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A STUDY OF THE CHANGES IN THE RANGE SIZES OF WHITE-VENTED MYNAS IN SINGAPORE

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ABSTRACT. – The white-vented myna *Acridotheres javanicus* population has declined from 229,000 in the 1980's to 139,000 in the 2000's. The total range (i.e. the area that includes all the locations where the bird is ever found) and home range (i.e. the area in which an animal spends most of its time while foraging, mating and caring for the young) of seven white-vented mynas were determined by radiotelemetry between 8 November 2001 and 14 January 2002 in Singapore. These were compared to the total and home ranges recorded for eight white-vented mynas in 1988 by Kang (1989, 1992). Both the total and home ranges were found to be significantly smaller in the later study (14.0 ± 5.0 ha, and 4.0 ± 1.0 ha, respectively). Possible explanations for the difference in range sizes include differences in transmitter-mounting techniques, differences in the duration of study and a possible impact of the rising crow population on the myna population in Singapore.

KEY WORDS. – *Acridotheres javanicus*, home range, invasive species, Singapore, total range, white-vented myna.

INTRODUCTION

White-vented mynas *Acridotheres javanicus* are successful invasive birds in Singapore, where they are common and penetrate all parts of the island (Hails, 1985). In the 1980s, there were approximately 229,000 mynas in Singapore. I extrapolated this figure from data from Kang (1989). In recent years (2000 to 2001), however, the population size of the white-vented myna has declined to around 139,000 (Lim et al., in press).

In 2001, I carried out radiotelemetry on seven white-vented mynas to find out if this change in population size was also accompanied by a change in home and total range sizes. I compared the range sizes I obtained for these mynas with the range sizes determined for the same species by Kang (1989, 1992) in Singapore, which was the only previous study of the range sizes of white-vented mynas in Singapore.

MATERIALS AND METHODS

Study area. – The study was carried out on the main island of Singapore (01°37'N, 103°75'E) from 8 November 2001 to 14 January 2002. The main island has an area of 648 km^2 and a human population of 3.9 million (Singapore Department of Statistics, http://www.singstat.gov.sg/). Singapore has an equatorial climate with a mean annual precipitation of 2,353 mm, mean daily humidity of 84%, and a mean annual temperature range of 24°C to 31°C (Meteorological Service Singapore, http://www.gov.sg/metsin/). Four study sites were chosen, each representing a predominant habitat: park, housing estates, non-residential buildings with open vegetated space and rural habitats (Fig. 1).

Study subjects. – White-vented mynas are endemic to Java and Bali, Indonesia (Feare & Craig, 1998). They were probably introduced to Singapore around 1924 (Gibson-Hill, 1949).

Bird capture. – The mynas were baited with bread coated with butter containing 3% (by bait mass) of alpha-chloralose, which is an oral anesthetic. Experimentation with different doses showed that small doses (1-3%) caused the birds to lose motor control within 15 to 30 minutes and eventually to lose consciousness for two to four hours, while higher doses (more than 3%) resulted in death of the animals. No birds suffered mortality when the safe dosage was maintained. The dosage of 3% was used as it produced a quick response (within 15 minutes) and hence minimized the dispersal distance of the dosed birds and yet was low enough not to kill the birds. The birds were checked for age, feather condition, and moulting and breeding status. Only non-moulting, adult birds with good feather condition and no signs of active breeding were tagged.

***Radiotagging.* –** G3-IV transmitters (from AVM Instrument Company, Ltd) tuned to a frequency of 216 MHz were attached to the tail feathers of each myna using cyanoacrylate adhesive. Each transmitter weighed 2.5 g (approximately 2.5% of the bird's body weight; less than the maximum 3% recommended for tail-mounts by Kenward, 1987) and had a possible lifespan of two months. Once the birds were observed to show normal behaviour (e.g., no excessive preening, ability to walk and feed), they were released where they were caught. All birds were released early in the day to allow them time to rejoin their conspecifics and forage before going to roost.

***Radiotracking and range analysis.* –** The mynas were tracked using a 3-element collapsible Yagi antenna on days with no rain, with equal weight given to all hours of the day, and with a minimum of a 30-minute interval between consecutive locations. The birds were sighted using binoculars or the naked eye where possible. Data collected included the location, habitat, time, weather and behaviour of the bird. Minimum convex polygon sample-size bootstrap test was performed on the locations recorded for each bird in order to determine the sampling saturation point. Data collection ceased once the saturation point was reached for each bird. The locations of the bird were plotted onto an electronic street directory using Arcview ™ geographic information system (GIS) software. The home range is defined as the area in which an animal spends most of its time while foraging, mating and caring for the young (Burt, 1943). The daily range of a myna may not be a single contiguous area but could consist of several regularly used sites. The diurnal activity centers (DACs) were defined as the areas regularly used by the birds during the day (Morrison & Caccamise, 1985; Kang, 1992). The home range was the total area of all the DACs used by each bird. The total range (TR) was the area that included all the locations where the bird was ever found (Kang, 1992). The home and total ranges were calculated using the minimum convex polygon method (Kenward, 1987).

***Statistical analysis.* –** The mean sizes of the total and home ranges were calculated for white-vented mynas radiotracked in 1988 and 2001. Mann-Whitney test (SAS Institute, 1990) was performed to determine whether there was a significant difference in the total and home ranges recorded for white-vented mynas between 1988 (using data from Kang [1989, 1992]) and 2001.

RESULTS

Seven white-vented mynas were radiotracked by me from 8 November 2001 to 14 January 2002. This sample size was comparable to the eight adult mynas radiotracked by Kang (1989, 1992). Mynas BK1, BK2 and BK3 were found in a housing estate habitat, mynas ECP1 and ECP2 were found in habitats consisting of both parks and housing estates, myna NUS1 was found in a habitat consisting of non-residential buildings surrounded by open fields and myna LC1 was found in a rural habitat. The mynas radiotracked in this study were found in similar habitats to the mynas radiotracked by Kang (1989, 1992). The total and home ranges recorded for

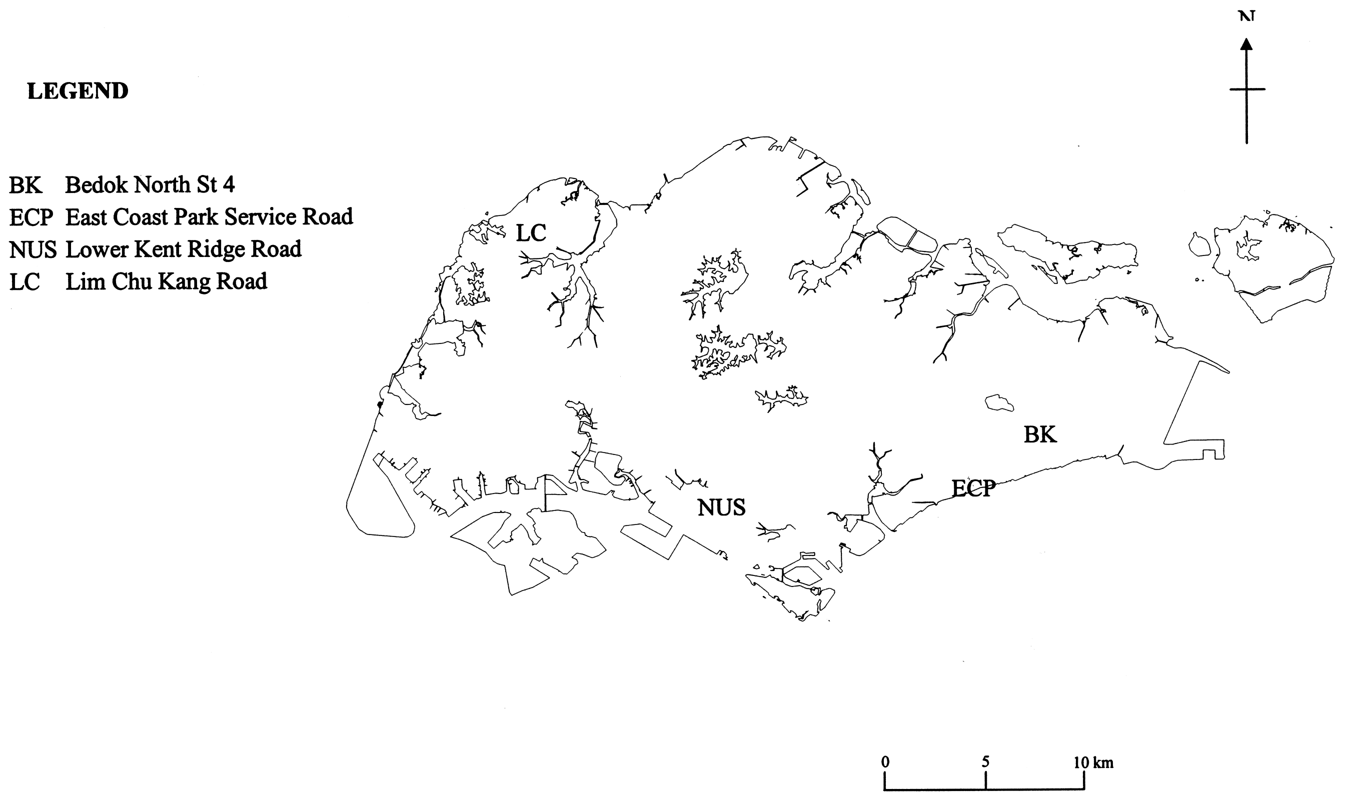

Fig. 1. Map of Singapore showing localities of seven white-vented mynas radiotracked in Singapore from 8 November 2001 to 14 January 2002.

the mynas in my study varied between 0.2 and 32.0 ha, and between 0.2 and 12.0 ha, respectively (Fig. 2). The total and home ranges recorded for the mynas by Kang (1989, 1992) varied between 14.0 and 847.0 ha, and between 4.0 and 62.0 ha, respectively (Kang, 1989). The mean ± standard error (S.E.) for the total and home ranges recorded for the mynas in my study were 14.0 ± 5.0 ha and 4.0 ± 1.0 ha, respectively. The mean ± S.E. for the total and home ranges recorded by Kang (1989) were 308.0 ± 113.0 ha, and 30.0 ± 8.0 ha, respectively. The differences in both the total and home ranges between studies were significant ($Z = 2.14$, $Z = 2.50$, $P = 0.02$, $P = 0.01$, df = 1, 1).

DISCUSSION

The size of both the total and home ranges were smaller for the white-vented mynas in my study than in the study by Kang (1989, 1992). I put forth several possible hypotheses for these differences.

First, although there are certain similarities between my study and that carried out by Kang (1992), such as the same method of baiting and capturing the mynas, the same radio frequencies and antenna used, similar radiotransmitters from the same manufacturers, similar habitats in which the mynas were studied and the same method of calculating the range sizes, there were also differences such as the differences in the method of attaching the transmitters onto the mynas and the duration of the radiotracking study. In Kang's (1989, 1992) study, the transmitters were attached onto the backs of the mynas in back-pack style in order to distribute the weight of the transmitter evenly and minimize any effects on the flight and balance of the birds. While the tail-mounted method is a known and used method (Kenward, 1987), it is possible that the flight and balance of the tail-mounted birds could have been affected. This has not been tested for white-vented mynas. However, a study on eight tail-mounted starlings by Bray et al. (1975) has shown that there was no difference in the behaviour of instrumented birds from that of other birds in the flock, and the unrestricted flight of the radio-tagged birds was exemplified by an instrumented starling that was observed leading a flight of 11 starlings.

The study by Kang (1989, 1992) was carried out over a period of nine months. My study was carried out for three months. It is possible that the long-term ranging behaviour might be different from the short-term ranging behaviour, and might be affected by factors such as courtship, nesting and caring for young.

Another possible explanation for this difference in range sizes could be a possible impact of the rising crow population on the myna population in Singapore. In recent years, the house crow population has increased 30-fold from between 1,800 to 3,700 (Hails, 1985b) to around 131,000 (Lim et al., in press). The recent study by Lim et al. (in press) suggested that the house crow may be out-competing the white-vented

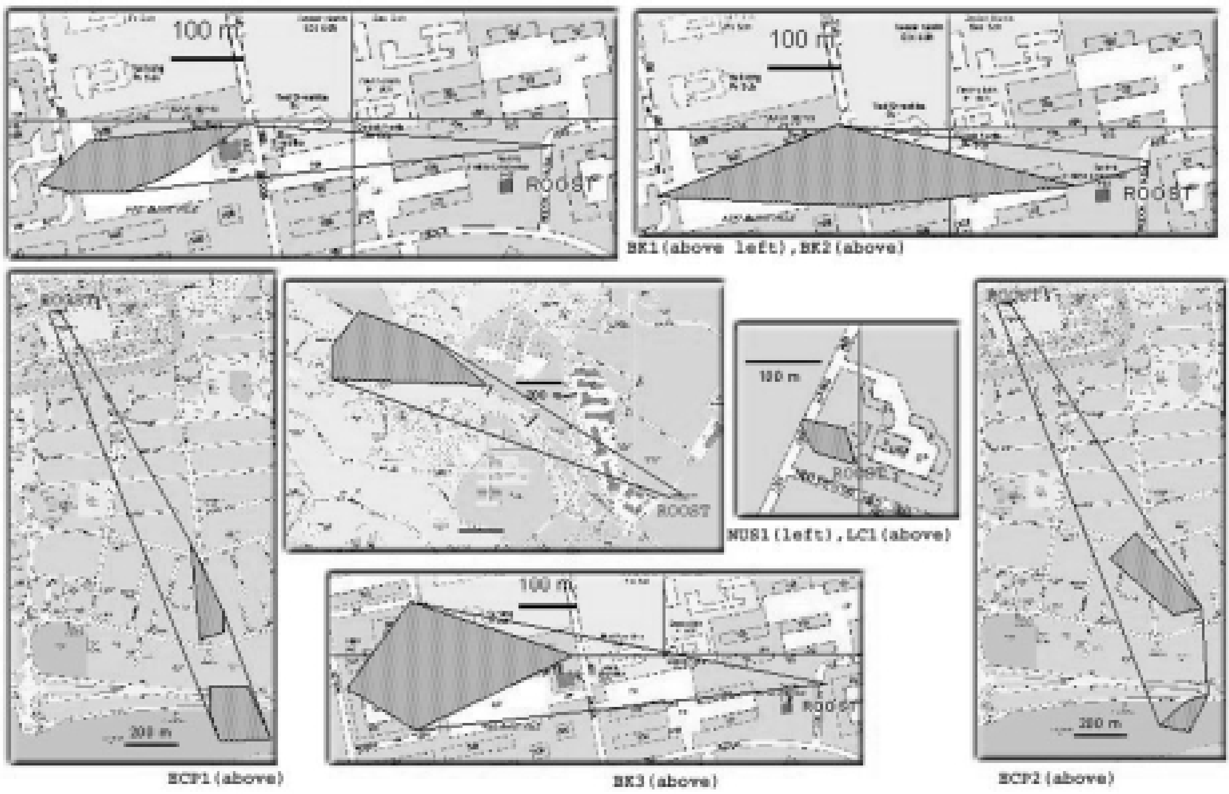

Fig. 2. Minimum convex polygons of the total and home ranges of seven white-vented mynas radiotracked in Singapore from 8 November 2001 to 14 January 2002. Diurnal activity centres (DACs) and home ranges are represented by stippled areas and total ranges by both stippled and non-stippled areas. Acronyms next to figures refer to individual mynas.

myna. It cited two lines of evidence for this claim. First, the explosion of the house crow population was mirrored by a fall in the population of the white-vented myna. Second, public housing estates (defined as government built high-rise apartments, including apartments with commercial outlets on the ground floor and high-rise dormitories), where house crows were abundant, had comparatively less white-vented mynas compared to private estates (defined as private high-rise apartments and condominiums), even though public estates probably possessed at least the same amount of resources such as extensive landscaping and anthropogenic food sources. Both species utilize similar habitats, roost trees and food resources. King et al. (1975) observed that white-vented mynas thrived in areas of human habitation such as cities and gardens, and Long (1981) recorded the presence of house crows in many towns and cities. White-vented mynas and house crows roost communally, usually in tall, large trees such as Angsana *Pterocarpus indicus* in urban areas (Hails, 1985; Kang & Yeo, 1993; Peh & Sodhi, 2002; Yap et al., 2002). Both are omnivorous, and feed on a wide variety of food (Ali & Ripley, 1972; Kang, 1992). The larger size (length of 40 cm; mass of 250 g [Robson, 2000; Lim Haw Chuan, pers. comm.]) of the house crow may confer it a competitive advantage over the much smaller-sized white-vented myna [length of 24 cm; mass of 90 g (Counsilman et al., 1994; Robson, 2000)]. Also, white-vented mynas are usually submissive rather than aggressive in their interactions with other birds, whereas house crows have been observed to be generally aggressive to white-vented mynas (Kang, 1989). House crows have also been observed as threatening to nests of other species (Hails, 1985; Madge & Burn, 1994).

There is much public and governmental concern currently about the status and control of the populations of these two highly successful invasive species in Singapore (e.g., Peh & Sodhi, 2002; Soh et al., 2002; Yap et al., 2002; Brook et al., in press; Lim et al., in press). If the rising crow population is in fact suppressing the population growth of mynas in Singapore, this could have important ramifications in the direction of management and control of these invasive birds in Singapore. For example, in Singapore, the Agri-food and Veterinary Authority of Singapore (AVA) has funded an initiative to study intensively the autecology and behaviour of the house crows with a view to providing scientifically rigorous guidelines to managers prior to the initiation of a large-scale control programme. The management goal was to determine the level of culling required to reduce crow density from its 2001 level of 190 birds km^{-2} to a target density of <10 birds km^{-2} within a 10 year period (i.e., to <5% of current density) (Brook et al., in press). If this control programme succeeds in diminishing the crow population, the sudden removal of one of the myna's major competitors may lead to an ecological "release" (Blondel, 2000) and impel an explosion in myna numbers (Brook et al., in press). Therefore, it is critical when managing the populations of invasive birds to consider their status, ecological associations and the consequences of shifts in population demographics on other invasive species.

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