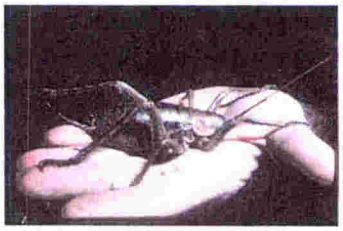
RESTORATION OF THREATENED SPECIES POPULATIONS:

TUATARA REHABILITATIONS AND RE-INTRODUCTIONS





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A thesis submitted for the degree of
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IN SEARCH OF THE TRUTH

SUCCESS !?

ABSTRACT

The role of scientific theory in encouraging greater efficiency and accountability for the restoration of threatened species populations is assessed for an endemic New Zealand reptile, the tuatara *Sphenodon spp*. The value of examining assumptions underlying concepts such as 'habitat requirements' theory and incorporating scientific principles into species recovery are discussed and perceived habitat needs for tuatara tested through experimental application.

Species restoration in New Zealand, especially re-introductions, are typically undertaken as one-off, non-replicated, management exercises (trials). The lack of comparative controls for trials means that the reason for success or failure of management actions cannot be identified accurately and therefore, cannot be used to improve the probability of success for subsequent re-introductions. Trials also reinforce conservative re-introductions of species to habitats in which species are known to survive, because the risk of failure is inherently lower than re-introductions to dissimilar habitats where habitat suitability is unknown.

An alternative approach is to plan management actions as experiments. Testing the full range of perceived habitat needs of species as experimental comparisons identifies the relative importance of tested factors (e.g. predators, refuges) for species recovery and identifies new management strategies (e.g. reduced level of predator control). Constructing testable hypotheses for the environmental factors thought to affect the success of restoration projects for tuatara identifies (among others) three factors:

1. absence of the introduced rat, the kiore (*Rattus exulans*)
2. presence of seabird colonies
3. presence of open canopy forest

The threat posed by kiore to established tuatara populations was investigated by determining the existence and degree of food competition before and after an eradication program for kiore on offshore islands. Kiore successfully out-competed tuatara for favoured food items, but the degree of competition differed between forest types. Competition for food was greater in the early regenerating forest than the mature forest. These data support models which propose that kiore are but one of a number of historical and current environmental factors influencing the persistence of native fauna and

that management tools other than eradication may enable restoration of fauna in the presence of kiore.

To test the importance of two environmental factors, forest development and the availability of refuges, in determining the establishment of new populations of tuatara, a planned experimental re-introduction was conducted on Moutohora Island. Tuatara were released into sites where the forest was young with a closed canopy and older with a more open canopy, and in sites where refuges (seabird burrows) were distributed evenly at high densities and where burrows clumped with few burrows between patches. Vegetation age and burrow dispersion had no measurable effect on the survivorship or condition of tuatara. Although tuatara released in areas where burrows were clumped dispersed significantly further from their release points and continued to disperse away from release sites throughout the study, tuatara in all release sites were considered to still be reproductively viable 16 months after the re-introduction. Therefore, sites which support open and closed canopy forest, and seabird burrows at high and low densities should be considered as habitat options for future re-introductions of tuatara.

Testing habitat needs as well-planned experiments offer more reliable information to guide future re-introductions than that generated by trial releases or releases to similar locations. Future re-introductions of tuatara and other wildlife should be designed as experiments to test declared mixes of habitat factors. This will accelerate species recovery by identifying important habitat prerequisites for re-introduction and management options for achieving these, thus refining criteria used for selecting new sites and increasing confidence, efficiency and accountability of subsequent management actions. An example of designing re-introductions as experiments is included as a plan for the re-introduction of tuatara to Tiritiri Matangi Island.

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DISCLAIMER – The views expressed in this thesis are those of the author and do not necessarily reflect those of the individual contributors.

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PREFACE

The commitment shown by conservation practitioners to restoring threatened species is nothing short of astounding. Unfortunately, the concomitant degree of biodiversity loss is also astounding. The Draft Biodiversity Strategy for New Zealand (the Department of Conservation (DoC) & Ministry for the Environment (MfE) 1998) merely confirms widely held beliefs that despite decades of conservation action and specifically targeted funding, biodiversity loss continues at an ever-greater rate. Also apparent is the inability of conservation agencies to meet even the most modest of conservation objectives solely through government-sponsored funding. To achieve more meaningful conservation gains will require a smarter approach to managing biodiversity, not necessarily a more intensive or extensive approach.

Prerequisites for smarter conservation are increased efficiency and accountability of management actions. Efficient management results from testing alternative management approaches against each other and produces solutions which are cost-effective and which maximise conservation gains. Accountable management relies upon correctly identifying all relevant stakeholders and incorporating their needs into decisions when determining alternative management strategies. Moreover, accountability requires that decision-making frameworks and subsequent actions correspond to the quality of information available so that decisions made are morally, scientifically and socially defensible.

The application of sound scientific principles to management actions is a key component for assessing the success of conservation outcomes. **CHAPTER ONE** explores how the use of experimental procedures in threatened species recovery can identify alternative management options and improve the efficiency and accountability of management frameworks and decisions.

Where information of species decline is unreliable and incomplete, yet alternative options for achieving conservation gains have not been explored or assessed, conflict between conservation stakeholders over the most effective approach can occur. **CHAPTER TWO** provides the first experimental test of dietary interactions between the endemic tuatara *Sphenodon punctatus* and the introduced kiore *Rattus exulans*. Impact by kiore on tuatara has long been assumed to occur but has never been experimentally tested. The adoption of widespread eradication programmes for kiore on islands under these assumed interactions has recently lead to conflict between New Zealand's

principle conservation management authority and others who propose alternative approaches for managing kiore populations whilst also achieving species recovery.

Achieving the most efficient approach to species recovery means measuring comparative conservation gain from viable management alternatives. Underlying assumptions made by managers for habitat suitability of species reintroductions have the potential to unjustifiably reduce the number and range of locations in which effective recovery can be achieved. For tuatara, two environmental factors thought to be important criteria for selecting new re-introduction sites are experimentally assessed in **CHAPTER THREE**. The importance of adopting experimental approaches to species management is also discussed, as is the importance of directly involving people in conservation to foster awareness and support for conservation initiatives.

Major findings from this research and their application to conservation theory and management are presented in **CHAPTER FOUR**.

In recognition of the important role that both science and the general public play in ensuring that conservation actions are effective, efficient and accountable, **CHAPTER FIVE** outlines a working plan for the re-introduction of tuatara to Tiritiri Matangi Island. Tiritiri is an open public access wildlife sanctuary and has the habitat heterogeneity amenable to further exploring the habitat needs of tuatara through well-planned experimental releases.

Throughout this study, data have been gathered on varied topics peripheral to the core experimental sections of this thesis. **CHAPTER SIX** details three papers or articles prepared as summaries of some of these additional data. A brief list of papers proposed, or under way, for the remainder of this data are also included.

Thesis Structure

The thesis is written as a series of stand-alone proto-papers to facilitate publication. Some overlap occurs between chapters, especially in descriptions of tuatara biology and references. At present, Chapter 3 has been submitted to a journal and Chapter 5 to the New Zealand Department of Conservation. Other chapters will shortly be submitted to journals.

REFERENCES

Department of Conservation and Ministry for the Environment 1998. Draft Biodiversity Strategy for New Zealand. Department of Conservation, Wellington, New Zealand.

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APPENDICES

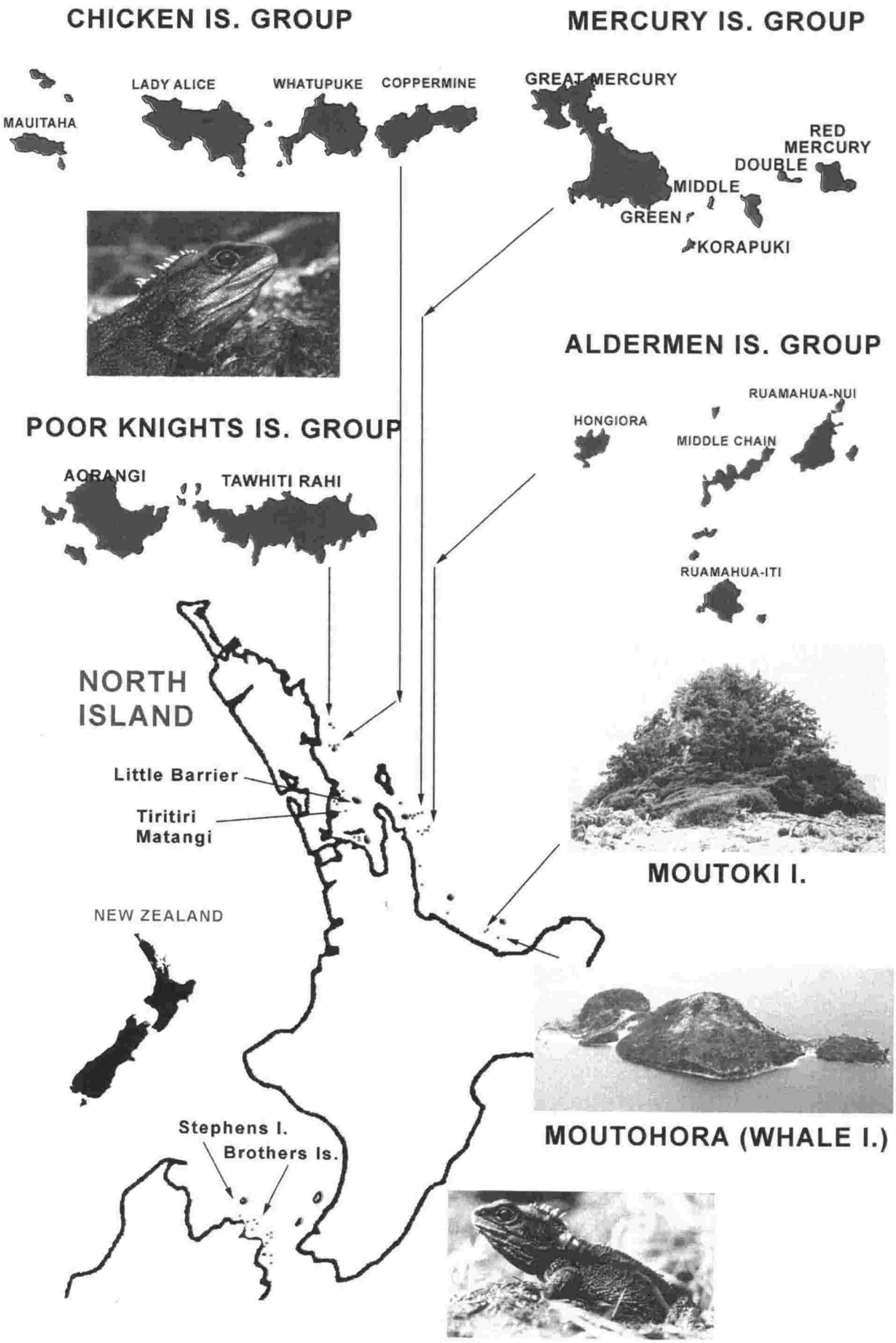

Plate 1

Location of New Zealand islands or island groups mentioned in this thesis.