J Raptor Res. 38(3):278–282

PREMIGRATORY COMMUNAL ROOSTS OF THE LESSER KESTREL IN THE BOREAL SUMMER

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KEY WORDS: *Lesser Kestrel;* Falco naumanni; *premigratory aggregations; communal roosts.*

The Lesser Kestrel (*Falco naumanni*) is a small migratory falcon breeding in the Palearctic and wintering mainly in Africa (Siegfried and Skead 1971, Cramp and Simmons 1980). This species is considered to be a threatened species listed as Vulnerable (BirdLife International 2002). Although many aspects of their breeding biology have been studied (e.g., Negro et al. 1992, Donázar et al. 1993, Hiraldo et al. 1996, Tella et al. 1996a, 1996b, 1997) there is little known about the post-fledging period of this species (but see Bustamante and Negro 1994, García 2000, Olea 2001a). This period can be particularly critical for the survival of the juvenile falcons because recently fledged birds have little experience in foraging, and in avoiding predators and human activities (Anders et al. 1998). During the post-fledging period, Lesser Kestrels seem to increase significantly in their abundance in some areas in northern Spain, where breeding populations are small or nonexistent (e.g., Llamas et al. 1987, Jubete 1997, Román 1998, Olea 2001b) and gather in communal roosts (Olea 2001b, Ursúa and Tella 2001).

Avian communal roosting is thought to provide survival benefits (Blanco and Tella 1999) in terms of decreased predation risk and increased foraging efficiency (Beauchamp 1999). Some evidence also suggests that such roosts could facilitate social relationships with implications in the regulation and viability of bird populations (Blanco et al. 1993, Blanco and Tella 1999) and in the conservation of some raptor species (Donázar et al. 1996). To manage and conserve a bird population, it is necessary to understand the requirements and the limiting factors of a population throughout the annual period (Steenhoff et al. 1984). For Lesser Kestrels, information on summer communal roosts is incomplete. The species has been studied during winter in Spanish areas (Negro et al. 1991) as well as in Africa (austral summer; Siegfried and Skead 1971, Kopij 2002). To our knowledge, the only published information on Lesser Kestrel roosts during the summer in the Palearctic comes from Spain and Italy, and consists of anecdotal records of two roosts (Tejero et al. 1982 and Aparicio 1990, respectively) and on the monitoring of birds at four roosts during a single summer (Palumbo 1997, Olea 2001b, Ursúa and Tella 2001). Here, we examine the use of communal roosts by Lesser Kestrels in northwestern Spain during three summers. We describe roost site characteristics and examine numbers and temporal variation of roosting Lesser Kestrels.

METHODS

Communal roosts were located in the province of León, northwestern Spain, at about 800 m above sea level, between the towns of Santas Martas and Sahagún (42°25′–42°17′N, and 5°23′–5°06′W; 11.7°C annual mean temperature and 486 mm rainfall). The study area covers 384 km^2 devoted to cereal crops. This area was selected because communal roosting was observed previously (Olea 2001b; pers. obs.). In 2002, we documented 23 breeding pairs of Lesser Kestrels in the study area. The landscape was flat and open, with practically no trees. The area is broken up by a number of small seasonal streams flowing in a north-south direction. When this study was conducted, the fields had been partially harvested and the area was mostly dominated by stubble and fallow fields (74% of the area). The area is also crossed by a recently-built highway.

Roost Site Detection. An effort was made to find all roosts in the study area. We looked for roost sites between 20–26 August 1998. In 2001 and 2002 the search for roosts began on 25 July and 1 July, respectively. We first checked the roosts used by Lesser Kestrel in previous years. Next, we searched for new roosts in the area until the end of the summer. Several observers with binoculars (8×) and telescope (20–60×) were distributed across the area at the best vantage points. Roosts were located during late afternoon, because during this period the Lesser Kestrels tended to gather around "staging" areas near roosts. These aggregations were fairly conspicuous and easy to detect. From these sites, kestrels progressively moved toward the roost sites about an hour before sunset.

Monitoring of Roosting Birds. We counted birds at the roosts between 26 August and 26 September in 1998 (every 3–7 d, 7 monitoring d), between 25 July and 10 Oc-

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Table 1. Characteristics of the premigratory communal roosts of Lesser Kestrels during summers of 1998, 2001, and 2002 in northwestern Spain. Study periods: 26 August–8 Septermber 1998, 25 July–10 October 2001, and 1 July–9 October 2002.

	ROOSTS						
SUBSTRATE	A EVERGREEN OAK	B PYLONS (380 kV)	C BLACK LOCUSTS AND COMMON PEAR	D POPLAR PLANTATION	E SEVERAL UTILITY POLES (<45 kV)	F PYLON (380 kV)	G POPLAR PLANTATION
Distance to power-line (kV) in m	30 m (45 kv)	0 m (380 kV)	20 m (<45 kV)	40 m (380 kV)	0 (<45 kV)	0 (380 kV)	40 m (<45 kV)
Max. no. of kestrels							
1998	355 (29 August)	262 (31 August)	96 (2 September)	106 (8 September)			
2001	200 (12 August)			750 (31 August)	27 (31 August)	7 (6 September)	85 (18 September)
2002	360 (4 September)			641–666 (2 August)			

tober in 2001 (every 1–17 d, 14 monitoring d) and between 1 July and 9 October in 2002 (every 1–11 d, 23 monitoring d). In 1998 and 2001, we began to count birds at roosts on 26 August and 25 July, respectively, after the Lesser Kestrels began using roosts. For this reason, in 2002 we initiated monitoring several weeks before the previous years to determine accurately the date when Lesser Kestrels started to use the roosts.

Except in 1998, we tried to census Lesser Kestrels using all roosts simultaneously. Only one roost was monitored in 1998; in 2001 and 2002, the two largest and more-stable roosts were monitored during the entire study period. Observation sites were at ground level and 300–600 m away from the roosts. Individuals were counted using binoculars and 20–60× spotting scopes. To avoid bias in the counting between observers, the same persons monitored the same roosts. Although this does not eliminate potential biases among roosts, counts of Lesser Kestrels in the roosts were facilitated by their behavior. Specifically, before roosting, kestrels perched on powerlines, where time was spent preening, or bathed in the sand. Thus, we believe that the census of kestrels was reliable.

We counted individuals going to roosts in 2.5–5 min intervals from 30 min before sunset until all individuals entered the roost. The highest evening count was used as the roost count for that day. In roost A, we censused Lesser Kestrels when perching on powerlines close to the small and scattered group of evergreen oak trees (*Quercus ilex*), which they used as roost sites (Table 1). At this roost, birds flew as singles, in pairs, or in small groups from the wires to the trees, but not in the opposite direction. This made counting kestrels relatively easy.

In 2002, we could not obtain accurate counts of Lesser Kestrels entering one of the roosts on several occasions (6 of 23 censuses) because roosting activity was erratic. Therefore, kestrels were counted immediately following sunrise leaving the roost (from 30 min before sunrise until after all the kestrels left the roost).

RESULTS

Description of the Roost Sites. In 1998, four communal roosts of Lesser Kestrels were found. Roost site A was located in a small evergreen oak forest, where Lesser Kestrels used a group of five scattered evergreen oaks 5–8 m high, and close to a road (<150 m; see Table 1). Roost B, was located on three utility pylons (380 kV). More than 90% of the individuals roosted on a single pylon. Roost C was on three trees (two black locusts [*Robinia pseudoacacia*] and common pear [*Pyrus communis*]) 6–7 m high Roost D was in a poplar (*Populus* sp.) plantation of 612 m^2 with poplars 20–28 m high.

All four roosts were in the vicinity of powerlines (<50 m), ranging from <45–380 kV (Table 1), where the birds grouped, rested and preened before going to the roost. The shortest distance between roost sites was 6 km (between roosts A and C), and the longest, 17 km (between roosts A and D).

In 2001, we located four roosts, two of them were the same as in 1998 (A and D). The two new roosts were on electric poles (E on several <45 kV poles and F on 380 kV poles). In 2002, Lesser Kestrels used roosts A and D, but in roost A the birds used a larger number of evergreen oaks in the forest than in 1998 (see above).

Change of Roost Sites within the Year. On 10–12 September 1998 some changes in the roost sites were observed: kestrels stopped using roost B and roost A was moved 0.5–1.5 km from the previous roost location. On 17–18 September 2001, the kestrels in roost D split into three groups, one stayed in roost D, another moved to roost G, and the third group of kestrels left and were not located. In 2002, the kestrels in roost D split temporally (between 27 and 29 August) in three groups, using two other nearby plantations of poplars (not included in Ta-

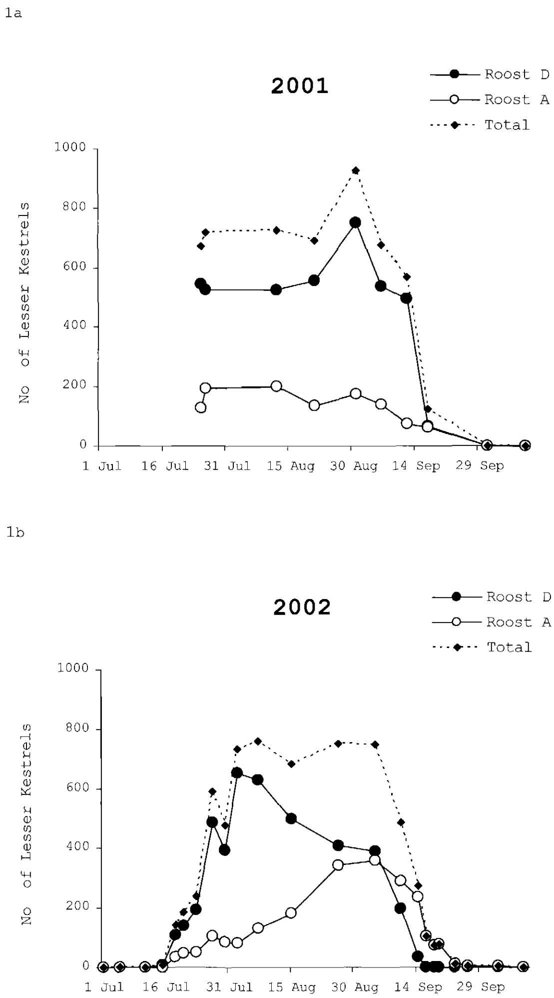

Figure 1. Seasonal variation of Lesser Kestrel abundance at roosts A and D, and total number (sum of kestrels using main roosts A and D); in summer of 2001 (a), and summer of 2002 (b).

ble 1). Later that year (between 29 August and 4 September), roost D was reused.

Roost Dynamics. In 1998, the mean number of Lesser Kestrels in roost A was 320 until 10 September; this number peaked on 29 August, with 355 individuals. The number of Lesser Kestrels decreased markedly after 10 September (particularly between 10–17 September), until 26 September, when no individuals were detected at the roost.

The abundance pattern of roosting Lesser Kestrels at roosts A and D varied between 2001 and 2002. During 2001, the number of birds in roost D tended to be about three times higher than in roost A (Fig. 1a). The maximum number of birds in roost D was 750 (31 August), and 200 birds in roost A (12 August). The number of Lesser Kestrels decreased markedly after 7 September in both roosts. From October, no birds were observed in the roosts. The maximum number of birds summing up both roosts, simultaneously censused, was 925 (31 August; Fig. 1a). Two other small roosts (E and F) were used in 2001 (Table 1).

In 2002, the first birds using the roosts were observed on 15 July and 18 July in roosts D and A, respectively (Fig. 1b). Use of the two roosts by kestrels through time during the post-fledgling period differed in 2002. Roost D increased markedly until 2 August (peak = 653 birds), while kestrels at roost A steadily increased until 4 September with 360 birds (Fig. 1b). No birds were observed in roost D on 16 September, while there were no birds in roost A on 3 October. The maximum number of birds, summing up both roosts, was 761 in 2002 (7 August; Fig. 1b).

Roosting Behavior. During 2001 and 2002, the roosting behavior was different at the two primary roosts observed (D and A). At roost D, the birds formed generally a cloud-like flock circling above the roost ca. 10 min before entering the roost. However, at roost A the birds flew directly from powerlines or the ground to roost as singles, in pairs, or in small groups. Lesser Kestrels entered the roosts from sunset until ca. 30 min later. In 2001, Lesser Kestrels entered the roosts between 3 and 34 min after sunset. In 2002, Lesser Kestrels entered the roosts from 1.3 min before–23 min after sunset.

DISCUSSION

In the study area, close to 1000 Lesser Kestrels used communal roosts at some point during the summer. Similar aggregations have been found during this period in northeastern Spain (Ursúa and Tella 2001). Because our study area had only 23 Lesser Kestrel breeding pairs in 2002, the large population we found using roosts in summer indicates that most birds were adults or juveniles coming from other areas, as previously suggested by other authors (García 2000, Ursúa and Tella 2001) and supported with observations on post-fledging dispersal (Olea 2001a).

In our study area, Lesser Kestrel used the roosts from mid-July until late September. This temporal pattern differs somewhat from that found by Ursúa and Tella (2001) in two roosts in northeastern Spain (Navarra), where birds used the roosts from early June. This difference could be due to the fact that the Navarra roosts could be used by the local population during the breeding period, contrary to what has been observed in our study area. Another possible explanation would be that there are differences in breeding phenology and/or variations in the dates of first occupancy of roosts among years.

The number of birds at the roosts increased from mid-July, probably due to the arrival of post-breeding individuals. The decrease in the number of Lesser Kestrels from September coincided with the migration to winter quarters (Bernis 1980), and was consistent with observations by Ursúa and Tella (2001). The maximum of birds, summing up the two larger roosts simultaneously censused, was reached in August in both years (Fig. 1). This agrees with what has been observed in Navarra (Ursúa and Tella 2001) and Italy (Palumbo 1997). Nevertheless, the date of the maximum number of birds varied between roosts, especially in 2002 (Fig. 1b). The cause of this difference between the roosts A and D is not clear, but it could be due to the fact that roost D was censused at sunrise during 6 d (between 27 July and 15 August; Fig. 1b). Kopij (2002) found Lesser Kestrels arriving to the roosts several hours after sunset, therefore the number of birds counted at sunrise may be larger than at sunset. If so, the peak observed on 2 August could be due to differences in the counting procedures. However, we do not know whether Lesser Kestrels arrived after sunset counts at the roosts we studied, and if that was so, what fraction of the population it represented. On the other hand, the observed negative trend in number of birds from 7 August (counted at sunrise) was maintained, although the censuses from 15 August were carried out at sunset, suggesting that such potential bias was minimal (Fig. 1b). Alternatively, the different dynamics of roosts A and D in 2002 could be due to interchange of individuals between roosts (individuals at roost D switched to using roost A later during the post-fledging period; Fig. 1b).

Lesser Kestrels returned to the study area year after year and were faithful in their use of communal roosts, with two roosts used at least during 3 yr, suggesting that this area could be used as a regular premigratory area. Areas occupied by a relatively high post-breeding population of Lesser Kestrel, such as our study area where the post-breeding numbers largely exceeds the breeding population, has also been found in northern Spain (Ursúa and Tella 2001), and this could be the case elsewhere (e.g., Jubete 1997, Román 1998). The apparent fidelity to roost sites suggests an important role for these summer areas. Aparicio (1990) and Morton (1992) have suggested that food supply is important during the period prior to migration when individuals molt and fatten, and may be a critical factor for the survival of some raptor species during dispersal (Newton 1979, Korpimäki and Lagerström 1988, Miller et al. 1997). Therefore, the availability of areas with sufficient food supply during this period (e.g., with high densities of Orthoptera, the main food of Lesser Kestrel; Franco and Andrada 1977, Tejero 1982; pers. obs.) could be important. In our study area high densities of grasshoppers occur primarily during summer, and this resource is used by the post-breeding Lesser Kestrel population (P. Olea and A. de Frutos unpubl. data), suggesting a role for this area as a premigratory feeding and staging area.

The ca. 1000 Lesser Kestrels counted in our roosts and the ca. 3000 birds found by Ursúa and Tella (2001) in two roosts in northern Spain, may indicate that a significant fraction of the Spanish Lesser Kestrel population (12 000 breeding pairs; BirdLife 2002) gathered in only four roost sites in this post-fledging period, suggesting the importance of these sites for conservation (Ursúa and Tella 2001). Therefore, we suggest that further studies are required to identify other areas and roosts used by the Lesser Kestrel during the post-fledging period. Also, the potential role that these areas could be playing in the ecology and conservation of Lesser Kestrel populations needs to be examined.

RESUMEN.—Existe poca información sobre dormideros comunales estivales de cernícalo primilla (*Falco naumanni*) en la región Paleárctica. Estudiamos los dormideros comunales de cernícalo primilla durante los veranos de 1998, 2001, y 2002 en un área agrícola (384 km^2 con 23 parejas reproductoras) en el noroeste de España. Los dormideros se buscaron intensivamente cada año por todo el área de estudio y se registró el número de cernícalos primillas que usaron los dormideros. Los dormideros se ubicaron en diferentes substratos, tanto naturales (árboles) como artificiales (torres de alta y baja tensión). Se localizaron cuatro dormideros de cernícalo primilla en 1998 (96–355 aves), cinco en 2001 (7–750 aves) y cuatro en 2002 (360–666 aves). Los dos dormideros con mayor número de cernícalos primillas fueron usados durante los tres años de estudio. El número máximo de cernícalos primilla en los dos dormideros más grandes fue de 925 aves en 2001 y 761 en 2002. El número de cernícalos primillas alcanzó el máximo en Agosto, probablemente por la llegada de individuos de otras áreas, y descendió en Septiembre, coincidiendo con la migración. La gran concentración de cernícalos y la fidelidad a los lugares usados como dormideros sugiere un importante papel de estas áreas en la ecología y conservación del cernícalo primilla.

[Traducción de los autores]

ACKNOWLEDGMENTS

We are grateful to Jesús Fernández, Rafael González, Olga Mora, Cristina Trigal, María del Carmen Cordero, Soledad, Irene Marcos, Rodolfo Pozuelo, Tania Velasco, Enrique Osorio, and Francisco J. Purroy for their help during the fieldwork. We thank Álvaro de La Puente, Jesús Fernández, and Rafael González, who loaned us their telescopes. Vittorio Baglione and two anonymous referees provided valuable suggestions on the manuscript Juan José Prat improved the English. This research was partially supported by Monteleón-Caja España Foundation. A. de Frutos was financed by a predoctoral fellowship from the University of León.

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Received 15 July 2003; accepted 26 May 2004
Associate Editor: Juan José Negro