

## SHORT NOTE

Microgeographic variation in song phrases of tui (*Prosthemadera novaeseelandiae*)

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Geographic variation in song structure or dialects are well described and widespread in a number of avian species (Mundinger 1982; Searcy *et al.* 1997). Dialects are defined as differences in the songs of separate populations of the same species (Marler & Tamura 1962). Such differences have been demonstrated in syllables, distinct sections of syllable sequences (phrases), and songs (Catchpole & Slater 2008; Manjunath & Josh 2012). Regional dialects are thought to be maintained across the generations via cultural evolution, where young birds learn the local dialects from their parents and neighbours (Gill 2007; Luther & Baptista 2009). Avian dialects have been found over a number of different spatial scales. Macrogeographic variation in syllables, phrases or songs can be described as dialects shared by a whole population, whereas microgeographic variation in syllables, phrases or songs are dialects shared only by a small group of neighbours (Mundinger 1982). Microgeographic differences in song have been described over spatial scales varying from just a few kilometres in

the skylark (*Alauda avensis*; Briefer *et al.* 2011) and black-capped chickadee (*Parus atricapillus*; Ficken & Weise 1984) to over 10 km in the sage sparrow (*Amphispiza belli*; Rich 1981).

The tui (*Prosthemadera novaeseelandiae*), an endemic New Zealand honeyeater, produces complex songs made up of syllables frequently comprised of multiple syllables and phrases with a range of bell and flute-like noises, cackles, barks, chimes, harsh clicks and wheezes (Moon 1996). However, detailed studies of tui vocalisations have been scarce to date (see Hill *et al.* 2013). In this paper, we report differences in song phrases of tui at a smaller spatial scale than that reported previously.

Variation in the song of tui was studied at Tawharanui Regional Park, a predator-controlled mainland island situated 90 km north of Auckland (36° 22' S, 174° 50' E). Tui songs were recorded at 4 sites within the park. These sites were Anchor Bay, Jones Bay, the western end of the Ecology Bush, and Maori Bay (Fig. 1). The distances between these sites ranged from approximately 500 m (between Anchor Bay and Ecology Bush; Ecology Bush and Maori Bay) to approximately 1000 m (between Jones Bay and all other sites).

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**Fig. 1.** Map of Tawharanui Regional Park with the 4 study locations of Anchor Bay, Jones Bay, Ecology Bush and Maori Bay. Map from Google Maps.



Song recordings and corresponding behavioural observations were made in the tui breeding season between Oct 2010 and Jan 2011. A total of 40 hours of song recordings were collected at each site using a Sennheiser ME67 shotgun directional long-range microphone and a Marantz PMD620 digital recorder, at a sampling rate of 44.1 Kilohertz (kHz).

Among 303 different songs recorded from the 4 sites at Tawharanui Regional Park, we found a unique song phrase within each of the 4 sites (Fig. 2). Each phrase was produced by several different individuals at one site and was not recorded from the other 3 sites with in the Park.

The Anchor Bay phrase consisted of 5 syllables. This phrase was produced by and recorded from 4/4 males, around the Anchor Bay site in a territorial context. The first syllable of this phrase was occasionally heard in the Ecology Bush tui and was incorporated into a song but the entire phrase was not replicated at any of the other 3 sites.

The Jones Bay phrase was complex and consisted of 7 different syllables. This phrase was recorded from 3/3 different individuals within the Jones Bay area and was not recorded or heard at any other part of Tawharanui. However, the terminal syllable has been detected on Tiritiri Matangi I, an offshore island approximately 24 km south east of Tawharanui, where it was incorporated into territorial male, long-range broadcast songs (Samuel Hill, *pers. obs.*).

The Ecology Bush phrase consisted of 6 different syllables. This phrase was produced by tui when landing in a tree with conspecifics and given in social and aggressive contexts. It was heard being sung by at least 3 different individuals. This phrase and its corresponding behavioural context was only produced at Ecology Bush and at no other location

around Tawharanui. This phrase consisted of 6 quick-fire syllables all at low frequency (minimum frequency: 0.7 kHz and maximum frequency: 3.2 kHz).

The Maori Bay phrase consisted of 10 short syllables. This phrase was only produced at Maori Bay by 2 pairs of adult tui whose territories were in close proximity to each other. This phrase was produced by both individuals after landing in a tree and on 2 occasions, produced by all 4 individuals which had confronted each other in a pohutukawa tree (*Metrosideros excelsa*).

The close association of family members and young tui may be a factor that gives rise to the localised dialects (Bergquist & Craig 1988) observed in this study. Prolonged association would allow young birds to learn the songs of other family members. Such unique regional phrases may serve as a means of distinguishing neighbours from strangers by local tui. The 'dear-enemy hypothesis' predicts a less aggressive response towards neighbours than birds from farther territories (Briefer *et al.* 2008). Such localised phrases may play an important role in such interactions. However, dialects would only persist if the young do not disperse, otherwise new birds will arrive with their natal songs. For dialects to persist, the incoming dispersing birds will also have to learn the local dialect. There are a number of studies that have found this to be the case (*e.g.*, Planqué *et al.* 2013), though not in tui and this will need to be investigated.

Future research should focus on the temporal variations on such localised phrases and whether or not these phrases vary or remain stable over time. Furthermore, the responses of tui to such phrases from different regions can be explored through playback experiments.

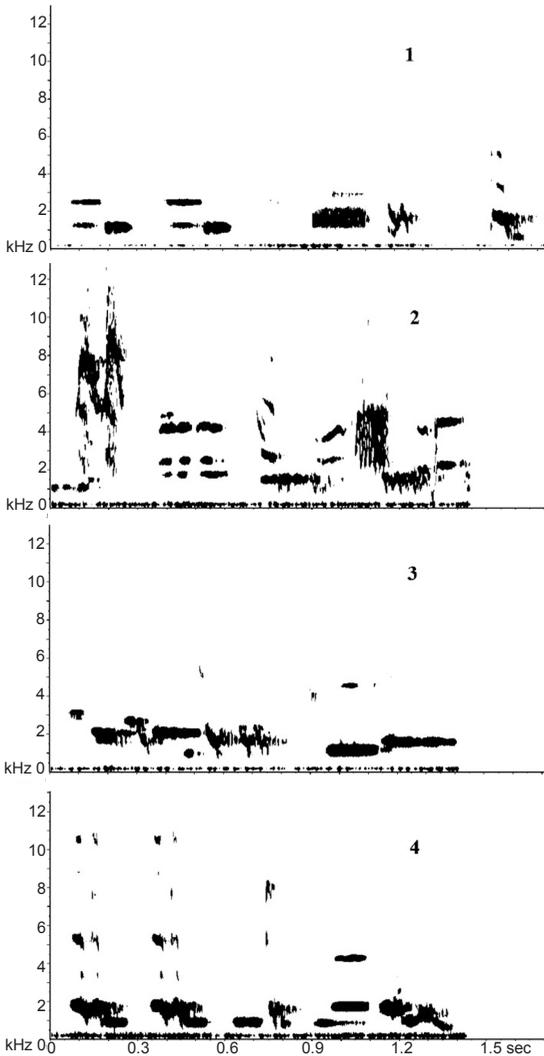


Fig. 2. Spectrograms of common localised songs and phrases found at 4 different areas of Tawharanui Regional Park. 1. Anchor Bay, 2. Jones Bay, 3. Ecology Bush, 4. Maori Bay.

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