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**Effects of Urban Noise on
Vocalisations of Tūī (*Prothemadera
novaeseelandiae*)**

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

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(2015)

Abstract

The two most important functions of avian acoustic communication are territory defence and mate attraction. As such the effective communication of these signals is critical for individual reproductive success. However if these vocal signals are masked by anthropogenic noise, their signal efficiency is reduced and this may result in direct negative fitness consequences. Therefore knowledge on how urban habitat features including anthropogenic noise affect avian vocal communication is important in understanding the evolution of animal communications in urban ecosystems. Such knowledge is also important for the management of endangered and declining species in urban areas.

Little is known about how birds respond to the highly variable levels of urban noise in urban habitats. In this study I investigated spectral and temporal differences in songs between populations of tūī (*Prosthemadera novaeseelandiae*) in urban habitats with both high noise levels (near motorway) and lower noise levels (distant from motorway). Male long-range tūī songs were collected during the breeding season (October 2012 to February 2013) at three paired sites, with one of each pair situated within 100m of a motorway and the matching site within 2-3 kilometres from the first site and the motorway. Urban noise levels (dB) were measured at all sites. I compared motorway and non-motorway urban songs to determine whether tūī shift the frequency, duration, trill components and output of songs in response to anthropogenic noise. Songs were also recorded at two paired non-urban sites over 50 kilometres from the urban sites (Mahurangi Regional Park and Wenderholm Regional Park) and spectral characteristics were also compared between these non-urban and the urban sites. I compared song rate and singing rate to investigate whether song output varied with noise levels and between urban and non-urban habitats. Through comparison of the degree of syllable sharing and proportion of unique syllables and phrases at these sites, I explored the presence of song dialects at urban and non-urban sites.

From 63.5 hours of field sampling, I collected a total of 1017 long-range broadcast songs (627 songs from motorway sites and 390 songs from non-motorway sites). A significantly higher minimum frequency was found in songs

from the noisier, motorway sites compared with those from non-motorway sites. Motorway songs had shorter song durations and decreased syllable diversity than non-motorway songs. There were also a significantly lower proportion of trills in the songs at sites near to motorway. As predicted a smaller syllable repertoire size was found in the sites near the motorway compared to repertoires at non-motorway sites.

The presence of site-specific syllables and phrases and site-specific clusters in a Ward cluster analysis, as well as a reduced degree of syllable sharing between urban sites indicated the formation of local dialects in these fragmented urban sites.

This study has provided data of bird song variation within urban ecosystems of varying noise levels. These findings aid our understanding of modifications to tūī songs to avoid the masking effects of low frequency traffic noise. Song duration, trill proportion and repertoire size have all been demonstrated as being subject to sexual selection. Changes in these aspects at noisy urban sites are considered adaptations to urban effects. Such changes may have further implications for other important behavioural aspects such as mate choice and can have profound effects on tūī population dynamics between urban fragments. Understanding these urban effects on bird songs and other important behavioural aspects are important not only for advances in ecological theory in urban ecology, but also for conservation management of urban habitats. For example, dialects between urban fragments may create a reproductive barrier for dispersing birds, therefore reducing gene flow between sites. Habitat corridors should be considered in urban designs, not only to increase gene flow of species with poor dispersal ability, but may also help to connect populations of highly mobile species such as tūī.

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Acknowledgements

Firstly I would like to thank my main supervisor Weihong Ji who tirelessly gave me comments and encouragement and always conveyed such an enthusiasm for studies on tūī. Thank you for giving me the opportunity to undertake this thesis at Massey. Thanks also to co-supervisors Michael Anderson and Dianne Brunton for discussions and help with revisions. Mat Pawley and Daniel Thomas from IMNS, thank you both for your statistical support and ideas.

Massey regulars in the lab, thanks for your support and discussions; Brig Krieg, Jenny Laycock, Marleen Baling, Luca Butikofer, Christophe Amiot, John Cope, Tom Dixon, and Kelsey Nichols. Also to Manuela Barry and Luis Ortiz-Catedral.

Fieldwork for this project at Mahurangi Regional Park, Wenderholm Regional Park, Auckland Botanic Gardens and central sites was conducted with permission from Auckland Council. In addition, a huge thank you is given to Tim Lovegrove, Matt Maitland and Emma Bodley from Auckland Council who provided advice and information about my study sites.

To my wonderful partner Felicity Moore, you have helped me through many difficulties, assisted me in the field, proof-read my drafts and provided me with tireless support and encouragement. You have taken a great interest in my study subject and have always kept me up to date with tūī activity in the garden.

Sam Hill thank you for sharing your ideas and fascination of all things tūī, your support and encouragement have been incredible. You encouraged me to take on this study and I have enjoyed the experience of working together in the field and in the lab.

Thank you to Charlotte Antonievich for giving up her day to help format this thesis. Thank you also to my father Robert and my mother Miriam for supporting my desire to undertake this project, together with my siblings Rachael and Jason and my nephew Elvis. Thanks to all my family and friends for bearing with me during this incredible journey.