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Birds of allotment gardens in Warsaw

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The main factors influencing the avifauna were the development of vegetation and breeding places for hole nesting species. The richest avifauna was recorded in gardens at the stabilized stage, which is reached about 20 years after establishing a garden. In such gardens there nested 13–16 species (83–118 per/10 ha) and in winter there occur 11–14 species (56–190 ind./ /10 ha). The size of the area (from 3–8 ha), the situation of a garden and differences of the frequency of people ned no considerable influence on the breeding avifauna composition. It was found out that the character of the avifauna of allotments is distinctly urban.

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Птицы садово-огородных участков в Варшаве

Исследовали гнездовую авифауну в 10-ти садово-огородных участках и зимующую авифауну на 7-ми участках различного возраста, а также на двух территориях бывших садово-огородных участков, превращенных в парки. Главным фактором, определяющим авифауну, было развитие растительности и наличие гнездовий для дуплогнезников. Наиболее богатой авифауной отличались стабилизированные участки, что достигается в возрасте около 20 лет. На таких участках гнездилось 13–16 видов (83–118 гнездовых участков на 10 га), а зимой встречалось 11–14 видов (56–190 особей на 10 га). Площадь (при величинах от 3 до 8 га), различия в посещаемости людьми, близость коммуникационных трасс и положение сада не влияли существенным образом на гнездовую авифауну. Констатировали, что авифауна садово-огородных участков носит четко городской характер.

INTRODUCTION

The term "allotment garden" denotes area consisting of numerous small garden plots which seldom exceed several hundred m² – in Warsaw usually

300 m². They are usually situated on the outskirts of cities and their main function is to provide recreation and conditions for amateur gardening by city dwellers. Garden cabins in those allotments are not permanently inhabited and cultures do not serve for commercial purposes. In relation to agrocoenoses allotments are characterized by a considerable degree of culture diversity, intensive presence of people over the whole area, densely and regularely distributed garden cabins and fences. In relation to urban parks the main differences are more uniform habitat structure and a specific composition of vegetation — young fruit trees and intensive usable cultures.

In Poland only the breeding avifauna of 4 allotment gardens has been studied so far: in Legnica (TOMIAŁOJĆ 1970), in Poznań-Jeżyce (MROCZKIEWICZ 1975), in Września (LEWARTOWSKI in litt.) and in Wrocław (JAKUBIEC and BLUJ 1977). The last of the named papers not only gave results from the area studied, but compared the avifauna of allotments in 7 European cities as well. They used materials from Wrocław and Legnica, from Hamburg (MULSOW 1968), Dortmund and Cologne (ERZ 1964), Coswig (ZIMMERMANN 1968) and Fröse (BÖHM 1968). Data on the avifauna of allotments have also been given by SENGENBERGER (1968, 1969) from Leipzig, SAEMAN (1970) from Karl Marx-Stadt, HEITKAMP and HINSCH (1969) from Göttingen and SIMMS (1975) from suburbs of London. A number of general statements based on some of above German studies, were also given by MULSOW (1976). The only study of the wintering avifauna has been carried out in a garden in Poznań-Grunwald (GÓRSKA, GÓRSKI 1980).

STUDY AREAS

The 12 gardens investigated were all situated within the administrative area of Warsaw. Symbols of their names, as used in this paper, are given below and their north (N), south (S), east (E) and west (W) boundaries described. The names of the streets from which the symbols of the areas have been made are in bold type. In brackets is the name of the quarter where a given area is situated.

TR — **Trojdena** — S, Żwirki i Wigury — E, (Rakowiec).
BO — **Borowiecka** — N, (Wólka Żerżeńska). The census plot was a belt 250 m wide from Borowiecka St. in the eastern part of the garden.
GW — a canal along **Gwiaździsta** — W, a park on the eastern extension of Podleśna — N, (Marymont). The census plot consisted of the northern part of the garden.
ŚM — **Śmigłowca** — W, Jerozolimskie — N, Drawska — S, (Szczęśliwce).
TO — **Toruńska** — S, Stalingradzka — S, (Pelcowizna).
PS — an excavation for a tram line along **Pstrowskiego** — N, (Młociny).
OD — **Odyńca** — S, Racławicka — N, Niepodległości — E, Komarowa — W. (Mokotów).
PY — **Promyka** — S+W, Gwiaździsta — E, "Marymont" club — N, (Marymont).
ŻW — **Żwirki i Wigury** — W, Rostafińskiego — N, Cmentarz Żołnierzy Radzieckich park — S (Rakowiec). The census plot consisted of 250 m wide belt in the central part of the garden.

WA — **Waszyngtona** — N, a canal along Międzynarodowa — W, Kinowa — E, a avenue dividing two areas of allotments — S, (Grochów). In 1973 the census plot consisted of a belt 300 m wide along the W border, in 1974 — a belt of 370–420 m wide along the E border. The plots overlapped in a belt of 180 m wide.
PM — **Pole Mokotowskie.** Armii Ludowej — N, Waryńskiego — E, (Śródmieście).
SY — **Sady Żoliborskie** — S, Załuskich — W, Tołwińskiego — N, (Żoliborz).

Data describing study areas are in Table 1. The PM area which was investigated as an allotment garden in 1973, was converted a year later into a part of Pole Mokotowskie park — therefore data from 1974 and 1976 do not refer to the area utilized as allotments. Also the SY area few years before investigations was converted from the allotments into a park for a housing estate.

RESULTS OF CENSUSES

The breeding season. The composition of the avifauna of that period is in Table 2. Apart from the breeding species, species-visitors were considered that did not nest within the census plot, but occurred there constantly throughout the breeding season. The data were collected during 7–9 censuses from mid-March to mid-June by the use of mapping method. The data collected are mainly from one season. In relation to two areas (ŻW and WA) where censuses were repaeted during two years, a comparison using Renkonen's index (Romaniszyn 1972) revealed a high degree of similarity (S — 76% for ŻW, and 74% for WA). In the case of PM garden no such a comparison was possible due to a considerable change of the habitat (Table 1). The assumption that material from one season provides sufficient degree of representativeness is supported by the results of investigations carried out in allotments by other authors during 3 seasons (Jakubiec and Bluj 1977, Zimmermann 1967) or even 8 seasons (Sengenberger 1969). Part of the data are from very small areas which may be a cause of errors in abundance estimation.

In Tables 2 and 3 the data on biomass are based on Ferens (1967, 1971).

The winter season. The basic data on the composition of the avifauna are in Table 3. The materials were collected during 3 or 2 censuses from mid-December to February 20, in the morning and noon. Both winters (1974–1976) when the investigations were carried out, were mild with little snow. Censuses were carried out only in those periods when there was a snow cover, which was never deep, however. The small number of censuses and the lack of data from several years are drawbacks in the material collected. However, the degree of conformity in the data obtained was considerable — see "Characteristics of the avifauna" below. Therefore, even with these limitations, the collected material makes it possible to draw conclusions about the composition of the wintering avifauna of allotments.

Table 1. Description of the study areas. Data marked with asterisks refer to the different years. Symbols for the areas explained in the text.

Symbol for the area	TR	BO	GW	ŚM	TO	PS	OD	PY	ŻW	WA	PM	SY
Years of investigations during the breeding season	1973	1973	1973	1974	1973	1974	1973	1973	1971* 1973**	1973* 1974**	1973* 1974** 1976***	1974
Area of census plot in ha (total area)	3,5	11 (18)	10,5 (16)	2,5	4	8,5	8	11	10 (16)	12,5* 15,5** (60)	3	4,5
Age of the garden (years) and its function: – allotment gardening – converted into park	1	2	3	6	6	8	ca70	ca40	ca50	ca35	ca40 ca40	ca40
Situation: CC – in the city, C – on the outskirts, – outside the city	CC	– –	C	C	C	C	CC	C	CC	CC	CC	CC
Immediate surrounding of garden: two marks – major contact within 100 m with habitat type, one mark – minor immediate contact or major contact within 100–250 m, – – – little or no contact, T – major transportation arteries, B – built up areas, W – wooded parkland, 0 – open park, cultivated or vacant areas	TT BB W 00	– – – – – – 00	– – – – W 00	T B W 00	T BB – – 00	– – B – – 00	TT BB – – – –	– – B W 00	TT B WW 00	TT BB W 0	– –*** TT*** B W 0* 00*****	T BB – – – –

Nest sites for hole-nesting birds:											++*	
++ – garden cabins ca 30/1ha,	– –	+	+	++	++	++	++	++	++	++	– –*****	– –
+ – considerably lower density,												
– – – no cabins or any other buildings. Number of starling-sized nest									63*	19*	4*	
boxes	0	2	3	0	1	4	25	20	59**	22**	2**1***	0
Total number of nest boxes	0	3	5	2	3	13	65	55	153*	54*	9*	0
									144**	70**	4**3***	
Frequency of people: – – < 10/ha,											++*	
+ – 10–25/ha, ++ – 25–60/ha	– –	– –	+	– –	++	++	++!	+	+	++	+*****	– –
Frequent presence of dogs (C), cats											F*	
(F), colonies of rabbits (0)	F		0		F	F	F!	OF	0	F	C*****	FC
Breeding of pigeons, poultry or dogs						+	+			+		
Water bodies within or on the border												
of the area		+	+							+		

Table 2. Breeding season avifauna. Numbers – density of breeding (B) species (territories per 10 ha); V or v – species visitors occurring constantly throughout the whole breeding season, V! – high abundance, V – small quantity, v with numbers – density (individuals per census per 10 ha); abundance of species – dominants underlined (over 10%) or in bold type (5–10%). Biomass includes B+V species. H′ – species diversity index (ERDELEN 1977).

Symbol for the area	TR	BO	GW	ŚM	TO	PS	OD	PY	ŻW		WA		PM			SY
Age of the garden (years)	1	2	3	6	6	8	ca 70	ca 40	ca 50		ca 35		ca 40			ca 40
Area of census plot – ha	3,5	11	10,5	2,5	4	8,5	8	11	10		12,5	15,5	3			4,5
Years	1973	1973	1973	1974	1973	1974	1973	1973	1971	1973	1973	1974	1973	1974	1976	1974
Anas platyrhynchos			1													
Vanellus vanellus		1v														
Perdix perdix	B	2	2						1	1						
Columba domestica	2v						1v							6v	2v	8v
Streptopelia decaocto							2	1		1v	1	1		7		
Cuculus canorus		B	B								B	B				
Strix aluco									V	V						
Dendrocopos minor								1								
Delichon urbica											V	V				
Hirundo rustica		V	1													
Galerida cristata	3				V	1										
Motacilla alba		3	1		2											
Motacilla flava	3	2	2													
Lanius collurio			1													
Sturnus vulgaris	7v	3	4	2v	5	6	12	14	20	14	8	10	7	7	3	3v
Oriolus oriolus							1	V	1v	1v	1	1			V	
Pica pica		1v	1v			1	1	1	V		1v	V	1v	V		2

Corvus monedula	16v	4v	V	1v	V	V	V						12v	2v		
Corvus corone cornix			V						1v	V						
Acrocephalus palustris				4												
Hippolais icterina							1	1		1	2	1	3			
Sylvia atricapilla						1			1	1	1		3			
Sylvia curruca				4	2		2	1	2	2	2	1	7			
Sylvia communis			1													
Muscicapa striata							1	1	3	4	2	1	3			
Oenanthe oenanthe		3	2		V											
Phoenicurus ochruros		4	1										3			
Phoenicurus phoenicurus							4	4	6	4	1	1	7			
Luscinia megarhynchos												1				
Turdus merula			V	V	2	V	1	2	8	12	10	6	13	13	3	V
Parus major		V	V		5	8	5	4	8	5	6	4	10		V	4
Parus caeruleus					2		4	2	4	3	3	2				
Passer domesticus	25v	14	20	16	18	50	11	26	9	13	42	50	47	10	7	43v
					V!	V!	V!	V!			V!	V!		17v	29v	
Passer montanus	V	9	24	68	45	7	49	23	49	55	14	19	23	3		2
Fringilla coelebs												1				
Serinus serinus										1						
Carduelis chloris	V		V	4		2	4	1	1	2	2	1		3	3	2
Carduelis carduelis		V				1	1		1	V			3			
Acanthis cannabina	3	3	V	4	5	1										
B + V species	10	16	20	9	12	12	17	15	17	20	19	18	13	9	8	8
Breeding species	4	10	13	6	9	10	15	14	13	14	15	15	12	6	4	4
Species diversity H′	2,0	2,8	2,3	1,5	2,2	1,9	2,7	2,6	2,7	2,6	2,7	2,3	2,9	2,4	1,9	1,9
Territories – number	4	46	61	25	35	64	81	91	113	118	118	152	39	13	5	5
Territories per 10 ha	11	42	58	100	86	75	101	83	113	118	94	98	130	43	17	11
V – ind. per 10 ha	50v				V!	V!	V!				V!	V!		35v	33v	54v
Biomass kg per 10 ha	9	5	7	6	5	5	10	5	8	8	8	8	8	11	4	5

Table 3. Winter avifauna. Data for the winter 1974/75. Numbers – abundance of indyviduals per census per 10 ha. Abundance of species-dominants (over 10%) – boled face. + – abundance below 0,5 ind./10 ha.

Symbol for the area	BO	GW	ŚM	OD	PY	ŻW	WA	PM 1974/5	PM 1975/6	SY
Area of census plot in ha	11	10,5	2,5	8	11	10	15,5	3	3	4,5
Perdix perdix	3		8							
Streptopelia decaocto				9	2	2	1	1		
Columba domestica				6						11
Dendrocopos major						1	+			
Sturnus vulgaris										1
Corvus monedula		2						20		8
Corvus corone cornix	3	+			1	2	+			
Corvus frugilegus	**8**	**11**		**46**	**18**	**23**	**39**	**61**	**46**	**119**
Pica pica	2	4	2	2	2	5	1		4	
Garrulus glandarius						1				
Bombycilla garrulus				1		15				7
Turdus merula		+	2	11	3	8	2	3	4	
Turdus pilaris	3	+	4	5	5	12	3		3	
Parus major	7	6		**29**	**11**	**24**	**13**	13	3	11
Parus caeruleus					1	1				
Parus palustris						1				
Passer domesticus	4		8	**46**	6	**14**	**25**	3	**10**	**23**
Passer montanus	**13**	**33**	4	**26**	6	5	**11**	**51**	**31**	
Carduelis chloris	4			9						
Pyrrhula pyrrhula					+					1
Coccothraustes coccothraustes					1					
Emberiza citrinella	4									
Number of species	10	8	6	11	12	14	10	7	7	8
Density ind./10 ha	**48**	**57**	**28**	**190**	**56**	**116**	**95**	**154**	**101**	**181**
Biomass kg/10 ha	7	6	5	24	9	16	16	28	18	47

DEPENDENCE ON THE STAGE OF A GARDEN

In Table 4 the gardens are arranged according to their age and their function (allotments used for gardening and those converted into parks).

Allotments in 1–st year. Data are from TR area. It had no fences between the plots and no garden cabins. The vegetation consisted mainly of cultivated vegetables and flowers. There were only few, very young, trees and bushes. The bird community, poor both in species and abundance, was not typical of allotments. It consisted of species typical of open parks and urban vacant areas – *Perdix perdix, Galerida cristata, Motacilla flava, Acanthis cannabina.* Most of the avifauna consisted of birds-visitors coming from neighbouring

Table 4. Character of the avifauna of gardens at different stages. Means in brackets. %% calculated as a part of the total density. B — breeding species, V — constantly occuring species-visitors, H — hole nesting species, L — low nesting (below ca 1,5 m) species using open nests, E — species nesting in elevated (above ca 1,5 m) open nests.

Stages	1-st year	2–3 years	6–8 years	Stabilized	Converted into a park
Gardens	TR	BO, GW	ŚM, TO, PS	PM 1973, OD PY, ŻW, WA	PM 1974–1976 SY
Breeding season avifauna:					
B species — number	**4**	**10, 13**	**6-10**	**13–16**	**4–6**
— ter./10 ha	11	42, 58	75–100	83–118 (105)	11–43 (24)
V species — number	**6**	**6, 7**	**2–3**	**1–5 (3)**	**3–4**
— ind./10 ha	50 = 68%	ca5			33–54 (61%)
Biomass B+V kg/10 ha	9	5, 7	5–6	5–10 (8)	4–11 (6)
H species — number	**0**	**5, 6**	**2–6 (4)**	**6–7**	**2–3**
— ter./10 ha, (%)	0	32, 51 (81%)	72–84 (78%)	74–96 (83%)	7–20 (53%)
Breeding *Passer* sp. — % of total B density	0	54% 76%	71–84%	51–69%	18–42% (30%)
L species — number	**4**	**4, 6**	**2–3**	**1–3**	**0**
— ter./10 ha, (%)	11=100%	9, 8 (18%)	4–12 (8%)	1–10 (3%)	0
E species — number	**0**	**0**	**1–3**	**4–8**	**2–3**
— ter./10 ha, (%)	0	0	2–5 (4%)	10–24 (14%)	7–23 (47%)
Winter avifauna:					
Number of species		**8, 10**		**11–14**	**7–8**
Ind./10 ha		48, 57		56–190 (114)	101–181 (145)
Biomass kg/10 ha		6, 7		9–24 (16)	18–47 (31)
Columba domestica + *Streptopelia decaocto* + *Passer domesticus* — ind./10 ha, (%)		0, 7 (11%)		13–32 (33%)	3–19 (75%)
Corvus sp. — ind./10 ha, %		11, 12 (23%)		18–46 (31%)	46–118 (46%)

built up areas — *Columba domestica*, *Sturnus vulgaris*, *Corvus monedula* and *Passer domesticus*.

2–3 years old allotments. The BO and GW areas with very young trees and bushes, but fully developed cultures of vegetables and flowers, belonged to this group. Some of the plots still had neither cabins nor fences, and some cabins were being built. Presence of cabins or piles of building materials distinctly changed the character of the avifauna. These areas were inhabited not only by a group of species occurring at the stage of a 1–st year garden, but by a group of other species as well. These were also species of open areas — *Oenanthe oenanthe*, *Motacilla alba* and *Phoenicurus ochruros*, but which required holes for nesting. *Sturnus vulgaris*, *Passer domesticus* and *P. montanus* also began nesting there. These latter species are the first and most typical element of the stabilized avifauna of allotments. It was due to them that the quantitative level of avifauna increased and the group of birds- visitors ceased being dominant. This was therefore the first stage at which the avifauna of the allotments had an individual character even, when as in the case of BO area, the garden was surrounded by rural agrocenoses.

6–8 year old allotments. The ŚM, TO and PS areas belong to this category. They were fully developed with respect to gardening and buildings, but trees were still young. As trees and bushes grew, the species of open areas disapeared and were gradually replaced by bush and tree species — *Pica pica*, *Sylvia curruca*, *Turdus merula*, *Parus major*, *P. caeruleus* and *Chloris chloris*. The quantitative level of the avifauna was high, nearly maximal, and the hole nesting species reached their full abundance.

Stabilized allotments. Those were fully developed with respect to vegetation, buildings and other arrangements. Three age categories were distinguished among gardens studied (Table 1): 35–40 years old (WA, PM, PY), ca 50 years old (ŻW) and ca 70 years old (OD). A comparison of the avifauna of particular gardens in relation to these categories does not demonstrate any significant differences that could be connected with age factor. This is not surprising because fruit trees are replaced at a fairly young age — usually not later than 30 years. Even if they are kept longer they are not allowed to reach considerable heights or to form holes. Therefore, since the age about 20 years, the trees in allotments do not create any new elements significant for the avifauna. Ground level vegetation, bushes and the general arrangement of a garden reach the stage of stabilization considerably earlier. So the stabilization threshold of the avifauna composition of allotments should occur below 20 years after the founding of a garden. This conclusion is confirmed by data from 14–17 years old garden in Coswig (Zimmermann 1967) and the garden in Września (Lewartowski in litt.) which was 12–15, and about 20 years old in different parts. Species typical for stabilized gardens occurred in full abundance in these areas.

In comparison with other stages the breeding avifauna of the stabilized gardens in Warsaw had the highest abundance and variety of species. No open area species, typical of the earlier stages occurred in the stabilized gardens. The group of bush and tree nesters included those absent at earlier stages — *Hippolais icterina*, *Streptopelia decaocto*, *Oriolus oriolus*, *Muscicapa striata*, *Phoenicurus phoenicurus*, *Fringilla coelebs* and *Serinus serinus*. Also the abundance of *Turdus merula* was considerably higher. The high abundance of the two *Passer* species and *Sturnus vulgaris* recorded in 6–8 years old gardens did not change. Also during the winter variety of species and the abundance were higher in the stabilized gardens than in younger ones (Tables 3 and 4).

Allotments converted into parks. This category was represented by the PM area in 1974 and 1976 and the SY area. In both of them the allotments were eliminated at the stage of a stabilized garden. Vegetables, flowers, bushes, cabins and fences were removed and only fruit trees were left in a grassy area. These changes deprived most stabilized garden species of possibilities for breeding. Thus the breeding avifauna of the garden-park consisted of only a few species occurring at minimal abundance. Similar to a 1–st year stage garden, the percentage of birds-visitors coming from neighbouring areas was considerable. In winter, however, with the low number of species, the density of individuals was high. It was mainly due of the high number of *Corvus frugilegus* for which the open space in the ground level was a convenience in comparison with other types of gardens.

DEPENDENCE ON THE SIZE, SITUATION AND SURROUNDINGS OF THE AREA

Size of the area. The areas of the stabilized allotments investigated in Warsaw varied from 2,5 to over 60 ha — the large areas BO, GW, ŻW and WA were investigated mainly in selected census plots. With two exceptions (the garden in Poznań — 3,2 ha and in Coswig — 8 ha) the studies in other cities were carried out in areas of 10–25 ha.

As far as the occurrence of particular species is concerned, the material from Warsaw showed the dependence on the size of a garden only in relation two species: *Oriolus oriolus* occurred only in gardens at least 8 ha (the OD garden distinctly limited by buildings) and *Cuculus canorus* which was determined by considerably large areas (gardens BO, GW and WA surrounded by parks and woods). Data from other authors reveal that in the avifauna of allotments species requiring green areas larger than few ha (e.g. woodpeckers or *Garrulus glandarius*) are rare even in gardens larger than 20 ha.

Size and the number of species. Gardens of the area 3 ha (PM 1973) and 8 ha (OD), surrounded by building or vacant habitats, had numbers of breeding species (12 and 15) similar to those in other large areas (12–16 species). However the allotment garden in Poznań (Mroczkiewicz 1975) of 3,5 ha had a distinctly poorer breeding avifauna (9 species). A comparison of the number

of species with the size of the area for the 8 gardens from the literature mentioned above and for the areas OD, PR, ŻW and WA in Warsaw reveals no correlation between these elements (r = 0,1), when the gardens below 8 ha were not considered. It may therefore be concluded that in the case of a stabilized garden the threshold of size above which the area factor becomes not significant for specific variety is between 3 and less than 8 ha.

Situation in the city. Based on the compilation of the avifauna of 7 stabilized gardens, JAKUBIEC and BLUJ (1977) found the situation in the city to be the main factor influencing the avifauna of the allotments. They considered together the situation of the garden on the macro-scale of the city and the immediate surroundings (e.g. neighbourhood of buildings). These two factors do not always agree and that is why here they are considered separately.

Data on the macro-situation of the investigated areas are given in Table 1. The PM garden was nearest (1–2 km) to the centre of the city, other gardens included into "CC" category were within the radius of 4 km in highly urbanized areas. The BO garden was the only one definitely situated outside the city in an agricultural setting. It was more than 10 km from the centre and about 4 km from the nearest urban built up areas.

The avifauna of the breeding season was compared between areas of different macro-situation, but the same age (BO with GW), between areas of similar macro-situation, but different age (TR with others marked "CC") and also between gardens of different management (gardens-allotments with gardens-parks) within the same category for age and macro-situation. This comparison indicates that the macro-situation has no significant influence either on the breeding population density or the number of species. In winter however, the outskirts areas (GW, PY, ŚM) and the suburban one (BO) had a density distinctly lower than almost all those situated in the city (means 47 : 134 ind./ /10 ha). Similar comparisons of the presence of particular species confirm the insignificant influence of macro-situation during the breeding season. Apart from the visiting *Vanellus vanellus* and the wintering *Emberiza citrinella*, the avifauna of the BO allotments showed no differences that might be connected with its situation outside the city. *Columba domestica* was the only species recorded entirely in gardens within the city. No dependence on macro-situation was observed for *Passer domesticus* and *P. montanus* or for species which are new in urbanized areas in Warsaw — *Pica pica*, *Corvus corone cornix* (in breeding season and in winter) and *Turdus pilaris*.

Buildings in the neighbourhood. Of the 12 areas investigated 6 had long borders with large complexes of buildings. This was most distinct in the OD garden which was entirely surrounded by blocks of flats. The entirely different position had the BO garden which was more than 1 km away from the nearest complexes of suburban rural buildings.

JAKUBIEC and BLUJ (1977) have reported, that in a large garden in Wrocław,

the part nearest buildings was considerably poorer with respect to number of species than parts further from the buildings. The density, however, was higher, this being mainly due to a high abundance of *Passer domesticus* and *Streptopelia decaocto*. Also in the garden in Poznań (MROCZKIEWICZ 1975), entirely surrounded by buildings, *Passer domesticus* was the most abundant species, but the total density of the avifauna was rather low. The data from Warsaw (Tables 1 and 2) do not present any distinct dependence between the abundance of the breeding population of *P. domesticus*, or its proportion in relation to *P. montanus* and the nearness of buildings. Among areas situated near buildings some had a very high abundance of breeding (PY, WA) or visiting (TR, SY) *P. domesticus*. In others (TO, OD) the species was less numerous or, at any rate, its abundance was lower compared with that of *P. montanus*. On the other hand, some gardens far from buildings (PS, PM 1973, GW or even BO) had high abundances of *P. domesticus*, equal to or higher than that of *P. montanus*. In the area WA, the largest one of those adjoining buildings, the avifauna composition was compared in belts situated at different distances from buildings. It appears from Table 5 that near buildings the density of *P. domesticus* was slightly higher but the differences were not significant ($P < 0.5$).

Table 5. Breeding avifauna of the area WA in belts at different distances from buildings. In the two seasons different parts on opposite sides of the garden and adjoining different built up areas were investigated. W – western part (1973), E – eastern part (1974). Density – number of territories per 10 ha.

	Part	Distance from buildings (belt area in ha)	
		up to 150 m	150–300 m
Density of breeding *Passer domesticus*	W	36 (5 ha)	32 (8 ha)
	E	50 (5 ha)	45 (11 ha)
Density of other species	W	45 (5 ha)	52 (8 ha)
	E	59 (5 ha)	40 (8 ha)
Number of species per 10 ha	W	14	17,5
	E	16	6

The total denisty of the breeding season avifauna and its species variety demonstrated no distinct dependence on the neighbourhood of buildings (Tables 2 and 5). This is also true for particular species, with the exception of *Columba domestica*, the occurrence of which was made possible by the studied factor (gardens TR, SY, OD). In winter, however, the OD garden, surrounded by buildings, had the highest density of avifauna (Table 3). A very high winter density (222 ind./10 ha) was also recorded in a building-surrounded garden in Poznań (GÓRSKA, GÓRSKI 1980).

Transportation arteries in the neighbourhood. Here were considered arteries with an intensity of traffic of about 2000 vehicles per hour in the

rush hour, some busiest ones in Warsaw. A comparison of the avifauna (number of species, density, the presence of particular species) in gardens with different degrees of exposure to major transportation arteries (Table 1) did not show any consistent patterns. The sizes, and homogenity of the habitat, of WA and ŻW gardens made it possible to investigate the avifauna composition in belts situated at different distances from the transportation arteries. The results in Table 6 indicate no dependence of the investigaged elements of avifauna on studied factor.

Table 6. Breeding avifauna in belts at different distances from transportation arteries. Area of belts: ŻW 1973 – 2,5 ha (at the distance < 100 m), 5 ha (100–300 m), 2,5 ha (> 300 ha); WA 1973 – 3 ha, 6,5 ha and 3 ha; WA 1974 – 4 ha, 7,5 ha and 4 ha.

Distance of the belt	Number of species			Density of breeding population – territories per 10 ha											
				Total			*Passer domesticus*			*Passer montanus*			Species breeding in open nests		
	ŻW 1973	WA 1973	WA 1974	ŻW 1973	WA 1973	WA 1974	ŻW 1973	WA 1973	WA 1974	ŻW 1973	WA 1973	WA 1974	ŻW 1973	WA 1973	WA 1974
< 100 m	9	7	5	92	96	115	16	37	62	36	17	22	16	23	12
100–300 m				146	96	88	18	48	45	38	7	4	24	17	14
> 300 m	8	6	4	84	87	100	0	33	45	36	27	32	24	20	10

The nearness of green areas – wooded and open parks, cultivated land (Table 1) – did not show any distinct influence on the avifauna of the allotments investigated.

DEPENDENCE ON OTHER FACTORS

Vegetation. The influence of the developmental stages of the vegetation upon the avifauna has already been presented (see p. 8–11). At the stabilized stage the gardens in Warsaw usually had no tall trees and no larger bushes. In a few cases when there were tall trees in the allotments or on their borders, they were the preferred nesting sites of *Pica pica*, *Oriolus oriolus* and *Streptopelia decaocto*. In the OD garden *Oriolus oriolus* choose a walnut tree which was the tallest tree there.

The extent to which the presence of tall trees and complexes of bushes may enrich the allotment avifauna is exemplified by the garden in Wrocław (Jakubiec and Bluj 1977). In this respect that garden was particularly favourably arranged. The highest avifauna density (122 ter./10 ha) and the close to the maximal variety of breeding species (26) have been recorded there. The enriched vegetation there was connected with the breeding of species rare in other allotments – *Dendrocopos major*, *Garrulus glandarius*, *Phylloscopus trochilus*, *Sylvia borin*, *S. communis* and *Luscinia megarhynchos*. The comparison

of the stabilized allotments against the gardens turned into parks (Tables 2, 3 and 4) is a opposite example of the dependence of the avifauna on vegetation. In the gardens SY and PM 1976 the impoverishment of the herbaceous layer and an almost complete lack of undergrowth were associated with the absence of at least 4 of the most frequent species – *Sylvia curruca*, *Hippolais icterina*, *Sylvia atricapilla* and *Turdus merula*.

Hole nest sites. According to data from the literature, hole nesting species predominate numerically in allotment avifauna. Gardens in Dortmund and Cologne (Erz 1968) are the only exceptions in this rule. In Warsaw, with the exception of allotments converted into parks, their percentage was 74–90% (Table 4). Since there were no holes in trees they nested only in nest boxes or nooks and crannies of garden cabins. Data on these two elements are in Tables 1 and 7. The material from Warsaw and from the literature leads to the following conclusions:

Table 7. Abundance of nest boxes (per 10 ha) and breeding population of hole-nesting birds (territories per 10 ha).

	T	BO	GW	ŚM	TO	PS	OD	PY	ŻW 1971	ŻW 1973	WA 1973	WA 1974	PM 1973	PM 1974	PM 1976	SY
Starling-sized nest boxes	**0**	**2**	**3**	**0**	**3**	**5**	**31**	**18**	**63**	**59**	**20**	**14**	**13**	**7**	**3**	**0**
Starling population	0	3	4	0	5	6	12	14	20	14	8	10	7	7	3	0
Nest boxes of all sizes	**0**	**3**	**3**	**8**	**8**	**15**	**81**	**50**	**153**	**144**	**43**	**45**	**30**	**13**	**10**	**0**
Passer sp. population	0	23	44	84	62	58	60	50	58	68	55	68	70	13	7	2
Phoenicurus phoenicurus and *Parus* sp. population	0	0	4	1	0	0	13	10	18	12	10	7	13	7	17	4

1) The number of starling-sized nest boxes was the main factor regulating the abundance of this species, but only to a saturation leval which, under optimum conditions (OD, PY, ŻW, garden in Wrocław), did not exceed 20 ter./ /10 ha. The ŻW garden was optimal with respect to feeding conditions because it was situated among parklands and open green areas. This garden was an example of a great excess of nestboxes for *Sturnus vulgaris* in relation to the potential breeding density of this species. Garden cabins played no significant role for this species. The data from the ŚM, TO and PS gardens show, that only

very few pairs used breeding sites there. Also according to the data of SENGENBERGER (1968, 1969) a shortage of suitable nest boxes in allotments in Leipzig was, during the 8 years of the study, a factor succesfully limiting the *S. vulgaris* population to 2–6 ter./10 ha, although the total avifauna density was high.

2) The total number of nest boxes of all sizes did not influence the density of *Passer domesticus* and *P. montanus*, both in the case of considerable shortage of boxes (GW, ŚM, TO, PS) and a great excess (ŻW, gardens in Wrocław, Fröse and Leipzig). Garden cabins provided a sufficient number of nest sites. Breeding places in boxes and cabins were equally readily inhabited by the two species. Therefore it was not an element differentiating their breeding distribution.

3) The data of BÖHM (1968), SENGENBERGER (1968, 1969) and particularly JAKUBIEC and BLUJ (1977) demonstrate that under conditions of a large supply of nest boxes a high abundance of *Passer* sp. did not eliminate an abundant occurrence of *Phoenicurus phoenicurus* and *Paridae*. The material from Warsaw (especially the comparison of ŻW with WA and PY) suggests that with limited supply of nest boxes and a high density of *Passer* sp. (WA and PY) the abundance of *Phoenicurus phoenicurus* and *Paridae* was lower than with an excess of boxes (ŻW).

4) SENGENBERGER (1969) considered 15 nest boxes per 1 ha to be the optimum, economically justifiable density of boxes in allotments. The data from Warsaw and the quoted literature indicate that such a number of boxes does in fact provide a sufficient excess because the total density of hole nesting populations seldom reaches 10 ter./1 ha. Moreover, the data from Warsaw indicate, that nooks in garden cabins compensate even large shortages of small nest boxes. However, in order to secure a full composition of the avifauna it is necessary to provide starling-sized boxes, 2–4 per 1 ha. It may be that if larger boxes were introduced such necessary in the allotments biocenosis birds of prey as *Strix aluco* and *Athene noctua* would live there.

Presence of people, dogs and cats. The intensity of presence of people was determined by a method previously applied in investigations on the avifauna of parks (LUNIAK 1974). The mean number of people present per ha during the hours of highest occupancy on nice weekdays during the breeding season was used. These data are presented in Table 1.

The presence of people, dogs and cats might have been a factor limiting the abundance of breeding population of species nesting on the ground or low bushes ("L" species — see Table 4) as was found in investigations carried out in parks (LUNIAK 1974). It should be stressed that the material discussed refers to occupied breeding territories only and not to the success of breeding attempts in which case the dependency would be probably greater. A comparison of the data from Table 1 with the avifauna composition of gardens at different stages shows:

1) In all of the 6 young gardens the density of the above-mentioned group of species was lower in gardens with the greater occupancy by people (GW, TO, PS) than in the less frequently visited ones (TR, BO, ŚM), which confirms the

hypotesis. In stabilized gardens no such dependence was recorded. In both cases, however, the abundance of that group of species was low, which is a well known pattern in urban habitats.

2) In the gardens converted into parks (PM 1974, 1976, SY), in spite of the low frequency of people, there were no "L" species, which was due to a lack of vegetation on the bushes level that was important because of the frequent presence of dogs (Table 1).

3) In 8 gardens at different stages where cats occurred frequently (Table 1), in 3 cases the group of "L" species occurred more numerously than the average for a given stage of garden, and less numerously in 5 cases. For 5 areas without cats the analogous proportion was 4 : 1. But there were only slight differences in densities, therefore no significant influence of cats in this respect has been indicated.

4) In the gardens studied no influence of the occupancy of people or cats, treated either separately or together, on the total density of avifauna or the number of species was recorded. It may be assumed that under conditions of the generally high level of antropogenic pressure in the allotments habitat a range of variation in the factors discussed was no longer very significant for the avifauna.

Antropogenic food. The gardens investigated were not permanetly inhabited by people and therefore there was little food from garbage and from feeding by people accessible to birds. Only in 3 gardens (Table 3) did the owners of several allotments keep dogs, pigeons or poultry all the year round, and this provided some readily accessible food for birds. A comparison of the materials from Tables 2 and 3 shows that in the breeding season this element did not determine the abundance of the two *Passer* species, or their mutual quantitative relation, it only determined the occurrence of *Streptopelia decaocto*. In winter, however, in the gardens OD and WA in which domestic animals were kept, there was a significant ($P < 0.01$) dominance (compared to PY and ŻW) of the abundance of *Passer* sp. and *Corvidae*. This was probably influenced, however, by the neighbourhood of build up areas (Table 1).

Abundant fruit is a typical trophic element of allotment gardens. During summer and autumn *Passer* sp., *Sturnus vulgaris*, *Corvus monedula*, *Pica pica*, *Oriolus oriolus* and *Turdus merula* were seen feeding on sweet and sour cherries, sometimes on grapes and pears. In the winter period the presence of numerous *T. merula* and *T. pilaris* in most of the gardens investigated may, to a large extent, have been connected with fruit left on trees or on the ground. Other birds also feeding on fruit — *Coccothraustes coccothraustes*, *Bombycilla garrulus* and *Carduelis chloris* — seldom occurred in the winter avifauna of the allotments.

CHARACTER OF THE AVIFAUNA OF ALLOTMENT GARDENS

Species composition. The number of breeding species recorded in stabilized gardens in Warsaw (13–16) was usually lower than that recorded in cities situated more to the west, especially in Cologne (24 and 27), Hamburg

(26), Dortmund (24–25) and Wrocław (20–22). These differences were mainly influenced by two factors: 1) a stage of urbanization of birds, and 2) vegetation:

1) Species common in western cities and recorded in the avifauna of allotments there, such as *Columba palumbus*, *Prunella modularis*, *Garrulus glandarius*, *Troglodytes troglodytes*, *Turdus philomelos* and *Erithacus rubecula*, do not form urbanized populations in Warsaw. Neither do they occur as breeding species in allotments, though they visit them during migrations.

2) The gardens above with the greatest number of species had particularly rich vegetation (groups of trees and bushes) and therefore many species rarely found in allotments occurred there — *Phylloscopus collybita*, *P. trochilus*, *Sylvia borin* and most species mentioned in item 1).

Of the 45 breeding species recorded in all the other allotments only 22 occurred in Warsaw, plus one that has not been recorded elsewhere — *Dendrocopos minor*.

A comparison of the avifauna of 5 stabilized gardens in Warsaw demonstrates a considerable similarity of the species composition indicated by values of Jaccard's index QS of 66–76 and by a comparison of repetition from two years — 86 (WA) and 89 (ŻW). Comparison with other areas in Poland (gardens in Poznań, Wrocław, Legnica and Września) gives values of QS index from 67–78.

In the stabilized gardens of Warsaw, 11 species had a frequency of occurrence (number of gardens and number of years) 6 or 7 for 7 possible: *Oriolus oriolus*, *Sturnus vulgaris*, *Hippolais icterina*, *Muscicapa striata*, *Phoenicurus phoenicurus*, *Turdus merula*, *Parus caeruleus*, *P. major*, *Passer domesticus*, *P. montanus* and *Carduelis chloris*. To a considerable degree (8 species) this list agrees with the composition recorded with similar frequency in gardens in other cities. *Oriolus oriolus*, *Muscicapa striata* and *Hippolais icterina* were species less frequently recorded in other cities. *Sylvia communis*, *Accanthis cannabina*, *Fringilla coelebs* and *Serinus serinus*, which in other cities were among the most frequent species, nested rarely or not at all in Warsaw, though they are not uncommon in this city.

Abundance. The density of the breeding population of the stabilized gardens in Warsaw was within the range recorded in most of other areas — from ca 80 ter./10 ha (gardens in Hamburg, Dortmund, Cologne and PY in Warsaw) to ca 120 ter./10 ha (Wrocław, Leipzig and ŻW in Warsaw). Only densities recorded in Września, Legnica and Poznań (40–50 ter./10 ha) and a part of the garden in Wrocław which adjoined buildings (158 ter./10 ha) exceed that fairly even level. In biomass the avifauna of the gardens in Warsaw reached a level similar to that in other areas during the breeding season — 5–10 kg/10 ha. For instance, it may be estimated as ca 8 kg/10 ha for the garden in Wrocław, ca 6 kg each for Cologne and Hamburg, and 4,5 kg for Coswig. Only in the gardens of the lowest abundance (Legnica, Poznań and Września) it was only 3–4 kg/10 ha.

Dominant species. A very high proportion of *Passer domesticus*, *P. montanus* and *Sturnus vulgaris* was typical for the avifauna of the allotment gardens in Warsaw. In all gardens each of these species exceeded 10 % of the total avian community. In a few cases the proportion of *Parus major* and *Turdus merula* exceeded 5 %. The factors responsible for the changeable quantitative relationships between the two main dominants, *Passer domesticus* and *P. montanus*, have not been explained. However, their total abundance is remarkable (Table 7) being even as high as ca 50–85 ter./10 ha, this probably being the saturation level. Such a high density of *Passer* sp. has been recorded only in Wrocław. *P. montanus* was also the dominant in other cities while *P. domesticus* was dominant less frequently and *Sturnus vulgaris* only in 4 areas (Wrocław, Września, Hamburg and Göttingen), which was probably due to the intentional control of this species in some gardens. In other cities the percentage of *Turdus merula* (usually over 10 %) was higher than in Warsaw which was connected with a more advanced degree of urbanization of this species. The case of *Phoenicurus phoenicurus*, which reached the position of quantitative dominant in 6 gardens (in Poland only Legnica), was probably similar.

Winter avifauna. Apart from the garden in Poznań there are no data for comparison. 22 species were recorded in all gardens in Warsaw and the investigations in Poznań added only one species to this list (*Certhia brachydactyla*). Particular gardens showed a marked similarity of species composition. The stabilized gardens in Warsaw had values of the QS index of 70–83 and this index was high for data from different years for the PM garden (QS = 71). A comparison with the garden in Poznań produced values of 64–72. Gardens at different stages had a higher similarity quotient in winter (QS = 57–67) than in the breeding season. *Corvus frugilegus*, *Pica pica*, *Turdus merula*, *Parus major*, *Passer domesticus* and *P. montanus* were the most frequent species, recorded in at least 9 of the 11 gardens studied in Warsaw and Poznań. In Warsaw a similar frequency (8 of 10) was recorded for *Turdus pilaris*, a species not found in Poznań. The data on the total abundance of the winter avifauna was quite variable, which migh have been due to the small number of censuses and weather conditions. It was distinctly lower in the young gardens (28–57 ind. per 10 ha) both compared with the breeding season and with the stabilized gardens. There the winter density was also lower (56–190 ind. per 10 ha) than in the breeding season. This proportion was reversed only in the gardens converted into parks. However, in biomass categories the winter avifauna was almost everywhere more abundant than in the breeding season one (Table 4) which is mainly due to the frequent presence of birds of greater body weight (*Corvidae*, *Columba domestica*). As mentioned-above, the differences in density were mainly associated with the different situations of the gardens, particularly nearness of buildings. The building--surrounded garden in Poznań had a density 222 ind. per 10 ha and biomass ca 42 kg per 10 ha.

Specific character of the allotment avifauna. ERZ (1964) and TOMIAŁOJĆ (1970) have described the allotment avifauna as closer in its character to agrocoenoses than to urbicoenoses. The material presented here does not confirm this thesis. The urban character of the bird community in the allotments is indicated mainly by following: 1) a distinct dependence of the species composition on the presence of urbanized populations; 2) a considerably higher quantitative level of the winter avifauna than in agrocoenoses, a feature characteristic of urban avifauna. These urban features were present even in the BO garden situated far from the city and among agroceonoses. In relation to the avifauna of urban built up areas the bird community of allotments was characterized by an absence of breeding *Columba domestica*, *Corvus monedula*, *Micropus apus* and *Delichon urbica* which nest in high buildings, a considerably higher percentage of birds breeding in open nests, a greater variety of species in the breeding and wintering avifauna. In relation to the avifauna of parks the allotments had an avifauna poorer with respect to number of species and lower percentage of species breeding in open nests, and a scarcity of species nesting in high trees (e.g. *Corvus cornix*, *C. frugilegus*, *C. monedula*, *Strix aluco*).

CONCLUSIONS

1) The process of developing the avifauna of allotment gardens from a not specific bird community inhabiting the area at the time of founding the garden to a typical stabilized community lasts for about 20 years. The first species typical of the stabilized community, *Passer domesticus*, *P. montanus* and *Sturnus vulgaris*, inhabit a garden from the time garden cabins are built, which create nest sites for these species. Apart from them, during the first few years, urban species of open areas are temporary components of the allotment avifauna. With the development of the vegetation these are replaced by bush and tree species. The avifauna of gardens of the age over ca 20 years do not undergo any distinct changes connected with increasing age of the allotments. Compared to earlier stages the avifauna of stabilized gardens has the greatest number of species (in Warsaw 13–16 breeding species were recorded), the highest density (in Warsaw 80–120 ter. per 10 ha) and is least subject to the influence of the avifauna of surrounding areas. The conversion of an allotment garden into a park, with almost only fruit trees and lawns left, resulted in a great reduction of breeding avifauna, its abundance, species composition and ecologically individual character.

2) A 3–8 ha area was the threshold size above which the size of the garden had no distinct significance on the number of species in its avifauna, within range of sizes studied. Different situations of the gardens within the city or outside it and the nearness of buildings did not greatly influence the breeding avifauna, but in winter gardens on the outskirts of the city or far from buildings had a poorer avifauna. Closeness to transportation arteries was of no importance

to the avifauna, and urban parklands influenced it only slightly. An enrichement of the vegetation by groups of bushes and taller trees conditioned the occurrence of at least 8 species of the allotment avifauna in Poland. The number of suitable nest boxes was a main factor regulating the abundance of *Sturnus vulgaris* up to the level of saturation of the breeding population of this species (ca 20 ter. per 10 ha). A lack of boxes was not the factor limiting the abundance of either *Passer* species because garden cabins provided them with a sufficient number of breeding places up to the saturation level of the breeding population (ca 80 ter. per 10 ha). The recorded differences of the frequency of people, dogs and cats were not significant for the avifauna of stabilized gardens which everywhere was formed under conditions of a considerable intensity of antropogenic pressure.

3) In Warsaw the avifauna of the gardens at comparable stages was fairly similar. In relation to most of gardens in other cities the Warsaw gardens had a similar total density (80–120 ter. per 10 ha) and biomass (5–10 kg per 10 ha) of the breeding season avifauna and a lower number of breeding species (13–16). This difference was mainly due to a lower number of species that form urbanized populations in Warsaw (compared to more westerly cities) and the poorer vegetation of the allotments. The list of the most frequent species was similar in Warsaw and in the other cities. The winter avifauna in Warsaw consisted of 22 species with the total density lower (56–190 ind. per 10 ha) than during the breeding season, but with the distinctly higher biomass (9–24 kg per 10 ha). The allotment avifauna had a definitely urban character but it showed characteristic differences in relation to the avifauna of urban parks and built up areas.

4) An improvement of the allotment avifauna should be directed at increasing its variety and, its usually poor, species composition, mainly by enriching the vegetation in the group of trees and bushes. It is particularly desirable to introduce raptors there — *Strix aluco* and *Athene noctua*. This may be achieved by providing suitable nest boxes.

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STRESZCZENIE

[Ptaki ogrodów działkowych w Warszawie]

Badania prowadzono w latach 1971–1976. W okresie lęgowym objęto nimi 10 ogrodów działkowych, a zimą – 7, a poza tym – w obu porach roku – 2 tereny dawnych działek, które zostały przekształcone w parki. Dane o usytuowaniu badanych terenów oraz wyjaśnienie używanych w pracy skrótów ich nazw podano na str. 2–3, a ich opisy zestawiono w tab. 1.

Skład awifauny badanych terenów w okresie lęgowym przedstawiono w tab. 2. Dane te zostały zebrane przy zastosowaniu metody kartograficznej (7–9 liczeń). Obraz awifauny zimowej (tab. 3) opiera się na wynikach 2–3 liczeń dokonanych przy mało obfitej okrywie śnieżnej.

Wiek ogrodów (od nowo założonego do kilkudziesięcioletnich) oraz ich aktualna funkcja (ogrodnictwo działkowe lub park) były głównymi czynnikami kształtującymi awifaunę (tab. 4). W ciągu pierwszych lat składnikami awifauny działek były miejskie gatunki otwartych przestrzeni: licznie zalatywały też ptaki z sąsiednich terenów zabudowanych. W miarę rozwoju szaty roślinnej zastępowały je gatunki zarośli i zadrzewień (tab. 2). Osiedlenie się pierwszych gatunków, typowych dla zespołu ustabilizowanego i w nim dominujących (wróbla domowego, mazurka i szpaka), następowało w momencie zbudowania

domków ogrodniczych. Proces wykształcania się ustabilizowanego, typowego dla działek, zespołu trwa około 20 lat. W porównaniu z wcześniejszymi stadiami charakteryzuje go największa różnorodność gatunków, najwyższy poziom ilościowy i najsłabsze wpływy awifauny terenów sąsiednich. Przekształcenie ogrodu działkowego w park powoduje znaczne zmniejszenie liczby gnieżdżących się gatunków.

Powyżej powierzchni 3–8 ha wielkość powierzchni terenu działkowego nie miała wyraźnego wpływu na liczbę gatunków lęgowych. Różnice usytuowania terenu w obrębie miasta lub poza nim, a także sąsiedztwo zabudowy (tab. 5), nie miały w okresie lęgowym wyraźnego wpływu na skład awifauny, natomiast zimą tereny peryferyjne i oddalone od zabudowy miały awifaunę uboższą. Nie uwidacznił się wpływ sąsiedztwa ruchliwych tras komunikacyjnych (tab. 6). Wzbogacenie szaty roślinnej działek grupami zarośli i wyższych zadrzewień warunkuje występowanie co najmniej 8 gatunków spośród awifauny ogrodów działkowych w Polsce. Liczba odpowiednich skrzynek lęgowych była głównym czynnikiem limitującym liczebność szpaka (do osiągnięcia liczebności ca 20 terytoriów/10 ha). Brak skrzynek nie był czynnikiem ograniczającym liczebność obu gatunków wróbli, którym domki działkowe zapewniają dostateczną liczbę miejsc lęgowych (do osiągnięcia liczebności ca 80 terytoriów/10 ha). Obecność ludzi, psów i kotów nie miały większego znaczenia dla awifauny ogrodów ustabilizowanych, wszędzie ukształtowanej w warunkach znacznego nasilenia presji antropogenicznej.

W Warszawie poszczególne ogrody, w porównywalnych stadiach, miały dość podobną awifaunę. W stosunku do większości ogrodów w innych miastach, tereny w Warszawie mają zbliżony poziom ilościowy awifauny okresu lęgowego (83–118 terytoriów/10 ha, biomasa 5–10 kg/10 ha), ale mniejszą liczbę gatunków lęgowych (13–16), co wynika głównie z mniejszej, w porównaniu z terenami położonymi bardziej na zachód, liczby gatunków, które wytworzyły w Warszawie zurbanizowane populacje oraz uboższej szaty roślinnej. Lista najczęściej gnieżdżących się gatunków jest w Warszawie i innych miastach dość podobna. Awifaunę zimową tworzą w Warszawie 22 gatunki o liczebności niższej w porównaniu z okresem lęgowym (56–190 osobn./10 ha), ale o wyraźnie wyższej biomasie (9–24 kg/10 ha).

Awifauna ogrodów działkowych ma wyraźnie miejski charakter, wykazuje też specyficzne różnice w stosunku do awifauny miejskich parków i terenów zabudowy.

Kształtowanie awifauny ogrodów działkowych powinno prowadzić do zwiększenia różnorodności jej składu gatunkowego — głównie przez wzbogacenie szaty roślinnej w grupy drzew i zarośli. Szczególnie pożądane byłoby osiedlenie — w wyniku rozwieszenia odpowiednich skrzynek lęgowych — puszczyka i pójdźki.

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