ACTA ORNITHOLOGICA
Vol. 29 (1994) No. 1

Waldemar BIADUŃ

Winter avifauna of urban parks and cemeteries in Lublin (SE Poland)

Biaduń W. 1994. Winter avifauna of the parks and cemeteries of Lublin (SE Poland). Acta orn. 29: 15–27.

Abstract. Bird communities of 10 parks and cemeteries in Lublin (SE Poland) were studied in the winter seasons of the years 1988/89 to 1990/91. Each season, nine census visits were made to the study areas in the period November-February. A total of 44 species were recorded (of which 10–32 occurred in particular areas). Dominant were 11 species, which accounted for 77–93% of the populations studied. Commonest in all areas, and in all years, were *Corvus frugilegus* and *Parus major*. Densities of birds ranged from 36–62 individuals/10 ha (in peripheral areas) to 619 during one census visit to a small cemetery in the central part of the City. Permanent changes in the sizes of wintering populations were not noted in the course of the different seasons. In successive years, the species compositions and dominance structures in particular areas were either identical, or distinctly similar. In comparison to that of other towns and cities, the winter avifauna of Lublin is rich, and particularly notable for the significant representation of *Picidae* and *Strigidae*.

Key words: birds of towns and cities, wintering birds, city parks, Lublin.

Medical Academy of Lublin, Dept. of Biology and Parasitology, Staszica 4, 20-081 Lublin, POLAND.

Received 10 Dec. 1993, accepted 14 Febr. 1994.

INTRODUCTION

In Poland, the avifauna of urban green areas is known better than that in other urban and non-urban habitats. However, a decided majority of the work done has been concerned with birds in the breeding season (Luniak 1983, Tomiałojć 1977).

To date, wintering communities of birds have only been described in Warsaw (Luniak 1981) and in Poznań (Górski & Górska 1080). In addition, general information about, or mentions of, the avifauna in the winter period have been provided by several authors (Górski 1981, Okulewicz 1971, Riabinin & Olearnik1985, Strawiński 1963).The subject matter is of interest on account of the considerable influx of birds into towns and cities during the winter period, and the significance of this phenomenon for the process of urbanization of avifauna.

A previous work (Biaduń 1994) described the breeding avifauna of parks and cemeteries in Lublin. This paper presents the wintering communities in these same areas.

STUDY AREAS AND METHODS

With 352,500 inhabitants, Lublin is the largest Polish city east of the Vistula. It lies in the valley of a small river Bystrzyca. Within the administrative boundaries of the city there are two forest complexes covering several hundred hectares. These did not constitute a subject of the present research.

Lublin's urban green space is limited, and covers a total area of only 1062 ha. All Lublin's cemeteries and larger parks were included in research carried out in the course of three winter seasons (1988/89 to 1990/91). These green spaces, covering a total of 123,5 ha, were as follows:

– Ludowy Park (PL) – a 30.1 ha park with large open spaces. Founded in 1953, its tree stands are dominated by broadleaved species. It is bounded by the Bystrzyca and by sugar factory settling ponds to the W and SW.

– Lipowa Street Cemetery (CL) – a cemetery in the city centre area covering 18.4 ha and founded in 1816. It is surrounded on all sides by roads and built-up

areas. There are old stands of trees. with *Thuja* species dominanting in the undergrowth.

– The Botanic Garden (OB) – set out in a peripheral location in 1946, and covering 18.0 ha. Old stands of trees occur in some parts and there is a considerable diversity of biotopes. The Garden is surrounded by a mosaic of habitats.

– Majdanek Cemetery (CM) – a 16.4 ha cemetery founded on the periphery in the 1970s and characterized by extensive open areas. Groups of trees – predominantly coniferous – are restricted to the edges, which are surrounded by meadows and fields.

– Saski Garden (OS) – a 12.9 ha city-centre park with old stands of trees. Founded in 1837, it is surrounded by roads and built-up areas.

– Unicka Street Cemetery (CU) – an 11.0 ha area in the shape of a considerably-elongated rectangle, it was set aside in 1932 and is surrounded by roads, built-up areas and open areas. The undergrowth is dominated by *Thuja sp.*

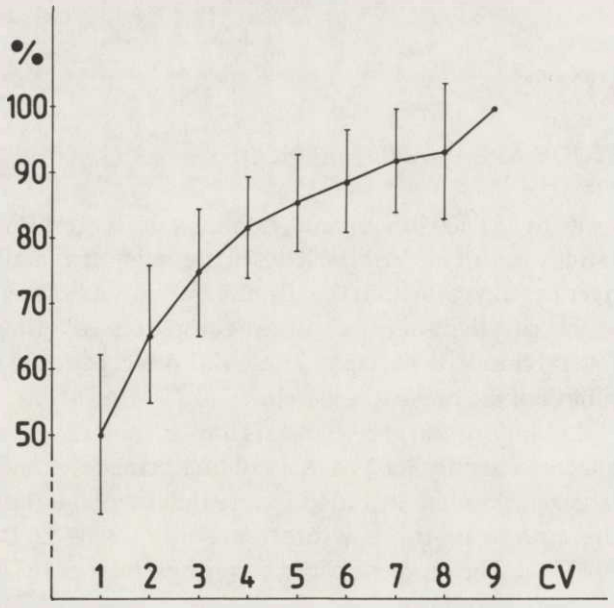

Fig. 1. Percentage detection of species in relation to the number of census visits (CV) made in a season – mean values (the curve) and standard deviations from 24 census cycles: three year's data from 7 areas and one year's data from a further 3.

[Ryc. 1. Wykrywalność gatunków w zależności od liczby liczeń w sezonie. (CV) – wartości średnie i odchylenie standardowe z 24 cykli liczeń na poszczególnych powierzchniach. Dane trzyletnie z 7 powierzchni + jednoroczne z 3 powierzchni.]

– The Wood in Czechów (LC) – a smalll (6.0 ha) afforested complex with a peripheral location. Broad-leaved trees predominate in a tree stand about 30 years old. Surrounded by roads and open areas.

– Akademicki Park (PA) – a small (5.5 ha) city-centre park founded in the 1950s. Busy roads lie to the E and S, built-up areas in the other directions.

– Kalinowszczyzna Cemetery (CK) – a 2.7 ha cemetery which is the oldest in the city; having been founded in the 18th century. The udergrowth is poorly-developed and the area is surrounded by open or built-up areas.

– Bronowicki Park – a 2.5 ha city-centre square with an old stand of trees. Founded in the middle of the last century, it is surrounded by busy roads and built-up areas.

Direct, continuous feeding of birds by people was not noted in any of the areas studied. A more detailed characterization of the study areas was given in the previous work (Biaduń 1994).

Census visits (9 per area per season) were carried out between the last third of November and the end February. They were always made before noon, and areas of 8–20 ha (mean 13 ha) were censused in the course of one hour.

DETECTION ABILITY SPECIES

In a single visit to an area it was usual to discover about half of the species recorded there in a given winter season. Calculated on the basis of the results obtained in particular areas in the different years, the minimum mean index of detection was 40% and the maximum 70%. These indexes are in accord with those cited by Dannenburg (1977). There was no apparent relationship between the effectiveness of censuses and the time of the winter season or the size of the study area.

On average, the first visit to an area revealed 50.0±12.1% of the number of species recorded there in the whole of a winter. After the third visit, this value had increased to 74.8±9.6%, and after the fifth to 85.3±7.3%. The sixth visit was the earliest occasion on which there was no further increase in the number of species recorded (such a situation arose in 4 cases out of 24). In 17 cases, the number of species recorded continued to grow up to the last (9th) census visit (Fig.1).

The material obtained was used to verify the method employed by Luniak (1981) in Warsaw parks, which involved counting 2–3 times in the season. Two variants were simulated: counting 3 times (on the basis of results obtained in counts made in mid-December, mid-January and mid-February) or counting twice (using results from counts at the end of December and the end of January). Values obtained in this way were compared with full data obtained in the course of all counts. Comparisons were made separately for the different study areas and for each year.

In 12 cases out of 24, the first variant did not reveal 1–2 species considered to be permanent in a study area. Omitted most often (3 times were *Turdus pilaris* and *T. merula*. *Pyrrhula pyrrhula* and *Accipiter nisus* went unregistered twice and *Picus viridis*,*Passer domesticus*, *Coccothraustes coccothraustes*, *Dendrocopos medius* and *Parus montanus* once. Detected on average were 75% (60–87%) of all species and 95% (80–100%) of those permanent.

Still greater errors were recorded when the results from 2 counts were compared with the full monitoring from all 9. A total of 21 permanent species were omitted, and omissions were made in as many as 19 caseS out of 24. In over half (10) of these cases, some 2–5 species went unregistered. In such a way of counting *Passer domesticus* and *Turdus pilaris* went unregistered four times, *Pyrrhula pyrrhula* and *Carduelis chloris* three times, and – among others – *Regulus regulus*, *Passer montanus*, *Streptopelia decaocto*, *Certhia brachydactyla* and *Dendrocopos major* went unregistered twice. Finally, *Dendrocopos medius*, *D. minor*, *Bombycilla garrulus*, *Carduelis carduelis*, *Corvus corone* and several othe species were not found at all. Sometimes these were the only cases in which a given species was registered. Revealed on average were only 64% (42–83%) of all species recorded and 88% (67–100%) of those permanent.

These counts indicate that the results of 2–3 censuses may not be recognized as giving a representative picture of the winter avifauna of urban green space.

COMPODITION OF AVIFAUNA

Tables 1–4 present results in the form of mean population sizes (the mean number of individuals per 10 ha per census) and mean biomasses (in kg/10 ha per count). Values for density are only given for species which were recorded at least 3 times in the study period, and which represented at least 0.1% of the total numbers of birds occurring in that area. These were recognized as the permanent species in the given area. Remaining species were signified by the sign "+". In the case of biomass, numbers are given only for species whose values exceeded 0.1 kg/10ha per count.

Species composition and numerical dominance were compared using the indexes of Sorensen and Renkonen, in the version employed by Głowaciński (1975).

A total of 44 species were recorded in the study areas. As Tables 1–4 show, particular areas had between 10 species (at LC) and 32 species (at PL). In larger areas, the numbers recorded in a particular year were close to those recorded in the course of the entire study period (at 74–97%). However, in smaller areas the numbers in any particular year were distinctly lower (at 60–84%). Densities of birds wintering in the peripheral areas (CM, OB and LC) were by decidedly lower than in the remaining areas. Highest densities were noted in the smallest areas (619 individuals/ 10 ha per count at CK and at PB). These values were between several and ten to twenty times higher than those noted in OB (52), LC (62) and CM (36). In the other city-center parks and cementaries densities ranged from 98 to 210 individuals/ 10 ha per cont. Indices calculated for biomass looked similar but showed still greater differences: with CK having 229.5 kg/10 ha, as compared to PB with 119.8, OB with 14.4, LC with 12.9 and CM with 8.4.

NUMERICAL DOMINANCE STRUCTURE

Of the 44 species recorded, 11 were amongst the dominants (>5%) on at least one occasion. These species were: *Corvus frugilegud*, *C. monedula*, *Pica pica*, *Parus major*, *P. caeruleus*, *Phyrulla phyrulla*, *Carduelis spinus*, *Passer domesticus*, *Turdus pilaris*, *Asio otus* and *Streptopelia decaocto*. All together these species constituted between 77.0 and 99.4% (mean 85%) of the total numbers of birds wintering. Values calculated on the basis of biomass were still higher, with the biomass of birds of these species taking 72.5-99.4% (mean 93%) of the total. In city-center areas (CL, CU, CK, OS, PA and PB), *Corvus frugilegus* alone had values for biomass of between 87.0 and 93.5%.

Table 1. Winter fauna of the Lipowa Str. Cemetery (CL), Saski Garden (OS) and Botanic Garden (OB) – density (ind./10ha/census visit), dominance (%) and biomass (B – kg/10ha/census visit).

[Tabela 1. Awifauna zimowa Cmentarza przy ul. Lipowej (CL), Ogrodu Saskiego (OS) i Ogrodu Botanicznego (OB) – zagęszczenie (os./10/ha/1 liczenie), dominacja ilościowa (%) i biomasa (B – kg/10ha/1 liczenie).]

	CL (18.4ha)				B	OS (12.9 ha)				B	OB (18.0 ha)		B
	'88/89	'89/90	'90/91	%		'88/89	'89/90	'90/91	%		'90/91	%	
Corvus frugilegus	149.2	90.5	93.7	61.3	55.5	154.4	99.7	105.6	57.0	59.9	13.6	26.2	6.8
Parus major	13.5	21.3	17.2	9.5	0.3	30.2	32.2	33.8	15.3	0.6	7.4	14.2	+
Streptopelia decaocto	24.2	10.8	5.9	7.5	2.7	31.6	5.9	6.0	6.9	2.9			
Pica pica	2.9	4.4	3.5	2.0	0.7	1.6	2.4	1.4	0.8	0.4	5.1	9.8	1.0
Parus caeruleus	4.8	5.4	4.2	2.6	+	6.9	4.6	4.9	2.6	+	3.7	7.1	+
Pyrrhula pyrrhula	0.8	5.7	0.3	1.3	+	8.8	3.8	8.4	3.3	0.2	0.7	1.3	+
Turdus merula	2.1	2.9	1.7	1.2	0.2	3.1	4.7	4.2	1.9	0.4	0.5	1.0	+
Corvus monedula	1.7	0.6	0.5	0.5	0.2	18.5	9.5	11.2	6.2	3.3	9.7	18.7	2.4
Carduelis spinus	34.5	3.1	9.8	8.7	0.2						2.6	5.0	+
Sitta europaea	0.7	1.7	1.7	0.8	+	1.3	2.4	3.1	1.1	+	0.8	1.5	+
Dendrocopos major	+	0.4	0.4	0.2	+	+	0.9	0.7	0.2	+	0.5	1.0	+
Strix aluco						0.4	0.7	0.8	0.3	0.3	0.7	1.3	0.3
Certhia brachydactyla	0.5	1.1	0.2	0.3	+	0.5	0.4	0.4	0.2	+	+	+	+
Passer montanus	+	+	1.1	0.2	+	+	1.2	+	0.2	+	1.1	2.1	+
Dendrocopos medius	+	0.2	–	0.1	+	0.3	0.3	+	0.1	+			
Passer domesticus						7.7	9.6	6.6	3.8	0.2			
Troglodytes troglodytes	–	0.6	+	0.1	+	–	+	–	+	+	0.1	0.2	+
Phasianus colchicus											2.2	4.2	2.2
Parus ater	–	2.6	5.6	1.5	+								
Carduelis chloris	0.5	+	+	0.1	+	+	+	–	+	+	+	+	+
Regulus regulus	0.7	2.1	0.4	0.6	+	+	–	–	+	+	0.1	0.2	+
Turdus pilaris	0.4	+	1.3	0.3	+	–	–	+	+	+			
Corvus corone	+	+	+	+	+						2.1	4.0	1.2
Fringilla coelebs	+	+	–	+	+	–	+	–	+	+	0.4	0.8	+
Picus viridis	–	–	+	+	+	0.3	+	+	0.1	+	0.1	0.2	+
Bombycilla garrulus	–	5.9	+	1.1	0.1								
Accipiter nisus	+	+	+	+	+						0.1	0.2	+
Parus montanus											0.4	0.8	+
Coccothraustes coccothr.	+	+	+	+	+	+	+	+	+	+	+	+	+
Dendrocopos syriacus						–	–	+	+	+	+	+	+
Certhia familiaris	–	+	+	+	+	–	+	+	+	+	+	+	+
Dendrocopos minor	+	–	–	+	+								
Carduelis carduelis	+	+	–	+	+								
Erithacus rubecula	–	+	–	+	+								
Falco columbarius	–	+	–	+	+								
Sturnus vulgaris	–	+	–	+	+	+	+	–	+	+			
Perdix perdix											+	+	+
Anas platyrhynchos											+	+	+
Total – sp.	23	29	24	31		20	22	20	25		27		
Density and biomass	236.5	159.3	147.5		(60.4)	265.6	178.3	187.1		(68.4)	51.9		(14.4)

Table 2. Winter awifauna of Ludowy Park (PL), Akademicki Park (PA) and Wooded in Czechów (LC). Explanations – see Tab. 1.

[Tabela 2. Awifauna zimowa Parku Ludowego (PL), Parku Akademickiego (PA) i Zadrzewień na Czechowie (LC) – objaśnienia – patrz Tab. 1.]

	PL (30.1ha)				B	PA (5.5ha)				B	LC (6.0ha)		B
	'88/89	'89/90	'90/91	%		'88/89	'89/90	'90/91	%		'90/91	%	
Corvus frugilegus	54.7	27.3	28.1	37.6	18.3	133.3	105.2	108.3	61.3	57.8	22.0	35.5	11.0
Streptopelia decaocto	20.7	20.1	2.1	14.6	2.9	9.1	2.6	1.4	2.3	0.9			
Parus major	11.6	20.0	9.0	13.8	0.3	30.7	40.6	30.9	18.1	0.7	18.5	29.8	0.4
Pica pica	5.4	5.8	4.6	5.4	1.1	5.0	6.5	4.0	2.8	1.0	7.0	11.3	1.4
Parus caeruleus	2.8	2.1	2.3	2.5	+	4.8	4.8	3.4	2.3	+	10.4	16.8	0.1
Pyrrhula pyrrhula	11.0	7.4	11.1	10.0	0.3	12.3	12.7	15.3	7.1	0.4	2.8	4.5	+
Turdus merula	1.1	3.5	0.7	1.8	0.2	6.5	7.5	6.5	3.6	0.7	+	+	+
Turdus pilaris	0.7	1.7	0.1	0.8	+	3.4	1.4	2.6	1.3	0.2	+	+	+
Carduelis spinus	7.9	1.1	4.0	4.4	+	3.2	+	+	0.6	+			
Dendrocopos major	+	0.4	0.3	0.2	+	–	0.6	–	0.1	+			
Coccothraustes coccothr.	0.3	0.9	0.2	0.5	+	+	+	0.6	0.1	+			
Carduelis chloris	0.4	0.5	+	0.3	+	1.2	+	+	0.2	+			
Certhia brachydactyla	+	0.5	0.5	0.3	+	1.0	+	–	0.2	+			
Corvus corone	3.4	1.4	1.2	2.0	1.2	–	–	+	+	+			
Carduelis carduelis	0.7	8.5	1.1	3.5	+						+	+	+
Fringilla coelebs	0.8	0.3	0.7	0.6	+	–	+	–	+	+			
Passer montanus	+	3.7	0.2	1.3	+	+	–	–	+	+			
Parus montanus	+	+	+	+	+	+	–	–	+	+	1.3	2.1	+
Sitta europaea	–	0.3	+	0.1	+								
Dendrocopos minor	+	+	0.1	+	+								
Accipiter nisus	+	+	0.1	+	+	–	–	+	+	+	+	+	+
Dendrocopos syriacus	0.3	0.2	–	0.1	+	–	+	–	+	+			
Picus viridis	–	+	0.1	+	+	–	+	–	+	+			
Passer domesticus	+	+	–	+	+	+	+	+	+	+			
Bombycilla garrulus	+	+	–	+	+	–	+	–	+	+			
Erithacus rubecula	+	+	–	+	+	+	–	–	+	+			
Regulus regulus						+	–	–	+	+			
Dendrocopos medius	+	+	–	+	+								
Corvus monedula	+	–	–	+	+								
Troglodytes troglodytes						+	–	–	+	+			
Accipiter gentilis	–	+	–	+	+								
Phasianus colchicus	+	+	+	+	+								
Parus ater						–	+	–	+	+			
Certhia familiaris						–	–	+	+	+			
Sturnus vulgaris	–	+	–	+	+								
Parus palustris	–	+	+	+	+								
Total – sp.	27	31	24	32		18	19	15	27		10		
Density and biomass	121.8	105.7	66.5		(24.5)	210.3	181.9	173.0		(61.8)	62.0		(12.9)

Table 3. Winter avifauna of the Unicka Cemetery (CU) and Majdanek Cemetery (CM). – Explanations – see Tab. 1.

[Tabela 3. Awifauna zimowa Cmentarza przy ul. Unickiej (CU) i Cmentarza na Majdanku (CM) – objaśnienia – patrz Tab. 1.]

	CU (11.0ha)				B	CM (16.4ha)		B
	'88/89	'89/90	'90/91	%		'90/91	%	
Corvus frugilegus	117.9	69.5	89.5	60.2	46.1	8.2	22.9	4.1
Parus major	14.0	22.5	18.2	11.9	0.4	3.7	10.3	+
Pica pica	7.0	7.4	3.9	4.0	1.2	9.1	25.4	1.8
Corvus monedula	6.8	6.1	6.1	4.1	1.6	1.7	4.8	+
Asio otus	1.2	–	3.5	1.0	0.5	4.3	12.0	1.3
Parus caeruleus	2.3	2.2	1.4	1.3	+	0.3	0.8	+
Passer domesticus	1.6	5.5	1.7	2.0	0.1	2.3	6.4	+
Pyrrhula pyrrhula	1.5	8.8	0.9	2.4	0.1	0.2	0.6	+
Carduelis chloris	5.9	1.3	+	1.6	+	1.1	3.1	+
Regulus regulus	1.1	0.9	1.4	0.7	+	0.7	1.9	+
Parus ater	–	1.8	0.5	0.5	+	1.2	3.3	+
Certhia familiaris	–	+	0.6	0.1	+	0.3	0.8	+
Streptopelia decaocto	1.8	0.6	+	0.5	0.2	+	+	+
Passer montanus	1.4	+	1.3	0.6	+	1.3	3.6	+
Accipiter nisus	–	0.3	+	0.1	+	+	+	+
Carduelis spinus	17.2	1.3	18.5	8.0	0.2			
Turdus merula	+	0.8	+	0.2	+			
Certhia brachydactyla	+	0.3	+	0.1	+	+	+	+
Corvus corone	1.1	+	+	0.3	0.2			
Dendrocopos major	–	0.6	0.4	0.2	+			
Dendrocopos syriacus	0.4	0.4	–	0.2	+			
Phasianus colchicus						0.9	2.5	0.9
Athene noctua						0.5	1.4	0.1
Strix aluco	–	–	0.4	0.1	+			
Turdus pilaris	–	+	+	+	+	+	+	+
Coccothraustes coccothraustes	+	+	+	+	+	+	+	+
Carduelis carduelis	–	+	+	+	+			
Troglodytes troglodytes	+	+	+	+	+			
Picus viridis	+	–	–	+	+			
Bombycilla garrulus	+	–	–	+	+	+	+	+
Erithacus rubecula	–	+	–	+	+			
Sturnus vulgaris	+	–	–	+	+			
Emberiza citrinella	–	+	–	+	+	+	+	+
Buteo lagopus						+	+	+
Total – sp.	22	26	25	31		23		
Density and biomass	181.2	130.4	148.3		(50.7)	35.8		(8.4)

Table 4. Winter avifauna of the Kalinowszczyzna Cemetery (CK) and Bronowicki Park (PB). Explanations – see Tab. 1.

[Tabela 4. Awifauna zimowa Cmentarza na Kalinowszczyźnie (CK) i Parku Bronowickiego (PB) – objaśnienia – patrz Tab. 1.]

	CK (2.7ha)				B	PB (2.5ha)				B
	'88/89	'89/90	'90/91	%		'88/89	'89/90	'90/91	%	
Corvus frugilegus	453.2	328.6	413.9	64.4	199.3	264.0	205.8	192.0	66.7	110.3
Streptopelia decaocto	28.6	19.8	16.3	3.5	4.3	59.4	27.1	14.2	10.2	6.7
Parus major	44.0	36.9	33.7	6.2	0.8	36.0	52.4	30.6	12.0	0.8
Pica pica	2.4	7.9	5.5	0.9	1.1	9.7	8.4	+	1.8	1.2
Parus caeruleus	3.2	7.1	4.0	0.8	+	9.3	7.1	2.6	1.9	+
Passer domesticus	4.4	4.0	+	0.2	+	19.9	11.5	5.3	3.7	0.4
Pyrrhula pyrrhula	+	6.3	–	0.3	+	4.5	+	17.8	2.2	0.2
Turdus merula	–	3.6	1.2	0.2	0.2	2.6	+	–	0.3	+
Corvus monedula	90.1	50.0	90.9	12.4	19.2	+	+	+	+	+
Passer montanus	25.0	23.8	21.0	3.8	0.6	–	+	–	+	+
Carduelis chloris	3.6	7.5	4.8	0.9	+	+	+	–	+	+
Coccothraustes coccothraustes	+	+	+	+	+	–	1.3	+	0.1	+
Turdus pilaris	10.3	5.2	102.0	6.3	3.9					
Dendrocopos major						+	3.1	2.2	0.5	+
Sitta europaea						–	–	2.2	0.2	+
Certhia brachydactyla						1.3	+	–	0.1	+
Dendrocopos medius						1.3	–	–	0.1	+
Accipiter nisus	–	–	+	+	+					
Troglodytes troglodytes	+	–	–	+	+					
Accipiter gentilis	+	–	–	+	+					
Bombycilla garrulus	–	+	–	+	+					
Erithacus rubecula	+	–	–	+	+					
Sturnus vulgaris	–	+	–	+	+					
Dendrocopos syriacus						+	–	–	+	+
Dendrocopos minor						+	–	–	+	+
Certhia familiaris						–	+	–	+	+
Carduelis carduelis						–	–	+	+	+
Total – sp.	15	15	13	19		15	15	12	20	
Density and biomass	664.8	500.7	693.3		(229.5)	408.0	316.7	266.9		(119.8)

Corvus frugilegus and *Parus major* occured as dominants in all the areas studied. In 6 cases, they were together representated between 70.6% (CK) and 79.4% (PA) of the total number of birds in wintering communities. Their share at the remaining study areas (CM, OB, PL and LC) was also large, though distinctly smaller (at between 33.2% at CM and 65.3% at LC). This had a decisive influence on the Re values obtained in comparisons between the wintering populations in the different areas. The index showed that, with values between 73.5 and 85.5%, the populations of CL, CK, CU, OS, PA and PB belonged to the same grouping. At the same time, the index was greater than QS in almost all cases.

In the group of dominants, the aforementioned species were usually accompanied by two others (most often by *Streptopelia decaocto* - four times, or *Pica pica*, *Corvus monedula* and *Carduelis spinus* – each 3 times). Only in the cases of OB and PL were the numbers of dominants greater (at 6 and 5 species respectively).

12 further species were registered amongst the permanent ones in 3 or more areas. In terms of numerical dominance, these rarely constituted more than 1–2%

Table 5. Frequency (number of areas) and highest density recorded (ind./10ha/census visit) of some species – as dominants (Dom.) and in total. Symbols of areas – see Tab. 1.

Tabela 5. Częstość występowania i zagęszczenie wybranych gatunków. Symbole powierzchni – p. Tab. 1.]

	Frequency		Highest density		
	Dom.	Total			
Corvus frugilegus	10	10	453.2	CK	'88/89
Parus major	10	10	52.3	PB	'89/90
Pica pica	4	10	9.7	PB	'88/89
Streptopelia decaocto	4	8	59.4	PB	'88/89
Corvus monedula	3	8	90.9	CK	'88/89
Carduelis spinus	3	5	34.5	CL	'88/89
Parus caeruleus	2	10	10.4	LC	'90/90
Pyrrhula pyrrhula	2	10	17.8	PB	'90/91
Passer domesticus	1	7	19.9	PB	'88/89
Turdus merula	0	9	7.5	PA	'89/90
Carduelis chloris	0	9	7.5	CK	'89/90
Regulus regulus	0	6	2.1	CL	'89/90
Corvus corone	0	5	3.4	PL	'88/89
Sitta europaea	0	5	3.1	OS	'90/91
Parus ater	0	4	5.6	CL	'90/91

of the total number of birds. 11 further species occurred permanently in only 1–2 areas, but the majority of them were also observed in many other areas. The last 10 species were recognized as those noted exceptionally or flying in from neighbouring areas.

SEASONAL AND YEARLY CHANGES

Permanent changes in the size of wintering populations were not on the whole recorded in the course of a season. Only one slight, but distinct, peak of numbers was identified. This arose annually in the first half of January, and was in the main connected with an increase in the numbers of *Corvus frugilegus*. Snow cover was maintained for a total of 115 days in the course of the three years. In general, it did not lie for longer than a few days, and was only maintained for longer in 2 cases: from 23 XI–15 XII 1989 and from 28 I–28 II 1991. The depth at these times only reached a few cm. Throughout the period, no visible link was found between this factor and the number of species in, or total size of, the wintering population.

Significant tendencies were not noted either when it came to changes in the occurrence of particular species in the course of the winter. The snow-free and warm winters of the first two season had a notable influence in ecncouraging breeding behaviour amongst birds in the second half of February. Observed then was an increase in many of the study areas of such species as *Streptopelia decaocto*, *Carduelis chloris*, *Corvus monedula* and *Turdus merula*.

Recorded in the different years 1988/89, 1989/90 and 1990/91 were 35, 38 and 41 species respectively. The last result may be explained by the inclusion in the last year of research of 3 new areas (LC, OB and CM) in which birds not noted previously were recorded. 31 species were observed in all 3 winters, and a further 8 were seen in 2 out of 3.

QS and Re indices calculated for the same areas in different years showed a predominat tendency for near-identicality of the populations compared (QS>80%, Re>70%). Higher values in the case of the Renkonen index were noted many times, and this was a consequence of almost identical numerical dominance structure (a great representation of *Corvus frugilegus* and *Parus major*).

The highest mean densities were noted in the 1988/89 season. In the remaining two seasons, the numbers of birds were about 25% lower. This resulted mainly from a fall in the numbers od *Corvus frugileus* and – to a lesser extent – of *Streptopelia decaoto*.

CHARACTERISTICS OF THE AVIFAUNA

Listed among the dominants were 11 species: *Corvus frugileus* and *Parus major* in every case, and the remainder 1–4 times (Table 5). *Corvus frugileus* was decidely the most numerous (representing 22.9–66.7% of the total numbers of birds in different areas). This constituted a considerable fraction of the population even in peripheral areas, and its place was taken only once (at CM) by *Pica pica*. Its density exceeded the value of 450 ind./10 ha while the share in biomass reached more than 90% several times (CL, CU, PA, PB). In absolute terms, the biomass of *Corvus frugileus* amounted to between several kg/10 ha in peripheral areas and 110 (at PB) to 199 (at CK). The share taken by *Parus major* amounted to between 6.2 and 29.8%. The last value related to LC, where densities were

however two times lower than those recorded for the species in areas PB, CK and PA. However, from the point of view of biomass (at 0.07–0.79 kg/10 ha), *Parus major* always gave way to several other species besides *Corvus frugileus*.

Parus caeruleus was a permanent component of the winter avifauna of the parks and cemeteries of Lublin. It occurred in all areas, and sometimes appeared among the dominants (at OB and LC). The list of most frequent species is completed by *Pica pica* and *Pyrrhula pyrrhula* (Table 5). The first of these was found among the dominants in four areas (LC, OB, CM and PL), and represented – as far as biomass was concerned – a significant element of the wintering assemblage. *Pyrrhula pyrrhula* had such a character in areas (PA and PL) with a large representation of broadleaved trees, whose seeds are its main food.

Occuring four times as a dominant *Streptopelia decaoto*, was not recorded in two areas (OB and LC), and it was only an accidental species in one further area (CM). This clearly attest to the avoidance of peripheral areas by this species – something also confirmed in the breeding season (Biaduń 1994). On the other hand, this species was amongst the dominants in city-centre parks and in cemeteries (CL, OS, PB and PL) – in terms of both numbers (6.9–14.6% of the total) and biomass (2.7–6.7 kg/10ha). The remaining species occurring amongst dominants at least once appeared irregularly. This related above all to *Carduelis spinus*, which occurred as a dominant as many as three times (at CL, CU and OB),but which was not recorded at all in five other areas. A decisive factor in this was the presence of species of *Thuja*, in whose crowns the species was most often observed. A similar note applies to two typical synanthropes – *Passer domesticus* and *Corvus monedula*. In several cases the absence of these species was probably connected with the fact that food was not provided in any of the areas. However, in areas CK, OS and OB *Corvus monedula* only gave way to *Corvus frugileus* where biomass was concerned. A typical nomadic species, *Turdus pilaris* appeared rather irregularly in all areas. It usually stayed to the moment of complete exhaustion of food resources, and then changed its feeding area. Its presence amongst the dominants at the smallest of the cemeteries (CK) was probably connected with residence after leaving roosting sites.

Appearing regularly in the majority of the areas studied, and representing permanent elements of their winter avifauna, were several further species: *Turdus merula, Carduelis chloris, Certhia brachydactyla, Passer montanus, Sitta europaea* and *Dendrocopos major*.

Observed constantly at three cemeteries (CL, CU and CM) were *Regulus regulus* and *Parus ater*. An exception was the first study season, during which the second of the aforementioned species was not noted. The presence of these birds was linked with the occurrence in the areas of *Thuja* species and spruces. Occurring similarly were *Certhia familiaris* and three species of woodpecker: *Picus viridis, Dendrocopos medius* and *D. syriacus*. In conctrast, D. minor was met with more rarely and was counted amongst accidental species.

Occurring among the permanent species in the areas less frequented by people (i. e. OB and PL) were *Corvus corone, Accipiter nisus* and *Carduelis carduelis*, as well as *Fringilla coelebs*, which wintered in small numbers. *Coccothraustes coccothraustes* was observed at as many as 9 areas (though usually at the beginning or end of the study period). It was counted among permanent elements of the avifauna three times (at PL, PA and PB). Owls were noted in several areas: *Asio otus* at CM and CU, *Strix aluco* at CU, OB and OS, and *Athene noctua* at CM. *Asio otus* created roosts of 10–20 birds in the crowns of spruces (at CM) or *Thuja* species (at CU). Thanks to this, the species was found amongst the dominants in the first case. The remaining owls were noted singly (in tree holes, the crowns of trees or holes in buildings) The list of permanent species is completed by *Troglodytes troglodytes* (at OB and CL), *Bombycilla garrulus* (at CL), *Parus montanus* (at OB and LC) and *Phasianus colchicus* (at CM and OB).

The remaining species, recorded sporadically as accidentals, were: *Accipiter gentilis, Falco columbarius, Buteo lagopus, Emberiza citrinella, Anas platyrhynchos, Parus palustris* and *Perdix perdix*. Two more species (*Sturnus vulgaris* and *Erithacus rubecula*) were attempting to winter in the study areas.

Fringillidae were most-fully-represented in the population, with 7 species. Also noteworthy was the considerable number of *Picidae* (5 species, including 4 permanent ones). The representation of *Corvidae* and *Paridae* (4 and 5 species respectively) was in line with expectations. Also recorded were as many as 4 species of birds of prey and 3 of owls.

DISCUSSION

The winter avifauna of towns and cities is considerably less well-known than the breeding avifauna. Differences in the methodology applied in the winter studies (Górski 1981, Górski & Górska 1980, Hudec 1976, Luniak 1981, Okulewicz 1971, Riabinin & Olearnik 1985, Sasvari 1981, Strawiński 1963, Szczepanowski 1984) give rise to a situation in which – in the majority of cases – results are comparable only where species composition is concerned.

The winter avifauna of Lublin's parks and cemeteries included 44 species observed between the end of November and the end of February. This is rich when compared with the results obtained from this type of environment by other authors. The presence of 29 species was noted in work carried out by Hudec (1976) on areas of trees in Brno. 36 species were noted in similar environments in both Olsztyn (Okulewicz 1971) and Toruń (Strawiński 1963). Regular counts made in various biotopes in Poznań revealed surprisingly low species diversity (a total of 34 species in 13 areas). Of these species, only 18 were recorded in Poznań's urban parks and zoological gardens (Górska & Górski 1980).

Working in Budapest, Sasvari (1981) noted a very similar number of species (42) to that reported in this study. It should be noted, however, that his research also took in extensive forested complexes covering more than 100 hectares within the boundaries of the city. In passing, it is interesting to note that – in spite of the considerable climatic differences – the winter avifauna of Budapest was most similar to that studied in Lublin from the point of view of species compositions (QS: 81.4%). A distinctly smaller number of species (32) was shown for the parks of Warsaw (Luniak 1981). This is probably an effect of the methods employed then, as 2–3 counts per season may have prevented detection of as many as 1/4 to 1/3 of the species (see introduction). Also speaking for this are the results obtained for 7 Warsaw parks by Szczepanowski (1984), who demonstrated the occurrence of 40 species in the course of two seasons. However (as that author emphasized), the proximity of the Vistula River could have had an influence on this, as could the fact that observations continued until the end of March.

Comparisons based on the works cited above showed that bird communities of tree-covered areas in other towns and cities were similar to those found in this study (QS: 71.8–81.4%). Only in the comparison with Poznań (using data from Górska & Górski 1980) were the two wintering populations found to be different.

Many of the species observed in other towns and cities were not found in Lublin.Particularly characteristic is the absence of *Columbia livia* – a species that is very common in other cities. Also going unobserved was *Garrulus glandarius*, which has been noted elsewhere, but which is observed very rarely in Lublin, and only on passage. The author also failed to observe *Carduelis cannabina*, *Acanthis flammea*, *A. flavirostris* and 10–20 other species.

On the other hand, *Dendrocopos syriacus* (which was also noted in Brno and Budapest), was characteristic for the parks and cemeteries of Lublin. This species has appeared in Poland relatively recently (Ciosek & Tomiałojć 1982). Also interesting is the clearly defined presence of *Asio otus* which was observed only sporadically away from Lublin – and only in Słupsk and Toruń. At the same time, daytime roosts of this owl are a quite well-known phenomenon in the towns and cities of Western Europe (Creutz 1979, Herzig & Konig 1980). Also noteworthy is the presence of *Parus montanus*, which is a breeding bird in several Lublin parks. Apart from *Dendrocopos syriacus*, two other woodpeckers (*Picus viridis* and *Dendrocopos medius*) appear amongst the typical species wintering in the areas studied. These were also noted by Sasvari (1981) in Budapest, but in much larger areas.

The numbers of species registered in particular areas varied from 10 to 32, and were very high. The values recorded for some of the areas (PL, CL and CU) were clearly above the highest noted to date in comparable environments (Górski & Górska 1980, Luniak 1981, Szczepanowski 1984). Furthermore, it is worth noting that, at 19 and 20 respectively, the numbers of species recorded in the smallest sites (CK and PB) were not much different from those given by Luniak (1983) for areas that were many times larger. They clearly exceed (by several tens to 100%) the values given for areas of similar size. Attesting to the probability that this is linked with the census methods used are the studies made in Warsaw parks by Szczepanowski

(1984): his results, obtained from 14–16 counts, are close to those obtained in this study.

It would therefore seem to be very important that the methods used in quantitative research into winter avifauna should be standardized. The need for this has also been recognized in work by other authors (Brewer 1978, Oelke 1977, Rollfinke & Yahner 1980).

The densities recorded in the different areas were very varied. Densities were quite low in peripheral areas and did not exceed 100 ind./10ha per count. They were clearly higher in other areas, and reached highest values (330–619 ind./10ha) in the smallest areas, and those with central locations. These results are typical of those gained in studies of this type of environment (Luniak 1981, 1983, Szczepanowski 1984).

According to other authors (Górska & Górski 1980, Luniak 1981, Szczepanowski 1984), densities depend first and foremost on feeding. However, direct feeding was not observed in the areas studied in Lublin, and it is therefore difficult to give an unequivocal interpretation of the results obtained. It would seem that the numbers of birds were influenced quite significantly by the very presence of people, who may – in an incidental and unconscious way – create possibilities for birds to gain food. This phenomenon should therefore be recognized as a particular form by which the food resources utilized by birds are supplemented.

There were no directional changes in the composition and numerical representation of the avifauna in the course of a season, with the exception of a small increase recorded in all years in the second half of January. This was influenced mainly by changes in the numbers of *Corvus frugilegus* and is in accordance with the findings of other authors considering the wintering of this species in Basel (Böhmer 1973) and Vienna (Grüll 1991). Differences between particular years also resulted mainly from changes in the numbers of *Corvus frugilegus*.

It is difficult to evaluate the influence of snow cover and sub-zero temperatures on the species composition and numerical representation of the birds noted in this study. Such conditions were more or less restricted to February 1991, and did not give rise to any obvious changes in the species composition or numerical representation of the wintering avifauna. This contradicts the findings of Górski & Górska (1980) and Szczepanowski (1984) concerning increases in the numbers of species and individuals in a snowy period of winter. Also contrary to the aforementioned conclusion of the author is that from Grossu & Radu (1970), who recorded a fall in the number of species and individuals in Bucharest, during frosty and snowy winters.

The structure of numerical dominance was slightly different from that noted in the studies by Luniak (1981) and Szczepanowski (1984). Although *Corvus frugilegus* and *Parus major* were also the foremost determinants, a distinct share was additionally noted in Warsaw for *Columba livia*, *Anas platyrhynchos* and *Passer domesticus*, which either were absent from Lublin's parks or else were not noted among the dominants. On the other hand *Streptopelia decaocto*, *Carduelis spinus* and *Pyrrhula pyrrhula* were amongst the most numerous species in the areas studied. The first of these is also one of the most abundant species in the breeding season. On the other hand, the other two found abundant sources of food in some areas (PL, CL, PA, CU and OB): in the form of the seeds of broadleaved trees – for *Pyrrhula pyrrhula* – or coniferous trees – for *Carduelis spinus*. In the case of *Pyrrhula pyrrhula*, it is the seeds of maples and ash which are the basic food in winter (Newton 1968, Summers 1982).

Studies by Riabinin & Olearnik (1985) in various biotopes in Lublin recorded 46 species between 1955 and 1983. Amongst these were some species not noted in the present study as a consequence of their being typical of other habitats (in the cases of *Fringilla montifringilla*, *Emberiza calandra*, *Plectrophenax nivalis*, *Galerida cristata*, *Alcedo atthis* and *Larus ridibundus*) or as a result of the fact that they are met with exceptionally (in the cases of *Turdus iliacus*, *Aegithalos caudatus* and *Motacilla alba*. In turn, Riabinin & Olearnik (1985) did not mention *Dendrocopos syriacus* – which in this work was characteristic of the environments studied, but which had not yet appeared in the city in the period of the aforementioned study. Also going unrecorded in that study were *Asio otus*, *Strix aluco* and several other species. In the case of the owls, the earlier absence was the result of the different methods employed in research.

However, where the species composition of the avifauna of areas planted with trees is concerned, the results obtained in this study were not very different from those mentioned by the aforementioned authors (QS = 92%)

CONCLUSIONS

1. From analysis of material obtained in 9 counts, it was shown that 2–3 counts in the course of a winter season will not reveal 1/4 to 1/3 of the number of species occurring. It is possible to establish the composition of a winter bird community, and to follow changes in it, if use is made of methods similar to those employed for quantitative research on breeding populations.

2. Studies of the winter avifauna of 10 parks and cemeteries in Lublin revealed 44 species – a high figure in comparison with data from other towns and cities. The considerable representation of *Picidae* and *Strigidae* was noteworthy.

3. Reported densities of the avifaunas in the areas studied were typical for this type of environment and were dependent on the size and location of an area. Densities were highest (330–619 ind./10ha per count) in the smallest areas, lower (at 98–210 ind./10ha) in large city-centre areas, and lowest (30–62 ind./10ha) in peripheral areas. It would seem that the presence of people was a significant factor increasing densities – even though there was no direct feeding by people in the areas studied.

4. Quantitatively, the dominant species were a decided majority (77,0 – 93,4%) of wintering populations. Decisive in this were *Corvus frugilegus*, whose representation in terms of biomass averaged 80%, and *Parus major*.

5. Significant overall changes in the avifauna of particular areas were not revealed in the course of a winter season, and nor was there any relationship with snow cover.

Translated From Polish by dr. James Richards.

REFERENES

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

Böhmer A. 1973. Zur Überwinterung der Saatkrähe *Corvus frugilegus* bei Basel. Orn.Beob., 70: 103–112.

Brewer R. 1978. A comparison of three methods of estimating winter birds populations. J. Field Ornithol., 49: 252–261.

Ciosek H., Tomiałojć L. 1982. [Syrian Woodpecker breeding in Poland]. Prz. zool., 26: 101–109.

Creutz G. 1979. Winterliche Ansammlung von Waldohreulen (*Asio otus*). Abh. Ber. Naturkundesmus. Görlitz, 53: 27–29.

Dannenburg F. 1977. Fehler bei der quantitativen Ermittlung von Vogelartengemeinschaften durch Wochenend – und Eizelbegehungen (am Beispiel des Münchner Olympiaparks). Verh. orn. Ges. Bayern, 23: 19–59.

Głowaciński Z. 1975. [Birds of the Niepołomice Forest (A faunistic-ecological study)]. Acta zool. cracov., 20: 1–87.

Górska E., Górski W. 1980. [Birds wintering in Poznań]. Acta orn., 17: 271–295.

Górski W. 1981. [Species composition, number and biomass of the birds community of town Słupsk and its surroundings in the different phenological periods of the year]. Słupskie Pr. mat. przyr., 2: 199–235.

Grossu A., Radu D. 1970. Observations ecologiques concernant les oiseaux de Bucarest en hiver. Comun. zool., 267–271.

Grüll A. 1981. Das räumliche Aktivitätsmuster der Saatkrähe (*Corvus frugilegus*) im Laufe des Winters in Wien und Umgebung. Egretta, 24: 39–63.

Herzig L., Konig J. 1980. Beobachtungen an einer Waldohreulen (*Asio otus*) Geselischaft im Fuldaer Stadtgebiet während der Wintermonate 1978/79 nebst Ergebnissen von Gewöllananalysen. Beitr. Naturk. Osthessen, 16: 127–132.

Hudec K. 1976. Der Vogelbestand in der Städtischen Umwelt von Brno (CSSR) und Seine Veranderungen. Acta Sc. Nat. Brno, 10: 1–54.

Luniak M. 1981. The birds of the park habitats in Warsaw. Acta orn., 18: 335–374.

Luniak M. 1983. The avifauna of urban green areas in Poland and possibilities of managing it. Acta orn.,19: 3–61.

Newton I. (ed.). 1968. Bullfinch and fruit buds. Probl. Birds as Pests, London-New York: 199–209.

Oelke H. 1977. Bisher angewandte Methoden der Wintervogelbestand saufnahmen, ein Überblick. Vogelwelt, 98: 66–75.

Okulewicz J. 1971. [Birds of Olsztyn and its vicinity]. Acta orn., 13: 127–171.

Riabinin S., Olearnik M. 1985. [From observations on bioecology of birds of Lublin during winter season]. Ann. UMCS, Sect. C, 40: 133–143.

Rollfinke B. F.,Yahner R. H. 1990. Effects of time of day and season on winter bird counts. Condor, 92: 215–219.

Sasvari L. 1981. Birds communities in the parks and squares of Budapest. Opusc. zool., 17–18: 121–143.

Summers D. D. B. 1982. The survival of bullfinches on cultivated fruit buds. J. Appl. Ecol., 19: 813–819.

Strawiński S. 1963. [The birds of the town of Toruń]. Acta orn., 7: 115–156.

Szczepanowski R. 1984. Zimowanie ptaków w parkach Warszawy (próba analizy). M. Sc. thesis, Warsaw Univ.

Tomiałojć L. 1977. [Birds census work in Poland – a progress raport. Prz. zool., 21: 244–252.

STRESZCZENIE

[Awifauna zimowa parków i cmentarzy Lublina]

Praca przedstawia wyniki liczeń awifauny zimowej w latach 1988/89–1990/91 na 10 cmentarzach i

parkach Lublina. Rozmieszczenie i charakterystykę badanych powierzchni przedstawiono w poprzedniej pracy (Biaduń 1994).

Liczenia (po 9 w każdym sezonie) prowadzono w ciągu 1–3 zim od III dekady listopada do końca lutego, zawsze w godzinach przedpołudniowych. W ciągu godziny liczono ptaki na obszarze 8–20 (średnio 13) ha. W pierwszych rejestracjach na poszczególnych powierzchniach wykrywano 50% (25–62%) ilości gatunków stwierdzanych na nich w ciągu zimy. Po trzecim liczeniu wartość ta wzrastała do 75% (53–83%), a po piątym – do 85% (63–96%). W 17 przypadkach (tereny/lata) liczba gatunków wzrastała aż do ostatniego liczenia (ryc. 1).

Na uzyskanym materiale przeprowadzono weryfikację stosowanej przez Luniaka (1981) w parkach Warszawy metody 2–3-krotnego liczenia w trakcie sezonu. Symulowano dwa warianty: liczenie 3-krotne w oparciu o wyniki uzyskane w liczeniach przeprowadzonych w połowie grudnia, połowie stycznia i połowie lutego oraz liczenie 2-krotne oparte na wynikach z liczeń w końcu grudnia i końcu stycznia. Tak otrzymane wartości porównano z danymi uzyskanymi w trakcie wszystkich liczeń. W wariancie pierwszym średnia wykrywalność gatunków wyniosła 75% (60–87%), w drugim – zaledwie 64% (42–83%). Obliczenia wykazały, że wyniki 2–3 liczeń nie mogą być uznane za reprezentatywne dla obrazu zimowej awifauny zieleni miejskiej.

Skład awifauny przedstawiono w tabelach 1–4. Wartości liczbowe zagęszczenia podano jedynie dla gatunków, które stwierdzano co najmniej 3-krotnie w badanym okresie i stanowiły przynajmniej 0.1% ogólnej liczebności. Uznano je za gatunki stałe dla danej powierzchni. Porównania składu gatunkowego i dominacji ilościowej wykonywano stosując wskaźniki Sorensena i Renkonena w wersji zastosowanej przez Głowacińskiego (1975).

Stwierdzono ogółem 44 gatunki, na poszczególnych terenach – od 10 do 32 gatunków. Najwyższe zagęszczenie stwierdzono na terenach najmniejszych (CK i PB – odpowiednio: 619 i 331 osobn./10ha/1 liczenie. Przekraczało ono kilka-kilkanaście razy wartości odnotowane na powierzchniach peryferyjnych (36–62 osobn./10 ha). 11 spośród stwierdzonych gatunków znalazło się co najmniej raz w grupie dominantów stanowiących łącznie 77.0–93.4% zimujących zgrupowań. Zdecydowanie najliczniejszym gatunkiem okazał się *Corvus frugilegus*, którego zagęszczenie osiągało wartości ponad 450 osobn./10ha (tab.5). Do najczęstszych gatunków należały także *Parus major*, *P. caeruleus*, *Pica pica* i *Pyrrhula pyrrhula*.

W trakcie sezonu nie stwierdzano w zasadzie trwałych zmian liczebności zimujących populacji. W poszczególnych latach stwierdzono 35 (1988/89), 38 (1989/90) i 41 (1990/91) gatunków. 31 gatunków obserwowano przez wszystkie sezony. Wskaźniki QS i RE obliczone dla tych samych powierzchni w poszczególnych latach wykazały w przeważającej większości identyczność porównywanych populacji.

Awifauna zimowa parków i cmentarzy Lublina wykazuje wyraźne podobieństwo (QS: 71,8–81,4%) w porównaniu do podobnych środowisk innych miast, wyróżnia się jednak bogactwem gatunków.

Charakterystycznymi gatunkami dla Lublina okazały się dzięcioły (m.in. *Dendrocopos syriacus* i *D. medius*) oraz sowy (*Asio otus*, *Strix aluco*).

Ilość gatunków na poszczególnych powierzchniach była stosunkowo wysoka. Wartości stwierdzone na niektórych terenach (PL, CL,CU) wyraźnie przekraczały najwyższe notowane dotychczas dla porównywalnych środowisk.

Zagęszczenie stwierdzone na poszczególnych powierzchniach było bardzo zróżnicowane i zależało od wielkości oraz położenia terenu. Otrzymane wyniki są typowe dla uzyskiwanych w innych badaniach tego typu środowisk.

Redaktor pracy: prof. Maciej Luniak