

Nest site and Breeding Biology of the red-footed falcon (*Falco vespertinus*) in northern Italy

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The Red-footed Falcon *Falco vespertinus* is a migratory raptor, whose main winter quarters are in Angola, Namibia, Botswana, Rhodesia and South Africa (Glutz *et al.* 1971, Moreau 1972).

Within the usual breeding area, the Red-footed Falcon is a colonial breeder, although solitary pairs are sometimes recorded (Kève and Szitt 1957, Cramp and Simmons 1980, Haraszthy and Bagyura 1993). It breeds in old corvid nests, mainly in exploiting colonies of Rook *Corvus frugilegus*, although Hooded Crow *Corvus corone ssp. cornix*, Carrion Crow *Corvus corone ssp. corone* and Magpie *Pica pica* nests are sometimes used.

Suitable breeding habitats includes open steppe, wooded steppe and cultivated fields (Cade 1982). Such landscapes support high densities of large insects, mainly from the order *Orthoptera*, which feature prominently in the Red-footed Falcon's diet. Other prey types which are especially important during the chick-rearing phase include small mammals and amphibians (Haraszthy *et al.* 1994).

According to the most recent censuses (Hagemeijer and Blair 1997) the core breeding area is in Hungary (2200 pairs) and the southern regions of the former Soviet Union (15 000 - 40 000 pairs). Small numbers also breed in Romania (200 - 600 pairs), Moldova (120 - 200 pairs) and Ukraine (400 - 600 pairs).

Reports of the Red-footed Falcons breeding to the north and west of their traditional range have become increasingly frequent over the past three decades: in Germany (1976), Austria, Finland, Poland and France (1993) (Hagemeijer and Blair 1997). Breeding was first confirmed in Italy in 1995 in the Province of Parma, although Red-footed falcons may have bred in Tuscany before this date (Brichetti *et al.* 1996, Romé and Quagliarini, 1979).

This paper describes some details of the nesting biology of the small population of Red-footed Falcons which has since established itself on the Parma Plain. Data on the Red-footed Falcon's nesting behaviour and success on the fringes of its expanding geographical range will help us to inform local conservation efforts to maintain and encourage the growth of populations in recently settled areas.

The study area comprised 17 Km² located near the town of Busseto (44°59'N - 10°04'E). Although 63% of the land was devoted cereal production, average field size was relatively small (mean field surface = 0.0276 Km²; min. = 0.0181 Km²; max. = 0.0534 Km²). The main crops grown in the area were maize (*Zea sp.*), wheat (*Triticum sp.*) and barley (*Hordeum sp.*). Altitude ranged between 20 and 40 m above sea level, annual rainfall range of 600-900 mm and temperature varied between approximately 13 and 26 °C over the course of the year.

Observations have been carried out over three alternate days per week, from 15 April to 15 August. Data were collected by means of 8 x 42 binoculars. In winter 1997/98, a census of corvid nests was made in and around the area in which Red-footed Falcons had bred. All corvid nests in an area of 160 Km² were located and the following information recorded for each one: tree species, tree height, canopy height and nest height.

The density of breeding Red-footed Falcons in the study area was estimated in accordance with the "Nearest-neighbour distance" method (Newton *et al.* 1977, Court *et al.* 1989). Statistical significance was set at P < 0.05 and statistics were computed using SPSS 8.0 statistical package for PCs.

The lengths of the incubation and nestling periods were similar to those reported in Cramp and Simmons (1980):

22 - 23 days from the onset of incubation to hatching, and 27 - 30 days between hatching and fledging.

Therefore, whenever it was not possible to have a record of the incubation date or the fledging date, these were estimated by assuming the periods reported by Cramp and Simmons (pairs 6 and 9; Table 1).

In the study area nesting occurred in 1997 and 1998. About the pre-breeding migration data in the study area (Fig. 1), the first observation of Red-footed Falcon was recorded on the 18th of April in 1997 and on the 28th of April in 1998. Instead the last observation was recorded on the 16th of May in 1997 and on the 1st of June in 1998. The daily max number of individuals was 11 in 1997 and 40 in 1998. Finally the daily mean (\pm se) number of individuals was 5 ± 2.27 in 1997 and 15.2 ± 3.45 in 1998.

In 1997 four out of seven pairs successfully fledged chicks, and in 1998 two out of four pairs were successful (Table 1). The mean number of fledgings/successful nest, was 2.67 ± 0.88 se ($n = 3$) in 1997 and 1.5 ($n = 2$) in 1998. The minimum distance between nests was 579 ± 149 m in the first breeding season and 750 ± 298 m in the second one. Density values were 1.99 pairs/km² in 1997 and 2.09 pairs/km² in 1998.

All but one nest (90.9 %), were on poplars *Populus nigra* and in all cases Hooded Crow nests were used (Table 1). In each reproductive season none of the nests occupied by the Red-footed Falcons was on the same tree. In 1997 an adult female/subadult male pair bred successfully and fledged one young. This observation confirms that sexual maturity is reached in the first year (Dementiev and Gladkov 1951,

Horváth 1955). In 1998 breeding occurred in two nests utilised the previous year by Red-footed Falcons.

The height of the trees with at least one corvid nest in the study area does not differ from that in the neighbouring area ($n = 1344$; two-sample Kolmogorov-Smirnov $Z = 0.909$; ns).

Nest height differ in the two areas only in 16-20 m class of trees ($n = 1344$; $Z = 1.408$; $P < 0.05$). The Red-footed Falcon consequently manifests a preference for nests situated at 11-15 m high and this on trees 16-20 m high (Table 1).

In the study area, nests on the top of tree crown were predominant (79.71%). On the contrary, nests of Red-footed Falcons had some foliage covering in the 81.82% of the cases. Nests with at least 5 m canopy overhead were preferred by Red-footed Falcons ($n = 80$; $df = 1$; log-likelihood $G^2 = 15.95$; $P < 0.01$). These preferences could be the consequence of a compromise between nest height and the foliage covering above the nest, as a probable defence against solar radiation and bad weather.

The length of settlement and fledging period was very similar in the two seasons (settlements: 32 and 31 days; fledgings: 11 and 11 days) (Fig. 1). The ten days shift in 1998 settlement remains equal through all phases. The synchrony is probably due to the colonial nature of this Falcon. The synchronous patterns would be kept also in solitary or semi-colonial pairs, as observed in the study area (Table 1). In conclusion the low number of pairs is probably related to the absence in our territory of colonial corvids and the lability is probably because these pairs are on the border of their customary breeding range.

Table 1. Features of Red-footed Falcon: nest in 1997 and 1998.

Year	Pair	Species of tree	Height of tree (m)	Height of nest (m)	Settlement date in the nest	Start of Incubation	Hatching date	Fledging / brood size	Fledging date	Nest deserting date
1997	1	<i>Ulmus campestris</i>	= 10	= 10	22 Apr	30 May	23-24 Jun	0/3	-	9 Jul
	2	<i>Populus nigra</i>	16-20	11-15	26 Apr	-	-	0/0	-	3 Jun
	3	»	16-20	11-15	3 May			?/2		
	4	»	16-20	11-15	3 May	19 May	13-14 Jun	4/4	9 Jul	
	5	»	16-20	11-15	9 May	30 May	21-22 Jun	0/0	-	30 Jun
	6	»	16-20	11-15	23 May	31 May	22-23 Jun ^a	3/3	19 Jul	
	7 ^b	»	16-20	11-15	23 May	31 May	22-23 Jun	1/1	19 Jul	
1998	8	»	16-20	11-15	11 May	9 Jun	-	0/0	-	13 Jun
	9	»	16-20	11-15	20 May	5 Jun	27-28 Jun ^a	1/3	27 Jul	
	10	»	11-15	= 10	5 Jun	17 Jun	9-10 Jul	2/3	6 Aug	
	11	»	11-15	11-15	10 Jun	-	-	0/0	-	1 Jul

^a Estimated data; ^b Age of the male = 5 (cod. EURING)

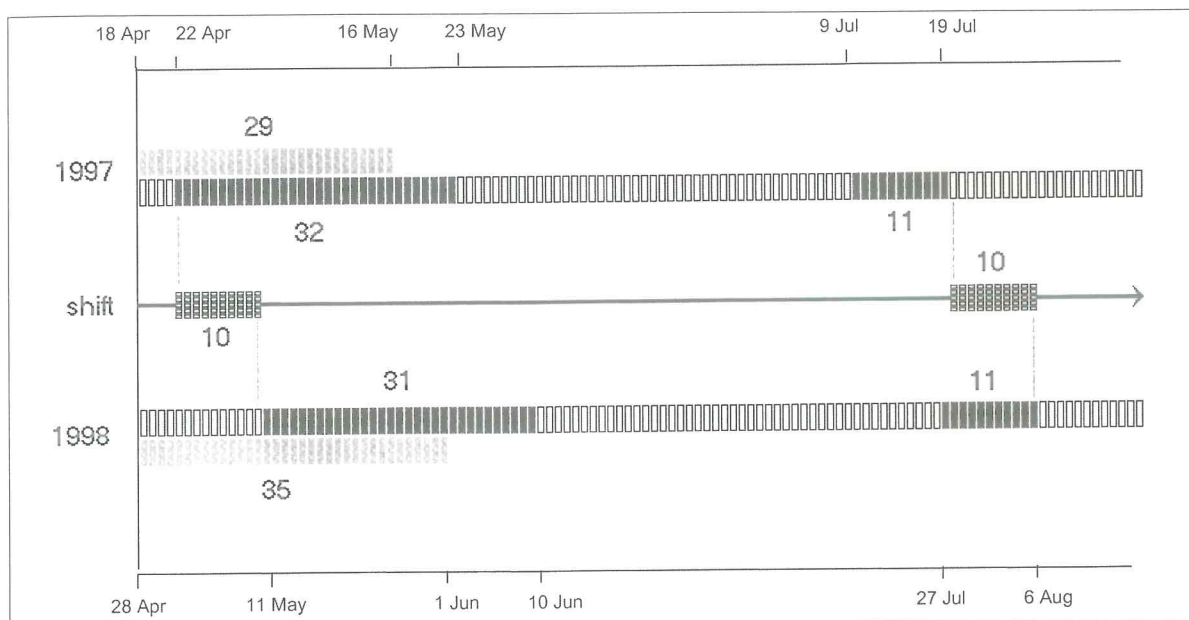


Fig. 1. Settlement and fledging periods (black bar) in relation to the days of the pre-breeding migration of the species (grey bar), in 1997 and 1998.

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Riassunto - Una popolazione di *Falco cuculo* di sette coppie nel 1997 e di quattro nel 1998 si è stabilita nella pianura padana, in provincia di Parma. Le coppie hanno utilizzato nidi di *Cornacchia grigia*, posti su alberi di 16-20 m d'altezza e con una copertura fogliare perlomeno di 5 m di spessore. In entrambe le stagioni riproduttive è stata riscontrata un'elevata sincronia tra le diverse coppie, malgrado l'assenza di vere e proprie colonie, caratteristiche nell'areale riproduttivo tipico della specie.

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