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**Conservation Genetics of the  
World's Most Endangered Seabird,  
the Chatham Island Tāiko  
(*Pterodroma magentae*)**

**Hokopapa o tch Tchāik  
Whakapapa o te Tāiko**

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Hayley Ann Lawrence

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Doctor of Philosophy in Molecular BioSciences  
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*Ko te manu e kai ana i te miro, nōna te ngahere*  
*Ko te manu e kai ana i te mātauranga, nōna te ao*

*The bird that partakes of the miro berry has the forest,*  
*The bird that partakes of knowledge has the world*

The rākau momori (tree carving) above is the cultural and intellectual taonga of the Māori people and has been reproduced with the permission of Hokotehi Māori Trust.



# Abstract

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The research field of genetics provides useful tools to investigate the biology of species that are difficult to observe and study and are especially valuable in guiding the conservation of endangered species. The Chatham Island Tāiko (Tchāik, *Pterodroma magentae*) is the world's most endangered seabird with an estimated population size of just 120-150 birds, including only 8-15 breeding pairs. This thesis used genetic techniques to investigate aspects of Tāiko biology and relationships in order to aid Tāiko conservation. The mitochondrial cytochrome *b* gene and duplicated regions of domain I of the mitochondrial control region were DNA sequenced in almost the entire known Tāiko population. The level of genetic variation revealed in Tāiko was unexpectedly high considering endangered species typically exhibit low genetic diversity. Sequencing of ancient DNA from subfossil Tāiko bones allowed an investigation of the past level of genetic variation and the species' previous geographic distribution. A large proportion of the genetic diversity of the extinct Tāiko populations was retained in the remnant population. However, genetic variation in Tāiko chicks was low, thus genetic diversity in the population could be lost in just a few generations. There are many non-breeding Tāiko so DNA sexing was used to examine sex ratios in the population. Almost all unpaired birds were male, which signified a potential Allee effect (i.e. that a reduced density of potential mates is decreasing population productivity). Further understanding of the Tāiko mating system and behaviour was obtained by parentage, sibship and pairwise relatedness analyses of genotypes at eight microsatellite DNA loci. It is important that Tāiko are found so they can be protected from introduced predators. The results of mitochondrial DNA sequencing and microsatellite DNA genotyping indicated that there are likely to be more Tāiko breeding in undiscovered areas. Analysis of philopatry using both mitochondrial and nuclear markers can assist conservation by the identification of areas to search for these undiscovered individuals. Tāiko may have once and could still be found on islands near South America since DNA sequencing showed the Magenta Petrel type specimen (collected in 1867 in the South Pacific Ocean) is a Tāiko.



# Acknowledgements / Ngā Mihi

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*Ehara taku toa i te toa takitahi engari he toa takitini*

Not the strength of one alone, but that of many

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# Thesis Structure, Financial Support and Regulatory Compliance

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This thesis begins with a general introduction (chapter one) providing the background and intellectual framework that underpins the thesis. Details of the focal species, its cultural importance, history and conservation have also been included. Further chapters two to seven have been written as 'stand-alone' scientific papers. Therefore some information provided in the introduction will be briefly outlined again in chapter introductions. The final chapter (eight) is a discussion of the conclusions and applications of the research findings and potential future research.

## *Financial Support*

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## *Ethics Approval*

This research had ethics approval from the New Zealand Department of Conservation (DOC) Animal Ethics Committee for sampling from Tāiko (AEC 43). After consultation with imi / iwi and the Chatham Island Conservation Board, the Institutional Biological Safety Committee of Massey University granted permission for cloning (GMO 03/MU/15). The collection of Tāiko bones from natural deposits was covered by DOC permit no. WE/116/Res. I also obtained permission for the collection of Tāiko bones from the Chatham Island Conservation Board, landowners, the Hokotehi Moriori Trust, Te Runanga o Wharekauri Rēkohu and some members of Ngāti Mutunga. All bones once sampled were returned to the Chatham Islands within two years of collection, as agreed.

# Table of Contents

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	<b>Page Number</b>
Abstract	i
Acknowledgements / Ngā Mihi	iii
Thesis Structure, Financial Support and Regulatory Compliance	vii
Table of Contents	viii
List of Figures	x
List of Tables	xi
Chapter One:	
<b>General Introduction</b>	<b>1</b>
Thesis Rationale and Overview	10
References	12
Chapter Two:	
<b>High Mitochondrial and Nuclear Genetic Diversity     in the World's Most Endangered Seabird</b>	<b>21</b>
Introduction	22
Methods	24
Results	25
Discussion	29
Acknowledgements	32
References	32
Chapter Three:	
<b>Ancient DNA Study of the Past Genetic Diversity     and Breeding Distribution of the Tāiko</b>	<b>39</b>
Introduction	40
Methods	43
Results and Discussion	45
Acknowledgements	48
References	49
Chapter Four:	
<b>Detection of the Existence of Undiscovered Individuals     of a Critically Endangered Species with Genetic Signatures</b>	<b>53</b>
Introduction	54
Methods	58
Results	59
Discussion	63
Acknowledgements	65
References	65

		<b>Page Number</b>
Chapter Five:	<b>Excess of Unpaired Males in the World's Most Endangered Seabird</b>	<b>71</b>
	Introduction	72
	Methods	73
	Results and Discussion	74
	Acknowledgements	77
	References	77
Chapter Six:	<b>Nuclear Genetic Data Illuminates Behaviour and Familial Relationships in Tāiko</b>	<b>81</b>
	Introduction	82
	Methods	84
	Results	88
	Discussion	92
	Acknowledgements	95
	References	95
Chapter Seven:	<b>The Magenta Petrel – Solving a 140 Year Old Mystery</b>	<b>101</b>
	Introduction	102
	Methods	104
	Results and Discussion	106
	Acknowledgements	111
	References	111
Chapter Eight:	<b>General Discussion</b>	<b>115</b>
	Research Findings and Applications to Conservation	116
	Some Avenues for Future Research	117
Appendix A:	<b>Supplementary Material for Chapter Two</b>	<b>119</b>
	Methods	119
	Results and Discussion	121
	References	123
Appendix B:	<b>Supplementary Material for Chapter Three: Tāiko Subfossil Bones</b>	<b>125</b>
	References	129
Appendix C:	<b>Supplementary Material for Chapter Three: Technical Aspects of Ancient DNA Research</b>	<b>131</b>
	References	134
Appendix D:	<b>Genetic Data</b>	<b>137</b>

# List of Figures

---

	<b>Page Number</b>
<b>1.1</b> Timeline	5
<b>3.1</b> Possible Tāiko distribution	41
<b>3.2</b> Network and geographic distribution of modern and ancient haplotypes	46
<b>4.1</b> The distribution of Tāiko burrows in the southwest of Chatham Island	55
<b>4.2</b> Networks of mitochondrial DNA haplotypes of Tāiko	60
<b>4.3</b> Correlogram plot of the genetic correlation coefficient as a function of distance for adult Tāiko associated with known locations	61
<b>4.4</b> The distribution of Tāiko with significant local correlation values	62
<b>5.1</b> The geographic location, burrows and breeding habitat of the Tāiko	72
<b>6.1</b> Correlogram plot of the genetic correlation coefficient as a function of distance for adult Tāiko associated with known locations	92
<b>7.1</b> Voyage of the <i>Magenta</i> across the South Pacific Ocean in 1867	102
<b>7.2</b> The Magenta Petrel type specimen	103
<b>7.3</b> Phylogenetic relationship of the Magenta Petrel to <i>Pterodroma</i> petrels	107
<b>7.4</b> Phylogenetic relationship of the Magenta Petrel to <i>Pterodroma</i> and <i>Pseudobulweria</i> petrels	110
<b>A.1</b> Neighbour net network for fragment 1 and fragment 2 mitochondrial control region haplotypes in Tāiko	122
<b>B.1</b> Locations of searches for Tāiko bones / living birds	126

# List of Tables

---

	<b>Page Number</b>
<b>2.1</b> Variable nucleotide sites of 21 mitochondrial DNA haplotypes in Tāiko	26
<b>2.2</b> Comparisons of Tāiko mitochondrial DNA diversity with Procellariiform, Charadriiform and other avian species of varying conservation status	27
<b>3.1</b> Variable sites in cytochrome <i>b</i> defining haplotypes in modern and ancient Tāiko	45
<b>4.1</b> Results of a two-dimensional local spatial autocorrelation analysis in Tāiko	62
<b>5.1</b> Sex ratios in Tāiko ( <i>Pterodroma magentae</i> )	75
<b>6.1</b> Number of alleles, observed and expected heterozygosities for Tāiko individuals for seven microsatellite DNA loci	88
<b>6.2</b> Results of a two-dimensional local spatial autocorrelation analysis in Tāiko	91
<b>B.1</b> Subfossil bones collected in this study	127
<b>B.2</b> Subfossil bones from the Canterbury Museum, Christchurch, New Zealand	127
<b>B.3</b> Subfossil bones from the Otago Museum, Dunedin, New Zealand	128
<b>D</b> Genetic Data	138



