



Roosting Site and Perch Site Preferences and Artificial Nest Box Utilization by the Barn Owl *Tyto alba* (Scopoli, 1769) in Madurai District, Tamil Nadu, India

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Abstract

A total of 56 Barn Owl *Tyto alba* roosting sites were recorded in Madurai District of Tamil Nadu, India, between 2007 and 2009. Barn Owl roosting sites were observed in various places such as temple towers, compound walls, buildings, wells, trees and artificial wooden nest boxes. Although Barn Owls used a variety of roosting sites, man-made structures were mostly preferred (73%) in the study area. Barn Owls used a variety of perch sites during foraging, with electric poles being the most favoured perch type (47.2%). Of the 17 nest boxes erected in various sites, 7 (41%) were used by Barn Owls for roosting and nesting. This occupancy rate suggested not only those insufficient natural nesting sites were available, but also that nest boxes could be used to increase Barn Owl populations in agricultural areas, both for conservation purposes and for biological pest control.

1. Introduction

The Barn Owl *Tyto alba* is a cosmopolitan species found all over the world, except Antarctica (Taylor 1994). Barn Owls have been mentioned and depicted in letters, books, movies, folk lore, myths and superstition from all over the world. This is one of the reasons why the Barn Owl is one of the most commonly known owl species and has at least 18 different names (Sieders 2009). In many ways, Barn Owls have been associated with death and misfortune. This is likely due to their nocturnal activity and high screeching call. However, they have also been associated with wisdom and prosperity (Sieders 2009).

The Barn Owl is nocturnal and feeds almost exclusively on small mammals, especially rats, shrews, mice and occasionally birds, bats,

reptiles, amphibians and insects (Mushtaq-ul-Hassan *et al.* 2004, Sommer *et al.* 2005, Leonardi & Arte 2006, Santhanakrishnan *et al.* 2010). Barn Owls are often found in close proximity to man, and their occurrence is strongly associated with the presence of buildings with suitable apertures for roosting or nesting (de Bruijn 1994, Shawyer 1994). Man-made constructions such as buildings, barns, disused houses and ruins are favoured roosting sites (Golawski 2003). Barn Owl populations are declining in many parts of the world due to loss of suitable nesting sites, loss of quality hunting habitat, changes in agricultural practices and climate change (Bunn *et al.* 1982, Shawyer 1987, Marti 1997).

A wealth of information is available on the diet of the Barn Owl in different parts of the world (Alivizatos & Gounter 1999, Mushtaq-ul-

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Hassan *et al.* 2004, Leonardi & Arte 2006, Magrini & Facure 2008). To our knowledge, however, little information is available on roosting site and perch site preferences of the Barn Owl either in India or elsewhere. Research on the Barn Owl in India has been confined mainly to studies of feeding behaviour and diet (Neelananarayanan 2007a, b) and, to a lesser extent, nest-sites (Nagarajan *et al.* 1995), utilization of man-made nest boxes (Neelananarayanan *et al.* 1995) and sexual dimorphism (Kanakasabai *et al.* 1996). The aim of this study was to describe the roosting site and perch site preferences and utilization of artificial nest boxes by the Barn Owl in Madurai District, Tamil Nadu, India.

2. Materials and Methods

2.1. Study area

The present study was carried out in Madurai District of Tamil Nadu, India, during 2007–2009. Madurai District is situated on the banks of the River Vaigai (9°56' N and 78°07' E). The total geographical area of the district is about 1,088,622 sq km and the topography is mainly flat with some hills in a few areas. Paddy is the predominant cultivated crop in the study area; however other crops such as sugarcane, banana, jasmine, betelvine, groundnut and sorghum are also cultivated in some regions. The district receives most of its rainfall during October–December (north-east monsoon). During the summer season, the air temperature reaches a maximum of 40°C and a minimum of 26°C. The average annual precipitation is about 850mm.

2.2. Roosting site

Roosting sites of Barn Owls were located using various methods. Most of the roosting sites were identified by systematically searching all the possible man-made structures in the study area after first obtaining permission from the property owners. The property owners were shown photographs of Barn Owls and asked if they had ever seen owls in their property and if so, if the owls had ever roosted there. Freshly deposited pellets, white droppings on the walls, old feathers, the remains of uneaten prey and carcasses of dead owls were taken as indication of the presence of Barn Owls. The extensive wooded areas in the district were searched tree-

by-tree both by day and by night for possible roosting sites. Information provided by the local people, tree climbers and farmers with regard to owls roosting in tree cavities and other structures was considered and checked later.

The total height of the structure or tree used as a roosting site and the height of the roosting site above ground level were measured in meters using an altimeter. The DBH (Diameter at Breast Height) of roosting trees was measured using a standard measuring tape (Nagarajan 1998). In order to assess factors determining the roosting site preferences of Barn Owls, the following variables were measured around each roosting site *viz.*, the distances from the roosting site to the nearest perch, agricultural land, grove of trees, water source, fallow land, foot path, human habitation, paved road and temple (Santhanakrishnan 1987).

2.3. Perch site

The perch types of the Barn Owl were categorized as electric power poles, trees, shrubs, fence posts, embankments, buildings, sticks and the ground. Percentage of use of these various types of perches was calculated by following the method of Bell & Ford (1990). In the present study, we measured two heights: the overall height of the object or structure on which a Barn Owl was found perched (perch site height) and the height at which the Barn Owl was seen perched while feeding (perching height). The total heights of the perch sites used by Barn Owls were grouped into various class intervals *viz.*, 0–2m, 2–4m, 4–6m, 6–8m, 8–10m, 10–12m, 12–14m, 14–16m and >16m. Perching heights were also grouped into 2-metre intervals (0-2m, 2-4m, 4-6m, 6-8m, 8-10m, 10-12m, 12-14m, 14-16m and >16m) and their percent was calculated.

2.4. Nest box utilization

The Barn Owl nest boxes were constructed using ¾" thickness country wood as suggested by Neelananarayanan *et al.* (1995). Limited funding and some other difficulties, such as the destruction or theft of boxes by local people, restricted our efforts to 17 artificial wooden nest boxes (40" length, 16" height and 6x6" hole) which were erected in the study area. The nest boxes were placed in trees and man-made

sites at various heights above ground level and were regularly checked to see if Barn Owls were roosting or nesting in them.

3. Results

3.1. Roosting site

Fifty-six roosting sites used by Barn Owls were located in the study area. Barn Owls used various kinds of sites namely man-made sites, unused wells, artificial wooden nest boxes and natural trees (Table 1).

Man-made sites made up the greatest proportion of Barn Owl roosting sites, comprising 73.2% (Table 1). Temple towers were the most commonly occupied sites (37.6%) among man-made sites, followed by used and unused buildings (23.2%) and holes in compound walls (12.5%). The mean height of the roosting site was $12.3 \pm 5.50\text{m}$ (range 4.6–27m) and mean height of the actual roost was $8.8 \pm 5.10\text{m}$ (range 1.6–22m) above ground level (Table 2).

Four roosting sites were holes inside wells. All the wells were located very near to human habitation but were no longer being used by humans. The mean depth of the wells was $8.3 \pm 2.54\text{m}$ (range 6.1–10.5m), while the mean

depth at which the Barn Owls were roosting was $4.4 \pm 3.1\text{m}$ (range 1.8–7.1m) (Table 2).

In the study area, four roosting sites were located in Coconut trees *Cocos nucifera*. The total height of the roosting trees ranged between 5.5 and 7.0m with a mean of $6.0 \pm 0.7\text{m}$. The Barn Owls preferred to roost at a mean height of $4.2 \pm 0.6\text{m}$ (range 3.5–5m). The mean DBH of the roosting trees was $36.0 \pm 10.5\text{cm}$ (range 23–46cm) (Table 2). The distance between different indicated micro-habitats was not longer than 1.0 km. The potential habitats such as the nearest perch site, water sources, fallow land, foot path, groves (of mixed tree plantations), human habitation, road (the nearest paved road) and temple were closer (within 200m radius) to all kinds of Barn Owl roost sites (Table 2).

Table 1. Types of Barn Owl roosting sites recorded in the study area.

| Roosting sites | Number | Percentage |
|----------------|-----------|--------------|
| Temple towers | 21 | 37.6 |
| Buildings | 13 | 23.2 |
| Compound walls | 7 | 12.5 |
| Nest boxes | 7 | 12.5 |
| Wells | 4 | 7.1 |
| Trees | 4 | 7.1 |
| Total | 56 | 100.0 |

Table 2. Roosting site and microhabitat characteristics of Barn Owls in the study area. Values are Mean \pm SD; N=number of roosts

| Variables | Trees (N=4) | Nest boxes (N=7) | Wells (N=4) | Man-made sites | | | |
|---------------------------------------|-------------------|---------------------|--------------------|----------------------|----------------------|----------------------|---------------------|
| | | | | Temple towers (N=21) | Buildings (N=13) | Compound walls (N=7) | Total (N=41) |
| Roost site characteristics | | | | | | | |
| Total roost site height (m) | 6.0 ± 0.71 | 12.7 ± 2.14 | 8.3 ± 2.54 | 14.4 ± 5.96 | 11.7 ± 4.35 | 7.0 ± 0.73 | 12.3 ± 5.50 |
| Roost height (m) | 4.2 ± 0.65 | 9.2 ± 1.60 | 4.4 ± 3.06 | 11.1 ± 5.87 | 7.6 ± 2.30 | 4.3 ± 1.90 | 8.8 ± 5.10 |
| DBH (cm) | 36.0 ± 10.55 | -- | -- | -- | -- | -- | -- |
| Micro-habitats characteristics | | | | | | | |
| Distance to perch (m) | 1.6 ± 0.48 | 30.4 ± 47.55 | 6.8 ± 3.70 | 9.0 ± 9.04 | 6.1 ± 3.07 | 3.3 ± 1.82 | 7.1 ± 6.99 |
| Dist. to agricultural land (m) | 208.2 ± 28.03 | 966.5 ± 1207.75 | 225.0 ± 202.07 | 645.0 ± 840.70 | 1871.5 ± 1245.70 | 117.1 ± 16.55 | 943.8 ± 1124.79 |
| Dist. to water source (m) | 7.5 ± 4.50 | 587.1 ± 965.28 | 0.3 ± 0.25 | 32.3 ± 14.28 | 30.8 ± 19.74 | 27.0 ± 22.56 | 31.0 ± 17.30 |
| Dist. to fallow land (m) | 10.4 ± 2.05 | 51.4 ± 46.16 | 1.5 ± 0.58 | 71.9 ± 42.41 | 97.3 ± 59.95 | 31.4 ± 17.49 | 73.0 ± 50.19 |
| Dist. to foot path (m) | 6.6 ± 2.33 | 35.3 ± 50.12 | 4.5 ± 0.58 | 4.5 ± 3.46 | 7.3 ± 10.14 | 2.5 ± 1.40 | 5.1 ± 6.32 |
| Dist. to grove of trees (m) | 5.1 ± 4.59 | 186.0 ± 224.66 | 40.0 ± 11.55 | 153.5 ± 189.24 | 109.3 ± 113.56 | 78.5 ± 67.93 | 126.7 ± 152.80 |
| Dist. to human habitation (m) | 136.7 ± 87.93 | 158.4 ± 234.28 | 15.0 ± 5.77 | 15.3 ± 9.66 | 53.3 ± 82.64 | 22.1 ± 6.99 | 28.6 ± 49.01 |
| Dist. to road (m) | 112.7 ± 71.21 | 14.8 ± 16.40 | 110.0 ± 103.92 | 34.1 ± 33.70 | 71.1 ± 46.42 | 22.5 ± 2.89 | 45.6 ± 40.93 |
| Dist. to temple (m) | 500.0 ± 0.00 | 97.1 ± 77.07 | 155.0 ± 5.77 | 113.0 ± 99.82 | 246.1 ± 166.41 | 12.5 ± 5.09 | 130.1 ± 142.04 |

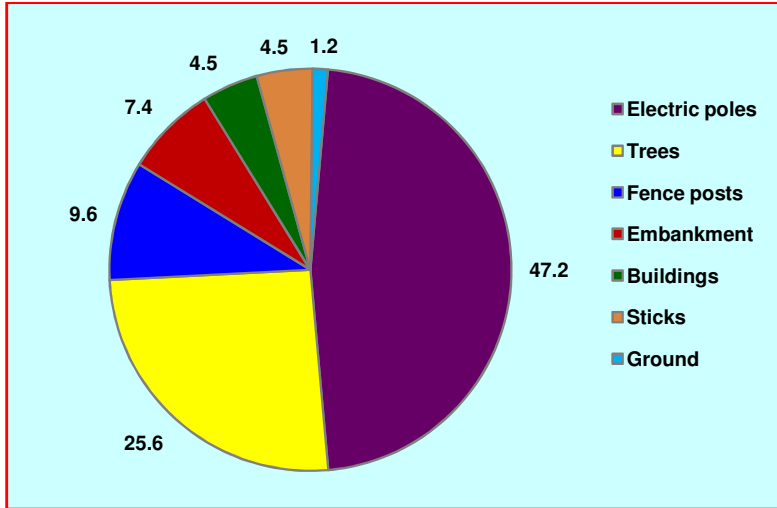


Fig. 1. Percent use of various types of perch site by Barn Owls in the study area ($N=313$).

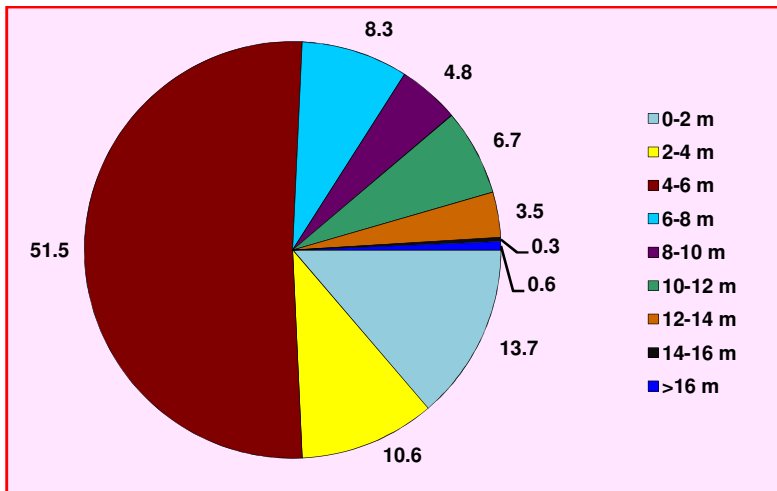


Fig. 2. Percent use of various heights of tree, building and other object on which Barn Owls were found perching in the study area ($N=313$).

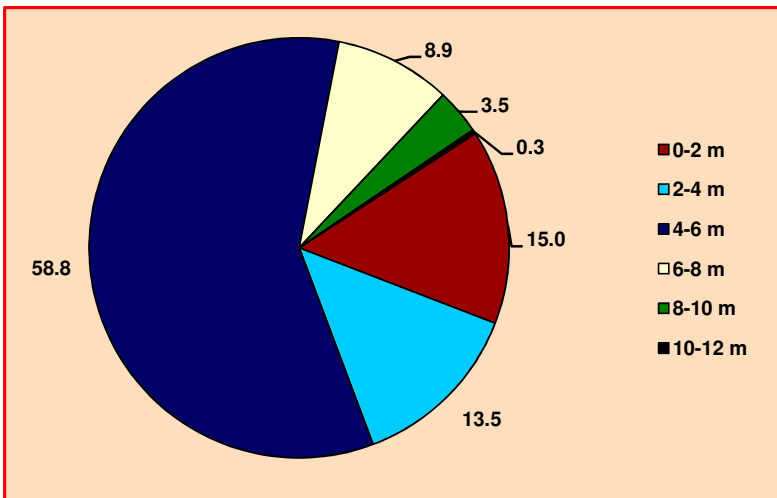


Fig. 3. Percent use of various perching heights selected by Barn Owls in the study area ($N=313$).

Table 3. Occupancy of nest boxes by Barn Owls in the study area.

| Site | No. of boxes installed | No. of nest boxes occupied | | Total occupied |
|--------------|------------------------|----------------------------|----------|----------------|
| | | Roosting | Nesting | |
| Building | 8 | 3 | 1 | 4 |
| Temple | 3 | 1 | 0 | 1 |
| Tree | 2 | 0 | 0 | 0 |
| Wall | 2 | 0 | 0 | 0 |
| Water tank | 2 | 1 | 1 | 2 |
| Total | 17 | 5 | 2 | 7 |

3.2. Perch site

Barn Owls used a variety of perch sites in their foraging areas. Of these, electricity poles were the most preferred sites (47.2%), followed by trees (25.6%). Other perch sites, which included sticks, buildings, embankments, fence posts and the ground, were all used on less than 10% of occasions (Fig. 1).

The height of the object or structure on which Barn Owls perched varied from 0 to 20m, with objects or structures in the height category 4–6m being the ones most preferred by the owls (51.5%). Barn Owls perched on the ground or on structures under 2m high on 13.7% of occasions, and on trees or structures in the height category 2–4m on 10.6% of occasions, while all other height categories were used on less than 10% of occasions (Fig. 2).

The height of the actual perch used by the Barn Owls ranged from 0 to 11m, with the most preferred height category being 4–6m (58.8%). The other height categories of perches used regularly by Barn Owls were 0–2m (15.0%) and 2–4m (13.4%) (Fig. 3).

3.3. Nest box utilization

A total of 17 nest boxes were installed in various sites including buildings ($N=8$), temple towers ($N=3$), trees ($N=2$), compound walls ($N=2$) and water tanks ($N=2$). Five of these nest boxes were used for roosting and two for nesting. The occupancy rate of nest boxes during the study period was 41% (Table 3). All the boxes were erected at a height of 4–15m, in which Barn Owls showed a preference of using more than 60% of nest boxes at a height of 8–12m. The Barn Owls mostly preferred (57%) the nest boxes found inside unused buildings (Table 3).

4. Discussion

4.1. Roosting site

In the study area, Barn Owls appear to depend heavily on man-made sites, especially temple towers, for use as roosting sites. The preference of temples as roosting sites by Barn Owls may be due to their suitability and availability coupled with the non-availability of natural trees in the study area. In the absence of suitable man-made sites, Barn Owls readily use other sites such as artificial wooden nest boxes, wells and trees for roosting. Frequent use of man-made sites by Barn Owls is common throughout the world (Colvin 1984, Andrusiak 1994, Shawyer 1994, Santhanakrishnan 1995, Golawski 2003). Man-made sites provide a number of advantages over natural sites. Firstly, they provide better protection against extreme temperatures, rainfall and wind. During the colder months, buildings provide better insulation and warmer conditions for Barn Owls than natural sites. Barn Owls have little fat reserves and with a relatively low plumage insulative value (Johnson 1994) are sensitive to cold weather. Many researchers have worked on the micro-climate of roosting sites and the effects of roosting site insulation (Millsap & Millsap 1987, Andrusiak 1994). A sheltered place to roost may enable Barn Owls to conserve energy otherwise lost through thermogenesis, thus allowing them a wider margin for survival when temperatures are low and small mammalian prey are few due to heavy rain (Hayes & Gessaman 1980). Santhanakrishnan (1987) stated that Barn Owls preferred to roost and nest only in dark places where the light intensity was between 0.5 and 1.25 lux units. Man-made structures also offer safety from predators. Crows *Corvus* spp., Common Myna *Acridotheres tristis* and Common Babbler *Turdoides caudatus* will mob any owl they detect roosting or flying outside during the daytime, but were never seen inside a building. Barn Owls flushed from their roosting site during the daytime were immediately set upon by crows and were seen to dive back into the roosting site that they had just left. Inside buildings, cats and monkeys are probably the major predators of Barn Owls.

The availability of surrounding micro-habitats is another important factor determining roosting site preferences in Barn Owls. The present study indicates that human habitation,

groves of trees, a water source and fallow land are generally to be found close to Barn Owl roosting sites. These habitats harbour and supply a variety of smaller mammals such as House Rat *Rattus rattus*, Grey Musk Shrew *Suncus murinus*, mice *Mus* spp., bats, birds and small reptiles which formed a major component of the prey items of Barn Owls in the study area (Santhanakrishnan *et al.* 2010).

4.2. Perch site

The availability of suitable perch sites is an important factor in the selection of foraging habitat by Barn Owls, which usually adopt the sit-and-wait hunting strategy (Santhanakrishnan 1995). Various authors have reported that the hunting technique of Barn Owls involves either energy-consuming searching flight, or rather time-consuming perch hunting; often a combination of both methods is used (Marti & Hogue 1979). In the present study area, Barn Owls used more man-made perches than natural perches to scan the habitat during foraging. Most perches used by Barn Owls in the study area were electricity poles and trees. Many researchers have established that electricity poles and electric power transmission towers are commonly used by a large number of raptors and that they use them as perch sites for various activities (Smith 1985, Lammers & Collopy 2007). In the present study, most of the observations of foraging Barn Owls were made around human habitation, agricultural fields, fallow land and groves of trees. Electricity poles may provide suitable perches for Barn Owls; the number and distribution of such structures may be sufficient in most areas to provide access to all available hunting areas. In those habitats devoid of electricity poles and trees, Barn Owls will utilize fence posts, buildings, sticks and agricultural bunds as perches because they provide ready access and an unobstructed view. However, the selection of perch sites might vary from region to region based on the abundance, availability and type of prey, habitat type, climatic conditions and behavioural characteristics of the birds (Beachly *et al.* 1995, Adamik *et al.* 2003, Yosef 2004, Asokan & Ali 2010).

The perch sites available in the study area ranged in height from 0 to 20m and Barn Owls mostly perched at a height of 4–6m (Fig. 2). Santhanakrishnan (1995) stated that Barn Owls

generally hunt their prey from any perch that is 3–15m above ground level. Higher perches may provide a larger field of view and increase the chances of detecting prey. In general, Barn Owls take their prey from the ground surface, although they will occasionally capture chiropteran bats in the air. Hence these height ranges may be more suitable for detecting and hunting the prey. The types of perch and perching heights used by Barn Owls in the study area did not vary with season, perhaps because the Barn Owls were hunting similar prey in the same habitats throughout the year.

4.3. Nest box utilization

Artificial wooden nest boxes have been readily used by owls and are widely used in long-term studies of owls (Southern 1970, Marti *et al.* 1979). Johnson (1994) stated that by providing nest boxes for Barn Owls, their breeding population densities were increased above former levels which were thought to be limited by the availability of natural sites. Lenton (1978) demonstrated that the breeding density of Barn Owls in Malaysia could be increased with the provision of nest boxes. He also established that the Barn Owls occupying the nest boxes were very useful in controlling the introduced tree rats in tea estates and oil palm plantations in Malaysia. Nest boxes provide a number of advantages to the owls such as larger clutch size, higher fledging success, lower predation rates and better protection from the weather (Johnson 1994, Cayford 1992, Walk *et al.* 1999). Providing nest boxes for owls is an important management tool that might enhance the stability and productivity of owl populations. Two nest boxes were used for breeding in the present study; one inside a building and the other inside a water tank. In addition to these, five more nest boxes were used by owls for roosting. Thus 41% of the nest boxes were occupied by Barn Owls. An important factor that might deserve attention here is inter-specific competition for nest sites. The Rock Pigeon *Columba livia* and Common Myna *Acridotheres tristis* are known to compete with Barn Owls for nest sites. During the present study, these two species occupied 3 and 2 nest boxes, respectively, and bred successfully. From our experience, we suggest that there is a shortage of nest sites for owls as well other birds both in natural situations and

man-made structures. We conclude that by selecting nest boxes, Barn Owls are adapting to an adequate substitute for natural sites which are in short supply.

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