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Urban and rural populations of the Magpie *Pica pica* in the Koszalin Region, NW Poland

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Abstract. A study in the years 1978–1982 and 1992 took place in 11 towns covering 263 km² and 6 areas of farmland covering 560 km². Magpies were found to inhabit all of the towns in the 1970s and 1980s, at population densities ranging from 0.05–3.1 pairs/km² (mean 1.5). Mean breeding densities were 3.6 and 0.9 pairs/km² in urban and suburban areas respectively. In the years to 1992 the breeding population in towns increased 88%, with 1992 densities varying between 0.3 and 4.5 pairs/km² (mean 2.8). The increase was much more marked in urban areas (129.5% to a mean of 8.2 pairs/km²) than in the suburbs (up 35% to 1.2 pairs/km² on average).

Rural populations were dominated by village-dwelling Magpies (respectively 60% and 76% of the breeding populations in 1979–82 and 1992). Nesting densities on farmland remained in the range 0.2–1.8 (mean 1.0) pairs/km² throughout the period, with increases being confined to villages (12.4 pairs/km² 1979–82, cf. 21.3 in 1992) and neighbouring farmland showing a 13% decrease. It is concluded that the ecological success (i.e. increased numbers) of Magpies is a consequence of progressing synanthropization and synurbization.

Key words: Magpie *Pica pica*, breeding density, urban habitat, rural habitat

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INTRODUCTION

The Magpie *Pica pica* is one of the model species for research of the synanthropization and synurbization of birds. However, in spite of the considerable number of works presenting the abundance and breeding density of populations of the species in agricultural landscapes (e.g. Fjeldsa 1983, Hordowski 1994, Jabłoński 1976, Jerzak 1989, Klafs & Stubs 1977, Klejnotowski 1972, Kragenow & Schwarz 1970, Moller 1973) and towns and cities (e.g. Frank 1975, Haafke 1987, Harmata 1985, Jerzak 1989, Klejnotowski 1974, Kavanagh 1987, Lenz & Witt 1976, Luniak *et al.* 1997, Tatner 1982, Witt 1985, 1989, Vuorisalo *et al.* 1992) of various parts of Europe, there is only little information detailing densities in the two types of environment on the

regional scale, and even less on changes in the abundance of the species in urban and agricultural areas of the same region over a longer period of time (e.g. Jerzak 1989, Klejnotowski 1972, 1974).

The aim of the research was thus to obtain information on densities and to compare the dynamics of the abundance of breeding populations of Magpies in the urban and agricultural areas of the Koszalin Region, which lies along the central stretch of Poland's Baltic coast.

STUDY AREA

The 6,527 km² Koszalin Region is in the central part of Poland's Baltic coast (Fig. 1). The width of this belt is

generally 25–30km, with only the western part extending inland some 60km in a SE direction.

Work on the abundance of breeding populations of Magpies was done in all 11 of the Region's towns and cities, as well as in 6 large study areas in the agricultural landscape (Fig. 1, Tab. 1). The urban areas were divided into three groups on the basis of size (Tab. 1), with 3 small towns having built-up areas of up to 200ha each and populations of up to 10,000; 6 medium-sized towns covering 200–1000ha of built-up land each and having 10–50,000 inhabitants and two large towns covering more than 1000ha of built-up

Green space with taller vegetation generally occupied only 2–8% of urban zones. Only in some of the seaside health resorts did urban zones include more substantial areas of forest with centres for recuperation and recreation within them — e.g. more than 10% of the urban area of Kołobrzeg and even 20% of that of Ustka (Tab. 1).

The cover of forests in suburban zones ranged from 2–4% in the case of Darłowo and Sławno — which are located in the extensive unforested valley of the Wieprza, to 60–65% in the case of Łeba, Koszalin and Ustka (Tab. 1).

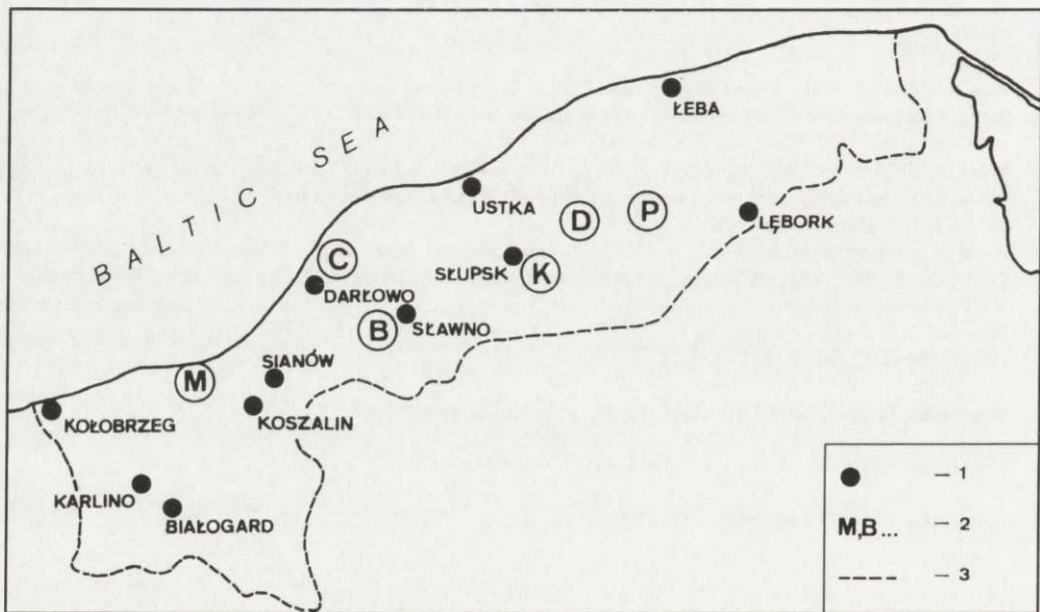


Fig. 1. The study area. 1 — towns, 2 — farmland plots, 3 — Koszalin Region.

[Ryc. 1, Teren badań. 1 — miasta, 2 — powierzchnie w krajobrazie rolniczym, 3 — Pobrzeże Koszalińskie.]

land and having populations over 50,000. Another classification distinguished 4 coastal towns from 7 away from the coastal area (Fig. 1). All of the towns are in the valleys of rivers flowing into the Baltic or into coastal lakes. The research was carried out within administrative boundaries, with a distinction being drawn between built-up areas and those occupied by transportational infrastructure on the one hand (i.e. the urban zone), and remaining areas within town limits (i.e. the suburban zone), (see Tab. 1). All the towns had developed similarly, with an oldest central area surrounded by suburban development with villa districts towards the edges and a peripheral zone of new residential and industrial districts beyond that.

The study areas in agricultural landscape (Fig. 1) embraced extensive areas (6674–11,460ha) of cultivated fields, meadows and pastures along with settlements, roads and limited (0.6–8.4%) areas of forest (Tab. 2). Two of the areas („Mielno” and „Cisowo”) were in the immediate vicinity of the coast, while the remaining four were in the centre of the research region (Fig. 1). The total area studied represented almost 9% of Koszalin Coastal Region, with the figure rising to 12% when the urban areas studied were added in. The density of population in the rural areas was very similar in all sites in the agricultural landscape other than „Mielno”, where it was twice as high (Tab. 2).

METHODS

The nests of Magpies were counted in the years 1978–1982 and in 1992. In the first period, town nests were counted in spring 1978 (in the cases of Koszalin, Sławno, Lębork and Ustka), 1979 (Słupsk and Darłowo), 1981 (Kołobrzeg and Białogard) and 1982

development of foliage on trees. Autumn counts, beginning in mid-November, followed leaf-fall. Nests in towns were counted by one or two observers, while those in agricultural study areas involved teams of 4–6 observers in cars. In spring, each newly-built nest was accepted to equate to a breeding pair. In autumn, nests belonging to different pairs were considered to be those

Table 1. Characteristics of the towns investigated. (%) — percentage of green areas in urban zone or forests in suburban zone.

[Tabela 1. Charakterystyka badanych miast. (%) — udział terenów zielonych wewnątrz miast lub lasów na peryferiach.]

Town	Urban zone		Suburban zone		Total ha	Inhabitants (thousands)	
	ha	(%)	ha	(%)		1978–82	1992
Kołobrzeg	720	(13)	1847	(12)	2567	38	46
Darłowo	312	(3)	1678	(2)	1990	13	16
Ustka	289	(22)	721	(65)	1010	14	17
Łeba	167	(2)	1313	(60)	1480	3	4
Karlino	163	(4)	758	(19)	921	5	6
Sianów	126	(4)	1467	(38)	1593	5	6
Białogard	545	(4)	2027	(13)	2572	20	24
Koszalin	1704	(6)	4829	(64)	6533	83	110
Sławno	339	(6)	1244	(4)	1580	13	15
Słupsk	1406	(6)	2904	(18)	4310	84	102
Lębork	493	(8)	1287	(27)	1780	28	35
Total (Mean)	6261	(7)	20075	(29)	26336	306	381

Table 2. Characteristics of farmland plots investigated. (%) — percentage of forests.

[Tabela 2. Charakterystyka powierzchni próbnych w krajobrazie rolniczym. (%) — udział lasów.]

Farmland plots	Study area (ha)				Inhabitants per 100ha
	Villages	Open farmland	Total	(%)	
"Mielno"	446	9 490	9 936	(4.4)	68
"Boleszewo"	244	8 176	8 420	(0.6)	29
"Cisowo"	344	8 990	9 334	(1.4)	35
"Kobylnica"	206	6 674	6 880	(8.4)	35
"Damnica"	274	9 176	9 450	(8.2)	33
"Potęgowo"	490	11 460	11 950	(4.2)	28
Total (Mean)	2004	53 966	55 970	(4.5)	(38)

(Karlino and Sianów). In the agricultural areas, counts were made in spring 1979 (in the cases of "Boleszewo", "Kobylnica", "Damnica" and "Potęgowo"), in autumn 1980 and 1982 ("Cisowo") and in 1982 ("Mielno"). The second (1992) period of research saw counts of nests made in all towns in spring and in agricultural areas outside the breeding season in autumn 1992 and winter 1993. Spring counts sought nests between the end of March and mid-May — i.e. before or during the

that were intact and located at distances of more than 50–70m from one another. Groups of (2–3) nests including only one which was intact were regarded as belonging to the same pair. The positions of nests were mapped.

The mean annual rate of increase in urban and rural populations was estimated by calculating the percentage increase in the number of nests between the first and second study periods and by dividing this by

the number of years between the middle of the first period and 1992, (i.e. 12.5 in the case of urban populations and 12 in the case of agricultural ones).

RESULTS

There were considerable differences in the breeding densities of the Magpie populations between towns in the Koszalin Region (Tab. 3). The highest densities of nests in both the first and second study periods were noted in the medium-sized and large towns located away from the coastal belt. Those observed in the port towns, and in the small towns away from the coast, were significantly lower. However, differences in

proportion of Magpies nesting in urbanized areas (overall 57%). It was only in Karlino, Sianów and Białogard that the greater number of pairs were suburban, rather than urban, nesters (Tab. 3). In the years between 1978–82 and 1992 the breeding population of Magpies in towns almost doubled. The greatest increases in the numbers of nests were noted in Darłowo, Ustka and Sianów (Tab. 3), where the species was either absent or represented by a few pairs only in the course of the first study period. In contrast, the population declined slightly in Karlino in the period, and by as much as 50% in Łeba. The remaining towns were characterized by something like a doubling of populations. The proportion of total numbers of pairs nesting in urban zones increased further than that of

Table 3. Number and changes of Magpie breeding population in towns studied. (%) — percentage of pairs nesting in both zones compared.

[Tabela 3. Zmiany liczebności lęgowej populacji sroki w badanych miastach. (%) — procentowy udział par gniazdujących w strefie miejskiej i podmiejskiej.]

Town	Urban zone				Suburban zone				Total			
	1978–82		1992		1978–82		1992		1978–82		1992	
	p./km ²	(%)	p./km ²	(%)	p./km ²	(%)	p./km ²	(%)	n	p./km ²	n	p./km ²
Kolobrzeg	1.5	(58)	3.0	(73)	0.4	(42)	0.4	(26)	19	0.7	30	1.2
Darłowo	0.3	(100)	2.9	(53)	0	(0)	0.5	(47)	1	0.05	17	0.8
Ustka	0.7	(100)	3.8	(85)	0	(0)	0.3	(15)	2	0.2	13	1.3
Łeba	3.0	(63)	1.8	(75)	0.2	(37)	0.1	(25)	8	0.5	4	0.3
Karlino	3.1	(31)	3.7	(40)	1.4	(69)	1.2	(60)	16	1.7	15	1.6
Sianów	1.6	(40)	7.1	(39)	0.2	(60)	0.9	(61)	5	0.3	23	1.4
Białogard	5.9	(48)	11.0	(74)	1.7	(52)	1.0	(26)	66	2.6	81	3.1
Koszalin	3.6	(62)	10.5	(78)	0.8	(38)	1.0	(22)	99	1.5	229	3.5
Sławno	7.4	(52)	9.8	(47)	1.8	(48)	3.0	(53)	48	3.1	70	4.4
Słupsk	3.9	(56)	9.1	(66)	1.5	(44)	2.3	(34)	98	2.3	195	4.5
Łębork	5.1	(73)	10.9	(78)	0.7	(27)	1.2	(22)	34	1.9	69	3.9
Total (Mean)	3.6	(57)	8.2	(69)	0.9	(43)	1.2	(31)		1.5		2.8
Total nests	224		514		172		232		396		746	

density (Tab. 3) were significantly greater in the first study period than in the second, with a 62-fold range of values for the whole administrative areas (urban + suburban zones) of the different towns in the period 1979–82 (extremes noted for Sławno and Darłowo), as against a 15-fold range in 1992 (extremes noted for Słupsk and Łeba). In the case of the built-up areas of towns the respective ranges were 25-fold and 6-fold. Finally, the densities of Magpies in urban areas were 4 times greater than in the suburban zones in the first period and nearly seven times greater in the second (Tab. 3).

The first period of research was characterized by the fact that almost all of the towns had a greater

those in suburban zones. By 1992, 69% of pairs were nesting in urban zones (a difference from the situation in the years 1978–82 significant at $p < 0.001$, U test). A prevalence of suburban-nesting pairs was only noted in Karlino and Sianów, where it was maintained, and in Sławno, where it became marked (Tab. 3). The mean annual rate of increase of the breeding population between 1978–82 and 1992 was over 7%, and was nearly three times greater in the urban zone than in the suburban zone (Fig. 2).

Compared with the situation in towns, densities of nests in the agricultural landscape varied less. The highest values were noted for the "Mielno", "Boleszewo" and "Kobylnica" areas, with a rather

lower one at "Cisowo", and the lowest at "Damnica" and "Potęgowo" — the most easterly of the study areas (Tab. 4). The extreme values for densities in the agricultural landscape varied across a 15-fold range in 1979–82 and a 9-fold range in 1992. Settlements were characterized by an 11-fold range at both times, while the agricultural areas beyond displayed a 30-fold range

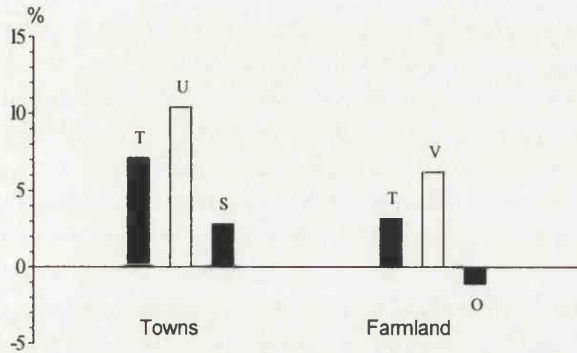


Fig. 2. Mean increase rate (%) of the breeding Magpie population from urban and rural habitats between 1978–82 and 1992. T — total, U — urban zone, S — suburban zone, V — villages, O — open farmland.

[Ryc. 2. Średnie roczne tempo wzrostu (%) lęgowej populacji sroki w miastach i w krajobrazie rolniczym pomiędzy okresem 1978–82 a rokiem 1992. T — razem, U — strefa miejska, S — strefa podmiejska, V — wioski, O — tereny poza wioskami.]

increased by 38%. This disguised a range of increases from area to area of between 162% and 93% in "Damnica" and "Potęgowo" down to as little as 9 and 12% respectively in the coastal areas of "Cisowo" and "Mielno". Population increases were mainly observed within settlements (from 36% up in Mielno to 131% up in Potęgowo, with an overall figure for the increase of 75%). In contrast, most agricultural areas outside villages witnessed a decline in numbers (of between 6% in "Boleszewo" and 49% in "Cisowo", with the overall figure for the decline being 17%). The mean annual rate of increase for all the agricultural areas combined was 3.2%, with the figure being almost twice as high in settlements and with the fields beyond showing a fall in numbers of 1.1% per year on average (Fig. 2).

The period between the first and second sets of counts was characterized by an increase in all areas in the numerical prevalence of pairs nesting in settlements as opposed to beyond them. The extreme values were 62% of pairs for "Potęgowo" and 80% for "Boleszewo", with the overall figure being 76% of pairs, and the difference with the situation in 1979–82 was significant at $p < 0.001$ by U test.

The densities of Magpies in village settlements were clearly higher than in the built-up areas of towns. In the

Table 4. Number and changes of the farmland Magpie breeding population in the plots studied. (%) — percentage of pairs nesting in both zones compared.

[Tabela 4. Zmiany liczebności lęgowej populacji sroki w krajobrazie rolniczym. (%) — procentowy udział par gniazdujących w wioskach i poza wioskami.]

Plot	Villages				Open farmland				Total			
	1979-82		1992		1979-82		1992		1979-82		1992	
	p./km ²	(%)	p./km ²	(%)	p./km ²	(%)	p./km ²	(%)	n	p./km ²	n	p./km ²
"Mielno"	21.7	(63)	29.6	(77)	0.6	(37)	0.4	(23)	153	1.5	171	1.7
"Boleszewo"	24.6	(65)	50.8	(80)	0.4	(35)	0.4	(20)	92	1.1	154	1.8
"Cisowo"	9.0	(48)	15.4	(76)	0.4	(52)	0.2	(24)	64	0.7	70	0.7
"Kobylnica"	18.4	(58)	35.9	(78)	0.4	(42)	0.3	(22)	66	1.0	95	1.4
"Damnica"	2.2	(75)	4.7	(62)	0.02	(25)	0.1	(38)	8	0.1	21	0.2
"Potęgowo"	3.3	(52)	7.5	(62)	0.1	(48)	0.2	(38)	31	0.3	60	0.5
Total (Mean)	12.4	(60)	21.2	(76)	0.3	(40)	0.3	(24)		0.7		1.0
Total nests	248		433		166		138		414		571	

of densities in the years 1979–82 and a 4-fold range in 1992. The densities attained by Magpies in villages were distinctly higher than those in the areas beyond, with a 41-fold difference in the first period and a more than 70-fold difference in the second.

All areas other than "Cisowo" had a majority of pairs (overall 60%) nesting in settlements. In the period between 1982 and 1992 the total size of the population

first period of counts this difference for all areas combined was a 3.4-fold one, while by 1992 it had declined to a 2.6-fold difference (Tab. 3, 4). Comparison of nest densities in suburban areas and agricultural areas outside settlements revealed that the former were higher — 3 times higher in the years 1979–82 and 4 times higher in 1992. These comparisons resemble data from Fig. 2 in showing a higher dynamic for the

increase in nesting densities in urban areas than in rural ones.

DISCUSSION

The Koszalin Region is in western Poland, where the process of synurbization of Magpies was already well advanced by the 1960s (Klejnotowski 1974). It began much later in the eastern part of the country (Luniak 1974) — a fact reflecting the trend in Europe as a whole for towns and cities to be colonized by the species in an east-west direction (Luniak 1983, Jerzak 1989). There were differences in the degree of advancement of the colonization of the towns in the study region: nests were present at higher density in larger towns and in medium-sized ones located at a certain distance from the coast. Population densities were significantly lower in port towns and small towns beyond the coastal belt like Karlino and Sianów. However, there was no clearer link between the location of a town further or less far to the west and the population densities of Magpies. In the largest towns — Koszalin and Słupsk — Magpies were present in small numbers as early as in the 1950s (Górski 1982 and unpublished data), and the possibility cannot be excluded that they were nesting there even earlier. The commencement of the colonization of towns in the area was linked with the development of urban districts and their expansion into areas in which Magpies were already nesting. Such a phenomenon was observed in the late 1950s and early 1960s in Koszalin, whose development took in patches of scrub and tree vegetation along rivers and in the middles of fields, where Magpies were breeding. However, because the development avoided wetter enclaves of scrub where Magpies nested, the birds were not forced to abandon their territories, but rather confined themselves to a change in the height at which nests were located, making use of tall trees. In the autumn-winter season, Magpies learned how to penetrate built-up areas in search of food, and after several to between 10 and 20 years — when housing estate trees had reached the appropriate heights, they moved into the immediate vicinity of buildings. As time passed, urban populations may secondarily colonize suburban areas, especially when human activities ensure the emergence

of new biotopes which favour the species, such as allotments. Such a situation has been observed in Słupsk (Górski 1982).

The thesis concerning the origins of suburban populations (at least in part) from the pioneer groups which colonized towns gains support in observations made in Darłowo and Ustka. In these towns, the first period of study was characterized by the nesting of Magpies in single pairs, in the park and town cemetery only: nests were not noted in the suburbs. However, by 1992, the majority of potential territories had already been occupied and nests had appeared in the suburban zone. In general, however, the proportion of nests in urban areas increased almost two-fold in the period of study in relation to the fraction of nesting pairs in suburban areas (Tab. 3). The increase in populations in built-up areas took place — as was found in the case of detailed research on the Słupsk population (Górski & Kotlarz 1997) — as a result of a considerable increase in densities in environments already occupied by Magpies (villa districts), and only to a much lesser extent as a result of the penetration of districts not previously colonized by the species (centres and new residential areas). However, the increases in suburban areas were mainly due to expansion into biotopes created thanks to human activities which were not occupied previously (allotments).

The density of Magpies in European towns and cities is increasing constantly and possible differences between particular areas are thus dependent on the period in which the research was carried out, apart from any other factors. Densities comparable with those in the towns of the Koszalin Region are those given for Ratingen — 2.0–2.1 pairs/100ha (Haafke 1987), the small towns of the Ziemia Lubuska area — 2.7–3.9 pairs/100ha (Jerzak 1989) and Gliwice — 3.2 pairs/100ha (Dyrcz *et al.* 1991). In turn, markedly higher figures have been provided for West Berlin, Szczecin, Zielona Góra, Poznań, Warsaw and Lwow (Luniak *et al.* 1997). High densities considerably above those noted for any of the towns studied have been given for the villa districts of some European cities like Dublin — 16.6 pairs/100ha (Kavanagh 1987), Poznań — 21–25 pairs/100ha (Mizera 1988) and Turku — 14 pairs/100ha (Vuorisalo *et al.* 1992).

The mean annual rates of increase in breeding populations which were estimated for the Koszalin

The mean annual rates of increase in breeding populations which were estimated for the Koszalin Region were 10.4% for built-up areas and 7.1% for urban and suburban zones together. These values are within the range given for other European towns and cities. In Manchester in the years 1977–1979, the mean rate of increase in the breeding population was 10.3% (according to data from Tatner 1982). Other figures are 5.8% in the years 1984–89 in West Berlin (data from Witt 1989), and increases in the density in Poznań of 10.4% between 1963 and 1969 and as much as 28% a year in the period 1969–82 (data from Klejnotowski 1974 and Mizera 1988). In Dublin, increases in density over a 13-year period averaged out at 13% per year, with an increase of 16.4% a year at the end of the period (1980–83). In Zielona Góra, the mean rate of increase in the years 1984–87 amounted to about 20% (about 14% a year in a smaller area in the years 1971–87), with the increase in the remaining towns of the Ziemia Lubuska region being only 12.9% per year (Jerzak 1989).

In the agricultural landscape, differences in the density of nests between areas with extreme values for density showed a downward trend as time passed (data from tab. 4). This attests to the gradual saturation of areas with higher densities. A similar phenomenon is also described from towns, especially in the cases of medium-sized towns and the majority of those located further from the coast, where there was a significant evening — out of densities in the second study period (data in Tab. 3).

Against the background of other larger areas of agricultural landscape in Central Europe, the densities of the breeding populations of Magpies in the Koszalin Region (0.7–1.0 pairs/km² of biotope mosaics including settlements) attains entirely comparable values (cf. Diettrich 1981, Dyrz *et al.* 1991, Fjeldsa 1983, Górski 1988, Hordowski 1994, Jabłoński 1976, Jerzak 1989, Klafs & Stubs 1977, Klejnotowski 1972, Kragenow & Schwarz 1970, Moller 1973). The upward trends for populations of Magpies noted in the study area are not confirmed more widely in older observational material (e.g. that of Klejnotowski 1972). However, contemporary data confirm increased densities in agricultural areas — e.g. near Tyniec Mały in Silesia in 1972, the density reached 0.4 pairs/100ha, and as early as in 1982

0.85 pairs/100ha (Dyrz *et al.* 1991). This equates to a mean annual increase of 11.25%.

In the study area, the increase in the abundance and density of Magpies in the agricultural landscape was achieved almost entirely in areas of human settlement, where the annual rate was over 6%. In contrast, in agricultural areas, excluding those with the lowest densities of Magpie nests, there was a fall in numbers in comparison with the first study period. This gives justification for the thesis that the ecological success (here increased size) of the Magpie population in the Koszalin Region has occurred as a consequence of the ongoing synanthropization and synurbization of the species.

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STRESZCZENIE

[Liczebność i zagęszczenie miejskich i wiejskich populacji lęgowych sroki na Pobrzeżu Koszalińskim]

Badania prowadzono na Pobrzeżu Koszalińskim w 11-tu miastach i 6-ciu powierzchniach próbnych w krajobrazie rolniczym (ryc. 1, tab. 1,2). W miastach wydzielono strefę miejską (obszar o przewadze terenów zabudowanych i komunikacyjnych) oraz podmiejską (pozostałe tereny w administracyjnych granicach miasta). W krajobrazie rolniczym wydzielono osiedla wiejskie i pozostałe tereny. Teren badań obejmował łącznie ok. 12% obszaru Pobrzeża Koszalińskiego. Gniazda sroki liczono w dwóch okresach — w latach 1978-82 i w roku 1992. Terminy „liczebność” i „zagęszczenie gniazd” — rozumiano w tej pracy jako określenia liczby terytoriów okupowanych przez oddzielne pary lęgowe.

Na przełomie lat 70-tych i 80-tych sroka zasiedlała już wszystkie miasta na Pobrzeżu, jednak jej liczebność była tam silnie zróżnicowana (tab. 3). Podczas, gdy w niewielkich miastach portowych na Wybrzeżu (np.

Darłowo, Ustka) proces osiedlania się sroki dopiero zaczynał się, w miastach oddalonych od wybrzeża, a zwłaszcza największych (Koszalin, Słupsk), gniazdowała już w znacznej liczbie (tab. 3). Prawie we wszystkich miastach przeważały liczebnie pary gniazdujące w strefie miejskiej, łącznie 57% całej populacji. Do roku 1992 lęgowa populacja sroki zwiększyła swoją liczebność prawie dwukrotnie w porównaniu z okresem 1978-82. Największy przyrost odnotowano w Darłowie i Ustce. Pogłębiła się przewaga frakcji par gniazdujących w strefie miejskiej (69% liczby par; różnica istotna w stosunku do pierwszego okresu badań przy $p < 0.001$, test U). Średnie roczne tempo wzrostu w miastach pomiędzy pierwszym a drugim okresem badań wynosiło 7% i w strefie miejskiej było prawie trzykrotnie wyższe niż w podmiejskiej (ryc. 2).

W pierwszym okresie badań na wszystkich powierzchniach próbnych w krajobrazie rolniczym (poza „Cisowem”) większa część par gniazdowała w wioskach (łącznie 60%, tab. 4). Do roku 1992 całkowita liczebność populacji wzrosła o 38%, najbardziej na najmniej licznie zasiedlonych powierzchniach „Damnica” i „Potęgowo”, najmniej — na terenach nadmorskich „Mielno” i „Cisowo”. Wzrost liczebności zanotowano głównie na terenie wiosek i w nielicznie zasiedlonych terenach rolniczych. Natomiast na większości obszarów rolniczych położonych poza wioskami nastąpił spadek liczebności w stosunku do stanu z pierwszego okresu badań. Średnie tempo wzrostu dla całego zbadanego obszaru krajobrazu rolniczego wyniosło 3,2% rocznie, podczas gdy w samych wioskach było prawie dwukrotnie wyższe, natomiast na polach odnotowano spadek liczebności — średnio o 1,1% rocznie (ryc. 2).

Zagęszczenie sroki w miastach było zróżnicowane (tab. 3), bardziej w pierwszym niż w drugim okresie badań, co zdaje się wskazywać na tendencję do wyrównywania różnic. W miastach różnice między skrajnymi wartościami zagęszczenia w pierwszym okresie badań były 62-krotne (Sławno — Darłowo), a w 1992 roku już tylko 15-krotne (Słupsk — Łeba). W strefie miejskiej różnice były odpowiednio 25- i 6-krotne. Zagęszczenie gniazd sroki w strefie miejskiej w obydwu okresach badań było wyższe (odpowiednio — 4- i 7-krotnie) niż w strefie podmiejskiej.

Zagęszczenie gniazd sroki w krajobrazie rolniczym nie było tak silnie zróżnicowane jak w miastach (tab. 4).

W latach 1979–82 skrajne wartości zagęszczenia dla powierzchni polnych różniły się 15-krotnie, a w roku 1992 już tylko 9-krotnie. W przypadku wiosek w obydwu okresach badań różnice były 11-krotne, a dla terenów poza wioskami — odpowiednio — 30-krotne i 4-krotne. Zagęszczenie w wioskach było znacznie wyższe niż poza wioskami — w pierwszym okresie badań 41-, a w drugim — aż 70-krotnie.

Zagęszczenie w wioskach było 3-krotnie wyższe niż w strefie miejskiej. Zagęszczenie gniazd sroki na terenach podmiejskich przewyższało zagęszczenie na terenach rolniczych poza wioskami — w latach 1978–82 około 3-krotnie, a w roku 1992 — już 4-krotnie. Wyniki te, podobnie jak i dane z ryc. 2 wskazują na wyższą

dynamikę wzrostu zagęszczenia sroki w miastach w porównaniu z terenami wiejskimi.

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