J Raptor Res. 38(2):161–163

UNUSUAL NESTING OF THE LESSER KESTREL (*FALCO NAUMANNI*) IN THESSALY, GREECE

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KEY WORDS: *Lesser Kestrel;* Falco naumanni; *breeding success; fledglings; nesting.*

The Lesser Kestrel (*Falco naumanni*) is a small falcon that breeds colonially and nests mainly in walls or roofs of houses, stables, barns, castles or churches, as well as in tree holes, earth cliffs, and in rocky outcrops (Cramp and Simmons 1980). Although the species was considered to be one of the most abundant European birds of prey, it has suffered from a massive population decline in large parts of its western Palearctic range between the 1960s and 1980s (Cramp and Simmons 1980, Biber 1996), now is of global conservation concern (SPEC 1 category), and considered to be vulnerable in Europe (Hagemeijer and Blair 1997). The reasons for the dramatic decline include the reduction of favorable nesting habitats (restoration and demolition of old buildings), and the intensification of agricultural practices (destruction and loss of foraging areas, and the reduction of prey availability; Donázar et al. 1993, Forero et al. 1996, Tella et al. 1998).

The trend of the Greek population, which comprises ca. 14–15% of the European total, has been similar. In Greece, the Lesser Kestrel shows a discontinuous distribution and now it is mainly concentrated in Thessaly, where Hallmann (1996) in a preliminary report recorded 104 colonies and a total of 2679 pairs.

The objectives of the present study were to estimate the breeding success of Lesser Kestrels nesting on the ground and in a fowl-run with hens and to compare these estimates to those of other colonies.

STUDY AREA AND METHODS

Megalo Monastiri is a small village at the southeastern part of the Larisa plain, central Greece. The village is situated on the edge of a hilly terrain, surrounded by grasslands and agricultural land, where the dominant crops are cereals and cotton, with small areas of almond trees. The altitude ranges from 50–120 m above sea level. The climate is thermo-mediterranean, with a mild rainy winter and a dry and hot summer. The mean annual precipitation is about 465 mm concentrated during the winter.

We located and monitored nests from March–September 1999. Most (75%) of the nests were found during the incubation period, while the rest were found at the beginning of the egg-laying stage. Nests' contents were checked every 15 d to record possible reproductive failures, but in three periods they were checked more frequently: (1) during the beginning of incubation to assess clutch size; (2) just after hatching to estimate hatching success, brood size at hatching, and date of hatching; and (3) during fledging to record the number of young fledged (Steenhof 1987). A pair which laid eggs was defined as a reproductive pair, a successfully-breeding pair was one that fledged at least one young, and breeding success was defined as the percentage of successful territorial pairs (Newton 1979, Steenhof 1987). Means ±SE are presented in the text and differences (using the Mann-Whitney U-test and the Fisher's Exact test for 2 × 2 tables) considered significant at $\alpha = 0.05$.

RESULTS AND DISCUSSION

A colony of 18 Lesser Kestrel breeding pairs, in an old building in Megalo Monastiri village was recorded in 1998. The next yr, the local municipality demolished the old building and cleared away most of the debris because it was dangerous for the people living in the area. Early in the next breeding season, the same numbers of Lesser Kestrel pairs were recorded at the location of the old building, as most of adult Lesser Kestrels show high fidelity to their breeding colonies (Serrano et al. 2001). We recorded a total of eight breeding attempts of Lesser Kestrels nesting on the ground, 75% of which were successful. Although ground-nesting behavior had not been observed before, the overall breeding success for these Lesser Kestrels was slightly higher than that recorded for the entire population in Megalo Monastiri in 1999 (69.7%, $N = 33$ pairs), but this difference was not significant (Fisher's Exact test, $P = 0.569$; Bakaloudis et al. 2000).

There were no significant differences in any reproductive parameter between the colony that nested on the ground and the population that nested on the buildings of the village. The mean clutch size was 3.1 ± 0.35 eggs, similar to the population in the village (3.5 ± 0.22; Mann-Whitney U-test, $P = 0.288$). Eighty-four percent of 25 laid eggs on the ground hatched successfully, resulting in a mean brood size at hatching of 2.6 ± 0.26, which was similar to the mean brood size for the pairs nesting on buildings (3.1 ± 0.19, $N = 26$; Mann-Whitney U-test, $P = 0.143$). Two of four unhatched eggs disappeared about 14 d after the incubation had begun. In both cases large eggshell fragments were found and we suspect that

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domestic cats (*Felis catus*) and rats (*Rattus rattus*) were responsible for destroying those eggs. The mean brood size at fledging per successful pair was lower in the pairs nesting on the ground (2.67 ± 0.33, N = 6) than the pairs nesting in buildings (3.09 ± 0.2, N = 23), but not significantly so (Mann-Whitney U-test, P = 0.371). The mean number of young fledged per reproductive pair that nested on the ground was 2.00 ± 0.5 (N = 8) and did not differ from the mean number of kestrels reared by pairs that nested on the buildings (2.15 ± 0.29, N = 33; Mann-Whitney U-test, P = 0.771). Seventy-six percent of 21 hatched eggs on the ground produced fledglings successfully. Most chick mortality (80%) occurred when the adults deserted the nests about 20 d after hatching. Although there was indication of the cause of those losses, which could be due either to an accident to their parents or to poor parental care, the feathered chicks in two broods (pairs D and H) died from starvation. In another case (pair C), the predated downy chick was found close to the nest with its siblings and had probably been killed by a rat. No evidence of cannibalism was observed in the colony of Lesser Kestrel on the ground, as was reported by Negro et al. (1992) for other colonies in Spain. The proportion of nests failing during incubation was lower than pairs nesting on the ground than nesting on buildings (58.3%, N = 7). Conversely, broods in nests on the ground (25%, N = 3) were more likely to fail than those in buildings (16.7%, N = 2; Fisher's Exact test, P = 0.045). This was due mainly to the higher predation pressure during the nestling stage on pairs nesting on the ground.

In general, breeding parameters of the Lesser Kestrel colony on the ground were similar to that of other populations, except for clutch size, which was lower than in other studies. Variations in clutch size and breeding success were also reported for other Lesser Kestrel populations (Negro and Hiraldo 1993, Tella et al. 1996) and may be related to changes in food availability from yr to yr or to habitat type (Newton 1979, Negro et al. 1992, Negro and Hiraldo 1993, Tella et al. 1996). The Lesser Kestrel that we studied fed exclusively on insects, mainly crickets and grasshoppers (Orthoptera), the populations of which fluctuate from yr to yr in the study area. The low clutch size of Lesser Kestrels that either nested on the ground or on the buildings in 1999, suggests that the period of study was a yr of food shortage, compared to that recorded for the same study area in 2000 (Bakaloudis et al. 2000). Finally, the percentage of unhatched eggs was low and similar to the results of other studies (Negro et al. 1993), suggesting that the hatching success either of Lesser Kestrels that nested on ground or on buildings in Megalo Monastiri village was not negatively affected by contamination. However, the widespread use of pesticides in intensive cultivation could be a possible reason for adult deaths or for low feeding rates (i.e., the observed mortality of chicks due to starvation) as these could affect prey populations negatively during the late stage of the nestling period. The fact that Lesser Kestrel relies heavily on prey species that inhabit intensively-cultivated land, might be a cause of concern for the future.

We also monitored the breeding success of five pairs found nesting in a fowl-run. The mean clutch size was 3.2 eggs (SE = 1.5), brood size 2.8 young (SE = 1.3), and breeding success 60%. Sixty-nine percent of 16 laid eggs hatched successfully and 91% percent of the hatched eggs produced fledglings (N = 2). Between one and three hen eggs were also found in each kestrel nest. Also, one nest was found in a plastic barrel with two eggs, but failed to produce young and another one in an oil barrel with two eggs, which fledged one young successfully.

In conclusion, we suggest that the unusual ground-nesting observed, as well as the nesting in fowl-runs and in barrels, may be associated with the lack of other suitable nesting sites (Forero et al. 1996), the relative absence of predators (Balfour 1955, Seago 1967, Piechocki 1982, Village 1990) at this site and by the high fidelity exhibited by adults to their breeding colonies (Serrano et al. 2001).

RESUMEN.—Presentamos informacion sobre 8 nidos de *Falco naumanni* que han hecho nido en el suelo debajo de los restos de un edificio antiguo demolido en Thessalia, Grecia Central en 1999. Las variables reproductivas como tamapo de puesta en el momento del vuelo (3.1 huevos puestos), el tamapo de pollada (2.6 pollos) y éxito reproductor (2.6 pollos) no tienen diferencias importantes comparados con los que han sido observados en instalaciones humanas en la misma región de estudio. En el 75% de los nidos se ha criado con éxito al menos un pollo, con un promedio de 2.0 pollos por pareja reproductora. Cinco parejas han sido localizadas en gallineros usando los mismos nidos de las gallinas y tres de ellos criaron pollos con éxito. Una puesta fue encontrada en un cubo de plástico y otra en un barril de aceite.

[Traducción de los autores]

ACKNOWLEDGMENTS

We would like to thank E. Vlachou, E. Dafos, V. Botzorlos, T. Papadopoulos, and D. Tsalagas for their assistance with the fieldwork. We are also grateful to the 4th Hunting Federation of Sterea Hellas and Municipal Enterprise and Ecotourist Center of Dadia, which have supported this research financially. We also thank Drs. J.J Negro, D. Serrano, and an anonymous referee who reviewed and greatly improved this manuscript.

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Received 29 January 2003; accepted 29 December 2003
Associate Editor: Juan José Negro

J Raptor Res. 38(2):163–168

FAT STORES OF MIGRANT SHARP-SHINNED AND COOPER'S HAWKS IN NEW MEXICO

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KEY WORDS: *Cooper's Hawk*; Accipiter cooperii; *Sharp-shinned Hawk*; Accipiter striatus; *avian energetics*; *migration*; *fat scores*; *fat stores*.

Birds use stored fats to supply energy during times when foraging is limited or not possible (King 1970, Blem 1980). During migration, stored fat allows birds to make uninterrupted flights between places and times when foraging can occur and fat stores can be replenished (King 1970, Blem 1980). The amount of fat that birds store during and leading up to migration varies widely (Blem 1980). Fat stores ranged from 4% of total body mass in Common Buzzards (*Buteo buteo vulpinus*) migrating through Israel (Gorney and Yom-Tov 1994) to

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