Notornis, 2009, Vol. 56: 40-43
0029-4470 © The Ornithological Society of New Zealand, Inc.

Use of song to monitor North Island tomtits (*Petroica macrocephala toitoi*) at Atuanui, Mount Auckland

B. MICHAUX
Box 191, Kaukapakapa, New Zealand

Abstract Singing and territorial behaviour of North Island tomtits (*Petroica macrocephala toitoi*) were used to monitor population size over a 3-year period at Atuanui, Mount Auckland Scenic Reserve, North Auckland. Male tomtits were observed singing year-round with singing peaking in the period from Nov to Jan. The general territorial behaviour of Atuanui tomtits was similar to that reported for other North Island populations, with territorial males resident in all months and most territories occupied in successive years. Density of territories was stable over the 3-year period but vacancies in suitable habitat suggest the population is not at carrying capacity.

Michaux, B. 2009. Use of song to monitor North Island tomtits (*Petroica macrocephala toitoi*) at Atuanui, Mount Auckland. *Notornis 56(1)*: 40-43.

Keywords North Island tomtit; *Petroica macrocephala toitoi*; song; population monitoring

INTRODUCTION

North Island tomtits (*Petroica macrocephala toitoi*) are rare between Whangarei and the southern Waikato (Heather & Robertson 1996). This 'gap' in distribution is confirmed in the latest *Atlas of Bird Distribution* (Robertson *et al*. 2007), which shows few populations in the Rodney/Kaipara District. The decline of tomtits in this region is not understood although loss of nests by introduced predators could be one reason. For example, the ship rat (*Rattus rattus*) is a major predator of tomtit nests (Brown 1997, Knegtmans & Powlesland 1999). Brown (1997) reported that ship rats were responsible for 16/24 nest failures; not only did ship rats destroy eggs and young, they also preyed upon adult females while on the nest. High rodent density may also compete directly with tomtits through reducing the abundance of ground-living arthropods or understorey berry-producing shrubs (Heather & Robertson 1996). Possums (*Trichosurus vulpecula*) are also known to predate tomtit nests, and Knegtmans & Powlesland (1999) reported increased nesting success of tomtits in Pureora Forest that was coincidental with increased possum control.

Understanding the persistence of isolated populations of native birds, and how they respond to predator control, is critical for planning effective conservation measures. Tomtits are potentially a good indicator species for the effectiveness of pest control programmes, because their vulnerability to introduced mammalian predators means their number would be expected to increase with pest control (e.g. Knegtmans & Powlesland 1999, Brown 1997). Tomtits are also easily monitored because males are sedentary and proclaim their territories with a distinctive and far-carrying song (Skinner 1978, Heather & Robertson 1996). This can be especially important in forest environments where birds are more commonly heard than seen.

In this study I surveyed the singing and territorial behaviour of North Island tomtits in a remnant population located at the Atuanui Scenic Reserve. To provide baseline data for the effectiveness of future increased pest control in this area, I used seasonal patterns of singing behaviour to estimate the number of territorial males present over the 3-year period. My results suggest that the population of tomtits in this reserve is stable,

Received 1 March 2008; accepted 9 Sep 2009
Corresponding author: *michaux@xtra.co.nz*

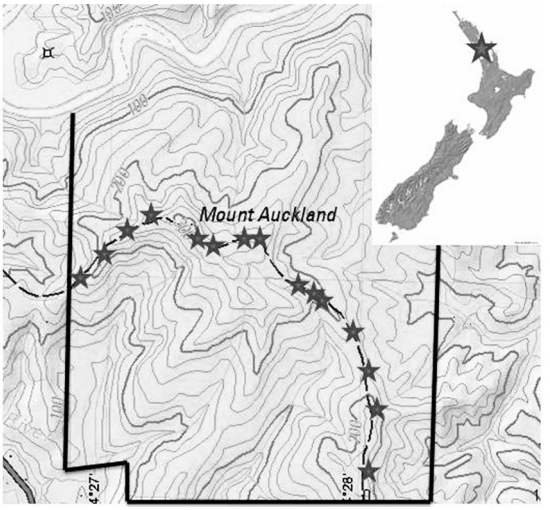

Fig. 1. Locality map of Atuanui/Mount Auckland Scenic Reserve (inset, star), and contour map of the reserve showing the approximate positions of male tomtit territories (stars). Border of the reserve is outlined. Dashed line represents the walking track.

but the presence of vacancies suggest pest control should lead to an increase in the population.

METHODS

Atuanui Scenic Reserve is a 615 ha native forest bordering the eastern shore of the Kaipara Harbour (Fig. 1). This reserve is the largest protected native forest block in the Kaipara district. It is a typical Northland coastal kauri – podocarp – hardwood forest. Scattered groups of regenerating kauri (*Agathis australis*) and the podocarps rimu (*Dacrydium cupressinum*), kahikatea (*Podocarpus dacrydoides*) and totara (*P. totara*) grow within a mosaic of hardwood species including taraire (*Beilschmiedia tarairi*), karaka (*Cornyocarpus laevigatus*), puriri (*Vitex lucens*), kohekohe (*Dysoxylum spectabile*), kowhai (*Sophora tetraptera*) and rewarewa (*Knightia excelsa*). There are also some local rarities including the parasitic orchid *Danhatchia australis* (for which Mount Auckland is the type locality) and the King fern (*Marattia salicina*). Although it has been an indigenous state forest since 1887 it has been logged (but never burnt over).

Possum (*Trichosurus vulpecula*) control within the reserve is carried out by the Auckland Regional Council on behalf of the Department of Conservation every 4 or 5 years, with the most recent carried out in Oct 2007. The Department of Conservation issues recreational hunting licences for fallow deer (*Cervus dama*) and feral goats (*Capra hircus*), and also employs professional deer cullers. As a result the avifauna of Atuanui appears to be more diverse than equivalent habitats in the region. Plans by the Atuanui Restoration Project for more intensive mammal control will see the establishment of bait stations and trap lines to control rodents and mustelids in 250 ha of the reserve.

I made a total of 108 visits to the reserve between 2005 and 2008 (26 visits in 2005/06, 29 visits in 2006/07, and 53 visits in 2007/08). The increased number of visits in 2007/08 was the result of including a return journey in my surveys from Aug 2007 onwards. Prior to Aug 2007, I walked the Atuanui track from the south. From Aug 2007 onwards, I would wait at the northwestern boundary of the reserve for 30 minutes before returning back along the track (Fig. 1). As observations on the outward journey were made in the morning while those of the return journey were collected in the early afternoon, I tested whether song frequency varied with time of day and thus affected my survey results. However, differences in the number of songs detected did not differ significantly between morning and afternoon (χ^2 = 0.48, df = 1, p = 0.92) and all data were subsequently combined in further analyses.

All surveys in the reserve were made from the Mount Auckland track (Fig. 1). When male territorial songs were heard, I stopped and recorded the position of the singing bird with a handheld GPS (eTrex, Garmin International). Positions were only recorded when I was sure that different birds were singing. Male tomtits will sometimes follow humans entering their territory and continue singing periodically. To avoid counting the same bird twice, I either had to hear 2 birds 'duetting' or to have covered sufficient distance (> 100 m) without hearing any song, before recording another song as belonging to a separate male. All observations were recorded between 0900 and 1400 NZST, including observations made on the return surveys that began in 2007 (see above). The track was walked at the same pace each survey. Dawson *et al*. (1978) showed that significant observer differences existed in the counting of tomtit numbers in their study, but as all observations in this study were made by the author observer bias was not a factor.

Song records were plotted onto a map that had been divided into a 100 X 100m grid (i.e., blocks of 1 ha). Occupation of territories was assessed by 3 criteria; the number of times singing was recorded in a block over the year; the spread of singing records in a block over the year; whether singing was recorded in a block during the peak singing times of Nov-Dec (Fig. 2). Criterion two was needed to differentiate between, for example, 3 records of singing within the same block during May, Aug, and Nov - indicating a high likelihood of a male present year round and defending a territory in that block – as opposed to 3 records for May, which may indicate a non-territorial or transient male. Singing

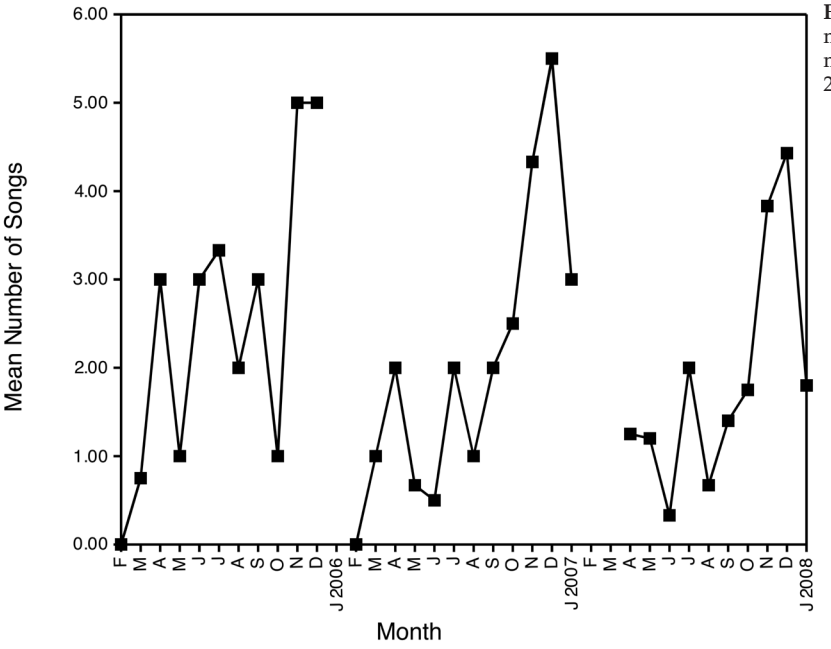

Fig. 2. Graph showing monthly mean number of songs over a 36 month period. No data for Jan 2006 or Feb and Mar 2007.

during the peak months of Nov-Dec was also regarded as evidence of the presence of a territorial male.

RESULTS

Seasonal differences in singing frequency

Variation in mean number of male tomtits heard singing per month is shown in Fig. 2. Males were heard in almost every month surveyed over the 3 year period, suggesting they reside year round in their territories. There was also a clear seasonal pattern of singing, with a peak in the 3 month period from Nov to Jan, with lower and more variable levels of singing during the rest of the year. The period in which singing was least frequent occurred in the late summer period from Feb to March (Fig. 2) when the birds had finished breeding and were presumably moulting.

To analyse seasonal patterns of singing frequency, I grouped mean monthly data into 3 month intervals that corresponded roughly to the 4 seasons (Feb-Apr, May-Jul, Aug-Oct, and Nov-Jan). There was no significant differences in the pattern of singing between years (χ^2 = 0.57, df = 6, P = 0.99). To test for differences with season I calculated expected frequencies using either the average rate of songs over the entire year, or by comparing observed values of songs per visit (combined data for the 3 years) against those expected from a Poisson distribution (λ = 2.25). The latter assumes the pattern of singing follows a random distribution. If I assume an average rate of singing across the year, observed seasonal differences in singing were not significantly different in any of the 3 individual years, but the combined data showed that seasonal pattern of singing was significantly different from that expected from a Poisson distribution (χ^2 = 23.84, df = 5, P = 0.0006).

Seasonal and annual variation in territorial behaviour

I estimated there were 15 tomtit territories along approximately 4 km of the track during 2007/08 (Fig. 3). Of these territories, at least 11 (73%) had been occupied during the 3 years of the study. The persistence of territory occupation suggests the population was stable over the period of study. My observations also indicate that not all territories were occupied every year (Fig. 3). This suggests the Atuanui population is not saturated and the carrying capacity may not be reached.

DISCUSSION

This study confirmed that male tomtits within Atuanui scenic reserve remain on their territories year round, and that their territory songs can be heard at any time of the year with a peak singing period during Nov to Dec. Fifteen territories were identified and mapped in 2007/8, 11 of which had been occupied for all 3 years of monitoring. Although birds were not banded, the presence a male in the same location over several years suggests either that males maintain a long-term fidelity or

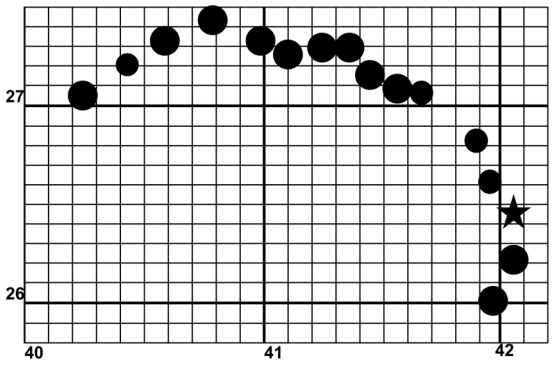

Fig. 3. Summary map of tomtit territories during the 2007/8 season. Large circle = territory occupied 2005-2008, smaller circle = territory occupied 2006-2008, star = territory occupied 2005-2007. Grid references from topographic map 260-Q09.

territories are successively occupied by different males. The similar number of territories each year also suggests the Atuanui population of tomtits is relatively stable, but a number of observations indicate that the reserve could support a larger population of tomtits. For example, the average distance between territories at Atuanui is about 300m which is equivalent to a territory size of 7 ha, larger than the average size of tomtit territories reported in the literature (Skinner 1978). This suggests that more territories could be accommodated along the track. There also appears to be fewer tomtits in Atuanui than in equivalent habitats in Ark in the Park, Waitakere Ranges (where all pests are controlled), indicating that tomtit numbers are not at full carrying capacity at Atuanui (*pers. obs*.).

It was not possible to convert territory numbers to absolute bird numbers because 15 territories may not equal 15 pairs of birds. For example, equal sex ratios cannot be assumed if there is differential female mortality (Donald 2007). As rats were not controlled at Atuanui during my survey and differential female mortality has been documented in tomtits (Brown 1997), I could not assume a balanced sex ratio. Even if there were 15 pairs present, it is not possible to scale territory count data to calculate total numbers for the entire reserve. For example, if we assume that tomtit song can be heard up to 50 m from the track, then the total area sampled was 40 ha along the 4 km length of the track, and an estimate for the total number of birds in the reserve would be 460. This estimate assumes habitat homogeneity with respect to tomtit territory requirements, and this is unlikely to be the case. Instead tomtit territories appeared concentrated on ridges with adjacent gullies (*pers. obs*.). It is possible that insect emergence may occur earlier on the ridges in the spring, and that the more sheltered gullies continue to provide food when the ridges dry out in summer.

Assessing the effectiveness of a management technique, such as predator control, requires the development of cost-effective and reliable methods to monitor its success on the targeted species. Thus, whether future intensive programmes of pest control at Atuanui bring any conservation return in terms of increased numbers of tomtits requires knowledge of their numbers before management and their response afterwards. This is turn requires survey methods that can be done effectively over the long term. My survey method can identify the presence/absence of tomtits and, if conducted when singing activity is at its peak, will identify active territories. My technique should also be useful for monitoring whether some of the 'vacancies' I observed become filled if pest control measures do indeed lead to increased numbers of tomtits in the reserve. According to my calculations, 8 visits (or 4 return journeys) during the peak singing period would have allowed me to identify 14 of the 15 active territories. Thus, with relative little effort, this would be sufficient to detect any large changes from year to year in the number of tomtit territories.

ACKNOWLEDGEMENTS

My thanks to an anonymous reviewer for their helpful comments on an early version of this paper.

LITERATURE CITED

Brown, K.P. 1997. Predation at nests of two New Zealand endemic passerines: implications for bird community restoration. *Pacific Conservation Biology* 3: 91-98.

Dawson, D.G.; Dilks, P.J.; Gaze, P.D.; McBurney, J.G.R.; Wilson, P.R. 1978. Seasonal differences in bird counts in forests near Reefton, South Island, New Zealand. *Notornis 25*: 257-278.

Donald, P.F. 2007. Adult sex ratios in wild bird populations. *Ibis 149*: 671-692.

Heather, B.D.; Robertson, H.A. 1996. *The field guide to the Birds of New Zealand*. Auckland, Viking.

Knegtmans, J.W.; Powlesland, R.G. 1999. Breeding biology of the North Island tomtit (*Petroica macrocephala toitoi*) at Pureora Forest Park. *Notornis 46*: 446-456.

Robertson, C.J.R.; Hyvönen, P.; Fraser, M.J.; Pickard, C.R. 2007. *Atlas of Bird Distribution in New Zealand 1999-2004*. Wellington, Ornithological Society of New Zealand.

Skinner, J.F. 1978. Status of the pied tit (*Petroica macrocephala toitoi*) in the Waitakere Range, Auckland. *Notornis 25*: 299-302.