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BREEDING SUCCESS OF LESSER KESTREL *Falco naumanni* BREEDING IN NEST BOXES AND OTHER SITES IN URBAN AREAS IN SOUTHERN ITALY

Gnezditveni uspeh južne postovke *Falco naumanni* v gnezdilnicah in drugih gnezdiščih na urbanih območjih južne Italije

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Renovation of historic buildings has a strong negative impact on Lesser Kestrel, by reducing nest site availability and reproductive success. In order to test the efficacy of nest boxes as conservation tools, we studied the occupancy rate of nest boxes and compared Lesser Kestrel breeding success in nest boxes and urban nests sites in southern Italy. The results showed that nest boxes are a useful management strategy. The reproductive parameters (mean laying date, brood size, number of fledged young) observed in nest boxes do not vary significantly from those in natural urban sites (wall cavities and attics).

Key words: Lesser Kestrel, *Falco naumanni,* breeding success, nest boxes and urban sites, Apulia, Italy
Ključne besede: južna postovka, *Falco naumanni,* gnezditveni uspeh, gnezdilnice in urbana območja, Apulija, Italija

1. Introduction

The Lesser Kestrel *Falco naumanni* is a colonial species that breeds in cavities in rocky cliffs, on man-made structures and, more rarely, on the ground (PALUMBO 1997, VLACHOS *et al.* 2004, MASCARA & SARÀ 2006). In western Europe, this species is closely tied to human activities, feeding in agricultural areas (PALUMBO *et al.* 1997) and nesting primarily within urban areas (NEGRO 1997, PALUMBO 1997, BUX *et al.* 2005). This is the case for colonies in Apulia and Basilicata (southern Italy), where pairs breeding in rural or natural habitats are extremely rare (PALUMBO 1997).

One of the major threats to populations breeding in Mediterranean countries is the destruction of cavities in walls and roofs, due to building renovation (CATRY *et al.* 2007).

The use of man-made nest boxes has proved to be a useful conservation tool for many bird species (PREMUDA *et al.* 2000), which can partly compensate for the loss of urban breeding sites, however, data on the use of nest boxes by Lesser Kestrels and their breeding success is still scarce (GONZALES & MERINO 1990, POMAROL 1996, CATRY *et al.* 2004 & 2007, SHULMAN-LIVEN *et al.* 2004).

The aims of this study were: (1) to quantify the occupancy rate of nest boxes by Lesser Kestrels; and (2) to compare the reproductive parameters of pairs breeding in nest boxes with other pairs breeding in 'natural urban' sites such as cavities in walls and attics.

2. Methods

2.1. Data collection

In January-February 2007 we installed 200 nest boxes in the towns of Gravina in Puglia (40°49'N, 16°25'E; N = 102), Altamura (40°49'N, 6°33'E; N = 50), Acquaviva delle Fonti (40°53'N, 16°50'E; N = 22), Cassano delle Murge (40°53'N, 16°46'E; N = 12) and Laterza (40°37'N, 16°47'E; N = 14). The study area includes SPA "Murgia Alta" (code IT9120007) and "Area delle Gravine" (code IT9130007) located in the southern part of Apulia region, between 300 and 580 m a.s.l. The Lesser Kestrel breeding population

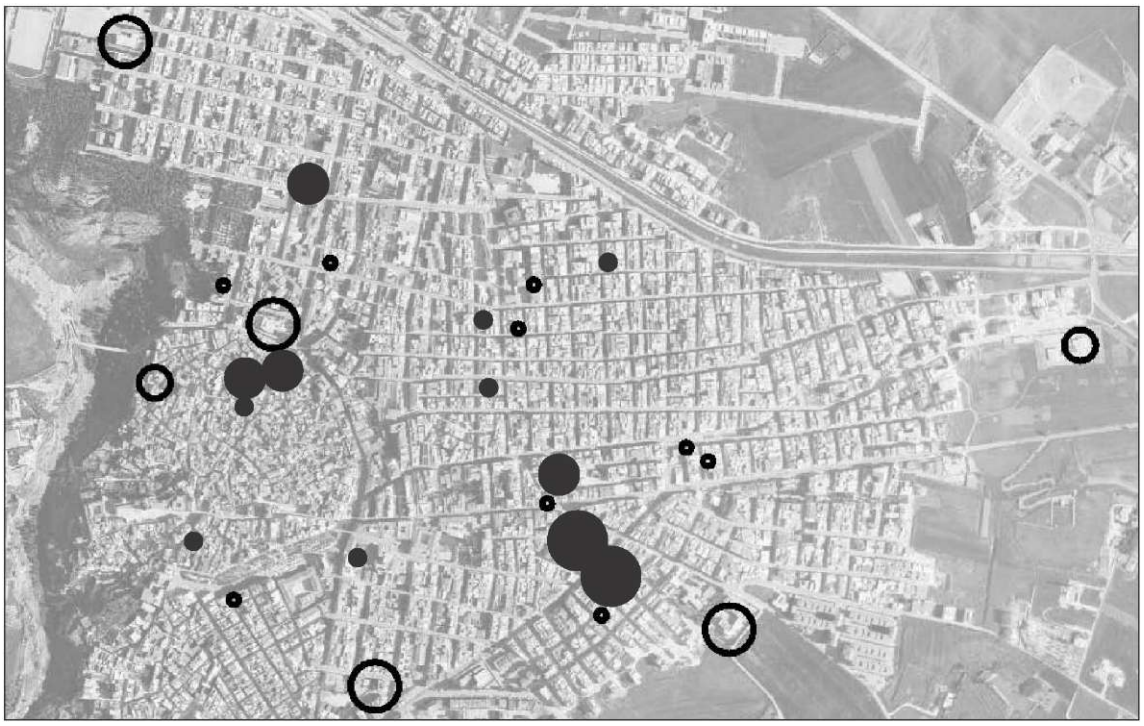

Figure 1: Nest box distribution in Gravina di Puglia (Ba) in 2007; empty black circles: nest boxes not used; filled black circles: nest boxes used or visited by Lesser Kestrel *Falco naumanni;* the size of the circles denotes number of nest boxes for each site: small circle 1-2 nest boxes, intermediate circle: 3-6 nest boxes, big circle: 7-10 nest boxes; N = 102

Slika 1: Razporeditev gnezdilnic v mestu Gravina di Puglia (Ba) leta 2007; prazni črni krogi: gnezdilnice niso bile uporabljene; polni črni krogi: gnezdilnice, ki so jih obiskale ali uporabljale južne postovke *Falco naumanni;* velikost krogov označuje število gnezdilnic za posamezno območje: mali krogi 1-2 gnezdilnici, srednji krogi 3-6 gnezdilnic, veliki krogi 7-10 gnezdilnic; N = 102

in the 5 colonies is estimated at 2784-3132 pairs (BUX 2008). The area belongs to the Mediterranean phytogeographical region, with wide extensions of pastures alternating with extensive farming and arboreal stands (olive and almond). Nest box distribution in Gravina di Puglia is shown in Figure 1.

Nest boxes were placed on the roofs of private and public buildings, both in historic town centres and in modern neighbourhoods; entrance holes were oriented away from the wall of the building. The nest boxes were constructed of fir and pine wood (approx. 10 kg weight). (Figure 2)

The base was 45 x 55 cm; 15 cm height at the front, 25 cm height at the back and a waterproof sheath was placed on the roof which made nest boxes better protected and more durable. In many cases, the nest boxes were placed in groups, 4-5 together on a single building. These nest boxes were placed 1-2 m from each other.

Additionally, four small disks were placed at the foot of each nest box in order to prevent them from touching the ground, and to keep humidity at bay. Soil was added to about 1 cm depth inside each box, both to provide a soft substrate for the eggs to be laid on and to prevent eggs from unnecessary rolling.

The entrance hole — 6 cm in diameter — was sized specifically for Lesser Kestrels, and allowed only this species to occupy the nest boxes, thus excluding eg. Feral Pigeons *Columba livia* var. *domestica.* A side entrance of 9 x 9 cm panel located on the side (left or right) of each nest box made it easier to clean and provided easy access for measuring and ringing the chicks. Each nest box was numbered to facilitate its identification during the monitoring carried out in the breeding season.

Nest boxes considered visited by Lesser Kestrels were those in which traces of the species' presence were found, such as tracks on the nest substrate inside the nest box, presence of pellets, and prey remains. Nest box breeding attempts (defined as a nests in which eggs were laid; STEENHOF 1987) by Lesser Kestrels were those in which egg-laying and the reproductive cycle

Figure 2: An example of a nest box for Lesser Kestrel *Falco naumanni* placed on the roof of a building

Slika 2: Primer gnezdilnice za južno postovko *Falco naumanni,* nameščene na strehi stavbe

took place. Breeding success parameters were also monitored in 38 'natural' nests located in the colonies in Gravina in Puglia and Altamura and the results compared with those for nest boxes.

We compare the main reproductive parameters between next boxes and nests placed in attics or wall cavities. The attics are trampling space between roof and extrados of attic. Generally, the Lesser Kestrel breeds on the floor and enters through holes of ventilation or crevices in the roof (made of tiles).

The cavities in the walls are holes and niches in the perimetric bearing walls of buildings and are inaccesible to man and, largely, to terrestrial predators (i.e. rats).

All the nest categories were visited at least twice between 15 May and 20 Jun 2007. This is the period in which egg-laying (between 15 May and 30 May) and initial chick rearing take place (BUX *et al.* 2005). If egg-laying did not take place in this period the nests were no longer monitored.

We determined the reproductive parameters (clutch size - number of eggs laid, egg-laying date, hatching success, brood size and number of fledged young) by visiting each occupied nest 4 or 5 times. Means ± SE (standard errors of the mean) are presented and differences between nest sites were determined using one-way ANOVA, Mann-Whitney U Test and Kruskall-Wallis post hoc test.

3. Results

In total we examined 58 nests, of which 27 (46.6%) were in attics (category a) 20 (34.5%) in nest boxes (category b) and 11 (19.0%) in cavities (category c). The occupancy rate of 200 nest boxes installed in 2007 was 8.0% (at least one egg laid) and in addition 39 (19.5%) boxes were visited by Lesser Kestrels (Table 1).

Overall, the average clutch size of the 58 occupied nests we checked was 3.9 ± 1.17 (N = 58) eggs. Nests with three, four and five eggs were the most frequent clutch sizes representing 88% of all nests surveyed (Figure 3). The average clutch size was 3.81 ± 1.36 (N = 27) eggs for nests in attics, 4.00 ± 0.77 (N = 11) eggs for nests in cavities and 3.95 ± 1.10 (N = 20) eggs for nest boxes. Overall, the first egg was layed in May in more than 90% of the cases, with a peak in the second decade. The earliest egg was laid on 9 May, and the latest on 3 Jun. The mean laying date was 12 May (N = 9) in attics, 11 May (N = 7) in cavities and 17 May

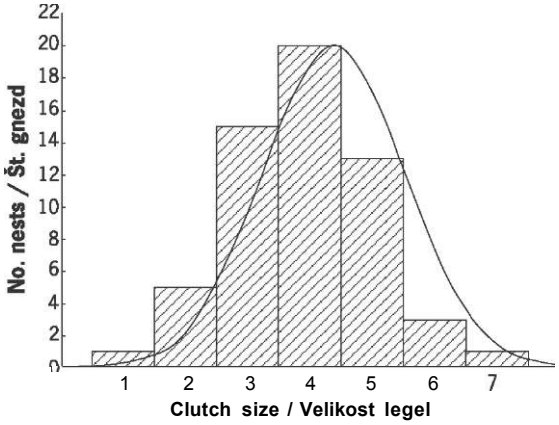

Figure 3: Clutch size for 58 Lesser Kestrel *Falco naumanni* nests studied in 2007. The variable shows a tendency towards normality (Kolmogorov-Smirnov test d = 0.17331, P < 0.10).

Slika 3: Velikost legel 58 južnih postovk *Falco naumanni,* zajetih v raziskavi leta 2007. Parameter kaže tendenco k normalnosti (test Kolmogorov-Smirnov d = 0.17331, P < 0.10).

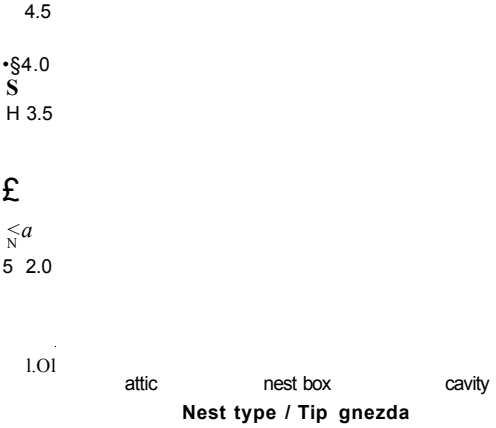

Figure 4: Brood size of Lesser Kestrels *Falco naumanni* for each of the three nest types: attic, nest box and cavity. Means and standard errors of the means are shown.

Slika 4: Velikost zaroda južne postovke *Falco naumanni* za tri tipe gnezd: na podstrešju, v gnezdilnici in v stenskih odprtinah. Prikazana sta povprečje in standardna napaka povprečja.

(N = 9) in nest boxes. The differences in mean laying date were not statistically significant (Kruskall-Wallis test; H = 3.55, df = 25, P = 0.169). The variation in the average clutch was not statistically significant (one-way ANOVA F_{255} = 0.127, P = 0.88).

Overall hatching success was 67% (N = 52), with an average brood size of 2.56 ± 1.33 (N = 52) chicks. In 63% of the cases the eggs hatched in the second

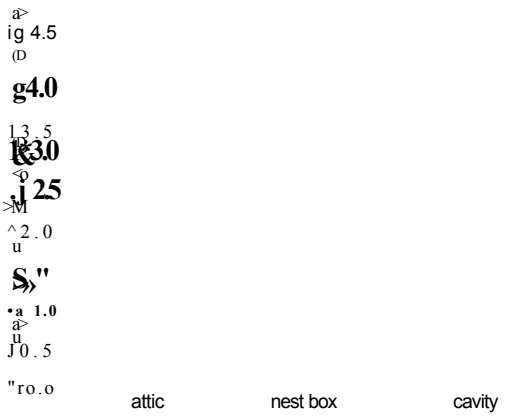

Figure 5: Numbers of fledged young of Lesser Kestrels *Falco naumanni* for each of the three nest types: (a) attic, (b) nest box, (c) cavity. Means and standard errors of the means are shown.

Slika 5: Število speljanih mladičev južne postovke *Falco naumanni* za tri tipe gnezd: (a) na podstrešju, (b) v gnezdilnici, (c) v stenskih odprtinah. Prikazana sta povprečje in standardna napaka povprečja.

decade of June. Cavity nests had a greater brood size i.e. 3.10 ± 0.74 (N = 10), compared to nests in attics with the mean 2.52 ± 1.31 (N = 23) and nest boxes with 2.32 ± 1.56 (N = 19). These differences were not statistically significant (one-way ANOVA $F_{2\,49}$ = 1.153, P = 0.32 - Figure 4). Taken together, the two 'natural' nest categories (attics and cavities) showed no statistically significant differences from nest boxes (t-test, t_{50} = 0.99, P = 0.326).

The average number of fledged young, calculated for all nest types, was 1.9 (N = 45), without statistically significant variation between all three nest types (Kruskal-Wallis test; H = 4.681, df = 45, P = 0.096). Nests in cavities had an average number of fledged young 2.70 ± 0.82 (N = 10), which was higher than those in attics, 1.66 ± 1.14 (N = 18) and nest boxes, 1.82 ± 1.47 (N = 17) (Figure 5). Paired comparisons show that the average number of fledged young in cavities is significantly higher than in attics (Mann-Whitney U Test, U = 36, P = 0.035) but there were no significant differences between nest boxes and either of the other two types (Mann-Whitney U Test, U = 54, P = 0.119).

4. Discussion

The occupancy rate for nest boxes installed in 2007 was not particularly high. Only 16 (8.0%) nest boxes had at least one egg laid. As many studies have shown (LACK 1955 & 1958, PERRINS 1979, ULFSTRAND *et al.*

Table 1: The overview of 200 nest boxes installed in Gravina in Puglia (Ba), Altamura (Ba), Acquaviva delle fonti (Ba), Cassano delle Murge (Ba) and Laterza (Ta) in 2007

Tabela 1: Pregled 200 gnezdilnic, name{~enih v mestih: Gravina in Puglia (Ba), Altamura (Ba), Acquaviva delle fonti (Ba), Cassano delle Murge (Ba) in Laterza (Ta) v letu 2007

	Installed	Visited		Occupied	
Town	No.	No.	%	No.	%
Gravina in Puglia	102	30	29.4	11	10.8
Altamura	50	2	4.0	2	4.0
Acquaviva	22	6	27.3	3	13.6
Cassano	12	0	0.0	0	0.0
Laterza	14	0	0.0	0	0.0
Total	200	39	19.5	16	8.0

1981, PREMUDA *et al.* 2000), the occupancy rate of nest boxes in their first year is low, and it is often necessary to wait one or two years for them to be fully accepted by birds. This is the case for Lesser Kestrels in Spain and Portugal (POMAROL 1996, CATRY *et al.* 2004 & 2007). In Italy, during a study on the breeding biology of Lesser Kestrels in the Santeramo in Colle colony, during 2003 and 2005, occupancy rates were 12% in the first year and 60% in the third year (BUX *et al.* 2005). CATRY *et al.* (2007) suggested, as has been found in many types of nest boxes for different birds, that nest boxes could be better quality nesting sites than natural ones, particularly with regards to protection from predators and reduced interspecific competition for limited nesting sites, and may provide an efficient conservation measure for Lesser Kestrels.

In our study nest boxes were used as nest sites for the first time (in the first year) and still provided similar breeding success rates as the other cavities, as there were no significant differences between the main breeding parametrs between nest sites. The data we gathered in another study shows that the tendency to occupy new nesting sites (such as nest boxes) is often strongly influenced by the state of the breeding season. In 2007, the worst breeding performance of the last five years was recorded (M. BUX *in prep.*; in the analysis using only nest in cavities and attics).

In conclusion, our research shows that wooden nest boxes are an effective conservation measure and can help to minimize potential negative effects of the disappearance of natural nesting sites for Lesser Kestrels (FRANCO *et al.* 2005, CATRY *et al.* 2004 & 2007), and they can provide a successful alternative in cases that require rapid intervention, such as natural cavities being destroyed by renovation of buildings.

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5. Povzetek

Prenova zgodovinskih stavb ima močan negativen vpliv na južno postovko, saj zmanjšuje razpoložljivost njenih gnezdišč in tudi njenega gnezditvenega uspeha. Avtorji so z namenom, da ugotovijo učinkovitost gnezdilnic kot varstvenega orodja, preučevali stopnjo zasedenosti gnezdilnic in primerjali gnezditveni uspeh južne postovke v gnezdilnicah s tistim v drugih urbanih območjih južne Italije. Rezultati so pokazali, da so gnezdilnice uspešno in koristno strateško orodje pri poskusih, da se ohrani ta vrsta. Parametri njenega razmnoževanja (srednji datum leženja jajc, velikost zaroda, število speljanih mladičev), zabeleženi v gnezdilnicah, se namreč bistveno niso razlikovali od parametrov na gnezdiščih v urbanih območjih (odprtine v zidovih in podstrešja).

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