Notes on the reproduction of Barn Owl *Tyto alba* in Madurai District, Tamil Nadu, India

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Introduction

Barn Owl *Tyto alba stertens* (Hartert, 1929), a widely distributed, resident, nocturnal raptor in India is closely associated with man and agriculture (Marti *et al*. 1979; Kahila *et al*. 1994; Santhanakrishnan 1995). It has a higher biotic potential and more flexible reproduction than most other owls and ecologically similar bird species. It commonly breeds after one year of age, produces large clutches (Colvin 1984) and often produces two and sometimes more broods per year (Lenton 1984; Schulz & Yasuda 1985). Barn Owl nests are found in tree hollows, gaps and crevices in abandoned buildings, temples, barns, ruins, etc. (Nagarajan *et al*. 1995). Its diet consist chiefly of smaller mammals particularly rodents but birds, reptiles, amphibians and insects are also eaten (Santhanakrishnan 1995; Mushtaq-ul-Hassan *et al*. 2004; Sommer *et al*. 2005, Leonardi & Arte 2006; Neelanarayanan 2007b). Extensive studies have been made on the nesting and feeding habits of the Barn Owl in many parts of the world (Roulin 2002; Altwegg *et al*. 2003; Haralambos *et al*. 2005) but little is known on the ecology of this species in South-east Asia particularly in India. Research on Barn Owl in India are mainly focusing their nest-sites (Nagarajan *et al*. 1995), utilization of man-made nest boxes (Neelanarayanan *et al*. 1995), sexual dimorphism (Kanakasabai *et al*. 1996), prey biomass estimation (Neelanarayanan 2007a) and diet composition (Neelanarayanan 2007b). In this paper we shortly describe the reproduction of Barn Owl in Madurai District, Tamil Nadu, India.

Materials and Methods

The present study was carried out in Madurai District of Tamil Nadu, India during 2007 - 2008. Madurai, lies between 9°56' N and 78°07' E, is situated on the banks of the River Vaigai. The total geographical area of the district is about 10,88,622 sq.km and topography is simple and flat as well as hilly in few areas. Paddy is the predominantly cultivated crop in the study area; however other crops such as sugarcane, banana, jasmine, betlevine, groundnut and sorghum are also cultivated in different regions. The District receives rainfall during October-December (north-east monsoon). Temperature during summer reaches a maximum of 40°C and a minimum of 26°C. The average annual precipitation is about 850mm.

Intensive searchers were made to locate the nests of Barn Owl in all the potential nesting sites *viz*., temple towers, buildings, barns, silos, arches, bridges, wells, trees etc in the study area. The presence of regurgitated pellets in the nest, white droppings on the outer wall of the cavity, the uneaten prey remains and food begging calls of chicks at nests and adult contact calls during night time were taken as clues for the identification of occupied sites and their breeding chronology (Nagarajan 1998; Mahmood-ul-Hassan *et al*. 2007). Besides, 17 artificial man-made wooden nest boxes (40" length, 16" height and 6x6" hole) were also erected in the study area to enhance the reproductive potential as well as to check the possibility of using the nest boxes for nesting.

The onset of nesting was determined by the presence of egg or young in the nest and nests containing one or more eggs or nestlings were defined as active nests. Once an active nest was located, it was periodically monitored (at least once in a day) to record the reproductive chronology. Information on nature and type of nest-site, clutch size, egg morphometry, incubation period, brood size, hatching and fledging success was collected from each nest (Nagarajan 1998; Mahmood-ul-Hassan *et al*. 2007).

Results

Thirteen active Barn Owl nests were recorded in the study area and all of them were found in man-made structures and artificial man-made wooden nest boxes. Of all nests, 53.8% of them were observed inside the temple towers, 23.1% in holes found in temple compound walls, 15.4% in artificial wooden nest boxes and 7.7% in holes found in pillars. The overall mean height of all the nest-sites was 11.5 ± 5.75m (range: 4.6 to 27.0m) and the mean nest hole height was 8.4 ± 4.83m (range: 1.6 to 22.0m). Barn Owls preferred nest-site which is very close to the potential micro-habitats *viz*., perch site, water sources, footpath, human habitations and road and these habitats found within 100m radius (Table 1).

Image 1. Clutch sizes of the Barn Owl eggs in the study area

Barn Owls eggs were roundish oval and pure white in colour without any markings. Clutch size is highly variable and the smallest being 4 and the largest of 8 eggs (Image 1). The overall mean clutch size was 4.9

Table 1. Nest-site & micro-habitat characteristics of Barn Owl in the study area (N=13)

Variables	Range	Mean ± SD
Total height of nest-site (m)	4.6 - 27.0	11.5 ± 5.75
Height of nest location (m)	1.6 - 22.0	8.4 ± 4.83
Distance to nearest perch site (m)	1.0 - 25.0	6.5 ± 6.70
Distance to nearest agricultural lands (m)	15.0 - 2750.0	942.7 ±142.49
Distance to nearest water sources (m)	5.0 - 60.0	28.8 ± 17.62
Distance to nearest footpath (m)	1.0 - 25.0	4.0 ± 6.48
Distance to nearest groves (m)	2.0 - 500.0	179.0 ± 197.90
Distance to nearest human habitations (m)	2.0 - 200.0	29.7 ± 53.15
Distance to nearest road (m)	2.0 - 150.0	31.17 ± 41.12
Distance to nearest temple (m)	9.0 - 500.0	139.54 ± 135.96

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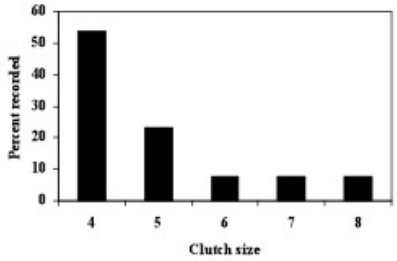

Fig 1. Clutch size variations of Barn Owl in the study area

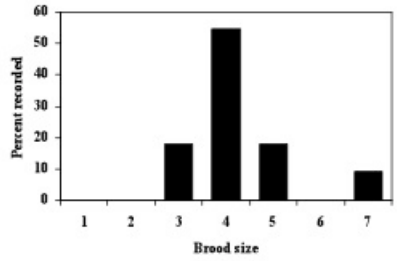

Fig 2. Brood size variations of Barn Owl in the study area

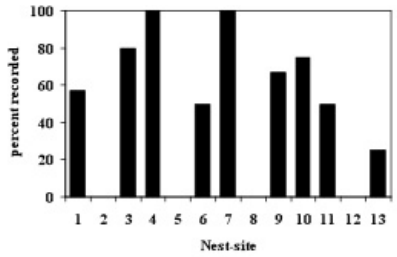

Fig 3. Nest-site wise fledging success of Barn Owl

(N=13) and nearly 54% of the clutches contained four eggs (Fig. 1). Mean size of the egg was 42.6 ± 3.34mm x 33.1 ± 1.97mm (length x width). The average weight of the egg was 22.3 ± 3.79g for 21 eggs (Table 2).

Incubation began once the first egg was laid and done only by the female in the present study. Male Barn owl was seen perching very closer to the nest or sometimes they may not be found. The incubation period was ranged between 27 and 36 days with a mean incubation period of 31.5 days. Mean brood size was 3.6 ± 1.89 (range 3-7) and brood size of four were not uncommon which yielded 54.5% of all the nests (Fig. 2).

Of the 64 eggs laid out of 13 clutches, 47 eggs hatched giving a hatching success of 73.4%. Totally 25 young ones fledged which has given a mean fledging success of 53.2% (Table 3). At two nest-sites 100% fledging success was noticed and 100% failure was encountered in four sites as well (Fig. 3).

Discussion

Barn Owls in the present study seem to have a peak breeding during the month of November to April and rarely between June and September.

Table 2: Egg morphometry of Barn Owl in the study area

Year	N	Length (mm)		Width (mm)		Weight (g)	
		Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
2007 2008	8 13	38.9-43.0 45.0-48.0	40.3 ± 1.32 44.0 ± 3.46	33.0-35.0 32.0-36.0	33.9 ± 1.13 32.6 ± 2.26	17.0-20.0 25.0-26.0	18.5 ± 1.20 25.6 ± 0.50
Total	**21**		**42.6 ± 3.34**		**33.1 ± 1.97**		**22.3 ± 3.79**

Table 3. Relationship between Barn Owl hatching and fledging success in relation to initial

Clutch size	No. of clutches	Total eggs	Egg hatched		Young fledged	
			N	%	N	%
4	7	28	22	78.6	14	63.6
5	3	15	9	60.0	3	33.3
6	1	6	5	83.3	4	80.0
7	1	7	4	57.1	0	0
8	1	8	7	87.5	4	57.1
	13	**64**	**47**	**47/64x100 = 73.4**	**25**	**25/47x100 = 53.2**

Santhanakrishnan (1995) recorded Barn Owl nests in all months except during July and August and a peak was noticed from January to April in the Cauvery delta region in Tamil Nadu, India. The year round breeding activities of Barn Owls were described by Lenton (1984) and Mahmood-ul-Hassan *et al*. (2007). However, the differences in breeding season in different locations could be related to the rain fall and agricultural operations, prey cycle and the availability of secure nest-sites. The abundance of rodents has been reported to strongly influence the reproduction of Barn Owls (Taylor 1994).

Barn Owl is primarily a cavity nester use hollow trees, holes in building and crevices in cliffs as nesting sites (Colvin 1984; Nagarajan *et al*. 1995). In the present study Barn Owl nesting's appear to depend largely on man-made structures (84.6%) particularly in temple complex. Apart from man-made structures they also used artificial wooden nest boxes (15.4%) for nesting. Interestingly no nests were recorded in natural tree cavities in the study area. Frequent use of man-made structures by Barn Owls for nesting is common and reported throughout the world. Santhanakrishnan (1995) and Nagarajan (1998) recorded more than 75% of the Barn Owl nest-sites were in temple towers in Cauvery delta region of Tamil Nadu. Ninety-three percent of 271 nests located in British Columbia were all in man-made structures, of which 82% were associated with farm buildings (Campbell & Campbell 1983). In Morocco 90% of Barn Owl nests were in man-made structures mostly on minaret of mosques, chimneys, ruins and cliffs (Rihane *et al*. 2004). Shawyer (1987) pointed out that man-made structures offer greater protection for young owls in the process of fledging. Fledglings can spend several days practicing flying skills inside the buildings without having to go outside to face predators and inclement weather.

The high preferences of temple towers by Barn Owls in the present study for nesting are attributed to the protection from mammalian and avian predators and also the close proximity to the foraging habitat. The availability of various habitat types within 1km radius of Barn Owl nest-sites revealed that human habitations dominated in and around all the nest-sites. These habitats are supposed to be the home for a variety of Barn Owl prey such as Grey Musk Shrew *Suncus murinus*, House Rat *Rattus rattus*, Mice *Mus* spp. and bats.

The mean height of nest-site and nest location height of Barn Owl in the present study were comparatively higher as reported by Bunn *et al*. (1982), Colvin (1984) and Mahmood-ul-Hassan *et al*. (2007) and significantly lower as reported by Santhanakrishnan (1995) and Nagarajan (1998). Colvin (1984) and Mahmood-ul-Hassan *et al*. (2007) observed that most of the nests were at trees whereas in the present study it was more in man-made structures. The considerable variation in these parameters in different regions suggest that height of the nest are relatively less important in nest-site preference than the presence of a suitable cavity/ hole. The micro-habitat availability study indicated that presence of human habitations (as a source of prey) around the nest-site is one of the important factors for the nest-site preference by Barn Owls. Similar observation was also recorded in the nest-sites of Barn Owl in Cauvery delta region of Tamil Nadu by Nagarajan (1998).

The egg dimensions of the present study were more or less similar to those of previous studies of Colvin (1984), Lenton (1984) and Santhanakrishnan (1995). In the present study the mean clutch size of Barn Owls were 4.9 eggs with a range of 4-8 eggs. Santhanakrishnan (1995)

and Nagarajan (1998) reported that mean clutch size of Barn Owl in Cauvery delta region was 5.4 and 4.9 eggs respectively. The clutch size of Barn Owls showed variation between geographical regions. For example, the mean clutch size was 6.6 eggs in Malaysia (Lenton 1984), 6.5 eggs in British Columbia (Andrusiak 1994), 5.91 eggs in Morocco (Rihane *et al*. 2004), 5.25 eggs in Pakistan (Mahmood-ul-Hassan *et al*. 2007) and 4.86 eggs in Great Britain (Shawyer 1987). Various factors such as age of female, food availability, intensity of predation, climate, type of habitat and geographic ranges may be attributed to the clutch size of Barn Owls (Colvin 1984; Mahmood-ul-Hassan *et al*. 2007).

The hatching success of Barn Owl in the present study was 73.4% which is more or less similar to the previous studies (Santhanakrishnan 1995; Nagarajan 1998; Andrusiak 1994; Martinez & Lopez 1999). Very low fledging success (53.2%) was recorded in the study area compared to the previous studies (Bendel & Therres 1990; Andrusiak 1994; Santhanakrishnan 1995; Nagarajan 1998; Rihane *et al*. 2004; Mahmood-ul-Hassan *et al*. 2007). Various factors have been suggested for the low fledging success in Barn Owls *viz*., less prey availability, predators, weather, human disturbances, changes in agricultural practices and inadequate place for growing chicks (Gubanyi *et al*. 1992; Salvati *et al*. 2002). Predation (fledgling of five nests were predated by domestic cats), parasites (5 chicks in 2 nests severely affected by parasites), cannibalism (observed in one nest) and human disturbance (observed in one nest) were the factors that affected the fledging success in the present study.

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