A Comparison of Common Breeding Bird Populations in Hamburg, Berlin and Warsaw

Authors: Witt, Klaus, Mitschke, Alexander, and Luniak, Maciej

Source: Acta Ornithologica, 40(2) : 139-146

Published By: Museum and Institute of Zoology, Polish Academy of Sciences

URL: https://doi.org/10.3161/068.040.0209

ACTA ORNITHOLOGICA
Vol. 40 (2005) No. 2

A comparison of common breeding bird populations in Hamburg, Berlin and Warsaw

Klaus WITT[1], Alexander MITSCHKE[2] & Maciej LUNIAK[3]

[1]Hortensienstrasse 25, D-12203 Berlin, GERMANY, e-mail: Klaus.Witt@gmx.de
[2]Hergartweg 11, D-22559 Hamburg, GERMANY, e-mail: AMitschke@aol.com
[3]Museum and Institute of Zoology, Wilcza 64, 00–679 Warszawa, POLAND, e-mail: luniak@miiz.waw.pl

Witt K., Mitschke A., Luniak M. 2005. Population densities of common breeding bird populations in Hamburg, Berlin and Warsaw. Acta Ornithol. 40: 139–146.

Abstract. Avifaunas of three large cities (Hamburg, Berlin and Warsaw) situated in the northern lowlands of Central Europe along an 850-km-long west-east line were compared. Estimates of several species' breeding populations in these cities were used to calculate their densities in the total area of breeding habitat in each city used by the species in question. The relationship of the densities of several common species was compared. Of 39 species analysed, 18 showed higher densities in Hamburg, 4 in Warsaw and 2 in Berlin. A gradient of increasing density from Warsaw to Berlin and Hamburg (Western gradient) was found for 16 species: *Columba palumbus*, *Troglodytes troglodytes*, *Prunella modularis*, *Turdus merula*, *T. philomelos*, *T. viscivorus*, *Sylvia atricapilla*, *Phylloscopus collybita*, *Ph. trochilus*, *Regulus regulus*, *R. ignicapillus*, *Garrulus glandarius*, *Parus cristatus*, *Certhia brachydactyla*, *Fringilla coelebs*, *Pyrrhula pyrrhula*. An opposite (Eastern) gradient was found for only 3 species: *Columba livia f. domestica*, *Oriolus oriolus* and *Passer domesticus*. Suggested causes for most of the larger differences among the three cities in the densities of particular species are the variation in the richness of vegetation (higher in both German cities) and differences in the stage of synurbization (i.e. adaptation to the urban environment) of specific avian species. In a few cases, factors such as the geographic range of a species, the attitude of humans (in the case of the Feral Pigeon), and specific, slight variations in habitat are put forward to explain the differences found.

Key words: urban avifauna, breeding bird densities, synurbization, Hamburg, Berlin, Warsaw

Received — June 2005, accepted — Nov. 2005

INTRODUCTION

There are a few papers which make comparisons of the avifaunas of entire cities on a species level (Witt 1980, Luniak 1990, Dinetti 1994, Konstantinov et al. 1996). A recent article analysed bird species diversity in different habitats of cities in the northern hemisphere by comparing species richness and community composition between periurban and urban landscapes by Clergeau et al. (2001). They found no effect of adjacent landscapes on species diversity of urban areas. All of these studies deal with the presence of species and not with their abundances. However, there are some new data available on populations in complete cities: from Hamburg, Berlin and Warsaw which could be investigated for possible dissimilarities of the abundance structure (Luniak et al. 2001, Mitschke & Baumung 2001, Otto & Witt 2002).

We wondered if it was possible to use information on population sizes to further differentiate between species common to all three cities? However in such comparisons, there are at least two problems which should be solved. First, a comparison by total numbers of territories of species is not valid because numbers vary for the different areas of the cities. Second, if densities for whole areas of the cities are calculated, they may be biased by different areas of habitat assemblages. Here, we try to find an answer to this problem using the areas of different city habitats in which the species predominantly live are known and allow calculation of gross densities of territories related to habitat.

The aims of this paper were: 1) to assess the general densities of several species in relation to their habitat in the three cities in order to explain the potential differences in terms of the impact of geographical (East-West gradient) or ecological factors on the avifauna; 2) to test the method of using density relations to conduct these types of comparisons.

CITIES STUDIED AND MATERIALS

The main sources of data for this study are recent monographs of the avifauna of Hamburg (Mitschke & Baumung 2001), Berlin (Otto & Witt 2002) and Warsaw (Luniak et al. 2001).

These three large cities extend along a geographic latitude of 52–54° N for about 850 km West to East (between 10° and 21° E) from Hamburg, near the mouth of the Elbe River, through the inland metropolis of Berlin at the confluence of the Spree and Havel Rivers, and to the inland site of Warsaw on the Vistula River. Their distance to the nearest Sea (North or Baltic) varies to some extent: Hamburg is 80 km from the North or Baltic Sea, Berlin is 170 km away, and Warsaw is 260 km from the Baltic Sea. Therefore, Hamburg has the most pronounced maritime influence with its more Atlantic climate whereas the continental climate gradually increases its presence from Berlin to Warsaw (Table 1). The sizes of all three cities vary by less than a factor of two. However, the statistics for gross habitat features show some divergence (Table 1) especially for the proportion of green areas (Warsaw with the least), forests (Hamburg with the least), farmland (Berlin with the least) and water estuaries (Warsaw with the least). In general, Warsaw's park vegetation and greenery in the built-up areas is the poorest among the three cities due to worse water conditions (lower precipitation, few water bodies), barren sandy soils, few old tree stands and also too intensive gardening in public areas. Since 1997 (Table 1) Warsaw has lost some farmland to new building developments, however, the data on the avifauna were collected mainly before these changes took place. Greenery forms a part of the built-up zone; however, this is treated as a separate category here as some avian species inhabit them more or less exclusively. The proportion of the densely built-up zone and number of inhabitants is largest in Berlin and lowest in Warsaw. However, the density of humans (calculated solely for the built-up zone) increases from Hamburg to Berlin to Warsaw. In all three cities nest-boxes are commonly used in green areas as a measure of bird conservation. Additional information on these three cities — their history, development and avifauna was recently published by Witt (2005), Mulsow (2005) and Luniak (2005) in the monograph "Birds in European cities" (Kelcey & Reinwald 2005).

All of these differences may influence the distribution and numbers of breeding bird species to some degree, especially for certain species of farmland, forest or wetlands, that find their special habitat in only one of the cities. However, this paper's main interest is to compare the situation of urban birds, which colonize at least part of the built-up zone. And for those species, the habitats they occupy are much more alike among the cities.

Estimates of the numbers of all breeding species were deduced from field work in all three cities. In the case of Hamburg, a complete atlas

Table 1. Comparison of the demographic and physiographic parameters of three cities. % — portion of the habitat type in the total area of the city.

Parameters	Hamburg (ca. 1995)	Berlin (2001)	Warsaw (1997)
Inhabitants (million)	1.8	3.4	1.6
density for the entire city area (per km^2)	2400	3800	3200
density for the built-up areas (per km^2)	4300	5400	6200
Total area (km^2)	747	892	494
built-up areas, including urban green areas (%)	56	70	52
green areas - parks, gardens, cemeteries etc. (%)	8	11	6
forest parks (%)	9	18	15
farmland (%)	27	5	29
bodies of water (%)	8	7	4
Climate			
mean January temp. (°C)	+0.3	-0.5	-3.4
mean July temp. (°C)	17.1	17.9	18.1
mean precipitation (mm per year)	729	596	505

was made based on estimating the total number of territories of a species per grid unit of 1 km^2 in 1997–2000 (Mitschke & Baumung 2001). Participants in the field work were asked to perform a complete census on a sub-area of a square in question and to estimate from here the total numbers for all species of that square.

In the case of Berlin, a complete atlas was mapped on the basis of the qualitative presence/absence of species per grid unit of about 1 km^2 in 1976–1984 (Ornithol. AG Berlin (West) 1984, Degen & Otto 1988). This was followed by a quantitative mapping on the basis of 26 ha grid units for 110 km^2 of the southwest portion of the city in 1989–1991 (Witt 1997). Participants censused numbers of territories for given numerical categories on each grid unit. Data on about 80 rarer species additionally were mapped for the whole city up to 1999. A complete survey of all quantitative data resulted in new estimates of the total numbers of all breeding species (Otto & Witt 2002).

For Warsaw (Luniak et al. 2001), an atlas project was carried out in 1986–1990, with considerable updating in 1999–2000. Instead of a regular grid system, an irregular shaped plot system related to the mosaics of habitat distribution in the city was used. Total numbers of species populations for the entire city were estimated by the addition of numbers (their ranges) from each plot. In spite of some differences in techniques of collecting data in the three cities the final results — estimation of the total population of particular species in each city, seem to be comparable.

The accuracy of the data may differ to some extent between cities investigated. For Hamburg no statement of an accuracy is given, however, the method may provide an uncertainty level of ± 20%. For Berlin total numbers are estimated in the range of ± 20% for less abundant species and up to ± 50% for the most abundant species and some colony breeders. Approximately the same is true in the case of Warsaw. Hence, comparisons have to cope with these uncertainties and differences may be discussed only if they exceed a factor of three, which avoids overlap of uncertainty ranges.

The literature does not provide examples of any similar studies in Europe. A background completing basic data of this work can be found in ornithological monographs of three other large cities situated along the same East-West axis — Poznań (Ptaszyk 2003), Brussels (Rabosee 1995, Weiserbs & Jacob 2005), London (Hewlett 2002), and additionally from Bonn (Rheinwald 2005) and Lublin (Biaduń 2004, 2005) — a city of 400 thousand inhabitants which is situated 160 km SE from Warsaw. However, these papers do not provide the quantitative data required to conduct a comparison using the method proposed above.

METHODS

To compare the totals of each species of the three cities, the effect of the different amounts of inhabited areas must be discarded. Therefore, densities need to be calculated. A first test for overall densities for the entire area of a city did not work well in all cases, especially where a species selectively used only certain parts of the city. Therefore species' densities were calculated for some sub-areas (areas with particular types of habitats) of the city where there was sufficient knowledge about such use. Four groups of bird species were distinguished according to their breeding occurrence in particular assemblages of habitats (Table 2).

The city with the widest distribution of a species was used to select a habitat structure valid for all three cities. In the case of building-breeders with a wide distribution in farmland villages, such as House Martin *Delichon urbica* or Black Redstart *Phoenicurus ochruros*, only the area of the built-up zone (excluding the farmland area) was used for density calculations, assuming that all buildings were included in the statistics of the built-up area. Bird species that only breed in forests or farmland are excluded from consideration, as these are not typical urban species. No calculations could be made for waterfowl, because densities based solely on the area of water cannot describe

Table 2. Total areas (km$^{2)}$ of habitat assemblages used to calculate bird populations densities in studied species. Classification of species into particular group — see Table 3.

Groups of species	Habitat assemblages	Hamburg	Berlin	Warsaw
Land birds with wide habitat distribution	Total city area without bodies of water	686	833	475
Birds specific to built-up areas	Built-up zone + urban green areas	420	627	259
Forest birds also inhabiting urban green areas	Forests + urban green areas	126	260	101
Farmland birds also inhabiting the built-up areas	Farmland + built-up zone	620	674	402

sufficiently well the wide diversity of water habitats found in the three cities.

The types of habitat distinguished here are not in themselves homogeneous. The habitat gradient of the built-up zone ranges from districts of single-houses to housing estates with large apartment buildings, heavily built-up central zones and industrial areas with a wide differentiation in greenery. However, the gross feature is quite comparable for all three cities. Densities of species calculated from such large areas are taken as means from the heterogeneity of habitat. A second factor of variance is the uncertainty of total numbers. As discussed in the previous chapter the estimated uncertainty level of up to ± 50% for total numbers are valid also for relational scales between the three cities. Such relational scales are calculated as follows:

1) assign a species to one of the habitat types named in Table 2;
2) take the mean total number of that species for each city and divide it by the relevant habitat area to find the density;
3) divide the density of the species in each city by the smallest density of that species from all cities to get a density ratio with a minimum factor of 1. If a zero occurs in one of the cities, the division is done with the smallest value larger than zero.

RESULTS AND DISCUSSION

The main results of the work include the densities of different bird species calculated as territories/km^2 and the relational scale of numerical occurrence of the species in the three cities. Four groups of birds were analysed (Table 3).

Land birds with wide habitat distribution

Most species in this group, which is distributed over the whole land area of a city, showed a strong preference for Hamburg with the lowest position in Warsaw. Densities in Berlin are on an intermediate level, but in almost all cases they are closer to Hamburg than to Warsaw. Nearly all of the species (an exception is the Chiffchaff *Phylloscopus collybita*) showing this gradient of density are bush- and tree-breeders. Their higher abundance in Hamburg, and lowest in Warsaw, could be to some degree explained by the richness of vegetation (see section "Materials"), which translates into favourable nest and foraging sites for these birds.

The Western gradient of increasing densities of the Blackbird *Turdus merula*, Wren *Troglodytes troglodytes*, Wood Pigeon *Columba palumbus*, Dunnock *Prunella modularis*, Song Thrush *Turdus philomelos*, Mistle Thrush *Turdus viscivorus*, Short-toed Treecreeper *Certhia brachydactyla* and Jay *Garrulus glandarius* is also well-known evidence of a more advanced process of synurbization (i.e. adaptation to urban environment, Luniak 2004) of these species in Western Europe (Glutz von Blotzheim & Bauer 1985–1997). Data from Brussels (Rabose 1995, Weiserbs & Jacob 2005) and London (Hewlett 2002) in the West, and Lublin in SE (Biaduń 2004, 2005), confirm such gradient, in respect with these species. The phenomenon of synurbization of the Wood Pigeon in Europe was described by Tomiałojć (1980) and that of the Blackbird — by Luniak et al. (1990). In the case of the Treecreeper, old tree stands (Hamburg and Berlin) in urban parks, could also play a role.

As concerns the Dunnock, its preference for an Atlantic climate — moderately cool climate with relatively high precipitation (Glutz von Blotzheim & Bauer 1985) — is probably a factor influencing its high density in Hamburg. This is confirmed by data from London, where the Dunnock occurs commonly (Hewlett 2002) and from Lublin — where it is practically absent as a breeding species (Biaduń 2004, 2005). The case of the Bullfinch *Pyrrhula pyrrhula*, is not clear, as it is a species with boreal preferences (Glutz von Blotzheim & Bauer 1997). It has a high density in Hamburg, and London as well, but it has a very limited distribution in Brussels, which suggests, as with the Dunnock, a hypothesis about a preference for the Atlantic climate (Rabose 1995, Hewlett 2002).

Only one species in this group of birds, the Oriole *Oriolus oriolus*, showed a distinct dominance in Warsaw. Its Eastern gradient is confirmed by data from Poznań and Lublin (Ptaszyk 2003, Biaduń 2004, 2005), where this bird commonly breeds, and from Brussels, Bonn and London in the West, where its breeding was not proved (Rabose 1995, Hewlett 2002, Rheinwald 2005, Weiserbs & Jacob 2005).

Species specific to built-up areas

They nest predominantly in buildings. An exceptional concentration is found in Warsaw for three species. The House Sparrow *Passer domesticus* is a much discussed species because of its decline in some parts of Western Europe (e.g. Summers-Smith 2003). The lowest density in

Hamburg is consistent with this trend, as Mitschke & Mulsow (2003) found decreases of 75% in House Sparrows on census plots in Hamburg from the 1960s to the end of the 1990s. In Berlin, no overall decreases were found during the last decade and high densities in the built-up zone have actually been documented (Böhner et al. 2003). The highest density of the House Sparrow in Warsaw could be an artefact caused by the lack of current data, because this species was last censused there at the end of the 1980s. Provisional estimations from 2005 (data of A. Węgrzynowicz) suggest that the present population of the House Sparrow in this city seems to be smaller now than in the past, but its decrease is definitely not so deep as it is in London (e.g. Summers-Smith 2003) and Hamburg. Some decrease of the House Sparrow is also reported from cities East of Warsaw — Lublin (Biaduń 2004) and Moscow (Konstantinov & Zakharov 2005).

Table 3. Comparison of densities in distinguished groups of species. Species in each group are ranked according to their highest density in one of the three cities.

Groups of species	Population densities (territories/km^2)			Density ratio (:1)		
	Hamburg	Berlin	Warsaw	Hamburg	Berlin	Warsaw
Widely distributed land birds						
Turdus merula	102	60	16	6.4	3.8	1
Parus caeruleus	45	54	9	5	6	1
Parus major	53	1	19	2.8	2.2	1
Sturnus vulgaris	19	36	32	1	1.9	1.7
Troglodytes troglodytes	26	1.3	0.2	130	7	1
Columba palumbus	25	18	2	12	9	1
Phylloscopus collybita	24	2	4	12	1	2
Fringilla coelebs	21	6	12	3.5	1	2
Prunella modularis	20	0.3	0.4	67	1	1.3
Erithacus rubecula	18	7	6	3	1.2	1
Sylvia atricapilla	17	5	4	4.3	1.3	1
Turdus philomelos	7	2	1	7	2	1
Pyrrhula pyrrhula	5	0.007	0.04	700	1	6
Garrulus glandarius	4	1.1	0.6	7	2	1
Certhia brachydactyla	2.7	1.0	0.2	14	5	1
Turdus viscivorus	1.7	0.001	0.02	1700	1	20
Oriolus oriolus	0.07	0.16	0.84	1	2.2	12
Birds specific to built-up areas						
Passer domesticus	70	220	390	1	3	5.6
Columba livia f. urbana	25	40	170	1	1.6	7
Corvus monedula	1	0.2	46	6	1	230
Apus apus	13	21	17	1	1.5	1.3
Delichon urbica	6	13	8	1	2	1.3
Phoenicurus ochruros	4	8	4	1	2	1
Forest birds also inhabiting urban green areas						
Phylloscopus trochilus	36	8	15	4.5	1	2
Sitta europaea	14	14	4	3.5	3.5	1
Regulus regulus	11	0.2	0.2	55	1	1
Ficedula hypoleuca	4	7	4	1	1.8	1
Parus atricapillus	6	0.8	0.5	12	1.6	1
Regulus ignicapillus	5	0.01	0	50	1	0
Coccothraustes coccothraustes	4	2	4	2	1	2
Parus cristatus	3.6	1.2	0.7	5	1.7	1
Picus viridis	0.3	0.3	0.2	1.5	1.5	1
Farmland birds also inhabiting built-up areas						
Carduelis chloris	29	62	4	7	16	1
Pica pica	12	6.4	10	1.9	1	1.6
Corvus corone cornix/corone	7	7	3	2.3	2.3	1
Sylvia curruca	3.5	4	5	1	1	1.3
Motacilla alba	5	0.4	1.5	13	1	4
Hippolais icterina	1	2	3	1	2	3
Carduelis cannabina	1	0.2	1.5	5	1	7.5

The high density of the Feral Pigeon *Columba livia f. urbana* in Warsaw may be connected to human attitude. The species is well tolerated by the public in this city, and even its nesting on balconies and attics is often allowed, whereas Feral Pigeons are much more often persecuted in German cities. The reason for the extreme dominance of Jackdaws *Corvus monedula* in Warsaw is not clear — it could be connected with favourable nest sites in empty spaces under the roofs of apartment buildings. Among the remaining species in this group that showed no significant density differences, the House Martin in Hamburg was strongly concentrated in farmland villages, whereas in Berlin and Warsaw it was much more widespread in the typical built-up zone of the inner city and in areas of high-rise buildings.

Forest birds also inhabiting green areas

The occurrence of these birds in the built-up zone is restricted to green habitats, mostly in parks and cemeteries. In the majority of species, the highest densities were found in Hamburg, with an astonishingly high dominance of Goldcrest *Regulus regulus* and Firecrest *Regulus ignicapillus*. This may be due to a higher proportion of Spruce *Picea abies* in that city, a tree preferred by both species (e.g. Glutz von Blotzheim & Bauer 1991). However, spruces are common in Berlin as well. Hamburg is near the western border of the Firecrest's geographic distribution while Warsaw and Lublin are near its eastern border (Marchant in Hagemeijer & Blair 1997). The Firecrest indeed does not breed in the last two cities. In London it is a rare species, whereas the Goldcrest is widely distributed in that city, so the Atlantic climate may be a significant factor for this species.

The higher density of Willow Warblers *Phylloscopus trochilus* in Hamburg than in both of the other cities may be assigned to a better habitat structure of birch *Betula* woods and the semi-open landscape of the Elbe River marshes there. It is unclear whether habitat structure also explains the preference for Hamburg by the Marsh Tit *Parus palustris* and Crested Tit *Parus cristatus*. Similarities of habitat use with that of the Goldcrest may be suspected for the Crested Tit. However, Hamburg dominates by less than a factor of 10, which may be due to a greater variety of habitats used by the Crested Tit. The low density of the Nuthatch *Sitta europaea* in Warsaw is probably due to the young age of tree stands there.

Farmland birds also inhabiting the built-up zone

This group is much less differentiated among the three cities than in the case of birds originating from forests. Only three species — the Greenfinch *Carduelis chloris*, Pied Wagtail *Motacilla* alba and Linnet *Carduelis cannabina* — show significant variation of densities. Differences of their occurrence in the three cities are probably caused by the micro-structure of habitats used by the particular species, not by factors of a geographic character.

CONCLUSIONS

1. Using the density of a particular species in its specific habitat type, estimated for the scale of an entire city, seems to be a useful method for comparing the common elements of various cities' avifauna. The main condition of application of this method are reliable data on the total population of particular bird species in each of the cities compared, independently of the field method which was used to obtain such data.
2. This type of analysis indicated a number of significant differences in the breeding occurrence of several species among the three cities compared. Of the 39 species analysed in this study, 18 species showed significantly higher densities in Hamburg, 4 in Warsaw and 2 in Berlin.
3. The gradient of increasing density from Warsaw to Berlin and Hamburg (Western gradient), was found for 16 species: *Columba palumbus*, *Troglodytes troglodytes*, *Prunella modularis*, *Turdus merula*, *T. philomelos*, *T. viscivorus*, *Sylvia atricapilla*, *Phylloscopus collybita*, *Ph. trochilus*, *Regulus regulus*, *R. ignicapillus*, *Garrulus glandarius*, *Parus cristatus*, *Certhia brachydactyla*, *Fringilla coelebs*, *Pyrrhula pyrrhula*. An opposite (Eastern) gradient was found for only 3 species: *Columba livia f. domestica*, *Oriolus oriolus* and *Passer domesticus*.
4. Among the considered causes of higher densities in particular cities are:

a) A greater richness of vegetation in Hamburg and Berlin, as a result of higher precipitation (Atlantic climate, abundance of water bodies) and soil conditions, older tree stands and a more nature-friendly maintenance of urban green areas. These factors probably affect all the species showing a Western gradient of increasing densities.

b) Stage of synurbization (adaptation to urban environment) of populations of particular species inhabiting the three cities. This factor is probably secondary to the richness of vegetation, which is a favourable condition required by rural species colonizing cities. The most distinct examples of the synurbization gradient indicated in this study are: *Columba palumbus*, *Troglodytes troglodytes*, *Prunella modularis*, *Turdus merula*, *T. philomelos*, *T. viscivorus*, *Garrulus glandarius*.

c) A more tolerant attitude of humans is probably a factor influencing differences in the density of the Feral Pigeon between Warsaw and both German cities.

d) The species' geographic range could be the cause of differences in the occurrence of *Regulus regulus*.

e) Various specific elements in the habitat and its structure could be among the causes of significant differences found in the cases of *Sitta europaea* and *Certhia brachydactyla* (old tree stands), *Phylloscopus trochilus* (birch and willow woods), *Regulus regulus* and *R. ignicapillus* (stands of Spruce). These types of factors could also affect *Motacilla alba*, *Carduelis chloris* and *C. cannabina*.

REFERENCES

Biaduń W. 2004. [Birds of Lublin]. Wyd. Akademii Medycznej, Lublin.

Biaduń W. 2005. Lublin. In: Kelcey J. G., Rheinwald G. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 171–196.

Böhner J., Schulz W., Witt K. 2003. Bestand und lebensraumspezifische Dichten des Haussperlings in Berlin. Artenschutzreport (Sonderheft) 14: 13–17.

Clergeau P., Jokimäki J., Savard, J.-P. L. 2001. Are urban bird communities influenced by the bird diversity of adjacent landscapes? J. Appl. Ecol. 38: 1122–1134.

Degen G., Otto W. 1988. Atlas der Brutvögel von Berlin. Naturschutzarbeit Berlin Brandenburg, Beiheft 8.

Dinetti M. 1994. The urban ornithology in Italy. Memorabilia Zool. 49: 269–281.

Glutz von Blotzheim U., Bauer K. M. 1985–1997. Handbuch der Vögel Mitteleuropas Bd. 10–14. AULA, Wiesbaden.

Hagemeijer W. J. M., Blair M. J. (eds). 1997. The EBCC atlas of European breeding birds: their distribution and abundance. London. T&AD Poyser.

Hewlett J. (ed.). 2002. The breeding birds of the London area. London.

Kelcey J. G., Rheinwald G. 2005. (eds). Birds in European cities. Ginster Verl., St. Katharinen.

Konstantinov V. M., Nowicki W., Pichurin A. G. 1996. Recent changes in the avifauna of cities in European Russia and Eastern Poland — results of a questionnaire. Acta Ornithol. 31: 59–66.

Konstantinov V. M., Zakharov R. 2005. Moscow. In: Kelcey J. G., Rheinwald G. 2005. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 197–214.

Luniak M. 1990. Avifauna of cities in Central and Eastern Europe — results of the international inquiry. In: Luniak M. (ed.). Urban ecological studies in Central and Eastern Europe. Ossolineum, Wrocław, pp. 131–149.

Luniak M. 2004. Synurbization — adaptation of animal wildlife to urban development. In: Shaw W. W., Harris L. K., VanDruff L. (eds). Urban wildlife conservation, Proc. 4th International Symp., Univ. of Arizona, Tucson, pp. 50–55.

Luniak M. 2005. Warsaw. In: Kelcey J. G., Rheinwald G. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 389–415.

Luniak M., Kozłowski P., Nowicki W., Plit J. 2001. [Birds of Warsaw 1962–2000]. Warszawa.

Luniak M., Mulsow R., Walasz K. 1990. Urbanization of the European Blackbird — expansion and adaptation of urban population. In: Luniak M. (eds). Urban ecological studies in Central and Eastern Europe. Ossolineum, Wrocław, pp. 187–200.

Mitschke, A., Baumung, S. 2001. Brutvogel-Atlas Hamburg, Hamb. Avifaunist. Beitr. 31.

Mitschke A., Mulsow R. 2003. Düstere Aussichten für einen häufigen Stadtvogel — Vorkommen und Bestandsentwicklung des Haussperlings in Hamburg. Artenschutzreport, (Sonderheft) 14: 4–12.

Mulsow R. 2005. Hamburg. In: Kelcey J. G., Rheinwald G. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 127–151.

Ornithol. AG Berlin (West) 1984. Brutvogelatlas Berlin (West). Ornithol. Ber. f.- Berlin (West) 9, Sonderheft.

Otto W., Witt K. 2002. Verbreitung und Bestand Berliner Brutvögel, Berl. Ornithol. Ber. 12, Sonderheft.

Ptaszyk J. 2003. [Birds of Poznań — their qualitative and quantitative condition and its changes in the period 1850–2000]. Wyd. Naukowe UAM, Poznań.

Rabosee D. 1995. Atlas des oiseaux nicheurs de Bruxelles 1989–1991. Soc. d'Etudes Ornithol. Aves. Liege.

Reinwald G. 2005. Bonn. In: Kelcey J. G., Rheinwald G. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 41–54.

Summers-Smith J. D. 2003: Sparrows in the United Kingdom – decline and fall? Artenschutzreport (Sonderheft) 14: 17–20.

Tomiałojć L. 1976. The urban population of the Wood Pigeon, *Columba palumbus* Linneaus 1758, in Europe — its origin, increase and distribution. Acta Zool. Cracov. 21: 585–631.

Weiserbs A., Jacob J.-P. 2005. Brussels. In: Kelcey J. G., Rheinwald G. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 81–101.

Witt K. 1997. Halbquantitative Brutvogeldichten im 26 ha-Gitternetz für 11000 ha o in Berlin mit Bezug zu Lebensraumtypen. Berl. Ornithol. Ber.7: 119–204.

Witt K. 2005. Berlin. In: Kelcey J. G., Rheinwald G. (eds). Birds in European cities. Ginster Verl., St. Katharinen, pp. 17–39.

STRESZCZENIE

[Porównanie zagęszczenia populacji pospolitych ptaków lęgowych Hamburga, Berlina i Warszawy]

Podstawą opracowania są dane z aktualnych monografii awifauny Hamburga (Mischke & Baumung 2001), Berlina (Otto & Witt 2002) i Warszawy (Luniak et al. 2001). Te trzy miasta (Tab. 1) leżą wzdłuż osi wschód — zachód na przestrzeni 850 km w pasie szerokości geograficznej (52°–54°N).

W przeprowadzonym porównaniu wykorzystano zawarte w w/w monografiach dane o ogólnej liczebności populacji poszczególnych gatunków oraz powierzchni odpowiednich dla nich środowisk w danym mieście. Wyróżniono tu cztery grupy gatunków (Tab. 2 i 3): 1) — lądowe o najszerszym rozmieszczeniu środowiskowym w całym mieście; 2) — specyficzne dla terenów zabudowy; 3) — leśne zamieszkujące też tereny zielone; 4) — ptaki środowisk wiejskich wy-stępujące też na terenach zabudowy. Jako podstawę zaliczenia gatunku do grupy przyjęto dane z miasta, gdzie ten gatunek był wykazywany jako lęgowy w najszerszej gamie środowisk. Podstawą porównania była ogólna liczebność danego gatunku w poszczególnych miastach podzielona przez obszar odpowiednich dla niego makro-środowisk (liczba terytoriów/km^2). Następnie przeprowadzono porównanie tych wartości zagęszczeń przyjmując jako "1" wynik najniższy spośród trzech miast. Ze względu na niedokładności danych wyjściowych w pracy zajęto się różnicami występowania tylko tych gatunków, które wykazały ponad trzykrotną różnicę współczynnika zagęszczenia.

Spośród 39 analizowanych gatunków 18 wykazało istotnie wyższe zagęszczenia w Hamburgu, 4 gatunki — w Warszawie (gołąb miejski, wilga, kawka, wróbel) i 2 w Berlinie. Zachodni (od Warszawy do Hamburga) gradient wzrostu zagęszczenia wykazało 16 gatunków: grzywacz, strzyżyk, pokrzywnica, kos, drozd śpiewak, paszkot, pokrzewka czarnołbista, pierwiosnek, piecuszek, mysikrólik, zniczek, sójka, sikora czubatka, pełzacz ogrodowy, zięba, gil. Przeciwny (wschodni) gradient wykazały tylko 3 gatunki: gołąb miejski, wilga i wróbel. Stwierdzone różnice występowania można wiązać w największym stopniu z bogatszą roślinnością Hamburga i Berlina w stosunku do Warszawy. Ten czynnik, sprzyjający osiedlaniu się ptaków w mieście stymuluje procesy synurbizacji, których zaawansowanie u większości analizowanych gatunków wykazuje gradient zachodni. Wysokie zagęszczenie gołębia miejskiego w Warszawie, w porównaniu do obu miast niemieckich znajduje uzasadnienie w różnicach stosunku ludzi do tego ptaka. Zróżnicowanie występowania mysikrólika wiąże się z zasięgiem geograficznym gatunku. Stwierdzone różnice występowania kilku innych gatunków zależą zapewne w dużym stopniu od mikrostruktury środowisk.

Wyniki pracy, zdaniem autorów, potwierdzają przydatność zastosowanej metody dla podobnych porównań, jeśli dostępne są dane o całkowitej liczebności populacji poszczególnych gatunków i powierzchni zasiedlanych przez nie środowisk.