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**Evolutionary consequences and
fitness correlates of extra-pair
mating in the tūī, *Prosthemadera
novaeseelandiae***

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

Doctor of Philosophy

in

Ecology

at Massey University, Auckland,
New Zealand

Sarah Jane Wells

2014

Frontispiece



“Me he korokoro tūi”

“How eloquent he is; he has the throat of a Tūi”

Maori proverb

Abstract

Animals of many different taxa exhibit sexual dimorphism in phenotypic traits that have evolved through male-male competition and/or female mate choice. Many bird species also engage in extra-pair mating that can exert significant selection pressures on male secondary sexual characters. Studies examining the evolution of sexual dimorphism in birds have demonstrated that the degree of plumage dimorphism is positively related to rates of extra-pair paternity (EPP) among species. In contrast, it is generally argued that sexual size dimorphism (SSD) is not related to EPP but instead is associated with social polygamy. Thus understanding the adaptive function of extra-pair mating may shed light on the evolution of male sexually selected traits. It is argued that females increase offspring fitness by maximising the benefits they receive from males through extra-pair mating. Females are hypothesised to gain direct benefits such as parental care or territory quality through social mate choice, as well as indirect benefits such as compatible genes or good genes benefits through extra-pair mate choice. However, despite much research, the exact adaptive function of female genetic polyandry is still debated.

This thesis investigates the influence of sexual selection on the evolution of reproductive behaviours and male secondary sexual characters. We examine correlates and fitness consequences of female within-pair and extra-pair mate choice in the New Zealand tūī, *Prosthemadera novaeseelandiae*. Tūī are unusual for a socially monogamous passerine in that they exhibit extreme SSD. They also

possess unique ornamental white throat feather plumes which are larger in males, but of which the functional significance is unknown. We discover that tūi possess one of the highest rates of EPP of any socially monogamous bird: EPP occurred in 72% of all broods and 57% of all offspring were extra-pair. Our results show that tūi exhibit a level of SSD normally associated with strong polygamy, with males being 50% heavier than females. In addition, male body size and ornament size are strong predictors of paternity success. Thus, contrary to current opinion, these findings demonstrate that EPP can be causal in the evolution of SSD. Furthermore, this study provides needed evidence that selective pressures, acting via EPP, can lead to the evolution of male ornaments.

Females paired with large social males gained direct benefits that increased offspring survival. Parental ability was not related to male size suggesting that large males may instead provide higher quality territories. Two traits correlating with male extra-pair mating success also predicted offspring fitness: extra-pair young and the offspring of genetically dissimilar sires possessed faster growth rates, and females mated to highly ornamented males overproduced sons to gain offspring with greater reproductive potential. These findings suggest that females gain indirect benefits from extra-pair mate choice, and support both the Fisher-Zahavi good genes and compatible genes hypotheses as functional benefits of female genetic polyandry.

Examination of tūi parental provisioning rates revealed that males provided significantly less parental care than females. Male ornament size was inversely related to paternal effort, providing further support that ornamentation indicates indirect rather than direct benefits in tūi. In addition, males with lower paternity of

their broods provided more care than males gaining full paternity. When considered together with female choice for highly ornamented extra-pair males, these findings suggest the existence of alternative male reproductive strategies in which males trade-off investment in offspring with mating effort in response to their residual reproductive potential.

Tūi are unusual in that they possess several attributes commonly associated with social polygyny, such as extreme SSD, multiple male traits, and reduced paternal care. Although the selection pressures leading to the evolution of ornamentation and SSD in tūi remain to be clearly resolved, the relationship between these two traits is likely complex. We argue that these traits may have evolved through male-male competition but are reinforced by female choice for dominant males. This study substantially furthers our knowledge of tūi mating behaviours and makes a significant contribution towards understanding the functional significance of male traits and EPP. Finally, our findings have implications for sexual selection theory pertaining to the evolution of SSD.

Acknowledgements

The biggest thanks go to my supervisors who have each taught me so much during this time. I feel very lucky to have no less than three supervisors that have each contributed different sets of skills towards this thesis. First and foremost I would like to thank the endless dedication of my supervisor Weihong Ji. Thank you for giving me the opportunity to do my PhD at Massey. You have always had such faith in me, which has spurred me on when things were not going quite to plan. You have been a mentor as well as a supervisor. Your words of encouragement and the scientific discussions we have had have been a sounding board for many ideas that I hope we can build on in the future. Many thanks to my secondary supervisor Dianne Gleeson and Landcare Research, without whom this PhD would never have happened. Dianne was one of the first people to give me a job in New Zealand and it has all gone from there. Thank you for organising all the research funding for the genetics work, I am very grateful and feel very lucky that I had never had to worry about running out of money. Well, that is, until I ran out of money! Thank you for all your support with the genetics analysis, it has been great to have someone so knowledgeable onboard to guide me. Last but definitely not least, many thanks to the supreme king of framework, my third supervisor Jim Dale. Your extensive breadth of knowledge and critical input has been invaluable and has helped to guide this thesis to where it is today. You always found time to respond to my many requests for advice and comments and they were always very insightful.

I must sincerely acknowledge Landcare Research who provided the funding for genetic analysis for this project and have been involved in my career in New

Zealand back in 2005. In particular, Gary Houliston and Frank Molinia went out of their way to make sure I had what I needed after Dianne Gleeson moved to Australia. This is an incredible company made possible by incredible people, and it has been great to be a part of it.

Fieldwork for this project was conducted at Tawharanui Regional Park with permission from Auckland Council and the Department of Conservation. In addition, a huge thank you is needed to Tim Lovegrove and Matt Maitland at the Auckland Council for their financial and logistic support for this project. I am incredibly grateful to you both for funding the fieldwork, and allowing my volunteers and I to stay at Tawharanui for almost 5 months a year. I would not have been able to achieve half of what I have without your support. A big thank you also to Moe and Colin at Tawharanui for your support with my fieldwork. You made my time up at the “vol hole” a fun experience and I never got tired of seeing your cheeky faces at the end of a long day. Moe, I hope the “bo” finds its’ “at”.

No PhD would be complete without extensive, sometimes fatiguing, statistical analysis. I am indebted to Beatrix Jones, David Aguirre, and Adam Smith for help with statistical analysis. Some of you may have driven me to tears of frustration (you know who you are!) but it was worth it in the end. Thanks also to Dianne Brunton for giving me the opportunity to be part of the Ecology and Conservation group and your advice on my project.

Lab work can be sometimes tedious, but never a dull day was had with Ana Ramón-Laca, Diana Prada, Robyn Howitt, Shelley Myers, Julia Allwood, and Tom Winstanley. My Landcare girls (sorry Tom!) provided so much help and support and always had time to work through a solution to a problem with me. Thank you

for providing epic lunchtime feijoa-eating competitions accompanied by good banter. I am also grateful for the advice of Duckchul Park who always has the answer for any genetic problem you can possibly think of, and to Shaun Forgie for making me laugh with his hilarious attempts at conducting lab work and our HK BBQ sessions with Quentin Paynter. May that place remain open, cheap, and with amazingly hot sauce forever.

A huge thank you to the many volunteers I had in the field, Fatima Torrico (Fats), Helen Cadwaller, Damien Menard, Ulla Kail, Jordi Segars, Mariska Kraaij, and Mithuna Sothieson. Particularly to Sam Hill who had to spend a month alone with me on the Chatham Islands, you kept me sane. I feel very lucky to have had such great volunteers and without whom I would not have been able to accomplish so much. A big thanks to Kevin Parker, Luis Ortiz Cathedral, Michael Anderson, Mark Delaney, Marleen Baling, and David Gudex-Cross, both for their help in the field and for collecting samples for me. I am grateful to Barry Lett, for allowing me to catch so many tui on his property and for turning a blind eye to the Tourettes which seemed to grip me whenever a tui managed to get a good hold of me.

Merci beaucoup à « Crazy Christophe », t'es complètement fou mais ça m'a fait plaisir de partager un bureau avec toi. Encore merci pour ton aide sur le terrain et pour tes corrections sur ma thèse. C'est à ton tour maintenant ! J'espère que je pourrais aussi t'aider quand tu reviendras.

To all my friends and colleagues at Massey and around the world, from New Caledonia to the UK, thank you so much for your support during this project. A special mention goes Marc Oremus for starting this whole thing and having faith in me, to Sara, Jez, and Loosie for being the best flatmates and being so supportive, to

ma poulette, Anne-Sophie Boyer, for her support and encouragement, to Megan Young for the surf trips that gave me perspective, to Hannah Wannah Jones for weekends in Raglan and mutual rants about PhD issues, and to my girls in Europe who I have missed so much: Sophie Hodder, Lucy Nicholson, Harriet Sandliands, Sarah Ellis, Lucy Abrahams, Charlie Palmer, Mathilda Evans, Sara Peterman, and Heather Davies. I know I may not have been in as much contact with many of you as I should have but I promise that will now change!

Finally my long-suffering family deserve much credit and my gratitude for putting up with, and supporting, a permanent student. Thanks particularly to my auntie Caro for your encouragement and to Granny S for being so amazing at 95 years old and showing no signs of slowing down! To my soon-to-be family, the “Van clan”; Paula and Jeff, Carly and Scott, Jason, and Margaret and Eddy, thank you for all your support you have given me over the past years. I feel very lucky to have a second family so close, while mine is so far away. To my amazing Dylan, I honestly do not think I could have done this without you by my side. You have got me through endless meltdowns and your smile at the end of the day is all that I have needed to make the world seem right again. I can’t wait for the surf trips and the new adventures. Love you newt. And last but not least, I dedicate this thesis to my parents. You started this whole thing by getting me into nature at a very young age, showing me the small things, and taking me on hikes armed with a bumblebee survey kit (the joys of having a science teacher as a mother!). You have nurtured and supported me without question my whole life, and I feel very lucky to have been guided by your immense knowledge and wisdom. Thank you for everything.

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