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DYNAMICS OF THE DEPARTURE OF MAGPIES *Pica pica* AT A COMMUNAL ROOST-SITE IN SOFIA (W BULGARIA)

Dinamika odletov srak *Pica pica* na skupinskem prenočišču v Sofiji (Z Bolgarija)

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A communal roost of Magpie *Pica pica,* in a park in the southern part of Sofia (W Bulgaria), was studied between the end of September 2007 and the middle of April 2008. The roost-site of the Magpies was in a thicket of deciduous and coniferous trees, up to 6 m high, in a natural dip in the relief, well protected from the wind and from human interference. The number of birds in the roost reached its maximum in February, with a peak of 724 birds on 21 Feb 2008. Their departure from the park with the roost site, started at an average 31.24 ± 8.3 min before sunrise, continued for 23.4 ± 4.4 min, and ended at an average 7.8 ± 6.4 min before sunrise. The beginning of the departure period was significantly earlier ($U = 4$, $p < 0.05$) and the duration of the period significantly longer ($U = 20.5$, $p < 0.05$) after the start of breeding attempts at the beginning of February. The average evenness index of departure (after Levins) was 8.16 ± 4.4 and its values were significantly higher after the start of breeding attempts, corresponding to more even departure from the park ($U = 13$, $p < 0.05$). The between-days dynamics of the departure showed that most birds flew off in the second third of the daily departure period, but significantly more Magpies took off in the last third of the departure period after the start of breeding attempts. The opposite is true for the period before the breeding attempts.

Key words: Magpie, *Pica pica,* communal roost, departure dynamics
Klju~ne besede: sraka, *Pica pica,* skupinsko preno~i{~e, dinamika odletanja

1. Introduction

The Magpie *Pica pica* is a territorial bird all the year round but roosts communally during the winter (GLUTZ VON BLOTZHEIM & BAUER 1993, CRAMP & PERRINS 1994). Roost-site selection and the influence of factors like weather conditions and human disturbance on the dynamics of the communal roosts have been widely studied (M0LLER 1985, REEBS 1986 & 1987, PONZ MIRANDA & MONROS GONZALEZ 2000, CZECHOWSKI *et al.* 2005). The main advantage of the Magpie's communal roost could be energy conservation in winter (MUGAAS & KING 1981). The function of the communal roost as a place where Magpies may monitor the quality of their neighbours, including their mating status, was discussed by M0LLER (1985).

The population of Magpies in the city of Sofia has increased significantly over the last two decades (NANKINOV *et al.* 2005). In the period 1998-1999 they numbered 690 breeding pairs (KAMBUROVA 2004) and there were seven communal roosts observed, with a maximum number of 1932 Magpies in one roost (KAMBUROVA 1999, cited in GEORGIEV & ILIEV 2009). NANKINOV *et al.* (2005) reported communal roosts with 20 and up to 220 birds in three parks of the capital city. GEORGIEV & ILIEV (2009) studied the numbers of a communal roost all the year round, and observed a maximum of 1405 birds in winter, with later arrivals in spring than in other seasons.

In this study I report the departure dynamics of Magpies in the latter communal roost in Sofia.

2. Study area and methods

2.1. Study area

Sofia is the capital city with over 1.5 million inhabitants and an area of 492 km^2. The present study relates to a roost-site in the park of the University of Forestry, with an area of 4.46 ha (N42°39', E23°21'). The park is situated in a small river valley with southwest-northeastern orientation. The river now crosses the park via underground pipework. All distances and areas are measured using the Garmin eTrex Legend Global Positioning System and the program MapSource, Version 6.11.6 (Garmin Ltd.). The altitudinal difference between the lowermost north-eastern and highest south-western (603 m a.s.l.) parts of the valley is 12 m. The park consists mainly of exotic deciduous and coniferous trees and shrubs. Most of it was neglected in recent years and is quite inaccessible and undisturbed. It is enclosed by streets on three sides, which separate it from the residential areas and university buildings, and in the north borders on the University of Forestry campus.

The roost-site was situated in the middle of the park, at the bottom of the valley, in a thicket of up to 6 m high *Tilia* sp., Cherry Plum *Prunus cerasifera,* Tree-of-Heaven *Ailanthus altissima, Acacia* sp., Silver Birch *Betula pendula,* mixed with Western Red-cedar *Thuja plicata,* Norway Spruce *Picea abies,* Serbian Spruce *Picea omorika,* Scots Pine *Pinus sylvestris* and Italian Cypress *Cupressus sempervirens.* An alley divides the site into two parts of 155 m^2 and 783 m^2. The Magpies spent the night mainly in the smaller part, where the vegetation below the roost was white from their excrement.

2.2. Bird counts

The birds were counted during their morning departure, from a vantage point in the highest situated southern street. It was established in the winter of 2006/2007 that the birds fly away mainly in south-easterly and south-westerly directions, towards the outskirts of the town. There are still residential areas of detached houses there, as well as open low-grazed pastures and abandoned arable lands.

Magpies usually gather in groups on the higher trees at the periphery of the park, from where they fly over the motorways and outlying buildings. Some low-flying birds may well have escaped unnoticed in the northward direction in the morning twilight, and not been recorded. All observations were made in the mornings with high visibility, without fog or rain. The records were made once every ten days in the period 30 Sep 2007 - 14 Apr 2008, with 21 records at intervals of 9.8 ±1.8 days. The air temperature in the mornings was measured at the observation point. The number of birds taking off from the park was registered at 2-minute intervals. The first Magpies flying out of park marked the start of counting period. The end of this period was determined by the end of departure and the return of birds in the park, the number of the latter being deducted. The total daily number of birds in the roost was determined as the sum of the number of Magpies that had remained on the tops of the trees in the park and the number of birds which departed.

The observations of Magpie behaviour were made from a vantage point. Details of breeding stages were collected in the park with the roost-site and around the University campus: earliest courting in the nesting territories on 28 Jan, the start of the nest building on 30 Jan, a nest with two eggs on 14 Mar, and the earliest fledglings on 4 May 2008.

The total number of other corvids Corvidae was determined during their morning departure from the park.

2.3. Data analysis

The evenness of departure from the park was determined by the Evenness Index (LEVINS 1968):

$$H = \sum p_i^2$$

where p_i is the proportion of Magpies taking off at an interval i of 2 minutes in the respective record. The Index explains the within-day dynamics. Lower values indicate greater differences in the number of departing birds at successive 2-minute intervals during their departure from the park, while higher values indicate a more even departure.

The period of daily departure was divided into three equal intervals, in order to study the between-days dynamics, by comparing the mean numbers of Magpies taking off in the respective thirds.

Statistical analyses were calculated by program Statistica for Windows, Version 5.0. The Spearman's rank correlation coefficient (r_s) and non-parametric Mann-Whitney U-test were used, two-tailed and statistically significant at $p < 0.05$. All means are arithmetic means ± standard deviations.

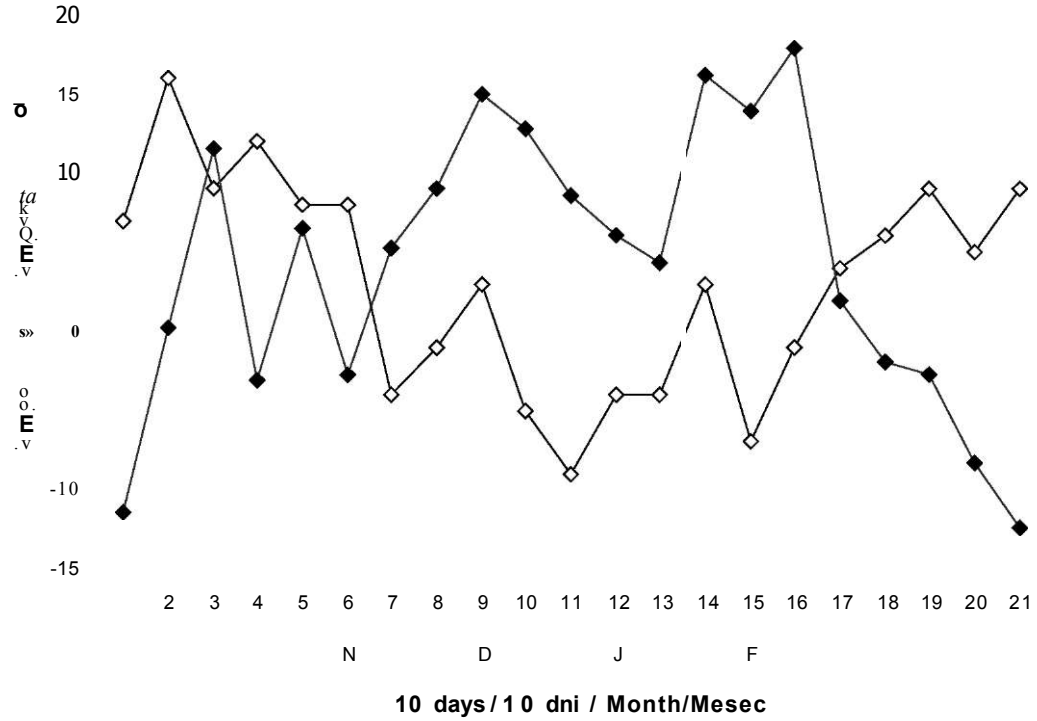

Figure 1: Magpie *Pica pica* numbers (black diamonds) at the roost-site and the air temperature (white diamonds) in the mornings in the period 30 Sep 2007 - 14 Apr 2008 (Sofia, W Bulgaria; the vertical line marks the start of the breeding attempts)

Slika 1: Število srak *Pica pica* (črni rombi) na prenočišču in temperature zraka (beli rombi) zjutraj v obdobju 30.9.2007 - 14.4.2008 (Sofija, Z Bolgarija; navpična črta označuje začetek poskusov gnezditve)

3. Results

3.1. Number of Magpies and other corvids in the roost-site

Altogether 82 birds gathered on 30 Sep 2007 and numbers fluctuated strongly in October and November (first 7 counts in Figure 1). The changes in daily numbers of roosting Magpies were smaller in December and January. The start of the breeding attempts in the last days of January, with a consequent increase in the number of roosting birds, peaking at 724 birds on 21 Feb 2008. Their number in the roost then gradually decreased with advancement of the breeding period. On the last day of observation, 14 Apr 2008, 58 birds were present. The correlation between the morning temperatures and the number of communal roosting birds before the start of the breeding attempts was not significant (r_s = -0.408, df = 11, p > 0.05). (Figure 1)

Around 35 Jackdaws *Corvus monedula* slept in the high trees in the Magpie's roost site between the last days of September and 10 Oct 2007. Around 60 birds returned to the roost-site on 21 Feb and the flock reached 180 birds on 14 Apr 2008. They returned their breeding places in the tile-roof of the University campus after flying off each day.

3.2. Dynamics of the departure and changes in behaviour of the Magpies

The earliest Magpies departed from the park in almost complete darkness 31.24 ± 8.3 min before sunrise. The departure from the roost continued for 23.4 ± 4.4 min and ended 7.8 ± 6.4 min before sunrise. The beginning was independent of the number of the roosting birds and the morning temperature (r_s = 0.127, r_s = 0.202, df = 21, p > 0.05), as was the duration of departure (r_s = 0.287, r_s = 0.429, df = 21, p > 0.05).

The beginning of the departure period of Magpies from the park was earlier, relative to the sunrise, after the day when breeding attempts started (before the start of breeding attempts 26.8 ± 6.7 min, and after the start 38.5 ± 4.7 min, U = 4, p < 0.05). Earlier flying off correlated significantly with longer overall time of departure from the park (r_s = 0.643, df = 21, p < 0.01).

Table 1: Daily departure dynamics of Magpies *Pica pica* from the park with the roost-site (Sofia, W Bulgaria); differences between the thirds of the departing period and relative to the start of breeding attempts are presented by comparison of the percentage of total number of Magpies

Tabela 1: Dnevna dinamika odletov srak *Pica pica* iz parka s prenočiščem (Sofija, Z Bolgarija); predstavljene so razlike v tretjinah obdobja odleta in glede na začetek poskusov gnezdenja, s primerjavo odstotkov od celotnega števila srak

Periods of the departure from park (thirds)/ Obdobja odhoda iz parka (tretjine)	Departing Magpies/ Odletajo~e srake (%)		U-test (percentage of total number of Magpies)/ U-test (odstotek od celotnega števila srak)
	Before / Pred 1 Feb 2008* (n=i3)	After / Po 1 Feb 2008* (n=8)	
First / Prva	31.95 ± 15.45	19.53 ± 6.39	U = 21, p < 0.05
Second / Druga	41.83 ± 9.31	42.11 ± 8.70	U = 51, p > 0.05
Last / Tretja	27.37 ± 9.28	38.36 ± 9.76	U = 22, p < 0.05

* start of breeding attempts

The duration of the departure period was significantly longer after the start of breeding attempts (before the start 21.6 ± 2.7 min, after the start 26.4 ± 5.2 min, U = 20.5, p < 0.05).

The evenness index of departure varied between 4.49 and 11.20 (8.16 ± 4.4). The values were significantly higher after the start of the breeding attempts (before the start 7.30 ± 1.62, after the start 9.56 ± 1.32, U = 13, p < 0.05). The greatest number of birds (153, 37.5%) departing in a 2-minute interval was recorded on 25 Jan 2008.

The greatest number of birds usually departed in the second third of the departure period (Table 1). Significantly more birds flew off in the first third of the departure period before the start of breeding attempts than in the period after its start. The opposite dependence applies to the last third of the departure period.

On average, 7.4 ± 3.1% of the roosting birds stayed in the crowns of the trees in the park. The only exception was on the last day of observation, when only the nesting Magpies remained. The proportion of birds that stayed at the roost did not correlate significantly with the total daily number of birds in the roost, the morning temperature or the beginning and duration of departure. The largest number of birds (388, 30.9%) stayed at the roost on 5 March 2008, prior to the start of egg-laying.

Before the start of breeding attempts, the Magpies departed silently from the park. The first change took place on 25 Jan 2008, when two groups of 13 and 8 birds returned to the park in the middle of the departure period. They landed silently on a tree, without courting signs and, after a short period of preening, joined a group of departing birds. The Magpies started communicating loudly during departure on 4 Feb 2008 while previously they were heard only at the roost-site. From that date onwards, the Magpies remaining in park courted and chased each other in the vegetation.

4. Discussion

Roosting in the dense vegetation at the low part of the valley is in accordance with the Magpies' roost-site preferences (M0LLER 1985, REEBS 1987, BOKOTEI 1997, CROSBIE *et al.* 2006), according to which the birds can reduce their metabolic needs in the milder microclimatic conditions of the roost (MUGAAS & KING 1981). The roost-site location meets the requirements for the protection from the wind (WALSBERG 1986, CZECHOWSKI *et al.* 2005). The park is close to open landscape at the end of town, which offers optimum locations for roost-sites, according to BOSCH & HAVELKA (1998).

The communal roost existed all year round (GEORGIEV & ILIEV 2009). The differences in the number of roosting Magpies between this study and that of GEORGIEV & ILIEV (2009) could be the result of different vantage points and counting methods. Fluctuation in numbers between days is probably due to differing preferences for the roost-site, depending on climatic conditions. PONZ MIRANDA & MONROS GONZALEZ (2000) reported abandonment of roosts in farmlands and increasing numbers of birds in urban roosts during cold days. One should also consider the fact that Magpies can fly up to 4 km so as to reach a roost (GLUTZ VON BLOTZHEIM & BAUER 1993).

Magpies usually roost only with conspecifics, but other corvids have been found in their communal roosts (GLUTZ VON BLOTZHEIM & BAUER 1993, CRAMP & PERRINS 1994, NANKINOV *et al.* 2005). The abandonment of the studied roost by Jackdaws in the cold period may be due to the difference between the two corvids in roost-site preferences for wintering.

MØLLER (1985) reported that the Magpies from the best territories depart first and those from the worst territories depart last. Regarding the roost-site studied in this work, with the advance of the breeding period, departure started earlier, though an ever increasing number of birds remained in the park around the roost-site, and did not appear to be in a hurry to depart. Consequently, significantly more birds flew off in the last third of the departure period after the start of breeding attempts than in the period before its start. GEORGIEV & ILIEV (2009) observed the same change in arrival dynamics of Magpies in the same park during the spring, when they flew later to the roost-site. The large number of non-breeders in the studied roost probably explains the significant differences in the characteristics of the departure before and after the start of the breeding attempts. The proportion of non-breeders could reach 26—56% of the population (GLUTZ VON BLOTZHEIM & BAUER 1993). The number of non-breeders in the area remains unknown but GEORGIEV & ILIEV (2009) reported 139 Magpies in the communal roost in July 2007.

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5. Povzetek

Med koncem septembra 2007 in sredino aprila 2008 je avtor članka v parku, ki leži v južnem delu Sofije (Z Bolgarija), preučeval srake *Pica pica* na njihovem skupinskem prenočišču. Srake so si prenočišče izbrale sredi sestoja listavcev in iglavcev, visokih do 6 m, v naravni depresiji, dobro zaščiteni pred vetrom in motnjami ljudi. Število ptic na prenočišču je doseglo višek pozimi, in sicer 724 osebkov 21.2.2008. Njihov povprečni odlet iz sestoja v parku s prenočiščem je trajal 23.4 ± 4.4 min, začel pa se je v povprečju 31.24 ± 8.3 min pred sončnim vzhodom in se končal v povprečju 7.8 ± 6.4 min pred sončnim zahodom. Začetek obdobja njihovega odletavanja je bil neprimerno zgodnejši ($U = 4$, $p < 0.05$) in trajanje obdobja občutno daljše ($U = 20.5$, $p < 0.05$) po začetku njihovih prvih gnezditvenih poskusov v začetku februarja. Izračunani povprečni indeks enakomernosti odleta je bil 8.16 ± 4.4, katerega vrednosti so bile občutno višje po začetku gnezditvenih poskusov in pomenijo bolj izenačene odlete iz parka ($U = 13$, $p < 0.05$). Meddnevna dinamika odletanja je pokazala, da je večina ptic odletela v drugi tretjini dnevnega obdobja odletanja, daleč največ srak pa je zapustilo park s prenočiščem v zadnji tretjini obdobja odletanja, po prvih poskusih gnezditve. Obratno velja za obdobje pred prvimi poskusi gnezditve.

6. References

BOKOTEI, A. (1997): Numbers and distribution of the Magpie *Pica pica* in Lvov Ukraine. — Acta Ornithologica 32: 5—7.

BOSCH, S. & HAVELKA, P. (1998): Telemetrische Untersuchungen zur Tagesaktivität der Elster (*Pica pica*) im Winter. - Die Vogelwarte 39: 171-175.

CRAMP, S. & PERRINS, C. (eds.) (1994): The Birds of the Western Palearctic. Vol. 8. - Oxford Univ. Press, Oxford.

CROSBIE, S., BELL, D. & BOLEN, G. (2006): Vegetative and thermal aspects of roost-site selection in urban Yellow-billed Magpies. - The Wilson Journal of Ornithology 118: 532-536.

CZECHOWSKI, P., JERZAK, L., ZDUNIAK, P. & BOCHENSKI, L. (2005): Is the communal roosting behaviour of the Magpie *(Picapica)* wind dependent? An example from an isolated population in W Poland. - Ardeola 52: 333-339.

GEORGIEV, K. & M. ILIEV, M. (2009): Numbers and arrival dynamics of communally roosting Magpies *(Pica pica)* in the dendrological park of the University of Forestry - Sofia, Bulgaria. - Biotechnol. & Biotechnol. Eq. 23: 250-253.

GLUTZ VON BLOTZHEIM, U. & BAUER, K. (eds.) (1993): Handbuch der Vögel Mitteleuropas. Bd. 13—III. - AULA-Verlag, Wiesbaden.

KAMBUROVA, N. (1999). [Distribution of the Magpie *(Pica pica* L.) in Sofia]. BSc Thesis, Sofia University. (In Bulgarian)

KAMBUROVA, N. (2004): Magpie *(Pica pica)* population density and habitat distribution in the city of Sofia. pp. 451-455 In: PENEV, L., NIEMELÄ, J., KOTZE, J.& CHIPEV, N. (eds.): Ecology of the City of Sofia. Species and communities in an urban environment. - Pensoft Publ., Sofia - Moscow.

LEVINS, R. (1968): Evolution in changing environments. - Princeton University Press, Princeton.

NANKINOV, D., NIKOLOV, B., DALAKCHIEVA, S. & DINKOV, H. (2005): Concentrations of corvids Corvidae in Sofia city (Bulgaria) during the winter 2004/2005. - Ciconia 14: 48-56.

M0LLER, A. (1985): Communal roosting in the Magpie *(Pica pica).* - Journal für Ornithologie 126: 405-419.

MUGAAS, J. & KING, J. (1981): Annual variation of daily energy expenditure by the Black-billed Magpie: a study of thermal and behavioral energetics. - Studies in Avian Biology 5: 1-78.

PONZ MIRANDA, A. & MONROS GONZALEZ, J. (2000): Dos factores que influyen en el stablecimiento de los dormideros comunales en la urraca *(Pica pica):* las actividades humanas y las temperaturas mi'nimas. - Ardeola 47: 85-87.

REEBS, S. (1986): Influence of temperature and other factors on the daily roosting times of Black-billed Magpies. - Canadian Journal of Zoology 64: 1614-1619.

REEBS, S. (1987): Roost characteristics and roosting behaviour of Black-billed Magpies, *Pica pica,* in Edmonton, Alberta. - Canadian Field-Naturalist 101: 519-525.

WALSBERG, G. (1986): Thermal consequences of roost-site selection: the relative importance of three modes of heat conservation. - Auk 103: 1-7.

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