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POPULATION DYNAMICS OF THE MAGPIE *PICA PICA* IN ZIELONA GÓRA

ABSTRACT

The study describes the development of the population of Magpies *Pica pica* in the city of Zielona Góra, western Poland, based on earlier reports and a recent count in 2016. In the first half of the 20th century, there were only 5–7 pairs, corresponding to a density of 1.4 pairs/km^2. At that time 2–3 pairs nested in the city center. In 2006 and 2007 a further study revealed very high values of 26.9 and 27.6 pairs/km^2, respectively, followed by a subsequent decrease to 6.6 pairs per km^2 in 2012. However, the population seems to have stabilized at that level, as shown by the results of the most recent count in 2016 (6.4 pair/km^2).

Key words: Magpie, *Pica pica*, synurbization, urbanized, population dynamics, urban habitat preferences, nesting trees, Zielona Góra,

INTRODUCTION

Rapid urban development has been observed for the past 200 years., resulting in drastic changes in the environment. Many species of animals have had to adapt to these changes. One of the species that perfectly adapts to the urban ecological niche is the Magpie *Pica pica*. The species benefits from a lack of competition, high availability of food, shelter and breeding sites within urban areas. As a consequence, populations began to increase, with a larger number of individuals found in urban than in uninhabited rural areas.

This phenomen is known as "synurbization" and the respective species are referred to as urbanized (Bocheński 2001). The Magpie is a numerous species in Poland. It occurs throughout the country, avoiding only larger forest areas. The highest numbers are found in the western parts and Lesser Poland, and the species is least numerous in the North and North-east (Jerzak *et al.* 2005). Local populations are highest in urban areas followed by those inhabiting agricultural land.

MATERIAL AND METHODS

The study was conducted in the Zielona Góra (278,3 km^2) in the Lubuskie province, western Poland. The city is surrounded by forests, which form a suburban zone. 47,0% of the total area of the city is covered by forests, while 3,5% of green areas are parks (2010 data). The best known green areas of the city are the parks of Tysiąclecia, Sowiński, Winny and Piastowski.

For the study, the city area was divided into several urban habitat types according to Tomiałojć (1970) and Strawiński (1971) as follows:

- Downtown – city center and old town (high traffic, compact building, low percentage of high greenery),
- Housing estates – includes new and old type of buildings, compact lines of buildings, courtyards, squares, lawns, tree clumps, less traffic,
- One family housing estates – loosely arranged buildings, mostly low and surrounded by gardens, smaller parks, low traffic, located in the outskirts,
- Green areas – complexes of gardens, agricultural land, wasteland, characterized by highly varied greenery, limited human influence on landscape structure, very low traffic,
- Industrial areas – high levels of human transformation, degraded land covered with concrete, single green or clump of trees and fragments of ruderal vegetation,
- Urban and central parks – located inside urban built-up areas or on the outskirts of the city.

In order to estimate the breeding density of the Magpie in Zielona Góra, all nests of the species were counted in selected representative areas of the city (23 km^2), see Fig. 1 in April 2016. In addition, the species of trees with Magpie nests were noted.

RESULTS

148 occupied Magpie nests were found on all the study sites combined, which corresponds to a density of 6.4 pairs/km^2.

15 different species of trees were used for nest building by Magpies. The most common were: Lime (*Tilia sp.*) 22.3%, Populus (*Populus sp.*) 18.9%, Birch (*Betula sp.*) 17.5%, Oak (*Quercus sp.*) 9.4%, Maple (*Acer sp.*) 7.4% and Acacia Robinia (*Robinia pseudoacacia*) 6.7%. All other trees, i.e. Spruce (*Picea sp.*), Willow (*Salix sp.*), Asparagus (*Fraxinus sp.*), Pine (*Pinus sp.*), Larch (*Larix sp.*), Hornbeam (*Carpinus sp.*), Chestnut (*Aesculus sp.*) and fruit trees, were used in only less than 4.5% of cases.

Fig. 2 shows the number of nests occupied by the Magpie on all study sites investigated, and Fig. 3 the proportion of nests found in the respective habitat type.

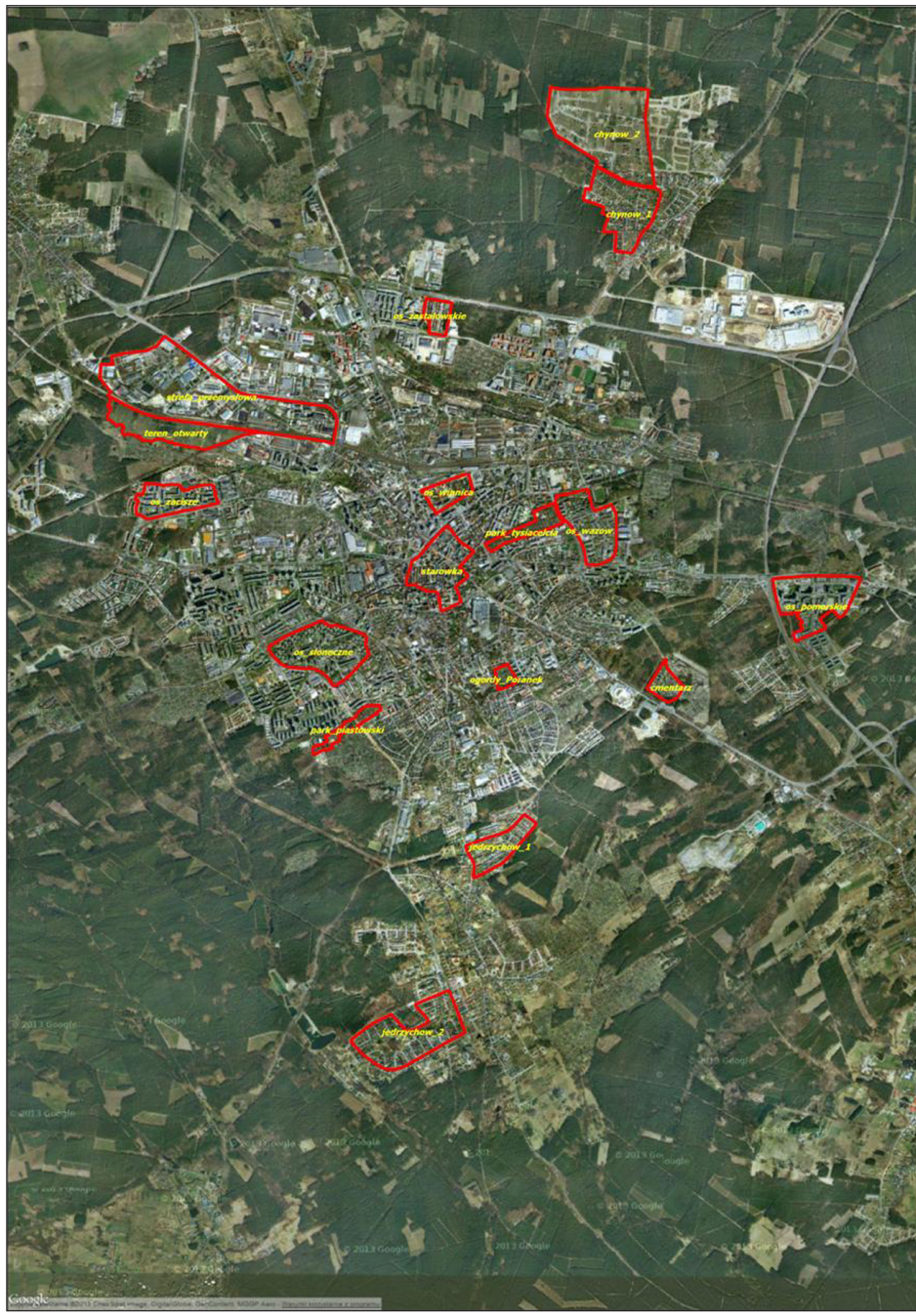

Fig. 1. Location of the study areas in Zielona Góra

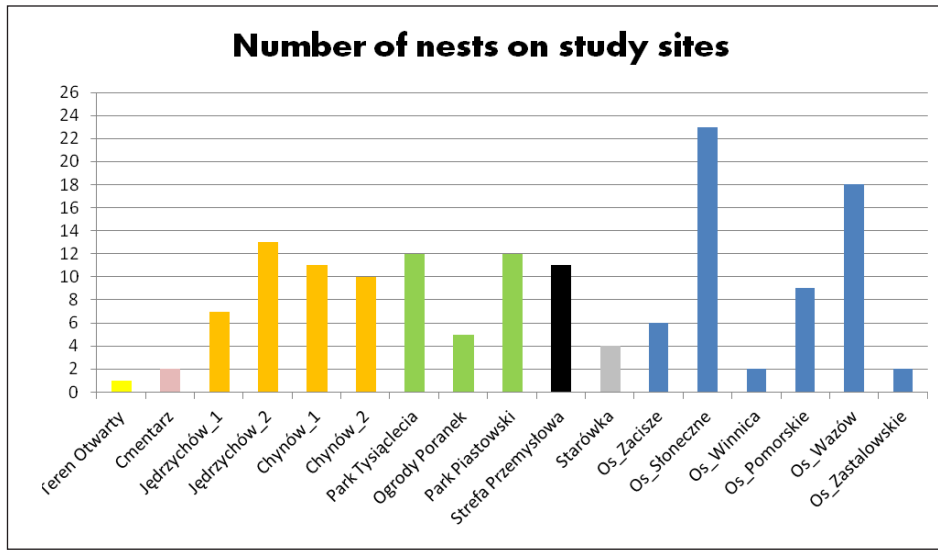

Fig. 2. Number of occupied Magpie nests found on the different study sites in Zielona Góra in 2016. Column colours indicate habitat types: light yellow – green areas, pink – cemetery, dark yellow – one family housing estates, green – central urban parks, black – industrial area, grey – old town /city centre, blue – housing estates

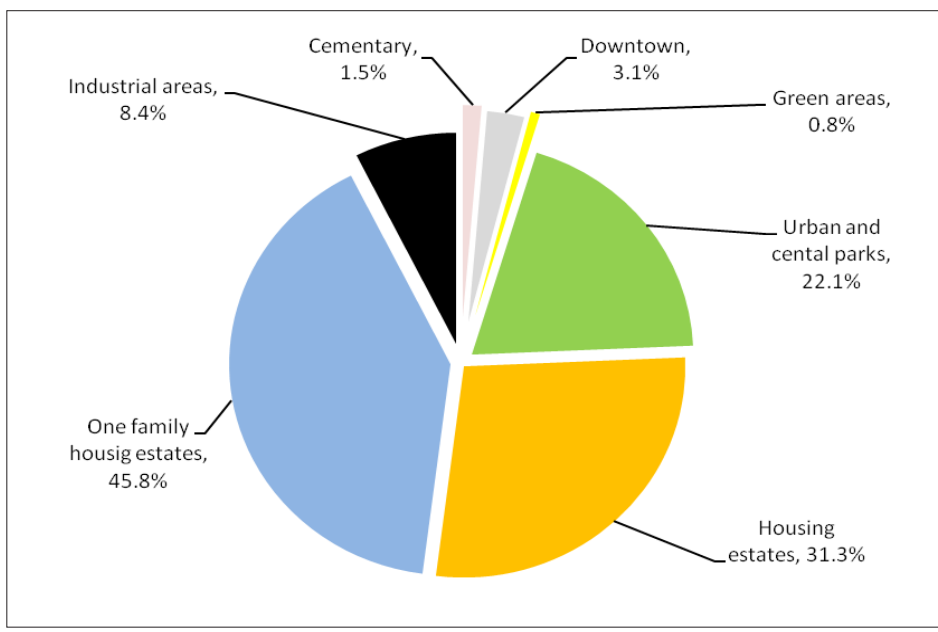

Fig. 3. Proportion of occupied Magpie nests found in different urban habitat types in Zielona Góra in 2016

DISCUSSION

In the first half of the 20th century, the population of Magpies in Zielona Góra consisted of only 5–7 pairs, of which 2–3 nested in the city center (Gruhl 1929). This low number corresponded to a density of about 1.4 pairs/km^2. However, in 1971, the density already had reached a value of about 7 pairs/km^2 (Bocheński 2001). Fig. 4 shows that the population was still continuously growing between 1982 and 2007 (Jerzak 2002, Bocheński 2001, Jerzak *et al.* 2008). However, a count conducted in 2012 revealed a sharp decline in the urban area of Zielona Góra within just a few years, resulting in only 6.6 pairs/km^2 (Kubów 2012). This value is very close to the 6.4. pairs/km^2 found 2016 (present study), indicating that the population has probably stabilized on that level.

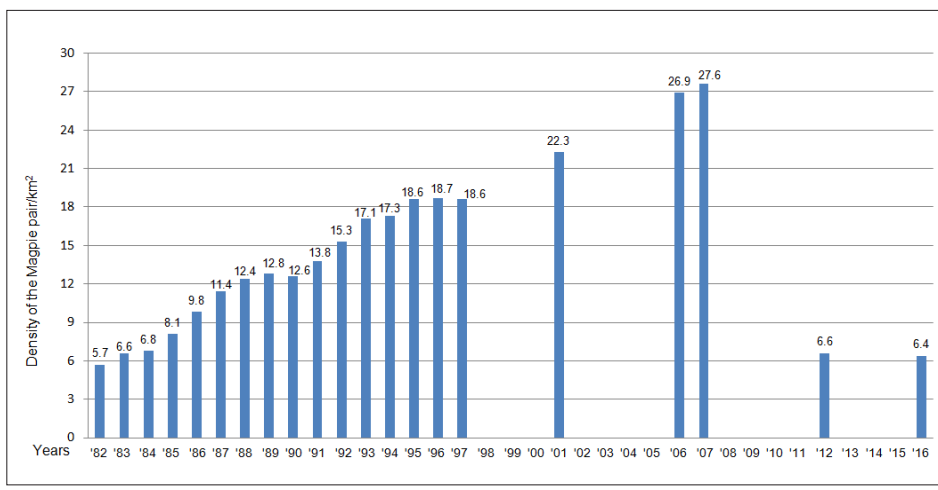

Fig. 4. Population dynamics of the Magpie in Zielona Góra between 1982 and 2016. Data for 1982–1997 from Jerzak (2002), for 2001 from Bocheński (2001), for 2006–2007 from Jerzak *et al.* (2008), and for 2012 from Kubów (2012). 2016: results of the present study.

Magpie densities in other cities vary enormously, from less than 1 to more than 30 pairs/km^2 (see appendix). Numbers are influenced by the presence of the Hooded crow *Corvus cornix* and in urban centers – is correlated with the density of peopzle (Lerzak *et al.* 2008). In the central urban areas of the Finnish cities of Rovaniemi and Turku, the density was about 13 and 5 pairs/km^2, respectively (Jokimaki *et al.* 2017). However, these densities are much lower than those observed in Central European towns (17–57 pairs/km^2). It would appear that the Magpie density has reached its upper-limit at least in the urban core areas of Rovaniemi, where the population has been relatively stable for a long time, whereas the suburban population still seems to be increasing (Jokimaki *et al.* 2017).

The population decline in Zielona Góra may have been due to niche saturation in the urbanized part of the city. Interspecific competition for nesting sites, food and

shelter was observed. The Magpie finds food, e.g., at is rubbish sites, which are increasingly protected now and, therefore inaccessible to the birds. The number breeding Hooded crows (Bocheński 2001) and Eurasian jays *Garrulus glandarius* is also increasing in cities. Both Hooded crows and domestic cats (*Felis domesticus*) prey on Magpies and may reduce the population (Jerzak 2008). Magpies are territorial. In the non-urban environment, the shortest distance between adjacent nests is 100 m, sometimes exceeding 200 m (Birkhead 1991, Jerzak 2001). In 2001 in Zielona Góra, it was found that nests were often only 50–80 m apart.

The proportion of each tree specie selected for nest building by the Magpie during several studies in Zielona Góra was similar (Tab. 1). Differences may be affected by tree felling, tree occupation by another species, or relocation of a Magpie breeding pair to another more convenient site.

Table 1. Percentage of tree species used for nesting by the Magpie in Zielona Góra

Tree species	Bocheński 2001	Jerzak *et al.* 2006	Jerzak *et al.* 2007	Kubów 2012	This study 2016
Populus sp.	38%	36,8%	37,2%	26,3%	18,9%
Betula sp.	13,4%	12,3%	12,2%	12,5%	17,6%
Quercus sp.	7,4%	7,3%	6,6%	9,8%	9,5%
R. pseudoacacia	6,0%	4,5%	5,2%	6,6%	6,8%
Titla sp.	<5%	11%	10,4%	7,2%	22,3%
Acer sp.	<5%	6,5%	6,2%	24,3%	7,4%
Pinus sp.	<5%	1%	<1%	<5%	<4,5%
fruit tree	<5%	2,9%	3,2%	<5%	<4,5%
Fraxinus sp.	–	<1%	<1%	<5%	<4,5%
Picea sp.	–	1,5%	1,4%	<5%	<4,5%
Salix sp.	–	9,1%	10,9%	<5%	<4,5%
Larix sp.	–	<1%	<1%	<5%	<4,5%
Padus sp.	–	–	–	<5%	–
Carpinus sp.	–	–	–	<5%	<4,5%
Aesculus sp.	–	1,6	1,7%	<5%	<4,5%

Tab. 2 shows trees species commonly selected for nesting by the Magpie in other, mostly European, cities (Jerzak 1997). Most common species were *Populus sp.*, *Betula sp.*, *Tilia sp.*, *Acer sp.*, *Robinia sp.* And *Pinus sp.*.

Comparing countries, the Magpie is most likely to choose trees of the following species (Jerzak 1988):

– Aserbijan: *Juglans sp.*, *Morus sp.*,
– Kazakhstan: *Beiula sp.*, *Populus tremula*,
– East Germany: *Betula sp.*, *Salix sp.*, *Populus tremula*,
– Italy: *Populus sp.*, *Robinia pseudoacacia*, *Populus nigra italica*,

Table 2. Tree species used for nesting by the Magpie in Eurasian cities (Jerzak 1997)

Manchester (GB)	*Populus nigra*, *Crataegus monogyna*, *Phtanus hispanica*
Sheffield (GB)	*Platanus sp.*, *Acer sp.*, *Fagus sp.*
Cuxhaven (D)	*Ulmus sp.*, *Populus sp.*, *Betula sp.*
Oldenburg (D)	*Quercus sp.*, *Betula sp.*, *Pinus sp.*
Bonn (D)	*Populus sp.*, *Aesculus hiypocnstanum*, *Quercus sp.*
Oberhausen (D)	*Platanus acerifolia*, *Populus sp.*, *Robinia sp.*
Berlin E. (D)	*Populus sp.*, *Platanus aceńfolia*, *Aesculus hippocastanum*, *Tilia sp.*
Berlin W. (D)	*Populus nigra pyramidalis*, *Betula sp.*
Poznań (PL)	*Populus sp.*, *Acer sp.*, *Tilia sp.*, *Aesculus hippocastanum*
Cracow (PL)	*Populus sp.*
S. Slovakian towns (SVK)	*Populus sp.*, *Betula sp.*, *Prunus spinosa*, *Pirus sativa*
Saratov (RUS)	*Ulmus sp.*, *Populus sp.*, *Acer sp.*
Voronezh (RUS)	*Populus sp.*, *Ulmus sp.*, *Acer sp.*, *Fraxinussp.*
Bukhara (UZB)	*Robinia sp.*, *Fraxmus sp.*, *Salixsp.*, *Pinus sp.*
Seoul (KOR)	*Robinia pseudoacacia*, *Quercus acutissima*, *Populus euroamericana*

– Great Britain (Scotland): *Acer pseudoplatanus*, *Fagus silratica*, *Crataegus sp.. Prunus spinosa*,
– Great Britian (England): *Crataegus sp.*, *Ilex sp.*, *Sorbus sp.*, *Populus sp.*,
– Denmark: *Ulmus sp.*, *Populus sp.*, *Fraxinus sp.*, *Acer pseudoplatanus. Sorbus sp.*, *Salix sp.*, *Crataegus sp.*, *Betula sp.*, *Crataegus sp.*, *Prunus spinosa*,
– USA: *Populus* sp., *Salix* sp.. *Crataegus* sp.,

The result from the 2016 count in Zielona Góra show that the Magpie willingly chooses nesting sites near buildings, within housing estates 40.5%, one family houses estates 27.7%, and urban and central parks 19.6%. In a study 2006–2007 (Jerzak *et al.* 2008) nests were most often built in housing estates and parks and only reluctantly in one family houses estates.

Field studies show that most trees chosen by the Magpie for nesting grow near residential buildings (one family housing estates, housing estates – own data), which is connected with access to food. In 2016, the areas least often selected by the Magpie in Zielona Góra were a cemetery and an open area, also indicating that the species prefers human-dominated habitats. Furthermore, the Magpie is more likely to choose industrial zones than municipal cemeteries (own data).

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APPENDIX

Densities of urban Magpie populations recorded in Eurasian countries (after Jerzak 2002)

Country	Density of the Magpie pair/km^2 (over the year)	Country	Density of the Magpie pair/km^2 (over the year)
Germany	2.3 (Erfurt) 3.1–3.5 (Wilhelmshaven) 1.42–2.13 (Bad Segeberg) 1.5–2.5 (Bonn) 1 (Getynga) 0.3–3.9 (Hamburg) 1 (Emden) 0,1–0,73 (Rostock) 1 (Oldenburg) 1.5–1.7 (Leverkusen) 1.3 (Parchim) 1.5 (Wismar) 0.4–1.3 (Cuxhaven) 0.8–7.4 (Berlin) 1.5–2.7 (Ratingen) 1.1–11.7 (Bremen) 2–6.5 (Oberhausen) 1.6–1.7 (Reinbek) 1–9.7 (Osnabrueck) 10–29 (Köln) 0.5–1.05 (Ulm)	Russia	10.3 (Satatov) 11 (Engels) 5.2 (Khvalynsk) 11 (Balashov) 19 (Tatishchevo) 7 (Atkarsk) 5.7 (Marks) 6.5 (Krasny Kut) 9 (Novouzensk) 4 (Aleksandrov Gaj) 3.2–15.3 (Svierdlovsk) 5–10 (Komsomolsk/Amur) 15.7 (Khabarovsk)
Finland	5 (Turku) (Jokimaki *et al.* 2017) 14.0 (Turku) 13 (Rovaniemi) (Jokimaki *et al.* 2017)	Poland	8.7 (Szczecin) 3.3–25 (Poznań) 4,5–15,6 (Kraków) 3,2 (Gliwice) 11 (Białogard) 10 (Koszalin) 9.1 (Słupsk) 10.9 (Lębork) 6–57 (Warszawa) 3.5 (Olsztyn)
Ireland	16.6	Denmark	3.3–4.6
Ukraine	8 (Lvov)	Belgium	30–40 (Brussels)
South Korea	3.5 (Seoul)	Great Britain	1.5 (Edinburg) 16.4 (Manchester)
Holland	6.2–13.6		