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Ranging behaviour of Tyto alba in a ricefield from radio telemetry studies.

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ABSTRACT

A radio telemetry study was conducted on the barn owl, *Tyto alba* in the ricefield area of Sungai Burung in the district of Kuala Selangor, Malaysia. Radio tracking data were obtained from four females and only one male. The home range sizes of females based on the 95% Mean harmonic calculations were 0.60, 0.70, 1.98 and 2.85 hectares. The home range size of the single male was 5.70 hectares. The smaller home range size in ricefield compared to another study in oil palm may reflect the greater abundance of rats in the former The core area sizes of the females based on the 50% Mean Harmonic calculations were 0.20, 0.11, 0.33 and 0.25 hectares. The core area sizes of the females constituted from 8.9 to 34.2% of the calculated home ranges. Two pairs of breeding females whom nest boxes were in close vicinity showed mutually exclusive home ranges and core ranges. This indicate breeding females may avoid one another or exhibit some form of territorial behaviour.

ABSTRAK

Satu kajian radio telemetri telah dijalankan ke atas burung pungguk jelapang *Tyto alba* di kawasan sawah padi Sungai Burung di daerah Kuala Selangor, Malaysia. Data radio trekking telah diperolehi dari empat burung betina dan hanya seekor burung jantan. Luas banjaran kediaman burung betina berdasarkan kepada pengiraan Min Harmonik 95% ialah 0.60, 0.70, 1.98 dan 2.85 hektar. Luas banjaran kediaman seekor burung jantan tersebut ialah 5.70 hektar. Luas banjaran kediaman yang lebih kecil di sawah padi berbanding sebuah kajian di kawasan kelapa sawit mungkin menunjukkan bilangan tikus yang lebih banyak di sawah padi. Luas kawasan ters bagi burung betina berdasarkan pengiraan Min Harmonik 50% ialah 0.20, 0.11, 0.33 dan 0.25 hektar. Luas kawasan teras ini mewakili di antara 8.9 sehingga 34.2% dari luas banjaran kediaman yang dikira. Dua pasang burung betina yang sedang membiak dan menduduki kotak sarang yang berhampiran menunjukkan banjaran kediaman

dan kawasan teras yang tidak bertindan. Ini menunjukkan burung betina yang sedang membiak mungkin mengelak di antara satu sama lain atau mempamirkan satu bentuk lakuan kewilayahan.
Key words: *Tyto alba*, home range, territorial behaviour, ricefield rat, radio telemetry

INTRODUCTION

The Barn owl *Tyto alba* is a proven controller of rats in oil palm estates, whereby the latter constitute its major diet (Lenton, 1978). Provisioning nest boxes in oil palm has encouraged the barn owl to breed and increase in numbers for effective control of rats (Smal, 1988). Following the success in oil palm, a similar program to boost barn owl populations in paddy fields was carried out under the initiative of the Department of Agriculture (DOA). Nest boxes were first erected in Tanjung Karang, Selangor in 1988 and by 1993 the barn owl program had been implemented in all paddy growing states throughout the Peninsular. Prior to the barn owl programmes (BOP), farmers had to rely heavily on rodenticides. However despite the heavy usage of rodenticides, estimated to cost around RM30/ha/yr, the average rice crop loss to rat activities remain high, reaching 18% in some years (Anon, 1997). However, following one year of the implementation of the barn owl program the quantity of rodenticide baits distributed to farmers by DOA decreased from 42.8 tons to 26.7 tons. By 1994, DOA had stopped distributing baits to farmers. This indicates the success of the barn owl program in dealing with rat infestation. Baitings regularly carried out by farmers, on their own accord, was also reduced from eight rounds to a single round starting from 1993.

Census data has shown that the rice crop lost to rats has been drastically reduced from 7 – 12% prior to the implementation of the BOP to less than 2% (Anon, 1997). However, one factor that may determine population size of the barn owl is nest box density. Availability of suitable nest sites is thought to be an important population limiting factor. Additionally breeding owls tend to be territorial, putting an upper limit to the owl density. Therefore an optimum density of nest boxes need to be established in order to perpetuate a viable owl population for sustainable rat control. One way of achieving this is to gauge the home range size of *T. alba*; and to what extent they are territorial.

MATERIALS AND METHODS

Study site.

The study was conducted in a BOP area at Parit Tiga, Sungai Burung in the district of Kuala Selangor, Selangor. The number of standing nest boxes in the area (3, 615 hectares) was 79. Sungai Burung comes under the Tanjung Karang Irrigation Area, covering a total acreage of 19, 438 hectares. with the number of standing nest boxes totaling 605. The study was conducted from July to October, 1999 and from Disember 1999 to February 2000, both during the breeding season, which coincided with the start of the paddy planting calender.

Radio telemetry

The study relied on radio telemetry, whereby the spatial locations of individual owls were mapped. These radio locations were used to analyse individual home range sizes and their spatial relationship with other owls with the help of a computer programme. The radio telemetry set consisted of a radio receiver Model CE – 12 (Custom Electronics of Urbana Inc) with a frequency range coverage of 150 – 152 MHz, LF – 1 transmitters, powered by 1.5V battery and a 3 element Yagi antenna. The whole package weighed approximately 20 g. The smallest bird fitted with radios weighed 480 g so that the transmitter-bird weight percentage did not exceed 5%. A heavier transmitter probably affects behaviour and movement of animals (Wolton and Trowbridge, 1985; Pouliquen *et al.*, 1990).

Individual owls from breeding pairs were captured from their nest box; transmitters pre-set to emit signals at unique frequencies were mounted and harnessed on their back, and released. By tuning the radio receiver to the desired frequency and following the path of the strongest signal, the postion of the owl can be ascertained on the ground. Each owl was followed for at least 10 cumulative days, every four to five days from dusk (1830 hours) to dawn (0630 hours) Three to four radio locations were recorded for each owl for each radio tracking session, when the owls were not in the box, giving a total of 30 - 40 locations,

deemed sufficient for home range measurements and for the purpose of interspecific comparison (Kenward, 1987).

Radio signals were detectable from at least 100 m away and were pin-pointed by walking along the path of the strongest signal. Apparent animal location was determined to be accurate within 1 – 2 metres as confirmed by actual sighting. Telegraph poles and other landmarks were conveniently used as grid markers to mark bird locations on the map. When radio location was uncertain, triangulation (Kenward, 1987) was employed. This involves taking bearings from at least three different points. The point at which the bearings intersect was designated as the bird location.

Home range size was calculated using the Minimum Convex Polygon and the Mean Harmonic method. The first, which is frequently adopted in home range studies, permitted interspecific comparisons of size of home range. The second allowed demarcation of the 'core area' which can be assumed as the defended perimeter, if territoriality is exhibited by the owls. By convention, 95% and 50% of the utilized area calculated with the Mean Harmonic method are regarded as the home range and the core area, respectively. Calculations were done with the Ranges IV software (Kenward, 1988).

RESULTS

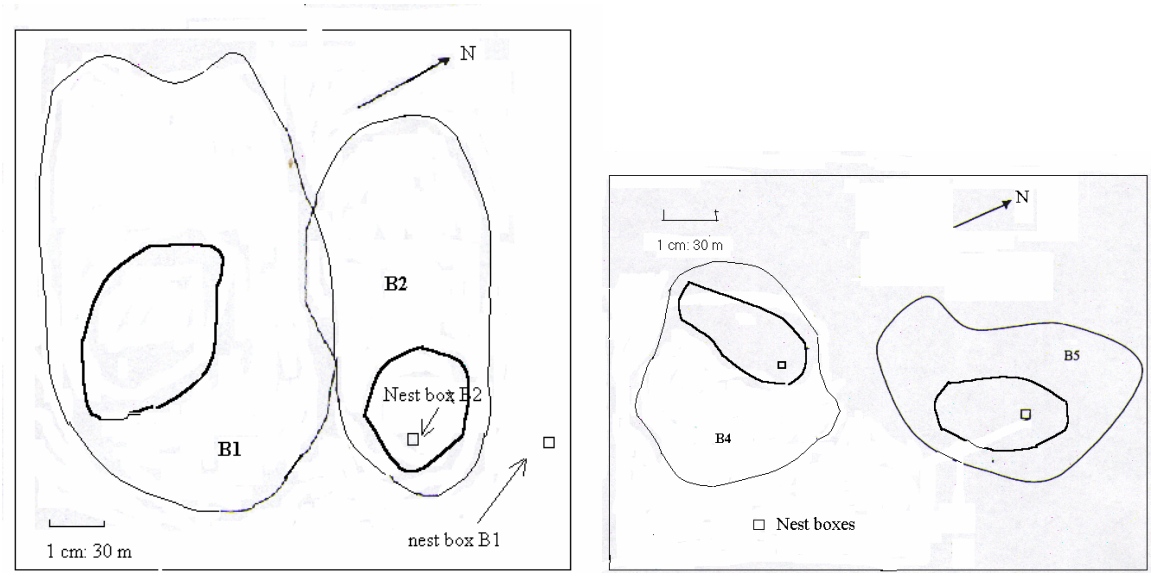
Sufficient data was collected from four females and only one male (J3) and their home range size is shown in Table 1. Signals from the other male (J6), however, could only be detected on very few occasions when it returned to the nest box. Attempts to tracked its movement by covering a radius of 2 km from it's nest box have failed to locate the bird.

Owl	Sex	Weight (g)	Date tracked	Radio freq	MH 95% (ha.)	MH 50% (ha.)	MCP (ha.)
B1	F	650	14/7 – 9/10/99	150.012	2.852	0.2554	2.858
B2	F	655	14/7 – 9/10/99	150.039	1.989	0.3347	2.981
J3	M	480	10/12/99 – 18/2/00	150.068	5.707	0.870	4.549
B4	F	633	10/12/99 – 18/2/00	150.250	0.705	0.1134	1.036
B5	F	620	10/12/99 – 18/2/00	150.101	0.6057	0.2069	1.269
J6	M	520	10/12/99 – 18/2/00	150.278	-	-	-

Table 1: Home range size and core area of *Tyto alba* calculated using the Mean Harmonic (MH) and the Minimum Convex Polygon methods.

The calculated area from the two methods were comparable and highly correlated (r = 0.957). The core area ranged from 8.9 % to 34.2% of the home range size calculated using the 95% HM method. Since there was only a single male, comparison between male and female range size is not possible, although it is at least 2.4 and 1.8 times larger than the average female home range based on the 95% HM and the MCP method respectively.

Females B1 and B2 occupied adjacent nest boxes which were 70 m apart. Two other females B4 and B5 also occupied nest boxes located 150 m apart. These owls were tracked within at the same period i.e. B1 and B2 from 14/7 to 9/10/99 and; B4 and B5 from 10/12/99 to 18/2/00. They have exclusive ranges except for B1 and B2 which overlapped a little at the boundary (Figure 1). However the core areas for both pairs were exclusive.



(a) (b)

Figure 1: Home range of (a) females B1 and B2 and (b) females B4 and B5

DISCUSSION

The home ranges of female *Tyto alba* in this study (0.6 to 2.8 ha) is comparable to that in oil palm i.e. 2.16 ha. (Norsahm, 1987). However, compared to the present study, the home range of male in oil palm was much larger i.e. 41.5 ha. Lenton (1980) showed a larger home range i.e. 20 - 78 ha. during the non-breeding season. During the breeding season, the home range size for the male was much larger i.e 142 ha. In this study, since the single male could not be detected on most days, the recorded range size can be assumed to represent a small fraction of the true range size. For comparison the ranges of barn owl in a grassland habitat in North America varies from 436 to 1414 ha. (Colvin, 1984). These large variation is range sizes most probably reflects prey abundance in the respective habitat, i.e. the higher the prey density, the smaller the home range. Oil palm and paddy in Malaysia most probably support greater prey numbers in comparison to most North American habitats.

Generally, home range can vary because of differences in the quality of the habitat, the distribution and the abundance of food or population density (Ostfeld 1990). This has been widely established in small mammals particularly rodents whereby increase in food availability resulted in smaller home ranges (Taitt et. al 1981; Ims, 1987). Comparison of home ranges based on a trapping study conducted on the wood rat *Rattus tiomanicus* in different habitats in Malaysia showed that home ranges are smaller in mixed vegetation than in grassland, which was associated with higher food abundance in the former (Harrison, 1958). Studies based on radio telemetry showed that home ranges of *Rattus tiomanicus* in grassland was substantially larger i.e. 0.327 hectare (Sanderson & Sanderson, 1964), compared to oil palm i.e ranging from 0.09 to 0.26 hectare (Norsham, 1987).

Rat population density varies in different habitat, which are primarily influenced by food abundance/availability, and this in turn influences range sizes of the barn owl. Wood (1969) concluded that in oil palm there is an average of about 111 rats per acre (274 rats per ha.) A survey conducted by Sumangil (1990) in the Philipines and Murakami *et al.* (1990) in Indonesia indicate that rat numbers in ricefield can reach up to 900 rats per hectare and 725 rats per hectare respectively in the absence of control. However, population assessment of ricefield rat in Malaysia using traps only yield a small estimate of the actual population size (Wood, 1971). Rat population densities may vary from one area to another in the same habitat and barn owls may cover as much area needed in order to meet its daily food requirement and thus the wide difference in range sizes between and within similar habitats.

Breeding females may avoid one another as reflected from the exclusive home ranges in this study. However, Lenton (1983) found that owls defend less rigid territories at higher owl densities and that ranges overlap considerably. Other questions like whether males exhibit territorial behaviour and whether females tolerate the presence of another male in their territory, however, could not be answered as very few owls of which only one male was radio tracked. However, based on the large area covered by the male, in this study, it is most likely that their presence is tolerated by other pairs. Observations in the field support this; up to four owls were seen perching together on trees and overhead lines in close proximity to each other. Besides, breeding pairs are committed to one another, returning to the same nest box year after year. Therefore, there is no real need to exhibit territorial aggression towards 'intruding' males. Territorial aggression, prevalent in small mammals, is one form of a defense mechanism to secure limited food resources or to protect young from infanticidal adults (Otsfeld, 1990; Wolff, 1993). In the case of *T. alba* in the ricefield, food is presumably abundant and infanticide (adult devouring owlets) is not known in this species.

Results from this study indicate that, a female, based on the largest range size calculated i.e. close to 3 ha., may need at least a clearance of 100 m all around its nest for it's exclusive use or core area, assuming a circular home range. Nest boxes, therefore, may have to be erected at least 100 m apart. Placing nest boxes too close to each other, may cause some females, as exhibited by females B1 and B2 in this study, to be displaced and forage far from home. However, an observation noted by Lenton (1983) shows that owls bred successfully in an oil palm plantation eventhough nest boxes were placed only within 50 m apart. An initial high density of nest boxes at around one nest box per 2 hectares was suggested by Smal (1988) in oil palm to encourage breeding and to increase owl numbers. He found the occupancy rates in subsequent breeding seasons were not as pronounced as the first, giving an indication that as the owl population stabilizes it will approach the carrying capacity of the habitat. Smal *et al.* (1990) constructed a model to predict rat population behaviour subject to barn owl predation. He found that a density of one pair per 5 ha. is viable for adequate control of rats in oil palm. However, in order to establish an optimum density of barn owl in ricefield, a more extensive radio tracking study, involving a large number of birds would have to be carried out.

CONCLUSION

The ranging behaviour of barn owls, *Tyto alba*, in a ricefield was studied using radio telemetry. The home range size of females varied from 0.6 to 2.8 ha. The home range size of male was larger than female by at least 2.4 times. The core area size of breeding females ranged from 0.1 to 0.3 ha, constituting 8.9 to 34.2% of the home range. Females occupying neighbouring nest boxes maintained exclusive ranges, a sign of territorial behaviour. Males ranged over extensive area and their presence may be tolerated by unrelated females.

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