

Ecological Aspects of Long-term Changes in Population Density of the Kestrel *Falco tinnunculus* around Sofia

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INTRODUCTION

The Kestrel is very common in Bulgaria. It is a migratory and partly resident species, seen more rarely in winter, mainly in lowlands (Sineonov 1986).

The Sofia Plain is an area of 1180km² with a mean altitude of 550m a.s.l. and surrounded by the Stara Planina, Viskyar, Lulin, Vitosha and Lozenska Planina mountains. The climate is continental temperate, with a relative humidity of 40-78%. The annual rainfall is 6.25ml/m², with highest values in May/June and lowest in December. Snow cover in winter remains on average for up to a few days.

METHODS

During investigations conducted from 1979 to 1991, data on the species' distribution, ecology and factors influencing population size were collected. One-day trips were made during all seasons of the year. The birds were observed using 7x30 and 10x50 binoculars. Prey items were identified by analysis of pellets and by direct observation. Nests below 600m altitude were mapped on a 2km UTM grid.

RESULTS

A notable concentration of the species was observed near fields of alfalfa, where the Common Vole *Microtus arvalis* is most numerous. During the study period 40 pellets were analysed and the following components identified: *Microtus arvalis*, *Arvicola terrestris*, *Crocidura leucodon*, *Lacerta* sp., *Streptopelia turtur* (direct observation), *Motacilla flava*, *Anthus* sp., *Passer domesticus*, Chrisomelidae, Scaracidae, Curculionidae, Carabidae, *Carabus convexus*, *Coccinella septempunctata*, Arachnea, Coleoptera and Orthoptera.

The basic component of the diet was the Common Vole, but the spectrum varied in the different seasons and in different parts of the plain. For example, three pellets found on 4 April 1991 east of Sofia (UTM grid GN 03-6, Fig. 2) contained only insects (*Coleoptera*), probably due to the fact that other species were less active and difficult to catch. In the north-western regions of the plain, where there are nearby areas of karst, apart from the dominant *Microtus*, two *Crociodura leucodon* and pellets containing only *Acrididae* were found (UTM grid FN 74-18, Fig. 2). The percentage of birds in the diet increases in July-August, when House Sparrows are present in the field in great flocks.

According to Baumgart (1971), the Kestrel's habitats in Bulgaria are quite different from those in Germany, since in Bulgaria the species nests mainly on rocks. This was confirmed by our investigations in several rocky areas with a high population density: near the village of Carlucovo (5 June 1990), among rocks near Belogradchik (25 April 1989), around Lacatic (10 May 1987) and along the Zemen gorge (May-June 1983) an average density of 1.6 pairs per km² was recorded. By comparison, in areas with highest density of breeding birds in the Sofia Plain (UTM grid GN 03-6,11; GN 02-5,9,10), only 0.9 pairs per km² were found in 1979.

Figure 2 gives data about the breeding distribution of the Kestrel in the Sofia Plain. The number of pairs fluctuates from year to year. There are insufficient data for a quantitative evaluation of the whole area (approx. 900km²) for each year, but the average number of pairs is about 70 (0.08 per km²). According to Yancov (1983), in 1982 about 15 breeding pairs became established in Sofia, with a further increase possible (Donchev & Yancov 1989).

The highest density of Kestrels was to the east of Sofia. In an area of 30km² (UTM grid GN 03-2,7,12,1,6,11; GN02-5,10,15,4,9,14,3,8,13) 27 breeding pairs were found during 1979 (0.9 prs/km²), but a sharp decrease in their number has since taken place: 1980 - 25 pairs; 1981 - ?; 1982 - 23 pairs; 1983 - 24 pairs; 1984 - 18 pairs (adverse changes to the habitat, with ca. 20% of the wetlands drained and 30% of the alfalfa replaced with maize); 1985 - 12 nests destroyed by electricians, only 6 established in trees; 1986 - 6 pairs (ca. 50% of the marshes filled in and 20% of the alfalfa replaced with cereals); 1987 - 7 pairs; 1988 - ?; 1989 - 5 pairs (chlororganic compounds used against the Common Vole); 1990 - 3 pairs (similar measures, 4 young birds found poisoned); 1991 - 5 pairs (a cold spring with heavy rains; one nest abandoned). It is obvious that the main reason for this decrease was the adverse human impact.

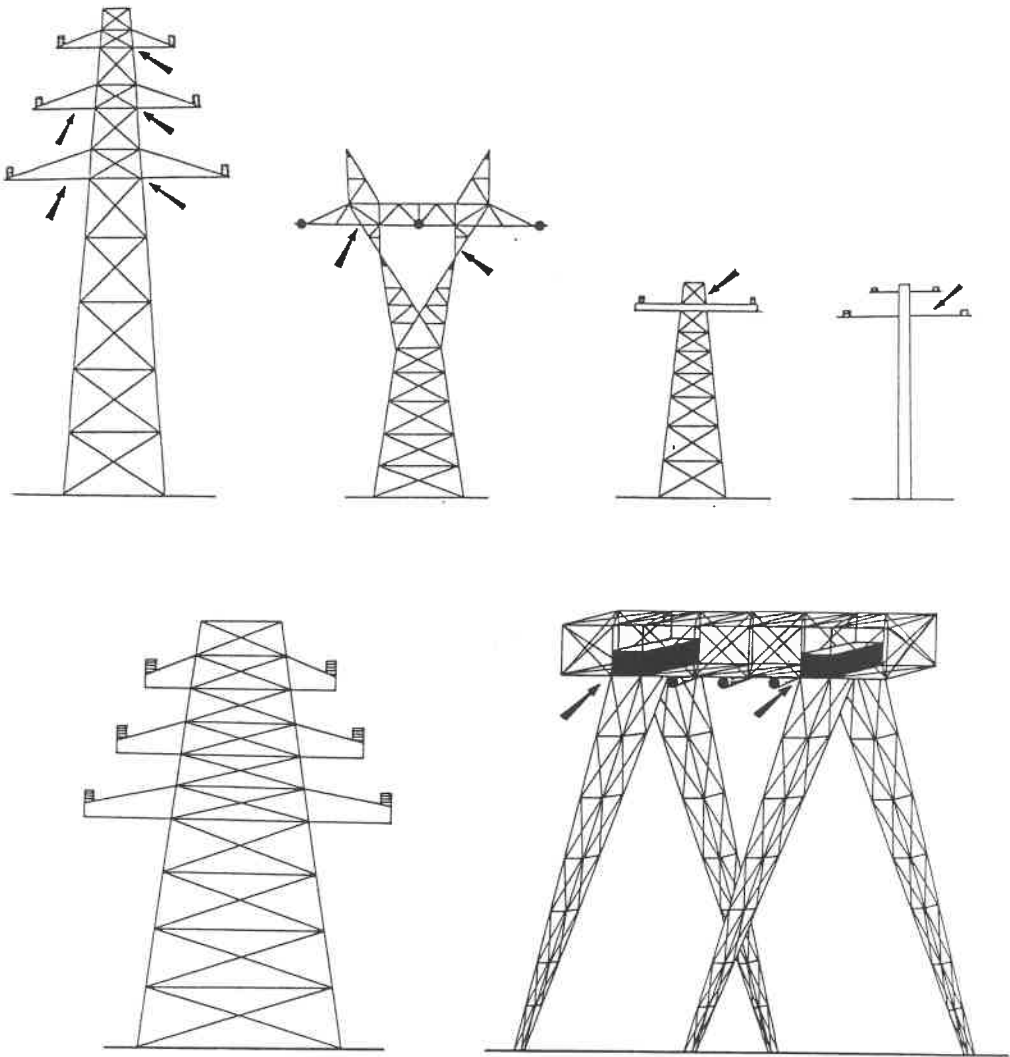
Negative factors of prime importance are:

1. Changes in agriculture, in particular from alfalfa to maize and cereals, resulting in deterioration of the food base and hunting conditions. Maize is a particularly unfavourable environment for fledglings; when attempting to alight on a stem they fall to the ground and are unable to resume flight. In 1980 four young from three broods died in this way. The opposite effect was observed in alfalfa in 1984; even young birds unable to fly could make their way through this environment a distance of 150-200m to the base of their nest site, where they were fed by their parents.
2. The filling with garbage of a considerable part of the marshes in the area, about 50% being converted into a rubbish dump, leading to a great increase in the population of Magpie, Hooded Crow and Rook and also to unfavourable environmental conditions for the Kestrel.
3. Destruction of nests by electricians when painting the pylons.
4. Treatment of cultivated land with chlororganic compounds against the Common Vole in 1991. As a result of this campaign, thousands of birds were poisoned. Many dead Rooks were found near Sofia, but only a few Kestrels.

The study area is characterised by wide open areas with a rich food base but few suitable nest sites. The only such sites available are the electricity pylons and shelter belts of trees, situated several km apart. The great density of the Magpie population -- 2.43 pairs per km² (calculated in May 1991 along a 60km route)-- tends to pre-empt all suitable nest sites. Pylons are used for nesting by the Magpie only if other possible sites are absent. In the mountains and foothills there are no Magpie nests on pylons.

Building their nests on pylons, the Magpies create nest sites for the Kestrel but deplete the rich

Figure 1. Different types of electricity pylons around Sofia. The nest sites are marked by arrows.



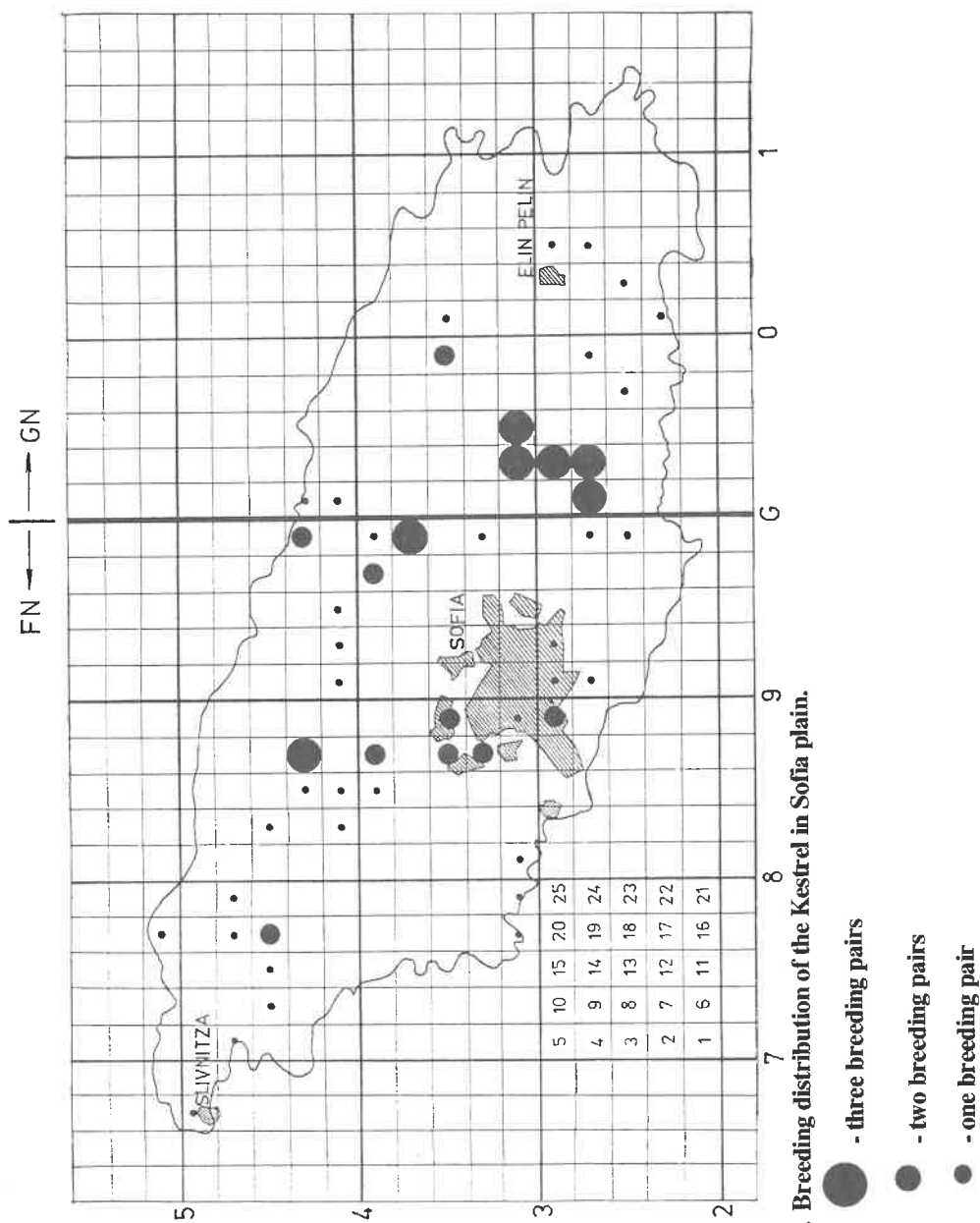


Figure 2. Breeding distribution of the Kestrel in Sofia plain.

food base of the agricultural landscape. Pylons about 20m high are mostly preferred by the Kestrel (Fig. 1). Interestingly, during 1973 the nests in the same region were mainly in trees (Nankinov 1981). On the Sofia Plain the following sites were occupied and nests distributed as follows: Holes in rocks - 2; Cliffs of scree - 1; Abandoned quarries - 2; Buildings - 8; Trees - 27 (poplars, 16; willows, 7, false acacias, 4); Metal constructions - 6; Tree hollows - 1; Bridges - 2; Electricity pylons - 23.

Pylon nests have the following advantages over trees: 1. they provide the highest sites in the region; 2. they are more durable, lasting for 5-7 years, whereas those in trees last only 1-4 years; 3. they provide security from natural enemies and humans; during the study period two people were electrocuted in attempts to reach a Kestrel's nest, an Eagle Owl was killed in similar circumstances, and a Goshawk died from collision with a cable whilst attacking young Kestrels.

The breeding cycle starts at the end of February, the earliest courtship flights being recorded on 28 February 1983. Most copulations occur during March and early April. Out of a total of 27 clutches, 2 with 2 eggs, 2 x 3, 12 x 4, 8 x 5, 2 x 6 and 1 x 7 were recorded. In some clutches one or rarely two unhatched eggs were found. According to Styanov (in press) the number of young averages 3-5. On 20 June 1980 a nest with 7 fledglings was found.

The following losses were recorded: 1. a female killed in a swooping attack on a Goshawk; 2. three young killed by a cat; 3. four juveniles poisoned by chlororganic substances in 1990; 4. four fledglings died after falling into maize; 5. two juveniles died from collision with cables (Sileva & Stoyanov, in press); 6. a young bird became entangled in a polyethylene cord in a Hooded Crow's nest (Todorov, pers. comm.): such cords are used for baling straw and taken by the Hooded Crow as nest material; 7. two adult birds caught after entering a building; 8. two adults and one young caught in clapnets for songbirds; 9. seven young taken by children and falconers; 10. two juveniles killed in collision with cars; 11. three adults and one juvenile died from unknown causes.

Interspecific competition affects the Kestrel population only indirectly. On the Sofia Plain nine species of owls have been recorded (Nankinov 1982; Yancov 1983). The Kestrel is known to be a prey of the Eagle Owl, Tawny Owl, Barn Owl and Little Owl (Mikkola 1983). The most dangerous natural enemy is the Eagle Owl, but this species is very rare in the region; in studies of its diet in other parts of the country the Kestrel was represented by only one individual (Boev, in press).

The following cases of interspecific rivalry were recorded: 1. on 10 May 1988 a pair of Kestrels chased away an incubating (?) Long-eared Owl and took over its nest (Stoyanov, in press); 2. on 15 July 1991 a Kestrel lost its prey as a result of a kleptoparasitic attack by a Hobby (Todorov, pers. comm.); 3. on 20 July 1980 three pairs with neighbouring nests simultaneously attacked a Goshawk, one female being wounded and subsequently dying; 4. three young were killed by a cat; 5. in four cases Kestrels chased away Magpies and occupied their nests.

Mobbing of Kestrels was observed by 31 species of birds, the most active being *Parus major* (18 cases), *Pica pica* (16 cases), *Corvus corone* (13 cases), *Passer domesticus* (8 cases) and *Vanellus vanellus* (7 cases). Attacks by the Hooded Crow are the most dangerous.

A marked sensitivity to sudden human activity in the Zemen gorge was noted. When building operations started in the gorge of the river Shagava, the number of nesting pairs diminished from 11 to three during the spring of 1990. The only unusual factor was the great noise. In 1991, after completion of the building works, the number of breeding pairs increased.

Apart from the principal ones cited above, two other types of negative factor influence the species. Such secondary negative factors are those which do not provoke permanent changes in the population but only fluctuations, e.g. unfavourable climatic conditions and almost all kinds of human impact which affect a few birds only. Factors of the third type, such as interspecific rivalry, are not a direct result of human activity. The Kestrel has adapted to such factors during the long process of evolution. The numerous Magpie population provides suitable nest sites but on the other hand has a negative influence on the Kestrel's food base.

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REFERENCES

- BAUMGART, W. 1971.** Beitrag zur Kenntnis der Greifvögel Bulgariens. *Beitr. Vogelk.* 17.
- BOEV, Z.** (in press). Species composition and metric characteristics of the bird victims of the Eagle Owl. *Hist. Nat. Bulgarica*, Sofia, BAN.
- DONCHEV, S. & P. YANCOV 1989.** Stages in synantropisation and urbanisation of Bulgarian birds. *Ecology* 22, Sofia, BAN. (in Bulgarian)
- MIKKOLA, H. 1983.** *The Owls of Europe*. Calton, T. & A. Poyser.
- NANKINOV, D. 1981.** Some observations on Bulgarian birds of prey. *Bull, Bird Banding* N9. Inst. Bulg. Ring. Centre, Sofia, BAN (in Bulgarian).
- NANKINOV, D. 1982.** The birds of Sofia. *Bull, Bird Banding* N12. Inst. Bulg. Ring. Centre, Sofia, BAN.
- SILEVA, R. & G. STOYANOV** (in press). Raptors and owls brought to Sofia Zoological Gardens, 1950-1989. *Bull, Bird Banding*. Inst. Bulg. Ring. Centre, Sofia, BAN.
- SIMEONOV, S. 1986.** The birds of Pirin Mountain. In *Fauna of SW Bulgaria*, Vol. 1. Sofia, BAN. (in Bulgarian).
- STOYANOV, G.** (in press). Observations on some Falcons during 1980-1990. *Bull, Bird Banding*. Inst. Bulg. Ring. Centre, Sofia, BAN
- YANCOV, P. 1983** The Birds of Sofia. D. Phil. Thesis, Sofia, BAN.

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