chose the land and took refuge in the forest, becoming the ancestor of ngārara.

Glossary of Māori words:

Iwi – Tribe, extended kin. A large group descended from a common ancestor.

Kaitiaki – Guardian, custodian or protector.

Kōrero – Oral tradition.

Mokomoko – lizards, including geckos and skinks.

Ngārara – Reptiles, also includes the giant reptiles of Māori legends.

Pepeha – Introduction, tribal saying. A pepeha is a set of verses that describes a person's

links to a particular iwi and their links to the area and their ancestors.

Rohe – Territory, boundary. Often referring to the region a particular iwi identifies with.

Tāngata whenua – Indigenous people of the land.

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Chapter 1

General Introduction



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