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**SEASONAL CHANGES IN GROUP SIZE
AND FORAGING ACTIVITY
IN AN URBAN POPULATION OF MAGPIES (*PICA PICA*)**

ABSTRACT

We studied seasonal variation in group size and feeding activity in an urban population of Magpies in Zielona Góra, Western Poland. Each month from 1984 to 1987 we counted the species along a 10 km transect across the city and noted the number of single birds, pairs and flocks as well as flock size. In 1999 and 2000 we regularly observed Magpies foraging on the lawns of a park of Zielona Góra and recorded the number of pecks, as a measure for feeding activity. Magpies were most often encountered as single birds in April and May, as pairs in March, and in flocks in August. This pattern is predominantly dictated by the constraints of the breeding season and by reproductive success. The mean flock size was highest in August. Pecking rate showed a minimum in the summer months, with no sex-specific difference. However, males were much more active in foraging during winter, probably due to their larger body size and the respective higher energetic requirements.

Key words: Magpie, urban population, group size, foraging activity.

INTRODUCTION

The Magpie *Pica pica* is as a corvid species with a rather variable social organization, ranging from territorial pairs, family groups, and flocks of non-breeding individuals to large winter roosts (Birkhead 1991, Glutz von Blotzheim 1993, Kooiker & Buckow 1999, Vines 1981). One of the main factors determining the number of individuals in an area is the abundance, distribution and availability of food (e.g. Newton 1980, Schoener 1971). Food can also have a pronounced effect on group size, and flocking is often seen as an indication of clumped food resources. Furthermore, males and females often have different foraging strategies, especially during the breeding season when offspring must be reared.

During the last decades, Magpies have increased strongly in many cities of their European breeding range (Jerzak 2001b, Kooiker & Buckow 1999), probably as a result of favourable conditions such as low predatory pressure and abundant natural and

anthropogenic food. The species is now considered as well adapted to urban environments (Jerzak 2001a), and urban populations can be distinguished on a variety of factors from rural ones (Birkhead et al. 1986, Krystofkova et al. 2011).

Since 1970 we have been conducting a long-term study on several aspects of the population biology of the species in the city of Zielona Góra, western Poland (Jerzak 2001a, b). Here Magpies have reached one of the highest abundances ever recorded for cities, with up to 30 pairs/km² (Bocheński et al. 2011, Jerzak 2001a). In the present paper we report the results of a study of seasonal changes in group size and foraging activity, an aspect which has rarely been studied in dense populations in the urban environment.

MATERIAL AND METHODS

Study area

Data on group size and foraging were collected in Zielona Góra, the capital of the Lubuskie province in western Poland (51° 56' N, 15° 30' E). The city is inhabited by about 118.000 inhabitants and has a size of 58.3 km², of which about 23 km² is built-up area. It is mainly surrounded by forest.

Behavioural observations

On one Sunday each month from 1984 to 1987, we searched for Magpies along a 10 km transect across the town (about 4 km in city and 6 km in suburb). Whenever the species was detected, we noted whether it occurred as a single individual, a pair, or in a flock, i.e. three or more individuals. In flocks, the total number of individuals was counted.

In 1999 and 2000, we studied the foraging rate in one of the city parks with lawns each month. Foraging was quantified by noting the pecks per minute, separately for males and females. Males and females can be identified by behaviour (Birkhead 1991). The total observation time amounted to 8 hrs and 38 min.

RESULTS

Occurrence of groups

The probability of detecting single birds, pairs or flocks, respectively, clearly changed in the course of the year. Flocks were most often seen in August, but the likelihood decreased throughout fall and reached a second peak in January (Table 1, Fig. 1). Only occasionally were flocks encountered from March to May. In March Magpies occurred mainly in pairs. Single birds were common in April and May, which is the period of nest-building and egg-laying in Zielona Góra (Jerzak 2001a).

Table 1. Percentage of encounters with Magpies as single birds, in pairs or in flocks in Zielona Góra (in brackets = the absolute number of encounters)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Single bird	19.4	19.4	26.4	54.1	45.5	26.7	21.9	25.2	25.9	28.1	28.3	25.8
Pair	38.0	45.8	53.7	36.4	32.7	36.0	38.4	19.4	32.3	43.2	42.6	39.9
Flock	42.6	34.8	19.9	9.5	21.8	37.3	39.7	55.4	41.8	28.7	29.1	34.9
Total	100.0 (131)	100.0 (96)	100.0 (121)	100.0 (26)	100.0 (28)	100.0 (108)	100.0 (75)	100.0 (66)	100.0 (152)	100.0 (59)	100.0 (122)	100.0 (168)

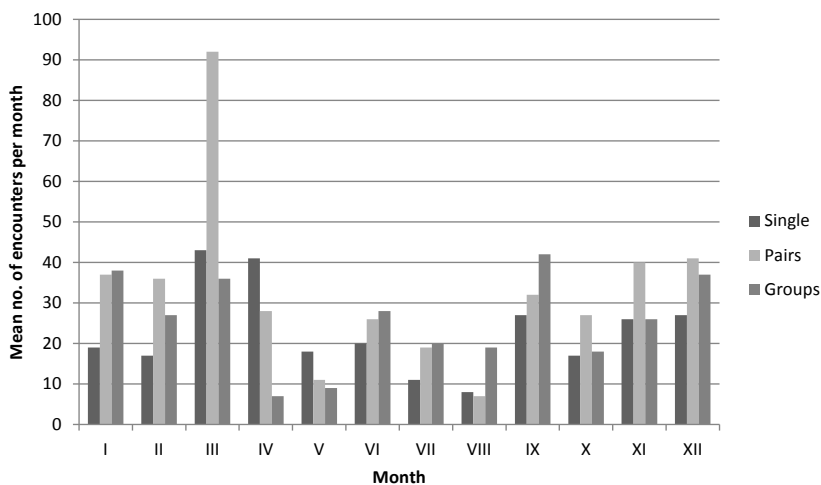


Fig. 1. Number of single birds, pairs and groups of Magpies encountered each month in Zielona Góra

Flock size

In the course of the study we detected 198 magpie flocks, with a total of 944 individuals. The average number of birds per flock was 4.8 (SD = 2.8). Flock size was highest in August (followed by May) and especially low in June and July (Table 2).

Table 2. Total number of Magpie groups and individuals as well as average number of birds per group encountered during each month in Zielona Góra

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Groups	19	17	20	4	4	23	15	9	28	10	22	27	198
Individuals	112	79	101	22	24	85	60	57	124	49	100	141	944
Individuals per group	5.9	4.7	5.1	5.5	6.0	3.7	4.0	6.3	4.4	4.9	4.5	5.2	4.8

Most flocks consisted of three or four birds (Fig. 2), and larger groups could usually be seen during the winter months. Groups in May consisted mostly of pairs with their fledged young.

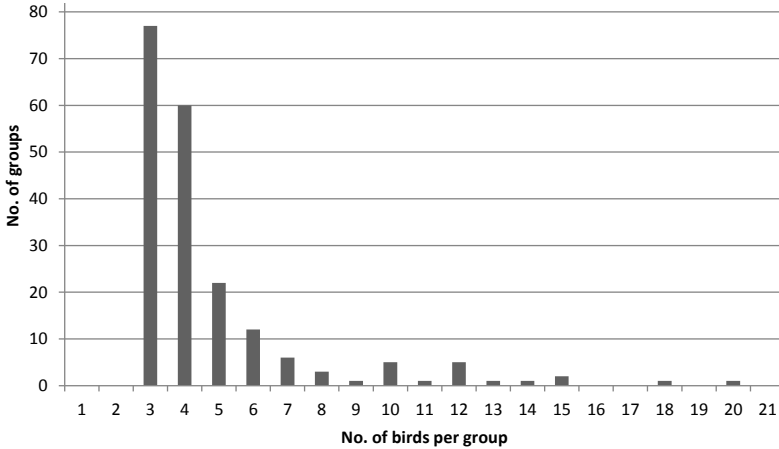


Fig. 2. Frequency of different sizes of Magpie flocks (n = 198) encountered in Zielona Góra

Foraging

There were pronounced seasonal changes in foraging activity (Fig. 3). As the breeding season progressed, the pecking rate declined to low levels of 5.1-7.5 pecks/min. from June to September. Maximum levels with up to 15 pecks/min. were reached in winter and early spring. The low pecking rate noted in February must be seen as an artefact, because heavy snow cover strongly impeded the observations.

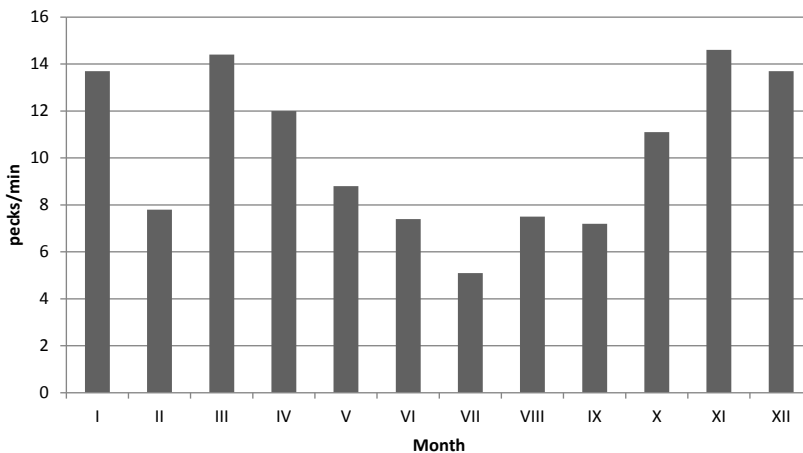


Fig. 3. Seasonal variation of foraging activity of Magpies in Zielona Góra

The foraging rate was higher for males from late fall (October) to early spring (March); Fig. 4, table 3. Foraging of females started to increase in January and reached

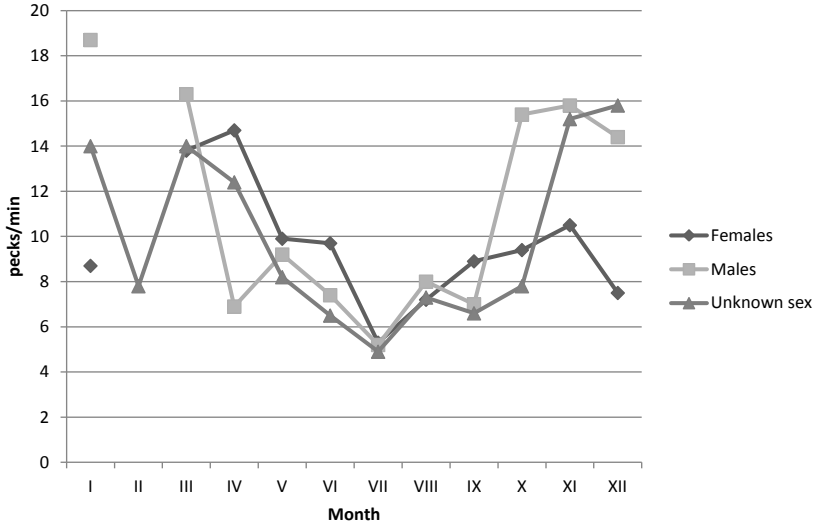


Fig. 4. Seasonal variation of foraging rates of Magpie males, females and birds of unknown sex in Zielona Góra

Table 3. Foraging rates of Magpies in Zielona Góra. S = sum of pecks/sum of sec. observation time, M = mean number of pecks/min., N = number of foraging bouts, Fe = female, Ma = male, Un. = unknown sex, T = Total for all birds. Missing data for males and females in February are due to heavy snow cover

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Fe	16/	-	145/	71/	344/	88/	77/	79/	101/	58/	42/	15/	1036/
S	110		630	290	2095	545	875	660	680	370	240	120	6615
M	8.7	-	13.8	14.7	9.9	9.7	5.3	7.2	8.9	9.4	10.5	7.5	9.4
N	2	-	9	4	21	5	12	11	9	4	4	2	83
Ma	24/	-	162/	44/	249/	93/	66/	80/	49/	100/	63/	42/	972/
S	77		595	385	1630	755	765	600	420	390	240	175	6032
M	18.7	-	16.3	6.9	9.2	7.4	5.2	8.0	7.0	15.4	15.8	14.4	9.7
N	2	-	6	6	17	7	11	10	6	4	4	3	76
Un	170/	24/	484/	544/	716/	149/	138/	102/	207/	41/	295/	79/	2949/
S	735	185	2068	2635	5214	1382	1680	840	1885	316	1165	300	18 405
M	14.0	7.8	14.0	12.4	8.2	6.5	4.9	7.3	6.6	7.8	15.2	15.8	9.6
N	12	4	28	31	51	20	20	14	25	7	17	7	236
T	210/	24/	791/	659/	1309/	330/	281/	261/	357/	199/	400/	136/	4957/
S	922	185	3293	3310	8939	2682	3320	2100	2985	1076	1645	595	31 052
M	13.7	7.8	14.4	12.0	8.8	7.4	5.1	7.5	7.2	11.1	14.6	13.7	9.6
N	16	4	43	41	89	32	43	35	40	15	25	12	395

a maximum in April with 14.7 pecks/min., a level much higher than that recorded for males at this time (6.9 pecks/min.). The pecking rate remained on lowest levels for both sexes throughout the summer months, with a minimum reached in July. Please note that missing dates for males and females in February are due to heavy snow cover which strongly impeded observations.

DISCUSSION

Magpie groups

The pronounced seasonal changes in the occurrence of flocks and in group size in the Magpie are to a large extent influenced by the constraints of the breeding season and the reproductive success. Pairs were most often encountered in March. This is the period when magpies prepare for breeding, i.e. both partners are engaged in nest building/repairing, and mate guarding during foraging is commonly observed (e.g. Glutz von Blotzheim 1993). However, single birds were more often seen than pairs in April and May, when the female usually incubates the clutch or stays inside the nest to keep the nestlings warm and, if necessary, defend the nest while the male does most of the food provisioning.

After leaving the nest, fledglings and parents stay close together for a certain period of time during foraging, accounting for the rather high group size observed in May. When young birds separate from their parents and feed on their own, the group size decreases, i.e. from May to June/July. It increases again in August when juveniles of neighbouring territories associate in juvenile groups which roam in their parents' home ranges.

Magpie flocks in Sheffield ranged from ten to 52 birds (Birkhead 1991). In that area the average number of individuals in groups of non-breeding birds varied in the course of the year and was highest (four to six individuals) from December to February (Birkhead et al. 1986). Flocks with three or more Magpies, often exceeding 100 birds, are common from September to April. In Danish farmland this period extends from November to February (Møller 1983).

Foraging behaviour

The results of our study clearly indicate that foraging rates are highest during winter and lowest in summer (see also Møller 1983). This general pattern can be explained by (1) a higher energy requirement during the cold period of the year and (2) a more constrained availability of food in winter when grounds are more likely to be frozen and, consequently, ground-dwelling invertebrates less active. Especially snow cover causes the pecking rate of Magpies to increase, as shown in a study by Møller (1983). It must be noted, however, that the general time spent feeding is highest during late spring and summer when food is abundant and pairs must take care for nestlings and

fledglings (Birkhead 1991, Glutz von Blotzheim 1993, Møller 1983). But longer daylight in summer, and hence a longer period suitable for foraging, also allows to slow down the foraging pace, i.e. pecking rate. Furthermore, due to more abundant and varied food in summer Magpies can forage more selectively at that time of the year (comp. Møller 1983).

Møller (1983) noted foraging rates of 13.1-14.1 pecks/min. for Magpies in Danish farmland, which are higher values than those observed in the present study in the urban environment of Zielona Góra (9.4-9.7 pecks/min.). Furthermore, Danish Magpies occupying territories of higher quality pecked at lower rates than those holding low quality territories (Møller 1982). The lower pecking rates in Zielona Góra, therefore, may indicate that territories in an urban environment are better in terms of food abundance and/or quality. An additional positive factor in cities is certainly anthropogenic food, often available to Magpies in garbage bins (Jerzak 2001a) or left on the ground. Also the milder urban climate compared to rural areas, with grounds less often frozen and fewer days with snow cover (Kuttler 1998), results in more favourable feeding conditions.

In a study by Tucker (1989) the number of earthworms, which are important food for Magpies in some areas, was found to be up to five times higher on grassland than on stubble fields or ploughed land. A similar pattern exists for other invertebrates (ibid.). This high abundance of invertebrates is probably an important factor which had favoured the colonization of the urban environment by magpies, as cities usually offer plenty of lawns.

Sex differences in foraging activity were most pronounced in winter, with males feeding at a higher rate than females. Males have a higher body mass (Birkhead 1991, Glutz von Blotzheim 1993) and, therefore, need more energy, which is especially important in winter with its limited food supply. In February and March, the period of nest building, there is an additional burden on males because they are usually more active than females in gathering nest material. In April, the difference in feeding activity changed pronouncedly in favour of females, which now need a high energy intake for the production of eggs. We found almost no sex differences from May to September, when days are long (see also Møller 1983) and insect food abundant.

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