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SHORT NOTE

Decline in common mynas (*Acridotheres tristis*) between 1971 and 2019 in central Auckland, New Zealand

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The common myna (*Acridotheres tristis*) was introduced to New Zealand in the 1870s in Dunedin and Christchurch but found the areas generally unfavourable (Long 1981; Miskelly *et al.* 2019). Progeny from these releases were taken to the lower North Island, and from there, over generations, the population gradually colonised northward to predominantly remain established north of the 40th parallel (Cunningham 1948, 1950, 1954). Mynas established in Auckland during the late 1950s (McKenzie 1960) and had spread across mid-Northland by 1965 (Falla *et al.* 1979).

During 1969–71, the common myna's ecology was studied by Counsilman (1971, 1974a&b) in central Auckland (Fig. 1). The study established a baseline distribution of 53 pair territorial boundaries during the breeding season, November–April (Counsilman 1971, 1974a,b; Fig. 1), the location of non-paired groups, the pair establishment process, and the sites and use of evening roosts. In the non-breeding season, paired mynas visited their home ranges daily, frequently calling on arrival in the early morning and then joined groups of other pairs and non-paired courting birds to interact and forage (Counsilman 1971). In 1969–71 birds flocked in the southern Auckland Domain but were absent from other nearby sites like bush areas in the domain and bare land associated with the development of the Grafton Gully North Western Motorway (route 16, Fig. 1) and "spaghetti junction" (Counsilman 1974b). The number of active pair sites changed during the breeding season, and birds potentially left the central city in March–April (Counsilman 1971). From late September, pairs returned to their territories and defended them from other non-territory holders but frequently did not reside in their territories until breeding between November and mid-March (Counsilman 1971). Mynas used three night-roost sites (Counsilman 1974a & b); two full-year sites in Phoenix palms (*Phoenix canariensis*) on the margin of the study area in Parnell in the grounds of the Foundation for the Blind (Fig. 1), and one "summer roost" within the Auckland Domain in a stand of *Cupressus* spp. (Fig. 1). Unpaired birds, pairs that failed to breed, and the males of breeding pairs used the year-round roosts during the breeding season, and all birds, including pairs with second clutch young, used these roosts from mid-March.

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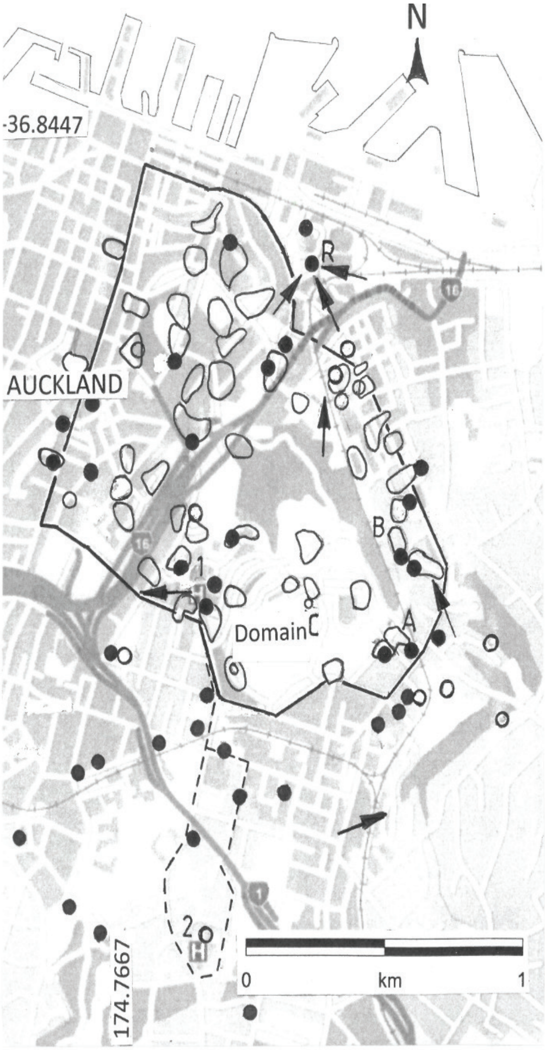

Figure 1. Distribution of Myna in central Auckland, New Zealand. Outlined polygons are territorial boundaries in 1969–71 (*after* Counsilman 1974a); ●, sites with myna pairs in 2019, ○, sites with an individual calling myna in 2019. R = the Te Taou roost, A = the Foundation for the Blind roost, B = the Parnell roost and C = the Auckland Domain roost. 1 = Auckland Hospital and 2 = Mercy Hospital. The arrows are the direction of moving pairs in the late evening in 2019. The solid line defines the extent of the survey site, which runs clockwise from the left north from Karangahake Road up Queen Street, east along Beach Road to Parnell Rise, south-east along Parnell Road, then west along Carlton Gore Road, and then north along Park Road, over the Grafton Bridge and Karangahake Road. The dotted line is the 2019 walk-past survey route up Park and Mountain Roads (between the hospitals) and Almorah and Maungawhau Road.

I re-visited the entire study site during 33 weekdays, in the pre-breeding season between 13 August and 26 September 2019, to look at population dispersion and flock sites, establish the distribution and site use of the 53 territories mapped by Counsilman (1974a), assess the location of full-year roosts and assess distribution using walking counts over a wider area of the surround.

During August–September 2019, Auckland weather had showers most days, and the temperature minima and maxima were between 6–10°C and 14–19°C, respectively. There were only three fine days with limited cloud or wind. Most of the survey work took place after 1000 h, but I did a walk-past survey over parts of Mountain Road between Auckland and Mercy Hospitals between dawn and 1000 h (Fig. 1).

I visited each of the territorial areas detected by Counsilman (1974a) 3–6 times and observed for ten minutes during each visit. I noted any broad changes in the environment at each previously occupied and occupied territory (Tables 1 & 2) but could not assess the location of important attributes like nest sites because the birds were not actively looking for them.

I spent evenings locating active roost sites and assessing the direction that birds were traveling to roost sites from within and just outside the study area. I re-visited the active roost site on 9 August 2020 to establish whether mynas and other birds were still using it.

In 2019, I did not find any winter flocks of young or unpaired birds throughout the study area. There was limited use of the upper domain by mynas and then only near the Auckland Hospital boundary. A small temporary group of eight birds formed on 9 September 2019 at Khyber Pass on the study site margin, but this group comprised paired birds from that site and others and dispersed after a few minutes rather than moving about as a flock.

Counsilman (1974a) identified 13 home ranges in the area before the breeding season in 1970 and a further 40 territories established during the breeding season (November–March). In 2019, there were 19 pairs visiting home ranges during the pre-nesting period (Fig 1). Fourteen of these pairs were at sites where mynas were present in 1970–71. There were also three other sites where pairs existed in 1969–71, where I recorded a single bird in 2019. None of the three territories in the Auckland Domain or Parnell Rise regions occupied during the entire 19 months in 1969–71 had mynas in September 2019. Fourteen (43.8%) of the still occupied sites were those that fledged young in 1970–71, and four of those territories were temporarily abandoned in 1970–71 when fledglings were still dependent on parents, suggesting that food was limited or other factors were present (Counsilman 1971, his Appendix 3).

Table 1. The types of vegetation in the existing common myna sites in central Auckland in September 2019.

	Vegetation in the study area					
	Occupied 1970–71 & 2019			Occupied only in 2019		
Site structures	gardens	park	street trees	gardens	park	street trees
Motorway	1	-	-	-	-	-
New buildings	2	3	2	-	2	1
Old & new buildings	5	3	3	1	1	2
Old buildings	1	-	-	-	3	1

Table 2. Common myna presence in September 2019, at the 53 locations mapped home ranges in 1970–71 by Counsilman (1974a). Old building = all buildings existed in 1969. New buildings = all building built after 1969.

Built structures in territories	Not occupied in 2019	Still occupied in 2019
Motorway	2	1
Motorway and new buildings	1	0
New buildings	14	7
Old and new buildings	7	11
Old buildings	4	1
Parkland lacking buildings	5	0

Only six (28.5%) of the territories that did not fledge young were being visited in 2019.

During August–September 2019 detection of mynas at Counsilman's identified territories occurred on average during only 49.9% (*SD* = 16.6, range = 16.7–100, *n* = 31) of visits. The low level of detection and individual behaviour showed that mynas were not yet present in these territories throughout daylight. Visits of less than five minutes during the breeding season in Onerahi, Whangarei, detected more than 95% of the known resident mynas (*AJB*, *unpubl*. *data*). Similar rapid detection is evident in Newcastle, Australia (Haythorpe *et al.* 2014). The only site where mynas were detected each visit in Auckland (*n* = 6) was at Te Taou Crescent.

Table 3. Detection of common mynas during walk-past surveys in Epson, Auckland, 3–26 September 2019.

Site	Detected	Not detected	Detection %
Outhwaite Reserve	7	26	21.2
Kyber Pass	2	11	15.4
St Peters School	4	25	13.8
Mt Albert Grammar	3	24	11.1
Mercy Hospital	3	15	16.7
Maungawhau Road	8	8	50.0

Walk-past surveys between Auckland and Mercy Hospitals in September 2019 found what appeared to be very favourable residential sites for myna unoccupied (Table 3, Fig. 1). However, Counsilman (1971) indicated that parental care often extended to home ranges beyond the territorial boundaries.

In 1969–71, mynas flew to roost sites from within the intensive study area and from other nearby sites up to 1.6 kilometres away (Counsilman 1974b). Mynas use direct flights towards staging or roost sites (*AJB*, *unpubl*. *data*), so they would have crossed the Auckland Domain in 1969–71. In 2019, no mynas flew over Auckland Domain (*n* = 7 surveys). The only roost site found was within the park enclosed by Te Taou Crescent (Fig 1; front of old Auckland Railway Station). Pairs within the study site flew to the Te Taou site along local valleys. Birds on the study area's margin also flew towards Newmarket Park and west from the hospital (Fig. 1).

The catchment of pairs flying to the Te Taou roost was not established and extended eastward. However, the area servicing the roost site in 2019 was likely to have differed from the area that serviced the roost sites in 1969–71, where full-year roosts held 360 birds in August–September 1969, 490 birds in March 1970, and at least 190 birds in late October 1969 (Counsilman 1974b). These roosts included birds from within the intensive study area and from up to 3 km away (Counsilman 1974b). In September 2019, the Te Taou site held less than 60

Table 4. Counts of common mynas and other birds roosting at Te Taou roost site, Auckland, September 2019.

	Common myna					Common starling	Rock pigeon	House sparrow
	birds	flocks	% single	% pairs	% groups			
12 September 2019	58	32	25.0	71.9	3.1	1,299	6	127
17 September 2019	55	29	17.2	79.3	3.4	1,705	2	30
19 September 2019	49	28	25.0	75.0	0.0	875	8	12
23 September 2019	58	31	12.9	87.1	0.0	1,140	13	33
mean ± *SD*	55 ± 4.2	30 ± 1.8	20 ± 6.0	78.3 ± 6.6	1.6 ± 1.9	1,254 ± 347	7.3 ± 4.6	50 ± 52

mynas spread over four phoenix palms (Table 4), and in August 2020, it contained 22 mynas. The birds arrived as single birds, pairs and groups of three and four. The groups of three and four were all birds that staged (assembled) on the roofs of buildings surrounding the roost site. They arrived at the staging site as pairs or individuals ($n = 20$). The proportion of groups exceeding two birds entering roost trees at the Te Taou (2.1%) was lower than the 8–60% of arrivals at roosts between November 1970 and April 1971, and June 1971 (Counsilman 1974b). The lack of larger groups indicated that in 2019 there was no staging taking place outside of the roost's immediate surroundings and that the distances flown to the roost were small and comprised a low-density population of mynas (*AJB, unpubl. data*).

In 1970–71, the upper Auckland Domain contained 11 territories, and many myna flocks used it for foraging and socialising (Counsilman 1974a). New pairs formed from within these flocks (Counsilman 1974a), and it was likely that the majority of pairs that established new home ranges at the start of the 1970 breeding seasons were birds from the flock (Counsilman 1974a). In 2019, searches in the streets and parks in the study area and its surrounds did not find any flocking birds. Consequently, unless Auckland central was acting as a late breeding sink during the 2019–20 breeding period, there could have been as few as 17–20 pairs now using the study area.

The one roost site survey that I carried in August 2020 before a COVID-19 lockdown prevented further surveys indicated that the population was potentially smaller than in 2019. However, mynas do use multiple roosts. In India, the changes in numbers at the same roosts between consecutive days ranged between -9.6% and 6.9% at a major roost (4,300–5,300 birds), -6.3% and 17.1% at medium-sized roost (900–1,200 birds) and -25.3% and 18.2% at small-sized roost (300–700 birds; Mahabal *et al*. 1990). The Te Taou roost differed between -12.2% and 18.4 % (Table 4). In Pune, densities increased in the evenings from 0.13 to 4.96 birds per hectare when mynas flew in from rural areas (Mahabal *et al.* 1990). The Auckland Central density is unlikely to change with the time of the day and was a maximum of 0.49 mynas per ha in 1970–71, and 0.16 birds per in September 2019.

Counsilman (1971) listed three requirements for myna territories; a suitable nest hole site, an open habitat, and a large area with various land cover. In Auckland, the most likely reasons for this breeding population reduction are increased disturbance and the loss of breeding sites. Some of these issues were evident in 1970–71. Mynas deserted the Foundation for the Blind roost in March 1970 after the roost site a Phoenix palm was trimmed (Counsilman 1974a). Two pairs of mynas abandoned their home ranges between 0800 h and 1730 h during weekdays due to human disturbance but stayed in their home ranges during the weekends when the disturbance was less (Counsilman 1974a). In Melbourne, Australia, ground foraging mynas were disturbed by people at *c.* 5 m away (McGiffin *et al.* 2013) so high densities of people would restrict ground use.

Since 1971, Auckland's human population has increased from 698,000 to over 1,571,718 (Counsilman 1974a; Statistics New Zealand 2018). Most of the 53 sites identified in 1970–71 have been modified, and the only places that appeared to have limited modification were in northern Stanley Street and the Auckland Domain. The Stanley Street site was still occupied but had considerable human and traffic disturbance. The upper domain was in constant use by people during the day and evening in early spring 2019. In 1970–71, nine (50%) successful breeding pairs overlapped part of the Auckland Domain (Counsilman 1971). In 2019 only six of these territories had mynas, and no new sites were found.

During the past 48 years, there has been considerable replacement and upgrading of buildings in central Auckland. In 1969–71, 85% of the nests were under metal rooves, funnels and gutters, roof vents, holes and crevices in buildings, and only 11% in vegetation (Counsilman 1974a). Unfortunately, Counsilman (1971) did not provide any information on the nest type and other attributes in any territory. Mynas currently occupy sites with pre-1969, post-1969 and a mix of buildings (Table 2), but a relationship between built habitat age and occupancy is not apparent. In 2019, there was no significant difference in the proportional occupancy of sites with post-1969 buildings and those with a mix or that were purely pre-1969 buildings ($\chi^2 = 0.2311$, *df*. = 1, $P > 0.05$). Also, newly occupied sites in September 2019 included buildings that were all built after 1969 ($n = 3$). All currently occupied sites had some trees (Table 1), which myna young require as they leave nest sites (Counsilman 1971).

This study was confined to September, before expected breeding or full occupancy of breeding sites (Counsilman 1971). Consequently, it was impossible to evaluate current territories' boundaries and essential attributes, which needed to occur between November and March (Counsilman 1971, 1974b). Minimal changes can dictate breeding site suitability for mynas. In Whangarei, one myna territory comprising a road, pasture, and a lamppost with a possum guard was deserted after the possum guard was removed (*AJB, unpubl. data*). What appears to be favourable sites for mynas, have been created in central Auckland in the past 48 years, but these areas lacked pairs in September 2019. These areas include the North Western Motorway margins (Route 16) to the Port of Auckland, which has had extensive marginal planting areas but only one pair of mynas.

This study only presents a view of the myna composition in the study area in two periods. The drivers for the decline in population size are unknown and can only be resolved by more in-depth work. Defining these drivers is important because mynas are considered invasive pests in some situations (Lowe *et al*. 2000; Peacock *et al.* 2007). Studies on the impact or mynas on bird community composition and habitat often use information from ecological studies (Eddinger 1967; Sengupta 1968; Counsilman 1971; Wilson 1982) to define the attributes to measure and the spatial scales for data collection (Lim *et al.* 2003; Chong *et al.* 2012), and to discuss the relevance of their results (Pell & Tidemann 1997; Crisp & Lill 2006; Grarock *et al.* 2012). It is important that the correct information is assessed or erroneous conclusions will be reached (Crisp & Lill 2006).

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