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Changes in the House Sparrow *Passer domesticus* population in cities and towns of Poland in 1960–2010

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Abstract: The paper presents an analysis of changes in the House Sparrow *Passer domesticus* numbers in Polish cities and towns from the 1960s to the first decade of the 21st century based on published data. The long-term data from 294 study plots (50.6 km^2) illustrate changes in numbers of breeding House Sparrows, and allow to calculate mean densities for successive decades. Data collected in 34 Polish cities and towns, in two types of urban habitats – housing estates and parks (including cemeteries and squares) were used. The frequency of occurrence of the House Sparrow in housing estates has not changed over the years – it was recorded as a breeding species on 98–100% of plots in particular periods. In 1960–1979, 1980–1989 and 1990–1999, mean densities of House Sparrows in this habitat ranged from 57.3 to 84.2 pairs/10 ha. However, in the 2000s the density was much lower (18.5 pairs/10 ha). The frequency of occurrence in parks, a suboptimal habitat, decreased from 62–76% in 1960–1999 to 34% in the 2000s, and the mean densities from 5.5–9.1 pairs/10 ha to 1.4 pairs/10 ha, respectively. The results indicate that the sharper decline of the House Sparrows numbers in Polish cities/towns began on the turn of the 20th century and has been continuing until now, but some signals of a crisis in the House Sparrows population had been recorded before.

Key words: House Sparrow, *Passer domesticus*, decline in abundance, urban habitats

Zmiany liczebności wróbla *Passer domesticus* w miastach Polski w latach 1960–2010. Abstrakt: W pracy podjęto próbę określenia zmian liczebności wróbla *Passer domesticus* w miastach Polski od lat 60. XX wieku do pierwszej dekady XXI w. na podstawie opublikowanych danych. Praca przedstawia wieloletnie dane z powierzchni badawczych, bezpośrednio ilustrujące zmiany liczebności lęgowej wróbla oraz analizę porównawczą jego średnich zagęszczeń w kolejnych dekadach. Do wyliczenia średnich zagęszczeń wykorzystano dane z 294 powierzchni badawczych (o łącznej pow. 50,6 km^2) w 34 miastach Polski, reprezentujących dwa typy środowisk miejskich: osiedla mieszkaniowe i środowiska parkowe (parki, cmentarze, skwery). Frekwencja występowania wróbla w osiedlach nie zmieniła się w ciągu lat (stwierdzany był jako gatunek lęgowy na 98–100% powierzchni w poszczególnych okresach). Jego średnie zagęszczenia w tym środowisku w latach 1960–1979, 1980–1989 i 1990–1999 wyniosły 57,3–84,2 pary/10 ha, natomiast na początku XXI wieku były już wyraźnie niższe (18,5 pary/10 ha). W środowiskach parkowych frekwencja występowania wróbla spadła z 62–76% w latach 1960–1999 do 34% na początku XXI wieku, a średnie zagęszczenia wyniosły odpowiednio 5,5–9,1 par/10 ha i 1,4 pary/10 ha. Wieloletnie dane z izolowanych powierzchni badawczych w obu środowiskach w większości potwierdzają wyniki porównawczych analiz zagęszczeń. Uzyskane wyniki wskazują, że wyraźny spadek liczeb-

ności wróbla w miastach Polski rozpoczął się na przełomie XX i XXI wieku i trwa do chwili obecnej. Pewne sygnały regresu jego populacji zaczęły pojawiać się jednak już wcześniej, a proces ten mógł mieć zróżnicowany początek i przebieg w poszczególnych miastach.

Słowa kluczowe: wróbel, *Passer domesticus*, spadek liczebności, środowisko miejskie

In recent decades a serious decline in the numbers of House Sparrow *Passer domesticus* has been found in a part of its range. In Great Britain, where the status of the species is quite well described, its numbers decreased by ca 60% between the 1970s and the beginning of the 21st century (Robinson et al. 2005). A considerable decrease has been found also in other countries of western and northern Europe, e.g. in Finland, Germany, the Netherlands and Belgium (Väisänen & Solonen 1997, Engler & Bauer 2002, de Laet & Summers-Smith 2007), as well as in North America (e.g. Erskine 2006), Australia (Olsen et al. 2003) and India (Bhattacharya et al. 2011). The populations from large cities underwent the most severe changes. For example, numbers of House Sparrow in Hamburg decreased by 75% from the 1960s to the end of the 1990s (Mitschke & Mulsow 2003), in London during 10 years (1994–2004) – by over 60% (Raven et al. 2005), and in Prague from 1985–1989 to 2002–2004 – by 65% (Fuchs in: Havlíček 2011). Only in Berlin the population of House Sparrow did not change considerably in two recent decades (Böhner & Witt 2007).

Data on changes in the House Sparrow numbers in Poland and other countries of east-central Europe are less numerous. The source of the data have been programs of common breeding birds monitoring (e.g. Reif et al. 2009, Kuczyński & Chylarecki 2012) usually run for a few years, counts on small, isolated study plots (mainly in urban parks, e.g. Tomiałojć 2007, 2011, Czyż 2008, Grochowski & Szlama 2010), as well as general statements (not supported by numbers) included in ornithological monographs of cities and towns (Konstantinov et al. 1996, Flousek & Gramsz 1999, Luniak et al. 2001, Stój & Dyczkowski 2002, Bokotey & Gorban 2005, Markowski 2009). Data on changes in the House Sparrow populations based on larger number of study plots derive from only a few cities in Poland (Biaduń 2008, Dulisz & Zasitko 2008, Węgrzynowicz 2013 msc). These are usually comparisons of results collected in two periods which do not allow to determine when a decline started.

The paper presents an analysis of changes in the number of House Sparrows in cities and towns of Poland based on comparison of its mean breeding densities in successive decades (from the 1960s to the first decade of the 21st century) in the two most important types of urban habitats. The analysis is supported by results of multi-year counts at study plots i.e. data directly presenting changes in the House Sparrow numbers.

Material and methods

The analysis is based on published data on breeding densities of the House Sparrow in cities and towns of Poland. In most cases, these data derive from censuses of the whole avifauna assemblages on particular study plots that were carried out using variants of the mapping technique (Tomiałojć 1980). Data collected using quick methods of counting, based on a small number of visits carried out in a short time were used to a smaller extent. The application of these methods in quantitative avian studies is discredited due to high probability of over- or under-estimation of numbers in many bird species (Tomiałojć 2010). However, it is necessary to point out that even when the rules of mapping technique are strictly abided by, the accuracy of counting sparrows by different authors may vary considerably, and their numbers are often underestimated (L. Tomiałojć – pers. comm.).

The results presented in this paper consist of two parts: comprehensive analysis based on comparison of mean densities on all study plots in successive periods, and the presentation

of data from multi-year censuses directly illustrating changes in numbers on particular plots (in at least a 7-year period).

Densities of the House Sparrow in housing estates and in park habitats (parks, cemeteries, squares) were analyzed separately. The material was divided into five periods corresponding to successive decades (from the 1960s to the first decade of the 21st century), but in the case of housing estates data from the 1960s and 1970s were combined as the sample from the former period was quite small.

The mean breeding densities in particular decades were calculated by summing up the number of pairs on all study plots representing the given type of habitat and dividing the sums by a total area. If data from one plot represented more than one year in a decade, the mean value was used. If results for a given plot were collected during a few decades, data representing each decade were presented separately. When an area or a number of study plots for a particular city/town exceeded 30% of the total area or a number of all analyzed plots in a given decade, some of the plots were deleted to avoid overrepresentation of data from particular plots. In such cases plots with extremes (the largest or the smallest densities) were rejected so that the amount or area of the remaining data did not exceed the above proportion. However, in the analysis of frequency of the House Sparrow occurrence, the data from all study plots were used. The frequency of occurrence was defined as the proportion of study plots where the House Sparrow was recorded at least in one year in a given decade.

In general, data from 129 study plots in housing estates (total area of 32.3 km^2) and 165 plots in park habitats (18.3 km^2; Table 1) from 34 cities/towns of Poland were used in a comprehensive analysis (Fig. 1). The plots represented cities and towns of various size, although most of them were localized in large cities (over 100.000 inhabitants). Housing estates in large cities constituted 79% of the total area of analyzed study plots and 83% in the case of park habitats. The fewest plots were localized in small towns (below 20.000 inhabitants) – the proportion of their area was 1.2% and 3.1% in the two habitats, respectively. The proportions of plots representing three size categories of cities and towns (large, medium and small) where quite even in particular decades, so the city size should not largely influence the results of the analysis.

The number of study plots in particular cities/towns ranged from 1 to 63 (Fig. 1). The area of particular plots ranged from 4.0 to 150.0 ha in housing estates (mean 25.0 ha) and 0.5–50.0 ha in park habitats (mean 11.0 ha). The total number of samples (i.e. sum of all counts in each year on all plots) amounted to 227 in housing estates and 425 in parks. The number of plots used in the analysis of frequency of the House Sparrow occurrence ranged in particular decades from 24 to 55 (4.7–13.0 km^2) for housing estates, and from 20 to 67 (2.3–7.2 km^2) for park habitats. In some decades the number and area of study plots used to calculate mean and median densities were lower than those used in the analysis of frequency (Table 1).

To verify statistical significance of differences in House Sparrow densities in particular decades, the Mann-Whitney U test (when two periods were compared) or Kruskal-Wallis test (comparison of more than two periods) was used. The chi-square test was used to verify differences in frequency. The statistical analysis was carried out with application of Statgraphics 5.1 Plus software.

The direct data on multi-year changes in the House Sparrow numbers in housing estates in Poland presented in this paper come from only three cities (a total of 31 study plots). Data from parks, cemeteries and squares represent 11 cities and towns. The area of study plots in park habitats ranged mostly from 10 to 35 ha. The counts in this habitat were conducted usually in two or three periods. In most cities/towns the data were collected in single parks, and only in Warsaw and Lublin they are based on results from larger number of study plots.

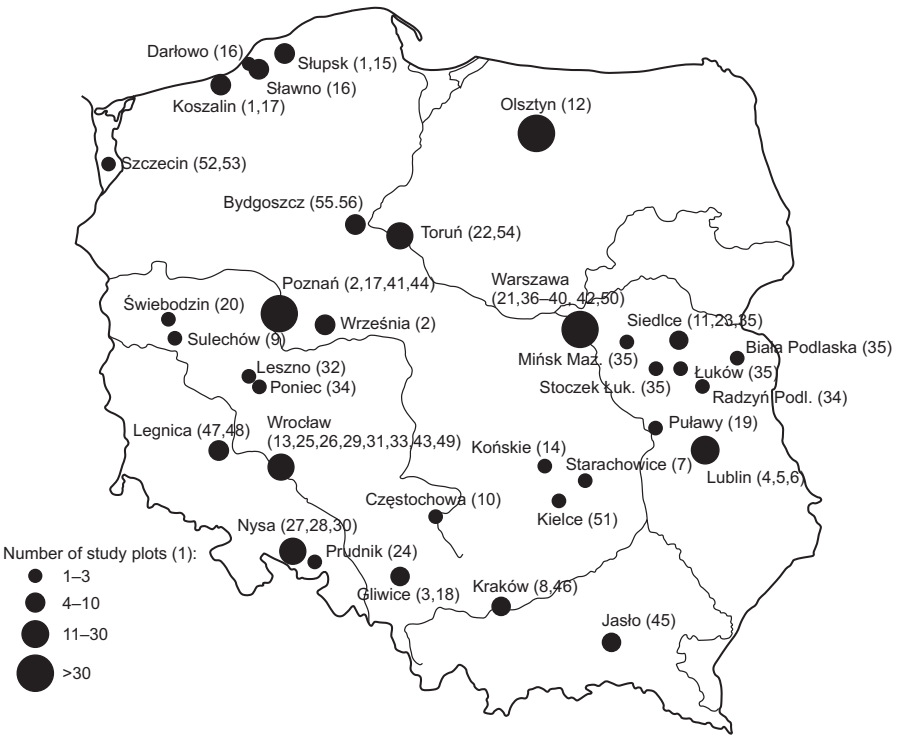

Fig. 1. Distribution of study plots used in the analysis of the House Sparrow density. In brackets – sources of data: 1. Antczak 2004, 2. Bednorz et al. 2000, 3. Betleja et al. 2006, 4. Biaduń 1994, 5. Biaduń 1996, 6. Biaduń 2008, 7. Błoński 2008, 8. Brożek 1978, 9. Czwałga 1992, 10. Czyż 2008, 11. Dombrowski & Łuczak 1998, 12. Dulisz & Zasitko 2008, 13. Dyrcz et al. 1991, 14. Fijewski 1998, 15. Górski 1982, 16. Górski & Górska 1974, 17. Górski & Górska 1979, 18. Grochowski & Szlama 2010, 19. Jabłoński 1982, 20. Jermaczek et al. 1990, 21. Jędraszko-Dąbrowska et al. 2008, 22. Kasprzyk 1993, 23. Kasprzykowski & Łuczak 2000, 24. Kopij 1995, 25. Kopij 2004, 26. Kopij 2005, 27. Kopij 2006, 28. Kopij 2007, 29. Kopij 2010, 30. Kopij & Wolanin 2010, 31. Kopij & Zendwalewicz 2009, 32. Kuźniak 1996, 33. Lontkowski 1989, 34. Lorek 1992, 35. Luniak 1974, 36. Luniak 1981, 37. Luniak 1994, 38. Luniak et al. 1986, 39. Luniak et al. 2007, 40. Marczak 1983, 41. Mizera 1988, 42. Nowicki 1992, 43. Orłowski et al. 2006, 44. Ptaszyk 2003, 45. Stój & Dyczkowski 2002, 46. Tomek 1969, 47. Tomiałojć 1970, 48. Tomiałojć 2007, 49. Tomiałojć 2011, 50. Węgrzynowicz 2013 msc, 51. Wilniewczyc 1997, 52. Wysocki 1995, 53. Wysocki 2001, 54. Zalewski & Przystalski 1993, 55. Zieliński 2001, 56. Zieliński 2004

Rys. 1. *Rozmieszczenie powierzchni badawczych wykorzystanych w analizie zagęszczeń wróbla. (1) – liczba powierzchni badawczych. W nawiasach podano źródło danych*

Results

Housing estates

From the 1960s to the 1990s breeding House Sparrows were recorded in all housing estates studied. In the 2000s, the frequency of House Sparrow in this habitat was 98% (Table 2).

The maximal densities of House Sparrows recorded in housing estates were the highest in 1960–1979 and the lowest in the 2000s (Table 2). In successive periods densities >50 pairs/ha were recorded on 71, 62, 26 and 15% of study plots (χ^2 =38.91; df=3; P<0.001), including densities of >100 pairs/10 ha on 26.0, 8.3, 2.9 and 1.8% of plots, respectively (χ^2=19.41; df=3; P<0.001). The mean densities were the highest in 1960–1979 (84.2 pairs/10 ha), and dropped to 67.1 and 57.3 pairs/10 ha in the 1980s and the 1990s, respec-

Table 1. Number and area of study plots used in comparison of the House Sparrow occurrence in different periods. In brackets – number/area of plots used to calculate mean densities in successive periods (see text)
Tabela 1. *Liczba i areał powierzchni badawczych wykorzystanych do analizy porównawczej występowania wróbla w różnych okresach. Wartości w nawiasach odnoszą się do liczby/areału powierzchni wykorzystanych do obliczenia średnich i median zagęszczeń w kolejnych okresach (p. tekst). (1) – lata, (2) – osiedla mieszkaniowe, (3) – środowiska parkowe, (4) – liczba miast, (5) – liczba powierzchni, (6) – powierzchnia razem [ha], (7) – razem*

Years (1)	Housing estates (2)			Park habitats (3)		
	Number of cities/towns (4)	Number of study plots (5)	Total area [ha] (6)	Number of cities/towns (4)	Number of study plots (5)	Total area [ha] (6)
1960–1969	9	38	785.2	10	20	226.5
1970–1979				15	59 (46)	618.0 (543.0)
1980–1989	7	24	474.7	9	67	708.0
1990–1999	5	39 (15)	1302.8 (401.4)	13	32	384.2
2000–2010	5	55 (27)	1141.2 (779.4)	11	58 (48)	718.4 (574.8)
Total (7)	18	129	3230	31	165	1830

tively. However, the differences between these three periods were not significant ($H_{2,77}$ =3.37; P=0.182). The mean density at the beginning of the 21st century amounted to 18.5 pairs/10 ha and was ca 3.0–4.5 times lower than in previous decades. The difference in densities between this period and years 1960–1999 was significant (Z=216.5; P<0.001).

The number of House Sparrow pairs in three housing estates of Lublin (total area of 40.2 ha) decreased from 350 in 1992 to 122 in 2006, i.e. by 65% (Biaduń 2008). In six housing estates in Warsaw (total area of 107 ha) numbers of the species decreased by 33% from the 1980s to the beginning of the 21st century (Węgrzynowicz 2012a). However, in Olsztyn, where studies were conducted in two periods (1993–1996 and 2006–2007) in 22 housing estates (4.1–394.9 ha), the total number of House Sparrows did not change markedly, though changes on some plots were considerable (Dulisz & Zasitko 2008).

Table 2. Occurrence of the House Sparrow in two types of habitats in different periods
Tabela 2. *Występowanie wróbla w dwóch typach środowisk w różnych okresach. (1) – lata, (2) – osiedla mieszkaniowe, (3) – środowiska parkowe, (4) – zagęszczenie (par/10 ha), (5) – frekwencja (%), (6) – mediana, (7) – maksymalne*

Years (1)	Housing estates (2)			Park habitats (3)		
	Density (p/10 ha) (4)		Frequency [%] (5)	Density (p/10 ha) (4)		Frequency [%] (5)
	median (6)	maximal (7)		median (6)	maximal (7)	
1960–1969	74.9	280.2	100	3.6	68.6	65
1970–1979				3.8	82.8	76
1980–1989	58.8	152.0	100	5.0	97.9	76
1990–1999	51.8	200.9	100	1.4	80.0	62
2000–2010	16.4	116.7	98	0.0	55.5	34

Park habitats

The frequency of occurrence of the House Sparrow in parks, cemeteries and squares ranged 62–76% from the1960s to the1990s ($\chi^2=3.03$; df=3; P=0.392) and in the first decade of the 21st century it was only 34% (difference with mean frequency in 1960–1999; $\chi^2=5.20$; df=1; P<0.001).

The maximum densities in park habitats were the highest in the 1980s and the lowest at the beginning of the 21st century (Table 2). From the 1960s to the 1990s densities >5 pairs/10 ha were recorded on 40–48% of study plots ($\chi^2=0.89$; df=3; P=0.831), including densities >10 pairs/10 ha – on 20–31% of plots ($\chi^2=1.51$; df=3; P=0.679). At the beginning of the 21st century these proportions were considerably lower: 14.0% (significantly less than in previous decades; $\chi^2=4.06$; df=1; P<0.001) and 6.8% (significant difference in comparison with previous decades; $\chi^2=3.14$; df=1; P=0.002), respectively. The mean density of House Sparrows was the highest in the 1980s (9.1 pairs/10 ha) and a little lower in the 1960s, 1970s and 1990s (6.0, 5.5 and 6.0 pairs/10 ha, respectively). In the first decade of the 21st century the mean density amounted to 1.4 pairs/10 ha and was ca 4.0–6.5 times lower than in previous periods. The differences in densities in first four periods were not significant ($H_{3,165}=2.77$; P=0.430). However, mean density in these decades was significantly higher than at the beginning of the 21st century (Z=1831.0; P<0.001).

The published data indicate that changes in the House Sparrows number in parks between the 1960s, 1970s and 1980s were often negligible. This was the case of parks of Siedlce in 1968–1986 (Dombrowski & Łuczak 1998), as well as that of downtown parks of Częstochowa in 1978–1987 (Czyż 2008) and Poznań park between the 1970s and the 1980s (Mizera 1988). The slight decline (from 10 pairs in 1974 to 5–8 at the end of the 1980s) was found only in a park in Gliwice (Grochowski & Szlama 2010). On the other hand, in 9 of 13 parks in Warsaw (total area of 150 ha) investigated in the 1970s and the 1980s, the number of House Sparrows increased, and in other ones no significant changes were recorded. The direct reason of this increase was probably an introduction of nest-boxes between both periods (Nowicki 1992). Numbers of the House Sparrow increased also in one of Wrocław parks in 1970–1989 (Tomiałojć 2011), which the most likely resulted from the occupation of a newly risen building by sparrows (L. Tomiałojć – pers. comm.).

Data on changes up to the 1990s derive from few study plots. In one of the parks in Koszalin (area of 20 ha) the number of breeding pairs of House Sparrows decreased from 26 in the 1970s to 2 in 1998 (Górski & Górska 1979, Antczak 2004). In two downtown parks of Łódź the number of pairs decreased five times between 1972 and 1999 (Markowski 2009).

The changes up to the 2000s are better documented. From the 1970s–1980s to the 2000s the House Sparrow left 13 of 23 parks (total area of 248 ha) in Warsaw and its total number in this habitat decreased by 45% (Węgrzynowicz 2012a). In the same period a substantial decline was found in two other parks of Warsaw (Luniak et al. 2007, Jędraszko-Dąbrowska et al. 2008). Even sharper decline was found in Lublin, where between the 1980s–1990s and 2002–2007 the mean density of House Sparrow in parks (total area of 94 ha) fell from 11.9 to 0.5 pairs/10 ha, and in squares (17.4 ha) – from 11.5 to 3.1 pairs/10 ha (Biaduń 2008). Data from other cities and towns derive mostly from single study plots. Between the 1970s and the beginning of the 21st century a considerable decrease or total abandonment have been found in parks and squares in Słupsk, Legnica and Częstochowa (Antczak 2004, Tomiałojć 2007, Czyż 2008). In the same period a weaker decrease was recorded in Gliwice park (Grochowski & Szlama 2010). However, in Słowacki Park in Wrocław the number of House Sparrows has not changed significantly since the 1990s (Tomiałojć 2011).

Discussion

At the beginning of the 21st century, the mean densities of the House Sparrow in housing estates and park habitats in cities and towns of Poland were lower than in 1960–1999 by 68–78% and 75–85%, respectively. These values should not be considered as the actual indices of changes in abundance as the compared values were calculated using data from different study plots in particular periods. However, the differences in densities between the second half of the 20th century and the first decade of the 21st century are apparent, and the significant decrease in numbers of the House Sparrow in cities and towns of Poland seems to be an indisputable fact.

In the 20th century, European population of the House Sparrow crashed twice – for the first time in the 1920s/the 1930s in Great Britain (as well as in the United States). It was the result of limitation of food for sparrows (oat *Avena sativa* seeds) as a consequence of disappearance of horses from municipal streets (Rand 1956). After a period of recovery, the population of House Sparrow in Western Europe started to diminish in the 1970s (Summers-Smith 2003). In Great Britain, a decline was found first in agricultural landscape, whereas in cities it started in the late 1980s or at the beginning of the 1990s. However, the decline in cities was more dramatic than in agricultural landscape (Crick et al. 2002). It seems that populations of House Sparrow in cities and towns of Poland were quite stable up to the 1990s and the noticeable decrease took place only in the first decade of the 21st century. However, a comparison of proportion of housing estates, where densities of House Sparrow exceeded 50 and 100 pairs/10 ha suggests that some negative changes could have occurred already in the 1990s. This hypothesis is supported also by low median density in park habitats in the 1990s as well as direct data on changes before the end of this decade in parks of two cities (Koszalin and Łódź). It should be marked that the decrease in House Sparrow numbers could have started at different time periods in particular cities and towns. For example, Markowski (2009) states that the number of House Sparrows in Łódź has been decreasing since the 1960s, while in Olsztyn, on the other hand, its population has been stable in recent decades (Nowakowski et al. 2006). However, it is safe to say that a general decline in the number of House Sparrow in Polish cities/towns started only at the beginning of the 21st century or at the end of the1990s, that is some ten years later than in the cities of Western Europe.

In agricultural landscape of Western Europe (at least in Great Britain), populations of the House Sparrow stabilized in the 2000s, whereas in many cities of this part of the world the decline is still continuing (De Laet & Summers-Smith 2007). The results of Common Breeding Bird Monitoring Scheme in Poland demonstrate a general decrease in the House Sparrow numbers in 2000–2010 (by avg. 21%; Kuczyński & Chylarecki 2012). The latest data from two cities of Poland show that the decline is continuing and even has become more profound; up to 2010–2012 the House Sparrow abandoned all (16) studied parks and squares in Lublin (W. Biaduń – unpublished data), and its total number on several plots representing various habitats in Warsaw decreased in quite a short period (between 2005–2009 and 2012) by 58% (Węgrzynowicz 2012a).

The most important breeding habitat of House Sparrows in cities are housing estates, whilst green areas are rather a suboptimal habitat (Biaduń 2009, Węgrzynowicz 2013 msc). In all periods analyzed, the densities in housing estates were 7–15 times higher than in parks, cemeteries and squares. It is symptomatic that the decline in housing estates manifested itself by lower densities only, whereas in park habitats, apart from reduction in densities, the frequency of occurrence has decreased. In Warsaw, even a more significant decline than in parks

was found in allotment gardens (total area of 86 ha), where the number of House Sparrows decreased by 95% from the 1970s to the beginning of the 21st century (Węgrzynowicz 2012a). Thus, the decrease in House Sparrow numbers in urban green areas was steeper than in built-up areas. It seems that it was not the result of more disadvantageous habitat changes in green areas. It is more plausible that parks and allotment gardens were abandoned first, as they constitute suboptimal habitats for House Sparrows (with worse nesting conditions than in housing estates; Węgrzynowicz 2013a).

The intensification of agricultural practices is a widely accepted cause of the decrease in House Sparrow numbers in agricultural landscape of Western Europe, as in other bird species living in this habitat (Chamberlain et al. 1999, Donald et al. 2001, Engler & Bauer 2002, Newton 2004). However, the causes of decrease in European cities have not been fully recognized until now. One hypothesis refers to the limitation of availability of nesting sites as a result of renovation of buildings and introducing of modern, "proof" architecture (Summers-Smith 2003, Robinson et al. 2005). In spite of certain influence of this factor on local populations of House Sparrow in cities of Poland (e.g. Węgrzynowicz 2012a), some data suggest that, at least in some cities, it was not the main cause of a decline. The House Sparrow is quite flexible in nest site selection – although it prefers shelters in buildings, it may also nest in tree holes, nest-boxes, street lamps and even directly among branches of trees and shrubs or in vines growing on walls or trees (Kulczycki & Mazur-Gierasińska 1968, Anderson 2006). Regarding the limitation of available crevices in buildings, one should expect an increase in the use of the other, less-optimal sites by the House Sparrow. However, Biaduń (2004) reported that recently in Lublin House Sparrows used tree holes less frequently than before a population decrease had started. Similarly, in the 2000s in Warsaw nest-boxes were only sporadically used by House Sparrows, whereas in the 1980s they were occupied very often (Węgrzynowicz 2012). Moreover, during studies in Warsaw in 2005–2012, some nest sites in buildings previously occupied by sparrows, have been abandoned (Węgrzynowicz 2012a). There are also some interesting findings from Olsztyn – the House Sparrow abandoned housing estates in downtown, where only some buildings were insulated, and its number increased in blocks of flats where many buildings had been renovated (Dulisz & Zasitko 2008). Thus, in the latter habitat, renovations of buildings led here to only temporary reduction in the House Sparrow number. On the other hand, there is a good body of evidence for a strong influence of nest-sites loss on local populations of the House Sparrow – for example almost 100 pairs abandoned one of the parks in Lublin after removal of old street lamps where they had nested (Biaduń 2004). These contradictory facts involving the role of nest-site loss, point out that one should not draw conclusions on trends in the House Sparrow numbers on the basis of data from few study plots or from single habitats.

The studies in Leicester in 2001–2003 revealed a lack of invertebrates (food for nestlings) as the cause of low breeding success of House Sparrows, which could lead to decrease in their number (Peach et al. 2008). Also studies in Hamburg suggest that low breeding success of sparrows was the result of shortage of insects (Bower 1999). In Warsaw, on the contrary, breeding success of the House Sparrow in 2005–2009 was quite high (Węgrzynowicz 2013 msc). Thus, shortage of invertebrates does not seem to be a main factor responsible for a decline in this city.

The other hypotheses of decline in urban populations of House Sparrow refer to: the shortage of food for adults (including food waste), an increase of predation of cats *Felis catus*, sparrowhawks *Accipiter nisus* and corvids (Crick et al. 2002, Summers-Smith 2003, Robinson et al. 2005), as well as a negative influence of electromagnetic radiation (Balmori & Hallberg 2007, Everaert & Bauwens 2007). Some of the authors suggest that a decrease in

urban populations of the House Sparrow may be a result of coincidence of several factors or that the causes of decline are different in particular cities (Crick et al. 2002, Summers-Smith 2003, Robinson et al. 2005).

This paper provides the evidence for a general decrease in populations of the House Sparrow in Polish cities and towns, as well as tries to determine the onset of this process. However, there are only sparse data concerning the course and the intensity of changes in particular cities and towns. Also data showing causes of the decline in Poland are lacking. Thus, further studies on urban populations of House Sparrows in Poland are necessary, especially regarding that the decline in the species populations has become more serious recently.

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References

Anderson T. 2006. Biology of the ubiquitous House Sparrow: from genes to populations. Oxford University Press, New York.

Antczak J. 2004. Ptaki lęgowe parków miejskich Słupska i Koszalina. W: Indykiewicz P., Barczak T. (red.). Fauna miast Europy Środkowej 21. wieku, ss. 411–417. LOGO, Bydgoszcz.

Balmori A., Hallberg O. 2007. The urban decline of the House Sparrow (*Passer domesticus*): a possible link with electromagnetic radiation. Electromagn. Biol. Med. 26: 141–151.

Bednorz J., Kupczyk M., Kuźniak S., Winiecki A. 2000. Ptaki Wielkopolski. Monografia faunistyczna. Bogucki Wyd. Nauk., Poznań.

Betleja J., Cempulik P., Chrul Z., Grochowski T., Ostański M., Schneider G., Szlama D. 2006. Atlas ptaków lęgowych Gliwic, rozmieszczenie i liczebność w latach 1988–1990. Rocz. Muz. Górnośl. Przyroda 17.

Bhattacharya R., Roy R., Goswami C. 2011. Studies on the response of House Sparrows to artificial nest. Int. J. Environm. Sciences 1: 1574–1581.

Biaduń W. 1994. The breeding avifauna of the parks and cemeteries of Lublin (SE Poland). Acta Ornithol. 29: 1–13.

Biaduń W. 1996. Ptaki lęgowe i zimujące osiedli mieszkaniowych w Lublinie. Not. Orn. 37: 83–95.

Biaduń W. 2004. Ptaki Lublina. Wyd. AM, Lublin.

Biaduń W. 2008. Spadek liczebności populacji wróbla *Passer domesticus* w Lublinie. W: Indykiewicz P., Jerzak L., Barczak T. (red.). Fauna miast. Ochronić różnorodność biotyczną w miastach, ss. 115–123. Wyd. SAR „Pomorze", Bydgoszcz.

Biaduń W. 2009. Zmiany awifauny lęgowej zieleni miejskiej Lublina w latach 1982–2007 oraz ich przyczyny. Wyd. KUL, Lublin.

Błoński W. 2008. Ptaki parku miejskiego w Starachowicach. Kulon 13: 91–111.

Böhner J., Witt K. 2007. Distribution, abundance and dynamics of the House Sparrow *Passer domesticus* in Berlin. Int. Stud. Sparrows 32: 15–33.

Bokotey A.A., Gorban I.M. 2005. Numbers, distribution and ecology of the House Sparrow in Lvov (Ukraine). Int. Stud. Sparrows 30: 7–22.

Bower S. 1999. Fortpflanzungsaktivität, Habitatnutzung und Populationsstruktur eines Schwarms von Haussperlingen (*Passer d. domesticus*) in Hamburger Stadtgebiet. Hamb. avifaun. Beitr. 30: 91–128.

Brożek C. 1978. Ptaki cmentarza Rakowickiego w Krakowie. Przegl. Zool. 22: 63–74.

Chamberlain D.E., Fuller R.J., Shrubb M., Bunce R.G.H., Duckworth J.C., Garthwaite D.G., Impey A.J., Hart A.D.M. 1999. The effects of agricultural change on birds. BTO Res. Rep. 209.

Crick H.Q.P., Robinson R.A., Appleton G.F., Clark N.A., Rickard A.D. (eds). 2002. Investigation into the causes of the decline of starlings and house sparrows in Great Britain. BTO Res. Rep. 290.

Czwałga T. 1992. Awifauna lęgowa miasta Sulechowa w latach 1988–89. Lub. Przegl. Przyr. 3: 13–40.

Czyż S. 2008. Atlas ptaków lęgowych Częstochowy 2003–2007. Wyd. S. Czyż, Częstochowa.

de Laet J., Summers-Smith J.D. 2007. The status of the urban house sparrow *Passer domesticus* in north-western Europe: a review. J. Ornithol. 148: 275–278.
Dombrowski A., Łuczak J. 1998. Zgrupowania lęgowe ptaków w parkach Siedlec. Kulon 3: 151–184.
Donald P.F., Green R.E., Heath M.F. 2001. Agricultural intensification and the collapse of Europe's farmland bird populations. Proc. Royal Soc. London 268: 25–29.
Dulisz B., Zasitko E. 2008. Zmiany występowania wróbla *Passer domesticus* w różnych typach zabudowy w latach 1993–2007 pod wpływem modernizacji budynków. W: Indykiewicz P., Jerzak L., Barczak T. (red.). Fauna miast. Ochronić różnorodność biotyczną w miastach, ss. 103–114. Wyd. SAR „Pomorze", Bydgoszcz.
Dyrcz A., Grabiński W., Stawarczyk T., Witkowski J. 1991. Ptaki Śląska. Monografia faunistyczna. Uniwersytet Wrocławski.
Engler B., Bauer H.-G. 2002. Dokumentation eines starken Bestandsrückgangs beim Haussperling (*Passer domesticus*) in Deutschland auf Basis von Literaturangaben von 1850–2000. Vogelwarte 41: 196–210.
Erskine A.J. 2006. Recent declines of House Sparrows, *Passer domesticus*, in Canada's maritime provinces. Can. Field Nat. 120: 43–49.
Everaert J., Bauwens D. 2007. A possible effect of electromagnetic radiation from Mobile Phone Base Stations on the number of breeding House Sparows (*Passer domesticus*). Electromagn. Biol. Med. 26: 63–72.
Fijewski Z. 1998. Ptaki Parku im. Tarnowskich w Końskich. Kulon 3: 89–93
Flousek J., Gramsz B. 1999. Atlas hnízdního rozšíření ptákù Krkonoš (1991–94). Správa Krkonošského národního parku, Vrchlabí.
Górski W. 1982. Ptaki lęgowe Słupska i obszarów podmiejskich. Acta Zool. Cracov. 26: 31–93.
Górski W., Górska E. 1974. Porównawcze badania ilościowe nad ptakami Darłowa i Sławna. Not. Orn. 15: 105–113.
Górski W., Górska E. 1979. Ilościowe badania lęgowej awifauny Poznania i Koszalina w roku 1972. Acta Ornithol. 16: 1–17.
Grochowski T., Szlama D. 2010. Zmiany składu awifauny Parku im. Chrobrego w Gliwicach w latach 1974–2005. Ornis Pol. 51: 296–301.
Havlíček J. 2011 msc. Příčiny úbytku vrabce domácího v rùzných typech sídel – biotop? hnízdiště? potrava? Praca licencjacka, Południowoczeski Uniwersytet w Czeskich Budziejowicach.
Jabłoński P. 1982. Ptaki parku w Puławach w 1977 r. Not. Orn. 23: 47–54.
Jermaczek A., Jermaczek D., Filipczak K. 1990. Ptaki lęgowe miasta Świebodzina w latach 1988–1989. Lub. Przegl. Przyr. 1: 3–34.
Jędraszko-Dąbrowska D., Kucińska E., Gortat T., Górecki G., Brzeziński M. 2008. Czynniki kształtujące różnorodność zespołu ptaków Parku Wilanowskiego w Warszawie. W: Indykiewicz P., Jerzak L., Barczak T. (red.). Fauna miast. Ochronić różnorodność biotyczną w miastach, ss. 68–77. Wyd. SAR „Pomorze", Bydgoszcz.
Kasprzyk K. 1993. Badania ilościowe lęgowej awifauny nowych dzielnic mieszkaniowych w Toruniu. Acta Univ. Nic. Cop., Biol. 84: 127–143.
Kasprzykowski Z., Łuczak J. 2000. Awifauna lęgowa cmentarzy w Siedlcach. Kulon 5: 69–79.
Kopij G. 1995. Ptaki miasta Prudnika. Przyr. Śląska Opol. 1: 12–17.
Kopij G. 2004. Zespół ptaków lęgowych dzielnicy willowej Sępolna we Wrocławiu. Ptaki Śląska 15: 121–127.
Kopij G. 2005. Ptaki lęgowe Starego Miasta we Wrocławiu. Zesz. Nauk. AR Wrocław, Zootechnika 53: 1–9.
Kopij G. 2006. Zespół ptaków lęgowych centrum Nysy. Przegl. Przyr. 17: 79–86.
Kopij G. 2007. Zespół ptaków lęgowych parku miejskiego w Nysie. Przyr. Śląska Opol. 13: 27–29.
Kopij G. 2010. Zespół ptaków lęgowych Parku Południowego we Wrocławiu. Zesz. Nauk. Uniw. Przyr. Wrocław, Biologia i hodowla zwierząt 61: 81–85.
Kopij G., Wolanin J. 2010. Awifauna lęgowa Nysy. Przyr. Śląska Opol. 16: 1–21.
Kopij G., Zendwalewicz M. 2009. Ptaki Ogrodu Botanicznego we Wrocławiu. Zesz. Nauk. Uniw. Przyr. Wrocław, Biologia i hodowla zwierząt 58: 105–119.
Kuczyński L., Chylarecki P. 2012. Atlas pospolitych ptaków lęgowych Polski. Rozmieszczenie, wybiórczość siedliskowa, trendy. GIOŚ, Warszawa.

Kulczycki A., Mazur-Gierasińska M. 1968. Nesting of House Sparrow *Passer domesticus* (Linnaeus, 1758). Acta Zool. Cracov. 13: 231–250.
Kuźniak S. 1996. Atlas ptaków lęgowych Leszna w latach 1990–1993. Prace Zakł. Biol. i Ekol. Ptaków UAM 6.
Lontkowski J. 1989. Ptaki wróblowe (*Passeriformes*) północno-zachodniej części Wrocławia (z uwzględnieniem badań ilościowych metodą kartograficzną). Ptaki Śląska 7: 40–81.
Lorek G. 1992. Awifauna lęgowa miasta Ponieca. Lub. Przegl. Przyr. 3: 3–10.
Luniak M. 1974. Ptaki biotopów parkowych w małych miastach środkowo-wschodniej Polski. Acta Ornithol. 14: 99–143.
Luniak M. 1981. The birds of the park habitats in Warsaw. Acta Ornithol. 18: 335–370.
Luniak M. 1994. The development of bird communities in new housing estates in Warsaw. Memorabilia Zool. 49: 257–267.
Luniak M., Jabłoński P., Marczak P. 1986. Ptaki parku Łazienki Królewskie (Warszawa) w latach 1954–84. Acta Ornithol. 22: 23–50.
Luniak M., Kozłowski P., Nowicki W., Plit J. 2001. Ptaki Warszawy 1962–2000. IGiPZ PAN, Warszawa.
Luniak M., Lesisz M., Marciński A., Nowicki W. 2007. Ptaki Parku Skaryszewskiego w Warszawie w latach 1957–2006. Not. Orn. 48: 92–105.
Marczak P. 1983. Awifauna lęgowa Ogrodu Botanicznego Uniwersytetu Warszawskiego w roku 1980. Not. Orn. 24: 90–92.
Markowski J. 2009. Wróbel *Passer domesticus*. W: Janiszewski T., Wojciechowski Z., Markowski J. (red.). Atlas ptaków lęgowych Łodzi, ss. 248–249. Wyd. Uniw. Łódzkiego.
Mitschke A., Mulsow R. 2003. Düstere Aussichten für einen häufigen Stadtvogel – Vorkommen und Bestandsentwicklung des Haussperlings in Hamburg. Artenschutzreport (Sonderheft) 14: 4–12.
Mizera T. 1988. Badania ekologiczne synantropijnej awifauny dzielnicy Sołacz w Poznaniu w latach 1975–1984. Acta Zool. Cracov. 31: 3–64.
Moss S. 2001. The Fall of the Sparrow. BBC Wildlife, Nov 2001.
Newton I. 2004. The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. Ibis 146: 579–600.
Nowakowski J.J., Dulisz B., Lewandowski K. 2006. Ptaki Olsztyna. Pracownia Wyd. „Elset", Olsztyn.
Nowicki W. 1992. Zmiany awifauny lęgowej parków Warszawy (1975–1985) oraz zastosowanie skrzynek lęgowych dla jej kształtowania. Acta Ornithol. 27: 65–92.
Olsen P., Weston M., Cunningham R., Silcocks A. (eds). 2003. The state of Australia's birds 2003. Wingspan 13, suppl.
Orłowski G., Martini K., Martini M. 2006. Awifauna południowo-zachodniej części Wrocławia. Ptaki Śląska 16: 17–70.
Peach W.J., Vincent K.E., Fowler J.A., Grice P.V. 2008. Reproductive success of house sparrows along an urban gradient. Anim. Conserv. 11: 493–503.
Ptaszyk J. 2003. Ptaki Poznania – stan jakościowy i ilościowy oraz jego zmiany w latach 1850–2000. Wyd. UAM, Poznań.
Rand A.L. 1956. Changes in English Sparrow population densities. Wilson Bull. 68: 69–70.
Raven M.J., Noble D.G., Baillie S.R. 2005. The Breeding Bird Survey 2004. Report 10.
Reif J., Štastný K., Telenský T., Bejček V. 2009. Srovnání změn početnosti hojných druhů ptáků zjištěných na základě sítového mapování s údaji z jednotného programu sčítání ptáků v České republice. Sylvia 45: 137–150.
Robinson R.A., Siriwardena G.M., Crick H.Q.P. 2005. Size and trends of the House Sparrow *Passer domesticus* population in Great Britain. Ibis 147: 552–562.
Sanderson R.F. 1996. Autumn bird counts in Kensington Gardens. London Bird Report 60: 170–176.
Stój M., Dyczkowski J. 2002. Ptaki Jasła – liczebność, rozmieszczenie i ochrona. Bogucki Wyd. Nauk., Poznań.
Summers-Smith J.D. 2003. Decline of the House Sparrow: a review. Brit. Birds 96: 439–446.
Tomek T. 1969. Ptaki Parku im Dra Jordana w Krakowie w latach 1964–1967. Przegl. Zool. 13: 334–346.
Tomiałojć L. 1970. Badania ilościowe nad synantropijną awifauną Legnicy i okolic. Acta Ornithol. 12: 294–392.

Tomiałojć L. 1980. Kombinowana odmiana metody kartograficznej do liczenia ptaków lęgowych. Not. Orn. 21: 33–54.
Tomiałojć L. 1992. Czy wyniki z metody kartograficznej są porównywalne pomiędzy oddzielnie pracującymi, niedoświadczonymi obserwatorami? Not. Orn. 33: 131–140.
Tomiałojć L. 2007. Zmiany awifauny lęgowej w dwóch parkach Legnicy po 40 latach. Not. Orn. 48: 232–245.
Tomiałojć L. 2010. Niezrozumienie zasad opisywania ilościowego zespołów ptaków lęgowych. Ornis Pol. 51: 285–295.
Tomiałojć L. 2011. Changes in breeding bird communities of two urban parks in Wrocław across 40 years (1970–2010): before and after colonization by important predators. Ornis Pol. 52: 1–25.
Väisänen R.A., Solonen T. 1997. Population trends of 100 winter bird species in Finland in 1957–1996. In: Solonen T., Lammi E. (eds). Linnut-vuosikirja 1996, ss. 70–97. Helsinki.
Vincent K.E. 2005. Investigating the causes of the decline of the urban House Sparrow *Passer domesticus* population in Britain. PhD thesis, De Montfort University.
Węgrzynowicz A. 2012. The use of nest-boxes by two species of Sparrows *Passer domesticus* and *P. montanus* with opposite trends of abundance – the study in Warsaw. Int. Stud. Sparrows 36: 18–29.
Węgrzynowicz A. 2012a. Importance of nest sites availability for abundance and changes in number of House and Tree Sparrow in Warsaw. Int. Stud. Sparrows 36: 56–65.
Węgrzynowicz A. 2013 msc. Zmiany liczebności i uwarunkowania ekologiczne populacji wróbli *Passer domestucus* i *Passer montanus* w Warszawie. Rozprawa doktorska, Muzeum i Instytut Zoologii PAN, Warszawa.
Wilniewczyc P. 1997. Ptaki lęgowe parku im. Staszica w Kielcach wraz z przyległymi terenami zielonymi. Kulon 1: 47–51.
Wysocki D. 1995. Wstępne wyniki badań ilościowych awifauny Parku Żeromskiego w Szczecinie. Przegl. Przyr. 6: 77–81.
Wysocki D. 2001. Badania ilościowe awifauny Parku Żeromskiego w Szczecinie. W: Indykiewicz P., Barczak T., Kaczorowski G. (red.). Bioróżnorodność i ekologia populacji zwierzęcych w środowiskach zurbanizowanych, ss. 197–200. Wyd. NICE, Bydgoszcz.
Zalewski A., Przystalski A. 1993. Badania ilościowe awifauny lęgowej terenów zielonych w Toruniu w latach 1987–1989. Acta Univ. Nic. Cop., Biologia 43: 105–124.
Zieliński J. 2001. Awifauna lęgowa małych parków i cmentarzy w Bydgoszczy. W: Indykiewicz P., Barczak T., Kaczorowski G. (red.). Bioróżnorodność i ekologia populacji zwierzęcych w środowiskach zurbanizowanych, ss. 201–205. Wyd. NICE, Bydgoszcz.
Zieliński J. 2004. Awifauna lęgowa trzech terenów zielonych w Bydgoszczy. Przegl. Przyr. 15: 63–73.

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