

## Birds and bats using buildings as a place of breeding or shelter

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**Abstract:** *Birds and bats using buildings as a place of breeding or shelter.* The presence of birds and bats was analysed in buildings intended for thermal refurbishment. Study material was collected in the years 2012–2016 in 336 buildings from 11 voivodships. For detailed analyses concerning birds, data from three voivodships were selected: Kujawsko-Pomorskie, Łódzkie and Mazowieckie. To determine differences in the location of bat roosts, buildings from all voivodships were compared. Bird nesting places and daytime bat roosts were divided into 22 locations. Regional differences in the occupation of buildings were analysed. For comparison, the analysed buildings were divided into churches, tenements, public buildings, and residential blocks. Buildings used by birds were also compared with respect to the degree of urbanization of their surroundings. Species-specific differences in their preference for occupying buildings of different types were analysed in birds. Birds were found in 78.9% of buildings and bats – in 8.9% of buildings. Amount of 2,250 bird nests in 265 buildings and over 1,000 bats in 30 buildings were inventoried. The bird species most often found in buildings were: the swift *Apus apus* (40.5%), house sparrow *Passer domesticus* (31.7%) and jackdaw *Corvus monedula* (9.9%). Bat species found in buildings included: the common noctule *Nyctalus noctula*, serotine bat *Eptesicus serotinus*, lesser horseshoe bat *Rhinolophus hipposideros*, pipistrelles *Pipistrellus* and long-eared bats *Plecotus*. The house sparrow most often inhabited buildings in Kujawsko-Pomorskie Voivodship and the swift most often inhabited buildings in Voivodships Mazowieckie and Łódzkie. Birds in Kujawsko-

-Pomorskie Voivodship most often built their nests under roofs and birds from Voivodships Mazowieckie and Łódzkie in flat roof spaces. A total of 31 bat roosts were located in 30 buildings in 5 different locations. Bats most often occupied flat roof spaces and attics and least often occupied crevices behind the gutter.

*Key words:* birds and bats in buildings, nesting and roosting places

### INTRODUCTION

In Europe at least 15 or so bird species permanently or temporarily use buildings. Some of them like house sparrows *Passer domesticus* or swifts *Apus apus* have permanently migrated to towns, and buildings are their main nesting and resting places, though the latter species is also known to live in colonies on rocks or in tree holes (Gory 1997). An inventory of avifauna in Warsaw revealed permanent or temporary presence of 247 species, 132 of which were nesting species and 16 species built their nests in buildings (Luniak et al. 2001). Finding birds' nests in buildings is difficult and requires a great deal of experience (Zyskowski and Zielińska 2014). There are many places suitable for nesting and providing concealment from the sight of predators and humans. Birds carefully

hide their nests by exploiting available cracks in walls or rooms rarely or never used by man. Birds like the wood pigeon *Columba palumbus*, magpie *Pica pica*, great tit *Parus major*, blue tit *Cyanistes caeruleus*, song thrush *Turdus philomelos* or jay *Garrulus glandarius*, that rarely used buildings as nesting places years ago, now do so more and more frequently. One of the reasons noted for the decreasing number of bird populations that use buildings is renovation and thermal refurbishment of those buildings (Biaduń 2008, Grochowski 2012).

In Poland 26 bat species have been recorded so far (Ciechanowski and Bogdanowicz 2014, Uhrin et al. 2016). Most species are being found in buildings. Bats use various spaces in buildings for hibernation and reproduction (Kowalski and Lesiński 2000, Lesiński 2006). Man-made buildings are an important element in keeping synanthropic bat populations in good condition (Lesiński 2006). Bats use buildings as places for reproduction, hibernation and swarming, and as daily shelters. Searching for bats in various parts of a building is a very difficult task, even for chiropterologists with a lot of experience. Ultrasonic detectors, endoscopes and infrared cameras are used to find bats (Kowalski and Lesiński 2000). Flat roof spaces, attics, cellars are checked and wall cracks are inspected with the use of elevators and climbing equipment. Even with such techniques, the probability of detection is only between 50 and 90%. Therefore, it is important to disseminate good practices that should be implemented during any inventory of birds and bats in buildings.

All species of birds and bats are subject to strict or partial legal protection.

In order to directly protect animals, regulations prohibit intentional killing, mutilation and catching. Indirect impact on animals like scaring or disturbing is also prohibited. To protect animals' habitats, there are bans on the destruction or removal of nests and on the intentional prevention of animals from accessing their refuges. Despite these regulations, nests are destroyed as a result of renovations and thermal refurbishment. Bat habitats incur similar losses but the occurrence of this phenomenon is hard to assess because of two main reasons. First, there is no legal requirement to make an ornithological and chiropterological inventory before renovation of a building. The second reason is that the existing biological inventories are of poor quality.

The aim of the performed studies was to assess the frequency of occurrence of particular bird and bat species in buildings.

## MATERIAL AND METHODS

Studies were carried out in Poland in 11 voivodships: Małopolskie, Wielkopolskie, Mazowieckie, Dolnośląskie, Kujawsko-Pomorskie, Pomorskie, Podkarpackie, Łódzkie, Lubelskie, Śląskie, and Warmińsko-Mazurskie. Analysed buildings were situated in large (e.g. Łódź, Warsaw), medium-size (e.g. Inowrocław, Sochaczew) and small (e.g. Janikowo, Gniewkowo) towns and in rural areas (e.g. Żakowola Poprzeczna, Brzozowica Duża). Inventoried buildings included: residential blocks, tenements, churches, monasteries, and public buildings like schools, kindergartens, hospitals and city council offices.

Study material was collected in the years 2012–2016. In total, the presence of birds and bats was checked in 336 buildings. The duration of an inventory of birds' nests and bats' roosts in a building depended on its physical characteristics (size, condition of building elevations, access to rooms) and was prolonged as the number of difficulties in searching increased. The mean time of one inspection was from 40 to 120 min. The number of inspections per single building depended on the number of difficulties met while performing that inventory and varied from 1 to 5. Most buildings were inventoried during the breeding season (April through August).

Bird broods were searched for early in the morning, when most of birds show the highest level of activity, using binoculars or a telescope in the case of tall buildings. To find broods of swifts, observations were performed in the evening. In some cases a hydraulic jack was used to check openings and crevices in the elevation. A few buildings were surveyed outside of the bird breeding period. In this case the birds' species were determined based on nests or other remains confirming brooding had taken place (e.g. the presence of white excrements).

In order to record bats evening observations of the roost departure were performed. In some cases these animals were observed before sunrise during the morning swarming. Observations were supported by using a bat sound detector LunaBat DFD-1. Sounds were recorded by Zoom H1 and analyzed by the Cool Edit Pro 2.1 program to determine species or genus. In a few cases, bats were netted to confirm breeding status or to determine the exact species. Building interiors and

crevices were surveyed using torches and endoscopic cameras. Bat droppings and prey remains (e.g. moth wings) proved the presence of these mammals. Sites in building elevations occupied by bats were checked using a ladder or hydraulic jack and endoscopic cameras.

Bird nesting places and daytime bat roosts were divided into 22 sites: in flat roof space, in the attic, under finishing materials, under the roof, in electricity boxes, under window sills, on gutters, under gutters, in technological openings, in cracks, on balconies, in house martin nests, in vents, in the construction elements, in windows, on building elevations, on window sills, in lamp casings, behind LED advertising panels, in chimneys, under air-conditioners, behind outlets.

To determine regional differences in building occupation by birds, 245 selected buildings were divided into 2 groups. Buildings from Kujawsko-Pomorskie Voivodship constituted the first group and those from Voivodships Mazowieckie and Łódzkie – the second one. To determine differences in the location of bat shelters in buildings, data from all voivodships were compared.

All objects were divided into 4 groups: churches (19), tenements (36), public buildings (114) and residential blocks (167). All basic parameters like percentage of occupied buildings, species identification, location of nesting sites were compared.

Buildings were also divided into 3 groups with respect to the degree of urbanization: large towns of with population of  $\geq 50,000$  inhabitants (236), small towns with population of  $< 50,000$  inhabitants population (80) and rural areas

(20). All basic parameters listed above were compared.

Statistical analysis of data was carried out using the Statistica 13 software. The chi-square test was used to test the differences between species structure in groups (significance level  $P = 0.05$ ).

## RESULTS AND DISCUSSION

Birds were found in 78.9% of buildings and bats in 8.9% buildings. Amount of 2,250 birds' nests were inventoried in 265 buildings and over 1,000 bats were found in 30 buildings. Fifteen bird species were found to breed in buildings. The most frequently breeding birds were: the swift *Apus apus* 40.5%, house sparrow *Passer domesticus* 31.7% and jackdaw *Corvus monedula* 9.9%. The least frequently breeding species included the swallow *Hirundo rustica* (one clutch), magpie *Pica pica* (one clutch), song thrush *Turdus philomelos* (two clutches), and wood pigeon *Columba palumbus* (two clutches). Bat species noted in buildings included: the common noctule *Nyctalus noctula*, serotine bat *Eptesicus serotinus*, lesser horseshoe bat *Rhinolophus hipposideros*, pipistrelles *Pipistrellus* and long-eared bats *Plecotus*. The serotine bat was the most frequently noted, in 16 buildings, and the least frequently noted was the lesser horseshoe bat – in only one building. Places preferred by birds for nests were: flat roof space (36.8%), cracks under the roof (16.6%) and cracks in the building elevation (15.2%).

Comparative analysis of buildings from group I (Kujawsko-Pomorskie Voivodship) and from group II (Voivod-

ships Mazowieckie and Łódzkie) showed significant differences ( $\chi^2 = 92.5$ ;  $df = 13$ ;  $P < 0.001$ ) in the occupation of buildings by various species: the house sparrow, swift, jackdaw, house martin *Delichon urbicum*, rock dove *Columba livia* f. *urbana* and starling *Sturnus vulgaris* (Table 1). Total occupation was 85.4% in group I and 80.2% in group II.

TABLE 1. Percent occupation by selected species in analysed voivodships

Species	Kujawsko-Pomorskie ( $N = 622$ )	Mazowieckie, Łódzkie ( $N = 1\ 206$ )
<i>Passer domesticus</i>	37.3	26.6
<i>Apus apus</i>	37.0	47.0
<i>Corvus monedula</i>	7.7	12.5
<i>Delichon urbicum</i>	10.0	5.0
<i>Columba livia</i> f. <i>urbana</i>	2.1	5.6
<i>Sturnus vulgaris</i>	2.6	0.6
Others	3.3	2.7

Comparative analysis of groups I and II showed significant differences ( $\chi^2 = 537.2$ ;  $df = 19$ ;  $P < 0.001$ ) in different breeding sites of birds (Table 2). Flat roof spaces were most frequently occupied by birds in Voivodships Łódzkie and Mazowieckie while cracks under the roof were most frequently occupied in Kujawsko-Pomorskie Voivodship.

Occupation of buildings by particular species differed among three groups of buildings ( $\chi^2 = 238.3$ ;  $df = 28$ ;  $P < 0.001$ ) distinguished according to the degree of urbanization (Table 3). House sparrows and tree sparrows were noted most frequently in buildings situated in rural areas. The swift occupied buildings most frequently in small and large towns and

TABLE 2. Percent occupation of selected breeding sites in buildings of analysed voivodships

Location of breeding site	Kujawsko-Pomorskie (N = 620)	Mazowieckie, Łódzkie (N = 1 157)
Flat roof space	16.6	56.8
Under finishing materials	11.3	5.4
Under roof	26.0	4.3
In cracks	16.8	14.6
Under gutter	8.7	2.0
On a balcony	0.2	4.4
In window	9.7	0.4
Others	10.7	12.1

the house martin built its nests most often in buildings in small towns. Total occupation of buildings within large towns, small towns and rural areas was 80.1, 73.8 and 85%, respectively.

TABLE 3. Percent occupation of buildings from different locations by selected species

Species	Large town (N = 1 732)	Small town (N = 418)	Rural areas (N = 100)
<i>Passer domesticus</i>	30.7	30.6	55.0
<i>P. montanus</i>	0.7	3.8	16.0
<i>Apus apus</i>	43.5	34.9	12.0
<i>Corvus monedula</i>	10.6	7.4	8.0
<i>Phoenicurus ochruros</i>	0.5	0.2	4.0
<i>Delichon urbicum</i>	5.8	11.0	2.0
<i>Columba livia</i> f. <i>urbana</i>	5.9	8.1	0
Others	2.3	4.0	3.0

Occupation of breeding sites in buildings differed ( $\chi^2 = 510.8$ ;  $df = 42$ ;  $P < 0.001$ ) with respect to the degree of urbanization (Table 4). Flat roof space were most frequently occupied in large towns while in rural areas birds preferred to build their nests under finishing materials. Nests under the roof were mostly localised in small towns. Cracks were occupied with similar frequency in all locations.

TABLE 4. Percent of occupation of selected breeding sites in buildings in relation to the degree of urbanization

Location	Large town (N = 1 696)	Small town (N = 407)	Rural areas (N = 98)
Flat roof space	43.3	11.8	28.6
Under finishing material	7.2	3.4	13.3
Under roof	9.4	45.9	18.4
Under gutter	3.8	0.2	0
In a crack	15.0	15.0	15.3
Others	21.3	23.7	24.4

Total occupation and occupation by particular bird species differed ( $\chi^2 = 313.1$ ;  $df = 42$ ;  $P < 0.001$ ) among different types of buildings: churches (I), tenements, (II) public buildings (III) and residential blocks (IV) – Table 5. House sparrows preferably chose tenements and tree sparrows – public buildings. The swift most often occupied tenements, and least frequently residential blocks. The jackdaw preferred residential blocks and was absent from churches. Total occupation for groups I to IV was: 63.2, 86.1, 67.5 and 86.8%, respectively.

TABLE 5. Percent occupation by selected species of various types of buildings

Species	Church, monastery (N = 82)	Tenement (N = 239)	Public building (N = 790)	Residential block (N = 1 136)
<i>Passer domesticus</i>	32.9	38.1	30.1	31.4
<i>P. montanus</i>	0	0	4.3	0.9
<i>Apus apus</i>	47.6	51.0	40.6	37.7
<i>Corvus monedula</i>	0.0	6.7	5.4	14.4
<i>Phoenicurus ochruros</i>	0	0.4	1.5	0
<i>Delichon urbicum</i>	0	0	3.4	10.6
<i>Columba livia</i> f. <i>urbana</i>	15.9	1.7	11.9	2.2
Others	3.6	2.1	2.8	2.8

Birds occupied various nesting places in four types of buildings with different intensity ( $\chi^2 = 901.0$ ;  $df = 63$ ;  $P < 0.001$ ) – Table 6. Flat roof space were most often used in residential blocks and nests under roofs were most often built in tenements. Technological openings and the attics were preferred by birds in religious buildings.

Groups of particular bird species were compared among various types of buildings (Table 7), and showed significant differences ( $\chi^2 = 313.1$ ;  $df = 42$ ;  $P < 0.001$ ). The house sparrow, swift, jackdaw, house martin and starling most

often occupied residential blocks. Public buildings were preferred by the tree sparrow and rock dove.

Five places were differentiated in buildings occupied by bats. In total, 31 bat shelters were found in 30 buildings (Table 8). Statistical analysis did not show significant differences in occupation of each type of place ( $\chi^2 = 20.5$ ;  $df = 16$ ;  $P = 0.20$ ).

Three species among those nesting in buildings: the wood pigeon, song thrush and magpie were found incidentally since they do not typically build nests in buildings and their clutches may be con-

TABLE 6. Percent of nesting sites occupied by birds in various types of buildings

Location	Church, monastery (N = 84)	Tenement (N = 238)	Public building (N = 762)	Residential block (N = 1 117)
Flat roof space	26.2	0.0	36.0	46.0
Under roof	13.1	42.4	27.6	3.8
Under gutter	16.7	5.5	3.0	4.7
Technological openings	14.3	10.9	3.8	1.1
In crack	4.8	16.0	6.8	21.5
On balcony	0.0	0.0	0.0	4.7
In attic	15.5	2.1	6.7	0.0
Behind outlet	1.2	7.1	3.5	1.0
Others	8.2	16.0	12.6	17.2

TABLE 7. Percent presence of clutches of particular species in various types of buildings

Type of building	<i>Passer domesticus</i> (N = 714)	<i>Passer montanus</i> (N = 44)	<i>Apus apus</i> (N = 911)	<i>Corvus monedula</i> (N = 223)	<i>Delichon urbicum</i> (N = 148)	<i>Columba livia</i> f. <i>urbana</i> (N = 136)	<i>Sturnus vulgaris</i> (N = 27)
Church, monastery	3.8	0	4.3	0	0	9.6	3.7
Tenement	12.7	0	13.4	7.2	0	2.9	0
Public building	33.3	77.3	35.2	19.3	18.2	69.1	22.2
Residential block	50.1	22.7	47.1	73.5	81.8	18.4	74.1

TABLE 8. Numbers of bat shelters according to places in buildings (N = 31)

Species	Attic	Crack in the wall	Crack under finishing materials	Crack behind the outlet	Flat roof space
<i>Plecotus</i> spp.	4	0	0	0	0
<i>Rhinolophus hipposideros</i>	1	0	0	0	0
<i>Nyctalus noctula</i>	0	0	1	0	2
<i>Pipistrellus</i> spp.	0	2	1	0	4
<i>Eptesicus serotinus</i>	7	4	2	1	2

sidered exceptional there. The remaining 12 species most often build nests in buildings. This is a large pool of species considering a lack of building preferences and their relatively low number. For comparison, during the inventory of the whole of Warsaw, 16 species were found nesting in buildings (Luniak et al. 2001). Such a high diversity of species occupying buildings calls for selecting appropriate methods of ornithological inventory to ensure the possibility of finding every species. The species most frequently noted were the swift, house sparrow and jackdaw. All are the most common cavity nesters living in towns (Tomiałojć and Stawarczyk 2003). The swift, considered moderately numerous to numerous in the whole country (Tomiałojć and Stawarczyk 2003), achieves the highest densities in old town districts, e.g. 60–68 pairs/10 ha in Wrocław or 64 pairs/10 ha

in Leszno (Dyrzcz et al. 1991, Bednorz et al. 2000). In Warsaw its numbers are estimated at 3 to 6 thousand pairs (Luniak et al. 2001). A moderate increase in the number of this species has recently been noted in Poland (Chylarecki 2013). The house sparrow has the status of common nesting bird (Tomiałojć and Stawarczyk 2003), though recently a decrease in its abundance has been recorded in many European towns (Robinson et al. 2005, De Laet and Summers-Smith 2007, Chylarecki 2013, Węgrzynowicz 2013). The main reason of such a decline is renovation and thermal refurbishment of buildings, which has decreased the number of available nesting sites (Siriwardena et al. 2002, Summers-Smith 2003, Balaji 2014).

Swifts breeding in buildings were more common in Voivodships Mazowieckie and Łódzkie and less common

in Kujawsko-Pomorskie Voivodship. There are no data for comparisons and literature references report that the swift is most common in Mazury (Tomiałojć and Stawarczyk 2003). Observed differences may be explained by the fact, that studies in Voivodships Mazowieckie and Łódzkie included two large city agglomerations: Warsaw and Łódź. The swift prefers nesting in old town districts, which prevail in the two voivodships. According to Tomiałojć and Stawarczyk (2003), the jackdaw is distinctly more numerous in the east than in the west of the country. This was also reflected in our studies, in which the jackdaw nested more often in buildings in Voivodships Mazowieckie and Łódzkie than in those of Kujawsko-Pomorskie Voivodship.

Surprising results were obtained when comparing locations of nesting sites. In Voivodships Mazowieckie and Łódzkie more than half of the nests were located in flat roof space while in Kujawsko-Pomorskie Voivodship it was only 16.6% of nests. This is difficult to explain, more so that the availability of flat roof spaces was similar in both areas. In Kujawsko-Pomorskie Voivodship birds preferred to build nests in cracks under the roof.

Intra- and inter-specific differences were found in the occupation of buildings in large towns, small towns and in rural areas. The frequency of occupation of buildings by the house sparrow was similar in large and small towns but definitely smaller than in rural areas. The density of the house sparrow in housing estates in the 2000s was 18.5 pairs/10 ha (Węgrzynowicz 2013). In rural areas, the density was 17.4 pairs/10 ha (Dębowski et al. 2015). The tree sparrow was noted

most often in buildings situated in rural areas, which agrees with the literature data (Tomiałojć and Stawarczyk 2003). The house martin preferred occupation of buildings in medium-size towns. Most probably, this was associated with easy access to small water bodies resulting from habitat preferences of the species (Tomiałojć and Stawarczyk 2003). Such water bodies were situated in the outskirts of towns like Janikowo, Opole Lubelskie, Kruszwica, but were not always present in large towns.

An analysis of the selection of nesting sites brought about different results depending on the degree of urbanization. Birds in large towns preferred nesting sites in attics, while those in small towns chose places under the roof. The difference was not related to the availability of nesting places and the reason for such selection was hard to interpret. Comparison of building occupation by various species showed that the house sparrow preferred occupation of tenements and the differences in its preference of churches, public buildings and residential blocks were negligible. The tree sparrow was not present in churches and tenements, but occurred mainly in public buildings. The swift almost equally occupied different types of buildings and the house martin preferred residential blocks.

Nesting sites most frequently chosen by birds were those in flat roof spaces of residential blocks, under the roof in tenements and under the gutter in churches. One may consider that birds choose various nesting places depending on the type of a building. This is partially related to the availability of places in different objects, for example tenements usually



do not have flat roof spaces. Selection of such places is also species-specific in most common species: the swift, house sparrow and jackdaw. All these species prefer nesting places in flat roof spaces and the swift and house sparrow most often decide to build nests in the upper part of a building and hence select sites under the roof (Śálek et al. 2015).

Preference for buildings as nesting sites differed among species. The house sparrow, swift, jackdaw and house martin most often occupied residential blocks. Nearly half of house sparrows and swifts chose residential blocks, as did most jackdaws, starlings and house martins. This observation confirms the importance of such constructions, which are recently being replaced by modern high-rise residential buildings tightly and precisely finished and devoid of access to flat roof spaces. The tree sparrow and rock dove most often built their nests in public buildings. The occurrence of the rock dove in such buildings may be explained by the fact that public buildings are less often protected against bird habitation, when compared to residential houses.

The percentage of buildings occupied by bats was lower than given in other studies. For example, systematic checks of 238 buildings on forest clearings in Białowieża Forest in 2002 showed the presence of bats in 38 (16%) buildings (Mazurska and Ruczyński 2005). In another study, a survey of 900 church lofts, suitable for bats, revealed that bats were present in 118 of these church lofts (13%) (Fuszara et al. 1995). A still higher frequency of building occupation (1/3) was noted in 1991 on Krakowsko-Wieluńska Upland (Kurzak et

al. 1995) and in the Carpathians in the years 1999–2001 (nearly half of buildings) (Kozakiewicz 2003). A similar frequency (a half of the objects) of occupied religious buildings was found in the Lublin region (Grzywaczewski et al. 2005). Contrary to the former studies, bats' presence in the latter objects was also inferred from faeces; the same approach was adopted in our analyses. From among a total of 31 bat roosts, 12 were found in the attics. This finding agrees with other studies and confirms the attractiveness of such places for bats (Kowalski et al. 2001, Ciechanowski et al. 2002, Ciechanowski 2003, Lesiński 2006). The second place occupied by bats was cracks. Cracks in the wall and cracks under finishing materials were occupied 10 times. Other studies confirmed frequent occupation of such roosts (Kowalski and Lesiński 1995, Lesiński 2001). Literature data rarely give any information on roosts in attics of residential blocks (flat roof spaces). We found 8 roosts localised in such attics. These places are even more important because they were occupied by nearly 1,000 bats.

## CONCLUSIONS

The species composition and nesting or roosting site preferences in buildings depends on the type of building. These characteristics also differ between areas with different levels of urbanization and between different regions of Poland.

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**Streszczenie:** Ptaki i nietoperze wykorzystujące budynki jako miejsca lęgów i schronienia. Przeanalizowano występowanie ptaków i nietoperzy w budynkach przeznaczonych do termomodernizacji. Materiał został zebrany na 336 budynkach w latach 2012–2016 w 11 województwach, a do szczegółowej analizy ptaków wybrano dane z trzech województw: kujawsko-pomorskiego, łódzkiego i mazowieckiego. Porównanie kryjówek dziennych nietoperzy dotyczyło wszystkich województw. Miejsca lęgowe ptaków oraz kryjówek dziennych nietoperzy zostały podzielone

na 22 lokalizacje. Wykonano analizę różnic regionalnych w zasiedleniu obiektów. Wykonano porównanie zasiedlenia obiektów z podziałem na ich charakter: kościoły, kamienice, budynki użyteczności publicznej, budynki typu blok mieszkalny. Wykonano również porównanie budynków wykorzystywanych przez zwierzęta ze względu na stopień zurbanizowania ich lokalizacji. Porównano preferencje gatunkowe ptaków do zasiedlania budynków o różnym charakterze. Ptaki stwierdzono na 78,9% budynków. Nietoperze stwierdzono na 8,9% budynków. Zinwentaryzowano 2250 gniazd ptaków występujących na 265 budynkach i ponad 1000 nietoperzy znalezionych w 30 budynkach. Najczęściej stwierdzanymi gatunkami ptaków były jerzyk *Apus apus* 40,5%, wróbel *Passer domesticus* 31,7% i kawka *Corvus monedula* 9,9%. Gatunki nietoperzy wykryte na budynkach to: borowiec wielki *Nyctalus noctula*, mroczek późny *Eptesicus serotinus*, podkowicze mały *Rhinolophus hipposideros*, karliki *Pipistrellus* i gacki *Plecotus*. Wróbel najczęściej zasiedlał obiekty w województwie kujawsko-pomorskim (37,3%), a jerzyk obiekty w województwach mazowieckim i łódzkim (47,0%). W województwie kujawsko-pomorskim ptaki najczęściej budowały gniazda pod dachem (26,0%), a w województwach mazowieckim i łódzkim w stropodachu (56,8%). Wyróżniono pięć lokalizacji, w których łącznie stwierdzono 31 kryjówek nietoperzy znajdujących się na 30 budynkach. Nietoperze najczęściej zajmowały strych i stropodach (20), a najrzadziej szczelinę za spustem (1).

*Słowa kluczowe:* ptaki i nietoperze w budynkach, miejsca lęgowe i schronienia

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