Barn Owl *Tyto alba* breeding success in man-made structures in the Jordan Rift valley, Israel

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The Barn Owl is one of the most widespread (Burton 1984) and researched owls in the world, but information on its breeding success in the Middle East is limited (Kahila 1992). Barn Owls are obligate cavity nesters that nest in a wide variety of natural cavities such as in holes in trees and caves (Taylor 1994) and in abandoned Hamerkop *Scopus umbretta* nests in Africa (Wilson *et al* 1986, Fry *et al* 1988). There is also a long history of Barn Owls using buildings and other man-made structures as nest sites; *eg* in roofs of houses, towers and castles, on silos, water tanks, in barns, even in wells and of course in nest boxes (de Bruijn 1984, Petty *et al* 1994, Taylor 1994). The Barn Owl is one of the commonest owls in Israel (Shirihai 1996) but little information has been published of basic biology other than diet-related aspects (Dor 1982, Kahila 1992, Pokines & Peterhans 1997, Yom-Tov & Wool 1997, Tores & Yom-Tov 2003, Tores *et al* 2005, Charter *et al* 2007), although data are available on breeding success (Kahila 1992). Since 1983, Barn Owls have been used as biological pest control agents of rodents (Aviel *et al* 2003) in fields and plantations of kibbutzim (Israeli collective communities) in the Jordan Rift valley. The number of nest sites there increased after the erection of nest boxes throughout the valley and in other areas. Currently around 250 nest boxes are available there and some 1500 in Israel overall. Within the kibbutzim boundaries, as an expansion of the project, pairs of Barn Owls breeding in man-made structures other than nest boxes were also monitored. The main objectives were firstly to discover the breeding success of Barn Owl pairs breeding in these man-made structures, other than nest boxes, in the Jordan Rift valley and then to compare their breeding success with pairs breeding in nest boxes in fields.

The climate of the study area (combined area= 10 km^2) is hot/continental arid, the maximum and minimum mean daily temperatures being 32.3°C and 16.7°C respectively (during the March to July breeding season), and the average yearly rainfall being 267 mm (2001–2006 inclusive, Michael Hyman pers comm). The elevation of the study area is 150–250 m below mean sea level. All the kibbutzim are surrounded mainly by crop fields and date plantations, whose combined area is 65 km^2. The crops comprise fodder (wheat, sweetcorn, alfalfa, clover, vetch and oats), grain (wheat and sweetcorn), spices and herbs (oregano, hyssop, basil and dill).

METHODS

The study site comprised 21 nest locations, all "cavity-type" nests, located in 9 kibbutzim situated in the Jordan Rift valley, Israel (32°25'N, 35°31'E) (Figure 1). The kibbutzim and their respective number of nest sites were: Tirat Tsvi (N=7), Maoz Haim (N=4), Nir David (N=2), Kfar Ruppin (N=2), Reshafim (N=1), Neve Eitan (N=1), Sde Nakhum (N=2), Mesilot (N=1), and Shlukhot (N=1). Some nest sites occupied by Barn Owls had been noted as early as 1984. The 21 nests were in four different types of locations, all being in man-made structures: 15 were in guard towers, three in grain silos, two in water towers and one in an irrigation well. Guard towers are 4.5 m high, their internal dimensions being 2 m tall and 2 m in diameter (Plate 1).

We visited the nests during each breeding season, from 2002 to 2006 inclusive, to confirm which were active. Those nests we did not visit yearly were omitted from occupation

breeding success calculations. We calculated the number of young fledged (number of nestlings ringed minus the number found dead in the nests post-fledging) per breeding attempt (defined as a nest in which eggs were laid, Steenhof 1987), and the occupation rate (number of breeding attempts/number of years the nest location was available during the period of the study). As had been found for Barn Owls in the USA (Taylor 1990), Barn Owls in Israel are very sensitive to disturbance during incubation and will abandon clutches, and so clutch size for most pairs was not established. The four nests that we were only able to visit late in the study were excluded from the breeding success calculations because some nestlings had already fledged, and so we could not be certain of the total number of nestlings in them. Within each kibbutz, some Barn Owls bred high under inaccessible roofs or in delicate Mexican fan palms *Washingtonia robusta*, making it impossible to monitor these nests. Data are presented as mean values ± Standard Error.

All statistical tests were two-tailed and all tests were non-parametric. Descriptive breeding data were analyzed using Kruskal-Wallis ANOVA and Kruskal-Wallis Multiple Comparisons. Fisher's exact test was used for comparing nest occupation. Levels of significance were set at $P < 0.05$. Statistical analyses were performed using Statistica 8.0 software.

Figure 1. Location of the study site, Jordan Rift valley, Israel. © *Desh Institute (SPNI's Open Landscape Institute) and reproduced with permission.*

Plate 1. An example of a guard tower of a kibbutz in the Jordan Rift valley, Israel. © *Motti Charter*

RESULTS

During the 5 breeding seasons, 2002–06, 40 breeding attempts by Barn Owls were monitored, of which 38 (95%) succeeded in fledging at least one young. Twenty-one breeding attempts were recorded in guard towers, 10 in grain silos, 7 in water towers, and one in an irrigation well. The number of young fledged per breeding attempt pair was 4.94 ± 0.33 (36). Significant difference was found in the number of fledged young during 2002 to 2006 (Kruskal-Wallis$_{4,36}$ = 11.8, $P < 0.05$) with greater number of young fledged in 2004 than 2005 ($P < 0.05$; Kruskal-Wallis Multiple Comparisons) (Table 1).

The number of young fledged was similar in all four types of nest location; guard towers (5.1 ± 0.5, N= 19), grain silos (5.1 ± 0.7, N=10), water towers (4.8 ± 0.7, N=6) and the irrigation well (6.0 ± 0.0, N=1). Only two nests (both in guard towers) failed to raise young; the clutches both being abandoned for reasons unknown. One pair that bred in the irrigation well laid a second clutch after fledging an unknown number of nestlings (the nest was not visited early enough), but the eggs did not hatch. The rate occupation of the nest sites differed yearly between 2002 to 2006 (Fisher's exact test, $P < 0.05$) (Table 1). On average, 59% of available nest locations were occupied every year. Overall, guard towers were occupied 45% of the 5-year period, grain silos 89%, and the water tower and the irrigation well 100%.

TABLE 1. Breeding success (mean ± SE) of Barn Owls *Tyto alba* nesting in man-made structures other than nest boxes in the Jordan Rift valley, Israel, in the five-year period 2002 to 2006.

Year	2002	2003	2004	2005	2006
Number of available nests	7	7	17	21	21
Number of nests used	1 (14%)	3 (43%)	13 (77%)	14 (67%)	8 (38%)
Mean number of young	6.0 ± 0.0	4.7 ± 2.4	6.2 ± 0.4	3.9 ± 0.4	3.43 ± 0.6

DISCUSSION

Barn Owls bred successfully in all four of the man-made structures at least once and on only two occasions (5%) failed to fledge young. While the data from this study were drawn from a relatively small number of nests, the number of young per nest was higher than that found in most studies (range 1.9 to 4.6 nestlings) in Europe (Pikula *et al* 1984, Baudvin 1986, Muller 1989, Taylor 1994, Martínez & López 1999), USA (Otteni *et al* 1972, Klaas *et al* 1978, Marti & Wagner 1985), Asia (Lenton 1984) and Africa (Wilson *et al* 1984), but similar to one study only in the USA (Marti 1994). The occupancy rate of nest sites by Barn Owls in this study was similar to that of pairs breeding in purpose-designed nest boxes in the same region (56%, N = 186, Kobi Meyrom unpub), but more young per nest fledged from nests in the present structures than did from the purpose-designed boxes (4.9 *vs* 4.0 young respectively, N = 157). Our findings are at variance with those of de Bruijn (1984), who found that the success of pairs breeding in nest boxes was higher than in other types of nest locations.

It is interesting to note that in addition to hunting small mammals, mainly rodents, in fields up to 300 m from the nests, the pairs breeding in kibbutzim also fed more often on birds, probably caught within the kibbutzim, than did the pairs breeding in the nest boxes in the fields (Motti Charter unpub). Almost all the kibbutzim and other villages in the Jordan Rift valley have guard towers that were erected when they were settled. Long before the signing of the 1994 peace agreement between Israel and Jordan, the guard towers had fallen into disuse, but had not been dismantled, thus providing Barn Owls and other

species such as pigeons with a place to nest. The use to which these towers are now put, Barn Owl conservation, we hope is a symbol for the future.

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